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Microorganisms for the management of Phomopsis blight and fruit rot of eggplant caused by *Phomopsis vexans* (Sacc. & Syd.) Harter

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Antimicrobial action of *Bacillus subtilis ,Streptmyces griseus, Aspergillus* spp., *Penicillium* spp., *Trichoderma* spp. and *Periconia* sp. against *Phomopsis vexans*, the causal organism of eggplant blight and fruit rot, revealed the efficacy in terms of overgrowth, formation of vacuoles in mycelium, die back and mycelial-fruiting body damage, in variable proportion. *Trichoderma harzianum* and *Bacillus subtilis* were found most effective.

Key words : Eggplant, Phomopsis blight, biocontrol, antagonists

INTRODUCTION

Phomopsis blight and fruit rot of eggplant (*Solanum melongena* L.) incited by *Phomopsis vexans* (Sacc. & Syd.) Harter is the most serious and wide spread disease next to bacterial wilt. The disease has been reported to cause heavy losses from various countries and from different state of India. The disease has been observed in severe form around Jabalpur almost every year during October-Novermber, as well as April-May (Varma, 1996 and Vishunavat, 1992). Antifungal properties of several agro-chemicals and pesticides have been reported, however, the general consciousness for health and bio-safety inhibits the application of hazardous chemicals especially in the post GATT and WTO region. Hence present investigation has been attempted to evaluate the microorganism against blight and fruit rot pathogen.

MATERIALS AND METHODS

The purified bacteria, actinomycetes and fungi isolated from phyllosphere and rhizosphere of eggplant were evaluated for antagonism against *P. vexans* on PDA in Petri plates by presumptive test as described by Broadbent *et al.* (1971). One disc of *P. vexans* was placed in the center of each PDA plates. Simultaneously, the plate was inoculated with four different organisms to be tested for antagonism, at equi-distance . The test organisms showing inhibition of antagonistic behaviour were re-tested by bi-culture method. Separate plates were used for each microorganism. Seven mm discs of 10 days old culture of *P. vexans* was placed in each plate. Similarly, one disc of culture of fungi, bacteria and actinomycetes was also kept. The plates were kept for incubation at 25° C. Antagonistic behaviour was recorded under compound microscope and zone of inhibition was measured.

RESULTS AND DISCUSSION

Three bacteria (*Bacillus subtilis*), two actinomycetes (*Streptmyces griseus* and *Streptomyces* sp.) and seven fungi, *Aspergillus* spp., *Penicillium* spp., *Trichoderma* spp. and *Periconia* sp. were tested against *P. vexans*. The reaction of these micro-organisms to *P. vexans* is presented in Tables 1 and 2 and Figs. 1 and 2.

Varying degree of reactions have been encountered and documented herewith.

Reaction 1 : Inhibition of the fungus at a distance resulting in zone of inhibition with continuous growth of the antagonists. Three strains of *Bacillus subtilis* (S1, S2 and S3; Fig. 1F,G and H), two species of *Streptomyces* (Fig. 1E) and two fungi *Trichoderma viride* and *Periconia* sp. had the positive reaction. In case of *Periconia* sp. (Fig. 1 C and D) the growing hyphal tips of the test fungus turned black, which failed to grew on PDA due to die-back (Fig. 2A and B).

