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Effect of plant extracts against *Pythium aphanidermatum* – the incitant of fruit rot of muskmelon (*Cucumis melo*)

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ABSTRACT

An experiment was conducted during 2005–07 to utilize plant extracts as bio-fungicides for suppression of *Pythium aphanidermatum* causing fruit rot of muskmelon. Maximum inhibition of fungal growth was recorded with extracts (25%) of *Allium sativum* (82.01%), followed by *Azadirachta indica* (79.90), *Curcuma longa* (79.88%) and *Zingiber afficinales* (79.82%) in ethanol solvent. The least inhibition was recorded at 10% concentration of *A. cepa* (36.87%), followed by *Ocimum sanctum* (37.00%) in distilled water. Under field conditions *A. sativum* extract (25%) showed lowest diseases severity (5.97%), followed by *A. indica* (6.13), and *C. longa* (6.56%) ; *Z. afficinales* (ginger) (8.00%) *Datura stramonium* (Datura) (9.07%) *A. cepa* and *O. sanctum* also gave significant lower disease severity. Significantly highest disease severity was recorded in control [at 9th day post-inoculation (25.50%), followed by 9th day pre-inoculation (20.09%)].

Key words: Muskmelon fruit rot*, Pythium aphanidermatum,* Plant extract

Muskmelon *(Cucumis melo*) is primarily used as fresh fruit. The unripe fruit may be cooked as vegetable by the village folk. Rich in vitamin A, C, calcium, phosphorous and Iron, muskmelon provides a wholesome food, with 17% sugar. Seed kernels are edible, tasty and nutritious since they are rich in oil and energy. Muskmelon is boon for summer and prevents us from dehydration because it has sufficient amount of water. Fruit rot caused by *Pythium aphanidermetum* is a major disease which causes softening fruit tissues; which is contact with soil surface. It also spreads among fruits during storage and transit. Due to increasing awareness of pesticide hazards, there is a need to develop botanicals for control of plant diseases. The present investigation reports the influence of seven plant extracts against *P. aphanidermatum* pathogen causing fruit rot of muskmelon.

MATERIALS AND METHODS

The trials were carried out during 2005, 2006 and 2007 in summer at research farm of agriculture, Department of Botany, University of Allahabad. The trials were conducted in a randomized block design with 3 replications and 8 treatments. Leaves of neem *(Azadirachta indica),* datura *(Datura stramonium*), tulsi *(Ocium sanctum*) ; rhizomes of turmeric *(Curcuma longa),* ginger (*Zingiber officinales* Roscoe) ; and bulbs of Onion *(Allium cepa*) and garlic *(Allium sativum*), and untreared control. Three solvents, ie distilled water, ethanol and acetone were employed for extraction of plant parts and results were derived on the basis of their comparative toxicity study. Different parts of plant including leaves rhizomes and bulbs to be tested were first washed with sterilized distilled water and then air dried. The plant material was crushed in a blender using 1: 1 w/v, distilled water, ethanol or acetone for 100 g of leaves, bulbs and rhizomes separately (Sindhan *et al*. 1999). The material was homogenized for 5 min. filtered through muslin cloth and filtrate was centrifuged at 5 000 rpm for 15 min. the clear supernatant was collected. This was considered as 100% concentration and used for experiment at different dilutions.

Evaluation of plant extracts in vitro

For evaluation of antifungal activity of the extracts, the desired concentration of 10, 15, 20, and 25% was obtained by mixing plant extracts and potato dextrose agar (PDA) medium and pored in Petri-plate. For each treatment 3 replications have maintained. Pure culture of *P. aphanidermatum* was inoculated with mycelial disc taken

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Table 1 Effect of plant extracts on mycelial growth of *Pythium aphanidermatum*

