Pak. J. Bot., 15 (2): 93--98. 1983.

ECOLOGY OF A DRY STREAM BED IN PESHAWAR, PAKISTAN

S. M. CHAGHTAI AND HABIB-UR-RAHMAN KHATTAK

Department of Botany,
Islamia College, University of Peshawar,
Peshawar Pakistan.

Abstract

The dry stream offers a variety of habitats depending on the availability of moisture and the extent of biotic disturbance. A greater proportion of the inhabiting plants comprises of the annual weeds of winter crops. The moist sites are invaded in early winter. After the winter rains, only the deep-rooted species survive along the water course. On raised and gravel-excavated sites, only those species thrive which either resist or evade drought. All the sites do not seem to differ much floristically.

Introduction

This work aims at studying the ecology of a seasonal stream bed, primarily focusing attention on the sequence of changes occurring in winter vegetation. Peshawar lies in semi-arid to sub-humid, sub-tropical zones and the vegetation infact does show the effect of this particular type of climate (Naqvi, 1974). At places, the microclimatic differences have imparted a Mediterranean tinge to the vegetation. The dry stream bed supports a vegetation which differs considerably from the vegetation typical of Peshawar. With the inerease in population, new settlements are being made on the banks of the stream which increases the intensity of disturbance resulting in the change of vegetation. Keeping this fact in view, an attempt has been made to place the vegetation of this fast-changing area on record so that it may later be used on one hand for estimating the extent of disturbance made by man and his domestic animals and, on the other, for reference purposes.

'Narai Khwar', which in Pashto language means a small dry stream, lies west of Peshawar University at a distance of about 0.5 km and spans between 33° 55' and 34° north latitude and 71° 15' and 71° 30' east longitude. The seasonal stream originates from among the dry hills of Targi-sar and Gandah Gallah the elevations of which are 1595 m and 1219 m respectively. These hills lie 27 km southwest of Peshawar and belong to Hindu Kush mountain range. The 'Khwar', on its way down the hills, passes through the tribal areas of Malak Din Khel, Kamari and Qamber Khel, then flows through Peshawar

valley and finally enters a tributary of Kabul river at village Pir Bala, about 6 km northwest of Peshawar. On its way down, it runs a distance of about 33 km. The width of the stream bed differs at places and ranges between 90 m to 250 m. As it passes through a number of villages the extent of disturbance, because of grazing in spring and excavation of gravel, becomes more and more significant.

The area of study stretches over about 5 km and is located northwest of Peshawar University lying between Hyatabad town and village Palosai.

Materials and Methods

Eight stands covering about 5 km length of dry stream were selected for sampling. The vegetation was sampled in 25 x 50 cm quadrats laid systematically. Daubenmire's method was employed for determining canopy-coverage (Daubenmire, 1959). The number of plants of different species in a quadrat was also recorded. The density, canopy-coverage, frequency and their relative values were calculated.

The nomenclature followed in this work is that of Stewart (1972). The data, on which this work is based, was collected in the latter half of April, 1979.

Results and Discussion

The dry seasonal stream offers a variety of habitats depending on the availability of moisture and the extent of disturbance caused by the excavation of gravel. There exist three different groups of plants depending upon the type of habitat. The slightly raised sites, which come under water during the period of rains alone, are comparatively richer in clay proportion of the soil and support plants with strong tap roots. The sites which are regularly being excavated for gravel and hold moisture for a short period of time after rain, support scanty vegetation which is frequently being disturbed by gravel hunters. The plants inhabiting these sites either resist drought by developing roots which penetrate deep into the soil and continue absorbing water from deeper horizons of soil long after it ceases raining or evade drought by short-circuiting their life cycles. A smaller portion of stream bed which never exceeds more than two meters in width and is slightly deeper than the previous two sites has got water trickling for some part of the year especially when the collection and washing of the gravel is at its peak. This is the area which supports most of the mesophytes. The winter vegetation appears much earlier on it than the two other habitats largely because of the availability of moisture. These three habitats do not occupy larger areas, rather they comprise small patches forming a mosaic of habitats.

Of the total precipitation which Peshawar receives, about 52 percent takes place between February and April (Chaghtai *et al.*, 1978). Most of the plants inhabiting the

dry stream bed are early winter therophytes. The source of seeds seems to be the nearby crop fields and it is because of it that a greater proportion of the vegetation comprises crop weeds. During heavy rains, the stream is flooded with water and the vegetation remains submerged for several hours during each downpour. The shallow-rooted species are washed away by water currents. The gravely soil fails to retain moisture for a longer period of time. With the onset of summer, the amount of rainfall declines and the soil gradually becomes depleted in moisture. The deep-rooted species alone manage to obtain water from deeper layers of soil for sometime. High temperatures in June and July further accelerate the loss of water by evaporation from soil. By this time, most of the annuals complete their life cycles and reach the seed stage for tiding over the harsh and comparatively drier summer of Peshawar.

