Variability in Populations of Plant Parasitic Nematodes on Turfgrass

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Abstract

Two sites were selected, one in San Mateo County, California, USA (Site A) and one in Monterey County, California, USA (Site B) to repeatedly sample populations of three plant-parasitic nematodes: root-knot (*Meloiodogyne* sp., Goeldi, Tylenchida, Heteroderidae), ring (*Mesocriconema* sp., Hofmänner and Manzel, Tylenchida, Criconematidae) and spiral (*Helicotylenchus* sp., Steiner, Tylenchida, Hoplolaimidae) on turfgrass (*Poa annua* L.). Three samples were taken biweekly for 12 months from each location. Nematodes were extracted from soil around roots, were identified to genus and counted under a dissecting microscope. Populations of all three nematodes were variable during the year. Levels of spiral nematode were similar at both locations. Populations were highest at Site A in mid-August and at Site B in early November and these populations were significantly higher than when populations were at their lowest levels. Ring nematode populations were considerably higher at Site A than at Site B. Populations at Site A were highest in September and at Site B in November and these populations were higher than when populations were at their lowest levels. As with ring nematode, populations of root-knot nematode were typically higher at Site A than at Site B. At Site A, populations in April and September were higher than at the lowest times of the year. Peak populations at Site B were reached in September and in November. Knowing that populations are variable will aid in evaluating nematode problems.

INTRODUCTION

Plant parasitic nematodes are microscopic roundworms that can be a major problem in turfgrass maintenance. The following nematodes have been identified as causing damage in California turf: root-knot (*Meloiodogyne* sp., Goeldi, Tylenchida, Heteroderidae), ring (*Mesocriconema* sp., Hofmänner and Manzel, Tylenchida, Criconematidae), spiral (*Helicotylenchus* sp., Steiner, Tylenchida, Hoplolaimidae), dagger (*Xiphinema* sp., Cobb, Dorylaimida, Longidoridae), lesion (*Pratylenchus* sp., Filipjev, Tylenchida, Pratylenchidae), stubby root (*Trichodorus* sp., Cobb, Triplonchida, Trichoridae), pin (*Paratylenchus* sp., Micoletzky, Tylenchida, Tylenchulidae), seed and leaf gall (*Anguina pacificae*, Cid del Prado Vera and Maggenti, Tylenchida, Anguinidae), and sting (*Belonolaimus longicaudatus*, Rau, Tylenchida, Belonolaimidae) (Cid del Prado Vera and Maggenti, 1984; Radewald and Westerdahl, 1988; Westerdahl et al., 2000).

To improve our understanding of the biology of plant parasitic nematodes infesting turfgrass, two sites were selected for biweekly monitoring of nematode populations for approximately a year. Knowledge of nematode activity at various times of the year could facilitate development of nematode management programs.

MATERIALS AND METHODS

A single green was selected at the Olympic Club Golf Course in San Mateo County (Site A) and at Poppy Hills Golf Course in Monterey County (Site B), to monitor the populations of nematodes. Each site contained *Poa annua* turf infested with spiral, ring and root-knot nematodes. Golf course superintendents managed the two sites and collected turf samples for analysis approximately every other week from October 2002 until October 2003.

Each site was divided into three sections or replicates. From each replicate, 10 cores (2.5 cm diameter) were taken randomly to a depth of 10.0 cm, combined into one sample from each replicate, and delivered via overnight shipment to University of California, Davis for analysis. Nematodes were extracted from soil around roots via elutriation followed by sugar centrifugation (Byrd et al., 1976). Extracted nematodes were identified to genus and counted under a dissecting microscope. Data were subjected to repeated measures analysis of variance at $P = 0.05$ (SuperAnova, Abacus Concepts, Berkeley, CA).

Once during the sampling period, a composite soil sample from each site was analyzed by University of California DANR Analytical Laboratory for the following physical and chemical properties: pH, electrical conductivity, organic matter and soil texture by percent of sand, silt and clay.

RESULTS AND DISCUSSION

Northern California has approximately 400 golf courses and many of these consist largely of *Poa annua*, a bluegrass turf species. The climate in the coastal region, where the courses we sampled are located, is characterized by cool summers with coastal fog and mild winters with an average temperature of 14ºC. Spring and autumn months have warm clear days and cool nights. The rainy season is between November and April. In a previous study in which 14 courses were surveyed in Monterey and San Mateo counties, all courses (Westerdahl et al., 2004) had abundant populations of spiral nematode, 13 had ring nematode and nine had root-knot nematode, so the courses we selected for this study were representative of many courses in the surrounding area.

Both sites had a sandy textured soil with very similar sand, silt and clay content. The percent sand, silt and clay at Site A were 93, 43 and 3, respectively. At Site B, the percentages were 94, 4 and 2, respectively. The percent organic matter was 0.65% at Site A and 1.84% at Site B. The pH at both sites was similar, 6.9 at Site A and 6.6 at Site B. The EC was approximately five times greater at Site B than at Site A, 1.97 vs. 0.42 EC ($dS\ m^{-1}$).

