Host Plant Acceptance of Azalea Lace Bug (Heteroptera: Tingidae) For Selected Azalea Cultivars[1]

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ABSTRACT The host plant acceptance of azalea lace bug, *Stephanitis pyrioides* (Scott) for 20 cultivars of azalea, *Rhododendron* spp., was evaluated. Lowest acceptance, as measured by significantly reduced oviposition in both years of the study, was observed on the cultivar 'Macrantha.' Lowest levels of leaf injury and percentage leaf injury were also observed on 'Macrantha.' Bloom color and abaxial leaf texture did not affect acceptance. Monthly comparisons of all cultivars indicated significantly higher oviposition of all cultivars indicated significantly higher oviposition by azalea lace bug in June and July, 1989, and July 1990, than in the other months of the study (May - September).

KEY WORDS Insecta, *Stephanitis pyrioides,* insect acceptance, azalea lace bug, azaleas.

Azalea lace bug, *Stephanitis pyrioides* (Scott) (Heteroptera: Tingidae) is the most serious insect pest of azalea, *Rhododendron* spp. (Neal and Douglass 1988). Feeding by nymphs and adults results in mechanical injury to the foliage. Initially a stippled appearance is characteristic, but heavy infestations lead to leaf dessication. Azalea lace bug was introduced from Japan into New Jersey and rapidly spread south to Florida, and west to Missouri (Drake and Ruhoff 1965). Previous studies conducted on its biology have concluded that four generations occur annually in the middle Atlantic region (Braman et al. 1992, Neal and Douglass 1988, Beshear et al. 1976). The effect of plant growth regulators on development of azalea lace bug and their potential in integrated pest management has also been examined (Coffelt and Schultz 1988). Management of this pest has emphasized proper timing of chemical controls. The predator *Stethoconus japonicus* Schumacher (Heteroptera: Miridae) has provided natural control (Henry et al. 1986). Azaleas (*Rhododendron* sp.) are an important component of the urban landscape. For example, azaleas represented 20% of the plants found in homesite surveys of a Maryland urban pest management study (Holmes and Davidson 1984). The opportunity for identification and incorporation of plants less acceptable to insect pest feeding and damage into urban landscape pest management practices in enhanced by

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the variety of available ornamental plants. The number of azalea cultivars listed in current literature exceeds 6,000, with a wide selection of plant architecture, bloom time, and bloom color (Galle 1985). Mizell and Schiffhauer (1991) evaluated azalea cultivars for susceptibility to azalea leafminer, and found the Indica-type azaleas to be more susceptible. Braman and Pendley (1992) evaluated host plant resistance of deciduous azaleas to azalea lace bug, and found them to be less preferred than the control (evergreen cultivar 'Delaware Valley White.'). While differing levels of damage to evergreen azaleas by azalea lace bug in landscapes have been observed by the author, no research has been conducted on using host plant acceptance in an integrated pest management (IPM) program to reduce injury from this pest. The objective of this study was to compare levels of azalea lace bug oviposition and feeding on 20 cultivars of evergreen azaleas.

Materials and Methods

Ten plants each of 20 azalea cultivars propagated from cuttings in summer, 1988 were obtained from a commercial nursery in Tasley, VA in March, 1989. These cultivars were selected because of their high consumer demand. They are grown in large quantities by commercial nurseries in the mid-Atlantic region. Plants were transplanted into individual 4 1 plastic containers containing a mixture of peat and sand (3:1 by volume), and placed on a gravel-covered, simulated nursery production site located at the Hampton Roads Agricultural Experiment Station. (HRAES), Virginia Beach, VA. Plants were fertilized with a slow release fertilizer (Osmocote 18-6-12, Grace-Sierra Co., Fogelsville, PA) in May, 1989 and 1990 at a rate of 9 gms per container. Overhead irrigation was applied as warranted.

