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Management of damping-off of tomato with botanicals and bio-products in North Western Himalayas

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ABSTRACT

Damping-off is a serious disease of tomato nurseries which results in high seedling mortality. Seventeen locally available plant extracts, three neem based commercial fomulations, one botanical fungicide (Biotos), raw neem oil, neem cake extract (NCE), cow urine and cow dung ash were assessed for the management of damping-off of tomato under the mid hill conditions of North Western Himalayas (NWH). Among them, extracts of *Lantana camara,* neem cake extract, cow urine, *Urtica parviflora*, *Sapium* sp., *Ligustrum nepalensis*, *Eucalyptus* sp., Azadirachtin (Achook®) were found most promising for the management of pre-emergence damping-off and also simultaneously improved seedling emergence and seedling vigour. However, in case of post-emergence damping-off *Curcuma longa* and *Thuja compacta* were observed to be the most effective treatments. The study shows that the treatment of seed with extracts of *Lantana camara*, neem cake and cow urine can be effectively utilized as a cost effective and eco-friendly method for the management of damping-off of tomato in organic farming and remote areas of hills where pesticides availability is meager.

Key words: Tomato, damping-off, management, botanicals, bioproducts.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable crop of North Western Himalayas (NWH). The crop is grown from February to July as both main and off-season vegetable at different elevations contributing immensely to the hill economy. Damping-off is a major disease of tomato nurseries caused by complex of soil-borne pathogens like *Pythium aphanidermatum*, *Rhizoctonia solani* etc. Chemical fungicides are generally recommended for their control but frequent and injudicious use thereof lead to environmental pollution. The use of various botanicals and biocontrol agents is commonly recommended as an alternative approach for disease management. Several plant species have been reported to possess fungitoxic properties against various pathogens (Grayer and Harborne, 3; Raghav, 6). Also the botanicals/ bioproducts are more compatible with the environment than synthetic pesticides because of their fast degradation by heat, light and microorganisms. The *in vitro* efficacy of botanicals has been reported by various workers (Kumar *et al*., 4; Arya, 1) however, their *in vivo* efficacy is more important from the farmers' point of view particularly in organic farming technology and in remote hill places where supply of chemical pesticides is already very meagre. The NWH region boasts of a rich bio-diversity in flora and fauna and therefore, the present investigation was conceived with the prime aim to evaluate the efficacy of locally available botanicals/ bioproducts from NWH for the management of damping-off of tomato.

MATERIALS AND MATHODS

The experiment was conducted at the experimental farm of VPKAS, Almora located at Hawalbagh (29°36' N, 79°40' E and 1,250 m above msl) during two crop seasons. The site with a previous history of high damping off incidence was used during both the years. The soil was silty clay loam (0-15 cm), acidic (pH 5.9) in reaction with 0.09 dS m^{-1} electrical conductivity, 0.8 g kg^{-1} organic carbon, 414 kg ha^{-1} available N, 15.8 kg ha^{-1} available P, 183 kg ha^{-1} available K and 1.38 Mg m^{-3} bulk density. The Randomized Block Design was adopted with three replications for each treatment. Seventeen locally available plants were collected from the experimental farm and nearby areas. Apart from these, three commercial formulations of *Azadirachta indica*, one botanical fungicide (Biotos), raw neem oil, neem cake extract (NCE), cow urine, cow dung ash were also evaluated keeping a treated (Thiram @ 0.2%) and water soaked checks. The tomato seeds (var. Marglobe) were soaked in aqueous extracts of the17 local plants (10% w/v), three neem based products (0.1% v/v) and other products and bioproducts (raw neem oil @ 0.05% v/v; NCE @ 10% w/v and cow urine @ 20% v/v) for 16 h. Dry seed treatment was done with cow dung @ 1.0% w/w. Then seeds were sown in raised nursery beds each of 0.9 m × 0.5 m 0.15 m. The nursery beds were drenched

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with the extracts of botanicals and bioproducts along with thiram solution at the same dosages except cow dung ash on the 14th and 21st day after nursery sowing. Per cent incidence of damping-off was recorded at emergence and subsequent nursery stages. Vigour index was calculated by multiplying germination (%) with root + shoot length (cm) of seedlings at 25 days after sowing and expressed as whole number. The percent data on emergence, pre- and post-emergence damping-off was subjected to Arc Sine transformation. The transformed data was subjected to analysis of variance (ANOVA) and means were compared by least significant difference (LSD) test at 5% significance level (Gomez and Gomez, 2). All the package of practices recommended by VPKAS (Anon, 7) for NWH region was followed during the study.