Root-knot is an endoparasitic nematode. Juvenile nematodes penetrate plant tissues and the adults mature and lay eggs within the plant. The data reported are for populations of juveniles found within soil around roots. This stage was selected for sampling, because these are the populations most likely to be affected by various management techniques such as the application of soil amendments and nematicides, and are the most economical stage for evaluation by sampling techniques likely to be used by the industry. Spiral and ring nematodes are ectoparasites of turf, always being found outside of roots in the soil.

Populations of all four nematodes fluctuated throughout the year. Ring nematode populations (Fig. 1) were considerably higher at the Site A than at Site B. Populations at Site A were highest in September, and at Site B in November, and these populations were higher than when populations were at their lowest levels ($P = 0.05$). As with ring nematode, populations of root-knot nematode (Fig. 2) were typically higher at Site A than at Site B. At Site A, populations in April and September were higher than at the lowest times of the year ($P = 0.05$). Peak populations at Site A were reached in September and in November ($P = 0.05$). Levels of spiral nematode (Fig. 3) were similar at both locations. Populations were highest at Site A in mid-August and at Site B in early November and these populations were significantly higher than when populations were at their lowest levels ($P = 0.05$).

Site B is located approximately 250 km south of Site A and opened for play in 1986. Site A has been in use since 1919. The difference in the age of the two locations could have resulted in an older infestation at Site A that could account for the generally higher populations present there. The nematodes studied are capable of completing multiple generations each year, so the fluctuations observed could represent the hatching of succeeding generations.

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Figures

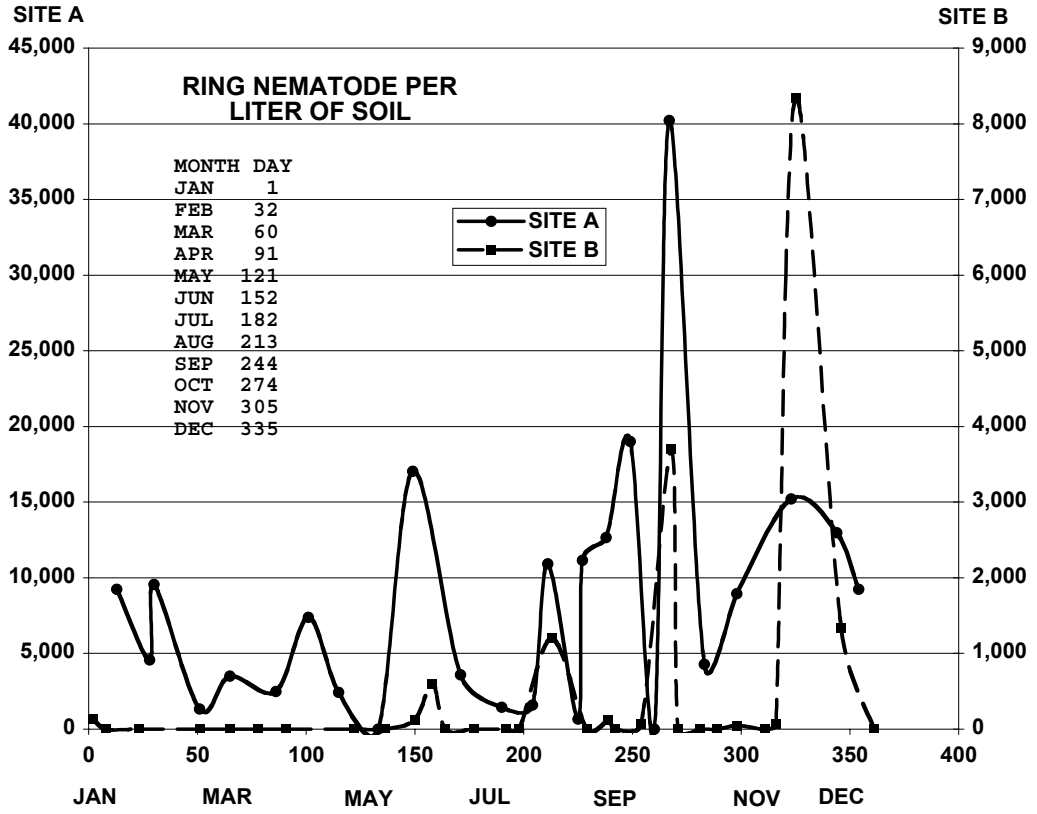

Fig. 1. Variability in populations of ring nematode on turfgrass at two sites.

