Effects of the nematode-trapping fungus, *Monacrosporium ellipsosporium* on *Meloidogyne incognita* populations in field soil

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SUMMARY

Monacrosporium ellipsosporium was frequently observed associated with *Meloidogyne* egg masses in some field soils and in potted cultures of the nematode. Six geographic isolates varied in their relative predacity toward larvae emerging from egg masses. An aggressive isolate, chosen for rapidity and abundance of trap formation *in vitro*, was tested in greenhouse and field tests for protection of tomato from *M. incognita*. A test of tomato in potted field soil inoculated at 1, 5 and 10 g fungal inoculum/15 cm pot, 15 days before nematode inoculation, showed significant reduction in plant damage at the 5 and 10 g levels, but none at the 1 g rate. Galling was reduced 42 % and 49 %, respectively, in the 5 and 10 g fungal treatments. Larvae in the soil and females/plant were also similarly reduced, but were the same as controls at the 1 g rate. In a field test using two levels of fungus on wheat grain substrate mixed into transplant holes for tomato seedlings, the improved plant growth and *M. incognita* reduction obtained at harvest were also in direct relationship to amounts of the fungus used, but the treatments did not differ statistically from the control.

RÉSUMÉ

Effet du champignon piégeur de nématodes, Monacrosporium ellipsosporium, *sur les populations de* Meloidogyne incognita *dans le sol*

Monacrosporium ellipsosporium est fréquemment observé en association avec les masses d'œufs de *Meloidogyne*, tant dans le sol naturel que dans celui provenant d'élevage en pot du nématode. Six isolats géographiques de ce champignon ont montré un pouvoir d'agressivité variable envers les larves provenant des masses d'œufs. Un isolat particulièrement agressif, choisi pour la rapidité et l'abondance de la formation des pièges *in vitro*, a été testé en serre et au champ pour la protection de tomates contre *M. incognita*. Un essai sur tomates en pots ensemencés avec 1, 5 et 10 g d'inoculum fongique par pot de 15 cm, 15 jours avant l'inoculation par le nématode, a montré une réduction significative des dégâts causés à la plante pour les inoculums de niveau 5 et 10 g, mais non pour celui de niveau 1 g. Le nombre de galles a été réduit de 42 et 49 % respectivement, pour les traitements de niveau 5 et 10 g. Les nombres de larves dans le sol et de femelles par plante sont également réduits, mais demeurent identiques pour le témoin et le niveau d'inoculum 1 g. Au champ, dans un essai à deux niveaux d'inoculum fongique ayant pour substrat des grains de blé placés dans les trous de transplantation des tomates, la meilleure croissance des plantes et la réduction de l'infestation par *M. incognita* étaient également en relation directe avec le taux de champignon utilisé mais, statistiquement, ces traitements ne différaient pas du témoin.

The nematode-trapping fungus *Monacrosporium ellipsosporium* (Grove) Subr. has been frequently observed by us to be associated with root-knot nematode egg masses. *Meloidogyne* spp. egg masses excised from roots of plants from greenhouse pot cultures and from field crops and then placed on water agar in Petri dishes often became overgrown with hyphae and conidiophores of the fungus. In some instances 60-70 % of all egg masses from a single sample were infested but more usually the fungus was isolated from only about 10-30 %. Eggs were never observed to be attacked by the fungus but larvae hatching from the eggs and moving over the surface of the agar were ensnared in large numbers by the sticky knob traps produced on the hyphae surrounding the egg masses *M. ellipsosporium* was also observed to be commonly associated with root-knot nematode infested vineyards throughout the San Joaquin Valley area of California. This association of the fungus with *Meloidogyne* egg masses prompted an investigation of the effectiveness of this antagonist in influencing root-knot nematode population dynamics and plant damage. Of five nematode-trapping fungi tested by Linford and Yap (1939) only *M. ellipsosporium* protected potted pineapple plants from root-knot nematode injury. Of six species tested by Mankau (1961), *M. ellipsosporium* was one of three species which gave a slight but significant degree of protection from *M. incognita* to potted okra and tomato plants. It also showed some beneficial effects

of the growth of tomato plants in combination with *Arthrobotrys dactyloides* in field microplot tests but gave no reduction in the final root-knot nematode population or in galling of roots.

