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Age of *Fusarium pallidoroseum* on Parthenium weed mortality

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Fungus culture suspension and culture filtrate of *Fusarium pallidoroseum* were prepared separately after different days of incubation viz., 7, 14, 21, 28 and 35 days at room temperature and their efficacy in reducing the Parthenium weed population and its seed germination was assessed under *in vitro* and glass house condition. The results revealed that young actively growing cultures of 7-14 days old were found to be highly pathogenic in causing maximum Parthenium mortality and reducing its seed germination. Regarding the culture filtrate, its phytotoxicity increased with increase in age of incubation upto 28 days and then declined.

Key words : Age ; culture suspension ; culture filtrate ; *Fusarium pallidoroseum ;* Parthenium mortality

INTRODUCTION

Parthenium histerophorus L., an exotic weed introduced into India through the imported wheat grains from USA under PL 480 scheme, is known to cause serious threat to crop production, animal husbandry and human health. In nature many diseases were found to affect parthenium and cause noticeable damage to its growth, establishment and multiplication (Pandey *et al.,* 1992 ; Kauraw and Bhan, 1995 ; Deshpande *et al.,* 1997; Evans, 1997 and DBT-GOI, 1997). Kauraw *et al.* (1997) observed the natural epidemics of parthenium diseases in and around Jabalpur, Madhya Pradesh, India due to *Fusarium pallidoroseum.* They also observed the maximum damaging potentiality of the pathogen on 21 days old seedlings under *in vitro.* The survey conducted during 1996-2000 in Tamil Nadu, India to find out an ideal bioherbicide under parthenium eradication programme revealed that 70% parthenium weed mortality was due to leaf blight and tip drying incidence caused by *Fusarium pallidoroseum* which proved to be highly pathogenic under *in vitro* and glass house condition. Determination of optimum age of inoculum to cause maximum disease is an important step in bioherbicide formulation. Therefore, the present study was carried out to know the optimum age of *Fusarium pallidoroseum* and its culture filtrate effective for parthenium mortality and its seed germination.

MATERIALS AND METHODS

This experiment was conducted to find out the optimum age of fungus culture suspension and culture filtrate of *F. pallidoroseum,* which caused maximum damage to the weed and its germination.

Preparation of the inoculum

Coon's (pH 6.6) broth inoculated with *F. pallidoroseum* culture disc (8 mm) was incubated for different periods *viz.,* 7, 15, 21, 28 and 35 days at room temperature. The mycelial mat was taken by filtering through Whatman No. 1 filter paper and the filtrate was passed through bacterial filter. The culture filtrate collected was used for bioassay. The fungus culture suspension (hither to referred as fungus culture) of the test pathogen was prepared individually by homogenizing 150 g of mycelial mat of different age along with spores of the pathogen in 1 liter of water (Hooda and Grover, 1988).

Effect on parthenium weed mortality

Parthenium plants were raised in earthen pots @ 10

plants/pot and maintained in glass house. Thirty days old plants were washed gently with sterile distilled water and allowed to dry. The plants were individually sprayed in the evening to the run off point with fungus culture or culture filtrate of different age along with Tween 20 (0.05%) using an atomizer. Parthenium plants received water + Tween 20 (0.05%) spray served as control. Then the plants were transferred into an environmental test chamber (Remi) maintained for 48 h at 28 ± 2° C and 95% RH immediately after spray and then transferred to the glass house. The disease incidence was recorded 15 days after spray. Each treatment was replicated thrice in a randomized block design. The PDI (%), leaf infectin (%) and plant mortality (%) were recorded. The disease intensity was graded as follows using 1 to 9 scale of Tamil Nadu Agricultural University e.g. score chart 1 : healthy, 3 : 1-10 % leaf area infected, 5 : 11-25 % leaf area infected, 7 : 26-50 % leaf area infected and 9 : >50 % leaf area infected. The per cent Disease Index (PDI) was worked out using the formula given by Mckinney (1923).

