Resistance of Selected Cool and Warm Season Turfgrasses to the Greenbug (Schizaphis graminum)\textsuperscript{1}

D.W. Jackson, K.J. Vessels, and D.A. Potter
Department of Entomology, University of Kentucky, Lexington, KY 40546

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Abstract. Three genetically diverse Kentucky bluegrasses (Poa pratensis L. cv. Kenblue, Vantage, and Adelphi) and 6 other turfgrasses were evaluated for susceptibility to the greenbug, Schizaphis graminum Rondani. Nine common lawn weed species were also tested as potential alternative hosts. Heavy greenbug populations and feeding damage occurred on all 3 bluegrasses and on tall fescue (Festuca arundinacea Schreb. cv. Kentucky 31) and chewings fescue (Festuca rubra var. commutata Guad. cv. Jamestown). Creeping bentgrass (Agrostis palustris Huds. cv. Penncross), bermudagrass (Cynodon dactylon L. cv. Midiron), perennial ryegrass (Lolium perenne L. cv. Derby), and zoysia grass (Zoysia japonica Steud. cv. Meyer) were not suitable hosts. No greenbugs survived on the 9 weed species tested.

The purpose of the present study was to evaluate the feeding preferences, survival, and fecundity of the greenbug on 9 common turfgrass species. No greenbugs survived on the 9 weed species tested.

The greenbug, long a serious and widespread pest of small grains and sorghum (6), has become an important problem of the turf industry within the last 10 years (4). Although in the past the greenbug was rarely considered a serious pest of turfgrasses, greenbug damage to home lawns has become increasingly common throughout the Midwest. Outbreaks are usually associated with intensively managed turfgrass, and may be linked to the increased use or misuse of fertilizers and pesticides.

Greenbugs are phloem-sap feeders and large numbers can seriously weaken a host plant. The aphid secretes a salivary phytotoxin which causes a characteristic burnt-orange color in the foliage. This phytotoxin may also move within the plant to weaken the root system. Damage nearly always begins in shaded areas under trees, but patches of dead grass can also occur in open, sunny areas. Greenbugs have become resistant to most common turf insecticides (3), and unchecked populations can exceed 5000 per 0.1 m\textsuperscript{2}.

Several distinctive greenbug biotypes have been identified on wheat, oats, and sorghum (5), and the aphid on turfgrass may represent a new biotype which prefers Kentucky bluegrass over other hosts (2, 4). However, the specific biotype, feeding habits, and biology of the greenbug on turfgrass have not been clarified. The purpose of the present study was to evaluate the feeding preferences, survival, and fecundity of the greenbug on 9 common lawngrasses, and to test the suitability of 9 common weed species as alternative hosts.

In the first experiment, ‘Kenblue’, ‘Vantage’, and ‘Adelphi’ were screened for nonpreference to the greenbug. These cultivars differ considerably in their color, growth habit, heat tolerance and genetic variability (1). Six other turfgrass species were also tested, including: creeping bentgrass, bermudagrass, chewings fescue, tall fescue, perennial ryegrass, and zoysia grass.

On June 18, 1980, 6-cm plugs of each turfgrass were taken from 4-year-old cultivar evaluation plots. Plugs were broken apart and individual plants were transplanted to 6-cm-diameter clay pots containing a mixture of 3 sphagnum peat moss:1 vermiculite:1 perlite (Pro-mix “BX”). To provide fairly uniform amounts of foliage, the number of plants varied from 1 to 5/pot. Potted plants were fertilized and held on a greenhouse bench under adequate light (white-washed glass) for 4 weeks. In the first experiment, single pots of each turfgrass were then transferred to 56 x 10-cm-deep galvanized metal flats. Different species and/or cultivars were spaced 5-cm apart, the spaces between the pots were packed with moist Pro-mix, and then a layer of fine screened soil was spread over the surface to allow the greenbugs easy movement between plants. The experimental design was a randomized complete block with 6 replications.

