Publication of the Carolinas Golf Course Superintendents Association

Carolinas green

March - April 2012

Palmetto Proud

SC Trio Find Own Road to Fields of Glory

Plus

Oh, Nematodes Where Art Thou

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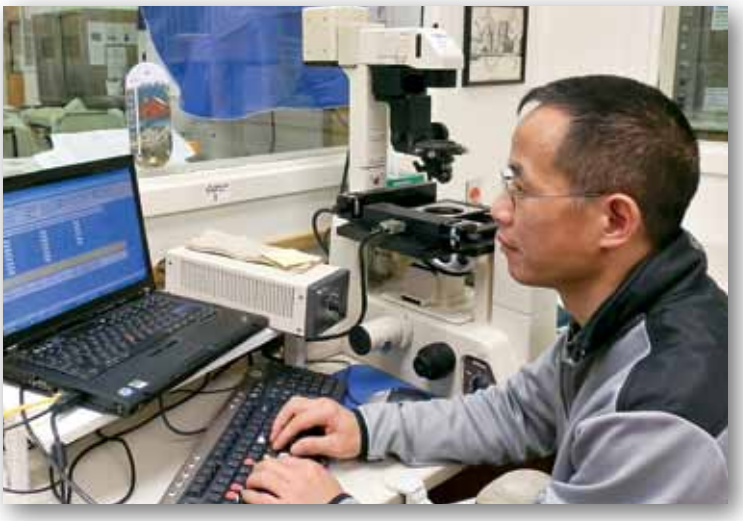
Plant-Parasitic Nematodes in Carolina Turfgrass



Dr. Weimin Ye at work in the Nematode Assay Section lab of the Agronomic Division of the NC Department of Agriculture and Consumer Services.

By Weimin Ye[1], Yongsan Zeng[2], Lane Tredway[2], Samuel Martin[3], Matt Martin[2] and Hanafy Fouly[3]

This survey was conducted to clarify the identity, prevalence and distribution of the soil-inhabiting nematodes that parasitize golf course turf in the Carolinas. The effort is a first step in an ongoing project to provide more precise and effective management options to golf-course superintendents. As the project continues, field tests will be conducted to document population dynamics of selected important nematodes and to test the efficacy of a variety of commercially available nematode management products.

In the summer of 2011, collaborators from North Carolina State University2, Clemson University3 and the NC Department of Agriculture and Consumer Services1 collected 282 soil samples from 111 golf courses in 39 counties throughout the Carolinas. Each sample was a thoroughly mixed composite of approximately 12 soil cores (1.5 cm diam. × 20 cm deep) collected randomly from an area of uniform characteristics and management primarily from putting greens, tees or fairways. A 500-cm3 subsample was taken from each composite and assayed for enumeration and identification of plant-parasitic nematodes. These tests were carried out by the Nematode Assay Section of the NCDA and CS Agronomic Division.

Most of the samples were from bermudagrass (72 percent) and bentgrass (22 percent) on sandy soils (92 percent). Other grasses included zoysia, seashore paspalum, tall fescue and centipede. Samples were taken from greens (43 percent), tees (24 percent), fairways (31 percent) and undesignated areas (two percent). In putting greens, 52 percent of the grasses were bermudagrass and 48 percent were bentgrass.

Survey data were used to generate maps showing the counties sampled and the distribution and relative frequency (average number per 500-cm3 soil from each county) of the 15 nematodes identified. All samples contained plant-parasitic nematodes, with ring, spiral, root-knot, stubby-root, sting, lance and stunt being most common. Samples taken from greens indicated higher percentages of infection by sting, ring, root-knot, lance and sheathoid nematodes on bermudagrass than on bentgrass. The presence of stubby-root, stunt and spiral nematodes, on the other hand, was more common on bentgrass greens.

Maps for each nematode surveyed can be viewed under the Research tab at the Carolinas GCSA web site, www.carolinasgcsa.org.

In general, bermudagrass would be expected to be the better nematode host since it grows primarily during the warmer months when nematodes are active. In golf courses, sting nematode is considered the most damaging species and this survey revealed the relatively wide distribution of sting nematodes in both states, associated primarily on courses located in the Sandhills and Coastal regions of both states, where native soils are sandy and the nematode is endemic. The study confirms previous knowledge that sting nematodes are found in soils of 80 percent or higher sand content.

High populations of stubby-root and root-knot nematodes in the Piedmont and western parts of the Carolinas, limited distribution of sheath nematodes along the coast, and the presence of dagger nematodes in South Carolina were observed. Sting and lance

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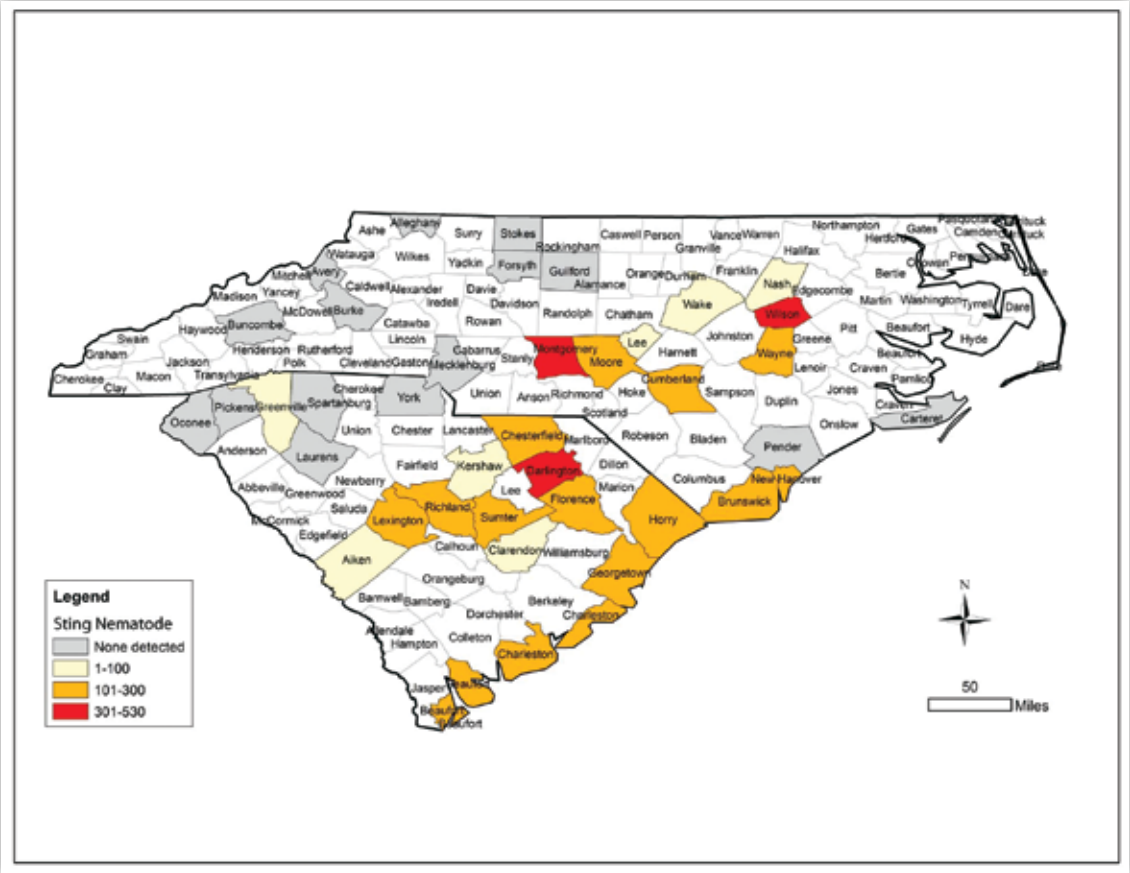

See maps showing which nematodes are where in the Carolinas by visiting the Research section of www.carolinasgcsa.org.

Figure 1. Sting nematode prevalence by county sampled in the Carolinas.

