



RESEARCH • IPM NEWSLETTER

RESEARCH IN WASHINGTON VINEYARDS ON *Anagrus* spp., Egg Parasites of the Grape Leafhopper, AND HOW IT RELATES TO LODI VINEYARDS

During the late 1980's and early 1990's a tremendous amount of research was conducted on grape leafhoppers and their natural enemies. Most of this research happened in California and New York vineyards, but very little in Washington vineyards. When it came time for me to decide what my master's research topic would be, my major professor Dr. David James and I decided to examine the effects of natural enemies, especially the parasitic wasp known as *Anagrus*, on leafhopper populations in Washington vineyards. I will now discuss some of the information we gathered in Washington and relate it to the vineyards here in Lodi.

I'll start with a little background first. *Anagrus* are very small parasitic wasps that do not sting humans. They only sting leafhopper eggs. *Anagrus* are so small that if three wasps were laid side by side in a row, they would fit inside of the period at the end of this sentence. Despite their small size, *Anagrus* wasps can devastate grape leafhopper populations. They do this by depositing their own eggs within those of the leafhopper's. The immature wasp then consumes the leafhopper egg for nutrients.

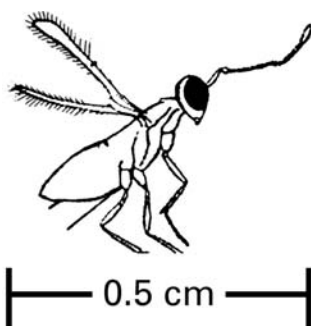
Once the wasp matures and emerges as an adult, it mates and then searches for another leafhopper egg to parasitize. During the winter, grape leafhoppers don't lay eggs because grapes lose their leaves. This means that *Anagrus* wasps need other leafhopper species that lay eggs in canes or shoots of a plant in the fall. *Anagrus* wasps will then parasitize these eggs during the winter and survive until the next spring. This is where my research kicks in. I wanted to figure out 1) what other plants *Anagrus* are found in, 2) what *Anagrus* species are present in Washington, and 3) how effective are *Anagrus* wasps at controlling grape leafhoppers.

Several plants other than winegrapes contained non-economically damaging leafhop-

pers that *Anagrus* could parasitize during the winter. These host plants include wild grape, blackberry (both California blackberry and Himalayan blackberry), dogwood, wild rose, ornamental rose, almond, peach, and apple. The utilization by *Anagrus* of alternate leafhopper hosts on these plants for overwintering is important. The proximity and abundance of these hosts to vineyards may facilitate spring dispersal of *Anagrus* at a level able to restrict spring and early summer leafhopper population development. Manipulations of habitat, leafhopper hosts, and *Anagrus* could potentially increase season-long parasitism in vineyards, and reduce grape leafhopper populations to non-economically damaging levels, in Washington and the Lodi area.

Not all *Anagrus* species in California and Washington are *Anagrus epos* as first thought by most researchers. There are many species; in fact, close to ten species have been identified in the western United States and probably more exist. This is a good thing. The more species we have attacking leafhoppers the better. However, this also means that there are more life cycles that we have to learn about in order to improve natural biological control of grape leafhoppers by these wasps. We discovered that at least five species of *Anagrus* exist in Washington vineyards instead of just the one as previously thought. Several of these same species exist here in the Lodi area. *Anagrus* are not picky when it comes to alternate overwintering leafhopper hosts but they often prefer one host over another and these hosts are not always found on one plant. It is then important to have diversity in your alternate vegetation, rather than just one type, to encourage parasitism by as many *Anagrus* wasp species as possible. Our research also examined the effects of pesti-

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cides on *Anagrus* survival and ecology. We found little difference in the number of *Anagrus* wasps in vineyards that were sprayed with insecticides to those that were not sprayed. It is likely that many pesticides are toxic to adult *Anagrus*. However, *Anagrus* populations may remain abundant in pesticide treated vineyards because adults can immigrate from unsprayed alternate habitat (mentioned above). Also, *Anagrus* larvae escape the dangers of short-lived “soft” pesticides because they develop within the protective covering of the grape leafhopper eggs. More research on this topic is being conducted in Washington to develop a thorough understanding of how chemical inputs effect *Anagrus*

populations and parasitism. This may allow for modifications in spray programs to maximize the benefits from these parasitoids.

Now that I have mentioned a portion of my research from Washington, I want to emphasize the point that developing a more diverse agroecosystem could make vineyards more favorable habitats for grape leafhopper natural enemies like *Anagrus*. Modifications in habitat diversity and improvements in spray programs will maximize benefits from conservation biological control, minimize grape production costs, and increase sustainability.