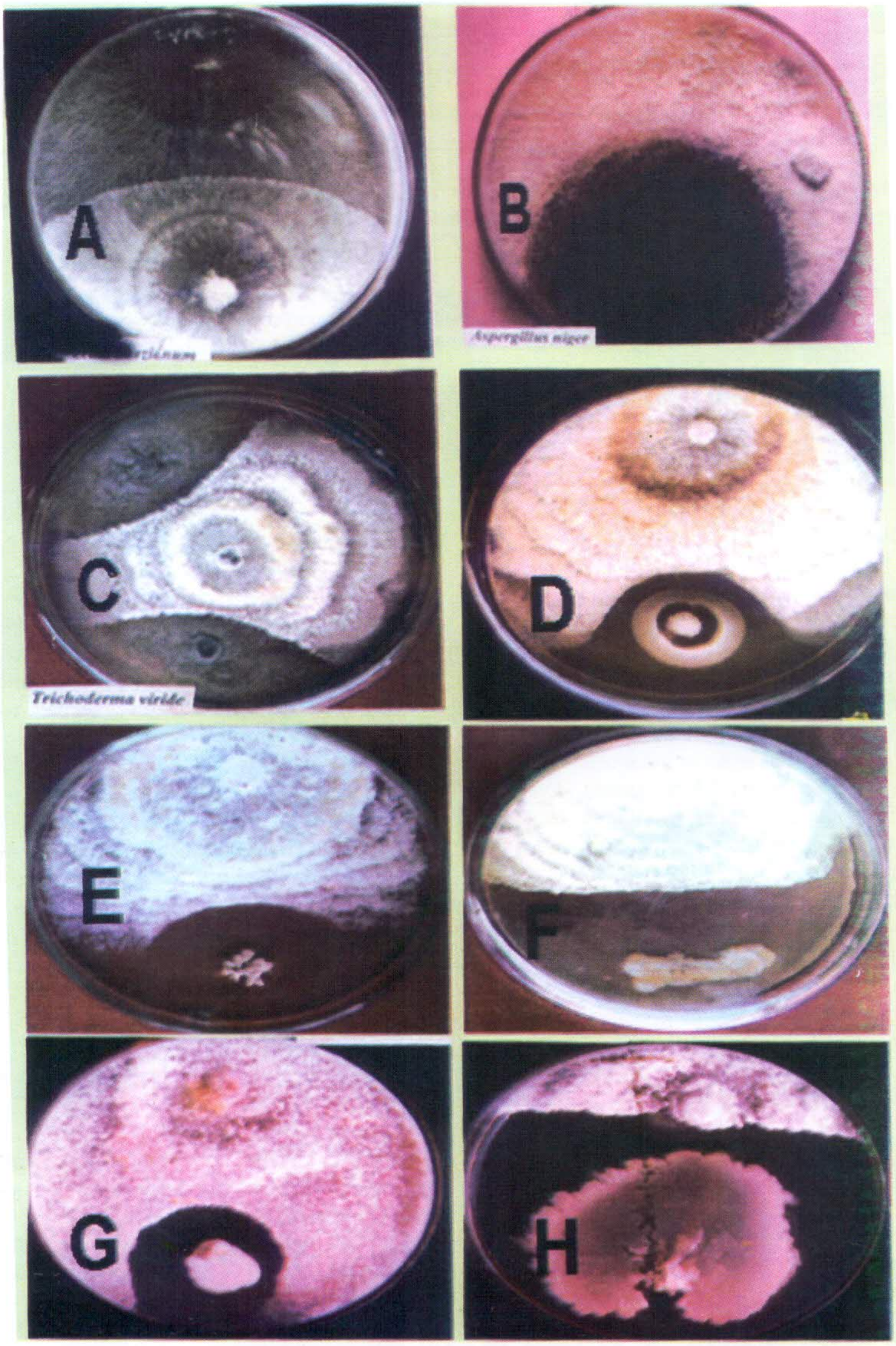

Fig.1 : Showing antagonistic activity of some fungi, bacteria and actinomycetes against *Phomopsis vexans*

