Section III.
Biological & Cultural Control

ANAGRUS SPP. EGG PARASITOIDS OF GRAPE, BLACKBERRY, AND WILD ROSE LEAFHOPPERS IN CENTRAL WASHINGTON

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In Washington, we have two leafhopper pests of wine grapes: the western grape leafhopper, *Erythroneura elegantula* Osborn, and the Virginia creeper leafhopper, *E. ziczac* Walsh. Growers typically spray for leafhoppers at least once per growing season. *Anagrus* spp. (Hymenoptera: Mymaridae) egg parasitoids are important biocontrol agents of grape leafhoppers in California. Grape leafhoppers overwinter as adults and *Anagrus* need leafhopper eggs in which to overwinter. Therefore, the main problem in using *Anagrus* for the biocontrol of grape leafhoppers appears to be sustaining large numbers of overwintering parasitoids. In California, blackberry and prune support leafhoppers that overwinter as eggs. Vineyards near blackberries or prunes had increased numbers of *Anagrus*. Our objectives were to identify the species of leafhoppers and *Anagrus* on blackberry and wild rose in Washington and to monitor leafhopper and *Anagrus* abundance through the year.

Materials and Methods

Leafhoppers were collected on blackberries and sent for identification. *Anagrus* specimens were obtained from 1) blackberries collected during the winter and early spring, and placed in emergence cages, 2) grapes collected from several sites in south central Washington, mostly in late summer and fall, and 3) yellow sticky traps placed in grapes, blackberries and wild rose. *Anagrus* specimens were sent to Serguei Triapitsyn at University of California, Riverside for identification. We recently have been identifying *Anagrus* using a key by Triapitsyn.

Adult leafhopper and *Anagrus* abundance and phenology were monitored with yellow sticky traps placed in a vineyard and in patches of blackberry and wild rose. Three traps were placed in each location. The traps were changed weekly and the numbers of adult leafhoppers and *Anagrus* were counted. In addition to the sticky traps, we collected leaf samples from the vineyard each week from May through October. Thirty leaves from the inner canopy were collected and the numbers of leafhopper nymphs, live eggs, parasitized eggs, and 'diseased' eggs were recorded. 'Diseased' eggs were clearly non-viable but the exact cause of death is in doubt.

Results and Discussion

Leafhopper identifications have not yet returned. The dominant leafhopper on blackberries was white and was probably the white apple leafhopper. A pale green/white leafhopper was the most abundant on the sticky traps in wild rose but we do not know if wild rose was the host.

Dr. Triapitsyn identified four species of *Anagrus*: *A. erythroneurae*, *A. daanei*, *A. atomus*, and *A. tretiakovae*. Only *A. atomus* and *A. erythroneurae* were recorded from dormant blackberries. *A. erythroneurae* was the only parasitoid found on dormant wild rose. *A. daanei*, *A. erythroneurae*, and *A. tretiakovae* were found in grape samples during the summer and fall. *A. daanei* appears to be the most common on grape but *A. erythroneurae* and *A. tretiakovae* also were common. *A. erythroneurae* overwinters on blackberry and wild rose leafhoppers and also attacks grape leafhoppers. The overwintering sites and hosts of the other grape leafhopper parasitoids, *A. daanei* and *A. tretiakovae*, are not known. *A. atomus* was not found in the grape samples.

The Virginia creeper leafhopper (VCLH) was the dominant leafhopper all year in the vineyard (Fig. 1). Yellow sticky traps caught a large number of overwintered VCLH in April and early May but the number of adults fell in late May and stayed low until the first generation of adults appeared in early July. The second generation of adults appeared in late August and peaked during September (Fig. 1). *Anagrus* first appeared in the traps during the third week in April (1.7 per trap), then disappeared until mid May (Fig. 2). It then occurred in low numbers (1.7 to 11.7 per trap) until early August when the numbers peaked at about 800 per trap per week, followed by a decline in October. This increase in *Anagrus* is a response to eggs laid by first generation leafhopper adults.

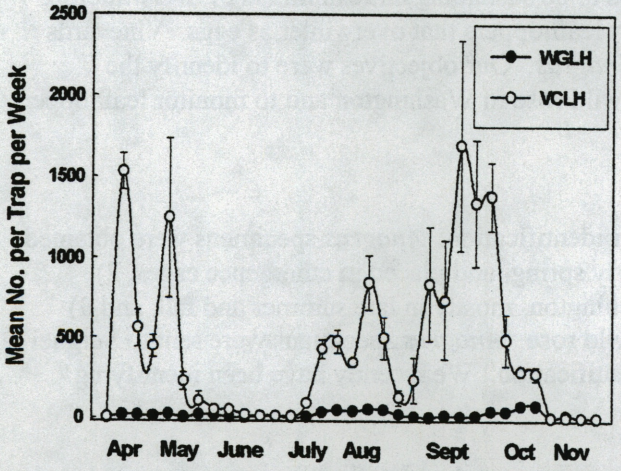

Fig. 1. Number of western grape leafhoppers (WGLH) caught on yellow sticky traps in a vineyard, 2000.