$$PDI = \frac{\text{Sum of total grades}}{\text{No. of leaves observed}} \times \frac{100}{\text{maximum grade}}$$

$$\text{Per cent incidence} = \frac{\text{No. of diseased twigs}}{\text{No. of healthy twigs}} \times 100$$

Effect on parthenium seed germination

Prechilled parthenium seeds were surface sterilized with 0.1% sodium hypochlorite ; washed thrice with sterile distilled water ; shade dried ; soaked individually in fungus culture or culture filtrate for 60 min. and the germination test was performed by roll towel method (ISTA, 1985). Seeds soaked in sterile distilled water served as control. One hundred seeds were used for each treatment and each treatment was replicated four times. The observation on seed germination was recorded seven days after inoculation (DAI). The root length and shoot length were also measured for ten randomly selected healthy seedlings and vigour index was worked out as Vigour index (Abdul – Baki and Anderson, 1973). = Germination (%) × Total seedling length (cm).

RESULTS AND DISCUSSION

Table 1 : Effect of age of fungus culture of *Fusarium pallidoroseum* isolates on symptom expression.

Age of Culture (days)	PDI* (%)	IOC (%)	Leaf infection* (%)	IOC (%)	Plant mortality* (%)	IOC (%)
7	87.77^{a} (69.56)	87.77	100.00^{a} (80.90)	100.00	70.00^{a} (56.79)	70.00
14	88.04^{a} (69.73)	88.04	100.00^{a} (80.90)	100.00	70.00^{a} (56.79)	70.00
21	72.23^{b} (58.18)	72.33	82.00^{b} (64.90)	82.00	51.11^{b} (45.67)	51.11
28	65.55^{c} (54.09)	65.55	70.00^{c} (59.34)	74.00	30.33^{c} (33.46)	30.33
35	46.04^{d} (42.71)	46.04	52.00^{d} (46.14)	52.00	25.67^{d} (30.46)	25.67
Control	0.00^{e} (5.74)	–	0.00^{e} (2.87)	–	0.00^{e} (9.10)	–

IOC — Increase over control

• Mean of three replications. (Data in parentheses are arcsine-transformed values). In columns of A and B, means followed by a common letter are not significantly different at 5% level by DMRT.

Table 2 : Effect of age of fungus culture of *Fusarium pallidoroseum* on parthenium seed germination.

Age of Culture (days)	Seed germination* (%)	Reduction over control (%)	Shoot length* (cm)	Reduction over control (%)	Root length* (cm)	Reduction over control (%)	Vigour Index*	Reduction on over control (%)
7	0.00^{a} (2.87)	100.00	0.00^{a}	100.00	0.00^{a}	100.00	0.00^{a}	100.00
14	0.00^{a} (2.87)	100.00	0.00^{a}	100.00	0.00^{a}	100.00	0.00^{a}	100.00
21	3.00^{b} (9.97)	96.20	0.48^{b}	90.64	0.43^{b}	89.59	3.00^{b}	99.59
28	10.00^{c} (18.43)	87.34	1.12^{c}	78.17	1.00^{c}	75.79	21.00^{c}	97.13
35	21.00^{d} (27.27)	73.42	2.91^{d}	43.27	2.43^{d}	41.16	112.00^{d}	84.68
Control	79.00^{e} (62.73)	–	5.13^{e}	–	4.13^{e}	–	731.00^{e}	

* Mean of three replications. (Data in parentheses are arcsine-transformed values). In a column means followed by a common letter are not significantly different at 5% level by DMRT.

