



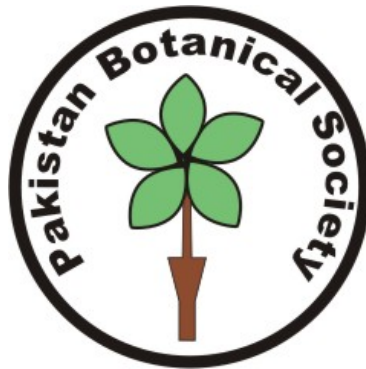
12th National & 3rd International Conference of Botany **ABSTRACT BOOK**

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ABSTRACT BOOK

September 1st to 3rd 2012

Quaid-e-Azam University,
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ORAL ABSTRACTS

OPBG 1

EFFECT OF NITROGEN FERTILIZER ON THE YIELD OF MUNGBEAN CULTIVARS UNDER THE AGROCLIMATIC CONDITIONS OF QUETTA

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The aim of the study was to evaluate the yield response of mungbean [*Vigna radiata* (L.) Wilczek] cultivars subjected to different levels of applied N fertilizer. To achieve the goal, an experiment was conducted in the experimental field of Agricultural Research Institute (ARI), Quetta. The soil of the study area was basic in reaction, salt free, medium textured having low organic matter & total N contents. Four diverse cultivars of mungbean viz., NM-92, NM-98, M-1, and NCM-209 were grown in kharif season for two consecutive years i.e., 2007 and 2008. Six different levels of N fertilizer were applied @ zero, 20, 40, 60, 80 and 100 kg ha⁻¹. At the same time a constant dose of P₂O₅ and K₂O were also applied to each N level (except control i.e. zero). Urea fertilizer was used as a source of N, while TSP and SOP as sources of P & K, respectively. The plot size for treatment and cultivar were kept as 22.8 and 2.40m², respectively. The plot was arranged in a randomized complete block design (RCBD). Fertilizer was kept in main plot and cultivar as sub-plots. Results showed that except of pods plant⁻¹ and pods length, all remaining yield and yield components exhibited significant (p<0.05) response toward added fertilizer. A maximum yield plant⁻¹ (18.99 g), yield plot⁻¹ (284.30 g) and yield ha⁻¹ (1185 kg) were obtained in nitrogen fertilizer @ 40 kg ha⁻¹. Results further showed that cultivars also responded significantly in relation to receiving various levels of applied N fertilizers. A maximum pods length (7.68 cm), 100 seed weight (6.30 g), yield plant⁻¹ (14.25 g), yield plot⁻¹ (214.3 g) and yield ha⁻¹ (893.6 kg) were obtained in NM-92 cultivar. Whereas, minimum values for the same attributes were recorded for NCM-209 cultivar, respectively. Hence mungbean NM-98 and M-1 were found intermediate in response toward added fertilizer. The correlation coefficient (r) studies exhibited that number of pods plant⁻¹ (r=0.351), pods length (r=0.255), yield plant⁻¹ (r=0.189) and yield plot⁻¹ (r=1.00) were significantly (p<0.05) and positively correlated with their grain yield (kg ha⁻¹). Thus based on correlation studies it can be revealed that cultivars under cultivation displayed a wide range of variation for most of the mentioned growth traits and could be exploited in breeding program to enrich the mungbean genetic affluence.

OPBG 2

CALLOGENESIS AND EMBRYOGENESIS IN ORCHID (*DENDROBIUM SABIN* H.) UNDER DIFFERENT LEVELS OF GROWTH REGULATORS

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Callogenesis and embryogenesis of orchid (*Dendrobium sabin* H.) was studied on MS media containing different levels of NAA for callogenesis, BAP alone and in combinations with NAA use for embryogenesis. Maximum (100%) success percentage was observed in MS medium supplemented with NAA (0.2 mg L⁻¹) after 10 days of culture and minimum (50%) success percentage was observed in control. Success percentage decreased with increase in time span and 93% success was observed in (0.2 mg L⁻¹) NAA after 40 days of culture. The embryoids obtained from induced calli showed greatest embryo formation (92%) at the highest level of NAA + BAP (0.4 mg L⁻¹ + 0.4 mg L⁻¹) than control (76%) while BAP alone comparatively gave better results than control. It is concluded that leaf disc explant of orchid induced maximum calli on callusing media at (0.2 mg L⁻¹) of NAA and induced calli showed maximum embryogenic response on media supplemented with MS medium at the highest level of NAA + BAP and developed somatic embryogenesis.

OPBG 3

QUANTITATIVE TRAIT LOCI MAPPING OF DROUGHT TOLERANCE AT GERMINATION STAGE IN BREAD WHEAT

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Drought is a major yield limiting factor in many crop species. Wheat is a major crop and staple food in Pakistan. Genetic linkage map construction based on linked DNA markers spanning whole wheat genome and subsequent QTL mapping for drought tolerance can enhance breeder's ability for effective selection. We used an F₈ population (80 lines) derived from the cross of OPATA x SH-349 for drought tolerance at germination stage under controlled conditions. The drought was induced by 15% PEG nutrient solution in acid washed sand medium under controlled conditions (14/10 hrs light and dark and 25°C). During four weeks of growth, data for germination percentage, germination rate index, shoot root lengths and dry weights were recorded. These data along with marker data were used for QTL mapping using QTL Cartographer V2.5 software. Single marker QTL analysis showed that 14 SSR markers were linked to QTLs for five traits in both drought and control condition. Using simple interval mapping and composite interval mapping, QTLs for different traits of interest were mapped on two linkage groups. On linkage group 1, QTLs for root length, shoot length, dry biomass and germination percentage were mapped under control and drought conditions. On linkage group 2, QTLs for germination percentage and germination rate were mapped under controlled and drought conditions. The population will be screened with more SSR markers to increase the genomic coverage of this map.

OPBG 4

MANAGEMENT OF BLACK SCURF OF POTATO WITH EFFECTIVE MICROBES, BIOLOGICAL POTASSIUM FERTILIZER (BPF) AND *TRICHODERMA HARZIANUM*

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The efficacy of soil application with microbial preparations viz. *Trichoderma harzianum*, effective microbe (EM) culture and biological potassium fertilizer (BPF) was evaluated for the management of soil-borne inoculum of black scurf of potato by sowing cv. Desiree. Soil application with three dosages of culture suspension of *Trichoderma harzianum*, effective microbe (EM) culture and biological potassium fertilizer (BPF) were applied in the soil to know the efficacy of these treatments in reducing the disease. Soil application with *T. harzianum* at the time of sowing followed by two and three dosages at 20 days intervals gave significant protection to eyes with EGI of 30.55%, SK 24.07%, SCI 36.10%, StCI 30.60%, BSDI 26.43%, and YR of 35.09% against the fungus which ultimately contributed to better crop stand and increased yield as compared to inoculated control and rest of the treatments. Soil application with *T. harzianum* gave significant protection to eyes, sprouts and stolons, against soil-borne inoculum of the fungus which ultimately contributed to better crop stand and increased yield as compared to inoculated control and rest of the treatments.

OPBG 5

LEAF RUST RESISTANCE IN SEMI DWARF WHEAT CULTIVARS: A CONSPECTUS OF POST GREEN-REVOLUTION PERIOD IN PAKISTAN

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Leaf rust, the most prevalent biotic stress in wheat growing areas, remains a global concern for wheat production. The pattern of leaf rust varies across countries and warrants assessing the pathogen and deployed resistant genes in cultivars. This study evaluates the genetics of thirty-eight wheat varieties using molecular markers for six significant *Lr* genes: *Lr10*, *Lr13*, *Lr24*, *Lr26*, *Lr27* and *Lr31* for the region. The analysis showed the presence of all six genes in only four varieties. Due to minor differences in loci, the PCR based screening could lead to erroneous results. Therefore, a novel ABI 3730 capillary array method was used with sensitivity of detecting as little as one nucleotide difference. This not only has verified their successful application in varieties with diverse genetic background but has helped in reliably detecting the presence of gene in commercial varieties. The STS markers (names) showed high efficiency verifying the presence of four effective genes (*Lr10*, *Lr21*, *Lr24* and *Lr27*) in our local cultivars with parallel analysis from field trial at Regional Agriculture Institute, Bahawalpur, Pakistan. The data thus collated provided useful information in marker assisted screening to integrate effective resistant genes. The data revealed wide distribution of *Lr10*, *Lr13*, *Lr26*, *Lr27*-*Lr31* and the absence of *Lr21* and *Lr24* in the Pakistani cultivars. Thus a clear gene pyramiding plan for wheat breeding may be developed.

OPBG 6

FIELD EVALUATION OF THREE SAUDI ARABIAN DATE PALM VARIETIES (AJWA, SAFAWI AND RUTHANA) AT KHAIRPUR, PAKISTAN

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The most of the varieties of Khairpur are sensitive to monsoon rains which synchronize with the ripening season. Urgent and rapid demand is being required for the high quality varieties resistant to monsoon rains. Offshoots of three well known date palm varieties Ajwa, Safawi and Ruthana from Al-Madina, Kingdom of Saudi Arabia were brought and cultivated in 2006 to study the adaptability of these varieties at the climatic conditions of Khairpur, Sindh, Pakistan. It is worth to mention that there is no evidence for these three cultivars in Pakistan and particularly Ajwa is restricted to climatic conditions of Al-Madina, Saudi Arabia and if established anywhere, variation occurred in the fruit size, texture and quality. The Sites were selected after comprehensive study of official records to find common climatic conditions in Khairpur and Al-Madina. The reading included minimum and maximum temperatures and relative humidity. An appropriate Performa was designed to drop the scientific and commonly used properties such as: Fruit length, fruit diameter, Flesh weight, stone weight, pH and Total Soluble Solids (TSS). New crop obtained in 2009. Previous data were recorded for 3 sequential seasons (2009-11). The general features of date palm culture in Al-Madina, Saudi are not much different from those in Khairpur, especially when climate, cultivation and utilization is concerned. It was concluded from the study that the climatic conditions of Khairpur are very much suitable for planting of alien varieties of dates like Ajwa, Safawi and Ruthana and other similar Saudi date palm varieties.

OPBG 7

IDENTIFICATION AND CHARACTERIZATION OF POST HARVEST FUNGAL PATHOGENS OF MANGO FROM DOMESTIC MARKETS OF PUNJAB

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A systematic survey was conducted during October 2011 to assess the status of major post harvest diseases of mango fruit in the major markets of Punjab. The data regarding prevalence, incidence and severity was collected and then pathogen was isolated by tissue segment method. General and specific media's were used to isolate the fungi and then eventually, frequency of each fungus was calculated media wise and location wise as well. The present study indicated that anthracnose and stem end rot were 100% prevalent diseases of Punjab. Present study revealed that anthracnose caused by *Colletotrichum gleosporioides*, stem end rot caused by *Lasiodyplodia theobromae*, *Alternaria* rot caused by *Alternaria alternata* and *Aspergillus* rot caused by *Aspergillus niger* and these were major post harvest diseases that damage the mango fruit after harvesting. As far as, it was also observed that malt extract agar and V-8 agar were the best media's for the growth of *Lasiodyplodia theobromae* and *Colletotrichum gleosporioides* fungi. By present investigation it would be possible to study the post harvest fungal pathogens of mango for their pathogenic behavior, fungicides resistance and genetic variability and these all investigations will be very helpful for the management of post-harvest diseases of mango.

OPBG 8

EFFECT OF PRUNING ON SEX EXPRESSION AND ITS RELATION WITH PHYTOHORMONES CONTENT IN MONOECIOUS CUCUMBER**HIDAYATULLAH^{1*}, ASGHARI BANO² AND KHALID MAHMUD KHOKHAR¹**¹*Vegetable Crops Research Programme, Horticulture Research Institute, National Agricultural Research Center Islamabad, Pakistan,* ²*Professor, Department of Biological Sciences, Quaid-e-Azam University Islamabad, Pakistan*** Corresponding author's e-mail address: hidayatu_2003@yahoo.co.uk*

The effect of mechanical stress on sex expression in cucumber cultivar Sialkot selection was examined. This mechanical stress was created by pruning of lateral branches. Seeds were sown in the field and after reaching the required number of lateral branches according to respective treatment, each new coming lateral branch were pinched off. The greatest increase in female flower production, lowest ♂ to ♀ sex ratio, highest number of fruits/plant and yield were recorded with the treatment T₄ (main stem with 3 lateral branches) compared with control (without pruning). This is due to decrease in endogenous GA level at blooming and fruiting stages and increase in IAA level at flower initiation, blooming and fruiting stages. Yield increase in relation to control recorded up to 61 %.

OPBG 9

LINE × TESTER ANALYSIS FOR GRAIN YIELD AND YIELD RELATED TRAITS IN MAIZE VARIETY SARHAD WHITE**HIDAYAT UR RAHMAN^{1*}, ASIF ALI¹, ZAHIR SHAH², M. IQBAL³ AND M. NOOR¹**¹*Deptt. of P.Breeding & Genetics, Agricultural University, Peshawar, Pakistan*²*Deptt. of Soil & Env. Sciences, Agricultural University, Peshawar, Pakistan*³*Cereal Crops Research Institute, Pirsabak, Nowshera, Pakistan**Corresponding author's e-mail: h_rahman_pbg@yahoo.com*

This study was conducted to evaluate the performance of testcross hybrids for grain yield and other morphological traits. The objectives were to determine the magnitude of heterosis, combining ability, nature of gene action for ten quantitative traits in testcross hybrids of maize variety Sarhad white. The experiment was conducted to generate 42 testcross hybrids from 14 S₂ lines, three testers viz., Jalal, Kiramat and WD2. These along with five commercial checks viz., Azam, 3025, 30P45, 30K08 and Opener were evaluated in partially balanced lattice square design with two replications at experimental farm Khyber Pakhtunkhwa Agricultural University, Peshawar, Pakistan, during 2010-2011 in two seasons i.e. in spring (February - June) and summer (July - October). Data were recorded on days to tasseling, silking and pollen shedding, anthesis silking interval (ASI), plant height, ear height, ear length, number of kernel rows per ear, 100 grain weight and grain yield. Results revealed the existence of highly significant differences among testcross hybrids for all parameters except kernel rows per ear, which was non significant. Lines effect was significant for plant height, non significant for the traits viz., days to tasseling, pollen shedding, cob length, kernel rows per ear, while rest of the traits exhibited highly significant variations among female (Lines). Testers and interaction effect was highly significant for all the traits under study except ASI and kernel rows per ear, which were non significant for testers. However, highly significant variations were observed for all the traits except kernel rows per ear. Testcross hybrids expressed significant variability for 10 quantitative characters studied. The study on heterosis for grain yield revealed that 14 testcross hybrids showed significantly positive and 28 testcross hybrids showed significantly negative mid parent, while 6 testcross hybrids expressed significantly positive and 36 testcross hybrids expressed significantly negative better parent heterosis. For grain yield significant standard heterosis in positive direction was observed for 8 testcross hybrids over the check Azam, for 2 testcross hybrids over 30P45, for 30 testcross hybrids over 3025, for 29 testcross hybrids over 30K08 and for 8 testcross hybrids over the commercial check Opener. It is suggested to evaluate the identified testcross hybrids in large scale trial to confirm their superiority. The study on the combining ability revealed that the lines viz., SWAJK 1-4, SWAJK 3-1, SWAJK 3-3, SWAJK 3-4, SWAJK 4-3 and SWAJK 4-4 revealed significant GCA effects and the tester WD2 was found to be best general combiners than the rest. Regarding SCA effects, 12 testcross hybrids showed significant positive SCA effects for grain yield. Promising hybrids involving high × high parental GCA effects for grain yield may be used for further improvement of lines by selection in advanced generations.

OPBG 10

MOLECULAR CHARACTERIZATION OF OLIVE GERMPLASM USING DNA MARKERS**IHSAN ULLAH^{1*}, SYEDA MAARIYAH HASNI², MUHAMMAD ZAFFAR IQBAL¹, MUHAMMAD NAWAZ² AND SHAKRA JAMIL¹**¹*Agricultural Biotechnology Research Institute, AARI, Faisalabad;* ²*Govt. College University, Faisalabad***Corresponding author's e-mail: ihsan.ullah_tlw@yahoo.com*

Olive (*Olea europea* L.) is prized for its premium oil quality as well as table use. Extensive natural plantation of wild species of olive exists in several parts of Pakistan particularly in Khyber-Pakhtoonkhwa and Balochistan indicating possibility of successful plantation of cultivated olives. However, endemic olive accessions found in Pakistan are uncharacterized, hindering any systematic plan to propagate and promote commercial cultivation. Hence the present study was conducted at Agricultural Biotechnology Research Institute, Faisalabad in context to characterize a set of olive germplasm by using DNA markers. A total of 32 olive varieties/genotypes were subjected to 100 Random Amplified Polymorphic DNA (RAPD) markers for molecular characterization through determination of genetic distance and relatedness among olive genotypes and construction of a dendrogram for assessment of their phylogenetic relationships. The eightyinformative DNA markers identified through RAPD profiling varied in size from 290 to 2150 bp. The resulting similarity matrix revealed a high degree of mean genetic diversity of 29% among the genotypes studied. The genotypes Hamdi and Nocellara emerged as most similar with value of 96%. The genotypes Mavrino and HP-Olive were found most dissimilar with dissimilarity coefficient of 50%. Cluster analysis using NTSYspc 2.2 software grouped 32 genotypes into seven main clusters i.e. A, B, C, D, E, F and G. It was concluded that a considerable genetic diversity exists among Pakistani olives. The information generated here will be useful for characterization of olive germplasm and finding variety specific markers.

OPBG 11

ANALYSIS OF SOIL MICROBIAL BIOMASS DYNAMICS IN RAINFED WHEAT FIELDS IN ARID ZONE OF PAKISTAN

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In order to investigate Soil Microbial Biomass (SMB) dynamics in rainfed wheat fields, a field (model) experiment was conducted in research farm of Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi in 2010. Wheat (*Triticum aestivum*, Chakwal-50) was grown under three treatments of recommended doses of nitrogen and phosphorous (NP) as control (CK); no other fertilizer was used. In study half recommended dose of NP ($\frac{1}{2}$ NP) at the rate of 40:20 kg NP ha⁻¹ and full recommended dose of NP (NP) at the rate of 80:40 kg NP ha⁻¹ was applied. A composite soil sample was taken from the depth of 0-15 cm from each treatment, every month throughout the growing period of crop. Each time soil microbial biomass parameters as soil microbial biomass C, N, P, C:N and C:P (C_{mic} , N_{mic} , P_{mic} , $C_{mic}:N_{mic}$ and $C_{mic}:P_{mic}$) were determined by using fumigation extraction method and the results were co-related with the growth stages of wheat, climatic parameters (Air temperature, Soil temperature, Rainfall and Soil moisture content) and the effect of treatments. The results indicated that C_{mic} , $C_{mic}:N_{mic}$ and $C_{mic}:P_{mic}$ were highest at the early stage of wheat crop then declined in the middle and lowest at the crop maturity while N_{mic} and P_{mic} were low in the initial growth period of wheat crop then reached to their peak point in middle and were lowest at the stage of maturity. All indices of SMB were increased by providing a balance fertilizer which was cleared from the results, in CK the total amount of C_{mic} , N_{mic} , P_{mic} , $C_{mic}:N_{mic}$ and $C_{mic}:P_{mic}$ during whole wheat growth was 861.08 mg kg⁻¹, 84 mg kg⁻¹, 31.91 mg kg⁻¹, 83.81 mg kg⁻¹ and 224.19 mg kg⁻¹ while in $\frac{1}{2}$ NP it was 1260.4 mg kg⁻¹, 104.07 mg kg⁻¹, 45.69 mg kg⁻¹, 98.35 mg kg⁻¹ and 230.33 mg kg⁻¹ and the values of these parameters in NP was 1435.42 mg kg⁻¹, 112.68 mg kg⁻¹, 59.65 mg kg⁻¹, 102.78 mg kg⁻¹ and 198.5 mg kg⁻¹, respectively. Seasonal variation was more visible in this study. The climatic data indicated that there was extreme drought as in initial four months (October, November, December and January). The average rainfall was only 8.2 mm while in next four months (February, March, April and May) it was higher as compared to initial period the average rainfall during this period was 70 mm during this period. The average values of C_{mic} (155.79 mg kg⁻¹), $C_{mic}:N_{mic}$ (12.72 mg kg⁻¹) and $C_{mic}:P_{mic}$ (28.57 mg kg⁻¹) were high during drought period while N_{mic} (12.33 mg kg⁻¹) and P_{mic} (5.65 mg kg⁻¹) were low during this period as compared to rainy season. SMB was also fluctuated by temperature, both air and soil temperature was involved in this variation. C_{mic} , P_{mic} and $C_{mic}:N_{mic}$ were high in winter when the temperature was much low as in January the average temperature was 12°C and was high in spring while N_{mic} and $C_{mic}:P_{mic}$ were high in summer when the average temperature of May was 29°C. The fluctuation in pH was also observed in this study but it was fluctuated up to 8 in the whole experiment even under treatments as well as seasonal changes. The considerable seasonal changes and variation due to fertilization in SMB indicated the direct relationship of nutrient and season parameters with overall SMB and its paramount impact on growth and yield of crop in arid zones of Pakistan.

OPBG 12

TISSUE CULTURE RESPONSES OF SOME WHEAT (*TRITICUM AESTIVUM* L.) CULTIVARS GROWN IN PAKISTAN

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Good tissue culture response for callus induction and regeneration is prerequisite for improvement of wheat through genetic transformation. Tissue culture response of six wheat cultivars was studied using MS and N6 medium supplemented with different concentration of 2,4-D (2,4-Dichlorophenoxyacetic acid) and BAP (6-benzylaminopurine) for callus induction and regeneration, respectively. Mature seeds were used as explants. All cultivars exhibited best response for callus induction and regeneration on MS medium as compared to N6 medium. However, significant differences among cultivars were observed. Each cultivar responded differently at different levels of growth regulator for callus induction. Inqalab-91 and Lasani-08 showed maximum callus induction (90 %) and (78.78 %), respectively at 3mg/l of 2, 4-D. Tatara showed 84.43 % callus at 2.0mg/l, chakwal-97 77.08 % at 2.5 mg/l while GA-02 and Khyber showed 74.30 % and 65.97 % callus induction response, respectively, at 3.5 mg/l of 2, 4-D. As regards regeneration, direct shoots and roots development were observed by using different concentration of BAP. Significantly higher regeneration (59.33%) was observed in Chakwal-97 with 3.0 mg/l of BAP while least regeneration was observed in Khyber (17.33%) at 4.0 mg/l among all cultivars. It was also observed that all cultivars showed shoot as well as root development with 3 and 5mg/l of BAP. Using 8mg/l agar rather than 6 and 10 mg/l significantly enhanced regeneration ability of cultivars. The results of present findings will be helpful for selecting the most tissue culture responsive cultivars for genetic transformation against different biotic and abiotic stresses as well as for improvement of important agronomic traits of wheat crop.

OPBG 13

GLU-D^T1 ALLELIC VARIATION IN SYNTHETIC HEXAPLOID WHEATS DERIVED FROM DURUM CULTIVAR ‘DECOY’ × AEGILOPS TAUSCHII ACCESSIONAL CROSSES

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Characterization of high molecular weight glutenin subunits is the fundamental approach for categorizing genotypes with good bread making quality. Allelic variation at *Glu-D^T1* locus is major determinant of bread wheat end use quality. In synthetic hexaploid wheats (SHWs), the D-genome encodes numerous allelic variants of high molecular weight glutenin subunits that require appropriate identification prior to their exploitation for bread wheat improvement. This study was conducted to identify allelic variation at *Glu-D^T1* locus of 47 accessions of D-genome synthetic wheats derived from the crossing of durum cultivar “Decoy” with different accessions of *Aegilops tauschii*. Biochemical (SDS-PAGE) and molecular marker techniques were used to stringently characterize allelic differentiation. Ten different alleles at *Glu-D^T1* locus were observed which formed 16 different subunit combinations. The frequency of inferior quality encoding allele, 1Dx2+1Dy12, was low (19.14%) as compared to the frequency of superior quality encoding allele, 1Dx5+1Dy10 (21.27%). Additional validation was carried out with co-dominant molecular markers for *Glu-A1c* (Null), *Glu-D1d* (1Dx5+1Dy10), *Glu-D1a* (1Dx2+1Dy12) and *Glu-D1-1g* (1Dx2.1) alleles. The high number of glutenin subunits observed in SHWs are suggestive that somewhat narrow genetic base for D-genome encoded glutenin subunits in bread wheat may be broadened by exploiting this diploid genomic grass resource through targeting allelic transfers from the synthetic hexaploid genetic stocks. The identification of these new allelic combination resources in SHWs also provide an option replacing other inferior alleles within the D-genome within elite cultivars by better allelic variants that have become available at the *Glu-D^T1* locus of SHWs being inherited from diverse *Ae. tauschii* accessions.

OPBG 14

EFFECT OF POLLEN SOURCES AND PLOIDY LEVELS ON DOUBLED HAPLOID PRODUCTION IN WHEAT

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Field experiments carried out to analyse the efficiency of pollen parents reflected that embryo formation was significantly affected by maize pollen sources in wheat x maize crossing. Crosses among selected pollen sources, 'FSH-399', 'Sultan' and '73Q3' were found as efficient pollen parents that yielded higher embryo formation (28.0%) when crossed with wheat. Various pollen sources were evaluated for the efficiency of embryo formation. The results expressed that crosses between wheat F_1 "MH-97 x Auqab-2000" and the maize cultivar 'Sadaf' yielded on average 37.67% embryos/pollinated florets, so 'Sadaf' was identified as best pollen source to use in wheat x maize crossing. Results of crosses between the best pollen sources and various female wheat parents of different ploidy levels (hexaploid and tetraploid) indicated that hexaploid wheat perform better than tetraploid in crosses with maize. However, successful production of embryos at a relatively high frequency could be achieved in tetraploid wheats with 'FSH-399'. The highest frequency of seed set was produced from a cross between the hexaploid wheat Cross "MH-97 x Auqab-2000" and 'Neelum'.

OPBG 15

DEVELOPING PROTOCOL FOR GENETIC TRANSFORMATION OF GRAPES (*VITIS VINEFERA*) KING'S RUBY C.V

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The grape (*Vitis vinifera* L.) belongs to the family Vitaceae, is commercially grown in the world. This crop is seriously damaged by fungal diseases and growers are being faced extensive losses in yield and quality annually. This problem can be overcome by breeding and by application of chemical but unfortunately, both struggles still ineffective due to long time process of breeding and chemical / fungicides may have hazardous health effect and undesirable environmental risk. Method of genetic transformation enhances defense mechanism of plant against disease. The present study was therefore, carried out to develop protocol for genetic transformation of King's Ruby variety of grapes through *Agrobacterium tumefaciens*. The chitinase for (fungal resistance) and GUS gene (for phenotypic expression of transgenes) was introduced in callus, developed from *in vitro* leaves through *Agrobacterium* strain (LBA4404) harbouring plasmid pBI121 *nptII* as selectable marker gene in GUS and *hptII* for chitinase gene. For tissue culture and transformation parameters, *in vitro* shoot tips were established and significantly higher number (5.33) and length of shoots (2.7 cm) was recorded when half strength MS media was supplemented with BAP and GA₃ @ 1 mg⁻¹ and 0.1 uM⁻¹. The highest callus induction rate (73.0%) was obtained on media having 2-4-D+ BAP+NAA at the rate of 2.0mg⁻¹, 0.3mg⁻¹ and 0.2 mg⁻¹. Concerning regeneration rate, maximum was 53.33% as a result of treatment combination NAA and BAP with concentration of 0.5 mg⁻¹ + 1.5 mg⁻¹. Regarding transformation efficiency rate, ten minutes inoculation period with bacterial suspension showed the highest transformation efficiency rate 2.83 with chitinase gene but with Gus gene maximum transformation efficiency was 2.5. Infected calli with chitinase gene and Gus gene co-cultivated for 2 days showed the maximum transformation efficiency 2.75 and 3.25. For elimination of excess bacteria, cefotaxime sodium treatment (300 mg⁻¹) showed the highest survival rate 3.16 for chitinase gene and 2.5 for calli treated with Gus gene. Among washing duration treatments, 45 minutes washing have shown best results in calluses treated with chitinase gene (3.08) and Gus gene (3.08) than remaining all other treatments. The maximum i.e. 2.83 transformation efficiency rate was achieved at 10 mg⁻¹ of hygromycin for selection of transformed calli. Highest (2.25) transformation efficiency and survival rate was yielded when kanamycin was used at the rate of 100 mg⁻¹. Five out of 8 calli showed positive expression and 62.5 % transformation efficiency through histochemical GUS assay. The presence and stable integration of transgenes in transgenic calli was confirmed by PCR in case of infection with chitinase gene. Present results navigated that optimization for genetic transformation was simple and efficient technique, could be helpful for further genetic improvement against fungal disease, reduce the demand of fungicides and also overcome the hazardous health and environmental risks.

OPBG 16

THERAPEUTIC HORTICULTURE: INFLUENCING PSYCHOLOGICAL RESPONSES OF SURGICAL PATIENTS AND THEIR ENVIRONMENTAL ASSESSMENT SCALE

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Therapeutic impact of foliage plants and flower arrangements were evaluated on the post operative recovery of surgical patients in hospital wards. Two hundred and seventy surgical patients were randomly assigned to hospital wards with plants and without plants representing ward A and ward B, respectively, making a lot of one hundred and thirty five patients in each comparing ward. Eight species of flowers and foliage plants were placed in ward A. Various methods like Patient's questionnaire, small group discussion with ward nurses and focal interviews with ward doctors were used for collecting patient's data. Data collected includes patients' physiological status evaluating traits viz., ratings of patient's anxiety, fatigue, pain intensity and patient's social behavior, Environmental Assessment Scale, Patient's personal preferences for plants and flowers and intake of postoperative analgesics. Statistically analysis of data was done through Statistical Package for Social Studies (SPSS) by using chi-square test. More effective health signs were observed for patients admitted in the ward A than those in the ward B. Patients admitted in ward A had significantly fewer consumption of postoperative analgesic because of exhibiting more controlled and normal psychological and cognitive responses. Patients' stays in plants and flowers experienced less intensity of pain, anxiety, fatigue, elevated mood and were socially more active and friendly towards other patients and nursing staff, expressing more positive feelings and satisfying comments about their ward when compared with patients in the control group i-e., ward B. A more calm, soothing and pleasing ward environment was described by patients stayed in ward with plants and flowers in comparison to patients in no plants ward. Additionally most of the patients in ward A preferred Cut flowers, especially red color roses over the green and variegated foliage plants. Furthermore, Small group discussion and focal interviews with nurses and doctors affirms that arrangement plants and flowers in hospitals is an effective, inexpensive and more productive complementary approach in medical field for surgical patients. These findings confirm and approve the application of therapeutic horticultural approach for patients in hospitals.

OPBG 17

FORAGE YIELD AS AFFECTED BY COMMON VETCH IN DIFFERENT SEEDING RATIOS WITH WINTER CEREALS IN POTHOWAR REGION OF PAKISTAN

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In rainfed area of Pothowar, there is little trend to inter or mix crop the cereals with legumes for production of nutritious forage. The main problem for raising livestock in these areas is the provision of green fodder for animal during winter months. The livestock community has no option except to feed wheat straw and summer cereal stalks to their livestock which are nutritionally not rich source of feed for animals. Therefore, an experiment was conducted to evaluate the forage yield of three winter cereals viz: oat, wheat and barley by mixing with vetch legume in three different ratios as 87:13, 75:25, 50:50 in addition to establish pure stands of cereals as well as vetch to find out the best yielding seeding combination. The experiment was conducted at University Research Farm (URF) Chakwal Road PMAS-Arid Agriculture University Rawalpindi during winter 2010 -2011. From the results it was concluded that cereal - vetch combination in 75:25 seeding ratio performed better in terms of green as well as dry matter yield production irrespective of mixed cereal crop. Land equivalent ratio showed that oat-vetch, barley -vetch and wheat - vetch 75:25 seeding ration resulted 1.06, 1.04 and 1.10 LER values which clearly indicates the advantage of cereal-vetch combinations over pure stands. Similarly, oat-vetch, barley- vetch and wheat-vetch in 75:25 seeding ration resulted 6.16%, 4.8% and 10.00% higher water use efficiency (WUE) and an average 16.28 %, 16.80% and 23.90% higher photosynthetic active radiation (PAR) values than their respective pure stands indicating the efficient utilization of natural resources. The wheat-vetch, oat-vetch and barley 75:25 seeding ratio produced 7 %, 4% and 5% respectively higher green forage yield than their respective cereal crops sown in pure stand. The number of tillers and leaves per plant increased with the increase of seeding proportion of vetch plants in the respective mixtures clearly indicating the beneficial effect of cereal -legume mixture on forage yield.

OPBG 18

VIRULENCE PATTERN OF STRIPE RUST (*PUCCINIA STRIIFORMIS*) IN PAKISTAN

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Wheat stripe rust (Yellow rust disease) caused by fungus *Puccinia striiformis* f.sp. *tritici* is the major problem of wheat production in the most parts of Pakistan and appears every year in the country. Monitoring of the pathogen virulence factors and their changes provides basic information for the development of an early warning system to breeders and researchers. To monitor the yearly regular virulence changes of yellow rust, a nursery specially designed comprised of yellow rust differentials received from ICARDA and released Pakistani commercial wheat varieties were planted at hot spots of yellow rust for the five consecutive years 2005-2010. Upon the appearance of high infection and severity under natural infection on susceptible variety Morocco (universal check) the response of each line was assessed. In five year studies, the lines showed the similar behavior at all the tested location. Results revealed that no virulence was observed on yellow rust resistance genes *Yr3*, *Yr5*, *Yr10*, *Yr15*, *YrSP*, and *YrCVat* all locations. Virulence on genes for yellow rust resistance *Yr1*, *Yr2*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr24*, *Yr26*, *Yr27*, *Yr28*, *Yr29* and *Yr31* was common during 5 years of study at almost all locations. Some isogenic lines in different genetic background responded differently. Wheat commercial varieties showed erratic pattern. Seher-2006 leading wheat variety was found resistant to yellow rust at all tested locations. Newly released wheat varieties Faisalabad-2008, Lasni-08, Aas-2010, Hashim-08, Janbaz, Ghaznavi, BARS-2009, NIFA-Barsta10, NARC-2009 and AARI-2010 were found effective against the prevailing races of yellow rust. Year 2007-08 was totally escaped for yellow rust in the Pakistan.

OPBG 19

MOLECULAR GENETIC VARIATION FOR STRIPE RUST RESISTANCE IN PAKISTANI SPRING WHEAT

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Stripe rust caused by *Puccinia striiformis* f. sp. *tritici* is one of the major biotic constraints to wheat production throughout the world. Stripe rust can be effectively controlled by developing resistant wheat varieties. This, however, requires identification of resistant sources to be used as parents in breeding programs. Molecular markers provide a quick way of detecting rust resistance genes in adapted wheat material. The present study was conducted to detect stripe rust resistance genes in 60 Pakistani adapted spring wheat varieties using 11 pairs of microsatellite and sequence tagged site markers. In this study, maximum frequency of stripe rust resistance gene was observed for *Yr26* (72-80%) followed by *Yr5* (45%), *Yr10* (30%), *Yr9* (25%), *Yr18* (8-15%) and *Yr17* (11%), respectively. Results of this study can help wheat breeders in pyramiding rust resistance genes in future wheat varieties using Marker Assisted Selection.

OPBG 20

NUMBER OF GENES AND THEIR EFFECTS CONTROLLING GRAIN FILLING DURATION IN TWO WHEAT (*TRITICUM AESTIVUM* L.) CROSSES

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Genetic effects for grain filling duration (GFD) were determined in two bread wheat combinations (B-92 x Frontana: Cross 1; Inqilab-91 x FS: Cross 2) during 2006-07 and 2008-09. The genetic effects were determined by using joint segregation analysis (JSA) as statistical procedure designed for six basic populations P₁, F₁, P₂, B₁, B₂, and F₂. The results indicated that the trait in the crosses was controlled by mixed action of two major genes along with polygene with their additive and dominant effects. Negative additive effects were found due to both first and second major genes in the crosses in both years indicating that the major genes may affect the trait adversely except cross 1 during first year where the additive effect was positive due to the second major gene. However, positive additive effects due to polygene were observed in the crosses during both seasons. Transgressive segregates for both long and short GFD indicated the dispersion of favorable and adverse genes in the parents. Major genes heritability for the trait was higher compared to that of the polygene in B₁, B₂ and F₂ for the crosses with highest environmental influence. Additive genetic effect of major genes and polygene were pronounced thus selection of desirable recombinants for both short and long GFD may be delayed up to advance generations such that maximum favorable genes are accumulated in the recombinants.

OPBG 21

ACIDOVORAX AVENAE SUBSP. AVENAE FIRST TIME CAUSING RED STRIPE OF SUGARCANE IN PAKISTAN**M. I. HAQUE^{1*} AND SYED ZIA-UL-HUSSNAIN²**¹*Department of Plant Pathology, Pir Mehr Ali Shah (PMAS) Arid Agriculture University Rawalpindi, Pakistan*²*Department of Plant Pathology, Pir Mehr Ali Shah (PMAS) Arid Agriculture University Rawalpindi, Pakistan***Corresponding author's e-mail: irfan52@uaar.edu.pk*

Acidovorax avenae subsp. *avenae* is the causal agent of red stripe disease of sugarcane, an important new disease appeared from the last two years on the sugarcane promising clones in Punjab Province, Pakistan. Watery green stripe near the midrib of the leaf was observed on promising clones of sugarcane viz: NSG-49, CPSG-2453, CP-NIA-82-223, CSSG-2402 and US-114 planted during autumn 2009-2011. Bacterial colonies were obtained from infected leaf of the variety CSSG-2402 on yeast extract dextrose chalk agar (YDC) media. The isolate were tested for gram reaction, oxidase, urease production, citrate utilization and catalase activity. DNA was extracted and 1500bp 16S rRNA gene was amplified by using universal primer. Amplified product has been purified and in the process of sequencing for the identification of *Acidovorax avenae* subsp. *avenae*. On the bases of morphological appearance, biochemical and molecular characterizations bacteria was identified as *Acidovorax avenae* subsp. *avenae*. The strain was detected by direct antibody coating Enzyme Linked Immunosorbent Assay (DAC-ELISA) using antiserum raised against *Acidovorax avenae* subsp. *avenae*. 27 Clones were used for ELISA test at 405 nm. The bacterium suspension (5×10^7 CFU/ml) was prepared from freshly grown pure culture of *A. avenae* subsp. *avenae* for inoculation into the growing points. The pathogen was re-isolated from the inoculated plants and identified as *A. avenae* subsp. *avenae*. To our knowledge this is the first report of red strip of sugarcane in Punjab province of Pakistan.

OPBG 22

THE EFFECT OF PLANTING DATE, IRRIGATION AND NITROGEN ON SOME TRAITS OF FORAGE MILLET (*PENNISETUM AMERICANUM* VAR. NUTRIFEED)**MOHAMMAD JAVAD SEGHA TOLESLAMI¹, GHOLAMREZA MOUSAVI² AND MAHDI JAFARI³**¹*Associated professor of Islamic Azad University, Birjand branch, Iran*²*Assistant professor of Islamic Azad University, Birjand branch, Iran*³*Former M.Sc. Student of Islamic Azad University, Birjand branch, Iran*

In order to study the effect of irrigation, nitrogen and planting date on forage millet an experiment was conducted in Nehbandan, Iran in 2010. A double split plot design based on randomized complete block with three replications was used. Two planting dates (21st May and 9th June), two irrigation intervals (one and two weeks) and three nitrogen levels (75, 150 and 225 kg ha⁻¹) were as main plot, sub plot and sub sub plot, respectively. The results showed that planting date, irrigation interval and nitrogen levels had a significant effect on the most measured traits. The second planting date (9th June) reduced significantly plant height, stem diameter and leaf to stem ratio, but increased tiller number per plant and biomass yield. Although every other week irrigation significantly declined plant height, stem diameter, tiller number per plant, biomass yield and WUE, but increased leaf to stem ratio. Nitrogen application increased significantly all above mentioned traits. Interaction of irrigation and nitrogen on WUE was significant. In weekly irrigation treatment (non stress condition) application of 225 kg ha⁻¹ N compared to 75 kg ha⁻¹ N, increased WUE, but in every other week irrigation treatment (water stress condition) high quantity nitrogen application decreased WUE. In conclusion the highest biomass yield was obtained in the second planting date, weekly irrigation and application of 225 kg ha⁻¹ nitrogen.

OPBG 23

WHEAT RESPONSE TO VARIOUS TILLAGE-HERBICIDE INTERACTIVE SYSTEMS UNDER SEMI-ARID CLIMATE**M. RAMZAN ANSER², FAISAL ZAHOOR¹, MUHAMMAD AZIM MALIK², KHALID MAHMOOD¹, MUSHTAQ HUSSAIN KAZMI¹, MUHAMMAD RAHEED² AND S. H. RAZA³**¹*Department of Agronomy, Faculty of Agriculture, Rawalakot, University of Azad Jammu & Kashmir*²*Department of Agronomy, PMAS-Arid Agriculture University, Rawalpindi*³*Institute of Plant Nutrition, Olshausenstr 40-60 24098, CAU Kiel, Germany*

Rainfed wheat is the major stay of resource-poor farming communities to earn livelihood in drought and erosion hit northern region of Punjab (Pothwar) where it is grown in rotation with summer fallow. Intensive tillage system involving one deep ploughing with Moldboard plough at the onset of monsoon during summer followed by 7-8 shallow cultivations during the fallow period (till wheat sowing) has been regarded as one of the best management practice (BMP) to control weeds and harvest rainwater in soil profile for succeeding wheat. However, the trends of farmers shifting to conservation tillage in dryland areas with Eco-fallow management system lead us to conduct a field studies to develop alternate, farmer friendly and sustainable tillage systems. This research evaluated the impact of various tillage-herbicide interactive systems on in situ rainwater harvesting and wheat yield. The experiment integrated glyphosate as eco-fallow management. The experiment was laid out in Randomized Complete Block Design with three replications and net plot size of 14 m x 10 m. Wheat cultivar “GA-2002” was planted as a test crop. The data showed the superiority of conservation tillage in terms of conservation of moisture and increasing wheat grain yields. Results also elaborated that tillage cannot be completely eliminated for profitable fallow management. However, deep ploughing with moldboard followed by single application of glyphosate proved potential option for substituting shallow tillage carried out during summer season. The additional benefits under this tillage system included saving in fuel, labour and lower depreciation and maintenance costs for tillage machinery in addition to unquantifiable environmental benefits.

OPBG 24

IMPROVEMENT IN FRUIT YIELD, QUALITY AND FRUIT DROPPING CONTROL IN KINNOW (*CITRUS RETICULATA* BLANCO) THROUGH APPLICATION OF GROWTH REGULATORS, POTASSIUM AND ZINC

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Kinnow fruit (*Citrus reticulata*) is one of the best commercial fruits of Pakistan. It is cultivated on a large area in the Punjab province due to its reasonably higher yield, quality, taste and flavor than those of the other citrus fruits. However, its average yield in Pakistan is far below than that of the other citrus growing countries of the world. Fruit dropping is one of the promising reasons of low citrus fruit yield in Pakistan, which is thought to be mainly due to hormonal imbalance in the plants. This imbalance may occur due to nutrient deficiency in soils of orchards, water shortage and insect pest attack to the citrus trees. Therefore, some experiments were conducted to assess the influence of growth regulators [2-4 D and salicylic acid (SA)] and nutrients like potassium (K) and zinc (Zn) to improve yield and quality of citrus fruit and control the fruit drop at four selected sites in the citrus growing tract of Punjab, Pakistan. Foliar applications of 2-4 D, SA, K and Zn significantly improved the number of fruits per plant, fruit weight, juice percentage, total soluble solids (TSS), acidity, ascorbic acid, and TSS/acid ratio and reduced the fruit drop. Application of 2-4 D + K + Zn and SA + K + Zn showed beneficial effects on all the afore-mentioned parameters.

OPBG 25

TAILORING SOME COARSE AND FINE RICE GENOTYPES FOR LOW-ZINC-INPUT SUSTAINABLE AGRICULTURE

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Rice genotypes differ in their zinc (Zn) deficiency tolerance. Genotypes with high Zn-use-efficiency are considered part and parcel of the low-Zn-input sustainable agriculture. To explore genotypic differences in response to Zn deficiency, a hydroponics experiment was conducted with 20 salt-tolerant and salt-sensitive rice genotypes including IR-36 as Zn efficient check using completely randomized design. One hundred seeds (sterilized with 1% sodium hypochlorite for 3 minutes) of each rice genotype were germinated in Petri dishes for 6 days. These seedlings were then transplanted in an aerobic chelate-buffered nutrient solution. Three levels of Zn activities (2, 10 and 40 pM) were imposed for 35 days in hydroponics' tanks. The pH of nutrient solution was maintained between 5.4 and 5.6 using 3.0 mM 2-(4-morpholino)-ethanesulfonic acid (MES). Phosphorus supplement was checked to avoid toxic levels of P accumulation at 2 pM (Zn²⁺) activity. Zinc efficiency varied 26.7 to 71% among the tested genotypes. Seven genotypes proved to be Zn-efficient, 05 Zn-inefficient, and the left-over 12 were classed as intermediate. The rice genotypes Shua-92, Shandar, IR-36 and IR-8 were the most Zn efficient whereas, RG-120, Sarshar and Latifee were observed as most Zn inefficient. Zn-efficient genotypes extracted more Zn in their shoots than inefficient genotypes, but the correlation between shoot Zn and shoot dry matter production was poor. All the genotypes accumulated higher concentrations of iron (Fe), copper (Cu), manganese (Mn), and phosphorus (P) at Zn deficient level as compared to adequate levels.

OPBG 26

VARIATION AND DISTRIBUTION IN SEED STORAGE STARCH AMYLOSE CONTENT AND ITS ASSOCIATED 60KD WAXY PROTEIN BAND IN PAKISTAN RICE GENETIC RESOURCES

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Starch is one of the principal constituent (constituting about 90% of its dry weight) of rice grain determining the cooking quality. Cooked grain resistance to disintegration is also related to amylose content, with high amylose rice being the most resistant and waxy rice the least resistant. Due to the importance of variation and mutation in genetical studies and being material source for improvement in existing varieties, search for diversity (apparent amylose content) in rice was carried out. A large variation was recorded for the apparent amylose content as determined by colorimetric method. The amylose content ranged between 5 to 30%. The geographical distribution of amylose content in the four regions of collection showed that the widest variation was recorded from Khyber Pakhtunkhwa/Northern Areas. In Pakistan rice cultivars two types of banding pattern was observed for 60kD waxy protein band, which is related to the synthesis of amylose. The 60kD high type which is *Wx^a* and mainly present in IR36 types was dominant in Pakistan rice cultivars (89.3%), while, the 60kD low type were only 10.7%. The 60kD high types were distributed in all locations while the 60kD low types were mainly found in the Khyber Pakhtunkhwa / Northern Areas. This study suggests that greater diversity exist in Khyber Pakhtunkhwa and NA of Pakistan for starch characteristics and genetic erosion has occurred in Punjab probably due to introduction of improved varieties.

OPBG 27

PERFORMANCE EVALUATION OF COMMON CLEMENTINE ON VARIOUS ROOTSTOCKS

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Common Clementine (*Citrus clementina* Hort. Ex Tan.) was grafted on nine rootstocks i.e. Kryder Trifoliolate, Towne Trifoliolate, Rich Trifoliolate, Beneke Trifoliolate, Holansis Trifoliolate, AA18 Trifoliolate, Gou Tou Sour orange, Da Hong Pao Mandarin and Carrizo Citrange during 1992. The grafted plants flowered in 1996 and these were evaluated for fruit yield and quality over a period of 12 years (1996 – 2007). Fruit yield was inconsistent with great variation when Clementine scions were grafted on Gou Tou Sour orange and Da Hong Pao Mandarin. The rootstock Carrizo Citrange resulted in significantly higher and Da Hong Pao Mandarin significantly lower average fruit yields for the last four years of trial. However, Holansis Trifoliolate gave maximum percentage of large sized fruits, followed by Kryder Trifoliolate and Towne Trifoliolate. Significantly higher percentage for medium sized fruits was recorded in case of Da Hong Pao Mandarin, followed by Gou Tou Sour orange. Maximum average fruit weight was recorded for Kryder Trifoliolate and Holansis Trifoliolate, followed by Towne Trifoliolate, Rich Trifoliolate, AA18 Trifoliolate, Beneke Trifoliolate, Carrizo Citrange and Da Hong Pao Mandarin. Juice percentage in Clementine fruits was significantly higher for Carrizo Citrange and all the Trifoliolate rootstocks except AA18 Trifoliolate which stood at par with Gou Tou Sour orange and Da Hong Pao Mandarin. Total soluble solids were also significantly higher for all the trifoliolate rootstocks followed by the Carrizo Citrange. No significant differences were found for acidity content of the juice for the rootstocks used. However, TSS: acidity was significantly higher for Carrizo Citrange, followed by Kryder Trifoliolate and Towne Trifoliolate. These results indicated that Carrizo Citrange performed better as compared to other rootstocks while Da Hong Pao Mandarin and Gou Tou Sour orange were not suitable rootstocks for common Clementine.

OPBG 28

TAGGING GENES FOR VELVET HAIRINESS IN COTTON USING RAPD MARKERS AND BULKED SEGREGANT ANALYSIS

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Trichomes also known as hairs are one of the major important morphological parameters of plant resistance to insects in cotton. The larvae of cotton pink bollworm hatching from eggs laid on the vegetative parts of cotton plants are disoriented by trichomes and hence, the number of larvae reaching the bolls is reduced. Variations in form, function and distribution of hairs within a species have been exploited in developing insect resistant cultivars. The DNA marker for the velvet hairiness trait was identified using Random Amplified Polymorphic DNA (RAPD) technique through bulked segregant analysis. A cross of velvet hairy and less hairy genotypes was made and segregating F_2 generation was developed for DNA marker studies. Out of the 320 RAPD primers used, 36 showed polymorphism among the parents. Primer GLG-6₉₇₅ showed tight linkage with the trait after segregation analysis of the individual F_2 plants. This RAPD marker may be converted into SCAR (Sequence characterized amplified regions) in future for use in molecular breeding or genetic studies.

OPBG 29

ASSESSMENT OF GENETIC DIVERSITY IN STRIPE RUST RESISTANT NUWYT LINES USING MICROSATELLITE MARKERS

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Stripe rust is one of the most devastating diseases, caused by *Puccinia striiformis f. sp. tritici*, affecting a huge amount of wheat crops worldwide. In this study, the genetic diversity of 16 National Uniform Wheat Yield Trial (NUWYT) candidate lines was evaluated by using 22 screened microsatellite markers. These lines were found resistant for stripe rust at adult plant stage. Microsatellite markers identified 16 loci and detect a total of 38 alleles, with an average of 2.375 alleles per locus. The number of alleles ranged from 1 to 5 alleles and the highest number of alleles were associated with B genome (25), as compared to D (11) and A (2) genomes. The allelic Polymorphism Index Content (PIC) reflecting the gene diversity of these microsatellite markers ranged from 0.00 to 0.66, with an average of 0.2702. The maximum PIC value of 0.6686 was observed for *xgwm* 159-5B and 0.6423 for *xgwm* 413-1B. The gene diversity ranged from 0.00 to 0.710, with an average of 0.304. The genetic similarity matrix was used to construct a dendrogram and the cluster analysis was performed by the use of UPGMA algorithm. This divided the entire 16 candidate lines into 3 main clusters on the basis of their similarity. Our results indicate that the genetic diversity among the 16 candidate NUWYT lines was very narrow.

OPBG 30

SCREENING AND STABILITY ANALYSIS OF SALT TOLERANCE WHEAT GENOTYPES UNDER FIELDS OF HIGHER SALINITIES

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Potential salt tolerant genotypes that could survive under saline fields of Electrical Conductivity (EC) ranging between 15-20 dS m⁻¹ were selected for screening under salinity levels ranging between ECe20-25dS m⁻¹. The objectives were i) to test the extent of salt tolerance in the test material and ii) identification of and stable wheat genotype. Experiment of was conducted in the saline fields of Pacca Ana near Faisalabad in 2004 in split plot design with three replications: salinity treatments as main plot and wheat genotypes as subplot. The harvesting was made from the one meter square plot and grain yield (Gram plot⁻¹) was calculated. Of the ten genotypes, 3 along with both tolerant and sensitive varieties planted as check could not germinated. The remaining 5 genotypes exhibited grain yield in the range of 14.4-1.6 g m⁻². These five genotypes along with sensitive check were studied for stability parameters. Analysis of variance for genotypes, environment and their interaction based on means over replicate indicated highly significant ($p < 0.001$) differences. Three lines deviated non-significantly, one significantly ($p < 0.05$) while the sensitive check and genotype WL-1073 deviated highly significantly ($p < 0.001$) from zero. Overall mean values for grain yield also differed significantly. Two lines exhibited grain yield more than the average yield of all the six genotypes. Linear regression coefficient (bi) and deviation from regression (S2d): the two stability parameters also indicated significant differences

($p < 0.01$ and 0.001) in individual genotypic response towards salinity as their values ranged between 0.37 (L-9) and 1.84 (L-22). None of the genotypes exhibited bi-value equal to 1.0 although, value of Chakwal-97 was nearly equal to 1.0 while WL-1073 exhibited the highest bi-value (1.84) followed by WL-1076 (1.64) and Inqlab-97: sensitive check (0.75). Significant variations were also observed in deviation from regression. None of the genotypes exhibited S^2d value equal to 0. This paper will describe details and significance of these observations.

OPBG 31

GENETIC DIVERSITY IN BASMATI AND NON-BASMATI RICE VARIETIES BASED ON MICROSATELLITE MARKERS

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Molecular markers are useful tools for evaluating genetic diversity and determining cultivar identity. The purpose of this study was to evaluate the genetic diversity within a diverse collection of rice (*Oryza sativa* L.) accessions, and to determine differences in the patterns of diversity within the aromatic and non-aromatic rice varieties. Forty rice accessions were evaluated by means of 24 microsatellite markers distributed over the whole rice genome. A total of 66 alleles were detected at 24 SSR loci, and the number of alleles per marker ranged from 2 to 4, with an average of 2.75. Polymorphism information content (PIC) value ranged from 0.0476 (RM315) to as high as 0.5993 (RM252), with an average of 0.3785 per marker. The average genic diversity over all SSR loci for the 40 genotypes was 0.4477, ranging from 0.0488 to 0.6638. Major allele frequency ranges from 0.4250 to 0.9750, with an average of 0.6472. The dendrogram based on the cluster analysis by microsatellite polymorphism, grouped 40 rice cultivars into three groups effectively differentiating basmati cultivars from non-aromatic cultivars. These results could be useful for monitoring purity, genotype identification and for plant variety protection.

OPBG 32

INTEGRATION OF NOVEL CHLOROPHYLL GENES FROM BLACK PINE INTO THE CHLOROPLAST GENOME OF TOBACCO

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Gymnosperms owing the presence of dark-operative protochlorophyllide oxidoreductase pathway are able to reduce protochlorophyllide to chlorophyllide leading to the formation of chlorophyll in dark, whereas angiosperms are unable to do this and are less photosynthetically efficient. Plastid encoded genes *chlL* and *chlN* are reported to be involved in the functioning of the enzyme Dark-operative Protochlorophyllide Oxidoreductase (DPOR). The genes were isolated from black pine and cloned into the species-specific chloroplast targeting vector; harboring FLARE-S, a fluorescent selection marker. The final transformation vector was used to introduce genes into the tobacco chloroplast genome using biolistic approach. Here, we report stable integration of both genes along with translationally fused marker genes (*gfp* and *aadA*) into the inverted repeat region of plastome which was confirmed by Polymerase Chain Reaction and Southern blot analysis. Morphological and physiological analyses of the transgenic plants compared with non-transformed wild type tobacco plants revealed that the activation of dark-operative pathway requires additional factors/genes to *chlL* and *chlN* genes to regulate the plant cell machinery.

OPBG 33

GENETIC DIVERGENCE IN TARAMIRA (*ERUCA SATIVA* L.) GERMPLASM BASED ON QUANTITATIVE AND QUALITATIVE CHARACTERS

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The breeding potential of the *Eruca sativa* (Taramira) genotypes held in IABGR gene-bank has not been exploited to date. A total of 100 *Eruca sativa* genotypes collected from various eco-geographical regions of Pakistan were assessed to estimate the phenotypic diversity for various quantitative and qualitative characters. A significant level of morphological diversity was recorded for a number of traits. The correlation coefficient analysis suggested that some traits had significant positive correlation with seed yield. Multivariate analysis was executed in order to set up similarity and dissimilarity patterns. Principal component (PC) analysis explained a high level of variation for most of the qualitative and quantitative agronomic characters. Cluster analysis suggested that genotypes were mainly grouped due to their morphological dissimilarities. Best Taramira accessions have been chosen on the basis of their most excellent agronomic performance from 100 genotypes. Our findings have an important application for *Eruca sativa* germplasm evaluation, improvement, classification and preservation in Pakistan.

OPBG 34

THE EFFECT OF NITROGEN RATE AND PLANT DENSITY ON MORPHOLOGICAL TRAITS AND ESSENTIAL OIL YIELD OF CORIANDER

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In order to study the effect of nitrogen rate and plant density on morphological traits and essential oil and fruit yield of coriander, a split-plot experiment was carried out in research field of Islamic Azad University, Birjand Branch, Birjan, Iran in 2010 based on a randomized complete block design with three replications. The main plots were nitrogen rates at four levels (0, 40, 80 and 120 kg N/ha) and the sub-plots were plant densities at three levels (30, 40 and 50 plants/m²). The results showed that nitrogen rate had significant effect on fruit yield, essential oil percent and yield traits and interaction between nitrogen rate and plant density only affected fruit yield but change in plant density significantly affected all traits except essential oil percent. Means comparison showed that as N fertilization rate was increased from 0 to 80 kg N.ha⁻¹, plant height and fruit yield were increased by 19.8 and 74.1 %, respectively. Also, essential oil percent increased from 0.153 to 0.33% and essential oil yield was grater 2.68 times. Moreover, means comparison showed that the increase in plant density from 30 to 50 plants/m² increased plant height, first fruit distance from ground, fruit and essential oil yield by 14.3, 27.6, 31.3 and 36.8%, respectively while stem diameter and branch number per main stem were decreased by 22.2 and 13.9%, respectively. Given the results of the study, the treatment of 80 kg N/ha application with the density of 50 plants/m² recommended for the cultivation of coriander in Birjand, Iran.

OPBG 35

ANTIOXIDANT ACTIVITY AND PROTECTING ABILITY OF DIFFERENT CULTIVARS OF SUGARCANE AGAINST DNA DAMAGE

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High intake of natural antioxidants has been associated with lower incidence of chronic diseases such as cancer and heart diseases. Thus, there is need to find out the diet rich in antioxidants and phenolics. *Saccharum officinarum* was carried out to evaluate and explore new potential sources for natural antioxidants. DNA damage caused by exposure to reactive oxygen species is one of the primary causes of DNA decay in most organisms. Antioxidant activity was determined by 2,2-Diphenyl-1-picrylhydrazyl method. The phenolic content was determined by Folin-Ciocalteu's reagent. Whereas, site specific DNA damage was induced by using Fe+H₂O₂ and the gel pattern was studied using agarose gel electrophoresis. The aqueous extracts of leaves of thirteen varieties of sugarcane were studied for their antioxidant activity and protective effect on DNA damage. These varieties showed good antioxidant properties (IC₅₀ values ranged from 18.75±1.2 to 27.67±0.45 µg/ml) and possess strong capability to protect DNA damage induced by hydroxyl radical generated in Fenton reaction. The high antioxidant activity and DNA protecting ability of sugarcane may be due to their phenolic content.

OPBG 36

CLIMATE CHANGE IMPACT ON SUNFLOWER PRODUCTIVITY UNDER AGRO-ENVIRONMENTAL CONDITIONS OF PAKISTAN: SIMULATION & FIELD STUDY

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Sunflower is the world's third most important oil-producing crop, accounting for about 13% of the total world edible oil production. Local availability of edible oilseeds in Pakistan hardly meets the demand and this is the scenario since decades. It is much susceptible to climatic variables and hence climate could have significant effect on its production. The present study of simulation evaluates the impact of climate change on sunflower crop in contrasting agro-environments of the Punjab-Pakistan. The validated model (OILCROP-SUN model) has reasonably predicted phenology, crop growth and yield of sunflower crop. The crop was found to be sensitive to changes in carbon dioxide (CO₂) and temperature. Future climate change scenario analysis showed that sunflower yields are likely to reduce in both irrigated and rainfed conditions. The increase in CO₂ concentration from 360 ppm to 550 ppm has no effect on crop duration at different experimental locations. On the other hand, total dry matter (TDM) will increase with increased CO₂ concentration. Difference in the average values of crop duration in sunflower hybrids were 2.22%, 3.88% and 4.37% at Multan, Faisalabad and Gujranwala experimental locations, respectively. The achene yield was also significantly affected by the increase in CO₂ concentration from 360 ppm to 550 ppm at all the experimental locations. These effects gave maximum with differences of 4.23% at Gujranwala, followed by Faisalabad with the difference of 3.87% and minimum difference 2.14% was observed at Multan experimental locations, respectively with 550 ppm CO₂. Results of present study showed that, increasing temperature will shorten crop duration from planting to physiological maturity (with difference of almost 14 days in 2020's and 21 days in 2050's, respectively), thus retards the growth and development and ultimately decreased the yield than current situation at all the experimental locations. Future studies for possible effects of climate change on field crop production should therefore includes, more number of weather stations to better reflect the heterogeneity in different cropping areas. Standardization of field crop production technology through crop growth models should be initiated. Development of site specific mitigation strategies to enhance agricultural productivity under changing climate scenarios.

OPBG 37

AGRONOMIC EVALUATION OF COTTON (*GOSSYPIUM HIRSUTUM* L.) ADVANCED STRAINS FOR FIBER QUALITY AND YIELD PARAMETERS UNDER TANDO JAM ENVIRONMENTAL CONDITIONS

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Forty three advanced strains of cotton (*Gossypium hirsutum* L.) were evaluated along with three commercial check varieties Sadori NIA-ufoq and CRIS-134 at Nuclear Institute of Agriculture (NIA), Tando jam during 2011-2012 for their fiber quality and yield parameters. The trial was conducted in RCBD with three replicates. Five plants from each entry of random selected for taking fiber quality and yield parameters. The data were recorded on sympodial branches plant⁻¹, boll weight plant⁻¹, seed index (g), staple length (mm), ginning out turn %, micronaire µg inch⁻¹ and seed cotton yield kg ha⁻¹. Five strains were higher (26-28) in sympodial branches plant⁻¹ than check varieties (24-18), seven strains were boll weight ranging from (3.06g - 3.50g) than check varieties (2.27 g - 2.57g). Eight strains gained higher seed index ranging from (7.06g to 7.76g) than check varieties (6.50g - 6.86g), eleven strains possessed more staple length (28.03mm - 29.83mm) than check varieties (27.14mm - 28.00mm). Five strains were higher in ginning out turn percent (36.47% - 40.68%) than check varieties (35.42% - 36.37%). Two strains took fine fiber (3.36-3.38) and rest of strains and checks are medium micronaire values (4.00-4.40). Similarly seven advanced strains had significantly more seed cotton yield kg ha⁻¹ ranging from (4240-4867 kg ha⁻¹) than check varieties (2959-4100 kg ha⁻¹).

POSTER ABSTRACTS

PPBG 1

PHENOLOGY AND ACCUMULATIVE HEAT UNIT OF VARIOUS WHEAT CULTIVARS UNDER LATE SOWING HIGH TEMPERATURE

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Delay in wheat sowing in rice-wheat cropping system is perhaps the one of the major factors responsible for low crop yield. This reduction in yield is due to the sub-optimal temperature during the different phenological stages of wheat crop. Therefore, phenological performance of five newly developed wheat varieties (viz. Lasani-2008, Faisalabad-2008, Shafaq-2006, Sahar-2006 and Inqlab-91) were evaluated under two growing environments; one is normal growing environment (sowing at November 10) and the other is heat stressed environment (sowing at December 10). Results indicate that normal sowing took more number of days to attain different phenological stages, higher accumulative heat unit and heat use efficiency as compared to the late sowing. In case of late sowing, the varieties phased a significant level of high temperature stress that also significantly affected the required days to attain crown roots, tillering, booting, heading, anthesis, grain filling and maturity of all varieties including the yield as compared to normal sowing. Under late sowing high temperature, Faisalabad-2008 took maximum days and higher accumulative heat unit to attain all phenological stages. To conclude variety Faisalabad-2008 ontogenically being more plastic performed well under late sown high temperature conditions. Nonetheless variety Inqlab-91 was at the top when planted timely.

PPBG 2

SOME PHYSIOLOGICAL AND GENETICAL DETERMINANTS OF SALT TOLERANCE IN SORGHUM (*SORGHUM BICOLOR* L.): BIOMASS PRODUCTION AND SALINITY MEDIATED NITROGEN METABOLISM

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Salinity stress limits the crop production due to which shortage in food, feed and industrial raw materials are being observed all over the world. The plant productivity can be increased by introducing salt tolerant crop cultivars. Therefore, a study to identify the physiological and biochemical determinants for salt tolerant in sorghum was conducted under greenhouse conditions. Physiological and biochemical attributes i.e., biomass, proteins, total nitrogen, total free amino acids, nitrate reductase activity (NRA) and nitrous oxide were estimated in two salt tolerant and two salt sensitive genotypes/cultivars of sorghum. Salinity stress reduced biomass mass of shoots (22.3%) and roots (24%), total proteins (34%), NRA (13%), nitrous oxide (54%), total nitrogen of shoots (52%) and roots (45.4%) while increase in total free amino acids (37%) were recorded for all the sorghum genotypes/cultivars. On the basis of results obtained using the above physiological and biochemical traits, sorghum genotypes/cultivars JS-2002 and Sandalbar were categorized as tolerant, Noor medium sensitive and FJ-115 as sensitive one. The results also indicated that the physiological and biochemical attributes can be used to identify the salt tolerant and sensitive sorghum genotypes/cultivars leading.

PPBG 3

MODELING GROWTH, DEVELOPMENT AND SEED COTTON YIELD OF PROMISING COTTON CULTIVARS AT VARYING NITROGEN INCREMENTS WITH DIFFERENT PLANTING DATES UNDER DSSAT

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CSM-CROPGRO-Cotton Model under DSSAT V 4.0.2.0 was used for dynamic simulation of development, growth and seed cotton yield of four cotton cultivars (CIM-496, CIM-506, NIAB-111 and SLH-284) at varying N increments (50, 100, 150 and 200 kg ha⁻¹ sown at different timings (20 May and 10 June) at three locations (Faisalabad, Multan and Sahiwal). Model performance was satisfactory for crop phenology at all locations with a % error of 1.49 and RMSE 0.68. According to model simulations May sown crop maturity ranged between 172 to 176 days as against June sown which took between 147 to 153 days which were in close proximity with the observed values at three locations. As regards canopy development the simulated and observed values were much closer to each other with low root mean square error ranging from 0.79 to 1.26. Leaf area index prediction was 4.17 compared to observe 4.16 values for May sown and 3.22 to 3.17 in June sown crop. Coefficient of regression for the pooled data was 0.87 but values were higher at different locations. Model overestimated total dry matter at all locations with low RMSE of 289.52 kg ha⁻¹ giving strong relationship of 95 % between simulated and observed data. CROPGRO-Cotton Model over predicted by 8 % of simulated seed cotton yield in early sown than late sown. Root mean square error for low Nitrogen (50 kg ha⁻¹ application crop was 42-198 kg ha⁻¹ than high dose of N (200 kg ha⁻¹) that ranged between 95-195 kg ha⁻¹. Coefficient of regression for different locations ranging from 0.93 to 0.99 and for pooled data 0.994 %. Overall Model performance under DSSAT was good. There is a dire need to assess impact of climate variation on seed cotton yield under various climatic regions to ensure fiber quantity in future.

PPBG 4

PHYSIOLOGICAL EXPRESSIONS AND DRY MATTER PRODUCTION OF MAIZE (*ZEAMAYS L.*) IN RESPONSE TO TILLAGE AND NITROGEN APPLICATION

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Subsoil compaction and injudicious use of nitrogenous fertilizers are the key factor for lowering the maize yield which can be improved by ameliorating the subsoil compaction and proper application of nitrogen. Physiological expressions and dry matter production of maize (*Zea mays L.*) in response to tillage and nitrogen application was studied through two years field experiments conducted at University of Agriculture Faisalabad, Pakistan during 2008 and 2009. The experiments comprised of three tillage systems (conventional tillage, tillage with mouldboard plough + 2-cultivations and tillage with chisel plough + 2-cultivations) and three nitrogen rates (100, 150 and 200 kg ha⁻¹) laid out in randomized complete block design (RCBD) with split plot arrangement replicated thrice. Tillage systems and nitrogen levels significantly affected physiological attributes and dry matter production in maize. Significantly larger leaf area index, leaf area duration, crop growth rate and dry matter obtained from chisel tilled plots compared with other tillage systems. Increasing nitrogen application rate resulted in increased maize physiological attributes and dry matter production. Significantly larger leaf area index, leaf area duration, crop growth rate, dry matter production and harvest index recorded with 200 kg ha⁻¹ nitrogen application. Therefore, it may be concluded that maize hybrids should be grown with 200 kg ha⁻¹ nitrogen application by preparing the field with chisel plough followed by cultivator to obtain higher dry matter yield.

PPBG 5

PRELIMINARY STUDIES OF ASSOCIATION MAPPING IN COTTON

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To the extent of our knowledge conventional DNA marker studies and finding their utilities in marker-assisted breeding are handicapped in cotton due to low genetic diversity. Cotton leaf curl disease (CLCuD), a disease of viral origin, has substantially depresses cotton production in Pakistan, thus a major handicap in achieving sustainability. Disease was also reported in neighboring countries like China and India. The present study was designed to find out the DNA markers—predominately simple sequence repeats (SSRs) associated with the genes conferring tolerance and or resistance to CLCuD followed by testing their efficacy in marker assisted breeding in cotton. Initially, a total of 10 cotton genotypes (five highly tolerant and five high susceptible) of diverse origin were selected for the study including nine *Gossypium hirsutum* accessions and one *Gossypium arboreum* accession (immune to the disease). We surveyed 322 SSRs derived from bacterial artificial chromosome (BAC) ends of *Gossypium raimondii* genome sequences. Out of these, 65 primer pairs were polymorphic. The polymorphism percentage was 20.18 and the extent of genetic similarity was in the range of 81.7% to 98.7%. The similarity matrix was used for studying their phylogenetic relationship using

unweighted pair group method of arithmetic means (UPGMA). Dendrogram showed grouping of genotypes in two distinct clusters comprising of tolerant and susceptible genotypes except *G. arboreum* confirming its distinct origin. The *G. arboreum* is a diploid species and is one of the progenitors of cultivated tetraploid species. Out of the polymorphic markers, two SSR markers PR-91 and CM-43 that were amplified in tolerant genotypes which were subsequently surveyed on 185 cotton genotypes. The markers were present in 23 highly tolerant cotton genotypes building a strong association between resistance trait and marker. These preliminary results set a stage for doing in depth marker-trait association studies which will be instrumental for initiating marker assisted selection.

PPBG 6

ASSESSMENT OF SALT TOLERANCE AMONG DIFFERENT SUNFLOWER ACCESSIONS

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Twenty sunflower (*Helianthus annuus* L.) accessions were evaluated against three different salinity levels. Triplicated completely randomized design was followed. Salinity was developed with NaCl to achieve the final salinity levels of 3 dSm⁻¹, 6 dSm⁻¹ and 9 dSm⁻¹, whereas control contained tap water. Data of 60 days old ten seedlings from each entry was recorded and analyzed. Accessions G-36, G-61, A-23, A-6, and A-185 performed better in both controlled and saline conditions. These accessions showed better biomass production and high shoot and root growth by least concentration of Na⁺ and higher concentration of K⁺ and Cl⁻ in leaf sap resulting in better K⁺:Na⁺.
Key words: Sunflower, salinity, genetic variability.

PPBG 7

EVALUATION OF GENETIC DIVERSITY IN BREAD WHEAT (*TRITICUM AESTIVUM* L.) BY SDS-PAGE ANALYSIS

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Genetic diversity of wheat varieties are of great interest in reducing genetic vulnerability which lead to stable control of production. Wheat seed-storage proteins from 42 wheat genotypes were analyzed by sodium dodecyl sulphate polyacrylamide gel (SDS-PAGE). Electrophorogram for each variety were scored and Jaccard's similarity index (JSI) was calculated. Genetic diversity of wheat was evaluated via unweighted pair group method with arithmetic averages (UPGMA) cluster analysis by constructing dendrogram for high and low molecular weight (HMW, LMW) gluten subunit bands. The greatest similarity index (97.4%) was observed between 2SRRSN-6038 and Zarghoon-79, while the lowest similarity index (31.6%) was observed between 2SRRSN-6013 and Abadgar-93. It is concluded that seed storage protein profiles could be useful markers in the studies of genetic diversity and classification of genotypes, which can be used to improve the efficiency of wheat breeding programs in cultivar development especially in a developing country like Pakistan.

PPBG 8

BIOASSAYS GUIDED FRACTIONATION OF *CHENOPODIUM ALBUM* L. FOR EVALUATION OF ITS ANTIFUNGAL ACTIVITY TO CONTROL ONION BASAL ROT PATHOGEN *FUSARIUM OXYSPORUM* F. SP. *CEPAE*

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Present study was carried out to investigate the antifungal activity of different parts of *Chenopodium album* for the management of Fusarium basal plate rot disease of onion (*Allium cepa*) caused by *Fusarium oxysporum* f. sp. *cepae*. In laboratory bioassays, the effect of methanolic leaf, stem, root and inflorescence extracts of 0.5, 1.0, ...3.0% (w/v) of *C.*

album was investigated against growth of the target fungal species. All the extracts showed variable antifungal activity. Inflorescence extract was found to be the most effective where different concentrations of the extract reduced the fungal biomass by 24–80%. Methanolic inflorescence extract was successively extracted with *n*-hexane, chloroform, ethyl acetate and *n*-butanol in increasing order of polarity. Ethyl acetate fraction exhibited the highest antifungal activity resulting in 68–100% reduction in fungal biomass. Three fractions viz. A, B and C were isolated from ethyl acetate fraction of inflorescence extract through thin layer chromatography (TLC). TLC fraction A exhibited the highest antifungal activity with minimum inhibitory concentration (MIC) of 250 $\mu\text{g mL}^{-1}$. The present study concludes that antifungal constituents of ethyl acetate fraction of methanolic inflorescence extract of *C. album* can be used as natural fungicides for the control of basal plate rot pathogen of onion.

PPBG 9

EXPLORING THE GENETIC POTENTIAL OF *PLANTAGO OVATA* GERMPLASM

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Plantago ovata, commonly known as Ispaghol in Pakistan, is an important medicinal plant. Research about its medicinal properties is expected to increase its economic value. However, genetic potential of available *Plantago ovata* germplasm is not fully explored for utilization in crop improvement. The present experiment was conducted to study the genetic potential of 47 *Plantago ovata* accessions from India(4), Mexico(1), USA(27) and different parts of Pakistan(15) being stored at Gene Bank of Plant Genetic Resources Program, NARC, Islamabad. The experiment was planted at Cholistan Institute of Desert Studies, Bahawalpur and data were recorded for agronomic traits including plant height, tillers per plant, inflorescence length, 1000-grain weight and grain yield. Significant genetic variation was found for tillers per plant and grain yield while low variance was observed in case of plant height, inflorescence length and 1000-grain weight. Nine accessions were observed with grain yield of 60–80g per row with row length of 2 meters while three accessions had grain yield above 80g per row. These accessions are selected for future use in crop improvement. Cluster analysis using UPGMA for five agronomic traits divided the accessions into four major clusters that helped in describing the genetic diversity of germplasm.

PPBG 10

TILLAGE AND CROP SEQUENCE EFFECT ON SOIL ORGANIC CARBON FRACTIONS AND AGGREGATE STABILITY IN DRYLAND POTHWAR, PAKISTAN

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Soil organic carbon (SOC) is emerging as a key indicator for assessing sustainability of soil and crop management systems. Tillage systems and crop sequences greatly alter the SOC fraction but the effects are site specific. A field experiment was conducted in a warm subhumid subtropical dryland Pothwar of Pakistan to evaluate the effect of different tillage systems and crop sequences on soil organic carbon fractions. The treatments were arranged in a split plot design having tillage treatments (conventional tillage, CT; minimum tillage, MT and moldboard plow, MP) in main plots while crop sequences (Fallow–Wheat, FW; Mungbean–Wheat, MW; sorghum–wheat, SW; green manure–wheat, GW and mungbean–chickpea, MC) in subplots. The highest C mineralization was observed under MT tillage in combinations with SW, GW and MW rotations (447.67, 441.73 and 406.40 $\mu\text{g g}^{-1}$ soil day⁻¹ respectively). The highest particulate organic carbon (POC) was observed in the combination of MP tillage with FW crop sequence (12.17 Mg ha^{-1}), while least POC was under CC tillage with MW crop sequence (2.82 Mg ha^{-1}) and MT tillage with GW crop sequence (2.91 Mg ha^{-1}). Total organic carbon varied non-significantly between 11.45 to 12.89 Mg ha^{-1} for tillage systems and between 8.89 to 14.41 Mg ha^{-1} for crop sequences. The highest proportion of stable aggregate was observed under combinations of MT tillage with SW and MC sequence (31.25 and 27.22%, respectively), while the least aggregate stability was observed under MP tillage with MC sequence (5.00 Mg ha^{-1}). It is concluded that minimum tillage and elimination of fallow enhances active SOC fraction and soil aggregation under subtropical dryland conditions.

PPBG 11

INCIDENCE OF *BOTRYODIPLODIA THEOBROMAE* ON GUAVA ORCHARDS IN DISTRICT SHEIKHUPURA ITS CHEMICAL MANAGEMENT**ASMA SAFDAR^{1*}, SAJID ALEEM KHAN² AND M. A. SAFDAR³**¹Rice Research Institute, Kala Shah Kaku²Department of Plant Pathology, University of Agriculture, Faisalabad³Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad^{*}Corresponding author's email: asma1207@gmail.com

A survey was carried out in District Sheikhpura for the assessment of guava decline. Maximum disease prevalence (100%) and disease incidence (36%) was recorded in Tehsil Sharaqpur. Samples of plant roots, shoots and soils were randomly collected for the isolation and identification of pathogens. Colonization percentage of the *Botryodiplodia theobromae* in 1987 tissues of 326 samples was counted to be (48.84%) maximum, followed by *Fusarium oxysporum* f.sp. *psidii* (44.10%), *Phytophthora parasitica* (38.10%), *Fusarium solani* (35.10%), *Helminthosporium* spp. (15.20%) and *Curvularia* spp., (11.20%). *Aspergillus flavus* and *Aspergillus niger* were also isolated from the samples but mostly from twigs. *Rhizopus* spp. was the least frequent fungi. Isolated fungi were multiplied and purified on PDA. Most dominating isolated fungus (*Botryodiplodia theobromae*) was evaluated for pathogenicity. Management of the *B. theobromae* was done under *in vitro* and *in vivo* conditions. *In vitro* efficacy of seven fungicides viz. Carbendazim, Thiophanate-methyl, Alliette, Acrobat MZ 75/667WP, Dithan M-45 80% WP, Mancozeb 80% WP and Metalaxyl plus Mancozeb 72% WP was evaluated against *Botryodiplodia theobromae* by Inhibition zone technique at different doses viz. recommended (R), 0.75R, 0.50 and 0.25R. All the employed doses of the test fungicides significantly reduced the biomass of the test fungal species but recommended dose rate reduced more significantly. In field experiment, Carbendazim was found to be more effective than other fungicides checked in reducing the fungal infection in guava trees, suppressing the dieback and wilting resulting in significant enhancement in vegetative growth of plants.

PPBG 12

ANTIOXIDANT ACTIVITY AND LIPID PEROXIDATION OF SELECTED WHEAT CULTIVARS UNDER SALT STRESS**AURANGZEB RAO^{1*}, SYED DILNAWAZ AHMAD¹, SYED MUBASHAR SABIR², SHAHID AWAN¹, ASAD HUSSAIN SHAH¹, SYED RIZWAN ABBAS¹, SAIMA SHAFIQUE, SARDAR ALI AND FAREED KHAN¹**¹Department of Plant Breeding and Molecular Genetics, University of the Poonch Rawalakot Azad Kashmir Pakistan²Department of Eastern Medicine and Surgery, University of the Poonch Rawalakot Azad Kashmir PakistanCorresponding author's email: aurongzebrao@yahoo.com

Antioxidants and dietary fibers are compact sources that are recommended for healthy diets in whole grain foods. The antioxidant activity, total phenolic content and lipid peroxidation was estimated among fifteen cultivars of wheat which are commonly used in Pakistan and the effect of salt stress on the antioxidant activity and phenolic content was also evaluated. The two parameters had a strong correlation ($r = 0.98$) for diverse array of wheat. The results revealed that different concentrations of wheat (25-300 µg/ml) showed antioxidant activity under salt stress (i.e. electrical conductivity, 2EC, 4 EC, 8 EC and 16 EC). The inhibitory concentration (IC₅₀ values) of different cultivars of wheat ranged from 22.9 to 27.01 µg/ml. On the basis of comparison of scavenging percentage of non-stress and stressed wheat groups, we have concluded that LU26-CTR, PAS-90, BARS, NARC, WAFaq, LISANI, SEHAR, MEHRAJ and SHAFaq are salt tolerant varieties. The change of phenolic content under salt stress suggests that wheat uses antioxidant properties of phenolics as a mechanism of salt stress. Whereas, the results of lipid peroxidation has indicated that LU26-CTR, PAS-90, BARS, NARC, FSD-08, PIRSBK-09, SEHAR and SH-03 are salt resistant varieties as they showed a less percentage increase in lipid peroxidation (malondialdehyde content) compared to control at maximum dose of salt.

PPBG 13

NUTRITIONAL PROFILE, MYCOFLORA ASSESSMENT AND AFLATOXIN CONTAMINATION IN CHICKPEA (*CICER ARIETINUM L.*)**AYSESHA TANIA¹, ABIDA AKRAM¹, NAFEESA QUDSIA HANIF^{2*}, MUHAMMAD ARSHAD¹ AND ABDUL RAUF¹**¹Department of Botany, PMAS - Arid Agriculture University Rawalpindi, Romer Labs, Pakistan Rawalpindi,²Romer Labs, Pakistan-Rawalpindi^{*}Corresponding author: qudsia09@yahoo.com

Chickpea (*Cicer arietinum* L.), a very common and cultivated crop is belonging to family *Fabaceae*. During present study, fifty samples (n=50) collected from three arid districts of Punjab put forth for assessment of mycoflora, aflatoxins contamination and nutritional profile. The results revealed sixteen fungal isolates belonging to 6 fungal genera were observed in chickpea samples. Observations revealed that *A. niger*, *A. flavus*, *mucor* and *Alternaria alternata*, were predominant fungi. A total of 333 fungal isolates were identified. Co-occurrence of fungal isolates showed maximum number of fungal isolates were twelve out of sixteen (n=16), whereas, minimum number of fungal isolates were only two. The comparative study of mycoflora of three districts of Punjab showed that highest incidence of fungal flora was found in samples collected from district Rawalpindi (12 isolates) followed by Khushab district (117 isolates) and district Chakwal (isolates 96). Among chickpea samples, only two samples were found positive for aflatoxin B₁ with value 19ppb and 18 ppb of samples Khushab and Rawalpindi respectively. Fifty (n=50) chickpea seed samples were analyzed for nutritional profile. The comparative nutritional profile of chickpea seed samples of 3 districts of Punjab showed that high protein contents were found in Chakwal district (23.47%) followed by Rawalpindi district (22.96%) and Khushab district (22.79%) respectively. The moisture content of seed samples of Chakwal (6.40%) was higher followed by Khushab (5.90%) and Rawalpindi (5.52%). The higher crude fiber content was found in samples collected from Khushab district (5.89%) followed by Chakwal (5.89%) and Rawalpindi district (5.83%). Similarly, crude fat of seed samples of Rawalpindi district was 5.41% followed by Chakwal (5.09%) and Khushab (5.00%). While crude ash content of district Rawalpindi was higher i.e. 3.16% followed by Khushab (3.12%) and Chakwal (2.99%) respectively.

PPBG 14

EFFECT OF EXOGENOUS APPLICATION OF NATURAL AND SYNTHETIC GROWTH ENHANCERS ON QUANTITATIVE AND QUALITATIVE ATTRIBUTES OF TOMATO (*LYCOPERSICON ESCULENTUM*)

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In pot experiment, soil and foliar application of a natural and synthetic plant growth enhancer i.e. moringa leaf extract (MLE) and benzyl amino purine (BAP), respectively was estimated for growth and development of tomato. The treatments were control (distilled water), MLE0 (100 % pure MLE), MLE10, MLE20 and 30 (10, 20 and 30 times diluted MLE, respectively) and BAP (50 mg L⁻¹). The foliar application of BAP and MLE30 enhanced the number of vegetative and flowering branches of tomato as compared to other treatments. Whereas, soil application of MLE 30 and MLE 20 enhanced the vegetative and flowering branches, respectively. Similarly, foliar application of BAP and MLE30 showed maximum flower number and heaviest fruit weight per plant. Exogenous application of BAP or MLE 30 comparatively increased chlorophyll *a* and decreased chlorophyll *b* contents. Total soluble protein was maximum with BAP, MLE 20 and MLE 30 either soil or foliar application. In comparison, foliar spray of MLE 30 recorded maximum contents of enzymatic antioxidants superoxide dismutase (SOD), peroxidase (POD), catalase (CAT), total phenolics and fruit lycopene contents in tomato. Foliar application of MLE or BAP was more effective for tomato growth and development as compared to soil applied.

PPBG 15

GAS EXCHANGE ATTRIBUTES CAN BE VALUABLE SELECTION CRITERIA FOR SALINITY TOLERANCE IN CANOLA CULTIVARS (*BRASSICA NAPUS* L.)

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Present study was carried out to access inter-cultivar variation for salt tolerance in canola (*Brassica napus* L.) by using photosynthetic attributes including photosynthetic pigments as selection criteria. Four cultivars of canola viz. Oscar, Ac Excel, Cyclone and Dunkled were screened at 120 mM NaCl at vegetative stage. Salt stress reduced photosynthetic rate (*A*), transpiration rate (*E*), stomatal conductance (*g_s*), sub-stomatal CO₂ (*C_i*) conc. at different growth

stages. Salt stress also markedly reduced chlorophyll a, chlorophyll b and total chlorophyll contents. Generally, plant biomass declined under the salt regime of all the cultivars. Nevertheless, cultivar Dunkled had higher, Oscar and Ac Excel intermediate while; Cyclone had lower shoot and root fresh weight under saline condition. However, cultivar Cyclone was lower in chlorophyll a and chlorophyll b under the salt stress in contrast to Ac Excel. A significant variation was also shown in gas exchange attributes under the stress. Photosynthetic (*A*) and transpiration rates (*E*) was higher in Dunkled than of Oscar and Cyclone under the stress. On the basis of data, it may be concluded that fresh weight of shoot and root had positive correlation with physiological photosynthetic rate (*A*) among all the four cultivars; thus, photosynthetic rate (*A*) can be an effectual selection criteria for salt tolerance under salt regime.

PPBG 16

BIOCIDAL PROPERTIES OF CITRUS OILS AGAINST DENGUE MOSQUITO *Aedes albopictus*

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Ethnobotanical studies provide valuable resources for the development of new product. Recently, plant based compounds have got much attention because these are risk-free and eco-friendly. In the course of screening naturally occurring oils from plants; especially, the potential of citrus seed and peel were investigated. Five citrus (seed and peel) oils were tested against dengue mosquito, *Aedes albopictus* as larvicide, adulticide and repellent. The results showed sweet lime (FSD) possess highest potential in all biological actions (larvicide, adulticide and repellent) followed by sweet lime (SWL). Whereas grapefruit peel exhibited maximum potential against larval as well as adult stages of the test insect. However, the seed oils are effective than peel oils and the oils extracted from Faisalabad (FSD) collected citrus fruits are more potent than that of Sahiwal (SWL).

The present study indicates that the oils extracted from citrus seeds are very effective in suppressing the population of dengue mosquito. Further, research must be needed to know the variation (potential) on the basis of fruit harvesting, soil factors and environmental factors.

PPBG 17

DIVERSITY ANALYSIS IN CHILIES FOR AGRONOMIC TRAITS AND TOTAL SEED PROTEIN PROFILE

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Chilli is one of the versatile and remunerative vegetable crops. Genetic diversity assessment has been made in local and exotic chilli germplasm on the basis of morpho-agronomic traits and seed storage protein profile at Institute of Agri-biotechnology and Genetic Resources, NARC, Islamabad during 2010-11. High variance for fruit yield, no of fruits per plant, plant height, no of seed per fruit and seed diameter was observed. The correlation coefficients displayed significant and positive correlation among yield contributing traits. Leaf length and width had a significant and positive correlation with yield which can further be addressed for chili breeding. Fruit length showed significant correlation with pedicel length, total fruit yield and single fruit yield and showed non significance to others. Fruit yield per plant show significant correlation with fruit wall thickness and seed diameter. Cluster analysis placed all accessions into different groups regardless of their collection, origin. However, genetic relationship among these accessions revealed useful information for further in-depth studies. Contrary to morpho-agronomic traits, variability observed for seed-protein profile based on SDS-PAGE was low among chili accessions. The preliminary information on state of genetic variability would be useful in devising meaningful crop improvement program in chilli.

PPBG 18

BENEFICIAL EFFECT OF *VIGNA RADIATA* L. TO SUBSEQUENT WHEAT CROP

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Crop rotation is a supportive management practice in which legumes greatly improve the growth and yield of subsequent cereal crop particularly wheat. In this study, effects of mungbean on the following wheat crop were determined. Experiment was done with two sets of wheat crop, one set of wheat crop was grown following mungbean crop, while second set was grown after fallow period. Contribution of wheat crop towards soil quality was evaluated in terms of comparison of soil physical and chemical properties before and after sowing of mungbean. Plant density, total biomass, grain and straw yield, concentration of micro and macronutrients and phytohormones of wheat crop following mungbean were determined. Comparison between data obtained from wheat crop after mungbean and wheat crop after fallow period was done. Result showed increased amount of soil phosphorous from 10ppm to 38ppm, potassium from 130ppm to 300ppm, nitrate-nitrogen from 12ppm to 22ppm and soil moisture content by 12% after mungbean. Increased amount of nitrogen and other nutrients in wheat crop was also observed. This study proved that crop rotation is helpful to increase yield of wheat crop due to increased amount of nitrogen and other micro and macro nutrients by mungbean as compared to wheat which follow the fallow period.

PPBG 19

**INHIBITION OF *RHIZOCTONIA SOLANI* WITH ISOTHIOCYANATES
PRODUCED BY BRASSICACEAE SPECIES**

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The efficacy of bio-fumigation crops viz. Indian mustard (*Brassica juncea*), canola (*Brassica napus*), black mustard (*Brassica nigra*), radish (*Raphanus sativus*), turnip (*Brassica rapa*) and cabbage (*Brassica oleracea*) as green manure and soil incorporation of chopped green leaves of radish (*Raphanus sativus*) turnip (*Brassica rapa*) and cabbage (*Brassica oleracea*) was evaluated to check the potential disease-suppressive activity of allelochemicals produced by glucosinolates hydrolysis following soil incorporation in managing the soil-borne inoculum of black scurf of potato against susceptible cultivar Desiree. Ten treatments viz. green manuring of 25 days old Indian mustard (*B. juncea*), canola (*B. napus*), black mustard (*B. nigra*), radish (*R. sativus*), turnip (*B. rapa*) cabbage (*B. oleracea*) and soil incorporation with chopped leaves of radish (*R. sativus*), turnip (*B. rapa*) and cabbage (*B. oleracea*) were employed and compared with inoculated control. Disease was evaluated using parameters i.e. eyes germination inhibition (EGI), sprouts killing (SK), stem canker index (SCI), stolon canker index (StCI), black scurf disease index (BSDI) and yield reduction (YR). Green manuring of canola with 19.91% (EGI), 18.13% (SK), 28.95% (SCI), 25.10% (StCI), 28.11% (BSDI) and 28.86% yield reduction followed by the soil incorporation of chopped leaves of turnip (*B. rapa*) canola with 25.58% (EGI), 21.73% (SK), 31.33% (SCI), 28.15% (StCI), 34.33% (BSDI) and 40.07% yield reduction, significantly managed and reduced the soil-borne inoculum of *R. solani* and distinguishably exhibited the higher efficacy of allelochemicals produced by glucosinolates hydrolysis following soil-incorporation as compared to the rest of the treatments and conferred significant protection against soil-borne inoculum of the fungus when compared with the inoculated control and rest of the treatments. The roots of turnip are generally used as vegetable and the leaves are thrown away as litter. These leaves can be collected and incorporated in soil as compared to the green manuring of canola (*B. napus*) which not only involve the cost of the seed but also an extra 25-30 days of farm practices. Increased doze of turnip leaves may further reduce the losses caused by black scurf disease.

PPBG 20

**GENOTYPIC × ENVIRONMENT INTERACTION OF CASTORBEAN
GROWN OVER MULTIPLE YEARS**

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This research work was performed at Nuclear Institute for Agriculture and Biology (NIAB) Faisalabad Pakistan and castor mutants under study were obtained after treating three castor varieties viz. DS-30, C-176 and DC-15 with gamma rays ranging from 100-500 Grey during Kharif 2003. The selection was performed in M_2 generation and confirmation of characters in the subsequent generations. Vigorous selections remained in progress during each succeeding generation for desirable yield and yield components. Then afterward these elite selected mutant lines were evaluated from 2007 to 2010 in randomized complete block design (RCBD) in three repeats. Combined analysis of variance indicated that genotypes (A), environment (B) and interaction between $A \times B$ was highly significant. Overall mean performance of castor mutants showed significant differences with maximum seed yield (2776 kg ha^{-1}) estimated in mutant NIAB Castor-2012 and minimum in standard check DS-30 (1825 kg ha^{-1}). NIAB Castor-2012 produced 52.10% higher seed yield followed by L-57-32-784 (39.78%) and M-7-35-1-2 (35.34%). Regarding regression coefficient (b), mutant line L 36-24-124 was more near to unity followed by NIAB Castor-2012. Standard check DS-30 not only produced poorest seed yield but had very less regression coefficient value (0.585) which indicated that variety is most suited to special type of environment. The maximum value of regression coefficient was estimated in mutant DC-1525421 ($b=1.299$) which showed that the line is most suited for rich environment. Standard deviations to regression (Sd^2) values were not higher and less than unity and ranged from 0.107 to 0.390. Mutant line NIAB Castor-2012 had minimum value and standard check DS-30 with highest value. Moreover, mutant line NIAB Castor-2012 had less maturity period (125 days) as compared to 200 days of DS-30 and it can easily be harvested in one cutting operation before cultivation of wheat and can be best fitted in wheat-castor rotation. Development of this early mutant has created the chances of adaptation of economically potential castor as major a crop that will contribute in meeting the increasing demands of castor oil.

PPBG 21

COMPARING SALINITY TOLERANCE OF FIVE HIGH YIELDING, NON-AROMATIC RICE (*ORYZA SATIVA* L.) CULTIVARS OF SINDH

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Rice (*Oryza sativa* L.) is the second staple food crop of Pakistan. It occupies about 10% of the total cultivated area in Pakistan. However, its growth and yield reduction is a serious issue in salt-affected areas. This study was conducted to evaluate salinity (NaCl) tolerance of five local non aromatic, coarse rice cultivars viz; IR-6, IR-8, DR-82, DR-83 and DR-92. The study comprised of a hydroponics experiment. That was conducted at the Department of Soil Science, Sindh Agriculture University Tandojam. The pure seeds of all five cultivars were obtained from Rice Research Institute Larkana Sindh, Pakistan. The nursery of each cultivar was initially raised in double acid washed river bed sand on distilled water for a period of two weeks. Thereafter homogenous seedlings of each cultivar were transplanted into plastic tubs containing 25 liters of 40 mM, 80 mM, 120 mM, and 160 mM NaCl solutions. The experiment was launched following a two factor completely randomized design with five replications. Plants were allowed to grow up to six weeks after transplanting. The results showed that the plants of cultivar DR-92 grown in all treatments were taller, with more leaves and had higher dry root and shoot weights as compared to other cultivars. The better performance of cultivar DR-92 was associated with less Na more K⁺ and higher K⁺/Na⁺ ratio than all other cultivar tested.

PPBG 22

MOLECULAR CHARACTERIZATION OF LINSEED GERMPLASM USING DNA MARKERS

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DNA markers are useful tools for assessment of genetic diversity and phylogenetic analysis. Though co-dominant markers like microsatellites are more useful for diversity studies, however high cost incurred on characterization of such marker has confined its development and application to economically important crops. Random amplified polymorphic DNA (RAPD) are influential markers for diversity studies in orphan crops like linseed where no co-dominant markers are available. The present study was aimed for molecular characterization of linseed germplasm comprising 40 lines using RAPDs. A total of 120 RAPD primers were employed and 82 were found informative indicating a high level of polymorphism of 68%. The amplified products ranged from 250 to 1850bp in size. RAPD fingerprinting produced 92 markers, however, 85 unambiguous and scoreable loci were utilized for diversity analysis. Resulting similarity matrix revealed a moderate degree of mean genetic diversity of 16% among the lines studied. In pair wise combinations, L-1 and L-4 emerged as most related with values of 91%, whereas

L-20 and L-27 were found most dissimilar with similarity coefficient of 38%. Cluster analysis conducted through NTSYspc 2.2 using 85 loci, data could group 30 genotypes into five main clusters A, B, C, D and E containing 3, 5, 2, 5, 15 lines respectively. To the best of knowledge, present study is first report on genetic diversity analysis of linseed germplasm maintained in Pakistan using DNA markers. The information obtained here on genetic distances will be useful in future cultivar development and molecular characterization of linseed germplasm.

PPBG 23

WHEAT GERMPLASM CHARACTERIZATION ON THE BASIS OF MORPHOLOGICAL MARKERS

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Germplasm, the collection of gene pool is playing a vital role to improve the crop efficiency through breeding procedures. Breeders are always in search of old and novel genetic stock to strengthen their plant breeding programme and to incorporate available desirable genes in the existing material. To enrich the wheat breeding and to widen the genetic diversity, gene bank having diversified landraces, old and new local and exotic wheat varieties, advance/mutant lines possesses various multiple genes for desired traits likewise high grain yield, stress tolerance, disease and lodging resistance and good grain quality has always been the top priority of the breeders. Wheat breeding programme at Nuclear Institute of Agriculture (NIA) has collection of new and old indigenous and exotic germplasm consisting of 312 genotypes possesses multiple traits. Germplasm comprised of wild wheat species, diploid, tetraploid and hexaploid wheats. Keeping in view the importance of this novel stock, the germplasm was characterized morphologically for its better validation to facilitate the future breeding. The data was recorded for various traits like time of ear emergence and maturity, plant height, disease and lodging resistance, seed color and size etc. The present paper will present the detailed information of the wheat gene-pool available at NIA, Tandojam; it will be helpful for the breeders of Pakistan and globally.

PPBG 24

GENETIC ANALYSIS FOR SOME QUANTITATIVE TRAITS IN F₄ SEGREGATING POPULATION OF WHEAT

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Twenty five F₄ segregating progenies of bread wheat were evaluated along with their parental lines under field conditions. Genetic analysis was performed by calculating the genetic parameters viz., heritability (%) in broad sense, genetic advance (G.A), genetic variance (v.g) phenotypic variance (V.p.) and the environmental variance (v.e.). Observed means were compared by standard error. Wide genetic variation among progenies were observed for various morphological traits viz., grain yield, 1000-kernel weight, heading time and maturity period as compared to their parental lines. Results revealed that the seven progenies out of 25 showed the highest heritability (%) in broad sense for 1000-grain weight ranging from 80-95% coupled the highest genetic advance (7.38 to 17.34). Eight crosses combinations showed highly significant improvement over their both the parental lines for 1000-kernel weight and yield traits. Six segregating populations showed early maturity (106-116 days) than their parental lines. Genetic analysis of various yield components provides a valid understanding of the segregating progenies and to know the useful parental line for future cross breeding.

PPBG 25

SPECIES DIVERSITY OF GENUS *PUCCINIA* PERS. (BASIDIOMYCOTA; UREDINALES) PARASITIZING POACEOUS HOSTS FROM PAKISTAN

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Poaceous weeds are an important competitor of all economically important crop plants worldwide as well as in Pakistan. This paper presents new records, host records and distribution of some graminicolous rust fungi from Pakistan. During August 2009 to October 2010, different areas of Pakistan including Fairy Meadows (Northern Areas), Jalkhud, Khaira gali, Khanspur-Ayubia, Khanspur-village, Sharan (Khyber Pakhtoonkhaw), Lawat, Leepa valley and Sharda (Azad Jammu & Kashmir) were surveyed for rust fungi. As a result of this study, twelve (12) *Puccinia* species were found parasitizing fourteen (14) different host plants belonging to Poaceae. Among these, *Puccinia brachypodii-phoenicoidis* var. *davisii* and *P. substriata* var. *imposita* are described as new records for Pakistan. Telial stage of *Puccinia brachypodii* var. *arrhenatheri* is described for the first time from Pakistan. In addition, *Agrostis gigantea* for *Puccinia agrostidis-caninae* and *P. brachypodii* var. *poae-nemoralis*, *Agrostis stolonifera* for *P. agrostidis-caninae*, *Agropyron striatum* for *P. graminis* subsp. *graminicola*, *Digitaria setigera* for *P. substriata* var. *imposita*, *Helictotrichon virescence* and *Sporobolus arabicus* for *P. coronata* var. *himalensis*, *Koeleria macrantha* for *P. brachypodii* var. *arrhenatheri*, *Piptatherum laterale* for *P. brachypodii-phoenicoidis* var. *davisii*, *Poa polycolea* for *P. brachypodii* var. *poae-nemoralis* and *Themeda anathera* for *P. versicolor* are new poaceous hosts for these rust fungi from Pakistan. *Puccinia cynodontis*, *P. melanocephala* and *P. sorghi* have previously been reported from Pakistan but herein described as new records for Azad Jammu & Kashmir, Pakistan. In addition to the light microscopy, Scanning Electron Microscopy (SEM) has been utilized to magnify wall ornamentation of spores for accurate identification. This information will ultimately lead to the use of these fungi as biocontrol of weeds to increase agricultural productivity.

PPBG 26

PHYSICO-CHEMICAL CHARACTERISTICS, PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITIES OF APPLE (*MALUS DOMESTICA* BORKH) VARIETIES/GENOTYPES FROM AZAD JAMMU AND KASHMIR

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Apple (*Malus domestica* Borkh) belongs to the Rosaceae family, is one of the dominant orchard crop of Azad Jammu and Kashmir and abundantly grown in all temperate zone. The objective of this study was to compare the physico-chemical properties and antioxidant activity of apple varieties/genotypes grown in temperate region of Azad Jammu and Kashmir. To characterize the available genotypes from three locations of Poonch Division (Rawalakot, Bagh and Sudhnotti), forty five varieties/ genotypes were selected on the basis of plant vigour and quality of fruits. Selected sites were visited thrice at the stage of flowering, fruit setting and fruit maturity. Regarding *in situ* observation for plant morphology, selected varieties/genotype number of branches varied from 4.55 (Genotype C) to 6.66 (Starking Delicious), average number of flowers ranged from 2567 (genotype C) to 3271 (Starking Delicious). Flowering duration, average number of fruit set, fruit set percentage, fruit maturity percentage and days taken from fruit set to the fruit ripening varied from 14.78 (Red Delicious) to 17.22 days (Genotype A), 454.2 (Genotype B) to 582.7 (Red Delicious), 15.29 (genotype B) to 19.37% (Chotta), 13.12 (genotype B) to 17.06% (Spartan) and 139 (Genotype C) to 155 days (Kashmiri and Royal Galla) respectively. Leaf area varied from 25.01 (Spartan) to 39.98 (Royal Galla). Fruit weight varied from 122.6 (Spartan) to 209.2 g (Royal Galla) and for interaction 224.5 g was noted in Royal Galla at Bagh. Fruit length and fruit diameter ranged from 4.88 (genotype A) to 6.43 cm (Royal Galla) and 5.16 (Genotype A) to 6.80 cm (Royal Galla) respectively. pH, total soluble solids (TSS), vitamin C content, acidity%, reducing sugar, non reducing sugar and dry matter content varied from 3.62 (Ammri) to 4.0 (Royal Galla), 12.06 (Starking) to 14.47 Brix° (Ammri), 12.33 (Banki) to 14.01 mg/100g (Royal Galla), 0.25 (Genotype C) to 0.36 % (Ammri), 7.50 (Golden Delicious) to 8.64 mg/100g (Kala Kalu), 1.89 (Kala Kalu) to 2.34 mg/100g (Royal Galla) and 14.05 (Starking) to 16.47% (Ammri) respectively. The interaction values for Vitamin C 14.35 mg/100 g was noted in Red Delicious at Sudhnotti. The values of total phenolic content, total antioxidant activity and total monomeric anthocyanin content ranged from 2.20 (Royal Galla) to 8.15 mg/g (Kala Kalu), 81.72 (Banki) to 165.90 µg/ml (Genotype A) and (Genotype A) and 4.86 (Spartan) to 7.40 mg/L (Genotype B) respectively. Interaction effect for total phenolic content, total antioxidant activity and total monomeric anthocyanin content was seen in 12.10 mg/g in Ammri at Rawalakot, 211.30 mg/ml in Genotype B at Sudhnotti and 8.83 mg/L in Genotype B at Bagh location respectively. The result suggested that genotype is the main factor that determine the composition of bioactive compounds in apples and this provides important information on how to make the best use of the apple varieties investigated. The evaluation of these genotypes was not only provide important information regarding nutritional status of genotypes for the commercial exploitation but also navigate the biodiversity exist in *Malus* germplasm in this region.

PPBG 27

PHYSIOLOGICAL AND FORAGE PERFORMANCE OF HYBRID VS COMPOSITE BRASSICA VARIETIES UNDER RAINFED CONDITIONS

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Fodder crops are grown in rainfed areas on very limited area due to small land holdings and competition area wise with food and cash crops. Livestock is an alternate source of economic stability and livelihood in dry land farming conditions especially when crop failed due to harsh climate. Development of livestock in marginal areas and drier is not possible without nutritional forage. Keeping in view this background, a field experiment was carried out at University Research Farm (URF), Chakwal Road Rawalpindi during winter 2010-11 to evaluate physiological and forage response of hybrid vs composite brassica varieties under rainfed conditions. Experiment consisting of one composite (Chakwal Sarson) and three hybrid (Hyola-401, Omega-1 and Omega-3) of brassica was arranged in randomized complete block design with three replications. The results regarding physiological and forage yield performance showed significant difference among each-others. Maximum values of physiological parameters such as photosynthetic rate ($4.3 \mu\text{mol m}^{-2} \text{s}^{-1}$), transpiration rate ($0.9 \text{ mol m}^{-2} \text{s}^{-1}$), stomatal conductance ($0.21 \text{ mol m}^{-2} \text{s}^{-1}$), stomatal resistance ($45.8 \text{ m}^2 \text{s mol}^{-1}$) and photosynthetic active radiation ($1536.2 \text{ mol m}^{-2} \text{d}^{-1}$) were recorded by hybrid brassica Hyola-401 followed by Omega-3 and Omega-1 and minimum by composite brassica cultivar Chakwal sarson. Highest forage yield of 70 t ha^{-1} can be obtained for hybrid brassica Hyola-401 as a result of better performance. On the basis of these investigations, it is concluded that Hyola-401 hybrid brassica can be adopted for more forage production under rainfed conditions. The obtained results will be presented in the conference.

PPBG 28

CHEMICAL COMPOSITION AND SENSORY EVALUATION OF TEA (CAMELLIA SINENSIS) COMMERCIALIZED IN PAKISTAN

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The quality of black and green commercial tea samples was accessed by physicochemical analysis for mineral composition and sensory evaluation. Significant variations in physicochemical and organoleptic parameters observed. The moisture, protein, fat, crude fiber, water extracts and ash contents of the commercial tea samples were found to be in the range of 2.46–7.47, 0.87–1.141, 0.94–2.15, 11.23–17.21, 32.34–53.61, and 3.29–5.86%, respectively, whereas caffeine and catechin were found in the range of 2.34–4.33% and 0–7.44%, respectively. The highest percentage of moisture, protein, fat, and crude fiber contents were observed in green tea samples while highest percentage of ash and water extracts were observed in black tea samples. Calcium, magnesium, sodium, potassium and manganese were found to be in the range of 1.47–3.84, 2.97–5.66, 0.39–1.83, 3.01–4.00, 1.09–2.43 mg/l, respectively, with maximum amounts found in green tea as compared to black tea.

