

## Weed Hosts of Root-Knot Nematodes Common to Florida<sup>1</sup>

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Root-knot nematodes (*Meloidogyne* spp.) are the most widespread and damaging of the plant-parasitic nematodes found in Florida, and they survive and even thrive on weeds. To date, about 97 root-knot nematode species have been described, but within the genus, *M. arenaria*, *M. incognita*, and *M. javanica* (peanut, southern and Javanese root-knot nematodes, respectively) represent 95% of all root-knot nematode problems in Florida. Other root-knot nematodes found causing problems in specific crops in the state include *M. graminis*, *M. mayaguensis* and *M. paritityla* (grass, guava and pecan root-knot nematodes, respectively). Weeds and nematodes are widely present in Florida agro-ecosystems, and the interaction of these primary pests can magnify problems compared to each acting alone. Because weeds are widely present and many are good hosts of root-knot nematodes, weed control is an excellent first step in reducing root-knot nematode damage in Florida agriculture.

To determine the status of weeds as hosts of root-knot nematodes, greenhouse and field evaluations were used to measure nematode reproduction of individual nematode and weed

combinations. For practical field observations, however, galling on plant roots most times indicates nematode reproduction on a weed or crop plant and generally the greater degree of galling, the greater root-knot nematode reproduction on the plant (Figure 1).

### Importance of Weeds as Nematode Hosts

The host status and degree of nematode reproduction on weeds is a major concern in developing and implementing integrated nematode management programs because weeds are almost universally present during crop growth and afterwards in fallow periods. This is contrary to modern perceptions of many professionals who now consider that weeds are not major constraints in agricultural production due to the excellent control provided by herbicides. However, weed control is often conducted relative to weed populations and threshold levels established for weed/crop competition. If weed populations are relatively low or grow only late in the season, it may be viewed as unprofitable to perform weed control, regardless of

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**Figure 1.** Root galling (knots) on Amaranth infected with Guava root-knot nematode (*Meloidogyne mayaguensis*).

whether these weeds are hosts of plant-parasitic nematodes. Additionally, most row crop and vegetable acreage remains fallow for long periods of the year, and weeds grow in abundance during these periods. These fallow periods may last from 3-6 months and are natural in most crop production cycles. For example, in north Florida thousands of acres of cotton and peanut are harvested in September and October each year, and the land may not be used again for crop production for over 6 months until planting commences the following May.

Nematode reproduction on weeds may seem to be a simple problem to solve – simply control weeds, particularly in the off-cropping season. However, this could lead to increased grower cost, greater soil erosion potential, less nutrient recycling, and lower soil organic matter levels. Some options to reduce these negative aspects would include selectively eliminating major weed hosts with herbicides (mostly broadleaf weeds), encouraging the growth of non-host weeds (mostly grassy weeds), or planting cover crops that suppress weed populations. It is



**Figure 2.** Unless controlled during the off-season, weeds may maintain or increase nematode populations.

important to emphasize that without a strong weed management program both in-season and off-season, the benefits of crop rotation for nematode management can be quickly annulled by weed hosts of plant-parasitic nematodes.

### Weeds as Monitoring Tools

Knowledge about weeds as hosts of root-knot nematodes, particularly weeds known to be highly symptomatic hosts, makes it possible to use existing weeds to monitor fields for those nematodes. This is especially important when laboratory assays are impractical or when more data points on nematode infestation are needed than can be derived by laboratory soil assay alone. For instance, the citron melon has been used to monitor the peanut root-knot nematode in north Florida fields and several leguminous weed species were used to index a root-knot nematode infestation in fields to be planted to cantaloupes.

## Conclusions

Information presented in Table 1 shows only those weed species found to be hosts to one or more common root-knot nematodes found in Florida. However, it is important to also remember that some weeds are NOT hosts of plant-parasitic nematodes, a fact that may be useful in management programs. For example, UF/IFAS Nematologist Dr. Harlan Rhoades found that a summer cover crop of hairy indigo (*Indigofera hirsuta*) was a non-host to the southern and Javanese root-knot nematodes as well as the sting nematode (*Belonolaimus longicaudatus*). In field experiments, hairy indigo rotation was very effective for control of those nematode species in subsequent vegetable crop production.

