HOST SUITABILITY OF SOME VINCA AND SALVIA CULTIVARS TO TWO ISOLATES OF ROOT-KNOT NEMATODES

ROBERT MCSORLEY AND JOHN J. FREDERICK
University of Florida, IFAS
Department of Entomology and Nematology
Gainesville, FL 32611-0620

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Abstract. Several cultivars of vinca (Catharanthus roseus), also known as Madagascar periwinkle, and salvia (Salvia spp.) were evaluated for their responses to an isolate of Meloidogyne incognita race 1 and to an isolate of M. javanica in separate tests conducted in a growth room. At >100 days after inoculation, vinca cv. Grape Cooler was nearly free of galling from both nematode species, but moderate to high numbers of very small galls were produced on the other vinca cultivars (Blush Cooler, Little Bright Eyes, Little Mixed Colors, Peppermint Cooler). Despite the presence of small galls, almost no viable eggs were produced on any vinca cultivar (≤0.7 juveniles hatched per plant). Almost no galling was observed on the salvia cultivars Sea Breeze, Flare, Lady in Red, Victoria, and Bonfire, and juveniles hatched from eggs produced on these cultivars represented ≤3.5% of the initial inoculum. However, severe galling (4.5-5.0 on a 0-5 scale) occurred on salvia cv. Oxford Blue, and nematode population levels increased on this cultivar. In general, results with M. incognita and M. javanica were similar for all tested cultivars. With the exception of cv. Oxford Blue salvia, the relatively high levels of resistance observed in the other salvia and vinca cultivars suggest that they may have potential use in the design of landscapes compatible with these nematode populations.

Herbaceous ornamentals and bedding plants are widely used as landscape plants in many regions of the United States. However, the susceptibility of some bedding plants to root-knot nematodes (Meloidogyne spp.) has been recognized for many years (Goff, 1936). Therefore the potential exists for nematode damage in the landscape or for the buildup of nematode populations on susceptible hosts. With the use of nematode-resistant or tolerant plants, it may be possible to design landscape plantings that are compatible with the root-knot nematode isolate present in a particular site (McSorley, 1994). Such an approach first requires a detailed knowledge of the susceptibility of ornamental plant cultivars to root-knot nematodes.

Although the susceptibility of most of the vast numbers of ornamental cultivars to root-knot nematodes remains unknown, much new information has been obtained in recent years. A number of perennial herbaceous ornamentals adapted to the northeastern United States have been examined for their responses to Meloidogyne hapla (LaMondia, 1995, 1997). Some types of annual bedding plants, important in seasonal plantings in the southeastern states, have been examined for their responses to M. incognita (McSorley and Frederick, 1994; Walker et al., 1994; Walker and Melin, 1998), M. javanica (McSorley and Frederick, 1994), or M. arenaria (McSorley, 1994; McSorley and Frederick, 1994; Walker and Melin, 1998). Of the plants examined, several cultivars of salvia (Salvia splendens) and vinca (Catharanthus roseus) were rated resistant or only slightly susceptible to M. incognita race 3 (Walker et al., 1994). ‘Bonfire’ salvia and ‘Little Bright Eyes’ vinca (also called periwinkle) were resistant to M. incognita race 1 and only marginally susceptible to M. javanica (McSorley and Frederick, 1994). The objective of the research presented here was to determine the response of several salvia and vinca cultivars to M. incognita race 1 and M. javanica.

Materials and Methods

Two separate experiments were conducted, one with an isolate of M. incognita race 1 and one with an isolate of M. javanica. Five commercially available cultivars of vinca (Ferry-Morse Seed, Fulton, Ky.) were examined: Blush Cooler, Grape Cooler, Little Bright Eyes, Little Mixed Colors, and Peppermint Cooler. Salvia cultivars examined included S. splendens cv. Bonfire, S. splendens cv. Flare, S. coccinea cv. Lady in Red, S. farinacea cvs. Sea Breeze and Victoria, and S. horminum cv. Oxford Blue. These commercial salvias (Bonfire from Ferry-Morse Seed, Fulton, Ky.; others from W. Atlee Burpee & Co., Warminster, Pa.) represent red (Bonfire, Flare, Lady in Red) and blue (Oxford Blue, Sea Breeze, Victoria) cultivars.