PPBG 29

ENHANCING PHOSPHORUS USE EFFICIENCY IN CEREALS BY PHOSPHORIC ACID APPLICATION IN ALKALINE CALCAREOUS SOILS

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Major causes of low P use efficiency are the inefficient existing phosphate fertilizers and inappropriate methods of their application. Studies were conducted to investigate the impact of premixing, subsurface placement and fertigation of P fertilizers (phosphoric acid, DAP and TSP) on P use efficiency and yield of wheat, maize and rice. In general, lower P rates ($22 \text{ \& } 44 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$) in wheat exhibited higher P use efficiency. Phosphoric acid was found a better P source while its placement in wheat & maize was a better method of application. Relative efficiency of the P sources in wheat &

maize was generally in the order: phosphoric acid > TSP > DAP and performance of methods of application in wheat & maize was in the order: placement 5 cm below seed > fertigation at first irrigation > premixing at sowing. Phosphorus uptake was influenced significantly by different rates of P fertilizer application. In general, maximum P uptake was observed in case of the highest rate of phosphoric acid (88 kg ha⁻¹ P₂O₅) applied as subsurface placement. Phosphorus treatments also improved N uptake by grain. The post harvest soil analysis showed no adverse effect of phosphoric acid addition on soil properties (pH, EC, CaCO₃, organic matter) even on addition of its highest rate. Overall, the studies revealed phosphoric acid as a better and cheaper alternative to DAP/TSP for wheat, maize and rice production.

PPBG 30

EFFECT OF BORON AND GA3 ON THE FLOWERING AND FRUIT SETTING IN OLIVE (*OLEA EUROPAEA* L.) CV. USLU.

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A field experiment was carried out to evaluate the efficiency of Boron and Gibberellic Acid (GA3) on fruit setting phenomenon in Olive cultivar Uslu at the Experimental Olive fruit orchard at NARC, HRI during 2010. The Olive plants were sprayed with 3 levels of Boron @ 0.03, 0.06 and 0.09 % and (GA3) was also sprayed in 3 levels (0.20ppm, 0.25ppm and 0.30ppm) after flowering after flowering opening. The results showed that maximum flowering (No. 778) with the application of Boron treatment @ 0.09%, while GA3 maximum flowering (No. 189) with 30 ppm treatment. Maximum fruit setting (34) was recorded with Boron spray @ 0.06%, and it was followed by the application of Boron @ 0.09% (28) and maximum fruit setting (21) was observed with GA3 treatment @ 20ppm. Maximum fruit set on the basis of total number of flowers was also observed by the application of Boron treatment @ 0.06% (2.14), while GA3 maximum fruit set (1.09) was recorded with GA3 treatment @ 20ppm. On the basis of above results it may be concluded that Boron @ 0.06% and GA3 @ 20ppm was optimum for improvement in number of flowers, fruit set, fruit size and even fruit weight in Olive cv "Uslu"

PPBG 31

EFFECTS OF PHOSPHORUS LEVELS ALONE OR IN COMBINATION WITH FARMYARD MANURE ON GROWTH, YIELD AND NUTRIENT CONTENTS OF WHEAT IN RAINFED CONDITIONS

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A field experiment was conducted at National Agricultural Research Centre, Islamabad to assess the effects of different combinations of phosphorus (P) fertilizer with or without farmyard manure (FYM) on growth, yield and nutrient contents of wheat during 2008-09. The soil of experimental area was sandy, clay, alkaline calcareous in nature with low fertility and deficient in phosphorus. Single super phosphate as P source (@ 20, 30, 40 and 50 kg/ha) was applied with or without FYM at the time of sowing. Because of different combinations of fertilizer P and FYM, statistically significant differences in biological yield, grain yield and yield components of wheat were recorded. Maximum wheat grain yield of 4580 kg ha⁻¹ was obtained with the application of full fertilizer and FYM. Minimum grain yield and biological yield were recorded with no fertilizer and only FYM application. It is suggested that P 50 kg/ha with combination FYM is recommended for growing of wheat in rainfed conditions.

PPBG 32

SPATIO-TEMPORAL CROPPING SYSTEMS TO ENHANCE HARVEST OF RESIDUAL SOIL MOISTURE CONTENT FOR SUCCEEDING CROPS IN POTHWAR PLATEAU.

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Soil moisture deficiency is the major yield limiting factor in rainfed areas of Punjab. A series of field experiments was therefore, conducted to study the effect of ten different spatio-temporal cropping systems on the harvest of residual soil moisture content for succeeding crops in Pothwar plateau. Three distinct agro-ecologies were selected for the study representing high, medium and low rainfall conditions. The three year study (2003-2006) evaluated various cereal and legume-based mono and multiple cropping systems including representative summer and winter crops of the rainfed region i.e. Wheat, Canola, Groundnut, Maize, Oat, Sunflower and Mungbean. The results revealed that legume-based cropping systems conserved relatively a higher percentage of volumetric soil moisture (9-13%) at all locations in comparison to non-legume based systems indicating the need to include legumes in the conventional mono cropping systems. The sunflower-based system with Mungbean as intercrop and groundnut-based cropping system harvested 13 and 16% higher soil moisture than maize-based system for succeeding winter crops, respectively under high rainfall conditions. The groundnut-based systems harvested 19% higher soil moisture compared to conventional wheat based system (fallow-wheat) in high rainfall zone. Under medium and low rainfall agro-ecologies, groundnut-based cropping systems harvested 27% higher residual soil moisture compared to sunflower + mungbean intercropping system. The residual soil moisture availability to a soil depth of 0-30 cm was enhanced by 5 and 7% in sunflower + mungbean intercropping and groundnut-based cropping systems as compared to maize-based cropping systems, respectively in high rainfall zone. Similarly, residual soil moisture harvesting was increased by 7 and 14% in groundnut-based cropping in comparison to sunflower + mungbean intercropping and maize-based cropping systems under medium rainfall conditions. The harvest of residual volumetric soil moisture content was also enhanced by 10 and 17% in groundnut-based crop sequences compared to sunflower + mungbean intercropping and maize based cropping systems under low rainfall zone of Pothwar tract.

PPBG 33

PERFORMANCE OF LOCALLY DEVELOPED SUNFLOWER HYBRIDS IN PAKISTAN

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Among locally developed sunflower hybrids, 48 hybrids were evaluated in a triplicate RCBD for nine agronomic traits under field conditions at NARC, Islamabad during spring 2011. The data were analyzed for genetic parameters including correlation coefficients and path analysis along with multivariate analysis. Significant differences among for all the traits indicating the diverse nature of hybrids, whereas correlation and path analyses highlighted the importance of seed yield contributing traits among the hybrids. The negative correlation of oil contents with seed yield had been long been reported that is suggested to break it using novel breeding techniques. Cluster analysis based on Euclidean dissimilarity revealed seven clusters at 25% linkage distance. Varying numbers of hybrids were grouped according to agronomic performance that indicated the worth of cluster analysis for depicting diversity among the hybrids. The hybrids with various mean values could be the basis for identifying the best hybrid/s for general cultivation.

PPBG 34

EFFECTS OF GAMMA (Γ) IRRADIATION ON HYDROCYANIC ACID CONTENTS IN SUDAN GRASS (SORGHUM VULGARE VAR, SUDANESE)

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Hydrocyanic acid is a strong poison. The toxicity of hydrocyanic acid is due to its great heavy metal affinity leading to cytotoxic hypoxia. At low concentration, it is bound to other compounds. It is also present in many foods and species. Cyanogenic glucosides occur naturally in many species of plants including Sudan grass. Cyanogenesis is the biochemical

process in which release of hydrocyanic acid (HCN) occurs when plant tissue is damaged as it occurs on ingestion in the grazing animals. The presence of cyanogenic glucosides in Sudan grass (*Sorghum vulgare* var. *Sudanese*) is an anti-nutritional factor due to which the potential exists for cyanide to pre-dispose selenium deficiency in grazing animals. A considerable genotypic variation in cyanogenesis is present in Sudan grass and it is important that highly cyanogenic Sudan grass lines are identified to ensure that germplasm used in breeding programs does not lead to the release of cultivars that exceed safe levels of this anti-nutritional element. An Australian procedure based on the picrate assay and utilizes computer imagery and calibration relationships between spectral intensity (Red, Green, Blue bands) of the color reaction on picrate paper with cyanide in standard solutions to predict hydrocyanic acid concentration in Sudan grass leaves was followed. Different doses of gamma rays were applied to develop the variability for the reduction of HCN in Sudan grass under study. Regression Models developed through "R" for CN vs. Treatments of Gamma (γ) irradiation showed negative correlation which mean that with the increase in radiation dose rate the values of CN decreased significantly ($P < 0.05$). A few treatments i.e. T4, 6, 8 & 10 proved to be very much effective in the reduction of HCN Contents significantly ($P < 0.05$) and destructed HCN contents substantially as compared with T1 (Control) & all other treatments. This may be due to precursor of HCN or CN ions affected by radiation due to which production of HCN is reduced. This could be cyanogen glucoside in the plant or seed or check on the enzymatic activity producing HCN. The variability in these doses may be manipulated for the development of reduction or fully destruction of HCN in Sudan grass and HCN free varieties or mutants may be produced in this way.

PPBG 35

PHYSIOLOGICAL AND BIOCHEMICAL RESPONSE OF COTTON GENOTYPES TO DIFFERENT SALINITY LEVELS AT EARLY GROWTH STAGES

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The study was carried out to screen different cotton (*Gossypium hirsutum* L.) genotypes for salt tolerance by using solution culture method. Different physiological and biochemical standards were used for screening against salt tolerance. Thirteen cotton genotypes were evaluated for comparative performance at three NaCl concentrations viz. control 0 ds/m, 8 ds/m and 16 ds/m. Triplicated complete randomized design was followed. Plants were harvested forty five days after the imposition of the treatments. Ten seedlings from each accession were taken to record data. Depending upon the response of genotypes at 8 ds/m, NIAB-111 and Russian (RL) were found most susceptible and SLH-41 and UCD-581 were found most tolerant, whereas at 16 ds/m, NIAB-111 and MS-39 were determined as most susceptible and Grppg-25, FH-982, TX-DOS-5-76C and Russian okra (RL) as most tolerant. According to cluster analysis, these genotypes were grouped in 7 different clusters on the basis of their similarities regarding response to salt stress.

PPBG 36

GROWTH, YIELD AND RADIATION USE EFFICIENCY OF MAIZE HYBRIDS AT VARYING NITROGEN LEVELS

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Nutrients have a well-known effect on growth and yield of cereals. Among various nutrients, nitrogen plays a key role in improving maize yield but demand of crop for nitrogen varies with the cultivars. The study was conducted at Agronomic Research Area, Department of Agronomy, University of Agriculture, Faisalabad during 2009 with objectives of optimizing N fertilization and also to improve its utilization efficiency for promising cultivars of maize. The experiment was laid out in randomized complete block design with split plot arrangement. Data on leaf area index (LAI), total dry matter (TDM), fraction of intercepted radiation (Fi), accumulated radiation interception (Sa), and grain yield were taken into account for calculating radiation use efficiency (RUE). Mean maximum value of fraction of incident intercepted radiation (Fi) remained 96 % at 75 days after sowing (DAS) due to maximum crop canopy development. The hybrid Monsanto-919 used radiation more efficiently (3.53 g MJ^{-1}) for TDM accumulation and (1.42 g MJ^{-1}) for grain yield. Nitrogen application of 300 kg ha^{-1} statistically proved to be better to convert radiation into dry matter production.

PPBG 37

DEVELOPING A SUSTAINABLE AND ECO-FRIENDLY WEED MANAGEMENT IN MAIZE

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To determine the effect of different mulching treatments against weeds in maize, an experiment was laid out in simple RCB Design in summer during 2011. The mulching treatments consist of farmyard manure, chicken manure, black plastic, white plastic, hand weeding, weed as mulch and weed check. The data were recorded on nitrogen content in weed (%), weed frequency (%), fresh weed biomass (kg ha^{-1}), dry weed biomass (kg ha^{-1}), plant height (cm), fresh biological yield (kg ha^{-1}), harvest index (%) and cost benefit ratio. Higher nitrogen content in weeds were observed in chicken manure which are statistically at par with farmyard manure while lower nitrogen content were recorded in hand weeded plots. Maximum weed frequency (71.61 %) was recorded for *Cyperus rotundus* L., while the minimum weed frequency was observed for *Convolvulus arvensis* L. (9.52). Highest fresh weed biomass was recorded in weedy check ($389.90 \text{ kg ha}^{-1}$) and the lowest fresh weed biomass was recorded in hand weeding (35.10 kg ha^{-1}) followed by black plastic (92.93 kg ha^{-1}) and white plastic ($128.70 \text{ kg ha}^{-1}$). Different mulching treatment did not significantly affected plant height. Highest biological yield (8979 kg ha^{-1}) was recorded in hand weeding plots however, it was statistically at par with black plastic producing biological yield ($8671.7 \text{ kg ha}^{-1}$) while minimum biological yield (3800 kg ha^{-1}) was recorded in weedy check plots. Maximum cost-benefit ratio was observed for hand weeding plots (6.5) while minimum cost-benefit ratio was observed for chicken manure (4.6). The results showed that it is necessary to cover the soil surface with different materials to obtain high biological activity, retain soil moisture and to achieve a good control of weeds.

PPBG 38

IMPROVEMENT IN FLAG-LEAF AREA OF WHEAT BY ZINC APPLICATION: ITS EFFECT ON YIELD AND GRAIN-ZINC CONCENTRATIONM. HASSAN^{1*}, A. RASHID^{2*} AND I. CAKMAK³¹Plant Breeding & Genetics Division, Nuclear Institute for Agriculture & Biology (NIAB), Faisalabad, Pakistan²Pakistan Academy of Sciences, 3 Constitution Avenue, Islamabad, Pakistan³Faculty of Engineering & Natural Sciences, Sabanci University, Istanbul, Turkey**Corresponding author's e-mail: mhj407jb@yahoo.com*

Five field experiments under uniform set of different Zn treatments were conducted in Zn-deficient soils of Pakistan. Wheat (*Triticum aestivum* L., cv. Sehar-2006) was planted at each sites. Each experiment comprised of 10 treatments: (1) RFU (Recommended Fertilizer Use, i.e., 120 kg N as urea+ $80 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ as triple superphosphate); (2) RFU + Soil Zn (i.e., $50 \text{ kg ZnSO}_4 \cdot 7\text{H}_2\text{O ha}^{-1}$); (3) RFU + Foliar Zn (i.e., 0.5 % solution of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$); (4) RFU + Soil Zn + Foliar Zn (i.e., $50 \text{ kg ZnSO}_4 \cdot 7\text{H}_2\text{O} + 0.5 \text{ % ZnSO}_4 \cdot 7\text{H}_2\text{O ha}^{-1}$); (5) RFU + OMEX- I, Foliar Zn (i.e., Omex-Type- I Foliar Zn); (6) RFU + Omex Type-II Foliar Zn; (7) Urea-Zn ($120 \text{ kg N} + 80 \text{ kg P}_2\text{O}_5 + 25 \text{ kg ZnSO}_4 \cdot 7\text{H}_2\text{O ha}^{-1}$); (8) RFU+MESZ-Zn (Mosaic-soil Zn); (9) MESZ-Zn (Mosaic-soil Zn)+Foliar Zn (as above); and (10) Urea-Zn + Foliar Zn (as above). The experiment was carried out as a randomized complete block design with six replications by keeping plot size of $3.6 \times 9.6 \text{ m}$. Maximum increase in flag-leaf area 21.69 cm^2 was achieved by treatment (7) Urea-Zn; however, increase in flag-leaf area with treatments: (9) MESZ-Zn + Foliar Zn, (6) RFU + OMEX-II Foliar Zn, (10) Urea-Zn + Foliar Zn, and (5) RFU + OMEX-I Foliar Zn, was at par with maximum value. Similarly, significant increase in grain yield was observed by both soil application and foliar spray of Zn in all experiments ($P < 0.05$; Table 1). Highest yield of 5.01 t ha^{-1} was obtained with soil applied MESZ-Zn; however, grain yields obtained with RFU + soil Zn + foliar Zn and RFU + Omex Type-II foliar Zn were similar to the maximum yield. All Zn treatments increased flag-leaf area, grain Zn concentration, and grain yield ($p < 0.05$); and foliar feeding was more effective than soil applied Zn in Zn-deficient calcareous soils.

PPBG 39

EFFECTS OF ANISEED (*PIMPINELLA ANISUM*) ON OVERALL PERFORMANCE AND MILK COMPOSITION OF DAMANI GOATSM. IFTIKHAR¹, S. AKHTER¹, A. REHMAN^{1*}, T. A. KHATTAK², K. KALEEM², M. SHOAIB⁴, Z. R. KHALIL¹, AND M. I. KHATTAK³¹Department of Livestock Management, KP Agricultural University Peshawar, Pakistan.²Livestock Research and Development Station, Dera Ismail Khan, Pakistan.

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Aniseed (*Pimpinella Anisum*), is an annual plant, found in warm climates, of average height of 30-50cm with grayish-brown color. Botanically aniseed belongs to family *Apiaceae* (*Umbelliferae*) from class Magnoliopsida. Medicinally this plant is used as growth promoter & immune stimulator and increased dry matter intake. An experiment was carried out to evaluate the effect of different doses of aniseed on Feed intake (FI), Weight gain (WG), milk yield (MY) and milk composition of Damani goats at Livestock research and Development station, Dera Ismail Khan. A total of 20 early lactating Damani goats (n=20) with homogenous characteristics were randomly grouped on the basis of three different concentration of aniseed viz. 1, 2 and 3.0g/kg body weight supplementation, whereas one group was assigned as control group. Data regarding FI, WG, MY and milk composition were recorded at weekly interval for 8 weeks. Milk samples for milk composition were determined by method described by Association of Official Chemists Inc. Virginia, USA. Results showed highly significant effect ($P < 0.05$) of aniseed on FI, WG, MY and milk composition except ash and Total Solid (TS). Aniseed supplementation @3g/kg body weight boost feed intake from 4.317 to 5.865kg/day, milk yield from 1022 to 1432ml/day. Regarding milk composition significant increase in milk protein, lactose, and SNF while significant decrease in milk fat% was observed. Further studies on the immune aspect of the said plant may be conducted in animals and human.

PPBG 40

INFLUENCE OF CROP ROTATION AND SOWING TIME ON EPIDEMIC OF CERCOSPORA LEAF SPOT OF PEANUT UNDER RAINFED CONDITIONS

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Cercospora leaf spot (CLS) is yield reducing biotic stress of peanut under rainfed conditions of crop cultivation. Crop rotation with non-host crops and alteration in sowing time aims at to mitigate disease impact on yield and yield parameters. Sowing of peanut crop in fallow land or in land with one or two years rotation of non-host crop of Cercospora leaf spot delayed disease initiation from 58 to 108 days and gave better yields than plots with left over seed of previous year. Lesser infection percentage increase rates 13.91, 11.72 and 7.71 in fields with one year, two year and fallow rotation lands respectively, than in fields with left over seed (18.98%) resulted in lesser area under disease progress curve. Under experiment on influence of planting time on Cercospora leaf spot disease initiated 23- 65 days early in late sown crop (20th May to 30th June) than in earlier sown crop. Minimum initial infection percentage 3.64 to 5.32 was recorded in 30th April to 20th May sown crop. Minimum area under disease progress curve (audpc) 1606 – 2006 and minimum final infection percentage 72.18- 89.28 were recorded in 10th to 30th June sown crop. Among parameters like days to disease initiation, initial infection percentage, final infection percentage, audpc and yield positively correlates ($r = 0.47- 0.90$) with days to disease initiation and negatively with amount of initial infection percentage.

PPBG 41

EVALUATION OF BARLEY GENOTYPES FOR YIELDING ABILITY AND DROUGHT TOLERANCE UNDER IRRIGATED AND WATER-STRESSED CONDITIONS

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Twelve barley genotypes based on different selection methods were evaluated for stress tolerance under drought and irrigated conditions. The results of a correlation matrix revealed highly significant associations between Grain Yield (Yp) and Mean Productivity (MP), Stress Tolerance Index (STI), Geometric Mean Productivity (GMP) and Yield Index (YI) under irrigated conditions while Mean Productivity (MP), Yield Stability Index (YSI), Stress Tolerance Index (STI), Geometric Mean Productivity (GMP) and Yield Index (YI) had a high response under stressed condition. Based

on a principal component analysis, Geometric Mean Productivity (GMP), Mean Productivity (MP) and Stress Tolerance Index (STI) were considered to be the best parameters for selection of drought-tolerant genotypes. The 2-row barley genotypes B-07023 and B-07021 performed better in yield response under drought conditions and were also found to be more stable under stress conditions. Furthermore, drought stress reduced the yield of some genotypes while others were tolerant to drought, suggesting genetic variability in this material for drought tolerance.

PPBG 42

RAPID DECLINING OF MANGO, CITRUS AND SHEESHAM TREES: AN ENVIRONMENTAL ISSUE AND ITS CONSEQUENCES ON SOCIOECONOMICS OF BHIMBER AREA (AK) PAKISTAN

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A new and rapidly spreading disease decline of mango (*Mangifer indica*), citrus (*Citrus esculentus*) and shesham (*Dalbergia sisso*) trees in Bhimber area has been investigated spatially. The rapid declining of these species population has threatened their fruit production and timber quality in Azad Kashmir Pakistan. This loss not only shed their impacts on socioeconomics of people of Bhimber area but also shifted the paradigm towards biotic and abiotic stress on other species in forest ecosystem. In present study mango, citrus and shesham trees declining due to different factors are being taken into consideration. The samples were obtained from healthy as well as diseased plants both from field and by artificially inoculated plants. A comparison of the diseased and healthy vascular tissues (from collar portion, roots and branches) anatomy were observed by submerging these sample pieces into water and boiling to make them soft. Several fungi including *Botryodiplodia theobromae*, *Ceratocystis fimbriata*, *Phoma spp*, *Aspergillus spp*, *Cladosporium spp*, and *Nattrasia spp* were found. These pathogens invade in the xylem tissues and block the up take of mineral and nutrients, ultimately which result the declining of the tree. These pathogens primarily infect through wounds on the trunk or branches and rapidly invade the rays and fibers. A wood beetle is also responsible for wound of mango tree, and through this path these pathogen enter into the plant. Phytosociological and anatomical characteristics of healthy and decline mango, citrus and shesham trees were quite different not only from each other but also int. Due to fungal infection the vessel diameter, vessel length, ray height, ray width, fiber length and lumen diameter of decline tree was larger as compare to that of healthy samples. The present study will be help full for the plant pathologist to find out the solution of the declining. The current study will be useful to assess the biodiversity loss and their consequences on the socioeconomics of society.

PPBG 43

GENETIC VARIABILITY IN PROLINE AND ITS RELATIONSHIP WITH YIELD AND YIELD PARAMETERS OF COTTON CULTIVARS GROWN UNDER WATER STRESS CONDITIONS

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Water scarcity is an important factor limiting cotton production worldwide particularly in Pakistan. To identify drought tolerant genotypes, it is vital to understand their genetic variation for different biochemical traits under water limited conditions. In the present study, cotton (*Gossypium hirsutum* L.) accessions were evaluated under two irrigation regimes viz. well watered (W₁) and limited water (W₂) conditions. Before physiological maturity, cotton leaves were collected and analyzed for proline accumulation. At maturity, data regarding yield and yield parameters were recorded. Significant reduction in case of proline, and yield parameters was observed under W₂ condition in all the genotypes; however, Correlation between the yield parameters of cotton and proline was determined. This study shows that proline was regulated genetically and environmentally in the tested cotton genotypes. It was concluded that proline can be used as biochemical marker for screening cotton germplasm for drought tolerance as well as for evolving high yielding drought tolerant varieties of this crop. The findings are useful in bridging plant biochemistry and molecular biology for identifying and selecting genes involved in conferring drought tolerance in cotton.

PPBG 44

ANALYSIS OF COMBINING ABILITY STATUS AMONG PARENTS AND HYBRIDS IN TOMATO

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+A set of 12 F₁s developed by line × tester mating design were studied to investigate the nature and relative contribution of general combining ability, specific combining ability and simple correlation of selected tomato cultivars for yield and yield related traits in tomato. Data recorded for different traits as plant height, fruit length, fruit width, fruit weight, number of fruits per cluster, number of flowers per cluster, days to first picking, number of branches per plant and fruit setting percentage showed that variability among crosses was mainly due to contribution of lines and line × tester interaction. Correlation studies showed that fruit yield per plant has strong positive correlation and significant values ($p \leq 0.01$) for branches per plant and fruit setting per percentage while plant height had negative significant correlation for number of flowers per cluster. For specific combining ability, cross combinations CLN-2001 × BL-1175, BL-1173 × BL-1175, CLN-2001A × BL-1176 and cross BL-1173 × BL-1176 showed positive specific combining ability effects for fruit yield per plant while lines CLN-2001A and BL-1174 were found as good general combiners in term of fruit yield per plant. Among testers, BL-1176 and 17895 showed good general combining ability effects for fruit yield per plant. So these lines may be useful as parents in a local varietal development program.

PPBG 45

SCREENING OF FORAGE GENOTYPES FOR SALT TOLERANCE AND FORAGE PRODUCTION IN SALINE ENVIRONMENTS IN PAKISTAN

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In Pakistan, about 6.68 Mha of arable land is affected by salinity and/or sodicity to varying degrees. The salt-affected areas face the problems of both shortage and quality of fodder to meet feeding/dietary requirements of livestock animals. The objective of present work was to screen forage germplasm for improving productivity of saline marginal lands with brackish water. A large number of varieties provided by ICBA including summer forage species, *Sorghum* (25) and Pearl millet (30), and winter forages species Barley (25), *Brassica* (4), Alfafa (8) and Fodder beet (7) were screened under saline field conditions. Local forages, Berseem (4) and Oat (4), were also included in the trials. Forage production was determined at three salinity levels in the field, i.e. low (3-8 dS m⁻¹), medium (8-12 dS m⁻¹) and high (12-18 dS m⁻¹). Winter forages were irrigated with tube-well water (EC 3.9 dS m⁻¹, pH 8.0, SAR 24.9 and RSC 7.6 meq l⁻¹) while summer forages were generally irrigated with tube-well water but occasionally with canal water. Further evaluation of selected forage species/varieties was done at farmers' fields under low (ECe 5 dS m⁻¹) and medium (ECe 10 dS m⁻¹) salinity. Biomass yield was gradually reduced with increase in salinity of the soil. Forage production of most of the tested species may not be economical at high salinity levels above 12 dS m⁻¹. Most of the barley, *Brassica*, *Sorghum* and Pearl millet varieties provided by ICBA were either superior or similar in dry matter production as compared to local varieties. Among winter forages, *Brassica*, oat and barley had higher yields than others under low and medium salinity, however, at high salinity the differences between species were narrow. Pearl millet had outstandingly higher yield than *Sorghum* particularly under low salinity. Barley cultivars 116/2A, 91/2A 57/2D and 59/3A, *Brassica* varieties Hobson, Hyola-60 and Hyola-43, Fodder beet variety Maestro, Oat F-311 and Berseem Faisalabad Super late produced maximum dry matter at low to medium salinity. Two local varieties of alfalfa: AARI-lucerne and Sargodha-lucerne proved superior to other local or ICBA provided varieties. *Sorghum* genotypes ICSR-9302-1, ICSR-172, ICSV-745 and Speed Feed and Pearl millet varieties, IP-22269, IP-6111 and IP-19586 produced higher biomass yield over a range of salinity levels.

Based on further 2 year data from testing on farmers' fields, the ICBA provided germplasm (Barley, *Sorghum* and Pearl millet) gave higher forage yields, particularly under low and medium salinity (up to 12 dS m⁻¹), as compared to local genotypes. Cultivation of selected forages resulted in 40-50% increase in forage production and thus carrying capacity of saline marginal lands (≤ 12 dS m⁻¹) on private farms. The work conducted under this study has confirmed the potential for use of saline lands and brackish water for forage production on sustained basis.

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VARIABILITY ASSESSED IN RED ROT RESISTANT SOMACLONES OF SUGARCANE GENOTYPE S97US297 IN R₁ AND R₂ GENERATIONS

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Sugarcane globally is a major source of commercial sugar. In world production Pakistan is 5th in ranking Breeding sugarcane under climatic conditions prevailing in Pakistan is very difficult. Somaclonal variation provides an alternate to generate variability in the existing genotypes. Fifteen red rot resistant entries (somaclones) selected from R₀ generation were studied in R₁ and R₂ generations in three replications using randomized complete block design. Analysis of variance and different genetic parameters were calculated. Cluster analysis was done using Ward's method. Somaclones showed highly significant difference in all the agronomic and quality traits except pol and purity in R₁ generation. Whereas in R₂ generation significant and highly significant differences were observed in all the parameters studied. A wider variation was observed in all the characters especially in morphological traits. Variance computed in the table indicated that maximum variation was found for leaf area, plant height, cane height, number of millable canes and cane yield. The genotypic variances for the said characters were 897.34, 142.23, 87.58, 75.65 and 59.57 respectively. Genotypic variance followed the same trend as of phenotypic variance for all the characters. High genotypic coefficient of variability as well as phenotypic coefficient of variability percentage was observed for number of internodes, number of millable canes, cane yield and cane weight. Heritability estimates in broad sense were relatively high for almost all the traits studied especially cane thickness, number of millable canes, cane yield, cane weight and leaf area in R₁ generation whereas in R₂ generation only plant height, number of internodes and leaf area showed high heritability. This indicated the presence of additive type of gene action in the expression of these parameters. In both the generations somaclones divided into three clusters. Formation of clusters indicated the presence of similarities with in cluster and divergence with the somaclones present in the other clusters. Two years studies authenticate that these are the somaclones which are on the basis of parameters studied close to each other and with the parent, however somaclones are resistant to red rot and parent is susceptible to red rot disease.

PPBG 47

EFFECT OF FOLIAR FEEDING ON BIOFORTIFICATION OF WHEAT

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Wheat grown on calcareous or alkaline soils produces grain/ flour deficient in micronutrients particularly Zn and Fe etc. Moreover, in recent years, production of wheat is going down due to imbalanced use of nutrients particularly micronutrients. Soil application of micronutrients merely meets the demand of wheat for micronutrients due to fixation in soils. However, alternate and reliable approach for biofortification of wheat is foliar application of micronutrients. A mixture of six micronutrients was formulated by adding an appetizer that improves the uptake of nutrients from foliage surface. A series of experiments were conducted on former fields in the district of Toba Tek Singh with collaboration of Endowment Fund Secretariat, University of Agriculture, Faisalabad to evaluate the effect of foliar application of multinutrients plus soil applied fertilizers on growth and yield of wheat. Multinutrients were sprayed @ 500, 1000, 1500 ml acre⁻¹ in the presence of soil applied recommended dose of NPK fertilizers while NPK fertilizer alone was kept as control. Results revealed that foliar application of multinutrients significantly affected yielding parameters of wheat that ultimately caused increase in wheat yield per hectare. Foliar application of multinutrients also affected biological yield of wheat and improved wheat grain production by 25-30% compared to soil applied fertilizers. Moreover, foliar feeding increase uptake of Fe, Zn, Cu, B and Mn by wheat grains by 37, 64, 82, 63 and 52% over grains produced by traditionally used fertilizers, respectively. Similarly, significant increase in benefit-cost ratio and value-cost ratio makes foliar application of multinutrients economically more cost effective and more reliable supplementary approach for farmers. Comparison of all tested rates showed that application of foliar spray of multinutrients at the rate of 1000 ml acre⁻¹ in two splits must be applied along with soil applied NPK fertilizers to get maximum grain yield of wheat.

PPBG 48

DATE PALM CULTIVATION IN SINDH: CURRENT STATUS AND FUTURE PROSPECTS**MUSHTAQUE AHMED JATOI****Date Palm Research Institute, Shah Abdul Latif University, Khairpur, Sindh, Pakistan.***Corresponding author's e-mail: mushtaqjatoi@gmail.com*

Date palm is one of the oldest plants cultivated by man and its origin is thought to be Mesopotamia (Iraq) or Gulf region. However the Date seeds at least 5000 years old found in the storage godowns in the excavation of Moen-jo-Daro storage vases indicates the presence of date palm cultivation in ancient Sindh. Khairpur is the biodiversity centre of dates in Pakistan having more than 300 date varieties. Almost 85% of the Sindh dates produced only in Khairpur. Although, Pakistan ranked 5th in terms of production and 3rd in terms of Export (quantity wise) in the World, but with 382 \$/ton is not even enlisted/ranked among top 20 exporting countries in terms of Unit value (\$/ton). The export difficulties of dates is mainly due to using centuries old fashioned traditional methods of pre and post harvesting, dearth of advanced dates processing and preservation units, standardized packaging and presentation, national branding and market diversification and establishment of modern marketing system facilities. The strength and weaknesses of date palm production and marketing are highlighted and discussed in this study under following sections: Location and growing areas, cultivar selection, labour versus mechanization, production and harvesting, marketing and economic viability and sustainability. The study aimed to highlight the de facto situation of the date palm industry in Sindh and to improve the circumstances.

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CHEMICALS APPLICATION TO ALLEVIATE DROUGHT STRESS AND ENHANCE PRODUCTIVITY OF *BRASSICA NAPUS* CV BULBUL-98 UNDER LIMITED MOISTURE CONDITIONS**NADIA MUBARIK, AQIB IQBAL*, IJAZ ALI AND ZAHOOR AHMAD SWATI***Institute of Biotechnology and Genetic Engineering, Khyber Pukhtoonkhwa Agricultural University Peshawar, Pakistan***Corresponding author's e-mail: aqib72@aup.edu.pk*

Drought stress greatly affects productivity and growth of plants and plays a central role in their geographical distribution. Many studies in recent years have shown that exogenous application of various chemicals can enhance plant stress resistance, a phenomenon known as priming. In the present experiment, *Brassica napus* seedlings were pre-treated with $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ and H_2O_2 in different concentration as foliar sprays prior to exposure to drought stress conditions. Pre-treatment of plants with these chemicals resulted in a decrease in RWL (rate of water loss), quantities of H_2O_2 and damage to cellular membranes. Similarly, an increase in RWC (relative water content) and chlorophyll content, and induction of proline and specific proteins was also noted under drought stress in chemically primed seedlings. The proteins differentially accumulated and induced after the interactive effect of these chemicals and water availability were also identified.

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RESPONSE OF FINE RICE (*ORYZA SATIVA* L.) TO APPLICATION OF VARIOUS MICRONUTRIENTS IN DIFFERENT RICE CULTURES**NAEEM SARWAR^{1*}, MUHAMMAD MAQSOOD¹, MUHAMMAD ASHFAQ¹, EHSAN ULLAH¹, HAKOOMAT ALI², TASNEEM KHALIQ¹, KHURAM MUBEEN¹ AND ABDUL SATTAR¹**¹*Department of Agronomy, University of Agriculture, Faisalabad 38040 (Pakistan)*²*Department of Agronomy, University College of Agriculture, Bahuddine Zakariya University, Multan (Pakistan)***Corresponding author's e-mail: bajwa834@gmail.com*

Rice cultivation is in shift from flooded to aerobic condition for water wise rice cultivation all over the world. Thus the field experiment was conducted to explore the role of boron and zinc on growth and yield of fine rice in different rice cultures: Aerobic rice, Flooded rice and "Flooding for two weeks after transplanting and then maintained at field capacity up to panicle initiation and again kept flooded starting from panicle initiation up to physiological maturity" in growing seasons of year 2009 and 2010. Study revealed that changing soil water contents, micronutrients dynamics in the soil was changed which had significant effect on growth and yield of fine rice. The growth parameters (LAI, LAD, TDM, NAR and chlorophyll contents) of rice crop were significantly hassled when it was subjected to grow in aerobic condition. However, crop was not affected significantly when it was grown in modified rice culture and performed as good as the normal flooded rice. Results also indicated that introduction of aerobic rice cultivation for fine rice can increase the deficiency problem of micronutrients (B & Zn) in calcareous soils.

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EXPRESSION OF DEFENSIN LIKE GENE IN *PISUM SATIVUM*NAFISA¹ AND AMNA SHOAIB²*Institute of Agricultural Sciences, University of Punjab, Pakistan***Corresponding author's e-mail: nafisa.farooq@hotmail.com*

Food contamination problems due to biotic and abiotic stresses are important issue of the modern word. The current work was performed to investigate the influence of southern blight diseases on germination and growth rate of pea (*Pisum sativum* L.) grown under abiotic stress of Cu(II). In pot trials, Cu(II) was applied @ 1.25, 2.5, 3.75 and 5.0 mg Kg⁻¹ in 3 kg of soil filled in 12cm x 12 cm (diameter x depth) plastic pots. Inoculum of *Sclerotium rolfsii* was applied @ 7 g in 3 Kg of soil. Important growth parameters were recorded in 4-week and 8-week old pea seedling. Results showed that germination rate, shoot and root growth parameters significantly ($P > 0.05$) reduced up to 40%, 10-35% and 10-40% in plant treated with pathogen. There was 30%, 10-30%, 3-30%, 10-40% reduction in germination rate, shoot length, fresh & dry biomass and 5-30%, 5-24%, 3-50% suppression in root length, fresh & dry biomass of 30 days and 60 days old plants in the plants. Morphological symptoms like chlorosis, crinkling and wilting of the bottom leaves, stunt root and stems were observed at both harvested time. The expression of defensin like gene (Def) were checked thorough PCR techniques. Plant under pathogenic conditions showed higher expression of Def. Plants suffered both pathogen and metal stress environments demonstrated that the band thickness increased with increasing metal doses. It can be concluded that the synergistic effect of *Sclerotium rolfsii* and copper produce more resistant in plants. So, only the recommended amount of copper based pesticides must be used to control the disease. Excess usage of them can result in land degradation that in turn affects food safety and crop production. Therefore, in future there should be minimum use of such soil contaminates and research should be focused on land reclamation with eco and environment friendly plants.

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CATEGORIZATION OF BER GERMPLASM THROUGH BEARING AND ASSOCIATED CHARACTERSNASEEM SHARIF^{1*}, NOOR- UN- NISA MEMON², FAKHRULDIN RAZI³ AND MUHAMMAD JAFAR JASKANI⁴¹*Horticultural Research Institute, AARI, Faisalabad, Pakistan,*²*Department of Horticulture, Sindh Agriculture University, Tandojam, Pakistan,*³*Citrus Nursery Sanitation Laboratory, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan*⁴*Plant Tissue Culture Cell, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan***Corresponding author's e-mail: seemiua@gmail.com*

Thirty four commercial varieties of local underutilized fruit Ber were categorized to overcome the glut market dilemma at Horticultural Research Institute AARI, Faisalabad and Jujube Research Station, Tandojam Sindh during 2010-2011. Traits viz., pedicel length (cm), calyx color, period of blooming (days), peak time of blooming (days), time of fruit set (days), peak time of fruit set (days), time of harvest (days), and peak time of fruit harvest (days). Results revealed significant difference among pedicel length ranged from 0.32cm (Gorh) to 0.58cm (Dehli Sufaid) for Faisalabad germplasm and 0.25cm (Khirol Ratam) to 0.62cm (Gola Late) for Sindh germplasm while no variation was recorded for calyx color. Varieties were classified as early, medium and late. At Faisalabad conditions Karela, Umran, Khobani were classified as early; Fauladi, Suffon, Anokhi as mid and Dehli White, Gorh and Dilbhar as late varieties. In Sindh Gola Early, Gola Grape, Soofi Umran and Soofi Sialkoti as first-rate early, Gola late, Gola Saffina, Gola Kararri, Soofi Gilli, Soofi Sanghar and Soofi Local as mid whereas White Chambeli, Khirol Mukhri, Khirol Desi, and Khirol Ratam categorized as late varieties.

PPBG 53

INHERITANCE OF OKRA LEAF TYPE, GOSSYPOL GLANDS AND TRICHOMES IN COTTONNAUSHERWAN NOBEL NAWAB^{1*}, ABID HUSSAIN², GHULAM JEELANI¹, MUHAMMAD SUDHEER TARIQ³, TAJ NASEEB KHAN¹, MUHAMMAD FAROOQ¹ AND ALI RAZA GURMANI⁴¹*Vegetable Crops Research Programme, Horticultural Research Institute, NARC, Islamabad, Pakistan.*²*Director Cotton Research Institute, Ayub Agricultural Research Institute, Faisalabad, Pakistan.*³*Horticultural Research Institute, NARC, Islamabad, Pakistan.*

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Cotton growing in Pakistan is facing a great threat from the insect pest perspective, which has developed resistance in the versatile insect pest population against the high doses of chemical sprays used in the past years. Such a growing resistance in the cotton insect pests against the insecticide/pesticide application needs to be redressed. Insect non-preference traits exist in nature which can reduce the insect pest population by ultimately reducing the high cost being spent on the insecticide/pesticide application. In cotton, the traits like okra leaf type, trichomes and gossypol glands confer significant resistance against some of the major insect pests including the sucking and chewing insect complex. These traits are oligogenically controlled. Inheritance of these traits is simple. Crosses were made among the contrasting traits. The segregating populations along with the parents, F_1 and back crosses for each trait under study were subjected to the inheritance studies. Okra leaf type, trichomes and gossypol glands behaved like any incompletely dominant allele. The chi-square well fits to 1:2:1 in the F_2 .

PPBG 54

AGRO-PHYSIOLOGICAL RESPONSE OF SOME WHEAT CULTIVARS TO PHOSPHORUS

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Agro-physiological response of some wheat cultivars to differential phosphorus fertilization were conducted at the Experimental Farm, University College of Agriculture, Bahauddin Zakariya University, Multan (Pakistan). Experiments were carried out for two consecutive years. The soil was a calcareous clay loam and the climate was arid in nature. Each experiment was replicated four times in a randomized complete block design (RCBD) with split plot arrangement. Five wheat cultivars were sown with different levels of phosphorus fertilization. Experimental treatments were as Phosphorus levels $P_1 = 60$, $P_2 = 90$, $P_3 = 120$ (kg ha^{-1}) and Wheat cultivars $V_1 = \text{Uqab-2000}$, $V_2 = \text{Inqulab-91}$, $V_3 = \text{Bhakar-2002}$, $V_4 = \text{Iqbal-2000}$, $V_5 = \text{MH-97}$ were used. The crop was sown during the second week of November each year. The data on various agronomic and physio-chemical characteristics of the crop were recorded following standard procedures. Various cultivars of wheat and different P levels produced variable total dry matter and grain yield. However, grain yield in Inqulab-91 and Iqbal-2000 was the highest and equal during both the years. Application of $120 \text{ kg ha}^{-1} \text{ P}_2\text{O}_5$ recorded the maximum grain, straw and biological yield ha^{-1} . Sowing of Inqalab-91 with the application of $120 \text{ kg ha}^{-1} \text{ P}_2\text{O}_5$ materialized into the highest net field benefit and benefit cost ratio while the lowest were recorded for Uqab-2000 fertilized with $60 \text{ kg ha}^{-1} \text{ P}_2\text{O}_5$. Inqulab-91 and Iqbal-2000 out yielded all other cultivars, however, were at par with each other for grain yield.

PPBG 55

EFFECT OF ZINC FERTILIZATION ON DRY MATTER PRODUCTION AND MINERAL COMPOSITION OF IRRIGATED COTTON

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Studies on effects of Zinc (Zn) nutrition on biomass production and its concentration in irrigated cotton (*Gossypium hirsutum* L.) are limited. Thus, a permanent layout [two-years field experiment (2004 and 2005)] was conducted to study the impact of Zn fertilizer at 0.0, 5.0, 7.5, 10.0, and 12.5 kg ha^{-1} on the chemical composition and biomass production of cotton plant at maturity. The soil at experimental site was alkaline (pH 8.1), calcareous (CaCO_3 5.6%), and silt loam (Typic Haplocambid). The concentration of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), boron (B), copper (Cu), iron (Fe), manganese (Mn), and Zn were determined in leaves, stems, burs, seed and lint. Results showed that increasing Zn levels significantly caused the progressive accumulation of Zn in leaves and other plant parts. The N, K, B and Zn concentrations in leaves, seed, stems, burs and lint were increased with Zn rates; whereas concentrations of P, Ca, Mg, Cu, Fe and Mn were decreased. Increased Zn application exerted positive effect on dry matter production could be explained by the improvement in the nutritional status of the essential macronutrients and micronutrients.

PPBG 56

MANGO FRUIT QUALITY, STORABILITY AND MARKETABILITY IN RESPONSE TO PRECOOLING AND VARIOUS FUNGICIDAL TREATMENTS

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Postharvest disease incidence along the supply chains does limit the shipment potential of mango fruit around the globe. These studies were targeted to study the impact of precooling and efficacy of a Syngenta product viz a viz Tecto (a.i. Thiabendazole-500g/L) at different concentrations alone and in combination with Sportak (a.i. Prochloraz-450g/L) against postharvest disease development in a commercial mango cv. Sufaid Chaunsa of Pakistan. The fruit subjected to on-farm forced air precooling and transported under low temperature conditions (11°C; 80-85%RH) had significantly ($P \leq 0.05$) lesser disease and better fruit quality along with more shelf life and higher marketability index as compared to non-precooled and traditionally transported mangoes. Moreover, non-precooled fruit had significantly higher rate of respiration (CO_2 liberation) and more weight loss as compared to precooled fruit. Among the tested fungicidal combinations, combined application of Tecto @ 2000 ppm with sportak @ 0.5ml/L (Tank mix; HWT-52°C; 5 min) performed better with significant disease control (i.e. stem end rot, side rot and anthracnose) and more marketability index during storage and ripening. The tested alone concentrations of Tecto (1000, 1500 and 2000 ppm) could not perform well in this regard. However, the effect of Tecto 2000 ppm was relatively better (but non-significant) in terms of marketable fruit followed by Tecto-1500ppm than other Tecto concentrations, carbendazim and mancozeb. This paper discusses the effect of precooling and different fungicidal treatments (alone or in combination) on postharvest disease development, marketability, shelflife and physico-chemical quality of Sufaid Chaunsa mangoes.

PPBG 57

EFFECTS OF GAMMA IRRADIATION ON SEEDLING STAGE OF DIFFERENT WHEAT VARIETIES

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Induced-mutation is playing a significant role in crop improvements. To determine the effects of various doses of gamma on seed germination and some other growth traits, the experiment was conducted under laboratory conditions. The dry seeds of two widely adapted commercial wheat varieties Khirman and TD-1 along with two advance lines NIA-Saarang (drought tolerant) and ESW-9525 (salt-tolerant) were irradiated using ⁶⁰Co gamma rays with different doses viz., 150 Gy, 200 Gy, 250 Gy and 300Gy. Data were recorded on germination (%), shoot length (cm), root length, shoot fresh weight (mg) and root fresh weight was statistically analyzed. All the measured seedling characters showed significant ($P > 0.05$) reduction with the increase of gamma-irradiation dose i.e. 250 and 300 Gy respectively; however, germination delayed due to higher doses of gamma rays. Genotypes showed differential response to various doses. Genotypes Khirman and ESW-9525 were found more sensitive as compared to NIA-Saarnag and T.D-1. Khirman and NIA-Saarang were more responsive to higher doses as compared to T.D-1 and ESW-9525 for shoot length. The information generated through present studies will be useful for the breeders to select mutant plants with desirable traits in successive mutation generations and to determine the suitable dose to obtain more genetic variability.

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NITROGEN AND RADIATION USE EFFICIENCIES OF C₄ SUMMER CEREALS TO NITROGEN SPLIT APPLICATION

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We studied the response of three C₄ summer cereal crops i.e. maize (*Zea mays* L.), millet (*Pennisetum americanum* L.) and sorghum (*Sorghum bicolor* L.) cultivars to split nitrogen for nitrogen and radiation use efficiencies (N&RUEs) under irrigated arid environment. Field studies were conducted at the Agronomic Research Area, Bahauddin Zakariya University Multan, Pakistan during the summer seasons 2010 and 2011. The treatments consisted of three cultivars each of three summer cereal crops i.e. maize (V₁ = Sahiwal-2002, V₂ = MMRI Yellow and V₃ = Pearl), millet (V₁ = YBS-93, V₂ = YBS-89 and V₃ = 18 BY) and sorghum (V₁ = Jumbo, V₂ = YSS-98 and V₃ = YSS-9) and five nitrogenous splits i.e., NS₀ = control, NS₁ = whole N at sowing, NS₂ = ½ N at sowing + ½ N at 1st irrigation, NS₃ = 1/3 N at sowing + 1/3 N at 1st irrigation + 1/3 N at 2nd irrigation and NS₄ = ¼ N at sowing + ¼ N at 1st irrigation + ¼ N at 2nd irrigation + ¼ N at 3rd irrigation. Among cultivars Pearl, 18 BY and Jumbo produced the highest total dry matter (TDM) and grain yield, respectively. Agronomic nitrogen use efficiency (ANUE) for maize, millet and sorghum varied from 15.38 to 33.47 kg kg⁻¹. Among N splits, NS₃ recorded the highest ANUE of 19.11 to 38.05 kg kg⁻¹ for maize, millet and sorghum crops, respectively. Economic nitrogen use efficiency (ENUE) for maize, millet and sorghum crops ranged from 5.04 to 9.12 \$ kg⁻¹. Radiation use efficiency (RUE) for C₄ summer cereal crops ranged from 2.11 g MJ⁻¹ to 3.47 g MJ⁻¹. However, higher RUE values were observed in case of NS₃ split and the lowest were found in case of NS₄ split for maize, millet and sorghum crops.

PPBG 59

EFFECT OF INTERCROPPING ON ROOT ROT DISEASE AND AGRONOMIC PERFORMANCE OF GROUNDNUT

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The experiment was comprised of five treatments viz. (i) Negative control (No treatment) (ii) Positive control (*Fusarium solani* (FS) inoculation alone) (iii) *Pennisetum glaucum* + FS (iv) *Sorghum bicolor* + FS (v) *Zea mays* + FS. Plants were free of disease in negative control treatment. In positive control disease incidence was 98%. Intercropping of *P. glaucum*, *S. bicolor* and *Z. mays* significantly reduced disease incidence to 77%, 44% and 55% respectively. In positive control disease severity rating was in range of 0-3. *P. glaucum* and *S. bicolor* reduced the disease severity to 0-1 and 0-2 respectively. In groundnut intercropping with *Z. mays* disease severity was 0-3. Plant mortality was 21% in positive control. Intercropping of *P. glaucum* reduced the mortality to 21% where as *S. bicolor* and *Z. mays* reduced the plant mortality to 17% and 18% respectively. All treatments significantly affected groundnut yield. In negative control yield was highest and lowest in positive control. *Z. mays* intercropping alleviated the negative effect of *F. solani* inoculation to a significant level.

PPBG 60

GENETIC DIVERSITY AS REVEALED BY RAPD ANALYSIS AMONG THE CHICKPEA GENOTYPES

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The objectives of this study were to estimate the genetic diversity and to evaluate the relationship between eight chickpea genotypes that is the valuable source for breeding. Chickpea seed is a good source of carbohydrates and proteins, constituting 80% of the total dry seed weight. The variable response of chickpea genotypes were characterized by using the 15 RAPD primers. The total numbers of amplification products generated were 915, and among them 898 were found to be polymorphic. The number of amplification products ranged from 28-81 from 15 arbitrary primers. The molecular weight of the generated bands in the present study ranged from 100 bp -2968 bp. Primers BG-30, C and OPA-02 generated the maximum number of amplified products. Minimum number of 28 RAPD products were obtained with OPA-04. 16 RAPD products were recorded as unique or species specific and resulted in 98.1% of polymorphism.

PPBG 61

COMPARISON OF WHEAT SOMACLONES WITH THEIR RESPECTIVE PARENTS UNDER SALT STRESS CONDITIONS

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To induce the genetic variability in wheat for salt tolerant, ten wheat varieties i.e. Chenab-70, Punjab-76, Pasban-90, Inqulab-91, Punjab-96, Uqab-2000, AS-2002, Bhakhar-2000 and Ufaq-2002 were used to develop salt tolerant wheat somaclones at four salinity levels, i.e., 0, 50, 100 and 150 mM NaCl. The so developed somaclones of various wheat genotypes along with their parents/ mother plants were sown in pots having artificially developed four levels of salinity i.e., 0, 4, 8 and 12 dSm-1 using NaCl salt to study and compare different agronomic traits i.e. number of spikes per plant, number of grains per spike, 100 grain weight and yield per plant among themselves. It was observed that salinity decreased No. of spikes, spikelets, 100 grain weight and yield per plant. The maximum 100 grain weight in control treatment was observed in AS-2002(P) and Bhakhar-2000(P) followed by Inqulab-91(S) and Punjab-76(P) as compared to other somaclones/genotypes of wheat. Uqab-2000(S) was also at par with its parent Uqab-2002(P). At EC level of 4dSm-1, Inqulab-91(P), Inqulab-91(S) and Bhakhar-2000 (S) were salt tolerant. At EC 8dSm-1, Bhakhar-2000(S) and LU-26S (P) were noted as the best tolerant while at EC12dSm-1 Inqulab-91(P) was superior to all other genotypes. As for as yield per plant is concerned somaclones Inqulab-91(P) and Bhakhar-2000(S) were found salt tolerant at 8dSm-1 in yield per plant.

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ASSESSMENT OF SEED-BORNE MYCOFLORA AND NUTRITIONAL PROFILE OF LENTIL (*LENS CULINARIS*) GROWN IN ARID REGION

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Lentil (*Lens culinaris*) is a common and the oldest domesticated pulse and has relatively higher contents of protein, carbohydrate and calories as compared to other legumes. During present study fifty samples from different arid regions of Punjab viz. Chakwal (n=16), Khushab (n=17) and Rawalpindi (n=17) were investigated for its mycoflora and nutritional profile. A total of 14 fungi including *A. niger*, *A. flavus*, *A. ibericus*, *A. sydowi*, *A. fumigatus*, *alternariatenuissima*, *A. solani*, *Penicillium notatum*, *Rhizopus nigricans*, *culvularia clavata*, *F.oxysporum*, *Paecilomyces variotii*, *Mucor* and an unknown spp. were isolated from lentil seeds and 240 fungal isolates were identified. Among all lentil samples co-occurrence of fungal isolates were ranged from 1-11 species. The dominating fungal isolates were *A. niger*, *A. flavus*, and *mucor* whereas *Paecilomyces variotii* and *Alternaria tenuissima* were observed in minimum numbers. The comparative study of mycoflora of three districts of Punjab showed that highest incidence of fungal flora was found associated with district Khushab (84 isolates) followed by Chakwal district (76 isolates) and district Rawalpindi (74 isolates). Fifty (n=50) lentil seed samples collected from 3 arid regions of Punjab put forth for chemical analysis. The proximate analysis of seed samples of Chakwal showed average values of moisture (5.52±1.05), protein (23.46±1.05), fiber (4.43±0.80), fat (1.57±0.39) and ash (2.43±0.40) contents. The nutritional profile of seed samples of Khushab showed average values of moisture (5.19±0.78), protein (23.87±1.16), fiber (4.38±0.60), fat (1.63±0.45) and ash (2.24±0.41). Similarly, the proximate analysis of lentil seed samples of Rawalpindi showed average values of moisture (5.81±0.95), protein (24.32±0.89), fiber (4.67±0.93), fat (1.55±0.44) and ash (2.22±0.48). The comparative nutritional profile of lentil seed samples of 3 districts showed that high protein contents were found in Rawalpindi district (24.32±0.89) followed by Khushab district (23.87±1.16) and Chakwal district (23.46±1.05) respectively. The higher crude fiber content was found in samples collected from Rawalpindi district (4.67±0.93) followed by Chakwal (4.43±0.80) and Khushab district (4.38±0.60). Similarly, crude fat (%) of seed samples of Khushab (1.63±0.45) district was followed by Chakwal (1.57±0.39) and Rawalpindi (1.55±0.44). While crude ash content of district Chakwal was higher i.e. 2.43±0.40 followed by Khushab (2.24±0.41) and Rawalpindi (2.22±0.48) respectively.

PPBG 63

ZINC APPLICATION RESPONSES OF AUTUMN PLANTED SUNFLOWER HYBRIDS ON PHENOLOGICAL, YIELD AND QUALITY ATTRIBUTES.

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Zinc (Zn) as important micronutrients for plants improves growth, seed yield and quality of agronomic crops. A field trial was conducted to investigate the impact of Zn fertilizer on phenology, yield and oil contents of autumn planted sunflower hybrids. Experiment comprised of two hybrids viz; HYSUN-33 and S-278 placed in main plots and six Zn levels (control, 5, 10, 15, 20 and 25 kg Zn ha⁻¹) in sub plots. Results revealed that leaf area index, head diameter, number of achenes per head, 1000 achenes weight, achenes yield, biological yield and harvest index were significantly affected by different zinc levels whereas plant height, days taken to 50 % flowering, heading and maturity were statistically non-significant. The sunflower hybrid Hysun-33 recorded maximum seed yield at the rate of 15 Zn kg ha⁻¹. Zinc applied @ 15 kg ha⁻¹ produced maximum values for all these traits as compared to control. Maximum oil and protein percentages were obtained at 5 kg Zn ha⁻¹ significantly higher from control but statistically at par with other zinc levels. This study concluded that Zinc fertilization promoted growth, yield and quality of sunflower hybrids.

PPBG 64

EFFICACY OF DIFFERENT HERBICIDES FOR WEED MANAGEMENT IN WHEAT CROP

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The field study was conducted at Agricultural Extension Farm, Dargai, KPK during 2011 to assess the comparative efficacy of different herbicides for weed management in wheat crop under agro-climatic conditions of Pakistan. The experiment was laid out with four replications in randomized complete block design (RCBD). The experiment consisted of hand weeding a weedy check and six herbicides. The post emergence application of herbicides included Aim 40 DF @ 0.02 kg a.i. ha⁻¹, Agritop 500GL⁻¹ @ 0.43 kg a.i. ha⁻¹, Isoproturon 50WP @ 1 kg a.i. ha⁻¹, Puma super 75EW @ 0.75 kg, Topik 15WP @ 0.04 kg and Buctril super 60EC @ 0.45 kg. For comparison hand weeding and weedy check were also included. In each replication six treatments of these six herbicides were kept. The significantly affected parameters were fresh weed biomass (kg ha⁻¹), thousand grain weight (g), number of tillers m⁻², weed control efficiency (%) and grain yield (kg ha⁻¹). Statistical analysis showed that maximum weed efficiency (84%) was recorded for Isoproturon 50 WP whereas minimum value (37%) was for Aim 40 DF. Similarly maximum number of tillers m⁻² (250) was recorded for Isoproturon 50 WP and minimum (133) in weedy check. The herbicide Isoproturon 50 WP @ 1.0 kg a.i ha⁻¹ is applied as post emergence in wheat performed well in the entire weed and wheat crop data and exhibited effectively weed control in wheat.

PPBG 65

PRODUCTION AND QUALITY IMPROVEMENT OF LETTUCE (*LACTUCA SATIVA L*) THROUGH CONTAINERIZED GROWING MEDIA UNDER COLD GLASSHOUSE CONDITIONS

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Plants grown in the containers are restricted to a limited volume of the media consequently, required the careful management in maintaining the characteristics, like organic/inorganic contents, carbon nitrogen ratio, bulk density, percentage of air, CEC, pH value of the media and the required nutrient feed in the form of solution. The use of solid substrates including perlite, peat, straw bale, soil-based compost greenhouse border soils were experimented to grow the seedlings (transplants) and then planting media for the growth and development of cos lettuce (*Lactuca sativa L.*, var. *longifolia*) in the cold (unheated) glasshouse to investigate the responses of seedlings and planting media as independent entity and also demonstrated the effect of their interaction on the crop under question. Significant results of many physical and yield parameters (mainly including plant height, head diameter, number of days from sowing to harvesting, total and marketable plant weight, percentage of tight and loose heads, status of tip burn etc.) were appeared indicating that different media have vital potential for the production of seedlings and production of cos lettuce. Seedlings grown in perlite or peat compost lead to higher yield grown in different planting media through bag culture technique. Perlite with bags culture produced the yield at parallel with greenhouse border soil; however, it possesses many advantages over the other containerized growing media including border soil. The alternative use of straw bale substrates over soil and other media exhibited significant performance in growth and development of lettuce plants. Containerized soil-based compost in bag culture, though economical but requires great care especially to avoid compactness for improving growth and yield. For high and quality winter crop production, perlite or border soil planting media in combination with peat or perlite seedling media can be of good match for obtaining average yield of 4.78 kg/m².

PPBG 66

DIVERSITY ANALYSIS AND RELATIONSHIPS AMONG GINGER LANDRACES**SHAKEEL A. JATOI¹* AND KAZUO N. WATANABE²**¹*Plant Genetic Resources Programme, National Agriculture Research Centre, Islamabad-4500, Pakistan*²*Gene Research Centre, Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan**Corresponding author's email: sajatoi@gmail.com

Ginger (*Zingiber officinale*) is a valuable spice and aromatic crop having medicinal significance. To have insight into variability pattern and relationships among ginger landraces, the current study was undertaken at University of Tsukuba, Japan during 2005-2006. High variance for plant height, rhizome weight, rhizome thickness, sheath length, tillers per plant and leaf length was observed in the germplasm assayed. Principal component analysis explained 80% and 90% of the total variation by the first four PCs during the year 2005 and 2006, respectively. The representative accessions acquired from the genebank remained dispersed in the three clusters during both the years displaying variability among accessions. The ginger accessions collected from local markets were found interspersed among all the clusters during both years. The ginger genotypes displayed positive and significant correlations among different quantitative traits during the two years. Plant height, leaves per tillers, tiller thickness appeared to be of prime importance as they directly influence rhizome yield, and provide a good indication for future's emphasis in crop improvement in ginger. No relationship between distribution pattern and acquisition source was observed in this study. The different approaches used to analyze different aspects of ginger provided a deep insight and indicated existence of considerable variability and diverse base which has been prioritized for crop improvement.

PPBG 67

COMPARATIVE PERFORMANCE OF SEMI-DWARF AND DWARF WHEAT GENOTYPES**SHAYAN SYED¹, MAHBOOB ALI SIAL²* AND KHALIL AHMED LAGHARI²**¹*Department of Plant Breeding & Genetics, Sindh Agriculture University Tandojam*²*Nuclear Institute of Agriculture (NIA), Tandojam*Corresponding author: shy2syed@yahoo.com

Semi-dwarf advance wheat genotypes possesses plant height above 100 cm and dwarf genotypes with below 80 cm plant height were evaluated for yield and various yield associated traits along with check varieties Khirman, TD-1 and Yecora. The experiment was conducted under normal (7th November) and late sowing (1st January). Semi-dwarf genotypes MASR-07, MASR-64, NIA-10/8, BWB-84, BWS-77 and NIA-9/5 produced higher yield than dwarf genotypes at both planting times. However, dwarf genotypes headed and matured earlier than semi-dwarf ones and also had higher number of grains per spike, main spike yield and 1000-grain weight. These finding gave a clue that dwarf genotype possess many good traits to produce higher yield but they could have required different agronomic practices such as high inputs etc. This paper will discuss the detailed study of newly developed genotypes for their different traits and will highlight the impact of Rht genes to improve the crop productivity.

PPBG 68

PATHOGENIC VARIATIONS AND CHARACTERIZATION OF *STREPTOMYCES SCABIES* ISOLATES FROM POTATO TUBERS IN RAWALPINDI DISTRICT**SHAZIA SHAHZAMAN, FARAH NAZ*, C.A.RAUF, I.U.HAQUE AND K.RIAZ***Department of Plant Pathology, PMAS-UAAR, Pakistan**Corresponding author's email: nazfrh@yahoo.co.uk

Incidence and occurrence of common scab caused by *Streptomyces* spp. was probed in different areas of Rawalpindi District viz. Taxilla, Hassan abdal, Qazi abad and New City (Taxilla). Survey was carried out at the time of harvest and tubers were examined for the presence of scab lesions. Scab lesions differ in color from brown to black; small raised cork-like tissue in the region of the lenticels to large deep depressed areas. Mean Incidence of disease 81.75 % was recorded which was significantly high. Out of four varieties viz. Bartina, Desiree, Santé & Cardinal sown in four fields, progeny tubers of Bartina variety were found to have highest CSDI (94.66%) followed by Cardinal (78%), Desiree (68%) and Santé (65%). Pathogen was isolated from diseased potato tubers and twenty five purified isolates were named after the areas viz. Qazi Abad (Road Side) AQAR-1, AQAR-2, AQAR-3, AQAR-4, AQAR-5 from Taxilla, BTB-1, BTB-2, BTB-3, BTB-4, BTB-5

from New City, CNC-1, CNC-2, CNC-3, CNC-4, CNC-5 from Qazi Abad (Middle Block side), DQAB-1, DQAB-2, DQAB-3, DQAB-4, DQAB-5 from Hassan Abdal, EHA-1, EHA-2, EHA-3, EHA-4, EHA-5. All isolates were found positive for hypersensitive reaction on tobacco plant. Ten isolates viz. AQAR-1, AQAR-2, BTB-1, BTB-2, CNC-1, CNC-2, DQAB1, DQAB-2, EHA-1 and EHA-2 when subjected to biochemical tests were Gram positive. Microscopy (100X) revealed that cells were filamentous ~1 µm wide with average length of the cells 10-100 µm. The pathogenic variability among these *Streptomyces* isolates was established on cv. Bartina. All the isolates showed positive pathogenic response on cv. Bartina as compared with control where no common scab symptoms were observed on progeny tuber. Mean common scab disease index (CSDI) revealed by these isolates on progeny tubers however, was significantly different from each other. Isolate CNC-2 was found most virulent followed by CNC-1, DQAB-1, DQAB-2, BTB-1, BTB-2, AQAR-1, AQAR-2, EHA-2 & EHA-1. Common scab was prevalent in the field located away from the road and the intensity decreased as moved toward the road bank from the center of the field.

PPBG 69

INVESTIGATIONS FOR COMPLEXITY OF ASCOCHYTA BLIGHT OF CHICKPEA AND IDENTIFICATION OF RESISTANT SOURCES

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Chickpea (*Cicer arietinum* L.) is the most important winter food legume of Pakistan cultivated rainfed in the areas of Punjab and Khyber Pakhtoon Khawa (KPK). Blight caused by *Ascochyta rabiei* (Pass.) Lab. is the most devastating disease in all the chickpea growing countries including Pakistan. The inter-relationship of disease factors including inoculum potential, plant age, effect of leaf wetness and latent period with pathogenesis revealed a linear relationship between disease severity and inoculum concentration. Inoculation of chickpea cultivars; Punjab 91 and C 727 at physiological stages ranging from 2 to 12 weeks (seedling to reproductive stage) resulted that 2-weeks old seedlings were more susceptible to disease than the adult plants that suggested screening of huge nurseries at seedling stage followed by tolerant lines to screen under field conditions. Two to three days incubation period coupled with 1-2 sprays a day had a pronounced effect on disease development. Disease severity index (DSI) ranged from 44 to 82% indicating maximum at vegetative stage in the cultivar “C 727”, whereas the lowest DSI was on the cultivar “Dasht”. In another experiment, 42 isolates of *A. rabiei* sampled from chickpea growing areas exhibited variation in morphological and cultural characteristics. The virulent isolates could be categorized on the basis of clusters. The susceptible differentials (C727, ILC 263, C 44 and CM 72) were identified but no variety was resistant that might be due to complex nature of *A. rabiei*. Clustering pattern indicated the exchange of breeding material and disease cultures among the researchers or high heterogeneity in the isolates. One experiment comprising of 448 genotypes were screened against blight at two stages and none of the genotypes was highly resistant at any stage, whereas 46 at seedling in the greenhouse and 94 at pod formation stage in the field were resistant. Common genotypes, which were resistant at both the stages were suggested to be utilized in breeding programme to build disease resistance pyramids due to complex nature of *Ascochyta* blight.

PPBG 70

PROBING GENETIC RESISTANCE AGAINST STEM RUST IN WHEAT VARIETIES OF PAKISTAN

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Stem rust is a destructive disease of wheat worldwide especially Ug99 which threatens wheat production globally. The geographical location of Pakistan demands an efficient method for identification of resistant genetic resources, to minimize the Ug99 threat. The present study provides information about effective resistant genes *Sr22*, *Sr24*, *Sr26*, *Sr31* using closely linked molecular markers. The efficiency of markers was ascertained by comparative analysis of field trials in 2011 at Kaghan, Pakistan. Results revealed that the effective *Sr26* gene is absent in respective germplasm and making it an appealing choice for pyramiding program under MAS. Our work appraises the extensive distribution of *Sr22* gene in Pakistani wheat varieties to increase the resistance against different isolates including Ug99. Pakistani wheat commonly bears *Sr24* and *Sr31* but the TTKST and TTKSK have also been shown to exhibit virulence to these genes. Although these genes do not provide an adequate level of resistance but they are effective in different combinations to develop durable resistance. The data provided in this work will facilitate the marker-assisted selection to develop durable resistant in short period by reducing environmental factors. This study concentrate that mutable pathogenic microbes requires continuous research and attention. The identification of truly durable resistant genes are indispensable for wheat stem rust.

PPBG 71

MORPHO-AGRONOMIC CHARACTERIZATION OF OKRA GERMPLASM

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In present study 36 genetically diverse genotypes of Okra were evaluated to find out their similarities and differences based on morphological traits for the target of genetic advancement. Among all genotypes only twenty seven succeeded to germinate. The experiment was laid out in Randomized Complete Block Design (RCBD) with two replications. Morphological traits of the genotypes were measured according to the coding criteria specified by the Standard International Crop Descriptor for okra. Cluster analysis based on 14 qualitative and 14 quantitative variables grouped all the accessions into two linkages and four clusters. A dendrogram was primed to clarify the relationship between the genotypes. One pair of genotypes showed 38% similarity which is the least percent of similarity between any two genotypes in Okra population. Six pairs of genotypes were fifty (50%) similar, which indicates that they are in line at half the characters evaluated. Five genotypes of short growth habit, less fruit length and vast fruit diameter grouped under one linkage. All the data obtained disclosed that the genotypes significantly varied from each other with respect to all the characters studied. Okra genotypes; 000034 and 000036 produced strong branches with fruits near to the ground, but gave high yield. These could be chosen for crossing with other genotypes; 020535 and Bemisal with orthotropic branching (erect growth), normal plant height & low yield in order to get a best type of okra varieties having high yield and erect growth for commercial productions.

PPBG 72

ASSESSMENT OF GENETIC DIVERSITY IN SOME ACCESSIONS OF *SACCHARUM OFFICINARUM* L. BY MEANS OF MORPHOLOGICAL CHARACTERS, WITH PRINCIPAL COMPONENT ANALYSIS (PCA).

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Ten accessions of sugarcane (*Saccharum officinarum* L.) viz. CP-77-400, CP-72-2086, BF-129, CPF-234, SPF-213, HSF-242, HSF-240, Col.72, Triton and No. 46 were evaluated for twelve characters and genetic diversity investigations were done by PCA. The experiment was conducted in triplicated randomized complete block design (RCBD). Analysis of variance portrayed highly significant differences among the accessions for all the traits. In Principal component analysis (PCA) no. of millable canes, no. of stools per plant and internodal distance contributed positively towards genetic diversity and all other traits contributed negatively towards diversity, in first two PCs i.e. PC1 and PC2. Most of the varieties showed greater extent of genetic diversity contributed by morphological traits.

PPBG 73

MICROSATELLITE (SSR) MARKERS A TOOL; FOR GENETIC DIVERSITY ASSESSMENT AMONG SUGARCANE ACCESSIONS.

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Thirty SSR primer pairs chosen randomly from the SSR primer collection were used to detect polymorphism in 17 sugarcane accessions. A total of 62 DNA fragments were generated by the 30 primers with an average of about 2.14

bands per primer. Bands that a primer yielded in the study ranged from 1 to 4. The genetic distances for SSR data using 17 sugarcane accessions, was constructed based on Nei (1978) and relationships between accessions were portrayed graphically in the form of a dendrogram. The value of genetic similarity ranging from 62.90% to 90.30% was observed among the 17 sugarcane accessions. The highest genetic similarity of 90.03% was seen among genotypes S-2003-US-118 and S-2003-US-312. From present study it may be concluded that SSRs markers are best tool for investigation of genetic diversity in sugarcane.

PPBG 74

GENOTYPIC DIFFERENCES AGAINST PEG SIMULATED DROUGHT STRESS IN TOMATO

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Osmotic stress simulation at 4% PEG concentration was used to investigate the effect of drought stress on ten tomato varieties at seedling stage. The parameters recorded were germination (%), root and shoot length (cm), fresh and dry biomass (g). Seed sowing was conducted with distilled water (control) and PEG6000 solution using between paper method. The data recorded after ten days of stress treatment showed variable responses under induced stress and revealed significant differences for all the parameters investigated. Regarding relative performance, Punjab Chohara was found to be the best genotype, followed by Feston and Ratan whereas Money Maker and Tom Round were the genotypes whose relative performance remained poor under stressed conditions. The results obtained during this study can be used for manipulation of tomato cultivars for further crop improvement.

PPBG 75

CADMIUM INDUCED CHANGES ON GROWTH, YIELD AND ELEMENT UPTAKE OF MAIZE AND ITS PHYTOEXTRACTION THROUGH EDTA AND CITRIC ACID

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The experiment was conducted to test the potential of two chelating agents (citric acid and EDTA) on the uptake of Cd and its effect on the growth, nutrient uptake and yield of two maize varieties. Two doses of Cd (150 and 300 mg kg⁻¹ soil) were used with a single dose (0.5 g kg⁻¹ soil) of EDTA and citric acid each. The accumulation of Cd was enhanced by EDTA whereas citric acid reduced its uptake. Correlation between Cd contents in shoot, root and grain versus the ionic content (Mg, K, Ca, P, Fe, Zn) showed negative relationship for most of the ions except phosphorous which showed positive correlation. Yield per plant and total grains weight was reduced by the application of Cd and EDTA, however, addition of citric acid countered the toxicity of Cd. Cadmium toxicity did not affect the 100 grain weight. But Cd toxicity reduced the number of grains, instead of grain size. The variety viz. Pak Affgoee showed more reduction in yield under Cd stress as compared to Sahiwal-2002.

PPBG 76

GENETIC DIVERSITY IN INDIGENOUS RICE GERMPLASM FOR QUALITATIVE AND QUANTITATIVE TRAITS

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This study was performed to assess genetic diversity in indigenous rice germplasm for morphological characteristics at KP Agricultural University, Peshawar during 2009 rice crop growing season. Seventy-seven accessions of rice were planted in randomized complete block design using two replications. Data were collected on 11 qualitative and 16 quantitative

traits. The genotypes showed variation for some of the qualitative traits like flag leaf angle, ligule color, awning, awn color, panicle type and apiculus color. Highly significant ($p \leq 0.01$) differences among the genotypes were observed for culm length, flag leaf length, flag leaf width, days to 50% flowering, panicle length, primary branches panicle⁻¹, length of primary branches panicle⁻¹, secondary branches panicle⁻¹, spikelets panicle⁻¹, grain length, grain width, 1000-grain weight, biological yield and grain yield. Cluster analysis for qualitative traits revealed four clusters at the dissimilarity level of 6.92 while for quantitative traits nine clusters were identified at the dissimilarity level of 5.44. The first and second principal components of principal component analysis explained 21.3 and 13.2% of the total variation, respectively. The first component was dominated by panicle length, primary branches panicle⁻¹, length of primary branches panicle⁻¹ and spikelets panicle⁻¹. The second component was characterized by days to flowering, biological yield, grain yield and 1000-grain weight. Entry number 10 showed the longest panicles (35.7 cm) while entry 28 displayed the highest primary branches panicle⁻¹ (13.5). Maximum number of secondary branches panicle⁻¹ (55) was observed for entry number 46 while the highest number of spikelet panicle⁻¹ (353) was observed for entry 50. Rice entry 56 showed maximum value (39 g) for 1000-grain weight while entry 26 displayed maximum grain yield (15833 kg ha⁻¹). On account of excellent performance for yield and yield associated traits, entries 10, 28, 46, 50, 56 and 26 are, therefore, recommended for onward use in rice breeding programs for possible introgression of the desired traits into cultivated traits.

PPBG 77

A TECHNIQUE FOR LAND MANAGEMENT ALTERNATIVES BASED ON IDENTIFICATION OF APPROPRIATE TREE SPECIES CORRESPONDING TO PARTICULAR SOIL ATTRIBUTES OF DISTRICT VEHARI, (PUNJAB), AND PAKISTAN

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Overexploitation and environmental degradation has led to limited forestry resource base in Punjab, Pakistan. As the wood production from the state forests fails to meet the ever increasing demand, currently, >90% of fuel wood and nearly 50% of timber is being contributed by the private sector, through Agroforestry, that involves tree plantation on agricultural farm lands. The main objective of the present study relates to the development of maps using GIS software, enabling selection of tree species, keeping in view the ecological perspective. The first phase of the study involved the identification of soil series; complete physical and chemical analysis of soil characteristics; and identification of any soil attribute limiting tree growth. The second phase of the study was based on assessment of feasibility of a particular area in *District Vehari, Punjab Pakistan*, for growing a particular tree species. The information generated from the first phase was utilized to prepare overlay maps, on the basis of which most suitable species corresponding to particular soil attribute could be identified. This technique offers time and cost effective land management options for agroforesters.

PPBG 78

IMPACT OF DIFFERENT PLANTING PATTERNS ON GROWTH, YIELD AND RADIATION USE EFFICIENCY OF SPRING MAIZE (ZEA MAYS L) IN SEMIARID ENVIRONMENT

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A field experiment was carried out in 2010 to determine the effect of planting patterns on growth, yield and radiation use efficiency of spring maize (*Zea mays* L) hybrids. The experiment was laid out in Randomized Complete Block Design (RCBD) with Split plot arrangement having four replications. Three Hybrids (Pak-HIB-7177, Pak-HIB-7188 and FSH-793) were randomized in main plots and four planting patterns i.e. S₁ (Single row (SR) flat sowing), S₂ (Single row-twin row (SR-TR) flat sowing), S₃ (SR ridge sowing) and S₄ (Single side and double side (SR-DR) ridge sowing) in sub plots. Results indicated that genotypes and planting patterns affected significantly leaf area index and crop growth rate. Maximum leaf area duration on 87 DAS was 214 days in FSH-793. Overall mean leaf area duration was 197 days in the season. The effect of planting patterns on the fraction of intercepted radiation was significant at all stages of crop growth and was highest (0.9389) at 72 DAS captured by H₁. Maximum plant height (155.9 cm), cob

length (18.27 cm), number of grains per cob (361), 1000-grain weight (237.6 g), grain yield (5868 kg ha⁻¹) and biological yield (16500 kg ha⁻¹) was produced by FSH-793. Whereas S₄ pattern gave the highest values of all these parameters. The hybrid FSH-793 performed better compared to other hybrids and planting pattern S₄ where maize was sown on ridges in single row double row contributed higher grain yield compared to other planting patterns.

PPBG 79

EVALUATION OF MOLECULAR MAPPING POPULATION FROM WHEAT/SYNTHETIC HEXAPLOID CROSSES FOR DROUGHT TOLERANCE

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The novel genetic diversity of “D genome” can be exploited to address the devastating problem of drought in wheat crop. To enhance the breeding efficiency in stress prone environments globally several molecular mapping populations have been produced. The focus of this study was to phenotype the drought molecular mapping population (DR.MP-3), derived from an opata/synthetic wheat hexaploid cross combination by various morphological and physiological parameters for drought tolerance under *In vivo* and *In vitro* conditions. The results from the morphological parameters showed that three genotypes viz. 118, 23 and 14 performed better for spike length, number of grains per spike and 1000 grain weight equally, under drought stress conditions. These genotypes also showed better defensive mechanisms under *In vitro* conditions against drought through high accumulation of proline and more antioxidant activity. The best lines of drought mapping population based on both morphological and physiological evaluation were 14, 17, 23, 55, 108, 118, 122, 150 and 152, as these genotypes performed best equally under both *In vivo* and *In vitro* testing. The present study based on morphological and physiological evaluation suggested that unique genetic diversity from *Aegilops tauschii* can be harnessed to get more yield by improving the existing cultivars against abiotic stress.

PPBG 80

SALICYLIC ACID PRE-SOAKING FOR GERMINATION OF SWEET PEPPER UNDER SALT STRESS

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A laboratory study was conducted to examine the role of salicylic acid (SA) pre-soaking on *Capsicum annum* seed germination and seedling vigor under salinity stress. The study was carried out in Sanyo Incubator MIR-253 at 24°C. A set of seeds was pre-soaked with H₂O whereas three set of seeds were pre-soaked with 0.1, 0.3 and 0.5 mM salicylic acid (SA), respectively for 3 hours under aerobic conditions. Three levels of salinity (0, 5 and 10 dS m⁻¹) were used. Four seeds were placed on whatman No. 42 in each petridish. Data related to germination of seeds was recorded after an interval of 24 h. It was observed that SA pre-soaked seeds show an increase in percent germination rate (40-60%), chlorophyll contents measured with portable chlorophyll meter (30-70%), seedling biomass (10-30%), shoot length (8-26%) and root length (12-40%) compared to H₂O pre-soaked seeds under salinity stress. Results suggest that pre-soaking of sweet pepper seeds with 0.3 mM SA has potential to mitigate reduction in seed germination of sweet pepper.

PPBG 81

EVALUATION OF RICE HULL AS POTTING SUBSTRATE FOR GROWTH AND FLOWERING OF *DAHLIA HORTENSIS*

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The effects of rice hull as potting substrates on growth and flowering of *Dahlia hortensis* was studied. Plants were grown in rice hull substrate in different combinations with silt. The experiment was carried out in completely randomized design (CRD) with five treatments. The results associated with plant growth indicated that plant height, number of leaves, number of

flowers and corm weight were the maximum in silt+ rice hull combination (1:1 ratio by volume). Dahlia plants grown in silt+ rice hull combination (1:2 ratio by volume) produced early flowering, maximum flower diameter, flower stalk and side shoots. Data regarding number of corms per plant was statistically non-significant. The present study revealed that a rice mill waste in the form of rice hull is a good and cheap source as potting substrate constituent for the production and flowering of dahlia plants.

PPBG 82

EVALUATION OF VARIOUS HERBICIDES FOR WEED MANAGEMENT IN POTATO IN PESHAWAR PAKISTAN

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Weed control is one of the most important factors for a successful crop production and therefore the prevention of weed-crop competition at an early stage plays a very important role. Potato is grown at large scale in Khyber Pakhtunkhwa-Pakistan, but due to lack of proper attention potato yield is always quite lower in comparison with the developed countries. Besides, other factors, weeds are one of the serious obstacles in producing lower yields. In this context, an experiment was designed during 2009-10 at Agriculture Research Institute Tarnab Peshawar Khuber Pakhtunkhwa Pakistan, in which there were a total of nine treatments including eight herbicides and a weedy check. Metribuzin 70% WP (metribuzin), Gramoxone 200 SL + Dual gold 960EC (gramoxone + s-metolachlor), Sencor 70 WP (metribuzin), Torrent 50 WDG (terbutryn + terbuthylazine), Solanum 500 SC (terbutryn + terbuthylazine), Dual gold 960EC (s-metolachlor), Multiquat 200 SL (gramoxone) and Gramoxone 200 SL (gramoxone) were the herbicidal treatments that were evaluated. Among the herbicides, Metribuzin 70% WP, Torrent 50 WDG, Solanum 500 SC, and Multiquat 200 SL were used as candidate herbicides for registration purpose and the rest of the herbicides were standard ones for comparative evaluation. The results obtained revealed that all the herbicides had a significant effect on weed density m^{-2} and also on tuber yield of potato. Herbicidal treatments convincingly reduced the weed population as compared to the control treatments having 104 weeds m^{-2} . The reduction in weed population ranged between 80.5 to 95.7% in the herbicidal treatments which was quite impressive effect. No crop injury was observed in any of the herbicides used in the experiment; however the crop was kept in shelter while using the contact herbicides, gramoxone. The herbicide treatments of Gramoxone 200 SL + Dual gold 960 EC @ 3.75 lit + 2.50 lit, Gramoxone 200 SL @ 3.75 lit, and Multiquat 200 SL @ 3.75 lit ha^{-1} gave best potato tuber yields i.e. 15910 kg, 15288 kg, and 15022 kg ha^{-1} , respectively, which were statistically similar as well. Therefore, the respective increase in yields over weedy check was 36.13, 33.53, and 32.35% over weedy check treatments (10162 kg ha^{-1}). It can be concluded that gramoxone can result in best yields and must be used for weed control in potato using a shelter for the crop to avoid any injury.

ORAL ABSTRACTS

OPBB 1

COMPARATIVE ASSESSMENT OF GLUTENIN COMPOSITION AND THEIR RELATIONSHIP WITH GRAIN QUALITY TRAITS IN BREAD WHEAT GERMPLASM

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Baking industry exigencies and wider consumer preferences are highly demanding variable end product use of bread wheat. The diversity in bread wheat to fulfill these demands is primarily dependent on the D-genome encoded glutenins complemented by desirable glutenins from the A- and B- genome. The present study was designed to evaluate and compare glutenin compositions and their effect on key quality parameters in D-genome synthetic hexaploid derivatives (SHD) and conventional bread wheat (BW) germplasm. The germplasm set selected encompasses the earlier investigated drought tolerant characteristics. Grain quality analyses have provided a stringent selection sieve to select the drought tolerant genotypes with desirable end quality characteristics. Several unique D-genome encoded HMW-GS were found along with favorable alleles at A- and B-genomes. D-genome encoded subunit Dx5+Dy10 which is known to encode superior grain quality attributes was observed in 63.64% genotypes followed by 1Dx2+1Dy12 (30.91%). Apart from HMW-GS, PCR based allele specific markers were used to identify allelic variation at Glu-3 loci (LMW-GS), which had a significant effect on visco-elastic properties of wheat dough. These analyses are more robust and now considered superior over the earlier conventional technique of SDS-PAGE for identifying LMW-GS. Several combinations of favorable LMW-GS alleles were observed at Glu-A3 and Glu-B3 loci. Key quality parameters like protein, sedimentation volume and carotenoids differed significantly within genotypes. Higher values for desirable quality values were found in synthetic derivative genotypes and as well as in conventional bread wheat varieties. Our results have established significant variability in quality characteristics and glutenin composition among D-genome synthetic hexaploid wheat derivatives as compared to conventional bread wheat germplasm suggestive of their ability to improve quality traits in bread wheat.

OPBB 2

QUANTITATIVE TRAIT LOCI MAPPING OF DROUGHT TOLERANCE AT GERMINATION STAGE IN BREAD WHEAT

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Drought is a major yield limiting factor in many crop species. Wheat is a major crop and staple food in Pakistan. Genetic linkage map construction based on linked DNA markers spanning whole wheat genome and subsequent QTL mapping for drought tolerance can enhance breeder's ability for effective selection. We used an F8 population (80 lines) derived from the cross of OPATA x SH-349 for drought tolerance at germination stage under controlled conditions. The drought was induced by 15% PEG nutrient solution in acid washed sand medium under controlled conditions (14/10 hrs light and dark and 25°C). During four weeks of growth, data for germination percentage, germination rate index, shoot root lengths and dry weights were recorded. These data along with marker data were used for QTL mapping using QTL Cartographer V2.5 software. Single marker QTL analysis showed that 14 SSR markers were linked to QTLs for five traits in both drought and control condition. Using simple interval mapping and composite interval mapping, QTLs for different traits of interest were mapped on two linkage groups. On linkage group 1, QTLs for root length, shoot length, dry biomass and germination percentage were mapped under control and drought conditions. On linkage group 2, QTLs for germination percentage and germination rate were mapped under controlled and drought conditions. The population will be screened with more SSR markers to increase the genomic coverage of this map.

OPBB 3

COMPARATIVE ARTEMISININ ANALYSIS IN *ARTEMISIA ANNUA* AND *ARTEMISIA DUBIA* TRANSFORMED WITH TWO DIFFERENT *AGROBACTERIA* HARBOURING *ROL ABC* GENES

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Artemisinin, a potent antimalarial drug and a major constituent of *Artemisia*, is effective against quinine resistant strains of *Plasmodium*. Chemically it is an endoperoxide sesquiterpene lactone. It is a potent antimalarial drug that has also been proven very effective in treatment of cancer. The *rol ABC* genes have been shown to enhance production of secondary metabolites in plants, possibly through stimulation of defense pathway. The aim of the present study was to enhance artemisinin production in the transformed and untransformed plants of *Artemisia annua* and *Artemisia dubia* through transformation with *rol* genes by using *Agrobacterium tumefaciens* and *Agrobacterium rhizogenes*. *Agrobacterium tumefaciens* strain LBA4404 containing pRT99 and *Agrobacterium rhizogenes* strain LBA8196 and 9402 harboring *rol ABC* genes were used for the transformation experiments. PCR and Southern hybridization confirmed the T-DNA integration events in *Artemisia dubia* roots. The transformed roots proliferated much more vigorously compared to untransformed roots. HPLC analysis showed higher concentration of artemisinin in transformed plants of both *A.annua* and *A.dubia* transformed with control plants while no artemisinin was observed in control roots. Transcriptomic study of *A.annua* and *A.dubia* allowed sequencing the transcriptome of these species for the first time. 16400 Contigs were generated by aligning different transcriptome sequences. BLAST of 500 contigs was performed with nt/nr database. 264 contigs showed homology with genomes of different organisms. Up and down regulation and Putative gene functions were predicted.

OPBB 4

DYNAMICS OF mRNA OF GLYCINE-RICH RNA-BINDING PROTEIN DURING WOUNDING, COLD AND SALT STRESSES IN *NICOTIANA TABACUM*

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Glycine-rich RNA-binding proteins (GRPs) are RNA-binding proteins that contain one or more RNA recognition motif (RRM) or consensus RNA-binding domains at their N-terminus and a glycine-rich domain at their C-terminus. Their function is not well characterized but GRPs are implicated in plant stress responses, owing to the fact that their mRNA level increases under these conditions. In order to gain an insight into the role at molecular level, the study was designed to observe the dynamics of *NtGRP1* during exposure to stresses i.e. wounding, cold and salt stress by real-time PCR. Expression was found to be modulated by wounding in five months old plants. For cold stress, plants were transferred to 4°C for 24 hours at different developmental stages, wherein expression of mRNA was found to be up-regulated. Variation in transcript level was also seen in response to treatment with various concentrations of NaCl. The detailed characterization of GRPs is expected to enhance our understanding about role of GRPs in plant stress metabolism.

OPBB 5

MOLECULAR CLONING AND CHARACTERIZATION OF ARF1 AND COPI COAT PROTEINS FROM *MEDICAGO TRUNCATULA* CV. JEMALONG

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The integrity of the Golgi apparatus in both plant and mammalian cells is dependent upon a coordinated flow of COPII (coatamer protein) coated vesicles in anterograde (forward) and of COPI coated vesicles in retrograde (backward)

direction. Although a fair amount of work on vesicular trafficking has been published in *Arabidopsis thaliana* not much information is available related to the secretory pathway in other higher plants. In the present study we have used *Medicago truncatula*, a model plant for legume species as for symbiotic and pathogenic interactions, to identify Arf1 and COPI components of the early secretory pathway. Their localisation and interaction with the Golgi apparatus in the root cells has been identified by confocal and two-photon laser microscopy. EST databases of the *M. truncatula* were screened and putative homologues for all seven coatamer proteins and MtArf1 were identified. Two isoforms of the α -COPI subunit and MtArf1 genes were isolated from *M. truncatula* cDNA libraries and were sequenced. GFP fusions of MtArf1, dominant active (Q71L), dominant inactive (T31N) forms of MtArf1 and two isoforms of MtzCOPI were expressed in transgenic “hairy root” and their subcellular localisation were analyzed. Our results show that MtArf111::GFP, Mtz-COP1::GFP and Mtz COP2::GFP were localized on mobile Golgi structures, streaming along the ER network and were sensitive to brefeldin A, indicating their potential association with Golgi stacks. This study demonstrates an important role of Arf1 and COPI proteins in early secretory pathway in root cells of *M. truncatula*.

OPBB 6

BACTERIAL BIOFILM FORMATION INHIBITION BY BLOCKING FLAGELLAR ASSEMBLY

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Biofilms formation is a major hazardous problem from both clinical and environmental perspective. Flagellum-mediated motility is important for biofilm formation by several gram-negative bacteria. >50 genes are involved in flagellar biosynthesis and function in *Salmonella typhimurium*. The flagella basal body is a representative of Type III protein secretion systems; used by several gram-negative bacterial pathogens to colonize foreign tissues and substrates. The mechanism of flagellar assembly was analyzed in *S. typhimurium*, using bioinformatics analysis to identify conserved structural elements. In this study, FliH a flagellar protein that is needed for flagellar assembly and may be involved in a specialized protein export pathway was cloned and overexpressed. Using vital dyes, visualization of single and motile was established based on optical microscopy techniques which will extend initial evidence that flagellum-mediated rotation is critical for biofilm formation. The flagellar basal body is a particularly convenient drug target, since the architecture of most its components has been determined near atomic resolution and it is an ancient evolutionarily conserved macromolecular assembly. The knowledge gained will also have implications for elucidation of the mechanistic design principles underlying protein secretion complexes.

OPBB 7

IN VITRO CYTOTOXIC ENHANCING ACTIVITY OF TRITERPEN SAPONINS FROM GYPSOPHILA PILULIFERA ON SAPORIN A TYPE-I RIPS

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A cytotoxic triterpenoid saponin was isolated from the under-ground parts of *Gypsophila pilulifera* Boiss. & Heldr. (Caryophyllaceae) naturally grow in the southwestern region of the Turkey. The structures of saponin was elucidated as 3-O- β -D-galactopyranosyl-(1 \rightarrow 2)-[β -D-xylopyranosyl-(1 \rightarrow 3)]- β -D-glucuronopyranosyl quillaic acid 28-O- β -D-glucopyranosyl-(1 \rightarrow 3)-[β -D-xylopyranosyl-(1 \rightarrow 4)]- α -L-rhamnopyranosyl-(1 \rightarrow 2)- β -D-fucopyranosyl ester on the basis of extensive spectral analysis and chemical evidence. The separated triterpenoid saponin was isolated from *Gypsophila pilulifera* for the first time. The saponin compound displayed significant cytotoxicity against A549 cell line with IC50 values >16 μ M.

OPBB 8

TISSUE CULTURE INDUCED SOMACLONAL VARIATION: A POTENTIAL SOURCE OF GENETIC VARIABILITY FOR DEVELOPING DROUGHT TOLERANT PLANTS OF WHEAT

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Drought, a serious threat to world agriculture, demands neo-breeding approaches. Tissue culture being a mutagenic process induces somaclonal variations, which can be manipulated for improving drought tolerance of commercial cultivars of wheat. Present study was conducted to explore potential of somaclonal variation to improve drought tolerance of wheat. Micro-clumps of calli induced from immature embryos of wheat cv. GA-2002 were cultured on MS based medium supplemented with PEG-6000 induced osmotic stress of -0.9 MPa for four week followed by another selection cycle. PEG-6000 tolerant calli were regenerated to R0 somaclones and selfed to produce R1 seeds. The progeny of R1 seeds (R1 generation) and their donor parent cv. GA-2002 were raised in pots and compared for drought tolerance. Artificial water stress was induced by withholding water for 2, 4, 6, and 8 days along with control. Water stress led to a reduction of relative water content (RWC), excise leaf water loss (ELWL), leaf succulence and specific leaf weight (SLW), while an increase in ABA content of both R1 somaclones and their parent cv. GA-2002. The R1 somaclones showed significantly greater tendency to conserve RWC, leaf succulence and less ELWL in response to higher regimes of water stress imposed for six or eight days. Similarly, significantly higher ABA contents were accumulated by R1 somaclones than parent cv. GA-2002 in response to water stress of 4, 6 and 8 days. Results from physiological bases of drought tolerance indicated that somaclonal mutants had higher drought tolerance than their parent cv. GA-2002. It is concluded that tissue culture induced somaclonal variation are potential source of genetic variability to be exploited for developing drought tolerant plants of wheat in the presence of suitable selection agent.

OPBB 9

AMPLIFICATION AND SEQUENCING OF INTERNAL TRANSCRIBED REGIONS 1& 2, AND 5.8S RDNA FROM LOCAL ISOLATES OF FUSARIUM SPECIES

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Fusarium oxysporum is a phytopathogenic fungus. It is widely distributed around the globe. Classical classification of *F. oxysporum* is based on phenotypic observations which highly vary and are also sensitive to environment. In *Fusarium* taxonomy this problem is recently being addressed by sequence comparison at different loci. Internally transcribed spacer (ITS) region including 5.8S rRNA coding region in ribosomal DNA is one of the favorite targets for this purpose. The focus of present study was on the genetic diversity analysis of the ITS regions of rRNA gene complex of local isolates of *Fusarium*. The genomic DNA of these isolates was amplified using FoxF, FoxR and FoxIR primers designed at the end, and start of conserved 18S region, and between ITS1 and ITS2 respectively. FoxF and FoxR primer set amplified ~500 bp product from all *F. oxysporum* strains. The amplified products were sequenced and sequence analyses have shown that *F. oxysporum* f.sp. *ciceri* strains couple of SNPs. Similarly *F. oxysporum* f. sp. *lentis* has shown variations with with two strains of *F. oxysporum* f. sp. *ciceri* at two position. Comparison of *F. moniliforme* isolates with *F. oxysporum* isolates have revealed that 5.8S region is identical in all isolates while significant sequence variation was observed in ITS regions of *F. oxysporum* and *F. moniliforme*. Insertions and deletions of many nucleotides were observed at several positions which differentiate *F. moniliforme* from *F. oxysporum*. The phylogenetic analysis revealed no significant different among local isolates and internationally reported sequences. From a clear grouping of *F. moniliforme* and *F. oxysporum* isolates into different clades it may be evident that ITS regions are useful for classifying *F. oxysporum* isolates at specie level.

OPBB 10

TRANSGENIC TOBACCO WITH RICE FAE GENE SHOWS ENHANCED RESISTANCE TO DROUGHT STRESS

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Plants have evolved various adaptative traits to cope successfully with the stresses. Among them, cuticular waxy coating layer may serve as protecting barrier to diminish water loss, which consequently imparts drought resistance in plants. In order to characterize the role of rice FAE in drought tolerance, the OsFAE transgene was incorporated into tobacco via *Agrobacterium*-mediated leaflets transformation with sense sequence orientation under control of constitutive promoter CaMV35S. PCR and RT-PCR assays suggest that the OsFAE transgene has incorporated in tobacco genome and over-expressed in the transformed tobacco leaves. The characterization assay revealed some correlation between OsFAE transgene expression and drought tolerance in transgenic tobacco. The drought parameters data reveal that the transformed tobacco lines exhibit relatively less wilting on withheld-water stress, early recovery from the stress, containing higher relative water contents. Additionally, the transgenic tobacco lines exhibit more protein contents after exposure to sub-lethal drought stress and relatively higher contents were measured in them as compared to control on re-watering after 48 hours. Proline contents were found higher in the transgenic lines as compared to control under drought on 6th day of with-held water stress. Data shows that leaf water potential was less negative in the selected transgenic lines as compared to control on both; 10th day of with-held water stress and after 24 hours rehydration.

OPBB 11

MINING OF POLYMORPHIC MICROSATELLITE MARKERS IN SILICO FOR DIAGNOSIS OF BASMATI RICE ADULTERATION

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Microsatellite markers including Simple Sequence Repeats (SSRs) are used to differentiate between species including closely related cultivars due to their uniqueness for genome. The objective of the present study is to devise a molecular marker based procedure for the detection of adulteration of the highly valued basmati rice with non-basmati rice. 10 publicly available genomic sequences for basmati rice (*Oryza sativa indica* group) were retrieved from the NCBI database. The manipulation of these sequences was carried out for mining microsatellites, a total of 3258 microsatellites were identified. This was accomplished by the use of microsatellite development software "SSR Locator". The same software designed 99 primers specific to the identified SSR markers. Simulated polymerase chain reaction (PCR) eliminated primer redundancy to select 40 potential primers generating specific amplicons. The selected primer pairs were analyzed further for their specificity by using NCBI BLASTN tool which ascertained that 4 out of the 99 designed primers are specific solely to the basmati rice (*indica* group) genome, hence assuring the further utility of these primers for the differentiations of the basmati rice from non-basmati rice for the eventual detection of adulteration in these two cultivars of rice. Similarly, three complete sequences of non-basmati (*japonica*) rice were retrieved and from 4788 primers that were generated for *japonica* we propose 2 primer pairs specific to *japonica* rice cultivar to use for the verification on adulteration of non-basmati rice in basmati rice sorts.

OPBB 12

DEVELOPMENT OF PUTATIVE MOLECULAR MARKERS TO TRACE DURABLE RUST RESISTANCE GENES IN WHEAT BREEDING STOCKS

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Wheat plays a central role in Pakistan's food economy in terms of production and consumption. Wheat shares 3.1% of national GDP. Rusts are among the devastating diseases of wheat. A large number of rust resistance genes are known in wheat for stripe (yellow), leaf (brown) and stem rust. Selection for durable resistance in rust breeding programs is typically carried out in field screening nurseries or under controlled conditions only for advanced breeding lines. Marker Assisted Selection (MAS) can be useful under such conditions. Availability of small number of DNA markers for identification of genes involved in rust resistance makes MAS application difficult. Identification and designing of new PCR primers may help to select rust resistant genotypes from wheat breeding stocks in early segregating generations. This study is designed with aim to identify and design PCR primers for resistance genes in wheat breeding stocks. Data and sequences were retrieved through extensive literature and databases search. Data mining was done on public domain available databases i.e., NCBI nucleotide, GrainGenes and PlantGDB. A total of 12 sequences for leaf rust resistance, 13 for stripe rust resistance and 2 for stem rust resistance were retrieved. Homology studies, motif finding and their phylogenetic analysis was done to infer their possible functions and to develop PCR primers to mark the rust resistance genes in wheat germplasm. These markers were validated for detection of rust resistance gene among 16 local varieties, which proved valuable for future wheat breeding.

OPBB 13

MOLECULAR MAPPING OF STRIPE RUST RESISTANCE GENE YRSN78 IN WHEAT LINE SHAANNONG78

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Stripe rust, caused by *Puccinia striiformis* f. sp. *tritici* is an important disease in wheat growing areas worldwide. Growing resistant cultivar is the best strategy to control stripe rust. The wheat line 'Shaannong 78' displays race-specific resistance to stripe rust. To identify the genetic basis of resistance, Shaannong 78 was crossed with susceptible cultivar Mingxian 169. Seedlings of the parents and F1, F-2, and F3 populations were inoculated with race CYR 32 of *Puccinia striiformis* f. sp. *tritici* under controlled green house conditions. One single dominant gene conferring resistance to stripe rust was identified, designated as YrSN78. The resistance gene YrSN78 was tagged by screening 1,528 simple sequence repeat (SSR), and two 1BL.1RS linked markers (XAF4 and XH20). In bulked segregant analysis, three molecular markers XAF4, XH20, and Xbarc8 were closely linked to YrSN78 and mapped to chromosome 1BL.1RS with genetic distances 1.7 and 2.8cM. Pedigree analysis and linked molecular markers suggested that YrSN78 is different from previously identified genes Yr9, YrCn17 and Yr212, and it may be new gene or allele at Yr9 on chromosome 1BL.1RS. The gene YrSN78 in combination with other stripe rust resistance genes, and linked molecular markers could be useful in marker assisted breeding programs for stripe rust resistance in wheat

OPBB 14

OPTIMIZATION OF QUANTITATIVE REAL-TIME PCR ANALYSIS FOR RELIABLE DETECTION AND QUANTIFICATION OF FUSARIUM OXYSPORUM IN WHEAT

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Early detection of *Fusarium oxysporum* in wheat is very important for its effective control. Use of quantitative real-time PCR is a modern technique to detect and quantify fungal intensity. In this experiment, this technique has been used to see susceptibility of four wheat cultivars (CS-12, FD-05, TJ-9, and ZY-19) to *Fusarium oxysporum*. Typical *Fusarium oxysporum* symptoms like slight vein clearing, epinasty and wilting of leaves developed 8 days post infection (dpi) and became severe 15 dpi. Apparently, these symptoms were more prominent in FD-05 and TJ-9, as compared to other two varieties. Quantification of *Fusarium oxysporum* DNA in wheat seedlings on 8 and 15 dpi revealed the highest amount of DNA in FD-05 and relatively higher amount of DNA in TJ-9 and CS-12 while the lowest DNA concentration was found in ZY-19. The amount of fungal DNA in FD-05 remained constant on 8 and 15 dpi while it increased in all other lines. In addition, real-time PCR was used as *Fusarium oxysporum* detection method in wheat field plants, irrigation water and soil and the fungus was successfully detected in these field samples before the appearance of typical symptoms. These results provided us an easy and comprehensive approach for reliable detection of *Fusarium oxysporum* at early infection stages.

OPBB 15

LEAF PROTEOME ANALYSIS OF CLEMATIS CHINENSIS: A TRADITIONAL CHINESE MEDICINE (TCM) BY TWO-DIMENSIONAL ELECTROPHORESIS TECHNIQUE

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Two-dimensional electrophoresis (2-DE) technique has become an important integral part of taxonomic, phylogenetic and pharmaceutical studies in plants. Proteomics has been used here in identification of different taxa of genus *Clematis* employed as

Traditional Chinese Medicines (TCMs) in China. Leaf proteins of *Clematis chinensis* and some other species of *Clematis* were extracted using three different methods and their profiles resolved on 2-DE. Comparative analysis of employed extraction methods revealed phenol-SDS method (PSM) to be the best protocol having protein quantity i.e. 2.35 ± 0.345 mg/g. For analytical and preparative runs proteins were detected by silver staining and comassie blue (CBB) staining, respectively. Master maps of the three replicas of each species were compared by ImageMaster 2D Platinum software (Amersham Biosciences). The results of this differential analysis predicted that nine proteins were solely present in *C. chinensis* when compared with *C. finetiana* and *C. armandii*. The 2-DE gel pictorial profile depicted general distribution of 1085 spots on stained gels and out of these only 255 protein spots (23.5%) were common to all analyzed taxa. The visualized protein spots showed pI range from 3.0 to 10.0 (pH) and Mr of 7 kDa to 70 kDa. Nine proteins were exclusively specific to *C. chinensis* when compared with *C. finetiana* and *C. armandii*. A trend of up-regulation in thirteen proteins in *C. finetiana* (0.75-0.95 fold) and twelve proteins in *C. armandii* (1.05-1.66 fold) was found. A reverse perspective of down-regulation for seven proteins (0.66-0.94 fold) was seen in *C. finetiana* and for three proteins (1.07-1.20 fold) in *C. armandii*. Intra-section genetic distance (GD) was estimated 0.4-0.45 in analyzed species of subsection *Clematis* and inter-section GD was 0.25-0.55 among species of subsection *Rectae*. Proteins were identified by LC-MS/MS technique. Identified proteins are mostly related to energy metabolism (ATP synthesis), photosynthesis, environmental stimuli, regulating RNA metabolism, regulating growth hormone, mitochondrial functions and regulating gene expression in response to cellular state. The efficiency and applicability of proteomic approach as biomarker for identification of TCMs and other taxa has been described discussed.

OPBB 16

PROFILING THE CARROT (DAUCUS CAROTA) MICRORNAS AND THEIR TARGETS

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MicroRNAs (miRNAs) are small, non-protein coding and negative regulatory RNAs approximately 18-26 nucleotides in length. The comparative genomic methodology due to their conserved nature is a rational approach for the novel miRNAs discovery. In this study, total 17 novel miRNAs from 12 families were identified in an important vegetable carrot (*Daucus carota*). All the miRNA families (dca-mir-156, 160, 167, 172, 774, 778, 854, 1310, 5015, 5030, 5658 and 5664) are found for the first time in carrot. All 17 miRNA precursors form stable minimum free energy secondary structures and the mature miRNAs reside in the stem region of the secondary structures. Their putative targets were also identified. These findings will be useful to understand the complicated negative gene regulation in an important plant carrot.

OPBB 17

HPLC-DAD ANALYSIS AND FREE RADICAL SCAVENGING POTENTIAL OF QUERCUS DILATATA L

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Free radicals are molecules or atoms that have at least one unpaired electron which increases the chemical reactivity of the molecule. The main objective of the present study was to evaluate the antioxidant potential and HPLC analysis of antioxidant compounds (rutin, quercetin and gallic acid) in *Quercus dilatata* L. The antioxidant activity of *Q. dilatata* L. extracts/fractions was determined by using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay. Four partitioned fractions of *Q. dilatata* (n-hexane, ethyl acetate, n-butanol and aqueous) were prepared among which ethyl acetate fraction showed highest activity (IC₅₀ 38.02 µg/ml). Furthermore, the screening of rutin, quercetin and gallic acid in the partitioned fractions was done by HPLC-DAD which showed that the most active fraction i.e. ethyl acetate fraction contained all of them while aqueous fraction showed the presence of two i.e., rutin and gallic acid. Butanol fraction showed only rutin content, while n-hexane fraction did not show the presence of any of the above mentioned compounds. Thus it can be concluded that good antioxidant potentials may be due to the presence of these well known antioxidant compounds in *Q. dilatata* in association with other unidentified compounds.