Overall, information on the host range of root-knot nematodes on weeds is incomplete and sometimes contradictory, and many additional studies are necessary to adequately describe this subject. For example, a recent review article stated that weed hosts had only been studied for 14 of the 97 species of root-knot nematodes known worldwide (1). In addition, there are 3479 recognized weed species in the Weed Science Society of America database, suggesting that much is left to be known about weed hosts to root-knot nematodes.

Lastly, weeds present in agricultural fields any time during the year may compromise carefully documented and effective rotation systems for nematode management. Thus, weed management both within and after the normal cropping cycle is an overlooked yet critical component of nematode management systems.

## Literature

A more complete listing of weed hosts of root-knot nematodes worldwide may be found in:

1. Rich, J. R., J. A. Brito, R. Kaur, and J. A. Ferrell. 2009. Weed species as hosts of *Meloidogyne*: A review. *Nematropica* 39:157-185.

## Weed Hosts of Root-Knot Nematodes Common to Florida

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**Table 1.** List of selected Florida weeds, their common names and botanical families occurring as hosts of root-knot nematodes commonly found in Florida.

Scientific name <sup>x</sup>	Weed Common name	Family	Root-Knot Nematodes <sup>y</sup>
<i>Abutilon theophrasti</i>	Velvet leaf	Malvaceae	Ma, Mi, Mj, Mm
<i>Acalypha australis</i>	Australian acalypha	Euphorbiaceae	Mi
<i>A. setosa</i>	Copperleaf	Euphorbiaceae	Ma, Mi
<i>Achillea millefolium</i>	Common yarrow	Asteraceae	M. sp. <sup>z</sup>
<i>Achyranthes aspera</i>	Prickly chaff-flower	Amaranthaceae	Mi
<i>Aerva javanica</i>	Kapok bush	Amaranthaceae	Mi
<i>Ageratum conyzoides</i>	Goat weed	Asteraceae	M. sp.,
<i>Alternanthera sessilis</i>	Sessile joyweed	Amaranthaceae	Mi
<i>Amaranthus graecizans</i>	Tumbleweed	Amaranthaceae	Mi, M. sp.
<i>A. hybridus</i>	Smooth pigweed	Amaranthaceae	Ma, Mi, Mj
<i>A. palmeri</i>	Palmer amaranth	Amaranthaceae	Ma, Mi
<i>A. retroflexus</i>	Redroot amaranth,	Amaranthaceae	Ma, Mi, Mj, Mm
<i>A. spinosus</i>	Spiny amaranth	Amaranthaceae	Ma, Mi, Mj, Mm
<i>A. viridis</i>	Slender amaranth	Amaranthaceae	Mi
<i>Ambrosia artemisiifolia</i>	Common ragweed	Asteraceae	Ma, Mi
<i>Avena</i> spp.	Wild Oats	Poaceae	M. sp.
<i>Axonopus affinis</i>	Carpetgrass	Poaceae	Mi
<i>Bidens alba</i>	Common beggartick	Asteraceae	Mi
<i>B. frondosa</i>	Devils'beggar tick	Asteraceae	Mi
<i>B. pilosa</i>	Hairy begger tick	Asteraceae	M. sp., Mj, Mm
<i>Bromus secalinus</i>	Cheat	Poaceae	Mi
<i>Capsella bursa-pastoris</i>	Shepherd's purse	Brassicaceae	M. sp.
<i>Celosia argentea</i>	Celosia	Amaranthaceae	Mi
<i>Cenchrus spinifex</i>	Field sandbur	Poaceae	Ma, Mi
<i>Cerastium fontanum</i> ssp. <i>vulgare</i>	Mouse ear chickweed	Caryophyllaceae	Mi
<i>Chamaesyce hirta</i>	Garden spurge	Euphorbiaceae	Mi
<i>C. maculate</i>	Spotted spurge	Euphorbiaceae	Ma, Mi
<i>C. prostrata</i>	Ground spurge	Euphorbiaceae	M. sp., Mm
<i>Chenopodium album</i>	Common lambs-quarters	Chenopodiaceae	Ma, Mi
<i>C. murale</i>	Nettle-leaf goosefoot	Chenopodiaceae	Mi
<i>Citrullus lanatus</i>	citronmelon	Cucurbitaceae	Ma
<i>Cleome viscosa</i>	Jasmin del rio	Capparaceae	Mi
<i>Cnidiosculus stimulosus</i>	Spurge nettle	Euphorbiaceae	Ma, Mm
<i>Commelina benghalensis</i>	Benghal dayflower	Commelinaceae	M. sp.
<i>C. communis</i>	Asiatic dayflower	Commelinaceae	M. sp.
<i>C. diffusa</i>	Spreading dayflower	Commelinaceae	M. sp.
<i>Conyza albida</i>	Fleabane	Asteraceae	M. sp.
<i>Crotalaria spectabilis</i>	Showy crotalaria	Fabaceae	Ma, Mi
<i>Cynodon dactylon</i>	Bermudagrass	Poaceae	Ma, Mi
<i>Cyperus</i> sp.	Sedge	Cyperaceae	Mj
<i>C. difformis</i>	Smallflower sedge	Cyperaceae	M. sp.
<i>C. esculentus</i>	Yellow nutsedge	Cyperaceae	Mi, Ma
<i>C. rotundus</i>	Purple nutsedge	Cyperaceae	Ma, Mi
<i>C. sanguinolentus</i>	Bloodscale sedge	Cyperaceae	M. sp.
<i>Dactyloctenium aegyptium</i>	Crowfootgrass	Poaceae	M. sp.