Plant extracts	Inhibition per cent of mycelial growth											
(Per cent concentration)	Distilled water				Ethanol				Acetone			
	10%	15%	20%	25%	10%	15%	20%	25%	10%	15%	20%	25%
Azadirachta indica	38.48	50.12	56.00	71.20	42.04	55.80	61.03	79.90	39.05	52.39	69.46	80.09
Ocimum sanctum	37.00	39.09	44.99	51.65	41.65	56.00	59.19	68.97	40.43	51.41	55.87	64.35
Allium sativum	40.23	52.14	63.00	71.29	50.11	67.27	71.09	82.01	47.07	61.00	67.15	79.10
Zingiber officinales	44.00	52.91	60.89	69.60	45.88	62.41	65.33	79.82	43.57	56.71	63.03	72.97
Curcuma longa	40.08	53.47	63.17	70.00	46.07	62.99	68.01	79.88	46.00	60.47	63.83	72.97
Datura stramonium	38.97	50.06	58.51	68.50	43.36	60.19	63.12	75.69	43.00	56.11	60.00	71.05
Allium cepa	36.87	39.13	40.00	47.61	40.08	55.54	57.09	62.83	39.31	49.57	58.59	61.71
Control	00.00	00.00	00.00									
CD (*P*=0.05)	3.29	0.81	0.61	1.00	0.73	0.81	1.59	4.62	0.68	7.29	1.59	0.76

Table 2 Effect of plant extracts on *Pythium aphanidermatum* fruit rot of muskmelon

	Pre-inoculation severity								Post-inoculation severity							
Plant extract	5th day				9th day				5th day				9th day			
Concentration	10%	15%	20%	25%	10%	15%	20%	25%	10%	15%	20%	25%	10%	15%	20%	25%
Azadirachta indica	12.83	12.45	10.66	9.54	14.19	10.55	8.69	6.41	13.40	11.39	9.97	9.50	14.56	13.13	9.54	6.13
Ocimum sanctum	13.63	13.00	11.75	10.71	15.16	14.44	12.98	12.13	14.67	13.88	12.07	11.59	15.86	14.01	13.00	12.91
Allium sativum	8.27	7.01	6.90	6.00	9.12	9.05	8.00	6.59	9.02	8.32	7.54	6.07	10.17	7.50	6.61	5.97
Zingiber officinales	10.63	10.11	9.07	8.00	11.77	10.10	9.54	9.01	10.36	10.05	9.55	8.35	12.69	11.89	10.10	9.63
Curcuma longa	8.34	8.10	6.78	6.56	10.59	9.00	8.37	7.54	9.55	8.49	7.33	6.87	11.51	10.44	9.34	7.83
Datura stramonium	11.05	10.54	10.00	9.59	11.45	10.35	9.59	9.07	12.00	11.65	10.77	9.36	14.31	12.00	11.05	10.58
Allium cepa	13.87	13.55	12.97	11.00	15.39	14.68	13.27	11.50	14.89	14.05	12.87	11.51	15.91	14.29	13.40	12.99
Control	15.58				20.09				16.33				25.50			
CD (*P*=0.05)	2.35	11.54	2.76	0.90	0.54	0.62	0.32	0.89	0.76	1.22	0.76	1.89	0.59	0.92	1.70	3.36

from 7-day old culture on PDA. The inoculated plates were incubated at 27 + 1 °C in BOD incubator and the mycelial growth of the fungus was measured after 7 days and antagonisitic potential of plant extracts was calculated as given below and the results are shown in Table 1.

$$I = \frac{C-T}{C} \times 100$$

where I, per cent inhibition in mycelial growth; C, growth of mycelium on control (mm); T, growth of mycelium in treatment (mm).