OPBB 18

FACTORS AFFECTING AGROBACTERIUM TUMEFACIENS MEDIATED GENETIC TRANSFORMATION OF SOYBEAN CULTIVAR NARC-7.**NEELAM TAJ¹, MUHAMMAD ZIA³, YAMIN BIBI^{1*}, NAVEED IQBAL¹, M FAYYAZ CHAUDHARY²**¹*Department of Botany, PMAS Arid Agriculture University Rawalpindi Pakistan*²*Department of Microbiology, Quaid-i-Azam University Islamabad Pakistan*³*Department of Biotechnology, Quaid-i-Azam University Islamabad Pakistan***Corresponding author's email: yamin.phd@gmail.com*

The aim of study was to optimize some transformation conditions of the soybean cultivar NARC-7 with *Agrobacterium tumefaciens* strain LBA4404 containing plasmid pLBRRolABCnptII. It was observed that *Agrobacterium tumefaciens* concentration at OD 1.0 at pH 5.4 at time of infection resulted maximum transformation efficiency. Shaking of culture and explants during infection also increased transformation efficiency many folds. Morphologically rolABC soybean transformants were dwarf with short internodal distance and wrinkled leaves. However, the transformed plants had long and profused roots as compared to control non-transformed plants.

OPBB 19

BAC DERIVED NEW SSRs FOR USE IN COTTON (GOSSYPIMUM SPP) IMPROVEMENT.**NABILA TABBASAM¹, YUSUF ZAFAR¹, MEHBOOB-UR-RAHMAN^{1*} AND ANDREW H PATERSON²**¹*Plant Genomics & Molecular Breeding Lab, National Institute for Biotechnology & Genetic Engineering (NIBGE), Jhang Road Faisalabad Pakistan*²*Plant Genome Mapping Laboratory, University of Georgia, Athens, Georgia 30602, USA.***Corresponding author: mehboob_pbd@yahoo.com*

A new set of SSRs with di-, tri-, tetra-, penta- and hexa-nucleotide repeats were fished out from bacterial artificial chromosome (BAC) ends and BAC clone sequences of *Gossypium raimondii*. A total of 1303 SSRs were designed: 766 from BAC end sequences and 537 from BAC clone sequences. These primer pairs were named as PR-GR-BESS and PR-GR-BS (PR for the last name of the both principal investigators, GR for *Gossypium raimondii*, BES for BAC end sequences, B for BAC clone and S for simple sequence repeat). Now onward these will be called as BAC-gSSRs in this manuscript. This new set of *G. raimondii* derived BAC-SSRs were tested for their transferability to other important cotton genomes including cultivated tetraploids (*G. hirsutum* and *G. barbadense*) and diploid ancestral species (*G. raimondii* and *G. arboreum*). In the present study, *G. raimondii* was used as a positive control for PCR amplification. BAC-gSSRs contained diverse types of repeat motifs. We identified 1303 BAC-gSSRs, out of these 731 were dinucleotide (56.10%), followed by tri (397, 30.46%), tetra (118, 9.05%), hexa (40, 3.06%) and penta (17, 1.30%). Hexa nucleotide repeats had shown the highest level of polymorphism (42.4%) followed by penta (35.29%), tetra (30.50%), tri (23.25%) and di (19.0%). More than 30 % of the SSRs amplified two fragments, separated in high resolution agarose metaphor gel electrophoresis. A total of 30% of the total primers were unable to amplify clear fragments in *G. arboreum* species. These primers produced some private alleles in *G. raimondii* and AD genome species indicating the specificity of these SSRs for D genome. For genetic diversity assessment, PIC values were calculated. Average PIC value was 0.39 with a range of 0.12 to 0.85. *G. arboreum* was found more close to *G. barbadense* (0.63) as compared to *G. hirsutum* 0.57 while *G. raimondii* showed equal genetic similarity with both the *G. hirsutum* (0.59) and *G. barbadense* (0.59). This study will be instrumental in developing dense genetic maps, and also initiating marker-assisted selection (MAS) in cotton.

OPBB 20

GENETIC DIVERGENCE AMONG PAKISTANI BREAD WHEAT VARIETIES AND ADVANCED LINES FOR RANDOMLY AMPLIFIED POLYMORPHIC DNA (RAPD) MARKERS**RAHEELA REHMAN¹, KAUSAR NAWAZ SHAH², M. SHAHID MASOOD¹, MUHAMMAD ARSHAD¹, M. FAHIM ABBAS¹ AND ABDUL GHAFOR¹**¹*National Agricultural Research Centre (NARC), Park Road, Islamabad, PAKISTAN,*²*Department of Plant Breeding and Genetic PMAS-Arid Agricultural University, Rawalpindi, PAKISTAN***Corresponding author's email: raheelamalik87@yahoo.com*

A large number of wheat varieties have been bred over the years but very few have been investigated for genetic divergence at molecular level. The present paper explains the genetic diversity for Randomly Amplified Polymorphic DNA (RAPD) markers among wheat varieties as well as advanced lines. 20 RAPD decamer primers were used to determine the extent of genetic differences among 48 genotypes and half of the primers were monomorphic and other 10 generated 71 DNA fragments with an average of about 7.1 bands per primer. The primer OPE-01, OPB-13 and OPB-09 have 17%, 14% and 5.6% shared to the total polymorphism among total variation. Maximum 47 genotypes were amplified with the primer OPA-09 and minimum 11 with OPA-16. 6 genotypes NR-346, NR-373, NR-389, NR-383, WSP-148 and WSP-196 were the most diverse from rest of the genotypes for RAPD analysis. The information about genetic similarity and differences will be helpful to avoid any possibility of elite germplasm becoming genetically uniform.

OPBB 21

DEVELOPMENT AND CHARACTERIZATION OF BARLEY CORE COLLECTION: A STRATEGY FOR GERMPLASM MANAGEMENT

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Redundant materials in germplasm collections cause hurdles in gene bank management. Present study was conducted to analyze redundancies using Simple Sequence Repeats (SSRs) and to evaluate genetic diversity of barley germplasm comprising of 404 *Hordeum vulgare* landraces belonging to 8 different regions (Pakistan, India, Iran, Nepal, Iraq, Turkmenistan, Uzbekistan, Kazakhstan). In total 50 alleles were detected. Number of alleles observed was highest for Bmag0023 (11) followed by HVLOX (9), HVM54 (8), Bmag0382 (7), Bmag0500 (5), Bmag0490 (5) and HVID (5) locus. Allele size range was largest for HVLOX while it was lowest for Bmag0500. Allele frequencies were found highest for allele HVM54-120 (0.39) followed by HVID-80 (0.38) and Bmag0382-66 (0.35).

Core collection for the barley germplasm comprised of 42 patterns including 14 unique and 28 frequent patterns. The number of patterns observed in landraces of different regions was in the order of Pakistan > India > Nepal > Turkmenistan > Iraq > Iran > Uzbekistan > Kazakhstan. These patterns were clearly clustered into two groups using Jaccard's cluster analysis (group A and group B). Principal Component Analysis (PCA) also distributes these patterns into three groups. The overall results revealed that differentiation of patterns using Jaccard's cluster analysis was in accordance with PCA which revealed that these patterns were distributed with respect to their geographic regions. Furthermore, it was concluded that development of core collection is the one strategy besides other strategies to reduce redundancies in gene bank management and make the handling of germplasm easier.

OPBB 22

EVALUATION OF *CARALLUMA TUBERCULATA* PLANT AND CALLUS EXTRACTS AS FREE RADICAL SCAVENGER

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Caralluma tuberculata (Asclepiaceae) is a potent medicinal plant, traditionally used against sundry diseases including diabetes. In current study, *Caralluma tuberculata* fresh plant and callus were extracted with solvents of different polarities and extracts were evaluated for the presence of flavonoids, phenolics, DPPH scavenging activity and reducing power. As per results, flavonoids percentage in plant and callus extract was 0.092% and 0.039%, respectively. In case of fractions, highest yield flavonoids were recovered in water fractions of both plant and callus extracts i.e. 0.049% and 0.021%, respectively. The phenolics compounds percentage in plant and callus extract was calculated 0.16% and 0.057%, respectively. In further fractions, maximum phenolics compounds were harvested from water fraction of plant and callus. Extract of water also demonstrated the highest DPPH scavenging activity with EC₅₀ of 4.95 mg/ml after 30 min followed by the n-butanol fraction which exhibit EC₅₀ value 8.30 mg/ml after 30 min. The reducing power assay comprised dose dependent response and water fraction demonstrated the highest reducing power activity in both plant

and callus water fraction (optical density 0.729 and 1.232 at 10 and 20 mg/ml, respectively in plant and 0.595 and 0.619, respectively in callus). The greater amount of flavonoids, phenolic compounds and reducing power leads to more potent radical scavenging effect as shown by *Caralluma tuberculata* plant and callus extract. Current study supports the use of both plant and callus bodies of *Caralluma tuberculata* as sources of natural antioxidant compounds.

OPBB 23

MOLECULAR IDENTIFICATION AND COMPARATIVE ANALYSIS OF NOVEL 18S RIBOSOMAL RNA GENOMIC SEQUENCES OF WIDE RANGE OF WILD MEDICINAL PLANTS

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Ribosomal RNAs (rRNAs) are universally distributed and known for their functional equivalence among all the known organisms. Analysis of small-subunit rRNAs (16-18S rRNAs) can permit the accurate statistical measurement of a broad range of phylogenetic relationships due to highly conserved sequences. Therefore, we identified and partially sequenced novel isoforms of 18S rRNA gene from ten diverse wild medicinal plants including *Ferocactus glaucescens*, *Solanum Lycopersicum*, *Capparis deciduas*, *Calatropis procera*, *Cyamopsis tetragonoloba*, *Eruca sativa*, *Maytenus royleana*, *Prosopis Juliflora*, *Ficus carica* and *Mentha spicata*. Sequences were submitted to genebank followed by sequence analysis and confirmation by using bioinformatics tools. We used ClustalW for pairwise alignment of these novel sequences with other known 18S rRNA sequences to find out their phylogenetic relationships. Our results have shown highly conserved nature of 18S rRNA with variable regions might be indications of some historical signals. Secondary structure constraints of rRNA can affect their phylogenetic interpretations rarely. These novel 18S rRNA sequences can also be used as internal controls for several types of molecular analysis after accurate validations of their consistent expression in the given plant species in future studies, as less is known about these housekeeping genes of wild plants.

OPBB 24

PROTEOMIC AND TRANSCRIPTOMIC APPROACH TO EXPLORE THE MOLECULAR BASIS OF ADAPTATION OF AGAVE AMERICANA TO HEAT STRESS

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Crassulacean Acid Metabolism (CAM) plants have to cope with different environmental stresses including heat, water and/or CO₂-limited environments throughout their lifecycles. Heat stress affects the rate of the photosynthesis and related thermotolerance in many plants. To elucidate heat tolerance mechanism and role of stromal proteome in a heat tolerant plant *Agave americana*, we used a novel proteomics approach; Multidimensional Protein Identification Technology (MudPIT) followed by mass spectrometry (MS). Stromal proteins were extracted from heat stressed and control plants. Several differentially expressed stromal proteins were identified under heat stress followed by their in silico subcellular localization, biological and molecular functions. We identify 58 stromal proteins that that can play important role in photosynthesis, defense, plastid metabolic functions, hormonal biosynthesis, stress signal perception and transduction. Both nuclear and chloroplast encoded proteins decreased under heat stress suggesting disruption of physiological and metabolic pathways at high temperature stress. Similarly relative transcript levels of 16 selected stromal genes were analyzed. Both, MudPIT and real-time PCR analyses have shown up or down regulation of several proteins under heat stress. Absence of correlation between some transcriptomic and proteomics data revealed significant role of post-translational modifications in *Agave* thermotolerance. Taken together, our results provide the first extensive picture of proteomic and transcriptomic comparisons of stroma (chloroplast) of CAM plant under heat stress.

OPBB 25

INTEGRATION OF NOVEL CHLOROPHYLL GENES FROM BLACK PINE INTO THE CHLOROPLAST GENOME OF TOBACCO**SHAHID NAZIR¹ AND MUHAMMAD SARWAR KHAN^{2*}**^{1,2}*National Institute for Biotechnology and Genetic Engineering (NIBGE), Jhang Road Faisalabad, Pakistan,*²*Center of Agricultural Biochemistry and Biotechnology (CABB), University of Agriculture, Faisalabad Pakistan*^{*}*Corresponding author's email: sarwarkhan_40@hotmail.com*

Gymnosperms owing the presence of dark-operative protochlorophyllide oxidoreductase pathway are able to reduce protochlorophyllide to chlorophyllide leading to the formation of chlorophyll in dark, whereas angiosperms are unable to do this and are less photosynthetically efficient. Plastid encoded genes chlL and chlN are reported to be involved in the functioning of the enzyme Dark-operative Protochlorophyllide Oxidoreductase (DPOR). The genes were isolated from black pine and cloned into the species-specific chloroplast targeting vector; harboring FLARE-S, a fluorescent selection marker. The final transformation vector was used to introduce genes into the tobacco chloroplast genome using biolistic approach. Here, we report stable integration of both genes along with translationally fused marker genes (gfp and aadA) into the inverted repeat region of plastome which was confirmed by Polymerase Chain Reaction and Southern blot analysis. Morphological and physiological analyses of the transgenic plants compared with non-transformed wild type tobacco plants revealed that the activation of dark-operative pathway requires additional factors/genes to chlL and chlN genes to develop chlorophyll, and consequently photosynthetically competent chloroplasts.

OPBB 26

ALTERNATE RESISTANCE GENE AGAINST YELLOW RUST IN WHEAT**SHAHZADI FAIZA SAFDAR AND HAMID RASHID^{*}***Department of Bioinformatics, Mohammad Ali Jinnah University, Islamabad, Pakistan*^{*}*Corresponding author's email: drhamid@jinnah.edu.pk*

Yellow rust, also known as stripe rust, is one of the three wheat rust diseases principally found in wheat grown in cooler environments. Yellow rust, caused by *Puccinia striiformis* Westend. f.sp. *tritici*, is an important foliar disease of wheat, and development resistant cultivars are the most economical method of control. Of the three rust diseases of wheat, stripe (yellow) rust (YR) is the most damaging to grain yields in cool, moist environments. The minimum, optimum, and maximum temperatures for spore germination are 0°C, 9-12°C, and 20-26°C respectively. This disease was first discovered by Gadd in 1977, but proper identification as another rust-type disease was done by Eriksson and Henning in 1986. Chemical control of rusts is expensive and hazardous to the environment. Yr5 and Yr10 are resistance genes among many other resistance genes while PsMAPK1 is fungus protein causing yellow rust in wheat. The protein sequences of Yr5 and Yr10 was retrieved from NCBI and PsMAPK1 protein sequence was retrieved from UNIPROT. By the help of I-TASSAR 3D models of Yr5, Yr10 and PsMAPK1 were generated. The models were then validated by the help of Ramachandran plot assessment and then models were evaluated by energy minimization. After model evaluation docking was performed to find the alternate resistance gene from the Yr5 and Yr10 templates. The docking results shows the alternate gene which can be used as the alternate source to cure this disease in wheat. The 3D models show that how these resistance genes interact with the fungus proteins.

OPBB 27

GENETIC FINGERPRINTING OF LOCAL TURMERIC GENOTYPES USING RAPDS**SIFFATULLAH KHAN, SHAMA NAZ, REEMA AND REHAN NAEEM^{*}***Department of Biotechnology and Genetic Engineering, Kohat University of Science and Technology (KUST), Pakistan.*^{*}*Corresponding author E-mail: genomics_2003@yahoo.com*

Genetic fingerprinting of turmeric (*Curcuma longa* L.) genotypes were analyzed using Randomly Amplified Polymorphic DNA (RAPD) markers to reveal the genetic diversity among genotypes. DNA extraction was performed from turmeric leaf samples with the modified protocol of Doyle and Doyle (1990). RAPD analysis was performed among the turmeric genotypes collected from five different regions of Bannu including Ismail Khel, Kakki, Raakh

Sarkar, Michan Khel and Mandan. A total of 22 primer were evaluated for genetic diversity studies, of which three (OPE-07, OPC-01 and OPA-03) were found suitable. In total these generate 141 fragments, of which 40 fragments were polymorphic with 28.36% of polymorphism. All the amplified fragments ranged in size from 10 kb to 50 kb within all turmeric germplasm. The number of amplification products generated by each primer varied from 6 (OPC-01) to 17 (OPA-03). The polymorphism of local turmeric genotypes using OPA-03 (38.3%) was found highest followed by OPE-07 (25.0%) and OPC-01 (21.74%). It was observed that OPA-03 was better to discriminate genotype as compared to other markers. Cluster analysis using UPGMA algorithm placed the 50 genotypes of turmeric into 6 groups showing their differentiation on the basis of their locality. On the basis of population locality cluster analysis clustered all the collected turmeric genotypes of Bannu region into two Groups (Group I and Group II). Group I include population 3 which belong to Raakh Sarkar while Group II have population 1, 2, 4 and 5 which belong to Ismail Khel, Kakki, Michan Khel and Mandan respectively. The analysis showed that Raakh sarkar turmeric genotype is different from the other four regions of Bannu. Turmeric genotypes evaluated using RAPD in the present study is helpful to identify potential genotypes which give broadness to the germplasm base of turmeric breeding programs.

OPBB 28

COMPARATIVE ANALYSIS OF ANTIOXIDANTS AGAINST CADMIUM INDUCED REPRODUCTIVE TOXICITY IN ADULT MALE RATS

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Cadmium (Cd) is a highly toxic and induces male reproductive toxicity. The present study was conducted to compare and evaluate the potential benefits of three different antioxidants in reversing Cd induced reproductive toxicity in adult male rats. Rats (n=5) weighing 180 ± 20 gm were divided into 5 groups (control, Cd, Cd+sulforaphane, Cd+vitamin E, Cd+plant extract). Treated groups received CdCl_2 (0.2mg/kg), sulforaphane (25µg/rat), vitamin E (75mg/kg) and plant extract (100mg/kg) for 15 days. Blood samples and testicular tissues were obtained for estimation of testosterone, Zn and Cd concentration and daily sperm production/efficiency of sperm production. Cd exposure caused a significant decrease in final body weight ($p < 0.0001$). The plasma concentrations of Cd were significantly increased and Zn concentration decreased ($p < 0.0001$) in Cd group as compared to control group. The testicular concentrations of Cd were significantly increased and Zn concentration decreased ($p < 0.0001$) in Cd group as compared to control group. Cd exposure caused a significant decrease ($p < 0.0001$) in plasma testosterone concentrations and daily sperm production as compared to control group. More significant effects were observed with Cd + sulforaphane, Cd + vitamin E, Cd + plant extract treated groups in reversing Cd induced toxicity. Present findings suggest that *Ficus religiosa* and sulforaphane are powerful antioxidant than vitamin E in reversing the oxidative stress and can have a protective role against Cd induced reproductive toxicity in adult male rats. Part of the mechanism involved in this protective role seems to be associated with the antioxidant properties of these agents in reducing reproductive damage.

OPBB 29

ANALYSIS OF PAKISTANI RICE GENOME POLYMORPHISM BY USING RAPD PCR

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RAPD profiling is efficient in revealing usable level of DNA polymorphisms among the cultivars of rice. Out of 24 rice genomes, one hybrid (S1), 12 had fine (F group) and 11 had coarse (M group) seed texture. RAPD conditions were optimized and those genomes with best amplifications were selected for further amplifications. Gel electrophoresis showed that F and M rice genomes had more similarities but F11, F12, M1 & M2 of these two distinct textured groups had more similarities with less genetic distances. Total number of amplified bands was 519 in the 23 genotypes by using 11 random decamers. Sixty two polymorphic bands were observed among 23 rice cultivars. The similarity coefficients ranged from 0.16 to 0.87. Eighty seven percent similarities were observed between M4 and M7 but S1 give more polymorphism with respect to F4 and F7, while, all other genomes showed almost no or very less genetic distance among themselves. Dendrogram based on similarity coefficients was constructed by using the Unweighted Pair Group of Arithmetic Means (UPGMA). Cultivars clustered into 6 distinct groups (1-6) and two cultivars S1 and M3 stand separately, although, S1 & M3 both are located on the each side of the coarse cultivars group in the Dendrogram.

OPBB 30

ASSESSMENT OF GENETIC RELATIONSHIPS AMONG WHEAT GENOTYPES BY RUST RESISTANT MARKERS AND BIOINFORMATICS TOOLS**TAHSIN GULZAR, SADAF AMBREEN, MUHAMMAD YOUNAS, DR. ZAFAR IQBAL***Department of Bioinformatics and Biotechnology, G. C. UNIV. Faisalabad*

Wheat is the most important grain and a staple food for more than one third of the world population. Wheat production in the country has been well below potential. Diseases, especially rusts (Stripe/Yellow Rust, Stem Rust, and Leaf Rust) and emerging scenario of increased incidences of Powdery Mildew and aphid are major biotic stresses of wheat crop that inflict heavy losses when in epidemic form. Rust diseases of wheat are among the oldest plant diseases known to man. Three types of rust are: 1) Stem rust (also known as black stem rust). 2) Leaf rust (brown rust) 3) Stripe rust (Yellow rust). The present study was employed to investigate molecular characterization of twenty genotypes by using rust resistant markers. The aim of present study was to find out molecular genetic characterization for rust resistant genes. The accessions were subjected to Simple Sequence Repeats (SSR) to reveal genetic relatedness rust. Modified CTAB method was used for DNA extraction. Thirty molecular markers were used to identify the rust resistant genes related to leaf rust, stripe rust or yellow rust and stem rust in 20 genotypes. All the 20 genotypes have rust resistant genes against rust. Nineteen rust resistant genes were characterized which are Yr5, Yr15, Lr1, Lr19, Lr21, Lr39, Lr47, Lr50, Lr51, Lr52, Lr20/Sr15, Lr46+Yr29, Lr19/Sr25, Lr21/Lr22, Lr2/Lr22, Lr34+Yr18, Sr32/Sr36, Sr22 and Sr2. This knowledge about rust resistant genes in wheat will be helpful for plant breeders in the evolution of new varieties. It will support their decisions on the selection of parents for crossing and to widen the genetic basis of breeding. The ultimate goal of plant breeding is to generate improved genotypes of wheat with rust resistant traits.

OPBB 31

SELECTION OF TRANSGENIC CELLS/EXPLANTS USING Na⁺/H⁺ ANTI PORTER GENE AS A SELECTABLE MARKER-A SUSTAINABLE APPROACH**ZAHID ALI¹*, HANS MARTIN SCHUMACHER², HEIKO KIESECKER², HANS JOERG JACOBSEN³**¹*Department of Plant Sciences, Faculty of Biological Sciences, Quaid-i-Azam University Islamabad Pakistan*²*German Collection of Microorganisms and Cell Cultures (DSMZ), Braunschweig Germany*³*Department of Plant Biotechnology, Institute of Plant Genetics, University of Hanover, Hanover Germany*

The selection of transgenic cells/tissues based on the marker gene expression is a common practice and requirement in plant genetic transformation. However an efficient and reliable gene expression analysis in transgenic plant through out different developmental stages is of basic need. We report here the selection of transgenic cells/explants using Na⁺/H⁺ antiporter gene (Atnhx1) from Arabidopsis thaliana. Dicistronic binary vector system harboring the Na⁺/H⁺ antiporter gene as 1st cistron, downstream internal ribosome entry site and firefly luciferase was transformed into Nicotiana tobaccum by Agrobacterium mediated genetic transformation method. Comparative studies with salt challenged, transgenic in vitro cultured tobacco cells showed improved salt tolerance over their wild type counter part, based on the effect of an over expressed nhx1 gene. An increase in cell biomass and luc gene expression (being 2nd cistron) was observed in transgenic cells under NaCl stress condition. The regenerating transgenic explants harboring dicistronic expression cassette showed better performance under NaCl selection studies. The findings of this study show that Atnhx1 gene may be used as a selectable marker for the selection of transgenic cells/tissues using NaCl as a selective agent in the growth medium.

POSTER ABSTRACTS

PPBB 1

COMPARATIVE LIPID PEROXIDATION, LEAF MEMBRANE THERMOSTABILITY, AND ANTIOXIDANT SYSTEM IN THIRTEEN SUGARCANE GENOTYPES ON DIFFERING PEG CONCENTRATIONS

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PEG imposed at sugarcane with different concentrations resulted in an increase in lipid peroxidation and decrease in membrane stability, chlorophyll fluorescence ratio (fv/fm) and chlorophyll and carotenoid contents. The activity of antioxidant enzymes (ascorbate peroxidase, glutathione reductase, and superoxide dismutase) increased significantly under drought stress. The genotypes SPF-238 and US-633, which had the highest ascorbate peroxidase, glutathione reductase, peroxidase, catalase and SOD activity, had the lowest lipid peroxidation (malondialdehyde content) and highest membrane stability, chlorophyll and carotenoid contents under drought stress, while the susceptible genotypes US-153 and CPHS-35 exhibited lowest antioxidant enzyme activity, membrane stability, contents of chlorophyll and carotenoid with highest lipid peroxidation. The higher drought tolerance of varieties SPF-238 and US-633 were related to higher membrane stability, significant higher chlorophyll and carotenoid contents, and maintenance of high fv/fm ratio under drought stress and lower lipid peroxidation of membranes. Hence, the relative tolerance of a genotype to drought stress as reflected by its lower lipid peroxidation, and higher membrane stability and pigment concentration, is related to the levels of activity of its antioxidant enzymes.

PPBB 2

IN VITRO ROOTING AND ACCLIMATIZATION OF PINEAPPLE (ANANAS COMOSUS L. MERR.)

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Individual shoots of 10-12 cm length of micropropagated pineapple cv. 'Cayenne' were subjected to rooting experiment to investigate the effect of Plant Growth Regulators affecting in vitro rooting. Also, different soil mixtures were tested for acclimatization. Separated shoots from multiplication stage were cultured on MS basal medium supplemented with different concentrations of 0.0, 0.1, 1.0 and 3.0 mg l⁻¹ of IBA, NAA and IAA. After 3 months, the well-rooted plantlets were transferred into different soil mixtures of sand and peat-moss in greenhouse. The obtained results indicated that maximum roots number was achieved using 0.1 mg l⁻¹ NAA which enhanced thickness and length of white adventitious roots formation. The plantlets survival percentage in greenhouse was 100%. However, better growth and development of ex vitro plants was achieved using pure peat-moss in comparison to other mixtures with sand.

PPBB 3

EXPLOITATION OF GENETIC DIVERSITY FOR DEVELOPMENT OF POWDERY MILDEW RESISTANT AND LODGING TOLERANT GENOTYPES OF PISUM SATIVUM THROUGH MARKER ASSISTED SELECTION

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Genetic diversity in pea revealed significant relevance for selecting superior genotypes, and identification of the parents, especially for powdery mildew, a foliar disease caused by *Erysiphe pisi* Syd. The diverse groups were observed for indigenous as well as exotic pea germplasm for plant descriptor, agronomic traits, and molecular markers including

seed protein profiling that explained varying degrees of genetic dissimilarities. Under heavy infection load of powdery mildew created artificially under controlled conditions, three genotypes (Fallon, PS99102238 and PS0010128) were highly resistant among 535 diverse genetic resources, and the resistant genotypes were used for developing breeding populations to harbor various traits of economic importance including powdery mildew. The MAS proved its worth for selecting powdery mildew resistant gene *er1* in a hybrid involving resistant exotic genotype (Fallon^{er}) and one indigenous susceptible pea genotype (11760-3^{ER}). Genetic resistance to powdery mildew is available, and two recessive genes (*er1* and *er2*) have been reported, *er1* being important for genetic control, whereas *er2* grounds durability of resistance, however recently a new dominant gene (*Er3*) has been reported in *Pisum fulvum*, a wild relative of pea that is different from previously reported *er1* and *er2*. A novel RAPD fragment of 430 kb molecular weight generated by the primer “*OPB18* (5'-CCACAGCAGT-3') was linked to the *er1* gene with 83% probability, and was located at a distance of 11.2 cM from the source gene. Based on this marker, the breeding populations were screened and followed by subsequent MAS and conventional breeding techniques fifteen promising genotypes were developed. Due to emergence of new pathogens, the efficacy of these genes may be at risk, *Erysiphe trifolii* has been reported as other causal organism of powdery mildew that was not previously known. Hence a continued search for new and diverse resistant sources remains a priority in pea breeding and special emphasis should be paid to selection of resistance that will prolong durability of existing resistance genes. The MAS being an emerging approach in Pakistan has the potential for target breeding that has been widely employed worldwide in cereals and recently got popularity among legume breeders. Due to Mendelian inheritance, the *er1* gene was effectively exploited through MAS, whereas in case of complex traits single marker is not much effective, hence multiple markers with flanking regions are considerably better option.

PPBB 4

GENOMICS AND TRANSCRIPTOMICS ANALYSIS OF METAL ACCUMULATOR PLANTS IN BRASSICACEAE

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The genus *Brassica* contains a wide range of diploid and amphipolyploid species including some of the economically high valuable vegetables and oilseed crops used worldwide. The major industrial and food crops in *Brassica* are the closest relatives to the model plant *Arabidopsis thaliana*, and hence are major beneficiaries from the vast data of genomics and molecular genetics available in the database of *Arabidopsis thaliana*. Extensive genetic and molecular analyses have been undertaken for the six cultivated *Brassica* species. The four closely related crop species *B. rapa* (AA, 2n=20), *B. juncea* (AABB, 2n=36), *B. napus* (AACC, 2n=38), and *B. carinata* (BBCC, 2n=34) provide about 12% of the worldwide edible oil supply. The other two species *B. nigra* (BB, 2n=16) and *B. oleracea* (CC, 2n=18) provide many vegetables for healthy human diet having a valuable source of dietary fiber, vitamin C and other anticancer compounds. The comparative mapping between *Arabidopsis thaliana* and the well known oil crops in *Brassicaceae*, coupled with the basic knowledge of mutation based functional analysis in *Arabidopsis thaliana* and QTL mapping in *Brassicas*, could greatly contribute towards a better understanding of the genetic architecture for the conserved as well as the evolved traits of agronomic value of crop plants in *Brassicaceae*. *Brassica nigra* has the second smallest genome size (~ 632 Mbp) among the six cultivated species of *Brassica*. Approximately 25% of the documented metal hyper accumulating species are members of the *Brassicaceae* and some of them are being used for phytoremediation. The super metal accumulating capacity of *Arabidopsis halleri* and *Thlaspi caerulescens* have been well documented. Because of their slow growth and low biomass, other fast-growing and high biomass brassica crop plants, for example *Brassica juncea* and *Brassica nigra* have been evaluated for their ability to hyper accumulate metals from contaminated soils. The Diyabeker ecotype of *B. nigra* collected from southeastern part of Turkey was found to be hyperaccumulator of Cu. We carried out the comparative transcriptome analysis in order to find out the expression level of metal induced genes and transcriptome changes both in low and high Cu treated plants. Microarray analysis showed that some of the genes were highly expressed (several hundred fold) with Cu treated plants compared to control. Our microarray data using Affymetrix GeneChip Arabidopsis Genome Array (ATH1-121501 Genechip) indicate that possibly several genes including the genes in glutathione pathway, metal ATPase and ABC transporters are involved in metal tolerances in this ecotype.

PPBB 5

DETECTION AND APPRAISAL OF B-PHELLANDRENE IN CALLUS CULTURE OF MOMORDICA CHARANTIA L. CV. JAUNPURI AND JHALRI

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Conditions for callus induction were optimized using *in vitro* grown seedlings of *Momordica charantia* L. varieties i.e. Jaunpuri and Jhalri as explant source. Among various combinations of PGRs supplemented in MS medium, BAP/2,4-D proved to be the most suitable combination with different concentrations for callus induction in different explants of both varieties. Cotyledon explant of cv. Jaunpuri revealed best callus induction with 1.0mg l^{-1} BAP and 1.5mg l^{-1} 2,4-D in 8 days as compared to internode and apical bud, whereas the leaf explant produced callus with different concentrations of same combination i.e. 1.5mg l^{-1} BAP and 1.0mg l^{-1} 2,4-D. Cotyledon and leaf explants of cv. Jhalri responded at best to the same combination with variation of concentrations of PGRs i.e. in 1.5mg l^{-1} BAP and 1.0mg l^{-1} 2,4-D in 9 days. Best results from internode and apical bud were achieved in different concentrations (1.0mg l^{-1} BAP and 1.5mg l^{-1} 2,4-D). Best grown calli from different explants were analyzed through GC-MS for production of secondary metabolites (SM). Along with other SMs β -Phellandrene was the most prominent SM found in *in vitro* grown callus cultures of both the varieties. β -phellandrene is a naturally occurring terpene of essential oils of leaves and flowers and is widely used in perfumes, fragrances and artificial essential oils because of their pleasing aromas. The callus cultures of cv. Jaunpuri contained substantial amount of β -Phellandrene i.e. upto 30 percent of the total SMs as compared to cv. Jhalri and explant sources. The callus cultures of *M. charantia* can prove best alternative, rapid and uninterrupted source of natural β -Phellandrene production.

PPBB 6

BIOCHEMICAL INDICES OF DROUGHT TOLERANCE IN WHEAT AT EARLY SEEDLING STAGE

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Availability of biochemical markers to check drought tolerance at seedling stage could help in escalating selection intensity in breeding drought tolerant wheat varieties. For this purpose, four wheat genotypes with varying degree of drought tolerance were used to reveal the biochemical indices of drought tolerance at the seedling stage. Relatively tolerant genotypes (Sitta, Sarsabz and Fareed) accumulated higher peroxidase, sharply increased superoxide dismutase (SOD) (Fareed) and catalase (CAT) (in Sitta and Fareed) activities and total phenolics under drought stress. Drought tolerant genotypes also kept higher ascorbate compared to sensitive genotypes under stress and non-stress conditions while ascorbate peroxidase (APX) activity was not affected by drought stress. However, in relatively sensitive genotype Inqalab-91, drought caused a decrease in peroxidase (POD) and ascorbate and enhanced the proteases, APX and membrane lipid peroxidation measured as MDA content. In this sensitive genotype, MDA level was above two folds as compared to control. Drought stress induced compromised antioxidant activities and enhanced protein and lipid degradation played central role in drought sensitivity. While accumulation of higher antioxidants i.e. CAT, PODs, SOD and ascorbate resulting in better protection to biomolecules contributed significantly in conferring drought tolerance in wheat. Thus, antioxidants and stress markers can be efficiently and economically used as biochemical indices to screen/enrichment the wheat germplasm for drought tolerance at early seedling stage.

PPBB 7

SPATIO-TEMPORAL MONITORING OF GROUND LEVEL OZONE IN TWIN CITIES OF PAKISTAN

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Ground level ozone is a secondary air pollutant created by photochemical reactions between Volatile Organic Compounds (VOCs), oxygen and nitrous oxides (NO_x). Increasing levels of tropospheric Ozone have been reported to contribute to higher incidence of cancer among humans. Distribution of Tropospheric Ozone across Earth's surface is controlled by presence of sunlight and abundance of emission sources such as vehicles and petrol pumps. Twelve sample stations from the twin cities (Rawalpindi-Islamabad) were selected using ozone detector. Diurnal and seasonal ground level Ozone concentrations for winter and summer were measured over an eight month period at these stations. Pronounced seasonal and diurnal variations of ozone were observed. Analysis of data on diurnal ozone concentration showed that ozone concentrations were at their maximum in the morning (0.06 ppm in summer and 0.03 ppm in winter) and minimum in the evening (0.0084ppm in winter and 0.03ppm in summer). Seasonal trends of tropospheric ozone concentrations also showed variations. Peak concentrations of Ozone were reached in summer season (maximum concentration 0.06 ppm and minimum concentration 0.0375 ppm). Low ozone concentrations were recorded during winter season (maximum concentration 0.03 ppm and minimum concentration 0.0084 ppm). Spatial analysis of the diurnal and seasonal ozone conc. indicated that the stations downwind of the areas with

higher traffic flow and density of buildings had significantly higher ozone concentrations. Results indicated that, in areas of small scales, the spatial distributions of ozone concentration were non-uniform and there were appreciable day-to-day variability in spatial distribution. Trends of increasing tropospheric ozone concentrations in densely populated areas of the twin cities were also evident. This research will provide basic data to environmental and health policy makers for addressing urban health issues related to air pollutants.

PPBB 8

EFFECT OF DIFFERENT CONCENTRATIONS OF GA₃ ON *IN VITRO* MICROPROPAGATION OF POTATO VARIETIES

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The effect of different concentrations of GA₃ viz. 0.00, 0.12, 0.25, 0.50, 0.75mg/L on *in vitro* micro propagation of potato varieties Cardinal and Desiree was evaluated. The parameters included were percent sprout, plantlet height, number of nodes per plantlet, number of days to root initiation, and number of days to transferable height of the plantlets. Statistical analysis showed that the varieties, GA₃ concentration and varieties vs GA₃ concentration were highly significant for plant height, number of nodes per plantlet and number of days to transferable height of the plantlets. Plantlets developed in M.S media supplemented with 0.25 mg/L of GA₃ for Desiree and 0.12mg/L of GA₃ for Cardinal produce maximum plant height, more number of nodes, reduced no. of days to root initiation and took less number of days to transferable height of the plant. Plantlets developed in these treatments were healthy and vigorous than the plantlets developed in other treatments. The results have shown that sprout percentage was high in variety Cardinal and Desiree proved efficient in response of no. of days to transferable height of the plant.

PPBB 9

EFFECT OF GREEN TEA ON THE PRODUCTION OF ADVANCED GLYCATION END PRODUCTS

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Diabetes is characterized by increased protein glycation and the subsequent formation of fluorescent and cross linked advanced glycation end products (AGE). Green tea is widely consumed in Asian countries and is becoming increasingly popular in Western Countries. Green tea is considered to be anti-inflammatory, anti-oxidative, anti-mutagenic, and anti-carcinogenic, and can prevent cardiac disorders. It has been suggested that green tea consumption prevent type 2 diabetes. To study the effect of Green tea on the formation of Advance Glycation End Product, 32 combinations were made and all these combinations were placed at 37C° for five weeks. Browning production was determined; glycation level was measured by TBA method and AGE was determined by ELISA. Glycation level was mostly maximum in 5th week of incubation and inhibition of Glycation was mostly maximum in 3rd week but decreased in 3rd week of incubation but some results showed variable trends in inhibition of Glycation. Glycation level elevated in 1st week, became maximum in 3rd week but decreased in 5th week because in 3rd reaction Maillard reaction products were converted into advanced glycation end products. The present study reveals that green tea is effective in reducing the production of advanced glycation end product. Thus green tea is effective in reducing the production of advanced glycation end product and it may have a therapeutic effect in the treatment of glycation induced complication of diabetes.

PPBB 10

ANTIOXIDANT ENZYMES ACTIVITIES DURING REGENERATION OF ARGYROLOBIUM ROSEUM THROUGH CALLOGENESIS AND ORGANOGENESIS

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Antioxidant enzymes were studied in in vitro and in vivo *Argyrobium roseum* (Camb.) Jaub and Spach plants. Calli from leaf, hypocotyl and root explants was induced on MS medium supplemented with 0.5 mg/l BAP, 1.0 mg/l NAA, 1.0 mg/l AgNO₃ and 1.0 mg/l PVP. The calli was proliferated on same medium with different concentration of regulators. The embryogenic calli were cultured on MS medium containing 3.0 mg/l BAP, 2.0 mg/l NAA, 0.5 mg/l AgNO₃ and 0.5 mg/l PVP to induce shoots. The regenerated plants were rooted and acclimatized successfully. It was observed that catalase and peroxidase activities decrease during callus induction and proliferation while increase during shoot induction and regeneration period. While high level of ascorbate peroxidase was observed during callogenesis and proliferation and it gradually decrease during plant regeneration and acclimatized conditions. During callus induction same pattern of enzyme activity was observed originated from any type of explant. It was observed that in vivo plants from seeds and regenerated plants showed same pattern and near about same level of antioxidant enzyme activity. The level of antioxidant enzymes during callogenesis, organogenesis and acclimatization of *Argyrobium roseum* vary depending upon environmental and physiological conditions and cells have different concentrations to bear oxidative stresses.

PPBB 11

MYCOGRAPHIC ANALYSIS OF MACROMYCETES OF AYUBIA NATIONAL PARK, DEVELOPMENT OF IDENTIFICATION SOFTWARE AND INDICATION OF THREATENED SPECIES

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The current study was conducted for a duration of three years during which extensive surveys were made to the areas in and around Ayubia National Park including DungaGali, NathiaGali, Lalazar, Mukshpuri, Miranjani, KheraGali, Khanspur village, Bara Gali, and KozaGali. Studies were carried out to record the ecological as well geographic data of macromycetes prevailing in these areas. Further research was done to evaluate the current status of macromycetes in these areas to get an image of species richness and density of macromycetes in each designated area. Collected macromycetes were characterized on the morphological as well as anatomical basis. The **MycoSOFT-II**, a software has been developed for an easy access to identification of the macromycetes of the area. GPS coordinates were recorded to make a true print of ecological niche and amplitude of each mushroom with respect to both latitude and altitude. At the end, data comprised of three years was compared to fifteen years archives and current status of each of the macromycetes in the study areas was evaluated. Attempts are under way to restore the locally displaced species.

PPBB 12

ELABORATING THE ROLE OF GENOME B AND C FOR SUPPRESSING HOMOELOGOUS PAIRING IN GENOME A OF *BRASSICA*

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Eight digenomic triploids (4 each having genomes AAC and AAB) and 3 trigenomic haploids (genomes ABC) were synthesized through interspecific hybridization. Genome analyses of the synthetic hybrids revealed sever meiotic anomalies in the form of univalent, bivalent and multivalent associations. Gross pollen sterility was evident in all the hybrids. Though the frequency of chromosomal association, orientation of multivalents and the rate of synapsis was not uniform in hybrids or even in PMCs of the same hybrids; uniformity was recorded in the frequency of synaptic and asynaptic chromosomes at the genome level. Analysis of meiotic association revealed that the ratio of synaptic and asynaptic chromosomes remained nearly 70 to 30 percent in digenomic triploids or trigenomic haploids, respectively. The high frequency and nearly equal amount of IIs in digenomic triploids ABA and ACA proved that the genomes B and C do not interfere in homoeologous pairing among chromosomes of genome A obtained from different sources. Similarly allosyndetic associations among the genomes A, C and B prove the absence of pairing regulating genes in genome A.

PPBB 13

REASSESSMENT OF *MENTHA* SPECIES FROM KUNHAR RIVER CATCHMENT**ISRAR AHMAD¹, HABIB AHMAD¹, SAJIDULGHAFOOR¹ AND AJMAL IQBAL²**¹*Department of Genetics, Hazara University Mansehra, Pakistan*²*Department of Botany, University of Malakand, Pakistan*

Mentha specimens collected from Kunhar River catchment of Hazara region were analysed through numerical and molecular markers. For numerical analysis twenty two traits were used. Dendrogram analysis of morphological traits assorted the 25 *Mentha* collections into 4 groups viz, Group-A, B, C and D. Group-A showed 98% similarity (*M. longifolia*). Group-B showed 98% similarity (*M. spicata*). Group-C showed 92% similarity (*M. arvensis*). Group-D showed 89% similarity (*M. royleana*). Molecular analyses were carried out through 11 RAPD primers. Primers amplification revealed high level of genetic diversity (0-100%) existed among the *Mentha* collections. Dendrogram analyses based upon the genetic distance estimates conferred the cluster analysis of the morphological traits. Furthermore, the variations among populations of *M. royleana* need further elaboration through additional marker assisted discrimination for establishing their taxonomic status.

PPBB 14

AVICELASE (EXOGLUCANASE) PRODUCTIVITY OF *HUMICOLA INSOLENS* FLN-1 GROWN UNDER SUBMERGED CONDITIONS ON VARIOUS CARBON SOURCES**JHARNA RAFAQAT^{1,2}, FAROOQ LATIF¹, MUHAMMAD HAMID RASHID^{1*},
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The enzymatic hydrolysis of cellulose, a most abundant and renewable biomass on earth, into soluble sugars is carried out by the synergistic action of cellulases (multi-component enzyme system) consisting of three different enzymes i.e. endoglucanases, exoglucanases and β -glucosidases. During the last two decades, the use of cellulases has increased considerably in the pulp and paper industry and especially in textile industry. Other applications of cellulases are in: detergents, fabric rejuvenation, food industry, waste management, pharmaceutical industry, protoplast production, genetic engineering etc. Exoglucanases attack cellulose chain ends to produce cellobiose (a dimer of glucose linked by a β -1,4 glycosidic bond). The current study deals with the production of avicelase (exoglucanases) by a local strain *Humicola insolens* FLN-1. The culture was maintained on potato dextrose agar (PDA) slants. Forty five ml Eggins and Pugh medium, pH 5 was poured per flask and 12 flasks of 250 ml capacity were used per experiment. Acid washed glass beads (6-8) were added to each flask to break the fungal mycelia. The carbon sources 2% (w/v) used were: Sigma cell, Wheat straw, Corn cob, Wheat bran, CMC and Rice bran. Among these, corn cob was the best substrate for production of exoglucanase. Maximum avicelase and protein production was at 96 hours and was 0.718 U mL⁻¹ and 1.734 mg mL⁻¹, respectively. The specific activity of exoglucanase at 96 hours was 0.414 U mg⁻¹.

PPBB 15

PRODUCTION, PARTIAL PURIFICATION AND CHARACTERIZATION OF AVICELASE (EXOCCELLULASE) FROM *HUMICOLA INSOLENS* FLN-1**JHARNA RAFAQAT¹, FAROOQ LATIF², HAMID RASHID², TEHREEMA IFTIKHAR¹ AND MUBASHIR NIAZ^{1*}**¹*Laboratory of Mycology & Biotechnology, Department of Botany, Govt. College University Faisalabad*²*Industrial Biotechnology Division, NIBGE, Jhang Road Faisalabad, Pakistan.*^{*}*Corresponding author's e-mail: mmiaz_prof@yahoo.com*

Studies were carried out with the objective of the production of avicelase in a cost effective manner from *Humicola insolens* FLN-1. The studies included optimization of various production parameters like temperature, pH, various carbon and nitrogen additives. Large scale production using bioreactor leading to characterization of avicelase was also done. The strain produced avicelase enzyme which was thermostable up to 60°C. Partial purification was carried out through ammonium sulphate precipitation. Different experiments indicated the optimum pH 5.0 for avicelase activity. Our studies proved the substrate specificity of avicelase enzyme as well as in breaking cellulose only on exo positions polysaccharide chains. These studies are of significant industrial importance for conversion of plant biomass into biofuels and chemicals.

PPBB 16

EFFECTS OF THIDIAZURON ON *IN VITRO* PLANT REGENERATION AND RADICAL SCAVENGING ACTIVITY IN *BRASSICA RAPA* VAR. *TURNIP*

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The current investigation deals with evaluation of regeneration potential and antioxidative activities induced by TDZ (Thidiazuron (1-phenyl-3- (1, 2, 3- Thiadiazol-5-yl) using hypocotyl explants of *Brassica rapa* var. *turnip*. For the purpose either various concentrations of TDZ alone or a combination with other plant growth regulators (PGR's) were used. This treatment induced regeneration in all applied concentrations. The highest frequency of callogenesis obtained was 82% on MS medium containing 2.0 mg/L TDZ alone, while 0.5 mg/l TDZ and 0.5 mg/l BA proved to be the best combination for in-direct shoot organogenesis yielding 28 shoots per cultured callus with the mean shoot length of 2.78cm. Besides, the antioxidant potential of regenerated tissues was assessed by using DPPH (1,1 diphenyl-2-picrylhydrazyl) free radical. Regenerated shoots showed significantly higher radical scavenging activity than other tissues tested. TDZ induced regenerated plantlets showed highest antioxidant activity 80.1% as compared to individual regenerated plant segments' calli, shoots or roots and wildy grown plantlets and their tissues. The antioxidant activity of *in vitro* regenerated plantlets, calli and tissues was determined and compared with wildy grown plantlets and their tissues. During investigation *in vitro* derived plantlets showed higher antioxidant activity (~80.1%) than *in vitro* derived shoots and callus and wild plants. The main objective of the present study was to determine the effect of TDZ and optimize *in vitro* conditions for regeneration of *B. rapa* var. *turnip* from *in vitro* explant-derived calli and to investigate regenerated tissues for antioxidant potentials.

PPBB 17

PLANT REGENERATION FROM SEED DERIVED CALLUS OF MEDICINALLY IMPORTANT *BRASSICA RAPA* VAR. *RAPA*

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Brassica rapa var. *rapa* is a widely consumed vegetable and medicinally important plant, which serve as source of vitamin C and used as a folk remedy for cancer. In this study MS medium supplemented with different combinations of auxin and cytokinin were tested for their seed derived callus formation and subsequent *in vitro* plant regeneration capability. High induction frequency (56 ±2.2%) of soft white and purple watery translucent calli was achieved on medium containing 2 mg l⁻¹ NAA and 0.5 mg l⁻¹ BA with high yield (436.4±2.7 mg) within 3 weeks of incubation. Callus was differentiated on shoot induction medium with highest frequency of 83% and 23 shoots per explant on MS medium containing 0.5 mg l⁻¹ TDZ. Shoots were elongated on the medium of same composition by subculturing after 14 days of interval and subsequently transferred half strength MS medium for the root induction. All the regenerated plants were successfully acclimatized.

PPBB 18

ANALYSIS OF GENETIC VARIABILITY IN INTERSPECIFIC PROGENIES OF *BRASSICA NAPUS*/ *BRASSICA CAMPESTRIS* USING (SSRS)

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The plant materials investigated was the F₂ segregating progenies of interspecific crosses *B. napus* 501/*B. campestris* 118. A set of 90 genotypes (2 parents and 88 progenies) was characterized separately with 24 SSR primer pairs to cover as broadly as possible the diversity present in them. In initial screening only 12 out of 24 SSR primers combination amplified DNA while the remaining 12 SSR primers did not amplify DNA therefore those 12 SSR markers were not used for further analysis. The 12 SSR primer combinations amplified a total of 33 alleles, 32 polymorphic loci and one monomorphic locus. Primers BRMS-19 and BRMS-40 were highly polymorphic produced 4 bands. Primer Ra2-

D04 was less polymorphic and it produced only one band. The proportion of polymorphic loci was 96% which indicates high genetic diversity among the progenies. The average number of polymorphic alleles per locus was 2.66. The PIC values ranged from 0.395 for primer (Ra2-E03) to 0.726 for primer (BRMS-019) with an average genetic diversity (PIC value) of 0.584 per locus. Seven primers showed PIC values above 0.5 (50%) indicating high genetic diversity in the studied plant materials. Pair-wise similarity indices among 90 genotypes ranged from 0.3 to 0.95. Dendrograms obtained through UPGMA clustering of F_2 progenies depicted eight main groups using similarity coefficient of 0.70. The progenies could be similar to their parents if they have the same banding pattern as that of the parents and could be distinguished from each other by the combination of fragments which is repeatedly present in one progeny and absent in the other. Considerable genetic diversity has been found among progenies and their parents using SSR markers thus, SSR analysis proved to be a useful tool.

PPBB 19

STUDY OF POLYPEPTIDES INDUCED BY DROUGHT STRESS IN SOME LOCAL VARIETIES OF BARLEY (*HORDEUM VULGARE* L.)

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The present study aimed to investigate the morphological parameters and polypeptide profile in four cultivars of Barley (*Hordeum vulgare* L.) under drought stress. The plants were germinated under controlled environment at different concentrations of PEG (6000) i.e. 0, 5, 10, 15, and 20%. Morphological studies revealed that the most effected traits were germination percentage, leaf area, number of roots and leaves and fresh weight of plant at different stress levels in vitro condition. The germination rate and leaf area decreased with an increase in stress level. Plants showed maximum fresh weight at 10% PEG concentration after this level fresh weight of plant decreased gradually. It was revealed that SDS-PAGE analysis the common protein bands were of 26, 43 and 58 kDa. In case of Haider-93, larger number of protein expressed during control treatment, which gradually reduce with PEG concentration. 32 kDa, 22 and 55 kDa proteins were produced during stress treatment in case of Frontier-87. Greater number of proteins was produced as a result of stress in Frontier-87. In Sanober-96, no significant difference at protein level was observed whereas in Soorab-96, number of proteins were more at 10 and 15% PEG concentration. Immunoblot analysis of the total protein extracted from all the seedlings revealed that all the varieties were drought tolerant. In the western blot analysis of Haider-93, 43 and 38 kDa dehydrins were found to be induced at 15 % PEG treatment and the concentration of these protein is more at 15 % PEG treatment. Whereas in Frontier-87, the bands of 58 and 43, 26 and 17 kDa dehydrin proteins were present in all levels of treatment however its concentration varied. The 20 % PEG treatment showed the more dense and concentrated bands than the other varieties. In western blot analysis of Sanober-96, the dehydrin protein of molecular weight 58, 43 and 26 kDa were present clearly but these were more concentrated at 15% PEG concentration. In the western blot analysis of Soorab-96 dehydrin proteins of 58, 43 kDa were present at all concentrations of PEG. The proteins were more concentrated at 5, 10 and 20 % PEG treatment. In future, dehydrin genes isolation and its amplification through PCR with DHN probes can be done. It will provide an area of developing drought tolerant varieties of other plants.

PPBB 20

ANTIBACTERIAL ACTIVITY OF LEAVES EXTRACT OF *MORINGA OLEIFERA* LAM. FROM THAL DESERT, PAKISTAN

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The antibacterial activity of leaves extract of *Moringa oleifera* Lam. was screened against Gram positive (*Staphylococcus aureus*, *S. epidermidis*) and Gram negative (*Escherichia coli*, *Pseudomonas aeruginosa*) bacteria. The extractions were carried out using seven solvent extracts (i.e. n-hexane, chloroform, acetone, ethyl acetate, ethanol, methanol and water). The bacterial strains were tested at concentrations ranging from 12.5 to 100 mg/ ml by agar well diffusion method. The result reveals that leaves extracts possess highly significant inhibitory activity ($P < 0.01$) against the tested organisms. Amongst the solvent, acetone and ethyl acetate exhibited maximum antibacterial activity, followed by methanol and ethanol. The MIC values were ranged between 6-12mg/ml against all bacterial strains. The ethanolic extracts successfully inhibited *E. coli* and *P. aeruginosa* at 6mg/ml, which was equal to control. Based on the results, it can be concluded that *Moringa* leaves extracts can provide a cheap source of crude drug for mitigating diseases and can improve the quality of life of rural and poor inhabitants of developing countries like Pakistan.

PPBB 21

MORPHO-BIOCHEMICAL CHARACTERIZATION OF BRASSICA OILSEED GENOTYPES**MANSOOR AHMAD^{1*}, ZAHOO AHMAD SWATI², IMTIAZ ALI KHAN³ AND MUHAMMAD NAEEM³**¹*Directorate of Outreach, Agriculture Research Khyber Paktunkhwa, Peshawar.*²*Institute of Biotechnology and Genetic Engineering, KP Agricultural University, Peshawar.*³*Department of Entomology, KP Agricultural University, Peshawar*^{*}Corresponding author's email: mansooravl@yahoo.com

Genetically diversified Brassica oilseed representing four Brassica species, including, *Brassica napus*, *Brassica juncea*, *Brassica carinata* and *Brassica campestris*, were studied for their morpho-biochemical potential under field conditions. Generally, the genotypes exhibited variable morphological as well as biochemical response in almost all characteristics. Average maximum seed yield ha⁻² (2386 kg), plant height (214.3 cm) and number of branches (19.20 branches) were recorded in Peela Raya, where as, increased siliqua length (8.31 cm), seed/siliqua (23.57 seed) and 1000 seed weight (4.80 g) were recorded in Ganyou-5, Oscar and Westar, respectively. Maximum level of oil recovery and protein content were found in Oscar 52.10% and T-16-401 (52.10%), respectively. Minimum level of Glucosinolates (67.35 μ mg⁻¹) was found in Rainbow while maximum level (132.7 μ mg⁻¹) in T-16-40. The Oscar genotype was highest in moisture contents (7.09%), Westar in oleic acid (54.74%) and Raya Anmol for linolenic (12.86%) and erucic acids (56.2%).

PPBB 22

MORPHO-BIOCHEMICAL LOSSES IN BRASSICA OILSEED GENOTYPES DUE TO APHIDS**MANSOOR AHMAD^{1*}, ZAHOO AHMAD SWATI², MUHAMMAD NAEEM³ AND IMTIAZ ALI KHAN³**¹*Directorate of Outreach, Agriculture Research Khyber Paktunkhwa, Peshawar.*²*Institute of Biotechnology and Genetic Engineering, KP Agricultural University, Peshawar.*³*Department of Entomology, KP Agricultural University, Peshawar*^{*}Corresponding author: mansooravl@yahoo.com

Genetically diversified Brassica oilseed representing 4 Brassica species, including, *Brassica napus*, *Brassica juncea*, *Brassica carinata* and *Brassica campestris*, were studied for losses due to aphids under screen house conditions. Generally, the genotypes exhibited variable morphological as well as biochemical losses/gain in almost all characteristics. Highest average percent losses in seed yield, straw yield, plant height, number of branches, siliqua mr⁻¹ and leaves were recorded in Vanguard (57.87), Peela Raya (46.35), Westar (38.78), Crusher (27.78), Oscar (40.20) and Peela Raya (26.31) from an average aphid's density/plant of 101.3, 65.72, 108.2, 102.1, 113.9 and 65.72. Highest values for averages percent losses or gain in Oil, Protein, GSL, Moisture, Oleic acid, Linolenic acid and Erucic acid were recorded in Altex (9.22), Oscar (25.33), Rainbow (38.57), T-16-401 (21.33), Ganyou-5 (67.07), T-16-401 (19.80), and Legend (32.16) from aphid's density of 90.78, 113.9, 138.9, 59.00, 61.11, 59.00 and 114.8 per plant.

PPBB 23

ECO-CULTURAL OPTIMIZATION FOR GLUCOAMYLASE PRODUCTION BY *PENICILLIUM CHRYSOGENUM* UNDER SOLID SUBSTRATE CONDITIONS**MUBASHIR NIAZ^{*}, TEHREEMA IFTIKHAR AND MUHAMMAD HASSAN RAZA***Laboratory of Mycology & Biotechnology, Department of Botany, Government College University, Faisalabad*^{*}Corresponding author's email: mniaz_prof@yahoo.com

Different eco-chemical parameters were optimized for the production of glucoamylase by using *Penicillium chrysogenum* under solid substrate fermentation by using different agro-wastes including bagass, wheat bran, rice bran, tea waste and cob of corn at Laboratory of Mycology and Biotechnology GC University Faisalabad. Different eco cultural conditions including effect of size of inoculum, effect of changing pH were optimized for optimal enzyme production. Effect of incubation period, size of substrate, incubation temperature and different C, N additives were also optimized. Enzyme units were calculated spectrophotometrically by using glucose oxidase kit. Maximum production of glucoamylase units took place by using 10g of wheat bran as substrate, 1ml size of inoculum, at 30°C after 72h of solid state fermentation by using acetate buffer of pH 5.0. The production of glucoamylase was increased while using fructose as additional carbon source and soybean meal as additional nitrogen source. Enzyme units produced under laboratory conditions indicated the *Penicillium chrysogenum* can be utilized as alternative hyper-producer source of commercial production of glucoamylase but after doing further kinetic studies of the enzyme.

PPBB 24

COMPARATIVE STUDIES ON THE BIOSYNTHESIS OF TRIGLYCEROL ACYL HYDROLASES BY WILD & MUTANT DERIVATIVES OF *FUSARIUM* SP.**MUBASHIR NIAZ*, TEHREEMA IFTIKHAR AND SIDRA***Laboratory of Mycology & Biotechnology, Department of Botany, Govt. College University, Faisalabad***Corresponding author's email: mniaz_prof@yahoo.com*

The objective of the present work was to enhance the lipolytic potential of the *Fusarium* sp. (579) through chemical mutagenesis and optimization of culture condition for mutant in comparison to wild strain. This work was done in "Laboratory of Mycology and Biotechnology", Department of Botany, GC University, Faisalabad. For this purpose different parameters i.e., different media, size of inoculum, volume of fermentation medium, initial pH of fermentation medium, organic and inorganic nitrogen and carbon sources, metal ions, Incubation temperature and rate of fermentation was evaluated. In the present work, cells of the fungal strain was subjected to nitrous acid treatment at the dose of 0.1M for different time intervals ranging from 30-180 min. Among all mutants tested, M-49 mutant was found to be the best producer of lipases with an enzyme activity (54.83 ± 2.46^a U/mL). Among various media tested including M1-M7, M4 gave the maximum value of extracellular lipases by wild (17.86 ± 0.15^a U/mL) and mutant (35.36 ± 0.41^a U/mL). The maximum lipase activity was obtained at 35 °C after 72 h at pH 6 and by using 1.5 mL inoculum. Na^+ was showed to be the best metal ion for the lipase production. Peptone and NH_4NO_3 were the best organic and inorganic nitrogen sources @ 1% concentration respectively. Dextrose and soya bean were found to be the best carbon organic and inorganic sources @ 1% concentration.

PPBB 25

STUDIES ON THE PHYCOCHEMISTRY AND BIOLOGICAL ACTIVITY OF *SPIROGYRA RHIZOIDES* (CHLOROPHYCOTA)**M. N. KHALID¹ AND MUSTAFA SHAMEEL²**¹*Department of Botany, G.C. University Faisalabad, Pakistan*²*Department of Botany, University of Karachi, Karachi-75270, Pakistan*

The unbranched filaments of a grass green macroalga, *Spirogyra rhizoides* Randhawa were collected from freshwater habitats at Nai Baran in the Sindh Province of Pakistan and extracted in methanol. The extract revealed the presence of 22 different fatty acids, including 11 saturated and 11 unsaturated acids by GLC and GC-MS. The former acids were slightly larger in proportion (52.48 %) than latter ones (47.49 %). Margaric (10.33 %), parinaric (11.34 %) and oleic (12.86 %) acids were found in highest proportion, while palmitic acid occurred in small proportion (4.84 %). Furthermore, two sterols (isodecortinol & dinosterol), one monoterpene (9-hydroxygeraniol), one sesquiterpene (isoafracinol), one triterpene (30-nor-cyclopterosperrone) and a polysaccharide (xylasmacin) were also obtained from the extract by (EI, FAB, FD & HR)-MS and (¹H & ¹³C)-NMR spectroscopic techniques. The extract showed strong antimicrobial activity against 14 bacterial and 20 fungal species, including 7 human-, 5 plant- pathogens and 8 saprophytes.

PPBB 26

OPTIMIZATION OF QUANTITATIVE REAL-TIME PCR ANALYSIS FOR RELIABLE DETECTION AND QUANTIFICATION OF *FUSARIUM OXYSPORUM* IN WHEAT**M. FAROOQ HUSSAIN MUNIS, ASGHARI BANO, HASSAN JAVED CHAUDHARY, MUHAMMADI***Department of Plant Sciences, Quaid-i-Azam University, Islamabad*

Early detection of *Fusarium oxysporum* in wheat is very important for its effective control. Use of quantitative real-time PCR is a modern technique to detect and quantify fungal intensity. In this experiment, this technique has been used to see susceptibility of four wheat cultivars (CS-12, FD-05, TJ-9, and ZY-19) to *Fusarium oxysporum*. Typical *Fusarium oxysporum* symptoms like slight vein clearing, epinasty and wilting of leaves developed 8 days post infection (dpi) and became severe 15 dpi. Apparently, these symptoms were more prominent in FD-05 and TJ-9, as compared to other two varieties. Quantification of *Fusarium oxysporum* DNA in wheat seedlings on 8 and 15 dpi revealed the highest amount of DNA in FD-05 and relatively higher amount of DNA in TJ-9 and CS-12 while the lowest DNA concentration was found in ZY-19. The amount of fungal DNA in FD-05 remained constant on 8 and 15 dpi while it increased in all other lines. In addition, real-time PCR was used as *Fusarium oxysporum* detection method in wheat field plants, irrigation water and soil and the fungus was successfully detected in these field samples before the appearance of typical symptoms. These results provided us an easy and comprehensive approach for reliable detection of *Fusarium oxysporum* at early infection stages.

PPBB 27

EARLY STEPS OF LEAD-INDUCED OXIDATIVE STRESS TO *VICIA FABA* ROOTS: ROLE OF LEAD SPECIATION

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Metal speciation play important role in determining the potential toxicity associated with metals in risk assessment studies. In this study, lead-induced oxidative stress to *Vicia faba* seedlings was assessed against lead speciation and uptake. Young *Vicia faba* seedlings were exposed for 1, 4, 8, 12 and 24 h to 5 μ M of lead nitrate alone or chelated at two levels by ethylenediaminetetraacetic acid (EDTA) or citric acid (CA) in controlled hydroponic conditions. Lead increased the activities of superoxide dismutases (SOD), peroxidase (POD), ascorbate peroxidase (APX), guaiacol peroxidase (GPX) and glutathione reductase (GR) while reduced that of catalase (CAT) in *Vicia faba* roots. This increase/decrease in the activities of antioxidant enzymes was inhibited dose dependently by EDTA. In contrast, CA had no effect on Pb accumulation and antioxidant enzymes activities except that the activation/inhibition of antioxidant enzymes activities was delayed.

PPBB 28

INDIGENOUS MICROORGANISMS FROM THE MACRO-ENVIRONMENT CONSISTENCE SYSTEM OF BAMBOO

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Soil is a major reservoir for the microorganisms that have strong potential for the biodegradation of organic residue such as rice straw. In order to isolate these microorganisms, the pots filled with rice were placed under the bamboo shade (canopy). These rice pots were colonized by microorganisms. The pots were brought to the laboratory and then mixed with raw sugar. The mixture was put in the glass house under the controlled conditions for a specific time period. This mixture was then applied to the rice straw to observe composting. Microorganisms capable of composting were isolated and purified by growing on different culture media. Purified colonies were then proliferated in broth. Field and laboratory experiments were conducted to study the process of composting by the indigenous microorganisms. The objective of the above mentioned research work is to isolate and enumerate the types of microbial community structure in such macro environment by applying different methods.

PPBB 29

ANDROGENESIS THROUGH ISOLATED MICROSPORE CULTURE FOR THE PRODUCTION OF HAPLOID PLANTS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Isolated microspore culture provides excellent system to study molecular mechanism of plant cells towards embryogenic pathway, and production of plants from microspores or immature pollen exists naturally in many plant species. Some genotypes in hexaploid wheat exhibit the trait for androgenesis. Three wheat varieties (C-591, King Bird and Super B) were grown in Cornell mixture at Lethbridge Research Centre of Agriculture & Agri-Food Canada at photoperiod adjusted for 16 hours with full lights (250 μ M/min) at 18°C and eight hours dark at 14°C. After seven weeks eight tillers per variety were harvested and store at 4°C for three week with their bases in distilled water and head wrapped in aluminum foil to expose them to a certain stress. Isolation and purification of microspores involved multiple steps and at last cultured microspore into 15 mm Petri plates containing 3.3 ml of NPB-99 + 10 % ficoll and four ovaries as nurse tissue. Three micro liter Cefotaxime was added and finally microspore concentration was 1x10⁶ cells per ml with total 12 petri dishes obtained for each variety were incubated in the dark at 28°C for 21 to 35 days. Embryos larger

than 0.5 mm were removed from the petri dishes and plated on to GEM medium (20 ml in 10 cm petri dishes). The petri dishes were sealed with parafilm and placed 30 cm under Sylvania Gro-lux wide spectrum bulbs 40 watts delivering 80 $\mu\text{M m}^{-3} \text{ s}^{-1}$ (16-h light period) with a room temperature at 16°C. When the embryos turned green, they were aseptically transferred onto 50 ml rooting media in Magenta Vessels in the same conditions. Once the plants reached to 2-3 leaf stage and had sufficient root growth, the plants were transplanted into 4 x 8 Spencer-Lemaire root trainers (Spencer-Lemaire Industries, Edmonton) and placed into a growth cabinet with the same conditions as the mother plants. Varying degree of variance was observed for green embryos, plantlets and regenerated plants for all the three varieties, i.e., Super B being the higher, king bird medium and C-591 was poor production of haploid/double haploid plants. It was concluded that androgenesis can be controlled by various factors that was highly dependent on genotype, the physiological condition of the donor plant, stage of the microspores, type of stress pre-treatment.

PPBB 30

BIOINFORMATICS AND ITS APPLICATION IN AGRICULTURE AND PLANT SYSTEMATICS

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Human kind is on the brink of another revolution. There is no doubt that the mapping of the human genome, completed in June 2000, is one of the greatest scientific advancements in history. This breakthrough in biological research was made possible by advancements in using Bioinformatics (BI) and Computational Biology (CB). Comparative genetics analysis of the plants by application of BI has shown that the organization of their genes has remained more conserved over evolutionary time than was previously believed. These findings suggest that information obtained from the model crop systems can be used to suggest improvements to other food crops. At present the complete genomes of *Arabidopsis thaliana* and *Oryza sativa* are available. Genes from *Bacillus thuringiensis* that can control a number of serious pests have been successfully transferred to cotton, maize and potatoes. This new ability of the plants to resist insect attack means that the amount of insecticides being used can be reduced and hence the nutritional quality of the crops is increased. Scientists have recently succeeded in transferring genes into rice to increase levels of Vitamin A, iron and other micronutrients. This work could have a profound impact in reducing occurrences of blindness and anemia caused by deficiencies in Vitamin A and iron, respectively. The maturing time span and shelf life of tomato has been enhanced due to insertion a gene from yeast into the tomato. Progress has been made in developing cereal varieties that have a greater tolerance for soil alkalinity, free aluminum and iron toxicities. These varieties will allow agriculture to succeed in poorer soil areas, thus adding more land to the global production base. Research is also in progress to produce crop varieties capable of tolerating reduced water conditions. All these experiments are benevolent of BI being experimented *in silico* then confirmed *in vitro* and practised *in vivo*, respectively. Phylogeny is the origin and evolution of organisms. Amino acid sequences and characteristics of proteins are also used in plant systematics to solve taxonomic plethoras.

PPBB 31

MINERAL PROFILE ANALYSIS OF INDIGENOUS FEEDSTUFF FOR DAIRY ANIMALS

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Livestock is an integral part of agriculture in Pakistan accounting for ~ 37% of agriculture GDP and ~ 11.4% of total GDP. Pakistan ranks 7th amongst the milk producing countries. Buffalos happen to be the dominant animal in large dairy animals. To maintain and improve the current status of dairy livestock, a good health status of dairy animals is a prerequisite. For this purpose a proper feeding system needs to be established. The primary feeding system which is currently in practices is a total mixed ration system with considerable use of pasture system which lacks balance with regard to essential nutrients. While some information regarding use and maintenance of protein, carbohydrates and fat in buffalo diet has been required but information regarding mineral nutrition is grossly insufficient. This study was therefore conducted to determine the mineral status of feedstuffs which are locally and currently consumed by dairy animals. Four different types of feedstuffs were considered during the study which were green fodders (maize, millet and sorghum-21), grains and grain by-products (27), oil seed by-products (18), and dry roughages (9). Soil samples were also collected from the areas from where fodder samples were taken. Green fodder samples were collected from seven (7) different places of arid and irrigated zones of Rawalpindi and Islamabad tehsils. While feed ingredients were collected from Rawalpindi and Islamabad markets. The mineral analysis of above mentioned samples was done through Perkin

Ekmer atomic absorption with model number AA240FS. The data was analyzed by SPSS software. According to the results zinc was found to be high while cobalt was low among the studied micro-mineral elements of green fodders. On the other hand macro-mineral study of green fodders showed that potassium was found to be high while sodium was deficient. Zinc was also found to be high micro-mineral element in the studied grain and grain by-products whereas iron was deficient. Similarly macro-mineral elements for grain and grain by-products, potassium was high while sodium was low. In oil seed by-products, micro-mineral results showed that manganese was high while cobalt was deficient. In macro-mineral of oil seed by-products, potassium was high while sodium was deficient. Micro-mineral results of dry roughages showed high value of zinc and low value in cobalt, whereas in macro-minerals, potassium was high and sodium was low. The studied mineral profile of indigenous dairy feedstuffs might prove to be helpful in improving the diet of dairy animals and consequently their health status, which ultimately enhance the milk yield of dairy cattle.

PPBB 32

IDENTIFICATION OF MICRORNAS FROM 12 PLANT SPECIES OF FABACEAE

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MicroRNAs (miRNAs) are tiny, non-coding and regulatory RNAs approximately 21 nucleotides in length. They are reported in various plants but still needs discovery in important plant species. The 12 plant species of Fabaceae were subjected this time to identify their miRNAs. The virtual genomics approaches with combination of various bioinformatics' tools were applied to find the novel miRNAs. This research leads to the finding of 29 miRNAs belonging to 13 miRNA families; (mir 156, 159, 160, 162, 164, 166, 167, 168, 390, 393, 394, 5630 and 5658). All 29 miRNA precursors form stable minimum free energy stem loop structure as their orthologues form and the mature miRNAs reside in the stem portion of the stem loop structure. From the 29 miRNAs, nine belongs to *Arachis duranensis*, four to *Lotus japonicas*, three to each *Pisum sativum* and *Arachis hypogaea*, two to each *Arachis ipaensis* and *Phaseolus vulgaris* and one to each *Cicer arietinum*, *Phaseolus acutifolius*, *Lupinus luteus*, *Glycyrrhiza uralensis*, *Robinia pseudoacacia* and *Lathyrus odoratus*. These findings will be useful in the future to design and develop desirable traits in the 12 plant species of Fabaceae.

PPBB 33

DIVERSITY IN SEED STORAGE PROTEINS IN OAT (AVENA SATIVA L.) GERMPLASMS FROM PAKISTAN-I: VARIATION IN 12S GLOBULIN ACIDIC SUBUNITS

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The oat grains are gaining popularity for human consumption because of its dietary and health promoting benefits. The major seed storage protein of oat seed is 12S globulin which accounts for about 50% of total seed protein. 12S globulin is composed of heterogeneous acidic and basic subunits. The diversity of acidic subunits in oat germplasms was studied by Sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE). Total seed storage proteins were resolved on 12% SDS polyacrylamide gel. On the basis of banding patterns of acidic subunits, the oat germplasms could be classified into five variation groups (VG), i.e. VG-I, VG-II, VG-III, VG-IV and VG-V. The classification of 12S globulin acidic subunits into five distinct variation groups highlights the wide variation in acidic subunits among oat germplasms from Pakistan. The variation observed in acidic subunits of 12S globulin in oat germplasms could be further exploited for manipulating the nutritional quality of oat seed.

PPBB 34

IN VITRO GERMINATION AND CALLOGENESIS OF SAFFLOWER (CARTHAMUS TINCTORIUS L.)

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The present study describes the influence of plant growth regulators and culture conditions on callogenesis from different explants (leaf, root and internode) of *Carthamus tinctorius* L. commonly known as Safflower. The sterilized seeds were cultured on Murashige and Skoog (MS) basal medium for germination. Different explants (leaf, internode and root) obtained from *in vitro* grown seedlings were cultured on MS medium supplemented with different growth regulators (2, 4-D, TIBA, NAA, BAP, IBA) either alone or in different combinations. Moreover, effect of light and dark conditions has also been studied on callogenesis. The best callogenic response (100%) was obtained in MS medium supplemented with 10.7 μ M NAA and 2.22 μ M BAP from leaf explants and MS medium containing 10.7 μ M NAA and 2.22 μ M BAP exhibited maximum callus induction (97%) from internodal explants under light condition. While MS medium supplemented with 6.0 μ M TIBA proved to be the best for callus induction (95%) and proliferation from root explants under dark condition. For leaf and internodal explants calli were best proliferated under light condition but for root explants, dark condition had more impact on callus induction as compared to light condition.

PPBB 35

SOMATIC EMBRYOGENESIS PROTOCOL FOR MONO-EMBRYONIC MANGO (*MANGIFERA INDICA* L.) VARIETIES

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Direct somatic embryos were obtained from the nucelli of mono-embryonic mango (*Mangifera indica* L.) varieties (Langra and Chaunsa) of Pakistan. The effect of 2iP and 2,4-D with their combinations at 0.0, 0.5, 1.0, 2.0 mg l⁻¹ were investigated in order to induce the pro-embryogenic callus (PEC) from different types of explants (nucelli, zygotic embryos and full halves of immature seeds). Response of different explants was variety and fruit growth stage dependent. Nucelli explants of Langra only from 2 cm fruit size were able to induce somatic embryos. All explants were sterilized with 30% NaOCl solution for 15 minutes, but the additional treatment with 03% mercuric chloride (HgCl₂) solution for five minutes wasn't significant. Browning was decreased by treating the explants with the antioxidant solution of 100 mg l⁻¹ ascorbic acid and 150 mg l⁻¹ citric acid for five minutes. The PEC induced on the nucellar explants after two months using 2 mg l⁻¹ 2iP and 0.5 mg l⁻¹ 2,4-D and developed into pro-embryos. The matured pro-embryos were able to continue the growth and developed into small viable shoots within a couple of months when the medium involved 2 mg l⁻¹ 2iP and 0.5 mg l⁻¹ 2,4-D under the light conditions. However, further growth of pro-embryos was inhibited due to removal of 2,4-D from the medium, and early shifting to the light which may be produced precocious embryos. The obtained medium for somatic embryo induction and maturation composed of the basal medium of B5 macro-nutrients and MS micro-nutrients full strength and 400 mg l⁻¹ L-glutamine, 60 g l⁻¹ sucrose, 2.2 g l⁻¹ agar, 1.4 g l⁻¹ gel, 200 mg l⁻¹ activated charcoal supplemented with 2 mg l⁻¹ 2iP, 0.5 mg l⁻¹ 2,4-D under dark conditions. After somatic embryos regeneration, matured embryos were shifted into the light, for multiplication, shoot enlargement and root development by addition 0.1 mg l⁻¹ 2iP and 0.5 mg l⁻¹ Kinetin to the basal medium. Zygotic embryos and full halves of immature seeds explants found to proceed their growth into green seedlings. Seedling growth of the full half explants gone beyond growth of the zygotic embryo explant.

PPBB 36

OPTIMIZATION OF MICROWAVE ASSISTED EXTRACTION FROM BRYOPHYLLUM LEAVES AND ANTIFUNGAL RESPONSE OF CRUDE EXTRACTS

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Bryophyllum is an important plant used to treat various infections, bowel diseases, healing wounds and other ailments. During the present study Microwave assisted extraction methods were standardized and compared with the traditional soxhlet extraction methods for bryophyllum. Two *Bryophyllum* species *B. Pinnatum* and *B. Degremonteanum* were tested during the present work. Various experimental conditions, Power level (300-900), time (60sec-5 min), and different solvents were investigated to optimize the extraction procedure. It was observed that solvent has a significantly greater %age yield of extracts (upto 40%) was obtained by MAE methods. Antifungal studies showed that the extracts from both bryophyllum species successfully inhibited *Aspergillus niger* and *Trichoderma viridi* Results of the present study suggest that microwave assisted extraction is a better alternative to traditional soxhlet extraction method for bryophyllum.

PPBB 37

STANDARDIZATION OF CULTURE CONDITIONS FOR VARIOUS ALGAL SPECIES AND EFFECT OF VARIOUS SOLVENTS ON THE LIPID YIELD

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Algae are now gaining attention as a possible alternative of depleting fossil fuels. Choosing the right algal species is an important step for selecting a species for biofuel production. The present work aimed to investigate, estimate and compare the potentiality and sustainability of the use of different algal species. Culture conditions (temperature, light, pH and media) were standardized for the growth of algal species collected from various localities of Lahore. It was found that oedogonium and spirogyra are more prevalent filamentous algae in the area. Soxhlet extraction method was employed using different solvent systems to evaluate the role of different solvents for maximum algal oil extraction. 25 grams of dry weight of algae was used for extraction. Highest lipid percentage was obtained with methanol and chloroform in ratio 2:1 for oedogonium (5%) while for spirogyra maximum extract percentage (4%) was recorded when methanol was used as solvent. Evaluation of algal species was carried out by estimating biomass, lipid percentages indicated that oedogonium has high lipid content as compared to spirogyra.

PPBB 38

MOLECULAR EVALUATION OF *SCLEROTIUM ROLFSII* ISOLATES FROM CHICKPEA THROUGH RAPD PRIMERS

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Collar rot caused by fungus *Sclerotium rolfsii* Sacc., is among the biotic stresses causing heavy economic losses to chickpea crop every year. Previous work on this devastating fungus reported just its morphological and physiological aspects, but little is known at molecular level. Present research was focused on estimating the genetic variation through RAPD primers within 12 strains of *S. rolfsii* isolated from infected chickpea plants to reveal the factors causing damage to chickpea. Fungal strains were obtained from Crop Sciences Institute (CSI), National Agricultural Research Centre (NARC), Islamabad. RAPD analysis was performed in Biotechnology Laboratory, Department of Plant Breeding and Genetics, Pir Mehr Ali Shah Arid Agriculture University, during the year 2009-2010. Out of 40 random decamer primers studied, 6 primers gave clear, polymorphic amplification pattern in terms of band number. Total numbers of loci traced by these primers were 52. 100 % polymorphism was obtained. The value of similarity matrix ranged from 0.558 (55.8%) to 0.885 (88.5%). Strain AM-04 and AM-06 shared maximum 88.5% similarity while AM-07 and AM-09 were 55.8% similar. Cluster composition results indicated that AM-07 was most diverse from rest of genotypes which had shown genetic distance of 35.7%. Thus it would lead to variable pattern of infection and symptoms from rest of the strains. So this information will be helpful for plant breeders in the production of resistant varieties of chickpea against identified genetic composition of fungal strains and will help to reduce economical losses to chickpea.

PPBB 39

SOLID STATE FERMENTATION OF CORN STOVER BY *A. SYDOWII* FOR THE PRODUCTION OF INDIGENOUS EXOGLUCANASE

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Cellulases are the industrially important group of enzymes. Cellulolytic microorganisms produce and secrete these enzymes externally for the degradation of cell wall. The current study was designed for the maximum production of

Exoglucanase by *Aspergillus sydowii*. The enzyme produce at optimized conditions was partially purified by ammonium sulphate precipitation and gel filtration chromatography. Purified enzyme was characterized for pH, temperature and kinetic parameters. Corn Stover in powder form was used as a lignocellulolytic substrate of *A. sydowii* for the production of exoglucanase. Maximum activity (6.24 IU/mL/min) of exoglucanase was observed after 96 hours at 55°C temperature, 60% moisture level, 4 mL inoculum size and 5.5 pH. Exoglucanase production was enhanced by the addition of 0.5% of fructose as a carbon source and 0.3% of peptone as nitrogen source in cultural media. Further, 0.4% of tween-80 as a surfactant and 0.3% of cane molasses as mediator enhances the production of exoglucanase. Addition of 40% of ammonium sulphate cause maximum purification of crude exoglucanase. Sephadex G-100 column, 20cm long was used for the further purification. Purified enzyme was than subjected to characterization analysis. The K_m and V_{max} was found to be 4.15 μ M/min and 12.23 mM respectively. It has maximum activity at 55°C temperature and 5.2 pH using cellobiose as a substrate. Metal ions like Ca^{2+} , Mg^{2+} and Zn^{2+} has positive effect on exoglucanase activity.

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MORPHOGENIC INFLUENCE OF EXPLANTS TO TDZ AND OTHER PHYTOHARMONES ON THE ORGANOGENESIS OF *DAHLIA VARIABILIS* “RED SKIN”

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Conventional propagation of Dahlia through budding/grafting experiences several problems, e.g., floral non-uniformity, viral infections, and pest/disease infestations, which render their commercial production uneconomical. This study aimed at developing an efficient protocol for clonal propagation of Dahlia through somatic embryogenesis by employing different explants, and media enrichment with various concentrations of phytohormones. We tested three explants (meristem, inter-node, side-bed) of *Dahlia variabilis* cv. Red Skin for *in vitro* shoot regeneration in MS medium. Two types of growth regulators, viz., BAP and KIN, both at different concentrations (0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and 4.5 mg L⁻¹) were used alone and each in combination with various concentrations of TDZ (0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9 μ g L⁻¹) to enrich the medium. Meristem explants rendered the highest count and length of regenerated shoots, which could give successful propagation of *D. variabilis*. Addition of BAP at 3.0 mg L⁻¹ alone as well as along with 0.6 μ g L⁻¹ TDZ caused better somatic embryogenesis than with KIN alone or combined with TDZ at any concentration. In the next step, we compared two auxins, viz., IBA and NAA each at 0.5 and 1.0 mg L⁻¹ for *in vitro* root initiation from different explants. The highest rooting response (88%) was also from meristem on MS medium supplemented with 0.5 mg L⁻¹ IBA. This study concludes that the best protocol in clonal propagation of Dahlia is: use of meristem as explants growth on MS medium enriched with 3.0 mg L⁻¹ BAP and 0.6 μ g L⁻¹ TDZ for shoot induction, and further growth of these meristem generated shoots on MS medium with 0.5 mg L⁻¹ IBA for initiating the roots.

PPBB 41

A MODERATELY BORON-TOLERANT CANDIDATUS NOVEL SOIL BACTERIUM *LYSINIBACILLUS PAKISTANENSIS* SP.NOV.CAD., ISOLATED FROM SOYBEAN RHIZOSPHERE (*GLYCINE MAX* L.)

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A Gram-positive, motile, rod-shaped, endospore-forming and moderately boron (B) tolerant novel candidatus strain, designated as NCCP-54^T, was isolated from rhizospheric soil of soybean (*Glycine max* L.) sampled from the experimental area of Research Farm, PMAS Arid Agriculture University, Rawalpindi, Pakistan. To delineate its taxonomic position, the strain was subject to polyphasic characterization. Cells of the strain NCCP-54^T can grow at 10-45°C (optimum at 28°C) at pH ranges of 6.5-9.0 (optimum at pH 7.0) and in 0-6% NaCl (w/v) in tryptic soya agar medium. It can also tolerate 150 mM boric acid in agar medium, however, optimum growth occurs in the absence of boric acid. Based on 16S rRNA gene sequence analysis, strain NCCP-54^T showed highest similarity to *Lysinibacillus xylanilyticus* KCTC13423^T (99.1%), *Lysinibacillus*

*fusiformis*KCTC3454^T (98.5%), *Lysinibacillus boronitolerans* KCTC13709^T (98.4%), *Lysinibacillus parviboronicapiens* KCTC13154^T (97.8%), and *Lysinibacillus sphaericus*KCTC3346^T (97.5%) and less than 97% with other closely related taxa. The level of DNA–DNA relatedness between strain NCCP-54^T and the type strains of genus *Lysinibacillus* was <27 %. Strain was also studied chemotaxonomically. Whole-cell peptidoglycan of strain NCCP-54^T contained meso-diaminopimelic acid (meso-Dpm) as major diagnostic amino acids instead of lysine-aspartate (Lys-Asp) which is the characteristic of the genus *Lysinibacillus*. The major polar lipids were diphosphatidylglycerol, phosphatidylglycerol and phosphatidylethanolamine. MK-7 was the predominant menaquinone. The major cellular fatty acids were iso-C_{15:0} (30.29%) followed by iso-C_{16:0} (25.59%) and C_{16:1}ω7 alcohol (16.24%). The G + C contents of the strain is 37 mol%. The chemotaxonomic characteristics of the candidate novel strain matched those described for the members of genus *Lysinibacillus* except diagnostic amino acids contained in peptidoglycans. Phenotypic and phylogenetic analyses thus indicate that strain NCCP-54^T may represent a novel candidate status of species in the genus *Lysinibacillus*, for which the name *Lysinibacillus pakistanensis* is proposed. The type strain is NCCP-54^T (DSMZ 24784^T = KCTC= 13795^T). The DDBJ/EMBL/GenBank accession number of the 16S rRNA gene sequence of strain NCCP-54^T (DSMZ 24784^T = KCTC= 13795^T) is AB558495

PPBB 42

STRAIN IMPROVEMENT AND OPTIMIZATION OF MEDIA FOR THE PRODUCTION OF ALPHA AMYLASE BY *ASPERGILLUS ORYZAE*

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The present study deals with the improvement of strain using alternative treatment of physical and chemical mutagens. UV rays and ethidium bromide were used as mutagens in wild type locally isolated strain of *Aspergillus oryzae* for enhance production of alpha amylase. After mutagenesis and selection mutant strain of *Aspergillus oryzae* EtB12 showed 1.1 fold increase in enzyme activity compared to parental strain. Different fermentation media were tested for the production of alpha amylase. *Aspergillus oryzae* EtB 12 showed maximum production in M1 medium containing g/l Starch 10, yeast extract 3.0, MgSO₄.7H₂O, 0.005, CaCl₂.2H₂O 0.2, FeSO₄ 1, Peptone 20.

PPBB 43

POTENTIAL OF AZADIRACTIN-D FRACTION AGAINST *XANTHOMONAS ORYZAE* PV. *ORYZAE* CAUSE BACTERIAL LEAF BLIGHT DISEASE IN RICE

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In the present study 24 plants organic extracts (Chloroform) were tested through anti-bacterial susceptibility test against *Xanthomonas oryzae* bacterium causing Bacterial Leaf Blight disease in rice. *Azadirachta indica* extract showed high efficacy against Xoo bacterium forming larger inhibition zone (18.5 mm) with activity index (0.64). Further extract of *Azadirachta indica* fractionated, most active fraction were tested using bioautography agar overlay method against test bacterium, isolate, purify and characterized the most promising fraction and it's supposed to be 1-Tigloyl-3-acetyl-1, 1-hydroxymeliacarpin (Azadirachtin D).

PPBB 44

EFFECT OF DIFFERENT GROWTH REGULATORS AND MEDIA ON CALLUS INDUCTION IN AMLA (*EMBLICA OFFICINALIS*)

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In present investigation, the effects of different media (Murashige and Skoog medium, Woody Plant Medium) and different plant growth regulators on callus induction under light and dark conditions were determined. Nodal and

internodal explants approximately 1.0 cm in length were cultured on WPM and MS medium containing different plant hormones. MS basal medium supplemented with 2.0mg/l 2,4-D and 0.5mg/l BAP under dark condition and 0.5mg/l 2,4-D under light condition proved best media for the callus induction from nodal explants. For internodal explants best results of callus induction were obtained from MS medium containing 1.5mg/l 2,4-D under both light and under dark conditions. WPM containing 3.0mg/l 2,4-D was best for callus induction from nodal explants under light condition. Similarly, WPM containing 2.0mg/l 2,4-D was best medium for induction of callus from internodal explants under light condition and no callus induction was observed under dark condition. Calli color under dark condition was white and off-white while under light condition it was green in color.

PPBB 45

DETECTION OF MOLECULAR MARKERS BY COMPARATIVE SEQUENCE ANALYSIS OF ENZYMES FROM *MYCOBACTERIA* SPECIES

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Mycobacterial species are one of the most ancient and perilous pathogens of *Homo sapiens*. Among these *mycobacterial* pathogens, non-tuberculous mycobacteria (NTM) and mycobacterial tuberculosis complex (MTC) is the causative agent of a relatively milder form of Tuberculosis, which leads to the misidentification of strains due to absence of characteristic phenotypic patterns. Traditional methods for identification of these groups of pathogens are time consuming, lack specificity and sensitivity. Therefore, more rapid, responsive and cost-effective methods are required for the accurate identification of *mycobacterial* pathogens at their precise species level in routine diagnostics. In our study, we tried to identify certain markers in order to differentiate closely related cousin species of *Mycobacterium* genus including *M. bovis*, *M. avium*, *M. leprae* and *M. tuberculosis*. The nucleotide sequences of selected unique markers, including enzymes (used previously in various biochemical tests for the identification of *Mycobacterium* species), ORFs linked with these enzymes and functional proteins of their biosynthetic pathways were compared *in-silico*. Result analysis was used to make the hypothetical inference that the variations like SNPs in genomic sequences can be directly used for *Mycobacterial* species discrimination. Along with this, a database of these unique markers (enzymes and their linked ORFs) was developed to save the information of exclusive markers of individual *Mycobacterial* species at genome level. We believe that the *in-silico* identification and storage of these distinctive characteristics of individual *Mycobacterial* species will help in more precise recognition of pathogenic strains and hence species targeted therapy.

PPBB 46

BIOCONTROL OF *EUPHORBIA HELIOSCOPIA* USING FUNGAL PATHOGENS

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A pot experiment was conducted to determine the efficacy of different fungal pathogens (*Alternaria tenuissima*, *Alternaria alternata* and *Fusarium oxysporum*) to control *Euphorbia helioscopia* in crops. For this purpose transplantation of *E. helioscopia* was done in March 2010. The experiment was designed with three treatments having five replicates in each. Plantlets were inoculated with different concentrations (1×10^3 , 1×10^5 , 1×10^7 spores/ml.) of spore suspension of selected fungi. Maximum disease development was recorded in case of inoculation with water suspension of *Alternaria tenuissima* parameters studied for disease development were no. of infected leaves/plant and no. of spots on each leaf. No disease development was observed in control.

PPBB 47

MICROPROPAGATION AND SHOOT PROLIFERATION OF PYGMY GROUNDCHERRY (*PHYSALIS MINIMA* L.): A THREATENED MEDICINAL HERB

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In the present study, micropropagation and *in vitro* shoot proliferation of *Physalis minima* has been reported. Shoot tips and nodal explants (10-20 mm length) from field grown plants were cultured on Murashige and Skoog (MS) medium

supplemented with 0.1, 0.5, 1.0, 2.0, 3.0, 4.0 or 8.0 μM of N^6 -benzyladenine (BA), Kinetin (Kin) alone or in combination with Indole-3-butyric acid (IBA: 0.5, 1.0 or 2.0 μM). Maximum shoot induction (90 %) with 5 shoots was obtained at 5.0 μM Kin in combination with 1.0 μM IBA after 10 days from nodal explant. Nodal explants from these developing shoots were further used for multiple shoot formation. About 15 shoots per culture were obtained on MS medium supplemented with 2.0 μM BA after 15 days. Initially these shoots were quite vigorous and after 30 days glassy appearance was observed. To overcome this abnormality, shoot tips of these shoots were cultured on MS basal liquid medium in glass jars and maintained under the same culture conditions. Interestingly, 40 shoots with 90 mm length were obtained from the cultured shoot tips after 20 days and these cultures were further maintained for more than 90 days with no vitrification or necrosis. Shoot tips (20 mm long) from these long term maintained shoots were cultured on $\frac{1}{2}$ strength MS medium supplemented with different concentrations of either IBA or in combination with different concentrations of α -naphthalene acetic acid (NAA; 0.1, 0.2, 0.5, 1.0 or 2.0 μM). Highest rooting (100 %) with more than 50 roots of 15 mm length were obtained with 1.0 μM IBA after 15 days of culture. Rooted shoots were shifted to *ex vitro* condition in plastic pots filled with peat moss and sand (1:1) and watered with $\frac{1}{4}$ strength MS salts in greenhouse with 90 % survival after 4 weeks. Our study demonstrated that *P. minima* can easily be multiplied *in vitro* with BA and conserved in MS basal liquid medium for longer period of time.

PPBB 48

THE EFFECT OF HIGH CONCENTRATIONS OF METHYL PARATHION AT VARIOUS TEMPERATURES AND PH VALUES ON GROWTH OF PSEUDOMONAS IES-PS-1

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A lab scale study was conducted to investigate the effect of high concentrations of commercial grade methyl parathion (50 EC) on growth of indigenous soil culture in the presence of nutrient broth as growth medium under different environmental conditions such as pH and temperature. The high concentrations of pesticide were studied to investigate the potential of indigenous soil culture in bioremediation of pesticide contaminated sites. A pure culture, *Pseudomonas* IES-Ps-1, was isolated earlier in the lab and was reported to effectively degrade malathion, methamidophos, cartap and cypermethrin. Therefore, same culture was isolated again from the soil, and chemically characterized and morphologically identified. Bacterial growth was investigated in nutrient broth medium after addition of high concentrations of methyl parathion such as 0, 200, 400, 600, 800, 1000 and 1200 mg l^{-1} to determine tolerance limit of IES-Ps-1. No growth was observed at 1000 and 1200 mg l^{-1} of pesticide after 96 hrs of incubation compared to other concentrations of 200, 400, 600 and 800 mg l^{-1} . The growth was measured by taking optical density (OD) at 600 nm. The detailed pH (6, 7, and 9) and temperature (25, 30, 35 $^{\circ}\text{C}$) studies were conducted using higher methyl parathion concentrations of 400 and 800 mg l^{-1} . The maximum growth for both 400 and 800 mg l^{-1} of pesticide was observed at pH of 7 and temperature of 30 $^{\circ}\text{C}$. The maximum COD and TOC removal for 400 mg l^{-1} of pesticide were 50 and 52 per cent respectively, compared 46 and 49 per cent for 800 mg l^{-1} .

PPBB 49

EFFECT OF DIFFERENT PRETREATMENTS ON BREAKING SEED DORMANCY AND *IN VITRO* GERMINATION IN *JATROPHA CURCAS* L.

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Development of rapid and efficient propagation methods for *Jatropha curcas* are highly desirable since its seed's oil can be used as biofuel and hence of high economic value around the world. Dormancy, decreased viability with age, and low germination rate are amongst the common problems associated with its conventional propagation through seeds. *In vitro* germination of seeds, specifically during the dormant periods by using some pretreatments in the present research work were therefore focused to help resolve some of these limiting issues. Pretreatments included presoaking of seeds in water overnight, scarification, stratification and removal of seed coats. It was observed that the orientation of the seeds on the culture media also had an effect on its germination rate. Disinfection of naked seeds could not support subsequent germination so the seeds were disinfected before removing the seed coats. It was observed that the removal of seed coats only could break the dormancy of seeds to get 100% *in vitro* germination on full strength MS medium kept in the dark at $25 \pm 2^{\circ}\text{C}$ in the months of December to January. Such seedlings were shifted in light conditions (16h photoperiod) after

the root emergence at the same temperature to support chlorophyll development. Seedlings were successfully acclimatized by shifting to a mixture of peat, clay and silt (1:1:1 v/v) in greenhouse. Several factors governing dormancy, its control in this plant species are hence detailed and discussed in this manuscript. It is expected that the reported method of propagation would help to develop suitable tissues for germplasm preservation, large scale rapid plant propagation and may find its application in crop improvement and hence profitability in a broader sense.

PPBB 50

INTERCOMPARISON OF RHIZOSPHERIC MICROBIAL FLORA OF WILD AND MODIFIED VARIETIES OF SOME ECONOMICALLY IMPORTANT CEREAL CROPS

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The use of genetically modified plants is of great concern in the present scenario. Genetically modified plants (GMPs) offer many benefits, their engineering and cultivation has also fuelled considerable debate regarding possible undesirable environmental effects. There are concerns that the commercial cultivation of GM crops could result in adverse effects on the environment. The present study was designed to explore the effect of GM crops on soil microflora as compared to wild plant varieties. For this purpose a field experiment was designed in which wild and hybrid varieties were grown under natural conditions in completely randomized fashion. At maturation vegetative growth analysis of hybrid and wild varieties was carried out which showed non-significant difference in both varieties of the wheat but a pronounced difference was noticed in case of maize in which growth of hybrid variety was enhanced regarding all parameters. The plant roots were processed for mycorrhizal colonization that displayed the same results as revealed above. The rhizospheric soil was examined for the presence of soil microflora (fungi, bacteria and mycorrhizal spores). The results obtained from this study showed that no remarkable difference was present in the microbial flora of both the varieties.

PPBB 51

PHYTOCHEMICAL CHARACTERIZATION OF TEA GENOTYPES BASED ON THEIR MAIN QUALITY COMPONENTS

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Tea is the most popular non-alcoholic caffeine containing beverage obtained as an infusion of the leaves of *Camellia sinensis* (the tea shrub). Tea has recently been introduced in Pakistan as a crop and needs improved genotypes suitable to the local agro climatic conditions for fulfilling the local need. Keeping in view the dire need of understanding the genetic potential of tea genotypes this project was undertaken for characterizing all the tea cultivars currently grown in Pakistan. The cultivars were analyzed using phytochemical investigations. Thirteen tea genotypes comprising; 6 Promising lines, 4 Chinese varieties, 2 unidentified land races and a single Advance line grown at two locations in District Mansehra, were used. Phytochemical analysis of total polyphenols, amino acids, caffeine contents and water extracted substances from fresh tea leaves of the genotypes showed significant differences among genotypes having CV-percentage values of 18.13, 14.96, 11.0 and 5.0 respectively. Cluster analysis based on Euclidean Distance Coefficient, revealed four groups and separated the broad leaved genotypes from others. Similar results were observed using Principle Co-ordinate Analysis (PCoA). The plot of the first two components based on all characters showed a clear separation of broad leaved genotypes (*C. assamica*), namely IN-01-07 and SL-01-05 genotypes from the narrow leaved (*C. sinensis*) genotypes. Results obtained from phytochemical data clearly differentiated all the tea genotypes into two discrete groups viz. broad and narrow leaved genotypes.

PPBB 52

INCREASE IN RICE (*ORYZA SATIVA* L.) SEED VIGOR AND SUBSEQUENT GROWTH THROUGH POTASSIUM HUMATE APPLICATION

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An experiment was conducted in Institute of Plant Pathology, University of the Punjab, Lahore, during June 2009 to October 2009, to assess the effect of different concentrations of Potassium humate (0, 250, 500, 750 and 1000 mg per Kg) on Basmati Rice (*Oryza sativa* L.) in lab and field conditions. In this regard different vegetative (plant height; root, shoot length; fresh and dry biomass of root and shoot) and reproductive growth (number of tillers, flowers, grains, weight of 100 grains) parameters were recorded. The data interpreted exhibited that higher vegetative growth and yield production was carried out in rice at 500 mg/Kg concentration.

PPBB 53

DISEASE CONSTRAINTS OF HYDROPONICALLY GROWN GINGER (*ZINGIBER OFFICINALE* ROSC.)

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Hydroponics provides instruments for protection of the plants in the greenhouse since many exogenous factors can be easier controlled in soilless cultivation than growing in the soil. The present study was designed to identify the disease constraints of ginger in hydroponics in the Institute of Plant Pathology, University of The Punjab, Lahore. The ginger was grown in hydroponic medium and rhizome pathogens were isolated and identified. Growth of ginger was also analyzed in soil and soilless medium that was relatively better in soilless medium. In hydroponics the common disease observed was soft rot caused by both bacterial (*Pseudomonas* sp.) and fungal species (*Fusarium* sp.).

PPBB 54

ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL OF *AJUGA BRACTEOSA* L., AND *OTOSTEGIA LIMBATA* L., AGAINST PATHOGENIC MICROORGANISMS

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Ajuga bracteosa L., and *Otostegia limbata* L., are two plant species of family Lamiaceae. The crude methanol leaves extracts of these two medicinal plants were examined for their antibacterial, antifungal and antioxidant (radical scavenging) activity using 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical against clinically important species of bacteria and fungi were examined. Leaves extracts of these two plants were screened against six strains of bacteria (two were gram positive i.e. *Bacillus subtilis* and *Staphylococcus aureus* and four were gram negative i.e. *Vibrio cholerae*, *Enterobacter aerogenes*, *Escherichiacoli* and *Klebsiella pneumonia*) and two strains of fungi (*Aspergillus niger* and *Aspergillus fumigatus*). Eight concentrations (15 mg/ml, 12.5 mg/ml, 10 mg/ml, 7.5 mg/ml, 5 mg/ml, 3 mg/ml, 2 mg/ml and 1 mg/ml) were used to check the antimicrobial activity of plant extracts. Maximum inhibitory zone 30 mm was observed in *Otostegia limbata* and 25 mm in *Ajuga bracteosa* at 15 mg/ml mm for antibacterial activity. *Ajuga bracteosa* and *Otostegia limbata* gave response against both *Aspergillus niger* and *Aspergillus fumigatus*. This study establishes the effective ethnomedicinal use of these plants in the treatment of various infectious diseases. There is high potential for the exploitation of the plants for development of novel antimicrobial agents.

PPBB 55

QUANTITATIVE ANALYSIS OF WHEAT PROTEINS IN DIFFERENT VARIETIES GROWN IN SINDH, PAKISTAN

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Fourteen wheat varieties (Kiran-95, Amber, Sindh-90, Sarsabz, Khirman, Jauher-18, Mehran-89, Anmol-91, TJ-83, GP-256, GP-205, Marvi, and Soghat) collected from Nuclear Institute of Agriculture (NIA) and one unknown from local market, were analyzed for quantitative determination of proteins in term of suitability of wheat variety for baking purpose and nutritional point of view. The crude protein in all varieties was found in the range 8-15%. ANOVA analysis of results revealed the significant variation ($P < 0.05$) in crude proteins among the selected varieties of wheat with

coefficient of variability 0.065-0.713. The highest concentration of total protein found in variety Anmol (15.42 \pm 0.03) while the lowest concentration was detected in Local wheat variety (8.28 \pm 0.06). The all wheat varieties soluble and insoluble fraction were quantified; the range of albumin was found as 17.0-22.4%, whereas the globulin content was in the range of 5.0-7.82%. The values of glutenin were 43.0-50.43%, while gliadin comprised 21.63-27.80% of total protein. The ratio of gliadin/glutenin varied from 1.6-2.2, indicating good quality of wheat varieties for baking purposes and have good nutrition status. The variety Anmol ranked high and can be used for breeding purpose to enhance nutritional status of consumers.

PPBB 56

PRELIMINARY PHYTOCHEMICAL SCREENING AND ANTIOXIDANT POTENTIAL OF *CYMOPOGON JWARANCUSA* (JONES) SCHULT.

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The present study was aimed to screen preliminary bioactive chemicals and antioxidant potential of *Cymbopogon jwarancusa* (Jones) Schult. For this purpose, various solvent base plant extracts such as methanol, ethanol, chloroform and distilled water were screened for secondary metabolites. The methanolic and ethanolic extracts exhibited large group of chemicals such as alkaloids, tannins, flavonoids, phenol, saponins, terpenoids, and cardiac glycoside. The chloroform expressed alkaloids, tannins, flavonoids, terpenoids were present, while water extracts contained alkaloids, cardiac glycoside, saponin and terpenoids. All tested solvents failed to express cholesterol, phlobatanins and resin. The reducing power of the stem and root extracts were also evaluated and highest reducing power (1.192 and 1.137 respectively) was recorded at 100 μ g/ml. This study validates the traditional uses of this plant and could be exploited pharmaceutically for synthesis of potent drugs.

PPBB 57

A SIMPLE GENOTYPE-INDEPENDENT PROTOCOL FOR DIRECT REGENERATION AND TRANSFORMATION IN INDIAN MUSTARD

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A well developed regeneration system is prerequisite for genetic transformation in plants. Regeneration systems reported for many crops species, including Indian mustard, are genotype/variety specific, limiting transformation directly in high yielding commercial cultivars. Here we report development of a genotype-independent reproducible protocol for regeneration and Agrobacterium mediated transformation in Indian mustard (*Brassica juncea* L.). A total of 30 mustard cultivars/germplasm lines were tested against different growth hormones combinations, levels of optical densities and inoculation time. Maximum regeneration was recorded on MS medium containing 2mg/L 6-benzylaminopurine (BAP) and 0.2mg/L α -naphthaleneacetic acid (NAA). Cultivar KS-74 and RBJ-2K024 emerged as the most regeneration responsive genotypes. Transformation efficiency was tested in these two most regeneration responsive genotypes through *Agrobacterium tumefaciens* strain LBA4404 harbouring a binary vector pBI-121 with a selectable marker neomycin phosphotransferase-II gene (*NPT-II*) and a reporter β -glucuronidase gene. Confirmation of stable integration of transgene was conducted through PCR for *NPT-II* gene, and subsequent GUS assay on the PCR confirmed transgenic plants. High transformation efficiency up to 60% was recorded in regenerated plants where 4 days old cotyledonary petioles were isolated and only the cut end of the petiole was briefly immersed into the culture having 0.8 O.D₆₅₀. Development of this genotype independent protocol will facilitate transformation of target gene(s) directly into desirable genetic background in *Brassica Juncea*.

PPBB 58

ETHNO MEDICINAL AND PHARMACOLOGICAL INVESTIGATION OF *ARAUCARIA COLUMNARIS* HOOK. AND *CYCAS REVOLUTA* THUNB.