Materials and methods

Meloidogyne incognita used for inoculum was cultured on tomato *(Lycopersicon esculentum* Mill. cv. Tropic) in the greenhouse and the larvae were extracted from roots in a mist chamber. Field soil infested with *M. incognita* and possibly mixed with *M. javanica* was collected from a fig grove at Univ. of Calif. Riverside Experiment Station farm. Six isolates of *M. ellipsosporium* were chosen from the collection of our Nematode Pathobiology Laboratory for testing of predacity to root-knot nematode larvae. Five isolates (Acc. Nos. 578-6, 597, 582-9, 585-1 & 60) were from various areas of California's San Joaquin Valley, the first two from root-knot infested peach orchards, the second two from vineyards and the last was from a citrus orchard. A sixth isolate (100) was from a local ornamental planting.

To test relative predacity of the isolates, agar plugs were cut from corn meal agar (CMA) cultures of each fungus and placed in the center of 20 % CMA plates. When hyphal growth had extended several cm from the plug, a *Meloidogyne* egg mass which had been sterilized in a 10 % solution of commercial hypochlorite for a few minutes, were placed at the edge of the mycelium. Nematode-trapping was observed by inverting the plastic Petri dish and viewing through the bottom with a stereoscopic microscope. A grid was designed around each egg mass which permitted enumerating trapped larvae in contiguous zones extending away from the egg mass (Fig. 1) in each plate. Zone A, extended 5 mm in each direction from the egg mass and comprised a square of 100 mm^2; zone B, C and D., extended from 5-15, 15-25 and 25-35 mm, respectively, in each direction and formed successive contiguous square areas of 800 mm^2 surrounding the egg mass.

In an additional test to screen *M. ellipsosporium* isolates, spores of the fungus were examined for rapidity and abundance of trap formation when exposed to natural soil (A) and an aqueous extract of natural soil (B). In series A, root-knot infested field soil was placed in the bottom of 9 cm diam. Petri dishes, thoroughly moistened, stirred and the surface leveled. Two 12.7 mm diam. No. 740-E absorbent paper discs (Schleicher & Schuell) were placed on the surface of the moist soil. For series B, an extract of the same soil was prepared by adding

