Research Note

PERFORMANCE OF ARTHROBOTRYS *SPP., ALONE AND IN COMBINATION WITH* PAECILOMYCES LILACINUS, *AS BIOCONTROLLERS OF* MELOIDOGYNE INCOGNITA *IN TOMATO*[1]

Nematophilic fungi are used to attack the eggs and larvae of *Meloidogyne incognita* (Kofoid and White) Chitwood, affecting tomato production. Jatala et al. reported the use of *Paecilomyces lilacinus* (Thom) Samson for control of root knot nematodes of potato in Peru.[2] Candanedo-Lay et al. reported on the control of root knot and potato cyst nematodes with *P. lilacinus*.[3,4] During several decades, research on the control of nematodes has focused on the application of nematode-trapping fungi.[5] Recently, Royal 350, a commercial brand of an isolate of *Arthrobotrys* spp., was prepared by Cayrol and Frankowski[6] and Cayrol et al.[7] to control *Meloidogyne*.

The study herein reported was conducted to determine the potential of *P. lilacinus* and *Arthrobotrys* spp. alone or combined, to control *M. incognita*.

Twenty-one plastic containers, 10 cm diameter, were filled with a sandy loam (2.1% organic matter and 7.8 pH) sterilized with methyl bromide. There were seven treatments: (a) 6.25 g of rice colonized with *P. lilacinus* added to the soil two weeks before planting; (b) *Paecilomyces* added to the soil at planting; (c) *Arthrobotrys* spp. added to the soil at plant ing; (d) *Arthrobotrys* spp. plus *Paecilomyces* added to the soil at planting; (e) *Arthrobotrys* added to the seedbed three weeks before transplanting + *Paecilomyces* added to the soil two weeks before planting. Two control treatments with nematodes were also included. One was without fungi, and the other, also without fungi, included rice. Pots were planted with five-week old tomato seedlings (cv. Duke). The *Paecilomyces* isolate was obtained from Dr. Parvis Jatala, International Potato Center, Peru. The inoculum in a rice substrate was produced following the methodology suggested by Dr. Parvis Jatala. Commercial rice was imbibed in water and left overnight, then washed in tap water and autoclaved for 50 minutes. The autoclaved rice was transferred to a polyethylene bag (250 g rice/bag). One ml of

[1]Manuscript submitted to Editorial Board 11 October 1988.

[2]Jatala, P., R. Salas, R. Kaltenbach, and M. Bocangel, 1981. Multiple application and long term effect of *Paecilomyces lilacinus* in controlling *Meloidogyne incognita* under field condition. *J. Nematol.* 13: 445.

[3]Candanedo-Lay, E., J. Lara, P. Jatala y F. González, 1982. Evaluación preliminar del comportamiento de *Paecilomyces lilacinus* como controlador biológico del nematodo nodulador, *Meloidogyne incognita* en tomate industrial. *Nematropica* 12: 154.

[4]Candanedo-Lay, E., R. Rodríguez-Ch., y P. Jatala, 1982. Evaluación preliminar del comportamiento de *Paecilomyces lilacinus* como controlador biológico del nematodo del quiste de la papa. Nematropica 12: 154.

[5]Jatala, P., 1986. Biological control of plant parasitic nematodes. *Ann. Rev. Phytopathol.* 24: 453–489.

[6]Cayrol, J. C. and J. P. Frankowski. 1979. Une méthode de lutte biologique contre les nématodes á galles de racines appartenant au genre Méloidogyne. *Rev. Hort.* 193: 15–23.

[7]_____, _____, A. Laniece, G. Dhardemare, and J. P. Talon, 1978. Contre les nématodes en champignonnieré mise au point dún méthode de lutte biologique a l'aide dantipolis (Royal 300). *Rev. Hort.* 184: 23–30.