RESULTS AND DISCUSSION

All botanicals were found significantly effective in increasing the seedling emergence and vigour index of tomato seeds under field condition. Maximum per cent increase in seedling emergence over water soaked check was provided by extracts of *Lantana camara* (60.1%), neem cake extract (55.4%) and cow urine (51.0%) followed by *Urtica parviflora* and *Sapium* sp. (both being at par) (47.0%), *Ligustrum nepalensis* (45.5%), *Eucalyptus* sp. (45.3%), Azadirachtin (43.8%) and Azadirachtin (39.9%). The seeds treated with fungicidal check recorded 67.3 per cent increase in seedling emergence with 45.1 per cent disease control over check. All plant extracts, except Biotos were also found significantly effective in enhancing the vigour index as compared to water soaked check. The maximum increase in vigour index was recorded by *Lantana camara* (81.3%) followed by *Thuja compacta* (75.4%), *Parthenium hysterophorus* (69.5%), *Tagetes minuta* (69.5%), *Eucalyptus* sp. (64.3%) and Azadirachtin (64.1%). Thiram treated seeds showed an improvement of 77.8 per cent in vigour index over water soaked check. In case of pre- and post-emergence damping-off of tomato under field condition, maximum control of pre-emergence rot was recorded in treatment with *Lantana camara* (40.4%) and neem cake extract (37.0%) followed by cow urine (34.0%), *Sapium* sp. (32.9%), *Urtica parviflora* (31.4%) and *Ligustrum nepalensis* (30.4%), while thiram showed 45.1 per cent disease reduction over water treated check (Table 2). Comparatively lower incidence of post-emergence damping-off was observed in the experiment. The extract of *Curcuma longa* was found most effective for its control (62.3%) followed by *Thuja compacta* (39.2%) over check. Treatment with fungicide resulted in 32.5 per cent disease reduction over water treated check. *Eucalyptus* sp., azadirachtin, neem cake extract, cow dung ash and *Oxalis latifolia* were also found significantly effective in reducing post-emergence damping-off (control range from 27 to 32%) as compared to water soaked check (Table 2).

It is evident from the results (Tables 1 & 2) that the extracts of *Lantana camara* and neem cake were most effective in improving seedling emergence, and vigour index, and were also highly effective in reducing pre-emergence damping-off. However, in case of post-emergence damping-off *Curcuma longa* and *Thuja compacta* were found as the most effective treatments. Arya (1) has reported significant reduction in tomato damping-off with the seed treatment of neem cake extract. Prasad and Barnwal (5) tested efficacy of leaf extracts of *Azadirachta indica*, *Pongamia pinnata*, *Datura metel*, *Ocimum sanctum*, *Eucalytptus citriodora* and *Mentha arevensis* against *Stemphylium* blight of onion under field trials and found leaf extracts of *A. indica* and *D. metel* most effective. Damping-off disease is caused by a complex of soil borne pathogens and different pathogens may be responsible for causing damping-off in the pre- and post-emergence stages. The differential toxic activity of extracts of *Lantana*, neem cake, *C. longa* etc. against these different pathogens may account for this selective control of either pre- or post-emergence damping-off. In conclusion, the treatment of seed with extracts of *Lantana camara*, neem cake extract and cow urine can effectively be utilized as biopesticides for the management of damping-off of tomato in organic farming and remote areas of hills where pesticides availability is very meager. Use of extracts of *Urtica parviflora, Sapium* sp., *Ligustrum nepalensis*, *Eucalyptus* sp. and formulations of azadirachtin can also help to reduce damping-off along with improvement in seedling emergence and vigour.

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REFERENCES

1. Arya, S**.** 2005. Evaluation of tomto seed treatment with bio-control agents and soil amendment with neem cake against damping off. *Plant Dis. Res.* **20**: 187-89.

2. Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*. Kin Keong Printing Co. Pvt. Ltd., Singapore.

3. Grayer, R.J. and Harborne, J.B. 1994. A survey of antifungal compounds from higher plants. *Phytochem.* **37**: 19-42.

Table 1. Effect of botanicals and bioproducts on the seedling emergence and seedling vigour of tomato.