Don't Forget About Sulfur Stewardship!

Timing of this newsletter is such that much of the sulfuring that will be done for the season has already occurred. However, it is still important for all of us to remember the importance of sulfur stewardship. Sulfur is a reduced-risk, very effective way of managing powdery mildew in Lodi vineyards. Unfortunately, as pointed out in some of our meetings and newsletters the last couple of years, it has been the pesticide that receives the most public complaints. Therefore, if this situation is not improved upon, i.e. public complaints about sulfur reduced, then the California Department of Pesticide Regulation will be pressured by the state legislature to increase regulatory compliance required by growers and, in the extreme scenario, restrict its use. How can this be avoided? Through sulfur stewardship by growers and applicators! Below is a review of the important points of sulfur stewardship:

Being a Good Neighbor. Sulfur stewardship includes being aware of the concerns of neighbors and local communities. Consider a policy of discussing vineyard actions with neighbors, speaking with community organizations about the importance of sulfur as a relatively benign crop protection tool, and forming a regional team of growers to serve as the first contact with the public for negotiations and troubleshooting. These actions enable mutual understandings and better relations, thus decreasing the probability of complaints.

Canopy Management. Use trellis systems and canopy thinning techniques (e.g., leaf pulling, shoot thinning, cane

cutting) that open canopies to recommended levels. Besides benefiting fruit quality, a properly opened canopy provides conditions less conducive to mildew and other diseases, potentially enabling use of lower sulfur rates and fewer applications for achieving adequate coverage.

Monitoring Mildew Development. Use the powdery mildew index as a tool for optimally timing and possibly reducing the frequency of fungicide applications (including sulfur).

Establishing Buffers. Establish reasonable buffer zones to prevent drift onto sensitive areas and public exposure to applications. Buffer distances vary with weather conditions, formulation (dust/wettable), application method (ground/air), presence of barriers (e.g., trees), and characteristics of sensitive areas. If buffers determined for dust application overlap some border vine rows, apply separate fungicide sprays (less prone to drift) to these rows or dust border vine rows during conditions when buffers can be reduced.

Dealing with Extra-Sensitive Areas. Consider applying wettable sulfur or other low-risk fungicide sprays to vineyard portions or entire vineyards near extremely sensitive areas.

Selecting Rates. Adjust rates of sulfur or other fungicides to the lowest effective rate according to vine growth and development. Higher label rates may not be required early in the season to achieve adequate coverage. Use of lower rates also can decrease risks of pesticide drift, particularly for dusting sulfur.

Equipment Operation. Maintain, calibrate, and select application equipment to ensure accurate delivery of the intended rate. For dust, be extra cautious of drift during row turns and reduce RPM at row ends or shutoff dusting equipment if possible.

Weather Monitoring. Monitor weather conditions before and during applications. No sulfur applications can be made when winds exceed 10 miles per hour, but consider using an even lower threshold. Avoid applications when winds are blowing towards sensitive areas and during temperature inversions.

Timing Applications. Decrease public visibility and the potential for complaints by making applications during periods of least human activity (e.g., at night, weekends). Develop a sequence for application that attracts the least attention. For nighttime applications, minimize “noise” complaints by treating rows closest to residential areas before bedtime.

Resistance Management. Although mildew resistance to sulfur has never been found, consider rotations with other fungicides as a preventive measure against resistance and potential sulfur drift.





After a mild and relatively dry winter the new season started a little ahead of normal by 7 to 10 days. The early indications were a fairly dry year which was somewhat turned around with a rainy April. Besides the heavy rainfall April turned out to be one of the coolest in many years. The accumulated degree days (DD) for the month averaged about 179 DD for the Lodi district. The last time there were less than 200-degree days in April was 1983 with about 177 DD! I've been told not to mention that year again. It appears bloom is about a week behind, but vine growth is catching up with the warm weather.

The total rainfall for the current season is closer to normal, but there seems to be very little deep soil moisture this year, especially on vineyard sites with soil profiles deeper than three feet. What that may mean is care should be taken to not overdo the deficit irrigation programs with any hot spells later on in the season. As important as reduced deficit irrigation is for quality, watch out not to overdo the vine stress this year on young vines, own rooted vines with nematodes, poor soils or on certain varieties such as Chardonnay and Merlot. Last year there were some mid-season and late summer problems during periods of high temperatures.

In general the very cool April weather seemed to help keep powdery mildew, *Phomopsis* Cane and Leaf Blight and *Botrytis* shoot blight in fairly good check. Now that normal temperatures have returned vigilance should also be used in monitoring for powdery mildew; keep intervals reasonable or short and early season sulfur may be a good choice for resistance management and economics.