The results revealed that the young actively growing cultures (7-15 days old) of *F. pallidoroseum* were found to be more aggressive in reducing parthenium seed germination and causing maximum weed mortality than old cultures (>15 days old) (Tables 1 and 2). Identical results were also reported by Ramasamy and Shanmugam (1977), Ayanru and Green (1978) and Hooda and Grover (1988) with 3-5 days old cultures of *Macrophomina phaseolina*. Osman *et al.* (1992) found that 10 days old cultures of *Fusarium oxysporum* were highly virulent. Similar result was reported by Singh and Mehrotra (1982). They suggested that the young mycelial inoculum of *Rhizoctonia batatocola* was more effective in reducing the seedling emergence and increasing the percentage of infected gram plants. Recently, Pandey *et al.* (1998) reported the maximum mortality of parthenium seedling when actively growing mycelial propagules of *Sclerotium rolfsii* was used as inoculum. They also found that the medium lethal time (LT50) was significantly less in course of actively growing mycelial inoculum. This might be due to the young actively growing propagules have sufficient amount of energy and synthetic new structural materials which are essential for the initial infection, penetration and establishment of the pathogen inside the host. In the initial stage of culture growth, fungus gets plenty of available of nutrients from the culture media, which should direct the accumulation of appropriate endogenous resources essential of virulence.

Table 3 : Effect of age of culture filtrate of *Fusarium pallidoroseum* on symptom expression.

Age of Culture filtrate (days)	PDI* (%)	IOC (%)	Leaf infection* (%)	IOC (%)	Plant mortality* (%)	IOC (%)
7	0.00^{e} (5.74)	—	0.00^{e} (2.87)	—	0.00^{e} (9.10)	—
14	37.03^{d} (37.48)	37.03	67.40^{d} (55.18)	67.40	5.00^{d} (12.93)	5.00
21	71.48^{c} (57.72)	71.48	91.57^{c} (73.13)	91.57	26.67^{c} (31.00)	26.67
28	87.03^{a} (68.90)	87.03	100.00^{a} (80.90)	100.00	70.00^{a} (56.79)	66.67
35	82.59^{b} (65.34)	82.59	96.27^{b} (78.87)	96.27	40.00^{b} (39.23)	40.00
Control	0.00^{e} (5.74)	–	0.00^{e} (2.87)	–	0.00^{e} (9.10)	–

* Mean of three replications. (Data in parentheses are arcsine-transformed values). In columns of A and B, means followed by a common letter are not significantly different at 5% level by DMRT.

The data presented the Tables 3 and 4 clearly indicated that the virulence of culture filtrate increased with increase in age of incubation (28 days) and slowly declined thereafter. This was in agreement with the findings of Khare and Goswami (1996) who suggested that the activity of toxic metabolite of *Alternaria palanduii* in inducing symptom and inhibiting seed germination of onion increase with increase in age of culture filtrate. The enhanced actively of aged culture filtrate may be due to the presence of higher quantities of toxins and enzymes. Singh *et al.* (1986), similarly, found that *F. oxysporum* produced pectinolytic and

Table 4 : Effect of age of culture filtrate of *Fusarium pallidoroseum* on parthenium seed germination.

Age of Culture filtrate (days)	Seed germination* (%)	Reduction over control (%)	Shoot length* (cm)	Reduction over control (%)	Root length* (cm)	Reduction over control (%)	Vigour Index*	Reduction on over control (%)
7	78.50^{d} (62.38)	0.32	4.65^{e}	9.36	3.90^{e}	5.56	671.00^{e}	8.20
14	36.25^{c} (37.05)	53.97	3.08^{d}	39.96	2.55^{d}	38.26	204.00^{d}	72.09
21	17.75^{b} (24.95)	77.46	1.63^{c}	68.23	1.18^{c}	71.43	50.00^{c}	93.16
28	0.00^{a} (2.87)	100.00	0.00^{a}	100.00	0.00^{a}	100.00	0.00^{a}	100.00
35	2.00^{a} (8.13)	97.46	0.48^{b}	90.64	0.28^{b}	93.22	2.00^{b}	99.73
Control	78.75^{e} (62.55)	–	5.13^{f}	–	4.13^{f}	–	731.00^{f}	

• Mean of four replications. (Data in parentheses are arcsine-transformed values). In columns of A and B, means followed by a common letter are not significantly different at 5% level by DMRT.

cellulolytic enzymes into the culture filtrate. The mycelial inoculum plays an important role in the initial infection which leads to plant mortality as well as complete inhibition of seed germination and in later disease severity may be enhanced by their *in situ* production of toxic metabolites.