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Pharmacological studies of plant for the exploration of biological activities play important part in science of traditional medicine. In present investigation, organic extracts (methanol, ethanol and ethyl acetate) from leaves of *Araucaria columnaris* Hook. and *Cycas revoluta* Thunb. were subjected to the potential antibacterial, antifungal and antioxidant activities. The extracts were evaluated for their effectiveness against six bacterial strains including both Gram-positive and Gram-negative bacteria using agar well diffusion method. *In vitro* antifungal activity of organic extracts were analyzed against three pathogenic fungal strains viz. *Fusarium moniliforme*, *Helminthosporium sativum* and *Aspergillus niger* by agar tube dilution method. The antioxidant potential of extracts was determined on the basis of their scavenging activity of the stable 1, 1-diphenyl-2-picryl hydrazyl (DPPH) free radical. It was evident that these extracts from both plants were active against the bacteria under observation at low concentrations. However maximum zone of inhibition (40.33 ± 0.66 mm) was produced by methanolic extract from *Cycas revoluta*. Significant inhibition (90%) was observed against *Aspergillus niger* in case of methanolic extract from *Araucaria columnaris*. IC_{50} of the methanol extract of *Cycas revoluta* was $110.25 \mu\text{g/ml}$, which indicated the strong antioxidant activity of the plant. The results obtained from preliminary analysis suggest the presence of active secondary metabolites and it is recommended that further intensive studies should be carried out to explore hidden potential.

PPBB 59

EFFECTS OF OSMOTIC AND IONIC STRESSES ON REGENERATION CAPACITY OF RICE (*ORYZA SATIVA* L.) CALLI

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This research work was undertaken to assess the adverse effects of ionic, osmotic and ionic plus osmotic stresses on regeneration capability of calli of *Oryza sativa* L. cultivar Swat-1. Calli were induced from seeds explants on MS medium with 2 mg l^{-1} 2, 4-D and 0.25 mg l^{-1} kinetin, while the regeneration medium contained MS salts plus 1 mg l^{-1} IAA and BAP each with 30 g l^{-1} sorbitol. Two months old calli were cultured on regeneration medium with various concentrations of ionic (0, 10, 15 mM LiCl), osmotic (0, 100, 200 mM mannitol) and ionic plus osmotic stresses (0, 50 and 100 mM NaCl). The regeneration percentage of controlled (unstressed) calli was about 75 percent. Ionic stress of LiCl (10 mM) showed no adverse effects on regeneration percentage, however, the percentage reduced by 50 percent when LiCl concentration was raised to 15 mM. While regeneration capacity declined by 75 percent at both levels of NaCl stress. On the other hand no regeneration was observed at osmotic stress of 200 mM mannitol and 25 percent regeneration was recorded at 100 mM mannitol stress. It was observed that under control, NaCl and mannitol stress conditions proper plantlets were collected during 2nd and 3rd subcultures on regeneration medium, while under LiCl stress maximum plantlets were collected during 1st and 2nd cultures. This reveals that the influence of osmotic stress on regeneration frequency is more negative than only ionic stress, in addition moderate LiCl stress (10 mM) shorten the plantlet formation and recovery period.

PPBB 60

ASSESSMENT OF GENETIC RELATIONSHIPS AMONG WHEAT GENOTYPES BY RUST RESISTANT MARKERS AND BIOINFORMATICS TOOLS

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Wheat is the most important grain and a staple food for more than one third of the world population. Wheat production in the country has been well below potential. Diseases, especially rusts (Stripe/Yellow Rust, Stem Rust, and Leaf Rust) and emerging scenario of increased incidences of Powdery Mildew and aphid are major biotic stresses of wheat crop that inflict heavy losses when in epidemic form. Rust diseases of wheat are among the oldest plant diseases known to man. Three types of rust are: 1) Stem rust (also known as black stem rust) 2) Leaf rust (brown rust) 3) Stripe rust (Yellow rust). The present study was employed to investigate molecular characterization of twenty genotypes by using rust resistant markers. The aim of present study was to find out molecular genetic characterization for rust resistant genes. The accessions were subjected to Simple Sequence Repeats (SSR) to reveal genetic relatedness rust. Modified CTAB method was used for DNA extraction. Thirty molecular markers were used to identify the rust resistant genes

related to leaf rust, stripe rust or yellow rust and stem rust in 20 genotypes. All the 20 genotypes have rust resistant genes against rust. Nineteen rust resistant genes were characterized which are Yr5, Yr15, Lr1, Lr19, Lr21, Lr39, Lr47, Lr50, Lr51, Lr52, Lr20/Sr15, Lr46+Yr29, Lr19/Sr25, Lr21/Lr22, Lr2/Lr22, Lr34+Yr18, Sr32/Sr36, Sr22 and Sr2. This knowledge about rust resistant genes in wheat will be helpful for plant breeders in the evolution of new varieties. It will support their decisions on the selection of parents for crossing and to widen the genetic basis of breeding. The ultimate goal of plant breeding is to generate improved genotypes of wheat with rust resistant traits.

PPBB 61

BIOSYNTHESIS OF TRIACYLGLYCEROL ACYL HYDROLASES BY *PENICILLIUM CITRINUM* THROUGH SUBMERGED FERMENTATION TECHNIQUE

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The present study was conducted in Laboratory of Mycology and Biotechnology, Department of Botany, GC University Faisalabad. The purpose of study was the biosynthesis of triacyl glycerol acyl hydrolases by *Penicillium citrinum* through submerged fermentation. To enhance the triacyl glycerol acyl hydrolases production various parameters were optimized such as, selection of medium, effect of pH, effect of different carbon sources, effect of different nitrogen sources, effect of additional olive oil concentration, effect of size of inoculum, effect of volume of medium and effect of incubation time. Highest extracellular (33.40 ± 5.29^a U/mL) & intracellular (33.5 ± 0.360^a U/mL) lipase activity was obtained after 72 hours at pH 5. Five millilitre of inoculum size was optimized for maximum production of enzyme. In case of volume of medium 50mL volume gave maximum enzyme activity. Four mL of olive oil optimized for maximum lipase production. $(\text{NH}_4)_2\text{SO}_4$ as a nitrogen source and starch as a carbon source was selected for maximum lipase production. It is concluded from the study that the subject strain proved to be an equally good producer for the biosynthesis of extracellular and intracellular triacyl glycerol acyl hydrolases. These results indicates that the organism may be used for commercial product production.

PPBB 62

BIOSYNTHESIS OF AMYLOGLucOSIDASE BY *PENICILLIUM CITRINUM* USING SOLID SUBSTRATE FERMENTATION TECHNIQUE

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The present study was carried out to optimize the biosynthesis of amyloglucosidase by *Penicillium citrinum* through solid substrate fermentation. Amyloglucosidase is an industrially important enzyme which is used in textile, food and other industries. All the experimental work has been done in the Laboratory of Mycology & Biotechnology, Department of Botany, GC University Faisalabad. Different conditions were optimized for the production of enzyme biosynthesis including selection of an appropriate substrate, incubation time, inoculum size, incubation temperature, moistening agents, and effect of different additional carbon and nitrogen sources. Maximum production of amyloglucosidase was obtained at pH 5 i.e. 15.68 ± 2.87 U/mL/min by using phosphate buffer as moistening agent at 10% inoculum size after 72h of incubation at 30°C when media was supplemented with 1% sucrose and 1% soybean meal as carbon and nitrogen sources respectively. It can be concluded from above mentioned results, that production of amyloglucosidase can be enhanced by using wheat bran as major substrate by *Penicillium citrinum* through different physical and ecological conditions.

PPBB 63

COMPARATIVE STUDIES ON THE BIOSYNTHESIS OF TRIACYLGLYCEROL ACYLHYDROLASES BY A WILD AND MUTANT STRAIN OF *PENICILLIUM CHRYSOGENUM* THROUGH SUBMERGED FERMENTATION TECHNIQUE

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The present experiment was conducted in Laboratory of Mycology & Biotechnology, Department of Botany, Govt. College University Faisalabad with the objective to induce mutation for the enhancement of lipolytic potential of *Penicillium chrysogenum*. Chemical mutation was done by mutagenesis process in which nitrous acid was used. Screening of the mutants was done through solid state fermentation technique. The optimization of cultural and nutritional conditions for the production of extracellular and intracellular lipases by wild strain in comparison to mutant was carried out through submerged fermentation technique. The maximum extracellular and intracellular lipase activity was achieved when pH of the medium was adjusted to 8 and incubation temperature was 40°C. The incubation period optimized was 48h with an inoculum size of 2.5mL. Further volume of the fermentation medium, effect of additional carbon sources, effect of additional nitrogen sources, effect of various oils and effect of metal ions was also optimized to maximize the production of lipases. The maximum extracellular enzyme activity of 32.2±0.1^a U/mL was achieved by the mutant strain as compared to the wild strain (22.2±0.1^a U/mL). The results depicts that there is 145% increase in lipolytic potential in the mutant as compared to the wild strain after optimization of the cultural conditions.

PPBB 64

COMPARATIVE STUDIES ON THE BIOSYNTHESIS OF TRIACYLGLYCEROL ACYLHYDROLASES BY A WILD AND MUTANT STRAINS OF *ASPERGILLUS NIGER* THROUGH SUBMERGED FERMENTATION TECHNIQUE

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The present piece of study has been designed to improve the triacylglycerol acylhydrolases production by chemical mutagenesis of *Aspergillus niger* strain through submerged fermentation technique. This work was done in Laboratory of Mycology and Biotechnology, Department of Botany, Govt. College University, Faisalabad. Different parameters *i.e.*, incubation temperature, screening of substrates, rate of fermentation, Initial pH, fermentation of medium, effect of metal ions, carbon and nitrogen sources was optimized for wild and mutant strains. *Aspergillus niger* strain was subjected to nitrous acid treatment at the dose of 0.1M for different time intervals ranging from 30-180 min. Among all mutants tested, M-9 derived from parent was found to be the best producer of lipases with an enzyme production of (91.41±0.520^a U/mL) showing 363.31% increase in enzyme activity. Among various media tested M3 and M7 gave the highest units of extracellular lipases by wild (25.16±0.28^a U/mL) and mutant (124.83±0.76^a U/mL) strains respectively. Sucrose was found to be the best carbon source @ 1% concentration. Peptone as nitrogen source was found to be the best inducer for lipases production. The pH 9.0 at 30°C supported the maximum lipases production. One millilitre of inoculum was best supporter of best lipases production. Ca²⁺ ions supported good growth of fungus and showed maximum lipases production. It is evaluated from the results that the lipases produced from the subject organism can be useful in detergent industrially.

PPBB 65

COMPARATIVE STUDIES ON THE LIPASE BIOSYNTHESIS OF WILD AND MUTANT STRAINS OF *TRICHOPHYTON* SP. (MBL 23) THROUGH SUBMERGED FERMENTATION

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The present study was conducted in the laboratory of Mycology & Biotechnology, Department of Botany, Govt. College University, Faisalabad with the objective to investigate the production of extracellular and intracellular lipases by wild and mutant strains of *Trichophyton* sp. through submerged fermentation. Chemical mutation was done by nitrous acid which is reported to be an effective mutagen for the enhanced production of various industrially important enzymes. *Trichophyton* sp. was screened for the extracellular and intracellular lipases production. The maximum extracellular lipase activity (16.7±0.2^a wild; 25.5±0.1^a Mutant) was obtained at 35°C after 48 h at pH 7.0 and by using 1 mL inoculum level. Screening of mutants, screening of fermentation medium, organic nitrogen sources, inorganic nitrogen sources, carbon sources, additional oils, effect of pH, effect of incubation temperature, rate of fermentation and effect of metal ions were optimized for the maximum production of enzyme. There is overall 152% & 156% increase in the extracellular & intracellular enzyme production respectively.

PPBB 66

A COMPARATIVE ACCOUNT OF TWO ASCOMYCETOUS FUNGI FOR THE BIOSYNTHESIS OF B-D-FRUCTOFURANOSIDE FRUCTOHYDROLASE THROUGH SOLID STATE FERMENTATION TECHNIQUE

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The present study was conducted in the Laboratory of Mycology and Biotechnology, Department of Botany, Government College University, Faisalabad. The main objective of the study was to check the production potential of two ascomycetous fungi i.e., by *Aspergillus niger* & *Penicillium chrysogenum* for the biosynthesis of b-D-fructofuranoside fructohydrolase through solid state fermentation. Fungal cultures were obtained from the culture stock of the laboratory. For this purpose various parameters like effect of different substrate, size of inoculum, level of moistening agent, rate of fermentation, pH of moistening agent, quantity of substrate, incubation temperature and moistening agent were studied. Both fungi have shown maximum production with wheat bran i.e., *A. niger* (10.33 ± 0.29^a U/mL/min) & *P. chrysogenum* (9.49 ± 0.26^a U/mL/min). Maximum Invertase production was at 50°C after 72 hrs in both cases. Size of Inoculum optimized was 1mL with the level of moistening agent as 10mL. As far as the type of moistening agent is concerned *A. niger* gave highest production with distilled water (10.40 ± 0.36^a U/mL/min) while *P. chrysogenum* gave highest production (11.97 ± 0.03^a U/mL/min) with acetate buffer. Besides that the amount of substrate and pH of the moistening agent also played pivotal role in the enzyme production by both fungi. On the basis of the production units, it is concluded that *P. chrysogenum* is better source of enzyme as compared to the *A. niger*.

PPBB 67

PROCESS OPTIMIZATION FOR THE BIOSYNTHESIS OF B-D-FRUCTOFURANOSIDE FRUCTOHYDROLASE BY A LOCALLY ISOLATED CULTURE OF ALTERNARIA ALTERNATA

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In the present investigation a locally isolated culture of *Alternaria alternata* was exploited in order to check its potential for FFH (b-D-fructofuranoside fructohydrolase) production. Invertases (b-D-fructofuranoside fructohydrolase, FFH), EC 3.2.1.26 is a key enzyme used in confectionery and in the production of invert syrup. Different parameters for the process optimization of enzyme were analyzed like effect of incubation temperature, pH, different carbon and nitrogen sources, size of inoculum, different substrates and the effect of moistening agent. The effect of amount of substrate, rate of fermentation and sucrose concentration on enzyme production were also investigated. Optimum incubation temperature, pH, size of inoculum, rate of fermentation optimized was 30 °C, 5.5, 1mL, 72 h respectively. Sucrose and yeast extract @ 1% was optimized as additional carbon and nitrogen sources. Moreover, acetate buffer as moistening agent and banana peel @ 10g were optimized for highest enzyme production. The maximum enzyme yield obtained at optimum conditions found to be 61.45 U/mg.

PPBB 68

STUDIES ON THE BIOSYNTHESIS OF TRIACYLGLYCEROL ACYL HYDROLASES BY *PENICILLIUM* SP. ISOLATED FROM PICKLE (MBL-40) THROUGH SOLID SUBSTRATE FERMENTATION TECHNIQUE

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The fungal culture was taken from the Laboratory of Mycology and Biotechnology, Department of Botany GC University Faisalabad. *Penicillium* sp. were screened for the biosynthesis of triacylglycerol acyl hydrolases through solid

state fermentation. Different substrate was used but 10g of taramera was optimized for maximum production of enzyme. Different parameters such as size of inoculums, incubation temperature, pH, moistening agents' additional carbon and nitrogen sources were also optimized. Maximum production of the extracellular enzyme was optimized to be 77.26±0.52 U/mL. The highest enzyme specific activity 40.05 U/mg was achieved after 72 h of fermentation at 30°C by using taramera as most excellent substrate. The maximum enzyme activity, specific activity and total protein was enhanced when 10g substrate, 1mL inoculum, tape water with pH 9, 1% lactose and ammonium sulphate were used as carbon and nitrogen source respectively.

PPBB 69

PRODUCTION, PARTIAL PURIFICATION AND CHARACTERIZATION OF TRIACYLGLYCEROL ACYL HYDROLASES BY *FUSARIUM* SP. UNDER SUBMERGED FERMENTATION TECHNIQUES

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The present study was conducted in the Laboratory of Mycology Biotechnology, Department of Botany, Govt. College University Faisalabad, with the objective to Produce, partially purify and characterize the lipases by *Fusarium* sp. under submerged fermentation techniques. The effect of different environmental conditions such as rate of fermentation, inoculum size, volume of the medium, initial pH of the medium, additional carbon sources, inducers effect and additional nitrogen sources, on lipase production was investigated. The maximum extracellular and intracellular lipase activity was obtained after 48 h at 35°C pH 7. 2mL of inoculum optimized. 50 mL volume of fermentation medium gave the highest enzyme activity. Almond oil was best inducer while galactose and peptone gave the maximum extracellular and intracellular lipase activity when used as additional carbon and nitrogen source respectively. Isolation of lipase by ammonium sulphate precipitation by *Fusarium* sp. Characterization of enzyme was observed by effect of temperature, effect of pH and effect of metal ions on the activity of partially purified enzyme.

PPBB 70

PROCESS OPTIMIZATION FOR THE BIOSYNTHESIS OF B-D-FRUCTOFURANOSIDE FRUCTOXYDROLASE BY A LOCALLY ISOLATED CULTURE OF *RHIZOPUS OLIGOSPORUS*

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The present study deals with the optimization of different eco-cultural conditions for the production of invertase through solid substrate fermentation by using *Rhizopus oligosporus* as fungal source. This piece of work is performed in Laboratory of Mycology and Biotechnology, Department of Botany, GC University Faisalabad. Different physio-chemical parameters were optimized for enzyme biosynthesis including, different pH of moistening agent, incubation temperatures, different substrates, different quantity of substrate, rate of fermentation and different moistening agent. The maximum enzyme specific activity 17.51 U/mg was exhibited after 72 hours of fermentation at 30°C by using wheat bran as most excellent substrate. The enzyme activity, total proteins and specific activity was increased with 1mL inoculum size, 10g substrate and distilled water with pH 7.

PPBB 71

A COMPARATIVE ACCOUNT OF FERMENTATION TECHNIQUES FOR THE BIOSYNTHESIS OF TRIACYL GLYCEROL ACYL HYDROLASES BY A WILD STRAIN OF *BACILLUS SUBTILLIS*

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The present study deals with the biosynthesis of triacyl glycerol acyl hydrolases by a wild strain of *Bacillus subtilis* through solid & submerged fermentation techniques. For this purpose different agricultural by-products such as wheat bran, rice husk, almond meal, cotton seed meal, soybean meal, sunflower meal and mustard meal was checked for enzyme

production. Mustard meal was found to be the best supporter of lipases production with an inoculum size of 0.5mL. Other parameters studied was incubation temperature, type of moistening agent, pH of the moistening agent, additional nitrogen & carbon sources and effect of additional oils. The incubation period optimized was 72h. It is concluded at the end of the study that solid state fermentation supports greater production of enzyme as compared to the other one.

PPBB 72

A COMPARATIVE ACCOUNT OF TWO ASCOMYCETOUS FUNGI FOR THE BIOSYNTHESIS OF TRIACYL GLYCEROL ACYL HYDROLASES THROUGH SOLID SUBSTRATE FERMENTATION TECHNIQUE

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The present study deals with the biosynthesis of triacyl glycerol acyl hydrolases by two indigenous ascomycetous cultures of Fungi i.e., *Alternaria* sp. and *Saccharomyces* through solid substrate fermentation technique. For this purpose cultural conditions for the production of the enzyme was optimized. Different agricultural by-products such as wheat bran, rice husk, almond meal, cotton seed meal, soybean meal, sunflower meal and mustard meal was tested in order to check their effect on enzyme production. One milliliter of inoculum was also optimized after 48h of incubation at 30°C. Other environmental conditions optimized are; effect of various carbon sources, effects of oils, effect of organic & inorganic nitrogen sources.

PPBB 73

OPTIMIZATION OF EXTRACTION PROCESS OF CMCase FROM FERMENTED MATRIX OF *VIGNA MUNGO* IN SOLID STATE FERMENTATION

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Extraction of enzyme from fermented matrix is a key factor in Solid State Fermentation. In present studies the extraction of CMCase was optimized in detail and a significant increase about 1.5 folds in enzyme recovery was observed. The substrate, *Vigna mungo*, was fermented by *Aspergillus niger* under optimal conditions for CMCase production in SSF. CMCase was extracted by using different solvents including distilled water, acetate buffer, citrate buffer and phosphate buffer to achieve maximum recovery of the CMCase. Among tested solvents citrate buffer (0.05M) served as the best leachate. The maximum recovery of CMCase (1.542 IU/ml/min) was obtained with shaking at 120 rpm for ninety minutes with citrate buffer.

PPBB 74

PHYTOCHEMICAL ANALYSIS AND STUDY OF ANTIBACTERIAL, ANTIFUNGAL AND BRINE SHRIMP CYTOTOXICITY ACTIVITIES OF *FAGONIA OLIVIERI* (DC).

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In Pakistan *Fagonia olivieri* (Zygophyllaceae) is commonly used for the treatment of diabetes, cancer, fever, asthma, urinary discharges, toothache, stomach troubles and kidney diseases. Therefore the crude methanolic extract and various fractions of *Fagonia olivieri* are evaluated for phytochemical composition and *in vitro* various biological activities. The results of phytochemical analysis revealed the presence of tannins, saponins, cardiac glycosides, terpenoids, alkaloids, phlobatannins and flavonoids. All the extracts showed potent activity against Gram-positive, Gram-negative and fungal species. However, the most active fractions were ethyl acetate and butanol having the activity against maximum number of strains as compared to other fractions. These fractions also exhibited good cytotoxic activity as the maximum (96.66 %) was shown by the ethyl acetate fraction of the plant at 1000 ppm. These results indicated the potential of this plant for further work on isolation and characterization of the active principle responsible for antibacterial, antifungal and cytotoxic activities and its exploitation as therapeutic agent.

PPBB 75

**BISACCATE POLLEN FROM LATE PERMIAN, CHHIDRU FORMATION,
WESTERN SALT RANGE, PAKISTAN****UMERA DOGAR^{1*}, KHAN RASS MASOOD¹ AND AROOJ NASEER²**¹*Department of Botany, University of the Punjab, Lahore, Pakistan.*²*Centre for Undergraduate Studies, University of the Punjab, Lahore, Pakistan.***Corresponding author's E-mail: umeradogar@ymail.com*

Present paper deals with the bisaccate pollen recovered from the Chhidru Formation, Western Salt Range Pakistan. Chhidru Formation has a unique place as it represents the end Permian period and encloses the secrets of mass extinction event at the end of Paleozoic era. Lithologically the studied section consists of mainly calcareous sand stone, and shale. Palynological analysis of rock samples reveals wide range of bisaccates including 13 genera and 21 species with index pollen i.e. *Protohaploxipinus microcorpus*, *Guttulapollenites hannonicus*, *Klausipollenites schaubergeri*. All recovered pollen are described with their systematics and possible affinities. Both haploxylanoid and diploxylanoid forms are common at the end Permian representing the dominance of coniferous vegetation at the end of Paleozoic. The morphographic features of bisaccate pollen depict the near shore environment primarily sub tidal or may be intertidal with subtropical environment.

PPBB 76

**IN-VITRO CLONAL PROPAGATION OF WITHANIASOMNÍFERA: AN
IMPORTANT MEDICINAL PLANT****WASEEM SAFDAR^{1*}, HAMID MAJEED² AND BARKAT ALI³**¹*Department of Biochemistry, PMAS Arid Agriculture University, Rawalpindi, Pakistan*²*Food Science Department, Jiangnan University, Wuxi, China*³*National Institute of Bioremediation, National Agriculture Research Center, Islamabad, Pakistan***Corresponding author's E-mail: waseem.safdar@yahoo.com*

Withania somnifera is an important medicinal plant and used worldwide in pharmaceutical industry. Although *Withania* propagates vegetative in its natural state, but propagation rate is too slow to meet demand of high quality planting material for commercial cultivation. An efficient and rapid protocol for in vitro induction and complete plant regeneration of *Withania* has been developed. Leaf and Shoot cultures were initiated on Murashige and Skoog's (MS) medium (4.5 gm/L agar, and 3% sucrose and 0.8% plant agar) containing different concentrations of BAP (0.5 – 8.0 mg/L) with α -naphthaleneacetic acid (NAA) (0.2-1.0 mg/L), indole-3-acetic acid (IAA) (0.5-8.0 mg/L) and indole-3-butyric acid (IBA) (0.05-1.0 mg/L). Maximum shoot and root proliferation was achieved on medium containing BA 2.0 mg/L with NAA 1.0 mg/L IBA 0.1 mg/L. After successful propagation, plants were subculture in the above mentioned media. Then plants with higher growth was transferred to soil for acclimatization.

PPBB 77

**IN VITRO MICROPROPAGATION OF AN IMPORTANT MEDICINAL PLANT:
WATTAKAKA VOLUBILIS L.****WASEEM SAFDAR^{1*}, HAMID MAJEED², BARKAT ALI³**¹*Department of Biochemistry, PMAS Arid Agriculture University, Rawalpindi, Pakistan*²*Food Science Department, Jiangnan University, Wuxi, China*³*National Institute of Bioremediation, National Agriculture Research Center, Islamabad, Pakistan***Corresponding author's E-mail: waseem.safdar@yahoo.com*

Wattakaka volubilis is an important medicinal plant of the family Asclepiadaceae. Traditionally this plant is used to treat fever, cough, severe cold and rheumatic pain. Leaf of this plant is used to treat urinary troubles, dyspepsia and diabetes. The present study was designed to regenerate callus from leaf explants of *W. volubilis*. Leaf discs were inoculated on Murashige and Skoog's (MS) medium (3 % (w/v) sucrose, 0.8% agar) supplemented with a wide range of α -naphthaleneacetic acid (NAA) (0.1-2.0 mg/L). Maximum shoot length (28.6 \pm 0.49 cm) was observed at 0.5 and 1.0 mg/l NAA. The average shoot length was 11.2 \pm 0.07 cm. Small shootlets obtained, were transferred to shoot elongation medium supplemented with different concentrations of 6-Benzylaminopurine (BAP) (0.1-5.0 mg/l) and Gibberellic acid (GA₃) (0.1-5.0 mg/l) alone and with combinations. Elongated shoots were transfer in half strength MS basal medium supplemented with different concentrations of indole-3-butyric acid (IBA) (0.05-1.0 mg/L). After 6 weeks maximum

root length (12.2 ± 0.40 cm) was observed on a medium supplemented with 0.1 mg/l of IBA. Rooted plantlets were then acclimatized with a survival rate of 95% and transferred to the green house and thereafter successfully transferred to the field with 90% survival rate.

PPBB 78

DYNAMIC MODELING OF PHOSPHOROUS UNDER CHANGING CLIMATE

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Phosphorous plays an important role in the growth, development and yield of wheat crop. It is very essential to model phosphorous distribution under changing climate. The effects of high temperature, elevated CO₂ and drought on the availability of phosphorous were modeled using APSIM 7.4. The result depicted that with increased temperature uptake of P increases but up to certain limit. However with elevated CO₂ the uptake of P was found significantly high as compared to low CO₂ which was due to active photosynthesis by wheat as C-3 crop. The distribution of P in wheat under drought depicted negative trend. The model ability to simulate P distribution was close to accuracy which was validated by validation skill score like RMSE, R² and d-index. To use present knowledge efficiently it is envisioned that future P modeling could be used as a risk management tool for variety development, enhance crop production and sustainable agriculture under varying climatic regime.

PPBB 79

PRODUCTION OF ALGINATE BY *AZOTOBACTER VINELANDII* EMS-45 IN A STIRRED FERMENTOR

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The present study deals with the production of alginate by a mutant of *A. vinelandii* in a stirred fermentor. Results indicated that a mutant EMS- 45, obtained after EMS treatment gave better alginate production than other mutants. Different cultural conditions were also optimized for better alginate production. It was noted that maximum alginate production (6.52 g/l) was obtained with NRP medium after 96 h of incubation period. The incubation temperature 30°C, pH 7.0, aeration level (1.0 vvm), DO (2.5%), inoculum size (7.5%) and agitation speed 200 rpm were also optimized to obtain 1.88 fold higher production.

PPBB 80

STATISTICAL AND DYNAMICAL MODELING OF WHEAT (*TRITICUM AESTIVUM* L.) FUNGAL DISEASES UNDER CLIMATE CHANGE

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Simulation models as a research and decision-support tool have a significant role to improve the physiology of crop growth, development and to optimize the crop management strategies. Wheat was chosen as a host crop to study the impact of fungal pathogens on its growth and yield formation. The wheat pathogens (*Alternaria* and *Drechslera* leaf blight) inflict major damage to wheat crop and causes sufficient yield losses. Using a model of host-pathogen interaction can help to mitigate the problem of yield losses and to understand and explain this complexity. The present studies were divided into two phases; the first phase of this study consisted of Empirical modeling to build a Multiple Regression, Logistic Regression and Quadratic plateau model against independent data to predict the long terms (2050) effects of climate change (Temperature and Rainfall) on the epidemics of Wheat fungal diseases. The results depicted that Multiple

regression model could be used significantly to predict disease occurrence with good validation skill scores like R^2 and root mean square error (RMSE). The values for pathogen occurrence for alternaria were 0.54 with RMSE 15.2 and for drechslera was 0.63 with RMSE 11.2. Similarly for Logistic regression the maximum disease (drechslera) index was 1.7% when rainfall was 1.8mm. However with the increased rainfall 43.2mm, disease continuously decreased after that it remains constant. Quadratic plateau model of statistical analysis was a good method for predicting the maximum point of disease. Quadratic plateau model has shown that with the increase of temperature (36.9°C) alternaria disease increased continuously and goes to maximum point called as plateau after that it remains constant and no significant change has occurred. With the increased rainfall (43.2mm) alternaria disease increased continuously and goes to maximum point called as plateau after that it remains constant and no significant change has occurred. Increase of temperature (36.9°C) drechslera disease continuously increased and were going to the maximum point called as plateau after that it remained constant. Quadratic plateau model of logistic regression has shown that with the increase of rainfall (43.25mm) drechslera disease decreased continuously and was going to the minimum point after that it remained constant and no significant change has occurred. The second phase of this paper presents dynamic modeling to explain and understand the host-pathogen interaction. Climate change scenarios were created and Simulation was run in the framework of agriculture production system simulator (APSIM) model. The results were indicated that APSIM model was able to simulate the wheat biomass growth and yield formation, capable for simulating the impact of temperature and rainfall and can aid in providing farmer with information for their management decision. Therefore, APSIM model can assist in the development of a system approach to reduce the negative impact of pathogens on crops.

PPBB 81

COMPARATIVE STUDY ON BIOETHANOL PRODUCTION FROM *SACCHAROMYCES CEREVISIAE* THROUGH ALKALI AND ENZYMATIC HYDROLYSIS OF SUGARCANE BAGASSE

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Increasing costs of fossil fuels and their greenhouse gases emission are creating a dire need to explore cheaper and environment friendly biofuels. Although cereals and oil crops are being used for the production of biofuels but there is a need to produce more economical biofuels to compete with the already existing ones. To overcome this setback, Sugarcane bagasse residue a potential raw material for lignocellulosic ethanol production was obtained from Crescent Sugar Mills, Faisalabad. *Saccharomyces cerevisiae* an efficient organism having capability to convert both glucose and mannose into ethanol was used to produce ethanol from sugarcane industry. A lignocellulosic waste substrate sugarcane bagasse was subjected to alkali and ligninolytic enzymatic hydrolysis to remove the lignin content of the substrate. Delignified residues was treated with indigenously produced crude cellulases from *Trichoderma reesei* to convert into glucose. Then *Saccharomyces cerevisiae* was grown on hydrolyzate to produce ethanol under optimum growth conditions. The optimization conditions for fermentation like fermentation time, substrate level, pH, temperature were studied with comparison of alkali and enzyme pretreated substrate. Maximum ethanol production 32.45g/L was achieved under optimal conditions at 72h, 15g, 5.5 pH and 35° C using alkali pretreated substrate. From ligninase pretreated substrate, maximum yield 28.15g/L of ethanol was achieved under optimal conditions at 72 h, 15g, 5.5 pH, 35°C.

PPBB 82

EXPLORATION OF *CANDIDA* SPECIES FOR THE PRODUCTION OF GLUCOAMYLASE USING AGRICULTURAL BY-PRODUCTS

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Genome sequence analysis of *Candida* database indicates the presence of glucoamylase gene. However, the potential of *Candida* species for the production of glucoamylase has yet to be explored. In this context, three different species of *Candida* i.e. *C. tropicalis*, *C. utilis* and *C. lipolytica* were tested for the of glucoamylase production using solid state fermentation. Among these, *C. lipolytica* gave better production of the enzyme 72 h after inoculation compared to the others. So, eight different diluents were investigated to for glucoamylase production by *C. lipolytica*. Among these medium M5 (containing, %, w/v: soluble starch 5.0, yeast extract 3.0, urea 0.77, KH_2PO_4 3.0 and MgSO_4 0.5) was found to be the best. The glucoamylase secretion by *C. lipolytica* increased two fold after the optimization of cultural conditions such initial pH of diluent (5.0), substrate to diluent ratio (1:1) and inoculum size (1.5 ml).

PPBB 83

DEVELOPMENT OF FUNGAL CONSORTIUM FOR THE PRODUCTION OF ENDO-1, 4-B-GLUCANASE

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The present research work is focused on the development of fungal consortium and optimization of cultural conditions for the production of endo-1,4- β -glucanase on the expense of agricultural by-products. Mono and coculture of three different strains i.e., *Aspergillus niger*, *A. awamori* and *A. oryzae* were screened for the production of endoglucanase. Consortium of *A. niger* and *A. oryzae* gave better production of endoglucanase when wheat bran was moistened with M2 diluent containing (g/l): KH_2PO_4 2.0, $(\text{NH}_4)_2\text{SO}_4$ 1.4, urea 0.3, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ 0.3, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ 0.0014, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ 0.005, MnSO_4 0.0016, CoCl_2 0.002, CaCl_2 0.002, polypeptone 1.0 and Tween-80 2.0 ml. Culture conditions such as initial pH of diluent (5.5), substrate to diluents ratio (1:1) and incubation period (72 h) were also optimized. Maximum production of endoglucanase (327.38 ± 10.522 U/g/h) was obtained when 1.0 ml of conidial inoculums (0.5 ml of each strain) was used.

PPBB 84

LACTOSE AS ALTERNATIVE INDUCER FOR THE PRODUCTION OF RECOMBINANT α -AMYLASE FROM *THERMOTOGA PETROPHILA* UNDER THE INFLUENCE OF T7 PROMOTER

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T7lac promoter system has been developed by combination of T7 RNA polymerase promoter and lac promoter. So lactose, a natural inducer of lac operon, can be use as alternative to IPTG. The present study describes the use of lactose and selection of medium for the expression of extra cellular recombinant α -amylase from *Thermotoga petrophila*. in *E. coli* BL21 codon plus. The α -amylase was cloned previously in PET28a expression vector under the influence of T7lac promoter. Recombinant *E. coli* strain was grown in five different media (3xZYB, 3ZYBM9, ZYBM9, 4xZB & LB). Difference in expression of recombinant α -amylase on induction with IPTG and lactose in each media was determined in term of enzyme activity, protein contents and specific activity. Among all the media, 4xZB and ZYBM9 gave 13.13 ± 0.84 and 13.73 ± 2.01 units/ml/min with 100 mM lactose 48 hrs after induction. Due to statistically insignificant difference in α -amylase expression in the two media, both were tested for the effect of different concentrations of lactose as inducer. The recombinant enzyme activity and total protein both were comparatively higher in 4xZB medium on induction with 200 mM lactose when *E. coli* Codon Plus culture was incubated at 37°C for 48 hrs. The effect of heat shock with respect to point of induction showed that high expression level was achieved when *E. coli* cells containing recombinant plasmids were grown to 0.6 OD₆₀₀ were kept at 42°C for 1 hr in a rotary shaking incubator (200 rpm) immediately after adding 200 mM lactose.

PPBB 85

POTENTIAL OF MICROBIAL AND PLANT'S β -GLUCANS TOWARD LOWERING OF LDL AND ENHANCING OF HDL

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The effect of β -glucan, extracted from different sources such as barley, baker's yeast and plant extract (garlic and ginger), was examined on the total cholesterol, high density lipoproteins (HDL) and low density lipoproteins (LDL) level in mice. β -glucan extracted from barley lowered the total cholesterol from 180 mg/dl to 125 mg/dl, LDL from 30 mg/dl to 27 mg/dl while it showed no effect on HDL level. Yeast extracted β -glucan reduced total cholesterol from 180 mg/dl to 40 mg/dl and LDL from 30 mg/dl to 08 mg/dl, but it showed no effect on HDL value. Plant extract (garlic and ginger) lowered the total cholesterol from 180 mg/dl to 171 mg/dl and LDL from 30 mg/dl to 10 mg/dl and showed improvement in HDL content from 40 mg/dl to 124 mg/dl.

PPBB 86

BIOTECHNOLOGICALLY IMPORTANT THERMOPHILIC BACTERIUM ISOLATED FROM THE HOT SPRING OF AZAD KASHMIR-PAKISTAN

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A thermophilic bacterium (TP-2) was isolated from the Tatta Pani hot spring in Azad Kashmir and was characterized using phenotypic and genotypic characters. The strain developed slimy colonies with smooth margins while the cells were gram positive rods. Sequence analysis of its 16S rRNA showed that TP-2 had 89% homology with *Geobacillus debilis*. Growth occurred at pH values ranging from 5.5 to 9.0 and optimum pH for growth was found to be 7.0. The optimum temperature for growth was around 65°C. TP-2 gave positive results for ortho nitrophenyl-β-D-galactopyranosidase (ONPG), gelatin hydrolysis (GEL), produced acid from glucose, maltose and sucrose. It utilized glucose, fructose, maltose, lactose, sucrose, starch, xylan, filter paper and carboxymethylcellulose as sole carbon source.

PPBB 87

PLANT REGENERATION FROM *IN VITRO*-SELECTED SALT TOLERANT CALLUS CULTURES OF *SOLANUM TUBEROSUM* L.

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This research work reports *in vitro* direct selection of salt-tolerant callus cultures and subsequent plant regeneration in two potato cultivars (Cardinal and Desiree). Results have shown more than 50% reduction in relative fresh callus mass in the two potato cultivars exposed to 120 mM NaCl. Callus morphology correspondingly changed from off-white to blackish-brown at 120 mM to acutely-necrotic at 140 mM NaCl. Regeneration potential of recurrently-selected callus cultures (100 mM NaCl-treated) on salt-free regeneration medium (MS + 2.64 μM NAA and 1.00 μM TDZ) was not much different as compared to the control (non-selected ones). Regenerated plants from salt-tolerant callus cultures of both the cultivars after selection were transferred to soil and organic matter (50:50, v/v) for acclimatization in the greenhouse. It was observed that the recurrently-selected plants had higher fresh/dry weight and number of tubers compared with the control ones in both the cultivars. Likewise the protein, peroxidase (POD), catalase (CAT) and superoxide dismutase (SOD) activities have shown an increasing trend in salt-treated plants of both the cultivars. The results from this study highlighted a strong possibility for the selection of salt-tolerant callus lines of potato followed by an efficient plant regeneration and further acclimatization.

PPBB 88

SCREENING OF MEDICINAL NATURAL EXTRATCS FOR THEIR ANTIBACTERIAL ACTIVITY AGAINST *SALMONELLA* SPECIES

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The present study was aimed to screen out natural crude extracts exhibiting antibacterial activity against *Salmonella* causing gastrointestinal problems in humans. Fifteen *Salmonella* species were isolated from uncooked chicken, polluted water, rotten potatoes, beef, rotten eggs etc. Aqueous plant extracts of *Allium sativum* (garlic), *Nigella sativa* (kalwanji), *Azadirachta indica* (neem), *Ficus carica* (anjeer), and *Trigonella foenum-graecum* (methi) were checked against *Salmonella* species by well plate method. In addition to plant extract, honey was also used for antibacterial activity. Inhibition zones ranging from 2mm to 20mm were obtained with different concentration of plant extracts and honey. The antibacterial sensitivity pattern was in the order of kalwanji > garlic > honey > anjeer > methi > neem. The standard antibiotics such as Ceftriaxone and Ciprofloxacin were also used for comparison with natural extract for antibacterial activity. The extracts of *Allium sativum*, *Nigella sativa* and honey were found to be more effective against *Salmonella* species for which even Ceftriaxone was found ineffective.

ORAL ABSTRACTS

OPPP 1

INTRA SPECIFIC VARIABILITY AMONG *METARHIZIUM ANISOPLIAE* STRAINS IN THEIR ABILITY TO PRODUCE BALSTOSPORES IN LIQUID CULTURE MEDIA

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This study describes intra specific variability among *Metarhizium anisopliae* strains in terms of their ability to produce blastospores in selected liquid culture media. Blastospore production of 10 strains was evaluated in six different media representing different carbon and nitrogen sources. Irrespective of strain, media containing corn steep and yeast extract provided highest blastospore yield. Among different strains F10, ERL607, ARSEF 3297 and ARSEF 4556 produced significantly ($p < 0.001$) higher number of blastospores at 48 hours post inoculation (hpi). At 72 hpi, blastospore concentration was significantly higher for strains ARSEF 3297, CA1, F10, CA 22 and ARSEF 4556, while the strains, V275, UWS-2 and PW produced significantly lower number of blastospores. The single highest average production ($1.43 \times 10^8 \pm 1 \times 10^7$) was noticed in Adamek's modified medium (AMM) in case of CA1 at 72 hpi. Media influenced the morphology and budding pattern e.g. In Adamek's media (AM), blastospores were slender in shape and were observed frequently on apical as well as on lateral buds, whereas BH medium yielded blastospores which resembled aerial conidia. Blastospores produced on different media varied non-significantly among themselves as well as with aerial conidia in their virulence towards *Tenebrio molitor*. Spore bound pr1 of all blastospores was significantly lower than that of aerial conidia suggesting that other mechanisms might be involved in virulence of blastospores. Considering the intra specific variability in blastospore production, this study highlights the importance of screening strains for their ability to produce blastospores prior to optimizing media and culture conditions for blastospore production.

OPPP 2

PHYSIOLOGICAL RESPONSES AND DROUGHT RESISTANCE INDEX OF NINE WHEAT (*TRITICUM AESTIVUM* L.) CULTIVARS UNDER DIFFERENT MOISTURE CONDITIONS

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Nine commercial wheat cultivars of Pakistan viz; Inqulab-91, AS-2002, Sehar-2006, Shafaq-2006, Bhakkar-2002, Auqab-2000, GA-2002, Chakwal-50 and Fareed-06 were evaluated for their physiological performance and drought resistance index under different levels of soil moisture. Germination of these cultivars was tested under PEG induced osmotic stress of -2, -4, -6, and -8 bars. Highest germination percentage was observed for Fareed-06, Chakwal-50, GA-2002 and AS-2002 at -8 bars osmotic stress. To study physiological responses and drought resistance index plants were grown in clay pots and water equivalent to 75%, 50% and 25% field capacity was applied. Decrease in soil moisture significantly affected relative water content, leaf succulence, chlorophyll content, cell membrane stability index, number of grains/spike and 100 grain weight. Significant variation was found among cultivars. Based on physiological responses and drought resistance index performance of Chakwal-50, GA-2002 and Bhakkar-2002 were found relatively better under limited moisture conditions

OPPP 3

PHENYLALANINE AMMONIA-LYASE AND PEROXIDASE ACTIVITY IN BROWN RUST INFECTED TISSUES OF PAKISTANI WHEAT CULTIVARS

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Besides other factors resistance and susceptibility is the outcome of biochemical processes such as activities of defense-related enzymes. So in this study, Phenylalanine ammonia-lyase (PAL) and Peroxidase activity of resistant (Inqilab-91) and susceptible (Kirin-95) wheat cultivars were determined through spectrophotometer 8 hr, 24 hr, 48 hr and 72 hr post leaf rust inoculation. The results have shown that these enzymes were present in both the resistant and susceptible cultivar but the activity was more pronounced in the resistant one. Levels of PAL and Peroxidase were also investigated among inoculated and uninoculated plants within the same cultivar. Thus, the activity of both PAL and Peroxidase were significantly more in inoculated ones. The results have shown that the after 72 hr of inoculation Inqilab-91 had more PAL activity i.e., 5.47 IU/ml/min than in Kirin-95 i.e., 2.08 IU/ml/min at 270 nm. While Peroxidase activity in Inqilab-91 was 6.41 IU/ml/min and in Kirin-95, 3.66 IU/ml/min after 72 hrs of inoculation, observed under 470 nm wavelength. Increase in one's activity increases the other enzyme's activity. The activity was more prominent after 72 hrs of inoculation as pathogen had successfully established itself in the host plant tissue. The activities of these enzymes act as plant's active defense mechanism against the attack of pathogen and are considered as indicator for the resistance or vice versa.

OPPP 4

PRESENCE OF BIOACTIVE COMPOUND IN *LEPIDIUM SATIVUM* L. EXUDATES: ROLE IN ALLELOPATHY

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Lepidimoide is a naturally occurring disaccharide reported to be an oligosaccharin, i.e. to exhibit 'hormone-like' biological activity. It was found in cress (*Lepidium sativum* L.) root exudates and exerts apparently allelopathic effects on neighbouring *Amaranthus*'s seedlings. Quantitative test of cress exudates showed the presence of hexoses, pentoses, uronic acid and unsaturated uronic acid. TLC and PC were used as a qualitative tool to separate the different sugars. The bands in the oligosaccharide region were assumed to be biologically active. Paper electrophoresis was then carried out to determine the charge on compounds present in cress root exudates. The compounds present in the exudates migrated with the acidic and neutral markers on paper electrophoretogram. In an attempt to test whether the compound is of high or low M_r , the mucilage was partitioned by gel-permeation chromatography (GPC). GPC on Bio-Gel P-10 and P-2 suggested that the active principle had M_r ~500–750, compatible with oligosaccharide(s), suggesting that a particular oligosaccharide may be the active principle. TLC separation of bioactive fractions from P-2 showed that the bioactive compound migrated between GalA and Gal suggested that the bioactive compound is a disaccharide (lepidimoide).

OPPP 5

SHOOT TO ROOT RATIO DIFFER IN WARM SEASON C₄-CEREALS IN RESPONSE TO PLANTS COMPETITION UNDER LOW AND HIGH WATER LEVELS

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Shoot to root ratio (S:R) response of three warm season C₄-cereals (grasses) viz. corn (*Zea mays* L., cv. Hybrid-5393 VT3), grain sorghum (*Sorghum bicolor* L. Moench, cv. Hybrid-84G62 PAT), and foxtail millets (*Setaria italica*, cv. German Strain R) grown in pure and mixed stands was investigated at one month interval at West Texas A&M University, Texas, USA during spring 2010. The results indicated that the three warm season grasses responded differently in terms of S:R when grown in pure and mixed stands under low and high water levels at different growth stages. In the mixed stands, the roots and shoot biomass accumulation in millets decreased while its S:R increased and was considered the least competitor in the mixed stands than sorghum and corn. Corn plants on the other hand with higher root and shoot biomass accumulation but lower S:R was ranked first (strong) in terms of competitiveness in the mixed stands. Grain sorghum in the mixed stands, produced more root and shoot biomass while grown mixed with millets, but produced less root and shoot biomass in the corn mixed stands was therefore ranked second in terms of competitiveness (corn > grain sorghum > millets). Better understanding of root architecture of different crop species in pure and mixed stands could maximize water and nutrients uptake. Early emergence of the three cereals had positive effects on shoot and root biomass accumulation and was considered the best criteria in crops competitiveness. We also found that while decreasing in water level increased root biomass but decreased the S:R in the three cereals. With

advancement in crop age more increase in shoot biomass and S:R was noticed but decline in root biomass was observed. We suggests that more studies are required to assess more accurately the root biomass contribution of different crops species in pure and mixed stands to improve carbon sequestration into the soils under different environmental conditions.

OPPP 6

AGROBACTERIUM TUMEFACIENS MEDIATED OPTIMIZATION OF TRANSFORMATION IN *EUCALYPTUS CAMALDULENSIS*

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The River Red Gum (*Eucalyptus camaldulensis*) is a tree of the genus *Eucalyptus*. It is one of around 800 in the genus. It is a plantation species in many parts of the world, but is native to Australia, where it is widespread, especially beside inland water courses. The speed of growth of the tree makes it a useful plantation timber. The major goal from this study was to optimize a protocol for *Eucalyptus camaldulensis* transformation through *Agrobacterium tumefaciens* LBA4404 containing binary plasmid pGA482 with *uidA* (*Gus*) gene under *CamV35S* promoter and *nptII* gene driven by *Nos* promoter. Transformation was done using young leaves and cotyledonary leaves of young invitro plants under different optical densities (O.D) from 0.3-0.8 and different conditions of Acetosyringone, infection time and co-cultivation time. Confirmation of transformation was done through Gus histochemical staining followed by the selection of transformant on the basis of kanamycin resistance. Highest transformation was observed in leaf explants and the callogenesis was also found to be good. There was no transformation observed at O.D ranging from 0.3-0.8 using calli while O.D ranging from 0.3-0.5 was found to be most effective for young leaf explants. Infection time of 1-2 hour and co-cultivation of 1 day in dark were found most suitable for transformation.

OPPP 7

SALICYLIC ACID INDUCED SALINITY TOLERANCE IN MAIZE (*ZEA MAYS*)

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Salicylic acid (SA) a naturally occurring plant hormone is an essential signal molecule recognized to have diverse effects on biotic and abiotic stress tolerance. The present study was planned to investigate the role of SA in salt tolerance of maize. Experiment was conducted to study the SA induce physiological and biochemical changes in two genotypes of maize viz., Sahiwal-2002 and EV-20 in the presence and absence of salt. Salicylic acid @ 0, 0.25 and 0.50 mM L⁻¹ along with 120 mM NaCl L⁻¹ and Hogland's nutrient solution were applied as rooting medium to 25 days old plants. Results revealed that application of 0.50 mM L⁻¹ salicylic acid was most effective to reduce Na⁺ but increased K⁺ and Ca²⁺ concentration, shoot biomass as well as better yield under salt stress. Exogenous application of different concentrations of SA enhanced photosynthetic rate, transpiration rate, stomatal conductance, sub-stomatal CO₂ concentration, chlorophyll *b* contents and carotenoids in both genotypes of maize under salt stress. In conclusion, the level of 0.50 mM L⁻¹ SA by rooting medium was more effective as compared to 0.25 mM L⁻¹ level on growth, gas exchange characteristics, biochemical attributes and yield. Maize genotype Sahiwal-2002 perform better by increasing higher biomass, better gas exchange characteristics as well as higher K⁺/Na⁺ and Ca²⁺/Na⁺ ratios under salt stress.

OPPP 8

QUANTITATIVE TRAIT LOCI (QTLs) MAPPING OF DROUGHT TOLERANCE AT GERMINATION STAGE IN A WHEAT POPULATION DERIVED FROM SYNTHETIC HEXAPLOID AND OPATA

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Drought is a major limiting factor affecting productivity. Wheat is a major crop and staple food in Pakistan. Genetic linkage map construction based on linked DNA markers spanning whole wheat genome and subsequently QTL mapping for drought tolerance is a way forward to enhance breeder's ability for effective selection. An F₈ population derived from the cross of OPATA x SH-349 has been used. An experiment was conducted at germination stage under controlled conditions. The drought was induced by 15% PEG nutrient solution in acid washed sand medium. Microsatellite DNA markers data were used for linkage maps construction. Morphological data under drought and non-stressed conditions along with linkage maps data were used for QTL mapping. The results of QTL analysis using single marker analysis showed 14 SSR markers were linked to QTLs for five traits in both drought and control condition. Using simple interval mapping and composite interval mapping QTLs for different traits of interest were mapped on two linkage groups. On linkage group 1, root length, shoot length, dry biomass and germination percentage were mapped under control and drought conditions. On linkage group 2, germination percentage and germination rate were mapped under controlled and drought conditions. This map can be improved in future studies with more molecular markers improving genomic coverage.

OPPP 9

MICROBIAL DIVERSITY OF THE RHIZOSPHERE OF KOCHIA (*KOCHIA INDICA*) GROWING UNDER SALINE CONDITIONS

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The following study was conducted to find out the microbial diversity of the rhizosphere and rhizoplane of *Kochia indica* (halophyte plant). The main objective was to isolate the plant growth promoting rhizobacteria from the rhizosphere and rhizoplane of *Kochia indica* that are the beneficial bacteria with PGP traits. From the rhizosphere of *Kochia indica*, total 15 bacterial strains on LB medium, 38 strains on NFM medium, 14 on AP medium while 13 on HaP medium were isolated. From the rhizoplane of *Kochia indica*, 10 strains on LB medium, 13 strains on NFM medium, 4 strains on AP medium while 7 on HaP medium were isolated. Most of the bacteria that were isolated showed IAA production and phosphate solubilization. 52 out of 80 strains from the rhizosphere and 21 out of 34 strains from the rhizoplane were identified as phosphate solubilizing bacteria. 28 out of 80 isolates from the rhizosphere and 25 out of 34 isolates showed IAA production. Bacterial isolates were biochemically characterized by performing QTS. Quantification of IAA production by some of the bacterial strains was checked out and it was found that different bacteria had different potential of producing IAA. One of the nitrogen fixers isolated from rhizoplane NFP 9 showed similar properties to that of *Azospirillum halopraeferens*. It produced the maximum concentration of IAA and it was also able to solubilize the tricalcium phosphate. Alkaliphilic and halophilic bacterial strains were also isolated from this halophyte plant that showed PGP traits. Bacterial isolates were also screened out for the presence of Fluorescent Pseudomonads and only two strains exhibited fluorescence under the uv light.

OPPP 10

GAS EXCHANGE ATTRIBUTES CAN BE VALUABLE SELECTION CRITERIA FOR SALINITY TOLERANCE IN CANOLA CULTIVARS (*BRASSICA NAPUS* L.)

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Present study was carried out to access inter-cultivar variation for salt tolerance in canola (*Brassica napus* L.) by using photosynthetic attributes including photosynthetic pigments as selection criteria. Four cultivars of canola viz. Oscar, Ac Excel, Cyclone and Dunkled were screened at 120 mM NaCl at vegetative stage. Salt stress reduced photosynthetic rate (A), transpiration rate (E), stomatal conductance (gs), sub-stomatal CO₂ (Ci) conc. at different

growth stages. Salt stress also markedly reduced chlorophyll a, chlorophyll b and total chlorophyll contents. Generally, plant biomass declined under the salt regime of all the cultivars. Nevertheless, cultivar Dunkled had higher, Oscar and Ac Excel intermediate while; Cyclone had lower shoot and root fresh weight under saline condition. However, cultivar Cyclone was lower in chlorophyll a and chlorophyll b under the salt stress in contrast to Ac Excel. A significant variation was also shown in gas exchange attributes under the stress. Photosynthetic (A) and transpiration rates (E) was higher in Dunkled than of Oscar and Cyclone under the stress. On the basis of data, it may be concluded that fresh weight of shoot and root had positive correlation with physiological photosynthetic rate (A) among all the four cultivars; thus, photosynthetic rate (A) can be an effectual selection criteria for salt tolerance under salt regime.

OPPP 11

HIGHER ANTIOXIDANT CAPACITY PROTECTS PHOTOSYNTHETIC ACTIVITIES AS REVEALED BY CHL A FLUORESCENCE IN DROUGHT TOLERANT TOMATO GENOTYPES

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Drought is the most important factor limiting growth and yield of tomato. Genetic improvement in tomato for water stress tolerance is of prime importance for economically and efficient utilization of arid area land resources. Since photosynthetic efficiency and antioxidant capacity are associated with degree of water stress tolerance in tomato genotypes, experiment was conducted to assess whether plant antioxidant capacity protects the photosynthetic apparatus that ultimately results in enhanced photosynthesis leading to higher growth and productivity or plant photosynthetic machinery is adapted to water stress conditions. Fifteen tomato genotypes differing in their drought tolerance were subjected to different levels of PEG8000 (Control, 5%, 10% & 15%) at the seedling stage. It was concluded that water stress tolerant tomato genotypes (CLN-1767 and Lyallpur-1) also maintain relatively higher photosynthetic efficiency as assessed through A/Ci curve or PSII efficiency. Chlorophyll fluorescence measurements revealed that NPQ increased whereas the electron transport rate decreased under waters stress. Water stress tolerant tomato genotypes down regulate ETR with increase in NPQ to avoid photoinhibition and photodamage. Protection of photosynthetic machinery in water stress tolerant genotypes might have been due to higher antioxidant capacity. Water stress tolerant cultivars exhibited much lower lipid peroxidation, and showed increased activities of the enzymes involved in the ROS scavenging system. Up-regulation of the antioxidant system plays a role in water stress tolerance of tomato.

OPPP 12

INTERACTIVE EFFECT OF FOLIAR APPLICATION OF NITRIC OXIDE (NO) AND SALINITY ON WHEAT (*TRITICUM AESTIVUM* L.)

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The present experiment was conducted to assess the interactive effect of foliar application of nitric oxide (NO) and salinity on wheat (*Triticum aestivum* L.). Wheat cv.S-24 was grown under non-stressed or salt stressed conditions (0 and 150 mM NaCl). Different levels of NO (water spray, 0.05, 0.10, 0.15 mM) were applied as a foliar spray. Salinity applied through rooting medium significantly reduced growth attributes while foliar applied NO was found to be effective in amelioration of adverse effects of salt stress on growth parameters. Application of NO caused an increase in biomass of both lines under non-saline or saline conditions. Photosynthetic rate of cultivar increased due to NO applied foliarly both under control and saline conditions. Furthermore, increase in growth due to exogenously applied NO may have been due to changes in photosynthesis. As, net CO₂ assimilation rate (A), stomatal conductance (g_s) and transpiration rate (E) were significantly increased by application of NO as foliar spray. However, NO applied as a foliar spray did not change the sub-stomatal CO₂ suggesting that stomatal factors were not the major controlling factors for photosynthesis. However, photosystem-II activity in our experiment did not change by foliar spray of NO. Overall, the adverse effects of salt stress could be alleviated by exogenous application of NO.

OPPP 13

PHYSIO-MORPHOLOGICAL RESPONSES OF NATIVE ACACIA NILOTICA TO EUCALYPTUS ALLELOPATHY

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Allelopathic effects of exotic *Eucalyptus camaldulensis* Dehnh. have been widely reported and are considered the major factor limiting the establishment of native tree species in local forests. A lab study was conducted to investigate the allelopathic effects of *Eucalyptus camaldulensis* on native trees and *Acacia nilotica* was selected as bioassay plant. Since *Eucalyptus* leaf litter enters in the soil environment either in the form of solid matter or as aqueous extract. The allelopathic impacts of these two forms were assessed in laboratory experiment conducted at Green House of Institute of Plant Sciences, University of Sindh, Jamshoro, Pakistan. In a pot experiment the leaf litter was applied in total six concentrations along a control, no leaf litter. The three concentrations of ground solid leaf litter were mixed with soil in 10, 20 and 30% similarly, the aqueous stock solution of 1:20 was prepared and dilutions were made in 10, 20 and 30%. The plant parameters such as percent germination, relative germination ratio (RGR), percentage mortality rate (MR), seedling vigour index (SVI), chlorophyll content (mg/g), relative elongation of shoot (RERs), relative elongation of root (RERr), relative biomass ratio (RBR), fresh and dry weight (g) was calculated. Soil samples were taken from laboratory experiments and analyzed for pH, soil salinity, organic matter, N, P, K, and Na. Results suggest that *Eucalyptus* leaf litter and leaf litter aqueous extract significantly reduced the frequency of percent germination and relative germination ratio, *Eucalyptus* leaf litter show high mortality rate than leaf litter extract, reduced seedling vigour index, reduced the chlorophyll content, reduced the relative elongation of shoot and relative elongation of root, also reduced the fresh and dry weight of the plant. The soil pH decreased with increasing concentration while organic matter, nitrogen, phosphorus and potassium concentrations increased in soil with increasing concentration. The solid leaf litter was found more dangerous than aqueous extracts.

OPPP 14

COMPARING SALINITY TOLERANCE OF FIVE HIGH YIELDING, NON-AROMATIC RICE (*ORYZA SATIVA* L.) CULTIVARS OF SINDH

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Rice (*Oryza sativa* L.) is the second staple food crop of Pakistan. It occupies about 10% of the total cultivated area in Pakistan. However, its growth and yield reduction is a serious issue in salt-affected areas. This study was conducted to evaluate salinity (NaCl) tolerance of five local non aromatic, coarse rice cultivars viz; IR-6, IR-8, DR-82, DR-83 and DR-92. The study comprised of a hydroponics experiment. That was conducted at the Department of Soil Science, Sindh Agriculture University Tandojam. The pure seeds of all five cultivars were obtained from Rice Research Institute Larkana Sindh, Pakistan. The nursery of each cultivar was initially raised in double acid washed river bed sand on distilled water for a period of two weeks. Thereafter homogenous seedlings of each cultivar were transplanted into plastic tubs containing 25 liters of 40 mM, 80 mM, 120 mM, and 160 mM NaCl solutions. The experiment was launched following a two factor completely randomized design with five replications. Plants were allowed to grow up to six weeks after transplanting. The results showed that the plants of cultivar DR-92 grown in all treatments were taller, with more leaves and had higher dry root and shoot weights as compared to other cultivars. The better performance of cultivar DR-92 was associated with less Na more K⁺ and higher K⁺/N⁺ ratio than all other cultivar tested.

OPPP 15

**EFFECT OF PLANT DERIVED SMOKE SOLUTION ON ADVENTITIOUS ROOTS OF
IPOMOEA MARGUERITE, *EPPIPREMNUM PINNATUM* AND *ROSA INDICA* IN
 COMPARISON WITH AUXIN (INDOL-3-BUTYRIC ACID)**

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Stem cuttings is the sole and vital method of vegetative propagation, which is used to conserve the innate desirable characters of the parent plants. Plant derived smoke solutions is known to enhance seed germination and seedling growth. Therefore a study was designed to investigate the effect of plant derived smoke solutions (*Peganum harmala*, *Cymbopogon jwarancusa* and *Datura Stramonium*) with the dilutions i.e. 1:100, 1:500 and 1:1000 for 24 h on stem cuttings of *Ipomoea marguerite*, *Rosa indica* and *Epipremnum pinnatum* alone and in combination with IBA. On the other hand, *I. marguerite* and *E. pinnatum* were treated at 10, 20, 30, 40 and 50 ppm and *R. indica* at 100, 200, 300, 400 and 500 ppm with IBA for 24 h. The results revealed that plant derived smoke solutions significantly increased number of adventitious and lateral roots, root length, root fresh and dry weight of *I. marguerite*. Application of 10, 20, 30, 100, 200 and 300 ppm of IBA for 24 h resulted in significantly improved rooting while 40, 50, 400 and 500 ppm caused inhibition root. The inhibitory effect of IBA (40, 50, 400 & 500 ppm) was alleviated when the medium was supplemented with *P. harmala* 1:100 and 1:1000. These findings suggest that individual plant species have a specific requirement for the type, concentration and treatment duration of smoke solution. Further investigation in the same area could prove smoke solutions cost free and efficient regulators of vegetative propagation.

OPPP 16

**STUDY OF PHYTOCHEMICAL CONSTITUENTS FROM *RICINUS COMMUNIS* LINN.
 ROOTS AND THEIR EFFECT ON DIFFERENT STRAINS OF BACTERIA AND FUNGI**

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In the present study the bioactive components of roots of *Ricinus communis* Linn. have been evaluated for anti-bacterial and anti-fungal activity. The plant roots were extracted using different solvents such as *n*-Hexane, acetone, ethanol and ethanol: water (1:1). *n*-Hexane and acetone extracts were evaluated by Gas Chromatography Mass Spectrometry (GC-MS) which revealed the existence of 22 compounds, viz. Benzyl alcohol, 1-(2-Methoxy ethyl) benzene, Dodecane, Cyclobutanol, 4-Methyl tridecane, 6-Propyl tridecane, Hexadecane, Heptadecane, Octadecane, Nonadecane, Methyl Hexadecanoate, Methyl 14-Methyl-pentadecanoate, Ethyl Hexadecanoate, Eicosane, Methyl 9,12-octadecadienoate, Methyl 9,11-octadecadienoate, Ricinine, Methyl 16-Methyl-heptadecanoate, Ethyl 9,12-octadecadienoate, Ethyl 9,12,15-octadecatrienoate, Butyl Hexadecanoate and Tricosane. However, the High Performance Liquid Chromatography Mass Spectrometry (HPLC-MS) analysis of ethanol, ethanol : water (1:1) extracts revealed the existence of 20 compounds, which are as follows: 3-(3-Hydroxy-4-(vinylloxy) phenyl) acrylic acid, 3-*O*-glucosyl stigmasterol, Ricinine, 5-Methoxy-3-vinylloxy-4-*O*-pentaxylosyl methyl gallate, Caffeic acid, 3-*O*-xylosyl-rhamnoside brassicasterol, 12-*O*-xylosyl-rhamnoside densipolic acid, Ethyl-4'-*O*-xylosyl-glucosyl-rhamnoside ferulate, 2-*O*-xylosyl gentisic acid, 2-*O*-xylosyl salicylic acid, 3-*O*-glucosyl-rhamnoside lupeol, 2-(3,4-Dihydroxy-5-(vinylloxy)phenyl)-chroman-3,5,7-triol, 5,7-Dimethoxy galangin, 7-Methyl kaempferol-4'-*O*-xylosyl-xyloside, 7-Acetyl apigenin-4'-*O*-rhamnosyl-xyloside, 3',5'-Diallyl myricetin-4'-*O*-xyloside, 5,7-Dimethyl-3'-ethyl quercetin-4'-*O*-glucoside, 4-*O*-xylosyl-glucosyl-acetyl rhamnoside syringic acid, 7-Methyl kaempferol-4'-*O*-glucosyl-glucosyl-acetyl glucoside and 5,7-Dimethyl kaempferol-4'-*O*-glucosyl-glucosyl-glucoside. Some of the extracts containing these constituents showed promising anti-bacterial and anti-fungal activities.

OPPP 17

SPATIAL METAGENOMIC ANALYSIS OF BACTERIAL COMMUNITY ASSOCIATED WITH WHEAT RHIZOSPHERE GROWN IN RHIZOBOX

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Increased development in fields like molecular microbial ecology has revealed that the previous methods like culturing have been unable to present the real scope of microbial diversity. This is fact that scientists are still unable to culture majority of microbes present in any environment niche. Metagenomics has helped to explore the genetic diversity present in natural microbial communities. Rhizobox system helps to study the spatial distribution of bacteria in the rhizosphere. Taxonomic distribution of soil microbes is determined by root growth pattern and its exudates. Our study reveals a wide range of bacteria naturally associated with wheat roots but the magnitude of diversity however, depends on the method of analysis. To study microbial diversity rhizosphere was divided into eight zones. From the selected soil zones, DNA was extracted and 16S *rRNA* gene was amplified. 150 clones were selected randomly from transformed plates and confirmed for the presence of transgene. Out of total 16 types of clones obtained, zone 'A' contained seven types of clones while zone 'B' and 'C' having six and three types of clones respectively. Maximum diversity of clones was obtained from zone 'F' i.e. eight. As well as zone 'F' was harboring the maximum number of clones that are thirty six out of 150. Sequence analysis of culture-independent bacterial diversity showed that out of 150 clones sequenced, majority was occupied by uncultured bacteria i.e. 75%. Among others, beta-proteobacteria within Firmicutes, actinobacteria, acidobacteria, alpha-proteobacteria and gamma-proteobacteria were predominant groups. Phylogenetic analysis came up with sufficient amount of diversity in the clones obtained from the soil.

OPPP 18

SCREENING OF PGPR ISOLATES FROM SEMI-ARID SOIL AND THEIR IMPLICATION TO ALLEVIATE DROUGHT STRESS.

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During the present study isolation of twenty four PGPR isolates were made from rhizosphere soil of maize collected from semi-arid region of Kahuta, Pakistan. Physicochemical analysis of soil sample was made. Twenty four different bacterial isolates were obtained which varied considerably on the basis of colony morphology, Gram's test and catalase test but they were oxidase positive. Most efficient bacterial isolates were screened on the basis of their positive activity for any one of plant growth promoting traits (siderophore production, P-solubilization and bacteriocin production). The PGPR isolates 1K, KB and 9K solubilized phosphorous while 9K was selected as it showed maximum solubilization index. The isolates KB and 1K showed siderophore production, while only isolate KB showed bacteriocin production. The PGPR isolates 1K; KB and 9K were selected among all isolates for re-inoculation studies under induced drought stress condition on Maize. The PGPR isolate 9K increased drought tolerance in maize plants by proliferating root biomass and improving relative water content of leaves, significantly increased root to shoot dry weight ratio by 127 % as compared to un-inoculated drought stressed control. But as compared to inoculated control the root to shoot dry weight ratio was 26% higher whereas, the root length was 36% increased under drought stressed condition. The PGPR isolate 9K can be selected in the formulation of bio-fertilizers for alleviating drought effects in arid and semi-arid region.

OPPP 19

THE EFFECTS OF HUMIC ACID ON THE GROWTH AND QUALITY OF MAIZE FODDER UNDER ORGANIC MANAGEMENT

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Due to higher yield potential compared to other cereal maize is called as “Queen of Cereals”. The present study examined the effectiveness of humic acid (HA) as a source for enhancing growth and quality of maize fodder (*Zea mays* L.). The study was conducted at the Agriculture Research Station of King Abdulaziz University, Saudi Arabia by growing maize two times during the crop season spanning from September 2011– February 2012—using randomized block design. The research field was organically managed by incorporating 18 Mg ha⁻¹ farmyard manure one month prior to the crop sowing. The effectiveness of HA was studied as controls (H0: 0 kg of HA ha⁻¹), and with 6 different levels of HA (H1 = 5 kg of HA ha⁻¹; H2 = 10 kg of HA ha⁻¹; H3 = 15 kg of HA ha⁻¹; H4 = 20 kg of HA ha⁻¹; H5 = 25 kg of HA ha⁻¹; and H6 = 30 kg of HA ha⁻¹). Maize growth and quality parameters including plant height, number of leaves, leaf area, dry matter yield, minerals content, crude protein, and neutral detergent fiber (NDF) were measured 60 days after sowing (R1, Silks visibility stage) each time for the crop. Significant differences ($p < 0.05$) were observed for all the mentioned parameters across the HA levels. Based on this study, application of H4 (25 kg of HA ha⁻¹) may be recommended to improve growth and quality of maize fodder in similar environmental conditions. Further research in diverse plant environmental conditions may be recommended for the generalization of these findings.

OPPP 20

PERFORMANCE OF SUMMER FORAGE LEGUMES AND THEIR RESIDUAL EFFECT ON SUBSEQUENT OAT CROP IN SUBTROPICAL SUBHUMID POTHWAR (PAKISTAN)

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The present study was conducted to assess the performance of five tropical forage legumes of sesbania (*Sesbania aculeata*), cowpeas (*Vigna unguiculata*), rice beans (*Vigna umbellata*), lablab bean (*Lablab purpureus*) and cluster bean (*Cymopsis tetragonoloba*) with reference to a cereal fodder crop of millet (*Pennisetum typhoides*) and their residual effects on the succeeding oats crops under rainfed conditions at the National Agricultural Research Centre, Islamabad. The experiment was laid out according to Randomized Complete Block Design with three replications. No fertilizer was applied to the crop throughout the growing season. The highest dry matter yield of 8.9 t ha⁻¹ was obtained from millet, followed by cowpeas (4.4 t ha⁻¹), sesbania (4.4 t ha⁻¹), rice beans (2.9 t ha⁻¹), lablab bean (2.2 t ha⁻¹) while cluster bean produced lowest dry matter of 1.7 t ha⁻¹. Cluster bean had the highest crude protein content of 23.2 % followed by cowpea (22.6 %), lablab bean (21.6 %), rice bean (20.1 %) and sesbania (19.1 %). Millet had the lowest crude protein content of 6.2. Dry matter yield of oats owing to the previous crops was least after millet (7.5 t ha⁻¹) and ranged from 8.5 to 8.9 t ha⁻¹ after sesbania, cluster bean and cowpeas. Differences in crude protein content of oats as affected by the previous crops were non-significant and ranged from 9.4 to 9.7 %. Differences in crude protein yield of oats as affected by the preceding crops were statistically significant and ranged from 705 to 854 kg ha⁻¹. These differences were due to differences in their dry matter yield. It is concluded that cereal legume sequenced cropping system gave overall higher yield of the cropping system. Inclusion of tropical forage legumes into the current cereal based farming system of Pothwar will not only increase forage availability to the underfed livestock of the area resulting in the increased livestock production but will also improve the N fertility of the soil. Potentially higher production of the subsequent non-leguminous crops will result as residual effect of this improved N status.

OPPP 21

IN VITRO DEVELOPMENT AND IMPROVEMENT OF CHROMIUM (VI)-AFFECTED ADVENTITIOUS ROOTS OF *SOLANUM TUBEROSUM* L. WITH GA₃ AND IAA APPLICATION

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This study was undertaken *in vitro* to investigate the inhibitory effects of Chromium VI by using K₂Cr₂O₇ (a hexavalent chromium compound) on the growth of adventitious roots of potato (*Solanum tuberosum* L. cv Desiree) and to determine possible reversal of the detrimental growth effects with suitable combinations of GA₃ and IAA. Nodal segments as explants were grown on MS medium containing 100 ppm K₂Cr₂O₇ with or without 12, 16, 20 ppm GA₃ and 4, 16 ppm of IAA. The impact of applied Cr VI, GA₃ and IAA on external morphological parameters such as number of adventitious roots as well as rootlets, diameter, length, fresh/dry weights of roots of *in vitro* plants was studied. Efforts

were then focused to achieve the best combination of IAA and GA₃ in MS media for reversal of inhibitory growth due to Cr IV. It was observed that the applied Cr VI (100 ppm) alone in MS media inhibited root growth. However, addition of selected combinations of GA₃ and IAA in the MS media along with Cr VI improved the root growth. Increase or decrease in each parameter was recorded in comparison with the control after 30 days of inoculation. The plants grown on MS medium + 100 ppm K₂Cr₂O₇ resulted in reduction in number of adventitious roots up to 36.26%, number of rootlets (80.64%), diameter (37.27 %), fresh and dry weights (72.96 and 84.74 %, respectively) in comparison with control (MS medium). To analyze the possible reversal of Cr IV effects, data obtained from cultures, grown on various combinations of Cr (VI) + GA₃ + IAA, was compared to the cultures grown on MS + 100 ppm Cr (VI) medium. MS media containing 100 ppm K₂Cr₂O₇ + 20 ppm GA₃ + 16 ppm IAA enhanced the average number of roots from 4.78 to 62.6, number of rootlets from 2.6 to 28.2, diameter from 0.13 mm to 0.68 mm, fresh weight from 34.4 mg to 1234.75 mg and dry weight from 1.8 mg to 80.40 mg compared with cultures grown on MS + 100 ppm Cr (VI). The combination of 100 ppm K₂Cr₂O₇ + 20 ppm GA₃ + 16 ppm IAA was found to be the most effective for root development and growth than all other combinations. The results thus highlight the fact that the deleterious effects of Cr VI on potato growth *in vitro* can be reversed with suitable hormonal treatments. The results have thus possible implications on large scale potato cultivation under heavy metal stress in a broader sense.

OPPP 22

ANTIMICROBIAL POTENTIALS OF FRESH *ALLIUM CEPA* AGAINST GRAM POSITIVE AND GRAM NEGATIVE BACTERIA AND FUNGI

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Study to reveal the antimicrobial potentials of *Allium cepa* revealed that all the extracts from both fresh and old samples showed different ranges of antimicrobial activities. Ethyl acetate fraction showed inhibitory activities against all the eight microbes tested including bacteria and a fungus. Chloroform followed by butanol fraction also inhibited the activity of all the microbes except *Pseudomonas aeruginosa* which was highly resistant. Petroleum ether fraction was effective at both lower and higher concentration. Ethanol and water sub-fractions were found least effective or ineffective. Among gram positive microbes, *Bacillus subtilis* was the most susceptible bacteria inhibited by all extracts while the most resistant gram positive bacteria was *Staphylococcus aureus*. *Erwinia caratovora* and *Klebsella pneumonia* were the most susceptible gram negative bacteria while *Pseudomonas aeruginosa* and *Salmonella typhi* were the most resistant bacteria.

OPPP 23

CHEMICAL COMPOSITION AND SENSORY EVALUATION OF TEA (*CAMELLIA SINENSIS*) COMMERCIALIZED IN PAKISTAN

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The quality of black and green commercial tea samples was accessed by physicochemical analysis, mineral analysis and sensory evaluation. Significant variations in physicochemical and organoleptic parameters observed. The moisture, protein, fat, crude fiber, water extracts and ash contents of the commercial tea samples were found to be in the range of 2.46-7.47, 0.87-1.141, 0.94-2.15, 11.23-17.21, 32.34-53.61, and 3.29-5.86%, respectively while caffeine and catechin were found in the range of 2.34-4.33% and 0-7.44%, respectively. The highest percentage of moisture, protein, fat, and crude fiber contents were observed in green tea samples while highest percentage of ash and water extracts were observed in black tea samples. Calcium, magnesium, sodium, potassium and manganese were found to be in the range of 1.47-3.84 mg/l, 2.97-5.66 mg/l, 0.39-1.83 mg/l, 3.01-4.00 mg/l, 1.09-2.43 mg/l, respectively with maximum amounts found in green tea as compared to black tea.

OPPP 24

PROLINE ACCUMULATION IN BREAD WHEAT (*TRITICUM AESTIVUM* L.) UNDER DIFFERENT ENVIRONMENTAL CONDITIONS**M. AHMED^{1*}, FAYYAZ-UL-HASSAN¹ AND MUHAMMAD ASLAM²**¹*Department of Agronomy, PMAS, Arid Agriculture University Pakistan*²*Commissioner for Minor Crops, Ministry of Food and Agriculture Islamabad*^{*}*Corresponding author's email: ahmadmukhtar@uaar.edu.pk*

Proline, accumulates in plants under environmental stresses is proteinogenic amino acid and acts as a signal to triggers specific gene action which is essential for crop recovery from stress. The present study was designed with the objective to evaluate the impact of variable environmental conditions Islamabad, Chakwal and Talagang representing the high, medium and low rainfall zone of rainfed ecosystem on the proline accumulation at flag leaf stage of wheat. The experimental design was randomized complete block with four factors i.e. the environment (2008-09 and 2009-10), sowing management (Planting windows PW's; PW1, PW2, PW3, PW4 and PW5), genotypes (Chakwal-50, Wafaq-2001 and GA-2002) and locations (Islamabad, Chakwal and Talagang) replicated four times. Proline contents for two environments (2008-09 and 2009-10) in wheat flag leaf revealed that maximum contents recorded during 2009-10 while it remained significantly lowest during 2008-09. The increase in proline from favourable environment (2008-09) to stress environment (2009-10) was 23.39%. Similarly, proline contents for variable climatic locations of rainfed ecosystem depicted significant differences and maximum value of proline recorded at Talagang ($39.13 \mu\text{g g}^{-1}$) followed by Chakwal ($32.36 \mu\text{g g}^{-1}$) and Islamabad ($24.55 \mu\text{g g}^{-1}$). The significantly highest value at Talagang was due to environmental stresses like temperature and moisture while minimum at Islamabad was due to favourable environmental conditions. The proline declined from maximum value was 37.26%. However among PW's maximum proline recorded for PW5 ($35.42 \mu\text{g g}^{-1}$) was due to exposure of crop to environmental stresses due to late sowing. Meanwhile among genotypes maximum proline contents recorded in Chakwal-50 ($33.61 \mu\text{g g}^{-1}$) followed by Wafaq-2001 ($31.90 \mu\text{g g}^{-1}$) and GA-2002 ($30.52 \mu\text{g g}^{-1}$). Therefore from present study it was concluded that the exposure of wheat plant to stresses is positively correlated with proline and proline acted as an important stress-protectant to improve crop growth and resistance of wheat to environmental stresses.

OPPP 25

PRECURSOR (L-TRYPTOPHAN)-INOCULUM (RHIZOBIA) INTERACTIONS FOR IMPROVING GROWTH, YIELD AND NODULATION OF MUNG BEAN (*VIGNA RADIATA* L.)**MUHAMMAD ASHFAQ ANJUM^{1*}, ZAHIR AHMAD ZAHIR², SHER MUHAMMAD SHEHZAD³, MUHAMMAD ARSHAD² AND MUHAMMAD ASHRAF⁴**¹*Agri. Biotechnology Research Institute, AARI, Faisalabad*²*Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad.*³*College of Agriculture, University of Sargodha.*⁴*Department of Botany, University of Agriculture, Faisalabad.*^{*}*Corresponding author's email: ashfaq1038@gmail.com*

Auxin producing rhizobia are capable of improving growth and yield of the inoculated legumes. Addition of L-Tryptophan (L-TRP) to the inoculation media may further improve its effectiveness as a result of precursor -inoculum interactions resulting into microbial biosynthesis of auxins in the rhizosphere. Rhizobial strains were isolated from the mung bean nodules using dilution plate technique. Auxins produced by these rhizobial isolates were assayed in the absence and presence of L-TRP, a physiological precursor of auxins. There was a large variation in auxins biosynthesis capabilities of these rhizobial isolates and three rhizobial i.e. A23, N12 and N42 being most prolific in auxin biosynthesis were further tested alone and in combination with different levels of L-TRP (10-3, 10-4 and 10-5 M) for improving the growth, nodulation and yield of mung bean (*Vigna radiata* L.) in a pot trial conducted at the Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan. Mung bean seeds were inoculated with peat-based inocula and sown following complete randomized design (CRD) with six replications. Fertilizers, NPK were applied @ 30-25-0 mg kg⁻¹ soil as urea and single super phosphate (SSP) in all pots. Results depicted that rhizobial inoculation significantly improved the growth and yield parameters of mung bean. However combined application of rhizobia and 10-5 M L-TRP was more effective than their separate application in improving the growth and yield of mung bean. Results revealed that fresh biomass, seed yield, number of pods plant⁻¹, number of grains pod⁻¹, number of nodules plant⁻¹, nodular mass plant⁻¹, N and P contents in mung bean seeds were significantly increased compared to un-inoculated and untreated control. These results imply that supplementation of rhizobia with L-TRP could be a useful approach for improving growth, nodulation and yield of mung bean.

OPPP 26

EFFECT OF PLANT EXTRACTED SMOKE AND REVERSION OF ABSCISIC ACID STRESS ON LETTUCE

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The stimulation of seed germination by smoke and aqueous smoke extracts has received much attention in recent years. However, the combine effects of smoke with plant hormones on seed germination remain unknown. This investigation describes how lettuce seeds respond to smoke solution and how the smoke solution can alleviate Absciscic Acid stress? Dilutions up to 1:10000 were used. The result shows that Plant extracted smoke tested seeds had a significantly higher speed of germination, germination percentage, fresh weight, relative seed germination percentage, peak value, germination value, shoot and root length, germination index and vigor index as compared to control. It was found that different plant extracted smokes have different effects on the same plant and same plant extracted smoke has different effects on different plants. Moreover it was found that in the same plant, plant extracted smoke have different effects on different parts of the plant. It may be promoting one part and on the same time may inhibit the other part. E.g. *Cymbopogon jwarancusa* extracted smoke at a dilution of 1:10000 showed significant ($P<0.05$) increased root length but at the same time decreased shoot length as compared to control. Similarly 1:1000 dilution of maize smoke significantly ($P<0.05$) increased shoot length but at the same time decreased root length as compared to control. It is well-known that ABA strongly inhibits seed germination. When ABA dilutions were made in distilled water, no germination was recorded. But when ABA dilutions were made in most responsive smoke solutions (1:500 of *Cymbopogon* and 1:5000 of Maize), germination was recorded. It was observed that combine effect of ABA and Maize/*Cymbopogon jwarancusa* smoke solutions overcome inhibition of seed germination and also improved seedling vigor, indicating that smoke alleviated ABA stress not only at the germination level but also at seedling stage.

OPPP 27

EVALUATING PLANT WATER-USE EFFICIENCY AND YIELD OF COARSE RICE ADVANCE LINES/VARIETIES FOR SOIL WITH LIMITED MOISTURE CONTENT

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Studies were conducted to evaluate the coarse rice advance lines for soils low in moisture content through direct seeded sowing method. Four lines/varieties, i.e. RSP-1, RSP-2, KSK-133 and NIAB-IRRI-9 were grown under well, medium, low and soil-stored moisture levels in lysimeters. Significantly higher plant water-use efficiency (WUE) was attained by advanced line RSP-2 under medium-water (MW) conditions. The lowest WUE was observed in soil-stored moisture conditions for all the tested lines. Maximum grain yield plant⁻¹ was recorded in cultivar RSP-2 with well-water (WW) irrigation but the results were statistically at par with medium-water (MW) irrigation. Hence, MW irrigation resulted in 20% water-saving with non-significant yield loss for direct seeded RSP-2. Interaction between irrigation regimes medium- or low-water and line RSP-2 produced higher number of productive tillers plant⁻¹. The rice lines/varieties were also evaluated for excised leaf water loss (ELWL). Rice line RSP-2 took maximum time, i.e. number of days (6.75) to complete water loss which was followed by RSP-1 (5.88), NIAB IRRI-9 (5.82) whereas KSK-133 took the minimum days (5) which proved that RSP-2 used water most economically and can be grown on soil having limited moisture supply.

OPPP 28

EFFECT OF MICROBIAL INOCULATION ON WHEAT GROWTH AND PHYTO-STABILIZATION OF CHROMIUM CONTAMINATED SOIL**MUHAMMAD YAHYA KHAN^{*}, HAFIZ NAEEM ASGHAR, MUHAMMAD USMAN JAMSHAD AND ZAHIR AHMAD ZAHIR***Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad-38040, Pakistan**^{*}Corresponding author's email: yahya.1311@hotmail.com*

Chromium is one of the heavy metals which has harmful effects on human health and agriculture. The higher concentration of Cr(VI) in the plant root zone affects many physiological processes and inhibits plant growth. Plant growth promoting rhizobacteria (PGPR) can improve plant health in contaminated soil as well as convert Cr(VI) to less toxic Cr(III). In this study, 180 Cr(VI) tolerant bacteria were isolated and after screening 10 efficient bacteria capable to work under chromium stress conditions were selected. Wheat (*Triticum aestivum* L.) seeds were inoculated with selected bacterial isolates and sown in Cr(VI) contaminated (20 mg kg⁻¹) pots. Results showed that Cr(VI) contamination significantly suppressed the plant growth and development. However, inoculation improved plant growth parameters significantly compared to uninoculated plants. In inoculated pots Cr(VI) contents were decreased in soil upto 62% while plant analysis for Cr(VI) revealed that inoculation decreased uptake and translocation of Cr(VI) from soil to the aerial parts of plant. Concentration of Cr(VI) was upto 36% less in roots and 60% less shoots as compared to uninoculated plants grown in contaminated pots.

OPPP 29

EFFECT OF AZOSPIRILLUM INOCULATION ON MAIZE (ZEA MAYS L.) UNDER DROUGHT STRESS**QUDSIA BANO¹, NOSHIN ILYAS^{1*}, ASGHARI BANO², NADIA ZAFAR¹, ABIDA AKRAM¹,
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Azospirillum strains isolated from water stressed conditions can mitigate drought effects when used as inoculants. In this context, the research was designed to study the effects of *Azospirillum lipoferum* strain (Accession no. GQ255949) inoculation on biochemical attributes and growth of maize plant under drought stress. Effect of seed inoculation and rhizosphere inoculation were studied in two varieties of maize, which were subjected to drought stress at vegetative stage. Water deficiency affected accumulation of free amino acids, soluble sugars, proline and soluble protein contents. However, seed inoculated plants had an increased accumulation of 54.54 percent and 63.15 percent free amino acids and soluble sugars respectively, while rhizosphere inoculated plants showed 45.45 percent increase in free amino acids and 31.57 percent increase in soluble sugars as compared to control. The concentrations of soluble proteins on the contrary decreased in the similar order. The plants growth aspect i.e. shoot and root fresh weight, shoot and root dry weight, shoot length and root length, also showed results in consistence with the biochemical attributes. Thus *Azospirillum* strain showed promising effects and can be a potent inoculant for maize that can help the crop to endure limited water availability.

OPPP 30

**A MODERATELY BORON-TOLERANT CANDIDATUS NOVEL SOIL BACTERIUM
LYSINIBACILLUS PAKISTANENSIS SP.NOV.CAD., ISOLATED FROM SOYBEAN
RHIZOSPHERE (GLYCINE MAX L.)****RIFAT HAYAT^{1, 2, 3*}, IFTIKHAR AHMED^{2*}, YESEUL SIN⁴, JAYOUNG PAEK⁴, MUHAMMAD EHSAN^{1, 2},
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A Gram-positive, motile, rod-shaped, endospore-forming and moderately boron (B) tolerant novel candidatus strain, designated as NCCP-54^T, was isolated from rhizospheric soil of soybean (*Glycine max* L.) sampled from the experimental area of Research Farm, PMAS Arid Agriculture University, Rawalpindi, Pakistan. To delineate its taxonomic position, the strain was subject to polyphasic characterization. Cells of the strain NCCP-54^T can grow at 10–45°C (optimum at 28°C) at pH ranges of 6.5–9.0 (optimum at pH 7.0) and in 0–6% NaCl (w/v) in tryptic soya agar medium. It can also tolerate 150 mM boric acid in agar medium; however, optimum growth occurs in the absence of boric acid. Based on 16S rRNA gene sequence analysis, strain NCCP-54^T showed highest similarity to *Lysinibacillus xylanilyticus* KCTC13423^T (99.1%), *Lysinibacillus fusiformis* KCTC3454^T (98.5%), *Lysinibacillus boronitolerans* KCTC13709^T (98.4%), *Lysinibacillus parviboronicapiens* KCTC13154^T (97.8%), and *Lysinibacillus sphaericus* KCTC3346^T (97.5%) and less than 97% with other closely related taxa. The level of DNA–DNA relatedness between strain NCCP-54^T and the type strains of genus *Lysinibacillus* was <27 %. Strain was also studied chemotaxonomically. Whole-cell peptidoglycan of strain NCCP-54^T contained meso-diaminopimelic acid (meso-Dpm) as major diagnostic amino acids instead of lysine-aspartate (Lys-Asp) which is the characteristic of the genus *Lysinibacillus*. The major polar lipids were diphosphatidylglycerol, phosphatidylglycerol and phosphatidylethanolamine. MK-7 was the predominant menaquinone. The major cellular fatty acids were iso-C_{15:0} (30.29%) followed by iso-C_{16:0} (25.59%) and C_{16:1ω7} alcohol (16.24%). The G + C contents of the strain is 37 mol%. The chemotaxonomic characteristics of the candidatus novel strain matched those described for the members of genus *Lysinibacillus* except diagnostic amino acids contained in peptidoglycans. Phenotypic and phylogenetic analyses thus indicate that strain NCCP-54^T may represent a novel candidatus status of species in the genus *Lysinibacillus*, for which the name *Lysinibacillus pakistanensis* is proposed. The type strain is NCCP-54^T (DSMZ 24784^T = KCTC=13795^T). The DDBJ/EMBL/GenBank accession number of the 16S rRNA gene sequence of strain NCCP-54^T (DSMZ 24784^T = KCTC=13795^T) is AB558495.

OPPP 31

INFLUENCE OF DROUGHT APPLIED AT DIFFERENT GROWTH STAGES ON THE YIELD AND QUALITATIVE TRAITS IN MAIZE

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Drought has been shown to affect both quantity and quality of yield in different crop species. A field experiment was conducted at Ayub Agricultural Research Institute, Faisalabad, to assess whether drought applied at various growth stages could affect kernel yield and quality differently in maize (*Zea mays* L.) variety Agaiti-2002. There were four drought stress treatments i.e., withholding water at vegetative, silking or grain filling stage and normal irrigation (no stress). The results showed that withholding water at vegetative stage was very effective in increasing protein, total amino acids, total soluble sugars, glucose and sucrose contents in kernels of maize. In contrast, drought applied at kernel-filling stage increased total free amino acids, total phenolics, and activities of catalase and ascorbate peroxidase in maize kernels. Although drought decreased maize kernel yield at all developmental stages, the decrease was more pronounced at silking stage. Drought stress at vegetative stage improved kernel quality in maize. Taken together, the results suggested that incidence of drought should be avoided at silking stage to minimize yield losses and decrease in kernel quality in maize.

OPPP 32

OIL YIELD, FATTY ACID PROFILE, SEED YIELD AND YIELD ATTRIBUTES OF SUNFLOWER AS INFLUENCED BY AUTUMN PLANTING CONDITIONS IN ISLAMABAD

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Field experiments were conducted at National Agricultural Research Center, Islamabad during Autumn 2000, to explore the role of temperature on oil contents, fatty acids composition and heat units accumulation of local sunflower hybrids. Fourteen sunflower hybrids (Hysun-33, SMH-9902, SMH-9903, SMH-9904, SMH-9905, SMH-9906, SMH-9908, SMH-9909, SMH-9910, SMH-9911, SMH-9912, SMH-9913, SMH-9914, and SMH-9915) were sown in autumn season in randomized complete block design with four repeats under field conditions. Significant variation ($p < 0.05$)

was found among the sunflower hybrids for oil contents, oil compositions, heat unit accumulation, yield and yield components. Significantly highest oil contents and oil quality (highest linoleic acid %) were recorded by sunflower hybrid SMH-9914. On average Hysun-33, SMH-9910, SMH-9902 and SMH-9912 performed best for plant height, head diameter and achene yield plant⁻¹. It was concluded from the above study that the hybrid which accumulated higher heat units were late maturing, but hybrid with lesser heat units were early maturing. It was also perceived that temperature positively influence the oil quality of sunflower hybrid under autumn sown condition.

OPPP 33

DIFFERENTIAL GROWTH AND PHOTOSYNTHETIC RESPONSES BUT SIMILAR PATTERN OF METAL ACCUMULATION IN SUNFLOWER (*HELIANTHUS ANNUUS* L.) CULTIVARS AT ELEVATED LEVEL OF LEAD AND MERCURY

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Influence of lead and mercury levels (100 & 300 mg/Kg soil) on three sunflower cultivars (DK-4040, Hysun-33 & NK-278) was assessed by analyzing germination, various growth attributes (fresh and dry weights of root and shoot and plant height) and photosynthetic traits (leaf area, chlorophyll *a*, *b* and total) along with carotenoids. Bioaccumulation of metals in plant tissues were assessed by Atomic Absorption Spectroscopy (AAS). Both lead and mercury at a concentration of 100 mg/Kg of soil did not significantly influence the attributes studied. However, the most elevated level of metals (300 mg/Kg of soil) had caused a significant reduction of growth and pigments. Biomass production, leaf area, photosynthetic pigments and carotenoids content appeared to serve as potential indicators for metal tolerance. The results indicated distinct responses of the cultivars as well as differential effects of the tested metals. Among the cultivars, DK-4040 had consistently showed a better threshold for both metals at all levels as it excelled for 11 traits for mercury and 8 for lead. Hysun-33 also showed some tolerance while, NK-278 appeared to be a sensitive cultivar for most of the attributes in the presence of lead and mercury. The elevated levels of lead appeared to be more injurious to plants as compared with mercury for Hysun-33 and NK-278. The greater toxicity of lead can be attributed to translocation of metal from the roots to the aerial tissues. The ability of DK-4040 for sustainable growth, integrity of chloroplast, existence of a non enzymatic defense and restricted transfer of metal to above ground tissue seem to provide a compatible strategy for heavy metal tolerance. Based on the bioaccumulation of lead and mercury the cultivars can be placed among metal excluders.

OPPP 34

CHITINOLYTIC ACTIVITY OF INDIGENOUS *TRICHODERMA* SPP. AGAINST DIFFERENT FUNGAL PHYTOPATHOGENS

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The chitinolytic assay were used against the different fungal phytopathogens isolated. The different *Trichoderma* spp. TMK5, TMK6, TMK8, TMK9, TMK20, TMK21, TTK3, TTK5 and TTK6 were then screened for their chitinolytic activity on chitin synthetic medium (pH 4.7). Chitinase activity was identified due to formation of purple colored zones. Color intensity of the zones were taken as the criteria to determine the chitinase activity. TTK5 showed the highest chitinase activity followed by TMK5, TMK20, TMK21, TTK3 and TTK6 on that specific medium. The above *Trichoderma* spp. were then subjected to enzyme extraction on modified Richards's medium. *Trichoderma* spp. TMK21 showed the highest N-acetyl- β -D-glucosaminidase enzyme activity of 0.017 μ mol/ml/min. Endochitinase activity was measured by reduction of suspension of colloidal chitin. The TMK9 showed highest endochitinase activity. The highest enzyme unit was found in TMK20 (0.503 EU) while the lowest enzyme unit was found in TMK9 (0.033 EU). The partially purified enzymes were then used against the isolated fungal phytopathogens from the indigenous diseased vegetables (Onion, Green Chili, Okra, Ridge Gourd, Bottle Gourd, Bitter Gourd, Eggplant and Spinach). The fungal pathogens isolated included *Alternaria* spp. *Aspergillus* spp. and *Fusarium* spp. The chitinolytic enzymes extracted from *Trichoderma* spp. were effective against the mentioned phytopathogenic fungi and the correct combination of chitinase enzymes may increase in vitro antifungal activity.

OPPP 35

MORPHO-PHYSIOLOGICAL EVALUATION OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) GENOTYPES FOR IRON DEFICIENCY TOLERANCE

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Iron (Fe) deficiency is one of the major yield limiting factors in groundnut. The soils of Pothwar (90% of groundnut production area in Pakistan) are calcareous in nature, thus groundnut is exposed to Fe deficiency. Seeds of twenty varieties/ advance breeding lines of groundnut were collected from Barani Agricultural Research Centre (BARI), Chakwal and National Agriculture Research Center Islamabad to evaluate Fe deficiency responses. Pot experiment was conducted at PMAS-Arid Agriculture University Rawalpindi, arranged in completely randomized design. Seeds were germinated in pots with 1:1 soil to sand ratio with added recommended NPK fertilizer. Fe-EDTA (0.1mmol/L) was supplemented in Fe sufficient plants, however, no additional Fe was applied to Fe deficient plants. Physiological parameters such as chlorophyll content, active and total Fe contents were recorded for each genotype under Fe deficient and Fe sufficient conditions. Morphological parameters including pod number per plant, pod weight per plant, seed number per plant and seed weight per plant were recorded at harvesting stage. Genotypes were ranked by multivariate cluster analysis. Data showed that Bari-2000 and Chakori are among the Fe stress tolerant genotypes while Golden and Lish were among the Fe deficiency intolerant genotypes. Relative values for chlorophyll content ranged from 39% in Lish to 94% in Bari-2000. Total Fe content was 48% in Lish and 66% in Bari-2000. Relative value for Biomass produced by Chakori was 85% and by Golden 66%. The genotypes ranked best on the basis of morpho-physiological parameters will be helpful for making recommendations to groundnut farmers of the Pothwar region.

OPPP 36

INOCULATION OF *RHIZOBIUM LEGUMINOSARUM* WITH ACC-DEAMINASE CONTAINING PGPR FOR IMPROVING GROWTH, NODULATION AND YIELD OF LENTIL

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Lentil is a good source of protein and an important Rabi crop in Pakistan. There is a symbiotic relationship between legumes and rhizobia which result in the formation of nodules on roots and fix atmospheric nitrogen. Co-inoculation of plant growth promoting rhizobacteria (PGPR) containing ACC-deaminase with rhizobium has been reported to affect the growth and yield of legumes by creating additional infection sites as well as suppressing endogenous synthesis of ethylene during the rhizobial infection. A pot experiment was conducted to evaluate the potential of *Rhizobium leguminosarum* and ACC-deaminase containing PGPR for improving growth, nodulation and yield of lentil. For that, three pre-isolated strains of *Rhizobium leguminosarum* (LBR2, LCR1 and LLR3) and three of PGPR (LB5, LC3 and LC4) were acquired from the Soil Microbiology and Biochemistry Laboratory, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad and were evaluated for their efficiency separately as well as in combination. Results obtained from the experiment showed that the combination of rhizobium and PGPR (LC3*LLR3) performed overwhelmingly better than other treatments and control as well, followed by LB5*LLR2 and LC4*LLR2 combinations. More than 100% and 88% increases were observed in number of nodules and nodule fresh weight, respectively, by combination LC3*LLR3 with respect to the control. While the combination of rhizobia and PGPR (LB5*LLR2) increased almost 42% shoot length and 68% root length than the un-inoculated control and 20-30% increase was observed than single strain inoculation. In case of number of pods per plant co-inoculated treatment LC3*LLR3 showed promising results by increasing 52% yield than control and 10-45% increase than single inoculated and co-inoculated treatments, respectively, while maximum pod dry weight by the increase of 98% was also expressed by the same combination. However, further confirmation and evaluation of the LC3*LLR3 combination at farmer fields is needed.

OPPP 37

CHEMICAL CONTROL OF SUDDEN DECLINE DISEASE OF DATE PALM (*PHOENIX DACTYLIFERA* L.) IN SINDH, PAKISTAN

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The objectives of this research was conducted to find out the efficacy of six different fungicides against *Fusarium solani* soil borne fungus under Invitro for mycelial growth of fungus and field conditions for the control Sudden Decline Disease of Date Palm (*Phoenix dactylifera* L.) on the predominant cultivar of Aseel. The experiment was arranged in Randomized Complete Design (CRD) in the lab. All the systemic fungicides reduced the disease incidence but Bavistin and Topsin-M at high Concentration of 150 gm (PDA) medium is proved to be most effective against soil borne pathogens *Fusarium solani* followed by Ridomil-Gold and Aliette and lowest concentration 50 gm (PDA) medium whereas, contact fungicide Copper oxychloride and Mancozeb failed to inhibit the mycelial growth of *Fusarium solani*.

In field experiment were conducted in the research area of Date palm Research Institute; Shah Abdul Latif University Khairpur. The Carbendazim was found to be more effective than Thiophanate-methyl followed by Ridomil Gold and Aliette in reducing the fungal infection at 15 days interval of date palm orchards. The lowest disease was recorded in plants treated with Copper oxychloride and Mancozeb as compared to untreated date palm.

POSTER ABSTRACTS

PPPP 1

MODELING GROWTH, DEVELOPMENT AND SEEDCOTTON YIELD OF PROMOSING COTTON CULTIVARS AT VARYING NITROGEN INCREMENTS WITH DIFFERENT PLANTING DATES UNDER DSSAT

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CSM-CROPGRO-Cotton Model under DSSAT V 4.0.2.0 was used for dynamic simulation of development, growth and seed cotton yield of four cotton cultivars (CIM-496, CIM-506, NIAB-111 and SLH-284) at varying N increments (50, 100, 150 and 200 kg ha⁻¹ sown at different timings (20 May and 10 June) at three locations (Faisalabad, Multan and Sahiwal). Model performance was satisfactory for crop phenology at all locations with a % error of 1.49 and RMSE 0.68. According to model simulations May sown crop maturity ranged between 172 to 176 days as against June sown which took between 147 to 153 days which were in close proximity with the observed values at three locations. As regards canopy development the simulated and observed values were much closer to each other with low root mean square error ranging from 0.79 to 1.26. Leaf area index prediction was 4.17 compared to observe 4.16 values for May sown and 3.22 to 3.17 in June sown crop. Coefficient of regression for the pooled data was 0.87 but values were higher at different locations. Model overestimated total dry matter at all locations with low RMSE of 289.52 kg ha⁻¹ giving strong relationship of 95 % between simulated and observed data. CROPGRO-Cotton Model over predicted by 8 % of simulated seed cotton yield in early sown than late sown. Root mean square error for low Nitrogen (50 kg ha⁻¹ application crop was 42-198 kg ha⁻¹ than high dose of N (200 kg ha⁻¹) that ranged between 95-195 kg ha⁻¹. Coefficient of regression for different locations ranging from 0.93 to 0.99 and for pooled data 0.994 %. Overall Model performance under DSSAT was good. There is a dire need to assess impact of climate variation on seed cotton yield under various climatic regions to ensure fiber quantity in future.

PPPP 2

EVALUATION OF OILCROP-SUN MODEL FOR DIFFERENT PLANTING DENSITIES AT VARIOUS NITROGEN RATES UNDER SEMI-ARID CONDITIONS OF PUNJAB-PAKISTAN

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Recently the use of crop growth models in crop husbandry has become more common to provide the decisionsupport for farmers. The proposed study was conducted at Agronomy Research Area, University of Agriculture, Faisalabad during the year 2010 to evaluate OILCROP-SUN Model under DSSAT for simulating growth, development and achene yield of Sunflower hybrid S-278. The experiment was laid out using Split Plot Design with two planting densities (8.33 and 5.55 plants m⁻²) and three N rates (100, 125 and 150 kg ha⁻¹). Model accurately predicted the phenological events anthesis and maturity dates very close to observed values with RMSE of 0.82 and 1.76 for anthesis and maturity dates respectively. A strong relationship was recorded between observed and simulated values of achene yield kg ha⁻¹ with coefficient of regression (R²) of 95% for all combined treatments having RMSE of 34.95 kg ha⁻¹. Model predicted slightly lower TDM comparative to observed value for treatment 125 kg N ha⁻¹ with planting density 8.33 plants m⁻². Agreement of index (d-statistics) between simulated and observed data remained high with value of 0.99, likewise time course coefficient of regression (R²) ranged between 0.991 to 0.996. RMSE remained between 266 kg ha⁻¹ to 570 kg ha⁻¹ for total dry matter production. Model poorly evaluated canopy development for simulated and observed LAI values and common regression accounted for 83% of variability in the data. There is a dire need to evaluate OILCROP-SUN Model under various climatic regions of Pakistan and also to quantify the impact of climate change on Sunflower achene yield.

PPPP 3

WATER-SAVING RICE PRODUCTION USING ALTERNATE WETTING AND DRYING TECHNIQUE IN RICE BASED CROPPING SYSTEM IN SINDH, PAKISTAN

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In Asia, water is the most limiting factor for successful rice production. Water-saving planting system alternate wetting and drying/AWD was, therefore, studied at farmers' fields for rice cultivation at 9 locations during 2009 and 13 locations during 2010 of district Larkana, Sindh. The technology was evaluated in comparison with the traditional farmers' flooding practice. There were positive correlations among water-saving technology and yield components (productive tillers, 1000-grain weight than that of conventional practice. Average paddy yield was highest (6.04 t ha⁻¹ in 2009 and 6.61 t ha⁻¹ in 2010) in AWD. The lowest yield (5.34 ha⁻¹ in 2009 and 5.64 t ha⁻¹ in 2010) was recorded with the flooded rice. As a result of AWD, 13.20 and 17.06% increase in paddy yield over control was experienced in 2009 and 2010, respectively. A similar trend was observed for almost all the sites. The intervention AWD saved irrigation water by 38.92% and 43.78% during 2009 and 2010 over transplanted rice. The AWD system enhanced rice productivity owing to increased productive tillers and 1000 grain weight for optimal source capacity and sink strength to combat water scarcity situations prevailing under agro-ecological conditions of Sindh, Pakistan.

PPPP 4

POTENTIAL OF RHIZOBIUM INOCULATION TO ENHANCE THE YIELD AND NUTRIENT USE EFFICIENCY OF SPINACH

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PGPR is a group of microbes that exerts positive influence on the plants by producing plant hormones, antibiotics and solubilizing insoluble compounds. Rhizobium sp is also able to colonize the rhizosphere of cereals by stimulating the phytohormones and thus promote the growth of non-legumes. Species of Rhizobium have the potential to produce compounds (auxins, cytokinins, abscisic acid, lumichrome, riboflavin, lipo-chitooligosaccharides and vitamins) that promote plant growth. Spinach is an excellent source of beta carotene, vitamin C, E, and K, folic acid and oxalic acid. Spinach stimulates hemoglobin and red blood cell production. Present study was planned to investigate the potential of Rhizobium on the growth, yield and nutrient use efficiency of spinach. Field experiment was conducted at Soil Bacteriology Section on medium textured soil having pH 7.89, EC 1.4 dS m⁻¹, N 0.028 % and available P 8.1 mg kg⁻¹ soil. Rhizobium was isolated from nodules of chickpea and purified on yeast extract mannitol agar (YMA). Isolate having higher growth hormone level was used for experimentation. There were three fertilizer levels viz. 50-50-60, 75-50-60 and 100-50-60 kg NPK ha⁻¹. Results revealed that bacterial inoculation enhanced the yield parameters considerably at all three levels of fertilizer. Rhizobium inoculation at full fertilizer dose produced the maximum fresh and seed yield i.e. 15821 and 1487 kg ha⁻¹ as compared to control 12083 and 1116 kg ha⁻¹, respectively. Data clearly showed that Rhizobial inoculation significantly enhanced the yield parameters due to efficient nutrient uptake by spinach. It was also observed that increase in yield of spinach is fertilizer rate dependent.