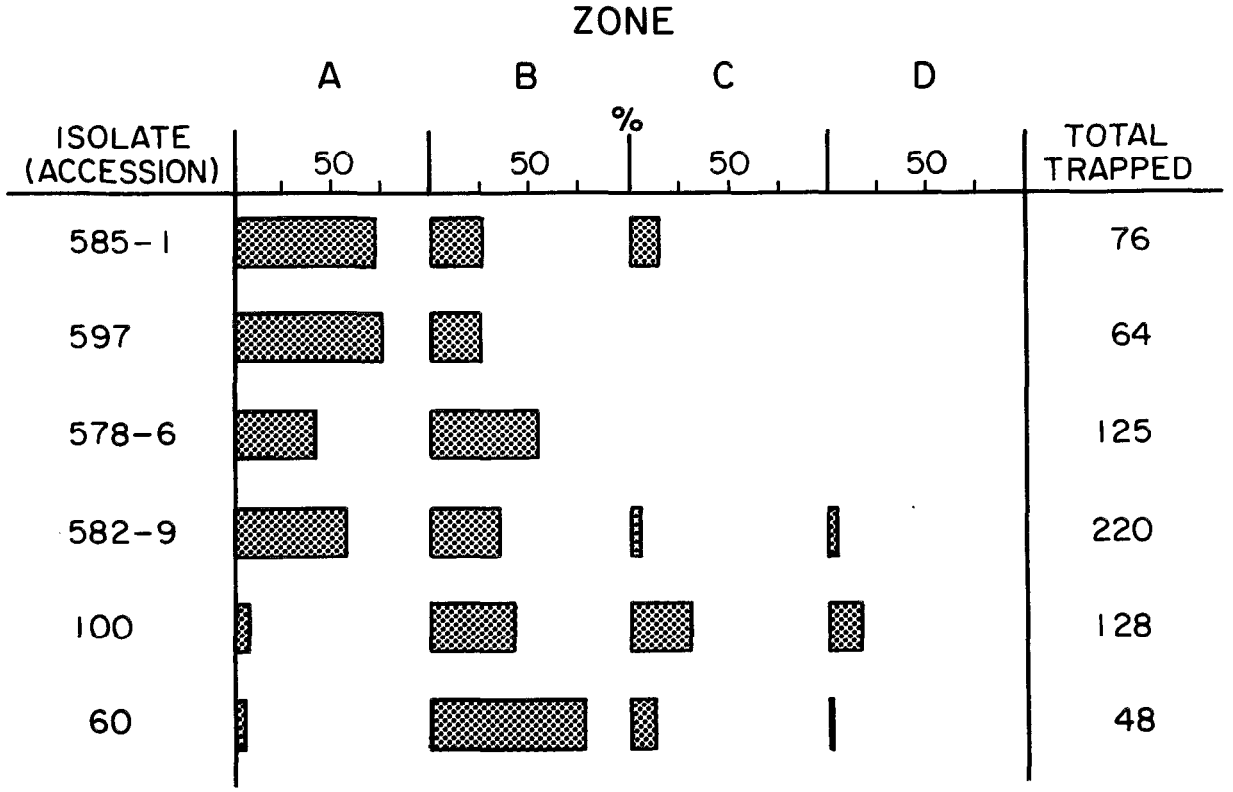

Fig. 1. Percentage of *Meloidogyne* larvae trapped by *Monacrosporium ellipsosporium* isolates in contiguous areas around egg masses on agar plates (average of three Petri dishes).

50 ml distilled water to 100 cm^3 soil, stirring for a short period and then decanting the water solution through each of a standard No. 20, 100 and 400 sieve to free it of nematodes. Enough soil extract was poured into replicate 9 cm Petri dishes to cover the bottom and then the absorbent paper discs were placed in the extract. A culture of *M. ellipsosporium* that had sporulated on CMA received 1 cm of distilled water to form a pool on the agar surface which was agitated to free the spores and produce a uniform suspension of spores. Five mm diam. water agar plugs were cut from a poured plate, picked up with a needle and touched to the spore suspension and then inverted and placed on the filter paper discs in both series of plates. After 48 h incubation, the WA plugs were removed to a microscope slide and observed under a compound microscope to count traps.

The *M. ellipsosporium* isolate No. 585-1, was chosen for greenhouse and field studies based on the laboratory tests above. Isolate No. 100 had been used for the preliminary greenhouse test conducted prior to the assay of isolates. The fungus was cultured on approximately 50 cm^3 quantities of sterile, moistened unhusked wheat kernels in 114 cm^3 bottles inoculated from Petri dish cultures. Some inoculum was also prepared in larger units.

Greenhouse tests

A preliminary test was conducted in which field soil containing approximately 250 *Meloidogyne* larvae/500 cm.., was used in three treatments : uninoculated soil in treatment A, the same soil mixed with 24 g *M. ellipsosporium* (Acc 100) inoculum/pot in treatment B, and a control treatment of steam-pasteurized soil (C) which did not receive fungus inoculum. There were three pots per treatment. All pots were planted with tomato seedlings after 10 days incubation and randomized on a greenhouse bench. After 39 days growth, the plants were measured and removed from the pots to observe root galling. Soil and root fragments from each pot were plated on three replicate 10 % CMA Petri dishes to recover predacious fungi present.

A second greenhouse test included five treatments replicated six times : (1) Root-knot larvae and 10 g/pot of the uninoculated fungal substrate, (2) Root-knot larvae plus 1 g/pot fungal inoculum and 9 g/pot uninoculated fungal substrate, (3) Root-knot larvae plus 5 g/pot fungal inoculum and 5 g/pot uninoculated fungal substrate, and (4) Root-knot larvae plus 10 g/pot fungal inoculum, (5) An autoclaved control soil without nematode or fungal inoculum but receiving 10 g/pot of the sterile wheat kernel substrate used to culture *M. ellipsosporium*. The fungus inoculum and uninoculated fungal substrate were mixed separately for each pot with approximately 1,500 g soil and then potted. The pots were incubated on a greenhouse bench for 10 days with adequate moisture and then the soil was sampled and plated for recovery of predacious fungi. Each pot was planted with one tomato seedling. After 24 hours, all pots in treatments 1 through 4 received 1,000 *Meloidogyne* larvae/pot in 5 ml water. The plants were grown for 45 days after inoculation with nematodes and then measured, removed from the pots and soil, weighed and rated for galling. Galls were excised from the roots of each plant, weighed and the percent root weight attributable to galls calculated. Total numbers of female *Meloidogyne* per root system were also counted. After plant roots were removed, the soil was also assayed for *M. ellipsosporium* by plating 1 g of soil particles on two 10 % CMA plates per replicate and root-knot larvae were extracted from 50 cm^3. Ten egg masses were excised from the roots of each plant in treatments 1-4 and plated on 20 % CMA for assay of *M. ellipsosporium*. The remaining original soil was returned to each respective pot and replanted with a tomato seedling. After 40 days, the second crop was harvested and measured as before.

