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Effect of seed treatment with plant products on damping-off incidence and on the population dynamics in chilli under pot study

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ABSTRACT
Among the various seed treatment with plant products combined seed treatment with sweet flag rhizome and Mahua oil cake extracts (1:1) at 20% Conc. recorded minimum pre and post-emergence damping off disease incidence of 7.90 and 10.66 per cent respectively. The maximum disease incidence of pre and post-emergence damping-off of 33.21 and 47.37 per cent respectively was observed in the inoculated control. Combined seed application with sweet flag rhizome an Mahua oilcake extracts (1:1) at 20% conc. recorded minimum population of *P. aphanidermatum* after 21 days of sowing ($3.10x10^3$ efu/g of soil) when compared with inoculated control (37.10×10^3 cfu/g of soil).

Keywords: *P. aphanidermatum*, sweet flag rhizome, Mahua oil extracts, chilli, pot culture, Metalaxyl.

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important commercial crops of India. Chilli is grown almost throughout the country. In Indian subcontinent, chillies are produced throughout the year in kharif and rabi seasons. The most important chilli growing states in India are Andhra Pradesh, Maharashtra, Karnataka, Orissa, and Tamil Nadu, which together constitute nearly 75 per cent of the total area. Andhra Pradesh tops the list in dry chilli production followed by Tamil Nadu, Maharashtra, Orissa, and Karnataka. In India, chilli is cultivated in an area of 774.87 thousand ha with an annual production of 1492.14 thousand tons of dried chilli. In Tamil Nadu, chilli is grown in an area of 50.67 thousand ha with an annual production of 23.06 thousand tons of dried chilli (Horticultural Statistics at a Glance; www.nbh.govt.in, 2016). The major chilli growing areas in Tamil Nadu are Ramanathapuram, Virudhunagar, Sivagangai, Salem, Tiruchirapalli, Cuddalore, Madurai, and Dindigul districts.

Chilli crop is affected by several diseases of biotic and abiotic nature leading to great loss to cultivators. Among those diseases, damping-off of chilli incited by *Pythium aphanidermatum* (Edson) F itz., is responsible for 90 per cent of plant death either as pre and post-emergence damping-off in nurseries and fields (Horst, 2013) [10]. The management of Pythium is very difficult due to its wide host range, soil-borne nature and prolonged survival of propagules in the soil (Hendrix and Cambell, 1973) [8]. Some isolates of Pythium are becoming less sensitive even to metalaxyl (Weiland *et al.*, 2014) [16] which is a commonly used fungicide. This has necessitated search for alternatives for controlling the damping-off disease. It is therefore essential to develop an effective, cheap and environmentally safe non-chemical method for the management of damping-off disease.

Various plant extracts and oilcake extracts have been reported to control plant diseases (Abdel-Monaim *et al.*, 2011; Ghasemi *et al.*, 2012; Gurjar *et al.*, 2012; Sivaprakash *et al.*, 2012; Vinayaka *et al.*, 2014) [1, 5, 7, 13, 15]. Several works have demonstrated in laboratory trials that different plant parts, such as roots, leaves, seeds, and flowers possess inhibitory properties against bacteria, fungi, and insects (Dellavalle *et al.*, 2011) [3]. Asha Devi and Deepak (2009) [2] showed that sweet flag rhizome and leaf extracts exhibited strong inhibitory action against *Aspergillus niger* and A. flavus. Such compounds being biodegradable and selective in their toxicity are considered valuable for controlling plant diseases (Fawcett and Spencer, 1970) [4]. The rhizomes of sweet flag possess active principle both α and β asarones which are believed to be responsible for their antifungal activity (Shanna *et al.*, 2014). Bio Pesticidal properties are

conferred by the presence of bitter saponins in the mahua seed cake (Gupta *et al.*, 2013) [6].

Evaluation of plant extracts and oilcake extracts against damping-off has previously attempted under greenhouse and field conditions (Kurucheve and Padmavathi, 1998; Muthukumar *et al.*, 2010; Sivaprakash *et al.*, 2012) [13, 12, 13]. Kagale *et al.* (2011) demonstrated that foliar application of the aqueous leaf extracts of *Ziziphus Jujuba* and *Ipomoea carnea* followed by challenge inoculation with *Rhizoctonia solani* which induces systemic resistance in rice.

