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STUDIES ON THE CONTROL OF TOMATO DAMPING-OFF DISEASE CAUSED BY *RHIZOCTONIA SOLANI* KUHN

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Abstract

Survey of tomato fields of Hyderabad district was conducted to estimate the incidence of damping-off disease. Maximum disease incidence was recorded at Village Darya Khan Nahiyoun (65.0%) followed by Khatian Satation (60.0%) and the minimum were at Khesano Mori (35.0%). *Rhizoctonia solani* Kuhn was isolated as the predominant damping-off fungus with highest frequency (60.0%) from the over all tomato fields followed by *Fusarium oxysporum* f. sp. *lycopersici*, *Macrophomina phaseolina*, *Alternaria solani* and *Verticillium albo-atrum*. Pathogenicity test of *Rhizoctonia solani* was conducted by artificially inoculating the steam sterilized soil. The maximum number of infected plants emerged from the infested soil after 30 days of sowing as compared to 15 days of sowing. The overall disease incidence was 63.63% from artificially infested soil whereas 13.33% was observed in un-inoculated soil. Four fungicides viz., Topsin-M, Benlate, Copper oxychloride and Derosal were applied as soil drench. Topsin-M significantly increased the germination, number of plants and plant growth followed by Benlate, Copper oxychloride and Derosal.

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the important sources among all the vegetables through out the world. It originated in tropical America and cultivated for thousand of years in Mexico and Peru before invasion of the Europeans. Tomato is also popular vegetable crop of Pakistan and is a good source of vitamins A, B and C (Khoso, 1994).

Tomato crop has a wide market value in Sindh and is the only source of supply in the late autumn and early winter. The yield per hectare in Sindh is low as compared to other parts of the country due to attack of several viral and soilborne diseases, that are responsible for damaging the quantity and quality of the crop every year. Among the soilborne fungal diseases, damping-off of seedlings and wilt of adult plants are caused by several species of *Fusarium*, *Pythium*, *Rhizoctonia* and *Verticillium* (Kaprashvili, 1996; Lucas *et al.*, 1997), and is widely distributed throughout the world. The literature available on the disease indicated that no work has been done on damping-off disease of tomato seedlings in Sindh. Therefore the studies were conducted for:

- Survey of tomato fields of Hyderabad district to estimate the disease incidence.
- Isolation and identification of different damping-off fungi associated with tomato seedlings.
- Pathogenicity test of *Rhizoctonia solani* applied in soil on tomato seedlings.
- To find out the effect of different fungicides on damping-off disease and plant growth.

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Materials and Methods

Survey: Tomato plants showing the damping-off disease symptoms were collected from tomato fields of Hyderabad district viz., Allah Dino Saand, Khatian Station, Khesano Mori, Rahooki, Tando Qaiser and village Darya Khan Nahiyoun to record variation in the disease incidence. The diseased plants were taken in plastic bags, brought to the laboratory for isolating the disease-causing fungi.

Isolation: Isolation was done from 100 small root pieces, cut from adjoining areas of diseased and healthy areas of the plants. Root pieces were washed under tap water for about 30 minutes to remove any dirt or soil particle. The root pieces were dipped in 0.01% $HgCl_2$ for about 2 minutes and then passed from two washes of distilled sterile water for 2-3 minutes each. The treated root pieces were dried completely and then transferred to Petri dishes containing sterilized potato-dextrose agar medium with five pieces per plate. All the plates were kept at $25 \pm 1^{o}C$ for 7 days.

The fresh growth of the fungi was transferred to freshly prepared potato-dextrose agar medium for sub culturing. The growth was sub-cultured/multiplied whenever needed during the entire study. The fungi isolated were identified by studying their typical mycelial growth produced on the potato dextrose agar medium and conidial morphology using standard diagnostic keys.

Pathogenicity test: The pathogenicity test of most predominant damping-off fungus, *Rhizoctonia solani* was done by mixing the fresh inoculum of the fungus with 1kg of steam sterilized soil in plastic pots. Eighty tomato seeds were sown per pot containing infested soil. The data was recorded on number of healthy and infected plant and disease incidence after 15 and 30 days of sowing from pots containing infested and un-infested soil.

Effect of different fungicides on damping-off disease and tomato plant growth: Twenty tomato seeds treated with 0.01% $HgCl_2$ were grown in pots containing steam sterilized soil. The soil was infested with fresh culture of *Rhizoctonia solani* and then treated with different fungicides viz., Topsin-M, Benlate, Copper oxychloride and Derosal by drenching. The seeds grown in infested and untreated soil served as control. The data was recorded on number of germinated plants, plant height and plant weight after 7, 15, 24 and 30 days of sowing.

