Section III
Biological & Cultural Control

SEASONAL ABUNDANCE OF *ANAGRUS* SPP. EGG PARASITOIDS OF GRAPE LEAFHOPPERS IN CENTRAL WASHINGTON

L. C. Wright, C. P. Storm, and D. G. James
Irrigated Agriculture Research and Extension Center
Washington State University
24106 N. Bunn Rd.
Prosser, WA 99350
509/786-9274 509/786-9280
lawrence_wright@wsu.edu chris@lodiwine.com david_james@wsu.edu

The western grape leafhopper, *Erythroneura elegantula* Osborn, and the Virginia creeper leafhopper, *E. ziczac* Walsh, are the most important insect pests of wine grapes in central Washington. Many years ago California entomologists discovered a species of *Anagrus* (Hymenoptera: Mymaridae) that parasitized grape leafhopper eggs and provided good control under certain conditions. Recent work on *Anagrus* systematics has revealed a complex of species in California vineyards. *Anagrus* spp. overwinter in leafhopper eggs but grape leafhoppers overwinter as adults. Therefore, *Anagrus* spp. must find other leafhopper hosts that overwinter in the egg stage. The movement of *Anagrus* from overwintering sites to vineyards in the spring appears to be the main obstacle to biological control. We have been studying *Anagrus* spp. in central Washington for the last four years to better understand its biology and to try to determine what can be done to enhance parasitism in vineyards. We have monitored seasonal abundance with yellow sticky traps, suction traps, and leaf sampling. Plants that were possible *Anagrus* overwintering sites were surveyed using emergence cages.

Materials and Methods

Pherocon AM (Trece Inc. Salinas, CA) yellow sticky traps were placed in five vineyards, five blackberry sites, and two wild rose sites. The traps were collected and examined weekly during the 2001, 2002, and 2003 growing seasons. Suction traps of the kind used for aphid monitoring were set up at three sites near vineyards in 2002. Two blackberry sites were added in 2003. Grape leaf samples were collected from 48 sites in 2001 and 30 in 2002. Sites were located in the Mattawa area, upper and lower Yakima Valley, the Walla Walla area, and the Columbia Valley. The sites were divided into three categories according to the amount of chemicals applied: sites with no chemicals applied (no-input sites), sites with low amounts of chemicals (low-input sites), and sites with high amounts of chemicals (high-input sites). Samples were collected monthly from June to September each year. The leafhopper egg parasitism was recorded and *Anagrus* adults were reared from parasitized eggs and identified to species. To

determine overwintering plant hosts, branches from more than 20 plant species were collected during the winters of 2000 to 2003 and placed in emergence cages to rear *Anagrus* that were present.

Results and Discussion

Yellow Sticky Traps. The trap catches from the blackberry sites were similar for the three years: relatively high numbers of *Anagrus* spp. in May and June followed by low levels in the middle of the summer and then an increase to higher levels in late August to early November. *A. erythroneurae* was the most common species trapped. The wild rose sites followed the same pattern of *Anagrus* abundance and *A. erythroneurae* was the most common species. In the vineyards, *Anagrus* numbers were low until late July or early August when numbers increased and stayed relatively high until late October. Again, *A. erythroneurae* was the most common species trapped. In vineyards *A. tretiakovae* had a peak in abundance starting in early August in 2001 and in late August in 2002. The early-season high numbers of *Anagrus* in blackberries and roses and the low numbers in grapes indicates that *Anagrus* spp. were abundant in the spring but were not flying to grapes in large numbers. Planting overwintering hosts near grapes appears to be a good tactic to increase early-season parasitism.

Suction Traps. In 2002, *A. erythroneurae* accounted for over 51% of the *Anagrus* catch. *A. nigriventris*, which does not parasitize grape leafhopper eggs, accounted for 40%. The grape leafhopper parasitoids, *A. daanei* and *A. tretiakovae*, each accounted for less than 2% of the catch. *A. erythroneurae* numbers were low until the end of August and then increased to relatively high levels until mid-October. The suction trap catch pattern was similar to that of the yellow sticky traps that were in vineyards. Analysis of the 2003 suction trap samples has not yet been completed.

Overwintering Plants. Over 20 plant species, mostly woody plants, have been examined for *Anagrus* during the winter. *A. erythroneurae* has been reared (often in large numbers) from Himalayan blackberry, and both wild and ornamental roses. Two specimens tentatively identified as *A. erythroneurae* were reared from bitterbrush. Three *A. tretiakovae* adults were reared from chokecherry and two from roses. No *A. daanei* have been found. Males and females in about equal numbers were reared from the winter samples. This suggests that overwintering females are unmated.

Leaf Samples. *A. tretiakovae* was the dominant species reared from grape leafhopper eggs from June to September in 2001 and 2002. In 2001 it accounted for 63%, *A. erythroneurae* 28%, and *A. daanei* for 9%. The numbers were similar in 2002: *A. tretiakovae* accounted for 73%, *A. erythroneurae* for 20%, and *A. daanei* for 7% of the *Anagrus* spp. reared from parasitized eggs. All *A. erythroneurae* came from eggs that had been laid singly (assumed to be *E. elegantula* eggs). *A. tretiakovae* adults were reared both from single eggs and eggs laid in groups (*E. ziczac* eggs). In 2002, 85% of the parasitized *E. elegantula* eggs were parasitized by *A. tretiakovae* and

15% by *A. erythroneurae*. Ninety one percent of the parasitized *E. ziczac* eggs were parasitized by *A. daanei* and 9% by *A. tretiakovae*. Overall parasitism of *E. ziczac* eggs was low in both years of the study. Percent parasitism of both leafhopper species in 2001 was less than 10% in June at sites of all types of chemical inputs. In September, parasitism increased to about 55% at no-input sites and 20 to 30% at low and high-input sites. In 2002, percent parasitism at all sites was 11 to 13% in June. Parasitism increased to 37% at no-input sites in September and to 20 to 30% at low and high-input sites. Late season parasitism was in the 80 to 100% range in a few vineyards in both years.

Results from California, British Columbia, and Washington show that *Anagrus* spp. have great potential as biological control agents for grape leafhoppers on wine grapes. In Washington the two less-abundant *Anagrus* species are responsible for most of the grape leafhopper parasitism. Suitable overwintering refuges for these *Anagrus* spp. should increase early season parasitism, which appears to be crucial for good biological control.