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Efficacy of botanicals against chilli powdery mildew caused by *Leveillula taurica* (Lev.) Arn.

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Abstract : Chilli powdery mildew incited by *Leveillula taurica (=Oidiopsis taurica)* is one of the most serious diseases in Tamil Nadu. The leaf extracts of *Azadirachta indica* (10 per cent) and bulb extracts *of Allium sativum* and *A.cepa* (5 per cent) were highly effective in inhibiting conidial germination of *L. taurica* under *in vitro* conditions. The same extracts were also promising in reducing disease intensity under greenhouse and field conditions.

Key words: Chilli powdery mildew, Leveillula taurica, botanicals, management

Introduction

Chilli *(Capsicum annuum* L.), an important spice crop is cultivated commercially in many parts of Tamil Nadu. Indian chilli is exported to over 90 countries and has become a good foreign exchange earner. In Tamil Nadu, the area under chilli cultivation is 76,138 ha. with a production of 55,266 tonnes. (Anonymous, 2000-2001). The diseases caused by fungal pathogens led to heavy yield losses in the field as well as in storage. Among the fungal diseases, powdery mildew disease incited by *Leveillula taurica* (Lev.) Arn. is one of the most destructive disease and caused yield loss upto 10-15 per cent. For the management of chilli powdery mildew, researches mainly concentrated only on fungicides which yielded success only to a limited extent, but encountering with undesirable problems. To alleviate all these ill effects environmentally safe, long lasting and eco-friendly non-chemical methods are in-need for effective plant disease management Hence, the present study is aimed to select suitable botanicals for the management of chilli powdery mildew.

Materials and Methods

Collection and maintenance of inoculum of Leveillula taurica in greenhouse

Chilli leaves (cv.K2) showing typical powdery mildew symptoms were collected from the orchard, Agricultural College and Research Institute, Madurai. Conidial suspension of *L.taurica* was prepared according to the methods of Sutton and Shane (1983). Conidia were harvested from diseased leaves by flooding the leaves with sterile distilled water. The process was repeated three times to obtain sufficient inoculum. The conidial suspension was strained through two layers of cheese cloth and centrifuged twice at 4000 rpm for 30 min. The conidial concentration was adjusted to 5 x 10^4 per ml with sterile distilled water (Souza and Cafe-Filho, 2003). To maintain the sufficient inoculum, 60 day old healthy chilli plants (cv.K2) in the greenhouse were sprayed with spore suspension, after making slight pin pricks. They were then covered with polythene bags for 24h to maintain high humidity for disease development. This inoculum was used for further studies.

Table 1. Screening of botanicals for antifungal activity against *L.taurica*

Sl.No.	Common name	Botanical name	Botanical family	Plant part used
1.	Thuthi	*Abutilon indicum* G. Don.	Malvaceae	Leaf
2.	Kuppaimeni	*Acalypha indica* L.	Euphorbiaceae	Leaf
3.	Naayuruvi	*Achyranthus aspera* L.	Amaranthaceae	Leaf
4.	Onion	*Allium cepa* L.	Alliaceae	Bulb
5.	Garlic	*Allium sativum* L.	Alliaceae	Bulb
6.	Neem	*Azadirachta indica* A.Juss.	Meliaceae	Leaf
7.	Papaya	*Carica papaya* L.	Caricaceae	Leaf
8.	Burmuda grass/hariali	*Cynodan dactylon* (L.) Pers.	Poaceae	Leaf
9.	Umathai	*Datura stramonium* L.	Solanaceae	Leaf
10.	Karisalanganni	*Eclipta alba* Hassk.	Compositae	Leaf
11.	Thulasi	*Ocimum sanctum* L.	Labiatae	Leaf
12.	Keezhanelli	*Phyllanthus niruri* L.	Euphorbiaceae	Leaf
13.	Kodukaipuli	*Pithecolobium dulce* Roxb & Benth	Mimosaceae	Leaf
14.	Seemai karuvel	*Prosopis juliflora* (SW)DC	Mimosaceae	Leaf
15.	Notchi	*Vitex negundo* L.	Verbenaceae	Leaf

