Short communication

Neth. J. Pl. Path. 76 (1970) 326–328

Control of rootrot of guar caused by *Sclerotium rolfsii* with *Streptomyces nigrifaciens*

K. C. BASU CHAUDHARY[1] and (SM.) S. GUPTA

Botany Department, Agra College, Agra, India

Accepted 16 June 1970

Attempts to control soil-borne diseases by introducing antagonistic actinomycetes into the soil had some success. Severity of *Pythium* rootrot of sugar cane and corn was diminished by such introduction of various actinomycetes into sterilized soil (Tims, 1932; Cooper and Chilton, 1947; Johnson, 1954). Lachance and Perrault (1953) reported that all the actinomycetes that displayed antagonistic activity against *usariumF oxysporum* f. *lini* in vitro delayed the onset of symptoms of flax seedlings growing in soil treated with actinomycetes. Mach (1956) observed that several actinomycetes that were antagonistic towards *Pythium debaryanum* and *Rhizoctonia solani* effectively prevented root rot development for a period of 12 weeks when applied to the soil eight days earlier than the pathogens.

The present investigation deals with experiments performed to study the control of rootrot of guar (*Cyamopsis psolaroides*) caused by *Sclerotium rolfsii* Sacc. under glasshouse conditions, through the application of *Streptomyces nigrifaciens* Waksman.

The experiments were laid in sterilized and unsterilized soils under glasshouse conditions. Earthenware pots, 10 cm in diameter, were sterilized and filled with sterilized and unsterilized garden soils. *Streptomyces nigrifaciens* and *Sclerotium rolfsii* were grown in petri dishes on potato-dextrose agar. After 10 days the pots were infested with *S. nigrifaciens* and *S. rolfsii* by introducing in the soil five discs (20 mm in diameter) of the inoculum of either organism. In the third set, the pots were infested with *S. nigrifaciens* seven days before the infestation with the pathogen and in the last set both the organisms were inoculated simultaneously. Five guar seeds which were surface-sterilized were sown in each pot. Six replications for each treatment were maintained. The plants were observed for six weeks from the date of sowing and disease development in each pot was noted. Gupta (1967) developed a method to demonstrate production of antibiotic substance in soil. The antibiotic substance was extracted by vigorously shaking *S. nigrifaciens* infested soil either with 15 ml of sterilized distilled water or with butanol for 10 minutes. The extracts were centrifuged and the supernatant liquid assayed for antifungal activity. In case of butanol extract, however, supernatant liquid was evaporated before the dry residue was taken up with 1 ml butanol

[1] Present address: Department of Plant Pathology, Faculty of Agriculture, Banaras Hindu University, Varanasi-5 (India).

Table 1. The effect of *Streptomyces nigrifaciens* on the incidence of rootrot of guar caused by *Sclerotium rolfsii*.

Pot No	Number of plants developing rootrot symptoms							
	unsterilized soil				sterilized soil			
	a	b	c	d	a	b	c	d
1	0	5	3	3	0	4	1	1
2	0	4	2	4	0	4	0	1
3	0	5	2	2	0	5	1	2
4	0	4	4	3	0	5	0	2
5	0	4	3	5	0	4	0	1
6	0	4	3	2	0	4	1	0
Mean	0	4.3	3.1[1]	3.1[2]	0	4.3	0.5[3]	1.1[4]

a =(control) soil not infested with *S. nigrifaciens* and *S. rolfsii*.
b = (control) pots infested with *S. rolfsii*
c = *S. nigrifaciens* introduced 7 days before *S. rolfsii*.
d = *S. nigrifaciens* and *S. rolfsii* introduced simultaneously.

[1] Significantly different from control b (unsterilized soil) at $P < 0.05$ and not significantly different from d (unsterilized soil).
[2] Significantly different from control b (unsterilized soil) at $0.05 < P < 0.10$.
[3] Significantly different from control b (sterilized soil) at $P < 0.01$ and not significantly different fromd (sterilized soil).
[4] Significantly different from control b (sterilized soil) at $P < 0.01$.

Tabel 1. Het effect van Streptomyces nigrifaciens op het voorkomen van wortelrot bij guar veroorzaakt door Sclerotium rolfsii.

and diluted with 9 ml sterilized distilled water. Parallel controls were also set up. The data presented in Table 1 indicate that guar plants developed rootrot symptoms but the number of plants developing symptoms was less in treatments when *S. nigrifaciens* was present. This reduction seemed to be greater when the antagonistic organism occurred in the soil a week before the infestation with the pathogen both in the sterilized and the unsterilized soil, though in neither case was the difference significant. During the course of the experiment it was also observed that in the control series (b), symptoms developed at an early stage whereas in other series the entry of the pathogen into the host was delayed.