Treatment	Seedling emergence (%)				Vigour index			
	1st year	2nd year	Mean	Increase in emergence (%)	1st year	2nd year	Mean	Increase in vigour (%)
Melia azadirach @ 10%	39.6 (39.0)	58.2 (49.7)*	49.9	23.5	864	1711	1288	23.6
Ocimum sanctum @ 10%	41.8 (40.3)	63.2 (52.7)	52.5	30.0	911	1938	1425	36.8
Ficus religiosa @ 10%	35.7 (36.6)	61.7 (51.7)	48.7	20.5	878	2097	1488	42.8
Lantana camara @ 10 %	57.95 (49.6)	71.5 (57.7)	64.7	60.1	1370	2407	1889	81.3
Tagetes minuta @ 10%	44.8 (42.0)	65.4 (53.9)	55.1	36.4	1051	2481	1766	69.5
Juglens regia @ 10%	43.4 (41.2)	59.9 (50.7)	51.7	28.0	978	1991	1485	42.5
Parthenium hysterophorus @ 10%	38.9 (38.6)	65.0 (53.7)	51.9	28.5	930	2601	1766	69.5
Oxalis latifolia @ 10%	41.8 (40.3	53.7 (47.1)	47.8	18.3	1035	1584	1310	25.7
Eucalyptus sp. (Safeda) @ 10%	53.7 (47.1)	63.7 (52.9)	58.7	45.3	1286	2138	1712	64.3
Sapium sp. @ 10%	56.2 (48.6	62.5 (52.2)	59.4	47.0	1289	1709	1499	43.9
Thuja compacta @ 10%	43.2 (41.1)	67.7 (55.3)	55.5	37.4	1126	2530	1828	75.4
Urtica parviflora @10%	46.8 (43.2)	72.0 (58.1)	59.4	47.0	1112	2300	1706	63.7
Ligustrum nepalensis @ 10%	56.8 (48.9)	60.8 (51.2)	58.8	45.5	1202	1951	1576	51.3
Zanthoxylum sp. @ 10%	35.5 (36.6)	70.5 (57.1)	53.0	31.2	476	2136	1307	25.3
Curcuma longa @ 10%	45.7 (42.5)	57.3 (49.2)	51.5	27.5	933	1958	1445	38.8
Vinca rosea @ 10%	52.0 (46.1)	52.7 (46.5)	52.4	29.7	1131	1379	1255	20.4
Ageratum conyzoides @ 10%	41.4 (40.0)	57.0 (49.0)	49.2	21.8	902	1679	1291	23.9
Azadirachtin 0.03% (Nimbecidine) @ 0.1%	53.6 (40.1)	59.4 (50.4)	56.5	39.9	1089	2185	1637	57.1
Azadirachtin 0.03% (Tricure) @ 0.1%	39.8 (39.1)	58.4 (49.8)	49.1	21.5	770	1787	1278	22.7
Azadirachtin 0.15% (Achook) @ 0.1%	48.9 (44.4)	67.2 (55.0)	58.1	43.8	1067	2353	1710	64.1
Biotos (Bot.fungicide) @ 0.1 %	43.9 (41.5)	52.9 (46.6)	48.4	19.8	653	1310	982	-

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Treatment	Seedling emergence (%)				Vigour index			
	1st year	2nd year	Mean	Increase in emergence (%)	1st year	2nd year	Mean	Increase in vigour (%)
Raw neem Oil @ 0.05%	23.7 (29.0)	72.7 (58.5)	48.2	19.3	473	2777	1625	56.0
Neem cake extract @ 10%	47.8 (43.7)	77.7 (61.8)	62.8	55.4	970	2231	1601	53.6
Cow urine @ 20%	57.1 (49.1)	64.9 (53.7)	61.0	51.0	1270	2019	1645	57.9
Cow dung ash @ 1.0%	38.2 (38.2)	68.9 (56.1)	53.6	32.7	691	1969	1330	27.6
Thiram @ 0.2%	63.2 (52.6)	72.0 (58.1)	67.6	67.3	1369	2337	1853	77.8
Control (water soaked)	43.4 (41.2)	38.4 (38.2)	40.4	-	816	1267	1041	-
LSD (P = 0.05)	4.01	6.93	-	-	153.49	301.01	-	-

*Figures in the parentheses are angular transformed values.

Table 2. Effect of botanicals and bioproducts on the pre- and post-emergence damping-off of tomato.

Treatment	Pre-emergence rot (%)				Post-emergence rot (%)			
	1st year	2nd year	Mean	Disease control (%)	1st year	2nd year	Mean	Disease control (%)
Melia azadirach @ 10%	60.5 (51.0)	41.8 (40.3)*	51.1	13.5	23.6 (29.0)	14.9 (22.7)	19.3	9.0
Ocimum sanctum @ 10%	58.2 (53.6)	36.8 (37.4)	47.5	19.8	28.1 (32.1)	28.8 (32.5)	28.5	-
Ficus religiosa @ 10%	64.4 (53.4)	38.4 (38.5)	51.4	13.2	26.1 (30.7)	12.5 (20.7)	19.3	9.0
Lantana camara @ 10 %	42.1 (40.4)	28.5 (32.3)	35.3	40.4	28.7 (32.4)	15.4 (23.1)	22.1	-
Tagetes minuta @ 10%	55.2 (48.0)	34.7 (36.1)	44.9	24.2	19.3 (26.1)	15.9 (23.5)	17.6	17.0
Juglens regia @ 10%	56.6 (48.8)	40.2 (39.4)	48.4	18.2	21.0 (27.2)	52.7 (46.6)	36.9	-
Parthenium hysterophorus @ 10%	61.1 (51.4)	35.0 (36.3)	48.0	19.0	18.2 (25.2)	24.6 (29.7)	21.4	-
Oxalis latifolia @ 10%	58.2 (49.7)	46.4 (42.9)	52.3	11.7	13.6 (21.5)	17.1 (24.4)	15.4	27.4
Eucalyptus sp. (Safeda) @ 10%	46.4 (42.9)	36.4 (37.1)	41.4	30.1	10.2 (18.5)	18.6 (25.6)	14.4	32.1
Sapium sp. @ 10%	43.9 (41.5)	35.5 (36.6)	39.7	32.9	21.1 (27.3)	12.3 (20.5)	16.7	21.2
Thuja compacta @ 10%	56.8 (48.9)	32.4 (34.7)	44.6	24.7	12.2 (20.4)	13.5 (21.6)	12.9	39.2