Floristic differences in the vegetation were of low magnitude. The mean number of species per stand was 12.625 ±.

Medicago polymorpha is the leading dominant in seven of the eight stands sampled (Table 1). The remaining one stand is dominated by *Calendula arvensis* with *M. polymorpha* as co-dominant. Besides these, some of the species which are co-dominants in different stands are *Herniaria hirsuta, Malcolmia africana* and *Hordeum leporinum* but their importance values are far lower than the dominants. In addition to dominants and co-dominants, the other species fail to give a significant impression which is quite clear from their markedly low importance values. The shallow root system, which is of no help to these plants in coping with the high speed water currents during winter rains, may largely account for their failure to establish well in any habitat. The shallow-rooted pioneers are washed away by winter rains and the plants of this category recorded in the study area at the time of sampling in April, belong either to second string of pioneers or the remnants of the vegetation left on raised sites.

The plants which appear even before the first showers of winter are *Aristida cyanantha, Chenopodium album, Medicago polymorpha, Notoceras bicorne, Polygonum plebejum* and *Solanum surattense.* Of the five pioneers, *P. plebejum* and *S. surattense* are perennials; the remaining are annuals and make their first appearance in moist places and it is from here that they reach the other habitats. *M. polymorpha* invades the moist sites quite early in winter. Later, it spreads from here to the other two habitats and there it persists for a longer period of time. *M. polymorpha* is an annual weed of winter crops and possesses a shallow tap root system and thus cannot withstand high speed water currents (Luthra, 1933). It is a seral plant; has got a wider ecological amplitude and grows in many types of soils (Ibrahim, 1968). The small and light seeds are easily carried by rain water (Luthra, 1933) and the species spreads rapidly along the water courses. The two co-dominants namely *H. hirsuta* and *Calendula arvensis* invade the area late in winter. The presence of *C. arvensis,* an annual weed of the crops of the cold season, may largely be attributed to sandy soil of the stream bed and the proximity of the crop fields which

Table 1. Importance values of the plants.

Species	*Stands*							
	1	2	3	4	5	6	7	8
Anagallis arvensis	–	2	–	–	–	–	–	–
Antirrhinum orontium	–	–	2	6	–	–	8	–
Astragalus scorpiurus	17	19	7	11	–	–	–	5
Aristida cyanantha	–	–	–	1	4	–	6	–
Boerhaavia coccinea	–	–	4	–	–	–	–	–
Calendula arvensis	52	19	30	27	108	36	59	18
Chenopodium album	2	2	7	2	–	–	–	–
Conyza bonariensis	–	–	–	–	4	3	8	–
Cynodon dactylon	–	5	–	–	–	–	15	-
Filago hurdwarica	–	4	16	5	15	18	–	–
Herniaria hirsuta	20	26	53	46	39	33	13	29
Hordeum leporinum	18	16	7	7	–	–	–	59
Koelpinia linearis	–	–	2	1	–	–	–	–
Lamarckia aurea	–	–	–	1	–	–	–	–
Malcolmia africana	32	19	12	21	24	70	–	25
Medicago polymorpha	108	102	108	108	85	85	127	106
Notoceras bicorne	17	22	32	18	4	11	23	19
Plantago ciliata	14	14	22	7	4	–	–	9
P. ovata	5	17	10	20	–	20	–	9
Polygonun plebejum	–	19	2	11	–	24	48	–
Setaria glauca	2	–	–	–	–	–	–	–
Silene conoidea	–	–	–	4	–	–	–	14
Silybum marianum	–	3	–	–	–	–	–	–
Solanum surattense	2	7	–	–	–	–	8	–
Spergula pentandra	–	–	–	–	4	–	–	–
Trigonella incisa	9	15	–	–	–	–	–	–
	13	*17*	*15*	*17*	*10*	*9*	*10*	*10*

serve as a source of seeds (Luthra, 1933). It has got a strong tap root system and once it reaches the area it gets itself firmly established. *H. hirsuta,* an annual winter weed, was found to be abundant on gravely dry places (Bhopal & Chaudri, 1977; Stewart, 1958). It is present in all stands primarily because of its capability of thriving in xeric conditions. *Polygonum plebejum,* a perennial weed of cultivated and waste places, invades the moist edges of the water channels and persists on the edges even when the habitat has gone dry (Kashyap & Joshi, 1936; Stewart, 1972). *Chenopodium album,* a fast growing annual weed, was observed in four stands only. Contrary to its liking for sandy soil, it was largely reported from moist places (Jafri, 1966). It escapes rigours of moisture and temperature reigns by passing into seed stage (Crafts & Robbins, 1962). It establishes itself near water courses early in winter and persists there because of its strong tap roots (Luthra, 1933); whereas on other sites it does move but is soon wiped out either by water currents or gravel hunters.