Investigations by Gottlieb and Siminoff (1952), Gottlieb et al. (1952) revealed that chloromycetin and actidione are produced in the soil by *Streptomyces venezulae* and *S. griseus*. Similarly *Trichoderma viride* (Wright 1954) formed gliotoxin and *Penicillium nigricans* (Wright 1955) produced griseofulvin in sterilized soil. There are several examples of antibiotic production by micro-organisms in soil. These antibiotics can control plant diseases (Stevenson 1954, Gupta 1967). Investigation also reveals that the antagonistic organism when introduced into the soil can effectively control rootrot development in guar plants. An indication was obtained that control may be more effective when the antagonist was introduced earlier than the pathogen as it could proliferate and produced enough active substance to check the multiplication of the pathogen. In sterilized soil, with no competition either between the antagonist and other soil microflora or between their metabolic products, the control was more effective than in unsterilized soil.

Acknowledgment

The authors are much indebted to Prof. S. Sinha for facilities and suggestions and to the CSIR, New Delhi, for grant of fellowship to one of us (SG).

Samenvatting

Bestrijding van wortelrot bij guar (Cyamopsis psolaroides) veroorzaakt door Sclerotium rolfsii met behulp van Streptomyces nigrifaciens

Schimmelziekten die via de grond overgaan, kunnen soms door antagonistische actinomyceten met enig succes worden bestreden. Zo tastte wortelrot – veroorzaakt door *Pythium* – maïs en suikerriet minder aan als er verschillende actinomyceten aan de grond werden toegevoegd.

Bij dit onderzoek werd getracht het wortelrot van 'guar' (*Cyamopsis psolaroides*), veroorzaakt door *Sclerotium rolfsii*, te bestrijden met behulp van *Streptomyces nigrifaciens*.

Het aantal planten dat symptomen vertoonde na inoculatie met *S. rolfsii* was geringer wanneer *S. nigrifaciens* voorkwam (Tabel 1). Het effect van de antagonist was groter in gesteriliseerde dan in ongesteriliseerde grond.

References

Cooper, H. E. & Chilton, S. J. P., 1947. Occurrence of *Actinomyces* antiibotic to *Pythium* in some sugar-cane soils of Louisiana. (Abstr.) Phytopathology 37: 5.

Gottlieb, D. & Siminoff, P., 1952. The production and role of antibiotics in soil. II. Chloromycetin. Phytopathology 41: 91–97.

Gottlieb, D., Siminoff, P. & Martin, M., 1952. The production and role of antibiotics in soil. IV. Actidione and clavacin. Phytopathology 41: 493–496.

Gupta, S., 1967. Physiological studies on the production and action of an antifungal substance by an actinomycete. Ph. D. Thesis, Agra University, Agra.

Johnson, L. F., 1954. Antibiosis in relation to *Pythium* root rot of sugar-cane and corn. Phytopathology 44: 69–73.

Lachance, R. O. & Perrault, C., 1953. Antagonisme des microorganismes du sol envers *Fusarium oxysporum* f. *lini* agent de la flébrissure du lin. Can. J. Bot. 31: 515–521.

Mach[1], F., 1956. Untersuchungen über die Möglichkeiten einer Bekämpfung phytopathogener Pilze mit einer saphrophytischen Bodenphase (Vermehrungspilze) durch Superinfektion mit antagonistisch aktiven *Streptomyces* stammen. Zentbl. Bakt. ParasitKde (Abt. II) 110: 1–25.

Stevenson, I. L., 1954. Antibiotic activity of actinomycetes in soil and their controlling effect on root rot of wheat. J. gen. Microbiol. 14: 440–448.

Tims, E. C., 1932. An actinomycete antagonistic to a *Pythium* root parasite of sugar-cane. (Abstr.) Phytopathology 22: 27.

Wright, J. M., 1954. The production of antibiotics in soil. I. Production of gliotoxin by *Trichoderma viride*. Ann. appl. Biol. 41: 280–284.

Wright, J. M., 1955. The production of antibiotics in soil. II. Production of griseofulvin by *Penicillium nigricans*. Ann. appl. Biol. 43: 288–296.

[1] Original not seen.