PPPP 5

EXOGENOUSLY APPLIED SILICATE AND ABSCISIC ACID AMELIORATES THE GROWTH OF SALINITY STRESSED WHEAT (*TRITICUM AESTIVUM* L.) SEEDLINGS THROUGH Na⁺ EXCLUSION

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Experiments were undertaken to investigate the role of abscisic acid (ABA) pretreatment and silicate (Si) application, alone or in combination, on the growth of wheat seedlings both under control and saline conditions. Caryopses of two wheat genotypes Kharchia-65 (salt tolerant) and Punjab-85 (salt sensitive) were pre-treated with ABA (10⁻⁵ M) for 24 h. Ten-day-old seedlings were exposed to 100 mM NaCl with or without 3 mM Si for 16 days. The results illustrated that exogenously applied Si alone as well as with ABA significantly improved growth by reducing Na⁺ concentration and Na⁺/K⁺ ratio in both wheat genotypes. Moreover, Si and ABA application enhanced chlorophyll contents and net assimilation rate of NaCl stressed wheat genotypes through up-regulation of antioxidative enzyme level. The Na⁺ entering in the shoots through an apoplastic route was estimated in wheat seedlings with the fluorescent tracer, the trisodium salt of 8-hydroxy-1, 3, 6-pyrenetrisulphonic acid (PTS). The genotype Punjab-85 maintained higher Na⁺ in its apoplast as compared to Kharchia-65 under NaCl salinity. The results suggested that Si alone or with ABA significantly reduced bypass flow in both genotypes; however, pretreatment with ABA only significantly reduced bypass flow in Punjab-85. We conclude that silicon should be seen as an essential nutrient for wheat, and the seed soaking with ABA enhances salt tolerance, mainly for sensitive genotypes of wheat.

PPPP 6

AMELIORATION OF SALT STRESS IN WHEAT (*TRITICUM AESTIVUM* L) BY FOLIAR APPLICATION OF NITROGEN AND POTASSIUM

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An experiment was conducted in the Department of Biological Sciences University of Sargodha, Sargodha, Pakistan during the year 2010. Different levels 0, 250, 500 mg/L of Nitrogen and 0, 200, 400 mg/L of Potassium were applied exogenously as a foliar spray to determine whether application of Nitrogen and Potassium could ameliorate the affect of salinity stress on wheat (*Triticum aestivum* L). It composed of three repeats. Each pot for this experiment purpose was filled with 8 kg well mixed soil. Different salinity levels were adjusted in accordance with saturation percentage of soil.

Different attributes from the experiment were collected such as plant height, shoot and root length, shoot, root fresh and dry weight, number of leaves, chlorophyll a, b and total, different ions contents and grain yield/ plant. Overall, salinity reduced the growth and development by effecting on the metabolic processes of plant and also affects the hormonal system of plant. Foliar spray of potassium and nitrogen mitigated the effect of salinity. When potassium and nitrogen was applied as foliar spray on the wheat plant it reduced the effect of salinity and increased the plant height under saline and non saline conditions. Similarly, positive influence of potassium and nitrogen was noted in shoot and root fresh and dry weight. Salinity also affects the chlorophyll contents but the application of potassium and nitrogen as foliar spray increased the chlorophyll contents under saline and non saline conditions. In case of ions contents foliar application of potassium and nitrogen also help to decrease the toxicity of sodium and increase K^+ concentration in shoot and roots. Similarly, grains yield is also decreased by salinity but foliar application of potassium and nitrogen mitigated the salinity effect on grains yield.

PPPP 7

ECTOMYCORRHIZAL DIVERSITY OF HIMALAYAN SPRUCE (*PICEA SMITHIANA*)

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This study focuses on the diversity of ectomycorrhizae associated with Himalayan spruce (*Picea smithiana*) from Himalayan forests of Pakistan. This tree grows at an altitude of 2500m-3300m and mostly present in mixed forests of *Pinus*, *Cedrus* and *Abies*. It is colonized by ectomycorrhizal fungi which were identified by morpho-anatomical and rDNA-ITS based techniques. Belowground ectomycorrhizal morphotypes were sampled, processed, identified and characterized. Results indicated that *Tomentella lapidum*, *Humaria hemispherica* and other unidentified basidiomycetous fungi were found to be involved in mycorrhizal association with *Picea*. Detailed morpho-anatomic descriptions of these mycorrhizae have also been provided. This investigation is the addition to the mycorrhizae of *Picea smithiana* and molecular techniques have been used to investigate the fungal diversity associated with it.

PPPP 8

GREEN MOULD AS POTENTIAL SCAVENGER OF CR(VI)

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Adsorption capability of indigenous soil fungus of Pakistan i.e. *Trichoderma harzianum* was determined through laboratory bioassays. Experiments were conducted by taking 0.1 g of powdered fungal biomass in 100 mL (25 mg L⁻¹) of metal solution kept at 150 rpm for 3 hrs. Results showed adsorption efficiency of *T. harzianum* biomass was 65% for Cr(VI). Langmuir and Freundlich isotherm models were used to explain this phenomenon. The solution pH selected in the range of 2-10 followed downward trend for metal uptake as maximum removal efficiency (77-80%) was noticed at pH 2-3. FTIR highlighted the involvement of amine (-NH₂) and hydroxyl (-OH) groups in adsorption process. Adsorption/desorption trials with four acids indicted that desorption of Cr(VI) follow the order of: CH₃COOH > HCl > HNO₃ > H₂SO₄. Adsorption based trials summarized that fungal biomass are potential, violent and inexpensive biomaterial with viable application in the removal of Cr (VI) from aqueous solution

PPPP 9

ICPS-87- RISK ASSESSMENT OF LEAD TOXICITY THROUGH GROWTH PERFORMANCE OF WHEAT PLANTS IN PUNJAB, PAKISTAN

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Present study was carried out to ascertain the effects of lead (Pb) on wheat (*Triticum aestivum* L. cv. Shafaq-2006). Different concentrations of lead nitrate (viz., 100, 200, 400, 600, 800, 1000 mg/Kg of soil) were applied to potted wheat plants while control plants were grown without lead nitrate in the soil. Plants grown in all Pb treatments were weak in texture and not much healthier comparative of control. It was found that maximum concentrations of Pb significantly reduced various attributes of growth, for instance, germination (>30%), plant fresh & dry weights (>70%), vigor index (89%), tolerance index (84%), leaves per plant (41%), and root fresh & dry weights (>50%) compared to control. Similarly, photosynthetic rate, transpiration rate and stomatal conductance of Pb-treated plants were reduced >70% in each, while chlorophyll (a, b, total) and carotenoids were reduced by >40% than control ones. In addition, decrease in protein contents (81%), phosphorous (60%) and potassium (55%) were also recorded. Pb accumulation was highly significant in shoots (9800%), roots (4600%), and in seeds (119%) comparative of control counterparts. Yield parameters like number of seeds per plant, seed weight per plant, 1000-seed weight and harvest index were reduced by 90%, 88%, 44% and 61%, respectively in Pb-treatments. It was concluded that lead seriously affects growth and yield performance of wheat crop and can be harmful if affected biomass are consumed by living organisms.

PPPP 10

ACCLIMATION OF CIMMYT WHEAT (*TRITICUM AESTIVUM* L.) LINES TO RAINFED ENVIRONMENT: WATER USE EFFICIENCY AND GRAIN YIELD

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In the present study, the performance of thirty (30) CIMMYT wheat (*Triticum aestivum* L.) lines with a local check were evaluated under rainfed environment. The data were recorded at the three different stages of the crop for plant dry mass production, dry mass production of leaves, amount of chlorophyll, leaf area and water use efficiency etc. At the maturity stage, the data for grain yield /ha and 100 grain weight were recorded. Results indicated that four wheat genotypes showed better performance in terms of plant dry matter production and grain yield under rainfed conditions. Among all these high yielding wheat genotypes two produced highest dry matter. It was observed that higher grain yield in CIMMYT wheat genotypes was associated with higher level of leaf chlorophyll, greater leaf area, greater dry mass production and improved water use efficiency of plants under rainfed environment. Furthermore, low yielding genotypes showed greater reduction in dry mass production and leaf area whereas, chlorophyll content of plants were at the moderate level. The local check, Faisalabad-08 showed reduced yield as compared to high yielding CIMMYT wheat lines. Significant reduction in leaf area and leaf chlorophyll content under rainfed environment was associated with reduced yield in this wheat genotype.

PPPP 11

SEED FERNS FLORA FROM EARLY PERMIAN (ARTINSKIAN), AMB FORMATION, WESTERN SALT RANGE, PAKISTAN

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This research article deals with the Seed Ferns flora from Early Permian (Artinskian), Amb Formation, Western Salt Range, Pakistan. The formation is richly fossiliferous consisting of sandstone, limestone and shales mainly. Recovered palynoflora is in good state of preservation. Out of total recovered thirty eight (38) form species and twenty two (22) form genera, Seed Ferns are represented by twelve (12) form species belonging to four (04) form genera. Among these Monosaccates, *Parasaccites* is most abundant genus and is represented by three (03) form species i.e. *Parasaccites ovatus*, *P. perfectus* and *P. invasus*, while *Plicatipollenites* represents *Plicatipollenites maculatus* and *P. densus*. *Playfordiaspora cancellosa* and *Potoniesporites densus* are also recorded in sustainable amount. Resolution of recovered data in term of palaeovegetational complex indicates existence of Glossopteroids and Gangamopteroids as the key floral elements. Palaeoenvironment inferred from palynological data represents extremely cold humid temperate climatic conditions existing at the time of deposition of Amb Formation. Based on exine color of palynomorphs, Munsell Prod Value varies between 13800-15810 which is near to oil and gas generating window.

PPPP 12

PLANT GROWTH PROMOTION AND SEED QUALITY ENHANCEMENT OF ETHIOPIAN MUSTARD AS INFLUENCED BY BIOINOCULANTS SUPPLEMENTED WITH MINERAL FERTILIZERS

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The present study was aimed to find out the impact of plant growth promoting rhizobacteria (viz. *Azospirillum brasilense* and *Azotobacter vinelandii*) either alone or in combination with different doses of chemical fertilizers on growth, seed yield and oil quality of *Brassica carinata* (L) cv. Peela Raya to obtain improved yield and good quality biodiesel. The chemical fertilizers viz. urea and diammonium phosphate (DAP) were applied in different doses as [Full (Urea 160kg/ha + DAP 180 kg/ha), half (Urea 80 kg/ha + DAP 90 kg/ha), quarter (Urea 40kg/ha + DAP 45 kg/ha)] respectively and PGPR were applied as seed inoculation. Maximum increase (48%) in chlorophyll contents was recorded in *A. vinelandii* supplemented with full dose of chemical fertilizers whereas; maximum leaf protein and leaf carotenoids (57% and 34%) were measured in full dose of chemical fertilizers. *A. brasilense* supplemented with full dose of chemical fertilizers improved number of branches plant⁻¹, number of seed siliqua⁻¹ and 1000 seed weight by 62%, 48%, and 45% respectively. *A. brasilense* and *A. vinelandii* with quarter dose of chemical fertilizers increased the seed oil content by 4%. Maximum increase in seed protein (17%) was recorded in *A. brasilense* in combination with full dose of chemical fertilizers. *A. brasilense* supplemented with half dose of chemical fertilizers showed 9% reduction in glucosinolate contents. Application of *A. brasilense* with quarter dose of chemical fertilizers significantly improved the oleic acid and linolenic acid contents by 24% and 33% respectively, whereas, significantly decreased (36%) the oil erucic acid content at P<0.05. It is inferred that PGPR in combination with half and quarter doses of chemical fertilizers can be used as bioinoculant in order to save 75% chemical fertilizer.

PPPP 13

EFFECTS OF MICROBES IN BIOFILM AND THEIR EFFECTS ON PLANT GROWTH

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The present study was conducted to characterize microbial isolates associated with biofilms and their effect on the wheat growth when used as bio-inoculants. The microbial mats were collected from stream of Quaid-i-Azam University. The biofilm analysis recorded three types of isolates named depending on the size and color of the colonies ASS, ASL and ASY. The crystal violet staining was used to differentiate between free floating and bound cells in the broth culture. The broth culture supplemented with 3 levels of 2 broad spectrum fungicide viz. Redomil and Dithane was used to inoculate with each isolate. The optical density was determined of the liquid culture after 24hr incubation of culture at 37°C was taken as measure of the growth of the isolates. The results revealed that the growth of isolated strains ASL and ASY were increased with increase in the level of both fungicides up to 100µL/L. The efficiency of these strains were checked on growth of wheat plant was conducted in Petri plates as well as in pots. The results revealed that ASY strain was more stimulatory (in culture without the fungicide supplement) than ASS and ASL strains in terms of shoot and root length, shoot and root fresh weight and shoot and root dry weight. Strain ASS found to exhibit significant interaction with of fungicide Redomil. The wheat seedlings inoculated with broth culture isolates supplemented with fungicide Redomil gave better results. The efficiency of the microbes with the combined use of bioinoculants and fungicide, which may be helpful for future recommendation to protect plants against fungal diseases.

PPPP 14

EFFECT OF PRE-ANTHESIS ASCORBIC ACID APPLICATION ON THE POST-ANTHESIS HIGH TEMPERATURE STRESS TOLERANCE IN SPRING WHEAT

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High temperature stress at anthesis stage is the major environmental constrain that significantly reduces desired crop production, particularly in self-pollinated crops like wheat. A number of studies have shown the involvement of ascorbic acid (AsA) in both redox-associated and developmental processes in plants. Therefore, the present study intended to determine the effects of pre-anthesis AsA applications against post-anthesis high temperature stress (40/25°C, day/night temperatures) tolerance in two wheat cultivars i.e., Shafaq-06 (temperature tolerant) and Fsd-08 (temperature intolerant). The seeds were sown in small pots filled with 3 kg sandy loam soil and placed in a Plant Growth Incubator at 25/15°C day/night temperatures. At pre-anthesis stage, ascorbic acid (0, 0.5 and 1.0 mM) was foliarly sprayed. Afterwards, the plants were divided into two groups and the one group was given high temperature stress (40/25°C, day/night temperatures, respectively) while the other group remained at normal temperature (25/15°C, day/night temperatures, respectively). High temperature stress increased oxidative stress and decreased membrane stability index leading to decrease in grain yield production in wheat. However, the application of AsA decreased H₂O₂ and malondialdehyde contents and increased leaf water contents and membrane stability under high temperature stress. Exogenous AsA considerably increased the ear length, number of spikelets per ear, number of grains per ear and grain yield under high temperature stress, particularly in temperature sensitive wheat cultivar.

PPPP 15

EFFECT OF DROUGHT STRESS ON GROWTH AND FLOWERING OF MARIGOLD (*TAGETES ERECTA*)

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Drought is an important abiotic stress that limits the plant growth and productivity. A pot experiment was conducted by using complete randomized design (CRD) with three replications (each replication contained three pots) to evaluate morphological and physiological attributes that can be used for characterization of drought tolerance in two cultivars of Marigold (Super Giant & Inca F1). Four drought levels at 100% (control), 80%, 70% and 60% field capacity were maintained throughout the experiment. Morphological characteristics including plant height (cm), root length (cm), number of leaves/plant, leaf firing percentage, leaf area (cm²), plant quality, shoot fresh and dry weight (gm), root fresh and dry weight (gm) and root-shoot ratio for fresh and dry weights were studied. Physiological parameters studied, were net CO₂ assimilation rate, transpiration rate, stomatal conductance (gs), sub-stomatal conductance, leaf water potential (MPa), water use efficiency (WUE), leaf water potential and chlorophyll content. Data were analysed using ANOVA technique and means were compared using least significant difference test (LSD) at P<0.05. Results showed that, overall plant quality of cultivars decreased with the progression of drought stress but "Inca F1" performed best as compared to other cultivar for all attributes studied.

PPPP 16

MOLECULAR DIAGNOSTICS OF FOODBORNE PATHOGENS (*SALMONELLA* SP.)

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Foodborne illness became the most prevalent among the human population. *Salmonella* species are one of the most significant foodborne pathogens all over the world but contributes to great morbidity and mortality in under developed countries. *Salmonella enterica* subsp. *enterica* serovar *enteritidis* and *typhimurium* are among the most common agents causing diarrhea in domestic animals and humans. The aim of the study was to develop a sensitive and rapid PCR based method for identification and detection of *Salmonella typhimurium* in chicken and chicken products from the different regions of Lahore. Conventional detection of *Salmonella* was based on the microbiological approaches by using selective media. For the rapid and reliable detection, molecular approaches were used. Total 120 samples were analyzed. The presence of *Salmonella typhimurium* in collected samples was assessed by performing the pre-enrichment followed by PCR. Two genes i.e. FimA and Sent were selected for the diagnostics of *Salmonella*. In this study *Salmonella* was detected in 3.3% of the samples taken from the poultry indicating the presence of the pathogens in poultry in Lahore region.

PPPP 17

EFFECT OF EXOGENOUS APPLICATION OF NATURAL AND SYNTHETIC GROWTH ENHANCERS ON QUANTITATIVE AND QUALITATIVE ATTRIBUTES OF TOMATO (*LYCOPERSICON ESCULENTUM*)

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In pot experiment, soil and foliar application of a natural and synthetic plant growth enhancer i.e., moringa leaf extract (MLE) and benzyl amino purine (BAP), respectively was estimated for growth and development of tomato. The treatments were control (distilled water), MLE0 (100 % pure MLE), MLE10, MLE20 and 30 (10, 20 and 30 times diluted MLE, respectively) and BAP (50 mg L⁻¹). The foliar application of BAP and MLE30 enhanced the number of vegetative and flowering branches of tomato as compared to other treatments. Whereas, soil application of MLE 30 and MLE 20 enhanced the vegetative and flowering branches, respectively. Similarly, foliar application of BAP and MLE30 showed maximum flower number and heaviest fruit weight per plant. Exogenous application of BAP or MLE 30 comparatively increased chlorophyll *a* and decreased chlorophyll *b* contents. Total soluble protein was maximum with BAP, MLE 20 and MLE 30 either soil or foliar application. In comparison, foliar spray of MLE 30 recorded maximum contents of enzymatic antioxidants superoxide dismutase (SOD), peroxidase (POD), catalase (CAT), total phenolics and fruit lycopene contents in tomato. Foliar application of MLE or BAP was more effective for tomato growth and development as compared to soil applied.

PPPP 18

AGROBACTERIUM TUMEFACIENS MEDIATED OPTIMIZATION OF TRANSFORMATION IN *POPULUS DELTOIDES*

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Populus deltoides also known as eastern cottonwood is native to North America and belongs to family Salicaceae. Because of its fast growth and wood quality the genus *populus* has economical importance for wood, paper and pulp industry. The main goal of the present study was to optimize a protocol for *Populus deltoides* transformation through *Agrobacterium tumefaciens* LBA4404 containing binary plasmid pGA482 with *uidA*(β -glucuronidase or *Gus*) gene under CamV35S promoter and *nptII* gene under *Nos* promoter. Nodal, intermodal and leaf explants from 4-5 months *invitro* plants were used for transformation; transformation was done under different optical densities ranging from 0.3-0.5 of *Agrobacterium tumefaciens* and different conditions of acetosyringone 200 μ M to 400 μ M, infection time and co-cultivation time. Confirmation of transformation was done through *Gus* histochemical staining followed by the selection of transformant on the basis of kanamycin resistance. Highest transformation was observed in leaf explants but the formation of callus was slow, node and internode though showed a little less transformation but the callogenesis was found highest in node and internode explants on CIM containing 2.5 mg/l BAP+2 mg/l NAA. O.D of *Agrobacterium tumefaciens* was effective from range of 0.3-0.5 Infection time and co-cultivation time of 1-2 hour and 1day in dark respectively were found to be best for the transformation.

PPPP 19

IMPACT OF DIFFERENT CULTIVATION PRACTICES BY CITRUS GROWERS ON CITRUS GREENING DISEASE IN SARGODHA, PAKISTAN

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Citrus is one of the highly prized fruit trees in the world. Pakistan ranked 13th among citrus producing country. Citrus is also subjected to virus biotic, and a biotic. Among these disorders virus and virus like disease are limiting factors for citrus production. Citrus greening disease (CGD) is one of the potential factors for low citrus production. These biotic and a biotic factors are also influenced by demographic and extension service which are practical in citrus orchards. A small scale survey in CGD affected citrus orchards of Sargodha, Pakistan was conducted. Survey was based with the aim to analyze the different factors like experience, education, yield, orchard status, citrus greening disease (CGD), citrus psylla, budding height, irrigation, fertilizer, chemical and pesticides used, extension field staff (EFS) visits, awareness about insect pests, harvesting techniques and intercropping. Chi Square was applied to check the association among different factors. There was a statistically significant association observed between orchard status and intercropping with Chi square value=15.00 having p-value of 0.0005531, orchard status and harvesting techniques with Chi square value= 15.00 having p-value of 0.0047. Statistical association of CGD with intercropping was found as Chi square value = 5.1278 having p value of 0.02345, CGD and harvesting technique was found as Chi square 10.833 with p-value of 0.004442 etc. In addition, relationship of farmer experience in citrus growing/cultivation with yield was also computed as $r=0.89$ with $p\text{-value}<.00001$, showing strong positive relationship between experience and yield.

PPPP 20

INTERACTIVE EFFECT OF PHOSPHATE SOLUBLIZING BACTERIA AND RHIZOBIUM INOCULATION ON BERSEEM.

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Co-inoculation of phosphate solubilizing bacteria (PSB) with Rhizobium stimulated plant growth more than their separate inoculation depending upon the soil conditions. Phosphorus is the integral part of plant body and generally deficient in our soils. This situation has certainly brought the subject of phosphate solubilization to the front line and dependence on costly mineral fertilizers is going to be revisited in future. Present study was designed to enhance the yield of berseem through co-inoculation of P-solubilizer and Rhizobium inoculation. Field experiment was conducted at Fodder Research Station, AARI, Faisalabad on a medium textured soil having pH 7.88, EC 1.62 dS m⁻¹, N 0.033%, available P 7.34 mg kg⁻¹ soil and organic matter 0.78%. Recommended dose of fertilizer (30-60 kg NP ha⁻¹) was applied. Rhizobium was screened out on the basis of their growth hormone production potential and P-solubilizer on the basis of P-solubilization extent. Results revealed that bacterial inoculations alone and in combination enhanced the fresh fodder and seed yield significantly. Co-inoculation of Rhizobium and PSB produced 71.90 tones ha⁻¹ compared to un-inoculated i.e. 56.44 tones ha⁻¹. Co-inoculation produced more seeds 664 kg ha⁻¹ compared to un-inoculated i.e. 592 kg ha⁻¹. Co-inoculation enhanced the nodule parameters significantly. Co-inoculation produced higher number of nodules and nodule mass i.e. 37, 0.67 g plant⁻¹ as compared to un-inoculated ones i.e. 19, 0.5 g plant⁻¹. Further studies at farmer fields should be carried out to validate the approach of co-inoculation.

PPPP 21

ISOLATION AND CHARACTERIZATION OF CHLORPYRIFOS DEGRADING BACTERIA FROM THE AGRICULTURAL SOILS

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Pesticides are indispensable to modern agriculture. Chlorpyrifos as an agricultural insecticide has been widely used and caused great pollution. As the chlorpyrifos causes toxicity in the environment, exploration of various chlorpyrifos degrading bacteria to clean up the pollutant is of immense importance. The research work was done on the isolation and characterization of microbial strains capable of degrading chlorpyrifos. Four soil samples were taken from a vegetable farm near Nankana Sahib. Samples were taken from the fields of *Brassica napus*, *Pisum sativum*, *Crocus sativus*, and *Raphanus sativus* having pH 7.4, 7.6, 7.5 and 7.9 respectively. Mineral salt medium and Mineral salt medium supplemented with nitrogen were used for the screening procedure by using enrichment culture technique. Total of eight bacterial strains were isolated on MSM and MSNM. The strains were designated as S1-a, S1-b, S2-a, S2-b, S3-a, S3-b, S4-a, S4-b. Isolated strains were characterized morphologically and biochemically.

All bacterial strains showed maximum growth at the pH 7 except strain S3-b which showed maximum growth at pH 5. Bacterial strains were unable to tolerate pH 10. Effect of temperature on bacterial growth was also studied. All the

bacterial strains showed maximum growth at 37°C. Growth behavior of isolated bacterial strains in mineral salt agar was observed by adding different concentration of chlorpyrifos in the medium. All the bacterial strains were able to tolerate chlorpyrifos up to 200 mg kg⁻¹. Maximum degradation was observed within first three days of incubation. The chlorpyrifos degradation was calculated by using optical density measurements, CFU counts, Thin Layer Chromatography (TLC) and HPLC.

PPPP 22

EFFECT OF DIFFERENT NITROGEN LEVELS AND CUTTING ON GROWTH BEHAVIOR OF DUAL PURPOSE BARLEY

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The availability of green fodder for livestock is one of the most important problems especially in winters. The aim of present study was to evaluate the dual purpose of barley for forage and grain yield. The experiments were conducted at Botanical Garden-Azakhel, University of Peshawar during 2011 by using RCB design with split plot arrangement. Barley was tested against different nitrogen levels (0 kg ha⁻¹, 50 kg ha⁻¹ and 100 kg ha⁻¹). It was found that 50 kg ha⁻¹ N showed maximum seedlings emergence m⁻², fresh and dry biomass, tillers plant⁻¹, leaves plant⁻¹, plant height, 1000 seeds weight and minimum days to emergence while 100 kg ha⁻¹ N displayed maximum tillers m⁻², grains spike⁻¹ and minimum days to maturity. No Cut had maximum fresh and dry biomass, tillers plant⁻¹, leaves plant⁻¹, tillers m⁻², plant height, grains spike⁻¹ and 1000 seeds weight while the cuts imposed significantly reduced all aforesaid parameters. The effect of two cuts was more severe as compare to one cut.

PPPP 23

EFFECT OF SALINITY ON GROWTH AND IONIC COMPOSITION OF ACACIA NILOTICA

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Acacia nilotica is one of those trees which can grow in severe soil and environmental conditions. It is highly resistant to drought and salinity. It has ability not only to tolerate harsh climate, but also plays an important role in the production of animal fodder, fuel-wood, timber, gums and tannins. Salinity problem is very common in Pakistan due to limited rainfall, high evapo-transpiration and high temperature. A pot-culture experiment was conducted to study the growth performance and ionic composition of Acacia nilotica under saline (10, 20 and 40 dS m⁻¹) and non-saline conditions in the wire house of the Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad. Salinity levels were created artificially by the addition of calculated amount of NaCl in the pots. After six months plants were harvested and different physical growth parameters including shoot and root fresh and dry weights, shoot and root lengths, number of leaves, number of branches and stem diameter were determined. After wet digestion Na⁺, K⁺ and Cl⁻ concentrations in root and shoot were determined. Salinity resulted in significant reduction of all the growth parameters whereas the concentration of the Na⁺ and Cl⁻ increased significantly with increasing the levels of salinity.

PPPP 24

PLANT GROWTH ATTRIBUTES OF RICE CULTIVARS UNDER PARACHUTE TRANSPLANTING

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Uprooting of the field raised rice nurseries damages rice roots during transplantation causing the plants suffer establishment shocks during early growth period. Root and shoot growth of Japonica rice (*Oryza stiva* L.) cultivar KS-282 and the Indica rice cultivar Super-Basmati were recorded to compare plant establishment under conventional uprooting/transplanting and thrown seedling (Parachute) methods. Nine rice plants from each planting method were extracted with entire root system to measure root length, number of seminal roots, shoot length, and number of tillers over 45 days of growth period. Uprooting for conventional transplanting reduced 35 % roots and 50 % reduction in the root length for both the rice variety. Generally, the Parachute transplanted seedling had longer roots and greater number of roots and tillers than those by conventionally transplanted seedling over the 45 days after transplanting. Nevertheless, the conventionally transplanted KS-282 attained the same root length as that of the Parachute transplanted whereas the conventional transplanted Basmati had shorter root and fewer tillers than the Parachute transplanted plants. The lowest number of tiller was in conventionally transplanted Super-Basmati and the highest in Parachute planted KS-282. The results suggested that the Super-Basmati being more sensitive to transplanting shocks than KS-282, and an indication of advantage of intact roots in Parachute planting for better plant establishment.

PPPP 25

MOLYBDENUM APPLICATION PROMOTES NODULATIONS AND YIELD OF PEAS

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Molybdenum deficiency affects nodules formation in legumes which is common in acid soil and rare in calcareous soil. But due to intensive cropping systems and lack of Mo in fertilization programme, its deficiency might have occurred in calcareous soil. For this purpose, a field study was designed in RCBD including six treatments and four replication to observe the effect of Mo application on nodulation and yield of peas. The treatments were set as: Control (T₁); 0.07% Mo as a foliar spray (T₂); 0.06% Mo as a foliar spray (T₃); 0.05% Mo as a foliar spray (T₄); 1/8 ounce acre⁻¹ as a seed treatment (T₅); 1 lb acre⁻¹ as a soil application (T₆). The seeds of peas treated with molybdenum (T₅) and soil applied Mo (T₆) increased number of effective nodulations plant⁻¹ (233.00) which enhanced the uptake of N, P, and K concentration (5.30, 0.76 and 3.35 %) in leaf resulting in improving root & shoot ratio (0.2833), pod length (9.10 cm), and pod yield (6.80 t ha⁻¹). However, foliar application of Mo did not show significant results. It was concluded that the best way of Mo application was seed treatment which affected all growth parameters under study and its importance in calcareous soil for leguminous crops cannot be ignored.

PPPP 26

RESPONSE OF MAIZE SEEDLING TO TIME AND CADMIUM APPLICATION

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Heavy metals are serious threats to agricultural productivity. Cadmium affects the every stage of plant development and plant metabolism. The increasing threat of environmental pollution necessitates finding strategies to cope with their ever-increasing adversaries. In view of the changing the ecological conditions mainly related to cadmium, this study was focused on determining the differential responses of two maize varieties, Pak-Afgoi and EV-1098 to cadmium stress. This study conducted in a test chamber, where plants were grown in pots at 28/22°C (day/night) with light/dark cycle of 14/10 h respectively. Fifteen days old seedling exposed to four different levels of cadmium (0.0, 3, 6, 9 mg/kg) for 10 and 20 days of treatments to evaluate the effect of cadmium on plant. Among the growth parameter shoot-root length, shoot-root fresh weight, shoot-root dry weight and leaf area were increased at 0.0, 3, 6 mg/kg levels in EV-1098, reduced in both varieties at the level of 9mg/kg CdCl₂ for 20 days treatments significantly (P=0.05). Chlorophyll a, b and total chlorophyll were reduced at all levels in both varieties, while more reduction at 9mg/kg CdCl₂ in Pak-Afgoi significantly. Total carotenoids were increased in both varieties at the level of 9mg/kg CdCl₂ on twenty day treatments in both varieties particularly in EV-1098 significantly. Relative membrane permeability, hydrogen peroxide, MDA contents and total soluble proteins increased in both varieties particularly in Pak-Afgoi at the level of 9mg/kg CdCl₂ for 10 and 20 days of treatments significantly.

PPPP 27

SOMACLONES DEVELOPMENT FOR HIGHER WHEAT (*TRITICUM AESTIVUM* L.) GRAIN YIELD: GROWTH AND BIOCHEMICAL ATTRIBUTES

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It is the need of the day to renovate or replace the existing wheat genotypes with evolved varieties having attractive agronomic traits to combat the food requirements of ever increasing population. Somaclones, regenerated from immature embryo derived callus are considered the excellent means of improving existing germplasm. The present study was carried out to explore the yield potential of somaclones of a high yielding wheat cultivar, inqalab-91 and to find out the agronomic and biochemical attributes linked with high grain production in these clones. The studies comprised of two phases of experimentations. In the first phase, somaclones of an elite wheat cultivar, Inqalab-91 were developed and petri plate experiments were conducted using fourteen somaclones. Seed germination rate, growth and biochemical attributes (chlorophyll contents, total soluble proteins, and protease and nitrate reductase activity) were recorded. In the second phase, field experiment was carried out and data for various growth and physiological characteristics were recorded. The results indicated that the somaclones producing higher grain yield also exhibited higher value for other yield components such as, total number of grains per plant¹, 100 grain mass, number of spikes plant¹ and number of grains spikelet¹. These somaclones also produced higher plant biomass at seedling, booting and milk development stages. Flag leaf area and plant biomass were positively related with grain yield. Higher protease and nitrate reductase activity at the seedlings stage, however, did not show any positive association with grain yield. All the fourteen somaclones did not differ significantly for seed germination rate and seedlings chlorophyll levels.

PPPP 28

PHYSIOLOGICAL AND BIOCHEMICAL RESPONSES OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL) TO HIGH TEMPERATURE STRESS

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High ambient temperature at the reproductive growth stage is one of the limiting factors reducing crop yield. Heat stress modifies distribution of amino acids and affects reproductive processes like gametes viability, fertilization and fruit set. Proline is one of the most abundant amino acids in reproductive parts of tomato and is considered to have a role in heat tolerance of crop plants. In the present study, 3 tomato genotypes; Suncherry, Walter and CLN-2498d were evaluated for their heat-stress response at the reproductive stage. Heat reduced number of fruits per plant, fruit size, number of seeds per fruit, pollen viability, relative ovule viability and proline accumulation in reproductive parts. It reduced fruit set in tomato genotypes Suncherry, Walter and CLN-2498d by 36%, 39% and 15% respectively. The total fruit weight per plant was highest in CLN-2498d followed by Walter and Suncherry. Heat-stress reduced the fruit size and the number of seeds per fruit in all the genotypes and most in Suncherry. It also reduced the male and female gametes viability. The relative reduction in pollen viability was greater in Suncherry and Walter and least in CLN-2498d where the ovule viability was least reduced in the Walter. Heat-stress enhanced proline accumulation in the leaf and decreased in reproductive parts. Increase in leaf proline and decrease in flowers and floral parts was greater in Suncherry and Walter and least in CLN-2498d. The pollen proline was highest in CLN-2498d and least in Suncherry.

PPPP 29

INTERACTIVE EFFECTS OF SALINITY AND BORON TOXICITY ON GROWTH AND PHYSIOLOGICAL PARAMETERS OF MAIZE

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Boron (B) is present at toxic concentration in soils that have been contaminated with B-contaminated water, sewage sludge or fly ash. Salinity and boron toxicity are also commonly present in soils of the arid and semi arid regions of the world. Despite the common existence of salinity and boron toxicity in many parts of the world, very little research has been done to investigate the interaction of salinity and boron toxicity. This study was conducted to investigate the growth and ionic composition of different maize genotypes under combined stress of NaCl salinity and B toxicity. Two salt-sensitive (EV-78, R-2303) and two salt-resistant (KS-64, R-2315) maize genotype were grown in nutrient solution in plastic tanks. One week after transplanting, salinity level (0 and 75 mM NaCl) with or without B level (2.5 mM and 5 mM) was developed in the solution of respective treatment tanks. The experimental design was split plot with three replications. Root and shoot fresh and dry weights and, root and shoot lengths were decreased significantly with salinity and boron toxicity alone and in combination. Salinity significantly increased shoot Na⁺ concentration and the addition of 5 mM B under saline conditions further increased the Na⁺ concentration as compared to salinity alone. K⁺ concentration was decreased significantly with salinity and application of B and this reduction is more pronounced in salinity + 5 mM boron treatment. There was significant increase in B concentration with increasing levels of toxic boron under non-saline as well as saline conditions. This study shows that toxic shoot ionic composition is mainly responsible of higher growth reduction of maize genotypes due to salinity x boron interaction. This study also shows that salt-resistant maize genotype EV-78 maintained better leaf ionic composition under salinity as well as salinity x boron toxicity and performed better than the salt sensitive genotype KS-64. Therefore the maize genotypes selected for salinity resistance may also be used for salinity x boron toxicity affected soils.

PPPP 30

CADMIUM TOXICITY ATTENUATION BY PARTHENIUM: A CASE STUDY

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Environment is depleting gradually and persistently due to anthropogenic activities and industrialization. Environmental pollution is a major concern regarding health and food security at world level. Organic and inorganic substances contaminate water, air and soil resources and render them unfit for agriculture and other purposes. Among them, different heavy metals acting as serious pollutants are released by industrial units, mining and burning of fossil fuels. These invade into the soil and water bodies after entering into wastewater. Thus, wastewater containing heavy metals contaminate flow channel, neighboring soil, catchment area and underground water through seepage and lateral flow. A study was designed to be used as model to eradicate heavy metals from waste-water, soils and making re-usable soils for agriculture. It involves phytoextraction, phytoaccumulation, metals hyperaccumulation, phytovolatilization and phytostabilization. Phytoremediation is rather a novel green-tech, solar powered, eco-friendly, substitute of extraction/pumping, cost-effective, sustainable, and its potential can be enhanced multifold through use of biotechnology. We exploited the potential of *Parthenium hysterophorus* (Gand booti) to mitigate Cadmium (Cd) toxicity in the soil. Pot experimentation using complete randomized block (CRDB) was carried out. Investigated data indicate that *Parthenium hysterophorus* shows resistance against Cd stress when different parameters were studied regarding morphology, physiology, growth and productivity. Three levels of Cd stress (50, 75 and 100 ppm) was employed on 30 days old plants. The *Parthenium* showed enhanced level of tolerance at 75 ppm. At this conc. the shoot and root length, shoot fresh and dry weight, root fresh and dry weight were increased as compared to control. However, Chl-a, Chl-b, total chlorophyll and carotene contents were reduced due to Cd treatment as compared to control. Moreover, under Cd stress the C_i and A decreased, while g_s and E increased. On the basis of data, it is concluded that *Parthenium* may be a candidate to be grown at the sites of wastewater and contaminated soil to reduce Cd toxicity burden.

PPPP 31

ASCERTAINING THE IMPACT OF HEXAVALENT CHROMIUM THROUGH WHEAT (*TRITICUM AESTIVUM* L.) PLANTS IN PUNJAB, PAKISTAN

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Different concentrations of hexavalent chromium (Cr^{6+}) ranging from 25 to 400 mg/kg of soil were applied to wheat plants to study its impact on different growth and physiological parameters. Plants grown without Cr^{6+} treatment were healthier and lush green as compared to counterparts grown in various Cr-treatments. It was recorded relative of control that photosynthetic rate, transpiration rate and stomatal conductance were reduced by 15-56%, 3-48% and 17-57%, respectively. Cr^{6+} seriously affected the growth of plants by reducing dry weights of root (5-67%) and shoot (2-37%) in different treatments compared to control plants. Chlorophyll 'a' and chlorophyll 'b' contents were lower in plants by 13-38% and 11-33%, respectively. Cr^{6+} accumulation was also significantly higher in seeds (10-179%) of treated plants. Highly significant reductions in nitrogen (16-69%), potassium (2-39%) and phosphorous (6-41%) contents were noted in the treated plants compared to control plants. Present study demonstrated that wheat fields irrigated with Cr^{6+} contaminated industrial wastewaters can cause serious health hazards associated with Cr^{6+} intake.

PPPP 32

MICROBIAL DIVERSITY AND ITS SALT TOLERANCE IN RHIZOSPHERE OF *SUAEDA FRUTICOSA*

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Microbial diversity in *Suaeda fruticosa*, a saline soil plant, was studied in two zones: rhizosphere and rhizoplane. Isolates were obtained on four different media (LB, HaP, AP and NFM). The colony morphology of all the isolates was studied. From the rhizosphere 54 strains were isolated (20 on LB, 17 on HaP, 10 on AP and 7 on NFM). From the rhizoplane 39 strains were isolated (16 on LB, 13 on AP, 2 on HaP, and 8 on NFM). The salt tolerance of isolates of halophilic media was studied as well. Majority of the nitrogen fixers isolated from both the zones were circular in form and were rod shaped. Biochemical traits were also studied with the help of Quick Test Strip (QTS-24). The salt tolerance of the isolates yielded good results with isolates HP8, 13, 14, 25, 26 and 32 enduring at 2M NaCl concentration. Two isolates from rhizoplane, HP-RS1 and RS2 also survived at this salt concentration. The study indicates that abundant halotolerant bacteria are present in rhizosphere and rhizoplane of *Suaeda fruticosa*. The aspect of plant growth promoting properties was also explored. Results indicated that 21 isolates from rhizosphere and 15 isolates from rhizoplane could produce Indole acetic acid in the presence of LB tryptophan and also solubilize phosphate. These properties are beneficial in addition to the aspect of salt tolerance.

PPPP 33

BIOCONTROL POTENTIAL OF THE INDIGENOUS TRICHODERMA ISOLATES AGAINST PLANT PATHOGENIC STRAINS OF FUSARIUM OXYSPORUM

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Several mycoparasitic strains belonging to the filamentous fungal genus *Trichoderma* are promising candidates for the biological control of plant pathogenic fungi as well as plant growth enhancers. In this study twenty four isolates of *Trichoderma* were isolated on PDA and antagonist effects of these isolates were evaluated against the plant pathogenic strains of *Fusarium oxysporum* (FO. 866, FO. 899, FO. 1025) in vitro. In dual culture, three of the *Trichoderma* strains (TMK22, TMK19, TMK20) completely inhibited growth of *F. oxysporum* FO866, followed by TMK11 and TMK9. The antagonistic effect of *Trichoderma* isolates against FO899 were in the range of 56 - 92 %. The highest inhibitory effect on growth of *F. oxysporum* FO1025 were achieved by TMK20 (95 %). Volatile metabolites of different *Trichoderma* strains were also effective against the different *F. oxysporum* strains. The present study resulted into some indigenous *Trichoderma* isolates having good to moderate antagonistic potential against the fungal phytopathogens that may be further utilized for development of biocontrol.

PPPP 34

EFFECT OF P-ENRICHED COMPOST ON GROWTH AND YIELD OF WHEAT (*TRITICUM AESTIVUM* L.) AND ITS RESIDUAL IMPACT ON GROUNDNUT (*ARACHIS HYPOGEAL* L.) PRODUCTIVITY

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A series of experiments were conducted to evaluate the solubility of phosphorus from hazara rock phosphate (RP) through composting with poultry litter (PL) at National Agricultural Research Centre Islamabad during 2010-11. The Phosphorus Enriched Compost (PEC) was prepared from RP and fresh poultry litter (PL) inoculated with Effective Microorganisms (EM) before composting. The highest available P of 1.6% was recorded in the treatment PL+RP+EM on day 120. The effect of prepared PEC was evaluated on wheat crop under following treatment arrangement; 1) Control, 2) Simple Poultry Litter (SPL) @ 6t ha⁻¹ 3) PEC @ 2t ha⁻¹ 4) PEC @ 4t ha⁻¹ 5) PEC @ 6t ha⁻¹ 6) SSP @ 80kg ha⁻¹. The results showed significant difference amongst the treatments. The treatment where PEC @ 6t ha⁻¹ superseded all the rest of the treatments for grain yield by producing 65%, 18% and 6.8% increase over control, SPL and SSP respectively and the effect on plant height was non significant. Post harvest soil analysis for available P showed 85%, 68%, 2.28% increase over control, SPL and SSP, respectively. The highest total P 0.52% and organic matter 0.78% was also recorded in the treatment where PEC@ 6t ha⁻¹ was applied. There was no significant effect recorded on soil pH amongst the treatments. The residual effect of PEC was determined through groundnut crop, laid out at the same lay out of previous wheat crop. Only 20 Kg ha⁻¹ nitrogen was applied from urea at the time of sowing. The groundnut cv. Chakori with seed rate 100 kg ha⁻¹ was sown in May, 2011 with row to row and plant to plant distance kept 45 × 10 cm. The results showed significant difference among the treatments. PEC@ 6t ha⁻¹ applied to the previous crop showed clear residual effect by increasing yield and yield components of groundnut. The significantly ($p \leq 0.05$) highest grain yield of 2631 kg ha⁻¹, total dry matter yield 16t ha⁻¹ and number of pods 44 plant⁻¹ were recorded in the treatment where PEC @ 6t ha⁻¹ was applied to the previous wheat crop. It can be concluded from the study that composting of RP with PL may enhance available P contents of the compost and it may enhance yield of two consecutive crops.

PPPP 35

THE SCREENING OF WATER STRESS TOLERANT WHEAT CULTIVARS WITH PHYSIOLOGICAL INDICES

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Development and cultivation of drought tolerant cultivars is prerequisite for wheat production under water deficit condition. Many new winter wheat varieties with high yield and good quality have been released and extensively cultivated in Winter Wheat Irrigation Region of China in recent years. However, if these cultivars are adapt to arid land need to be investigated. In the present study, five newly released elite winter wheat cultivars Xiaoyan22, Shaan354, Changwu134, Chang4640, Xinong928, including two reference cultivars Shanhe6 and Zhengyin1 with strong drought resistance and sensitiveness respectively, were used for assessment of water stress tolerance by three physiological indices i.e., relative water content (RWC), malonyldialdehyde (MDA), and free proline content (PC). The results showed that Changwu134 and Xinong928 had least reduction in leaf RWC, least increase in leaf MDA content and largest amount of PC accumulation under 48 or 72 hrs of water stress. While Xiaoyan22 exhibited greatest reduction in leaf RWC, largest increase in leaf MDA content and lowest amount of PC accumulation. The RWC and MDA content of Changwu134 and Xinong928 of stress treated group reached to the level of the control when stress was dismissed 24hrs, while those of Xiaoyan22 did not. Combining the three physiological parameters, the rank of water stress tolerance of these cultivars is: Xinong928>Shaanhe6>Changwu134>Chang4640>Zhengyin1>Shaan354>Xiaoyan22. Xinong928 is most drought resistant cultivar among the newly released wheat cultivars. The results provided important information for extending these new wheat cultivars to water deficient area.

PPPP 36

STUDY OF MICROBIAL DIVERSITY IN COTTON (*GOSSYPIMUM HIRSUTUM*) RHIZOSPHERE

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Microbial diversity of cotton rhizosphere was observed and microorganisms with plant growth promoting properties were selected. Colonies were isolated and streaked on two types of media: Lauria Bertani (LB) and Nitrogen Free Media (NFM). Thirty strains were isolated on LB media, whereas eighteen strains were isolated on NFM. All the isolates were studied for plant growth promoting properties like Indole Acetic Acid production (IAA) and Phosphate solubilization. IAA production was estimated both qualitatively and quantitatively. Many isolates showed good capacity to produce IAA, with isolates ARS 2 and ARS 33 producing 80µM/ml and 72µM/ml of tryptophan respectively. The phosphate solubilization activity was good in the isolates as well, with ARS 25 and ARS 33 producing the largest halozones. The isolates were also streaked on King's B media for the isolation of fluorescent pseudomonads. Two isolates, ARS 13 and ARS 38 produced good fluorescence and are tentatively characterized as *Pseudomonas fluorescens* (ARS 13) and *Pseudomonas aurantiaca* (ARS 38). It is for the first time that *Pseudomonas aurantiaca* has been reported in the rhizosphere of cotton plant. This strain has been reported to show good biocontrol properties and thus could be used as such. Quorum sensing positive signals were shown by isolates ARS 2, ARS 6 and ARS 38. Out of total 48 isolates, 85% could produce IAA. Out of the total isolates of LB, 93% could produce IAA. In case of the NFM, 72% could do so. In case of phosphate solubilization, 75% of the strains gave positive result. For phosphate solubilization by LB isolates, 83% were positive. While, for NFM the proportion was 61%. Out of the total 48 isolates, 75% of the isolates could both produce IAA and also solubilize phosphate as well. The findings are encouraging as these strains could be used as prospective biofertilizers as well.

PPPP 37

ENHANCING PHOSPHORUS USE EFFICIENCY IN CEREALS BY PHOSPHORIC ACID APPLICATION IN ALKALINE CALCAREOUS SOILS

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Major causes of low P use efficiency are the inefficient existing phosphate fertilizers and inappropriate methods of their application. Studies were conducted to investigate the impact of premixing, subsurface placement and fertigation of P fertilizers (phosphoric acid, DAP and TSP) on P use efficiency and yield of wheat, maize and rice. In general, lower P rates (22 & 44 kg P₂O₅ ha⁻¹) in wheat exhibited higher P use efficiency. Phosphoric acid was found a better P source while its placement in wheat & maize was a better method of application. Relative efficiency of the P sources in wheat & maize was generally in the order: phosphoric acid > TSP > DAP and performance of methods of application in wheat & maize was in the order: placement 5 cm below seed > fertigation at first irrigation > premixing at sowing. Phosphorus uptake was influenced significantly by different rates of P fertilizer application. In general, maximum P uptake was observed in case of the highest rate of phosphoric acid (88 kg ha⁻¹ P₂O₅) applied as subsurface placement. Phosphorus treatments also improved N uptake by grain. The post harvest soil analysis showed no adverse effect of phosphoric acid addition on soil properties (pH, EC, CaCO₃, organic matter) even on addition of its highest rate. Overall, the studies revealed phosphoric acid as a better and cheaper alternative to DAP/TSP for wheat, maize and rice production.

PPPP 38

TAXONOMIC STUDY OF FRESHWATER CHLOROPHYCOTA AND EUGLENOPHYCOTA FROM TEHSIL KASUR

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Kasur possesses many freshwater habitats like rivers, canals, streams and ponds. We have studied altogether four genera, *Characium*, *Pediastrum* and *Scendesmus* from Chlorophycota and *Phacus* from Eeglenophycota during March to September 2011, from various freshwater bodies of Tehsil Kasur. Genus *Characium* consists of 4 species *Ch. conicum*, *Ch. gracile*, *Ch. hookeri* and *Ch. obtusum*, *Pediastrum* has 8 species, *P. boryanum*, *P. duplex*, *P. integrum*, *P. obtusum*, *P. simplex*, *P. simplex* var. *duodenarium*, *P. tetras* and *P. tetras* var. *tetraodon*, 9 species *S. acuminatus*, *S. acutiformis*, *S. arcuatus*, *S. armatus*, *S. bijuga*, *S. dimorphus*, *S. denticulatus*, *S. denticulatus* var. *fenestratus* and *S. obliquus* belong to genus *Scendesmus* and genus *Phacus* includes 5 species, *Ph. acuminatus*, *Ph. caudatus*, *Ph. Lemmermanicum*, *Ph. pseudoswirenkoi* and *Ph. triquetus*. These species are being first time reported from Tehsil Kasur.

PPPP 39

MICROBIAL POPULATIONS AND ORGANIC CARBON FLUX AFTER THE APPLICATION OF WEEDICIDES IN WHEAT

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Use of weedicides, fungicides and insecticides is increasing day by day in the current intensive system. These chemicals are used against specific pests and weeds but the non-target microflora also gets the blunt / imbalance the natural microflora. It is the dire need to investigate the harmful / useful effect of these pesticides / fungicides / weedicides on soil micro flora. Present study was planned to evaluate the adverse effect of commonly used weedicides on useful soil microbial activities in wheat crop. Field experiment was conducted on sandy clay loam with pH, 7.77; EC, 1.40 dS m⁻¹; N, 0.036%, available P, 7.30 mg kg⁻¹ soil, organic matter 0.77% and microbial count before sowing was 29 x 10⁶. Four treatments including Control (No spray), Isoproturon 50% @ 800 g / acre, Bromoxynil + MCPA @ 500 ml / acre, Puma Super 7.5 EW @ 300 ml / acre. Fertilizer @ 125–100-50 kg ha⁻¹ was applied. Results showed that all the weedicides significantly decreased the total viable count, which were counted at different intervals (10, 20, 30 days after the application of weedicides). The highest damage after 10 days of application was observed with Bromoxynil + MCPA i.e. 15.60 x 10⁶ while the least with Isoproturon 50%. Weedicides damaged the soil microbial population first and then the healing effect was observed with time. The grain yield was at par with Isoproturon and Puma Super i.e. 6.25 and 6.17 t ha⁻¹ while the lowest was observed with control 5.67 t ha⁻¹. The highest damage to microbial population was done by Bromoxynil while Isoproturon affected the least. The highest microbial count was correlated with the total organic carbon.

PPPP 40

IMPACT OF MULTI-STRAIN INOCULATION ON GROWTH AND PRODUCTIVITY OF RICE

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Increasing population and deteriorating conditions of the cultivated fields, demand a biotechnology for sustainable growth and production of rice to ensure food security and environmental sustainability. Therefore, prospects of different rhizobial strains isolated from nodules of lentil (*Rhizobium leguminosarum* strain LSI-29, LSI-30) and mung bean (*Rhizobium phaseoli* strain A-2, S-17) were tried out in single, dual and multi strain combinations to enhance the growth and productivity of rice in a pot experiment using completely randomized design. Fresh cultures of individual strains and their balanced mixtures (1:1 v/v) were prepared for all possible combinations. Rice seedlings (Super Basmati) inoculated with combinations were transplanted in pots. Recommended nitrogen, phosphorus and potassium were applied (120, 60, 60 kg ha⁻¹, respectively) to each experimental unit. Outcomes of this experiment revealed that all the inoculated seedlings showed increment in vegetative and reproductive growth, whereas, co-inoculation of LSI-29 and A-2 and multi-strain inoculation of LSI-29, S-17 and A-2 remained more prominent. These strains owned the individualities including good root colonization (LSI-29, S-17 and A-2), phosphate solubilization (LSI-29 and A-2), exopolysaccharides (LSI-29, S-17 and A-2), chitinase (S-17), organic acid (LSI-29 and A-2) and indole acetic acid (LSI-29, S-17 and A-2) production. Results of the experiment proposed the use of multi-strain inoculants to improve growth and yield of rice. Further, field oriented evaluation is recommended to assess the potential of consortia inoculation for improving rice production.

PPPP 41

RESPONSE OF MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK.] TO CADMIUM AND NICKEL APPLIED AS SOIL TREATMENT**MUHAMMAD AQEEL* AND MUMTAZ HUSSAIN***Department of Botany, University of Agriculture, Faisalabad***Corresponding author's e-mail: aqeelbutt99@gmail.com*

The aim of the present investigation was to assess the effect of cadmium and nickel separately and in combination on some morpho-physiological, biochemical and yield characteristics of mungbean [*Vigna radiata* (L.) Wilczek.]. Two mungbean varieties viz., Mungbean var. 07002 and Mungbean var. M-1 were grown under nickel and cadmium application. Twenty days old plants were exposed to 15 or 30 mg L⁻¹ nickel and cadmium whereas control plants were treated with tap water only. Application of both nickel and cadmium caused significant reduction in all growth parameters as compared with that of control. The extent of decrease in growth due to cadmium compared with nickel. Although high concentrations of both the metals in the soil drastically reduced all gas exchange characteristic, growth of the plants, ionic contents and biochemical attributes in both mungbean varieties. Cadmium application caused more reducing effect as compared to nickel. In addition, all yield attributes of both varieties of mungbean reduced due to exposure of these metals in soil. In conclusion, Mungbean 07002 proved to be tolerant as it showed less reduction in growth, photosynthetic character, ion contents and yield as compared to Mungbean M-1.

PPPP 42

IMPACT OF PLANT GROWTH PROMOTING RHIZOBIA ON GROWTH, PHYSIOLOGY AND YIELD OF MAIZE**MUHAMMAD BAQIR HUSSAIN*, ZAHIR AHMAD ZAHIR AND SAJID MAHMOOD***Institute of Soil & Environmental Sciences, University of Agriculture, Faisalabad (38040), Pakistan***Corresponding Author's e-mail: baqirhussainus@gmail.com*

Rhizobium could be a potential bio resource for sustainable production of non-legumes. For that reason, rhizobial strains (*Rhizobiumphaseoli* RS-1, RS-3 and *Mesorhizobiumciceri* RS-8 and RS-12) having plant growth promoting characteristics like auxin, exopolysaccharides, chitinase, organic acid production and phosphate solubilizing activity and good root colonization ability were evaluated for their potential to improve growth, and yield of maize under field conditions. The strain RS-1 showed maximum improvement up to 98, 32 and 80% in photosynthetic rate, water use efficiency and stomatal conductance of maize, respectively, compared to uninoculated control. Whereas, strain RS-8 was more prominent in transpiration rate and 1000 grain weight giving 43 and 11% additions over control, respectively. Chlorophyll contents were higher in plants due to RS-12 inoculation with respect to all other inoculants and uninoculated control. But dry biomass and grain yield remained significant showing up to 17.9 and 26.3 Mg ha⁻¹ due to RS-3 inoculation. Results of the experiment demonstrate the potential of rhizobium species for improving growth and production of maize under field conditions. However, extensive evaluation of the selected rhizobial strains on farmer field is suggested for the confirmation of their prospective.

PPPP 43

FRUIT SIZE AND SAMPLING SITES REVEAL USEFUL INFORMATION ON SEED DORMANCY, VIABILITY AND GERMINATION IN TEAK (*TECTONA GRANDIS* L.)**MUHAMMAD AKRAM* AND FAHEEM AFTAB***Department of Botany, University of the Punjab, Q.A. campus, Lahore-54590, Pakistan***Corresponding Author's e-mail: m.akramks@yahoo.com*

In the present study, various aspects of dormancy, viability and subsequent germination of teak seeds either *in vivo* or under *in vitro* conditions were investigated in association with fruit size and few sampling sites. Drupes (fruits with seeds) were therefore collected from Changa Manga Forest Plus Trees (CMF-PT), Changa Manga Forest Teak Stand (CMF-TS) and Punjab University Botanical Gardens (PUBG) and categorized into very large (≥ 17 mm ϕ), large (12-16

mmØ), medium (9-11 mmØ) or small (6-8 mmØ) fruit size grades. Fresh water as well as mechanical scarification and stratification were tested for breaking seed dormancy. Viability status of seeds was estimated by cutting test, X-rays radiography and by *in vitro* seed germination. Results revealed that out of 2595 fruits from CMF-PT, 500 fruits were of very large grade. This fruit category also had highest individual fruit weight (0.58 g) with more number of 4-seeded fruits (5.29 %) and fair germination potential (35.32 %). Generally, most of the fruits were 1-seeded irrespective of size grades and sampling sites. Fresh water scarification had strong correlation ($R^2=0.9999$) with germination (44.30 %) as compared to mechanical scarification ($R^2=0.7975$; 35.3 % germination) and cold stratification ($R^2=0.6945$; 17.5 % germination) after 40 days of sowing. Similarly, sampling sites ($R^2=0.9999$) and fruit size grades ($R^2=0.9959$) also had significant influence ($P<0.0001$) on germination. Highest germination (82.33 %) was obtained on MS (Murashige and Skoog) agar-solidified medium as compared to Woody Plant Medium (WPM) (69.22 %). Seedlings from all the media were transferred to *ex vitro* conditions in the greenhouse and the highest survival rate (28.6 %) was observed in those seedlings that were raised on MS agar-solidified medium after 40 days. Our study demonstrated that there was an association between the studied parameters of teak seeds and the sampling sites or the fruit size. The study thus provides useful information that may find its application in sustainable teak propagation.

PPPP 44

OILSEEDS AND PGPR: POTENTIAL COMBINATION FOR PHYTOREMEDIATION

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Addition of sewage sludge, industrial effluents and other wastes into the soil contaminate / pollute / deteriorate the soils due to heavy metals and other toxic compounds. Contamination of soil ecosystem by the heavy metals like Cd, Cr, Cu, Hg, Pb and Ni etc has been accelerated amazingly due to rapid industrialization. Human activities also contributed in this regard by use of agro-chemicals, hazardous gas emissions, sewage, municipal wastes deposition, industry effluents and thus contaminated soil and environment severely. Excessive accumulation of heavy metals to soil and water results in severe health problems. High deposition rates of heavy metals damaged the soil fertility, reduced microbial activities and ultimately decreased crop yields. Phytoremediation is eco-friendly, cost effective and in-situ remediation technology for contaminated soils in which plants have been used as remediation agents and tolerate or accumulate metal concentration in the rhizosphere or plant tissues and detoxify contaminants through physical, chemical, and biological processes. Phytotechnologies that might be followed are phytoextraction, phytoexclusion, phytostabilisation, phytovolatilization, rhizodegradation and phytodegradation of metals. The model plants for phytoremediation belongs to oilseed crops having massive biomass, speedy growth rate and has potential to tolerate or accumulate metals in the different plant parts. Oilseed crops are hyperaccumulators and accumulate high metal contents in plant parts. Role of different oilseed crops to clear / reduce the pollutants was checked and the factors affecting the phytoremediation were discussed. PGPR besides plant growth promotion also served as a tool to degrade or transform contaminants to non or less toxic products, reducing the environmental pollution. PGPR changed the oxidation state of metals from toxic Cr (VI) to Cr (III). Present investigations covered the plant-metal, microbe-metal, plant-microbe-metal interactions and mechanisms opted by oilseeds and PGPR to remediate the soil. Comprehensive and detailed studies are required to check the role of different PGPR and oilseeds in accumulation of metals and translocation of metals within the plant body and to understand the rhizosphere ecology.

PPPP 45

PRECURSOR (L-TRYPTOPHAN)-INOCULUM (*RHIZOBIUM*) INTERACTION FOR PROMOTING WHEAT YIELD

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Sole dependence on mineral fertilizers results high input cost for raising crops. Plant nutritionists are in search of substitutes to mineral fertilizers or the way that enhance the efficiency of mineral fertilizers or to compensate /

supplement the mineral fertilizers. Microbial inoculants influenced the crops positively by different means and have potential to compensate the mineral fertilizers. *Rhizobium* is very well recognized due to its symbiotic relationship with legumes has now been used in non-legumes due to its great root colonization ability, growth hormone production potential, improving the nutrient use efficiency, P-solubilization and inducing systemic resistance. Being the physiological precursor of auxins, L-tryptophan (L-TRP) is involved in biosynthesis of IAA. Auxin biosynthesis potential of *Rhizobium* sp can be enhanced with the addition of L-TRP. Precursor-inoculum interaction offered constant source of hormones to plants and improved the growth and yield of cereals. Field and pot studies were planned to ascertain the role of microbial biosynthesis of auxins through L-TRP on auxins production potential and wheat growth. Different *Rhizobium* species were isolated and screened out for their auxin production potential and root / shoot elongation assay was carried out. Two N levels i.e. 80 and 120 kg ha⁻¹ was used while uniform rate of P and K i.e. 115 and 60 kg ha⁻¹ were used and L-TRP @ 10⁻⁵ M was applied as seed soaking for three hours. Results revealed that precursor-inoculum interaction has affected the yield components of wheat as compared to their separate application. Precursor-inoculum interaction produced highest grain yield of wheat at Soil Bacteriology Section, ISC&ES Faisalabad i.e. 5689, 5827 and 5042, 5292 kg ha⁻¹ at 80 and 120 kg N ha⁻¹, respectively. Other physical parameters, soil-plant analyses were also verified the approach of precursor-inoculum interaction. Precursor-inoculum interaction exhibited higher IAA equivalents in the rhizosphere soil of wheat determined at 15 and 30 days after germination.

PPPP 46

EFFECT OF SALINITY ON GROWTH AND MACRO AND MICRO NUTRIENT UPTAKE OF DIFFERENT WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES

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Salinity is one of the most important environmental factors affecting plant growth and productivity. Excess of soluble salts in root zone negatively affect plant growth and yield through nutritional imbalances, specific ion toxicities and osmotic effects. The present study has been conducted particularly to assess the nutritional limitations in five different wheat genotypes in response to salinity (15 dS m⁻¹). The experiment has been conducted in soil filled pots. There were five wheat genotypes with two treatments (non-saline and saline) and three replications. For non-saline (control) treatment a non-saline field soil (EC: 2.90 dS m⁻¹) was used and for saline treatment the salinity level of 15 dS m⁻¹ was created artificially by the addition of NaCl in this non-saline soil. The plants were harvested before the start of booting stage and plant growth parameters viz. fresh root and shoot weights, dry root and shoot weights and number of tillers per plant were recorded. The shoots and roots were digested and analysed for N, P, K⁺, Na⁺, Cl⁻, Fe, and Zn following standard methods. Shoot and root growth of the wheat genotypes was reduced by salinity as the shoot and root dry mass of all the wheat genotypes was decreased. Salinity increased Na⁺, Cl⁻, P and Zn concentrations in the shoots and roots. The NaCl salinity decreased N and Fe concentrations in the shoots. There was a genetic variation among the wheat genotypes for resistance to salinity which correlated with the accumulation of toxic ions and the uptake and accumulation of macro and micro nutrients. Therefore for successful wheat production from salt-affected soils salt-resistant wheat genotypes along with a better combination of nutritional supplements should be used.

PPPP 47

SALINE AGRICULTURE AN INNOVATIVE STRATEGY FOR ENHANCING LAND AND WATER AVAILABILITY IN SOUTH PUNJAB

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Pakistan a potential bread basket of the world is endowed by nature with large arable landmass of about 32 million hectares, only half of which is irrigated. Water scarcity and salinity are among major constraints of Pakistan agriculture. About 6.8 million hectares of land is reported to be affected by varying degrees of salinity and sodicity. Southern Punjab is extremely prone to salinity and aridity. Horizontal expansion is impossible unless we bring new lands and brackish water into production system. Multi location field experiments are being conducted to bring these problematic soils (arid and saline) and water into agricultural production system. Salt tolerant plant species such as *Salicornia bigelovii*, *Aster tripolium* (Sea spinach), *Casuarina*, *Diploataxis tenuifolia* have been grown on highly saline soils with brackish water at sand dunes of Cholistan desert. Initial one year results showed encouraging stand (65.8%) and growth (as measured by girth, number of branches and plant canopy) of the test plant species producing significant quantities of biomass, making ecosystem more living and providing farmers forage for their livestock and fuel wood for their livelihood. We calculated up to six of the most fundamental growth parameters according to a purely 'classical' approach on yearly basis. All of the estimates carry standard errors and 95 % confidence limits.

PPPP 48

BEHAVIOR OF DIFFERENT WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES IN SALINE SOIL

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Salinity primarily affects plants by inhibiting shoot growth. The level of growth reduction is influenced by the sensitivity of crop species and genotype. However, six wheat genotypes (9476, SARC-1, SARC-7, SARC-8, Bhakkar, Saher 2000) were tested for growth and physiological parameters under salinity stress. Wheat genotypes were subjected to two salinity levels (7.5 and 15 dS m⁻¹) along with control in a pot experiment under green house conditions. Chlorophyll content was recorded at flowering stage and fully expanded younger leaves were collected and stored in separate polypropylene tubes for sap extraction. Leaf sap was used for Na⁺, K⁺ and K⁺: Na⁺ determination. Among other genotypes, 9476 accumulated minimum Na⁺ and maximum K⁺ in the leaf sap. At maturity the data regarding plant height, number of spikes plant⁻¹, number of spikelets spike⁻¹, spike length, 100-grain weight, total grain weight pot⁻¹ and water potential was recorded. After the harvesting of wheat crop, soil samples were collected from these pots and were analyzed for Na⁺ and K⁺ in the soil by flame photometer. The data regarding chlorophyll content, plant height, number of spikes plant⁻¹, number of spikelets spike⁻¹, spike length, 100-grain weight, total grain weight pot⁻¹ and water potential resulted maximum for 9476 genotype. Our results showed that among selected wheat genotypes, 9476 performed best for growth and physiological parameters in this soil experiment under varying salt levels.

PPPP 49

RELEVANCE OF CADMIUM AND PROTON STRESS IN *ELODEA CANADENSIS* FOR PHYTOFILTRATION

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Acidity coupled with high levels of toxic-metal ions like cadmium (Cd), is the characteristic feature of leakage water from mining waste i.e. acid mine drainage, which may cause environmental problems. Phytoremediation using *Elodea canadensis* could be used to clean such waters as the species is able to modulate the surrounding water pH. Chlorophyll contents and distribution was studied after Cd treatment. Toxic effects of protons on fresh weights, malondialdehyde contents, chlorophyll contents, catalase and ascorbate per-oxidase activity in shoots were investigated. Phyllosphere pH changes by *E. canadensis* were monitored and shoot cation exchange capacity (CEC) was measured in the presence of slightly toxic Cd (different Cd salts were used) and proton concentration in the medium. The mean effective concentration of Cd was found to be 0.57 M that results in chlorophyll contents reduction of 50%. The protons concentration which causes 50% reduced growth corresponds to pH values between 3.3 and 5.65. The shoots of *E. canadensis* significantly enhanced the growth medium pH when stressed by slightly toxic Cd concentration and low pH. Cadmium stress enhanced the shoot CEC which indicates the development of new binding sites in this species. It was concluded that both Cd and proton stress triggers this macrophyte to modulate the medium pH which depends upon the cell wall modifications in this species. The fact that the medium pH strongly influenced the Cd uptake in *E. canadensis* makes our results interesting for phytoremediation of Cd polluted waters.

PPPP 50

IMPROVEMENT IN FRUIT YIELD, QUALITY AND FRUIT DROPPING CONTROL IN KINNOW (*CITRUS RETICULATA* BLANCO) THROUGH APPLICATION OF GROWTH REGULATORS, POTASSIUM AND ZINC

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Kinnow fruit (*Citrus reticulata*) is one of the best commercial fruits of Pakistan. It is cultivated on a large area in the Punjab province due to its reasonably higher yield, quality, taste and flavor than those of the other citrus fruits. However, its average yield in Pakistan is far below than that of the other citrus growing countries of the world. Fruit dropping is one of the promising reasons of low citrus fruit yield in Pakistan, which is thought to be mainly due to hormonal imbalance in the plants. This imbalance may occur due to nutrient deficiency in soils of orchards, water shortage and insect pest attack to the citrus trees. Therefore, some experiments were conducted to assess the influence of growth regulators [2-4 D and salicylic acid (SA)] and nutrients like potassium (K) and zinc (Zn) to improve yield and quality of citrus fruit and control the fruit drop at four selected sites in the citrus growing tract of Punjab, Pakistan. Foliar applications of 2-4 D, SA, K and Zn significantly improved the number of fruits per plant, fruit weight, juice percentage, total soluble solids (TSS), acidity, ascorbic acid, and TSS/acid ratio and reduced the fruit drop. Application of 2-4 D + K + Zn and SA + K + Zn showed beneficial effects on all the afore-mentioned parameters.

PPPP 51

SCREENING RHIZOBACTERIA CONTAINING ACC-DEAMINASE FOR GROWTH PROMOTION OF WHEAT SEEDLINGS UNDER WATER STRESS

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Due to climate changes globally, rainfall has become more erratic causing water shortages in the rainfed regions, resulting in reasonable yield reduction in cereal crops including wheat. Plant growth is inhibited due to higher levels of ethylene production in the rhizosphere under water stress conditions. Rhizobacteria containing ACC-deaminase can facilitate plant growth to overcome these harmful effects. Isolation of rhizobacteria containing ACC-deaminase from the rhizosphere of wheat grown in different districts of Chakwal, Attock and Rawalpindi, were screened for growth promotion of wheat seedlings under axenic conditions. The results of the laboratory experiments conducted on wheat revealed that some rhizobacterial isolates increased root and shoot growth as compared to the uninoculated control. The selected strains were again tested in soil to assess their effectiveness for improving growth of wheat seedlings under water stress soil conditions. The results exhibited that inoculation with selected isolates increased the root length (upto 54.6 %), shoot length (up to 80.2%), dry root weight (up to 54.2 %), dry shoot weight (up to 95.4 %) and lateral root number (up to 33.3%) of wheat seedlings grown at different water levels (i.e., 60, 45, 30 and 15% water holding capacity, WHC) over uninoculated control. These results clearly indicates that rhizobacteria isolated from rainfed regions were effective in promoting growth of wheat seedlings under axenic conditions.

PPPP 52

EFFECTS OF SILIQUA POSITION ON PHYSICO-CHEMICAL COMPOSITION OF *BRASSICA NAPUS* L. SEEDS

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The difference of time in opening of flowers and distance from ground may affect physico-chemical characteristics of Brassica seed. A study pertaining to record the effect of silique position on physico-chemical composition of seed was executed at Pir Mehr Ali Shah, Arid Agriculture University, Rawalpindi during 2008-9. The seed of canola variety

Bulbul-2000 were sown during month of October in 6×3 meters plot size maintaining distance of 20 cm between rows. Before start of flowering approximately 300 plants were selected to make three replications of 100 plants (in three rows) in each replication. Silique on main stem of each plant were labelled after shedding of petals on every second day starting from lowest silique which continued till the last silique on upper most portions. In total 12 silique position were labelled on main stem. Labelled siliques on each position were harvested separately. Seeds per silique, thousand seed weight, oil and protein content were determined from harvested siliques separately. Result showed consistent reduction in number of seeds per silique, thousand seed weight and oil content as pod formation progressed upward to the top. However, protein content depicted reverse trend to the above parameters which increased towards the top. Seeds/ silique and thousand seed weight infer an inverse relationship to silique position. However, protein accumulation exhibited a linear relationship to silique position.

PPPP 53

DEVELOPMENT OF TRANSGENIC WHEAT WITH LOW PHYTATE FOR INCREASING BIOAVAILABILITY OF IRON AND ZINC

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Wheat is the national staple food of many countries including Pakistan and is an important food crop worldwide. National Nutrition Survey indicates a gross malnutrition especially among women and children. 48.7% mothers and 29% children were iron deficient, 41% mothers and 37% children were zinc deficient in 2004. This study is aimed on increasing bioavailability of iron and zinc by targeting phytate which is a powerful chelator, binds with free metal ions to form mixed salts resulting in excretion by humans. Disarmed *Agrobacterium* strain AGL1 harboring the binary vectors containing single phytase gene under D-Hordein promoter and double phytase gene under D-Hordein and Glutenin promoter were developed for wheat transformation. Immature embryos of two wheat varieties Faisalabad 2008 and Seher 2006 were used in transformation. Six thousand calli generated from immature embryos were inoculated in different sets of experiments. Calli were shifted to regeneration medium, 120 putative transgenics were subjected to DL-Phosphinothricin (BASTA) selection medium. 30 putative transgenic plants were confirmed by BASTA paint and PCR with different sets of gene specific primer pairs. T1 seeds of these transgenic plants were sown in pots under natural conditions in net house. T1 plants showed comparatively better growth than control plants.

PPPP 54

TOXICITY OF LEAD, CHROMIUM AND CADMIUM METAL IONS IN VEGETABLES IRRIGATED WITH CITY EFFLUENT OF ISLAMABAD

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Most of the vegetables are grown around the cities and are often irrigated from the city effluent which contains heavy metals. Therefore research study was planned to study the level of three heavy metals such as lead, Cadmium and Chromium in the vegetables, soil and city effluents. The samples collected from different parts of the Islamabad and analyzed for three heavy metals with atomic absorption spectrometer. The results revealed that city effluent from different sites contained Lead in the range of 2.649 ppm to 3.169 ppm, Chromium 1.423 to 2.462 pp and Cadmium was 1.348 ppm to 1.969 ppm. The concentration of three heavy metals in the soil was higher in soil samples as well in the vegetables. Therefore, present study suggests the need to irrigate the vegetables grown around the Islamabad from heavy metals free water.

PPPP 55

PHOSPHATE SOLUBILIZING POTENTIAL OF *RHIZOBIUM* AND *BACILLUS* SPECIES FOR ENHANCING AVAILABLE PHOSPHORUS IN MAIZE CROP

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Phosphorus fixation in alkaline soils has become prevalent resulted in phosphorus deficiency. To circumvent this deficiency, organic and biological resources may be used that are cost effective, easy to use and eco-friendly. Phosphate solubilizing bacteria (PSB) secrete different types of organic acids like gluconic acid, lower the rhizosphere pH, consequently solubilize the precipitated phosphates and subsequently increased the crop yields. *Bacillus* sp is very good P-solubilizer and recently role of *Rhizobium* in P-solubilization has been reported. Field study was conducted with medium textured soil having pH 8.0, EC 1.7 dS m⁻¹, N 0.030% and available P 7.5 mg kg⁻¹ soil at Soil Bacteriology Section, AARI, Faisalabad. Fertilizer @ 120-60 kg NP ha⁻¹ was applied. *Rhizobium* was screened for auxin biosynthesis potential and *Bacillus* for P-solubilization potential. Results revealed that co-inoculation of *Rhizobium* and *Bacillus* produced fodder yield i.e. 82.33 compared to control 74.33 ton ha⁻¹. Photosynthetic rate in co-inoculation of *Rhizobium* and *Bacillus* was recorded as 58.5 followed by 56.1 with *Bacillus* and 48.2 with *Rhizobium* inoculation compared to control i.e. 46.4 µmol m⁻²s⁻¹. Data revealed that plant height increased from 250.67cm (control) to 257.67 cm (co-inoculation) and it was 256.3 cm and 252.7 by individual inoculation of *Rhizobium* and *Bacillus* respectively.

PPPP 56

RESPONSE OF ANTIOXIDANT ENZYMES ACTIVITIES IN SUNFLOWER (*HELIANTHUS ANNUUS* L.) TO EDTA GROWN IN PB CONTAMINATED MEDIUM

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A sand culture experiment was conducted in a net house under natural conditions to evaluate the effect of Pb, EDTA and Pb +EDTA on antioxidant enzymes activities in two sunflower hybrids i.e H-33 and 64A93. The experiment was carried out in completely randomized design with factorial arrangement. Eight treatments of Pb, EDTA and of their combinations i.e T₁ (Control), T₂ (1 mM Pb (NO₃)₂), T₃ (2 mM Pb (NO₃)₂), T₄ (1 mM EDTA), T₅ (1.5 mM EDTA), T₆ (1 mM Pb (NO₃)₂ + 1 mM EDTA), T₇ (1 mM Pb (NO₃)₂ + 1.5 mM EDTA), T₈ (2 mM Pb (NO₃)₂ + 1.5 mM EDTA) were applied and each treatment was replicated thrice. Contamination of Pb in the growth medium significantly enhanced the activities of super-oxide dismutase (SOD), catalase (CAT) and peroxidase (POD). Addition of EDTA alone in uncontaminated medium did not influence SOD activity, but its addition in the medium containing Pb, reduced SOD activity. EDTA alone in normal growth medium enhanced the activities of CAT and POD, however, when applied in combination with Pb, it significantly enhanced these enzyme activities in sunflower hybrids. Results clearly indicated that plants maintaining higher antioxidant enzymes activities are better for cultivation in heavy metal contaminated medium or soils. The addition of EDTA in heavy metal contaminated medium is beneficial in further enhancing the antioxidant enzymes activities which increases the abiotic stress tolerance in plants.

PPPP 57

BIOMASS ACCUMULATION AND POTASSIUM SUBSTITUTION BY SODIUM OF RICE GENOTYPES UNDER SALINITY STRESS IN HYDROPONICS

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Salinity containing neutral soluble salts coupled with waterlogging is an ever-present threat to agriculture crops. With the standpoint of addressing this menace a solution culture experiment was conducted to evaluate 10 rice genotypes including salt tolerant check IR-9 at seedling stage. The treatments were arranged in complete randomized design, replicated thrice in controlled growth cabinets (28°C) with specially designed germinators using 1/4th Hoagland nutrient solution salinized with different concentrations of sodium chloride (NaCl) i.e. control (0), 40 and 80 mM. The data revealed that all the genotypes showed tolerance at salinity level of 40 mM whereas, at 80 mM NaCl concentrations 2 genotypes exhibited tolerance, 3 medium tolerance, 3 medium sensitive and 2 sensitive, on the basis of less than 50% reduction in 6-7 variables. Furthermore, the genotypes IR-9 and Shua-92 showed promising response in biomass and proved as salt tolerant at 80 mM NaCl.

PPPP 58

IMPACT OF SALINE-ALKALI STRESS ON THE ACCUMULATION OF SOLUBLE SOLIDS IN TOMATO FRUITS**NOOR ELAHI JAN¹, JALAL-UD-DIN¹ AND SANHEYUKI KAWABATA²**¹*Plant Physiology Programme, CSI, National Agricultural Research Centre, Islamabad, Pakistan.*²*Graduate School of Agricultural and Life Sciences, The University of Tokyo, 1-1-1, Yayoi, Bunkyo-ku, Tokyo 113-***Corresponding author's e-mail: jan.yousafzai@gmail.com*

Growing of tomato plants in saline conditions, having high rhizospheric EC, is often reported with high soluble solids in fruits. However, saline-alkali stress conditions, having high rhizospheric pH as well as high EC, have never been studied to evaluate its impact on the soluble solids of tomato fruits. In this study, we investigated the impact of saline-alkali stress (0, 30, 60, 90, and 120 mM NaHCO₃) on the accumulation of soluble solids in tomato fruits. Addition of sodium bicarbonate (NaHCO₃) to plants highly increased pH as well as EC of the soil leachate but greater increase was observed with 90 and 120 mM NaHCO₃ in comparison to control treatment. Saline-alkali stress treatments did not influence the fruit dry weight, nonetheless, the content of fruit dry matter was increased significantly from 6.5% at control to 8.5% at 90 and 120 mM treatments. The content of soluble sugars increased to 3% in 90 mM treatment in comparison to control (2%), which was due to significant accumulation of hexose as well as sucrose in ripe fruits. In addition to carbohydrates, saline-alkali stress influenced the accumulation of organic acids in fruits, as well. Citric acid, being the major acid, showed positive correlation with the salt concentration, and was significantly high at stress treatments of higher than 30 mM. These results suggested that saline-alkali stress can increase the contents of fruit soluble solids in tomato, as is usually observed in saline stress conditions.

PPPP 59

SCREENING COMPETENT RHIZOBIAL ISOLATES FOR COMBATING SALINITY STRESS IN WHEAT SEEDLINGS**RAFIA MUBARAKA*, ZAHIR AHMAD ZAHIR, MUHAMMAD BAQIR HUSSAIN AND MUHAMMAD KHALID***Institute of Soil & Environmental Sciences, University of Agriculture, Faisalabad (38040), Pakistan***Corresponding author's e-mail: rafiamubaraka@yahoo.com*

In the rhizosphere of non-legumes, rhizobium instead of biological nitrogen fixation makes several other beneficial associations both under normal and stressful environments. A study was designed to scrutinize the efficient rhizobial isolates in enhancing survival of plants under salinity stress induced by NaCl. Fifteen pre-isolated rhizobial isolates from root nodules of *Vigna radiata*, *Cicer arietinum* and *Lens culinaris* were tested against three different salinity levels *i.e.*, control, 3% and 6% NaCl. These isolates were further tested for plant growth promoting activity using wheat as test crop in growth room conditions at three salinity levels *i.e.*, original EC 1.2 dS m⁻¹, 6 dS m⁻¹ and 12 dS m⁻¹. Most of the salinity tolerant rhizobia significantly enhanced the water use efficiency and survival of wheat seedlings at various salinity levels but isolates S-10 and S-11 performed competently. These isolates enhanced root/shoot length, fresh/dry weight and total biomass of the seedlings significantly at all salinity levels as compared to uninoculated control. Furthermore, these isolates were characterized for oxidase, catalase, chitinase, exopolysaccharides, siderophores, indole acetic acid and phosphate solubilization assay which might be the mechanisms of action for these bacteria to get associated and survive in rhizosphere and rhizoplane of seedlings and improve plant growth under salinity. Findings of these experiments describe the capability of rhizobia to be used as inoculants under salinity stress conditions and unlock the interest of researchers to further explore their potential as bio-inoculants to improve growth and productivity of non-legume under salinity stress situations.

PPPP 60

GENETIC DIVERGENCE AMONG PAKISTANI BREAD WHEAT VARIETIES AND ADVANCED LINES ON RANDOMLY AMPLIFIED POLYMORPHIC DNA (RAPD) MARKERS**RAHEELA REHMAN^{1*}, KAUSAR NAWAZ SHAH², M. SHAHID MASOOD¹, MUHAMMAD ARSHAD¹, M. FAHIM ABBAS¹ AND ABDUL GHAFOR¹**¹*National Agricultural Research Centre (NARC), Park Road, Islamabad, Pakistan*²*PMAS-Arid Agricultural University, Rawalpindi, Pakistan***Corresponding author's e-mail: raheelamalik87@aol.com*

A large number of wheat varieties have been bred over the years but very few have been investigated for genetic divergence at molecular level. The present paper explains the genetic diversity for RAPD markers among wheat varieties as well as advanced lines. Twenty RAPD decamer primers were used to determine the extent of genetic differences among 48 genotypes and half of the primers were monomorphic, and other ten generated 71 DNA fragments with an average of about 7.1 bands per primer. The primer OPE-01 contributed 17% to the total polymorphism while the primer OPB-13 had 14% share. The primer OPB-09 contributed 5.6% among total variation. Maximum genotypes (47) were amplified with the primer OPA-09 and minimum (11) with the primer OPA-16. Six genotypes NR-346, NR-373, NR-389, NR-383, WSP-148 and WSP-196 were the most diverse from rest of the genotypes for RAPD analysis. The information about genetic similarity and differences will be helpful to avoid any possibility of elite germplasm becoming genetically uniform.

PPPP 61

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PPPP 62

PERFORMANCE OF SUGARCANE GENOTYPES / GERMPLASM AGAINST FROSTTOLERANCE, HIGH CANE AND SUGAR YIELD UNDER THE AGRO CLIMATIC CONDITIONS OF PESHAWAR VALLEY

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Sugarcane is an important industrial cash crop of Pakistan. Due to multiple limiting factors, yield per hectare in Pakistan is about half of the top sugar production countries. The existing commercial varieties grown in the KPK province although contributing a lot to the cane yield but unfortunately are susceptible to frost which affect the germination and sugar quality of sugarcane. Keeping in view the importance of sugarcane existing sugarcane germplasm were evaluated at NIFA, Peshawar to identify frost tolerant high cane and sugar yield genotypes. The agronomic data on stool/stock was significantly different in all the germplasm. The highest stool/stock (5.3) was observed in line HOSG-529 followed by lines CPSG-24, CPSG-2476, CPSG-375, CPSG-192 and HOSG-1607 where (5.0) stool/stock was obtained. The data on cane thickness also significantly different from each other at 0.05 level of significance. The maximum cane thickness (28.3mm) was recorded in line CPSG-1602 followed by line CPSG-1004 with cane thickness of 27.0 mm. The highest number of nodes (19.0) was recorded in Line HOSG-1607 followed by line CPSG-468 with 18.3 nodes. The highest plant height (246 cm) was recorded in Line HOSG-2476 followed by line HOSG-104 with plant height of 227.6cm. According to chemical analysis of all the germplasm, the highest recovery of 12.18 was recorded in

line CPSG-1004 followed by Line HOSG-1021 with recovery of 11.67. The highest commercial cane sugar (13.61%) was recorded in Line CPSG-1004 followed by Line HOSG-1021 with 13.02% CCS. The highest purity of 84.89 % was recorded in line CPSG-1004 followed by line HOSG-315 with purity of 83.43%. The data related to the fiber % shows that the highest fiber content (11.80) was in line HOSG 1257, HOSG-118 and HOSG-439 followed by line CPSG-1275 with fiber (11.50%). The highest Pol of 18.78% was recorded in line HOSG-1021 followed by line CPSG-468 with 18.36% Pol. The frost/freezing data was recorded on visual observations of apical portion/meristem, lateral buds and internal freeze damage of the individual cane. Out of 53 lines, 18 were less affected by frost/freezing damage. Their apical portions remained green and lateral buds were normal. Out of 18 survived germplasm, juice quality of 12 lines was affected. While juice quality of six lines; CSSG-668, CSSG-676, CPSG244, HOSG-1145, HOSG-104 and QSG-69 were not affected. The remaining 35 lines were completely damaged by frost/freezing injuries.

PPPP 63

MORPHO-PHYSIOLOGICAL RESPONSES OF WHEAT (*TRITICUM AESTIVUM* L.) TO SIMULATED ACID RAIN AND MICRO NUTRIENTS

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The effect of simulated acid rain was evaluated on morphological, physiological and yield characteristics of wheat (*Triticum aestivum*) examined as a pot experiment during 2010-11. Two varieties of wheat i.e. Sahar 2006 and Shafaq 2006 with six treatments including control each having five repeats were used for experimentation. Sulphuric acid (H₂SO₄) at pH 3.0 and 3.5 were artificially prepared as simulated acid rain and micro nutrient i.e. Micron-T were applied by foliar spray separately and in combinations. Application of simulated acid precipitation caused significant reduction in all growth parameters as compared with that of control while micronutrients act as reducing agent against simulated acid application. As a result, Shafaq 2006 proved to be tolerant as it showed less reduction in growth, photosynthetic character, ion contents and yield as compared to its counterpart.

PPPP 64

ACIDITY IS AN IMPORTANT DETERMINANT FOR FRUIT TASTE IN APPLE

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Cultivated apple (*Malus x domestica* Borkh.) is one of the most diverse and ubiquitously fruit species. It is an important fruit crop of temperate regions. The antioxidant properties of phenolic compounds present in apple may contribute to health beneficial effects. The consumption quality of a fruit is one of the important criteria which determines its value for cultivation and breeding. Acidity has profound effects on the organoleptic quality of apples. An optimum acidity together with optimum sugar content is required for consumers. From previous studies we know that malic acid is the predominant organic acid associated with the pH in apples. Malic acid concentration decreases during development and maturation of the fruit and varies strongly between cultivars. It is synthesized in the cytosol, and transported into the vacuoles, where it can be accumulated. In view of that, it is likely that differences in malic acid content and pH in apple are caused by differences in accumulation of malic acid in the vacuole. This study reports on previous findings of genes influencing acidity in apple fruit and future functional studies. These functional studies will include transformation of apple cultivars or other model plant with the gene identified before i.e. *MdALMT2*. This will be performed in order to ultimately prove that *MdALMT2* is the causal gene for controlling malic acid (acidity) in plant cell vacuole.

PPPP 65

***PUNICA GRANATUM* (ANAR, FRUIT RIND) AS AN ALTERNATIVE MEDICINE FOR PARASITIC DISEASES**

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Punica granatum is described for its medicinal properties and about all parts of this plant are used in traditional medicine for the treatment of various diseases. Experiments were carried out to show antiparasitic activity of *Punica granatum* (Anar, fruit/seed). Buffaloes infected with schistosomiasis were treated with *Punica granatum* (group A) at dose level of 75 (sub-group A1), 150 (sub-group A2) and 225 (sub-group A3) mg/kg body weight respectively. To compare their efficiency another group of animals (group B) were treated with praziquantel at dose level 10 mg/Kg body weight. Efficacy (%) of praziquantel was noted 100% after first dose while that of herbal medicine reached up to this mark after administration of second dose of 225mg/kg body weight. Comparative efficacy (%) of praziquantel with lowest (75mg/kg) dose level showed significant ($P<0.01$) difference whereas 150 mg/kg and 225 mg/kg dose levels did not show any significant difference after treatment. Sub-group A3 showed significant ($P<0.001$) (87.8%) increase in milk production, while in group B 126% milk increase was noted that was highly significant ($P<0.001$). In all treated groups a highly significant ($P<0.001$) increase was noted in feed intake while the body weight increased non-significantly. Furthermore during herbal therapy no side effects (temperature, vomiting, sweating, diarrhea or abortion in pregnant female etc) of herbal medicine were seen. The reported work shows that *Punica granatum* is a good herbal medicine to treated animals infected with schistosomiasis with no side effect.

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POTENTIAL ANTICANCER AND ANTIMICROBIAL ACTIVITIES OF *LESPEDEZA BICOLOR* TURCZ (PAPILIONACEAE) RELATED TO ITS STRONG ANTIOXIDANT SYSTEM

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Anticancer activity against Human lung carcinoma (LU-1) and Human prostate carcinoma (LnCap) along with antimicrobial and antioxidant activity on DPPH ((1,1)-diphenyl-2-picrylhydrazyl) and Hydrogen peroxide radicals scavenging activity and the contents of total phenolic and flavonoids were assessed in methanol extract of *Lespedeza bicolor*. The highest content of total phenolic content was detected in the arial part of *Lespedeza bicolor* (0.5-1.7 mg gallic acid equiv./g), while the highest content of total flavonoids was found in the arial part of *Lespedeza bicolor* (0.102-0.148 mg/g D/W). *Lespedeza bicolor* arial parts and root extract showed IC₅₀ value of 12.5µg/ml and 50µg/ml against human lung carcinoma (LU-1) whereas, ≤ 12.5 µg/ml and 12µg/ml were calculated against Human prostate carcinoma (LnCap) cell line. MIC value of 20-35 µg ml⁻¹ has been observed against *Aspergillus fumigates*, *Aspergillus niger*, *Fusarium solani* and *Mucor sp* in comparison with 1-2.5µg/ml of Terbinafine used as a standard fungicide. MIC value of 20 µg/ml and 35 µg ml⁻¹ of *Lespedeza bicolor* arial parts and root extract against bacterial pathogen *Klebsiella pneumonia* and 20-50 µg ml⁻¹ against *Enterococcus* has been measured. DPPH radical scavenging activity of *Lespedeza bicolor* with IC₅₀ values of ≤ 50 µg/ml and ≤ 200 µg ml⁻¹ was observed whereas, hydrogen peroxide scavenging activity with IC₅₀ values of ≤ 25 µg/ml for arial parts and ≤ 50 µg ml⁻¹ for the root extract of *Lespedeza bicolor* has been shown with gallic acid ($R^2=0.819$) and ascorbic acid ($R^2=0.728$). These data suggested that the methanolic extract of *Lespedeza bicolor* could be potential candidates for natural antioxidants and anticancer.

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ASSESSING POTASSIUM NUTRITION STATUS OF SUGARCANE THROUGH SOIL AND PLANT ANALYSIS

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Potassium (K) fertilization is often not practiced by sugarcane growers despite the fact that sugarcane removes large quantities of K from soil. This study was therefore conducted to assess K nutrition status of sugarcane through soil and plant analysis. Thirty sugarcane plantations, with crop age 3-5 months, were selected at random in tehsils Tandojam and Tando Allahyar. Representative soil samples were secured from each location at 0-15 and 15-30 cm depths. Simultaneously, plant samples of index tissue of associated plants were also obtained from each of these locations. Fertilizer application practices followed by the growers were also recorded for each location. The soil samples were analyzed for physico-chemical properties and ABDTPA-extractable K, while plant tissue samples were analyzed for total K. The data were compared with

established critical levels to determine K nutritional status of sugarcane. Attempt was also made to determine the relationship between plant content of K and its concentration in associated soils. The quantity of fertilizer nutrients used annually by sugarcane growers ranged from 24-214 kg N (av. 153 kg N), 0-142 kg P₂O₅ (av. 113 kg P₂O₅), and 0-61 kg K₂O (av. 11 kg K₂O) ha⁻¹. Only 6 out of 30 growers used K fertilizers. Analytical data showed that the surface soils (0-15 cm) were medium to heavy in texture (clay 27.5 to 69.5%), generally non-saline (EC 0.23 to 2.41 dSm⁻¹), alkaline in reaction (pH 7.60 to 8.30), moderately calcareous in nature (lime 8.00 to 13.5%), and low in organic matter (0.17 to 1.17%). ABDTPA-extractable K contents ranged from 82 to 440 mg kg⁻¹ (av. 263 mg kg⁻¹) indicating that most soils were adequate in available K. Plant analytical data showed that leaf K contents ranged from 0.90 to 1.95% with average value of 1.42%. The leaf dry weights ranged from 24.3-52.3 g with average value of 37.6 g. The data for uptake of K in leaf samples ranged from 0.21-1.01 g with an average of 0.52 g. The values of coefficient of correlation (r) for the relationship between soil and leaf K varied with the depth of soil sample and ranged from 0.31 to 0.44.

PPPP 68

ECTOMYCORRHIZAL DIVERSITY OF HIMALAYAN SPRUCE (*PICEA SMITHIANA*)

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This study focuses on the diversity of ectomycorrhizae associated with Himalayan spruce (*Picea smithiana*) from Himalayan forests of Pakistan. This tree grows at an altitude of 2500m-3300m and mostly present in mixed forests of *Pinus*, *Cedrus* and *Abies*. It is colonized by ectomycorrhizal fungi which were identified by morpho-anatomical and rDNA-ITS based techniques. Belowground ectomycorrhizal morphotypes were sampled, processed, identified and characterized. Results indicated that *Tomentella lapidum*, *Humaria hemispherica* and other unidentified basidiomycetous fungi were found to be involved in mycorrhizal association with *Picea*. Detailed morpho-anatomic descriptions of these mycorrhizae have also been provided. This investigation is the addition to the mycorrhizae of *Picea smithiana* and molecular techniques have been used to investigate the fungal diversity associated with it.

PPPP 69

EFFECT OF PRESSMUD ON THE GROWTH, YIELD AND CHEMICAL COMPOSITION OF MAIZE

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Pressmud or sugarcane filter cake is valued as a soil amendment and potential source of organic matter and plant nutrients. This study was conducted to assess the nutrient contents and manorial value of pressmud. In this first part of the study, pressmud samples were collected from twenty-one sugarmills of Sindh and analyzed for macro and micronutrient contents. The second part of the study was a pot experiment on maize consisting of nine treatments including 5 rates of pressmud (5,10,15,20 and 25 tons ha⁻¹) and three fertilizer treatments (150-0-0, 150-75 and 150-75-60 kg ha⁻¹ N-P-K respectively), besides control treatment not receiving either pressmud or fertilizer. The treatments were replicated four times in a randomized complete block design and maize was grown 7 weeks. The analytical data showed that the values ranged from 1.38-2.29%, 1.29-1.90% and 0.62-1.98% for total N,P and K respectively with corresponding CV values of 14.2, 10.2 and 35.4%. Besides, it is rich source of micronutrients with average values: 68, 4446 and 214 mg kg⁻¹ of Cu, Fe, Mn and Zn respectively. It was further noted that the nutrient contents of pressmud were not only variable from one mill to the other, but also when the samples were taken at different times from the same mill. The results of the pot experiment revealed that there were pronounced positive effects of addition of fertilizers, particularly nitrogen on plant height and dry weights, and depressing effect of pressmud (5 t ha⁻¹) on maize growth and dry matter. However increase in the rate of pressmud from 5 to 15 tons ha⁻¹ slightly improved the growth and yield performance of maize. Drastic decline in maize dry matter yield was observed when the rate of pressmud was increased from 50 to 25 tons ha⁻¹. Plant analysis data revealed significantly increased in N contents with the application of N fertilizer but P and K fertilizer and pressmud did not significantly influence the N contents. It is hypothesized that the initial depressing effect of pressmud was related to presence of undecomposed organic matter and the high rates of pressmud. Thus the benefit of pressmud was observed in a follow up experiment on wheat involving same soil and previously applied pressmud. These data therefore show that pressmud could be used in the fields for increasing crop production.

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EFFECT OF RHIZOBIUM AND PGPR INOCULATION ON THE GROWTH AND YIELD OF SOYBEAN (*GLYCINE MAX* L.)**SEHRISH JAMIL*, M. AMJAD QURESHI, N. AKHTAR, A. IQBAL, F. MUJEEB AND L. ALI***Soil Bacteriology Section, Agri. Biotech. Research Institute, AARI Faisalabad.***Corresponding author's e-mail: sehri.j@gmail.com*

The soybean plant is an annual plant native to Southeast Asia. It has oblong pods that contain 2 to 4 seeds or beans. Soybeans are legumes, a member of the pea family, and have a high protein content of 40% by weight, 32% carbohydrate, 20% fat, 5% minerals and 3% fiber, and other trace substances. They are processed to make many foods and food additives. Soybean products are promoted for their protective properties against cancer. Keeping in view its food and curative properties a study was conducted at Soil Bacteriology Section, AARI, Faisalabad to promote its qualitative and quantitative yield. The soil was sandy clay loam having pH 8.1, EC 1.6dSm⁻¹, Nitrogen 0.033%, Olsen P 9.0 ppm and soil organic matter 0.6%. Results revealed that co-inoculation produced significantly higher biomass and pod yield i.e. 2,012 kg/ha followed by *Rhizobium* inoculation 1,877kg/ha as compared to control 1,012 kg/ha. Co-inoculation produced highest number of nodules and nodular mass i.e. 21 plant⁻¹, 0.29 g plant⁻¹, while *Rhizobium* inoculation produced 18 plant⁻¹, 0.27 g plant⁻¹ as compared to 11 plant⁻¹ and 0.19 g plant⁻¹ with control respectively. Co-inoculation performed better as compared to separate inoculation of *Rhizobium* and PGPR. Although soy bean is not a preferred crop in Pakistan, Its proper management and promotion may prove a big step towards future food security.

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HIGH FREQUENCY INDIRECT PLANTS REGENERATION FROM LEAF EXPLANTS IN *STEVIA REBAUDIANA* (BERT.)**SHAHID AKBAR KHALIL*, ROSHAN ZAMIR, NISAR AHMAD AND SYED ANWAR SHAH***Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Pakistan***Corresponding author's e-mail: shahidakhil@yahoo.com*

In present investigation high frequency indirect plant regeneration protocol was established from leaf explant of economical plant, *Stevia rebaudiana* (Bert.). In overall experiment, the best callogenic response (84.6%) was observed when leaf explants was cultured on MS-medium containing 2.0 mg l⁻¹ BA + 2.0 mg l⁻¹ of 2, 4-D. Similarly 2, 4-D alone (2.0 or 4.0 mg l⁻¹) or in combination with 1.0 mg l⁻¹ BA induced < 83% callus in *Stevia rebaudiana* leaf explants. It was observed that medium containing auxins produced yellowish green and granular callus, while medium containing combination of auxins and cytokinins produces green and compact callus. The green callus was subculture on shoot organogenesis medium. Maximum shooting (96%) was recorded when MS-medium was supplemented with 2.0 mg l⁻¹ BA. In contrast, 90% shooting response was also observed on 1.5 mg l⁻¹ BA along with 0.5 mg l⁻¹ GA₃. The same combination of PGRs also produced maximum number of shoots (106) per explant. While, 96 number of shoots/explant was observed when the medium containing 2.0 mg l⁻¹ BA alone. In the present experiment maximum mean shoot length of 29.5 cm was observed when the medium was supplemented with 1.0 mg l⁻¹ BA along with 1.0 mg l⁻¹ GA₃. Similarly 23.5 cm mean shoot length was also recorded for 1.5 mg l⁻¹ BA along with 0.5 mg l⁻¹ GA₃. Elongated shoots were transfer to rooting medium containing half MS or half B5 or full MS or full B5 along with different concentrations of auxins and cytokinins. Maximum (85.7%) rooting was recorded on ½ strength MS medium containing 0.5 mg l⁻¹ IBA and NAA. Maximum of 19 numbers of roots per plantlets with mean root length of 14.33 cm was recorded on similar composition of PGRs.

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GRAIN YIELD AND NITROGEN DISTRIBUTION IN WHEAT IN RESPONSE TO INOCULATION BY *AZOSPIRILLUM* SPP AND *AZORHIZOBIUM* SPP IN TWO DIFFERENT SOILS OF PAKISTAN**SHAHIDA N. KHOKHARI*, MOHAMMAD ALI KHAN¹, AFTAB AFZAL² AND RIZWAN AHMAD²***¹Soil Biology and Biochemistry, Institute of Natural Resources and Environmental sciences, National Agricultural Research Center, Park Road, Islamabad; ²Department of Botany, Hazara University, Mansehra***Corresponding author's e-mail : sbb233@yahoo.com*

Azorhizobium and *Azospirillum* of different physiological characters (nitrogen fixation, endophytic colonization, draught-tolerance and low temperature tolerance abilities) were compared as inoculant for wheat var. GA2002. The experiment was sown in two fields (fields 1 and 2) at National Agricultural Research Centre, Islamabad, during rabi 2006-2007, having 14% and 18% soil moistures respectively at the time of sowing. The experiment comprised of eight treatments, six inoculated (4 *Azospirillum* and 2 *Azorhizobium*) all supplemented with urea-N @ 50kg in field1 @ 60kg in field2, one fertilized control (receiving urea-N@100kg in field1 and 120kg in field2, and one uninoculated control receiving only starter doses (25kg N in field1 and 30kg in field2). All treatments (except uninoculated control) received phosphate (@ 80kg.ha-1) as single super Phosphate and Potassium (@ 60kg.ha-1) as potassium sulfate (K_2SO_4). All inoculated treatments in the presence of half dose of urea-N performed better or equal to fertilized control in either of fields. Increase in grain yield due to inoculation ranged from 11%-45% in Field 1 and 14-38% in Field 2, in comparison with un-inoculated control and 10% when compared with fertilized control. *Azospirillum* B3 and *Azorhizobium* 3.4ksk brought highest grain nitrogen as well as grain yield at 14% moisture level at sowing while *Azospirillum* A2 brought highest grain nitrogen as well as grain yield at 18% moisture level at sowing. *Azorhizobium* 3.4ksk also caused highest root nitrogen, next to fertilized control in both fields.

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PHYSIOLOGICAL EFFECT OF THE WASTEWATER OF HUDIARA DRAIN ON DALBERGIA SISSOO (ROXB.)

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Although the agricultural use of wastewater raises some environmental and human health concerns, water irrigation with wastewater is usually carried out by smallholders in dry areas. The present study reports on the physiological effect of several dilutions of the raw wastewater of the Hudiara drain on *Dalbergia sissoo* plants. Six-month old stumps were established in pots and irrigated for 18 months with: tap water (control, T0); 25% wastewater (T1); 50% wastewater (T2); 75% wastewater (T3); and 100% wastewater (T4). Results showed that the plant growth parameters decreased as the percent of wastewater increased. At T4 the shoot length, number of branches, number of leaves, and root length were reduced by 17%, 32%, 72%, and 31%, respectively, compared to the control (T0). The content of chlorophyll a, chlorophyll b and total chlorophyll increased in plants treated with wastewater at 25%, but decreased in T2, T3, and T4 treated plants. As the percent of wastewater in treatments increased, the accumulation of Na, Cd and Cr in tissues increased, while the concentration of K, P, Mg, and Fe decreased. Results suggest that the wastewater of the Hudiara drain diluted at 25% with tap water is a feasible option for the grow of *D. sissoo* in Lahore, Pakistan.

PPPP 74

PHYTO-MONITORING OF METAL POLLUTION RELEASED BY AUTOMOBILES ALONG MOTORWAY (M-3) AND NATIONAL HIGHWAY (N-5) IN PAKISTAN

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This study was planned to determine lead (Pb^{2+}) and cadmium (Cd^{2+}) contents in dust deposited on vegetation growing along roadsides Motorway (M-3) and National Highway, (N-5). The samples were randomly collected from five sites along both roads for periodic sample collection. The dust trapped by the leaves of different plant species varying in leaf and stem pubescence was digested and analyzed by the method of Florence and Batley, (1977). Traffic density was recorded on Faisalabad Toll-Plaza and Pindibhattian Interchange at M-3, while Gutwala Interchange and Khurrianwala Stop were the target sites at N-5. Record of vehicles entrance (2300 vehicles/day on M-3 and 1900 vehicles/day on N-5) and exit (1900 veh/day on M-3 and 1400 veh/day for N-5) was obtained from National Highway Authority. The unwashed and washed leaves of *Calotropis procera*, *Cenchrus ciliaris*, *Sesuvium portulacastrum* and *Phoenixrobelleni* on M-3 while *Nerium oleander*, *Acacia arabica*, *Calotropis procera*, *Parthenium hysterophorus* and *Cenchrus ciliaris* on N-5 were collected for determination of Pb^{2+} and Cd^{2+} contents on both roads. The Pb^{2+} conc. in roadside dust samples at M-3 showed weak correlation with the traffic density. The co-efficient of determination values ($R^2=0.189$) for metal content in dust samples of M-3 indicated weak association with traffic density and it contributed positively for increasing Pb^{2+} in the dust. Regarding N-5 less association for Cd^{2+} was observed in dust samples and traffic density. The data showed that Pb^{2+} and Cd^{2+} was high in unwashed leaves of plants on both roadsides as compared to control. The deposition of more Pb^{2+} was found in leaves of *Calotropisprocera* on M-3 while minimum in *Pheonix robelleni*. *Nerium oleander* L. had maximum deposition of Pb^{2+} at N-5 and minimum in *C. ciliaris*. The leaves of *Cenchrus ciliaris* trapped more Cd^{2+} at M-3 and less amount was accumulated in *P. robelleni* and in case of N-5.

PPPP 75

HEAVY METAL REMEDIATION BY FUNGI**SHAZIA IRAM, SEHRISH IQBAL AND KOUSAR PARVEEN***Department of Environmental Sciences, Fatima Jinnah Women University, Rawalpindi, Pakistan.***Corresponding author's e-mail: iram.shazia@gmail.com*

Heavy metal waste has increased rapidly since industrial revolution. Heavy metal pollution is a serious environmental problem of worldwide concern. Microbes are involved in waste degradation and nutrient cycling; hence they are capable of utilizing heavy metal as nutrients. They can be considered as one of the remediation tools for heavy metal. The purpose of present study was to see the tolerance of *Aspergillus flavus*, *Aspergillus fumigatus* and *Eurotium* spp against heavy metals (Ni, Cd, Cu). Eleven isolates were taken from the agricultural soil of Multan. Among them, one reference isolate of *Aspergillus fumigatus*, *Aspergillus flavus* and *Eurotium* spp was tested for tolerance at different concentrations of heavy metals like (0ppm, 50ppm, 100ppm, 150ppm and 200ppm) and on the basis of growth curve, different concentration of heavy metals ($\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{CdSO}_4 \cdot 8/3\text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) were selected for mean radial growth and tolerance index. At higher concentration a gradual decline in the radial growth of isolates. The isolates were classified into tolerant, moderate and sensitive on the basis of tolerance index. Isolates M14 (*Aspergillus fumigatus*), M20 (*Aspergillus flavus*) and M22 (*Eurotium* spp) showed maximum tolerance against $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ but isolates M17 (*Aspergillus fumigatus*), M18 (*Aspergillus flavus*) and M22 (*Eurotium* spp) showed maximum tolerance against $\text{CdSO}_4 \cdot 8/3\text{H}_2\text{O}$. At $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ isolate M17 (*Aspergillus fumigatus*), M20 (*Aspergillus flavus*) and M21 (*Eurotium* spp) showed maximum tolerance. The results of present study depicts that nickel and copper are more tolerant to fungi as compared to cadmium. This study will be helpful for devising remedial measures in term of bioremediation.

