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Management of sunflower powdery mildew caused by *Erysiphe cichoracearum* DC. with botanicals and natural products

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ABSTRACT

Sunflower is reported to suffer heavy losses because of fungal, viral and bacterial diseases and one of the prominent diseases among them is powdery mildew caused by *E. cichoracearum*. Recently Powdery mildew is most important limiting factors for production of sunflower in Karnataka. Management of powdery mildew in sunflower was studied in both *in vitro* and *in vivo* conditions. Azadirachtin, NSKE, Turmeric (leaf extract), *Lantana camara* (leaf extract) and *Ipomoea carnea* (leaf extract) were effective in inhibiting spore germination of pathogen both under *in vitro* condition at 5 per cent concentration. Similar trend was observed in field condition also with Azadirachtin and NSKE at 5 per cent concentration with least disease incidence of 25.78 and 27.56 per cent disease index, respectively in contrast to 83.33 per cent disease index in control.

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INTRODUCTION

Sunflower (*Helianthus annuus* L.) is native of Southern USA and Mexico. It is an important oil seed crop belonging to Asteraceae family and ranks third next to groundnut and soybean. Presently, in India sunflower is cultivated over an area of 2.4 million hectares with a production of 1.44 million tonnes and productivity of 608 kg/ha. Among various constraints, susceptibility to disease is considered to be one of the major constraints. Among different diseases noticed on sunflower, powdery mildew caused by Erysiphe cichoracearum has been considered as economically important disease. It affects most of the commercial varieties under present cultivation and it has been reported from different parts of the world. Recently Powdery mildew is most important limiting factors for production of sunflower in Karnataka.

Sunflower is reported to suffer heavy losses because of fungal, viral and bacterial diseases and one of the prominent diseases among them is powdery mildew caused by *E. cichoracearum* (Kolte, 1985, Gulya and Masirevic, 1991). Although many fungicides are recommended for the effective management of powdery mildew their usage is limited due to development of organic farming and ecofriendly management concept. It has encouraged the plant protection specialists to

develop plant extracts and natural products for the management of pest and diseases. The fungicidal spectrum of neem (*Azadirachta indica*) has already been investigated and reviewed in detail by Parveen and Alam (1993). The chemical basis of this antifungal activity has been attributed to the presence of oil in the plants parts of Azadirachta indica (Singh and Dwivedi, 1990). In order to evolve ecofriendly management practices present study has been formulated to evaluate botanicals under In vitro condition through inhibition of conidial germination of E. cichoracearum at different concentrations. Considering the encouraging results of in vitro studies, five botanicals with water sprayed control and untreated control were evaluated for their efficacy in disease control under field condition.

MATERIAL AND METHODS

In vitro evaluation of botanicals :

Various botanicals were evaluated under *in vitro* condition by spore germination technique against *E. cichoracearum*. Required concentrations (1, 2 and 5%) were prepared by extracting and dissolving known quantity of botanicals in sterile distilled water separately under aseptic conditions. The conidial suspension was prepared separately in sterile distilled water. A drop of a spore suspension was mixed with one drop of Botanicals solution in a cavity slide to achieve the required concentration. In each treatment three replications were maintained. Slides were then incubated at a room temperature (25±1°C) for 24 hours. The observation on the spore germination was recorded 24 hours after incubation under microscope at 40X magnification. A control with only sterile water was maintained. Per cent conidial germination was calculated.

The per cent inhibition was calculated by the following formula given by Vincent (1927).

$$\text{Per cent inhibition of spore germination} = \frac{C - T}{C} \times 100$$

where,

C- Germination of conidia in control

T- Germination of conidia in treatment

Botanicals were evaluated at 1, 2 and 5 per cent under *in vitro* condition by spore germination technique against *E. cichoracearum*. The botanicals found effective against powdery mildew of sunflower under *in vitro* condition were selected for testing in field.

Field evaluation of botanicals :

A field experiment was conducted during July to September 2008 at KVK, Gangavati under irrigated condition to find out the effective botanical against powdery mildew. The experiment was laid out in Completely Randomized Block Design (RCBD) with seven treatments and replicated thrice. In each treatment ten plants were tagged and the efficacy of seven effective botanicals was tested with one untreated control. The botanicals solutions were prepared by macerating the know quantity of botanical and dissolved in known quantity of water to get desired concentration. The first spray was given on the appearance of the infection on the lower leaves. Second spray was given after 15 days interval. The powdery mildew severity was recorded one day before the first spray and 15 days after every spray using 0-5 scale.

Vijayneem formulation with 1500 ppm Azadirachtin was used initially. It was diluted to 1:10 proportion. This was tested at 5 per cent concentration whereas; it is equivalent to 0.5 per cent *i.e.* 5 ml/litre of water.

RESULTS AND DISCUSSION

In the present study, six botanicals and three organics at different concentrations (1, 2 and 5%) had statistically significant effect on inhibition of conidial germination of *E. cichoracearum*. Azadirachtin (81.94%) was superior in inhibiting the spore germination at 5 per cent. which was on par with NSKE (78.33%) at 5 per cent concentration and lantana leaf extract (75.93%) at 5 per cent concentration followed by turmeric leaf extract (71.11%) and Ipomoea leaf extract (67.50%). As the concentration of the extracts increased the effectiveness also increased (Table 1).

