

Project Report – 2010
Southern Region Small Fruit Consortium

Proposal Category: ☒ RESEARCH ☐ OUTREACH

Proposal Status: ☒ NEW PROPOSAL ☐ Previously funded by SRSFC

PROJECT TITLE: Pathogenicity of ring nematodes: an emerging pest of blueberries
(*Vaccinium* spp.)

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Objective: To determine the severity and extent of nematode replant disease in blueberry in Georgia and North Carolina.

Justification: Blueberry replant disease is an emerging threat to continued blueberry (*Vaccinium* spp.) production in Georgia, and possibly in other growing areas of the Southeastern US.

Commercial blueberry acreage has increased dramatically over recent years, and at the same time, older farms are being replanted. Observations by growers, county agents, and specialists have identified poor growth, yellowing, and stunting associated with blueberry replant areas (Fig. 1). Symptoms on blueberry were similar to those seen in peach tree short-life disease, in which ring nematodes (*Mesocriconema* spp.) have also been implicated. As a result, farms showing blueberry replant disease were assayed for plant-parasitic nematodes, and high levels of ring nematodes were discovered. Association with nematodes does not prove that the nematodes were



Figure 1. Blueberry replant disease where the ring nematode count was 272/ 100 cm³ soil.

causing the symptoms observed. Experiments done in 2008 showed that ring nematode counts were lower and plant vigor ratings were significantly higher than controls in all fumigant nematicide treated plots. Positive results were observed both for Telone (1-3 dichloropropene), which controls primarily nematodes, and methyl bromide, which is a biocide and may also control other pathogenic organisms (Fig. 2). Subsequent to these field experiments, ring nematodes were collected from infested grower fields and applied to greenhouse pots and field microplots. In these more controlled experiments, it was again demonstrated that blueberry is a host for ring nematodes, and that the nematodes reduce plant vigor (Jagdale et. al. 2010). After it was determined that ring nematodes were pathogenic on blueberry, we proposed to conduct a nematode survey of blueberry farms in Georgia and North Carolina during the 2010 growing season.



Figure 2. Blueberry on a replant disease site treated with methyl bromide (left) and untreated control (right)

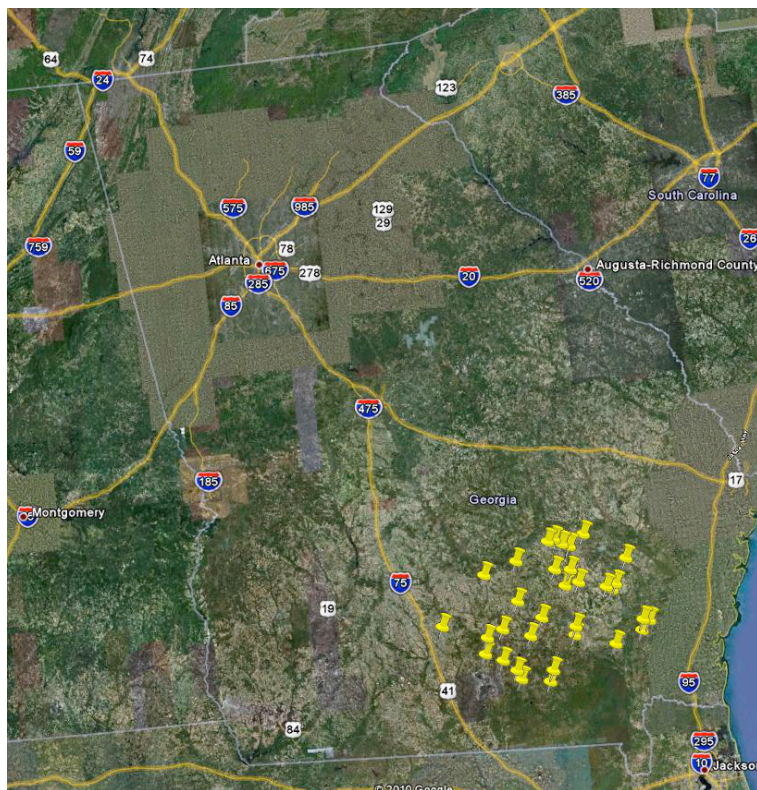


Figure 3. Nematode survey locations in SE Georgia, including Appling, Atkinson, Bacon, Berrien, Brantley, Clinch, Coffee, Jeff Davis, Lanier, Pierce, Ware, and Wayne Counties.

