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In vitro exploration of botanicals and fungicides against *Alternaria alternata* inciting leaf blight disease of chrysanthemum

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Abstract
In the present investigation, nine botanicals *viz.*, *Azadirachta indica*, *Sapindus mukorossi*, *Allium sativum*, *Calotropis procera*, *Psidium guajava*, *Vitex negundo*, *Gliricidia maculate*, *Solanum torvum* and *Lantana camara* each at 10% concentration and nine fungicides *viz.*, Difenconazole 50% EC, Thiophanate methyl 70%WP, Chlorothalonil 75% WP, Propiconazole 25% EC, Carbendazim 12% + Mancozeb 63% WP, Copper oxychloride 50%WP, Azoxystrobin 25% SC, Mancozeb 75% WP and Tebuconazole 50% + Trifloxystrobin 25% WG at different concentrations were evaluated *in vitro* for checking their efficacy against the chrysanthemum leaf blight causal fungus *Alternaria alternata*. Among all the plant extracts evaluated, Soapnut rind extract and neem leaf extract were most significantly effective in inhibiting the mycelial growth of *A. alternata* by 73.04% and 68.30%, respectively. Wild brinjal and Rui were least effective in controlling the mycelial growth of *A. alternata* with 31.82 and 20.96% inhibition, respectively. Amongst all the fungicides evaluated *in vitro*, propiconazole 25% EC @ 0.1% was emerged as the most promising fungicide in inhibiting mycelial growth of *A. alternata* with 94.07% inhibition over control. Thiophanate methyl 70% WP (0.1%) and chlorothalonil 75% WP (0.1%) were least effective which inhibited the mycelial growth of the test pathogen to the tune of 66.85% and 50.26%, respectively.

Keywords: Botanicals, fungicides, *Alternaria alternata*, chrysanthemum

Introduction
Chrysanthemum are flowering plants which signifies enchantress, virtuousness and beauty. Chrysanthemum is grown on commercial scale in India due to availability of land, skilled labour and various types of agro climatic zones. However, it is not possible to obtain good quality blooms that can be exported because of lower yields, short shelf life and attack of various fungal, bacterial and viral diseases. Among the various diseases of chrysanthemum, leaf blight caused by *Alternaria alternata* is one of the most devastating, catastrophic and ruinous disease. The disease leaf spot was first reported by Schmidt (1958) [7] caused by *Alternaria chrysanthemi*. The leaf blight disease caused by *Alternaria alternata* is a major stumbling block in successful cultivation of chrysanthemum in *Konkan.* Considering the heavy losses (both quantitative and qualitative) and regular incidence of *Alternaria* on chrysanthemum in recent past created interest to conduct this study. It is necessary to find out the most bona fide ways of controlling the disease through integrated approach of disease management by using easily available plant extracts, fungicides and beneficial bio-agents. Integrated approach will lead the use of fungicides in plant disease control to the lowest possible level. This will help the farmers to promote use of sustainable and eco-friendly disease management strategies and helps in bringing down the losses caused by heavy prevalence of leaf blight disease and consequently increasing the yield of chrysanthemum flowers.

Materials and Methods
All the laboratory experiments of the present investigation were conducted at Department of Plant Pathology, College of Agriculture, Dapoli, and Dist. Ratnagiri. Extracts from nine different plant species *viz.*, *Azadirachta indica*, *Sapindus mukorossi*, *Allium sativum*, *Calotropis procera*, *Psidium guajava*, *Vitex negundo*, *Glyricidia maculate*, *Solanum torvum* and *Lantana camara* were prepared as per the methodology given by Bhatti (1998) [3] and

evaluated for their efficacy against *A. alternata* using Poisoned Food Technique" each at 10% concentration with three replications in Completely Randomized Design. Nine fungicides from different fungicidal groups *viz.*, Difenconazole 50% EC, Thiophanate methyl 70%WP, Chlorothalonil 75% WP, Propiconazole 25% EC, Carbendazim 12% + Mancozeb 63% WP, Copper oxychloride 50%WP, Azoxystrobin 25% SC, Mancozeb 75% WP and Tebuconazole 50% + Trifloxystrobin 25% WG were evaluated *in vitro* against *A. alternata* by using "Poisoned Food Technique" with three replications in Completely Randomized Design. The inoculated plates were incubated at room temperature for seven days and radial colony growth was measured. The efficacy of plant extracts and fungicides against the test fungus was expressed as% inhibition of mycelial growth over control and that was calculated by using the formula given by Vincent (1947).