Field experiments

A test was set up in a root-knot nematode infested field at UC South Coast Field Station in which *M. ellipsosporium* inoculum was added to soil in transplant holes for tomato seedlings at two levels, a third treatment of control plants received uninoculated fungal substrate and an additional group of plants did not receive any treatment. The field was fairly uniformly infested with a moderate population of *M. incognita*. Tomato seedlings for transplanting were started in compartmented seedling trays in a lath house and were 7-10 cm tall when used. Seedlings used in the two fungal-inoculated treatments had the soil around each of their root systems injected with 2 ml of a blended liquid suspension of *M. ellipsosporium* from four 50 ml seventeen-day-old wheat germ extract cultures, four days before transplanting. The seedlings used in the fungus control treatment received 2 ml of distilled water. Each treatment had fifteen replicate seedlings and was surrounded by guard rows. The treatments were as follows :

A : Control, each transplant received 50 g uninoculated fungal substrate.

B : Each transplant received 5 g *M. ellipsosporium* inoculum and 45 g uninoculated fungal substrate (1 : 9 dilution).

C : Each transplant received 50 g *M. ellipsosporium* inoculum.

The 50 g fungal inoculum and/or substrate was increased in bulk with 250 g blow sand, so that for each treatment, 300 g of the amendment was thoroughly mixed in the transplant hole before the seedling was transferred. The fungus had been cultured for 11 days on wheat kernel medium before use in the test. The experiment was set out in the field on May 24th. Just prior to planting the field was assayed for the presence

of nematode trapping fungi (NTF). On June 22, the soil around five plants in each treatment was sampled and assayed for NTF. The plants were harvested on August 23rd and their roots indexed for galling. Egg masses were assayed for the presence of the fungus by placing fifty random egg masses from each treatment on WA. Ten random soil samples from each treatment were plated and assayed for NTF at harvest and five random 50 cc soil samples were extracted for *Meloidogyne* larvae.

Results

The different isolates of *M. ellipsosporium* used in the *in vitro* tests exhibited considerable variability in response to *Meloidogyne* egg masses and hatching larvae as the hyphae grew past the inoculated egg masses. Isolates 585-1 and 597 formed traps and ensnared larvae so rapidly and effectively that most of the trapped nematodes were in the 100 mm² area immediately surrounding the egg masses; 72.3 % and 72.4 %, respectively, of the larvae were caught in that zone. Isolate 582-9 also trapped most nematodes closest to the egg masses but captured more than the previous isolates in the second zone (35.9 %); the 800 mm² contiguous area surrounding the first zone. The other isolates (578-6, 60 & 100) produced the sticky knob traps much more slowly and allowed hatched larvae to scatter away from the egg masses (Fig. 1). These latter isolates allowed larvae considerable migration over the agar surface before being trapped. All isolates, however, eventually trapped all hatched larvae. The total numbers of larvae trapped by each isolate (Fig. 1) in the test are not necessarily a measure of efficiency but rather reflect variability in the numbers of larvae actually hatched from egg masses with different numbers of eggs.

When spores were exposed to field soil solutes, the same two isolates (585-1 and 597) exceeded the others in numbers of traps produced per spore over 48 h; both when exposed to solutes absorbed directly from soil and when exposed to a fluid extract of soil free of nematodes (Table 1). Results were similar with either technique. In the plates with moistened soil some nematodes moved onto the agar plugs and microscope observations indicated that isolates 585-1 and 597 clearly trapped more nematodes than the other isolates did in the limited area of the plug surface. *M. ellipsosporium* spores generally produce two germ tubes extending in opposite directions and when the young hyphae are exposed to stimuli from living nematodes they immediately form traps.