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Scientific name <sup>x</sup>	Weed Common name	Family	Root-Knot Nematodes <sup>y</sup>
<i>Datura innoxia</i>	Sacred datura	Solanaceae	<i>Mi</i>
<i>D. stramonium</i>	Jimsonweed	Solanaceae	<i>Ma, Mi</i>
<i>Daucus carota</i>	Wild carrot	Umbelliferae	<i>Mi, M. sp.</i>
<i>Desmodium</i> sp.	Beggarweed	Fabaceae	<i>Mi</i>
<i>Dichondra repens</i>	Dichondra	Convolvulaceae	<i>Ma, Mi, Mj, Mm</i>
<i>Digitaria horizontalis</i>	Jamaican crabgrass	Poaceae	<i>Mi</i>
<i>D. sanguinalis</i>	Large crabgrass	Poaceae	<i>Ma</i>
<i>Echinochloa colona</i>	Jungle-rice	Poaceae	<i>M. sp.</i>
<i>Echinochloa crus-galli</i>	Barnyard-grass	Poaceae	<i>Ma, Mi</i>
<i>E. muricata</i>	Rough barnyard-grass	Poaceae	<i>Ma</i>
<i>E. prostrata</i>	Eclipta	Compositae	<i>Mm</i>
<i>Eleusine indica</i>	Goosegrass	Poaceae	<i>Ma, Mi</i>
<i>Elymus repens</i>	Quackgrass	Poaceae	<i>M. sp.</i>
<i>Emilia sonchifolia</i>	Red tassel-flower	Asteraceae	<i>Mi, Mm</i>
<i>Erechtites hieracifolia</i>	American burnweed	Asteraceae	<i>Mi, Mj</i>
<i>Euphorbia heterophylla</i>	Wild poinsettia	Euphorbiaceae	<i>Mj</i>
<i>E. hirta</i>	Asthma plant	Euphorbiaceae	<i>Mi</i>
<i>E. tirucalli</i>	Indiantree	Euphorbiaceae	<i>Mm</i>
<i>Fatoua villosa</i>	Mulberryweed	Moraceae	<i>Mm</i>
<i>Hydrocotyle bonariensis</i>	Pennywort	Apiaceae	<i>Mm</i>
<i>Indigofera</i> sp.	Indigo	Fabaceae	<i>Mj</i>
<i>Ipomoea grandifolia</i>	Morning-glory	Convolvulaceae	<i>M. sp.</i>
<i>I. hederacea</i>	Ivyleaf morning-glory	Convolvulaceae	<i>Ma, Mi</i>
<i>I. quamoclit</i>	Cypressvine morning-glory	Convolvulaceae	<i>M. sp.</i>
<i>I. triloba</i>	Three-lobed morning-glory	Convolvulaceae	<i>Ma, Mi, Mj, Mm</i>
<i>I. tricolor</i>	Multicolored morning-glory	Convolvulaceae	<i>M. sp., Mm</i>
<i>Jacquemontia tamnifolia</i>	Small flower morning-glory	Convolvulaceae	<i>Ma, Mi</i>
<i>Lactuca saligna</i>	Willowleaf, lettuce	Asteraceae	<i>Mi</i>
<i>Leontodon hispidus</i>	Bristly hawkbit	Asteraceae	<i>Ma, Mm</i>
<i>Lucas aspera</i>	Thumba plant		<i>Mi</i>
<i>Macroptilium lathyroides</i>	Phasey bean	Fabaceae	<i>Ma</i>
<i>Malva neglecta</i>	Common mallow	Malvaceae	<i>Mi</i>
<i>Medicago lupulina</i>	Black medic	Fabaceae	<i>Mi</i>
<i>Melilotus alba</i>	White sweetclover	Fabaceae	<i>Mi</i>
<i>Melilotus indica</i>	Sourclover	Fabaceae	<i>M. sp.</i>
<i>Mikania micrantha</i>	Mile-a-minute	Asteraceae	<i>M. sp.</i>
<i>Mimosa pudica</i>	Sensitive Plant	Fabaceae	<i>M. sp.</i>
<i>Mollugo</i> sp.	Carpetweed	Aizoaceae	<i>Mi</i>
<i>Morella faya</i>	fayatree	Myricaceae	<i>M. sp.</i>
<i>Nasturtium officinalis</i>	Watercress	Cruciferae	<i>M. sp.</i>
<i>Oenothera biennis</i>	Common evening- primrose	Onagraceae	<i>Ma</i>
<i>Oxalis corniculata</i>	Creeping woodsorrel	Oxalidaceae	<i>M. sp.</i>
<i>Panicum miliaceum</i>	Wildproso millet	Poaceae	<i>Mi</i>
<i>P. repens</i>	Torpedograss	Poaceae	<i>M. sp.</i>
<i>Paspalum notatum</i>	Bahia-grass	Poaceae	<i>Ma, Mi</i>

