

# Plant-Parasitic Nematodes Associated with Maize in Cauca and Valle del Cauca, Colombia

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## ABSTRACT

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Sixteen species of plant-parasitic nematodes in 11 genera were recovered from 54 samples collected from the rhizosphere of maize in the departments of Cauca and Valle del Cauca, Colombia. *Pratylenchus* spp. were recovered most frequently from roots and second most frequently, after *Helicotylenchus* spp., from soil. *P. zeae* was by far the most common species of the genus recovered; the highest numbers were more than 91,000/g of dry root. *H. borinquensis* and *Paratrichodorus minor* were most prominent in the mountainous areas of Cauca but were found infrequently in Cauca del Valle.

Although nematodes are important in maize (*Zea mays* L.) culture in many parts of the world, relatively little work has been done with nematodes attacking this crop in Colombia, except *Pratylenchus thornei* in the Department of Cundinamarca (R. Barriga, *personal communication*). Reports from other Latin American countries indicate that nematodes are common around maize and that they are sometimes damaging to the crop (7,8,12,13). Because of increased interest in nematodes attacking maize in South America, the occurrence of some plant-parasitic nematodes associated with maize in southwestern Colombia is reported.

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## MATERIALS AND METHODS

Fifty-four composite samples of ten 2.5-cm cores taken to a depth of 20–25 cm were collected from the rhizosphere of maize in the departments of Cauca and Valle del Cauca during May 1983. Plant age averaged 52 days from seeding, with a range of 25–90 days. Five survey trips were made to different areas. Because the results are summarized partly by these areas, brief descriptions of the vicinities are given as follows (Fig. 1):

- Area 1, Valle del Cauca. On grounds of the Instituto Colombiano Agropecuario, Palmira; level, soils predominantly heavy.
- Area 2, Valle del Cauca. Mostly near Vijes, a few samples collected near Cali and Palmira; soils medium-textured to heavy.
- Area 3, Valle del Cauca: Jamundi, Cali. Cauca: Puerto Tejada, Santander; generally level, soils sandy to clay.
- Area 4, Cauca. Timbio, Patia. Small fields in highly dissected topography. Timbio: altitude generally higher than 2,000 m. Patia: altitude 400 m; soils mostly clay loams.
- Area 5, Valle del Cauca. Roldanillo, Ansermanuevo, Buga; generally level but

with some terracing, soils predominantly heavy.

Samples were processed by decanting and sieving 100 cm<sup>3</sup> of well-mixed soil from each sample and extracting the nematodes through tissue paper for 24–72 hr. Nematodes were recovered from roots mainly by the shaker method (3), except antibiotics were not used. A few root samples collected early in the survey were processed for endoparasites by placing 1–2 g of fibrous roots in a thin layer of water for 48–72 hr over a coarse



Fig. 1. Map of the departments Valle del Cauca and Cauca in southwestern Colombia.

mesh screen. Roots were dried and nematodes calculated as numbers per gram of dry root. Nematodes were preserved in 5% formalin at the Instituto Colombiano Agropecuario and returned to Iowa State University for identification. Ten percent of the nematodes were counted using a Hawksley slide. Prominence values (PV = density  $\sqrt{\text{frequency}}$ ) (1) were calculated for each species. Some specimens were not identified because of insufficient material or because they did

not fit described species. No attempt was made to identify the *Pratylenchus* spp. from area 1 (ICA). Representative specimens of most species were mounted in glycerine (10).

## RESULTS AND DISCUSSION

Sixteen species of plant-parasitic nematodes in 11 genera were recovered (Tables 1 and 2). *Helicotylenchus* spp. were recovered most frequently from soil. *Pratylenchus* spp. were recovered most

frequently from roots and second most frequently from soil (Table 1). *H. dihystra* was the most prominent species of the genus overall and was especially prominent in areas 1 and 5. *H. borinquensis* and *Paratrichodorus minor* were especially prominent in the mountainous area of Cauca but were found infrequently elsewhere (Table 2). *Pratylenchus zea* was by far the most common species of the genus obtained from either the soil or roots (Table 2). Other than *Rotylenchulus reniformis*, species in other genera were infrequent. Even though the fewest samples were collected in Cauca, these samples contained as many or more species compared with other areas. Samples collected in Cauca mountain valleys were mostly from fields of 1–2 ha where maize culture is more marginal than in many areas of Valle del Cauca.