Table 1

Number of sticky knob traps produced by *Monacrosporium ellipsosporium* on germ tubes from spores exposed for 48 hrs to moistened field soil and a nematode-free soil extract

Isolate	*On soil surface**	*In soil extract*
585-1	5	13
597	6	7
578-6	5	6
582-9	3	6
100	4	6
60	0.06	0

* Average of three replicate plates rounded to nearest whole number.

Table 2

Effect of *M. ellipsosporium* mixed in soil on greenhouse-grown tomato plants planted in root-knot nematode infested field soil

Treatments :	*A Field soil*	*B Field soil + 25 g fungus/pot*	*C Control pasteurized field soil*
Plant height (cm)	13.6*	25.4	24.5
Number leaves	9	12	12
Stem width (cm)	0.5	0.8	0.8
Dry weight tops (g)	1.6	5.8	3.7
Roots fresh weight (g)	1.6	3.7	3.5
Root gall index**	4	0.6	—

* Average on three replicates.
** Based on a scale of 1-5, reflecting percentage of total root system galled.

Greenhouse experiments

The preliminary test showed a striking reduction in root galling and plant stunting with the addition of *M. ellipsosporium* to field soil. The control plants (C) in pasteurized soil exhibited good growth over the 39 days of the test and had only a few small galls from larvae which may have escaped pasteurization. Plants in treatment A, hovewer, were severely stunted and their roots were heavily galled, while those in treatment B, amended with *M. ellipsosporium*, had very light galling and the best plant growth of all treatments (Table 2). *M. ellipsosporium* was recovered from all of the pots in which it had been inoculated at the end of the test.

The second test had striking reductions in galling and plant damage with moderate and high inoculum levels of *M. ellipsosporium* but less significant benefit from the light fungal inoculum. Galling was reduced by 49 % and 42 % respectively in the 10 g and 5 g fungal treatments,

but the 1 g fungal treatment was not significantly different from the fungus control. The number of females was reduced by 37 % in the 10 g treatment and by 32 % in the 5 g treatment and results were significant ($p = 0.01$). The 1 g inoculum level did not differ from the uninoculated treatment (Table 3).

Plant growth generally improved over the uninoculated treatment with each increment of fungal inoculum and at 10 g was the same as non-nematode infested controls (Table 3). In plant height and dry wt of tops, only the 10 g treatment was significantly greater than the uninoculated treatment and was also similar to the nematode control (Table 3).

After the plants were removed, the remaining soil was assayed for *Meloidogyne* larvae and *M. ellipsosporium*. Spores of the fungus were observed on 14 %, 30 % and 43 % of the plated soil particles, from the 1 g, 5 g and 10 g treatments, respectively. The fungus was not recovered from any pots in the control treatments. Similar results had been obtained at an initial assay of the fungus 10 days after its inoculation. The field soil used in this test contained a natural infestation of *Arthrobotrys oligospora, A. dactyloides, Monacrosporium eudermatum, Nematoctonus* sp. and *Stylopage* sp. and they were found sporadically in all treatments, but *M. ellipsosporium* was recovered only in the treatments in which it had been inoculated, both from soil and egg masses. Of the egg masses excised from roots in the nematode-infested treatments, 20 % contained *M. ellipsosporium* in the 5 g and 10 g treatments but the fungus did not appear on egg masses from the 1 g treatment and the fungus control.

The second crop of tomato plants replanted in all of the original pots was not significantly different among treatments at $p = 0.05$ in any respect, but the average growth of plants in the 10 g treatment was better than all other treatments. *M. ellipsosporium* was recovered from only one of 135 egg masses plated from the 5 g treatment and was not recovered from any egg masses in other treatments. Considerable unavoidable variation in the amount of soil remaining in individual pots for the second cropping possibly created a perturbation which may have adversely affected results, but it was clear that *M. ellipsosporium* had declined considerably.