Methods: In June, 2010, a systematic survey was conducted of plant-parasitic nematodes infesting commercial blueberry fields in Georgia and North Carolina. Working in conjunction with Cooperative Extension agents in Georgia, 33 blueberry farms in 12 counties in southeastern Georgia were selected for the survey (Fig. 3). At each farm, multiple samples were taken to represent different acreages, cultivars and production systems used on the site, resulting in a total of 289 survey samples. Each soil sample consisted of ten cores of soil taken from the root zones of five consecutive plants using a soil probe. On the first survey in Georgia, a mapping system was made for each farm location, marking the exact spot for each sample. Twelve inch garden markers were placed at the beginning and end of each sampling area. Sampling areas were generally determined by

counting rows from one corner of the field and counting plants into the interior of the field. This method was used for mapping ease and for locating sampling areas during follow-up soil sampling. Usually, two to four areas would be sampled per field site depending on the field size. The mapping system was used for the purpose of follow-up sampling in Georgia. A survey was conducted in North Carolina during August 2010 with similar sampling procedures, in which 10 farms were surveyed in 4 blueberry-producing counties for a total of 43 samples (Fig.4). Each survey sample was placed in plastic bags and transported back to our lab in coolers. In the lab, plant parasitic nematodes were collected from the soil by sieving and sucrose centrifugation and the nematodes were identified and counted with a stereomicroscope.

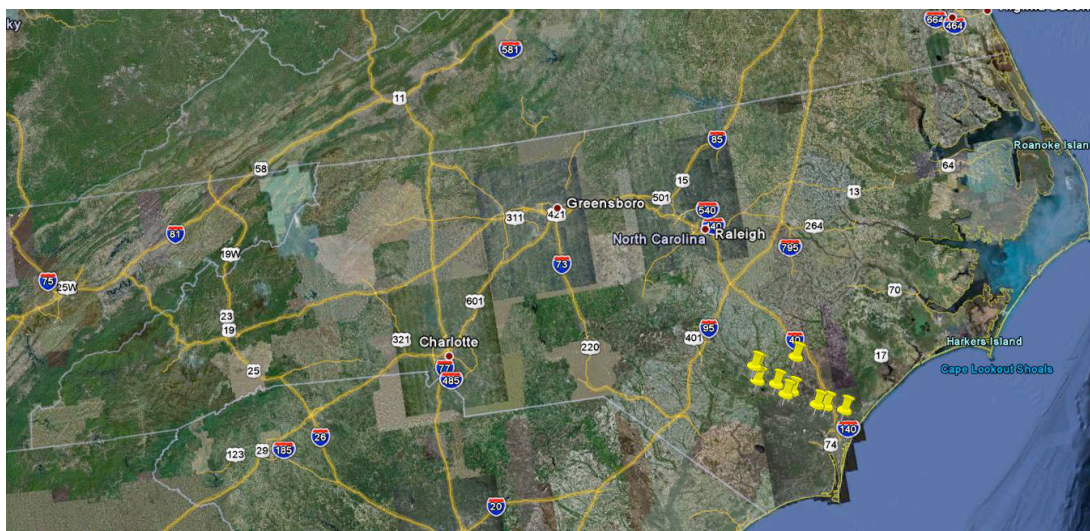


Figure 4. Nematode survey locations in SE North Carolina, including Bladen, Duplin, Pender, and New Hanover counties.