Table 1. Nematode population levels in turfgrass in the Carolinas (2011)

Species *	Population level (Nematodes per 500 cm3 soil) **
Ring	226 ± 659 (10–8,200)
Spiral §	290 ± 778 (40–6,650)
Root–knot	131 ± 195 (10–1,160)
Stubby–root	54 ± 71 (10–520)
Sting	177 ± 237 (10–1,200)
Lance	149 ± 215 (10–883)
Stunt §	191 ± 296 (40–1,867)
Sheathoid §	58 ± 65 (10–350)
Lesion §	47 ± 78 (10–420)
Dagger	40 ± 86 (10–471)
Sheath	164 ± 296 (10–1,200)
Cyst	136 ± 95 (20–270)
Pine §	45 ± 21 (30–60)
Awl	10
Needle §	20

* Species presented in order of prevalence
** Average number of nematodes per 500 cm3 soil ± standard deviation (minimum–maximum)
§ Although these nematodes feed on turf, they rarely cause enough damage to justify management.

Table 2. NCDA and CS Nematode Assay Report action codes based on nematode species and numbers per 500 cm3 of soil

		NCDA and CS Nematode Report Action Codes*		
Nematode		A	B	C
Sting	Belonolaimus longicaudatus	0	1–9	9+
Lance	Hoplolaimus galeatus	0–499	500–1000	1000+
Root–knot	Meloidogyne spp.	0–299	300–800	800+
Stubby–root	Paratrichodorus minor	0–499	500–1000	1000+
Ring	Mesocriconema spp.	0–999	1000–1500	1500+
Sheath	Hemicyliophora spp. Hemicaloosia spp.	0–499	500–1000	1000+
Dagger	Xiphinema americanum	0–99	100–500	500+
Cyst	Heterodera spp. Cactodera spp.	0–99	100–500	500+
Awl	Dolichodorus spp.	0	1–9	9+

* Nematode assay reports issued by the NCDA and CS Agronomic Division provide recommendations for nematode management in the form of Action Codes (A, B, C) for each species identified based on the number of individuals counted from a 500–cm3 subsample of soil.
A: The kinds/number of nematodes detected in this assay should not affect turf production.
B: Nematodes could damage turf. Chemical treatment may be beneficial, especially in unfavorable growing conditions.
C: Nematode populations are high enough to cause substantial damage. Apply a chemical soil treatment.

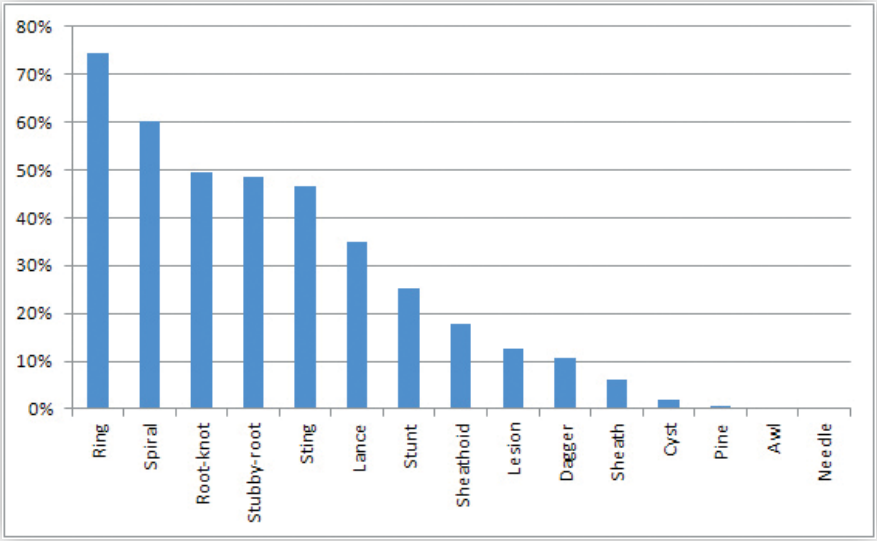

Figure 2. Nematode prevalence in turfgrasses in the Carolinas.

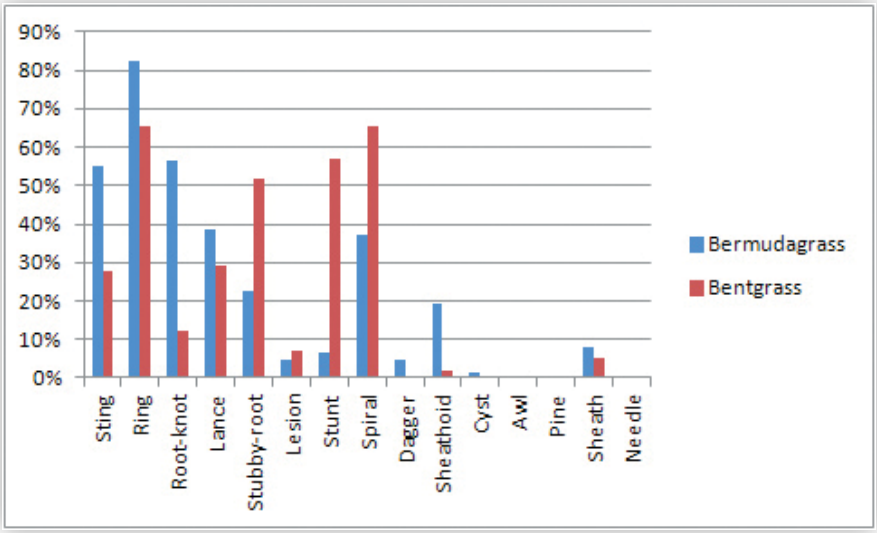

Figure 3. Comparison of nematode species prevalence on bermudagrass and bentgrass putting greens

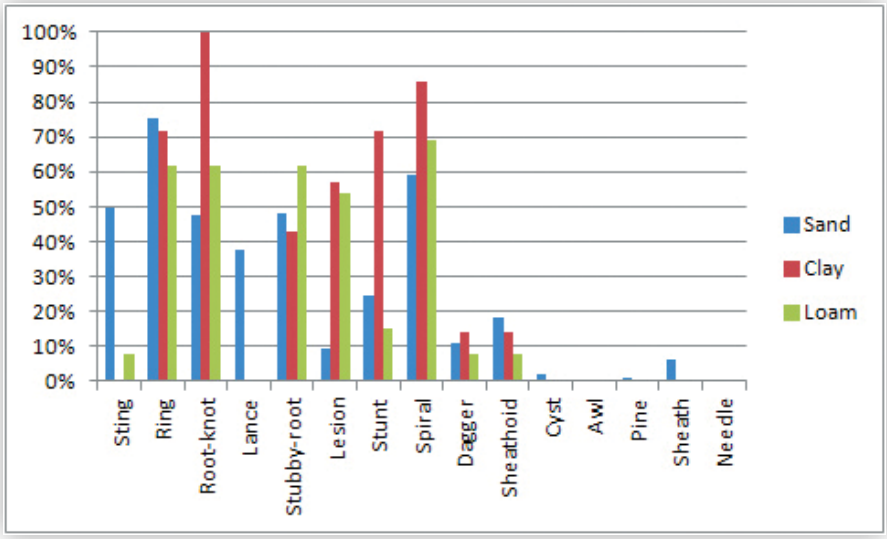

Figure 4. Comparison of nematode species prevalence among different soil types

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nematodes are limited to sandy soil, but root-knot, spiral and stunt nematodes were found in all soil types assayed. To put this information into perspective, Tables 1 and 2 relate nematode population numbers to the standard management recommendations issued by the NCDA and CS Agronomic Division. Visit www.ncagr.gov/agronomi/ for details on its nematode assay service.

