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Short Note

Evaluation of botanicals against *Phytophthora* blight of colocasia

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Abstract

In vitro **evaluation of five botanicals and four fungicides against *Phytophthora colocasiae*, an incitant of *Colocasia* blight, revealed that eupatorium with 76.2% inhibition of mycelial growth at 15g/L was the most and eucalyptus the least effective. With an increase in the concentration of botanicals, corresponding increase in mycelial growth inhibition was noticed. Calculation of EC_{50} values indicated that the pathogen was more sensitive to eupatorium (EC_{50}= 6.72 g/L) and least to eucalyptus (EC_{50}=12.37 g/L). With other botanicals, EC_{50} values ranged between 7.92 to 10.20 g/L. Among the fungicides tested against the pathogen, Ridomil MZ with 82.8% inhibition of mycelial growth at 0.1% and EC_{50} value of 144.64 µg/ml was most effective fungicide. Chlorothalonil 75WP and mancozeb 75 WP with EC_{50} values of 417.55 and 487.17 µg/ml were found comparatively less effective.**

Key words: Colocasia blight, botanicals, fungicides, Phytophthora.

Colocasia (*Colocasia esculenta* (L.) Schott.) commonly known as *arvi*, is an important tropical tuber crop grown throughout tropical to subtropical region of the world. Leaf blight, caused by *Phytophthora colocasiae* Rac., is the most destructive disease and assumes severe form in areas having high relative humidity and frequent rainfall (Gollifer and Brown, 1974; Ooka, 1990 and Hunter *et al.*, 1998). Loss in crop yield has been estimated upto 25 per cent mainly due to destruction of foliage and poor corm development (Misra *et al.*, 1996; Gurung, 2001).

Although number of fungicides are effective against the disease (Bergquist,1972; Aggarwal and Mehrotra,1987; Cox and Kasimani,1990 and Bhattacharyya and Saikia,1996) but with a limited success. The leaf and seed extracts and various botanical formulations are known to possess strong antifungal activity (Narsimhan *et al.*, 1998 and Amadioha, 2000). Therefore, in the present study, different botanicals and fungicides were evaluated against P. *colocasiae* to manage this devastating disease successfully.

Evaluation of botanicals

Efficacy of dried leaf powder of five plants *viz.*, wheat straw (*Triticum aestivum* L.), oat straw (*Avena sativa* L.), eupatorium (*Chromolaena odorata* L.), eucalyptus (*Eucalyptus longifolia* Link.) and persian liliac (*Melia azadirach* L.) was evaluated against *P. colocasiae in vitro*. Leaves of the test plants were dried, powdered and evaluated through poisoned food technique. Different concentrations of powders were mixed individually in sterilized lima bean agar (LBA) medium poured in sterilized petriplates under aseptic conditions and inoculated with 5 mm mycelial bit and incubated at 22 ± 1°C. Petriplates with LBA devoid of any botanicals served as control. When control petriplate filled completely then data on mycelial growth were recorded (Table 1) and percent growth inhibition (PGI) over check was calculated (Vincent,1947).

Evaluation of fungicides

Four brand name fungicides *viz.*, Ridomil MZ 72 WP, Matco-8-64 72 WP, Unilax 72 WP of metalaxyl 8% + mancozeb 64%, combiproduct and Curzate M8 72 WP (cymoxanil 8% + mancozeb 64%) and two non-systemic fungicides *viz.*, Indofil-M-45 (manozeb 75 WP) and Kavach (chlorothalonil 75 WP) were evaluated *in vitro* for their efficacy against *P. colocasiae* through poisoned food technique. Double strength of test concentration of fungicide was prepared and added to double strength LBA so as to get desired concentration *viz.*, 50, 100, 250, 500, 750 and 1000 ppm. LBA plates in triplicate containing each fungicide at desirable concentration were inoculated with 5 mm bit of 7 days old culture and incubated at 22 ± 1°C. Petriplates having LBA devoid of any fungicides served as control. When control petriplate filled completely, the data on mycelial growth were recorded and percent growth inhibition over control was calculated for each fungicidal concentration. EC_{50} values were calculated from log probit plots of percent inhibition of mycelial growth and concentration of fungicide/ botanical. The standard statistical procedures were employed for the analysis of data

Table 1. Effect of botanicals on the mycelial growth of *Phytophthora colocasiae*

Botanicals / Concentration (g/l)	Eupatorium		Oat straw		Persian liliac		Wheat straw		Eucalyptus	
	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition
0 (Check)	9.0 (17.5)	-	9.0 (17.5)	-	9.0 (17.5)	-	9.0 (17.5)	-	9.0 (17.5)	-
1		12.6 (20.8)		10.2 (18.6)		9.1 (17.6)		9.2 (17.7)		8.9 (17.4)
2		24.8 (29.9)		21.1 (27.4)		16.3 (23.8)		18.0 (25.1)		13.0 (21.1)
5		36.3 (37.1)		33.7 (35.5)		28.8 (32.5)		28.6 (32.3)		24.1 (29.4)
7.5		49.3 (44.6)		46.7 (43.1)		37.2 (37.6)		40.6 (39.6)		37.2 (37.6)
10		62.4 (52.2)		58.3 (49.8)		49.4 (44.7)		51.3 (45.8)		46.1 (42.8)
12.5		68.5 (55.9)		64.2 (53.3)		56.6 (48.8)		57.4 (49.3)		55.8 (48.3)
15		76.2 (60.8)		69.7 (56.6)		61.7 (51.8)		63.2 (52.7)		60.3 (50.9)
CD ($P \leq 0.05$)		(1.5)		(1.8)		(1.7)		(1.2)		(1.5)

Average of two tests of three replications each
Values in parentheses are arc sine transformed values

and least significant difference at 5% level were calculated (Cochran and Cox, 1970).

