Controlling *Meloidogyne javanica* on *Desmodium ovalifolium* with Grasses

JILLIAN M. LENNÉ, Tropical Pastures Program, Centro Internacional de Agricultura Tropical (CIAT), Apartado Aéreo 6713, Cali, Colombia

ABSTRACT

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The effect of grasses on the reaction of *Desmodium ovalifolium* (accession CIAT 350) to *Meloidogyne javanica* was measured. The nematode was less pathogenic to the legume in association with 22 of 49 grasses, including accessions of the promising pasture grasses *Andropogon gayanus, Brachiaria humidicola, B. mutica, B. ruziziensis, Panicum maximum*, and *Hemarthria altissima*. Roots of these grasses may produce substances that are toxic to *M. javanica*.

The root-knot nematode *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949 is distributed worldwide on *Desmodium* spp. (2,4,13,15). *M. javanica* can severely affect *D. ovalifolium* Guill. & Perr. (9), a promising forage legume in tropical Latin America (B. Grof, *personal communication*). Although *M. javanica* has not been detected at many pasture evaluation sites in tropical Latin America (9), it has caused severe damage to *D. ovalifolium* (accession CIAT 350) at several sites in Colombia and Brazil. The nematode causes stunting, chlorosis, and wilting of plants and, in severe infestations, defoliation and death.

Collection of new germ plasm of *D. ovalifolium* from Southeast Asia and screening for resistance to *M. javanica* have begun. However, selection of resistant material may take several years, and other methods of root-knot nematode control in pastures are being investigated.

Several plants antagonistic to nematodes have been reported; some produce toxins in their roots (7), including marigold (*Tagetes* spp.) (14), asparagus (*Asparagus officinalis*) (12), and some crucifers (3). Of more interest to tropical pasture research are pasture grasses that are antagonistic to nematodes, including *Chloris gayana* 'Katambora' (5), *Digitaria decumbens* (16), *Eragrostis curvula* 'Ermelo' (1,5,6,8), *Panicum maximum* 'Sabi' (5), and *Pennisetum glaucum* (10). In particular, *E. curvula*, when planted in rotations, has controlled root-knot nematodes in several crops in Africa (5,6,8). An experiment was therefore initiated to survey a range of grasses, including pasture grasses promising in tropical Latin America, to determine their effect in controlling *M. javanica* on *D. ovalifolium* CIAT 350.

MATERIALS AND METHODS

Preparation of plants. Acid-scarified seeds of *D. ovalifolium* CIAT 350 were germinated on moist filter paper in petri dishes. Seedlings were grown in the greenhouse in steam-sterilized soil (Oxisol from Santander de Quilichao, Colombia) in plastic pots (25 × 18 cm), two seedlings per pot. Recommended *Rhizobium* inoculum was applied 5 days after planting.

After 6 wk, vegetative propagules (two per pot) of 49 pasture grasses from 26 species were planted in the same pots. Grasses and legumes were grown for another 6 wk to allow root systems to become established. Treatments (*D. ovalifolium* alone and in combination with each grass and common marigold) were randomized and replicated four times.

Inoculum preparation and inoculation. Inoculum was prepared from galled roots of *D. ovalifolium* CIAT 350 plants maintained in the greenhouse in soil infested with an isolate of *M. javanica* from Santander de Quilichao. Galled roots were washed free of soil, shaken vigorously in 10% sodium hypochlorite solution for 3 min, and rinsed three times in sterile, distilled water. Roots were then chopped finely, wrapped loosely in paper tissue, placed on nylon mesh disks in petri dishes with sterile, distilled water, and incubated at 28 C. After 48 hr, suspensions containing second-stage larvae were separated and bulked for inoculum. The volume was adjusted to contain 20,000 nematodes per liter. With frequent agitation, 5 ml of inoculum (100 nematodes) was dispensed into a hole (0.5 cm in diameter and 10 cm deep) near the roots of each *D. ovalifolium* plant in three pots of each treatment. Sterile, distilled water (5 ml) was applied to small holes near the roots of each *D. ovalifolium* plant in one pot of each treatment. The inoculation procedure was repeated twice 8 wk apart.

