Resistance of Acacia to the Acacia Psyllid, *Psylla uncatoides*[1]

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Abstract

Thirty-one species of *Acacia* were quantitatively evaluated in the field at San Jose, CA, for resistance to the acacia psyllid, *Psylla uncatoides* (Ferris and Klyver). This insect causes foliage necrosis and dieback of the tips of susceptible *Acacia.* A few species exhibited no infestation by the insect, many were found highly to moderately resistant, and several were confirmed highly susceptible. Propagation and use of horticulturally desirable species of *Acacia,* locally adapted and with high resistance to the psyllid, are recommended where this pest occurs.

Index words: *Acacia,* Acacia psyllid, Host plant resistance, Pest resistance, *Psylla uncatoides* (Ferris and Klyver).

Introduction

Opportunities for identification and subsequent production of insect pest-resistant woody ornamentals are enormous. Unlike traditional food and fiber crops, useful, resistant ornamental plants can be derived from observation, screening, and selection, rather than from costly and lengthy plant breeding efforts. This is the result of the huge variety of ornamental material available, and of the probable willingness of most consumers to accept alternative plant species or cultivars so long as basic requirements of size, form, color, and other attributes can be met approximately. The reward for choosing pest resistant alternatives can be freedom from the necessity of treating those plants with pesticides. The maidenhair tree, *Ginkgo biloba* L., is an outstanding example of a tree highly resistant to insects as well as to bacteria, viruses, and fungi (6).

The subjects of selecting, and breeding, ornamental and forest trees for optimum performance have been covered in detail (2, 3, 4, 7, 11). Limitations were outlined by Weidhaas (13) who noted, among other points, our poor record of projecting what "new" pests might occur in the future on plants found resistant today, and the sometimes regional nature of pest resistance in plants.

The acacia psyllid, *Psylla uncatoides* (Ferris and Klyver), was introduced into California, apparently from New Zealand, about 1954 (1). It now occurs also in Arizona and Hawaii in the United States. This pest feeds on the terminal growth of certain *Acacia* and *Albizia,* causing chlorosis and dieback of plant tips (Fig. 1) and blackening of foliage from excreted honeydew (5). Observations indicated that some *Acacia* species were more susceptible than others. In an arboretum in southern California, Munro (8) appraised the relative susceptibility of over 100 *Acacia* and *Albizia* species to the psyllid but made no attempt to quantify his observations. To assess more rigorously susceptibility and resistance in *Acacia* to the psyllid, field investigations in northern California were conducted from 1974 to 1977.

Materials and Methods

Thirty-six species of *Acacia* were planted from seed in #1 nursery containers. When 4-6 months old, seedlings were planted outdoors at San Jose, CA, in the fall, 1974. Each species was replicated as a single plant 6 times in a randomized complete block design, with 2 m (6.5 ft) between plants in the row (blocks) and 3 m (10 ft) between rows. After growing for 2 years, plants were severely pruned in the fall, 1976, to ensure multiple new growing points which could be sampled for insects. Five species grew poorly and were not continued in the investigation.

Beginning in January, 1977, 2 growing tips, each 5-7.5 cm (2-3 in) long, were cut from each plant and transported to the laboratory where psyllid eggs and nymphs were counted under magnification. No attempt was made to count adult psyllids, for they fly readily

Fig. 1. Chlorosis and dieback of *Acacia* foliage (left) caused by the acacia psyllid.

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when the plant is disturbed. The above sampling process was repeated monthly through June, then bi-monthly through December.

Results and Discussion

Average numbers of psyllid eggs and nymphs collected over the entire sampling period on each *Acacia* species are shown in Table 1. As observed earlier by Munro (8), psyllid resistance ranged from complete resistance to highly susceptible. Several of the more commonly grown *Acacia* species in California are, unfortunately, highly susceptible, including *A. longifolia, melanoxylon,* and *retinodes.*

Numbers of nymphs, rather than eggs, were used as indicators of *Acacia* resistance in this study. Egg numbers consistently though differentially exceeded those for nymphs, probably as a result of predation (10), oviposition preferences, or because of the inability of all nymphs to survive on the various *Acacia* species as a result of antibiosis (9). Eggs of the acacia psyllid occasionally are laid on non-hosts such as citrus, but even if those eggs hatch they never give rise to nymphs beyond the first instar. It is not known whether *Acacia* species on which no eggs were deposited actually would support nymphs, or whether nymphs recorded on the various *Acacia* would actually mature to adults. Westigard et al. (14) investigated the latter point in the pear psylla, *Psylla pyricola* (Foerster) on different species and cultivars of pear.

Table 1. *Acacia* species ranked from least to most susceptible to acacia psyllid nymphs, San Jose, CA, 1977.