Fortuner (5) demonstrated the variability in tail shape with *H. dihystra*, a species common in our study. Thus, in this study, little credence was given the tail shape unless greatly divergent from the type, and many tail shapes demonstrated by Fortuner were found. More emphasis was placed on the position of the phasmid (ie, well anterior to the anus vs. at or near the anus level) or to the fusion or nonfusion of the internal lateral lines on the tail. Measurements of

**Table 1.** Frequency, average, and maximum of plant-parasitic nematodes in maize roots and soil associated with maize in Cauca and Valle del Cauca departments, Colombia (May 1983)<sup>a</sup>

| Genus                          | Frequency (%) | Average                               |  | Maximum |
|--------------------------------|---------------|---------------------------------------|--|---------|
|                                |               | Nematodes/100 cm <sup>3</sup> of soil |  |         |
| <i>Helicotylenchus</i>         | 70            | 32                                    |  | 480     |
| <i>Pratylenchus</i>            | 48            | 32                                    |  | 130     |
| <i>Rotylenchulus</i>           | 48            | 33                                    |  | 230     |
| <i>Meloidogyne</i>             | 11            | 3                                     |  | 100     |
| <i>Xiphinema</i>               | 11            | 1                                     |  | 10      |
| <i>Criconemella</i>            | 9             | 2                                     |  | 30      |
| <i>Paratrichodorus</i>         | 7             | 2                                     |  | 70      |
| <i>Tylenchorhynchus</i>        | 7             | 1                                     |  | 10      |
| <i>Longidorus</i>              | 4             | 1                                     |  | 2       |
| <i>Quinisulcius</i>            | 4             | 1                                     |  | 10      |
| <i>Hoplolaimus</i>             | 2             | 1                                     |  | 10      |
| <b>Nematodes/g of dry root</b> |               |                                       |  |         |
| <i>Pratylenchus</i>            | 94            | 5,475                                 |  | 91,270  |
| <i>Meloidogyne</i>             | 4             | 131                                   |  | 6,771   |

<sup>a</sup>n = 54.

**Table 2.** Prominence value (PV) of plant-parasitic nematodes associated with maize in five areas of Cauca and Valle del Cauca departments, Colombia (May 1983)