Reaction rating. Plants were harvested 24 wk after the first inoculation. Roots of *D. ovalifolium* plants were carefully

Table 1. Degree of galling caused by *Meloidogyne javanica* on *Desmodium ovalifolium* CIAT 350 growing in association with grass species after 24 wk

Degree of galling[a]	Grass species
None	*Brachiaria ruziziensis, Eragrostis curvula* 6073[b], *Hemarthria altissima* 663, *Ischaemum cilare* 6062, *Panicum maximum* 604, *Tripsacum andersonii* 6051, *Tagetes* sp.[c]
Slight	*Andropogon gayanus* 6053; *Brachiaria humidicola* 679, 682, and 6013; *B. mutica* 'Para'; *B. radicans; Eragrostis curvula* 6066, 6067, 6068, and 6075; *Paspalum dilatatum* 6049; *Setaria sphacelata* 6043; *Dichanthium aristatum; Digitaria* sp. 6014; *Panicum maximum* 6002; *Urochloa mosambicensis* 614
Moderate	*Axonopus micay* 6050; *Brachiaria decumbens* 6009 and 6012; *Chloris gayana* 6042; *Dichanthium aristatum* 'Angleton'; *Echinochloa polystachya* 6018; *Eragrostis curvula* 6064, 6065, 6069, 6076, and 6082; *Panicum maximum* 622; *Pennisetum purpureum; Digitaria* sp. 651; control[d]
Severe	*Andropogon gayanus* 621; *Brachiaria brizantha* 6016; *B. decumbens* 606; *Digitaria decumbens* 659; *Echinochloa pyramidalis* 657; *Eragrostis curvula* 6074, 6078, 6079, and 6081; *Hyparrhenia rufa; Panicum maximum* 695; *Panicum coloratum* 683; *Pennisetum purpureum* 672

[a] None = no galls on any roots; slight = small, single galls affecting 10% of roots; moderate = single galls and small confluent galls affecting 20–40% of roots; severe = single galls and large confluent galls affecting more than 50% of roots.
[b] CIAT accession numbers.
[c] Commercial marigold.
[d] *Desmodium ovalifolium* CIAT 350 only.

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washed free of soil and separated from grass roots. Reaction to root-knot nematodes was rated according to the following system: no galling = no galls found on any roots; slight galling = small, single galls affecting 10% of roots; moderate galling = single galls and small confluent galls affecting 20–40% of roots; and severe galling = single galls and large confluent galls affecting more than 50% of roots. Roots of *D. ovalifolium* and grasses were also examined for the presence of female nematodes and/or eggs.

RESULTS AND DISCUSSION

The effect of the grasses on the reaction of *D. ovalifolium* CIAT 350 to *M. javanica* is shown in Table 1. The control, *D. ovalifolium* alone, was moderately galled. *D. ovalifolium* was also moderately galled in association with 14 grasses that did not appear to affect the legume-nematode relationship. *D. ovalifolium* was severely galled in association with 13 grasses; roots of these grasses may produce substances that directly stimulate *M. javanica* on the legume or that affect soil microflora that may stimulate this legume-nematode relationship.

D. ovalifolium CIAT 350, however, was affected slightly or not at all by *M. javanica* in association with 22 grasses (Table 1), including accessions of *Andropogon gayanus, Brachiaria humidicola, B. mutica, B. ruziziensis,* and *Panicum maximum*, promising pasture grasses in tropical Latin America, and *Hemarthria altissima*, a promising forage in southern Florida (11). In particular, *B. humidicola* grows well with *D. ovalifolium* CIAT 350 (B. Grof, *personal communication*), and results suggest that the legume could be grown successfully in *M. javanica*-infested soil in association with *B. humidicola*.

Common marigold also effectively controlled *M. javanica* on *D. ovalifolium* CIAT 350, in agreement with previous reports (14) of its antagonistic properties to nematodes. Results obtained for *C. gayana* and *Digitaria decumbens* (Table 1) contradict previous reports of their antagonism toward nematodes (5,16). Neither galls nor nematodes were found on any grass roots growing in association with *D. ovalifolium* CIAT 350.

Differences within several species of grasses with respect to their effect on the reaction of *D. ovalifolium* CIAT 350 to *M. javanica* were observed (Table 1). For example, the legume was less affected by *M. javanica* when grown in association with five accessions of *E. curvula*, reacted to the same extent as the control in association with five other accessions of this grass, and was more affected by *M. javanica* in association with four other accessions of the grass. Similar variation was found among four accessions of *Panicum maximum* (Table 1). Suatmadji (14) reported similar intraspecific differences within plants as well as differences in the antagonistic effects of one plant species on different *Meloidogyne* spp. Toxins produced by certain plants may be specific to certain nematodes.

Further studies are planned to confirm greenhouse results. Attempts will be made to isolate and identify any substances toxic to nematodes.

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