SIGNIFICANCE

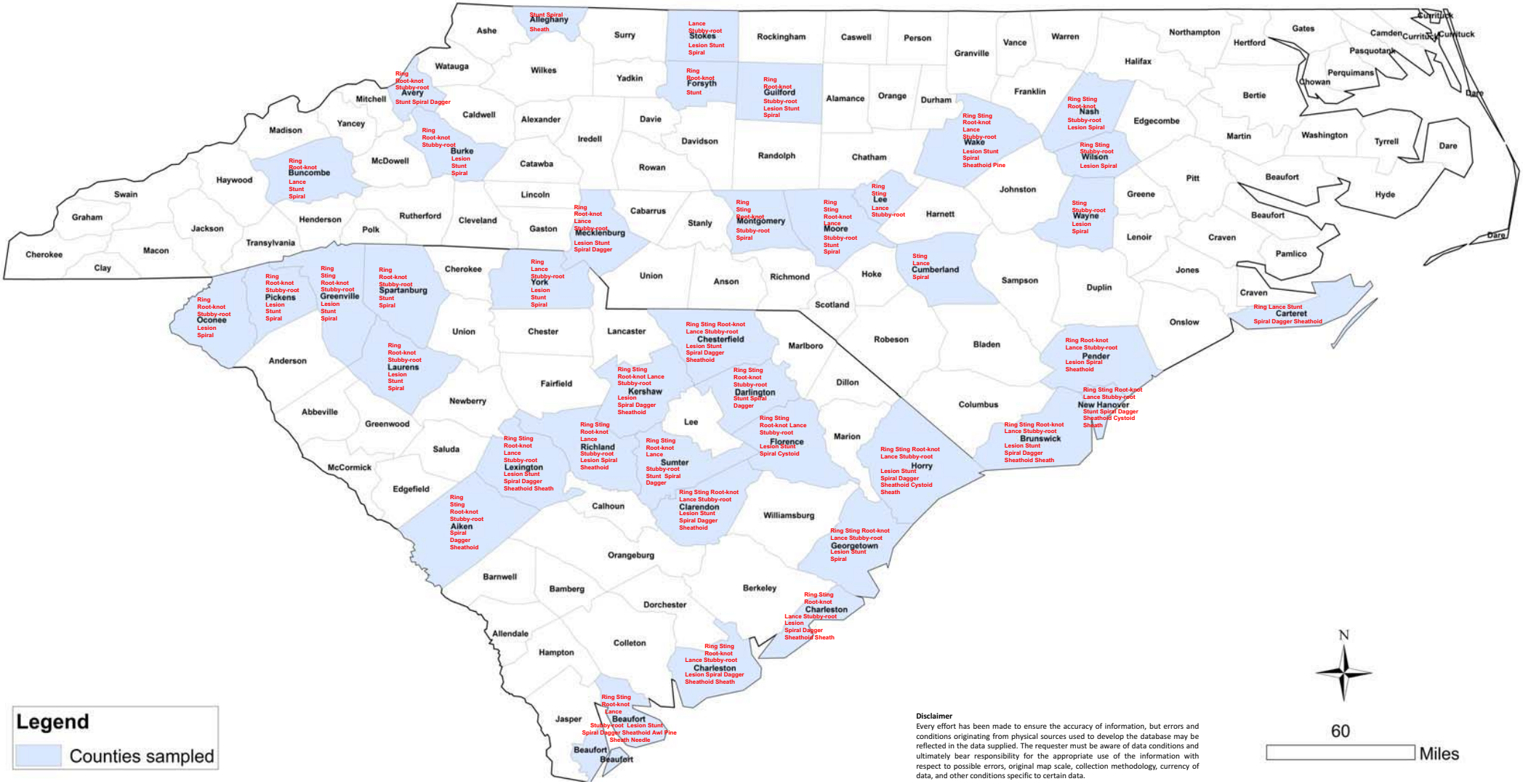
This study has provided a valuable overview of the prevalence and distribution of plant parasitic nematodes within and between North and South Carolina golf courses. Additional data are being collected from this study, including the identification of species of important nematodes, such as root-knot nematodes. At least two species of root-knot nematodes have been identified, including Meloidogyne graminis and M. naasi. This information provides a basis for further studies on their relative abundance and pathogenicity of these and others encountered to specific turfgrasses and perhaps their susceptibility to various nematode control products.

In South Carolina, a stubby root nematode was detected on one golf course and a sod production farm that is a different genus and species (Trichodorus proximus) than the common stubby root nematodes detected in this study (Paratrichodorus minor). Observations to date and experiments conducted in Florida indicated that Trichodorus proximus is much more virulent to certain warm season grasses than is Paratrichodorus minor. Experiments are being conducted on Trichodorus proximus in bermudagrass and zoysia, comparing its virulence to these grasses in comparison to sting nematodes.

Golf course turfgrasses, including bentgrass, bermudagrass and zoysiagrass, support a wide variety of plant parasitic nematodes as shown in this survey. Demands for high quality turf as well as a changing spectrum of products for nematode management make this study timely and fundamental for future continued work on this diverse and important group of turfgrass pathogens.

Acknowledgment: The authors wish to thank John Royals from Central Piedmont Community College for collecting South Carolina soil samples. This work was supported by a Rounds4Research grant from the Carolinas Golf Course Superintendents Association. Financial support was also provided by Bayer Environmental Science, Quali-Pro and Syngenta Lawn and Garden.

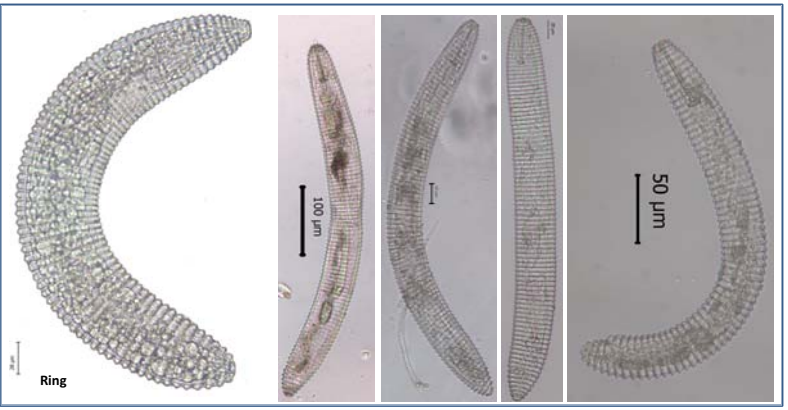
Nematode Distribution in Turfgrass in the Carolinas in 2011 Survey

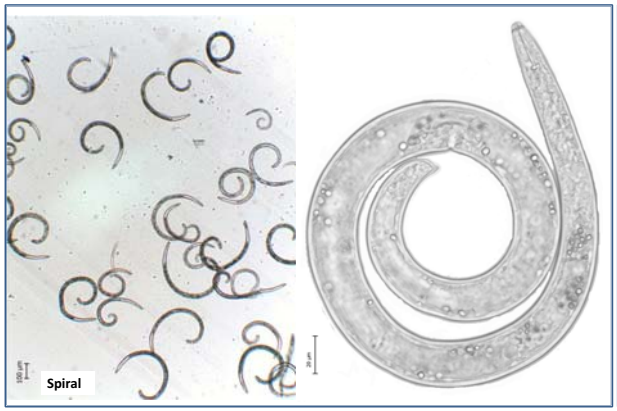


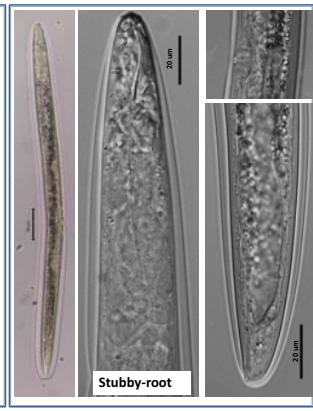
Disclaimer

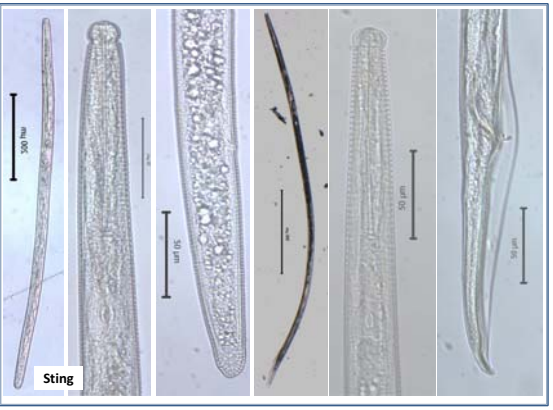
Every effort has been made to ensure the accuracy of information, but errors and conditions originating from physical sources used to develop the database may be reflected in the data supplied. The requester must be aware of data conditions and ultimately bear responsibility for the appropriate use of the information with respect to possible errors, original map scale, collection methodology, currency of data, and other conditions specific to certain data.