Table 2. *In vitro* efficacy of botanicals against *L. taurica*

Sl.No.	Treatments	Spore germination (%)	Percent spore inhibition over control
1.	*Abutilon indicum* G. Don.	65.28(53.89)	27.72
2.	*Acalypha indica* L.	64.99(53.72)	27.04
3.	*Achyranthus aspera* L.	48.06(43.88)	46.05
4.	*Allium cepa* L.	25.83 (30.54)	71.01
5.	*Allium sativum* L.	24.70 (29.80)	72.27
6.	*Azadirachta indica* A.Juss.	22.93 (28.61)	74.26
7.	*Carica papaya* L.	31.18(33.94)	65.00
8.	*Cynodan dactylon* (L.)Pers.	67.74(55.39)	23.96
9.	*Datura stramonium* L.	41.90(40.34)	52.97
10.	*Eclipta alba* Hassk.	47.41 (43.52)	46.78
11.	*Ocimum sanctum* L.	54.83 (47.77)	38.45
12.	*Phyllanthus niruri* L.	71.99(58.04)	19.29
13.	*Pithecolobium dulce* Roxb&Benth.	51.72(45.98)	41.94
14.	*Prosophis juliflora* (SW) DC	28.46 (32.24)	68.05
15.	*Vitex negundo* L.	33.91 (35.61)	61.94
16.	Wettable.sulphur	10.57(18.97)	88.14
17.	Control (distilled water)	89.08 (70.70)	-
	CD (P= 0.05)	1.87	

* Mean of three replications
Values in parenthesis are Arcsine transformed values.

***In vitro* evaluation**

Plant extracts were prepared from bulbs and fresh leaves by various plant species listed in table 1. Collected plant samples were first washed with tap water. They were then crushed in sterile distilled water at the rate of one gram tissue in one ml of water (1:1 w/v) and filtered through double layer of cheese cloth. This form the standard plant extracts solution (100 per cent). Dilution of the extracts with distilled water was made to obtain 10 per cent in case of leaf extract and 5 per cent in case of bulb extract (Sindhan *et al.,* 1999).

Conidia of *L.taurica* harvested from the chilli leaves, maintained in the greenhouse were mounted on cavity slides in a drop of water. Uniform smear was made and the conidia were fixed on the cavity slides by alternate drying. Slides with fixed spores were soaked separately, in lml of various plant extract. They were then incubated in moist chamber made from large petri dishes. Wet cotton pads were placed on backside of the slides to help the condensation of moisture. The slides were incubated at room temperature for ten days. Water without plant extract served as control and sulphur 0.25% was used as standard check. Each treatment was replicated three times in a complete randomized design. Ten days after incubation the numbers of germinated and ungerminated conidia were counted in ten randomly selected microscopic fields per slide.

Greenhouse evaluation

Promising plant extracts in the laboratory were further evaluated in the greenhouse. Chilli seedlings (cv.K2) were maintained in earthernware pots @ two seedlings per pot. At the flowering stage, the plants were sprayed, separately with promising plant extracts at 5 and 10 per cent concentrations subsequently after 24h with conidia *of L.taurica* ($5x10^4$ conidia /ml). Fifteen days after the inoculation, the disease intensity was assessed by examining the leaves from each treatment at random, using a 0-4 scale, where 0 = no disease; 1=1-10 per cent leaf area affected; 2=11-25 per cent leaf area affected, 3=26-50 per cent leaf area affected and 4=>50 per cent leaf area affected (Reuveni *et al.,* 1998). The per cent disease index was also calculated.

Field evaluation

Based on the performance in the greenhouse study, three promising leaf extracts *viz., Azadirachta indica, Prosophis juliflora* and *Carica papaya* and two bulb extracts *viz., Allium cepa* and *Allium sativum* were further evaluated against *L.taurica* under field conditions. The experiment was laid out in a randomized block design with three replications. Spraying of plant extracts was started as soon as disease symptom appeared and subsequent spray at 15 days interval. Treatments with sulphur and water spray served as standard check and control, respectively. Disease index was assessed as described earlier.