Greenbugs were collected by sweep netting from heavily infested Kentucky bluegrass lawns and held overnight on Kentucky bluegrass clippings. At the start of the experiment, each pot of grass was hand-infested with 12 adult female greenbugs. Flats were held in the greenhouse in 60 x 43 x 43-cm clear Plexiglas and screen rearing cages, and counts of adult and nymphal greenbugs were taken after 2, 7, and 10 days. It was evident after 7-10 days that the 9 turfgrasses could be separated into 2 main groups with regard to greenbug numbers (Table 1). Plants in the first group, including the bluegrasses and fescues, all supported large numbers of aphids and suffered severe tissue necrosis and burnt-orange leaf discoloration. The reduction in greenbug numbers between days 7-10 on ‘Kenblue’ Kentucky bluegrass indicated that greenbugs had begun to abandon the declining plants. A definite non-preference was shown by greenbugs for plants in the second group, including perennial ryegrass, creeping bentgrass, zoysia grass, and bermudagrass, and these plants suffered no visible feeding injury.

The second experiment tested the survival and fecundity of greenbugs caged on the 9 turfgrasses previously mentioned. Plants were preconditioned for 4 weeks as in the preceding experiment, and then 6 replications of each grass were individually transplanted with Pro-mix in 6-cm deep, 70-ml cylindrical plastic tumblers. Holes were cut in the bottom of larger (350-ml) clear plastic cups, which were fitted tightly over the top of each tumbler and covered with organdy cloth to complete the cage. Six adult female greenbugs were added to each cage, and counts of adults and nymphs were taken after 2, 7, and 10 days. All Kentucky

Table 1. Greenhouse evaluation of nonpreference and fecundity of greenbugs on 9 common turfgrasses.

<table>
<thead>
<tr>
<th>Turfgrass</th>
<th>Nonpreference test</th>
<th>Survival and fecundity test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Days after infestation</td>
<td>Days after infestation</td>
</tr>
<tr>
<td>Ky. bluegrass cv. Kenblue</td>
<td>15.2a rejected 20.3a;</td>
<td>10.7b rejected 6.9a; 35.8a 107.5a</td>
</tr>
<tr>
<td>Ky. bluegrass cv. Vantage</td>
<td>12.5ab rejected 21.3a;</td>
<td>28.8a rejected 9.6a 36.8a 98.6a</td>
</tr>
<tr>
<td>Ky. bluegrass cv. Adelphi</td>
<td>12.00b rejected 13.7a;</td>
<td>19.2ab rejected 4.4b 18.4b 86.2a</td>
</tr>
<tr>
<td>Chewings fescue cv. Jamestown</td>
<td>7.7abc rejected 23.5a;</td>
<td>18.5ab rejected 4.4b 18.4b 57.5a</td>
</tr>
<tr>
<td>Tall fescue cv. Ky 31</td>
<td>11.3abc rejected 14.7a;</td>
<td>26.7ab rejected 9.3a 17.2b 77.0a</td>
</tr>
<tr>
<td>Perennial ryegrass cv. Derby</td>
<td>7.0abcd rejected 2.0b;</td>
<td>0c rejected 1.2c 0c 0b</td>
</tr>
<tr>
<td>Bentgrass cv. Penncross</td>
<td>4.2bed rejected 1.2b;</td>
<td>0.2c rejected 0.2c 0b</td>
</tr>
<tr>
<td>Zoysia grass cv. Meyer</td>
<td>3.0ed rejected 0.7b;</td>
<td>0.7c rejected 0.8c 0b</td>
</tr>
<tr>
<td>Bermudagrass cv. Midiron</td>
<td>1.3d rejected 0.2b;</td>
<td>0c rejected 0.2c 0b</td>
</tr>
</tbody>
</table>

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\textsuperscript{a}Mean separation in columns by Duncan’s multiple range test, 5% level. Data transformed to $\ln x + 0.5$ prior to analysis.