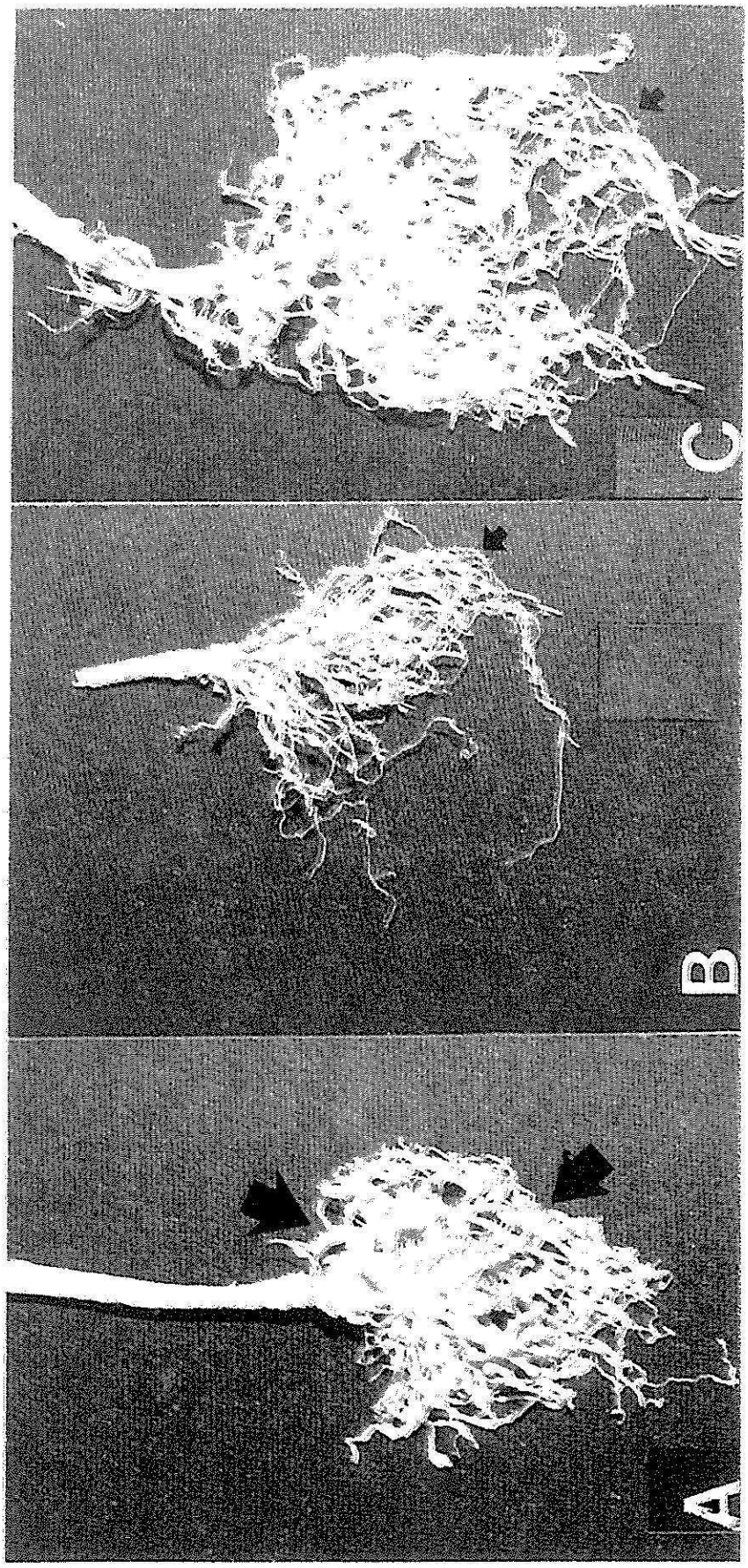

FIG. 1—Roots of tomato infected with eggs of *M. incognita*; A - nematode inoculated check with rice showing heavy nodulation; B - roots with *Paecilomyces lilacinus* added 2 weeks before planting showing little nodulation; C - tomato roots with *Paecilomyces* and *Arthrobotrys* added 2 and 3 weeks, respectively before planting showing few galls.