Individual seeds of the various cultivars were planted in 5-cm × 5-cm plastic trays in a mixture of ½ builder’s sand and ½ steam-sterilized soil (92% sand, 3% silt, 5% clay; pH 6.0; 1.2% organic matter). Three weeks after planting, seedlings were transplanted (one per pot) into the same soil mix in 12.5-cm-diam plastic pots with a capacity of approximately 825 cm³ soil. One week after transplanting, the soil was infested with Meloidogyne second-stage juveniles (J2).

Root-knot nematode isolates were maintained in a greenhouse on tomato (Lycopersicon esculentum cv. Rutgers). Nematode isolates were developed from single egg masses collected earlier from sites in Florida. The identity of each isolate was verified with a differential host test (Taylor and Sasser, 1978). Four days before initiation of an experiment, eggs of a given nematode isolate were extracted from tomato roots in 0.525% NaOCl (Hussey and Barker, 1973). Extracted eggs were incubated at 22°C on modified Baermann trays (Rodriguez-Kabana and Pope, 1981) for collection of J2, which were delivered into two holes (2 cm deep) in the soil at the base of the plant.

The experiment with M. incognita was inoculated on 25 July 1996 and terminated on 12 Nov. The experiment with M. javanica was inoculated 25 July 1996 and terminated 6 Nov. In both experiments, an inoculum density of 1,000 J2 per pot was used. For each experiment, each of the tested cultivars was replicated four times. Pots were arranged on raised benches in a randomized complete block design and main-
Table 1. Root gall ratings and numbers of second-stage juveniles (J2) hatched from eggs on bedding plants grown in soil infested with Meloidogyne incognita or M. javanica.

<table>
<thead>
<tr>
<th>Plant</th>
<th>Cultivar</th>
<th>M. incognita</th>
<th>M. javanica</th>
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<tr>
<td></td>
<td>Root-gall rating*</td>
<td>J2/plant</td>
<td>Root-gall rating</td>
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<tr>
<td>Vinca</td>
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<tr>
<td></td>
<td>0.50 c</td>
<td>0</td>
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<td>3.33 ab</td>
<td>0</td>
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<tr>
<td></td>
<td>4.50 ab</td>
<td>0.5</td>
<td>4.0</td>
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<tr>
<td>Salvia</td>
<td>0.50 c</td>
<td>0.2</td>
<td>0.25 c</td>
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<td></td>
<td>3.00 b</td>
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*Root gall rating on 0-5 scale: 0 = 0 galls, 1 = 1-2, 2 = 3-10, 3 = 11-30, 4 = 31-100, 5 = >100 galls per root system (Taylor and Sasser, 1978). Gall rating data are means of four replications. Separation in columns by the Student-Newman-Keuls test, 5% level.

Results and Discussion

Results of both experiments were relatively similar. On some cultivars, root-knot nematodes produced minute galls that were difficult to see without magnification. Moderate to high levels of galling were produced by both M. incognita and M. javanica on several vinca cultivars and on 'Oxford Blue' salvia (Table 1). Dissection of galls on the vinca cultivars revealed small females containing few eggs. Incubation of extracted eggs resulted in <1.0 J2 per plant for all the vinca cultivars evaluated (Table 1). Females on 'Oxford Blue' salvia produced large numbers of offspring, as indicated by the levels of J2 per plant (Table 1). Numbers of both M. incognita and M. javanica increased on this cultivar. Final numbers of M. javanica were nine times the initial inoculum level of 1,000 J2 per plant. Numbers of M. javanica recovered from the other salvia cultivars represented only 0.4-3.5% of the original inoculum level. During the course of these experiments, population levels of both nematodes declined greatly on all cultivars tested, with the exception of 'Oxford Blue' salvia.

The long duration of these experiments (110 d or 1540 degree days above a 10°C base for the M. incognita experiment, 104 d or 1456 degree days for M. javanica) should be sufficient for substantial nematode reproduction and possibly for the production of multiple generations. For example, two species of Meloidogyne completed their life cycles on susceptible 'Black Valentine' snap bean (Phaseolus vulgaris), producing J2 of the next generation in 49 d at temperatures of 22-25°C (Sydenham et al., 1996). Therefore the relatively low amount of viable J2 production on all but one of the cultivars evaluated here suggests that they are very poor or non-hosts of M. incognita race 1 and M. javanica.

Results of this study confirm a previous report (McSorley and Frederick, 1994) suggesting that vinca cv. Little Bright Eyes and salvia cv. Bonfire are poor hosts of M. incognita race 1 and M. javanica, and indicate that several other cultivars may also be poor or non-hosts. Several other cultivars of vinca and salvia (different from those tested here) were shown to have fairly high levels of resistance to M. incognita race 3 (Walker et al., 1994). The availability of several cultivars of vinca and salvia with resistance to common root-knot nematodes should allow landscape managers more choices and flexibility in designing plantings with these popular ornamentals.