Oviposition studies were conducted by removing a single cutting from each of the 200 plants, and placing each in a water-filled vase (4.5 × 5.5 cm) which was covered with a vented clear plastic cage (4.5 × 10.0 cm). Adult azalea lace bugs were collected from landscape plantings located at the HRAES and on the grounds of Old Dominion University, Norfolk, VA. Collections coincided with adult emergence of each generation. One female was placed on each cutting for 7 days. The number of eggs per cutting was determined by microscopic examination of the foliage. The procedure was repeated monthly during the non-diapausal period from May to September, 1989 and 1990. Following each cutting removal, plants were treated with one application of acephate 75 SP (Valent USA Corp., Walnut Creek, CA) at the labeled rate to insure no foliar injury or oviposition occurred from immigrant azalea lace bug. No toxic residue was evident in the subsequent trials (four weeks after application). In 1990, leaves used for oviposition study were also evaluated with a leaf area analysis system (Skye Instruments, Quakertown, PA), using a threshold level of leaf coloration that separated foliar feeding injury from total leaf area. Both injured and total leaf area were determined for each cultivar during the aforementioned months. The latter variable compensated for variation in leaf area between cultivars.

Oviposition, leaf area injury, and percent leaf area injury between cultivars were analyzed using the SAS general linear model procedure (SAS Institute

1985). Arcsin transformations were used for percent leaf injury. Means of variables with significant differences were separated using Duncan's multiple range test. Seasonal variation in azalea lace bug oviposition was determined using analysis of variance of monthly oviposition on all cultivars. Monthly means were separated using the aforementioned procedure. Abaxial leaf surface characteristics, bloom color and bloom period were recorded for each cultivar during both 1989 and 1990 to ascertain if these factors affected oviposition and/or feeding injury.

Results and Discussion

The cultivar 'Macrantha' had the lowest number of eggs deposited in both 1989 and 1990, significantly less than 17 of the remaining cultivars in 1989 ($F = 4.76$, df = 19,999, $P < 0.001$), and 8 of the remaining cultivars in 1990 ($F = 3.43$, df = 19,999, $P < 0.001$) (Table 1). 'Macrantha' also had the lowest leaf area injury ($F = 12.51$, df = 19,999, $P < 0.001$) and percentage leaf injury ($F = 13.73$, df = 19,999, $P < 0.001$),, both significantly lower than the remaining cultivars (Table 1). 'Macrantha' is a Satsuki hybrid, and was the only Satsuki in our study. It was also the latest blooming of the cultivars in our study. Whether the observed results were related to the blooming period and concurrent flush of new foliage growth would not be known without further evaluation of additional cultivars. Abaxial plant surfaces of the 20 azalea cultivars were compared by microscopic examination, and all had sparse amounts of leaf pubescence. Leaf pubescence, a common trait in host plant resistance of abaxial feeding and ovipositing insects (Schultz and Coffelt 1987; Sosa 1988, 1990), was apparently not a factor with non-acceptance of 'Macrantha.' There was also no relationship between bloom color and azalea lace bug oviposition or leaf area injury (unpublished data).

Azalea lace bug oviposition was significantly different between months when data from all cultivars were pooled (Table 2). In 1989, oviposition was significantly higher ($F = 48.1$, df = 4,999, $P < 0.001$) in June and July than in May, August, and September. In 1990, oviposition in July was significantly higher ($F = 147.5$, df = 4,999, $P < 0.001$) than the other months of the study. Such variation may be explained by differences in susceptibility caused by leaf age throughout the season. Azaleas have a flush of new foliage coinciding with the blooming period, with subsequent flushes of growth dependent on temperature and rainfall. Initially the new foliage is avoided by azalea lace bug and the previous year's growth is preferred, but, after it has matured, and the foliage from the previous year dies, the newer foliage is attacked.

The observed significant differences in cultivar acceptance provide a basis for selection and production of azalea cultivars with low levels of azalea lace bug injury. Some landscape requirements include specifications as to plant architecture, color, or blooming periods, for which 'Macrantha' may be inappropriate. However, evaluations using the methodology in this study could identify additional cultivars with low azalea lace bug acceptance and resultant injury. Physical, chemical, and seasonal aspects of host plant acceptance in azaleas need to be further investigated to identify responsible factor(s). Future plant breeding may include selectively incorporating such factors into landscape plants to suppress azalea lace bug injury.