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RESPONSE OF CANOLA (*BRASSICA NAPUS* L.) TO FOLIAR APPLIED TRIACONTANOL UNDER SALINE AND NON-SALINE CONDITIONS**SOBIA ZULFIQAR AND MUHAMMAD SHAHBAZ****Department of Botany, University of Agriculture, Faisalabad***Corresponding author's e-mail: shahbazmuaf@yahoo.com*

To assess the effect of exogenous application of triacontanol (TRIA) as foliar spray on canola cultivar RBN-3060, under saline and non-saline conditions, a greenhouse experiment was performed. Plants were grown in full strength Hoagland's nutrient solution for 56 days under non-saline condition, after which time, they were subjected to 0 (control), 100 mM and 150 mM NaCl. Three levels of TRIA (0, 0.5 mg L⁻¹ and 1 mg L⁻¹) were applied as foliar spray after 62 days of seed sowing. After 16 days of foliar application data for different growth, gas exchange characteristics and quantum yield of PS-II were recorded. Salt stress of root growing medium markedly decreased shoot and root fresh biomass, photosynthetic rate (A), transpiration rate (E), water use efficiency (A/E), stomatal conductance (g_s) and stomatal CO₂ concentration (C_i), while no significant effect of salinity was observed on quantum yield of PS-II. Exogenous application of TRIA as foliar spray ameliorate the adverse effect of salt stress effectively on plant growth.

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PHYSIOLOGICAL AND BIOCHEMICAL CHARACTERIZATION OF HALOPHYTES FROM KHEWRA SALT RANGE**TAMOOR-UL-HASSA AND ASGHARI BANO ****Department of Plant Sciences Quaid-i-Azam University, Islamabad 45320, Pakistan**Corresponding author's e-mail: asgharibano@yahoo.com.; Tel: 0092-51-90643096*

During the present investigation five wild plant species: *Solanum surattense* Burm. f., *Cenchrus ciliaris* L., *Aerva javanica* (Burman f.) A. L. Juss. ex Schultes, *Peganum harmala* L. and *Physalis minima* L. were collected from Khewra salt range (2.3: dS/m; pH: 8.5) to study the mechanism of their salt tolerance and to compare their physiology with that of plants of same species collected from non-saline soil of Rawalpindi (EC: 0.31 dS/m; pH: 7.4). The nutrient contents of rhizospheric soil, leaves and roots were measured. The salt tolerance ability of plants was evaluated on the basis of relative water contents (RWC), osmotic potential, electrolyte leakage, protein, sugar, chlorophyll, proline, Glycine betaine, activity of antioxidant enzymes and phytohormones (abscisic acid and trans zeatin riboside) production. Difference exist between halophytes genera with respect to accumulation of t-zr, ABA, SOD, POD, proline, glycine betaine and sugar DNA banding patterns appears to be related to the degree of salt tolerance. It is concluded that a mark difference exist between saline and non-saline collected plant samples on the basis of physicochemical and physiological parameters.

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PHYTOCHEMICAL SCREENING OF FOUR DIFFERENT ROOT EXTRACTS OF *AGERATUM CONYZOIDES* LINN. AND POTENTIAL ROLE IN ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY

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The aim of the present study is to identify the different classes of secondary metabolites present in the roots of *A.conyzoides* and to investigate the antibacterial and antifungal potential. The roots powder were subjected to Ultrasonic Assisted Extraction with *n*-hexane, acetone, ethanol and ethanol: water (1:1). General phytochemical screening revealed the presence of terpenoids, alkaloids, coumarins, sterols, flavonoids and cardiac glycosides while the absence of saponins, tannins, anthocyanidins, anthraquinones and phlobatanins in root extracts. The results indicated a reasonable antibacterial, antifungal potential and thus favour this plant to be a very important from medicinal point of view.

PPPP 79

EVALUATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA ASSOCIATED WITH WHEAT UNDER DROUGHT STRESS

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Wheat is the staple food crop all over the world. Wheat growth and yield is severely inhibited by abiotic stresses like drought. Plant Growth Promoting Rhizobacteria (PGPR) are helpful to increase the plant tolerance towards the drought condition. The purpose of this study was to isolate the efficient strains of PGPR that can promote wheat growth under drought stress. The research included the isolation and characterization of PGPRs strains isolated from roots and rhizosphere soil of wheatplants grown under different moisture regimes in the field and subjected to stress in pots. Sampling was done at two stages, i.e., vegetative and reproductive stages. Isolations were done from both the wheat rhizospheric soil and roots. Identification and characterization was done by various biochemical tests including oxidase, catalase and QTS tests. Stress intensity significantly affected the bacterial population and wheat growth, stress longevity only affected wheat water potential and water content. Certain PGPR isolates were promising in improvement of wheat growth under controlled conditions. Strains isolated from stressed sites were low in density but more efficient in plant's stress tolerance when inoculated.

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EFFECT OF PGRS (N₂ FIXERS) ON GROWTH OF WHEAT

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Plant growth promoting rhizobacteria (PGPR) help the growth of plants by various means like phosphate solubilization, production of siderophores and nitrogen fixation. The focus of present study was to evaluate the effect and survival of inoculated diazotrophs on the growth of wheat plants growing in autoclaved sand, soil and unautoclaved soil. Results of growth were far better in soil as compared to growth in sand. Bacterial strains KRS-3a, N-15 and N-5, were inoculated. Seven growth parameters were studied. The analysis revealed that all inoculants have positive effect on growth. Shoot length was significantly increased in plants inoculated with KRS-3a but significant increase in root length was observed in plants inoculated with N-5 maximum shoot biomass was increased in plants inoculated with N-22. Rhizospheric bacteria were isolated from the inoculated wheat plants to observe the survival of inoculated diazotrophs. Shape, motility, colony and cell morphology of the isolated strains was compared with the inoculated. Results indicated that some of the isolated strains were similar to the inoculated which assured the survival of the inoculated strains. Bacterial strains N-15, N-5 and N-22 can be useful inoculants for the growth of wheat plant. The present study suggests using of bacterial consortia rather than single strain inoculation to improve crop productivity.

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SYMPTOMATIC EXPRESSION OF TRISTEZA INFECTED CITRUS TREES IN PAKISTAN

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Variable symptoms were recorded during a survey in the citrus trees infected or suspected to be infected with citrus tristeza virus based on ELISA tests. Three citrus cultivars viz., kinnow mandarin, sweet orange and grapefruit were observed for symptoms. DAS-ELISA confirmed the presence of citrus tristeza virus in symptomatic trees. Sweet orange manifested main symptoms like bud union crease, pinholing, bark cracking, incompatibility, yellowing and dropping of leaves. Pinholing was particularly prevalent in sweet orange, kinnow and grapefruit, while incompatibility was only in sweet orange and grapefruit. Mild vein flecking was observed in lime during mechanical transmission but insect transmission was failed due to unknown reason which needs to be investigated in future.

PPPP 82

ANTIMICROBIAL EVALUATION AND PROXIMATE PROFILE OF *NEPETA LEAVIGATA*, *NEPETA KURRAMENSIS* AND *RHYNCHOSIA RENIFORMIS*

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The antimicrobial screening of the crude extracts and solvent soluble fractions of *Nepeta leavigata*, *Nepeta kurramensis* (Lamiaceae) and *Rhynchosia reniformis* (Papilionaceae) were investigated along with the proximate profile of the plants, for the purpose of standardization and quality control of bioactive components in such heterogonous botanicals and aid to drug discovery work with botanicals. The antibacterial results of *Nepeta leavigata* showed that the *n*-butanol fraction display outstanding activity against *E. coli* (85 % inhibition), *Proteusmorganii* (83% inhibition) while in *Nepeta kurramensis* chloroform fraction was outstanding against *Streptococcus cricetus* (89% inhibition), *Micrococcus flavas* (84% Inhibition). Where in *Rhynchosia reniformis* crude extract was exhibiting 100 % inhibition against *Streptococcus cricetus* only and ethyl acetate fraction presented outstanding activity against *Micrococcus flavas* (99% inhibition), *Streptococcus cricetus* (95% inhibition), *Proteus morganii* (90% Inhibition). In antifungal activities chloroform, ethyl acetate fractions of *Nepeta leavigata* and chloroform fraction of *N. kurramensis* were outstanding while in *Rhynchosia reniformis* chloroform fraction and methanolic extract were more reactive as compared to rest of fractions. The study was also carried out to assess the proximate composition of these medicinal plants, collected from Northern parts of Pakistan. In proximate analysis of a plant sample determines the total protein, fats, carbohydrates, ash, and moisture contents; reported as on % age basis. The analysis was carried according to AOAC methods. Results revealed that all the selected species were found to be a good source of ash, proteins and fats and can contribute greatly towards nutritional requirements and adequate protection against microorganism and other diseases.

PPPP 83

PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPRS) ENHANCE SEEDLING VIGOR AND SEEDLING GROWTH IN COTTON

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Plant Growth Promoting Rhizobacteria (PGPR) plays a significant role in seedling vigor and plant growth promotion. In this study twenty PGPR isolated from cotton rhizosphere in Pakistani soils were characterized and were found nitrogen fixing with substantial variation ranged from 8 (Z1)-1625 (Z5) n.moles acetylene reduced h⁻¹vail⁻¹. The fourteen bacterial strains produced indole acetic acid (IAA) ranging from 0.2 to 16.9 µgml⁻¹. The controlled experiments, conducted in sterilized sand have revealed that inoculation of selected PGPR strains have significantly increased the growth performance, total biomass and nutrient uptake ability of cotton plants. In a pot trial experiment, the significant increase in growth of cotton with different doses of nitrogen and phosphorous fertilizers has been demonstrated. The selected PGPR strains increase nutrient (NPK) uptake ability of cotton roots thus reducing the need for fertilizers which may prevent the accumulation of nitrates and phosphates in agricultural soils. The viable cells count at the time of sowing and harvesting depicted the persistence of the inoculated bacteria throughout the ontogeny of plants.

PPPP 84

GIBBERELIC ACID ALLEVIATES ADVERSE EFFECTS OF SALINITY STRESS BY OPTIMIZES IONS AND INCREASES GROWTH AND YIELD OF PEAS (*PISUM SATIVUM* L)

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Salinity is one of the main abiotic stresses which declined the growth and yield of crop plants including peas. Plant growth substances have long been demonstrated to exhibit favourable role in stress tolerance of plants. The present attempt deals with the role of GA₃ in the amelioration of salt stress in peas. Pre-soaking seeds with phytohormones like gibberellic acid (GA₃) proved useful for growth and yield of crop species grown under induced salt stress in potted plants. Experiments were conducted to investigate the GA₃ induced physiological changes in three varieties of Peas viz., Meteor FSD, Samrina Zard and IT-96. Ten days old seedlings were exposed to 0, and 50 mM NaCl salinity. Results showed that all the three levels (10⁻², 10⁻⁴ & 10⁻⁶ M) of GA₃ were effective to increase plant fresh/dry biomass and yield of peas; however, seed treatment with 10⁻⁴ M was more effective under salinity stress. Priming with GA₃ countered some of the adverse effects of NaCl by increasing chlorophyll pigment, proline production, sugar content, plant height and by reducing Na⁺ transport and Na⁺ fluxes concomitant with accumulation of K⁺ in shoots and roots under salt stress. The K⁺:Na⁺ ratio was also increased under salt stress. The performance of Pea variety Samrina Zard was better than Metoar, FSD and IT-96 both under controlled and salt stressed condition. It is inferred that the adverse effects of salt stress on peas can be alleviated by the seed pre-treatment with 10⁻⁴ M GA₃.

PPPP 85

CLASSIFICATION OF FORAGE GRASSES SPECIES BASED ON MINERAL COMPOSITION BY PRINCIPAL COMPONENT ANALYSIS (PCA)

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Fourteen trace metallic analytes (Co, Mn, Fe, Ni, Cu, Cr, Na, K, Cd, Mg, Li, Pb, Ca and Zn) in acid digests of forage grass species were determined and the data subjected to chemometric evaluation in an attempt to classify the 21 forage grass species. These forage grasses species included *Apluda mutica*, *Arthroxon prionodes*, *Avena fatua*, *Brachiaria reptans*, *Brachiaria ramosa*, *Chrysopogon aucheri*, *Cymbopogon jawaracusa*, *Cymbopogon martinii*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Dicanthium annulatum*, *Digitaria sanguinalis*, *Echinochloa colona*, *Eleusine indica*, *Eragrostis cilianensis*, *Heteropogon contortus*, *Pennisetum orientale*, *Phalaris minor*, *Poa annua*, *Sorghum halepense*, and *Themeda anathera*, were used as plant materials in this study. Nutrient compositions in these plants were determined by using Atomic Absorption Spectrophotometer. Correlation Analysis (CA), and Principal Component Analysis (PCA) were used as classification techniques. About 21 plants were classified in 5 groups by PCA.

ORAL ABSTRACTS

OPPE 1

PHOSPHATE SOLUBILIZING BACTERIA ASSOCIATED WITH VEGETABLES ROOTS IN DIFFERENT ECOLOGIES

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Forty one (41) isolates were recovered as phosphorus solubilizing bacteria from rhizosphere of healthy plants of pea, spinach, lady's finger, French bean, kulfa, cauliflower, turnip, brassica, cucumber, coriander, onion, potato, capsicum, salad, eggplant and field mint from 25 locations in Mansehra district, Taxila area and Islamabad. PSB population ranged from 1.95×10^7 in lady's finger to 5.33×10^9 in turnip in Mansehra area. It ranged from 1.9×10^6 in spinach to 1.3×10^9 in field mint in Taxila area while in Islamabad upto 8×10^5 in spinach. Highest Solubilization Index (4.25) was found in one isolate from spinach in Mansehra while 10 isolates from 10 vegetables had PSB of Solubilization Index in the range of 3.5-4.4 from Taxila area. Population in Taxila area was found negatively correlated with clay, phosphorus and organic matter while positively correlated with soil pH, EC and soil nitrate. All selected isolates were urease negative. This indicates that soils of these areas inhabit PSB with great potential to be used as bioinoculants.

OPPE 2

LIFE FORM DIVERSITY IN VEGETATION OF THE CHOLISTAN DESERT

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Life forms clearly indicate the spectra of vegetation of a particular area. Life form diversity of vegetation was studied during the preliminary survey of vegetation resources in the Cholistan Desert using Du Rietz method of classification with little modification in thirty (30) different stands at ten (10) different localities of both the Greater and the Lesser Cholistan regions. Mostly vegetation consisted of shrubs, scrubs and bushes. Among herbs and grasses 72% of flora were representing as perennial while 28% as annual from ten different localities of the Greater and Lesser Cholistan. In the Greater Cholistan Dessert, the vegetation was chiefly composed of theriophytes (27%), hemicryptophytes creepers (18.18%) and Arbustiform upright shrubs (16.36%), Arboriform tree and Hemicryptophyte rosular (3.64% each), Arbustiform thick stemmed shrub and Geophyte rhizomate (5.45% for each), Hemicryptophyte graminiform and hemicryptophyte caulifoliate shared (10.91% and 7.27% respectively) and minimum proportion was observed in respect of Arbustriform cushion shrub constituting 1.82%. Whereas, in the Lesser Cholistan vegetation percentage for Arbustriform upright shrubs and Theriophytes constituted (24% each), hemicryptophytes creepers (14%), while only (10% each) vegetation composition in respect of hemicryptophyte graminiform and Arbustriform thick stemmed shrub, followed by hemicryptophyte caulifoliate (6 %) Arboriform tree (4%) while Arbustriform cushion shrub, hemicryptophyte rosular, bulb geophyte and Geophytes rhizomata each comprising (2%) of total flora. The data were analyzed by using STATISTICA software package.

OPPE 3

STUDY OF POLLUTANTS (TOXIC/HEAVY METALS) IN SOME EDIBLE FRUITS OF QUETTA.

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This paper deals with the amount of concentration of trace elements present in edible fruits. During present investigation concentration of five metals (Cu, Zn, Fe, Cd and Pb) were estimated in fresh fruits i.e., apples, apricots and peaches collected from orchards/fields and the vendors in local markets of Quetta, area. Fe concentration was observed to be higher in peaches as compared to the other metals in fruit samples (e.g.; apple, apricot and peaches). It was found highest (46.77 µg/g) in peaches, in the manner of its content in investigated fruits Fe was: peaches > apricots > apples. The lowest (21.51 µg/g dry weight) was found in apples. In other fruits its content was between 21.51 and 46.77 µg/g dry weight. Average values for Zn was observed to be 2.22, 3.72 and 4.92 µg/g dry weights in apples, apricots and peaches respectively. Copper (Cu) is another important metal for human health as it is essential for function of many enzyme systems in the body. Its minimum and maximum values ranged from 1.36 – 9.54 µg/g dry weight. We also observed that the concentration of cadmium in fruits was within the range of 0.02 – 0.18 µg/g dry wt. In the fresh fruit samples collected, concentration of lead was found below detection limit (BDL- 0.20 µg/g dry weight). However, above mentioned allowable limits were assayed in some of the samples, as the high content was found in some of the apricot and peach samples. The findings of the present study are comparable with other studies undertaken in Pakistan, Turkey and Nigeria.

OPPE 4

GREEN MOLD AS A POTENTIAL SCAVENGER OF CR(VI)

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Metal removal capability of indigenous soil fungus of Pakistan i.e. *Trichoderma harzianum* (Rifai) was determined through laboratory bioassays. Experiments were conducted in flask by taking 0.1 g of powdered fungal biomass in 100 mL (25 mg L⁻¹) of metal solution kept at 150 rpm for 3 hrs. Results showed 65% adsorption efficiency of *T. harzianum* biomass for Cr(VI). Langmuir and Freundlich isotherms were used to enlighten biosorption phenomenon revealed 50 mg g⁻¹ adsorption capacity of the fungus. The solution pH selected in the range of 2-10 followed downward trend for metal uptake as maximum removal efficiency of 80% was noticed at pH 2-3. FTIR highlighted the involvement of amine (-NH₂) and hydroxyl (-OH) groups in adsorption process. Adsorption/desorption trials conducted with four acids indicted that desorption of Cr(VI) follow the order of: H₂SO₄ (0.1M) > HNO₃ (0.5M) > HCl (0.1M) > HCl (0.5M) > CH₃COOH (0.1M) > CH₃COOH (0.5M) > H₂SO₄ (0.5M). Adsorption based trials summarized that fungal biomass are potential, violent and inexpensive biomaterial with viable application in the biosorption of Cr(VI) from liquid media.

OPPE 5

PYTOSOCIOLOGICAL STUDIES OF THE VEGETATION OF SARSAWA HILLS DISTRICT KOLTI, AZAD KASHMIR

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Patterns of species composition and diversity in the lesser Himalayan subtropical forests of Kashmir were studied in relation to environmental variables and underlying anthropogenic influence. *Pinus-Poa-Maytenus*, *Myrsine-Themeda*, *Pinus*, *Colebrookia-Themeda-Dodonaea*, *Themeda-Carissa-Adhatoda*, *Themeda-Dodonaea-Eriophorum*, *Adhatoda-Themeda*, *Carissa-Myrsine-Themeda*, *Carissa-Themeda-Dodonaea*, *Dodonaea-Carissa-Pinus* communities were identified at different altitudinal ranges. Soil pH varied from 6.80 to 7.33, organic matter varied from zero to 4.30,

Potassium (K) varied from 40 ppm to 80 ppm and Phosphorus (P) varied from 1.25 ppm to 11.25 ppm. Severe erosion and grazing intensity was observed at all the study sites. A very low species richness varying from 10 to 17 was recorded indicating degraded forest structure. Comprehensive forest conservation policy with practical implementations is utmost essential in order to conserve the rapidly depleting forest resources of the area.

OPPE 6

AN APPRAISAL OF ECOLOGICAL DISTRIBUTION OF HERBACEOUS FLORA AT GATWALA FOREST PARK (GFP), FAISALABAD, PAKISTAN

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The classification of herbaceous vegetation into groups establishes the link between researcher and resource managers, because the natural ground flora of any region represents the soil conditions, climate trends and indirectly refers to the overall natural system. Classification is an eminent mean that provides a description of vegetation units within a particular region and it values to natural ground flora. It also helps us to determine the similar response which various species placed in a group exhibit over the ecosystem. The study has been conducted at the Gatwala Forest Park, a protected/game reserve area located in the heart of Pakistan's third largest metropolitan city Faisalabad, in the province of Punjab. This park spans over an area of 131 acres (53 hectares). Floristic data was randomly collected at the site for ground flora. The survey resulted in identification of 42 species belonging to various plant families. The major causative factor impeding this ground flora's growth was the presence of planted exotic species (as they take away the major chunk of nutrients and sunlight, or shed their leaves to cover the ground) and direct or indirect human activities. TWINSPLAN technique was used to classify the data collected. Dominant species observed there were *Cynodon dactylon*, *Dichanthium annulatum*, *Cenchrus pennisetiformis*, *Panicum antidotale*, *Malvastrum coromandelianum*, *Oxalis corniculata*, *Stellaria media*, *Ranunculus muricatus*, *Sisymbrium irio* and *Medicago lupulina*. Four Major groups are delineated using the ordination analysis. The study identifies and highlights the critical need for the protection and conservation of flora in Gatwala game reserve. Certain unique species were also identified with reference to previous studies hence imparting minimal influence on the ecosystem. The study highlighted the importance of conserving the indigenous flora.

OPPE 7

USE OF BIOREMEDIATED SEWAGE EFFLUENT FOR FISH SURVIVAL

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Two fresh water fish species Tilapia (*Oreochromis mossambicus*) and common carp (*Cyprinus carpio*) were cultured to investigate the survival rate in bioremediated sewage effluent of Shehzad town, Islamabad. The experiment was laid out in complete randomized design (CRD). Two earthen ponds one with fresh water and second with bioremediated sewage effluent, with dimension of 20x40 m were selected at Fisheries and Aquaculture Programme, NARC. Fish survival was investigated after fortnight sampling. Physicochemical parameters of bioremediated water were within permissible limit recommended for fish. Less than 1 % survival was observed in bioremediated water pond whereas 100% fish survival was recorded in fresh water pond. Investigation showed the higher level of $\text{NH}_4\text{-N}$ (31.08 mg L^{-1}), $\text{NO}_3\text{-N}$ (18.58 mg L^{-1}) and chlorides (39.61) in bioremediated sewage water were main cause of fish mortality. All other physicochemical parameters of were within permissible limit for fish survival. Hundred percent fish survival was recorded in bioremediated sewage effluent after phytoremediation with coontail (*Ceratophyllum demersum*) plant that has potential of removing ammonia, Nitrates and chlorides from sewage waste water. This study showed that this treated sewage water required further treatment for removal of $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$ and chlorides by using phytoremediating potential plant coontail (*Ceratophyllum demersum*).

OPPE 8

THE POTENTIAL OF *CHLORELLA VULGARIS* FOR WASTEWATER TREATMENT AND BIODIESEL PRODUCTION

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The release of municipal wastewater from various sources can cause contamination of water bodies and algal blooms. In this study isolated strain of *Chlorella vulgaris* was used for treatment of municipal wastewater and biodiesel production. Initially *Chlorella* culture was prepared in artificial media then it was inoculated in transparent and covered, glass ponds containing wastewater to investigate its treatment efficiency. A lab scale biological wastewater treatment design was also made using *Chlorella vulgaris*. Harvested biomass was transesterified to biodiesel using sodium metal as a catalyst. Percent reduction of COD, BOD, NO_3^- , PO_4^{2-} and TC (total coliforms) was almost similar in all types of transparent and covered ponds after treatment with *Chlorella vulgaris*. Analysis of selected parameters was carried out at each step of biological treatment design and maximum reduction percentage of COD (99.9%), BOD (100%), NO_3^- (99.98%), PO_4^{2-} (99.96%) and TC (100%), was observed by applying *Chlorella vulgaris*. Biodiesel produced by direct transesterification of dried algal biomass was analyzed and compared with ASTM standards. Results showed that biodiesel produced was of good quality and it can be used as a fuel in vehicles.

OPPE 9

EFFECT OF ACC DEAMINASE CONTAINING BACTERIA ON GROWTH OF WHEAT SEEDLINGS APPLIED WITH CHROMIUM CONTAMINATED WATER

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Chromium (Cr) is considered as toxic environmental pollutant and causes harmful effects on growth and development of plants and human health. Usually, high level of ethylene (a plant hormone) is produced in plants in response to any biotic or abiotic stress. Negative effect of Cr-imposed stress on plants may be minimized by using bacteria possessing an enzyme L-amino-cyclopropane-L-carboxylic acid (ACC)-deaminase. The aim of this study was to investigate the effect of plant growth-promoting bacteria containing ACC-deaminase on wheat under different levels of Cr applied to growth medium. Experiments were conducted under laboratory and lath house conditions. Results of this study demonstrated that inoculation of wheat seeds with two strains of bacteria *Pseudomonas fluorescens* (Q14) and *Bacillus thuringiensis* (KAP5) significantly increased the root length (up to 208 %), shoot length (up to 67 %), root dry weight (up to 140 %) and shoot dry weight (up to 71 %) respectively as compared to uninoculated control plants. Strain KAP5 possessing both ACC-deaminase as well as phosphate solubilizing activity was found to be the most effective in improving the plant growth compared to uninoculated control in both sand and soil experiments. Inoculation also significantly increased the accumulation of Cr in root and shoots compared to uninoculated control, where the Cr uptake $80.8 \mu\text{g g}^{-1}$ dry mass and $69.9 \mu\text{g g}^{-1}$ dry mass in root and shoot respectively, was observed. These findings indicated that ACC-deaminase producing bacterial strains could play vital role in improving the plant growth under metal-stress condition and they may enhance bioremediation process in Cr-contaminated environment. Moreover, presence of dual plant growth promoting trait such as ACC-deaminase and phosphate solubilizing activity could have more promising effect on plant growth and Cr removal than the single trait bacterium.

OPPE 10

THERAPEUTIC HORTICULTURE: INFLUENCING PSYCHOLOGICAL RESPONSES OF SURGICAL PATIENTS AND THEIR ENVIRONMENTAL ASSESSMENT SCALE

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Therapeutic impact of foliage plants and flower arrangements were evaluated on the post operative recovery of surgical patients in hospital wards. Two hundred and seventy surgical patients were randomly assigned to hospital wards with plants and without plants representing ward A and ward B, respectively, making a lot of one hundred and thirty five patients in each comparing ward. Eight species of flowers and foliage plants were placed in ward A. Various methods like Patient's questionnaire, small group discussion with ward nurses and focal interviews with ward doctors were used for collecting patient's data. Data collected includes patients' physiological status evaluating traits viz., ratings of

patient's anxiety, fatigue, pain intensity and patient's social behavior, Environmental Assessment Scale, Patient's personal preferences for plants and flowers and intake of postoperative analgesics. Statistically analysis of data was done through Statistical Package for Social Studies (SPSS) by using chi-square test. More effective health signs were observed for patients admitted in the ward A than those in the ward B. Patients admitted in ward A had significantly fewer consumption of postoperative analgesic because of exhibiting more controlled and normal psychological and cognitive responses. Patients' stays in plants and flowers experienced less intensity of pain, anxiety, fatigue, elevated mood and were socially more active and friendly towards other patients and nursing staff, expressing more positive feelings and satisfying comments about their ward when compared with patients in the control group i.e., ward B. A more calm, soothing and pleasing ward environment was described by patients stayed in ward with plants and flowers in comparison to patients in no plants ward. Additionally most of the patients in ward A preferred Cut flowers, especially red color roses over the green and variegated foliage plants. Furthermore, Small group discussion and focal interviews with nurses and doctors affirms that arrangement plants and flowers in hospitals is an effective, inexpensive and more productive complementary approach in medical field for surgical patients. These findings confirm and approve the application of therapeutic horticultural approach for patients in hospitals.

OPPE 11

SYNTHESIS OF ACTIVATED CARBON FROM TREE SAWDUST AND ITS USAGE FOR DIMINUTION OF COLOR AND COD OF PAPER-MILL EFFLUENTS

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In present work, activated carbons were prepared from saw dust of *Dalbergia sissoo*, *Cedrus deodara* and *Eucalyptus* spp. using H₃PO₄, H₂SO₄ and BaCl₂ as activating agents. The activated carbons were evaluated for reduction in color and chemical oxygen demand (COD) of a real paper industry effluents using batch-mode method to explore the effect of operating parameters (contact time, amount of activated carbon, wastewater concentration, solution pH etc). Statistical analysis revealed that all the activated carbons were significantly different in their efficacy for wastewater treatment. *Cedrus deodara* based activated carbon was most efficient; showed 93% COD reduction with 100% color removal and brought other physico-chemical parameters of wastewater within the permissible limits of WHO and NEQS. The maximum percent reduction of COD and color with *Dalbergia sissoo* activated carbon was 80% and 91%, respectively while with *Eucalyptus* spp. activated carbon; it was 74% and 85%, respectively. The effectiveness of activated carbon synthesized from sawdust of different plants for wastewater treatment was in the following order: *Cedrus deodara* > *Dalbergia sissoo* > *Eucalyptus* spp. The quality of wastewaters after treatment was found to be appropriate for direct discharge into streams and irrigation purpose. This study proved highly successful in addressing the local problem of paper industry effluents using locally available wood processing byproducts.

OPPE 12

ALLELOPETHIC EVALUATION OF SHARED INVASIVE PLANTS AND WEEDS OF PAKISTAN AND JAPAN FOR ENVIRONMENTAL RISK ASSESSMENT

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Pakistan and Japan have a large exotic flora in common, in spite of contrasting histories, physiographies and land-use patterns. Among these 39 common invading plants and weeds of Pakistan and Japan have been subjected to allelopathic evaluation. The plant species under investigation have been evaluated by subjecting their seedlings, leaf litter and volatiles through application of Plant box, Sandwich and Dish pack methods. The results obtained from 3 different methods have been statistically analyzed and the mean average values have been calculated for risk assessment. According to results, as a whole *Tagetes minuta* L. appeared to be the most noxious species among all due to maximum inhibitory effect shown on the *Lactuca sativa* L. growth followed by *Melilotus officinalis*, *M. alba*, *Datura stramonium*

and *Lantana camara*. While *Rumex crispus* and *R. conglomerates* have shown minimum inhibitory effect. The results presented could be utilized as benchmark information for further research on the elucidation of chemicals involved in the allelopathy in nature. The information obtained could also be helpful in the development of new and potent bioactive chemicals from natural products.

OPPE 13

***DIPLLOTAXIS TENUIFOLIA* L. (DC) AS A BIOMONITOR OF HEAVY METAL POLLUTION ALONGSIDE THE ROADS IN TURKEY**

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Diplotaxis tenuifolia is a widely distributed perennial ruderal in Turkey. It is used as an alternative food as well as for medicinal purposes. The samples were collected from 54 sites in Turkey, situated on habitats like highways, sideways, industrial areas, urban centres and rural environs. Concentration of lead, cadmium, copper, chromium, nickel and iron was determined in the whole plant as well as soils using Atomic Absorption Spectrophotometer. The results show that copper concentrations in the soils are highest near highway (45.533) and lowest around industrial areas (3.514), in plants values are highest in Urban areas (50.130) and lowest around sideways (32.377). For chromium concentrations in the soils are highest near sideways (18.397) and lowest around industrial areas (0.182), but in plants values are highest in Urban areas (0.238) and lowest around highways (0.114). In the case of nickel concentrations in the soils are highest around rural areas (0.726) and lowest around sideways (0.271), values in plants are highest around Industrial areas (0.238) and lowest around highways (0.182). The cadmium concentrations in the soils are highest around Industrial areas (0.726) and lowest around urban areas (0.000), whereas in plants values are highest around Industrial areas (0.016) and lowest around highways (0.005). Lead concentrations in the soils are highest near highway (2.865) and lowest around sideways (1.917), but in plants the values are highest in Urban areas (3.474) and lowest around sideways (2.420). The concentrations of iron in the soils are highest around Industrial areas (82.766) and lowest around sideways (54.073), in plants values are highest around urban areas (61.304) and lowest around industrial areas (20.600). There is substantial aerial deposition on the leaves for all four elements. Significant correlations were obtained between the heavy metal concentrations in surface soil taken from 0-10 cm depth and plant samples.

OPPE 14

ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF AN ETHNOBOTANICALLY IMPORTANT PLANT

***HELINUS LANCEOLATUS* WALL. EX BRANDIS OF DISTRICT KOTLI, AZAD JAMMU & KASHMIR**

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In this study, various extracts of *Helinus lanceolatus* Wall. ex Brandis., i.e. petroleum ether, chloroform, methanol and aqueous were obtained by maceration method. All these extracts were tested for their antioxidant potential, antibacterial and antifungal activities. Antioxidant activities were analyzed by four methods, i.e. 2,2-diphenyl-2-picrylhydrazyl radical (DPPH) scavenging activity, total antioxidant activity, ferric reducing antioxidant power (FRAP) assay and ferric thiocyanate assay along with the determination of their total phenolic contents. The results revealed that among these fractions the aqueous soluble fraction showed highest DPPH radical scavenging activity i.e. $79.01 \pm 0.09\%$ inhibition of DPPH radical at a concentration of 130 $\mu\text{g/ml}$ with IC_{50} value 15.29 ± 0.59 relative to butylated hydroxytoluene (BHT), i.e. 12.52 ± 0.89 $\mu\text{g/ml}$. Chloroform extract showed highest total antioxidant activity i.e. 0.840 ± 0.13 and highest FRAP value i.e. 90.66 ± 4.54 TE $\mu\text{M/ml}$ was shown by petroleum ether. Chloroform and methanol extract showed considerable amounts of total phenolic contents, i.e. 12.66 ± 1.20 and 44.66 ± 1.13 GAE mg/g respectively). Methanol extract showed good value of inhibition of lipid peroxidation, i.e. $59.11 \pm 0.12\%$. Antimicrobial

activities were carried out by well diffusion method against Gram +ve and Gram -ve bacteria and fungi. The highest zone of inhibition was formed by methanol extract, i.e. 50 ± 1.15 against the bacteria *Escherichia coli* and against the fungi *Aspergillus niger* 17 ± 2.6 mm by aqueous extract. The MIC results revealed that the methanolic extract shows more resistance against *Pseudomonas aeruginosa*, i.e. $0.001 \mu\text{g/ml}$.

OPPE 15

EFFECT OF PARTICULATE MATTER ON LEAF PIGMENT CONTENTS, STOMATA AND LEAF AREA OF SELECTED ROADSIDE PLANT SPECIES OF SIALKOT.

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Particulate air pollution caused by road construction and traffic has profound impacts on roadside trees. In this study the five common species of *Eugenia jambolana*, *Eucalyptus camaldulensis*, *Psidium guajava*, *Mangifera indica* and *Ficus religiosa* along seven major roads namely G.T Road Wazirabad, Daska Road, Air Port Road, Kashmir Road, Khadim Ali Road, Kulowal road and main Sialkot road were studied for the impacts of particulate air pollution on leaf pigment contents viz., Chl a, b carotenoids and anthocyanin's, stomata clogging and leaf area reduction. Experimental samples were collected from plants planted along roadside and less exposed samples were collected from the fields and villages away from the roads. Samples were analyzed in the laboratory. The results showed a significant number of clogged stomata and leaf area reduction in all species of experimental site and some trees of less exposed sites were also found to be showing the same results. It was found that highest number of clogged stomata was observed in *Eugenia jambolana* and *Ficus religiosa*, *Eucalyptus camaldulensis*, *Mangifera indica* and greatest leaf area reduction was observed in *Ficus religiosa* and *Eugenia jambolana*. Reduction in the chlorophyll "a", chlorophyll "b", total chlorophyll content and carotenoids were recorded in the selected trees of experimental site except *Populus alba* L. and *Eucalyptus globules* Labill. The anthocyanin concentration in all experimental samples was more than the controlled one.

OPPE 16

BACTERIAL EXPRESSION, PURIFICATION AND PARTIAL CHARACTERIZATION OF NEW RECOMBINANT CYSTEINE PROTEASE FROM MAIZE LEAVES: POST-TRANSCRIPTIONAL CHANGES UNDER OZONE STRESS

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Cysteine proteases are implicated in senescence, defense signaling pathways and cellular responses to biotic and abiotic stresses. In this context, we have cloned a novel cDNA encoding for papain family of cysteine protease from maize leaves. Mature part of papain-like protease was expressed in *Escherichia coli* using T7 promoter system. The recombinant protein was purified from inclusion bodies, refolded, characterized and used to produce corresponding antibodies in order to study post-transcriptional level of this specific protease under ozone stress. The results showed that ozone enhanced significantly papain-like cysteine protease at post-transcriptional level in 12th and 10th leaves of field grown maize plants. Simultaneously, senescence induced a rise in cysteine protease activity in both leaves. All together, these results suggest that ozone stress stimulates senescence processes, such as those related to proteolysis.

OPPE 17

EFFECT OF AIR POLLUTION ON THE LEAF MORPHOLOGY OF COMMON PLANT SPECIES OF QUETTA CITY

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The urban air pollution is a major environmental concern, particularly in the developing countries and in their major cities. Therefore, the present study was mainly aimed to study the effect of air pollution on the morphological characteristics of leaf of 13 common plant species viz., *Elaeagnus angustifolia* L., *Eucalyptus tereticornis* L., *Ficus carica* L., *Fraxinus excelsior* L., *Melia azadirach* L., *Morus alba* L., *Morus nigra* L., *Pistacia vera* L., *Prunus armeniaca* L., *Punica granatum* L., *Robinia pseudo acacia* L., *Rosa indica* L. and *Vitis vinifera* L. grown in the urban (polluted site) and peri-urban (non-polluted) sites of Quetta. Results showed that all plant species exhibited significant ($P < 0.05$) reduction at polluted site in their leaf length, width, area and petiole length when compared with the same plant species of non-polluted site. These plant species also showed significant variation in the growth of morphological parameters from season to season. Results also showed that the overall reduction % in leaf length, width, area and length of petiole during different seasons at polluted sites with respect to those of non-polluted sites were found maximum during summer (33.91, 36.61, 37.08 and 46.17 %), followed by autumn and lowest was recorded during spring season (28.39, 23.50, 32.49 and 26.34 %), respectively. Results also deciphered that minimum decrease in leaf length (19.86%), leaf width (17.81%), leaf area (22.66%) and petiole length (02.56%) was observed in *Vitis vinefera* L., *Pistacia vera* L., *Ficus carica* L. and *Pistacia vera* L. Whereas, maximum decrease 72.59, 50.58, 57.98 and 65.48% for the same attributes were noted in *Punica granatum* L., *Elaeagnus angustifolia* L., *Rosa indica* L. and *Eucalyptus tereticornis* L., respectively. Results further indicated that as the plants get ages, the reduction % of various leaf attributes of polluted plants also increased as compared with non-polluted plant species. This could be mainly due to maximum exposure of plants to air pollutants come from various auto emission sources.

OPPE 18

TOXICITY AND BIOACCUMULATION OF HEAVY METALS IN SPINACH SEEDLINGS GROWN ON FRESHLY CONTAMINATED SOIL

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Plants grown on soil contaminated with heavy metals (HMs) contain high concentrations of HMs in their tissues. HMs affect plants adversely because of their toxicity on plant growth, reduction in plant yield and inhibition of enzymatic activities. Greenhouse pot experiments were conducted to assess the uptake pattern and toxicities of three different doses of cadmium (Cd), lead (Pb), and zinc (Zn), both single and mix forms. Spinach (*Spinacia oleracea*) was used as representative vegetable for this study. Increasing concentrations of Cd, Pb and Zn in both single and mixture forms significantly ($p < 0.05$) reduced growth parameters of *S. oleracea* seedlings. The reduction in growth parameters of *S. oleracea* seedling showed the dose response for Cd, Pb and Zn in both single and mixture forms. The uptake patterns of Cd, Pb and Zn in Cd/Pb, Cd/Zn and Pb/Zn showed antagonistic impacts on each other, while toxicities caused by selected HMs were highest for Cd followed by Pb and Zn. Highest toxicity was observed in plant seedlings grown on Cd/Pb treated soil.

OPPE 19

ALLELOPATHIC INTERACTION OF *TARGETES MINUTA* L. AN ENVIRONMENTALLY SAFE BIOHERBICIDE

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The aim of present study was to evaluate allelopathic effects of *Tagetes minuta* L. for the control of important weeds, *Avena fatua*, *Rumex dentatus* and *Phalaris minor* in wheat. For this purpose leaf extract and leaf powder was used. In filter paper method different concentrations (50, 75 and 100%) of leaf extract of *Tagetes minuta* L. were applied to determine their effect on weed seed germination and growth of selected weeds. All the extract concentrations significantly reduced the germination of *Phalaris minor* and radical growth however the shoot length of the surviving seeds was not affected. In *Avena fatua* the shoot growth inhibition was concentration dependent. The germination of *Rumex dentatus* reduced only at 100 % concentration. Leaf extract of *Tagetes minuta* significantly reduced the germination of tested weeds and their germination reduction was in the order of 90.69%, 81.81% and 19.14% for

Phalaris minor, *Avena fatua* and *Rumex dentatus* respectively. Direct incorporation of leaf powder into the soil at the dose of 2g, 4g and 6g had no effect on shoot and root growth and germination% of all tested weeds except the root growth of *Rumex dentatus* at 6g/300g of soil mixture. The leaf mulch requires time to degrade and release allelochemicals into the soil. Results indicated that *Tagetes minuta* leaf extract can be used as an environmentally safe bioherbicide.

OPPE 20

WASTEWATER AND SOIL QUALITY ASSESSMENT OF NULLAH LAI OF PAKISTAN

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The present study examines the extent of pollution in Nullah Lai water due to untreated industrial and sewage waste. Ten wastewater and soil samples were collected from the ten different localities of Nullah Lai of Rawalpindi and Islamabad. The concentrations of heavy metals (Cu, Cd, Pb, Zn, Ni and Cr) were determined by atomic absorption spectrophotometry. The physical parameters pH, Electrical conductivity (EC), total dissolved solids (TDS), turbidity and temperature in water and soil samples were also determined. Higher values of heavy metals (Cd, Cr, Ni, Pb, Zn, Cu) and other physical parameters (pH, EC, Turbidity, TDS, Temperature) in wastewater samples from Rawalpindi and Islamabad clearly indicate the industrial and sewage pollution. Larger variations in the level of various parameters (pH, EC, turbidity, TDS, Cd, Cr, Pb, Zn and other metals) were observed along the Nullah Lai passed in different localities. These variations were due to different types of industrial effluents and small drains. The study showed that untreated industrial effluents were the major pollutants and the most feasible alternative is to convert the drainage network to a sedimentation and temporary storage reservoir. The present investigation proved that ninety five percent of the water samples are not for drinking purposes due to toxic level of heavy metal contents as prescribed by World Health Organization (WHO) guidelines but can be used for irrigation purpose.

OPPE 21

ACCUMULATION OF HEAVY METALS BY IN VITRO CULTURES OF PLANTS

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This research provides a brief overview of an environmental remediation technology, including an introduction to its general principles, reported applicability and utilization, and cited advantages/disadvantages in environment. Present study aims to search for the plants possible to grow in metal contaminated soils and accumulate metals in their biomass. The significance of the study is to analyze the wheat potential for phytoremediation and to check its metal absorbing capability for the improved soil and water health along with the effect of heavy metals on growth of wheat culture. Study was carried out on the wheat plantlets grown in vitro. The plants were exposed to aqueous solutions having concentrations 0.1mM and 0.5 mM of Pb^{+2} and Cd^{+2} , respectively. In the present investigation both metals are accumulated in wheat more than the defined standards; wheat culture accumulated maximum about 1499.88 mg of Cd^{2+} /Kg of biomass from 0.5 mM Cd^{2+} solution and 1190.652 mg of Cd^{2+} /Kg of biomass from 0.1mM Cd^{2+} solution and it accumulated 1914.36 mg of Pb^{2+} / Kg of biomass from 0.5 mM Pb^{2+} solution and 855.26 mg of Pb^{2+} /Kg of biomass of the 0.1 mM Pb^{2+} solution. Plants that accumulate 100 mg of metals per 1 kg of their biomass are preferred for phytoremediation so wheat can be used as a hyper accumulator for both Lead and Cadmium.

OPPE 22

TOLERANCE POTENTIAL OF FUNGI ISOLATED FROM POLLUTED SOIL OF MULTAN

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The present study is design to study and evaluate the tolerance potential of fungal strains i.e., *Aspergillus niger* against specific metals like $\text{Cr}(\text{NO}_3)_3$, $\text{Pb}(\text{NO}_3)_2$ and ZnCl_2 which were isolated from polluted peri-urban area of Multan. The degree of tolerance is measured through minimum inhibitory concentration (by applying different concentrations of metals). Tolerance potential showed either tested isolates are tolerant or moderately tolerant or sensitive. The findings of present study is depicted that *Aspergillus niger* showed different tolerance behaviour for different metals at different concentrations such as chromium and lead are more tolerated as compared to Zinc. The knowledge of the present study will be helpful for further research i.e. biosorption, bioremediation and genetic characterization in future purposes.

OPPE 23

TOLERABLE ANALYSIS OF THE FUNGI OF THE PERI-URBAN AGRICULTURAL AREA

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Peri-urban refers to farm units close to town which operate intensive semi-, or fully commercial farms to grow vegetables and other horticulture, raise chickens and other livestock, and produce milk and eggs. In present study the soil samples were collected from peri-urban agricultural locations of Hudiara drain, Lahore and Chahkayra Chack, Faisalabad. Among different strains of both peri-urban areas (Lahore and Faisalabad) only two strains of *Aspergillus niger* were tested for heavy metal tolerance and metal biosorption against Cr. The tolerant fungal strains were selected by repeated sub culturing in Petri dishes with increasing metal concentration (0.05, 2, 4, 6, 8 and 10mg/ml), in the PDA (Potato Dextrose Agar medium). The degree of tolerance was measured by radial growth (cm) in the presence of the various heavy metals salts and compared to a control, which contain no heavy metals. Tolerance was taken in terms of minimum inhibitory concentration. *Aspergillus niger* showed minimum growth at 6mg/ml against the tested heavy metal $\text{Cr}(\text{NO}_3)_3$ and exhibited radial growth (3-4.5 cm). The minimum inhibitory concentration for the tested fungus *Aspergillus niger* against heavy metal $\text{Cr}(\text{NO}_3)_3$ is 6mg/ml. *Aspergillus niger* showed maximum biosorption at 8mM in Faisalabad samples while in Lahore samples the maximum biosorption was at 10mM. The purpose of the present study was to see tolerance and biosorption of soil fungal population towards heavy metals present in the soil. The study focused on the fungal population which is tolerant to heavy metal salts and showed high biosorption potential.

OPPE 24

HEAVY METAL REMEDIATION BY FUNGI

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Tolerance test experiment is conducted to evaluate the tolerance / resistance level of fungi (*Aspergillus flavus*, *Aspergillus fumigatus* and *Eurotium spp.*) against metals (Ni, Cd, Cu) because metal pollution is of serious environmental problem of worldwide concern. Eleven isolates were isolated from the agricultural contaminated soil of Multan and tested at different concentrations (0 mg /l as a control, 50 mg/l, 100mg/l, 150mg/l and 200 mg/l) of metals ($\text{NiCl}_2.6\text{H}_2\text{O}$, $\text{CdSO}_4.8/3\text{H}_2\text{O}$ and $\text{CuSO}_4.5\text{H}_2\text{O}$). The gradual decline in the radial growth of isolates is observed at higher concentrations. The isolates were classified into tolerant, moderate tolerant and sensitive on the basis of tolerance index. Isolates M14, M20 and M22 showed maximum tolerance against $\text{NiCl}_2.6\text{H}_2\text{O}$ but isolates M17, M18 and M22 showed maximum tolerance against $\text{CdSO}_4.8/3\text{H}_2\text{O}$. At $\text{CuSO}_4.5\text{H}_2\text{O}$ isolate M17, M20 and M21 showed maximum tolerance. The results of present study depicts that isolated fungi were more tolerant to nickel and copper as compared to cadmium. This study will be helpful for devising remedial measures in term of bioremediation.

OPPE 25

EFFECT OF ACC DEAMINASE BACTERIA ON TOMATO PLANTS CONTAINING AZO DYE WASTEWATER

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The effect of plant growth promoting rhizobacteria (PGPR) on seedling germination, plant growth and biomass yield of tomato plant in presence of dye wastewater irrigation was evaluated in two experiments (lab scale and green house). Previously isolated strain *Pseudomonas fluorescens* (Q14) with ACC deaminase activity was used to check its effect to remediate dye contaminated water impact on plants. The maximum biomass production was obtained on application of 600 mg/L dye with selected PGPR as compared to control water. The dye concentration beyond 600 mg/L showed significantly repressed growth of plants. In plant biomass analysis root and shoot biomass were measured while in plant growth root, shoot length in both experiments was compared. It was also observed that the inoculation with plant growth promoting bacteria carrying ACC deaminase activity promote root and shoot growth as compared to un-inoculated plants at different Reactive Black B concentrations. Maximum shoot (46 cm) and root length (35 cm) was observed at 600 mg/L of Reactive Black B with inoculation, which clearly implies the importance of industrial wastewater for crop and vegetable grown under water stress conditions. These findings suggest that PGPR with ACC deaminase activity could be implied for increasing biomass production of wheat and maize irrigated with dye containing wastewater released from textile industries.

OPPE 26

EFFECTS OF LEAD RESISTANT BACTERIA ON THE EARLY GROWTH OF *VIGNA MUNGO* L. (HEPPER) UNDER LEAD STRESS

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Three lead resistant bacteria *Bacillus pumilus* (TE07), *Bacillus cerus* (TE12 & TE14), were examined for their plant growth promotion /remediation potential. Their ability to promote early growth and their effects on metal uptake by three varieties of *Vignamungo* L. (Hepper) i.e., NARC-Mash-2, NARC-Mash-3 and NARC-Mash-97 was screened out under different concentration (0, 1, 2, 5, and 10Mm) of lead. Different growth parameters (seed germination, seedling root and shoot length, seedling fresh and dry biomass, dry matter accumulation per seedling) and accumulation of lead by inoculated and non inoculated seedlings were observed and recorded. Results revealed that lead drastically reduce the seed germination and seedling growth of all three varieties of Mash, while bacterial inoculations improved various growth parameters of Mash. All bacteria for variety NARC-Mash-3 and strain TE-12 for Variety NARC-Mash-2 had a positive relationship to combat lead stress by improving the seedling growth. Study also revealed that genetic variation of both plant variety and bacterial strain is important in developing a successful remedial mechanism.

OPPE 27

MANGROVE ECOSYSTEM – THREATS AND MANAGEMENT

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Mangrove forests are the important feature of Pakistan's Coastline. Mangrove forests form complex intertidal ecosystem and are known for their high productivity and biodiversity. Mangrove forests especially along the Indus Delta and in Sonmiani are facing problems due to natural and anthropogenic activities. Mangrove forests act as the waste receiving sites especially near well urbanized and industrially developed city of Karachi. These areas received heavy metals like Fe, Mn, Cd, Cu, Zn, and Pb from the adjacent industrial zones. The management of these important habitats is a difficult task for authorities and require proper plan for the protection and management of mangrove forests. The abundance and variation in population and species composition of benthic organisms reflects the environmental conditions, which can be used in the long term monitoring and management of mangrove forests. The suggested mangrove ecosystem monitoring program based on Holistic Coastal Management may provide the reliable knowledge for the identification of trends and threats faced by mangroves along the coastal belt in Pakistan. The information suggestions given in this study can be used in the development of system plan for the effective management of mangroves protected areas in Pakistan. The long term monitoring of vulnerable mangrove areas is strongly recommended. The accumulated knowledge will be beneficial in the future management of mangrove forests in Pakistan.

OPPE 28

MANAGEMENT OF AVENA FATUA L. AND RUMEX DENTATUS L., IN ASSOCIATED CROPS WITH PLANT EXTRACTS**TAUSEEF ANWAR^{1*}, SHAHIDA KHALD¹, YASIR ARAFAT¹, SEHRISH SADIA² AND SANA RIAZ¹**¹National Agricultural Research centre, Islamabad²Department of Botany, PMAS University of Arid Agriculture, Rawalpindi^{*}Corresponding author's e-mail: tauseefsko@yahoo.com

The study was conducted to investigate the allelopathic effect of aqueous extracts of *Rumex dentatus* L., *Euphorbia helioscopia* L., *Parthenium hysterophorus* L. and *Carica papaya* L. on seed and seedling of *Avena fatua* L., *R. dentatus*, *Helianthus annuus* L., (K.S.E 7777), *Triticum aestivum* L., (Wafaq 2001) and *Zea mays* L., (Islamabad Gold 2010) on filter paper and soil in laboratory. Germination, radical length and plumule length of *T. aestivum* was significantly suppressed by *R. dentatus* and *P. hysterophorus* extracts while remained unaffected by *E. helioscopia* and *C. papaya* extracts when compared to control. *E. helioscopia* and *P. hysterophorus* extracts decreased the germination and subsequent growth of *A. fatua* and *R. dentatus*. There was no effect on growth of *Z. mays* and *H. annuus* when *E. helioscopia* extract was applied on seedling. *R. dentatus* exhibited auto-toxicity.

OPPE 29

AN ECOLOGICAL STUDY OF ENDEMIC PLANT *POLYGONUM ISTANBULICUM* KESKIN AND ITS ENVIRONS**VOLKAN ALTAY^{1*}, IBRAHIM ILKER OZYIGIT², MUSTAFA KESKIN², GOKSEL DEMIR³ AND IBRAHIM ERTUGRUL YALCIN²**¹Mustafa Kemal University, Faculty of Science & Arts, Biology Department, 31040, Antakya, Hatay, Turkey²Marmara University, Faculty of Science & Arts, Biology Department, 34722, Goztepe, Istanbul, Turkey³Bahcesehir University, Engineering Faculty, Environmental Engineering Department, 34353, Besiktas, Istanbul-Turkey^{*}Corresponding author's e-mail: valtay@mku.edu.tr

In this study, some ecological features of narrow endemic *Polygonum istanbulicum* Keskin, which was established as a new plant species in 2009, and its environs were examined. There are 41 known *Polygonum* taxa in Turkey and the genus is represented by 14 species in Istanbul. Plant and soil samples were collected from the place where the species merely lives in the world (Başbüyük Forest, Maltepe District, Istanbul /Turkey). Plant and soil samples were collected by using standard methods and root, branch, leaf and soil mineral nutrients (Ca, Cu, K, Mg, Mn, N, P, Na, Zn), were measured. Additionally, soil texture, structure and other physical and chemical measurements such as pH, total protein and electrical conductivity (EC) were determined.

OPPE 30

EVALUATION OF MOLECULAR MAPPING POPULATION FROM WHEAT/SYNTHETIC HEXAPLOID CROSS FOR DROUGHT TOLERANCE**WAQAS HUSSAIN¹, ZAHID AKRAM¹, TALAT MEHMOOD¹, GHULAM SHABBIR¹, REHMATULLAH QURESHI¹, U.SHAUKAT¹ AND ABDUL MUJEEB KAZI²**¹PMAS-Arid Agriculture University, Rawalpindi, Pakistan²Wheat Wide Crosses & Cytogenetics, NARC, Islamabad

The novel genetic diversity of "D genome" can be exploited to address the devastating problem of drought in wheat crop. To enhance the breeding efficiency in stress prone environments globally several molecular mapping populations have been produced. The focus of this study was to phenotype the drought molecular mapping population (DR.MP-3), derived from an opata/synthetic wheat hexaploid cross combination by various physiological parameters for drought tolerance under *In vivo* and *In vitro* conditions. The results from the physiological parameters showed that three genotypes viz. 118, 23 and 14 performed better under drought stress conditions. These genotypes showed better defensive mechanisms under *In vitro* conditions against drought through high accumulation of proline and more antioxidant activity. The best lines of drought mapping population based on physiological evaluation were 14, 17, 23, 55, 87, 80, 78, 108, 118, 122, 150 and 152, as these genotypes performed best equally under both *In vivo* and *In vitro* testing. The present study based on physiological evaluation suggested that unique genetic diversity from *Aegilops tauschii* can be harnessed to get more yield by improving the existing cultivars against abiotic stress.

OPPE 31

**PHYSIOLOGICAL AND GENOTOXIC ALTERATIONS INDUCED BY BORON IN
HELIANTHUS ANNUUS L. (SUNFLOWER)**

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Boron is an element that is found widely in nature. The excessive sources of boron compounds entering an ecosystem mainly are fuels, polymeric materials, ceramics, fertilizers, detergents and military vehicles or other industrial products. Although boron is an essential nutrient for certain organisms, excessive amount of boron in the environment may have adverse effects on organisms. Toxic levels of boron may be responsible for secondary effects on account of the reduction in plant growth and resulting in a change of physiology and biochemistry of plants. In recent years, boron usage has been increased dramatically in much of the modern world and as a consequence of the intensive use, boron toxicity tends to be more of a problem in the environment. In this study, *Helianthus annuus* L. was used as a study material because of its importance in our lives. Total chlorophyll, chlorophyll a, chlorophyll b, carotenoids, peroxidase activity and total protein contents of sunflower plant grown under different levels of boron exposures (in the range of 2-12 mM) were measured in order to make assessment for effects of boron toxicity. And for detecting the genotoxic effects of boron, the RAPD-PCR technique was performed. According to our results, changes in RAPD-PCR profiles following boron treatments included a variation in band intensities, a loss of normal bands, and the appearance of new bands compared to unexposed seedlings and total chlorophyll, chlorophyll a, chlorophyll b, carotenoids, peroxidase activity and total protein contents were altered extensively in *Helianthus annuus* L. grown with boron. Overall, there were increases in total protein contents by ~10% in leaf and ~145% in root under severe boron stress (12 mM). Similarly, peroxidase content was also increased by 16-fold in root at high level of boron exposure. After two weeks of exposure, total chlorophyll, chlorophyll a, chlorophyll b, carotenoids were substantially decreased by 46%, 42%, 55% and 43% under severe boron stress (12 mM), respectively.

OPPE 32

**MINERAL NUTRIENT UPTAKE STATUS OF ENDEMIC *ISOETES ANATOLICA* PRADA &
ROLLERI POPULATIONS FROM TURKEY**

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Isoetes genus is commonly known as the "quillworts" and considered to be "fern allies". There are about 200-250 species, with a cosmopolitan distribution but often scarce to rare. *Isoetes* often grow in extremely sensitive aquatic environments such as temporary ponds, streams, and lakes. They are therefore good indicators of environmental quality. *Isoetes anatolica* Prada & Roller is an endemic plant grows on calcareous soils on the edges of seasonal ponds located in a mountainous area near the southern coast of the Black Sea at 1400 m above sea level at Bolu, Turkey. In this study, mineral nutrient uptake statuses of *Isoetes anatolica* Prada & Roller populations were studied on the background of plant-soil interactions. The study materials were collected from the place where the species only lives in the world (Abant Region, Bolu/Turkey) by using standard methods and plant and soil mineral nutrient measurements (Al, B, Ca, Cu, Fe, K, Mg, Mn, Na, Ni and Zn) were done. ICP-OES were employed for the measurements during the study. Interrelations between mineral element contents in soil and plant were studied statistically. Several analyses were done and the results are presented. The data revealed that *Isoetes anatolica* Prada & Roller is capable of accumulating considerable amounts of certain minerals (B, Ca, Mn and Na).

OPPE 33

**EFFECT OF NI AND CD ON GLUCOSINOLATE PRODUCTION IN
*THLASPI CAERULESCENS***

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Hyperaccumulator plant species are studied because of their potential for cleaning up land contaminated with heavy metals, but another aspect of study relates to the reason for hyperaccumulation. The most accepted hypothesis over the last decades is elemental defence hypothesis stating that accumulated heavy metals defend the plants against herbivores and pathogens. Glucosinolates in hyperaccumulators are also known to defend the plants against these environmental stresses. Current study was designed to test any trade-off between these two types of defences in *Thlaspi caerulescens*. *Thlaspi* plants were grown in glass house at different Ni and Cd concentrations where clipping damage with scissors was applied to substitute herbivory. The maximum foliar Ni was observed as 233 mg kg⁻¹ whilst maximum Cd uptake was reported to be 318 mg kg⁻¹ of dry mass of *Thlaspi* shoots. There was a positive correlation between soil metal addition and concentration of shoot metals. There was no effect of clipping on shoot metal concentration. Surprisingly, there was no significant difference in concentration of total glucosinolates in damaged leaves as compared to their undamaged counterparts. There was no systemic effect of clipping damage on the induction of glucosinolates. Generally, lower concentrations of glucosinolates were observed in plants with higher foliar metal concentrations and vice versa. However, these trade-offs were only observed at highest Ni and Cd concentrations while at lower Ni and Cd concentrations, there was no trade-off between these two types of chemical defences. The overall conclusion was in support of the 'joint effects hypothesis'.

OPPE 34

THE INFLUENCE OF EARTHWORM *APPORRECTODEA CALIGINOSA* ON THE IRON TRANSPORT IN TWO SPECIES OF *ARABIDOPSIS*

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Iron (Fe) is an essential nutrient for plants as it is required for nitrogen fixation, respiration, photosynthesis, DNA synthesis and hormone synthesis. In fact, in the presence of earthworm, it was observed that the plants produce some signals of iron deficiency. This deficiency is not visible at the phenotypic level but at molecular level some of the transporter of Fe induced their expression in model plant *Arabidopsis* in the presence of earthworm *Aporectodea caliginosa*. We conducted an experiment to compare the expression of different genes involved in the transport of Fe such as FIT1, IRT1, FRO2, AHA2, NRAMP1, NRAMP2, NRAMP3, NRAMP4, NRAMP6 in two species of *Arabidopsis* (*Arabidopsis thaliana* and *Arabidopsis halleri*) in the presence of earthworms and without earthworms. We observed that the transcripts level of FRO2, IRT1, NRAMP1, NRAMP2, NRAMP4 and NRAMP6 in both species of *Arabidopsis* were increased in leaves of earthworm treated plants than control while in root their expression was almost same in both species. Moreover, the biochemical activity of FRO2 increased significantly in the roots of *Arabidopsis thaliana* with earthworm treatment than control. In addition, the morphological changes such root length, number of tips of roots, root volume and surface area of roots increased in the plants cultivated in the presence of earthworms. Therefore, the higher transcripts levels of above mentioned genes and biochemical activity of FRO2 in the leaves of earthworm treated plants could be due to iron deficiency.

OPPE 35

INTERACTION OF DEFENSE PATHWAYS IN TWO DIFFERENT ISOLATES OF STOLBUR PHYTOPLASMA-INFECTED TOMATO

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Phytoplasma are bacteria lacking cell walls, uncultivable *In vitro*, belonging to the class *Mollicutes*. They cause hundreds of plant diseases in diverse species of plants all over the world. They reside within sieve tube cells and are naturally transmitted between plants by sap-sucking insects in which they multiply belonging to the families Cicadellidae

(leafhoppers) and Fulgoridae (planthoppers). They induce severe symptoms like abnormalities or abortion of flowers and fruits. In tomato, two different isolates of stolbur phytoplasma, named C and PO, alter the plant morphology and developmental process by inducing different symptoms. Plants use different strategies to cope with harmful pathogens and insect herbivores. Salicylic acid (SA), Jasmonic acid (JA) and Ethylene (ET) (phytohormones) are primary signals in important defense pathways and regulate the plant's immune response against herbivore insects and pathogen. Very little is known about the pathogenesis mechanism but nothing is known about defense pathways against phytoplasma. For the first time, we studied the expression of defense genes including PRs, implicated in different defense pathways through real time RT-PCR. We found that SA, JA and ET dependent defense pathways were synergistically activated in stolbur C phytoplasma-infected tomato. In stolbur PO phytoplasma-infected tomato, SA and ET dependent defense pathway was up-regulated but JA mediated defense pathway was down-regulated by interfering with phytohormones synthesis. We suggested that induction of different defense pathways can be related due to the different virulence factors of stolbur C and stolbur PO phytoplasma which still have to be identified.

OPPE 36

STUDY OF LIPID-PROTEIN INTERACTION IN THE SECRETORY PATHWAY OF PLANT CELL BY RAISING AND USING ANTI-LIPID ANTIBODIES AGAINST PARTICULAR LIPIDS AND PROTEINS IN ARABIDOPSIS AND TOBACCO PLANTS

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The membranes of the cellular compartments in plants are composed of lipid and protein that are formed initially in the endoplasmic reticulum (ER) and then transported to all other compartments of the cell through the early secretory pathway. Machineries for protein transport in the secretory pathway are rather well known in animal and yeast cells but far less in plant cells. Analysis of the Arabidopsis (*Arabidopsis thaliana*) genome reveals 54 genes encoding SNARE proteins, some of which are expected to be key regulators of membrane trafficking between the endoplasmic reticulum (ER) and the Golgi. Keeping in view the importance of above mentioned SNAREs proteins and their interaction with lipids such as acyl-CoAs and PS, we performed the experiments and found their presence and involvement in membrane fusion events in the secretory pathway of Arabidopsis comparing with tobacco plant. In fact, we produced recombinant proteins for these 3 SNAREs and prepared antibodies against them. We purified, anti memb 11 and anti sed5 IgGs from the sera and tested them in Arabidopsis to see if native proteins would be recognized. We had also prepared anti acyl-CoAs antibodies and used them in immunoblot and found that they can recognize the acyl-CoAs when they are in interaction with some proteins, so these antibodies could help us to observe proteins interacting with acyl-CoAs. Therefore, we can say that acyl-CoAs are involved in membrane fusion.

OPPE 37

HEAVY METALS TOXICITY AND THEIR BIOACCUMULATION IN PURSLANE (*PORTULACA OLERACEA*) SEEDLINGS GROWN IN THE GREEN HOUSE ENVIRONMENT

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Heavy metals (HMs) are plant toxicants, they reduce plant yield, affect leaf and root growth and inhibit enzymatic activities. A pot experiment was conducted to study the toxicity of cadmium (Cd), lead (Pb) and zinc (Zn) in single form and mixture (Cd/Pb, Cd/Zn and Pb/Zn) to Purslane (*Portulaca oleracea*) seedling in case of fresh and dry weights, root and shoot lengths, shoot diameter, cell size and number of leaves. The results of the study indicated that increasing concentrations of selected HMs in seedlings tissues significantly ($p < 0.05$) reduced seedlings fresh and dry weights, root

and shoot lengths, shoot diameters, number of leaves and cell size. The reduction in growth parameters of the seedling showed the dose response for Cd, Pb and Zn in both single and mixture forms. Cd was more toxic to *P. oleracea* seedlings as compare to Pb and Zn. Root of *P. oleracea* seedlings was more sensitive to study HMs in comparison with shoot. Concentrations of selected HMs in the seedlings showed an increase with increasing concentrations in growing medium. The uptake patterns of Cd, Pb and Zn in Cd/Pb, Cd/Zn and Pb/Zn showed antagonistic impacts on each other and were reflected in response of growth parameters. The combine toxicities of Cd, Pb and Zn (Cd/Pb, Cd/Zn and Pb/Zn) were more than the toxicity due to single forms but less than their additive sums.

OPPE 38

SOME PHYSIOLOGICAL AND AUTECOLOGICAL FEATURES OF *CENTAUREA KILAEA* BOISS. FROM TURKEY

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This study deals with aspects of autecology of *Centaurea kilaea* Boiss. and characteristics of its habitat and distribution in Turkey. In this study, some physiological and ecological features of *Centaurea kilaea* Boiss. such as germination requirements, plant-soil interactions, its population biology were studied. The plant and soil samples were collected from Sofular Village (Sile District) and shore of Catalca District (Istanbul) in Turkey by using standard methods. Several methods such as the Scheibler, Wetdigestion, Kjeldahl and Olsen methods were employed for measurements of soil texture, structure and other physical and chemical measurements (pH, total protein and electrical conductivity etc.). During the experimental applications, equipments such as Spectrophotometer, Flame photometer, Calcimeter and ICP apparatus, etc. were used. The amounts were found out to be in the ranges of 0.007-0.2% for N, 0.0007-0.001% for P, 0.001-0.01% for K, 0.0001-0.0002% for Na in the soils. N, P, K and Na amounts were recorded as 2.17%, 0.005%, 0.1% and 0.006% in the plant, respectively. The data revealed that germination success of the seeds were influenced by environmental factors such as pH, germination season and temperature. Components and properties of soil were characterized by performing various analyses and the results are presented.

OPPE 39

MINERAL ELEMENTS IN *VERONICA SCUTELLATA* L. (GRASSLEAF SPEEDWELL) FROM BOLU-TURKEY: SOIL-PLANT INTERACTIONS

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Veronica scutellata L. is a species of flowering plant in the plantain family. It occurs in moist and wet habitat, such as ponds, marshes, and other wetlands. This study was conducted on *V. scutellata* L. to examine its mineral nutrient uptake status in terms of interactions between the soil and plant. Based on the interactions, the main factors were evaluated to find out their effects on the plant growth. The experimental materials were taken from the place situated in Southern coast of Black Sea at coordinates 40°36'N and 31°16'E at an altitude of 1400 m above sea level at Bolu, Turkey by using standard methods and plant (root, stem and leaf parts) and soil mineral nutrient measurements (Al, B, Ca, Cu, Fe, K, Mg, Mn, Na, Ni and Zn) were done. During the study, ICP-OES were used for the measurements. Several analyses were performed on the data and the results are presented. It was observed that considerable amounts of B, Ca, K, Mg, Mn, Na and Zn were accumulated by the plant.

OPPE 40

THE EFFECTS OF Ni ON *HELIANTHUS ANNUUS* L. TISSUE CULTURES IN DIFFERENT DEVELOPMENTAL PHASES

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The plant tolerance capacity to toxic metals and their accumulations of different plant parts have been researched with in vitro cultures for a long time. Evolution of metal tolerance has been well studied in numerous plant species, one of these plants is *Helianthus annuus* (sunflower). However, there are only a few studies considered the effects of heavy metals on in vitro regeneration capacities of cultured plants. In this research, the effects of nickel on in vitro development of *H. annuus* tissue cultures were studied. The seeds were aseptically germinated on hormone free MS (Murashige & Skoog, 1962) medium. After 10 days, leaf and cotyledonary nodes, including hypocotyl and epicotyl segments were used as initial explants. Control groups were cultured on MS supplemented with 1mg/L BA for callus induction, indirect regeneration and rooting. Besides, experimental groups were cultured in the same media composition including three different concentrations of NiCl₂.H₂O (0.50, 1.00 and 2.00 mM). Nickel accumulations in callus and shoots were measured by using ICP-OES. For rooting, regenerated shoots, which reached from 2 to 3 cm were transferred on MS media supplemented with 1 mg/l IBA. Fresh callus mass, percentage of callus induction for per explant, indirect shooting and rooting were determined.

OPPE 41

PHYSIOLOGICAL AND GENOTOXIC ALTERATIONS INDUCED BY BORON IN *HELIANTHUS ANNUUS* L. (SUNFLOWER)

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Boron is an element that is found widely in nature. The excessive sources of boron compounds entering an ecosystem mainly are fuels, polymeric materials, ceramics, fertilizers, detergents and military vehicles or other industrial products. Although boron is an essential nutrient for certain organisms, excessive amount of boron in the environment may have adverse effects on organisms. Toxic levels of boron may be responsible for secondary effects on account of the reduction in plant growth and resulting in a change of physiology and biochemistry of plants. In recent years, boron usage has been increased dramatically in much of the modern world and as a consequence of the intensive use, boron toxicity tends to be more of a problem in the environment. In this study, *Helianthus annuus* L. was used as a study material because of its importance in our lives. Total chlorophyll, chlorophyll a, chlorophyll b, carotenoids, peroxidase activity and total protein contents of sunflower plant grown under different levels of boron exposures (in the range of 2-12 mM) were measured in order to make assessment for effects of boron toxicity. And for detecting the genotoxic effects of boron, the RAPD-PCR technique was performed. According to our results, changes in RAPD-PCR profiles following boron treatments included a variation in band intensities, a loss of normal bands, and the appearance of new bands compared to unexposed seedlings and total chlorophyll, chlorophyll a, chlorophyll b, carotenoids, peroxidase activity and total protein contents were altered extensively in *Helianthus annuus* L. grown with boron. Overall, there were increases in total protein contents by ~10% in leaf and ~145% in root under severe boron stress (12 mM). Similarly, peroxidase content was also increased by 16-fold in root at high level of boron exposure. After two weeks of exposure, total chlorophyll, chlorophyll a, chlorophyll b, carotenoids were substantially decreased by 46%, 42%, 55% and 43% under severe boron stress (12 mM), respectively.

POSTER ABSTRACTS

PPPE 1

PREVALENCE OF KARNAL BUNT OF WHEAT IN PUNJAB AND KHYBER PAKHTUNKHWA, PAKISTAN

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Karnal bunt is one of the major diseases of wheat causing quality and economic losses in Pakistan. It decreases the weight of grains and makes it inedible for human. Prevalence of Karnal bunt has increased with the passage of time in Punjab and Khyber Pakhtunkhwa. This study was conducted to find out the Karnal bunt disease status in Punjab and KPK. A total of Two hundred and fifty two wheat samples were collected randomly from different districts of Punjab and KPK during the year 2011. Out of 252 samples collected, 39 samples were found infected with the disease. Prevalence of disease in Punjab samples were found 14.47 % and in KPK were found 25 %. In Punjab High infection percentage (50%) was found in Taxila and low infection percentage (5.5 %) was found in Rawalpindi. In KPK High infection percentage (100 %) was found in District Mardan and low infection percentage (20 %) was found in District Peshawar.

PPPE 2

NATURALISTIC PLANTING IN URBAN LANDSCAPE INCREASE BIODIVERSITY

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In urban areas biodiversity is continually declining due to increase in urbanization, industrialization and mechanization. The use of indigenous wild flora is continuously declining due to their unavailability and usual trend of using commercial plants in landscape. The full potential of wild flowers is often not met due to the lack of integrated planning and management and the limited specific knowledge based on wild flower adaptation. While wildflowers are relatively easy to care for and they require least maintenance, the idea of lazy gardening is going to popular around the world. When selecting wildflowers for a landscape, it is important to understand the conditions required by the plant when growing in the wild and to purchase plants from a reputable nursery. A lot of work is going on for the selection & development of native wildflowers for use in landscape. The present study was conducted to explore the possibilities of using wild plants for sustainable establishment of landscape in accordance with the perception of the people's and local conditions. The data was analyzed statistically by using the computer software Statistical Package for Social Sciences (SPSS). The idea of use of wild flowers in landscape received a quick response from the community and had great impact on the city environment. According to respondent's opinion, native wild flowers species can be a distinctive and exciting addition to the urban landscape and the use of local wildflowers in naturalistic plantings proved to be a low-cost technique for managing urban green areas, contributing to biodiversity, and a useful tool for the conservation of species.

PPPE 3

TILLAGE AND CROP SEQUENCE EFFECT ON SOIL ORGANIC CARBON FRACTIONS AND AGGREGATE STABILITY IN DRYLAND POTHWAR, PAKISTAN

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Soil organic carbon (SOC) is emerging as a key indicator for assessing sustainability of soil and crop management systems. Tillage systems and crop sequences greatly alter the SOC fraction but the effects are site specific. A field experiment was conducted in a warm subhumid subtropical dryland Pothwar of Pakistan to evaluate the effect of different tillage systems and crop sequences on soil organic carbon fractions. The treatments were arranged in a split plot

design having tillage treatments (conventional tillage, CT; minimum tillage, MT and moldboard plow, MP) in main plots while crop sequences (Fallow–Wheat, FW; Mungbean–Wheat, MW; sorghum–wheat, SW; green manure–wheat, GW and mungbean–chickpea, MC) in subplots. The highest C mineralization was observed under MT tillage in combinations with SW, GW and MW rotations (447.67, 441.73 and 406.40 $\mu\text{g g}^{-1}$ soil day $^{-1}$ respectively). The highest particulate organic carbon (POC) was observed in the combination of MP tillage with FW crop sequence (12.17 Mg ha^{-1}), while least POC was under CC tillage with MW crop sequence (2.82 Mg ha^{-1}) and MT tillage with GW crop sequence (2.91 Mg ha^{-1}). Total organic carbon varied non-significantly between 11.45 to 12.89 Mg ha^{-1} for tillage systems and between 8.89 to 14.41 Mg ha^{-1} for crop sequences. The highest proportion of stable aggregate was observed under combinations of MT tillage with SW and MC sequence (31.25 and 27.22%, respectively), while the least aggregate stability was observed under MP tillage with MC sequence (5.00 Mg ha^{-1}). It is concluded that minimum tillage and elimination of fallow enhances active SOC fraction and soil aggregation under subtropical dryland conditions.

PPPE 4

TEMPORAL VARIATION IN CHLOROPHYLL A, B AND CAROTENOID IN SELECTED TREE SPECIES OF DISTRICT CHAKWAL

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This research work intended to find out the comparative differences between the leaves pigment contents of *Ficus religiosa* L. and *Eucalyptus camaldulensis* Dehn. in order to find out selected plant species specific responses to temporal variation. Chlorophyll a, b and Carotenoids at different growth stages (young and old) and at different solar irradiance levels (shade and sun exposed leaves) were spectrophotometrically compared. Results indicated that young leaves displayed considerably higher values of these pigments in both the species. Whereas in the case of shade and sun exposed leaves the response was quite different in both species. Shaded leaves of *Ficus religiosa* and sun exposed leaves of *Eucalyptus camaldulensis* showed higher concentration of these photosynthetic pigments. In response to elevated temperature, leaves from all categories (despite fluctuations) showed increase in pigment contents up to certain temperature range (22° C- 28° C) and after this point decreased content of pigments were observed which indicate that these species were sensitive to high temperature range. Therefore, different strategies and precautionary measures should be taken in order to protect plant species from harsh temperature extremes.

PPPE 5

PHYTOCHROME MEDIATED GERMINATION RESPONSES IN RED.FAR RED IRRADIATED CUCURBITA PEPO L AND CITRULLUS VULGARIS T SEEDS UNDER DIFFERENT TEMPERATURES

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The effect of light and temperature was investigated in two species of cucurbitaceae cultivated in Balochistan namely, *Cucurbita Pepo* L and *Citrullus Vulgaris* T. The experiments were performed at constant temperature under white light, darkness, and far-red light. To investigate the role of phytochrome in seed germination, the imbibed seeds were also irradiated with pulses of red and far-red light of various durations. The seeds of *C. Pepo* and *C. Vulgaris* germinated optimally at 20 °C and were capable of germinating within a range of 15°C to 25°C, though at suboptimal temperatures a slight suppression in germination was observed under far-red light. The darkness and white light resulted in promotion of seed germination percentage final seed germination of *C. Pepo*, while the germination was suppressed under far-red light in cooler temperatures i.e. below 25°C. *C. Vulgaris* the germination rate were suppressed under far-red condition in optimum, sub optimum temperatures. The optimum temperature for seed germination of *C. Vulgaris* was observed to be 20°C; the seed germination in the species was suppressed by far red light at warmer temperatures whereas white light promoted the germination. A single red light pulse was to promote the seed germination rate in *C. Pepo* however, intermittent pulses of red followed by far red light promoted the seed germination *C. Pepo* and *C. Vulgaris* this effect was reversed when red light was followed by far-red light. On the basis of this reversal effect the involvement of phytochrome in the seed germination of *C. Pepo* and *C. Vulgaris* is proposed.

PPPE 6

ALLELOPATHY EFFECT OF MELIA AZEDARACH L ON TEST SPECIE**AFROZ R. KHAN*, TAHIRA MENGLE, SAFIA GULL, RUKSAHANA JABEEN AND MOHAMMAD SAEED***Department of Botany, Sardar Bahadur Khan Women's University Quetta, Pakistan.***Corresponding author's e-mail: rais_botany@yahoo.com*

In laboratory, trial the extracts of dried plant parts such as leaves and berries of *Melia azedarach* L. were used against the test specie *setaria italica*. The extracts were soaked for 24, 48, and 72hr and then seeds were treated by filtrate of extracts. The germination percentage, seedling growth and moisture content were reduced up on the concentration of aqueous extracts. The order of growth inhibition was berries>leaf. Berries extract showed more inhibitory effect as compare to control. The length of radical and plumule, fresh and dry weight were also reduced. (In 1.5gm, 72hours) While the leaf extracts show less inhibitory effect as compare to control. (In 1.5 gm, 24 hours) extract highly inhibitory in seedling growth. These inhibitory effects proved that *Melia azedarach* had water soluble allelochemicals that are released into environment and reduce the seed germination and seedling of associated species.

PPPE 7

CARBON STOCKS, CYCLING, SEQUESTRATION AND FOOD SECURITY**AHMET R. MERMUT***University of Saskatchewan, Saskatoon Canada, Harran University, Sanliurfa, Turkey*

With more intense, longer droughts in larger areas since the 1970s, particularly in the tropics, one of the most important issues facing the world today is the need to ensure food security through the sustainable management of water and soil resources. There is a need to understand interactions between climate and land degradation through dedicated observations of the climate system, proper assessment and management of water and land resources, and advances in climate science. The debate on the complex issue of quantification of carbon stocks is still evolving. It is generally agreed that carbon sequestration, especially in soils, could be a highly cost effective and environmentally sound mitigation technique. Natural resources, particularly land and water are increasingly restricted both in quality and quantity in most parts of the world. There are still sufficient water resources however, to produce food and fiber for a growing population but that trends in consumption, production and environmental patterns, if continued, will lead to water crises. Consumption and pollution of water by agriculture are becoming serious concerns. The challenges of climate change and the charge to maintain ecological integrity have been met with technologies such as conservation tillage, agroforestry, precision agriculture etc. New concepts such as multi-functionality of land, soil quality, sustainability of agriculture and carbon sequestration, have emerged leading to new management strategies and an enhanced quality of life.

PPPE 8

EFFICACY OF LIBYAN ISOLATES OF BACILLUS SUBTILIS AGAINST *FUSARIUM OXYSPORUM* AND *RHIZOCTONIA SOLANI***ALI ABULGASIM EL AGAEL***Department of Plant Protection, Tripoli University, Tripoli – Libya*

Fusarium and *Rhizoctonia* species cause seedling blight and foot rot of tomato and others of Solanaceae family. The aim of this investigation was to isolate natural bacterial antagonists from the tomato rhizosphere and screen them as seed treatments for the control of seedling blight of tomato. *Bacillus* was isolated from rhizosphere soil using selective media and screened for its antagonism against *Fusarium oxysporum* and *Rhizoctonia solani* using a dual plate bioassay. 10 antagonistic isolates of *B. subtilis* that showed in vitro clearly inhibition zones were identified by conventional methods. Isolates were subsequently evaluated as seed treatments (using an agar tube assay) for their ability to control seedling blight of tomato. One isolates were selected based on their activity. Trials have also been undertaken in a controlled environment trial. *B. subtilis* significantly ($P<0.05$) increased percentage seed germination, enhanced the growth of tomato seedlings (fresh weight and shoot length, and effectively reduced seedling blight of tomato. A small scale field trial confirmed the effectiveness of this isolate. In conclusion, natural rhizosphere bacteria *B. subtilis* have been isolated which show potential for the biocontrol of seedling of tomato.

PPPE 9

INTER-CULTIVAR GENETIC POTENTIAL OF HIBISCUS ROSA-SINENSIS FOR ADAPTATION TO CHANGING ENVIRONMENTAL CONDITIONS IN RELATION TO VARIOUS LEAF ANATOMICAL CHARACTERISTICS

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The genetic potential of different plant species to different environmental conditions differ in relation to different physiological, biochemical and anatomical characteristics. Of these varying attributes, leaf anatomical characteristics are the most important for the establishment of that cultivar in varied environmental conditions. So, the present study was conducted to assess the inter-cultivar genetic potential of Hibiscus in relation to leaf anatomical characteristics. To fulfill the study requirements Hibiscus rosa-sinensis and its six cultivars (were well adapted to their specific natural habitat) were collected from different areas of Punjab, Pakistan. Results showed significant variability among cultivars in relation to analyzed anatomical characteristics. Cultivars Lemon chiffon and Wilder's white emerge more promising among others by possessing more epidermal thickness, increased epidermal cell area, high cortical cell area and incremented stomatal density as compared with other cultivars. On the other hand, cultivars Cooperi alba, Mrs. George Davis and Frank green possessed least cortex cell area, lowest xylem region thickness and minimum phloem region thickness respectively. Overall, it can be concluded that anatomical genetic potential has endorsed cultivars Lemon chiffon and Wilder's white with enormous capability to grow well under variable environments.

PPPE 10

ASSESSMENT OF SALT TOLERANCE AMONG DIFFERENT SUNFLOWER ACCESSIONS

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Twenty sunflower (*Helianthus annuus* L.) accessions were evaluated against three different salinity levels. Triplicated completely randomized design was followed. Salinity was developed with NaCl to achieve the final salinity levels of 3 dSm⁻¹, 6 dSm⁻¹, and 9 dSm⁻¹, whereas control contained tap water. Data of 60 days old ten seedlings from each entry was recorded and analyzed. Accessions G-36, G-61, A-23, A-6, and A-185 performed better in both controlled and saline conditions. These accessions showed better biomass production and high shoot and root growth by least concentration of Na⁺ and higher concentration of K⁺ and Cl⁻ in leaf sap resulting in better K⁺:Na⁺.

PPPE 11

STUDY OF POLLUTANTS (TOXIC/HEAVY METALS) IN SOME EDIBLE FRUITS OF QUETTA

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This paper deals with the amount of concentration of trace elements present in edible fruits. During present investigation concentration of five metals (Cu, Zn, Fe, Cd and Pb) were estimated in fresh fruits i.e., apples, apricots and peaches collected from orchards/fields and the vendors in local markets of Quetta, area. Fe concentration was observed to be higher in peaches as compared to the other metals in fruit samples (e.g.; apple, apricot and peaches). It was found highest (46.77 µg/g) in peaches, in the manner of its content in investigated fruits Fe was: peaches > apricots > apples. The lowest (21.51 µg/g dry weight) was found in apples. In other fruits its content was between 21.51 and 46.77 µg/g dry weight. Average values for Zn was observed to be 2.22, 3.72 and 4.92 µg/gm dry weights in apples, apricots and peaches respectively. Copper (Cu) is another important metal for human health as it is essential for function of many enzyme systems in the body. Its minimum and maximum values ranged from 1.36 – 9.54 µg/g dry weight. We also observed that the concentration of cadmium in fruits was within the range of 0.02 – 0.18 µg/g dry wt. In the fresh fruit samples collected, concentration of lead was found below detection limit (BDL- 0.20 µg/g dry weight). However, above mentioned allowable limits were assayed in some of the samples, as the high content was found in some of the apricot and peach samples. The findings of the present study are comparable with other studies undertaken in Pakistan, Turkey and Nigeria.

PPPE 12

NICKEL TOXICITY MITIGATION FROM SOIL BY PARTHENIUM USING AS PHYTOREMEDIATION TOOL

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Various heavy metals including Nickel (Ni) contaminate water and soil resources to render unfit for agriculture. Conventional means of decontamination are costly and not eco-friendly. Thus, a study was designed to eradicate (Ni) from waste-water and soil using Parthenium as a phytoremediation model plant. Phytoremediation is rather a novel green-tech solar powered based technique, eco-friendly, substitute of extraction, cost-effective, sustainable and its potential can be enhanced using biotechnology tool. We exploited the potential of Parthenium to mitigate Ni toxicity in the soil using pot experimentation with complete randomized block (CRDB). Our data regarding morphology, growth, productivity and physiology indicate that Parthenium hyterophorus shows resistance against Ni stress. The Ni at 50, 75 and 100 ppm concentration was given on one month old plants. The Parthenium plants showed enhanced level of tolerance to Ni. The shoot and root length, shoot fresh and dry weight, root fresh and dry weight were increased as compared to control. However, Chl a, Chl b, total chlorophyll and carotene contents were low in Ni treated plants than of control. Moreover, under Cd stress, the Ci and A values declined, while gs and E increased. It may be concluded based on our data that Parthenium can be promising plant to be grown at the sites of wastewater and soil to reduce Ni toxicity burden.

PPPE 13

IMPACT OF DIFFERENT NICKEL CONCENTRATIONS ON GROWTH, BIOMASS AND SOME YIELD CHARACTERSTICS OF WHEAT (*TRITICUM AESTIVUM* L. VAR. SHAFaq-06)

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An experiment was conducted in order to find out the effect of different nickel concentrations on growth, biomass and yield attributes of wheat (*Triticum aestivum* L. var. Shafaq). The certified seeds of wheat were used and soil was mixed with different nickel chloride concentrations (50, 100, 150, 200, 250 and 300 mg/Kg of soil) to make treatment from T1 to T6. The control plants were grown in soil without salt. The study was carried out in order to find out the impact of nickel on different growth parameters viz; plant height, number of green and senescent leaves, number of tillers per plant. All the experimental plants showed reduction trend from T1 to T6 except the senescent leaves. Along with these the biomass (shoot fresh and dry weight, and root fresh and dry weight) and yield parameters (number of ears/plant, number of spikelets/ear, number of grains, ear and rachis length/plant and 1000 grain weight) were also carried out in laboratory in which decreasing trend was also observed from T1 to T6 as compared to control. So, present study will be helpful in determining the impact of nickel pollution on growth, biomass and yield attributes of wheat.

PPPE 14

FLORAL HOST PLANT RANGE OF BUTTERFLIES (*LEPIDOPTERA*) AT MULTAN, PAKISTAN

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A yearlong interaction of 14 butterfly species with 50 flowering plant species was observed during 2009. During net sampling time of 30.5 hours, 456 butterfly individuals were recorded on 6060 floral units. The community of butterflies was composed of 14 butterfly species in 11 genera and 5 families while community of plants was composed of 50 species in 48 genera and 24 families. Pieridae was the largest butterfly family. The most abundant *Danaus chrysippus*

and *Polyommatus eros* also visited the maximum number of plant species. *Lantana camara* (Verbenaceae) was butterfly most loving plant with the maximum number of butterfly species, followed by *Trifolium alexandrinum* (Fabaceae), *Cirsium arvensis* (Astraceae) and *Launaea procumbens* (Astraceae). Seven plant species held butterfly interactions for 5 to 9 months due to their prolonged flowering phenologies.

PPPE 15

BIOLOGICAL PARAMETERS AND PREDATORY POTENTIAL OF *MENOCHILUS SEXMACULATUS* FAB. (COLEOPTERA: COCCINELLIDAE) AT VARYING TEMPERATURE ON *RHOPALOSIPHUM PADI* L.

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The biological parameters of *Menochilus sexmaculatus* Fab. as influenced by different temperature regimes and host were studied at Insectary-Biological Control Laboratories, Institute of Plant and Environmental Protection (IPEP), National Agricultural Research Center (NARC), Islamabad. The results revealed that there was a significant effect of different temperature regimes on the development and predatory potential of *M. sexmaculatus* reared on *R. padi*. The egg incubation period of beetle was 4.16, 3.66, and 2.24 days at 22±1°C, 28±1°C and 34±1°C, respectively. Mean fecundity of the beetle was 430.53, 548.67 and 432.43 eggs, respectively. Percentage egg hatchability of the predator was significantly higher at 28±1°C. The total larval duration of predator was 9.47, 7.7 and 5.49 days, respectively. Duration of pupal period ranged between 2.21-4.35 days on *R. padi* at three temperatures. The pre-oviposition, oviposition and post-oviposition periods were 4.64 - 7.48, 24.99 - 39.93 and 4.76 - 8.09 days, respectively on *R. padi*. Mean predatory potential of all larval instars ranged from 148 - 162 aphids, respectively. The prey consumption of female beetle was significantly higher than male. The range of adult male consumed aphids from 2294 - 2422, respectively and female consumed from 2912 - 3085 aphids, respectively.

PPPE 16

NUTRITIONAL PROFILE, MYCOFLORA ASSESSMENT AND AFLATOXIN CONTAMINATION IN CHICKPEA (*CICER ARIETINUM* L.)

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Chickpea (*Cicer arietinum* L.), a very common and cultivated crop is belonging to family Fabaceae. During present study, fifty samples (n=50) collected from three arid districts of Punjab put forth for assessment of mycoflora, aflatoxins contamination and nutritional profile. The results revealed sixteen fungal isolates belonging to 6 fungal genera were observed in chickpea samples. Observations revealed that *A. niger*, *A. flavus*, *mucor* and *Alternaria alternata*, were predominant fungi. A total of 333 fungal isolates were identified. Co-occurrence of fungal isolates showed maximum number of fungal isolates were twelve out of sixteen (n=16), whereas, minimum number of fungal isolates were only two. The comparative study of mycoflora of three districts of Punjab showed that highest incidence of fungal flora was found in samples collected from district Rawalpindi (12 isolates) followed by Khushab district (117 isolates) and district Chakwal (isolates 96). Among chickpea samples, only two samples were found positive for aflatoxin B₁ with value 19ppb and 18 ppb of samples Khushab and Rawalpindi respectively. Fifty (n=50) chickpea seed samples were analyzed for nutritional profile. The comparative nutritional profile of chickpea seed samples of 3 districts of Punjab showed that high protein contents were found in Chakwal district (23.47%) followed by Rawalpindi district (22.96%) and Khushab district (22.79%) respectively. The moisture content of seed samples of Chakwal (6.40%) was higher followed by Khushab (5.90%) and Rawalpindi (5.52%). The higher crude fiber content was found in samples collected from Khushab district (5.89%) followed by Chakwal (5.89%) and Rawalpindi district (5.83%). Similarly, crude fat of seed samples of Rawalpindi district was 5.41% followed by Chakwal (5.09%) and Khushab (5.00%). While crude ash content of district Rawalpindi was higher i.e. 3.16% followed by Khushab (3.12%) and Chakwal (2.99%) respectively.

PPPE 17

LATE PALAEOCENE PTERIDOPHYTIC SPORES FROM PATALA FORMATION, WESTERN SALT RANGE, PAKISTAN

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Present investigation deals with the palynological examination of rock samples of Patala Formation (Late Palaeocene), Nammal Gorge Section, Western Salt Range, Pakistan. Lithologically, Patala Formation is predominantly comprised of olive green shales with subordinate marl, limestone, and sandstone with marcasite nodules. Throughout its extent, the Patala Formation conformably overlies the Lockhart Limestone and it is conformably overlain by Nammal Formation of Eocene age. Palynological data revealed diverse occurrence of pteridophytic palynotaxa. Most pteridophytic spores were of trilete type, viz., *Cicatricosisporites grandiosus*, *Cyathidites formosensis*, *Gleicheiniidites taiwanensis*, *Leiotriletes triangulatus* and *Polycingulatisporites reduncus* which were comparable to modern living taxa e.g., *Anemia*, *Cyathea*, *Gleichenia*, *Schizaea*, and *Pteris* respectively. Other pteridophytic spores were represented by *Lycopodiumsporites austroclavatidites*, *Lygodiumsporites lakiensis*, *Dandotiaspora reticulatus*, *Dandotiaspora sorangi*, *Dandotiaspora tenolata*, *Calamospora nathorstii* and *Leiotriletes maxoides*. Palynological data based on palaeofloral index indicated a warm humid tropical to subtropical climate with varying degree of rainfall during the deposition of Patala Formation in the Salt Range, Pakistan.

PPPE 18

EFFECT OF RATE AND DURATION OF SELENIUM SEED PRIMING ON GROWTH OF WHEAT (*TRITICUM AESTIVUM* L.) SEEDLINGS UNDER DROUGHT STRESS

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Insufficient stand establishment at early growth stages in wheat due to drought stress is a major problem that limits overall efficiency and yield of crop. Priming of seeds is an effective method for raising seed performance and improving tolerance of crops to abiotic stress especially drought. Two local wheat (*Triticum aestivum* L.) cultivars (Kohistan-97 and Pasban-90) were used to optimize the rate and duration of selenium (Se) seed priming for enhancing drought tolerance in wheat seedlings. The seeds were soaked in 25, 50, 75 and 1.0 μ M solutions of sodium selenate for 30 minutes ($\frac{1}{2}$ h) and one hour (1 h) at 25°C and later re-dried to their original moisture levels before sowing. The control treatments included dry seeds and seeds primed with distilled water. Drought stress was imposed by no water application after seedling emergence and the plants were harvested after three weeks to record data. Results indicated that Se seed priming is an effective technique to ameliorate the drastic effects of drought in wheat seedlings. Kohistan-97 was found to be more responsive to Se seed treatment as 1 h priming increased its dry matter stress index by 41% and root length stress index by 30% as compared to $\frac{1}{2}$ h soaking. The total biomass of Kohistan-97 was increased by 14% by 1 h priming while no significant effect of duration was observed on total biomass of Pasban-90. Among treatments, priming seeds with Se solution of 75 μ M significantly increased physiological indices and biomass of both cultivars as compared to control treatments. Selenium seed priming by 75 μ M for 1 h significantly improves drought tolerance of wheat seedlings at early growth stages.

PPPE 19

BIOCIDAL PROPERTIES OF CITRUS OILS AGAINST DENGUE MOSQUITO Aedes albopictus

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Ethnobotanical studies provide valuable resources for the development of new product. Recently, plant based compounds have got much attention because these are risk-free and eco-friendly. In the course of screening naturally

occurring oils from plants; especially, the potential of citrus seed and peel were investigated. Five citrus (seed and peel) oils were tested against dengue mosquito, *Aedes albopictus* as larvicide, adulticide and repellent. The results showed sweet lime (FSD) possess highest potential in all biological actions (larvicide, adulticide and repellent) followed by sweet lime (SWL). Whereas grapefruit peel exhibited maximum potential against larval as well as adult stages of the test insect. However, the seed oils are effective than peel oils and the oils extracted from Faisalabad (FSD) collected citrus fruits are more potent than that of Sahiwal (SWL). The present study indicates that the oils extracted from citrus seeds are very effective in suppressing the population of dengue mosquito. Further, research must be needed to know the variation (potential) on the basis of fruit harvesting, soil factors and environmental factors.

PPPE 20

IMPACT OF DORMANCY REGULATING CHEMICALS ON SEED DORMANCY OF THREE MEDICINALLY IMPORTANT GRASSES

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Influence of six dormancy regulating compounds (DRCs; Kinetin: 0.05 mM; Fusiccocin 0.05 mM, Proline: 0.1 mM; Betaine: 0.05 mM nitrate: 20 mM and thiourea: 10 mM) on seed germination of three medicinally important halophytic grasses *Phragmites karka*, *Dichanthium annulatum* and *Eragrostis ciliaris* was investigated under NaCl with 12 h photoperiod and complete dark (24 h). Final germination was 100 % in *P. karka* and *D. annulatum* and 60 % in *E. ciliaris* under non-saline condition of untreated control with a faster rate. However, both parameters showed a significant reduction in control treatments with increasing NaCl in the following order *P. karka* (30 % at 500 mM) > *D. annulatum* (25 % at 400 mM) > *E. ciliaris* (10 % at 125 mM). All DRCs partially alleviated enforced seed dormancy in *P. karka* and *D. annulatum* while induced dormancy in *E. ciliaris*. Rate of germination of selected species was partially improved by exogenous DRCs under NaCl stress, except kinetin and fusiccocin in *E. ciliaris*. Germination of test species was highly inhibited in dark than 12 h photoperiod. Germination inhibition of *P. karka* in 24 h dark was partially alleviated in kinetin and fusiccocin and osmotica (betaine and proline), while completely alleviated in nitrate. Among all DRCs, betaine and kinetin completely alleviated dormancy of *P. karka* and *D. annulatum* under NaCl and 24 h dark. However, there was no impact of any DRC on germination of *E. ciliaris*. Influence of different DRCs on germination of test species was quite variable. Our results indicate that exogenous DRCs could help in minimizing the problem of reduced and delayed germination of grasses under abiotic stresses.

PPPE 21

TAXONOMIC AND PHYCOCHEMICAL INVESTIGATION OF *GLOEOCAPSA COMPACTA* FROM THE PONDS OF DISTRICT BADIN, SINDH

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Freshwater blue-green algae *Gloeocapsa compacta* kütz was collected from the ponds attached with the typha plants and also free floating condition in the month of August 2008 from district Badin, Sindh (Pakistan). Investigated for its fatty acids sterol composition through column chromatography by using GC-MS, ¹H-NMR spectrometric techniques. The analysis FA-Methyl esters showed the presence of ten saturated and five unsaturated FAs. The saturated FAs were present in greater proportion (63.05%) then unsaturated once (34.79%). Among saturated FAs, n-Hexadecanoate was present in greater proportion (20.79%), while 3,8-dimethyl-2,7-nonatrienoate was the major unsaturated FAs (18.09%). Beside these, one sterol such as *β-sitosterol* was also detected and identified from this alga.

PPPE 22

COMPARATIVE EFFECTS OF EXOGENOUS GLYCINE BETAIN AND ASCORBIC ACID ON GAS EXCHANGE AND LEAF SCLEROPHYLLY INDICES OF *CERIOPS TAGAL* UNDER SALT STRESS.

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The aim of the present study was to investigate the effects of foliar spray of glycine betaine (GB) and ascorbic acid (AsA) on sclerophylly and gas exchange parameters of *Ceriops tagal* under salt stress. 6 month old seedlings were raised in non saline control ($EC = 6 \text{ dSm}^{-1}$), moderate salinity of half strength seawater ($EC = 28 \text{ dSm}^{-1}$) and higher salinity (equivalent to quarter times higher the strength of sea water with 70 dSm^{-1} EC). Plants were sub-irrigated for 4 weeks and foliarly sprayed with 20 mM GB and AsA. Both relative water content (RWC) and actual water content (AWC) decreased while leaf tissue density (LTD) was increased in saline conditions. AsA and water sprays caused a great reduction in all sclerophyllous parameters (LTD, RWC and AWC) when compared to control and GB. Gas exchange was improved in half strength seawater and reduced in higher salinity. AsA caused a significant reduction on leaf tissue density both in moderate and higher salinity. Although foliar sprays of both GB and AsA improved stomatal conductance (gS) and net photosynthesis (Pn) in saline conditions but, better results were found in AsA. Of all Exogenous treatments, AsA proved to be most effective in alleviating the negative effects of salts with improved gas exchange and leaf sclerophylly that resulted in better plant growth.

PPPE 23

MYCOGRAPHIC ANALYSIS OF MACROMYCETES OF AYUBIA NATIONAL PARK, DEVELOPMENT OF IDENTIFICATION SOFTWARE AND INDICATION OF THREATENED SPECIES

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The current study was conducted for aduration of three years during which extensive surveys were made to the areas in and around Ayubia National Park including DungaGali, NathiaGali, Lalazar, Mukshpuri, Miranjani, KheraGali, Khanspur village, Bara Gali, and KozaGali. Studies were carried out to record the ecological as well geographic data of macromycetes prevailing in these areas. Further research was done to evaluate the current status of macromycetes in these areas to get an image of species richness and density of macromycetes in each designated area. Collected macromycetes were characterized on the morphological as well as anatomical basis. The MycoSOFT-II, a software has been developed for an easy access to identification of the macromycetes of the area. GPS coordinates were recorded to make a true print of ecological niche and amplitude of each mushroom with respect to both latitude and altitude. At the end, data comprised of three years was compared to fifteen years archives and current status of each of the macromycetes in the study areas was evaluated. Attempts are under way to restore the locally displaced species.

PPPE 24

ROLE OF EPIDERMAL MORPHOLOGY IN THE IDENTIFICATION OF SOME MEDICINAL PLANTS OF QUETTA

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The epidermal morphology of 15 medicinal plants of 5 families of Quetta district was examined using light microscope. On the basis of dominant type of stomata, species were segregated; types of trichomes and other epidermal emergences were also examined. The result showed that epidermal cells are polygonal or irregular in shape. Stomatal types of all species studied were anomocytic, anisocytic, diacytic, or the transitional types. Size of Stomatal pore (average length and width), size of guard cells (average length and width) and percentage of the open and close stomata were determined. Stomatal density, stomatal frequency, stomatal index was calculated. It was concluded that the epidermal characters, stomatal types, epidermal cell wall undulation and type of trichomes are useful characters for the segregation the plant of medicinal values, beside this it is also helpful for taxonomic bases of identification. From the result of present study, it was concluded that epidermal characters are considered as useful tool for the segregation of adulterants. The statistical evaluation of the stomata and epidermis included mean, standard deviation, standard error were carried out. The result was significantly higher at > 0.5 level.

PPPE 25

IDENTIFICATION AND CHARACTERIZATION OF POST HARVEST FUNGAL PATHOGENS OF MANGO FROM DOMESTIC MARKETS OF PUNJAB

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A systematic survey was conducted during October 2011 to assess the status of major post harvest diseases of mango fruit in the major markets of Punjab. The data regarding prevalence, incidence and severity was collected and then pathogen was isolated by tissue segment method. General and specific media's were used to isolate the fungi and then eventually, frequency of each fungus was calculated media wise and location wise as well. The present study indicated that anthracnose and stem end rot were 100% prevalent diseases of Punjab. Present study revealed that anthracnose caused by *Colletotrichum gleosporioides*, stem end rot caused by *Lasiodiplodia theobromae*, *Alternaria* rot caused by *Alternaria alternata* and *Aspergillus* rot caused by *Aspergillus niger* and these were major post harvest diseases that damage the mango fruit after harvesting. As far as, it was also observed that malt extract agar and V-8 agar were the best media's for the growth of *Lasiodiplodia theobromae* and *Colletotrichum gleosporioides* fungi. By present investigation it would be possible to study the post harvest fungal pathogens of mango for their pathogenic behavior, fungicides resistance and genetic variability and these all investigations will be very helpful for the management of post-harvest diseases of mango.

PPPE 26

MYCOTOXIGENIC FUSARIUM SPP. AND FUSARIOTOXIN IN MAIZE GRAINS, COLLECTED FROM DIFFERENT CLIMATIC ZONE OF PAKISTAN

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Present study was planned to assess the *Fusarium* mycoflora, toxigenic *fusarium* species and fusariotoxins in maize (*Zea mays*). A total of sixty five samples were collected from different maize growing climatic zones i.e. very cool sub humid and arid (Swat), very cool and sub humid (Murree), cool and sub humid (Islamabad & Peshawar), warm and semi arid (Faisalabad), hot and arid (Multan and Sahiwal). A total of eleven *fusarium* species were isolated by deep freezing method i.e. *F. proliferatum* (57.14%), *F. subglutinans* (14.29), *F. chlamydosporum* (7.14%), *F. tricinctum* (7.14%), *F. graminearum* (7.14%), *F. poae* (7.14%), *F. nivale* (7.14%), *F. chlamydosporum* (7.14%), *F. acuminatum* (7.14%), *F. semitectum* (7.14%) and *F. anthophilum* (7.14%). Natural occurrence of *Fusarium* spp. were significantly ($P < 0.05$) high (75%) in cool climatic zones as compared to hot zones (8%) of Pakistan. Of them, *F. proliferatum*, *F. tricinctum*, *F. subglutinans*, *F. pae*, *F. nivale* and *F. acuminatum* found to be toxigenic. Maize samples were assayed for fusariotoxins by high performance chromatography coupled with fluorescence detection. Only one sample (1.53%) was found positive for zearalenone (ZON) and diacetoscripenol (DAS) in the warm, semi arid and cool sub humid zone with level of 500 and 354 µg/kg respectively. Among A-trichothecenes, 3.07% maize samples found positive for T-2 toxin and HT-2 with mean 500 and 475 µg/kg in cool and sub-humid zone as compared to hot arid zone i.e. 1.53% with mean of 450 µg/kg. Among B-trichothecenes group, deoxynivalenol (DON) with its derivatives i.e. 3-acetyl DON and 15-acetyl DON occurred in high incidence (6.15%) in cool climatic zone with mean values 876, 488 and 111 µg/kg respectively. Two samples (3.07%) were positive for Nivalenol with mean value 1197 µg/kg in cool region. Fumonisin were analyzed by ELISA technique and found 40.48% samples positive with mean value of 48.06 mg/kg (range 0.25-105 mg/kg). Among fusariotoxins, fumonisins were observed to be the most frequent mycotoxins of maize in all climatic zone of Pakistan.

