Pathogenicity and virulence of a root-knot nematode population (*Meloidogyne graminis*) on bentgrass

Witte, H., A. Ploeg, and J.O. Becker
Department of Nematology, University of California, Riverside, CA 92521.

We are investigating the biology and ecology of a root-knot nematode *Meloidogyne graminis* population recently discovered in roots of declining creeping bentgrass (*Agrostis stolonifera* L. cv. Penn A-4) greens on a golf course in Indian Wells, CA. The greens were established years earlier and were apparently unaffected until summer of 2005 when unthrifty growth was first observed. The decline increased each summer in severity until 2009, the year we started our investigation.

Greenhouse studies with *M. graminis* on creeping bentgrass (cv. Penn A-4) confirmed parasitism by the development of characteristic root galls and mature, reproducing root-knot nematode females (Fig. 1). However, even high infestation levels (1000 J2/100 cm^3) did not result in significant growth reductions of the grass under otherwise good growing conditions.

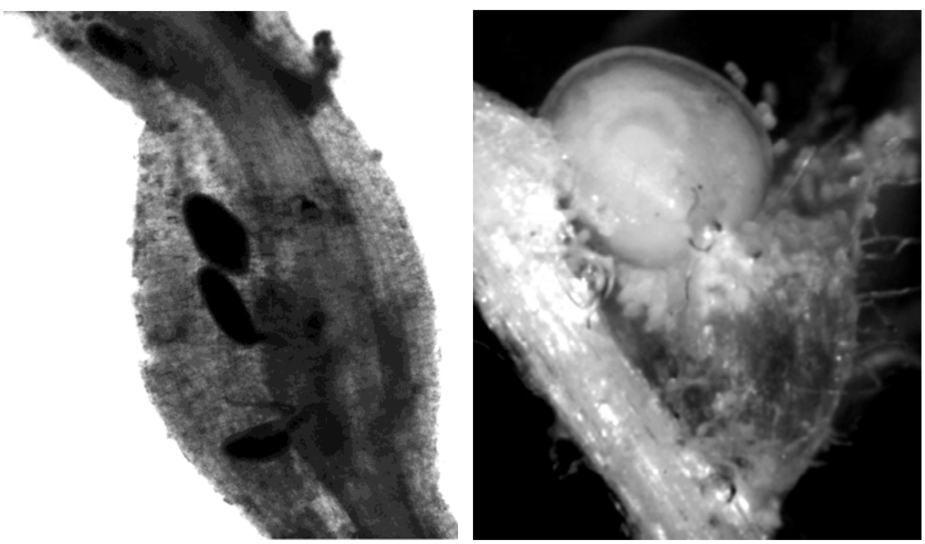

Fig. 1 Left: A galled bentgrass root containing juveniles of root-knot nematodes. The root was stained to visualize the otherwise transparent nematodes within the plant issue. Right: An egg producing female of *M. graminis* parasitizing a root.

Bentgrass quality frequently declines in summer when air and soil temperatures become less favorable for cool-season grasses. Studies at Kansas State University indicated that a decline in root activity of bentgrass occurred before a decrease in turf quality at soil temperatures of about 86˚F. Soil temperature recordings from irrigated turf at CIMIS stations in Rancho Mirage and in Cathedral City, CA between 2000 and 2004 showed that at 6 inches depth the temperature reached 90˚F only once per year (Fig. 2). During the following 5 years when disease symptoms appeared and became increasingly more severe, the number of days with soil temperatures at or above 90˚F was 22, 33, 45, 85, and 52 days, respectively. Thus, we hypothesized that at high soil temperatures additional root-knot nematode infestation may have accelerated the decline of the turf grass.

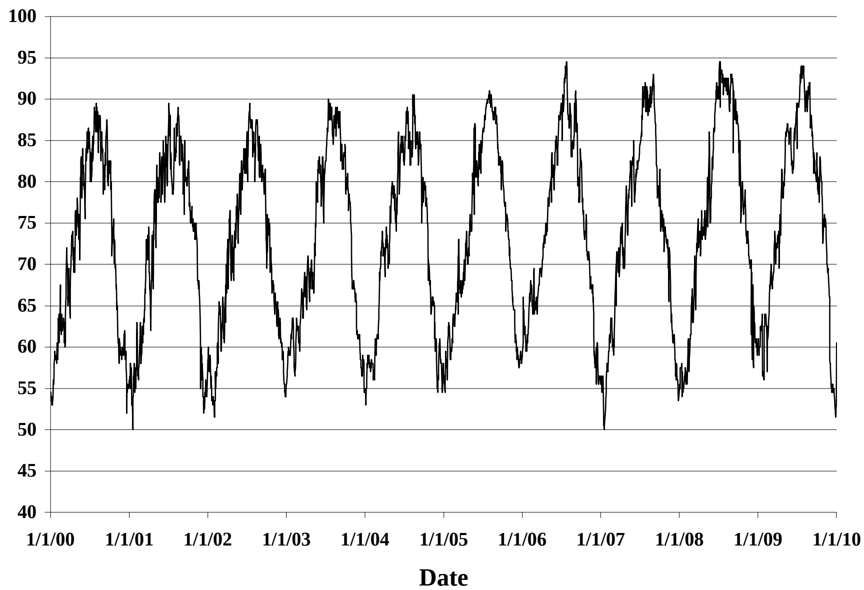

Fig. 2: Mean of maximum daily soil temperatures at 6 inches depth from CIMIS stations in Rancho Mirage, CA and in Cathedral City, CA between 2000 and 2010.

We tested this scenario in two independent greenhouse trials that utilized temperature regulated water tanks to keep the soil temperature of *M. graminis*-infested and nematode-free bentgrass cup cultures constant, each at 79˚F and 90˚F. The trials were arranged in a randomized complete block design with 6 replications. The grass was clipped only every other week to approximately 0.4 inch to avoid starving the roots of carbohydrates. After 6 months, the nematode population was determined by egg extraction and enumeration under 40X magnification.

There was more grass growth at the lower than the higher temperature but no differences in the weight of the grass clippings between infested and nematode-free treatments. At trial termination, the nematode population in the infested treatment was more abundant at the higher temperature. This was probably due to the faster development of the nematode, as its optimum temperature for development is closer to 90˚F than to 79˚F.

In conclusion, under otherwise good growing conditions parasitism of bentgrass cv. Penn A-4 by *M. graminis* did not appear to affect the fitness of the host even at high temperatures. Thus the cause of the observed turf grass decline may be related to other or additional biotic or abiotic stress such as short mowing height, traffic, water quality and quantity or secondary root infections by soilborne fungi. The result emphasizes the importance of accurate disease diagnosis to avoid futile and costly pesticide applications.