Table 1. Mean (SE) no. of eggs laid, leaf area injury, and % leaf injury of 20 azalea cultivars.

	Mean no. of eggs/cutting		Year (1990)	
Cultivar	1989	1990	Leaf injury (mm^2)	% leaf injury
Blauus Pink	20.1 (2.6) ab	33.7 (3.8) a-f	141.1 (8.3) b-d	55.5 (3.2) cd
Conversation Piece	14.9 (1.5) a-e	24.8 (2.7) c-h	109.9 (9.7) e-g	54.4 (3.7) cd
Coral Bell	14.5 (1.4) a-e	24.2 (3.3) d-h	72.2 (6.0) h	51.1 (3.5) de
Delaware Valley White	19.8 (2.1) a-c	34.3 (4.0) a-e	188.0 (11.3) a	49.0 (2.8) d-f
Elsie Lee	9.4 (1.5) ef	23.1 (2.5) e-h	112.7 (9.6) d-f	40.4 (3.4) ef
Gigi	20.5 (2.1) a	36.0 (3.8) a-c	148.3 (10.0) bc	56.5 (3.1) b-d
Girards Rose	19.8 (1.6) a-c	26.2 (3.3) c-h	105.7 (8.9) fg	56.4 (3.7) b-d
Hershey Red	16.5 (2.0) a-c	39.8 (4.2) a	121.4 (9.5) c-f	50.0 (3.3) de
Hino Crimson	18.6 (1.9) a-c	34.9 (3.5) a-d	118.3 (5.5) c-f	73.9 (3.1) a
Hot Shot	17.8 (1.7) a-c	30.6 (3.3) a-g	127.6 (10.7) b-f	50.7 (3.4) de
Karen	15.1 (1.8) a-e	30.3 (3.7) a-h	144.9 (11.3) bc	56.1 (3.1) cd
Kathy	10.1 (1.3) d-f	25.9 (3.2) c-h	154.1 (11.2) b	46.5 (3.0) d-f
Macrantha	5.2 (0.9) f	18.9 (2.8) h	29.7 (5.2) i	12.6 (2.1) g
Mary Lynn	15.3 (1.9) a-e	28.3 (3.7) b-h	131.7 (12.8) b-f	52.8 (3.7) cd
Mothers Day	20.2 (1.9) ab	22.3 (2.6) f-h	82.1 (6.9) gh	50.7 (3.9) de
Nancy	13.6 (2.1) c-e	26.8 (3.5) c-h	110.8 (7.2) d-g	51.5 (3.9) cd
Poukhanense	14.1 (1.9) b-e	39.4 (3.8) ab	128.0 (8.8) b-f	62.8 (3.4) bc
Purple Splendor	15.9 (1.9) a-d	38.8 (3.7) ab	139.4 (13.8) b-e	37.9 (3.4) f
Sherwood Red	17.3 (2.1) a-c	21.9 (2.7) gh	108.1 (8.4) fg	65.7 (3.4) ab
Tradition	16.9 (1.7) a-c	28.2 (3.1) b-h	106.1 (6.7) fg	70.9 (3.7) a

Means within a column followed by the same letter are not significantly different; Duncan's multiple range test ($P > 0.05$), SAS Institute, 1985.

Table 2. Mean eggs laid by azalea lace bug on 20 azalea cultivars.

Month	1989	1989
May	9.1 c	23.2 d
June	22.4 a	29.3 c
July	21.4 a	51.8 a
August	15.5 b	36.5 b
September	10.9 c	6.3 e

Means within a column followed by the same letter are not significantly different; Duncan's multiple range test (P > 0.05), SAS Institute, 1985.

Urban landscapes are diverse in their plant composition, but key plants exist within this diversity (Raupp et al. 1985). The observed significant differences indicate the importance of evaluating species and cultivars of these plants, such as azaleas, in the urban landscape for reduced host plant damage by their key pest(s). This knowledge would influence decisions as to plant composition in urban landscapes that may lead to reduced pesticide usage in the urban environment.

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