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Nematode survey locations in SE North Carolina, including Bladen, Duplin, Pender, and New Hanover counties. The mean population density of nematodes found in the survey locations is 1.0 nematode / 100 cm³ of soil (Table 1). The data for comparison, short life of peach, the damage threshold is 1 nematode / 100 cm³ of soil (Davis, R.F. et. al. 2009). This means that if the nematode is present at any density, the grower can expect crop losses to occur. This is not an unlikely scenario for blueberry, because like peach, the crop is grown over a period of many years. If any nematodes are present that are parasitic on blueberry, they will eventually increase to damaging levels. Other plant parasitic nematode species were present at low frequencies in the blueberry farms that were sampled, but their significance is not known. However, with the widespread distribution of ring nematodes in blueberry, and the demonstrated pathogenicity of this species, blueberry replant disease could become a major limitation to continued production on existing farms.

Plant parasitic nematode frequencies and population densities were lower in North Carolina than in Georgia (Table 2). The most frequently encountered nematode in North Carolina was the awl nematode (*Dolichodorus* spp.), found in 42 percent of the samples. Awl nematodes are not widely distributed, and are usually found in wet soils. Where they occur on a susceptible host, however, these nematodes are extremely damaging. In Florida, yield losses greater than 50% from awl nematodes have been observed on vegetables (Sikora, R. A., and E. Fernandez, 2005). Population counts are usually low for awl nematodes, even where they cause significant damage. The susceptibility of blueberry to awl nematodes is not known, but this possibility should be investigated. Both sheath and ring nematodes were also found in the North Carolina survey, but at relatively low frequencies. Dagger nematodes were found at low frequencies in both states, but it should be noted that these species are capable of transmitting plant viruses.

The economic impact of blueberry replant disease could be devastating to growers establishing new plantings. The estimated cost of establishing and maintaining blueberry is \$9,500 per acre per year (Fonsah et. al., 2007). For the critical first 4 years, this is a total investment of \$38,000 per acre. If the farm is infested with ring nematodes, as 48% of the fields sampled in Georgia were (Table 2), then the grower could lose the entire investment at about the time that the blueberries would normally be coming into production. It is possible to delay the onset of blueberry replant disease by application of soil fumigants, with considerable additional cost, but eventually the ring nematode will come back, and plant vigor will suffer, thus shortening the life of the planting. At this time there is no post-plant nematode control method available for blueberry. Cultural practices and plant resistance to nematodes need to be investigated for control of nematode pathogens in blueberry.

Table 1. Survey of plant-parasitic nematodes in commercial blueberry farms in Georgia, June 2010.

Nematode species	Percent frequency ^a	Mean density/ 100 cm ³ soil ^b	SD
Ring (<i>Mesocriconema</i> spp.)	48	290	618
Stunt (<i>Tylenchorhynchus</i> spp.)	8	18	17
Stubby root (<i>Paratrichodorus</i> spp.)	8	13	14
Lance (<i>Hoplolaimus</i> spp.)	7	130	224
Sheath (<i>Hemicycliophora</i> spp.)	6	46	41
Awl (<i>Dolichodorus</i> spp.)	2	19	12
Dagger (<i>Xiphenema</i> spp.)	2	16	9

^aPercent of total samples with species present, N=289 samples.

^bMean population density for samples with nematode species present.

Table 2. Survey of plant-parasitic nematodes in commercial blueberry farms in North Carolina, August 2010.

Nematode species	Percent frequency ^a	Mean density/ 100 cm ³ soil ^b	SD
Awl (<i>Dolichodorus</i> spp.)	42	19	18
Sheath (<i>Hemicycliophora</i> spp.)	16	17	12
Ring (<i>Mesocriconema</i> spp.)	12	18	11
Stunt (<i>Tylenchorhynchus</i> spp.)	9	17	12
Lance (<i>Hoplolaimus</i> spp.)	7	29	37
Dagger (<i>Xiphenema</i> spp.)	7	25	29

^aPercent of total samples with species present, N=43 samples.

^bMean population density for samples with nematode species present.

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