Results and Discussion

Symptoms: The damping-off occurred on seedling stage. In early stage, plants became stunted with typical discoloration at roots and formed small lesions on roots near to soil level. The spots coalesced together and formed large areas. In severe infection, the entire root found rotted and plants dried.

Incidence of damping-off at various tomato fields: Tomato fields of different localities of Hyderabad district were surveyed to estimate the incidence of damping-off disease. The maximum disease incidence was recorded at village Darya Khan Nahiyoun (65.0%) followed by Khatian Station (60.0%) and Rahooki (55.0%) as compared to other localities (Fig. 1). It might be due to conducive weather conditions prevailing in these areas, and hence caused severe yield losses every year due to the disease. Hafiz (1986) reported the considerable yield loss in tomato every year due to soil borne disease. Agrios (1988) found variation in association of fungi with soil borne diseases at different places.

Fontem (1993) surveyed 67 tomato fields and found that damping-off fungi *Rhizoctonia solani* and *Verticillium albo-atrum* attacked all tomato nurseries.

Isolation of damping-off fungi from infected tomato plants: Isolation from root portion of tomato plants was done on large scale. The fungi isolated were identified on their typical colony characteristics and are given in (Fig. 2). *Rhizoctonia solani* Kuhn was isolated with highest frequency (60.0%) followed by *Fusarium oxysporum* f.sp. *lycopersici.* The fungi with lowest frequency were *Macrophomina phaseolina, Alternaria solani* and *Verticillium albo-atrum*, respectively (Fig. 2). Similar fungi have been isolated from tomato seedlings by Gunasekaran *et al*., (1994). Mitidieri (1994) recorded damping-off as major disease on tomato and capsicum caused by *Sclerotinia sclerotiorum, Rhizoctonia solani, Sclerotium rolfsii* and *Pythium* spp. MacNish *et al*., (1995) detected AG-10 isolate of *Rhizoctonia solani* on potato dextrose agar medium. Kuprashvili (1996) and Lucas *et al*., (1997) isolated *Alternaria tenuis, A. solani* and *Rhizoctonia solani* from tomato fruit and seed rots.

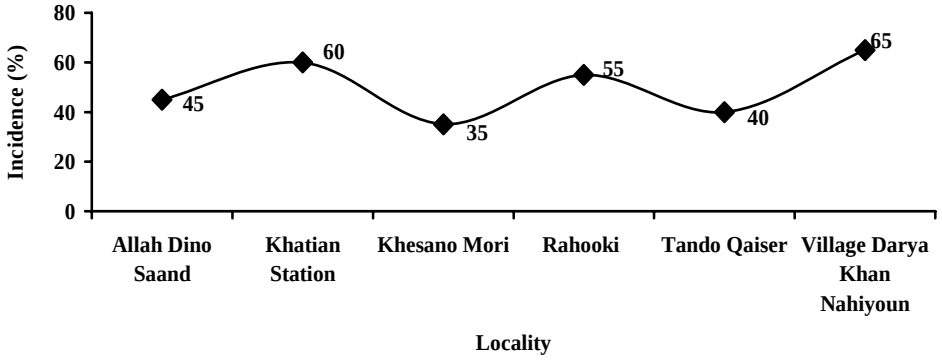

Fig. 1. Incidence of damping-off in tomato fields of Hyderabad district.

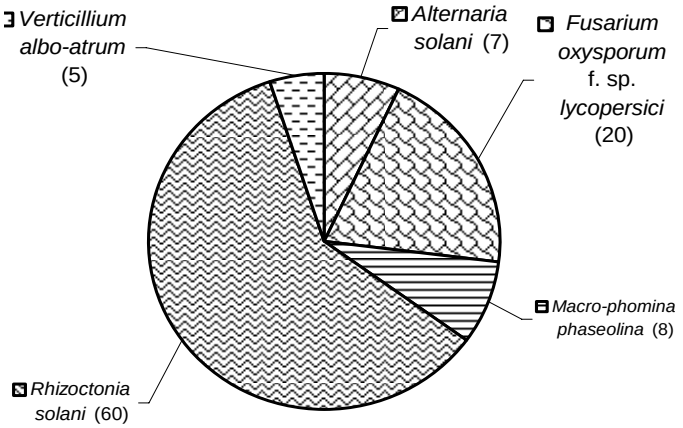

Fig. 2. Frequency of damping-off fungi isolated from infected tomato seedlings.