In contrast to the other cultivars examined, the salvia cv. Oxford Blue was highly susceptible to both M. incognita race 1 and M. javanica, and abundant J2 were produced on this host. The response of Oxford Blue differed markedly from the other blue salvia cultivars evaluated (Sea Breeze, Victoria). The difference in the responses of Oxford Blue from those of the other cultivars is further evidence that the response of cultivars within a particular genus or species of bedding plant cannot be generalized. Instead, the response of specific cultivars against resident nematode populations must first be evaluated before nematode-compatible landscapes can be designed.

Literature Cited


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GROWTH CONTROL OF SALVIA × ‘INDIGO SPIRES’ BY PHOTOSELECTIVE PLASTIC FILMS

LAURIE A. KRAMFOLZ AND SANDRA B. WILSON
University of Florida
Indian River Research and Education Center
Fort Pierce, FL 34945

NIHAL C. RAJAPAKSE
Clemson University
Department of Horticulture
Clemson, SC 29364

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Abstract. The use of chemical growth retardants is a common practice in the greenhouse industry for controlling plant height for optimal shipping, handling, and establishment in the field. The mandated restricted use of some growth regulating chemicals in agriculture has led to recent developments in greenhouse film production. Photoselective greenhouse films offer a non-chemical alternative to regulate plant growth. Plant response to a photoselective plastic film with a far-red (FR) absorbing property was tested using the perennial Salvia × ‘Indigo Spikes’. Films were designated AFR (FR light-absorbing film) and control (clear plastic film). Light transmitted through the AFR film reduced plant height by 36%, leaf dry weight by 25%, and stem dry weight by 55% compared with the control film. This correlated with a reduction in specific leaf dry weight and specific stem dry weight. The AFR film did not significantly affect the number of leaves compared with the control film. These results indicate that compactness of Salvia × ‘Indigo Spikes’ can be achieved by selective reduction of far-red wavelengths from sunlight.

Plant production facilities often depend on the use of chemical growth regulators to unify plant growth, reduce plant height for optimal shipping and handling, and improve establishment in the field (Noricini et al., 1996). However, due to increasing environmental and human health concerns, the use of some of these chemical regulators has been restricted in agricultural production. The rising interest and need of non-chemical alternatives for plant growth regulation of ornamental crops has led to developments in photoselective greenhouse films. These films are designed to absorb (FR; 700-800 nm) light wavelengths and increase red (R):FR ratios of the light spectrum, thereby producing shorter, more compact plants. However the magnitude of the response depends on the species and cultivar (Rajapakse et al., 1999). The objective of this work was to determine the effect of a photoselective greenhouse film (FR absorbing) on plant growth of the perennial Indigo Spires Salvia (Salvia × ‘Indigo Spikes’). Indigo Spires Salvia was chosen for this study due to its increasing popularity among consumers and its characteristic tall, lanky growth (up to 4 ft), which can make it difficult to handle and awkward to ship (Burnett et al., 2000).

Materials and Methods

Uniform plugs (approximately 7.8 cm tall) of Salvia × ‘Indigo Spires’ (Robrick Nursery, Hawthorne, Fla.) were planted into 3.8-L pots filled with soilless media (Fafard Mix #2, Fafard, Inc., Apopka, Fla.). All plants were top-dressed at a standard rate of 15 g/pot of 15N-9P-12K Osmocote Plus®. Plants were transferred to experimental chambers (90 × 60 × 60 cm) framed with PVC pipe and covered with photoselective (AFR) or non-photoselective (control), polyethylene films (Mitsui Chemicals, Inc., Japan). One fan was placed in each chamber with the opposite end slightly rolled up to ensure proper airflow and prevent heat build-up. Spectral distribution was measured at the beginning and end of the experiment (Table 1, Fig. 1) using a LI-1800 spectroradiometer (LiCOR Inc., Lincoln, Neb.). The photosynthetic photon flux (PPF) inside each chamber was adjusted to 181 ± 29 μmol·m⁻²·s⁻¹ using cheesecloth. Plants were inspected daily and hand watered as needed. Average minimum and maximum temperatures in the greenhouse were 17.0 and 35.2°C. Plant height (height from media level to apex), number of fully expanded leaves, leaf area, leaf color, flower number and dry