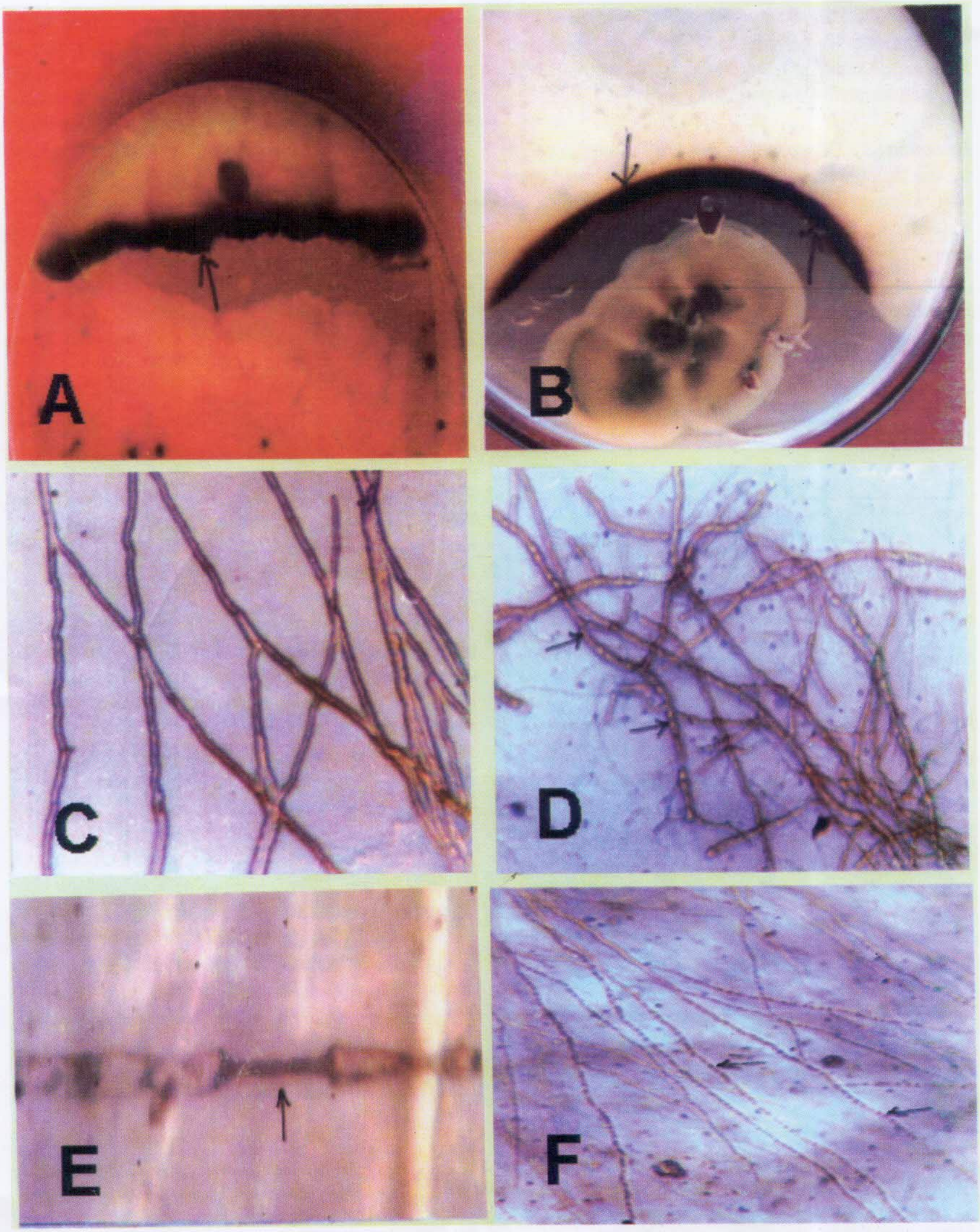

Fig.2 : Showing mechanism of action of some antagosits against *Phomopsis vexans*

Reaction 2 : Mutual intermingling of colonies of the test fungus and antagonist was recorded. *Aspergillus niger* and *Trichoderma harzianum* (Fig. 1A) had exhibited the reaction.

Reaction 3 : The growth of the fungus was checked by the antagonists. In this case only *T. harzianum* had shown the reaction. In bi-culture with *T. harzianum, P. vexans* failed to produce pycnidia even after 20 days of incubation period

Reaction 4 : No reaction – In this case *Aspergillus flavus, Penicillium funiculosum* and *P. pinophillum* showed the reaction.

