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Antagonistic activity of *Streptomyces* sp. and *Streptoverticillium* sp. towards *Macrophomina phaseolina* causing seedling blight of jute

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Screening of soil from different parts of West Bengal yielded several actinomycetes. *Streptomyces* sp. and *Streptoverticillium* sp. showed antagonistic reactions to *Macrophomina phaseolina* causing seeding blight of jute. In plate culture both the actinomycetes showed a clear inhibition zone against *M. phaseolina*. In soil, corn meal grown actinomycetes showed the most effective action in reduction of seeding blight of jute. The most effective method for disease control appeared to be the soil treatment with two *Streptoverticillium* isolates—NR7 and NR10, while the least effective were the Streptomycesisolate—NR_2 and KR_3 isolate of *Streptoverticillium*. However, the use of these two actinomycetes as seed coating agents did not show any significant reduction in disease.

Key words : *Streptomyces, Streptoverticillium,* antagonistic activity, *Macrophomina phaseolina,* jute

INTRODUCTION

Several actinomycetes have been shown to be antagonistic towards *Macrophomina phaseolina*, a soil borne pathogen of many crops in the tropics. The species reported to be antagonistic towards *M. phaseolina* include *Actinomyces griseus* (Orsenigo *et al.*, 1955), *Chainia antibiotica* (Thirumalachar, 1955), *Streptomyces griseus, S. albus* and *S. noursif* (Gaffar, 1971). A study was undertaken to investigate the antagonistic potential of two actinomycetes viz, *Streptomyces* sp. and *Streptoverticillium* sp. against *M. phaseolina in vitro* and their potential use in soil and seed for reduction of seedling blight of jute.

MATERIALS AND METHODS

Soil dilutions of 10^{-7}—10^{-8} concentration were prepared and plated on glycerine arginine medium and incubated for 3—4 days. The plates were then inoculated with a dilute hyphal preparation of *M. phaseolina* (from 3 days old cultures) and incubated at 37° ± 1°C. Promising isolates indicated by the clear zone. They were isolated and maintained on potato-dextrose agar slants. Random individual tests were made by placing *Macrophomina* hyphal block on the middle portion of the petridish and actinomycetes on the two other sides on potato dextrose agar medium.

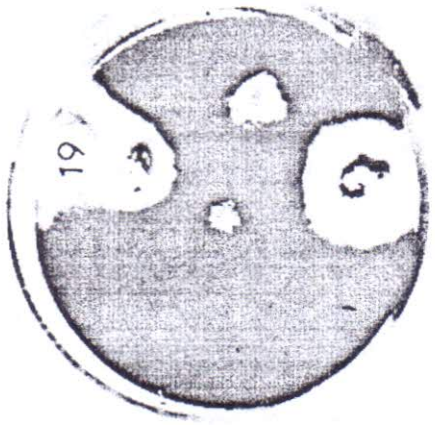
The promising isolates were sent to CMI, Kew, Surrey, England for identification and accesses.

In soil conditions for testing biological control potential, the antagonistic actinomycets were grown on soil corn meal medium (Gaffar, 1971) and Potato dextrose broth. These were mixed with the soil at the rate of 300g / Kg. and 150 ml medium / Kg. of soil respectively. The soil actinomycetes mixture was incubated under slightly moist conditions for five days. Jute seeds (var. JRC 412) were sown and the seedlings inoculated with sand maize meal grown *Macrophomina phaseolina*, keeping uninoculated controls.

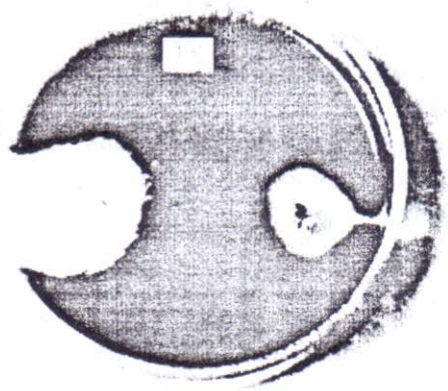
After 21 days seedling blight was recorded. In another trial, jute seeds were coated with actinomycetes and sown in soil. For days old jute seedlings were inoculated with *Macrophomina phaseolina* as in the earlier exeriment. In control set, seeds were sown without actinomycetes coating and inoculated in the same way. After 21 days seedling blight was recorded.

