



UC Cooperative Extension-Napa County and UC IPM
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The Napa County Wine grape Pest & Disease Control District sponsored a seminar on vine mealybug (VMB) on February 25. We discussed VMB detection, biology and management. As a follow-up, this article summarizes significant points from the day, focusing on issues that are of particular concern for management of VMB, and also addresses FAQs.

FOCUS ON VMB SAMPLING AND MANAGEMENT EARLY IN THE SEASON:

Since 2012, we have experienced warmer winter and spring temperatures, resulting in the development of large VMB populations much earlier in the growing season and necessitating the early adoption of management practices.

Historical trapping data (2002-2009) indicate that male VMB flights began in late May/early June in Napa. However, in 2014 we saw VMB males in the vineyard as early as March 13, and were reliably catching VMB males in traps by the end of March/early April. Adopting management practices early in the growing season can help prevent the growth of large VMB populations that can spoil clusters near harvest. Monitor VMB populations early in the season, and consider earlier deployment of mating disruption dispensers (see below), release of biological control agents such as *Anagyrus pseudococci* and *Cryptolaemus montrouzieri*, and early-season insecticides.

SELECT A MANAGEMENT PROGRAM APPROPRIATE TO THE VMB POPULATION:

Determine whether you have a low, moderate, or large population of VMB and select management tools appropriate to the population level. Mating disruption, biological control and ant baits may effectively contain low populations of VMB, whereas large populations may require the use of an aggressive insecticide program to lower populations before implementing an integrated approach.

TARGET INSECTICIDE SPRAYS FOR VMB:

VMB are often found in protected locations under the bark of the permanent wood. It can be difficult to achieve good coverage that is essential for control with contact insecticides. To make the most effective use of contact insecticides, target your sprays for VMB. This may involve (1) making sure nozzles are aimed where the VMB are most likely to be located—the cordon & upper trunk early in the season and the cordon & fruit zone later in the season; (2) increasing the spray volume to facilitate good coverage of the target zone; (3) making separate, focused sprays specifically for VMB, rather than adding a contact insecticide to a mildew spray pass.



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FREQUENTLY ASKED QUESTIONS

When should I deploy mating disruption dispensers?

VMB pheromone-baited traps can be a reliable indicator. Deploy a few traps in your “high pressure” VMB areas in mid-March (warm winter/spring) or early May (cool winter/spring), Follow [established trapping protocols](#). Check your traps at least once per week. When your traps consistently catch males, consider deploying mating disruption dispensers.

If I deploy mating disruption dispensers early, will they last the whole season?

The label indicates that the dispensers will remain active for up to 150 days under normal field conditions. So, if you deploy early, they will not be expected to remain active during the entire growing season. However, mating disruption is most effective when VMB populations are low to moderate in size, which is more typical early-season. Also, mating that occurs in the late summer and fall (Aug-Oct) is determining VMB population levels for the following growing season, not the current one.

*When should I release the parasitoid *Anagyrus pseudococci*?*

Under constant temperatures in the laboratory, the parasitic wasp, *A. pseudococci* completed development (from egg to adult emergence) at temperatures ranging from 57.2 to 93.2° F. Egg laying by female wasps was reduced or eliminated below 57.2° F. During the growing season, *A. pseudococci* completes 2 generations to each VMB generation. Monitor VMB populations and temperatures in the spring. When daytime temperatures are forecast to be at or above 60° F for several days, consider releasing *A. pseudococci*. Since *A. pseudococci* females prefer to lay eggs in 3rd instar VMB, monitor VMB to ensure that a population of 2nd and 3rd instar nymphs is present at the time releases are made. Argentine ants can disrupt the activity of *A. pseudococci*; monitor for Argentine ants and if present, consider implementing ant management strategies.

*How many *Anagyrus pseudococci* should I release?*

Studies have not been completed to determine the number of *A. pseudococci* needed to provide control of VMB populations. As part of an integrated program with mating disruption, ant bait and insecticides, an application rate of 500 to 2,000 females released per acre per month (Apr to Aug) provided control of VMB over a 3-year period. Releases made later than August generally do not contribute to population control in the current year, but may reduce VMB populations for the following season. Monitor for evidence of *A. pseudococci* activity in the vineyard, as described below. If you find significant evidence of activity later in the season (veraison to harvest), it may not be necessary to continue releases.

How can I monitor for evidence of Anagyrus pseudococci activity in the vineyard?

Quantifying the presence of *A. pseudococci* mummies and empty mummies is the easiest way to monitor. Mummies are the pupal stage of the wasp. *A. pseudococci* females lay their eggs inside VMB nymphs; the eggs hatch and the larvae develop inside the VMB, consuming its contents. When the wasp reaches the pupal stage, the VMB is dead, but its exoskeleton remains with the wasp inside. We refer to this dead VMB shell housing the wasp pupa as a mummy. Once the wasp emerges from the shell, it is referred to as an “empty mummy” (as pictured below) and has a round hole where the wasp chewed out of the shell. Monitor for mummies and empty mummies to evaluate the impact of the parasitoid. Occasionally, *A. pseudococci* females may also be seen in the vineyard; they are notable for their white antennae.

Top left: *Anagyrus* female searching for VMB host; note the characteristic white antennae.

Bottom left: *Anagyrus* female emerged from VMB mummy (K. Daane)

Right: VMB population on a grapevine; note the empty mummy (with the hole) in the center.



*When should I release the mealybug destroyer beetle, *Cryptolaemus montrouzieri*?*

C. montrouzieri can be an effective predator of VMB eggs and small nymphs, especially when VMB population are large. *C. montrouzieri* is adapted to tropical conditions, and development time is profoundly affected by cool temperature. The beetles could not complete development between 50 and 62.6° F; a minimum temperature of 69.8° F was required for the predator to feed and lay eggs. Peak activity of the larvae was observed around 82.4° F. Consider timing your releases for periods when VMB eggs are present in the vineyard, since beetles lay their eggs near VMB eggs

Which pesticides are effective for VMB?

The [UC IPM Pest Management Guideline for VMB](#) contains information on pesticides.

When designing a pesticide program, pay particular attention to the following factors:

- ♦ Resistance management (mode of action group number);
- ♦ Soil type when considering soil-applied materials;
- ♦ Requirements specific to that insecticide, such as the use of a surfactant, or sufficient leaf canopy;
- ♦ Recommended timing of application and whether to expect a delay between uptake and activity of the product; and
- ♦ Targeted VMB life stage: For example, when using an insect growth regulator, monitor and target the application when a majority of the population is in the crawler and young nymph stage.

Left: Larval stage of *Cryptolaemus montrouzieri* (mealybug destroyer beetle)

Right: *Cryptolaemus montrouzieri* beetle feeding on mealybug nymph (UC IPM).