Table 1. Pathogenicity test of *Rhizoctonia solani* on tomato seeds and seedlings.

Treatment	Healthy plants		Infected plants		Incidence %
	15 days after sowing	30 days after sowing	15 days after sowing	30 days after sowing	30 days after sowing
Infested soil	35	20	20	35	63.63
Un-infected	59	65	16	10	13.33

Table 2. Effect of different fungicides on damping-off disease, height (cm) and weight (mg) of tomato plants emerged from seeds inoculated with *Rhizoctonia solani*.

Fungicide	24 days after sowing (out of 20 seeds)		30 days after sowing (out of 20 seeds)		Plant heights (cm)	Plant weight (mg)
	Healthy	Infected	Healthy	Infected		
Benlate	12.50 b	7.50 c	9.75 b	10.25 c	8.32 b	226.57 b
Copper oxychloride	11.00 c	9.00 b	9.50 bc	10.50 bc	6.84 c	199.42 c
Derosal	10.75 c	9.25 b	8.50 c	11.50 b	5.74 d	162.33 d
Topsin-M	17.50 a	2.50 d	15.00 a	5.00 d	9.78 a	417.71 a
Control (-)	7.25 d	12.75 a	3.50 d	16.50 a	3.89 e	103.45 e
LSD (p< 0.05)	1.31	1.31	1.08	1.08	0.61	26.69

Similar letters do not differ from one another at LSD p<0.05 = 0.8350

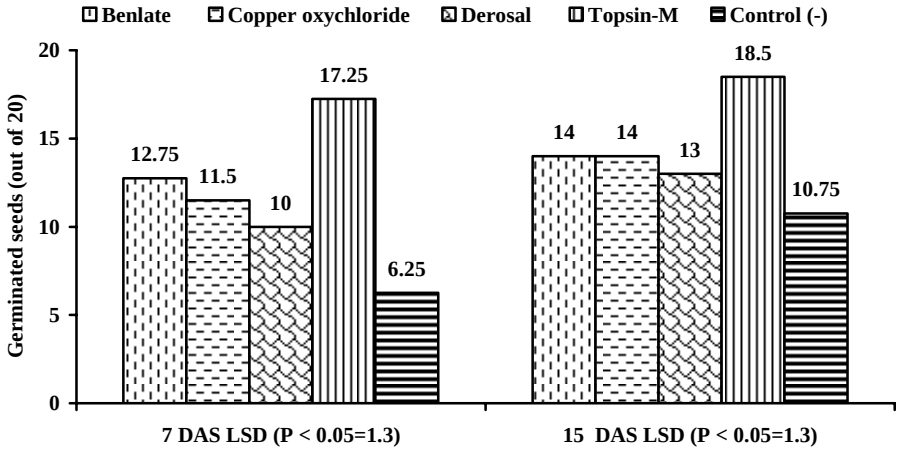

Fig. 3. Effect of different fungicides on germination of seeds inoculated with *Rhizoctonia solani.*

Rhizoctonia solani was isolated as predominant fungus from all diseased tomato plants and was identified on the typical characteristics as mycelium brownish, septate and forming new growth at right angle with long cell. The above characteristics agreed more closely with *Rhizoctonia solani* Kuhn.

Pathogenicity test: Pathogenicity test of *Rhizoctonia solani* was conducted under laboratory conditions by artificially inoculating the steam sterilized soil (Table 1). The maximum number of infected plants was obtained after 30 days of sowing as compared to 15 days sowing from the infested soil with the disease incidence of 63.63% as compared to un-infested soil where disease incidence was 13.33% (Table 1). Herrera Isla & Pena Pena (1984) found *Rhizoctonia solani* as more pathogenic on potato than tobacco.

Anderson (1985) conducted pathogenicity of *Rhizoctonia solani* and observed typical symptoms of the fungus on root and lower stem of mungbean. Chana *et al*., (1991) inoculated lentil plants with *Rhizoctonia solani* and noted typical symptoms within 7 days and obtained 100% infection on lentil grown in soil infested with the fungus.