\textsuperscript{b}Aphids had begun to abandon severely damaged ‘Kenblue’ plants after 10 days.
Resistance of Rose Rootstocks to Meloidogyne hapla, Pratylenchus penetrans, and Pratylenchus vulnus

K. Ohkawa
Kanagawa Horticultural Experimental Station, Ninomiya, Kanagawa, Japan
T. Saigusa
Yokohama Plant Protection Station, Yokohama, Kanagawa, Japan

Abstract. Eight rose rootstocks were tested in pot experiments for their suitability as host to Meloidogyne hapla Chitwood, Pratylenchus penetrans Cobb, and P. vulnus Allen & Jensen. Most rootstocks were host for both Pratylenchus spp. but great difference in host efficiency occurred. Rosa indica ‘Major’ and R. multiflora ‘60-5’ proved to be the most efficient hosts for P. vulnus and P. penetrans, respectively. M. hapla reproduced well on R. indica ‘Major’ but not on R. ‘Manetti’. R. ‘Manetti’ shows outstanding resistance, if not complete immunity to M. hapla. Other rootstocks showed infection varying from slight to severe.

M. hapla, P. penetrans, and P. vulnus are widely distributed in commercial rose greenhouses in Japan. Rosa multiflora Thunb., which is the leading rootstock used in growing greenhouse roses for cut flowers has shown to be susceptible to all 3 nematode species (2, 3, 4). In Japan, 1,2-dibromo-3-chloropropane (DBCP) soil drenches on established roses controlled M. hapla and P. vulnus and increased flower yields (3).

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M. hapla, P. penetrans, and P. vulnus, a test was conducted to find a resistant rootstock. Rose rootstocks obtained from the U.S.A., Israel, Kumamoto Prefecture, and Kanagawa Horticultural Experimental Station were tested to compare their suitability as hosts for M. hapla, P. penetrans, and P. vulnus.

The rootstocks tested were R. wucairina Crép. (broadly distributed in Japan and obtained from Kumamoto Prefecture), R. indica ‘Major’ (supplied from Israel through the courtesy of Mr. D. Gilad), R. ‘Maneti’ (virus-free plants were obtained from the U.S.A. through the courtesy of Dr. L.C. Cochran, Oregon State University), R. multiflora ‘K-1’, and R. multiflora ‘K-2’ (selections from Kanagawa Horticultural Experimental Station), and R. multiflora ‘ISU-60-5’, R. multiflora ‘ISU-71-6’ and R. multiflora ‘ISUD-1’ (U.S.A. selections by Dr. G.J. Buck, Iowa State University).

Two isolates of M. hapla were used in this test. M. hapla (Population A), originally isolated from ‘Marshall’ strawberry was increased and maintained on roots of string beans grown in volcanic soil. About 25 g of soil containing 1000 second stage larvae were added to each pot. M. hapla (Population B) inoculum was obtained from soil around ‘Hoko-wase’ plants. Each pot received 100 g of soil containing 1000 2nd stage larvae. P. penetrans isolated from radish and P. vulnus isolated from strawberry were increased and maintained on alfalfa callus tissue. Inoculations were made by transferring the nematodes into distilled water and pouring 40 ml suspension (4,800 nematodes) around the roots of the plants.

Cuttings 10 cm long were rooted in a mixture of steam-sterilized 3 perlite:1 peatmoss (v/v). After 5 weeks, rooted cuttings were transplanted to steam-sterilized 2 volcanic soil:1 western hemlock bark (v/v) in 30 cm diameter clay pots. Treatments were made after 17 days and the plants arranged in randomized blocks on a greenhouse bench. Each treatment was replicated 4 times. Greenhouse temperature during the experiment ranged from 17 to 30°C.

The experiment was terminated after 7 months. Nematode counts were made from soil and roots. Nematodes were extracted by the Baermann funnel method by placing 10 g of roots and 40 g portion of the mixed soil on separate funnels at 15°C for 25 hr.

For P. vulnus (Table 1), R. indica ‘Major’ was clearly the most susceptible