The xerophytic species such as *Solanum surattense* and other plants which can tolerate drought for a longer period of time appear on dry and gravel-excavated sites. The clay-rich raised areas retain moisture for a longer period of time and thus support the plants possessing extensively developed root systems which help them in absorbing water from deeper horizons of soil and also resist the high speed water currents. This vegetation need not short-circuit its life cycle and rather enjoys normal life span.

Boerhaavia coccinea, a perennial plant of dry sandy places, which flourishes well in summer (Bhopal & Chaudri, 1977), was observed in one stand only. With the approach of summer, it starts sprouting from root stocks which persist in the soil during severe winter when the above-ground parts of the plant die because of low temperature (Luthra, 1933). At the time of sampling the temperature was still low and it was because of this that *B. coccinea* could not sprout except in a place or two.

Aristida cyanantha, a grass of exposed places occurred at two sites and its presence is largely due to its fondness for gravely soil (Salim & Shahid, 1973). *Cynodon dactylon* occurred in raised sites and was totally missing from very dry places. *Hordeum leporinum* invades the area quite late after the winter rains when sufficient moisture has accumulated. The short-lived grass completes its life cycle with the advent of summer when the soil moisture is almost exhausted (Salim & Shahid, 1973). *Trigonella incisa* appears first near the water courses and spreads rapidly but is soon washed away because of its shallow fibrous roots (Luthra, 1933). *Plantago ovata* and *P. ciliata,* like other plantains, are believed to be associated with grassland communities (Sagar & Harper, 1960) and have been noticed from six stands each. They are largely confined to dry places because of their tolerance to high temperature and low moisture conditions (Stewart, 1958). *Conyza bonariensis* is a perennial weed of winter crops and has been noticed in three stands only. The plant with its shallow tap root system could not withstand the fast flowing water and was washed away from near the water courses. It, however, persisted in slightly raised clay-

rich localities.

It was observed that *Fumaria indica, Sonchus oleraceus, Convolvulus arvensis* and *Oxalis corniculata* are the early invaders of moist places. These plants were not encountered during sampling since they were washed away by winter rains.

Floristically all the stands do not seem to differ much. The absence of some species in some stands may largely be attributed to more than one factor of which microenvironment and the biotic interference may be placed at the top of the list.

References

Bhopal, F.G. and M. N. Chaudri. 1977. Flora of Pothohar and the adjoining areas. Part I. The Centrospermae. *Pak. Systematics,* 1: 38–128.

Chaghtai, S.M., S. H. Shah and M. A. Akhtar. 1978. Phytosociological study of the graveyards of Peshawar District, NWFP, Pakistan. *Pak. J. Bot.,* 10: 17–30.

Crafts, A. S. and W.W. Robbins. 1962. *Weed Control.* McGraw-Hill Book Co. Inc., N. York. 660 p.

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. *Northwest Sci.,* 33: 43-46.

Ibrahim, K. M. 1968. Some important native browse and forage plants of northern UAR, their ecology in relation to range management. *Pak J. For.,* 18: 155-168.

Jafri, S.M.H. 1966. *The Flora of Karachi.* The Book Corporation, Karachi. 375 p.

Kashyap, S. R. and A. C. Joshi. 1936. *Lahore District Flora.* The University of the Panjab, Lahore. 285 p.

Luthra, J. C. 1933. Punjab Weeds and their Control.

Naqvi, H. H. 1974. Some observations on the vegetation of Peshawar and the Khyber Pass, Pakistan. *Biologia,* 20: 151-162.

Sagar, G. R. and J. L. Harper. 1960. Factors affecting the germination and early establishment of plantains *(Plantago lanceolata, P. media* and *P. major).* in *The Biology of Weeds* (ed) J. L Harper. Blackwell Scientific Publications, Oxford. 256 p.

Salim, K. M. and R. G. Shahid. 1973. A winter flora of Cherat Hills. Part II. *Pak J. For.,* 23: 267-282.

Stewart, R.R. 1958. *The Flora of Rawalpindi District, West Pakistan.* Frontier Exchange Press Ltd., Rawalpindi. 163 p.

Stewart,R.R. 1972. An annotated catalogue of the vascular plants of West Pakistan and Kashmir. (ed.) E.Nasir and S.I.Ali, *Flora of West Pakistan.* Unversity of Karachi, Pakistan. 1028 p.