ORNAMENTALS NORTHWEST ARCHIVES

Sept.-Oct.-Nov. 1979
Vol.3, Issue 5
Pages 20-24

Dr. Lee Campbell
Washington State University Entomologist
Western Washington Research and Extension Center
Puyallup, WA 98371

DIFFERENTIAL FEEDING ON RHODODENDRON BY ADULT ROOT WEEVILS[1]

The root weevil problem here in the Northwest is really two separate and different problems. Root weevil adults feed on the foliage of their host plants eating notches in from the edge of leaves or from the edge of previous notches. Root weevil grubs feed on the roots of a variety of plants and under certain conditions cause a considerable amount of damage.

In the Northwest we have a dozen different species, or kinds, of adult root weevil that feed on ornamental plants, but several of those are much more common and important than the others. Usually the most damaging species we see, in western Washington at least, is the obscure weevil. Although in some places, especially in the late fall, woods weevil may be more abundant. Sometimes we see a garden where clay-colored weevil, *Otiorhynchus singularus*, is the predominant species; or one of the *Dyslobus* species may occasionally be the dominant kind. But, generally we are talking about obscure root weevil.

A few years back we began doing some work with protection of foliage from feeding by adult root weevils and found that Orthene was the best material for this use. We now have a local needs registration, a 24c registration, for Washington and Oregon for that use and apparently it has been working quite well for homeowners and people who maintain commercial landscapes. Some nurseries have used it to knock down the population of adult weevils, mainly to reduce the amount of egg laying so that they don't have such severe root problems from the grubs. Nurseries generally aren't as concerned about leaf notching as homeowners are.

When I first came to Washington al. talked to several people about insect problems on ornamentals and root weevil was mentioned often. One person I met, a nurseryman in Vancouver, suggested that adult weevils fed more on certain kinds of rhododendrons than they did on others, and he gave me some examples. I decided to try to categorize that difference in feeding and to see if we could exploit it in some way that would be useful. There are several goals that I would see for a study on the resistance of rhododendrons to feeding by adult root weevils. First, we could develop a list of rhododendrons that would be less likely to be fed on than others: this list could be useful to homeowners that aren't really concerned with having an extensive collection of rhododendrons, but simply want something pretty to put by the patio or pool. If we could tell them that a rhododendron chosen from List A would be more likely to remain free from adult weevil damage than rhododendrons in List B, that would be useful to them. Nurserymen might also use that list to (all other things being equal) concentrate propagation on the more resistant varieties or perhaps to charge a premium for a variety that could be advertised as more resistant to weevil feeding. A second goal might be to provide

breeders (hybridizers) of rhododendrons information which they could use in selecting parents for a particular cross they have in mind. Again, other things being equal, if you have a choice of two rhododendrons, both of which have an acceptable color that you want to try to get into a cross, and one of them is much more resistant to weevils than the other, why not use the resistant one? A third goal is concerned with the chemical basis for this difference in feeding. Generally when plants are found to be more resistant to feeding from any insect than some other plant there is a reason for that, and the reason is usually either chemical or structural. If there is a chemical basis for resistance, and if we could discover what that chemical difference is, it might be possible to use that difference to rapidly screen a bunch of seedlings from any cross and select out only the more resistant seedlings for further growing, or for evaluation. Depending upon what the chemical is, it might be possible to use it as a spray to repel weevils from plants which they would otherwise feed on. And a third aspect is that by knowing the chemical basis for resistance we would be furthering the scientific understanding of the basic process of host plant resistance.

So with these thoughts in mind we decided to conduct a fairly broad survey to determine which kinds of rhododendrons the weevils did feed on and which kinds they tended to avoid. We were interested in working mostly with serious rhododendron growers for that, one being that by so doing we would have a good range of different types of rhododendrons included in our survey; and, secondly (and at least as important) by concentrating on these serious growers, we would have available to us somebody who knew the names of the rhododendrons at which we were looking. Every plant is not labeled, and I certainly am not an expert in rhododendron identification.

Our survey, as it turned out, was concentrated mostly around the Puget Sound area from the northern part of Lake Washington down around the east side through Bellevue, Auburn, Tacoma, Olympia and up around the Sound, through Shelton and on north around Hood Canal to the Tonandos Peninsula. The way we conducted our survey was to simply go out to each of the gardens and observe the amount of feeding that had occurred on individual plants and then to give each of those plants a rating on a 0 to 3 scale with 0 being very little feeding (maybe a notch or two here and there but very little feeding); a plant given a rating of 1 had been fed on but the feeding was inconsequential; certainly nobody would worry about it. A rating of 2 meant that there was feeding which was beyond the point of acceptability; the plant was no longer aesthetically pleasing. A 3 rating was used for the worst cases, where leaves were really ragged and the plant was a disgrace.