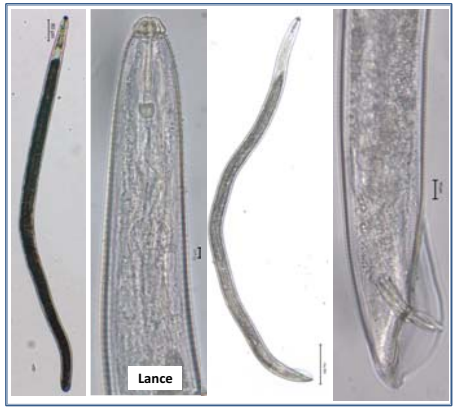
Nematodes Biodiversity from Turfgrass in the Carolinas in 2011 Survey

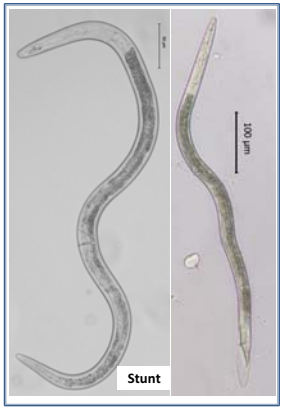


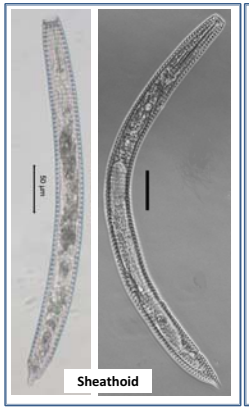


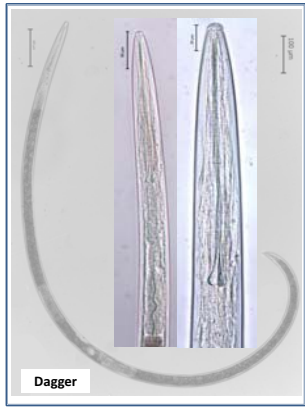


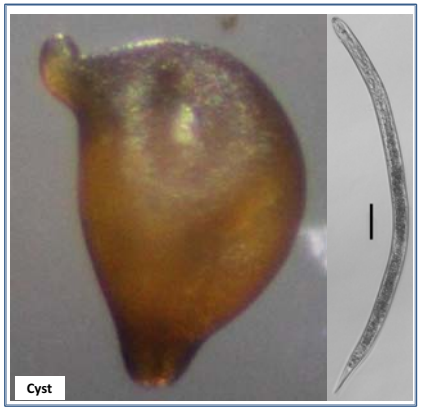


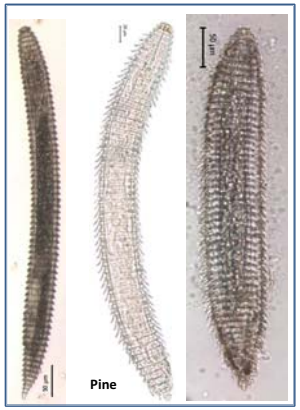


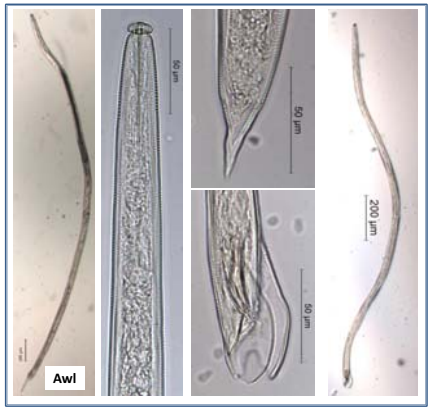


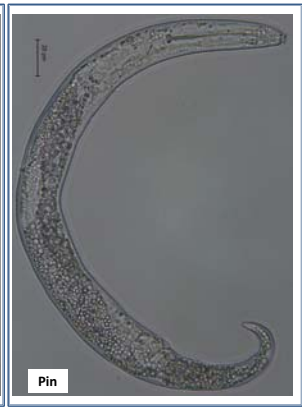












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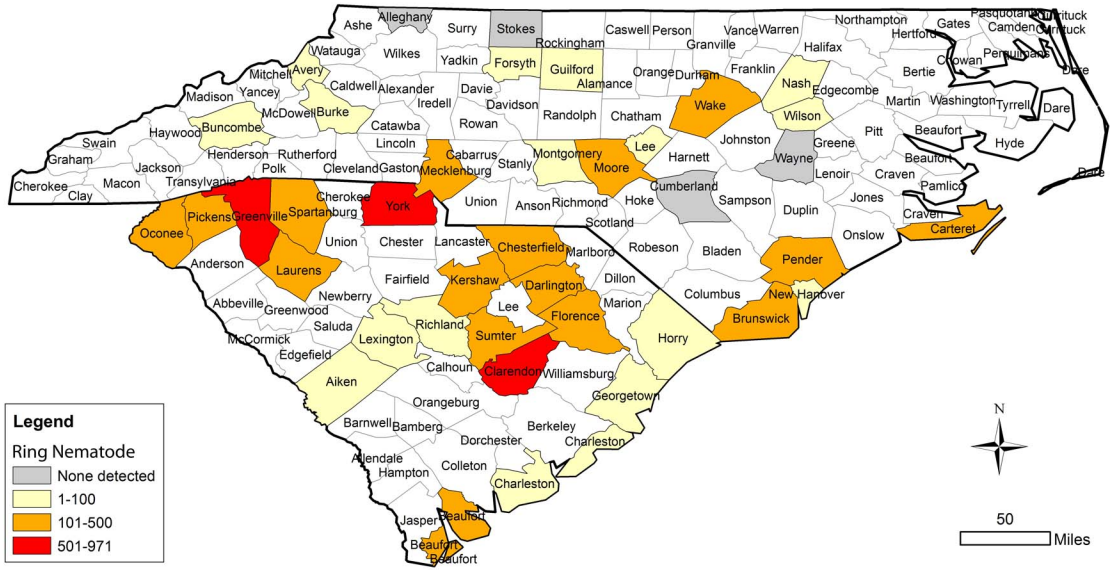