Effect of botanicals

The results revealed that with an increase in the concentration of the botanicals, a corresponding decrease in colony diameter and increase in percent inhibition of mycelial growth was noticed (Table 1). Among the botanicals, eupatorium and oat straw were found more effective whereas, persian liliac, wheat straw and eucalyptus less effective in inhibiting the mycelial growth of *P. colocasiae*. Maximum percent inhibition in mycelial growth (76.2%) was recorded at 15g/L concentration of eupatorium and minimum inhibition (8.9%) was recorded at 1g/L concentration of eucalyptus. The pathogen showed varied sensitivity to all the test botanicals with respect to mycelial growth (Table 2). It was more sensitive to eupatorium (EC_{50} = 6.72 g/L) and least to eucalyptus (EC_{50} = 12.37 g/L). Whereas the sensitivity to other test botanicals was intermediate (EC_{50} = 7.92-11.05 g/L). Statistically EC_{50} values of eupatorium and oat straw were at par but significant differences were found between other botanicals.

Table 2. Comparative EC_{50} values for *P. colocasiae* exposed to different botanicals

Botanical	EC_{50}*(g/L)
Eupatorium	6.72
Oat straw	7.92
Persian liliac	11.05
Wheat straw	10.20
Eucalyptus	12.37
CD ($P \leq 0.05$)	1.57

* Interplotted from log probit plots of per cent inhibition of mycelial growth and botanical concentration

Leaves and twigs of eupatorium contain pyrrolizidine alkaloids which are inhibitory to mycelial growth and sporangial / zoospore germination of *P. colocasiae*. Sheikh and Agnihotri (1972), Kaushal and Paul (1987) and Gurung (2001) demonstrated strong fungitoxic activity of eupatorium against the growth of various pathogens.

Effect of fungicides

Among different systemic fungicides, Ridomil MZ was found to be the most effective and 1000 ppm concentration resulted in 82.8 percent inhibition of mycelial growth over check (Table 3). Other brand name systemic fungicides like Matco, Unilax including Curzate at different concentrations caused 20.8-78.3% inhibition. Among non-systemic fungicides tested, Kavach was more effective compared with Indofil-M-45 and caused 69.1% inhibition of mycelial growth at 1000ppm concentration. All the test fungicides were more effective at higher concentrations (500-1000 µg /ml) in inhibiting the mycelial growth of the pathogen. *P.colocasiae* (Table 4) was more sensitive to systemic (EC_{50} = 144.64-277.08 µg/ml) than to non systemic fungicides (EC_{50} = 417.55-487.17 µg/ml). Ridomil MZ was highly effective in inhibiting mycelial growth of the pathogen with minimum EC_{50} value of 144.64 µg/ml. Significant differences were found between EC_{50} values of systemic and non systemic fungicides. Effectiveness of Ridomil MZ *in vitro* in inhibiting mycelial growth of *P. colocasiae* is reported by various workers (Aggarwal and Mehrotra, 1988; Gurung, 2001 and Ramarao and Umabala,1983). Maheshwari *et al.* (1999) demonstrated the effectiveness of Ridomil MZ, Indofil-M-45, Blitox 50 and Hill copper in completely inhibiting the mycelial growth of *P. colocasiae.*

Table 3. Effect of fungicides on mycelial growth of *Phytophthora colocasiae*

Fungicides / Concentration (µg/ml)	Ridomil MZ		Matco 8-64		Unilax		Curzate M8		Indofil M-45		Kavach	
	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition	Colony diameter (cm)	% inhibition
0 (Check)	9.0	-	9.0	-	8.4	-	8.7	-	9.0	-	9.0	-
	(17.5)		(17.5)		(16.9)		(17.2)		(17.5)		(17.5)	
50		22.4		21.4		20.8		21.3		18.3		19.6
		(28.3)		(27.6)		(27.1)		(27.5)		(25.3)		(26.3)
100		34.3		31.2		31.1		30.8		28.1		28.9
		(35.9)		(34.0)		(33.9)		(33.7)		(32.0)		(32.5)
250		52.4		47.2		43.2		43.7		40.4		41.8
		(46.4)		(43.4)		(41.1)		(41.9)		(39.5)		(40.3)
500		65.0		61.5		57.1		57.4		50.7		52.4
		(53.7)		(51.7)		(49.1)		(49.3)		(45.4)		(46.4)
750		77.6		72.7		68.2		69.3		61.4		64.6
		(61.8)		(58.5)		(55.7)		(56.4)		(51.6)		(53.5)
1000		82.8		78.3		77.7		75.4		65.0		69.1
		(65.5)		(62.2)		(61.8)		(60.3)		(53.7)		(56.2)
CD ($P \leq 0.05$)		(1.9)		(1.5)		(1.8)		(1.8)		(1.5)		(1.9)

Average of two tests of three replications each
Values in parentheses are arc sine transformed values

Table 4. Comparative EC_{50} values for P. colocasiae exposed to different fungicides

Fungicide	EC_{50}*(µg/ml)
Ridomil MZ	144.64
Matco	232.54
Unilax	263.68
Curzate M8	277.08
Indofil-M-45	487.17
Kavach	417.55
CD ($P \leq 0.05$)	47.35

* Interplotted from log probit plots of per cent inhibition of mycelial growth and fungicide concentration

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