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

Where,
I =% inhibition (mm)
C= Growth of fungus in control plate (mm)
T= Growth of fungus in treatment plate (mm)

Results and Discussion

Results (table 1, plate 1 and fig.1) revealed that all the phytoextracts evaluated were significantly effective in inhibiting the mycelial growth of leaf blight causing fungus *A. alternata*. Soapnut rind extract and neem leaf extract each at 10% concentration were found most significantly effective in inhibiting the mycelial growth of *A. alternata* with 73.04% and 68.30%, respectively. Leaf extract of *Lantana* came in third place in terms of controlling mycelial development with 45.33%. Extracts of Glyricidia (44.33%), Garlic (42.11%), Guava (40.93%) and Nirgudi (35.71%) were also effective in inhibiting mycelial growth of the test fungus. Wild brinjal and Rui were least effective in controlling the mycelial growth of *A. alternata* with 31.82 and 20.96% inhibition, respectively. The present findings are in close consonance with Arunkumar and Kamanna (2009) [1] who evaluated six plant extracts (each @ 2.5, 5 and 10% concentration) against *Alternaria alternata*, causing leaf blight of chrysanthemum and found that NSKE was found to be most superior in inhibiting the mycelial growth with 50.07% inhibition. Similarly Waghe *et al.* (2015) [6] evaluated five plant extracts (each @10 and 20%) against *Alternaria helianthi*, causing blight of sunflower. Results indicated that maximum inhibition in mycelial growth of the test pathogen was due to Neem (63.05 and 68.88%).

Table 1: *In vitro* efficacy of plant extracts against *A. alternata.*

Tr. No.	Botanical name	Common name	Conc. Used (%)	Colony dia. (mm)*	Percent inhibition
T_1	*Azadirachta indica*	Neem	10	28.53	68.30
T_2	*Sapindus mukorossi*	Soap nut	10	24.26	73.04
T_3	*Allium sativum*	Garlic	10	52.10	42.11
T_4	*Calotropis procera*	Rui	10	71.13	20.96
T_5	*Psidium guajava*	Guava	10	53.16	40.93
T_6	*Vitex negundo*	Nirgudi	10	57.86	35.71
T_7	*Glyricidia maculata*	Glyricidia	10	50.10	44.33
T_8	*Solanum torvum*	Wild brinjal	10	61.36	31.82
T_9	*Lantana camara*	Lantana	10	49.21	45.33
T_{10}	Control	-	-	90.00	-
	S.E.m ±			0.27	
	C.D at 1%			1.10	

(* Mean colony diameter.)

Results from table 2, plate 2 and fig.2 showed that all the fungicides evaluated were effective in inhibiting the mycelial growth of leaf blight causing fungus *A. alternata*. Propiconazole 25% EC @ 0.1% was emerged as the most significantly effective fungicide in inhibiting mycelial growth of *A. alternata* with 94.07% inhibition over control. Azoxystrobin 25% SC (0.1%), tebuconazole 50% + trifloxystrobin 25% WG (0.05%), difenconazole 50% EC (0.1%) were the next best treatments in order of merits with% mycelial inhibition of 89.44%, 89.00%, 88.00% and were statistically at par with each other. Copper oxychloride 50%WP (0.25%), mancozeb 75% WP (0.2%) and carbendazim 12% + mancozeb 63% WP (0.2%) were also equally effective against test fungus with 79.88%, 78.07% and 75.37% mycelial growth inhibition, respectively. Thiophanate methyl 70% WP (0.1%) and chlorothalonil 75% WP (0.1%) were least effective which inhibited the mycelial growth of the test pathogen to the tune of 66.85% and 50.26%, respectively. The results of present investigation are in close conformity with earlier report of Arunkumar and Kamanna (2009) [1] who found that complete mycelial growth inhibition of the *A. alternata* causing blight of chrysanthemum was observed due to propiconazole 25% EC @ 0.1%. Banne (2020) [2] studied *in vitro* efficacy of six systemic fungicides and seven non-systemic fungicides against *A. alternata* causing blight of chrysanthemum. He found that maximum inhibition of fungus was observed in case of propiconazole 25% EC.

Table 2: *In vitro* efficacy of fungicides against *Alternaria alternata*.

