# Additions to the Weed Host Range of *Meloidogyne hapla*

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**ABSTRACT**

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Susceptibility of 11 broadleaf weed species to *Meloidogyne hapla* was evaluated in the greenhouse. Common cocklebur (*Xanthium pensylvanicum*) and ivyleaf morning glory (*Ipomoea hederacea*) supported the heaviest reproduction and were important reservoirs of root-knot inoculum. Dog fennel (*Eupatorium capillifolium*), pitted morning glory (*I. lacunosa*), spotted spurge (*Euphorbia maculata*), velvetleaf (*Abutilon theophrasti*), spurred anoda (*Anoda cristata*), and jimsonweed (*Datura stramonium*) were parasitized by *M. hapla* but supported low to moderate egg production. Sicklepod (*Cassia obtusifolia*), prickly sida (*Sida spinosa*), and pokeweed (*Phytolacca americana*) were nonhosts.

The northern root-knot nematode, *Meloidogyne hapla* Chitwood, is an important plant-parasitic nematode in the United States but is not established beyond the 26.7 C isotherm for July (8). In the southeastern United States, *M. hapla* is widely distributed throughout North Carolina, northwestern South Carolina, and northern Georgia (8). From an economic standpoint, tobacco, soybeans, peanuts, tomatoes, peppers, sweet potatoes, Irish potatoes, cucumbers, cabbage, and strawberries are among the most severely affected crops. Several host range studies (2,3,6,9) have indicated that many weed species serve as important reservoirs of field inoculum of *M. hapla*.

We present information on the susceptibility of several common weeds of the southern United States to *M. hapla*.

## MATERIALS AND METHODS

Seeds of dog fennel (*Eupatorium capillifolium* (Lam.) Small), common cocklebur (*Xanthium pensylvanicum* Wallr.), ivyleaf morning glory (*Ipomoea hederacea* (L.) Jacq.), pitted morning glory (*I. lacunosa* L.), spotted spurge (*Euphorbia maculata* L.), sicklepod (*Cassia obtusifolia* L.), velvetleaf (*Abutilon theophrasti* Medic.), spurred anoda (*Anoda cristata* (L.) Schlecht.), prickly sida (*Sida spinosa* L.), pokeweed (*Phytolacca americana* L.), and jimsonweed (*Datura stramonium* L.) were germinated in vermiculite. Plants were transplanted into 10-cm-diameter clay pots containing sterilized sand-soil mix (1:1, v/v) equivalent to a sandy loam. Plants were watered daily and fertilized weekly with 100 ml/pot of fertilizer solution (2.5 g/L, 20-20-20, NPK, W. R. Grace & Co., Allentown, PA). Greenhouse temperatures were 20–30 C.

Inoculum of *M. hapla* came from infected tomatoes (*Lycopersicon esculentum* Mill. cv. Rutgers) maintained in continuous culture in a greenhouse. Eggs of *M. hapla* were extracted from the tomato roots using a NaOCl method (4). One week after transplanting, the upper third of potting soil in each pot was removed, 100 ml of water containing 10,000 eggs was applied to the soil containing roots, and the soil was replaced.

The experimental design was a randomized complete block with 11 treatments replicated six times. Root weight and number of galls and eggs per root system (4) were determined 1 mo after inoculation. Data were analyzed by an analysis of variance.

Oostenbrink's reproductive factor (R), defined here as number of eggs recovered from weed roots per number of eggs used

**Table 1.** Susceptibility and host suitability of 11 weed species to *Meloidogyne hapla*

| Scientific name | No. of galls[a] | No. of galls/g of root[b] | No. of eggs[c] | R[d] |
|---|---|---|---|---|
| Asteracea | | | | |
| *Eupatorium capillifolium* | 1,564 | 102 | 31,320 | 3.13 |
| *Xanthium pensylvanicum* | 416 | 30 | 129,627 | 12.96 |
| Convolvulaceae | | | | |
| *Ipomoea hederacea* | 727 | 87 | 81,387 | 8.14 |
| *I. lacunosa* | 776 | 19 | 13,307 | 1.33 |
| Euphorbiaceae | | | | |
| *Euphorbia maculata* | 582 | 68 | 11,293 | 1.13 |
| Fabaceae | | | | |
| *Cassia obtusifolia* | 0 | 0 | 0 | 0.00 |
| Malvaceae | | | | |
| *Abutilon theophrasti* | 433 | 48 | 21,903 | 2.19 |
| *Anoda cristata* | 0[e] | 0 | 3,560 | 0.36 |
| *Sida spinosa* | 0 | 0 | 0 | 0.00 |
| Phytolaccaceae | | | | |
| *Phytolacca americana* | 0 | 0 | 147 | 0.01 |
| Solanaceae | | | | |
| *Datura stramonium* | 685 | 32 | 230 | 0.02 |

[a] Mean number of galls per root system ($P = 0.01$).
[b] Mean number of galls per gram of fresh root ($P = 0.01$).
[c] Mean number of extracted eggs per root system ($P = 0.01$).
[d] Reproductive factor (R) = number of eggs recovered from weeds per number of eggs used for inoculation.
[e] No distinct galls observed.

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for inoculation, provides a measure of nematode reproductive capability (7). In this study, R is used to determine the relative rates of reproduction of *M. hapla* on several weed species.

## RESULTS AND DISCUSSION

The reaction of the selected weed species to *M. hapla* ranged from high susceptibility to immunity, with R values of *M. hapla* increasing with susceptibility of the weeds (Table 1). Common cocklebur and ivyleaf morning glory sustained moderate galling but supported the highest egg production. Dog fennel sustained heavy galling but was less suitable for egg production. Pitted morning glory, spotted spurge, and velvetleaf sustained relatively moderate galling in association with low egg production. No distinct galling was observed on the roots of spurred anoda, but some eggs were produced. Jimsonweed sustained moderate galling but was not suited for reproduction, an indication that the weed may be a trap plant. Sicklepod, prickly sida, and pokeweed were nonhosts.

At the end of the study, the growth of inoculated cocklebur plants equaled that of uninoculated plants. The tolerance of such a highly competitive weed to *M. hapla* threatens soybean yields in the southeastern United States, where common cocklebur is probably the most serious weed of this crop (10). Soybean and common cocklebur seedlings often emerge at the same time, but growth of the weed surpasses that of soybean after midseason, forming a dense canopy over the crop (1). As common cocklebur successfully competes for light, nutrients, and moisture during this time, soybean yields may be further reduced by the continuous production of inoculum of *M. hapla*. Ivyleaf morning glory, another major weed infesting soybeans in the southeastern United States (5), may also significantly contribute to field populations of *M. hapla*.

The successful infection of several selected weed species by *M. hapla* stresses the importance for adequate weed management programs for most major crops. Weeds serving as reservoirs of *M. hapla* inoculum not only threaten susceptible crop cultivars but resistance-breaking strains may develop when weeds maintain these nematodes in monocultures where resistant cultivars are grown for several years (8). Results further indicate that knowledge of a weed infestation in a given field and its potential for harboring plant-parasitic nematodes such as root-knot is beneficial to an integrated pest management program.

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