REFERENCES

Abdul - Baki, A. A. and Anderson, J. D. (1973). Vigour determination in soybean seed by multiple criteria *Crop Sci.*, **13** : 630-633.

Ayanru, D. K. G. and Green, R. J. (1978). Germinability of sclerotia of *Macrophomina phaseolina. Can. J. Bot.*, **56** : 1107-1112.

DBT-GOI (1996). Project on "Biological control approaches in the management of *Parthenium hysterophorus* L., *Solanum elaegnifolium* and *Eupotorium glandulosum.* Annual report, 1994-1006. Dept. of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore, India.

Deshpande, K. S., Deshpande, V. K. and Baig, H. M. V. (1997). Managing Parthenium : Achill's heel undamaged in : Proc. First Intl. Confr. Parthenium Management. Vol. II, (Eds. Mahadevappa, M. and V. C. Patil), October 6-8, UAS, Dharwad, Karnataka, India. 97-98 pp.

Evans, H. C. (1997). *Parthenium hysterophorus* : a review of its weed status and the possibilities for biological control. *Biocontrol News and Information,* **18** : 89-98.

Hooda, I. and Grover, R. K. (1988). Effect of age, quantity of inoculum and isolates of *Macrophomina phaseolina* on the pathogenesis of mungbean and its control by chemical. *Indian Phytopath.* **41** : 107-117.

ISTA (1985) International Rules of Seed Testing. *Seed Sci. and Technol.*, **13** : 299-355.

Kauraw, L. P. and Bhan, V. M. (1995). Pathogens associated with *Parthenium hysterophorus* and *Eichhornia crassipes. Weed News,* **2**(1&2) : 1-2.

Kauraw, L. P., Chile A. and Bhan, V. M. (1997). Evaluation of *Fusarium pallidoroscum* (Cooke.) Sacc. for the bio control of *Parthenium hysteroehorus* L. In : Proc. First Intl. Confr. Parthenium Management. (Eds. Mahadevappa, M. and V. C. Patill), October 6-8, UAS, Dharwad, Karnataka, India. 70-74 pp.

Khare, U. K. and Goswami, V. G. (1996). Studies on metabolites produced by *Alternaria porri,* the causal organism of purple blotch of onion. *Indian Phytopath.*, **49** : 167-169.

Mckinney, H. H. (1923). A new system of grading plant diseases. *J. Agric. Res.*, **26** : 195-218.

Osman, M., El-Sayed, M. A., Mohameb, Y. A. H. and Metwally, M. (1992). Effect of various culture conditions of *Alternaria alternata* and *Fusarium oxysporum* : culture media, temperature, age and carbon source. *Microbios,* **71** : 15-26.

Pandey, A. K., Farkya, S. and Rajak, R. C. (1992). A preliminary evaluation of *Fusarium* spp. for biological control of *Parthenium. J. Indian Bot. Soc.*, **71** : 103-105.

Pandey, A. K., Mishra, J. and Hasija, S. K. (1998). Effect of inoculum of mycoherbicidal potential of *Sclerotium rolfsii* against parthenium. *J. Mycol. Pl. Pathol.*, **28** : 284-287.

Ramasamy, R. and Shanmugam, N. (1977). Studies on factors influencing seedling disease of cotton *(Macrophomina phaseolina). Madras Agric. J.*, **64** : 413-415.

Singh, P. L. and Mehrotra, R. S. (1982). Penetration and invasion of gram roots by *Rhizoctonia bataticola. Indian Phytopath.*, **35** : 336.

Singh, V., Sinha R. K. P. and Sinha S. K. (1986). Effect of culture filtrate of seed borne mycoflora of soybean upon seed germinability and seedling length. *Indian J. Mycol. Pl. Pathol.*, **16** : 192-193.

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