Effect of different fungicides on damping-off disease and tomato plant growth: Different fungicides such as Benlate, Topsin-M, Derosal and Copper oxychloride were applied as soil drench. Seed germination was significantly increased with Topsin-M applied as soil drench after 15 days of sowing (18.50) followed by Benlate and Copper oxychloride (14.00). There was no significant difference in seed germination with Benlate, Copper oxychloride and Derosal recorded after 15 days of sowing (Fig. 3). The germination was significantly decreased in infested and un-treated soil (Fig. 3). The number of healthy plants was significantly increased in soils drenched with Topsin-M after 24 days of sowing (17.50) as compared to 31 days of sowing (15.00). The results were not significantly different in case of plants emerged from soil drenched with Copper oxychloride and Derosal after 24 days of sowing. The number of diseased plants increased when soil was not treated with fungicides (Table 2). Topsin-M was also found the best fungicide in increasing plant height (9.78 cm) and plant weight (417.71 mg) followed by Benlate (8.32 cm and 226.57 mg) as compared to other two fungicides (Table 2). The plant growth was significantly reduced in un-treated soil. Satija & Hooda (1987) got best control of the disease with Copper oxychloride. Whereas, Taha *et al.*, (1988) suggested Topsin-M and Benlate as the most effective fungicides in laboratory test against *Rhizoctonia* on tomato. Kassim *et al*., (1989) obtained high level of disease infection by using Sodium chloride in field soil. Cassiolata *et al*., (1991) tested vesicular arbscular mycorrhizal (VAM) fungi against *Rhizoctonia solani*.

References

Agrios, G.N. 1988. *Plant Pathology*. 3rd Ed. Acad. Press. California, USA.

Anderson, T.R. 1985. Studies on root rot and will of mungbean in Ontario. *Canadian Plant Disease Survey*, 65: 3-5.

Bedlan, G. 1986. *Rhizoctonia solani* in lettuce (Abstr). *Rev. Pl. Pathol*., 65: 5822.

Cassiolata, A.M.R., I.S. Melo and D.E. Melo. 1991. Interaction between *Rhizoctonia solani* and vesicular arbuscular mycorrhizal fungi in tomato. *Suma-phytopathologica*, 17: 3-4.

Chana, M.Y., M.A. Pathan, G.R. Solangi and M. Wondiar. 1991. Studies on *Rhizoctonia solani* (Kuhn) causing root rot of lentil. *Sarhad J. of Agri*., 11: 495-499.

Fontem, D.A. 1993. Survey of tomato diseases in Cameroon. *Tropiculture*, 11: 87-90.

Gunasekaran, C.R., A. Vinayagamurthy and P. Sundaran. 1994. Management of root-knot nematode and damping-off disease in tomato nursery. *South India Hort*., 42: 346-347.

Hafiz, A. 1986. *Plant disease*. Pakistan Agriculture Research Council, Islamabad. 552 pp.

Herrera Isla, L. and L. Pena Pena. 1984. Pathogenicity test on some isolates of *Sclerotium rolfsii* and *Rhizoctonia solani*. *Centro Agricola*, 11: 91-98.

Kassim, N.A., K.H. Taha and I.A.S. Seddyk. 1989. Effort of different concentration of sodium chloride on some fungi causing damping-off of tomato seedlings. *Mesopotamia J. of Agri*., 21: 343-351.

Khoso, A.W. 1994. *Growing vegetable in Sindh*. 2nd Ed. Allied Printing corporation, Hyderabad.136 pp.

Kuprashvili, T.D. 1996. The use phytocides for seed treatment. *Zashchita-I- Karantin- Rastenii*, 55: 31pp.

Lucas, G.B, C.L. Campbell and L.T. Lucas. 1997. *Introduction to plant disease identification and management*. CBS Pub. and Distributors, New Delhi. 364pp.

MacNish, G.C., D.E. Carling, M.W. sweetingham, A. Ugushi and K.A. Brainard. 1995. Characterization of anastomosis group-10 (AG-10) of *Rhizoctonia solani*. *Australian Pl. Pathology*, 24: 252-260.

Mitidieri, I. M-de. 1994. The main diseases, which affect horticultural crops grown under cover in northern Buenos Aires. *Acta Horticultural*, 357: 143-152.

Satija, D.V. and I. Hooda. 1987. Influence of farmyard manure in the efficacy of fungicides in controlling damping-off of tomato and chilli. *Vegetable science*, 14:58-64.

Taha, K.H, N.A. Kassin and N.Y. Mahmood. 1988. Chemical control of damping-off and root rot diseases of tomato plants. *Mesopotamia J. of Agri*., 20: 275-287.

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