Field experiment

The initial assay of the soil for NTF indicated that *Arthrobotrys oligospora, Monacrosporium gephyropagum* and *Stylopage* sp. were part of the resident flora of the field. After 29 days (June 22nd) the same three species were recovered from the control soil (A) and *M. ellipsosporium* but not *M. gephyropagum* was found in treatments B and C.

A slight stunting of the seedlings in the treatments as compared to untreated guard row plants not included in the experiment, was noted early in the growth of the tomato plants and remained evident until the plants were almost fully grown. However, at harvest these differences were not visually evident. A distinct faint odor could be detected from transplant holes in the amended treatments during the first few weeks and probably resulted from microbial activity on the fungal substrate. Microbial metabolites or ammonia from decomposition of the fungal substrate probably slowed growth of the seedlings initially.

At harvest, *M. ellipsosporium* was recovered from 5 % of the egg masses assayed in treatment B and from 2 %

Table 3

Control by the nematode-trapping fungus, *Monacrosporium ellipsosporium* of *Meloidogyne incognita* on tomato plants potted in root-knot infested field soil additionally inoculated with 1,000 larvae and grown for 49 days

Treatments	*Sterilized control*	*Meloidogyne + M. ellipsosporium* 1 g/pot	5 g/pot	10 g/pot	*Meloidogyne No Fungus*	*F. Values*
Plant Data						
Stem diam. (cm)	0.85	0.78	0.75	0.86	0.80	n.s.
Plant height (cm)	42	37	34	40	33	3.84*
Top Dry Wt. (g)	4.0	3.2	3.4	4.7	2.9	3.45*
Percent galled root tissue (by wt)	—	31	24	17	41	13.38**
Nematode Data						
No. larvae/50 cc soil	—	103	16	19	249	18.45**
No. females/root system	—	707	479	400	675	8.66**

* Significant at $p = 0.05$
** Significant at $p = 0.01$
(n.s.) = not significant

Table 4

Data from UC South Coast Field Station test utilizing *M. ellipsosporium* incorporated into tomato seedling transplant holes in irrigated field soil after 90 d growth season

Treatments	*Fresh Root Wt. (g)*	*Dried top Wt. (g)*	*Yield/plot (kg fruit)*	*Galling Index* (0-5)*	*R-k larvae/ 50 cm³ soil*
A. Fungus substrate only	52	40	4.8	4.2	3666
B. *M. ellipsosporium* 5 g/plant	52	44	5.3	3.9	1812
C. *M. ellipsosporium* 50 g/plant	49	50	6.3	3.7	2341

* 0 = 0 infection, 1 = 1-20 % (trace), 2 = 21-40 % (slight), 3 = 41-60 % (moderate), 4 = 61-80 % (severe), 5 = 81-100 % (very severe).

of the egg masses assayed in treatment C. The fungus was recovered from six of the ten soil samples assayed from treatment B, and eight of ten samples in treatment C.

The average number of larvae/50 cc soil extracted from treatments A, B and C were 3666, 1812 and 2341, respectively.

There was no significant difference between amended plants in root weight, shoot weight and galling index, although in each case, the averages for B were greater than A, and those for C were greater than B (Table 4). The roots of plants in treatment C were visually somewhat larger and slightly less galled than those in A and B. Yield was also greatest in C. There appeared to be a clear trend of protection by *M. ellipsosporium* but it was not substantial. Untreated guard row plants had a galling index of 4.9 compared to 4.2 for fungus control plants in the test (Table 4).

Discussion

Among the different geographic isolates of *M. ellipsosporium* we tested, considerable variation in trap formation and relative trapping activity was observed against root-knot nematodes hatching from egg masses on water agar. Such variation appears to be common, in our experience, and should be considered in any applied studies with these organisms. The *M. ellipsosporium* isolate which gave striking protection to plants potted in root-knot infested soil in the preliminary greenhouse test (No. 100), was not exceptional in trap formation or trapping efficiency when tested later with other isolates in the *in vitro* laboratory tests. The isolate chosen for further greenhouse and field testing (No. 585-1), however, trapped most of the larvae very close to the egg masses and was also one of the most prolific trap formers when conidia were exposed to natural soil solutes *in vitro* (Fig. 1, Table 1). These criteria were judged to be important for this type of fungal antagonist, particularly in relationship to the trapping of root-knot nematode larvae in the short span of time between hatching, leaving the egg mass, and penetrating a host root. There may be still other factors of equal or greater importance, however, which were not apparent in our tests; such as, available nutrients and ambient edaphic factors which affect trap formation.