Result and Discussion

A number of plant species have been reported to possess some natural substances in their leaves / bulbs which are toxic to many fungal pathogens (Singh *et al.,* 1984; Singh *et al.,* 1991; Biswas *et al.,* 1995).Hence, in the present studies due attention has been paid for utilization of plant extracts for the management of chilli powdery mildew.

Among the plant extracts, the leaf extract of *Azadirachta indica* at 10 per cent concentration and the bulb extracts of *Allium sativum* and *A.cepa* at 5 per cent concentration recorded maximum spore inhibition of 74.3, 72.3 and 71.0 per cent respectively. This was followed

Table 3. Greenhouse evaluation of botanicals against powdery mildew in chillies.

Sl.No.	Treatments	Per cent disease index*	Disease reduction over control. (%)
1.	*Allium cepa*	32.22 (34.58)	47.60
2.	*Allium sativum*	31.48(34.13)	48.80
3.	*Azadirachta indica*	26.29(30.85)	57.22
4.	*Carica papaya*	32.59(34.81)	46.99
5.	*Prosopis juliflora*	42.22 (40.52)	3 1.33
6.	Wettable sulphur	9.25 (17.71)	84.96
7.	Control (water spray)	61.48(51.64)	_.
	CD (P=0.05)	5.68	

* Mean of three replications, Values in parenthesis are Arcsine transformed values.

Table 4. Field evaluation of botanicals against powdery mildew in chillies.

Sl.No.	Treatments	Per cent disease index*	Disease reduction over control (%)	Yield (t/ha)
1.	*Allium cepa*	32.22 (34.58)	44.94	7.52
2.	*Allium sativum*	30.84(33.73)	47.30	7.68
3.	*Azadirachta indica*	28.15(32.04)	51.90	7.71
4.	*Carica papaya*	41.85(40.31)	28.49	7.39
5.	*Prosophis juliflora*	34.07(35.71)	41.78	7.47
6.	Wettable sulphur	9.97 (18.41)	82.96	7.69
7.	Control (water spray)	58.52(49.91)	-	5.57
	CD (P=0.05)	5.35		0.03

*Mean of three replications, Values in parenthesis are Arcsine transformed values

by *Prosophis juliflora* (68.1 per cent) and *Carica papaya.* (65.0 per cent).All these treatments were inferior to the fungicide wettable sulphur (standard check) at 0.25 per cent concentration, where the per cent of spore inhibition was 88.1 per cent (Table 2).

In greenhouse, the extracts from *A.indica* (57.2 per cent) was highly effective in reducing disease intensity.This was followed by the extracts of *A.sativum, A.cepa,* and *C.papaya,* which were equally effective (47.0-48.8 per cent) (Table 3). In field also same trend was reflected except the extract of *Carica papaya,* where the per cent of disease reduction was recorded as 51.9, 47.3 and 44.9, respectively. All these treatments recorded more or less same yield as that of fungicide treatment. However, all these plant extracts were inferior to fungicide treatment in reducing disease intensity (Table 4).

The antifungal activity of *A.indica* has been reported by Singh *et al.* (1984). The chemical basis of this antifungal activity has been attributed with the presence of oil in the plant parts of *A.indica.* The effectiveness of neem leaf extract on pea and mulberry powdery mildew had also been reported by Singh *et al.* (1991) and Biswas *et al.* 1995).The bulb extracts *of Allium* spp. (5 per cent) were also effective in combating chilli powdery mildew. Drastic reduction in disease intensity might be due to the presence of antimicrobial substance in the bulb *of Allium* spp. Similar result was also recorded on *Erysiphe polygoni* by Ramesh (1997).

Cavallito *et al.* (1944) isolated an antimicrobial substance *viz.,* allicin from the bulbs *of Allium* spp. Block *et al.* (1986) reconstituted a potent antithrombiotic agent called ajones from allicin. The antifungal activity of ajones against powdery mildew was also demonstrated by Yoshida *et al.* (1987) and Singh *et al.* (1990, 1992).

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