	Avg. no. per tip over 9 dates	
Acacia *spp.*	**Nymphs**	**Eggs**
aspera Lindl.	0 a[z]	0
podalyriifolia A. Cunn.	0 a	0
baileyana F. Muell.	.01 ab	.10
parvissima F. Muell.	.01 ab	.02
craspedocarpa F. Muell.	.02 ab	.06
armata R. Br.	.06 ab	.58
karoo Hayne	.06 ab	.22
cardiophylla A. Cunn. ex Benth.	.10 ab	.22
giraffae Burch.	.10 ab	.01
dealbata Link	.18 ab	1.12
gerardii Benth.	.18 ab	.71
albida Del.	.23 ab	2.38
collettiodes A. Cunn. ex Benth.	.30 ab	1.20
cultiformis A. Cunn.	.51 abc	1.74
decurrens (Wendl.) Willd.	.51 abc	.92
robusta Burch.	.58 abc	1.07
mearnsii De Wild.	.64 abcd	2.02
cunninghami Hook.	.81 abcd	5.63
iteaphylla F. Muell.	.83 abcd	4.71
cyanophylla Lind.	1.02 abcde	3.89
triptera Benth.	1.14 bcde	2.01
saligna (Labill) H. Wendl.	2.26 cdef	10.07
obtusata Sieber ex DC.	2.34 def	11.61
spectobilis A. Cunn. ex Benth.	3.03 ef	9.59
pendula A. Cunn. ex G. Don.	5.87 f	12.32
implexa Benth.	7.83 g	28.38
cyclops A. Cunn.	10.60 g	33.38
longifolia (Andr.) Willd.	11.73 g	40.17
penninervis Sieber ex DC.	12.09 g	46.17
melanoxylon R. Br.	24.42 h	32.48
retinodes Schlechtend.	30.11 i	80.16

[z]Mean separation within column followed by the same letter are not significantly different at the 5% level using Duncan's Multiple Range Test.

For all *Acacia* species combined, psyllid nymph numbers peaked during May. Variations in seasonal peaks of nymphs for 4 plant species are shown in Fig. 2. Such variations may explain in part differences in susceptibility of *Acacia* found in this study as compared to that by Munro (8). He reported, for example, *A. cyclops, melanoxylon,* and *penninervis* to be only lightly infested, whereas in this investigation those species were among the most heavily infested. He found no psyllid occurrence on *A. cyanophylla, dealbata,* and *giraffae,* whereas low populations were collected on those species at San Jose. Munro's (8) observations were made between March and June, and if he evaluated *A. melanoxylon,* for example, only during March he likely would have recorded low occurrence for that *Acacia.* These discrepancies emphasize a need to conduct evaluations of field resistance over an extended seasonal period. Additional factors which possibly contributed to differences between the results of Munro (8) and those reported here include environmental variables (12), and the fact that Munro's data were not quantified. He may have encountered psyllid numbers so great that "light occurrence," in his opinion, may be equivalent to the most heavily infested species reported here. Furthermore, he may not have worked with recently pruned plants.

Levels of *P. uncatoides* considered tolerable on landscape *Acacia* remain undetermined. Certainly, the more highly resistant species are acceptable in the horticultural industry. Location of plants in the landscape, from a visual perspective, has a considerable bearing on

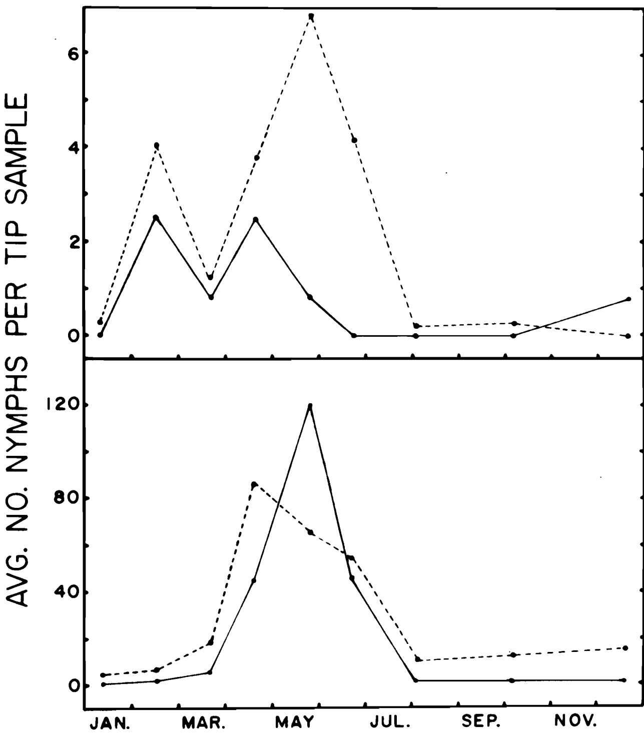

Fig. 2. Average psyllid nymph numbers for 4 *Acacia* species. Top (solid line) is *A. obtusata;* (broken line) *A. iteaphylla.* Lower (solid line) is *A. melanoxylon;* (broken line) *A. retinodes.*

acceptable levels of this and other pests. This research provides a basis for selection and production of *Acacia* species with different levels of resistance to the acacia psyllid to meet varying landscape requirements. In this regard the Saratoga Horticultural Foundation, Saratoga, CA, has identified a horticulturally-desirable *A. iteaphylla* specimen from among plants grown in the trial described above, has perfected means of propagating it vegetatively, and is pursuing a trademark for this accession which notes, among other attributes, its high resistance to the acacia psyllid.