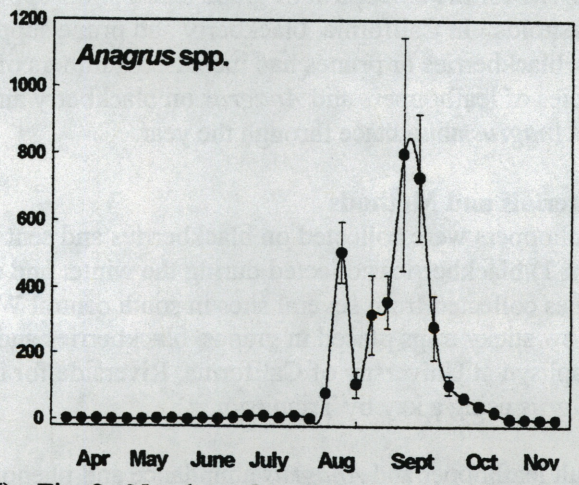

Fig. 2. Number of *Anagrus* spp. caught on yellow sticky traps in a vineyard, 2000.

Inner canopy leaf samples showed the two generations of VCLH nymphs (Fig. 3). Percent egg parasitism was relatively low until early September when peak parasitism reached 50 to 60% (Figs. 3). Unfortunately, this was long after peak leafhopper egg production. *Anagrus* populations can increase very fast but synchronization with the host is crucial. *Anagrus* numbers on yellow traps in blackberries followed the numbers of the white leafhoppers, which were the most abundant leafhoppers on blackberries (Fig. 4). *Anagrus* wasps were abundant in blackberries early in the season. These early season parasitoids could be important in grape leafhopper management. Yellow traps in the wild roses caught relatively low

numbers of *Anagrus* all through the season, probably reflecting the more diverse wild rose habitat. Increasing parasitism of the first generation grape leafhopper appears to be the key to regulating leafhopper populations.

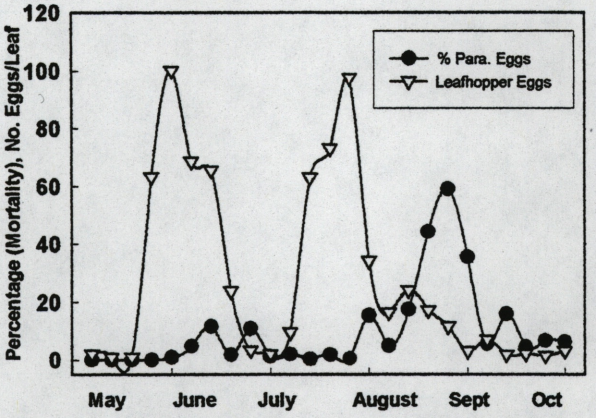

Fig. 3. Number of VCLH nymphs and percentage of parasitized leafhopper eggs on grape leaves.

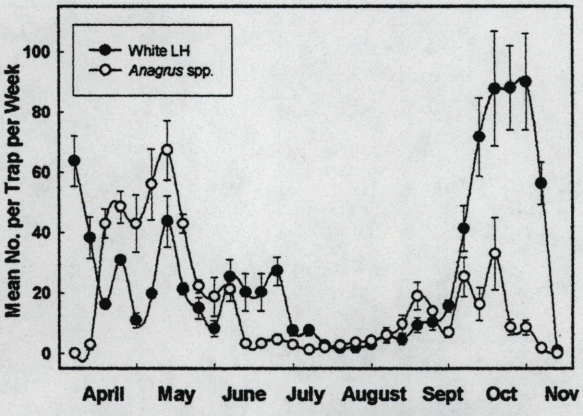

Fig. 4. Number of white leafhoppers and *Anagrus* caught on yellow sticky traps placed in blackberries, 2000.

The ecology of grape leafhopper parasitism in Washington is likely to be complex. We have two species of grape leafhoppers, probably three species of *Anagrus* attacking grape leafhoppers, unknown summer and overwintering leafhopper hosts and host plants. This complexity may afford many tactics to manage *Anagrus* parasitism of grape leafhoppers.