PPPE 27

MOLECULAR IDENTIFICATION, PHYLOGENETIC ANALYSIS AND BIOCHEMICAL CHARACTERIZATION OF ENDOPHYTIC BACTERIAL POPULATION ASSOCIATED WITH CITRUS CANCER INFECTED LEAVES IN PAKISTAN

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Citrus plant is confronted to various biotic and abiotic factors, which reduce the yield and deteriorate fruit quality. Citrus canker is the most devastating disease caused by *Xanthomonas axonopodis* pv. *citri*. Various endophytic bacteria have been reported in healthy leaves of citrus. However, endophytic bacterial population from canker lesions has not been studied particularly from Pakistani ecology. There is no report published on molecular identification of endophytic bacteria isolated from citrus canker lesions. It was expected that this bacterial population might comprised of other disease causing organisms. In the present study, fifty five morphologically different bacterial strains were isolated endophytically from citrus canker infected leaves. These strains were identified using 16S rRNA gene sequence. Comparative analysis of 16S rRNA gene sequence revealed that the isolated bacterial population belonged to thirteen different genera: Enterobacter (17 strains), Bacillus (7), Pseudomonas (6), Pantoea (5), Klebsiella (4), Microbacterium (4), Xanthomonas (3), Curtobacterium (2), Staphylococcus (2), Brevibacterium (2), Micrococcus (1), Acinetobacter (1), and Deinococcus (1). Phylogenetic analysis based upon 16S rRNA gene sequence depicted five candidate novel species, which belonged to genera: Pantoea, Pseudomonas, Deinococcus, Brevibacterium and Micrococcus. However, the novelty of these candidate strains can be established through further chemotaxonomic studies. The biochemical tests were performed using API 20E and API ATB-VET kits for strains representing each genera and/or candidate novel strains. Pathogenicity test performed in attached- and detached-leaf assays on citrus revealed that Xanthomonas produced canker symptoms but other strains also showed necrotic spots and lesions. These strains belonged to genera: Pantoea, Klebsiella, Pseudomonas, Deinococcus, Acinetobacter, Bacillus, Enterobacter, Curtobacterium, Staphylococcus and Micrococcus. A strain isolated from healthy citrus leaves, identified as *Bacillus methylotrophicus*, showed antimicrobial activity over Xanthomonas strains. It is concluded that citrus canker infected leaves are rich in endophytic bacterial community, some of which may be novel species.

PPPE 28

EFFECT OF DIFFERENT PLANTS EXTRACTS AND HERBICIDES ON INFESTING FLORA AND YIELD AND YIELD COMPONENTS OF CHICKPEA

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In order to study the effect of different plant extracts and herbicides on yield and yield components of chickpea, a field trial was carried out at New Developmental Farm, Khyber Pakhtunkhwa Agricultural University Peshawar during Rabi season 2010. The experiment was laid out in Randomized Complete Block (RCB) design with four replications. The applied treatments were Stomp 330 EC (2.47 lit h⁻¹), Dual Gold 960 EC (2.00 lit h⁻¹) as pre-emergence herbicide and Sorghum halepense L. (125 g lit⁻¹), Parthenium hysterophorus L. (125 g lit⁻¹), Helianthus annuus L. (125 g lit⁻¹) and Eucalyptus camaldulensis L. (125 g lit⁻¹) as post-emergence plant aqueous extracts and hand weeding and weedy check. Data were recorded on weed density m⁻², fresh weed biomass (g), dry weed biomass (g), plant height at maturity (cm), number of branches plant⁻¹, number of pods plant⁻¹, number of grains pod⁻¹, 100 grains weight (g), biological yield (kg ha⁻¹), grain yield (kg ha⁻¹), harvest index (%) and cost-benefit ratio (CBR). All the parameters were significantly affected by different treatments except number of grains pod⁻¹. Hand weeding proved to be the best for controlling weeds, increase number of branches plant⁻¹ (6.7), number of pods plant⁻¹ (31.75), 100 grain weight (25.17 g), biological yield (6160 kg ha⁻¹) and grain yield (2197 kg ha⁻¹) followed by Stomp 330 EC with (24.37 g) 100 grain weight, (5406 kg ha⁻¹) biological yield and (1840 kg ha⁻¹) grain yield. The minimum grain yield (1095 kg ha⁻¹) was recorded in weedy check plots. The pre-emergence herbicides showed more positive effects than the plant water extracts. Hand weeded plots had more consistency in controlling weeds and thus proved to be the most effective method. However, during the scarcity of labour, Stomp 330 EC could be used as an alternative weed management tactic in chickpea.

PPPE 29

GROWTH ANALYSIS OF SOME CHICKPEA (CICER ARIETINUM L.) LINES UNDER SALT STRESS

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A pot experiment was conducted to determine the growth analysis of some chickpeas (*Cicer arietinum* L.) Lines under salt stress. The experiment was conducted in the wire house of the Old Botanical Garden, University of Agriculture, Faisalabad. Seeds of different chickpea lines (CH32/02, ch73/02, CH77/02, CM84/02, CH07/02, CM83/02, CH21/02, CM85/02 and CH44/04) were sown completely randomized design (CRD). Three concentrations of salinity 0,

25 and 50 mM were applied exogenously after the establishment of the seedlings. Each treatment was replicated thrice. Data for different growth and yield parameters was recorded during the course of study and was subjected to statistical analysis for the comparison of treatment means. Exposure of chickpea lines to salt stress severely affected the morphological and yield parameters. Plant heights (root and shoot length) and fresh and dry weights were significantly reduced as compared to plants grown under salt free environment. Salt stress also caused reduction in ion uptake and accumulation. Marked reduction in both leaf and shoot Na^+ , K^+ , and Ca^+ contents was observed under salt stress application, photosynthetic pigments i.e. chlorophyll 'a', chlorophyll 'b' and carotenoids adversely effect by salt stress. Maximum reduction in all parameters was observed at 50 mM concentration of salt. Similarly, salt stress also caused reduction in seed yield per pot and no of pods per plant. This study proved that salinity is highly toxic that suppressed growth, yield and inhibition of ion uptake and accumulation in chickpea and Salinity decreases the photosynthetic pigments at every salinity level.

PPPE 30

CONTRIBUTION OF COMPATIBLE OSMOLYTES AND ANTIOXIDANT ENZYMES IN SALT TOLERANCE OF AVICENNIA MARINA

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Effect of sea salt was assessed on growth, antioxidant enzymes and osmolytes in a salt secreting mangrove, *Avicennia marina*. Seedlings were raised in five sea salt concentrations (having osmotic potentials of -0.02, -1.4, -2.8, -4.2 and -5.2 MPa corresponding to 0, 50, 100, 150 and 200% seawater) mixed with nutrient solution in a netted house. All young seedlings sub-irrigated with double strength seawater (-5.2 MPa) died within a week, while optimum growth was observed in 50% seawater. Hence, long term effect of control, optimum and maximum salinities (-0.02, -1.4 and -4.2 MPa) was noted after six weeks on plant performance. Shoot biomass increased in 50% seawater, while increased root:shoot ratio and reduction in total biomass was observed in highest salinity. MDA content was increased corresponding to the growth reduction in plants. Addition of salt (50% seawater) resulted in a rapid increase in osmotic potential along with a substantial increase in sugars and glycinebetaine in comparison to the non-saline control. Reduced SOD (superoxide dismutase) activity corresponding to the amount of H_2O_2 was observed at highest salinity. CAT activity decreased while those of APOx (Ascorbate peroxidase) and GR (Glutathione reductase) increased with the increases in salinity. These results indicate role of Halliwell-Asada pathway enzymes to overcome salt induced oxidative stress and increased production of osmolytes for osmotic adjustment at the cost of plant growth reduction.

PPPE 31

PALYNOLOGICAL CHARACTERIZATION OF TOBRA FORMATION FROM BURIHKEL SECTION, WESTERN SALT RANGE, PAKISTAN

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Recent investigations deal with the palynological analysis of Early Permian Tobra Formation (Asselian), Western Salt Range, Pakistan. Tobra Formation is predominantly composed of silt and sandstone. Palynological records from the Burikhel Section indicated the occurrence of trilete spores (*Leiotriletes psilatus*, *L. multistriatus*, *Punctatisporites psilatus* and *Verrucosisporites verrucatus*), monosaccates (*Plicatipollenites emerginatus*), bisaccates (*Corisaccites alutatus*, *Protohaploxypinus microsaccus*), polyplicates (*Gnetaceaepollenites simplex*), monosulcate (*Marsupipollenites triradiatus*, *Cycadopites follicularis*, and *C. megasinonicus*) and various monocolpate morphogenera. Recovered palynomorphs were in good state of preservation. Based upon botanical affinities, the recovered palynoflora revealed the numerical abundance of pteridophytes followed by Pteridospermales, Coniferales, and Cycadales. Palynological analysis of the early Permian deposits indicated fluvio-glacial climatic conditions during the deposition of Tobra Formation.

PPPE 32

PALYNOLOGY OF EARLY TRIASSIC SHALE FROM KHAN ZAMAN NALA, WESTERN SALT RANGE, PAKISTAN

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Present study reveals the palynological records of shaley rock samples of Early Triassic (Mianwali Formation) from Khan Zaman Nala, Western Salt Range, Pakistan. Palynological findings included trilete spores, bisaccate and monosaccate pollen, megaspores and acritarchs. Following palynotaxa were dominant viz; *Leiotriletes congoensis*, *Punctatisporites vermiculatus*, *P. edgarensis*, *Dictyotriletes danvillensis*, *D. densoreticulatus*, *Reticulatisporites reticulatus*, *R. lacunosus*, *Lundbladispora brevicula*, *L. obsoleta*, and *Triquitrites dividus*. Bisaccate pollen were also common e.g., *Protohaploxypinus goraiensis*, *P. varius*, *P. limpidus*, *P. microcorpus*, *Falcisporites* sp., *Striatopodocarpites rarus*, *S. pantii*, *Fimbriaesporites diffusus* and *Alisporites landianus*. Monosaccate pollen observed were sporadic i.e., *Parasaccites diffusus* and *P. tuberculatus*. One Spinose acritarch and a megaspore were found. Recovered palynoflora was in good state of preservation. There was an overall dominance of trilete spores while gymnospermic bisaccate pollen were frequently encountered followed by less frequent monosaccate taxa. Vegetational analysis indicated dominance of pteridophytes at the beginning of Triassic Period that was followed by coniferous vegetation (Gymnosperms) and sparse occurrence of seed ferns. Prevalence of pteridophytic taxa over other plant groups indicated sub-tropical to temperate climate at the time of deposition of studied strata. Presence of Acritarchs depicted the episodes of marine regressive environment in close proximity of active site of deposition.

PPPE 33

ROLE OF EDTA IN ENHANCEMENT OF HEAVY METAL UPTAKE AND THEIR ROOT TO SHOOT PARTITIONING IN *HELIANTHUS ANNUUS*

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Pot experiments were conducted to study the enhancement in the mobility and phytoextraction of heavy metals by EDTA and the potential for leaching of metals during the phytoextraction process. Experiments were performed in pots using coarse sand as an anchoring medium. Cultivars of *Helianthus annuus* were grown in sand fed with nutrient solution along with salts of heavy metals i.e. Cd, Cu, Cr and Ni, each in a separate experiment, at various concentrations. Pots were amended with EDTA after twenty days of growth. Leachates were collected at fortnightly intervals to study effect of chelating agent on leaching hazard of different heavy metals. This study shows that EDTA enhances heavy metal bioavailability and has differential behavior with different heavy metals. This research also highlights the hazard of metal leaching and emphasizes for the proper dose management of chelating agent so that the risk of contamination of groundwater by EDTA assisted phytoremediation could be minimized.

PPPE 34

EFFECT OF EARTHWORM PROCESSED FARMYARD MANURE ON THE GROWTH AND YIELD OF TOMATOES

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There is a pressing need to discover cost effective, eco- friendly and rapid technique for the efficient management of the solid waste. Earthworm (*Eisenia fetida*) was used to recycle cattle manure into value added materials i.e. vermicompost. The effect of vermicompost on the growth and yield of tomato plants was evaluated under a pot experiment. The experiment was laid out according to Complete Randomized Design (CRD) having four repeats and five levels of vermicompost ranging from zero to 100%. The control consisted of only soil without vermicompost, while other treatments were constituted of by substituting soil with equal volume of vermicompost @ 25%, 50%, 75% and 100% respectively. Data regarding growth and fruit setting were recorded weekly. It was observed that there was significant difference on the growth and yield of tomato plants grown on vermicompost mixed soil compared devoid of it. Highest growth and yield of tomato were observed from the pots with 75% vermicompost. The gradual increase was observed both in growth and yield by mixing from 25 to 75% vermicompost. However a significant decrease both in growth and yield observed with 100% vermicompost compared to 75% vermicompost potting media. Results also suggested that by adding vermicompost, pH of the soil decreased whereas EC, TOC, Phosphorus, Potassium and Zinc concentration increased respectively.

PPPE 35

OVEN DRIED BIOMASS OF INDIGENOUS *A. NIGER*: A CANDIDATE BIOSORBENT FOR BIMETAL REMOVAL

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Metals can cause health hazards if their concentrations exceed permissible limits and are known to accumulate within biological system. It is well documented that dead and non-growing microbial biomass can be used for the decontamination of metal loaded industrial wastewaters prior to discharge into natural waters. Batch Biosorption method was employed to evaluate the applicability of an indigenous *A. niger* strain for heavy metal removal from assimilated industrial wastewaters. Oven-dried biomass showed maximum removal of chromium and nickel upto 37% and 100% respectively. The biosorption of nickel and chromium in bi-metal system was upto 96% by oven dried biomass while 67% by non-growing biomass. The mechanism of uptake of nickel and chromium by *A. niger* in the present study by transmission electron microscopy was bioadsorption onto the cell wall of fungal biomass. Oven-dried biomass showed comparatively higher bi-metal (Ni and Cr) removal potential than non-growing cells under similar conditions. This *Aspergillus niger* isolate showed remarkable bioadsorption capacity for both nickel and chromium, hence has potential to be developed as viable biosorbent for industrial effluents treatment.

PPPE 36

BIOLOGY AND PREDATORY POTENTIAL OF COCCINELLA SEPTEMPUNCTATA LINN. ON GREEN BUG SCHIZAPHIS GRAMINUM R. UNDER CONTROLLED CONDITIONS

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The biology and predatory potential of *Coccinella septempunctata* Linn. were studied on green bug *Schizaphis graminum* (Rondani) under controlled conditions at Insectary-Bio Control Labs., Insect Pest Management Programme (IPMP), Institute of Plant and Environmental Protection (IPEP), National Agricultural Research Centre (NARC), Islamabad. The results revealed that egg incubation period of *C. septempunctata* reared on *S. graminum* was 5.12, 3.62 and 3.20 days at 20±1°C, 25±1°C, and 30±1°C, respectively. Mean fecundity and percentage egg hatchability was considerably influenced by temperature. The total larval duration of predator was significantly reduced with the increase in temperature. Pupal duration ranged between 5.22 to 14.01 days. The pre-oviposition, oviposition and post-oviposition periods ranged between 17.33 to 28.23, 10.20 to 22.2 and 9.93 to 21.93 days, respectively. Life span of adult male and female ranged from 30.00 to 44.73 and 58.90 to 73.70, respectively. Mean predatory potential of all larval instars ranged from 575.17 to 735.83 aphids. Mean predatory potential of adult male and female ranged from 1890.6 to 2571.7 and 2276.8 to 3262.8, respectively at all three temperatures.

PPPE 37

MELLISSOPALYNOLOGICAL STUDIES OF HONEYBEE FLORA OF ISLAMABAD, PAKISTAN

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Mellisopalynological analysis of honey were undertaken to determine the botanical origin of honey and bee flora of Islamabad, during January to December, 2006. Major, Medium and Minor sources of nectar and pollen to honey were identified. A total of 30 plants serve as a pollen sources to honey from amongst the fruit, ornamental tree, agricultural crops and wild weeds. Major pollen yielding plants viz., *Brassicacampestris* L., *Callistemoncitrinus* (Curt.) Stapf., *Citrussinensis* (L.) Osbek, *Eriobotryajaponica* (Thunb.) Lindlay, *Partheniumhysterophorus* L., *Chenopodiumalbum* L., *Abelmoschuseculentus* (L.) Moench, *Ageratumconyzoides* L., *Bauhiniaavariata* L., *Bischofiajavonica* Blume., *Bombaxceiba* Burm., *Cassiafistula* L., *Convolvulusarvensis* L., *Coriandrumsativum* L., *Cucumismelo-agrostis* L., *Debergiasisso* Roxb., *Delphiniumajacis* L., *Euphorbiahelioscopia* L., *Eucalyptuscammoldulensis* Dehn., *Grewiaasiatica* L., *Hameliapatens* Jacq., *Helianthus annuus* L., *Iberisamarara* L., *Jacrandamimosifolia* Juss., *Justiciaadhatoda* Linn, *Lagerstromiaindica* L., *Litchichinensis* Mill., *Melilotusindica* (L.), *Nastertiumofficinale* R. Br., *Prunusarmeniaca* L., *P. persica* Benth., and Hook., *P. bokhariensis* Royle., *Pongammiapinnata* (L.) Pierre., *Raphanussativa* L., *Rosa* sp., *Rumexdentatis* L., *Silibummerianum* L., *Sonchusasper* Hill., *Trifoliumalexandrium* L., *Verbenatunisecta* L were identified. Some of these plants serve as pollen while other serves as a nectar sources. These results give the general idea of range of plant species that occur in the region and their utility to the bees. An attempt has been made in this research work to bring together the available information because knowledge of bee plant species is necessary for the bee keepers so that they can make an efficient use of these resources for honey production.

PPPE 38

INTEGRATED FERTILIZER AND PESTICIDE MANAGEMENT FOR BT-AND NON-BT-COTTON (*GOSSYPIMUM HIRSUTUM* L.)

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The study was designed to devise a viable strategy for sustainable Cotton production through integrated fertilizer and pesticide use. The field trials of comparative fertilizer use efficiency for improved ion uptake under blended bio-fertilizer and pure application conditions of chemical fertililizer with integrated use of chemical/biochemical pesticides and biological control and its consequent effects on yield of Non-Bt and Bt cotton was done at Mongi Bangla (Tehsil Gojra), District Toba Tek Singh. It was observed that neither organic nor conventional strategies were favorable for better crop production and sustainability, nevertheless BMPs proved to be superior to aforementioned trials. Non-Bt cotton proved superior to Bt in all yield parameters which is contrary to the previous reports. In Non-Bt, T4 showed 29% improved boll weight and 201% seed cotton yield improvement per acre over control, while T5 was found to be the best management practice for Bt-Cotton as 40% improved boll weight and T1 102% seed cotton yield improvement per acre. Plant growth promoting rhizobacteria (in the form of Biopower, a NIBGE product) played a better role applied when applied in combined treatment with chemical fertilizer by enhancing crop yield, nutrients uptake and maintains soil fitness which established its proved eco-friendliness.

PPPE 39

CHEMICAL COMPOSITION AND SENSORY EVALUATION OF TEA (*CAMELLIA SINENSIS*) COMMERCIALIZED IN PAKISTAN

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The quality of black and green commercial tea samples was accessed by physicochemical analysis for mineral composition and sensory evaluation. Significant variations in physicochemical and organoleptic parameters observed. The moisture, protein, fat, crude fiber, water extracts and ash contents of the commercial tea samples were found to be in the range of 2.46–7.47, 0.87–1.141, 0.94–2.15, 11.23–17.21, 32.34–53.61, and 3.29–5.86%, respectively, whereas caffeine and catechin were found in the range of 2.34–4.33% and 0–7.44%, respectively. The highest percentage of moisture, protein, fat, and crude fiber contents were observed in green tea samples while highest percentage of ash and water extracts were observed in black tea samples. Calcium, magnesium, sodium, potassium and manganese were found to be in the range of 1.47–3.84, 2.97–5.66, 0.39–1.83, 3.01–4.00, 1.09–2.43 mg/l, respectively, with maximum amounts found in green tea as compared to black tea.

PPPE 40

GROWTH, WATER RELATIONS AND PHOTOSYNTHETIC RESPONSES OF A COASTAL HALOPHYTE LIMONIUM STOCKSII TO SALT STRESS**ABDUL HAMEED, SALMAN GULZAR, BILQUEES GUL AND M. AJMAL KHAN****Institute of Sustainable Halophyte Utilization (ISHU), University of Karachi, Karachi-75270, Pakistan***Corresponding author's e-mail: majmalk@uok.edu.pk*

Limonium stocksii (Boiss.) Kuntze is a coastal halophyte with potential to become a cut-flower crop. In this study, we examined the growth, water relations and photosynthetic responses of *L. stocksii* seedlings to increasing NaCl (0, 300 and 600 mM) under semi-controlled conditions. Plants appeared to maintain growth up to 300 mM NaCl by maintaining leaf ash content similar to controls, higher photosynthetic CO₂ assimilation, water use efficiency and leaf photosynthetic pigments and more negative leaf osmotic potential and xylem pressure potential. However, at 600 mM NaCl, plant growth, tissue water, photosynthetic CO₂ assimilation and photosynthetic pigments decreased to ~50% of non-saline controls with most negative leaf osmotic potential and xylem pressure potential. High salt treatment reduced growth in *Limonium stocksii* despite maintaining water use efficiency, dark respiration and chlorophyll a/b ratios similar to non-saline controls possibly through biochemical limitation of photosynthesis as a result of ion toxicity.

PPPE 41

RESPONSE OF MUNGBEAN [VIGNA RADIATA (L.) WILCZEK.] TO CADMIUM AND NICKEL APPLIED AS SOIL TREATMENT**MUHAMMAD AQEEL* AND MUMTAZ HUSSAIN***Department of Botany, University of Agriculture, Faisalabad, Pakistan***Corresponding author's e-mail: aqeelbutt99@gmail.com*

The aim of the present investigation was to assess the effect of cadmium and nickel separately and in combination on some morpho-physiological, biochemical and yield characteristics of mungbean [*Vigna radiata* (L.) Wilczek.]. Two mungbean varieties viz., Mungbean var. 07002 and Mungbean var. M-1 were grown under nickel and cadmium application. Twenty days old plants were exposed to 15 or 30 mg L⁻¹ nickel and cadmium whereas control plants were treated with tap water only. Application of both nickel and cadmium caused significant reduction in all growth parameters as compared with that of control. The extent of decrease in growth due to cadmium compared with nickel. Although high concentrations of both the metals in the soil drastically reduced all gas exchange characteristic, growth of the plants, ionic contents and biochemical attributes in both mungbean varieties. Cadmium application caused more reducing effect as compared to nickel. In addition, all yield attributes of both varieties of mungbean reduced due to exposure of these metals in soil. In conclusion, Mungbean 07002 proved to be tolerant as it showed less reduction in growth, photosynthetic character, ion contents and yield as compared to Mungbean M-1.

PPPE 42

ADDITION OF TELIAL STAGES OF CEROTELIUM AND PHAKOPSORA SPECIES (BASIDIOMYCOTA; UREDINALES FROM PAKISTAN)**MUHAMMAD FIAZ, HABIB AHMAD AND ABDUL NASIR KHALID**

Twenty species of *Cerotelium* and 90 of *Phakopsora* have so far been reported on different host families. Here both genera are represented by single species each with uredinal stage only. Telial stages of *Cerotelium fici* and *Phakopsora ziziphi* are being reported for the first time from (Khyber Pakhtoonkhaw) Pakistan which is an addition to the rust flora of Pakistan.

PPPE 43

LEAD-INDUCED TOXICITY TO VICIA FABA PIGMENT CONTENTS: COMPARISON OF FREE AND COMPLEXED LEAD**M. SHAHID^{1,2,3*}, C. DUMAT^{1,2}, J. SILVESTRE^{1,2} AND E. PINELLI^{1,2}**¹*Université de Toulouse; INP-ENSAT, Av. de l'Agrobiopôle, 31326 Castanet-Tolosan, France.*²*UMR 5245 CNRS-INP-UPS; EcoLab (Laboratoire d'écologie fonctionnelle) ; 31326 Castanet-Tolosan, France.*³*Department of Environmental and Energy Engineering, COMSATS Institute of Information Technology, Vehari, Pakistan*

Only few studies concern early steps of lead phytotoxicity in relation to its speciation and uptake. In this study, Pb-induced toxicity to *Vicia faba* pigment contents was assessed against Pb speciation and uptake. *Vicia faba* seedlings were exposed to 5 μM of lead nitrate alone or chelated by EDTA or citric acid for 1, 4, 8, 12 and 24 h in controlled hydroponic conditions. Lead toxicity reduced *Vicia faba* pigment contents after 24 h. Addition of EDTA to Pb solution reduced its translocation and alleviated Pb-induced toxicity to *Vicia faba* pigments. In contrast, citric acid had no effects on Pb accumulation and toxicity to plants.

PPPE 44

ROLE OF METAL SPECIATION IN EARLY STEPS OF LEAD-INDUCED ROS PRODUCTION AND LIPID PEROXIDATION IN *VICIA FABA* L. SEEDLINGS

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The present study evaluated the effect of metal speciation on lead-induced toxicity to *Vicia faba* seedlings. Young *V. faba* seedlings were exposed to 5 μM of lead nitrate in the presence and absence of ethylenediaminetetraacetic acid (EDTA) and citric acid (CA). All the treatments were exposed for 1, 4, 8, 12 and 24 h in controlled hydroponic conditions. The results showed that Pb toxicity to *V. faba* depends on its speciation and duration of exposure. Lead alone caused two burst of lipid peroxidation and H_2O_2 induction at 1 and 12 h in *V. faba* roots. In leaves, Pb-induced H_2O_2 induction and lipid peroxidation started after 8 h. Addition of EDTA dose dependently inhibited Pb-induced lipid peroxidation and ROS production indicating a protective role of this metal chelator. In contrast, CA did not show significant effects on Pb-induced lipid peroxidation and ROS production, but delayed the induction of effects. The present study suggested that metal speciation plays important role in early steps of Pb toxicity to *V. faba* seedlings.

PPPE 45

A COMPARATIVE STUDY OF CONE AND SEED MORPHOLOGICAL CHARACTERISTICS OF *JUNIPERUS EXCELSA* IN BALOCHISTAN, PAKISTAN.

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The present work has been undertaken to study the comparative cone and seed morphological characteristics of three provenances of *Juniperus excelsa* from Ziarat, Zarghoon Ghar, and Harboi. Cones of *J. excelsa* were randomly picked from healthy mature trees growing in natural stands. Values were calculated for the following parameters: cone diameter, cone weight, total number of seeds per cone and seed weight. Seed cutting test was also performed to determine empty, insect infested and filled seeds. Statistically significant differences were observed among the populations with regards to the cone size and number of seeds per cone. These differences were also found within each population, however these were not significant. Positive correlation was found between the increasing elevation and number of filled seeds. Cones from higher elevations allocate more biomass to the seeds. Filled seed were found to be 25%, 17%, and 9% in cones from Ziarat, Zarghoon Ghar and Harboi respectively. The average seed weight from cones growing at Ziarat was higher as compared to the other two sites. The study from all three provenances indicated that more than 75 percent seeds were empty, dead filled and contained dry shrunken embryos. The seed cutting test suggests that Juniper stands in Ziarat are relatively healthier. In addition the variations among populations of *Juniperus excelsa* in Balochistan with regards to cone and seed characteristics propose a time held effective geographical segregation of the Juniper tracts of Balochistan Pakistan.

PPPE 46

PHYTOTOXICITY EVALUATION OF MEDICINAL PLANTS AND WEEDS FOR AGRO-ENVIRONMENT RISK ASSESSMENT: LEAF-LITTER BY SANDWICH METHOD

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Experiments have been carried out at National Institute of Agro-Environmental Science, Tsukuba, Japan during 2008. In this experiment leaf-litter of twenty medicinal plants and weed species collected from Pakistan have been

evaluated for allelopathic activity by using sandwich method. The effects of phytotoxic compounds from dried leaf-litter of species on *Lactuca sativa* (lettuce) seedlings have been examined. Overall results showed that most of the medicinal plants and weeds were found with high significant inhibition value against lettuce seedlings supporting the hypothesis of the experiments carried out. Under sandwich method maximum radical growth inhibition has been observed against *Pyrus pashia* followed by *Solanum surattense* and *Solanum villosum*. It has been concluded that leaf-litter of medicinal plants and weeds may have strong allelopathic properties that can induce risk for any existing agro-ecosystem. However, the results may provide benchmark information for further research on the elucidation of chemicals involved in allelopathy and could also be helpful in the development of new and potent bioactive chemicals from natural products.

PPPE 47

PHENOLOGICAL PATTERNS AMONG THE VEGETATION OF GANGA CHOTTI AND BEDORI HILLS IN A MOIST TEMPERATE TO ALPINE FORESTS

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There were 206 plant species of 47 families consisting of 10 trees, 18 shrubs, 140 herbs and 38 grasses harbouring in Ganga Chotti & Bedori Hills during 1999 & 2000. The investigated area had two flowering seasons. The first spell 111 Spp (54% flowered while in the second spell 46% species flowered). Majority of herbaceous, shrubby trees species flowered from May to June and the flowering reached to the peak during July and August. Most species produced fruits during the first spell

PPPE 48

HIGH ALTITUDE FOREST COMPOSITION DIVERSITY AND ITS COMPONENT IN A PART OF GANGA CHOTTI AND BEDORI HILLS DISTRICT BAGH. AZAD JAMMU AND KASHMIR, PAKISTAN

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The effect of altitude on species diversity and its components was recorded in Ganga Chotti and Bedori Hills district Bagh Azad Jammu & Kashmir during 1999-2000. There were 30 plants communities merged in to four plant associations on the basis of cluster analysis. Average species diversity was highest 2.70 at the base (Alt1700m) in woodland temperate association. Then the diversity declined. At the top (Alt. 3000m) species diversity was 1.71, while in Monsoon diversity was 2.48 at the base and 1.72 at the top. Average species richness was highest at the base (4.06) then decreased with the increase in altitude. Equitability increases from 1700m – 3350m (0.71-1.07) while at the top it decreases (0.77). Species maturity in winter and monsoon was highest at the base and lowest at the top (3000m).

PPPE 49

LIFE FORM AND LEAF SIZE SPECTRA REPORTED IN MOIST TEMPERATE FOREST OF PIR-CHINASSI HILLS, DISTRICT BAGH AZAD JAMMU & KASHMIR

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Life form and leaf size spectra of 13 different plant communities were studied both qualitatively and quantitatively. These communities were grouped in to five plant associations. The data shows that hemicryptophytes and therophytes were dominant during spring and monsoon seasons quantitatively. Hemicryptophytes were dominant both in spring and monsoon, while therophytes appeared as a major group in the monsoon. Similarly, microphyllous species followed by nanophyllous species were dominant in spring and monsoon in the investigated area.

PPPE 50

AGGREGATION AND REGENERATION CAPACITY OF VEGETATION IN KOTLI HILLS AZAD JAMMU AND KASHMIR

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Degree of aggregation and age classes in forests of Kotli hills were recorded in relation to environmental variable and underlying anthropogenic influence. Aggregated species (36.27%) were dominant in the area followed by the intermediate species with share of 36.27 and 33.16 respectively. Similarly regeneration capacity of the forest shows that *Pinus roxburghii* and *Punica granatum* were the only regenerating species in the investigated area. The remaining eight species viz: *Olea ferruginea*, *Quercus dilatata*, *Flacourtia indica*, *Celtis eriocarpa*, *Grewia villosa*, *Acacia modesta*, *Ficus palmata* and *Mallotus philipensis* were not regenerating due to deforestation and overgrazing. These species are in endangered condition.

PPPE 51

PHYTOSOCIOLOGY OF SOME WEEDS OF WHEAT COMMUNITIES AROUND KOTLI FIELDS WESTERN HIMALAYA

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There were ten plant communities of weeds in wheat fields of Kotli. Communities were *Euphorbia-Desmostachya*, *Coronopus*, *Parthenium-Galium-Taraxacum*, *Zanthium-Bidens-Bothriochloa*, *Silybum* – *Amaranthus-Avena*, *Ranunculus*- *Silybum*- *Imperata*-*Oxalis*- *Cannabis* – *Vicia*, *Calendula-Fimbristylis-Desmodium*, *Taraxacum-Geranium*-*Poa*, *Phalaris-Geranium-Cynoglossum*, *Themeda-Cardus-Urtica*. The soil texture differs from loam to clay loam, loam and sandy loam with basic pH. Organic matter was high in all the communities, saturation varied from 30 to 51%, Nitrogen differed from 0.53 to 0.87%, Phosphorus from 9 to 16 ppm, potassium from 256 to 768 ppm, Electrical conductivity varied from 2.3 to 5.6 (Table 1).

PPPE 52

VARIABILITY ASSESSED IN RED ROT RESISTANT SOMACLONES OF SUGARCANE GENOTYPE S97US297 IN R₁ AND R₂ GENERATIONS

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Sugarcane globally is a major source of commercial sugar. In world production Pakistan is 5th in ranking Breeding sugarcane under climatic conditions prevailing in Pakistan is very difficult. Somaclonal variation provides an alternate to generate variability in the existing genotypes. Fifteen red rot resistant entries (somaclones) selected from R₀ generation were studied in R₁ and R₂ generations in three replications using randomized complete block design. Analysis of variance and different genetic parameters were calculated. Cluster analysis was done using Ward's method. Somaclones showed highly significant difference in all the agronomic and quality traits except pol and purity in R₁ generation. Whereas in R₂ generation significant and highly significant differences were observed in all the parameters studied. A wider variation was observed in all the characters especially in morphological traits. Variance computed in the table indicated that maximum variation was found for leaf area, plant height, cane height, number of millable canes and cane yield. The genotypic variances for the said characters were 897.34, 142.23, 87.58, 75.65 and 59.57 respectively. Genotypic variance followed the same trend as of phenotypic variance for all the characters. High genotypic coefficient of variability as well as

phenotypic coefficient of variability percentage was observed for number of internodes, number of millable canes, cane yield and cane weight. Heritability estimates in broad sense were relatively high for almost all the traits studied especially cane thickness, number of millable canes, cane yield, cane weight and leaf area in R_1 generation whereas in R_2 generation only plant height, number of internodes and leaf area showed high heritability. This indicated the presence of additive type of gene action in the expression of these parameters. In both the generations somaclones divided into three clusters. Formation of clusters indicated the presence of similarities within cluster and divergence with the somaclones present in the other clusters. Two years studies authenticate that these are the somaclones which are on the basis of parameters studied close to each other and with the parent, however somaclones are resistant to red rot and parent is susceptible to red rot disease.

PPPE 53

CONTROLLING AMMONIA VOLATILIZATION FROM UREA SURFACE APPLIED TO LOAMY SOIL

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Fertilizer consumption has increased three fold during the past 30 years. It reached one million nutrient tones in 1980/81, two million tones in 1992/93 and three million tones in 2002/03. Urea, today, is made in approximately 75 factories worldwide with a total capacity approaching 100,000,000 tons annually. Urea hydrolyzed by urease. Sodium thiosulfate (ST) has been reported to inhibit nitrification and urea hydrolysis and thereby reduces volatilization of urea nitrogen as ammonia from soils fertilized with urea. A laboratory experiment was carried out by adding ST to urea (10 % by volume). We evaluated ST as a soil urease inhibitor by studying its effects on urea hydrolysis. Encouraging results were found in reducing NH_3 losses when ST was applied it reduced NH_3 losses in cotton 35.13 %, 31.65 % and 35.35 %, 32.77 % in Rice soils in first and second experiment respectively. It functions as urease and nitrification inhibitor.

PPPE 54

SENSITIVITY OF SOME MARINE CYANOBACTERIAL SPECIES TO METHYL PARATHION (ORGANOPHOSPHATE PESTICIDE)

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Extensive use of pesticides in agriculture to control pest has led to environmental contamination. Pesticides pose serious threats to the natural ecosystem. In the present study, toxicity of methyl parathion (organophosphate pesticide) was assessed using cyanobacteria (blue green algae) as target organism. Cyanobacteria, the photosynthetic prokaryotes, play an important role in the energy transformation to higher trophic levels. Laboratory grown cultures of cyanobacteria were subjected to test pesticide and its photosynthesis was measured using Light/Dark method. The effect of pesticide on photosynthesis was noted. The acute toxicity of methyl parathion was determined by calculating IC_{50} of the test organisms. The results indicate that methyl parathion has low IC_{50} values, such as, 0.008 ppm, 0.9 ppm, 0.12 ppm and 0.031 ppm for *Synechocystis aquatilis*, *Komvophoron minutum*, *Gloeocapsa crepidinum* and *Gloeocapsa sanguinea*, respectively. Thus evidently reveal that the test pesticide has deleterious effects on photosynthetic ability of cyanobacteria, and hence on primary productivity. Lowering of primary production in the coastal waters would lead to the depletion of organisms in higher trophic level and thereby eventually effect the fishery production and also create human health issues.

PPPE 55

OUGENIOXYLON CHINJIENSIS SP. NOV., A NEW FOSSIL SPECIES OF THE FAMILY LEGUMINOSAE FROM CHINJI FORMATION SALT RANGE, PUNJAB PAKISTAN

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Present work is comprises of Anatomical study of fossil wood collected from Chnji formation (72°22' E, 32° 41' N) of Miocene age exposed at Chinji National Reservoir, The material consists of a single piece of fossil wood dark brown in colour. The three dimensional sections were prepared by ground thin section Technique. Microscopic examination of the characters compared with modern and fossil wood and found comparable with the family Leguminosae. The closest resemblance of our fossil wood is with the wood of Ougenia. This fossil wood shows close resemblance in respect of vessels, fibers, parenchyma and xylem rays character with the species such as ougenia dalbergioides Benth .Therefore it is considered as new species and it is named ougenioxylon chienjiensis sp. nov. The specific epithet refers to Chinji Formation to which fossil wood belongs.

PPPE 56

LUCERNE AS TRAP CROP IN WHEAT FOR DEVELOPMENT OF PREDATORS POPULATION AGAIST WHEAT APHIDS (*APHIDAIIDAE*: HOMOPTERA)

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Studies on utilization of lucern as a predator source in strips parallel to wheat cultivar, Inqlab-91 were compared with wheat not having lucern as trap crop during 2004-05. The experiment was laid out in Randomized Complete Block Design with three replications. Populations of aphids, ladybird beetles and syrphid flies were counted from each plant of one square feet of wheat. The maximum population of aphids was observed on plots not trap cropped with lucern. The establishment of beneficial insects on lucern harbouring aphids helped to delimit the aphid population in intercropped wheat plots and maintained them below economic injury level. This reveals the role of trap cropping of fodder crops in wheat to decrease the insecticide application chances on this cereal crop of great importance.

PPPE 57

EARLY EOCENE FILICINEAN SPORES FROM THE GHAZIJ FORMATION, NORTH EAST BALOCHISTAN, PAKISTAN

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The present paper deals with the analysis of some pteridophytic spores belonging to Early Eocene Ghazij Formation. This Formation is divisible into lower, middle and upper parts on the basis of lithological characteristics which are mainly sandy or calcareous shales with palynologically rich horizons. 21 form genera and 30 form species of pteridophytes were recovered. Some of the qualitatively significant trilete genera recovered from the lower strata are described and illustrated. Some significant forms include *Cicatricosisporites grandiosus*, *Cicatricosisporites paradorogensis*, *Dandotiaspora tenolata*, *Todisporites major*, *Gleicheniidites taiwanensis*, *Dictyophyllidites concavus*, *Leiotriletes triangulatus*, *Leiotriletes maxoides*, *Triplanosporites sinonicus* and *Verrucingulatisporites vittatus*. Resolution of palynological data in terms of palaeoclimate and palaeovegetation indicated warm to humid tropical environment with the existence of perennial water and Filicinean representatives as an essential component of ecosystem of that time.

PPPE 58

THE ECOGEOGRAPHIC ANALYSIS OF WILD ASCLEPIADS OF PAKISTAN

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Anecogeographic survey of wild asclepiads (Family Apocynaceae) was carried out using a database of 628 geo-referenced records associated with four major herbaria (ISL, KAR, RAW and PMNH) in Pakistan. Altogether thirty five species were recorded in the country that occur between 23°S and 37°N and at an altitudinal range of 08-2390 m. Among species *Pentatropis spiralis* and *Calotropis procera* were found widely distributed. However, several species were found rare or narrowly endemic such as *Ceropegia macrantha*, *Holostemma annularium*, *Vincetoxicum canescens* and *Orthanthra viminea*. Furthermore species like *Leptadenia pyrotechnica*, *Glossonema varian* and *Tylophora hirsuta* showed allopatric distribution. The data analysis further showed a number of places as either unexplored or extremely poor in their occurrence for example Sargodha, Khushab, Khairpur, Sanghar, Tharparkar, Chaghi, Ziarat, Zhob, Kohistan

and Dera Ismail Khan. The collated data was used to survey species rich area of Rawalpindi and Islamabad to find the current status of species occurrence. A comparison of herbarium and current field data revealed unexplored asclepiads diversity in the field. This is because most of the herbarium records were collected either along the road or across accessible places only. These collections based studies make innumerable contributions to science and society in areas as divergent as homeland security, public health and safety, monitoring of environmental change, targeted specie based research and traditional taxonomy and systematic.

PPPE 59

RESPONSES OF VARIOUS CANOLA CULTIVARS AGAINST AMBIENT OZONE POLLUTION

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The cultivars differences in the sensitivity of canola to ozone based on the dry weight was investigated using eight cultivars. On the 10th and 14th days after sowing, eight cultivars were exposed to 120 ± 8 ppb ozone for 5h per day (10:00 to 15:00) at 24 ± 1.0 °C, $72 \pm 9\%$ relative humidity and $300 \mu\text{mol m}^{-2} \text{s}^{-1}$ PPFD. The control plants were exposed to charcoal filtered air under the same climatic conditions. After two weeks of treatment i.e., 28 das, all the plants were harvested to determine leaf area and dry weight. The sensitivity of eight canola cultivars to ozone determined on the %age reduction in the total dry weight per plant compared to control was grading as Cyclon > Con-II > Con-I > Rainbow > Oscar > Dunkeld. This ranking could not be explained by the degree of ozone induce visible foliar injuries, whole plant growth rate and stomatal density. However, the reduction in the photosynthetic CO₂ uptake per unit amount of ozone absorbed by the leaf was significantly different among the three cultivars, and was ranked as Cyclon > Rainbow > Dunkeld. This grading coincided with that in the sensitivity of whole plant dry weight growth and or net photosynthetic rate to ozone. Therefore, the cultivars difference of canola in the sensitivity to ozone is generally considered to depend on the physiological detoxification capacity of cultivar for ozone in their leaves.

PPPE 60

STATUS OF BIOLOGICAL CARBON UNDER DIFFERENT LAND USES IN RAWALPINDI DISTRICT

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Soil biological carbon is an important component of soil ecosystem, which provides an effective forecast or soil quality deterioration. Anthropogenic activities related to land uses and agricultural practices modify both the quantity and quality of soil biological carbon. In present study the effect of these modifications on microbial biomass carbon (MBC) under forest, grassland and agricultural land was studied to identify biological carbon status in the soil ecosystem of Rawalpindi district. From each landuse 84 samples with replications were collected. Rapid microwave irradiation extraction method was used to measure microbial biomass carbon. Other soil parameters such as total organic carbon (TOC), pH, soil water, bulk density, electrical conductivity (EC) and microbial biomass nitrogen (MBN) were estimated. The data was interpreted by applying analysis of variance to compute means and least significant differences ($P < 0.05$). The results revealed that agriculture soil contained least biomass carbon as (294 mg kg^{-1}) compared to forest soil (420 mg kg^{-1}) and grassland soil (412 mg kg^{-1}). Microbial biomass carbon showed a positive correlation with pH ($R^2 = 0.98$), TOC ($R^2 = 0.95$), EC ($R^2 = 0.93$) and MBN ($R^2 = 0.85$). This indicated a strong relationship of microbial biomass carbon with soil characteristics. Forest and grassland had high amount of MBC as they were relatively undisturbed lands however due to unsustainable activities agricultural land showed 42% and 40% less MBC from forest and grassland soils respectively.

PPPE 61

MORPHO-PHYSIOLOGICAL RESPONSES OF WHEAT (*TRITICUM AESTIVUM* L.) TO SIMULATED ACID RAIN AND MICRO NUTRIENTS

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The effect of simulated acid rain was evaluated on morphological, physiological and yield characteristics of wheat (*Triticum aestivum*) examined as a pot experiment during 2010-11. Two varieties of wheat i.e. Sahar 2006 and Shafaq 2006 with six treatments including control each having five repeats were used for experimentation. Sulphuric acid (H_2SO_4) at pH 3.0 and 3.5 were artificially prepared as simulated acid rain and micro nutrient i.e. Micron-T were applied by foliar spray separately and in combinations. Application of simulated acid precipitation caused significant reduction in all growth parameters as compared with that of control while micronutrients act as reducing agent against simulated acid application. As a result, Shafaq 2006 proved to be tolerant as it showed less reduction in growth, photosynthetic character, ion contents and yield as compared to its counterpart.

PPPE 62

BIOCONTROL OF EUPHORBIA HELIOSCOPIA USING FUNGAL PATHOGENS

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A pot experiment was conducted to determine the efficacy of different fungal pathogens (*Alternaria tenuissima*, *Alternaria alternata* and *Fusarium oxysporum*) to control *Euphorbia helioscopia* in crops. For this purpose transplantation of *E. helioscopia* was done in March 2010. The experiment was designed with three treatments having five replicates in each. Plantlets were inoculated with different concentrations (1×10^3 , 1×10^5 , 1×10^7 spores/ml.) of spore suspension of selected fungi. Maximum disease development was recorded in case of inoculation with water suspension of *Alternaria tenuissima* parameters studied for disease development were no. of infected leaves/plant and no. of spots on each leaf. No disease development was observed in control.

PPPE 63

MIOPORE ASSEMBLAGE (TRILETE) FROM TREDIAN FORMATION (ZALUCH GORGE), WESTERN SALT RANGE, PAKISTANSADIA SAGHEER¹, KHAN RASS MASOOD¹, FAHIM ARSHAD² AND RIFFAT JABEEN¹¹*Department of Botany, University of the Punjab, Lahore.*²*Department of Botany, University of the Education, Okara Campus, Okara (Pakistan).*

Present study deals with the palynological analysis of the rock samples were obtained from an outcrop of Tredian Formation (Landa Member), Zaluch Gorge Section, Western Salt Range, Pakistan. Samples were palynologically investigated to generate palynological data. Studied section consisted of variegated beds of compact and fine grained sandstone with alternating shale. A rich palynoflora comprised of pteridophytic spores viz., *Calamospora flexilis*, *Cyclogranisporites arenosus*, *C. breviradiatus*, *Punctatisporites aerarius*, *P. curviradiatus*, *Apiculatisporites setulosus*, *A. abdatus*, *Verrucosporites populosus*, *Convolutispora fromensis* and *Lundbladisporella brevicula* was recovered from the sedimentary outcrop. Palynomorphs were present in good state of preservation. Based on the botanical affinities of recovered palynoflora, it revealed that Lycopsids and sphenopsid and ferns were major component of Mid Triassic flora of the Salt Range. Palaeoclimatic evaluation based on palynological data showed the dominance of cool temperate to sub-temperate climate with moderate to high humidity during Mid-Triassic sedimentation of Tredian Formation.

PPPE 64

EXOTIC CONOCORPUS PLANTATIONS AND URBAN ECOLOGY OF HYDERABAD CITY: A THREAT ANALYSISSAEED AKHTER ABRO¹, AMANULLAH MAHAR², SHER MOHAMMAD MANGRIO¹ AND FAROOQUE A. BUGHIO¹¹*Plant Ecology and Environmental Biology Lab, Institute of Plant Sciences, University of Sindh Jamshoro*²*Center for Environmental Sciences, University of Sindh Jamshoro***Corresponding author's e-mail : akhsaeed@gmail.com*

The exotic *Conocarpus* has been widely planted along the roadsides in Hyderabad city primarily because of its wide adaptation, faster growth and evergreen foliage. Extensive studies conducted on the ecological role of exotic species on local ecosystems suggest that exotic species adversely affect the ecology of local ecosystem by allelopathic impacts, competition with indigenous flora, changing habitat for indigenous avifauna as well as other wildlife and creates gaps in knowledge transfer about indigenous flora and fauna of the area. The town planners and urban development authorities of Hyderabad does not consider these adverse effects of mass scale plantations of exotic *conocarpus*. The present study has been conducted to assess the ecological misbalance in urban ecosystem caused by mass plantations of *conocarpus* in Hyderabad. The *conocarpus* plantations were surveyed for canopy cover, ground vegetation, leaf litter fall, accumulation of allelochemicals in soil, habitat and food supply for indigenous birds, pollen production and analysis of inflorescence

born chemicals. A questionnaire was developed to assess the transfer of indigenous knowledge about the past and present vegetation status of city. There were two groups of respondents interviewed one group was local inhabitants of age 50 to 60 and 2nd group was school children of age 10 to 20. The results of study showed that conocarpus had poor canopy as compare to indigenous trees, poor ground vegetation, high amounts of various allelochemicals in soil, complete habitat loss in terms of bird nesting, high amounts of pollen production and production of highly aromatic chemicals when inflorescences were soaked in water. It was also found that the indigenous knowledge transfer was poor and only 10 to 15 percent of young were known about the indigenous vegetation of the city.

PPPE 65

INTER-COMPARISON OF RHIZOSPHERIC MICROBIAL FLORA OF WILD AND MODIFIED VARIETIES OF SOME ECONOMICALLY IMPORTANT CEREAL CROPS

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The use of genetically modified plants is of great concern in the present scenario. Genetically modified plants (GMPs) offer many benefits, their engineering and cultivation has also fuelled considerable debate regarding possible undesirable environmental effects. There are concerns that the commercial cultivation of GM crops could result in adverse effects on the environment. The present study was designed to explore the effect of GM crops on soil microflora as compared to wild plant varieties. For this purpose a field experiment was designed in which wild and hybrid varieties were grown under natural conditions in completely randomized fashion. At maturation vegetative growth analysis of hybrid and wild varieties was carried out which showed non-significant difference in both varieties of the wheat but a pronounced difference was noticed in case of maize in which growth of hybrid variety was enhanced regarding all parameters. The plant roots were processed for mycorrhizal colonization that displayed the same results as revealed above. The rhizospheric soil was examined for the presence of soil microflora (fungi, bacteria and mycorrhizal spores). The results obtained from this study showed that no remarkable difference was present in the microbial flora of both the varieties.

PPPE 66

ASSESSMENT OF SEED-BORNE MYCOFLORA AND NUTRITIONAL PROFILE OF LENTIL (LENS CULINARIS) GROWN IN ARID REGION

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Lentil (*Lens culinaris*) is a common and the oldest domesticated pulse and has relatively higher contents of protein, carbohydrate and calories as compared to other legumes. During present study fifty samples from different arid regions of Punjab viz. Chakwal (n=16), Khushab (n=17) and Rawalpindi (n=17) were investigated for its mycoflora and nutritional profile. A total of 14 fungi including *A. niger*, *A. flavus*, *A. ibericus*, *A. sydowi*, *A. fumigatus*, *alternariatenuissima*, *A. solani*, *Penicillium notatum*, *Rhizopus nigricans*, *Culvularia clavata*, *F. oxysporum*, *Paecilomyces variotii*, *Mucor* and an unknown spp. were isolated from lentil seeds and 240 fungal isolates were identified. Among all lentil samples co-occurrence of fungal isolates were ranged from 1-11 species. The dominating fungal isolates were *A. niger*, *A. flavus*, and *Mucor* whereas *Paecilomyces variotii* and *Alternaria tenuissima* were observed in minimum numbers. The comparative study of mycoflora of three districts of Punjab showed that highest incidence of fungal flora was found associated with district Khushab (84 isolates) followed by Chakwal district (76 isolates) and district Rawalpindi (74 isolates). Fifty (n=50) lentil seed samples collected from 3 arid regions of Punjab put forth for chemical analysis. The proximate analysis of seed samples of Chakwal showed average values of moisture (5.52±1.05), protein (23.46±1.05), fiber (4.43±0.80), fat (1.57±0.39) and ash (2.43±0.40) contents. The nutritional profile of seed samples of Khushab showed average values of moisture (5.19±0.78), protein (23.87±1.16), fiber (4.38±0.60), fat (1.63±0.45) and ash (2.24±0.41). Similarly, the proximate analysis of lentil seed samples of Rawalpindi showed average values of moisture (5.81±0.95), protein (24.32±0.89), fiber (4.67±0.93), fat (1.55±0.44) and ash (2.22±0.48). The comparative nutritional profile of lentil seed samples of 3 districts showed that high protein contents were found in Rawalpindi district (24.32±0.89) followed by Khushab district (23.87±1.16) and Chakwal district (23.46±1.05) respectively. The higher crude fiber content was found in samples collected from Rawalpindi district (4.67±0.93) followed by Chakwal (4.43±0.80) and Khushab district (4.38±0.60). Similarly, crude fat (%) of seed samples of Khushab (1.63±0.45) district was followed by Chakwal (1.57±0.39) and Rawalpindi (1.55±0.44). While crude ash content of district Chakwal was higher i.e. 2.43±0.40 followed by Khushab (2.24±0.41) and Rawalpindi (2.22±0.48) respectively.

PPPE 67

DISEASE CONSTRAINTS OF HYDROPONICALLY GROWN GINGER (*ZINGIBER OFFICINALE* ROSC.)

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Hydroponics provides instruments for protection of the plants in the greenhouse since many exogenous factors can be easier controlled in soilless cultivation than growing in the soil. The present study was designed to identify the disease constraints of ginger in hydroponics in the Institute of Plant Pathology, University of The Punjab, Lahore. The ginger was grown in hydroponic medium and rhizome pathogens were isolated and identified. Growth of ginger was also analyzed in soil and soilless medium that was relatively better in soilless medium. In hydroponics the common disease observed was soft rot caused by both bacterial (*Pseudomonas* sp.) and fungal species (*Fusarium* sp.).

PPPE 68

ROLE OF *CARICA PAPAYA* L. IN REDUCING ENVIRONMENTAL HAZARDS OF HERBICIDES THROUGH ALLELOPATHY

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To evaluate allelopathic potential of *Carica papaya* against *Avena fatua*, *Euphorbia helioscopia*, *Rumex dentatus* and *Sorghum halepense* pot and aqueous extract experiments were conducted at Weed Management Lab (IPEP), NARC, Islamabad. In *Carica papaya* leaf powder shoot and root lengths of *Euphorbia helioscopia* and *Sorghum halepense* showed complete inhibition at high concentration (6g) only. In *Avena fatua* shoot and root growth was not affected. Shoot and root growth of *Rumex dentatus* was reduced significantly at high concentration only. *Euphorbia helioscopia* showed high reduction in percentage germination (50%) followed by *Sorghum halepense* (58.4%), *Rumex dentatus* (74.9%) and *Avena fatua* (75.8%). In *Carica papaya* leaf extract shoot length and root length of *Avena fatua*, *Euphorbia helioscopia* and *Rumex dentatus* were reduced significantly at high concentration (100%) only. Shoot and root growth was not affected in *Sorghum halepense*. Percentage germination was highly reduced in *Euphorbia helioscopia* (56.5%) followed by *Avena fatua* (59.5%), *Sorghum halepense* (70.5) and *Rumex dentatus* (76%). The result from the study strongly suggests use of *Carica papaya* as an environment friendly and cheap bioherbicide through allelopathy.

PPPE 69

WEED MANAGEMENT BY *CUSCUTA* L. (PARASITIC PLANT)

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Experiments were conducted to evaluate weed suppressing potential of *Cuscuta* against *Avena fatua*, *Euphorbia helioscopia*, *Rumex dentatus* and *Sorghum halepense*. Aqueous extract and pot experiments were conducted at Weed Management Lab (IPEP), NARC, Islamabad. In aqueous extract of *Cuscuta* shoot length and root length of *Euphorbia helioscopia* showed high reduction at 100% extract concentration only. In *Avena fatua* shoot length and root length was reduced significantly at 75% and 100% concentration. *Sorghum halepense* showed significant reduction at highest concentration. Percentage germination was highly reduced in *Euphorbia helioscopia* (38%) followed by *Avena fatua* (64%), *Sorghum halepense* (67.5%) and *Rumex dentatus* (88.5%). By using *Cuscuta* powder in pot experiment root growth of *Avena fatua* and *Euphorbia helioscopia* was totally inhibited at 6g of *Cuscuta* powder. Shoot length of *Avena fatua* was inhibited significantly at 6g and in case of *Euphorbia helioscopia* it was concentration dependent. In *Sorghum halepense* root and shoot growth was not affected. Root and shoot growth of *Rumex dentatus* was reduced at high doses of *Cuscuta* powder. Percentage germination was very much reduced in *Sorghum halepense* (52.5%) followed by *Euphorbia helioscopia* (55%), *Avena fatua* (70%) and *Rumex dentatus* (80%). The results from the study strongly suggest role of *Cuscuta* in weed management through allelopathy.

PPPE 70

INCREASE IN RICE (*ORYZA SATIVA* L.) SEED VIGOR AND SUBSEQUENT GROWTH THROUGH POTASSIUM HUMATE APPLICATION

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An experiment was conducted in Institute of Plant Pathology, University of the Punjab, Lahore, during June 2009 to October 2009, to assess the effect of different concentrations of Potassium humate (0, 250, 500, 750 and 1000 mg per Kg) on Basmati Rice (*Oryza sativa* L.) in lab and field conditions. In this regard different vegetative (plant height; root, shoot length; fresh and dry biomass of root and shoot) and reproductive growth (number of tillers, flowers, grains, weight of 100 grains) parameters were recorded. The data interpreted exhibited that higher vegetative growth and yield production was carried out in rice at 500 mg/Kg concentration.

PPPE 71

PHYSIOLOGICAL RESPONSE OF DIFFERENT MAIZE ACCESSIONS AT EARLY GROWTH STAGE UNDER LOW TEMPERATURE STRESS

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Changes in climate may creates hazards to which agricultural ecosystem is not well adapted. Low temperature, frost and snow fall decrease yield and damage crops by disturbing their individual physiology in a significant way. In order to study the impact of low temperature on agricultural crops, eighty five maize accessions were grown in a growth chamber within temperature range 8-10°C. Data from ten seedlings of each entry was recorded with a focus on low temperature stress related physiological indicators i.e. germination spread, root shoot ratio, chlorophyll a contents, chlorophyll b contents, β carotenoids and ascorbic acid. Among 85 maize accessions, F-134, UAF-1, B-304, EV-134 and F-144 showed better performance while B-326, F-114, POP-2007, VB-06 and B-327 showed highest level of susceptibility to low temperature. Higher contents of chlorophyll a, chlorophyll b, ascorbic acid and root shoot ratio were observed in F-134. UAF-1 gives better results for chlorophyll a, chlorophyll b and ascorbic acid. B-304 contained high contents of chlorophyll a, chlorophyll b, β carotenoids and ascorbic acid and EV-134 have high germination rate, root shoot ratio, chlorophyll a, chlorophyll b, β carotenoids while high contents of chlorophyll a, chlorophyll b and ascorbic acid were studies in F-144. Poor performing accessions failed to maintain high value of chlorophyll a and b, ascorbic acid and β carotenoids. The challenge to agriculture is to develop crop germplasm which has the capability to adapt fast enough to a changing climate.

PPPE 72

ASSESSMENT OF CARBON STORAGE AND SEQUESTRATION IN KATHAR GAME ECOLOGICAL RESERVE

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An ecological assessment study was carried out during September 2010 to August 2011 in Kathar Game Reserve, a dry scrub type of vegetation and a semi arid region in Rawalpindi District of Pakistan, to evaluate its potential as carbon sink source in different seasons i.e., moon soon, winter and summer. The area was found dominated by trees like *Olea ferruginea*, *Acacia modesta* and *Pinus roxburghii* while shrubs like *Dodonaea viscosa*, *Justicia adhatoda* and *Nerium oleander*. The diameter of these plants were converted into carbon sequestration potential using certain ecological calculations which were later on compared with height of the trees and cover of the shrub species to evaluate carbon potential of an ecological reserve. The highest calculated carbon sequestration among trees was of *Pinus roxburghii* having 83452 kg. While among shrubs, the highest sequestered carbon was found in *Dodonaea viscosa* with 485.71 kg of carbon. The vegetation on steep slopes of the reserve had comparatively higher carbon sequestration ability as compared to the plants growing in the plain area having higher biotic pressure and human influence.

PPPE 73

TOXICITY AND BIOACCUMULATION OF HEAVY METALS IN SPINACH SEEDLINGS GROWN IN FRESHLY CONTAMINATED SOIL.**SARDAR KHAN^{1*}, ALIA NAZ¹ AND SHAIKH SAEED AHMAD²***Department of Environmental Sciences, University of Peshawar, Pakistan**Department of Environmental Sciences, Fatima Jinnah Women University, Rawalpindi, Pakistan***Corresponding author e-mail: sardar.khan2008@yahoo.com*

Heavy metals (HMs) present in soil ecosystem adversely affect the plants because of their toxicity on growth, reduction in plant yield and inhibition of enzymatic activities. A greenhouse pot experiment was conducted using spinach (*Spinacia oleracea*) as representative vegetable to assess the uptake pattern and toxicities of three different doses of Cd, Pb, Zn, Cd/Pb, Cd/Zn and Pb/Zn. High concentrations of Cd, Pb and Zn in both single and mixture forms significantly ($p < 0.05$) reduced seedling biomass, seedling length, cell size, number of leaves, seedling diameter and mitotic index (MI) of the selected plants. The results indicated that the Cd caused severe plant toxicities as compared to Pb and Zn. Furthermore, the bioaccumulation patterns of selected HMs showed that Cd, Pb and Zn as co-pollutants affect the uptake of each other in antagonistic way. The toxicities due to Cd and Pb in all its three treatments were in order of Cd/Pb > Cd > Pb. Similarly in case of Cd and Zn were in order of Cd/Zn > Cd > Zn, while for Pb and Zn were Pb/Zn > Pb > Zn.

PPPE 74

THE INTRIGUING BEHAVIOR OF *TARGETES MINUTA* L.**SEHRISH SADIA¹, SHAHIDA KHALID² AND RAHMATULLAH QURESHI¹***¹Department of Botany, Pir Mehr Ali Shah Arid Agriculture University, Murree Road Rawalpindi, Pakistan.**²Weed Management, National Agriculture Research Centre, Islamabad, Pakistan.***Corresponding author e-mail: shahidakhalid@hotmail.com*

Every plant plays a unique role as an integral part of life on earth. One such plant, *Tagetes minuta* L. having allelochemicals and medicinally important essential oil, is found in some regions of Pakistan including Murree, Sawat, Hazara, Rawalpindi, Islamabad and Azad Kashmir. Terpenoides, saponins, tannins, flavonoides and alkaloids are present in aerial parts of this plant. *T. minuta* is inter-cropped with tomato as a root-knot nematocide. It is also used as weedicide, germicide, insecticide, fungicide and as a medicine. *T. minuta* is also found as a weed in maize field and strongly inhibits the root growth. Integrated approach is required for its management in crops while methods for its conservation as an important part of the floral biodiversity need to be identified.

PPPE 75

EFFECT OF ULTRA VIOLET LIGHT ON CHROMIUM TOLERANT ISOLATE OF *ASPERGILLUS NIGER***SHAHID GEORGE¹, NYLA SHUJA², SHAZIA IRAM¹, IFTIKHAR AHMAD² AND EHSAN AKHTAR^{*}***¹Department of Environmental Sciences, Fatima Jinnah Women University, Rawalpindi, Pakistan**²PARC Institute of Advanced Studies in Agriculture, National Agricultural Research Center, Islamabad, Pakistan*

Chromium is the third most toxic heavy metal around the world and is a great threat to environment and has a tendency to cause severe health impacts to humans. Different microbes present in the environment have the potential to remove such heavy metals. Furthermore, UV light has a tendency to cause DNA mutations in microbes that may lead to point mutation which in turn can contribute to the tolerance to heavy metals. The present study was conducted in order to evaluate, the effect of UV (258nm) light on filamentous fungus *Aspergillus niger* at different time exposure as mediated in changes in its growth, heavy metal tolerance and biosorption potential. The growing conidia of *A. niger* (K14), was exposed to UV light at the distance of 0.5m. All the variants after exposure to UV light decreased the growth efficiency but the variant exposed to 5 hour of UV light showed contrasting effect as the growth significantly increased as compared to control. Both the control and exposed fungus were then incubated for 7 days and radial growth (cm) was measured on daily basis. Different concentrations (500, 1000, 1500 and 2000ppm) of $\text{Cr}(\text{NO}_3)_3$ were used to analyse the metal tolerance potential of the control (non-irradiated) and mutant (irradiated for 5 h) variants. The heavy metal tolerance of the mutant variant was more as compared to the control. Furthermore, the effect of media conditions (pH, temperature, batch time and different metal concentration) upon the biosorption of $\text{Cr}(\text{NO}_3)_3$ by control and mutant variants of *A. niger* have been investigated. The rate of uptake of metal by the mutant variant was faster as compared to the wild, whereas the biosorption potential of both the variants was almost same. Optimum biosorption conditions have

been found for both the control and mutant variants at pH 6, temperature 30 °C, and 2 hour as optimum retention time for control and 1 hour for the mutant variant. After 2 hour 100% biosorption was obtained at 1000ppm of $\text{Cr}(\text{NO}_3)_3$ whereas, 99.35% biosorption was obtained after 1hr at 1500ppm by the mutant variant. Langmiur and Freundlich isotherms were used for the representation of data.

PPPE 76

EFFECT OF TEMPERATURE FLUCTUATIONS ON FATE OF ORGANIC MATTER IN SOILS OF SEMI-ARID REGION

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Organic matter in soil directly or indirectly effects physicochemical properties of soil. Changing temperature and forest fires, effect its mineralization in soil and bioavailability for plants. It is widely believed that global climatic change decreases organic matter in soil and increases green house gas emissions. To investigate possible implications of temperature change on organic matter fractionation, present study was conducted. Soil samples were collected from forest of Margalla Hills, Islamabad at H₁ 625 m, H₂ 785 m, H₃ 945 m heights and subjected to incubation experiments. Three temperature treatments (T₀ control, 150 °C, 200 °C, 250 °C) were applied and changes in electrical conductivity (EC), pH, humic acid (HA), fulvic acid (FA), total organic carbon (TOC) and nitrate-nitrogen (NO_3^- -N) were observed. Temperature increase effects organic matter negatively and transform its structure. In the present study 45% decrease in fulvic while 46% decrease in humic acid was observed at high temperature treatment. Degradation of total organic carbon was 90% at 200 °C which might be near to complete loss of soil carbon however rapid increase in TOC quantity at 250 °C could be the result of ash formation. Nitrate nitrogen content increase at application of 250 C was 24%. Effect of height on organic matter concentration (3%) was not very significant but a marginal increase may be due to more undisturbed soil, dense canopy and lower runoff conditions at high altitudes. The increase in soil organic carbon from higher elevation (945 m, 5.2 mg kg⁻¹) to lower elevation (625 m, 6.4 mg kg⁻¹) might be due to better stabilization of SOC at lower altitudes and well established ecosystems. The results of study suggest that lesser fractionation of soil organic matter is sensitive to higher temperatures.

PPPE 77

METAL TOLERANCE POTENTIAL OF FUNGI ISOLATED FROM POLLUTED SOIL OF MULTAN

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The ability of fungi to act as a biosorbent has been extensively evaluated and they have shown excellent metal sequestering abilities for heavy metals. In the present investigation 11 isolated fungi *Aspergillus niger* of peri-urban areas of Multan were studied for tolerance analysis against $\text{Cr}(\text{NO}_3)_3$, $\text{Pb}(\text{NO}_3)_2$ and ZnCl_2 . The degree of tolerance was measured by radial growth (cm) at different concentrations of chromium, lead and zinc. The growth rate of fungal isolates decreased with increase in metal concentrations. Radial growth was measured and *Aspergillus niger* showed more resistance towards lead and chromium as compared to zinc. Tolerance analysis showed that a few isolates were tolerant, some are moderately tolerant and some are sensitive towards metal concentrations. The purpose of the present study was to see tolerance behavior of fungal isolates of heavy metal contaminated soils of Multan. The knowledge of the present study will be helpful for further research i.e. biosorption and in future it would be possible to use tolerant fungi for bioremediation of polluted soil.

PPPE 78

TOLERANCE AND GENETIC VARIATIONS AMONG DIFFERENT SPECIES OF FUNGI FROM CONTAMINATED SOILS

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The present study has been carried out to understand the tolerance potential and genetic variability among the different species of *Aspergillus* and *Curvularia* isolated from agriculture soil of Kasur irrigated with water contaminated with sewage and industrial effluent. The degree of tolerance of fungi was measured by minimum inhibitory concentration in the presence of different concentrations of metals (Cr and Pb) and compared to control sample. Results are shown the variation in the tolerance level of different isolates of *Aspergillus* and few isolates were tolerant, moderately tolerant and some were sensitive. Genetic variability was studied by RAPD's technique with eight (8) primers of series OPB1-8 were tested against tolerant fungal strains. The genetic variation among the fungi of contaminated sites was not large due to their evolution and contamination sources and they were genetically correlated.

PPPE 79

PHYTO-CLIMATIC GRADIENT OF VEGETATION AND HABITAT SPECIFICITY OF INDICATOR SPECIES IN THE HIGH ELEVATION WESTERN HIMALAYAS

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Phyto-climatic gradient and ecological indicators can be used to understand the requirements, long term management and conservation strategies of natural habitats and species. For this purpose phytosociological attributes were measured using quadrats along transects on different slopes aspects across an elevation range of 2450-4100 m. Recorded 198 plant species were placed in five Raunkiaer life form classes among which the Hemicryptophytes (51 %) dominate the flora of the study area followed by Phanerophytes and Cryptophytes (Geophytes) with 15 and 13 % dominance respectively. Therophytes and Chamaephytes are represented by smaller numbers (12 & 10% each). Phyto-climatic gradient of vegetation was evaluated using Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA). Phyto-climatic relationships show that Phanerophytes especially tree species are widely distributed on northern aspect slopes whilst shrubs are more dominant on southern aspect slopes. Woody plants are dominant at lower altitudes (2450-2800 m), with a much smaller proportion occurring at middle elevations (2800-3300 m) whilst higher (3300-3900 m) and highest elevations (3900-4400 m) were dominated mainly by hemi-cryptophytes and crypto phytes. Our findings further elucidate that vegetation changes gradually from a moist-cool temperate Phanerophytic and Chamaephytic elements to dry-cold subalpine and alpine herbaceous Cryptophytic and Hemi-cryptophytic vegetation in the upper elevations. PCORD was used to calculate the indicator value of the species and thus selected at least one indicator (statistically significant) from each of the tree, shrub and herb layers in each habitat type and association. Indicator species were identified based on their faithfulness and abundance under the influence of decisive environmental variable identified by robust statistical significance. Fidelity of those indicators was also tested by their categorization in the fidelity classes. Location of such indicator was shown by data attribute plots using CANOCO and CANODRAW softwares. Assessment of Indicator species and ecological gradient in our study provide base for extensive conservation studies on biodiversity in mountain ecosystems.

PPPE 80

EFFECTS OF ACC-DEAMINASE BACTERIA ON GROWTH AND YIELD OF WHEAT (*TRITICUM AESTIVUM*) UNDER RAINFED CONDITIONS

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Four PGPR strains containing ACC deaminase were used to explore their prospective to improve growth and yield of wheat rainfed field conditions. Inoculated and un inoculated seeds of wheat cultivar CH-50 were sown in soil in jars at different water levels (field capacities 15%, 30%, 45% and 60%) and placed in a growth chamber. Results showed that "drought stress imposed effects" were appreciably decreased by inoculation with PGPR containing ACC deaminase on the growth and yield of wheat. Significant increase in root length, root weight, shoot length and no. of lateral roots were observed at different field capacities especially with PGPR D7 at 15% field capacity. These findings were further evaluated under rain fed field conditions. Promising increase in different growth and yield parameters were found in plants inoculated with D7 compared to un inoculated control. Leaf score, no. of tillers, root length, no. of lateral roots and oven dry root weight were significantly greater than un inoculated control. These results were further supported by

findings of “classical triple response” in etiolated pea seedlings where effect of externally applied ACC was diluted by applying PGPR. It can be concluded that the inhibitory effects of ethylene could be partially or completely eliminated by inoculation with PGPR containing ACC deaminase under rain fed conditions.

PPPE 81

TEMPORAL VARIATION IN LEAF PIGMENT CONTENTS IN SELECTED TREE SPECIES GROWING ALONG ROAD MAJOR NETWORKS IN RAWALPINDI

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The effect of temperature on leaf pigment content in selected tree species growing along the major road networks in Rawalpindi were studied. The leaf chlorophyll a & b, carotenoids anthocyanin contents of selected species were compared to find the temporal variation. Selected Plant species were *Morus alba* L., *Alstonia scholaris* L. Br., *Broussonetia papyrifera*, *Celtis eriocarpa* Decne., *Ricinus communis* L., etc. All the plants showed greater temporal variation in total chlorophyll content, carotenoids and anthocyanin except in *Broussonetia* that showed a greater reduction in leaf chlorophyll content when temperature rises above 35°C. Anthocyanin showed slight variation with the increase in temperature. The results showed the significant positive correlation between total chlorophyll contents, carotenoids and anthocyanin with the temperature for some plant species the results also presents variation among the species found in different sites derived from species specific response to the temperature. This study will help us to improve the plant eco physiology, productivity rates, radiation utilization efficiency, and competition among plants. The results will help us to determine temperature sensitivity of plants and selection of plants for the landscape. Regular leaf pigment monitoring will help us understand plant growth and development.

PPPE 82

BAHAVIOUR OF LENTIL SEEDLINGS IN THE PRESENCE OF LEAD AND LEAD RESISTANT BACTERIA

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Heavy metals are produced as a result of anthropogenic and industrial activities. Among them lead is most common metal worldwide. It is produced because of mining, smelting, paints and fuels. It is non-essential metal and its uptake hinders the normal development of plant organs, photosynthetic apparatus, enzymes, protein contents and imbalance in water uptake. On the other hands microbes are known for their beneficial role as plant growth promoters. This paper briefly discusses the role of lead resistant bacteria as growth promoter for lentil seedlings. For present study three lead resistant bacterial strains TE-9, TE-12 and TE-14 were chosen as they could tolerant more than 1000µg/ml lead in growth medium. Lens esculentum seeds were inoculated with these isolates under different concentrations (0, 1, 2 and 3mM) of lead acetate and grown for ten days in 10Klux light and 16 hours photoperiod at 25± 2 °C, in growth chambers. Lead caused reduction in different growth parameters (shoot length, root length, seedling length, fresh weight, dry weight) of control, while significant improvement in parameters caused by inoculation with aforementioned bacterial strains in lead supplemented environment. Bacterial inoculation enhanced the germination over the respective controls in all concentration (0, 1, 2, 3mM). Inoculation promoted the seedling length up to 11.63-31.31%. With the higher concentration of lead root length was drastically affected. All strains significantly enhanced the dry weight per seedling (2.5-24.83%). Lead accumulation was increased up to 99.87% in inoculated samples. Highest lead accumulation was observed with inoculation of TE-9. Strains TE-9 and TE-14 also enhanced total protein contents of the seedlings. Increment in protein content was 3.9-93.40%. The beneficial effects of bacterial isolates on plant growth varied significantly depending on individual bacterial strains. It was concluded that inhibitory effects of lead treatments were more prominent at higher concentrations but bacterial strains had positive impact under unfavorable conditions.

PPPE 83

EFFECT OF AUTO-EXHAUST EMISSION ON THE MORPHOLOGICAL AND ANATOMICAL CHARACTERS OF CASSIA SIAMEA AND SOLANUM NIGRUM L., GROWING IN DIFFERENT AREAS OF DISTRICT GUJRAT PAKISTAN AND DISTRICT BHIMBER AZAD KASHMIR

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Morphological and anatomical study of *Cassia saimea* L., *Solanum nigrum* L., From Gujrat and Bhimber depending on the environmental conditions, were carried out. Study includes the difference in the structure of leaves, root and stem morphology and anatomy due to the auto exhaust. The plants from both side showed visible morphological and anatomical changes in leaves (0.54µm versus 0.95 µm). However some reductions in the feature were observed in leaves morphometric which were collected from polluted area of Gujrat (Road side). Significant ($p < 0.05$) reduction in length of *Cassia saimea* Lam., (3.53 cm) *Solanum nigrum* L., (2.20) leaves found on the road side in Gujrat was recorded. Also, significantly ($p < 0.05$) reduction of stem epidermal cell, vascular and root upper and lower epidermis in plants from polluted area of Bhimber and Gujrat was noticed. Reduction in the pith cell of root and stem from polluted area was also observed. Due to unfavorable environmental conditions, root and stem of the plants from Gujrat and Bhimber showed reduction in cell size. All recorded differences in morphology and anatomical structure of *Cassia saimea* L., *Solanum nigrum* L., were caused by difference of cumulative environmental condition with dominant effects of the contamination degree of location, soil type and microclimate. *Cassia saimea* L., plant has been well known for its medicinal value and it contains a compound named Barakol. The leaves, tender pods and seeds are edible, but they must be previously boiled and the water discarded. Tea of younger leaves of *Solanum nigrum* L., is used for curing flue, cough and fever. Dried fruits are used for stomach diseases. Cooked as potherb and used to cure inflammation of internal organs. Poultice of leaves is applied on burnt skins and wounds. It is suggested *Cassia saimea* L., *Solanum nigrum* L., that should be given more preference for further plantation in the city, particularly along the busy roads. Keeping such record of anatomical and morphological data would be helpful in understanding the current trend of environment impact on plant growth and its consequent impacts quality and yield potential of medicinal plants.

PPPE 84

LOWER TRIASSIC PALAEOCLIMATIC INTERPRETATIONS BASED ON PALYNOLOGICAL DATA FROM MIANWALI FORMATION, WESTERN SALT RANGE, PAKISTAN

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Mianwali Formation represents the lowermost Early Triassic Strata of the Salt Range, Pakistan, deposited after the late Permian strata, represented by Chhidru Formation. This Early Triassic Strata represents the most diverse group of Palynostrata. The present study is based upon the climatic interpretations as depicted by Striated and Taeniate Bisaccates. 06 genera and 14 species of striated and taeniate bisaccates were recovered. The striated bisaccates like *Protohaploxylinus goraiensis*, *P. laticus*, *P. latissimus*, *P. panakii*, *P. amplius*, *Striatoabietes multistriatus*, *S. borealis*, *Lunatisporites pellucidus*, *L. beauchampii*, *L. arluiki*, *L. noviaulensis*, *Striatopodocarpites fuscus*, *S. cancellatus*, *Hemipollenites erebi* and *Scutasporites nanuki* were isolated through standard palynological procedures. As indicated by the pollen assemblage, the climate during the early depositional phase was hot humid (tropical to subtropical) ultimately shifting to mild temperate in the middle part finally reverting to arid subtropical to tropical. Pteridosperms were the dominant plant group on the basis of recovered pollen representing the final relics of the dying Glossopteris flora which was the climax vegetation of the mid and late Permian.

PPPE 85

EUPHORBIA HELIOSCOPIA L., AS A SOURCE OF BIO-HERBICIDE

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This study was conducted to investigate the allelopathic effect of sunspurge (*Euphorbia helioscopia* L.) leaf powder on seed and seedling of weeds, wild oat (*Avena fatua* L.) and toothed dock (*Rumex dentatus* L.) and associated crops, sunflower (*Helianthus annuus* L.), wheat (*Triticum aestivum* L.) and maize (*Zea mays* L.) on filter paper and soil in Weed Management Laboratory, Department of Plant and Environmental Protection, National Agriculture Research centre, Islamabad. *E. helioscopia* leaf powder significantly decreased the germination and subsequent growth of weeds *A. fatua* and *R. dentatus*. The radical and plumule growth of *Z. mays* and *H. annuus* decreased when *E. helioscopia* was applied to direct seeds while remained unaffected when applied to the seedlings. The leaf powder showed no effect on wheat seed germination, radical and plumule growth. It is suggested that *E. helioscopia* leaf powder can be used as a bio-herbicide.

PPPE 86

ETHNOBOTANICAL SURVEY OF SELECTED TOWNS OF GUJRANWALA, PUNJAB, PAKISTAN

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Plants are one of the greatest blessings. Mankind, from his creation depends upon plants for food, medicine, shelter and forage for his livestock. Present study was aimed to study about the ethnobotanical knowledge of people of three towns of district Gujranwala i.e., Kamoki, Mor Aimenabad and Qila Dedar Singh. Field surveys and interviews of 60 local people were conducted to document important information related to plants. Most of the people are poor and depends on plants for their domestic needs and for earning livelihood. People depend on the herbal medicines for the cure of ailments by using it according to the traditional knowledge. The area is known for the production of rice (*Oryza sativa*) and wheat (*Triticum aestivum*). Many of the industries are working for the processing of rice to fulfill the needs of exports of the country. Total of 96 plants species are identified. Out of which, 40 are cultivated species, 39 species which are medicinally important, 8 species used for veterinary purposes, 4 species for craft material, 21 used as fodder, 9 species of timber, 5 different varieties of rice and 7 species of fuel wood. Some of the plant species are used for more than one purpose like *Melia azadirachta* is used for medicinal purposes as well as for timber and fuel wood. *Dalbergia sissoo* is used as fuel wood and its branches are considered as best maswak. It relieves toothache. In Gujranwala, the production of super basmati for trade increases. Now the trend of growing vegetables disappears. People use to prefer those species which helps in the income generation. Most of the local people depend upon the plant materials but the darker side is the harvesting is unchecked and steps should be taken to utilize the plants in the sustainable way so that they can also be saved for our future generation.

PPPE 87

DUST ACCUMULATION CAPACITY AND ALTERATION OF VARIOUS BIOMETRIC AND BIOCHEMICAL TRAITS IN CULTIVATED POPULATIONS OF *FICUS CARICA* L.

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The dust accumulation capacity of *Ficus carica* L. was evaluated from eight different sites in and around Multan. The impact of dust accumulation was observed via various biometric attributes (leaf area, leaf fresh and dry weights) and biochemical attributes (chlorophyll contents, carotenoids & ascorbic acid) from leaves of *F. carica*. The maximum dust accumulation was occurred in the plants growing at Road sides while, the minimum dust was found on plants growing at Bahauddin Zakariya University. Dust accumulation has caused a significant effect on almost all foliage and biochemical attributes of *F. carica*. A positive correlation was found between dust accumulation and biometric attributes in *F. carica*. Biochemical responses had shown an inconsistency as chlorophylls (a, b & total), carotenoids decreased and ascorbic acid contents increased with an increase in dust accumulation. A negative correlation was found between dust deposition and chlorophyll contents. Whereas, accumulation of ascorbic acid was associated with a decline in pigment contents.

F. carica owing to its long petioles and broadly ovate leaves had shown the maximum dust accumulation capacity along road sides. In addition, degree of pubescence and large surface area allow the species to capture more dust particles which is an important manifestation of particulate pollution. Thus, *F. carica* can one of the important contributors for cleaning up dust pollution from the environment. The study clearly suggested that plantation of *F. carica* in dusty areas can control particulate pollution which may cause hazardous consequences for human health.

PPPE 88

GROWTH OF MANGROVE PLANTS, *AVICENNIA MARINA* AND *RHIZOPHORA* *MUCRONATA*, GROWING IN THE INDUS DELTA (HAJAMBRO CREEK)

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For the management of natural and rehabilitated mangrove forests assessment of growth of plants is necessary. Pakistan has one of the largest mangrove forests in the semi-arid region. Lack of clear annual growth rings, mangrove growth has been determined on the basis of internode production and elongation of the main stem. The growth rate of *Avicennia marina* (young plants and saplings) and *Rhizophora mucronata* (young plants) showed unimodal pattern, both in terms of elongation of the main stem and internodes productions. The daily rate of growth was $0.085 \pm 0.019 \text{ cm d}^{-1}$ *A. marina* plants, $0.036 \pm 0.009 \text{ cm d}^{-1}$ *A. marina* saplings, and $0.046 \pm 0.011 \text{ cm d}^{-1}$ for *R. mucronata* young plants, whereas total annual increment of plant length was $32.11 \pm 7.06 \text{ cm y}^{-1}$, $13.48 \pm 3.31 \text{ cm y}^{-1}$ and $17.23 \pm 4.05 \text{ cm y}^{-1}$, respectively. The total number of internodes was 9.13 ± 1.64 and 8.87 ± 1.51 internodes y^{-1} produced by the main stem of *R. mucronata* and *A. marina* saplings, respectively. The mean production of the internodes on the main stem of the *A. marina* saplings and on main stem of *R. mucronata* was found to be $0.0233 (\pm 0.00397)$ and $0.02409 (\pm 0.0043)$ internodes d^{-1} , respectively. The highest growth rates recorded for *A. marina* (young plants and saplings) were in the spring (Feb – Apr) and for *R. mucronata* in the summer (Jun – Aug). The lowest growth of all mangrove plants was in winters (Nov – Jan). This is the first report on the growth of mangrove plants growing in Indus delta.

PPPE 89

PHYTODIVERSITY, LIFE FORM, COMMUNITIES AND SPECIES DISTRIBUTION PATTERN IN MOUNTAIN ECOSYSTEM OF MIANDAM PAKISTAN

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Assessment of the spatial patterns of composition and distribution of species is central to understanding the health of mountain ecosystem. We investigated plant diversity and species distribution pattern in Miandam Valley in northwestern Pakistan along altitude and aspect as environmental gradients. A total of 246 species of vascular plants (168 genera and 73 families) were determined in six different vegetation zones, with Asteraceae, Lamiaceae and Rosaceae identified as dominant families. A total of 360 quadrates (60 in each zone) were taken along the altitudinal gradient and the cover and density of all vascular plants were recorded. Using phytosociological approach six plant communities were recognized; (i) *Pinus-Fragaria-Viburnum* (ii) *Picea-Viburnum-Fragaria* (iii) *Quercus-Fragaria-Viburnum* (iv) *Salix-Bergenia-Betula* (v) *Juniperus-Caltha-Poa* (vi) *Sibbaldia-Plantago-Senecio*. Index of diversity ranged from 0.76 to 3.5, species richness was 1.58 to 3.05 and degree of maturity varied from 20.75 to 45.00. Sorenson's index found 7.68 to 56.86% similarity between communities. Raunkier's life-form spectrum showed dominance of Hemicryptophytes and Therophytes, 28.45% and 22.35% respectively. In leaf size classes Microphylls were predominant with 58.94%. Nanophylls were 17.47%, Mesophylls 16.26%, Leptophylls 5.69% and Macrophylls 1.21%. The study concluded altitude, as the strongest environmental factor influencing the composition and distribution of species, with aspect also contribute significantly near the mountain peaks. Carcinoma (LU-1). The findings of this study support that medicinal plants are promising sources of potential antioxidants and may be efficient source to prevent the pathogenesis of some diseases.

ORAL ABSTRACTS

OPTE 1

FOLIAR EPIDERMAL STUDIES AS AN AID TO THE IDENTIFICATION OF GRASSES OF TRIBE ANDROPOGONEAE (POACEAE) FROM SALT RANGE OF PAKISTAN

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In the present investigations, 13 species of grasses belonging to 10 genera of tribe Andropogoneae (Poaceae) were collected from the Salt Range of Pakistan and their leaf epidermal studies were carried out. The leaf epidermal studies showed that all the species have paracytic stomata, with dumb bell shaped guard cells, except *Heteropogon contortus* and *Cymbopogon jwarancusa* in which guard cells are straight in the middle. Different types of subsidiary cells such as high dome shaped, triangular shaped or low dome shaped subsidiary cells are observed. The difference in shape of subsidiary cells can be used to differentiate problematic species such as genus *Bothriochloa* from *Dicanthium*, as these genera look similar morphologically. A diversity in shapes of silica bodies is observed in the species of this tribe, that is valuable for identification. Silica bodies are cross shaped, dumb bell shaped or intermediate between cross and dumb bell shaped. Bicelled microhairs of panicoid type are present in all the species except *Eulaliopsis binata* in which microhairs are absent. Rounded papillae are found absent in all species except *Cymbopogon jwarancusa* and *Heteropogon contortus*. The studies revealed that different leaf epidermal characters such as shape of subsidiary cells, silica bodies, presence or absence of microhairs, macrohairs and rounded papillae are valuable in the identification of grasses at the specific and generic level of the tribe.

OPTE 2

PALYNOLOGICAL DIVERSITY OF ECHINOPS IN THE TRIBE CARDUEAE (ASTEREAE) FROM PAKISTAN

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Pollen morphological characters of 11 species of *Echinops* (including five new reports and 1 endangered and a rare species) have been investigated from Pakistan. Pollen grains are prolate, prolate-spheroidal, subprolate and semi-rhomoidal in shape. Pollen grains in all the species are trizonocolporate. Pollen characters such as size, exine thickness and pollen spines are found considerably valuable taxonomic characters. On the basis of spinate and spineless pollen two groups have been established. *Echinops echinatus*, *E. prinolepis*, *E. aff. villosissimus*, *E. cornigerus* have spinate pollen while *Echinops gedrosiaus*, *E. giriffithianus*, *E. niveus*, *E. sulamiani*, *E. kandaharensis* and *E. leucographrus* have spineless pollen. There is a considerable variation in exine thickness. *Echinops niveus* and the rare species *E. kandaharensis* can be distinguished due to lower exine thickness (10 – 10.8µm) while *E. cornigerus* have highest exine thickness (20.7µm). The endemic species *E. prinolepis* has less exine thickness (11.5µm). Taxonomic status of the *Echinops* has been proposed to be classified in a separate tribe from Cardueae. A great range of spineless to spinate pollen of upto 4µm spines in *Echinops* species provide a useful diagnostic feature for further studying evolutionary situation and taxonomic debate in Asteraceae. There is a sufficient variation in exine thickness which has proved useful at specific level. On the basis of exine thickness 4 groups viz, Group I: *E. niveus*, *E. kandaharensis*, *E. prinolepis*, *E. aff. villosissimus* Group II: *E. leucographrus*, *E. giriffithianus*, Group III: *E. orientalis*, *E. sulamiani*, *E. echinatus*, *E. gedrosiaus*, Group IV: *E. cornigerus* are recognized.

OPTE 3

ENDEMIC PLANTS OF AYDIN MOUNTAINS AND CONSERVATION STRATEGIES

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Aydın Mountains (1724m.) are located among the borders of the provinces of Aydın, Denizli and İzmir in Western Anatolia. As a result of flora studies in the region, 836 vascular plant taxa belonging to 95 families and 395 genera were determined. Among these taxa, 21.48% belong to Mediterranean, 6.12% to Euro-Siberian, 3.96% to Irano-Turanian and 0.24% to Euxine floral elements. The number of endemic taxa in the study area is 73 which constitutes 8.77% of total flora. Environmental factors that threaten the endemic taxa, and conservation strategies and the IUCN threatened categories of species were discussed in this study.

OPTE 4

EFFECT OF GYPSOPHILA PILULIFERA BOISS. & HELDR. OVER BREEDING OF PLEUROTUS OSTREATUS (JACQ. EX FR.) KUMM.

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In this study, It researched effect of *Gypsophila pilulifera* Boiss.&Heldr. on growing of species of cultivated *Pleurotus ostreatus* (Jacq. Ex Fr.) Kumm. Breeding medium was prepared as 1 kg and cultivation medium content %43 straws of wheat, %10 dandruff of wheat and %4 plaster. Sequence is %20 (200g), %40 (400g) *G. pilulifera* was added. Tests were applied as 12 replication. Breeding medium which sterilized with autoclave method at 121 °C degree and 60 minutes and composts was put in incubation rooms after %4 micelle impregnation was applicated. *G. pilulifera* experimented about fungus efficiency, rate of biologic fertilization and impetus of micelle wrapping which was used as added materials. In addition to it was researched that effect to diameter of cap, length of peduncle and diameter of peduncle. . End of study, It was determined that highest wrapping impetus of micelle, fertilization of fungus, rate of biologic efficiency belong to compost (200g *G. pilulifera* +344g straw of wheat, +80g dandruff of wheat and 32g plaster).

OPTE 5

AN ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS IN SEMI-TRIBAL AREA, KURD SHARIF & SHO (DISTRICT KARAK (KHYBER PAKHTUNKHAWAH)

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Kurd Sharif & Sho (KPK) are fascinating places of Pakistan that have been never studied for its ethnobotanical values before by any botanist or historian. The present paper unravels the first botanic treasurer from this area and synthesizes first report related to the documentation and conservation of ethnomedicinal plants of the area and their socio-economic relationship with the forests and its resources. The site has high botanical diversity in the form of two lush green jungles natively known as “Kwand” and “Bund”. These jungles have a history of 150 years without any disturbance of anthropogenic activities under the status of “sacred jungles”. *Olea europaea* L. species and *Monothea buxifolia* (Falc.) A. DC. constitute the dominant flora of these jungles while *Acacia modesta* Wall. Ranked third of the most flourishing tree species here. Based on an ethnobotanical survey of the Kurd Sharif & Sho(KPK), this first report deals with 120 plant species used as folk drugs from 46 families. Most of the plants were reported to treat human

diseases since ages. *Viola canescens* Wall. ex Roxb., *Monothea buxifolia* (Falc.) Dene. ex Engler, *Grewia tenax* (Forsk.) Flori. *Berberis lyceum* Royle, *Rumex vesicarius* L., *Ehretia obtusifolia* Hoscht. ex DC. *Otostegia limbata* Benth. *Capparis spinosa* L. and *Buxus wallichiana* Baillon are included among the notable medicinal plants of the area whose number is declining day by day that are outside the sacred territory of jungles because of over and misuse. Well-preserved sacred jungles are storehouses of many endangered, valuable medicinal plants and serves as refuge to threatened species. There is dire need to upgrade the standard of livelihood of the local people of the area and to conserve and commercialize this treasure of medicinal plants.

OPTE 6

ETHNO-MEDICINAL ASSESSMENT OF SOME SELECTED WILD EDIBLE FRUITS AND VEGETABLES OF LESSER-HIMALAYAS, PAKISTAN

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The present investigation is an attempt to assess the ethno-medicinal worth of some selected wild edible fruits and vegetables used by the inhabitants Lesser Himalayas, Pakistan. Informed consent semi-structured interviews from 95 inhabitants of fifteen mountainous vicinities were conducted to collect data. A total of 20 wild edible fruits and vegetables belonging to 18 families and 18 genera were documented. *Amaranthus viridus*, *Berberis lycium* and *Zanthoxylum armatum* were found most significant ethno-medicinal species. Among wild edible fruits *Berberis lycium*, *Carissa opaca*, *Ficus carica*, *F. palmata* and *Ziziphus nummularia* express extreme citation; while *Amaranthus viridus* and *Solanum nigrum* were among the most popular wild edible vegetables. *Ficus carica*, *Ficus palmata*, *Phyllanthus emblica* and *Zanthoxylum armatum* were used equally as fruit and vegetables. Gathering, processing and consuming wild edible plants are still experienced in all explored areas. The tradition of using wild palatable plants is still alive in the rural populations of Lesser Himalayas, but is vanishing. Consequently, the recording, preserving, and infusing of this traditional knowledge to upcoming generations is pressing and vital.

OPTE 7

LINKING PLANT BIODIVERSITY WITH CONSERVATION AND LIVELIHOOD IMPROVEMENT OF INHABITANTS OF KALASH VALLEY, DISTRICT CHITRAL

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This study as designed to analyze endemic expertise and practices about Plant Biodiversity wealth with a view to elaborate the Ethnobotanical scope, conservation and livelihood improvement of the area. The species of Ethnobotanical uses were classified in to 36 groups on local utilitarian basis. Sixty-two plants were medicinal belonging to 37 families and 57 genera. 32 were Angiosperms, in which 31 were Dicots, 1 was Monocot, while 2 were Pteridophytes and 1 was Gymnosperm. Asteraceae with (7), Brassicaceae, Lamiaceae and Rosaceae with (4 each). Chenopodiaceae (3) Amaranthaceae, Apiaceae, Elaeagnaceae, Moraceae, Papilionaceae, Pinaceae, Plantaginaceae, Poaceae, Polygonaceae and Scrophulariaceae with (2 each), Adiantaceae, Berberidaceae, Boraginaceae, Cannabinaceae, Capparidaceae, Convolvulaceae, Cucurbitaceae, Equisetaceae, Fagaceae, Geraniaceae, Hypericaceae, Juglandaceae, Linaceae, Malvaceae, Oxalidaceae, Platanaceae, Punicaceae, Ranunculaceae, Solanaceae, Urticaceae, Violaceae and Verbenaceae with one species each. The species of medicinal uses were classified in to 116 groups used for various ailments. Local inhabitants as a religious obligation mainly dependent upon medicinal plants for treatment of diverse ailments. Being isolated for centuries, they rely on plant resources for various spheres of life. Therefore, this type of study may help in terms of recognition of the local community, plant conservation and uplift of the area.

OPTE 8

TETRAPOGON CENCHRIFORMIS AND PARAPHOLIS STRIGOSA, (POACEAE), TWO NEW REPORTS FROM PAKISTAN

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Tetrapogon cenchriformis (A. Rich.) Clayton and *Parapholis strigosa* (Dum.) C.E.Hubbard (Poaceae) are reported for the first time from Pakistan. *Tetrapogon cenchriformis* is characterized by spatheolate inflorescence, oval elliptic seeds and large stomatal complex, while *Parapholis strigosa* has long anthers, and straight spikes. The distinguishing morphological marker of *Parapholis strigosa* is the length of anthers. Anthers are large in *Parapholis strigosa* as compared to *Parapholis incurva* (L.) C. E. Hubbard. These two new reported species showed marked difference from the other species of *Parapholis* and *Tetrapogon* mentioned in Flora of Pakistan.

OPTE 9

PHYTOTHERAPY AMONG THE RURAL WOMEN OF ABBOTTABAD DISTRICT NORTHERN PAKISTAN

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The present communication highlights the scope of ethnomedicinal plants for women's health care in Abbottabad district, Northern Pakistan. Participatory Action Research (PAR) and field visits were planned to elicit information on the uses of various medicinal plants by women. Field trips were undertaken covering different rural and tribal populated areas of the district to document ethnomedicinal plants used by women for the treatment of various diseases. The women chieftains were accorded a significant role in discussions since they possess more cognizances about the utility of local herbal products in curing various diseases. The study revealed that 67 plant species belonging to 65 genera and 48 families are used in women's folk medicinal system. The most frequent ailments include irregular menstrual cycle, amenorrhoea, skin allergies, and leucorrhoea, as abortifacient, post delivery pain, dandruff, eczema, tonic after delivery and for breast milk secretion. All these herbal medicines belong to 65.67% herbaceous ground flora, 8.95% shrubs, 22.38% trees and 2.98% climbers. Resins, exudates, leaves, shoots, fruits, seeds, bark, tubers and roots are the plants components which are utilized as medicinal ingredients. Plant components are used fresh, dried or both. Further research is needed to isolate the compounds responsible for the observed biological activity.

OPTE 10

FLORISTIC DIVERSITY AND VEGETATION DISTRIBUTION IN THE SIREN RIVER CATCHMENT PAKISTAN

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The Siran River catchment represents an important part of the internationally recognized *Western Himalayan Province*. The River has its root nearly in an area of 1000 km². The area has a steep relief of 500m to 4000m within c.2-3km aerial displacement. It has variety of micro habitats with in the influence of various aspects, elevations, slopes, precipitation, soil and human interaction etc. Ecologically the area comes under moist temperate category, with the predominant features of *Sino-Japanese Region*, which is divided into six climatic zones with prominent Vegetational features is discussed here. The area preserve precious biodiversity resources like Himalayan Musk Deer, Kashmir Elm, Grey Langoor, Himalayan Black Bear, Monal and Koklas pheasants. The information provided here is the firsthand outcome of my field trips to the area.

OPTE 11

INDIGENOUS PHYTO-REMEDIES PRACTICED TO CURE FEMININE DISEASES IN TRIBAL COMMUNITIES OF KASHMIR HIMALAYAS**HAMAYUN SHAHEEN^{1,2*}, ZAHID ULLAH¹ AND MUSHTQ AHMAD¹**¹*Department of Plant Sciences, Quaid-I-Azam University, Islamabad, Pakistan*²*Department of Botany, University of Azad Jammu and Kashmir Muzaffarabad, Pakistan***Corresponding author's e-mail: hamayunmaldial@yahoo.com*

Women's reproductive cycles are very clinical and complex, having unwanted medical conditions. Himalayan Women have been trying to enhance their fertility and regulate their reproductive cycles throughout the history by practicing ethnomedicinal remedies, as they are reluctant to expose their feminine problems to doctors due to psychological, social and religious barriers. Present study reveals the ethnomedicinal recipes practiced by mountain women in Kashmir Himalayas for feminine diseases. Data was acquired by planned biological inventories, exclusive interviews and direct observations in the field. A total of 36 plants belonging to 27 families were recorded being practiced for feminine diseases in 43 different recipes. Major feminine diseases treated by ethnomedicine were menstrual disorders (32%); birth pain and bleeding (16%); Contraception and abortion (16%); enhancing fertility (9%), Sexual potency (9%) and Lactation (7%). Major plant parts utilized in recipes were roots (32%), whole plant (16%), leaves (16%), Seeds (9%), latex (7%) and fruit (7%). Decoctions (41%), raw plant parts (24%) and extracts (13%) were prevalent modes of ethnomedicinal remedies. 79.6% respondents were effectively involved in ethnomedicinal practices to treat feminine diseases. An increasing trend towards modern medical treatment was observed in younger generation correlated with higher education level. Paper discusses the ethnomedicinal treatment of feminine diseases in qualitative as well as quantitative methodology and elaborates how the local folklore can be used at regional levels to add new cures in feminine pharmacopeia.

OPTE 12

ETHNOBOTANICAL STUDIES AND CONSERVATION STATUS OF TREES OF DISTRICT ABBOTTABAD, PAKISTAN**HUMAIRA SAEED^{1*}, GHULAM MUJTABA SHAH², MANZOOR HUSSAIN², HABIB AHMED³ AND SHAZIA SULTANA¹**¹*Department of Plant Sciences Quaid-i-Azam University Islamabad*²*Department of Botany Govt. Postgraduate College Abbottabad*³*Department of Genetics Hazara University Mansehra***Corresponding author: gilanismile@yahoo.com*

The present study is first planned attempt to explore the ethnobotanical uses and conservation status of trees of District Abbottabad. A tree is a woody perennial plant that can reach more than six meters height on a single stem. An interviewed based survey was conducted in different rural and tribal areas of the research area. A total of 107 species of trees belonging to 43 families and 74 genera were found to be of ethnobotanically importance in the district. Highest number 65 species are utilized for fuel wood purposes, 53 species of medicinal trees, 9 for curing veterinary diseases, 35 as fodder, 37 yielding edible fruits, 28 as timber yielding, 32 as ornamentally important, 7 for hedging and fencing, 23 for Making agriculture implements. Conservation status assessment studies revealed that 10 species are critically endangered 7 species endangered and 8 species were found vulnerable. Other species are rare or common. Tree species, *Acer caesium* Wall. Ex Brandis, *Corylus colurna* L., *Euonymus hamiltonianus* Wall., *Euonymus pendulus* Wall., *Fraxinus excelsior* L., *Fraxinus xanthoxyloides* (G. Don) DC., *Prunus cornuta* (Wall. Ex Royle), *Quercus baloot* Griff., *Sorbus lanata* (D. Don.) Schauer. *Taxus wallichiana* Zucc. and *Ulmus wallichiana* Planch are found to be critically endangered species of the area. Results are enumerated in alphabetical order including botanical name, family, local Name, locality and ethnobotanical uses. There is a dire need to document the traditional knowledge as soon as possible, as the knowledge regarding medicinal usage of trees is eroding because of continuous deforestation Introduction of fuel efficient stoves and supply of natural gas in rural areas of district Abbottabad can be helpful in reducing pressure on tree species being used as fuel

OPTE 13

ETHNOBOTONICAL APPRISIAL IN SOUTHERN PLAINS OF TAKHT-E-SULEMAN HILLS**KHALID AHMAD¹, MUSHTAQ AHMAD¹, ZIA-UR-REHMAN MASHWANI^{1*} AND MUHAMMAD YOUSAF²**¹*Department of Plant Sciences, Quaid-i-Azam University, Islamabad, Pakistan*²*Departemnt of Botany, Govt. Post Graduate College Bannu, Pakistan***Corresponding author: zia.botany@gmail.com*

Takht-e-Suleman is the highest peak in the Suleman Ranges which form the eastern edge of Iranian plateau where the Indus river separate it from the sub-continent. The Sun facing southern slopes mainly comes under the F.R. Dera Ismail Khan was the study area. Studies have been carried out in the proposed area to assess, record and report the Ethnobotanical potential of the southern plains during 2010-11. A total of 85 individuals were interviewed in detail, equally distributed in the three main villages of the plain area. Out of total 66 species belonging to 37 families, in which only one (1) family was of Pterodophyte and the remaining 36 families belong to angiosperm distributed in 2 monocots and 34 dicot families. Mimosaceae and Malvaceae were the dominant families with five (5) species each. The other important families of the area were Papilionaceae (4 species), Asteraceae (4 species), Chenopodiaceae (4 species), Euphorbiaceae (3 species), Moraceae (3 species), Zygophyllaceae (3 species) respectively. In a total of 64 plants species, 34 plants were having medicinal properties, 01 plant were used in veterinary medicines, 23 plants as fodder for cattle, 27 species were used for fuel, 18 species gave valuable timbers, 02 plants in making agricultural tools and 12 plants as vegetables / pot herbs/salad. More than 62 % recipes involve the usage of whole plant. Regarding habit, 41 were herbs, 09 were shrubs and 16 were trees.

OPTE 14

FLORISTIC INVENTORY OF Khabaki Wetland Ramsar Site of the Salt Range Wetland Complex, Valley Soon Sakesar District Khushab

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Khabaki wetland an international Ramsar site is located in the salt range area of the Punjab province. Wetland is spread over an area of 283 hectares and is declared wildlife sanctuary under Punjab wild Act, 1974. It is shallow brackish lake. The wetland is located 10 kilometers north east of the Naushera village and 38 kilometer northeast of the Khushab district between 32degree-37mintue N latitude and 72 degree 14 minute longitude. It is located at elevation of 740 meter above mean sea level. The lake is fed by two small water springs and at least 20 small water streams originating on north and southern side of the hill range. The climate of the area is humid sub tropical continental type with hot to moderate summer and severe winter. The annual rainfall varies from 300 to 600 mm. The goal of the study was to provide the existing botanical inventory of the khabaki wetland. A floristic survey of the Khabaki wetland was carried out in 2010-2011. Summer and winter season flora was studied differently. Survey of the adjoining hills, cultivated land, range land, graveyards and wetland aquatic flora was carried out. Survey revealed that 52 herbs, 10 shrubs, 4 sub shrubs, 1 sedge, 13 grasses, and 26 trees exist at khabaki wetland. Poaceae was the dominant family in the area. Grass species provide fodder to the local people livestock. Flora of the Khabaki wetland was also studied from ethno botanical point of view and it was concluded that 50 species are used as medicinal plant, 25 as fodder, 4 as wild vegetable, 6 as wild fruit, 10 species used as fuel wood species. Major threat to the floral diversity include forest fire, developmental activities, deforestation, drought, and fuel wood. There is deterioration of the habitat due to overgrazing, mining and use of the land for agriculture.

OPTE 15

ETHNOBOTANY AND CONSERVATION STATUS OF FLORAL BIODIVERSITY OF HIMALAYAN RANGE OF AZAD JAMMU AND KASHMIR-PAKISTAN

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The main objective of the study was to determine the traditional ethnobotanical uses of the flora of Azad Jammu And Kashmir and its allied areas. Ethnobotanical information of 170 species, their uses as food, fodder, fiber, medicine and other uses were documented. A statistical formula was used to calculate the use value (UVs) of some selected species and the relationship between people's age and extent of their knowledge about plants so as to develop a valuation hierarchy of the selected flora. Conservation status of threatened flora has also been determined according to IUCN criteria. 10 species have been found threatened, out of which 5 species (50%) have been rare, 2 species (20%) vulnerable, 2 species (20%) endangered, 1 specie (10%) critically endangered and no plant species extinct locally. Rapid decline of plant resources needs in-situ and ex-situ conservation and training of the community regarding collection of medicinal plants and their marketing.

OPTE 16

SUSTAINABILITY ASSESSMENT OF TRADED MEDICINAL PLANTS OF BEHA VALLEY IN SWAT - PAKISTAN

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Biha valley-Swat has been surveyed to cover a brief analysis of the existing status of traded medicinal plants of the valley during expedition from March to June 2011. The main objective of the study was to document indigenous knowledge about medicinal plant resources of the area and to assess their conservation status through IUCN criterion. It has been resulted that out of 32 traded indigenous medicinal plants, 10 plant species *Teucrium stocksianum*, *Pistacia integririma*, *Juglans regia*, *Berberis lyceum*, *Acorus calamus*, *Paeonia emodi*, *Podophyllum hexandrum*, *Rheum australe* and *Valeriana jatamansi* including one mushroom species *Morchella esculanta* have been found as vulnerable to harvesting. It has been concluded that in upper Biha valley where cultivated land is quite less, home gardens and kitchen gardens establishment may be the best option for ex-situ conservation that can be adopted for sustainability of ethnobotanical resources. While in situ conservation measures need community participation. Medicinal plants as crop substitute in lower valley may succeed well. Moreover, the area has a great potential of Eco-tourism. This valley has a habitat favourable for endangered medicinal and economic plants in trade. Sustainable utilization of this precious natural resource is highly recommended.