Tr. No.	Fungicides	Conc. used (%)	Colony dia. (mm)*	Percent inhibition
T_1	Difenconazole 50% EC	0.1	10.80	88.00
T_2	Thiophanate methyl 70%WP	0.1	29.83	66.85
T_3	Chlorothalonil 75% WP	0.1	44.76	50.26
T_4	Propiconazole 25% EC	0.1	5.33	94.07
T_5	Carbendazim 12% + Mancozeb 63% WP	0.2	22.16	75.37
T_6	Copper oxychloride 50%WP	0.25	18.10	79.88
T_7	Azoxystrobin 25% SC	0.1	9.50	89.44
T_8	Mancozeb 75% WP	0.2	19.73	78.07
T_9	Tebuconazole 50% + Trifloxystrobin 25% WG	0.05	9.90	89.00
T_{10}	Control	-	90.00	-
	S.E.m ±		0.37	
	C.D. at 1%		1.48	

(* Mean colony diameter)

Plate 1: *In vitro* exploration of botanicals against *Alternaria alternata*

Plate 2: *In vitro* exploration of plant extracts against *Alternaria alternata*

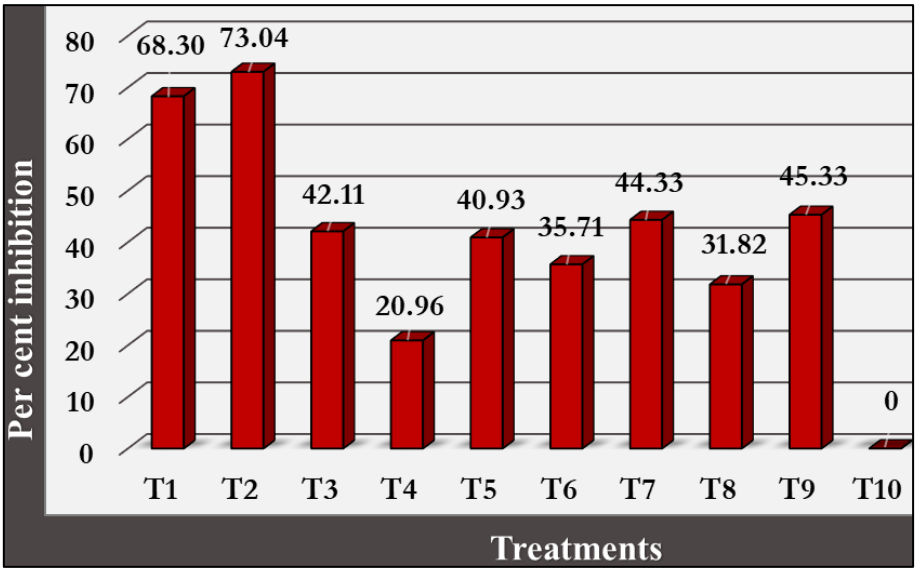

Fig 3: *In vitro* evaluation of plant extracts against *Alternaria alternata*

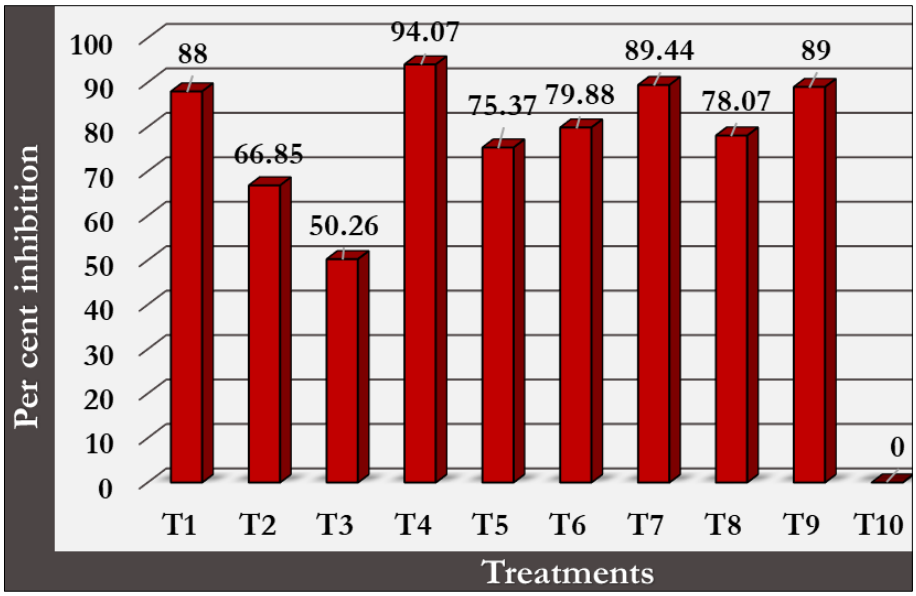

Fig 4: *In vitro* efficacy of fungicides against *Alternaria alternata*

Conclusion

From the results of present experiment it is concluded that leaf blight disease of chrysanthemum incited by *Alternaria alternata* can be effectively controlled by phytoextracts namely Soapnut rind extract or neem leaf extract @10% and of the fungicides propiconazole 25% EC @ 0.1% or Azoxystrobin 25% SC @0.1%, tebuconazole 50% + trifloxystrobin 25% WG @0.05% as they are most inhibitory to *A. alternata.*

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