The general sense seems to be that demand and to a lesser extent prices may be turning around. The Lodi District should be in a good position to be a part of a strengthening market. The season is young, but the cluster numbers look reasonable. Hopefully, Mother Nature

will be accommodating.

The state budget problems, the slow economy, the War on Terror and the viticultural threats of Glassy Winged Sharp Shooter (GWSS) and now Vine Mealy Bug (VMB) will provide for plenty of concerns. There has been a great deal of success in keeping the GWSS out of San Joaquin County, but that success will only last as long as the effort is sustained. The arrival of VMB sometime during the period of 1998 to 2000 brought an additional pest, which needs to be dealt with aggressively. There appear to be at least two limited infestations in the north area.

There have been several meetings introducing the pest itself, its potential for increased costs and the significant losses it can cause. If you haven't been able to attend one of these meetings, talk to a neighbor who has, or stop by the LWWC, the Ag Commissioners office or give me a call. There are full color informational posters available and the hope is we can identify any small infestations that have established and with a high degree of success eradicate them. As a grower or PCA you need to be on the lookout. Just as importantly, your tractor drivers, field crews or irrigators also need to be aware of the VMB.

With the increased use of IPM practices, less spraying and softer, more specific insecticides we are seeing more beneficial insects and a wider variety of minor pests. One of these is the Grape Mealy Bug (GMB). It is less aggressive and less damaging than the VMB, besides being a long time resident of the area. It is controlled for the most part naturally. Over the years there have been some outbreaks of GMB, but, it seems to come and go. The VMB will be a different more damaging long-term threat if it is ignored. If you have any questions talk to your PCA, or give Cliff Ohmart and his staff a call or again give me a call. The first thing is to identify which mealy bug you might have and then deal with it appropriately. There have been some very dramatic success

stories in other areas when the VMB has been controlled early.

It has taken many years of hard work to gain the long overdue recognition for quality fruit and distinctive wines from the Lodi district. Economic pressures make it almost impossible to carry another cost of production and an additional threat to quality or yield. With that in mind immediate identification and eradication will be an important investment.

On the more standard concerns of springtime production there is always plenty to think about, but consider the following:

Avoid excessive or "might-as-well" irrigations, but watch out for hot spells. In most vineyards there is little to no irrigation needed before late May or early June, even this year. Just be careful when it does get hot, as deep soil moisture is low this year.

Bloom time is traditionally and generally a good time to assess vine nutrition, especially with reliance on drip systems. Grape vines don't seem to need as much applied nutrients as most other commodities. From budbreak until bloom time shoots are relying almost entirely on stored reserves for nutrients, other than sugars produced from photosynthesis. Potassium and zinc deficiencies (boron in more recent years) have been a problem, but too much nitrogen has been more of a problem. A nitrogen program of 20 to 30 pounds actual nitrogen (N) per acre will maintain most high producing vineyards on a long-term basis. In most other situations, you may find 5 to 15 pounds of actual N per acre

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is enough depending on rootstock, site and well water nitrogen levels. It's possible to save some money and put it towards other nutrients, such as potassium (K) or to vineyard operations. Nitrogen is a very elusive thing to measure compared to other nutrients, but run a petiole analysis (leaf blades are no better and usually worse). Then talk it over with your PCA.

Crop load and canopy management are difficult subjects to discuss in a down market, but may be required to meet the winery demands for higher quality in the current competitive environment. There still is a lot of discussion as to what is more important leaf removal or shoot thinning. If you can only do one, shoot thinning may win out in most vineyards, unless there is extreme vigor or a history of bunch rot. The market may remain somewhat soft, but the district's quality and value are more evident than ever. Good luck in 2003.

UPCOMING MEETINGS

JUNE 17

Warm Climate Winemaking and Grapegrowing Symposium. Precedes the 54th Annual ASEV meeting at the Reno Hilton, Reno, NV. For more information phone 530 753 3142 or visit www.asev.org.

JUNE 18-20

54th Annual Meeting of the American Society for Enology and Viticulture, Reno Hilton, Reno, NV. For more information phone 530 753 3142 or visit www.asev.org.

JUNE 24

Practical Survival Strategies for Winegrape Producers. Madera Fairgrounds, 1850 West Cleveland Ave, Madera, CA. Organized by The Ecological Farming Association. For reservations and more information phone 831 763 2111.

JULY 18

Third Annual WineVision Meeting; 8:30 PM to 4:00 PM ; Napa Valley Marriott Napa, CA 94558. For More Information phone Waunice Orchid 707 261-8716.

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WINEGRAPE COMMISSION