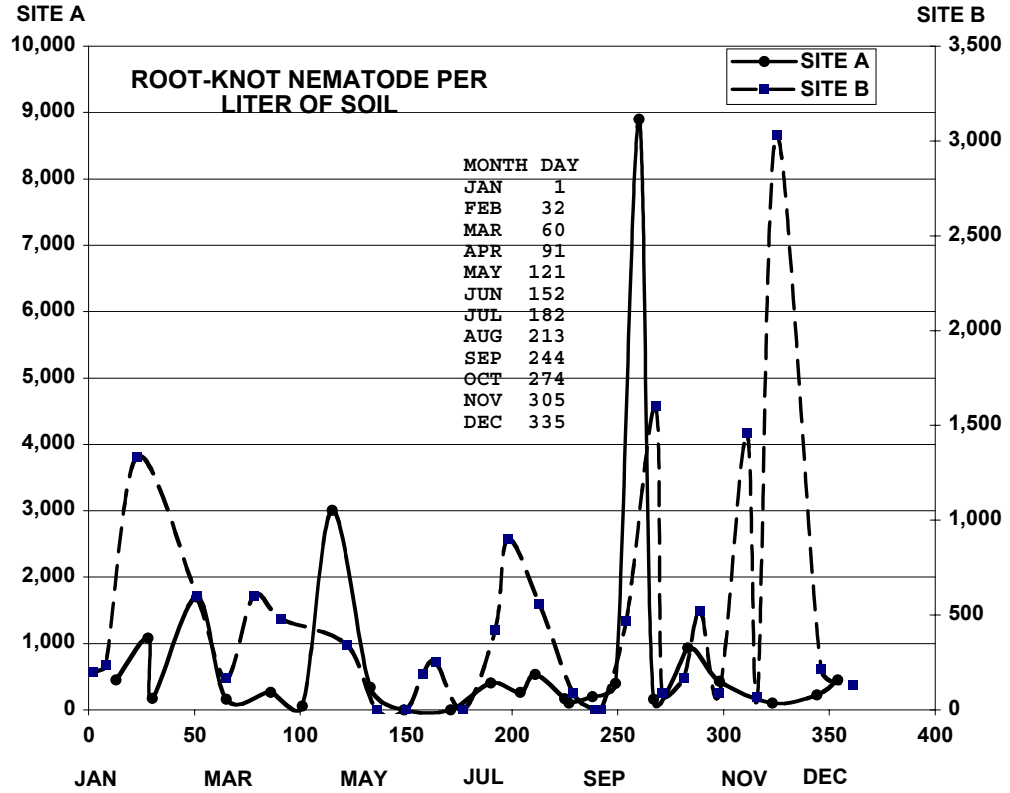

Fig. 2. Variability in populations of root knot nematode on turfgrass at two sites.

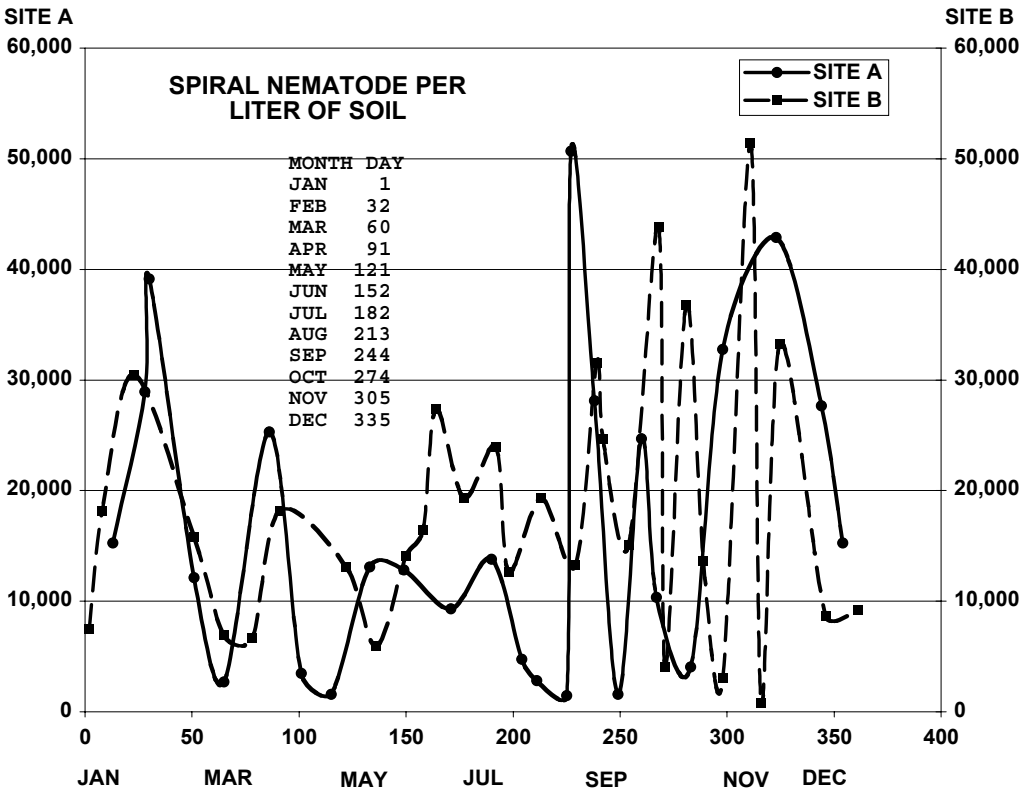

Fig. 3. Variability in populations of spiral nematode on turfgrass at two sites.