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<i>Passiflora mucronata</i>	Passion flower	Passifloraceae	<i>Mm</i>
<i>Pennisetum purpureum</i>	Napiergrass	Poaceae	<i>Mi</i>
<i>Peperomia pellucida</i>	Shiny bush, pepper elder	Piperaceae	<i>M. sp.</i>
<i>Physalis</i> spp.	Ground cherry	Solanaceae	<i>Ma, Mi, Mj</i>
<i>Physalis angulata</i>	Cutleaf groundcherry	Solanaceae	<i>Ma</i>
<i>Phytolacca americana</i>	American pokeweed	Phytolaccaceae	<i>Ma, Mi, Mj, Mm</i>
<i>Plantago major</i>	Broadleaf plantain	Plantaginaceae	<i>M. sp.</i>
<i>Poa annua</i>	Annual bluegrass	Poaceae	<i>M. sp.</i>
<i>Polygonum persicaria</i>	Ladysthumb	Polygonaceae	<i>Mi</i>
<i>Phragmites communis</i>	Common reed	Poaceae	<i>M. sp.</i>
<i>Portulaca grandiflora</i>	Showy purslane	Portulacaceae	<i>Mi</i>
<i>P. oleracea</i>	Common purslane	Portulacaceae	<i>Ma, Mi, Mj, Mm</i>
<i>Raphanus raphanistrum</i>	Wild radish	Brassicaceae	<i>M. sp.</i>
<i>Richardia brasiliensis</i>	Brazil pusley	Rubiaceae	<i>M. sp.</i>
<i>R. scabra</i>	Florida pusley	Rubiaceae	<i>Mi</i>
<i>Rumex acetosella</i>	Red sorrel	Polygonaceae	<i>Ma, Mi</i>
<i>R. crispus</i>	Curly dock	Polygonaceae	<i>Mi, Ma</i>
<i>Senna alata</i>	Emperor's candlesticks	Fabaceae	<i>Mm</i>
<i>S. obtusifolia</i>	Sickle pod	Fabaceae	<i>Ma, Mi, Mj, Mm</i>
<i>S. occidentalis</i>	Coffee senna	Fabaceae	<i>Mi, Mj, Mm</i>
<i>Sesbania</i> sp.	Sesban or sesbania	Fabaceae	<i>Mi, Mj</i>
<i>S. aculeate</i>	Prickly sesbania	Fabaceae	<i>Mj</i>
<i>Setaria pumila</i>	Yellow foxtail	Poaceae	<i>Ma</i>
<i>S. viridis</i>	Green foxtail	Poaceae	<i>Ma, Mi</i>
<i>Sida acuta</i>	Southern sida	Malvaceae	<i>Mi</i>
<i>S. spinosa</i>	Prickly sida	Malvaceae	<i>Ma, Mi</i>
<i>Solanum</i> sp.	Nightshade	Solanaceae	<i>Ma, Mi</i>
<i>Solanum americanum</i>	American black nightshade	Solanaceae	<i>Mi, Mj, Mm</i>
<i>S. nigrum</i>	Black nightshade	Solanaceae	<i>Mi, Mj, M. sp.</i>