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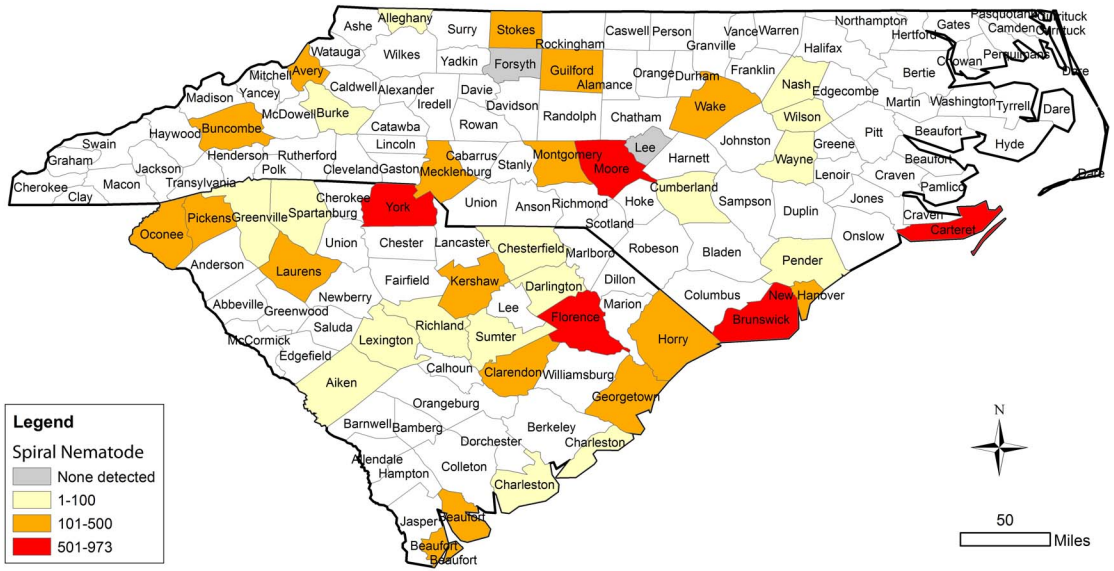
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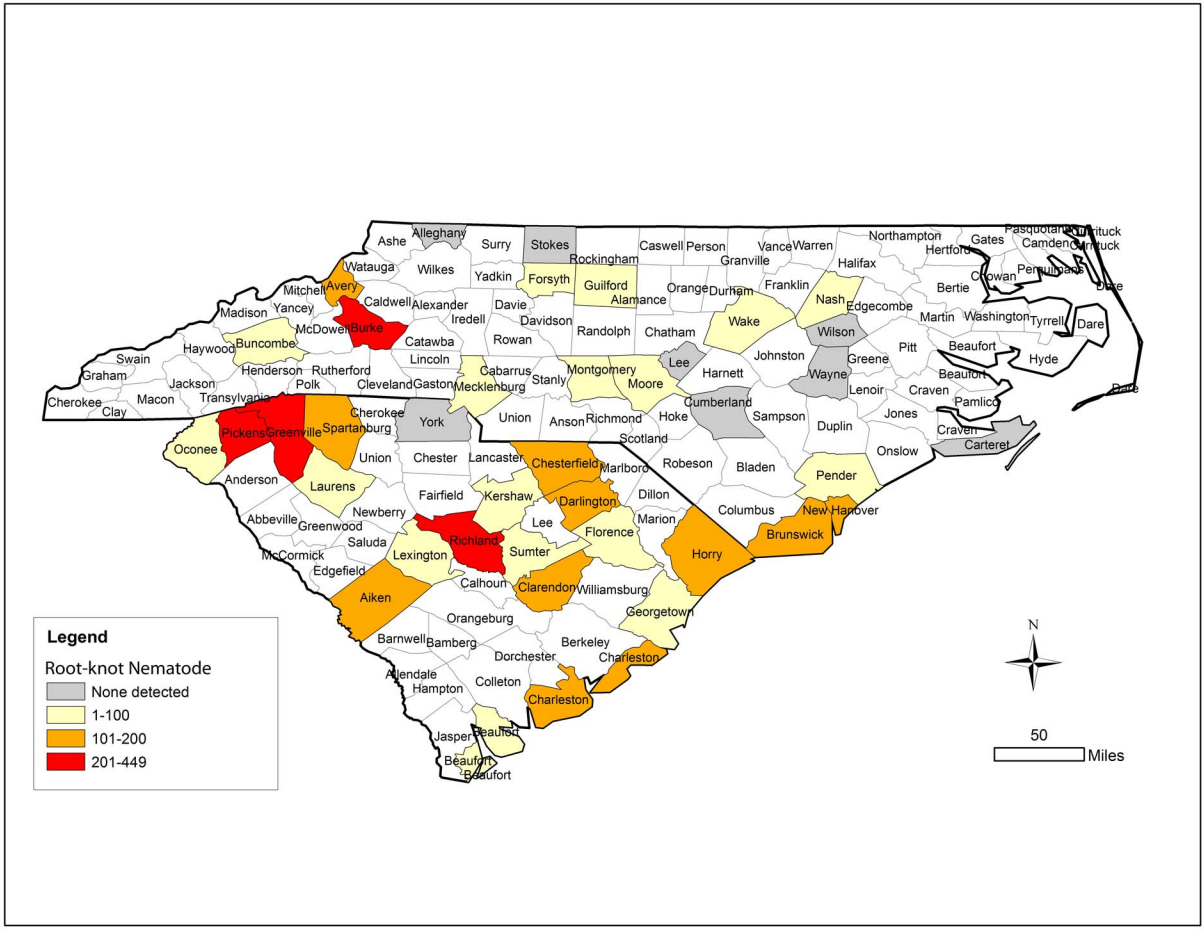
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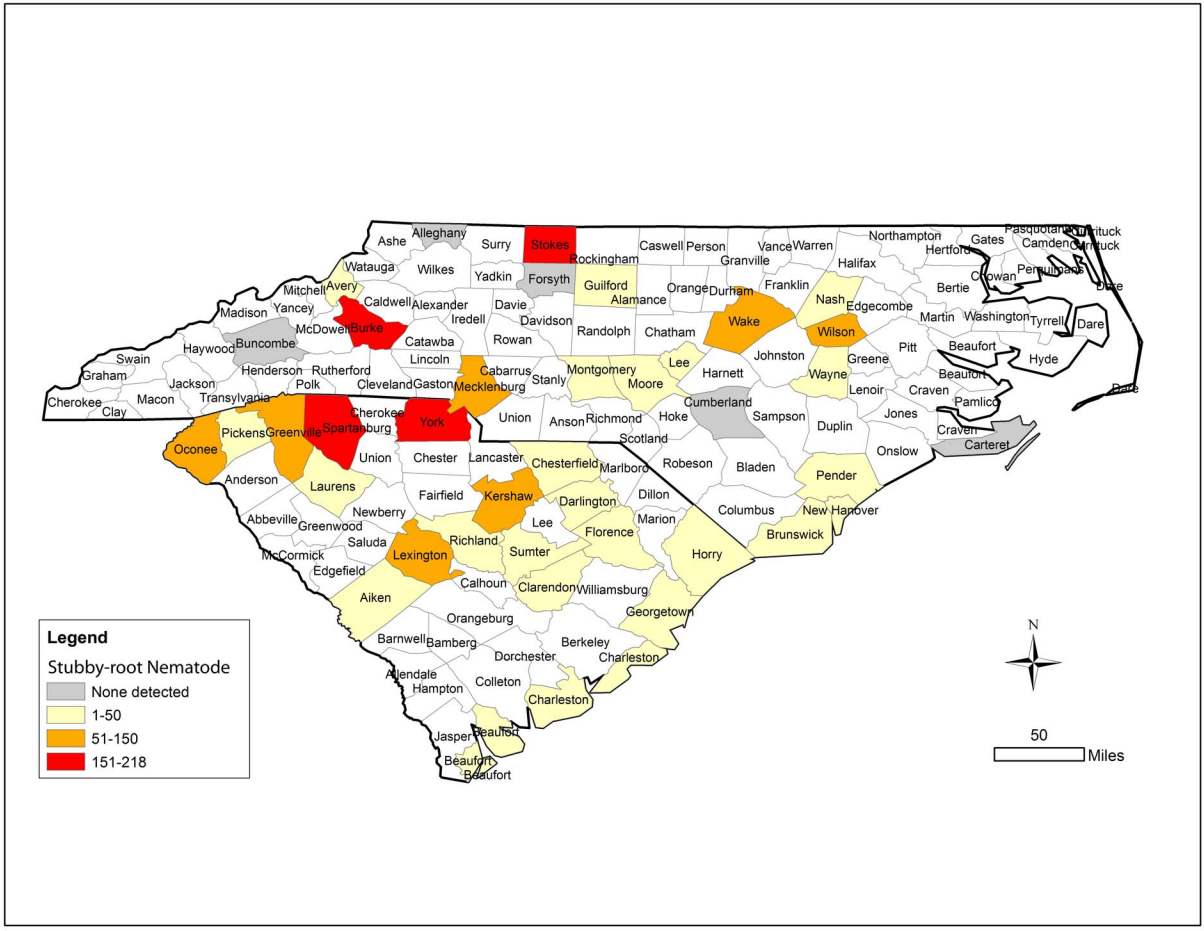
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Stubby-root Nematode
None detected
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151-218
N
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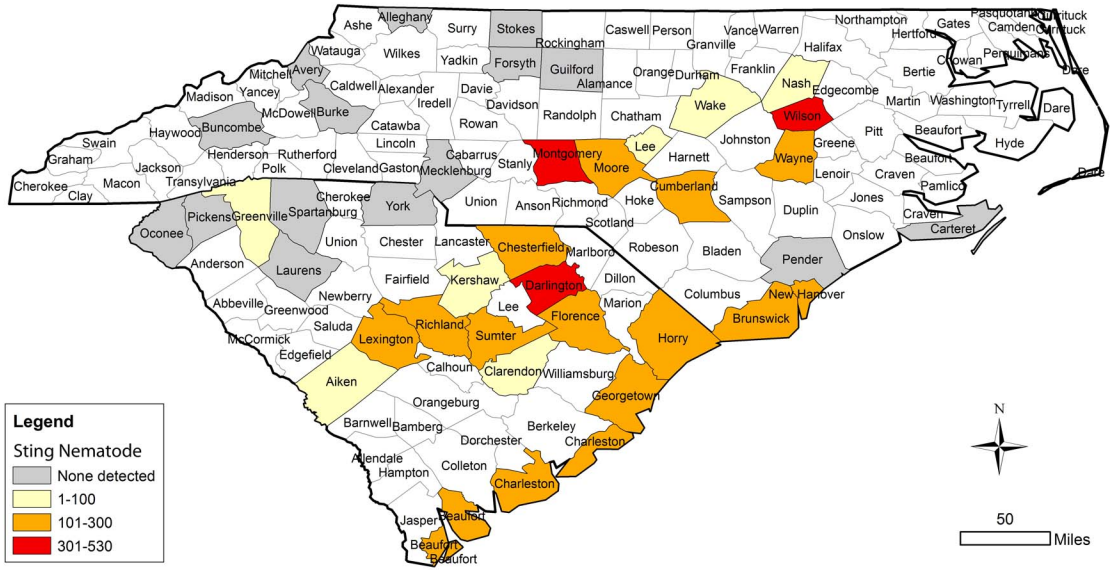
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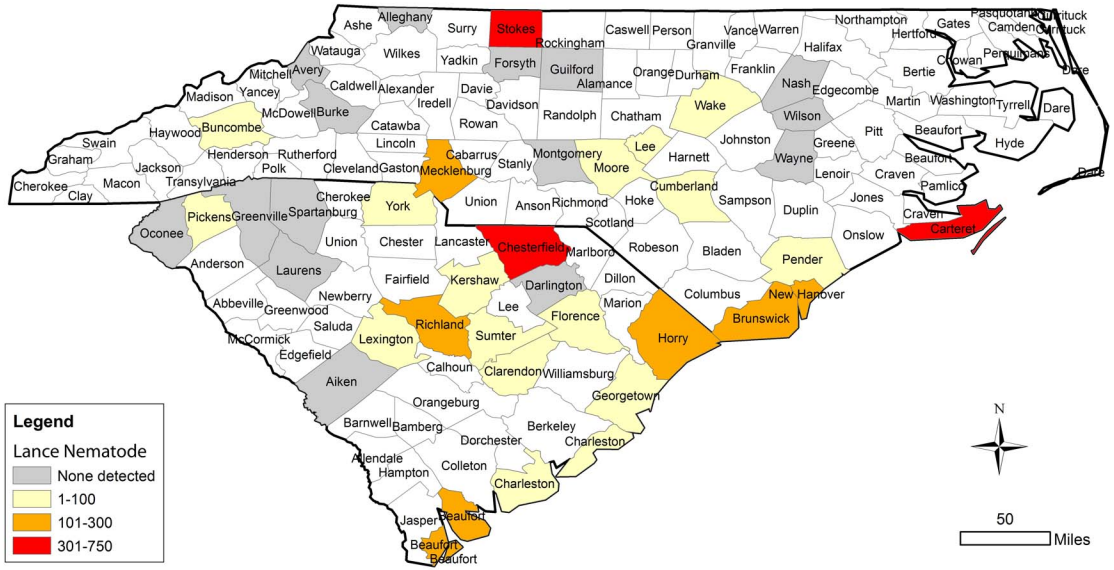