Experiments with NTF in potted soil have often shown reduction of pest nematodes in sterile soil, but have given very equivocal results in field soil (Hams & Wilkin, 1961; Mankau, 1980a, 1980b; Al-Hazami, Schmitt & Sasser, 1982). However, our preliminary greenhouse test in natural soil was unexpectedly striking. Plants in the soil inoculated with *M. ellipsosporium* were equivalent to or slightly better than those in pasteurized soil (Table 2). In the 10-day interval after fungus inoculation and before roots were available for invasion by the larvae, numbers of nematodes were greatly reduced, resulting in very minimal galling of the protected plants. Since no control was provided for the effects of the large amount of fungus substrate amended in this initial test, that factor was measured in the subsequent greenhouse test which indicated that it was apparently not important. The encouraging results in potted field soil and the fact that the fungus could be recovered after 39 days, prompted the more detailed greenhouse experiment and a field trial.

The protection from root-knot nematode damage afforded by *M. ellipsosporium* was verified in the second greenhouse test. Fungal density appeared to be a factor since no protection was observed from the lowest rate of fungal inoculum but the 5 g rate gave highly significant reduction in galling and the 10 g rate was even better, although not significantly different from the 5 g inoculum. The fungus did not appear to persist through a second cropping of the pots. Potted soil under greenhouse irrigation regimens may not be a very satisfactory habitat for this fungus although some NTF appear regularly as contaminants in potted soil.

The NTF flora naturally resident in the field soil used in the greenhouse could not be quantitatively estimated with any accuracy, but it did not appear to be a factor in the experiment since the species observed appeared

sparsely and very erratically. All that could be determined was that some propagules of the observed fungi were naturally present in the field soil. None of the five species found would have any special relationship with the root-knot nematode other than the possibility of trapping some migrating larvae if the fungi were in the predacious phases. These observations emphasize, however, the rather ubiquitous presence of NTF in soil. The soil in the field experiment, located in a different county, contained three species including two in common with the previous soil.

The field experiment indicated that inoculum would have been best applied in a form not containing a substantial substrate for microbial decomposition. The large amounts of fungal media mixed in transplant holes caused some minor growth retardation of the seedlings in all treatments, but they were affected equally and recovered later in the growth period. The fungus was recovered at harvest where it had been inoculated and there appeared to be a clear indication of protection by *M. ellipsosporium,* but it was not substantial or statistically signifiant.

These experiments showed that a fungus of this type, with some relationship to the root-knot nematode life cycle, can give a significant amount of protection from the nematode, but it may not be adequate or dependable enough to provide reproducible crop protection without resorting to other methods of control. If the fungus would persist in inoculated soil at a high and uniform level, good biological control of the nematode would probably occur or plant damage may, at least, be held to an economically tolerable level. We have noted that *M. ellipsosporium* can be isolated with great frequency and regularity from certain soils, for example, root-knot infested San Joaquin Valley vineyard soils (Mankau, unpubl. data); but, it is extremely rarely isolated from Southern California citrus soils infested with citrus nematode *(Tylenchulus semipenetrans)* for unknown reasons. It is very difficult to determine whether the fungus exerts a level of control of the root-knot nematode in the vineyards where it occurs, but, in many cases the mature vines give reasonably good yields and root-knot nematode populations are modest. Long-term specialized monitoring of field populations would be necessary to determine what relationships exist between the fungus and nematode population dynamics.

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M. ellipsosporium is a slow growing fungus which is usually classified in the more predacious or group 2 of NTF (Cooke, 1963; Jansson & Nordbring-Hertz, 1979). Fungi in this group have been rarely used in experiments on biological control of nematodes since the more rapidly growing network-trap formers in group 1, generally *Arthrobotrys* spp., have been favored by the concept of a more rapid colonization of soil. But it is quite likely that fungi, such as this species, with the more specialized traps and predacious physiology will be more effective in demonstrating biological control (Kerry, 1984). A great deal more information on the biology of *M. ellipsosporium* is required to determine the factors which would promote its colonization and persistence in soil and its predacious activity.

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