Table 1 : Reaction of *Phomopsis vexans* to fungi, bacteria and actinomycetes tested as bio-control agents

Group	Microorganism	Reaction			
		1	2	3	4
Fungi	*Aspergillus niger*	–	+	–	–
	Aspergillus flavus	–	–	–	+
	Penicillium funiculosum	–	–	–	+
	Penicillium pinophilum	–	–	–	+
	Trichoderma harzianum	–	–	+	–
	Trichoderma viride	+	–	–	–
	Periconia sp.	+	–	–	–
Bacteria	*Bacillus subtilis (S1)*	+	–	–	–
	Bacillus subtilis (S2)	+	–	–	–
	Bacillus subtilis (S3)	+	–	–	–
Actinormycetes	*Streptomyces griseus*	+	–	–	–
	Streptomyces sp.	+	–	–	–

(+) = Reaction observed; (–) = Reaction not observed.

Zone of inhibition formed in bi-culture method of various antagonists revealed that maximum (21.00 mm) was formed by *B. subtilis* S1 followed by *S. griseus* (15.22 mm) *Periconia* sp. (12.00 mm), *B. subtilis* S2 (10.50 mm), *Streptomyces* sp. (9.33 mm) and *B. subtilis* S3 (8.5 mm) (Table 2)

Table 2 : Inhibition zone developed due to *Phomopsis vexans* as observed in bi-culture plate method with antagonists

Antagonists	Inhibition zone (mm)	Growth of *P. vexans* (mm)
Periconia sp.	12.00	37.66
Bacillus subtilis S1	10.50	18.00 × 63.30
Bacillus subtilis S2	21.00	10.00 × 42.50
Bacillus subtilis S3	8.50	14.33
Streptomyces griseus	15.20	12.33
Streptomyces sp.	9.33	15.50

Mean of 10 replications.

Microscopic observations of the interaction of *P. vexans* with antagonists revealed that mycelium of the test fungus became thin, vacuolated coupled with shrinkage (Fig. 2 E) in mycelium. Whereas mycelium of the test fungus (Fig. 2 C) became thick, dark black and vacuolated due to *B. subtilis* isolates and *Periconia* sp.

Three fungi *Periconia* sp., *Trichoderma harzianum* and *T. viride* have been found antagonists to *P. vexans*. *T. harzianum* is antagonistic against many pathogenic fungi and to several including species of *Phomopsis, P. sclerotioides* and *P. viticola* (Wells *et al.,*1972, Blackman and Roderiguez-Kabana,1975, Ale-Agha *et al.,* 1974, Dubos *et al.*,1978; Jharia, 1985). *T. harzianum* reduced the growth of almost all the pathogens of eggplant tested and was found effective in reducing the disease symptoms on leaves and seedlings (Sharma and Dureja, 2004) However, no other reports are available against *P. vexans.* Three strains of *Bacillus subtilis* and two isolates of *Streptomyces* have been found antagonistic to *P. vexans.* These microorganisms have been found antagonistic to many pathogenic fungi and species of *Phomopsis* other than *P. vexans*. (Broadbent *et al.*,1971, Marriman *et al.*,1974, Guttar and Littauer, 1953 , Ahmed and Ahmed, 1965; Reddy and Rao, 1971). On the contrary, none of the *Penicillium* spp. were found antagonistic to *Phomopsis* in the present investigation as reported by Spencer (1977), This may be due to the difference in species of antagonists as well as testing organism. As regards the mechanism of antagonism of *T. harzianum* and *B. subtilis* strains, lysis of mycelium (Fig. 2 A and B), formation of vacuoles (Fig. 2 D and F), shrinkage ot mycylium (Fig. 2C) and blackening of hyphal tip (Fig. 2 A and B) were noticed which were in accordance with those reported by Jharia (1985) but no vesicles and chlamydospores like cells were observed as reported by Pezet(1974).

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