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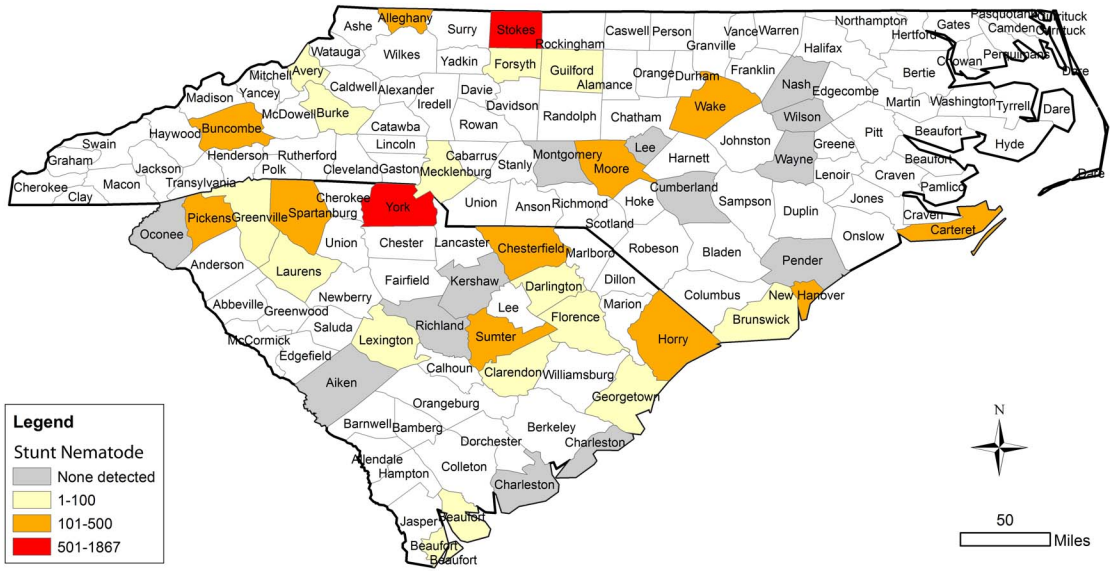
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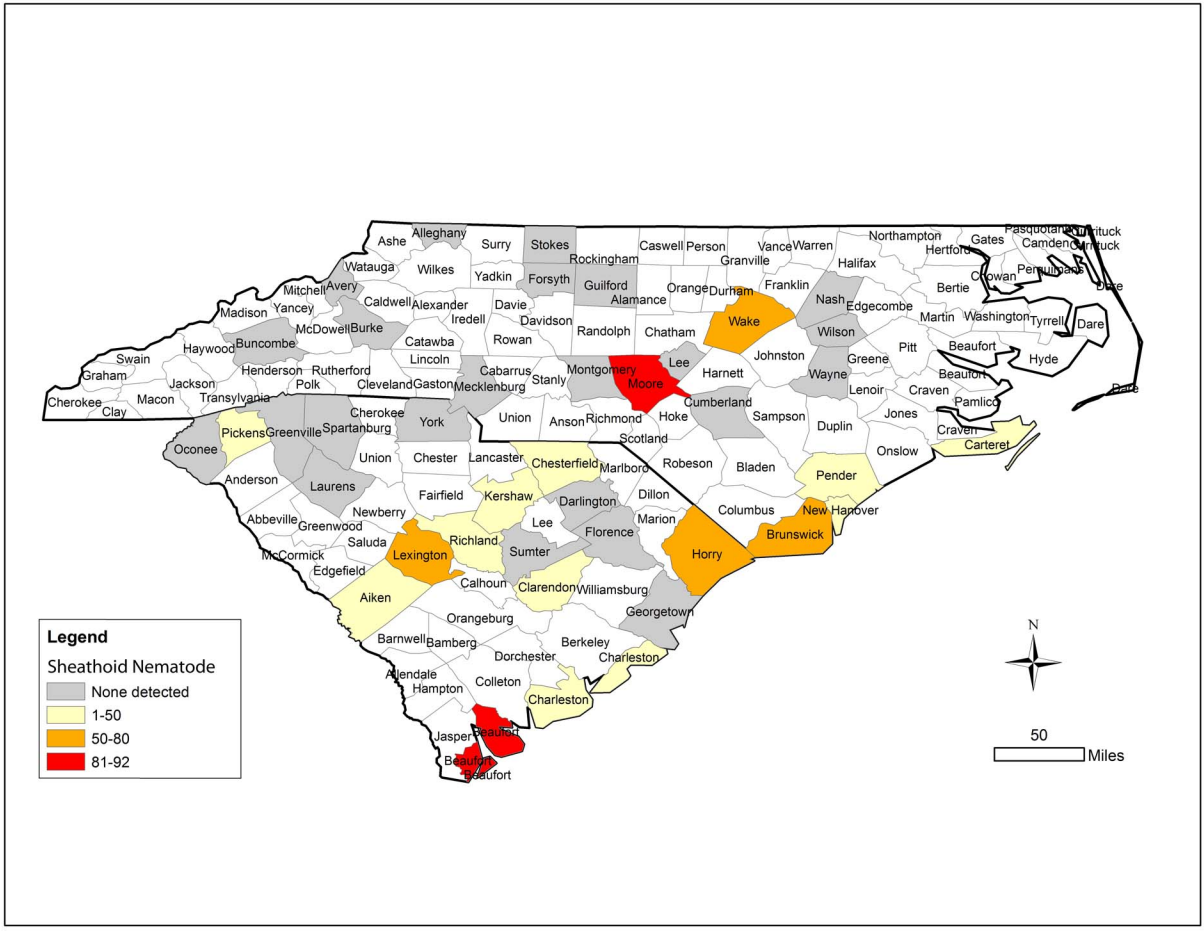
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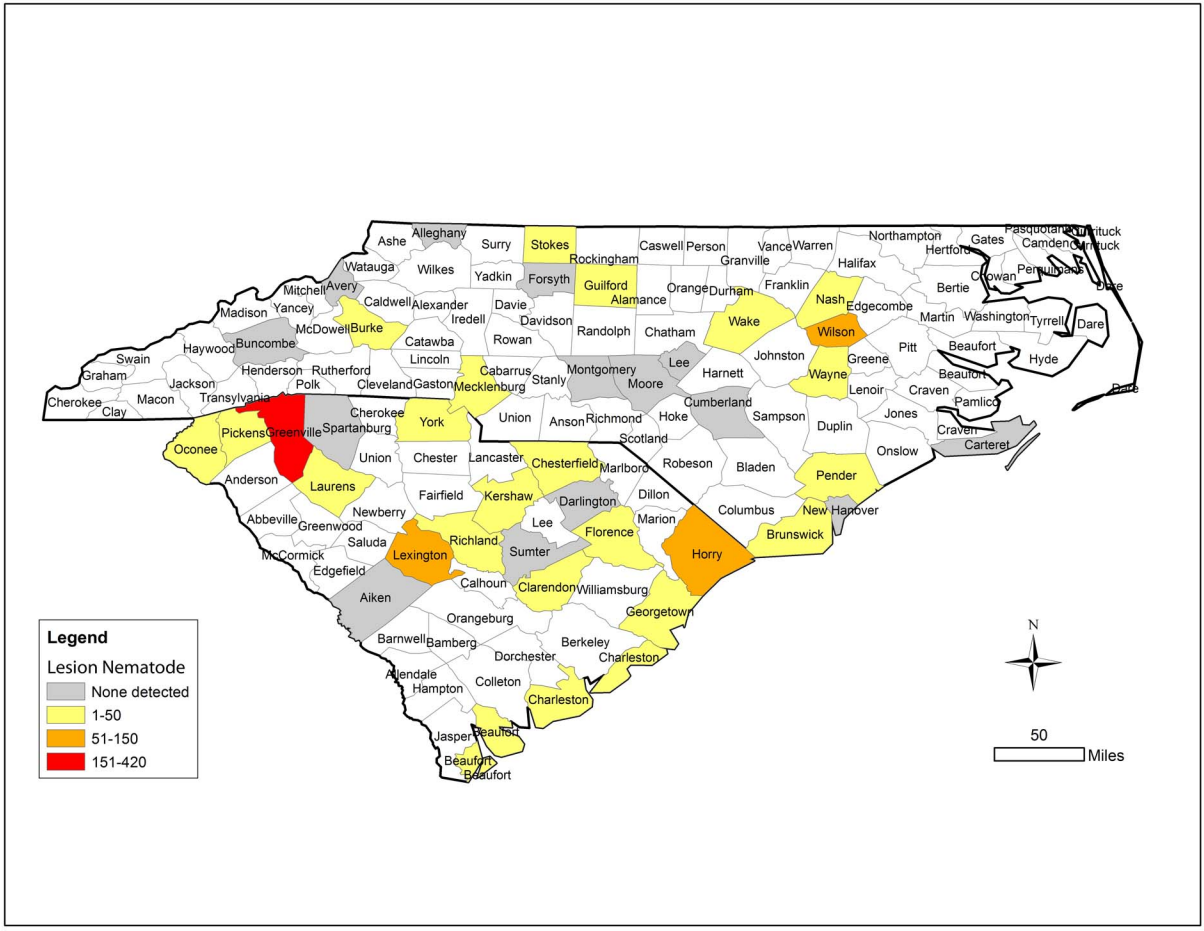
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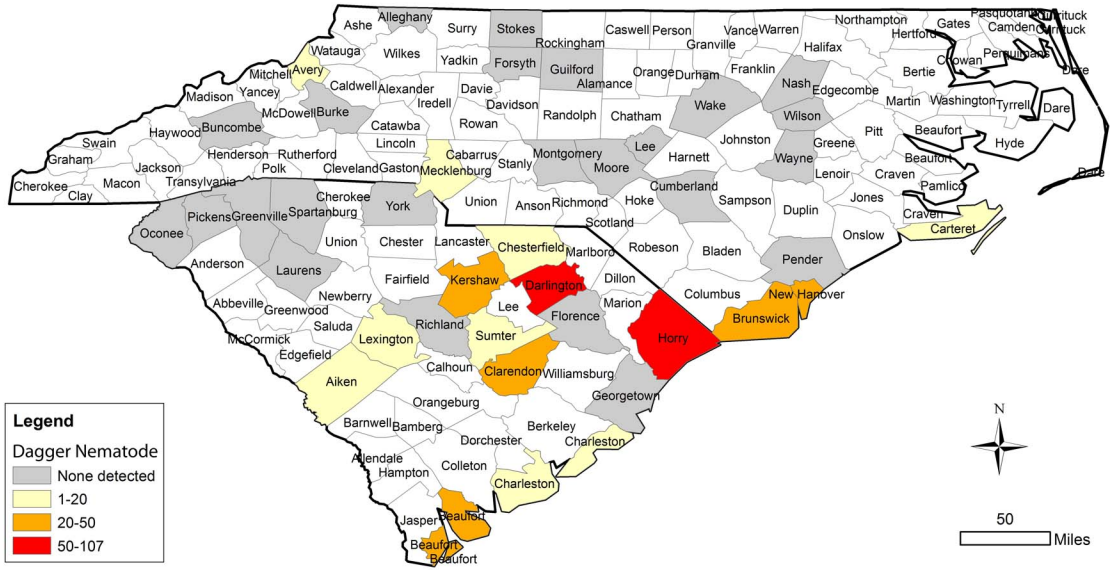
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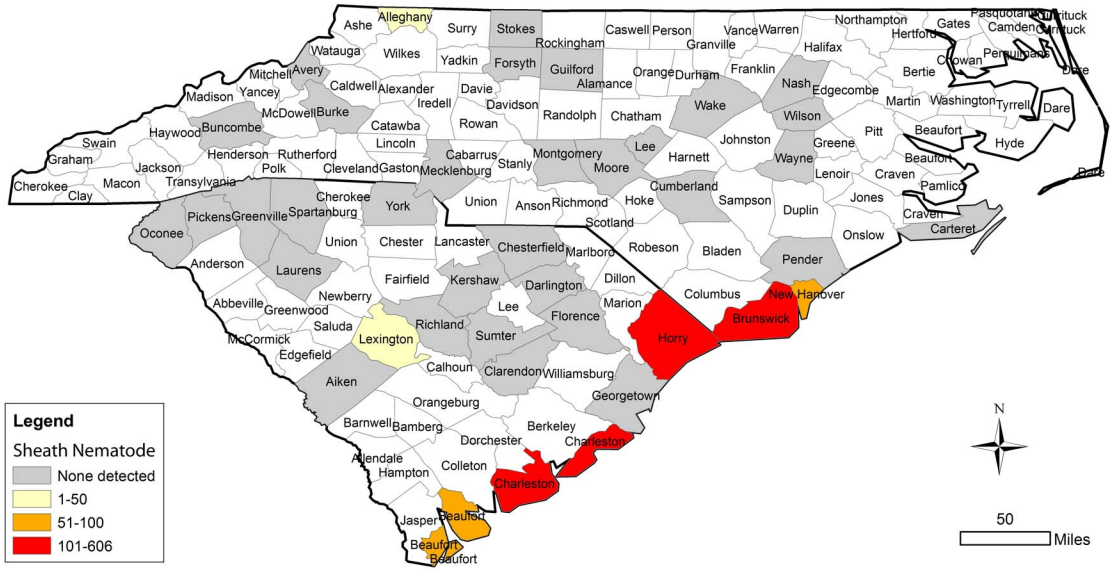
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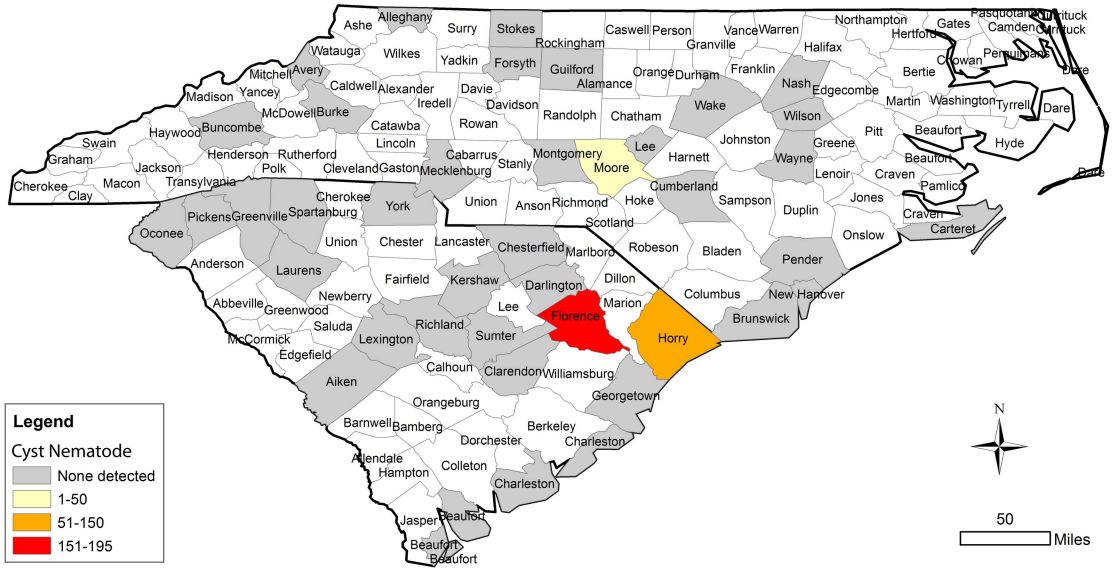