<i>S. torvum</i>	Turkeyberry	Solanaceae	<i>M. sp., Ma</i>
<i>S. viarum</i>	Tropical soda apple	Solanaceae	<i>Ma</i>
<i>Sonchus oleraceus</i>	Common sowthistle	Asteraceae	<i>Mi, Mj</i>
<i>Sorghum bicolor</i> ssp. <i>arundinaceum</i>	Wild sorghum	Poaceae	<i>M. sp.</i>
<i>S. halepense</i>	Johnsongrass	Poaceae	<i>M sp.</i>
<i>Spergula arvensis</i>	Corn spurry	Caryophyllaceae	<i>M. sp.</i>
<i>Spermaceoce confusa</i>	Button weed	Rubiaceae	<i>M. sp.</i>
<i>Stellaria media</i>	Common chickweed	Caryophyllaceae	<i>Mi,</i>
<i>Talinum triangulare</i>	Waterleaf	Portulacaceae	<i>Mm</i>
<i>Tamarix gallica</i>	Saltcedar	Tamaricaceae	<i>Mj</i>
<i>Taraxacum officinale</i>	Common dandelion	Asteraceae	<i>Ma, Mi</i>
<i>Thlaspi arvense</i>	Field pennycress	Brassicaceae	<i>Mi</i>
<i>Trifolium repens</i>	White clover	Fabaceae	<i>Mi</i>
<i>Urena lobata</i>	Cadillo	Malvaceae	<i>Mi, M. sp.</i>
<i>Urochloa ramosa</i>	Browntop millet	Poaceae	<i>M. sp.</i>
<i>Verbena officinalis</i>	Vervain	Verbenaceae	<i>Mi</i>

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Scientific name <sup>x</sup>	Weed Common name	Family	Root-Knot Nematodes <sup>y</sup>
<i>Veronica</i> spp.	Speedwell	Scrophulariaceae	<i>M. sp.</i>
<i>Vicia villosa</i>	Hairy vetch	Fabaceae	<i>Ma, Mi</i>
<i>Withania somnifera</i>	Ashwagandha	Solanaceae	<i>Mi</i>
<i>Xanthium strumarium</i>	Common cocklebur	Asteraceae	<i>Ma, Mi</i>

<sup>x</sup> Many scientific names of weeds and even family names have changed over the past few years; weed names presented herein are those used by the Weed Science Society of America (<http://www.wssa.net/Weeds/ID/WeedNames/namesearch.php>).

<sup>y</sup>*Ma* = *Meloidogyne arenaria* - Peanut root-knot nematode; *Mi* = *M. incognita* – Southern root-knot nematode; *Mj* = *M. javanica* – Javanese root-knot nematode; *Mm* - *M. mayaguensis* – Guava root-knot nematode.

<sup>z</sup> *M. sp.* = Species of root-knot nematode not identified.