Evaluation of plant extracts for suppression of fruit rot in vivo

Mature fruits of muskmelon were surface sterilized and inoculated separately with pathogen by cork wounding method. Plant extracts at different concentrations were tested against the fruit rot of muskmelon as pre and post inoculation treatments. In the pre inoculation treatment the fruits were first dipped in the plant extract for 5 min. and then inoculated, whereas in the post inoculation treatments the fruits were first inoculated and then treated with the plant extracts. The interval between pathogen inoculation and treatment was 12 hr. There were 3 replications in each treatment consisting 3 fruits in replication. The control fruits were treated with distilled water and the disease severity was recorded on 5 th and 9 th day after inoculation based on per cent fruit area infected. The data on disease spread in pre-inoculation and post inoculation treatments were shown in Table 2.

RESULTS AND DISCUSSION

Efficacy of plant extract in vitro

The efficacy of plant extracts increased with increase in concentration in all solvents and maximum inhibition of fungal growth of pathogen was recorded at 25% concentration of *A. sativum* (82.01% in ethanol solvent), followed by *A. indica* (80.09 and 79.90% in acetone and ethanol solvents respectively), *C. longa* (79.88% in ethanol solvent) and *Z. afficinales* (79.82% in ethanol solvent). While, least inhibition was recorded at 10% concentration of *A. cepa* (36.87%), followed by *O. sanctum* (37.00%) in distilled water. In general all plant extracts showed antifungal activity against *P. aphanidermatum* at all concentrations as compared to control.

Efficacy of plant extract in vivo

All plant extracts were significantly superior in reducing the disease severity as compared to control, in both the pre-inoculation and post-inoculation treatments. Among the different treatments *A. sativum* (garlic) showed lowest diseases severity of 5.97% at 9th day post-inoculation and 6.00% at 5th day pre-inoculation, followed by *A. indica* (neem) 6.13% at 9th day post-inoculation and at 9th day pre-inoculation, *C. longa* (turmeric) 6.56% at 5th day pre-inoculation and 6.87% at same day post-inoculation, *Z. afficinales* (ginger) 8.00% at 5th day pre-inoculation and *D. stramonium* (datura) 9.07% at 9th day pre-inoculation, *A. cepa* 11.0% at 5th day pre-inoculation and *O. sanctum*10.71% at 5th day pre-inoculation (all the above treatments gave lower disease severity at 25% concentration) also gave significant lower disease severity. Significantly highest disease severity was recorded in control at 9th day post-inoculation (25.50%), treatment followed by 9th day pre-inoculation (20.09%).

The present findings are in accordance with work of Singh and Prasad 1993. Leaf extract of neem *(Azadirachta indica*) 80% inhibited the mycelium growth of *Fusarium oxysporum* (Srivastava and Yadav 2008). Neem formulation (Achook) was found to be most effective in managing the *Fusarium* wilt of carnation with 89.63% disease control (Chandel and Tomar 2008). Kumar (2006) reported that leaf extract of *Jasminum dispermum* L., *Dodonea viscosa* L. and *Lantana camara* significantly reduced germination of *Pyricularia grisea* Sacc. casual organism of blast of paddy, 20% neem leaf extract proved highly effective in reducing apple fruit spoilage due to rotting (Chauhan *et al.* 2008). Singh *et al.* (2007) reported that marigold leaf extract, followed by neem leaf extract inhibited maximum colony growth and leaf extract of tulsi was least effective, followed by the extract of garlic against *Sclerotium rolfsii* causing collar rot of lentil. Neem cake extract showed the maximum inhibition per cent to mycelium growth (80.13%) of *Bipolaris oryzea*, the causal agent of brown spot disease of rice (Sankarasubramanian *et al.* 2008).

Bohra *et al.* (2006) reported that neem has active principles as *azadirractin, nimbin, nimbidin, nimbinene* and *azadirone* which are antifungal and anti-insecticidal in nature.

It is concluded from the above studies that plant extracts of *A. sativum*, *A. indica, C. longa* and *Z. afficinales* at 25% concentration can be used effectively for the control of *P. aphanidermatum*. Hence, use of these extracts will be environmentally safe approach for the management of the fruit rot of muskmelon.

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