OPTE 17

ROLE OF INDIGENOUS KNOWLEDGE IN BIODIVERSITY CONSERVATION OF AN AREA: A CASE STUDY IN SOONA VILLAGE, DISTRICT BHIMBER (AK)

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The diversity of indigenous knowledge (IK) do cascades imperative measures on socioeconomic and biophysical environments of an area. It is observed that IK not only does employ its role in sustainable livelihood of the community of the area but also it has massive importance in protection and propagation of biological diversity with applying this knowledge for better land use practices. The communities of the Soona village (SV) have acquisition of goods through access to and use of biological resources, especially non-timber forest products (NTFPs) and local agricultural products in daily life which has bestowed them a *knowledge power*. This power has the potential to access the natural resources and socially influencing others within local societies. The people of the employ their traditional knowledge for encroachment of different necessities of life and then do upsurge the biodiversity resources and do cater for its sustainability and conservation for future use. The conjunction of biodiversity (natural capital) and indigenous knowledge (social capital) culminate into establishment of sustainable ecosystem. IK do provide wit to the masses of area for sustainable use and protection and conservation of natural capital for tomorrow for forth coming generations. The people of SV do use their customarily IK for use of plant diversity from forest zone in scientifically manner. The study reveals that if people do care their environment then biological diversity never diminishes or become threatened.

OPTE 18

AN OVERVIEW OF THE ATMOSPHERIC POLLEN IN TURKEY AND THE NORTHERN CYPRUS

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The qualitative and quantitative analysis of atmospheric pollen on regional basis in different countries has increased. The reason for this is that pollen grains are a major cause for allergic asthma and hay fever (pollinosis) in sensitive people in particular children. Data obtained by using gravimetric (cm²/pollen grains) and volumetric (m³/pollen grains) methods in Turkey and the Northern Cyprus show, pollen concentrations during March, April, May, June and July are very high, but the densities vary on monthly basis depending on the phytogeographical division investigated. In general the dominant pollens in the atmosphere belong to *Alnus glutinosa*, *Carpinus*, *Castanea sativa*, *Chenopodiaceae* / *Amaranthaceae*, *Cupressaceae*, *Cupressaceae/Taxaceae*, *Fagus orientalis*, *Juglans regia*, *Morus*, *Olea europaea*, *Oleaceae*, *Pinaceae*, *Pinus*, *Pistacia*, *Plantago*., *Platanus orientalis*, *Poaceae*, *Populus*, *Quercus* and *Urticaceae*. In this paper, an attempt is made to present an overview of the studies undertaken on the pollen calendars of Turkey and the Northern Cyprus during the last few decades and their allergenic effects. This will contribute in the treatment of allergic diseases as well as improve the quality of life of people sensitive to pollen allergies.

OPTE 19

WOMEN'S INDIGENOUS KNOWLEDGE ABOUT MEDICINAL PLANTS OF KUCHLAK AREA DISTRICT QUETTA, BALOCHISTAN, PAKISTAN.

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An ethnobotanical survey was conducted in Kucklak area district Quetta during March, 2006 to September, 2006. Ethnobotanical informations were collected from local women of different ages from different sites of Kucklak area. Approximately 129 women were personally interviewed. The study mainly focuses on ethnobotanical information regarding traditional uses of plant. The attempt is endured to pool indigenous knowledge, with details of their local names, part use, and distribution and recipes of medicinal uses and also about those plants, which are imported from foreign or from other parts of the country. It was observed that a more complete knowledge is held by small majority of women and the medicinal plant use is not uniformly spread among the total population. It was also observed that the older generation has more knowledge than that of younger generation. In total 81 species are reported from the area, belonging to 35 families. Out of which 53 are wild and 28 are cultivated. These were classified as medicinal, as fodder, fuel wood, vegetable, as fruit and as ornamental plant while some other plant species were poisonous. All these 81 species are being utilized by the cure of different diseases and for other purposes. Some are utilized singly while others are used in admixture similarly certain plants are considered useful in only one specific diseases where as some have multiple uses. The current study is multidimensional in results that comprise conducting a scientific based study to know the impact of human on flora within their traditional value and norms of dealing with it.

OPTE 20

FLORAL INVENTORY AND ETHNOBOTANICAL STUDY OF NALTAR VALLEY GILGIT DISTRICT, PAKISTAN

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Naltar valley has a unique ecosystem, having diverse range of flora inhabiting some natural population of endemic plants listed as endangered category. The present study was carried out to explore the ethnobotanical study by the local inhabitants of Naltar during 2007-09. Detailed information was gathered through open ended questionnaires and interviews from the native herbal healers, shepherds, healers and midwives. Plants collected from the study area by using Global Positioning System (GPS-Arc Rgis 9.3) for plotting readings to locate the position, which represents 141 species, 107 genera and 48 families. Out of which 7 species belong to Gymnosperm while the rest 134 species to Angiosperms.

The highest number of species (133) is in practice for medicinal purposes followed by fodder and forage (101 species), fuel and timber (37 species), veterinary uses (27 species) and miscellaneous (10 species). Family Importance Value (FIV) indicates that Asteraceae was the most dominant (12.06%), followed by Fabaceae (7.09%), Polygonaceae and Rosaceae (7.67% each) while rest of the families have fewer species. The reported ethnoflora was comprised of 91 herbs and 23 shrubs. All 133 medicinal plants are in practice for 48 different diseases/ailments to treat locally by herbalists. Herbs usage for medicinal purposes and plant parts for preparation of recipes were documented, where powder form was the highest type of dosage (62.65%). Some traditionally made pills (6.02%) were also reported in common practice from the study area. Frequency distribution and data analysis was carried out by MS Excel Analysis ToolPak. The rapidly degrading ecosystem due to over harvesting coupled with overgrazing and un-sustainable management of flora causing threat to local biodiversity and need a comprehensive plan to protect natural resources.

OPTE 21

FLORA OF KHANPUR DAM, PUNJAB, PAKISTAN

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The present study was aimed at to record the flora of Khanpur Dam, Punjab, Pakistan. For this purpose, the whole area was surveyed during 2009 to 2010 for the collection of plant specimens with regular intervals. A total of 222 plant species belonging to 169 genera and 66 families were identified. Of them, two ferns, one gymnosperm, 39 monocots were determined. *Poaceae* was found the most dominant family in the flora of the project area that contributed 33 species (14.86%), followed by *Asteraceae* (26 spp., 11.71%), *Fabaceae* (13 spp., 5.86%), *Amaranthaceae* and *Lamiaceae* (9 spp., 4.05% each), *Euphorbiaceae* and *Solanaceae* (8 spp., 3.60% each), *Polygonaceae* (7 spp., 3.15%) and *Brassicaceae* (6 spp., 2.70%), while rest of the families had 1-5 species. It has been observed that most of the life-span of recorded taxa was annual natured (50.45%) followed by perennial (35.14%) and biennial (14.41%). Herbs were dominating fraction in habit of the flora forming 46.85%, followed by shrubs (17.12%), grasses (15.32%) and subshrubs as well as trees (7.66% each), whereas rest of 4 categories of habit were in the range of 3.15-0.49%. Therophytes were the most abundant life form that constituted 45.95% of the total flora, followed by *phanerophytes* (27.93%), *hemicyptophytes* (16.22%), *cryptophytes* (4.41%) and *chamaephytes* (4.50%). Two species viz., *Alternanthera paronychioides* and *Boerhavia diandra* reported for the first time from Punjab province.

OPTE 22

FLORISTIC ACCOUNT OF EMERGENT-AQUATIC AND MARSHLAND ANGIOSPERMS OF D.I.KHAN DISTRICT, KPK, PAKISTAN

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In the present study an account is given of an investigation based on the results of the Taxonomic research work conducted in Dera Ismail Khan (D.I.Khan) District, Khyber Pakhtunkhwa (KPK), Pakistan, from during 2005 to 2007. The area was surveyed and collection of semi-aquatic and marshland angiosperms was made at least 2 times from 15 sites of various aquatic habitats. The collected materials were identified with the help of available literature and by comparing with voucher specimens at the herbarium of the Department of Plant Sciences, Quaid-i-Azam University, Islamabad (ISL). In total 40 semi aquatic plant species belonging to 26 genera of 15 families were identified. Cyperaceae was the largest family that contributed 16 species (40%), followed by Poaceae with 6 species (15%), Polygonaceae 4 species (10%), Ranunculaceae and Typhaceae with 2 species (5% each); while 10 families contributed 1 species (2.5% each). Data inventory consists of botanical name, family, class, flowering period, availability, distribution and diagnostic characters. Detailed account of the semi aquatic and marshland angiosperms of Dera Ismail Khan is not available. Therefore, the present study is an attempt to highlight such angiospermic plant species.

OPTE 23

SYSTEMATIC IDENTIFICATION OF GENUS BRACHIARIA ON THE BASIS OF VEGETATIVE AND FLORAL MORPHO-PALYNOLOGICAL MARKERS (LM & SEM)**SHABNUM SHAHEEN, NIDAA HAROON, SEHRISH RAMZAN, FARAH KHAN AND ZARYAB KHALID***LC For Women University Lahore, Pakistan***Corresponding Author: shabnum_shaheen78@yahoo.com*

The present study deals with the few taxonomic parameters of the five species of genus *Brachiaria* carried out from Pakistan as there is confusion in identification of these species particularly on the basis of morphology and palynology. In the context of morphology, characters such as spikelet differentiation, lemma and palea shape and size, spike color, shape and size, glumes length and width were found useful in the delimitation of taxa in the genus. The inflorescence morphology particularly the spikelet was examined in detail and found to be highly variable. All the available records are listed and mapped. The palynological analysis provides qualitative and quantitative systematic data. The results showed some distinct palynological features. Variations in pollen characters like apertural form, exine ornamentation, pollen shape and size, polar and equatorial diameter and P/E ratio were observed. *Brachiaria villosa* was given in the flora of Pakistan (1990) and was considered to be of doubtful origin in Pakistan by Stewart. This species is also confirmed to occur in Pakistan in the present study. Also there is no published data already regarding the morpho-palynological distinctions among the species of *Brachiaria* particularly from Pakistan.

OPTE 24

POLLEN MORPHOLOGY OF *AJUGA* L., *LAMIUM* L. AND *PHLOMIS* L. FROM ABBOTTABAD DISTRICT**SHAMILA FIRDOUS^{1*}, HABIB AHMED², MANZOOR HUSSAIN³ AND MUQARRAB SHAH⁴**¹*Department of Botany, Hazara University, Mansehra, Pakistan.*²*Department of Genetics, Hazara University, Mansehra, Pakistan.*³*Department of Botany, Govt. Post Graduate College, Abbottabad, Pakistan.*⁴*Department of Microbiology, Hazara University, Mansehra, Pakistan.***Corresponding author's e-mail: shameela_firdous@yahoo.com*

Pollen morphology of six wild species belonging to three genera, (two each), of family Lamiaceae, (*Ajuga* L., *Lamium* L. and *Phlomis* L.) from district Abbottabad, have been studied. For this purpose, the plant specimens were collected from various localities of the district Abbottabad and voucher specimens were stacked at Herbarium of Hazara University (HUP) for future reference. Pollen morphology was examined under light and scanning electron microscope. Photomicrographs under light microscope as well as Scanning Electron Microscope (SEM) of pollen were incorporated to show the diagnostic features. Pollen grains are free, radially symmetrical, isopolar, trizonocolpate; prolate to subprolate to spheroidal, sexine is thicker than nexine. Tectums is fossulate and reticulate. Shape of pollen and exine ornamentation are found to be more significant characters and could prove to be a diagnostic feature for species identification.

OPTE 25

TAXONOMIC AND PHYTOCHEMICAL AUTHENTICATION OF HERBAL DRUG BARG - E- HENNA (*LAWSONIA INNERMIS*): A MULTIUSE MEDICINAL PLANT**SHAZIA SULTANA^{1*}, MIR AJAB KHAN, MUSHTAQ AHMAD, ASGHARI BANO, MUHAMMAD ZAFAR AND ZABTA KHAN SHINWARI****Department of Plant Sciences, Quaid-i-Azam University, Islamabad, Pakistan***Department of Biotechnology, Quaid-i-Azam University, Islamabad, Pakistan***Corresponding author's e-mail: shaziaflora@hotmail.com*

This paper deals with taxonomic and phyto-pharmacognostic screening of herbal drug Barg-e-Henna (*Lawsonia inermis*) with aims to authenticate the market samples from its adulterant. Hence the present attempt has been undertaken to authenticate genuine source of herbal drug Henna based on microscopic (LM & SEM) studies of palyno-anatomical features, behavior of powdered drug with different chemical reagents and fluorescence analysis (UV & FT-IR). This studies stated that the *Lawsonia inermis* multiuse herbal medicine recommended for hair tonic, antimicrobial and antifungal. It is stated that the use of classical in combined with advanced analytical tools may be useful to authenticate the genuine source of herbal drugs traded at global perspectives.

OPTE 26

PHYTO-CLIMATIC GRADIENT OF VEGETATION AND HABITAT SPECIFICITY OF INDICATOR SPECIES IN THE HIGH ELEVATION WESTERN HIMALAYAS

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Phyto-climatic gradient and ecological indicators can be used to understand the requirements, long term management and conservation strategies of natural habitats and species. For this purpose phytosociological attributes were measured using quadrats along transects on different slopes aspects across an elevation range of 2450-4100 m. Recorded 198 plant species were placed in five Raunkiaer life form classes among which the Hemicryptophytes (51 %) dominate the flora of the study area followed by Phanerophytes and Cryptophytes (Geophytes) with 15 and 13 % dominance respectively. Therophytes and Chamaephytes are represented by smaller numbers (12 & 10% each). Phyto-climatic gradient of vegetation was evaluated using Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA). Phyto-climatic relationships show that Phanerophytes especially tree species are widely distributed on northern aspect slopes whilst shrubs are more dominant on southern aspect slopes. Woody plants are dominant at lower altitudes (2450-2800 m), with a much smaller proportion occurring at middle elevations (2800-3300 m) whilst higher (3300-3900 m) and highest elevations (3900-4400 m) were dominated mainly by hemi-cryptophytes and crypto phytes. Our findings further elucidate that vegetation changes gradually from a moist-cool temperate Phanerophytic and Chamaephytic elements to dry-cold subalpine and alpine herbaceous Cryptophytic and Hemi-cryptophytic vegetation in the upper elevations. PCORD was used to calculate the indicator value of the species and thus selected at least one indicator (statistically significant) from each of the tree, shrub and herb layers in each habitat type and association. Indicator species were identified based on their faithfulness and abundance under the influence of decisive environmental variable identified by robust statistical significance. Fidelity of those indicators was also tested by their categorization in the fidelity classes. Location of such indicator was shown by data attribute plots using CANOCO and CANODRAW softwares. Assessment of Indicator species and ecological gradient in our study provide base for extensive conservation studies on biodiversity in mountain ecosystems.

OPTE 27

IN VITRO AND IN VIVO ANTHELMINTIC ACTIVITY OF FERULA COSTATA (KOR.) AGAINST GASTROINTESTINAL NEMATODES OF SHEEP

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This paper describes the in vitro anthelmintic activity of crude methanol extract (CME) and its n-hexane, ethyl acetate, chloroform and aqueous fractions of *Ferula costata* (Kor.), against *Haemonchus contortus* and in vivo activity of crude powder (CP) and CME against mixed culture of GINs. In vitro anthelmintic activity was determined by adult motility assay (AMA) and egg hatch test (EHT) against adult worms and eggs of *Haemonchus contortus* respectively. For in vivo activity, crude powder (CP) and CME of whole plant were administered to sheep infected with mixed species of GINs @ 1g, 2g & 3g kg⁻¹ body weight (b.w) and the activity was estimated by reduction in eggs per gram (EPG) of faeces on days 3, 7 and 14 post treatment (PT). Based on Lethal Concentration 99% (LC99) at 12 hr PT in AMA, the order of the potency of different extracts was exactly similar to the order of fractionation process of CME, i.e. CME showed the best activity (33.47 mg ml⁻¹) followed by hexane (39.77 mg ml⁻¹), ethyl acetate (42.76 mg ml⁻¹), chloroform (67.32 mg ml⁻¹) and aqueous fraction (539.27 mg ml⁻¹), while LC99 of positive control (Levamisole) was 1.257 mg ml⁻¹. However, differences between CME, hexane, ethyl acetate and chloroform fractions were non significant while aqueous fraction showed significantly lowest potency. The EHT showed that CME was at the top 23.08 mg ml⁻¹ and chloroform fraction remained at the bottom (100.32 mg ml⁻¹). However, the LC99 values of CME and all its fractions were non significantly different with each other. Activities of all the extracts were significantly lower than those of positive controls both in AMA and EHT. In vivo administrations revealed that both CP and CME were active to

variable extent. The in vivo anthelmintic activity increased with the increase in dose and days PT. Except the first dose of CP (1 g kg⁻¹ b.w) which showed non significant difference at day 3 and 7 PT, all the doses showed significantly different reduction in EPG compared to untreated control at all stages PT. CME @ 3g kg⁻¹ exhibited the best activity on day 14 PT (47.90%) but this reduction in EPG was significantly lower than positive control (Levamisole) @7.5mg kg⁻¹ b.w. (99.39%). Further in vivo and chemical investigations for accurate adjustment of dose and determination of active principle(s) are suggested.

OPTE 28

ADDITION TO FUNGI ON *AZADIRACHTA INDICA* FROM FAISALABAD AND GOJRA PAKISTAN

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Traditionally neem products have been used against a wide variety of diseases which include heat-rash, boils, wounds, jaundice, leprosy, skin disorders, stomach ulcers, chicken pox, etc. Modern research also confirms neem's curative powers in case of many diseases and provides indications that neem might in future be used much more widely. *Tiarospora madreeya* Höhn. and *Diplozythiella bambusina* Died., *Ulocladium chartarum*, *Cladosporium nigrellum* and *Didymostilbe coffeae* are the fungi reported first time on *Azadirachta indica* from Pakistan.

OPTE 29

AN ETHNOBOTANICAL STUDY OF DISTRICT MASTUNG, BALOCHISTAN, PAKISTAN

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Present studies were carried out during 2008 to investigate the ethno-botanical Profile of District Mastung Balochistan. The area is gifted with diverse and unique flora. The people of the area are dependent on the plants of their surroundings for medicinal, food, fodder, timber, fuel wood, field fencing and other cultural purposes. The local people of the area were investigated to gather information regarding the uses of plants for different purposes. Based on the type of usage, the major usage types includes 64 medicinal plants, 14 fuel wood species, 32 vegetables and pot herbs, 32 fruit yielding plants, 15 species for condiments, 19 species for construction and timber requirements. In order to understand the pattern of indigenous uses of medicinal plants a list of the major and most of the lesser categories of the ailments was prepared and categorized with the help of the medical practitioners. A total of 64 plant species used in curing 57 ailments. These ailments were further grouped into 12 broad classes of diseases in order to project the indigenous uses of medicinal plants for various ailments. The maximum number of plants was used for generalized body aches and colic, followed by gastrointestinal and dermatological problems. However due to the facilities and modernization the young generation is losing this indigenous knowledge.

OPTE 30

WILD EDIBLE PLANTS SOLD IN THE LOCAL MARKETS OF IZMIR

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In recent years, Mediterranean diet has been promoted as a model for healthy eating. One of the main characteristics of the Mediterranean diet is an abundance of plant food as fruits, vegetables, whole-grain cereals, nuts, and legumes. This paper compiles and evaluates the ethnobotanical knowledge currently available on wild edible plants sold in the local markets and traditionally used for human consumption in Izmir, a province on the Mediterranean coast of Turkey. The information about the use of wild edible plants was collected from 18 different open-air-markets in the city during two-year period, through unstructured interviews. In this study, a total of 46 wild edible plant taxa were established and also plant parts used, ethnographic data related to vernacular names, traditional tools and recipes were recorded. Family Asteraceae is represented by the highest number of taxa (7), followed by Apiaceae (6), Polygonaceae, Liliaceae and Lamiaceae (4), Amaranthaceae and Brassicaceae (2). The study showed that the plants used are either eaten raw, cooked by boiling in water, frying in fat or baked to be served as dishes such as stew, salad or as hot drink. During this ethnobotanical research, it was verified that wild edible plants play an important role in diet in Izmir. However, it was observed that the transfer of folk uses of these plants decreased in the last generations. In this context, the ethnobotanical research about wild edible plants should be extended to other areas of Turkey in order not only to preserve the traditional knowledge related to plants, but also to make it available for future generations as well.

OPTE 31

ETHNOMEDICINAL PLANTS USED FOR GASTROINTESTINAL AILMENTS BY THE RURAL COMMUNITIES OF KAGHAN VALLEY, MANSEHRA, PAKISTAN

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The research area Kaghan Valley is located in Northern Pakistan. The area is basically occupied by the rural communities and seasonal nomads. The present study deals with documentation of medicinal plant species used for various gastrointestinal ailments. A total of 56 plant species belonging to 35 angiospermic and 02 gymnospermic families were reported by local practitioners for the treatment of digestive tract problems like constipation, diarrhoea, gas trouble, heartburn, haemorrhoids, indigestion, nausea and ulcer. The prominent plant species include: *Achillea millefolium*, *Aconitum heterophyllum*, *Artemisia absinthium*, *Berberis lyceum*, *Carthamus oxycantha*, *Dioscorea bulbifera*, *Fraxinus excelsior*, *Hyoscyamus niger*, *Paeonia emodi*, *Plantago ovate*, *Punica granatum*, *Thymus serpyllum* and *Viola odorata*.

OPTE 32

PHYLOGENY OF CAREX L. (CYPERACEAE) FROM PAKISTAN BASED ON MATK GENE SEQUENCE VARIATION

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We generated partial sequences of chloroplast matK gene for 13 species of the genus *Carex* L. and two outgroup species. In addition 7 partial sequences of *Carex* were retrieved from the NCBI gene bank. *Kobresia schoenoides* and *Kobresia laxa* were selected as outgroup taxa. The sequenced fragments varied from 840 base pairs (bp) to 1320 bp in length, with 19.34% variable and 9% phylogenetically informative sites when the outgroups were excluded. The aligned sequences were analyzed by maximum parsimony and neighbor-joining methods using PAUP*, and obtained several most parsimonious trees. The reconstructed phylogenetic trees support that *Carex* is non-monophyletic. Within the *Carex* sub-genera *Psyllophora* and *Vigneastra* appear to be monophyletic, while sub-genus *Carex* and *Vignea* are paraphyletic. Several monophyletic groups can be recognized within the sub-genus *Carex* as well as *Vignea* corresponding to different sections. Taxa of the sub-genus *Carex* are divided into three sub-clusters (1) *C. melanantha*, *C. atrofusca*, *C. duthiei*, *C. pseudocyperus*, and *C. songorica* forming monophyletic group, closely related to *infuscata* group (2) *C. pseudobicolor*, *C. infuscata* and *C. psychrophila* (3) *C. cruenta*, *C. cardioplepis*, *C. schlagintweitiana* and *C. Fedia* differing from both the earlier groups in spike shape, length and arrangement. Based on these results, delimitation of the sections is discussed. The implications of phylogeny for sectional habit and inflorescence evolution has also been discussed.

OPTE 33

ANTIOXIDANT POTENTIAL OF ROOT BARK OF *BERBERIS LYCIUM* ROYLE. FROM WESTERN HIMALAYA, PAKISTAN

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This study was to compare the relative level of antioxidant activity of methanolic extract of root bark of *Berberis lycium* Royle., in different test systems of antioxidant determination i.e ABTS (2,2'-azinobis-(3-ethyl-benzothiazoline-6-sulfonic acid) radical cation assay, Phosphomolybdenum assay and reducing power assay. In all these assays the antioxidant activity of extract was compared to that of ascorbic acid. The antioxidant activity was highest in phosphomolybdenum assay followed by ABTS and reducing power assay respectively. In phosphomolybdenum assay extract showed maximum antioxidant activity of 84.55% and ascorbic acid showed 86.99% while in ABTS assay extract showed maximum antioxidant activity of 62.15% and ascorbic acid showed 88.3%. In reducing power assay increased concentration of sample and standard resulted in more reduction of ferric cyanide complex to ferrous form, thus showed increased antioxidant activity at higher concentration. In ABTS assay influences of both the concentration of antioxidant and duration of reaction on the inhibition of the radical cation absorption were taken into account when determining the antioxidant activity. On the basis of these results *Berberis lycium* is identified as a best source of free radical scavenging compounds.

POSTER ABSTRACT

PPTE 1

POLLEN MORPHOLOGY AS AN AID TO THE IDENTIFICATION OF THE TAXA OF TRIBE VERNONIEAE (ASTERACEAE)

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External pollen morphology of three species of *Vernonia* from Pakistan and two species from Pennsylvania & Georgia were examined by light and scanning electron microscope. Pollens are circular to semi-angular in polar view and spheroidal to sub-spheroidal in equatorial view. Pollen class is trizonocolporate with prominent spines. But pollen grains in *Elephantopus* are trizonocolporate and octazonocolporate. One species from Pennsylvania has highest number of spine rows between colpi (10 – 15) while *V. cinerea* from Pakistan has 5 – 6 spine rows. *Elephantopus tomentosus* also has 5 – 6 spine rows. Scanning electron microscopic studies revealed that pollen is fenestrate and lacunate. Exine sculpturing is echinolophate with micropunctate tectum. The germs *Elephantopus* can be distinguished from *Vernonia* due to prominent well developed pillar like *columella*. Pollen features are of taxonomic potential and would be helpful at the specific, generic and tribal level. On the basis of exine thickness 3 groups viz. Group I. *Vernonia cinerea*, *V. satigna*, Group II. *V. gigantea*, Group III. *V. anthelmintica*, *Elephantopus tomentosus* have been recognized.

PPTE 2

ETHNOMEDICINAL STUDIES OF DUGHALGAY VALLEY DISTRICT SWAT, KHYBER PAKHTOONKHWA, PROVINCE, PAKISTAN

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An ethnobotanical project was carried out in the Doghlagay valley of upper Swat. The Local population not only use indigenous medicinal plants for curing various diseases but also earn their live hood by selling some of them in the local market. 102 of these medicinal plants were collected in the area during summer 2011. The inhabitantants of the area utilize 102 species for various ailments the common ailments of the area are antiseptic, Aanthelmentic, Carminative, Expectorant, Astrangent and purgative. 30 species of them are collected for trad purposes, in which these medicinal plants such as Berberis lycium, Origanum vulgare, Bergenia ciliata, Aesculus indica, Podophyllum emodi, Pteridium aquilinum, Bergenia himalyca, Viola spp., Ajuga bracteosa, Morchella esculenta, Paeonia emodi, Atropa acuminata, Aconitum violaceum, Polygonum amplexicaulis, Bupleurum longicaule, , Juglans regia, Diospyrus lotus and Mentha longifolia are important. The availability of medicinal plants is decreasing day by day due to human population pressure, marketing pressure, grazing and unwise collection. Comprehensive conservation policy with practical implementations is utmost essential in order to conserve the rapidly depleting forest resources of the area. The present investigation will help in the preservation of indigenous knowledge of the local people, which is depleting day by day. The precious ethnobotanical knowledge is disappearing very fast, so this study could be helpful in conservation of ethnobotanical knowledge. Bistorta amplexicaulis Caltha alba Colchicum luteum Dioscoria deltoides Geranium wallichianum ,Paeonia emodi, Podophyllum emodi, Valeriana jatamans, Viola canescens and Viola biflora are some of the most threatened species and need special attention. Therefore it is recommended that Governamental organizations and non Governamental organization should pay possible attention to aware the local people about the future threats.

PPTE 3

DIVERSITY AND CONSERVATION STATUS OF MEDICINAL PLANTS OF NARAN VALLEY KHYBER PAKHTOONKHW 3 PROVINCE, PAKISTAN

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Present studies were carried out to investigate conservation status and diversity status of medicinal plants of Naran valley. The valley is located in the remote north western part of District Mansehra. The area is gifted with diverse and unique flora as it is adjacent to the confluence point of Himalayas, Hindu Kush and Karakorum. The people are mostly poor, illiterate and depend upon plant resources for their domestic needs. The inhabitants of Naran valley utilize 268 plant species for more than 42 domestic needs. Based on their type of usage, the major usage types include 150 medicinal plants, 49 fuel wood species, 33 fodder species, 24 vegetables and pot herbs and 38 veterinary medicinal plants. Most of the plants are used for multiple purposes. Some plants are also sold in the local markets, thus providing an additional source of income. The present study revealed that There are 52 threatened species, of which 21 endangered, 13 vulnerable, 18 are rare. Comprehensive conservation policy with practical implementations is utmost essential in order to conserve the rapidly depleting forest resources of the area. The present investigation will help in the preservation of indigenous knowledge of the local people, which is depleting day by day. The precious ethnobotanical knowledge is disappearing very fast, so this study could be helpful in conservation of ethnobotanical knowledge. Bistorta amplexicaulis Caltha alba Colchicum luteum Dioscoria deltoides Geranium wallichianum ,Paeonia emodi, Podophyllum emodi, Valeriana jatamans, Viola canescens and Viola biflora are some of the most threatened species and need special attention.

PPTE 4

ETHNOBOTANY OF JUNIPERUS EXCELSA IN BALOCHISTA PROVINCE, PAKISTAN

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Ethnobotanical data of Juniperus excelsa (M. Bieb). In Balochistan is documented from various historical, literary, linguistic and pharmacological view points. Field trips were conducted to different habitats of J. excelsa in Balochistan during 2009-2010 to collect ethnobotanical information about the plant. The present study reveals that J. excelsa is considered as a multi-purpose tree by indigenous people of Balochistan, and has been used as medicine for different ailments traditionally. Local communities, homeopathic doctors and pansars have been using different parts of this juniper species for different purposes especially for curing of cough and cold, stomach cramps, asthma, diuretic,

carminative, stimulant, dropsy, gonorrhea, gleet, leucorrhoea and skin diseases. Various parts of juniper are used in day to day life as fuel-wood, fencing fields/hoses; incense, decoration, bark thatching, material for constructing buildings and different kinds of household articles. Oil from Juniper berries have been used in several pharmaceutical products, cosmetic industry and as a popular flavoring agent for gin. A detail bioassay of the plant parts with different organisms will help in bioprospecting.

PPTE 5

ATMOSPHERIC POLLENS IN TURKEY AND THEIR ALLERGIC EFFECTS

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A qualitative and quantitative analysis of atmospheric pollen studies on regional basis is attracting great attention lately. The reason for this is that pollen grains are a major cause for allergic asthma and hay fever (pollinosis) in sensitive people. The studies in Turkey have increased during the last decade like many other countries in Europe. Pollen calendars are prepared all over Europe. Announcements on the pollen dispersal situation on television news programmes have been started. The studies undertaken in Turkey show that in the data obtained by using gravimetric (cm²/pollen grains) and volumetric (m³/pollen grains) methods, pollen concentrations during March, April, May, June and July are very high, but pollen densities vary on monthly basis depending on the region investigated. In general the dominant pollens in the atmosphere belong to *Alnus glutinosa*, *Carpinus* spp., *Castanea sativa*, *Chenopodiaceae/Amaranthaceae*, *Cupressaceae*, *Cupressaceae/Taxaceae*, *Fagus orientalis*, *Juglans regia*, *Morus* spp., *Olea europaea*, *Oleaceae*, *Pinaceae*, *Pinus* spp., *Pistacia* spp., *Plantago* spp., *Platanus orientalis*, *Poaceae*, *Populus* spp., *Quercus* spp. and *Urticaceae*. In this paper, allergenic effects of the pollen of these taxa is presented. This will prove helpful in the preparation of atmospheric pollen calendars for different regions and contribute to the treatment of allergic diseases as well as improve the quality of life of people who are sensitive to pollen allergies.

PPTE 6

TAXONOMICAL STUDIES OF BACILLARAE OF FISH FARMS FROM MULTAN CITY, PAKISTAN

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A total of 6 species with solitary organization belonging to one phylum, one class, one order, three families and four genera have been collected from fish farms of Multan city of Pakistan. Several trips were made to all sites i. e. Bypass Road, Mauza Khokhrain, Basti Dairapur, Bangla Stop and Old 21 No. Chungi. The collected specimens were investigated cytologically and morphologically and on the basis of such characters, they were taxonomically determined and described. Among Bacillariales, 3 families were identified, in which Genus *Cymbella*, *Synedra*, *Fragilariforma* were with 1, 1 species while Genus *Navicula* was represented by 3 species.

PPTE 7

DIPTEROCARPOXYLON RANILOTENSIS SP. NOV. A NEW TAXON OF DIPTEROCARPIACEAE FROM RANIKOT FORT AREA, DISTRICT JAMSHORO, SINDH, PAKISTAN

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Dipterocarpylon ranilotensis Sp. Nov. A new silicified wood is described from quaternary deposits of Dada formation exposed near Ranikot fort area district Jamshoro Sindh, Pakistan. (Lat. 26° 45' - 26° 00' N. Long. 67° 45' - 68° 00' E.). The rocks involved are Late Tertiary and Early Quaternary deposits (Pleistocene to Sub-recent). The xylotomical features of the present fossil woods affinites to the genus *Dipterocarpus* of family *Dipterocarpiaceae*. The specific epithet refers to the locality from where the fossil specimen was collected. Biogeography of the fossil wood has been suggested that the fossilized plants were not originated in the study area but, were transported from somewhere else. The size of the fossils indicate that source area was not far from the present study area.

PPTE 8

MYCOFLORA DETECTED FROM SEEDS OF SESAMUM INDICUM L. IN SIALKOT

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Sesame seeds (*Sesamum indicum* L.) from local markets of Sialkot were sampled for their mycoflora. Using blotter, deep freezing and agar plate method, seeds of three cultivars (black, white and intermediate) yielded various fungi. The three incubation methods showed that the seed borne fungi were encountered in higher percentage in the Agar plate method than other two methods. A total number of 35 species belonging to 10 genera of fungi were isolated. The prevalent genera were *Penicillium* (10 species), *Alternaria* (8 species), *Fusarium* (5 species), *Aspergillus* and *Cercospora* (3 species each). *Penicillium* was predominant followed by *Alternaria* and *Fusarium*. All detected fungi are the first record of mycoflora from sesame seeds in Sialkot.

PPTE 9

ETHNOBOTANY OF ESKİŞEHİR AND ITS ENVIRONS

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Eskişehir is located in the Central Anatolian province of Turkey. It is included in B3 grid square of Davis. There are more than 1000 plant taxa distributed in this State and its environs and nearly 220 are endemics. The phytogeographical distribution of plant taxa in the region is as follows; Mediterranean (25 %), Irano-Turanian (17 %) and Euxine (20 %). In this study attempt has been made to record and identify the uses of medicinal and aromatic plants administered by people in Eskişehir and its environs. A questionnaire including 20 questions such as; socio-economic status of the individuals, where from they obtained the plants, how, when, and what was their aim was was prepared and distributed to 641 persons above the age of 18 from different occupations. They were randomly chosen and interviewed. The data obtained was analysed via SPSS 19.0 package programme. The results revealed that; peppermint, thyme, fennel, anise, sage are used for stomach disorders; balm, walnut, hawthorn, black radish for cardiac diseases; and blueberry, cinnamomum, thyme, nigella, olive leaves and apricot seed for diabetes. In the majority of cases walnut, linseed and thyme are used against cholesterol; garlic and lemon for blood pressure; nigella, marshmallow flower, and nettle for allergy; black mulberry for mouth wounds; rosemary for migraine; centaury oil for joint pain. 50.2 percent of the individuals surveyed pointed out that they want to have education about conscious use of medicinal and aromatic plants. Majority of the persons benefited from the plants distributed in Eskişehir and its environs.

PPTE 10

THE ETHNO BOTANICAL USES OF TREES AND SHRUBS IN DISTRICT BATTAGRAM, KHYBER PAKHTUNKHWA PAKISTAN

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Present study was carried out to document the ethno-botanical uses of shrubs and trees in District Battagram, Khyber Pakhtunkhwa Pakistan. The local knowledge of medicinal plants was documented by using questionnaire consisting of semi-structured interviews employing a checklist of questions and direct observations. The aim of present study was to collect the information about the use of native plants, which were being utilized by the people for the treatment of different diseases. The ethnomedicinal uses of 90 plant species of shrubs and trees belonging to 51 families

were recorded during field trips from the research area. Local people use 22 plant species to control fever, 20 for skin and boils diseases, 18 for cough, 17 as astringent, 13 for diarrhea, 10 for each asthma, dysentery, rheumatism, tonic, anthelmintic, jaundice, diuretic, diabetes, carminatives and in eyes infections. They use the recipes of local plants in the form of decoction, powdered, juice, plant extract, poultice, paste and as fresh plant material. Field observation showed that vegetation of the area was generally threatened due to urbanization, deforestation, over grazing, habitat fragmentation, unscientific extraction of natural vegetation, introduction of the exotic taxa and habitat loss. Measures for the conservation of plant resources are urgently needed.

PPTE 11

STUDIES ON ANTIMICROBIAL ACTIVITY OF SOME SELECTED MEDICINAL PLANTS

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Medicinal plants are the plants which contain substances that can be used for therapeutic purposes or which are precursor of chemotherapeutic semi-synthesis. They are very important in relation to the health of people. Keeping in view the importance of medicinal plants, the work was conducted for the evaluation of antimicrobial activity and phytochemical screening of ethanolic and water extract of leaves of five medicinally important plants; Punica granatum, Mentha piperita, Vinca rosea, Carica papaya, and seeds of Centrathurum anthelminticum against eleven bacterial strain bacterial strains Staphylococcus aureus, Escherichia coli (ATCC 1-0192), Bacillus subtilis (BGSC 10419), Klebsiella sp.-S1, Pasteurella multocida, Methicillin-resistant Staphylococcus aureus (MRSA), Methicillin-sensitive Staphylococcus aureus (MSSA), Proteus sp.-S2, Bacillus sp.-7-1, Salmonella typhi and Pseudomonas aeruginosa. Plants were investigated for the presence of different phytochemicals i.e. glycosides, tannins, alkaloids and phenols by performing preliminary phytochemical tests, including TLC also. All the bacterial strains were identified, except Klebsiella sp.-S1, Proteus sp.-S2, and Bacillus sp.-7-1. Ethanol was found to be best solvent for the extraction of plant parts. The antibacterial activity were analyzed and compared by using MIC (Minimum Inhibitory concentration). The ethanolic leaf extract of Punica granatum, Mentha piperita and ethanolic seed extract of Centrathurum anthelminticum showed activity against antibacterial activity against six of the bacterial strains out of total of eleven, whereas the leaf extract of Carica papaya showed only two. The ethanolic leaf extract of Punica granatum, Mentha piperita and Centrathurum anthelminticum showed best activity against Bacillus subtilis (BGSC 10419) and Bacillus sp.-7-1 (50mg/ml). Ethanolic extract of Punica granatum leaves showed maximum antibacterial effect against the bacterial strains, so this was the most active plant, whereas the least active plant was Carica Papaya.

PPTE 12

ETHNOVETERINARY PLANT REMEDIES USED BY GUJJAR COMMUNITIES IN NORTHERN AREAS OF PAKISTAN

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Gujjar people are the least populous ethnic group in Northern areas of Pakistan and most are distributed in Mountainous areas of the County. Animal production plays an important role in Gujjar livelihoods and has abundant traditional knowledge of animal management and ethnoveterinary practices. This study documents the animal diseases, ethnoveterinary plant remedies and related traditional knowledge in Northern areas of Pakistan. This study was carried out in Northern areas of Pakistan between Jun 2010 to September 2011. Data was obtained through the use of semi-structured questionnaires, field observation and PRA tools. A total of 100 respondents (21 men and 79 women) provided information on animal ailments and ethnoveterinary plant medicines used for livestock production. Information on traditional ethnoveterinary medicine knowledge and choice of treatment providers was also obtained. Twenty-five animal conditions were identified in the surveyed area. The major and most common animal diseases among livestock were skin conditions, diarrhea, heat, fevers, colds, and parasites. Most ailments occurred between June and August. The ethnoveterinary medicinal use of 45 plant species was documented. Most medicinal species (84.7%) were collected from the wild. The most frequently used plant parts were whole plants (36.6%), followed by roots (21.2%). The most important medicinal plant species were *Acorus calamus*. (UV = 0.57), *Aconitum laeve* (UV = 0.77), *Bergenia ciliata* (UV = 0.53), *Ephedra gerardiana* (UV = 0.72), *Paeonia emodi* (UV = 0.70), and *Silene vulgaris* (UV = 0.50). Animal diseases treated with the

highest number of ethnoveterinary plant remedies were diarrhea (16 plant species), heat, fever, colds (11 plant species), retained afterbirth (11 plant species), and skin conditions and sores (11 plant species). Many villagers (52%) considered traditional remedies their first choice of animal disease treatment. Traditional ethnoveterinary knowledge was related to the local social-cultural characteristics of Gujjar communities. Animal production plays an important role in Gujjar livelihoods, and has abundant traditional knowledge about animal production and ethnoveterinary plant remedies. This traditional knowledge faces the risk of disappearing due to increasing modern veterinary medicine extension, livelihood changes and environment degradation. Animal diseases are a major constraint in livestock production in villages. Thus, some strategies and measures should be adopted in the future, such as further researches on culture and livelihoods, community-based validation of ethnoveterinary medicine and broad network building and knowledge sharing.

PPTE 13

AN ETHNOFLORISTIC STUDY OF THE PLANTS OF DISTRICT NANKANA SAHIB, PAKISTAN

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Work was carried out by gathering information on traditional uses of plants by the inhabitants of the area from Sep. 2009 to Oct. 2010. The area has great biodiversity and rich in ethnobotanical utilization. 253 plant species belonging to 81 families, including 1 Pteridophyte, 1 gymnosperm, 67 dicots and 12 monocot families were recorded. The inhabitants of the study area used 25 plants as fruit species, 21 as pot herb and vegetables, 44 as food, fodder and forage plant species, 4 as oil yielding plant species, 4 as smoked plant species, 2 as fumigant species, 9 are defined as timber wood species, 4 species are pickled, 5 species used as condiments and species, 4 species used as miswak, 5 species used as salad, 24 fuelwood species, 6 species used as fences and hedges, 4 species used in roofing and thatching, 25 plants as ornamental, 2 plant species as ethnoveterinary medicines, 162 ethnomedicinal plant species, 81 multipurpose plant species, 18 as honey bee plants and 6 plant species had no local use. The local people are using medicinal plants because they are poor, can't afford synthetic drugs and they have knowledge of medicinal plants. These investigations led to the conclusion that local authorities and other funding agencies should promote the cultivation and conservation of medicinal plants. Markets and industries should be promoted in the area to alleviate poverty.

PPTE 14

EXPLOITATION AND PROSPECTS FOR CONSERVATION: PLANT DIVERSITY OF DIR KOHISTAN VALLEY (KHYBER PAKHTOONKHWA), PAKISTAN

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Conservation of plant diversity assumes greater importance when the world is facing unprecedented loss of biological diversity. The area is gifted with diverse and unique flora, as it is adjacent to the confluence point of Himalayas, Hindu-Kash and Karakorum. Over exploitation of plant resources combined with improper harvesting and post harvesting techniques have intensified pressure on plant ethnobotanically flora of area. The inhabitants of the area have always used medicinally plants resources for their food, shelter, fodder, health care and other cultural purposes. It is, therefore, felt worthwhile to record the native uses of these plants before the information is lost. It is recorded that some species are extensively used by the indigenous communities. The major factors contributing towards plant biodiversity loss found were poverty, grazing of pasture, forest encroachment, grass cutting, wildlife hunting, lopping of trees for fodder, medicinal plant collection, agro-system threats, fuel collection, forest fire, soil-slope erosion and invasive species intensify the environment. The natural resources bases of Dir Kohistan Valley is deteriorating more rapidly than many other regions, but receive lesser attention than the other ecosystems. The conservation and sustainable use of potential plant species needed to be addressed. Concerted efforts are required broaden our understanding of the dynamics of floral values as well as local concepts in this remote part of the world, and to check species decline. For sustainable use, in situ and ex situ conservation, controlled harvesting, and afforestation may be the solution. Further extensive field conservation/management research is needed. The present study revealed that There are 58 threatened species in Dir Kohistan Valley, of which 22 endangered, 22 vulnerable, 14 are rare. Which shows that 6.7 % are endangered, 6.7 % vulnerable and 4.26 % rare. The study confirmed that the area possesses great potential for cultivation and sustainable harvesting of economically important plant resources. Species like *Geranium wallichianum*, *Paeonia emodi*, *Podophyllum emodi*, *Valeriana jatamans*, *Viola canescens* and *Viola biflora* indicate that these special attention before they are eroded genetically.

PPTE 15

ETHNO-MEDICINAL PLANTS USED TO CURE WOMEN DISEASES BY WOMEN OF KHANOZAI DISTRICT PISHIN, BALOCHISTAN, PAKISTAN

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The present survey was conducted during March 2007 to September 2008 in Khanozai area District Pishin. Ethnobotanical 129 Local women from different sites of Khanozai area were interviewed. The study mainly focused on ethnobotanical information regarding traditional uses of plants used for women diseases. Local names, parts use, method of part use and recipes of medicinal uses and also about those plants, which are imported from foreign or from other parts of the country were documented. A total of 26 species belonging to 18 families were reported from the area. These plant species were identified with the help of flora of Pakistan. It is noted that some species have multiple uses. It was also observed that the older generation has more knowledge than that of younger generation and indigenous knowledge is rapidly disappearing from the region, so preservation measures should be taken to conserve the ethnobotanical knowledge in rural areas of Pakistan.

PPTE 16

CONSERVATION ISSUES OF TREE FLORA IN NATURAL HABITATS OF TOTALAI TRACT DISTRICT BUNER

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In nature trees are always combating the threats of different types. Totalai Tract, having an area of 29853 ha is no exception from the general rules. We communicate the result of an intensive scientific survey of 26 trees species belonging to 21 families recorded here. The data obtained from extensive field observation, interviews with the traditional experts, scientific professional and herbaria record, treated against Rabinowitz methods and categorized according to the IUCN Criteria revealed that out of the 26 recorded species 7, 9, 8 and 1 established under the Critically Endangered, Endangered, Vulnerable and Regionally Extinct categories, respectively. It was concluded that almost all the trees found in the natural condition, are under severe extinction whose nature and extent varied from place to place. The conservation issues faced by the arboreal vegetation included; illegal cutting, habitat losses, agriculture extension and mineral mining, all these were due to the lack of the sense of ownership of natural conservation in the flora. The area needs complete protection, reintroduction of the suffered species, and recovery of the degraded habitat.

PPTE 17

SUSTAINABLE FOREST MANAGEMENT (SFM) IN PAKISTAN: HISTORY, PROBLEMS AND CHALLENGES

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We insinuate Pakistan's major forest types and deliberate forest management with in historical and theoretical framework including actions taken over the last decade toward achieving sustainable forest management (SFM). The assorted criteria and indicators for SFM put forth by various institutions are critically explored. The major problems are identified and different approaches for SFM acquirement in Pakistan are applauded. Pakistan possess wide variety of forests types because of complex topography and multiple climate regimes but unregulated exploitation and deforestation from last two decade caused many problems, such as, environmental degradation, valuable species extinction, rapid depletion of soil nutrients, increased soil erosion, silting and flooding. It is needed to plan and manage the natural forests recourses which not only improve the biological diversity but also enhance the livelihood of the local community. The reported article also discusses the current state of forest resources and forest policy changes in Pakistan, concluding with key challenges in order to compete with the needs of the future.

PPTE 18

CONTRIBUTION TO THE MUSHROOM FLORA FROM TWINCITY: RAWALPIND AND ISLAMABAD

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Seven hymenomycetous fungi (Mushrooms) were collected from twin cities area during July/ 2008. These were identified as the members of the order Agaricales of class Basidiomycetes. They belong to five genera: **Clitocybe fragrans*, **Collybia cookie*, **Coprinus radians*, **Coprinus stercolinus*, **Volvariella bingensis*, *Volvariella parvula*, and *Termitomyces microcarpus*. Five of them, marked with asterisk were reported for the first time from Pakistan.

PPTE 19

ETHNOBOTANICAL EVALUATION OF MEDICINAL PLANTS OF SABIRABAD AND ALLIED PERIPHERIES DISTRICT KARAK, PAKISTAN

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This study focused on the ethnobotanical investigation of Sabirabad and allied peripheries of District Karak Khyberpakhtoonkhwa Pakistan. It revealed that the local inhabitants utilize 43 plants 23 herbs 08 shrubs and 12 trees belonging to 27 different families for various purposes ranging from fuel wood, fodder to uses against various ailments. Family Solanaceae, Lamiaceae and poaceae provide four members followed by Zygophyllaceae, Mimosaceae, Moraceae apocynaceae, Rhamnaceae, Fabaceae, and Chenopodiaceae, two members each with the rest families providing one member each for use to the local community. This paper includes Plant botanical name, flowering season family name and plant part used ethnobotanically.

PPTE 20

NEW BOSWELLIC ACID DERIVATIVES FROM THE OMANI FRANKINCENSE (*BOSWELLIA SACRA*)

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Boswellia sacra is the least studied source of the frankincense resin compared to the other species of genus *Boswellia* and a very limited phytochemical and pharmacological work has been carried out on this precious resin. The most precious grade of Omani frankincense (Hojari Regular, HR) was subjected to phytochemical analysis for the first time in our research laboratories. The resin was extracted in methanol, followed by the separation of various fractions and isolation of pure compounds on the basis of increasing polarity of organic solvents (*n*-hexane, dichloromethane, and methanol). As a result of the repeated column chromatography and HPLC analysis on various fractions and sub-fractions, we have isolated many pure compounds, including two new derivatives (1-2; Figure 1) of boswellic acid with potent biological and pharmacological properties). The structure elucidation of the new compounds was carried out by the detailed NMR spectroscopy and mass spectrometry studies. The High Performance Thin Layer Chromatography (HPTLC) was also performed on some of the key fractions to get an insight into the HPTLC fingerprinting profile of the resin. Furthermore, for the optimization of the biological and pharmacological profile of the resin, the methanolic extract, the fractions/sub-fractions and the pure compounds were submitted to various biological and pharmacological assays and the results are included in the current study.

PPTE 21

NUTRITIONAL ASSESSMENT AND THE COMPOSITION OF ESSENTIAL OILS OBTAINED FROM DIFFERENT GRADES OF OMANI FRANKINCENSE RESIN AND LEAVES FROM *BOSWELLIA SACRA*

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The analysis of the volatile constituents of the hydrodistillate of resin from *Boswellia sacra* by GC-MS revealed the presence of 98 mono and sesqui-terpenes. The woody-balsamic smelling hydrodistillates were obtained in 5.3% to 12% yields as colorless and pale colored, non-viscous oils. All grades of the *Boswellia sacra* oleogum resin oils showed comparable chemical profiles. In all analyses carried out in the study, α -pinene was the only predominant compound (71.5-42.8%) followed by limonene (17.5-2.4%). The chemical constituents of the fresh resin collected one day before distillation are also reported. The volatiles of the essential oils collected at different distillation intervals (1 h to 20 h) were determined by the GC-MS analysis. For the first time the essential oil obtained from the dried leaves of *Boswellia sacra* tree was also analyzed by GC-MS which also revealed α -pinene as a major compound (68.6%). Furthermore, the analysis of the proximate composition of the leaves and six grades of resin was also performed using the standard methods of AOAC. The resins and leaves analyzed in this study were found to have the following ranges of the proximate composition: moisture (5.41-11.54%), dry matter (88.45-94.58%), alcohol soluble extractive (14.09-64.84%), ash (1.02-6.66%), crude fats (6.90-85.36%), nitrogen (0.04-0.18%), proteins (0.25-1.14%), carbohydrates (13.30-74.15%), and energy value (360.80-822.53 kcal/100g). The leaves of *Boswellia sacra* were found to have higher concentration of ash, fiber, and carbohydrates, but lower in fats, energy value, and alcohol extractives as compared to the resins. Unlike leaves, all the resins were found to be excellent source of lipids and consequently higher in energy.

PPTE 22

NEW RECORDS OF UREDINALES (BASIDIOMYCOTA) FROM AZAD JAMMU AND KASHMIR AND ADJACENT NORTHERN AREAS OF PAKISTAN

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A contribution is made to the rust fungus flora of AJ & K and adjacent Northern Areas of Pakistan. This work includes the survey of different areas of Azad Jammu & Kashmir (Lawat, Leepa valley and Sharda) and adjacent Northern Areas (Deosai Plains and Fairy Meadows) of Pakistan. During this survey, fourteen different host plants were found infected with thirteen rust fungi belonging to four different genera. Among these, *Puccinia chrysanthemi*, *P. cnici-oleracei*, *P. exhausta*, *P. komarovi*, *P. sibirica*, *Pucciniastrum agrimoniae*, *Tranzschelia discolor* and *U. lespedezae-procumbentis* are newly recorded from Azad Jammu and Kashmir while *Puccinia bistorta*, *P. nitidula*, *P. sibirica*, *P. swertiae* and *Uromyces vossiae* are first time reported from Northern Areas of Pakistan. Moreover, *Bistorta vivipara* for *Puccinia sibirica*, *Clematis grata* for *P. exhausta*, *Impatiens brachycentra* for *Puccinia komarovi* and *Prunus domestica* for *Tranzschelia discolor* are reported as new hosts for these rust fungi from Pakistan. In addition to the light microscopy, scanning electron micrographs have been incorporated to upgrade the previous descriptions and for correct identification of these fungi.

PPTE 23

PALYNOLOGICAL CHARACTERIZATION OF CERTAIN PAPILIONACEOUS TREES AND SHRUBS OF KAGHAN VALLEY MANSEHRA PAKISTAN

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Pollen morphology of 11 species belonging to 8 genera of family papilionaceae from Kaghan Valley, Mansehra were examined by light microscope. Pollen grains of papilionaceae are spherical, sub-spherical, sub-triangular, oblate, sub-oblate, per-oblate, prolate, tricolporate. Tectum is commonly reticulate or granulate. Sexine thicker than nexine, rarely being the same thickness.

PPTE 24

NOMENCLATURAL AMBIGUITY IN TRADED MEDICINAL PLANTS IN PAKISTAN: CASE - I GUL-E-GAOZABAN

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Gul-e-Gaozabn refers to flowers of a plant called ox tongue due to the rough, tongue shapes leaves of this plant belonging to the family Boraginaceae. Many members of which are used in native medicine around the world e.g. *Borago officinalis*, *Onosma bracteatum*, etc. Owing to the confusion existing in the literature and in the minds of Unani Herbal Practitioners a complete survey was conducted. Interviews were conducted with Crude herbal drug dealers, Unani herbal practitioners and experts of the field. A thorough literature reviews about the plants was conducted. Trade samples were analyzed and botanically identified. It was revealed that the drug known as Gul-e-gaozaban was not derived from the well-known plant *Onosma bracteatum* as mentioned over all the labels of the pharmaceutical products derived from this drug. However the drug which was found homogenous across the whole Pakistan as no adulterant and substituent was recorded is indeed derived from an Iranian Plant named as "*Echium amoenum*" well known because of its medicinal virtues. Herbal market survey also supported this finding that the drug is not indigenous or imported from India or China, infact being imported from Iran.

PPTE 25

GENETIC DIVERSITY IN INDIGENOUS SOYBEAN GERMPLASM AND ITS US ANCESTRAL LINES USING MORPHOLOGICAL AND MOLECULAR MARKERS

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Eighty one soybean lines comprising of 47 land races, 16 genotypes from NARC collection and 18 ancestral lines of US germplasm were studied for genetic diversity based on morphological markers i.e. seed shape, seed color, leaf color, leaf structure, flower color, flower position and plant structure along with molecular polymorphism against 20 RAPD primers. Chi-square test for homogeneity showed significant variability for seed shape (97.53%; round and 2.47%; wrinkled), seed color (51.85%; yellow, 19.75% green and 28.39%; black), leaf color (67.90% ; yellow and 32.10%; green) leaf structure (74.07%; narrow and 25.92%; broad), flower color (72.84%; white and 27.16%; purple), flower position (67.90%; terminal and 32.10%; axillary) and plant structure (46.90%; dense and 53.10%; less dense) which indicated presence of morphological genetic diversity. On the basis of molecular studies, only six were polymorphic out of 20 RAPD primers used that showed polymorphism in 29 out of 81 genotypes. The remaining genotypes were excluded from the molecular study. Pair-wise dissimilarity matrix for each primer followed by an average was calculated using bivariate data set generated from all loci of the RAPD primers. A total of 474 loci were detected with an average of 79 loci for each primer and 16.32 loci were amplified genotype⁻¹. Cluster analysis showed that genetic diversity exists among all three groups (land races, collection from NARC and US ancestral). High level of genetic polymorphism was observed based on the six RAPD markers i.e., GLG-09, GLG-20, GLG-03, GLD-20, GLC-09 and GLD-16. A dendrogram was constructed using Unweighted Pair Groups of Arithmetic Means (UPGMA), which distinguished the genotypes into four major groups. Group-IA comprised eleven land races genotype code (6-4, F(8-4), 6-6, 6-14, 6-8, 6-9, 8-12, 18-1, 6-5, 7 and 8-7) two US genotypes (code U1 and U18) and four NARC genotypes (code 003773, 003772, 003757 and 017452). Group IB comprised of eight US genotypes (code U6, U7, U10, U14, U17, U15, U8 and U13). Group-IIA comprised of one US genotypes (code U2) and one land races genotype (code 8-19). Group-IIB comprised of one US genotype (code U4) and one NARC genotype (code 003782). Based on molecular study soybean genotypes code 8-7 (land races) and U14 (US genotype; Ral soy) showed maximum genetic distance. This information can be utilized for genetic analysis, genotype identification from different sources and development of improved germplasm.

PPTE 26

MEDICINAL FOLK REMEDIES OF VEGETABLES

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Vegetables are the source of medication for preventive, curative, protective or primitive purposes. In this study, the use of medicinal vegetables and their role to treat different diseases has been observed. In this study twenty six vegetables belonging to 12 families; were investigated for various disorders. They were used for their preventive and curative properties. These vegetables, apart from their roles as food additives and supplements, they may also be utilized as effective and cheap source of antibacterial, antiviral, antifungal. Anti protozoal, anti-inflammatory, antidiabetic and antitumourgenic agents for the treatment of various infections. These vegetables include cruciferous vegetables, *Trigonella foenum-graecum*, *Abelmoschus esculentus*, *Solanum melongena*, *Momordica charantia*, *Lycopersicon esculentum*, *Allium cepa*, *Momordica tuberosa*, *Zingiber officinale*, *Spinacia oleracea*. *Daucus carota* and *Allium sativum* are the most important vegetables; while *Cucurbita pepo*, *Colocasia esculenta*, *Ipomoea batatas*, *Beta vulgaris*, *Phaseolus vulgaris*, *Brassica rapa*, *Raphanus sativus*, *Brassica oleracea*, *Cucumis sativus*, *Cucumis melo*, *Cucumis callosus*, *Ocimum gratissimum*, *Telfairia occidentalis* and *Solanum tuberosum* also play an important role in the treatment of different types of diseases. The study recorded that *Allium sativum*, *Spinacia oleracea* and *Daucus carota*, are the most relevant vegetables used in the treatment of various diseases while *Cucumis melo*, *Ocimum gratissimum*, and *Telfairia occidentalis* are less relevant vegetables. It was revealed that an intake of about 280 grams of vegetables per day per person is considered essential for maintenance of good health. Of this, leafy vegetables should constitute 40 percent, roots and tubers 30 percent and the other vegetables like brinjals, ladies finger the remaining 30 percent.

PPTE 27

GENETIC DIVERSITY IN PUMPKIN GENOTYPE: FIRST REPORT FROM PAKISTAN

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The wealth of genetic diversity in 30 genotypes of Pumpkin, collected from unexplored mountainous areas of Khyber Pakhtunkhwa, Pakistan was investigated through biochemical characterization. For biochemical characterization, Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis was carried out. The seed protein was resolved on 7.5% and 15% polyacrylamide gel. A total of 35% genetic disagreement was observed in the collected lines with linkage distances ranging from 0.00 – 0.83 (percent disagreement). Similarly, cluster analysis sorted total germplasm on the basis of 12 bands (total bands) into eight clusters. Cluster analysis exhibited moderate level of genetic diversity; to broaden the gene pool further collection of the important germplasm is needed.

PPTE 28

TRADITIONAL CULTURE AND NATURAL RESOURCE MANAGEMENT: A CASE STUDY OF BOKARWAL TRIBE IN TEHSIL SAMAHNI (AK)

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By application of participatory rural appraisal (PRA), a case study was conducted on one ethnic tribe (Bukarwals) of mountainous valley of Samahni (AK) on the interaction between traditional culture and natural management. The findings predict that at rural level, cultural beliefs, indigenous knowledge and local institutions were the major foundations of tradition resource management. The traditional management played an active in the regulating the pattern

and intensity if resource uses, and therefore conducted to maintain the environmental sustainability. Sacred sites are important to local communities for not only their cultural and social significances, but their economic and ecological functions as well. While declining of traditional culture has been one of the major causes of biodiversity loss in the past decades, environment destruction has in turn accelerated erosion of local culture. There is coexisting relationship between cultural and biological diversities. They do take imperative steps to preserve and conserve the fauna and flora. Informant consensus factor (ICF), fidelity level (FL) and data matrix ranking (DMR) were used as micro-statistical tools for analysis of gathered informations and results were justified by comparing previous findings.

PPTE 29

ETHNOBOTANICAL STUDIES ON PLANT RESOURCES OF KUKMONG, DISTRICT ABBOTTABAD

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Ethnobotanical studies were conducted in Union Council Kukmong of District Abbottabad from March 2011 to October 2011. The results revealed that 40 plant species belonging to 29 families are ethnobotanically used by local communities. These plants were classified for their ethnobotanical and economic uses. Most of the plants possess multiple uses. Family Rosaceae (7 species), Labiatae (3 species) and Moraceae (2 species) were important families in number of species. The survey revealed that there were 18 medicinal, 15 fuel wood, 12 fodder, 9 fruit yielding, 6 veterinary medicine, 4 vegetable, 4 for making agricultural implements and 1 species is used for making roofs.

PPTE 30

VEGETATION OF RANI KOT FORT AREA: A HISTORICAL HERITAGE OF SINDH, PAKISTAN

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The investigation on the vegetation and flora of the Ranikot fort area was undertaken during 2007. Ranikot Fort Area is a historical heritage of Sindh. So far there has been no publication on vegetation of this important historic site. 40 plant species belonging to 25 genera and 29 families are identified which includes monocot, dicots and Pteridophytes. This contribution provides information on plant biodiversity of Ranikot, a natural heritage of Sindh, Pakistan. We believe the world is a rich and diverse place full of interesting cultures and people, from whom there is a great deal to learn. Area under investigation is full of diversity of life, categorized as lower plants, monocots, dicots and variety of fossil woods. This study will help to develop the flora of Ranikot. It will provide a source of information to the researchers, tourists and scholars from different fields.

PPTE 31

EVALUATION OF PHYSICO-CHEMICAL CHARACTERISTICS AND GC-MS PROFILE OF FRUITS AND SEEDS OF OMANI DATE PALM (*PHOENIX DACTYLIFERA* L).

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Fruits of the date palm (*Phoenix dactylifera* L. Arecaceae) are commonly consumed in many parts of the world and are a vital component of the diet in most of the Arabian countries. Physico-chemical characteristics of the fruits and seeds of five date palm's varieties were studied at four different stages (kimri (1st stage), besser (2nd stage), rutab (3rd stage) and tamr (4th stage). The results showed characteristic variations from one stage to another between cultivars and seasons. The weight, length and diameter of both types (fruits and seeds) increased from Kimri to Better and then followed by a slow decrease in remaining two stages (rutab and tamr). The dates showed longer dimensions and heavier

weight at the better stage. Total sugars, total reducing sugars, total phenols and total tannins of fruits increased as the date matured, while the moisture content decreased. In case of *P. dactylifera* seeds, these values increased from kimri to rutab and then decreased. The chemical composition of the essential oil of kernel at tamr stage was analyzed by Gas chromatography-Mass spectrometry (GC-MS). Thirty nine volatile compounds were identified in the four date's seeds (Khalas, Naghal, Khasab and Barni) at tamr stage. The results indicated that 9-octadecenoic acid hexadecyl ether (74.60%), dodecanoic acid (56.93%), dodecanoic acid, 1, 2, 3-propanetriyl ester (44.22%), 9-octadecenoic acid (38.85%) are the major constituents. In addition, the cultivars are also rich in fatty acids, esters, and steroids.

PPTE 32

PHYTOPHARMACOLOGY OF *NEPETA CLARKEI*

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Pakistan has a unique biodiversity due to a variety of climatic zones ranging from sea level to 8611 m high altitudes. It has been bestowed by more than 6,000 species of higher plants, out of which more than 10 % are reported to have medicinal properties. The chemical constituents of *Nepetaclarkei* (Lamiaceae) has been previously reported to possess antimicrobial and antioxidant activities [1]. In our study, we subjected the various polarity extracts of *N. clarkei* for biological and pharmacological activities and chromatographic separations. A number of secondary metabolites including six new compounds (1-6; Figure 1) [2-3] were isolated as a result of the repeated column chromatography by using various polarity solvents. Some of the extracts showed promising antiglycation, cytotoxic, phytotoxic, insecticidal, antiplatelet and antimicrobial activities; while the purified compounds showed significant analgesic, anti-inflammatory, and CNS depressant activities.

PPTE 33

ETHNOBOTANICAL PROFILE OF 100 INDICATOR SPECIES IN TROPICAL DRY DECIDUOUS FORESTS OF PAKISTAN

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Plants are the priceless gift of nature and floral biodiversity have a key role in surviving human kind. Tropical dry deciduous forests of Pakistan are one of the valuable natural resource of the country. Ethno botanical survey was recorded in summer 2007 in 11 different districts and 100 indicator species, which were indigenous woody plants (trees and shrubs), were selected from the tropical dry deciduous forest of Pakistan. Different species have different role and were used on different ways. 100% of the plants were used either as food, fodder, Silkworms feeder, pollen source for bees or may have some importance from veterinary point of view. 95 % plants were important medicinally and were used in treating different human ailments. 42% plants were important for providing different service like fencing fields, ornamental, erosion control, stabilization and nitrogen fixing, shade tree etc. similarly 90 % of the plants were important for providing different products of daily use on small scale as well as large scale. The present study is a valuable guideline for agro-forestry, forestry, silviculture, horticulture and wildlife departments.

PPTE 34

MEDICINAL PLANTS PROFILE OF MADYANVALLEY, DISTRICT, SWAT, PAKISTAN

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Medicinal plants fulfill the basic needs of present and past civilizations. Medicinal plants are natural factories that produced valuable secondary metabolites which can be used for the treatment of various ailments. The present study was carried out to investigate the Ethnobotanical uses of medicinal plants of Madyan valley, District Swat. God has blessed this valley with diverse medicinal flora. Traditionally, herbal practitioners formulate these medicinal plants as Astringent, Anthelmintic, Antipyretic, Antiseptic, Aphrodisiac, Anticancer, Antispasmodic, Carminative, Checks bleeding, Demulcent, Diarrhea, Diuretic, Dysentery, Diaphoretic, Expectorant, Emetic, Epilepsy, Emollient, Fever, Hypertension, Heart diseases, Inflammation, Kidney diseases, Laxative, Narcotics, Purgative, Rheumatism, Respiratory diseases, Sedative, Skin diseases, Stimulant, Stomach diseases, tonic and Toothache. During the studies 18 plants of the area were found to be Diuretic, 16 were used as Tonic; 14 plants each were Astringent and Carminative; 13 plants were Purgative, 12 plants used for Respiratory diseases; 11 plants as Laxative; 10 plants used for Stomach diseases; 9 each for Diarrhea, Fever and Stimulant; 8 plants each for Skin diseases and Dysentery; 7 plants each used as Narcotic, Expectorant, Heart diseases and Aromatic; 6 plants each were used for Jaundice, Anthelmintic and Emetic; 5 plants are used for Toothache, and are Demulcent; 4 plants are Antipyretic; 3 plants are Antiseptic, Sedative, Aphrodisiac, Diaphoretic, and Emollient; 2 plants each were Anticancer and Antispasmodic and used in Epilepsy; 1 plant each used for Hypertension, Kidney diseases and Rheumatism.

PPTE 35

PRELIMINARY RECORD OF PHYTOPLANKTON DIVERSITY AND ABUNDANCE ALONG BALOCHISTAN COAST

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Pakistan has considerable maritime zone, influenced by atmospheric forcing and reversing monsoons resulting in the strong seasonal variability in its oceanographic conditions and has direct or indirect impact on marine coastal communities. Phytoplankton, mainly consisted of diatom (Bacillariophyta) and dinoflagellates (Dinophyta), are primary producers and play a vital role in transforming inorganic ions to organic matter through photosynthesis in the marine ecosystem. These organisms are sensitive to change in the environmental conditions. Therefore, changes in the species composition, relative abundance, and distribution of this important community may be regarded as important indicators of a shift in the coastal ecological condition and environmental health. Most phytoplankton research in Pakistan deals with taxonomic assessment and very little information with respect to distribution and species composition is available. The present study was undertaken with an objective to record the relative distribution and abundance of phytoplankton in the coastal waters along Balochistan coast (Miani Hor, Ormara, Astola Island and Jiwani). A total 59 taxa of diatom and dinoflagellates were observed from four sites during the survey. Twenty seven diatom species in 18 genera were recorded. Dinoflagellates appeared to be slightly more diverse consisting of 32 species belonging 15 genera. Among diatoms, *Chaetoceros curvisetum* was highest in abundance followed by *Chaetoceros danicus* and *Rhizosolenia imbricata*. On the other hand, *Gymnodinium* sp.1 was highly abundant compare to other species of dinoflagellates. *Cylindrotheca closterium* and *Navicula directa* (diatoms) were observed at all four sites and only one species of dinoflagellate, *Prorocentrum micans*, was observed at all sites. Jiwani appears to be highly diverse and most productive site has high abundance and diversity of both diatom and dinoflagellates.

PPTE 36

MEDICAGO SCUTELLATA (L.) MILL.: A NEW RECORD FOR PAKISTAN

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Medicago scutellata (L.) Mill. is reported for the first from Pakistan. The detailed description, affinities and its ecology is provided in this paper.

PPTE 37

THE GENUS AGARICUS (BASIDIOMYCOTA; AGARICALES), ITS DIVERSITY AND PHYLOGENY FROM LAHORE**RIZWANA NAWAZ*, ABDUL NASIR KHALID AND MUHAMMAD HANIF***Department of Botany, University of the Punjab Quaid-e-Azam Campus, Lahore, 54590, Pakistan***Corresponding author's e-mail: rizwana_nawaz786@yahoo.com*

During present study, species belonging to genus *Agaricus* were collected from Lahore. These were characterized morpho-anatomically and by amplifying ITS1/5.8s/ITS2 region of rDNA. It revealed into 7 different species belonging 5 different sections. *Agaricus* sp. 1 (matched with *Agaricus romagnesii* with Q.C=100% and M.I=97%) and *Agaricus* sp. 2 (matched with *Agaricus xanthodermus* with Q.C=100% and M.I=92%) fall in section *Xanthodermatei*. *Agaricus* sp. 3 (matched with *Agaricus* sp. GAL3083, Q.C=99%, M.I=96%) belongs to section *Minores*. *Agaricus trisulphuratus* falls in section TRb of Tropical clade. *Agaricus bitorquis* and *Agaricus bisporus* belong to Section *Bivelares*. *Agaricus bisporus* is a new record of Pakistan. *Agaricus* sp. 7 (matched with *Agaricus heterocystis*, Q.C=100%, M.I=99%) has no placement in any of the recognized sections of this genus, thus a new section will have to be erected to accommodate it. Detailed morpho-anatomical descriptions of all included species are provided along with their phylogenetic placement inferred from Maximum Likelihood (ML) criterion.

PPTE 38

AN ANNOTATED CHECKLIST, IDENTIFICATION KEY AND ILLUSTRATION OF THE VASCULAR FLORA OF SANDY DESERTS OF PUNJAB PAKISTAN**S. NIAZ, U. YOUNIS, R. RAJA, S. SULEMAN AND A.A. DASTI***Institute of Pure and Applied Biology, Botany Department, Bahauddin Zakariya University, Multan, Pakistan*

The present work is based on the results of intensive survey and study of sandy deserts (Cholisthan, Thal & foot Hills of Sulaiman Range) flora of Punjab, Pakistan. The deserts provide suitable habitats for growing of dicots and monocots and in the arid and semi-arid areas of Punjab, the flora are restricted to sand dunes, inter dunes and near water channels like tobas, doabs. Based on field collections and study of herbarium specimens in M. H. Bokhari Herbarium, B.Z.University, Multan an updated and annotated checklist of flora is provided with an identification key and illustration of almost all species of sandy desert. Altogether 170 vascular plant species were identified from this area belonging to 115 genera and 53 families. The dicots with 137 species comprise 80% of the flora of the area followed by Monocots with 33 species comprise 20% of the flora, the largest families in the area are Poaceae (26), Fabaceae(15), Asteraceae (9) Mimosaceae, Chenopodiaceae (8) species, Molluginaceae (5), Boreginaceae, Capparidaceae, Convolvulaceae Polygonaceae Rhamaceae and Solanaceae(4) Amaranthaceae, Asclepiadaceae Euphorbiaceae Tamaricaceae and Zygophyllaceae (3). The floristic composition of the area is strongly influenced by large number of adephatic conditions.

PPTE 39

A NEW SPECIES OF SUILLUS FROM CONIFEROUS FORESTS OF PAKISTAN BASED ON MORPHO-ANATOMICAL AND MOLECULAR ANALYSIS**S. SARWAR*, A.N. KHALID AND B. DENTINGER***Department of Botany, University of the Punjab, Quaid-e-Azam Campus, Lahore, 54590, Pakistan***Corresponding author's e-mail: samina_boletus@yahoo.com*

Suillus helypedensis sp. nov. (Fungi, Basidiomycota, Suillaceae) is described as a new species from coniferous forests of Pakistan based on morphological and molecular analysis. A description, illustrations, phylogenetic analysis and comparison with related taxa are presented.

PPTE 40

MORPHO-PALYNOLOGICAL STUDIES OF CERTAIN PLANTS BELONGING TO THE GENUS SOLANUM FROM ABBOTTABAD, PAKISTAN

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Certain plants belonging to genus *Solanum* growing in Abbottabad have been studied palynologically. During palynological investigation 6 species of *Solanum* belonging to family Solanaceae have been studied. Solanaceae is a eurypalynous family. Grains usually 3 (4) colporate, radially symmetrical, isopolar, prolate-spheroidal to oblate-spheroidal to oblate spheroidal to sub-prolate to per prolate or suboblate to oblate, size range: 8.55 - 72 µm and circular, semiangular or subangular, aperture drop type, labrum common type, exine usually 2 µm thick, nexine 1-1.5 µm thick. Tectum usually psilate, sexine reticulate, granulate or striato-reticulate, usually with OL or obscure pattern, 1-2 µm thick, nexine 1-1.5 µm thick. Most striking variation is found in the shape class, aperture type and tectal surface. The brief characteristic features of genus *Solanum* described in this work have been tabulated in Table-1. However the grains of this family which are usually tricolporate have direct relationship with the certain members of Scrophulariaceae.

PPTE 41

ANTIFUNGAL ACTIVITY OF BERBERIS ARISTATA DC. EXUDATE (RASAUNT) COLLECTED FROM LOCAL MARKET OF LAHORE, PAKISTAN

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Berberis aristata DC. is an important medicinal tree. Shoot exudates of this tree are extensively used in herbal medication which is imported in Pakistan from India. In the present study aqueous, methanol and n-hexane extracts from the *Berberis aristata* DC shoot exudate collected from local market of Pakistan were tested for their antifungal activity against *Fusarium solani* and *Aspergillus niger*. Different concentrations viz; 1, 2, 3, 4 and 5% of aqueous, methanol and n-hexane extracts were used in this study. 5% concentration of methanol solvent shoot extract significantly ($p < 0.05$) reduced the *Fusarium solani* growth by 87.3% and that of *Aspergillus niger* by 15.3%. The concentration of 5% of aqueous shoot extract reduced the *Fusarium solani* growth by 91.5% and in *Aspergillus niger* reduced the fungal growth by 47.2%. 5% concentration of n-hexane solvent shoot extract reduced the growth of *Fusarium solani* by 82.5% but it was found less effective in case of *Aspergillus niger* as compared to other solvents. Phenol analysis was done by Folin-Ciocalteu method. N-hexane solvent extract was found to have significantly lowest phenolic concentration as compared to other solvents. Thus phenol could be responsible for the inhibition of the tested fungal pathogen.

PPTE 42

PHYTOCHEMICAL ANALYSIS AND DETERMINATION OF MEDICINAL POTENTIAL OF ORGANIC KITCHEN WASTE

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Waste utilization is always an attractive idea for environmental scientists and pollution monitoring agencies. According to some reports approximately 400-500 grams of organic waste, including peels of fruits and vegetables, is generated per person per day. So many ideas are put forth to utilize this waste for the benefit of mankind, among which includes, conversion of this waste into biogas, its uses in pharmaceuticals, cosmetics, textile, and paper industries etc. Keeping this in view, the present study was designed to identify the medicinal potential of organic kitchen waste. We targeted peels and waste of fruits and vegetables commonly used in our country, for determination of phyto-chemistry.

Different bio-assays were employed including antibacterial, antifungal, antitumor and antidiabetic activity to assess the medicinal potential of waste produce in kitchen. Results revealed that some vegetables wastes, like green leafy waste of cauliflower, peels of radish, sweet lime, oranges, peas, pomegranate and bananas, which are otherwise considered useless, are rich in phytochemicals and exhibit antimicrobial activity against some pathogenic bacteria and fungi. However peels of radish and citrus exhibited antidiabetic activity while rest of material used had no effect on glucose level of experimental mice. In conclusion, the daily waste material produce in our kitchen have potential for being used in pharmaceuticals

PPTE 43

DOCUMENTATION OF FLORAL DIVERSITY OF BANJOSA GAME RESERVE OF AZAD JAMMU AND KASHMIR

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Banjosa (33° 48' 38" N, 73° 48' 59" E) is a small village (Tehsil Rawalakot, District Poonch) in State of the Azad Jammu and Kashmir (AJK), located midst thick forests of tall trees at an altitude of some 1,800 m above sea line in the Pir Panjal Range, constituting a part of the western extremities of the Great Himalayan Mountains. In 2005 it is declared as Banjosa Game Reserve (BGR) by the government of AJK. The primary target of a game reserve is the maintenance, conservation and restoration of one or more target species of animals or plants and its habitat. The detailed survey of flora of the reserve areas was carried out to assess the plant diversity and its documentation. The total area was divided into different transects and plants were collected. After identification, herbarium of each sample was prepared and kept in the museum of Bioresource Research Centre, Islamabad. Total of 116 species were identified, belonging to 46 families, 97 different genera. These 116 species include the vascular plants, tree, shrubs and herbs. There are considerable number of representatives of classes, gymnosperms and angiosperms. In conclusion approximately 20 km area of BGR has diversity in flora.

PPTE 44

PALYNOLOGICAL EVIDENCE OF PTERIDOPHYTIC PLANT COMMUNITIES IN LATE PERMIAN (DZULFIAN) DEPOSITS, WESTERN SALT RANGE, PAKISTAN

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Dzulfian deposits in the Salt Range, Pakistan are represented by the Chhidru Formation. These sediments are of extreme importance for being at the junction of Permo-Triassic boundary and are predominantly calcareous sandstone along with a sporadic sandy limestones, feldspar, muscovite, biotite and iron oxide. The palynological study from the top most ten beds (51-60m from the base) at the type locality (Chhidru Gorge Section) of Chhidru Formation was carried out which revealed a substantial proportion of pteridophytic spore assemblages in addition to pollen and spores belonging to other plant groups. Present paper deals with the trilete and monolete miospore genera including *Calamospora*, *Punctatisporites*, *Lophotriletes*, *Densoisporites*, *Laevigatosporites* and *Lunulasporites*. Recovered palynogenera are systematically described and discussed along with their possible plant affinities. The proportion of miospores in the whole recovered palynoflora suggested the existence of shade lover Pteropsids, Sphenopsids and Lycopsids in considerable numbers. Shallow marine environment was suggested during the depositional phase of Late Permian.

PPTE 45

TRADITIONAL ETHNOBOTANICAL USES OF HALOPHYTES COLLECTED FROM KATLANG REGION DISTRICT MARDAN, PAKISTAN

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The present study documented the traditional knowledge of medicinal halophytes of District Mardan (altitude of 400 to 1,700 m.a.s.l in 34° 05' to 34° 32' North latitudes and 71° 48' to 72° 25' East longitudes) Khyber Pakhton-Khwa (K.P.K), Pakistan. The varied climatic conditions in the area have resulted in a rich diversity of flora including halophytic species. The total of 31 halophyte species have been documented belonging to 14 families. Chenopodiaceae was recorded the dominant family with 8 species followed by Solanaceae and Asteraceae with 4 and 3 species respectively. Asclepiadaceae, Mimosaceae, Rhamnaceae, Zygophyllaceae and Poaceae each have 2 species. About 27% species has been used as blood purifier, 13% species are Painkiller, 13% are laxative whereas 22% species specially used as fodder. 11% species in the remaining has been used against asthma, 08% species used against ulcer while, 06% species including Suaeda fruticosa and Salicornia virginica have been used in soap industry. Carthamus oxycanthas and Haloxylon salicornicum has been used as a source of oil. The area is investigated for the first time and information about the traditional remedies were collected and documented. The cultivation and conservation of such natural resources may result in sustainable maintenance and utilization of these plants wealth and uplift the socio-economic status of the people.

PPTE 46

PRODUCTION POTENTIAL OF ECONOMICALLY IMPORTANT MEDICINAL AND AROMATIC PLANTS IN BALOCHISTAN, PAKISTAN

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Balochistan has great diversity of medicinal and aromatic plants (MAPs) due to diverse agro-ecological zones and climatic conditions. However, due to over-exploitation, un-controlled grazing and removal of vegetation the MAPs are mostly confined in protected areas or areas inaccessible to grazing and collection. Over- exploitation of MAPs in Balochistan caused serious threat to the survival and re-generation of many plant species. The present production of naturally occurring MAPs is not sufficient to meet the herbal industry demand on sustainable basis. Exploring the cultivation potential of MAPs in suitable ecological zones and conservation of naturally occurring MAPs in their natural habitats are some of the options to meet the country's demand. Despite, MAPs play a very important role in the livelihood of the rural community, little integrated research and development efforts have been taken for the promotion of this sector. The research and development activities on MAPs were initiated at Arid Zone Research Centre, Quetta by establishment of MAPs garden for research and demonstration, evaluation and identification of suitable genotypes/lines varieties of MAPs of commercial importance, registration of varieties/cultivars with Federal Seed Certification and Registration Department, development of package technology keeping in view the WHO guidelines and its demonstration and testing at farmers field. The available MAPs germplasm can be classified into four main groups: culinary herbs, medicinal herbs, perfumery herbs, and herbal teas. Germplasm of (*Carum copticum*, *Linum usitatissimum*, *Anethum sowa*, *Cuminum cyminum*, *Nigella stavia*, *Foeniculum vulgare*) was evaluated for various growth parameters and yield potential in Balochistan. Based on adaptability and yield potential one line each of these species has been selected. The selected white Cumin line has great demand due to high yield, aroma and disease resistance than the local cumin seed. The Fennel seed yield ranged from 1500 to 2000 kg/ha and Kalonji seed yield ranged from 800 to 1000 kg/ha. Herbs like Thyme, Oregano, Rosemary, Marjoram, Tarragon are some of the common culinary herbs in the world and also available in various markets of Pakistan. Production potential of these herbs were evaluated in various trials and results are very encouraging. These herbs can successfully be grown in various parts of Balochistan. AZRC has also launched the marketing of culinary herbs (Rosemary, Thyme and Oregano), herbal tea (German Chamomile, English Thyme) and Mint herbal mouthwash. Further integrated efforts of various sectors are required to promote MAPs conservation, cultivation, marketing, mechanized harvesting/flower picking, drying/storage techniques and cultivation practices in the existing cropping patterns.

PPTE 47

HEALTH-GIVING FLORA AND ETHNOECOLOGICAL KNOWLEDGE IN THE WESTERN HIMALAYAS: THE NARAN VALLEY PAKISTAN

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Mountain ecosystems all over the world support a high biological diversity and provide a home and services to some 12% of the global human population, who use their traditional ecological knowledge to utilise local natural resources. The Himalayas are the world's youngest, highest and largest mountain range and support a high plant biodiversity. Due to their remote location, harsh climate, rough terrain and topography, many areas within this region still remain poorly known for its floristic diversity, plant species distribution and vegetation ecosystem service. Naran valley in north-western Pakistan is among such valleys and occupies a distinctive geographical location on the edge of the Western Himalaya range, close to the Hindu Kush range to the west and Karakorum Mountains to the north. It is also located on geological and climatic divides, which further add to its botanical interest. In this remote mountainous region of the Himalaya, people depend upon local plant resources to supply a range of goods and services, including grazing for livestock and medicinal supplies for themselves. My research focuses on (i) assessment of medicinal plant species valued by local communities; (i) identification of traditional gradient of vegetation and knowledge. Our results demonstrate the range of ecosystem services that are provided by the vegetation and assess how utilisation of plants will impact on future resource sustainability. In present project 120 informants were asked at 12 main localities along the valley. SPSS was used for preliminary data analyses and CANOCO for gradient analyses. Results revealed that 102 species belonging to 52 families (51.5% of the total plants) are used for 97 prominent therapeutic purposes. The largest number of ailments cured with medicinal plants are associated with the digestive system (32.76% responses) followed by those associated with the respiratory and urinary systems (13.72% and 9.13% respectively). The ailments associated with the blood circulatory and reproductive systems and the skin were 7.37%, 7.04% and 7.03%, respectively. The results also indicate that whole plants are used in 54% of recipes followed by rhizomes (21%), fruits (9.5%) and roots (5.5%). The study not only contributes to an improved understanding of traditional ethno-ecological knowledge amongst the peoples of the Western Himalaya but also identifies priorities at species and habitat level for local and regional plant conservation strategies.

PPTE 48

ETHNO MEDICINAL AND PHARMACOLOGICAL INVESTIGATION OF *ARAUCARIA COLUMNARIS* HOOK. AND *CYCAS REVOLUTA* THUNB

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Pharmacological studies of plant for the exploration of biological activities play important part in science of traditional medicine. In present investigation, organic extracts (methanol, ethanol and ethyl acetate) from leaves of *Araucaria columnaris* Hook. and *Cycas revoluta* Thunb., were subjected to the potential antibacterial, antifungal and antioxidant activities. The extracts were evaluated for their effectiveness against six bacterial strains including both Gram-positive and Gram-negative bacteria using agar well diffusion method. In vitro antifungal activity of organic extracts were analyzed against three pathogenic fungal strains viz. *Fusarium moniliforme*, *Helminthosporium sativum* and *Aspergillus niger* by agar tube dilution method. The antioxidant potential of extracts was determined on the basis of their scavenging activity of the stable 1, 1-diphenyl-2-picryl hydrazyl (DPPH) free radical. It was evident that these extracts from both plants were active against the bacteria under observation at low concentrations. However maximum zone of inhibition (40.33 ± 0.66 mm) was produced by methanolic extract from *Cycas revoluta*. Significant inhibition (90%) was observed against *Aspergillus niger* in case of methanolic extract from *Araucaria columnaris*. IC₅₀ of the methanol extract of *Cycas revoluta* was 110.25 µg/ml, which indicated the strong antioxidant activity of the plant. The results obtained from preliminary analysis suggest the presence of active secondary metabolites and it is recommended that further intensive studies should be carried out to explore hidden potential.

PPTE 49

ETHNOBOTANICAL STUDY OF PLANT RESOURCES IN THE LOONIVILLAGE, TEHSIL KALLAR SYEDAN, DISTRICT RAWALPINDI, PAKISTAN

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An ethnobotanical study was conducted from April – June 2005 in the Looni Village. Main objectives of the study were to document plant resources, especially economically important plants of the area, to investigate the perception of people towards the uses of different plant species and to explore if there was any plant species under pressure from local

population by non sustainable use. Data collection involved both quantitative and qualitative measurements. Several field trips were made and an inventory of local plant species was made. Random sample of 70 local people was selected for data collection regarding uses of plants. Open ended questionnaires were used as main tool. Interviews were also conducted with some of the local informants. It was found that 74 different plant species belonging to 45 families were in use. Out of these 59 species were used as medicine, 12 plant species were used as fuel wood, 11 were used as fodder for cattle and 19 plant species were considered as food plants by the local people. Dominant families recorded were Moraceae, Euphorbiaceae, Fabaceae and Myrtaceae. Few of the plant species were noted to have multiple uses in that community and were in greater pressure.

PPTE 50

NEW RECORDS OF TRICHODERMA SPECIES FROM PAKISTAN, IDENTIFICATION BASED UPON ITS-RDNA SEQUENCING

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Trichoderma species are generally abundant in every environment because of their success in various heterotrophic interactions. Many Trichoderma species have various important applications in industry and human life, due to production of industrial enzymes. The species of this genus also have been adopted as agents of biological control of plant pathogenic fungi and as antibiotic producers. Because of the intimate relationship between Trichoderma and human activity, there is a great need for the accurate identification of Trichoderma species. For this purpose industrial effluents were collected from Kasur Tannery Water Management Agency, Kasur and from Nishat Textile Mill, Feroze Pur Road, Lahore. From these effluents micromycetes were isolated and purified on PDA and MEA. From the isolated species Trichoderma longibranchiatum Rifai, T. tomentosum Bissett and T. erinaceum are new record from Pakistan. These species have been described morphologically by cultural characterization and microscopic illustration. Proper identification has been supported by molecular method.

PPTE 51

PALYNOMORPHOLOGICAL STUDIES OF SELECTED MEDICINAL PLANTS FROM HARIPUR, KHYBER PAKHTUNKHWA, PAKISTAN

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The present study was confined to palynological studies of 20 species of 20 genera belonging to 6 families. The families were Asteraceae, Apilionaceae, Brassicaceae, Convolvulaceae, Verbenaceae, Umbelliferae. Comparative pollen analysis was based on type of pollen, shape in polar and equatorial view, polar: equatorial (P: E) ratio, length and width of colpi, exine thickness and sculpturing of pollen. Species possessed differences in the shape of either equatorial or polar views. Pollen fertility estimation ranged from 56 - 98.58%, which showed that pollen flora of selected species is well established.

PPTE 52

DIVERSITY AND PHYLOGENY OF HELVELLA (ASCOMYCOTA: PEZIZALES) FROM HIMALAYAN MOIST TEMPERATE FORESTS OF PAKISTAN

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Helvellaceae is represented by twelve species of the genus Helvella and frequently collected from Himalayan moist temperate forests of Pakistan. These species are described and illustrated morpho-anatomically and molecularly. Phylogenetic analysis has also been performed using nuclear ribosomal DNA of ITS region (ITS1–5.8S–ITS2). Out of these, three species Helvella costifera, H. fusca, and H. solitaria are first time reported from Pakistan. A key to the Helvella species from Pakistan is also provided.

PPTE 53

PHYTODIVERSITY, LIFE FORM, COMMUNITIES AND SPECIES DISTRIBUTION PATTERN IN MOUNTAIN ECOSYSTEM OF MIANDAM PAKISTAN

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Assessment of the spatial patterns of composition and distribution of species is central to understanding the health of mountain ecosystem. We investigated plant diversity and species distribution pattern in Miandam Valley in northwestern Pakistan along altitude and aspect as environmental gradients. A total of 246 species of vascular plants (168 genera and 73 families) were determined in six different vegetation zones, with Asteraceae, Lamiaceae and Rosaceae identified as dominant families. A total of 360 quadrates (60 in each zone) were taken along the altitudinal gradient and the cover and density of all vascular plants were recorded. Using phytosociological approach six plant communities were recognized; (i) *Pinus-Fragaria-Viburnum* (ii) *Picea-Viburnum-Fragaria* (iii) *Quercus-Fragaria-Viburnum* (iv) *Salix-Bergenia-Betula* (v) *Juniperus-Caltha-Poa* (vi) *Sibbaldia-Plantago-Senecio*. Index of diversity ranged from 0.76 to 3.5, species richness was 1.58 to 3.05 and degree of maturity varied from 20.75 to 45.00. Sorenson's index found 7.68 to 56.86% similarity between communities. Raunkier's life-form spectrum showed dominance of Hemicryptophytes and Therophytes, 28.45% and 22.35% respectively. In leaf size classes Microphylls were predominant with 58.94%. Nanophylls were 17.47%, Mesophylls 16.26%, Leptophylls 5.69% and Macrophylls 1.21%. The study concluded altitude, as the strongest environmental factor influencing the composition and distribution of species, with aspect also contribute significantly near the mountain peaks.

PPTE 54

STUDY OF MORPHOLOGY, ANATOMY AND CLASSIFICATION OF STOMATA IN SELECTED WEEDS

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In present study the Morphological, anatomy and investigations of stomata of the eight noxious weeds like, *Amaranthus viridis* L., *Chenopodium polyspermum* L., *Datura alba* L., *Euphorbia oblongata* L., *Oxalis corniculata* L., *Parthenium hysterophorus* L., *Sonchus asper* L. and *Xanthium strumarium* L. was carried out during April-June, 2011. Morphological features of these mentioned species were observed and recorded. Transactions of roots, stems of selected species along with their stomatal anatomy were prepared to examine under high-power microscope and photomicrographs were kept saved through digital camera facilitated through computer system. It was concluded that *Parthenium hysterophorus* L. and *Xanthium strumarium* L., which is equipped with elaborate vascular bundles both in root and stem clarify its adaptation in the severe climate of this rain fed area but because of its significant seed dispersal it is acclimatized in all the mentioned area while others like, *Amaranthus viridis* L., *Chenopodium polyspermum* L., *Datura alba* L., *Euphorbia oblongata* L., *Oxalis corniculata* L., *Sonchus asper* L., having the peculiar characteristics of a typical Mesophyte. So far as the anatomy of stomata is concerned the plants like, *Amaranthus viridis* L., *Parthenium hysterophorus* L., *Sonchus asper* L., and *Xanthium strumarium* L., have anomocytic type of stomata while others as *Datura alba* L., is well equipped with anisocytic. Likewise the *Oxalis corniculata* L., has paracytic and *Chenopodium polyspermum* L., has staurocytic type of stomata and therefore they can be adjusted in the prevailing environment easily.

PPTE 55

DRABA SHERWALII (BRASSICACEAE), A NEW ADDITION TO FLORA OF PAKISTAN**ZERQA NAWAZ^{1,2}, KALEEM ULLAH KAKAR¹, RIZWANA ALEEM QURESHI¹ AND M. ISHTIAQ¹**¹*Department of Plant Sciences, Quaid-i-Azam University, Islamabad, Pakistan*²*Department of Biology, Allama Iqbal Open University, Islamabad, Pakistan***Corresponding author's e-mail: zerqa.knawaz@yahoo.com*

Draba sherwalii Zerqa is described and illustrated as new from Gilgit- Baltistan, Pakistan. The morphological characters are aided by anatomical characters to support its position as new taxon. The relationship and distinguishing characters from its nearest relative *D. ellipsoidea* and *D. gracillima* are discussed.

PPTE 56

**ANTICANCER ACTIVITY OF GERANIUM WALLICHIANUM (GERANIACEAE)
INDIGENOUS TO WESTERN HIMALAYAS, PAKISTAN****ZIA-UR-REHMAN MASHWANI^{1,2*}, MIR AJAB KHAN², MUSHTAQ AHMAD², MUHAMMAD ZAFAR²
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The anticancer activity of methanolic extract of *Geranium wallichianum* (Geraniaceae) indigenous to Western Himalayas, Pakistan was determined with sulforhodamine B (SRB) staining assay. Human lung carcinoma (LU-1) and hormone dependent prostate carcinoma (LnCaP) cells (3×10^{-4} cells/ml) were seeded in 96-well plates and readed at 515 nm. During the anticancer evaluation of *Geranium wallichianum* six concentrations 80µg/ml, 65µg/ml, 50µg/ml, 35µg/ml, 20µg/ml and 5.0µg/ml were used. The methanolic extract exhibited IC₅₀ value of 25µg/ml against hormone dependent prostate carcinoma (LnCaP) whereas, the same extract resulted IC₅₀ \geq 75µg/ml against human lung carcinoma (LU-1). The findings of this study support that medicinal plants are promising sources of potential antioxidants and may be efficient source to prevent the pathogenesis of some diseases.

ORAL ABSTRACTS

OPPP 38

IMPACT OF SINGLE AND MIXED SPECIES INOCULATIONS ON THE GROWTH PROMOTION OF ECONOMICALLY IMPORTANT CROPS

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Pakistan is an agricultural country, where industrialization is taking place in a gradually increasing phase. Agricultural irrigation with industrial wastewater is a common practice in arid and semiarid regions and it is used as a readily available and inexpensive option to fresh water. Excess of heavy metals in water results in low crop yields, and soil deterioration occurs as well. The inoculation of pollutant-degrading bacteria on plant seed can be an important additive to improve the efficiency of phytoremediation. The aim of this study was to investigate the plant-microbial interactions between pollutants-resistant bacteria and the economically important crops. The strains used in this study were isolated from industrial wastewater of a local tannery. Three strains *Bacillus thuringiensis*, *Enterobacter* sp. and *Pseudomonas fluorescens* were used in this study. The seeds of all crops were inoculated with single species as well as mixed culture inoculations were also tested. The plants were grown in pots and plates and the growth parameters were determined after appropriate time interval. *Bacillus thuringiensis* was tested for its ability to colonize roots and to promote the growth of *Triticum aestivum*, *Helianthus annuus*, and *Cicer arietinum* alone or in combination with *Enterobacter* sp. and *Pseudomonas fluorescens*. All three strains were able to colonize the root system of crops but only *B. thuringiensis* and *P. fluorescens* promoted plant growth in single strain inoculation tests. Mixed strain inocula were less effective than single ones. Moreover, in one case, the dual strain inoculum (*B. thuringiensis* and *P. fluorescens*) did not have any significant effect on plant growth in contrast to the separate inoculation of both strains. Bacterial inoculations improved the growth of all crops. However establishment of large populations of bacterial inoculants on roots did not appear to be essential for plant growth promotion.

OPBB 32

IN SILICO PREDICTION OF REGULATORY ELEMENTS AND CORRESPONDING PROTEIN-DNA INTERACTION IN PLANT PROMOTERS

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The importance of *cis* or *trans* acting regulatory elements in gene regulation is quite obvious. Exploring these elements *in vivo* demands extensive experimentation and is time intensive. *In silico* methods of predicting these elements have been developed in this regard. In present study around 300 promoters belonging to monocots, dicots and algae were analysed through Consite tool for prediction of regulatory elements. Many putative regulatory elements of diverse functions were found in these promoters. In monocots, TATA-binding proteins (TBP), in dicots, hunchback and in Algae, aryl hydrocarbon receptor nuclear translocator (ARNT) were abundantly represented with 55, 33 and 86% respectively. It was observed that all three plant groups exhibited different families of transcription factors like basic helix-loop-helix (bHLH), basic helix-loop-helix-leucine zipper (bHLH-ZIP), Forkhead, RUNT, HOMEODOMAIN (HD)-ZIP, zinc finger (ZN-FINGER), REL, Nuclear receptor, MADS, bZIP and TATA-box. Moreover, selected transcription factors were explored through HADDOCK Webserver to predict possible interactions between their corresponding regulatory elements. It was observed that hydrogen bonds were mostly involved in these interactions. In addition, Lysine and Arginine were mainly found to be associated in establishing these interactions with thymine base.

OPPE 42

**ANATOMICAL ADAPTATIONS OF *CYNODON DACTYLON* (L.) PERS.
FROM THE SALT RANGE (PAKISTAN) TO SALINITY STRESS.**

II. LEAF ANATOMY

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Leaf anatomical modifications were examined in a naturally adapted salt tolerant population of *Cynodon dactylon* (L.) Pers., collected from a heavily salt affected soil in the vicinity of a natural salt lake, Uchhali Lake, in the Salt Range of the Punjab province of Pakistan. An ecotype of this grass was also collected from a normal non-saline habitat from the Faisalabad region, which was considered as a control. Both populations were subjected to salt stress in hydroponics. The salt treatments used were: control (no salt), 50, 100, 150 and 200 mM of NaCl in Hoagland's nutrient solution. After eight weeks of growth in hydroponics leaf and leaf-sheath anatomical characteristics in the differently adapted ecotypes were studied. The ecotype from the Salt Range was much better adapted to salt stress than its counterpart from the Faisalabad region. Anatomical adaptations in the salt tolerant ecotype to saline environments were very specific, and these were not only for the excretion of toxic ions but also accumulation of ions in the parenchymatous tissue. The prominent adaptive features in the salt tolerant ecotype were increased development of vesicular hairs for the exclusion of toxic ions through leaves as well as less affected parenchymatous tissue (mesophyll, bundle sheath, and bulliform cells) due to salt stress. Additionally, some adaptations reflected were the development of xeromorphic characteristics (decreased stomatal area and size on adaxial leaf surface, less affected epidermis, increased bundle sheath, and increased bulliform cell area) essential for checking undue water loss. Highly developed dermal tissue, particularly lower epidermis and bulliform cells, and decreased stomatal density and area in the salt tolerant ecotype seemed to be crucial for checking undue water loss under critical limited moisture environments.

OPTE 34

**ECONOMIC EVALUATION OF SOME PLANT RESOURCES FROM NEELUM VALLEY
AZAD JAMMU & KASHMIR (AJ&K)**

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Neelum valley (NV), Azad Jammu & Kashmir (AJ&K) was surveyed for the study and documentation of economic plants. The study employed common ethnobotanical methods including field observations, informant consensus factor (ICF), fidelity level (FL), data matrix ranking (DMR) and preference ranking (PR). Information collected from 100 informants was documented using rapid rural appraisal (RRA) method and visual appraisal approach (VAA). In this study, 58 economic plants of 52 genera and 38 families were documented, collected and identified to support the data. The leading family was Asteraceae (6 spp.), followed by Fabaceae, Fagaceae, Lamiaceae and Pinaceae (3 spp. each). The most common used parts were leaves (25.81%) followed by whole plant (16.13%), root and bark (12.90% each), fruit (10.75%), seed (6.45%), wood and flower (5.38% each), aerial parts (3.23%) and stem (1.08%). The economic use categories with relatively higher ICF values were medicinal and fuel (0.67% each), followed by construction (0.58%), fodder (0.37%), furniture (0.25%), vegetable (0.4%), veterinary (0.2%), ornamental (0.1%), and roof thatching (0.03%). The economically important plants with higher FL value were *Saussurea lappa*, *Aconitum chasmanthum*, *Ajuga bracteosa*, *Bistorta amplexicaulis*, *Geranium wallichianum*, *Jurinea dolomiaea*, *Cedrus deodara* (FL 100%). DMR results showed that *C. deodara* stood first being the most multipurpose medicinal plant, followed by *Quercus incana*. *C. deodara*, *Q. incana*, *S. lappa*, *A. bracteosa*, and *G. wallichianum* are under considerable biotic pressure due to extensive use in different life sustaining processes. In PR, informants ranked fuel (20.39%) as the leading threat to the floral diversity that results in biotic disturbances and deforestation. It was followed by construction (19.74%), timber

(18.42%), grazing (17.76%), urbanization (12.50%) and fire (10.53%). The ranking of threatened economic plants indicated that *S. lappa* is the most threatened followed by *A. chasmanthum* and *Abies pindrow*.

POSTER ABSTRACTS

PPBB 89

MARKER TRAIT ASSOCIATION FOR DROUGHT TOLERANCE IN HEXAPLOID WHEAT (*TRITICUM AESTIVUM* L.) GERMPLASM

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Plant productivity is greatly influenced by environmental stresses. Under stressful condition, plants develop a plethora of biochemical and molecular mechanisms to cope with new situations that causes expression of several genes by signal transduction, associated with stress tolerance. Plant osmotic stress responses are associated with changes in gene expression due to environmental stresses like drought, salinity and low temperature. Present study focused the DNA fingerprinting of wheat germplasm of different genotypes viz Local Genotype, Mapping Population, Synthetic and NIBGE on the basis of polymorphism. Amino acid proline is known to occur widely in higher plants and normally accumulates in large quantities in response to environmental stresses. In addition to its role as an osmolytes for osmotic adjustment, proline contributes to stabilizing sub-cellular structures (e.g. membranes and proteins), scavenging free radicals, and buffering cellular redox potential under stress conditions. Biochemical estimation of proline was done by spectrophotometric method. Root/Shoot ratio was enhanced in the drought affected genotypes. Proline promoted a positive effect in wheat germplasm under drought stress. For DNA fingerprinting studies, 45 SSR primer pairs of Ksum series were tested for polymorphism among different genotypes. The dendrogram results have shown the genotype association with the levels of proline during induced drought stress. The relationship between pattern of drought responsive biochemical attributes and DNA markers in the selected wheat genotypes was established with recommendation to select drought tolerant genotypes for sowing in drought affected areas.

PPBB 90

PROXIMATE, MINERAL AND FATTY ACID PROFILE OF LINSEED (*LINUM USITATISSIMUM* L.)

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Linum usitatissimum is commonly known as flax is very nutritious and highly suitable crop for medicinal and industrial uses. It is one of the renowned oil-seed crops in Pakistan. The proximate analysis of seeds was 8.03% moisture content, 3.33% ash content, 48.3% crude fat, 21.29% crude protein and 5.8% crude fiber. The zinc (Zn), Copper (Cu), iron (Fe), manganese (Mn), calcium (Ca), and magnesium (Mg) were determined by Atomic Absorption Spectrophotometer, sodium (Na) and potassium (K) by Flame Photometer and phosphorus (P) by Spectrophotometer. Some fatty acids: palmitic acid, Stearic acid, oleic acid, linoleic acid and linolenic acid, in plant seeds were determined. Gas chromatography methods were used for their determination. The results revealed that flaxseed contained ash (3.33%), crude protein (21.29%), crude fat (48.8%), crude fiber (5.88%) and moisture (8.03%). While the mineral determination gave the data that flaxseed contained Zinc (55.41 mg/kg), Copper (35.83 mg/kg), Iron (98.79 mg/kg), Manganese (54.66 mg/kg), Calcium (8016.6 mg/kg), and Magnesium (2466.6 mg/kg), sodium (671.5 mg/kg), Potassium (1409.5 mg/kg) and Phosphorus (1011.5 mg/kg). This study concluded that the tested flaxseed contained highest amount of protein and fats similarly, among minerals the tested flaxseed contained highest amount of K, P, Ca, and Mg whereas Na, Zn, Cu, Fe and Mn have lowest values. Fatty acid analysis revealed that seeds were rich with i.e. Stearic acid and Linolenic acid. The seeds of flaxseed serve as good supplements for some nutrients and minerals which are in a suitable amount. Whole flaxseed is a good source of oil, protein and dietary fiber as well as the Phytochemical antioxidants; lignin content. It is rich in Poly-unsaturated fatty acids (PUFA), practically linoleic acid and α -linolenic.

PPBB 91

**ISOLATION OF ACTIN AND GAPDH PARTIAL GENES FROM
NIGELLA SATIVA & *CAPSICUM ANNUM*****IRAM ZOVIA, MARIA MOHYUDIN, AND MUHAMMAD JAVID IQBAL* AND AMER JAMIL***

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Medicinal plants have contributed hugely medicine field, through providing ingredients for drugs or having played central roles in drug discovery. *GAPDH* and *Actin* genes were isolated from *Nigella sativa* and *Capsicum Annum* as these housekeeping genes were used as an internal control in gene expression studies. *Nigella sativa* and *Capsicum annum* are potent medicinal plants having good source of phenolics, antioxidants, carotenoids, phytochemicals. In plants, *Actin* cytoskeleton participates in the cell division, cell elongation, cell wall development, transport processes, and in programmed cell death. *GAPDH* exhibits a number of activities including phosphotransferase activity, DNA replication and DNA repair. DNA was extracted from *Nigella sativa* and *Capsicum annum* by CTAB method and PCR amplification was performed by using universal primers. Successful amplification of the *Actin* and *GAPDH* genes were achieved at 10 μ moles primer and 2 mM $MgCl_2$ concentration on 100 bp for *Nigella stiva* and *Actin* gene of 375 bp and *GAPDH* of 100 bp for *capsicum annum*. Outcome of the study has important implications in the study of gene expression and regulation in the plants.

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