When we did this in 35 gardens we generated a mass of data that was too unwieldy to handle in any way other than by computer. And so, with the help of our terminal technician at Puyallup, we entered all of this data in the Washington State University computer system and now have it stored and accessible to us so that we can make various sorts of manipulations and analyses. One thing that we have put into the computer program is the parentage for each of the rhododendron hybrids that we have seen, so that we can sort out by parent as well as by individual plants. For example, if we were interested in all hybrids that have the resistant species *williamsianum* in their background, we could ask the computer to list all of those that we have seen and the ratings that we gave each particular plant, or we could ask the computer for all plants that had *williamsianum* in the third generation; or any combination of things of that sort. The other thing that we have been able to do with this is to include hybrids which various people have

developed, but not named. If we knew the parents of these unnamed hybrids, we have included that data in our computer program so that this information too is available to us and can be included in our analyses.

I would like to share with you some of the results that we have obtained. But, before I start that, I should mention that, as many of you knew, Dr. Richard Clarke from Oregon State University and a graduate student did a laboratory study a couple of years ago where they detached leaves from various rhododendrons and offered them to obscure root weevil and noted the response. Their results have been published in various places. Our results differ somewhat from theirs and I think there are some good guesses as to why that might be. For example, their study was done only with obscure root weevil, our study was a field study and our plants were subject to feeding by many kinds of weevils. Secondly, their study was done on leaves that were taken from plants and maintained with their petioles in a water solution and our observations are on leaves that are still attached to plants and therefore may be somewhat different; we really don't know that. I don't know from how many sources they collected each rhododendron species that they used; in our study we saw each kind in several sites and have eliminated from my talk today any kind that we did not see at least seven times. Perhaps the place where a particular bush is grown somehow influences whether it is susceptible to weevil feeding or not. Our results in general do agree with theirs, but there are some differences. For example, they found that *bureavii* and *xanthocodon* were not fed on at all. We had a considerable amount of feeding on *bureavii* and a little bit less but still significant amount on *xanthocodon*. They found that *diaprepes* was a preferred host, one of the most heavily fed on, we found *diaprepes* was less fed on than *bureavii*. They found *discolor* very heavily fed on, and that, again, was one which we found only very moderate feeding on. At any rate our results generally agree with theirs, and these differences that we find simply raise questions for further research.

In discussing the results of our study I certainly don't want to stand up here and read to you extensive lists of species and hybrids and tell you how each compared to the other. We have seen hundreds of different ones and that would be extremely boring. For the species, I can talk about groups (the series or subseries) and discuss differences in terms of those, pointing out some of the more interesting things that we have observed. For the hybrids it is a bit more difficult and I think that probably the simplest thing to do is to talk in terms of what sort of generalized parentage we see in resistant hybrids vs. susceptible hybrids. We will leave the vast middle ground untouched today. We hope someday to publish several papers on this study and the details will be available to you then.

In talking to people who know rhododendrons about this differential feeding by root weevils, their common observation is that the Lepidotes are not fed on nearly so much as the Elepidotes. Well, after our many hours in the field and our computer technology we can say, in that regard, that the Lepidotes tend not to be fed on as much as the Elepidotes; but there are some interesting exceptions. Looking at a generalized pictures of the species, we see very susceptible ones in the Elepidotes and Azaleas, perhaps the most susceptible being the Ponticums, although there are a couple of the Ponticums which are quite resistant, namely *yukusimanum* and *ungernii*. Now that is kind of interesting because *ungernii* is quite similar to *smirnowii*, minor differences in the flowers and flower trusses being the main distinguishing characteristics. The leaves are quite similar, yet *ungernii* is quite resistant and *smirnowii* is very susceptible. Also in that same group, the pair of species *degronianum* and *metternichii* has quite similar leaves, again the major

difference between these species is flower morphology, but *degronianum* is about twice as resistant as *metternichii*. *Griersonianum* is a single species series which is quite susceptible. We find isolated cases of resistant species scattered throughout the Elepidotes, Taliense has a couple; in the Falconers series, *arizelum* is quite resistant. And in the Irroratum subseries the species *irroratum* is quite resistant. And a number of the Fortunei's are also. When we look at the Lepidotes we find, general resistance with the strongest resistance being in the Carolineanum series, Dauricum, Scabrifolium, the Lapponicums. Some of the more susceptible of the Lepidotes are in the Triflorum series with species such as *chasmanthum*, *keskei*, and *triflorum* itself being as susceptible as many of the Elepidotes, but still averaging somewhat less than the "2" which we consider to be unacceptable in our rating scheme.