The fungicidal spectrum of neem (*Azadirachta indica*) has already been investigated by Singh and Pande (1966) and reviewed in detail by Parveen and Alam (1993). Antifungal properties of *Azadirachta indica* were also established by Singh *et al*. (1984) and Usman *et al*. (1991). The chemical basis of this antifungal activity has been attributed to the presence of oil in the plants parts of *Azadirachta indica* (Singh and Dwivedi, 1990).

Five botanicals with water sprayed control and untreated control were evaluated for their efficacy in disease control under field condition (Table 2). The

Table 1: Effect of different botanicals on inhibition of conidial germination of *Erysiphe cichoracearum*

Sr. No.	Treatments	Concentration (%)					
		1%		2%		5%	
		Per cent germination	Per cent inhibition	Per cent germination	Per cent inhibition	Per cent germination	Per cent inhibition
1.	NSKE	33.33 (35.25)*	63.89 (53.04)	30.0 (33.20)	67.50 (55.22)	20.0 (26.55)	78.33 (62.23)
2.	Azadirachtin (1500 ppm, 1:10 dilution)	24.07 (29.29)	73.92 (59.35)	19.4 (26.05)	78.94 (62.76)	16.7 (23.85)	81.94 (65.07)
3.	Turmeric leaf extract	40.00 (39.22)	56.67 (48.81)	33.3 (35.25)	63.89 (53.04)	26.7 (30.98)	71.11 (57.56)
4.	*Ipomoea carnea* leaf extract	44.44 (41.79)	51.85 (46.04)	37.5 (37.75)	59.38 (50.38)	30.0 (33.20)	67.50 (55.22)
5.	*Acacia nilotica* leaf extract	70.00 (56.77)	24.17 (29.43)	55.6 (48.17)	39.81 (39.11)	50.0 (44.98)	45.83 (42.59)
6.	Papaya leaf extract	55.56 (48.17)	39.81 (39.11)	50.0 (44.98)	45.83 (42.59)	44.4 (41.79)	51.85 (46.04)
7.	*Lantana camara* leaf extract	31.11 (33.88)	66.30 (54.50)	25.0 (29.99)	72.92 (58.62)	22.2 (28.11)	75.93 (60.59)
8.	Butter milk	60.00 (50.75)	35.00 (36.26)	62.5 (52.22)	32.29 (34.61)	54.5 (47.59)	40.91 (39.75)
9.	Jaggary	56.67 (54.71)	27.78 (31.79)	62.2 (52.07)	32.59 (34.77)	60.0 (50.75)	35.00 (36.26)
10.	Control	92.31 (73.87)	0.00 (0.28)	92.3 (73.87)	0.00 (0.28)	92.3 (73.87)	0.00 (0.28)
S.E.±		0.67	0.71	0.75	0.81	1.11	1.16
C.D. (P=0.01)		2.70	2.85	3.02	3.24	4.45	4.68

*Figures in the parenthesis are arc sine transformed values

Table 2: Efficacy of botanicals against powdery mildew of sunflower under field condition

Sr. No.	Treatments	Con. (%)	Powdery mildew severity (PDI)			Per cent disease control	Yield (q/ha)
			Before spray	After I spray	After II spray		
1.	NSKE	5	13.11 (21.20)*	20.89 (27.15)	27.56 (31.47)	66.93	7.00
2.	Azadirachtin (1500 ppm, 1:10 dilution)	5	14.00 (21.90)	20.22 (26.70)	25.78 (30.49)	69.07	7.11
3.	*ipomoea carnea* leaf extract	5	14.89 (22.63)	28.22 (32.06)	47.11 (43.32)	43.47	6.13
4.	Lantana *camara* leaf extract	5	13.56 (21.45)	25.56 (30.33)	35.11 (36.30)	57.87	6.35
5.	Turmeric leaf extract	5	15.33 (23.01)	26.89 (31.21)	37.78 (37.88)	54.67	6.27
6.	Water spray	-	12.44 (20.51)	34.22 (35.78)	66.44 (54.60)	20.27	5.33
7.	Control	-	16.22 (23.72)	44.44 (41.79)	83.33 (66.13)	0.00	4.69
S.E.±			NS	1.02	1.64		0.20
C.D. (P=0.05)				3.14	5.04		0.63

*Figures in the parenthesis are arc sine transformed values NS=Non-significant

results after two sprays revealed that 5 per cent Azadirachtin (1500 ppm, 1:10 dilution) (25.78%) found to be significantly superior over other botanicals and it was on par with NSKE (27.56%) followed by lantana leaf extract (35.11%) at 5 per cent concentration followed by turmeric leaf extract (37.78%).

Rettinassababady *et al.* (2000) neem seed kernel extract (5%) was most efficient in suppressing the disease with increased yields. Mohan and Ramakrishnan (1991) opined that inhibitory action might be due to the presence of sulphur containing compounds *viz.*, Nimbicidin, Azadirachtin in *Azadirachta indica*. The neem extracts contain a high level of antifungal compound Azadirachtin was reported by several workers like Shivapuri *et al.* (1997) and Chaudhary and Jain (1998).

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