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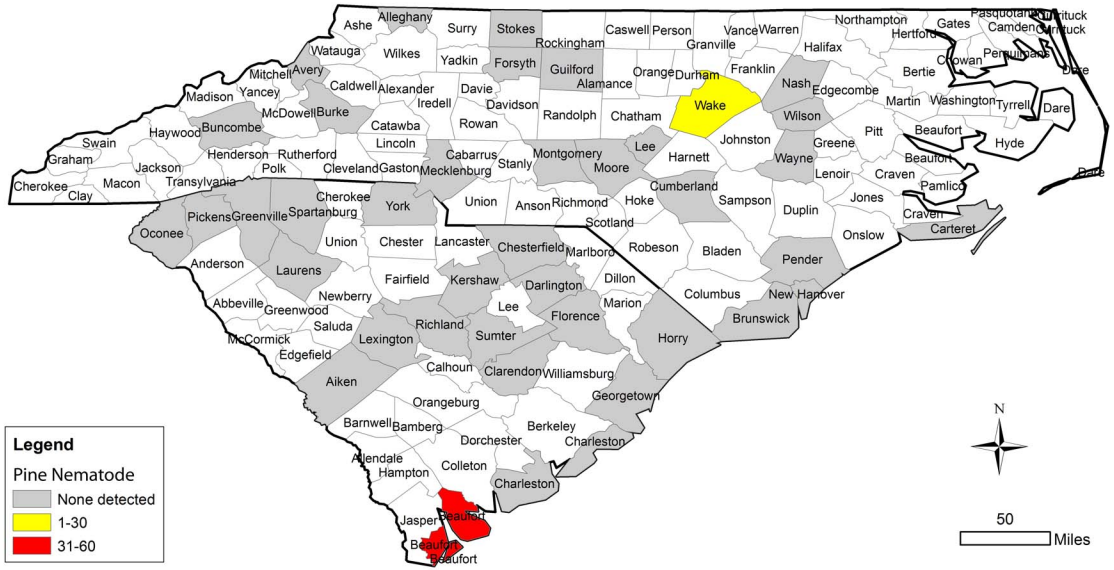
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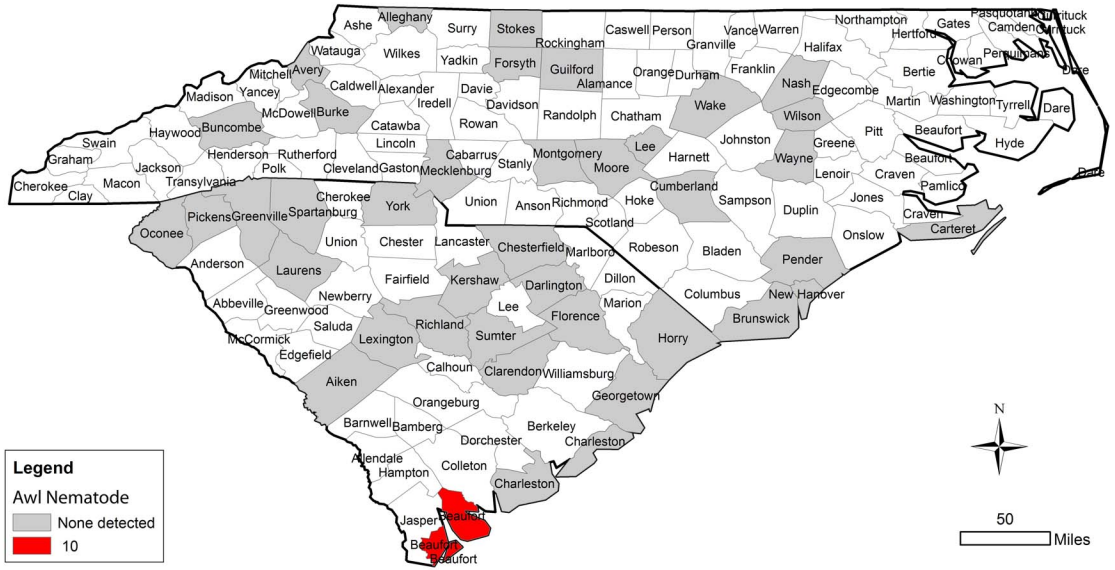
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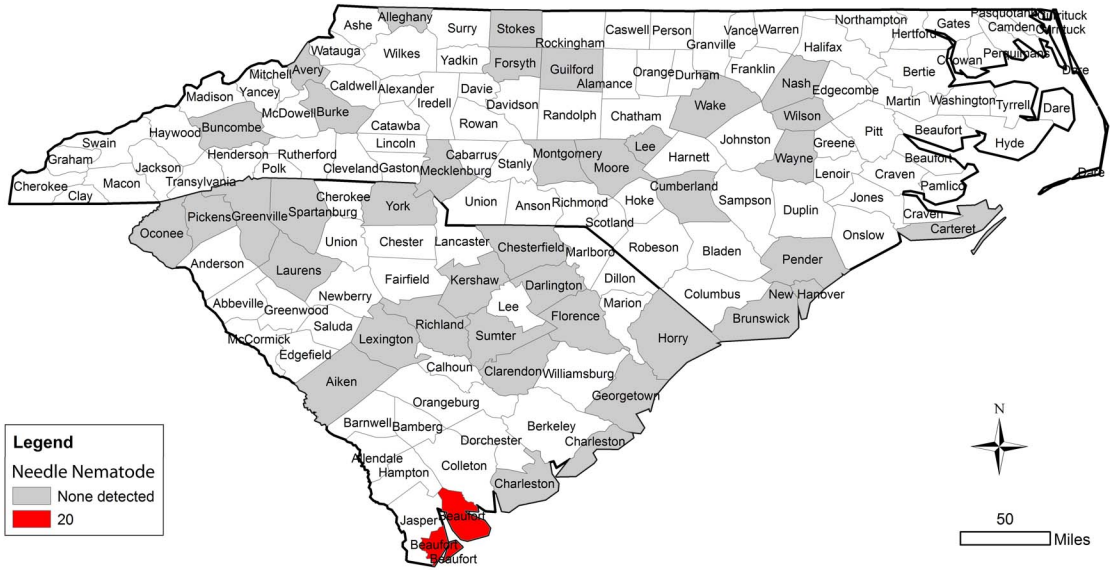
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Stanly
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Lenoir
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Anson
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Hoke
Sampson
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Pickens
Greenville
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Scotland
Duplin
Oconee
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Chester
Lancaster
Chesterfield
Marlboro
Robeson
Bladen
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Fairfield
Kershaw
Darlington
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Pender
Abbeville
Newberry
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Marion
Columbus
New Hanover
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