RESULTS

In plate culture a clear inhibition zone was observed with two actinomycets genera. Others did not show any antogonistic activity towards *M. phaseolina*. Among the two genera isolates NR_2, NR_7, NR_{10} and KR_3 were the positive potential indicated by very broad clear zones (Fig. 1). The potential antigonists were then partially microscopically characterized. These showed branched mycelial mass, produced in a verticil at regular intervals, chains are rounded oblong spores — NR_7, NR_{10}, KR_3 sp. Vegetative hyphae coenocytic, slender, aerial mycelium forms chains of spores 0.5–2.5 μ in idameter Gram +ve and aerobic — NR_2. The cultures were identified by C.M.I.Kew, London as *Streptomyces* (NR_2) and *Streptoverticilium* sp. (NR_7, NR_{10}, KR_3).



A



B

Fig. 1 : (A) Antagonistic activity of *Streptomyces* and (B) *Streptoverticillium*

Soil treatment with corn meal grown actinomycete isolates showed that all test/isolates were most effective in reduction of seedling blight of jute. When the isolates were delivered at the rate of 10% in corn meal medium, all treatments were found to be effective. Most effective appeared to be soil treatment with the two *Streptoverticillium* isolates NR_7 and NR_{10}. Relatively less effective were the *Streptomyces* isolate NR2 and KR3 isolate of *Streptoverticillium*. The results of experiment where soil treatment with potato dextrose broth was done more or less echoed those of the previous experiment, NR7 and NT10 being most effective following by KR3. The *Streptomyces* sp. was least effective. Seed treatment with these did not show any significent result (Table 1.)

Table 1 : Antagonistic activity of some Actinomycetes against *Macrophomina phaseolina* causing seedling blight of jute.

Antagonist Code No.	IMI No.	Generic Name	% reduction of seedling blight[a] cornmeal medium	Potato Dextrose broth	Seed coating with antagonist
NR_2	B 9947	*Streptomyces* sp.	54.08 (47.29) b	46.6 (43.05)	1.14 (1.28)
NR_7	B 9949	*Streptoverticillium* sp.	88.18 (69.82)	76.0 (60.67)	7.48 2.82)
NR_{10}	B 9950	*Streptoverticillium* sp.	85.28 (49.95)	83.9 (55.06)	8.30 (3.82)
KR_3	B 9948	*Streptoverticillium* sp.	58.57 (49.95)	67.2 (55.06)	14.14 (3.82)
		C. D. at 5%	9.36	18.81	NS

a $\frac{C - T}{C} \times 1000$ = % reduction of seedling blight

b figure in the parenthesis angular transform value.

DISCUSSION

The present investigations on the interaction of *Streptoverticillium* and *Streptomyces* sp. with *M. phaseolina* on agar plate and also in soil and seeds has given an indication that *M. phaseolina* is sensitive to the above two actinomycetes with these are applied to soil. All the isolates which antagonized *M. phaseolina* in the agar plate reduced the incidence of seedling blight of jute. It may be assured that the reduction of disease is due to the production of antibiotics by antagonistic activity of *M. phaseolina*. Reduction of diseases of many crops has been shown successfully using *Streptomyces* sp. by Singh and Mehrotra (1980) and Johnson (1954). It was also observed that seeds coated with

antagonistic actinomycetes failed to illicit remarkable response. Seeds of several family contain antimicrobial compounds (Nickell, 1959). which may cease the activity of antagonistic antimycetes. These experiments confirmed the promise is these isolates of actinomycetes positive as biocontrol agents for *M. phaseolina*. Subsequently using IMI No. B9950 (isolate NR_{10}) was investiagted in greater detail and a crude antibiotic was isolated with n-butanol (pH 7.0) that was highly potent against M. phaseolina and several other soil borne plant pathogones (Chattopadhyay and Sen, 1998).

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