| Genus<br>Species   | Areas     |            |            |           |            | All zones<br>(n = 54) |
|--|-----------|------------|------------|-----------|------------|-----------------------|
|  | 1 (n = 9) | 2 (n = 16) | 3 (n = 11) | 4 (n = 8) | 5 (n = 10) |                       |
| <b>PV based on nematodes/100 cm<sup>3</sup> of soil</b>            |           |            |            |           |            |                       |
| <i>Helicotylenchus</i> spp.  | 0.7       | 8.3        | 14.1       | 68.2      | 42.3       | 27.0                  |
| <i>Helicotylenchus</i> sp. (unidentified)                          | 0.7       | 0.3        | 1.6        | 1.6       | <0.1       | 0.9                   |
| <i>H. borinquensis</i> Roman                                       | 0.0       | <0.1       | 0.8        | 54.6      | <0.1       | 4.3                   |
| <i>H. crenacauda</i> Sher  | 0.5       | 0.0        | 0.6        | 0.0       | 0.0        | 0.1                   |
| <i>H. dihystra</i> (Cobb) Sher                                     | 26.4      | 1.1        | 4.6        | 0.4       | 36.8       | 10.5                  |
| <i>H. elegans</i> Roman  | 0.0       | 7.6        | 0.0        | 2.5       | 0.0        | 0.9                   |
| <i>H. tropicus</i> Roman   | 0.0       | 0.0        | 0.0        | 0.4       | 0.0        | <0.1                  |
| <i>Rotylenchulus reniformis</i> Linford & Oliveira                 | 73.0      | 3.2        | 12.9       | 0.0       | 58.1       | 22.8                  |
| <i>Pratylenchus</i> spp.   | 2.5       | 18.4       | 1.2        | 27.1      | 12.0       | 22.1                  |
| <i>Pratylenchus</i> sp. (unidentified)                             | 2.5       | 0.3        | 0.0        | 0.8       | <0.1       | 0.4                   |
| <i>P. brachyurus</i> (Godfrey) Filipjev & Schuurmans Stekhoven     | 0.0       | 0.2        | 0.0        | 0.9       | 0.0        | 0.1                   |
| <i>P. zea</i> Graham   | 0.0       | 15.3       | 1.2        | 10.9      | 8.2        | 6.8                   |
| <i>Meloidogyne</i> sp.   | 0.0       | 0.2        | 6.2        | 1.3       | 0.0        | 1.0                   |
| <i>Paratrichodorus minor</i> (Colbran) Siddiqi                     | 0.0       | 0.0        | 0.0        | 9.2       | <0.1       | 0.5                   |
| <i>Xiphinema brevicolle</i> Lordello & da Costa                    | 0.0       | 1.3        | 0.8        | 0.0       | 0.0        | 0.3                   |
| <i>Criconemella</i> sp., <i>C. ornata</i> (Raski) Luc & Raski      | 0.5       | 0.0        | 1.9        | 0.4       | <0.1       | 0.6                   |
| <i>Tylenchorhynchus</i> sp., <i>T. martini</i> Fielding            | 0.0       | 0.2        | 0.3        | 0.0       | 0.1        | 0.2                   |
| <i>Quinisulcius</i> sp.  | 0.0       | 0.0        | 0.0        | 0.4       | <0.1       | 0.1                   |
| <i>Hoplolaimus galeatus</i> (Cobb) Filipjev & Schuurmans Stekhoven | 0.5       | 0.0        | 0.0        | 0.0       | 0.0        | <0.1                  |
| <i>Longidorus laeviscapitatus</i> Williams                         | 0.0       | 0.0        | 0.1        | 0.0       | 0.0        | <0.1                  |
| <b>PV based on nematodes/g of dry root</b>                         |           |            |            |           |            |                       |
| <i>Pratylenchus</i> spp.   | 490.0     | ...        | ...        | ...       | ...        | ...                   |
| <i>Pratylenchus</i> sp. (unidentified)                             | 0.0       | 0.8        | 0.3        | 6.7       | 76.4       | 60.6                  |
| <i>P. brachyurus</i>   | 0.0       | 49.1       | 20.8       | 174.7     | 174.7      | 68.3                  |
| <i>P. coffeae</i> (Zimmermann) Filipjev & Schuurmans Stekhoven     | 0.0       | 0.0        | 0.0        | 0.0       | 76.2       | 6.2                   |
| <i>P. penetrans</i> (Cobb) Filipjev & Schuurmans Stekhoven         | 0.0       | 0.0        | 0.0        | 311.7     | 0.0        | 55.9                  |
| <i>P. zea</i>  | 0.0       | 6,542.3    | 956.4      | 3,323.8   | 7,137.5    | 3,673.4               |
| <i>Meloidogyne</i> sp.   | 0.0       | 0.0        | 0.0        | 0.0       | 272.1      | 25.0                  |

*P. penetrans* agreed generally with other descriptions except that the stylet, when measured in triethanolamine formalin (TAF) or glycerine, was slightly shorter than often described, usually about 15  $\mu\text{m}$  (never more than 16  $\mu\text{m}$ , compared with the more usual 15–18  $\mu\text{m}$ ).

Fortuner et al (6) considered *H. borinquensis* as species inquirenda and as a possible synonym of *H. agricola* (Elmilyg). *H. borinquensis* was described (9) as having small vulval membranes and was illustrated with the internal lateral lines not being fused on the tail. Specimens from Colombia agree with those described by Román except that a structure similar to a phasmid at the terminus of the lateral field was not noticed as mentioned for some specimens from Puerto Rico (9). The epithet of *H. borinquensis* is retained until the species question is resolved.

*R. reniformis* was commonly associated with maize in our survey. Maize, however, has generally been reported to be a nonhost or a poor host for the nematode (2,11), although Dasgupta and Seshadri (4) found that maize was a good host for one race of the nematode. Of the 25 samples that contained *R. reniformis*, only one containing few *R. reniformis* had maize as a previous crop. Most of the

25 samples had soybeans (*Glycine max* L.), a good host (11), as a previous crop. Thus, there is no substantial evidence that *R. reniformis* is a major parasite of maize in the areas sampled, and it is possible that the nematode survived from the previous crop.

Some findings in this report contrast with those of Vasquez (13) in the high plains of Mexico. *P. zaeae* was especially common in our work, but Vasquez did not report either *P. zaeae* or *P. brachyurus* as occurring around maize in Mexico.

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