Perhaps the hybrids are of more general interest than the species, because more people grow them, And again, I want to avoid listing hybrid after hybrid for you but I would like to quickly run through some of the resistant and some of the most susceptible ones with some indication of parentage in interesting cases. The most resistant hybrid that we have seen is P. J. Mezzitt, better known as just PJM, whose parents are *carolinanum* and *dauricum*, two of the more resistant of the species, both Lepidotes. The second most resistant one that we have seen is Jock; Jock has a couple of Elepidote species for parents, *williamsianum*, in the Thomsonii series, is one of the most resistant of the Elepidote species. The other Jock parent is *griersonianum*, a very susceptible species. And then comes Sapphire, which has *impeditum-augustinii* heritage, both resistant Lepidotes. Other very resistant hybrids are Rose Elf from *racemosum* and *pemakoense*, Cilipinense from a *ciliatum* and *moupinese* cross; all resistance must come from the male parent, in this case - Countess of Derby. Well we haven't seen any Countess of Derby to know whether it is resistant or susceptible, but if you trace back its parentage far enough you find that it has a *griffithianum*, *catawbiense* and *arboreum* background and *catawbiense* and *arboreum* are susceptible species. *Griffithianum* we have not seen and so have not been able to evaluate; however, it is in the Fortunei series, and the Fortunei's do include some fairly resistant species, notably *hemsleyanum*, which is as resistant as many of the Lepidotes.

Other resistant hybrids in order are Exbury Naomi, Virginia Richards, Cowslip (another *williamsianum* cross), Luscombei, Venessa, Ocean Lake, Dora Amateis and Crest.

Now for some of the more susceptible ones. At the top of the list is Creeping Jenny, a *griersonianum-forrestii-repens* cross. These two sister hybrids are the most susceptible. Not far behind is God Bug with *dicroanthum, griersonianum, wardii* heritage. Frank Galsworthy, Lamplighter (which is a Britania cross; many of the Brittania's are quite susceptible), Evening Glow, Harvest Moon, Unknown Warrior, Scarlet Wonder, Hello Dolly, Cary Ann, and Brittania. Well, we could go on and on listing these of course, but I think I'll stop there and just indicate that one very interesting observation that I could make about the hybrids is that when we start looking at the flower colors we find that at the resistant end of the hybrid list there are no reds, and that at the susceptible end of the hybrid list there are many reds. Also, in general, as you look at the parentage at the resistant end, you have predominantly Lepidotes and in the cases where there are Elepidote parents they are generally the more resistant Elepidotes. When you look at the susceptible end of the hybrid list you have basically susceptible parentage indicated.

Now there are a lot of things which we still don't know, many aspects that we don't understand and I would like to use one pair of hybrids to indicate some of the puzzles indicated that we have not solved. These are Jock, which I have already indicated to you is a very resistant *williamsianum-griersonianum* cross and Bowbells which is a Corona-*williamsianum* cross. Both *williamsianum* crosses, but Jock is very resistant and Bowbells is quite susceptible. Jock with a resistant mother and susceptible father and Bowbells with a mother in Corona whose parentage we don't know, but a hybrid which we have observed to be very susceptible and again *williamsianum* as the resistant male parent. So here we have two crosses, both involving resistant *williamsianum*, both involving susceptible second parents; one cross resulting in the resistant Jock and the other resulting in a quite susceptible Bowbells. A very intriguing family to study but one whose relationships we have thus far been unable to exploit.

I am not a chemist, so soon after beginning to look for the basis of resistance I began trying to involve others with more expertise than I have. Fortunately, Bob Doss, a USDA plant physiologist stationed at Puyallup, became interested and over the past couple of years has done some nice work on the rhododendron/weevil problem. Also now interested is Yosh Kimura, a Washington State University agricultural chemist. Yosh will be doing some gas chromatograph work with some of our leaf extracts and will try to identify the chemicals which are responsible for the differences we see. The extraction work in my lab is now being done by Allan Cairns, a Washington State University trained chemist who is supported by grant funds temporarily.

All of us hope, in the near future, to have some answers to the weevil problem for you.

[1] *A talk presented by Dr. Lee Campbell, August 25, 1979, at the 1979 Ornamentals Northwest Seminars in Portland, Oregon.*