Significance to the Nursery Industry

This research provides a quantitative rating of the relative resistance of 31 species of *Acacia* to the acacia psyllid. Depending on horticultural desirability and adaptability of these species to a given locale, nurserymen can propagate and market *Acacia* species highly resistant to the psyllid.

Literature Cited

1. Armitage, H.M. 1955. Current insect notes. Calif. State Dept. Agric. Monthly Bull. 54:164-166.

2. Gerhold, H.D., R.E. McDermott, E.J. Schreiner and J.A. Winieski (ed). 1966. Breeding pest resistant trees. Pergamon Press, London.

3. Hanover, J.W. 1976. Physiology of tree resistance to insects. Ann. Rev. Entomol. 20:75-95.

4. Hanover, J.W. 1980. Breeding forest trees resistant to insects. p. 487-511. In: F.G. Maxwell and P.R. Jennings (ed). Breeding plants resistant to insects. John Wiley and Sons, NY.

5. Koehler, C.S., M.E. Kattoulas and G.W. Frankie. 1966. Biology of *Psylla uncatoides*. J. Econ. Entomol. 59:1097-1100.

6. Major, R.T. 1967. The ginkgo, the most ancient living tree. Science 157:1270-1273.

7. Morgan, D.L., G.W. Frankie and M.J. Gaylor. 1978. Potential for developing insect-resistant plant materials for use in urban environments. p. 267-294. In: G.W. Frankie and C.S. Koehler (ed). Perspectives in urban entomology. Academic Press, NY.

8. Munro J.A. 1965. Occurrence of *Psylla uncatoides* on *Acacia* and *Albizia,* with notes on control. J. Econ. Entomol. 58:1171-1172.

9. Painter, R.H. 1968. Insect resistance in crop plants. University Press of Kansas, Lawrence.

10. Pinnock, D.E., K.S. Hagen, D.V. Cassidy, R.J. Brand, J.E. Milstead and R.L. Tassan. 1978. Integrated pest management in highway landscapes. Calif. Agric. 32(2) 33-34.

11. Santamour, F.S., Jr., H.D. Gerhold and S. Little (ed). 1976. Better trees for metropolitan landscapes. USDA Forest Service General Tech. Report NE-22.

12. Tingey, W.M. and S.R. Singh. 1980. Environmental factors influencing the magnitude and expression of resistance. p. 87-113. In: F.G. Maxwell and P.R. Jennings (ed). Breeding plants resistant to insects. John Wiley and Sons, NY.

13. Weidhaas, J.A., Jr. 1976. Is host plant resistance a practical goal for control of shade-tree insects? p. 127-133. In: F.S. Santamour, Jr., H.D. Gerhold and S. Little (ed). Better trees for metropolitan landscapes. USDA Forest Service General Tech. Report NE-22.

14. Westigard, P.H., M.N. Westwood and P.B. Lombard. 1970. Host preference and resistance of *Pyrus* species to the pear psylla, *Psylla pyricola* Foerster. J. Amer. Hort. Sci. 95:34-36.

Root Weevil Feeding on *Rhododendron:* A Review[1]

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Abstract

Specific chemical compounds present in *Rhododendron* leaves stimulate adult root weevil feeding. The resistance of certain *Rhododendron* species to weevil feeding is due to the presence of volatile terpene constituents of the leaves.

Index words: *Sciopithes obscurus* Horn, *Otiorhynchus sulcatus* Fab., black vine weevil, phagostimulant, feeding deterrent, insect repellent, phytosterols, flavonol glycosides, sugars, essential oils

Introduction

Rhododendron is a large genus with about 1000 species and at least 5000 named hybrids (14). Many of these plants are prized as ornamental shrubs and are grown in both northern and southern hemispheres where appropriate climates exist. Some cultivars, particularly from the azalea group, are grown for use as flowering pot plants.

Taxonomists divide the genus into 3 large groups (14). Two groups, the azaleas and elepidotes lack foliar scales and are thereby separated from the lepidotes, which are scale bearing. Lepidotes are subdivided taxonomically by differences in scale morphology (Fig. 4) (4).

Although rhododendrons growing under good conditions are relatively trouble free, some disease and insect problems occur. Coyier (7) recently reviewed some of

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