Materials and Methods

Effect of seed treatment with plant and oilcake extracts on damping-off incidence in chilli under pot culture

Pot culture study was conducted to test the efficacy of plant extract and oilcake extract either alone or in combined applications against damping-off in chilli. The pathogen was multiplied on sand-maize medium. This inoculum was used and incorporated into the pots (15x30 cm dia) or pro-tray at 1:20 (w/w) ratio of pathogen and soil. Sweet flag rhizome extract and Mahua oilcake extract (10% and 20%) either alone or in combined application as a seed treatment. The fungicide metalaxyl (0.1%) was used as positive control. Pathogen inoculated and uninoculated pots served as control. The experiment was conducted with three replications. This experiments in a randomized block design (RBD). The following treatments were included in these experiments:

- T1: Sweet flag rhizome extract (10%)
- T2: Sweet flag rhizome extract (20%)
- T3: Mahua oilcake extract (10%)
- T4: Mahua oilcake extract (20%)
- T5: Sweet Hag rhizome extract (10%) + Mahua oilcake extract (10%) @ 1:1
- T6: Sweet flag rhizome extract (20%) + Mahua oilcake extract (20%) @ 1:1
- T7: Metalaxyl (0.1%)
- T8: Inoculated control
- T9: Uninoculated control

The pre-emergence damping-off disease incidence was recorded at 7 DAS and post-emergence damping-off disease incidence was recorded at 14 DAS and per cent disease incidence was calculated as mentioned in the earlier experiment.

Enumeration of *Pythium* population in soil

The population of *Pythium* in soil was estimated by following the method of Stanghellini and Hancock (1970) [14]. The soil samples were a collected (0, 7, 14, and 21 days interval) from pot culture and pro-tray studies. One gram of soil sample was suspended in 10 m1 of sterile distilled water (SDW) and shaken well. Then one ml of this suspension was drawn immediately and transferred into nine ml of SDW by using pipette to get 10'2 dilution. One ml of this dilution was immediately dispensed as small drops on the surface of plain agar (2%) in a Petri plate. These plates were incubated at 28±2°C for 48 h. The number of hyphal strands emerging from the perimeter of each drop was counted under low power microscope (100x). Hyphae of *Pythium* were readily distinguished from other fungal hyphae by their rapid growth and tendency to grow in straight line away from the drop.

Results and Discussion

The data presented in the Table 1 revealed that seed treatment with plant extract and oilcake extract either alone or in combination showed significant influence on the incidence of damping-off in chilli under pot culture. Among the various seed treatment with plant products, combined seed treatment with Sweet flag rhizome and Mahua oilcake extracts (1:1) at 20% concentration recorded minimum pre and post-emergence damping-off disease incidence of 7.90 and 10.66 per cent respectively. It was followed by seed treatment with Sweet flag rhizome extract alone at 20% concentration recorded 8.10 and 12.30 per cent of pre and post-emergence damping-off disease incidence. The plant products at 10% concentration either alone or in combination was not highly effective in reducing the incidence of damping-off. The maximum disease incidence of pre and post-emergence damping-off of 33.21 and 47.37 per cent respectively was observed in the inoculated control.

Table 1: Effect of seed treatment with plant products on damping-off incidence of chilli under pot study

Tr. No.	Treatment	Concentration (%)	Seed germination (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)
1.	Sweet flag rhizome extract	10	86.64 (68.56)^{e}	15.25 (22.98)^{f}	20.19(26.70)^{e}
2.	Sweet flag rhizome extract	20	92.30 (73.88)^{b}	8.10(16.53)^{b}	12.15(20.39)^{b}
3.	Mahua oilcake extract	10	85.10(67.29)^{f}	18.27(25.30)^{g}	24.46 (29.64)^{f}
4.	Mahua oilcake extract	20	90.83 (72.37)^{c}	9.23(17.68)^{c}	14.67(22.52)^{c}
5.	Sweet flag rhizome extract + Mahua oilcake extract (1:1)	10	88.00 (69.73)^{de}	10.46 (18.86)^{e}	17.94(25.05)^{d}
6.	Sweet flag rhizome extract + Mahua oilcake extract (1:1)	20	94.66 (76.63)^{a}	7.90 (16.32)^{3}	10.66 (19.05)^{a}
7.	Metalaxyl	0.1	88.45 (70. 13)^{d}	10.24 (18.66)^{d}	17.58 (24.78)^{d}
8.	Inoculated control	-	62.34 (52.14)^{h}	35.21 (36.39)^{j}	47.37 (43.49)^{h}
9.	Uninoculated control	-	76.52 (61.01)^{8}	24.66 (29.77)^{h}	32.50 (34.75)^{g}