TABLE 1.—*Effect of the fungi* P. lilacinus *and* Arthrobotrys *spp. on* M. incognita *and root knot in tomato cv. Duke.*

Treatment	No. of eggs/ roots	Root knot index (0–5)
Paecilomyces 2 wks before planting + N	28,319 a	5
Paecilomyces at planting + N	88,128 b	5
Arthrobotrys at planting + N	57,056 ac	5
Arthrobotrys + *Paecilomyces* at planting + N	70,080 bc	5
Arthrobotrys 3 wks + *Paecilomyces* 2 wks before planting + N	82,213 bc	5
Check + N	84,608 bc	5
Check + rice + N	79,552 bc	5

N = nematode.

[y] All values in columns followed by the same letter do not differ (P = 0.05), according to Least Significant Difference Test (L.S.D.).

[z] Root-knot index based on the following scale: 0 = 0, 1 = 1 – 2, 2 = 3 – 10, 3 = 11 – 30, 4 = 31 – 100, 5 = greater than 100 galls.

a fungal suspension (*P. lilacinus*) was added to each bag, then incubated at 28-30° C for 10 days.

Arthrobotrys spp. provided by Dr. Rocío Rodríguez was obtained from alfalfa roots associated with root rot symptoms from Pennsylvania. The fungus was cultured in 20 cm of PDA petri plates incubated at 30° C for 10 days. The inoculum was prepared by scraping the surface of the fungal culture and then rinsing it with sterile distilled water. The mycelial suspension of 4 plates was poured in 200 ml of sterile distilled water. Five ml of the suspension were poured per cell of seedbed trays containing tomato seedlings.

All pots received 6,000 *M. incognita* eggs and second-stage juveniles added with an Oxford pipette. Nematode inocula were extracted from the tomato roots by the method of Hussey and Barker.[8] Three replicates per treatment were arranged in a complete randomized design and kept on a greenhouse bench for 45 days. Plants were watered as needed and fertilized periodically with N-P-K (20-20-20).

Forty-five days after inoculation with *M. incognita* eggs, mean values of a 0-5 gall index (0 = 0, 1 = 1 – 2, 2 = 3 – 10, 3 = 11 – 30, 4 = 31 – 100, 5 = over 100 galls) and number of eggs were recorded. Data were analyzed using analysis of variance (ANOVA) and differences compared by the least significant difference test (LSD).

Significantly fewer eggs of *M. incognita* were recovered from roots of plants inoculated with *P. lilacinus* 2 weeks before planting as compared to the other treatments except from those treated with *Arthrobotrys* at planting. These results show

[8] Hussey, R. and K. R. Barker, 1973. A comparison of methods of collecting inocula of *Meloidogyne* spp., including a new technique. *Plant Dis. Rep.* 57: 1025–128.

that *Paecilomyces* apparently works better when added to the soil prior to nematode inoculation, whereas *Arthrobotrys* performs better when added with the nematode at transplanting. Román and Rodríguez[9] found that *Paecilomyces* has a better control on *Meloidogyne* as the time lapse between the addition of the fungus and the addition of the nematode is increased in the same treatment. Even though a root knot index of 5 was obtained from all nematode inoculated treatments, roots from plants inoculated with *P. lilacinus* 2 weeks before planting showed the smallest root galls (Fig. 1).

Luis A. Sánchez
Research Technician
Nelia Acosta
Nematologist
Nydia Vicente
Research Assistant

[9]Román, J. and A. Rodríguez-Marcano, 1985. Effect on the fungus *Paecilomyces lilacinus* on the larval population and root knot formation of *Meloidogyne incognita* in tomato. *J. Agric. Univ. P. R.* 59 (2): 159–67.