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Treatment	Pre-emergence rot (%)				Post-emergence rot (%)			
	1st year	2nd year	Mean	Disease control (%)	1st year	2nd year	Mean	Disease control (%)
Urtica parviflora @10%	53.2 (46.8)	28.0 (32.0)	40.6	31.4	19.7 (26.3)	19.7 (26.4)	19.7	7.1
Ligustrum nepalensis @ 10%	43.2 (41.1)	39.2 (39.0)	41.2	30.4	22.0 (28.0)	15.9 (23.5)	18.9	10.8
Zanthoxylum sp. @ 10%	64.5 (53.4)	29.5 (32.9)	47.0	20.6	12.2 (20.4)	19.1 (25.9)	15.6	26.4
Curcuma longa @ 10%	54.3 (47.5)	42.5 (40.7)	48.4	18.2	10.5 (18.9)	5.5 (13.6)	8.0	62.3
Vinca rosea @ 10%	48.0 (43.9)	47.4 (43.5)	47.7	19.4	21.4 (27.6)	16.5 (24.0)	18.9	10.8
Ageratum conyzoides @ 10%	58.7 (50.0)	43.0 (41.0)	50.9	14.0	36.1 (36.9)	15.8 (23.4)	25.9	-
Azadirachtin 0.03% (Nimbecidine) @ 0.1%	46.4 (42.9	40.7 (39.6)	43.6	26.4	19.0 (25.8)	20.3 (26.8)	19.7	7.1
Azadirachtin 0.03% (Tricure) @ 0.1%	60.3 (50.9)	41.9 (40.3)	51.1	13.7	23.5 (29.0)	5.7 (13.8)	14.6	31.1
Azadirachtin 0.15% (Achook) @ 0.1%	51.1 (45.6)	32.9 (35.0)	42.0	29.1	29.2 (32.7)	22.6 (28.4)	25.9	-
Biotos (Bot.fungicide) @ 0.1%	56.1 (48.5)	47.2 (43.4)	51.7	12.7	18.1 (25.1)	26.8 (31.8)	22.5	-
Raw Neem Oil @ 0.05%	76.4 (60.9)	27.4 (31.6)	51.9	12.3	23.4 (28.8)	10.8 (19.2)	17.1	19.3
Neem cake extract @ 10%	52.3 (46.3)	22.3 (28.2)	37.3	37.0	18.5 (25.2)	11.0 (19.4)	14.8	30.2
Cow urine @ 20%	43.0 (41.0)	35.2 (36.4)	39.1	34.0	14.3 (22.2)	29.3 (32.8)	21.8	-
Cow dung ash @ 1.0%	61.8 (51.8)	31.2 (34.0)	46.5	21.5	17.7 (24.8)	12.1 (20.4)	14.9	29.7
Thiram @ 0.2%	36.9 (37.4)	28.0 (32.0)	32.5	45.1	18.7 (25.6)	9.9 (18.3)	14.3	32.5
Control (water soaked)	56.6 (48.8)	61.7 (51.8)	59.2	-	20.5 (26.9)	21.8 (27.8)	21.2	-
LSD (P= 0.05)	4.34	3.10	-	-	3.67	4.99	-	-

*Figures in the parentheses are angular transformed values

4. Kumar, A., Srivastava, A. and Gularia, S. 2006. Bioefficacy of plant extracts against *Alternaria* blight of rapeseed-mustard. *J. Mycol. Plant Path.* **36**: 168-70.

5. Prasad, S.M. and Barnwal, M.K. 2004. Evaluation of plant extracts in management of *Stemphylum* blight of onion. *Indian Phytopath.* **57**: 110-11.

6. Raghav, C.S. 2003. Medicinal plants on the touchstone of science. *Sci. Rep.* **40**: 53-60.

7. VPKAS. 2002. T*echnological Options for Improving Agricultural Productivity in the North-Western Hill*. Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR), Almora 263 601, UA, India, 70 p.

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