Values are mean of three replications

Data in parentheses indicate angular transformed values

In column means followed by same letter(s) are not significantly different (β=0.05) by DMRT

The data presented in the Table 2 revealed that combined seed application with Sweet flag rhizome and Mahua oilcake extracts (1:1) at 20% concentration recorded minimum population of *P. aphanidermatum* after 21 days of sowing (3.10x103 cfu/g of soil) when compared with inoculated control (37.10x103 cfu/g of soil). It was followed by the individual application of Sweet flag rhizome extract at 20% concentration recorded a population of 4.45x103 cfu/g of soil and Mahua oilcake extract at 20% concentration recorded a population of 5.36x103 cfu/g of soil.

Table 2: Effect of seed treatment with plant products on the population dynamics *of P. aphanidermatum* under pot study

Tr. No.	Treatment	Concentration (%)	Population of P. *aphanidermatum* (x10^3cfu/g of soil)			
			0 DAS	7 DAS	14 DAS	21 DAS
1.	Sweet flag rhizome extract	10	3.25^{cd}	10.43^{f}	8.06^{f}	7.33^{f}
2.	Sweet flag rhizome extract	20	3.00^{a}	7.98^{b}	5.26^{b}	4.45^{b}
3.	Mahua oilcake extract	10	3.25^{cd}	11.00^{g}	9.33^{g}	8.63^{g}
4.	Mahua oilcake extract	20	$3,10^{b}$	8.33^{C}	6.66^{c}	5.36^{C}
5.	Sweet flag rhizome extract + Mahua oilcake extract (1:1)	10	3.20^{C}	9.68^{e}	7.83^{e}	6.26^{e}
6.	Sweet flag rhizome extract + Mahua oilcake extract (1:1)	20	3.00^{a}	7.30^{a}	4.36^{a}	3.10^{a}
7.	Metalaxyl	0.1	3.10^{b}	8.90^{d}	6.83^{d}	5.80^{d}
8.	Inoculated control	-	3.35^{e}	23.54^{j}	30.74^{i}	37.10^{s}
9.	Uninoculated control	-	3.30^{de}	34.92^{h}	19.66^{h}	23.33^{h}

DAS - days after sowing

Values are mean of three replications

In column means followed by same letter(s) are not significantly different (p=0.05) by DMRT

Chandrashekhara *et al*., (2010) [2] observed that seeds treated with 10% concentration of *Viscum album* showed maximum protection against pearl millet downy mildew and increased grain yield considerably. Soaking lupine seed in the extract of *Nerium Oleander* and *Eugenia jambolana* leaves and *Citrullus Colocynthis* fruits significantly reduced damping-off and wilt diseases and significantly increased the growth and yield parameters (Abdel-Monaim *et al.,* 2011) [1]. Hooda *et al.,* (2011) [9] also showed that seed treatment with *L. camara* leaf extract (10%) and neem cake extract (10%) was highly effective in reducing damping-off of tomato.

Similar reports of the use of plant extracts in combination for better disease control than when used alone have been reported by several workers (Latha *et al.*, 2009; Muthukumar *et al.*, 2010; Sivaprakash *et al.*, 2012) [11, 12, 13]. The combined application of biocontrol agents with zimmu leaf extracts through seed treatment was highly effective in reducing the dreaming of incidence and increased the plant growth and yield of chilli (Muthukumar *et al.*, 2010) [12]. Sivaprakash *et al.,* (2012) [13] reported that combination of garlic bulb and eucalyptus leaf extract was highly effective in reducing the disease incidence of damping off of tomato.

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