

**1. Summary:** “Formation of a Mealybug Biocontrol Research Focus Group for Crush District 11”  
by PI Dr. Stephanie Bolton, Lodi Winegrape Commission

The project has successfully met its objectives as stated during the period of March 2017 – April 2018. The Lodi Mealybug Biocontrol Research Focus Group met monthly at a local diner to discuss vine mealybug biocontrol, researching topics such as which beneficial insects are present and effective in our area, current grower perceptions of beneficial insects and mealybugs, the likelihood of neighbor cooperation in vine mealybug management, ant control, Movento, organic options for mealybugs, and other topics related to vine mealybug biocontrol and management. The Focus Group became a center of learning and exploration where scientists, extension personnel, growers, pest control advisors, and the industry opened communication around the subject of mealybug biocontrol in efforts to develop real-world, applicable outreach materials and events which would propel our local winegrape industry forward and decrease our risk for further leafroll virus infections.

Through the conversations and learning experienced during the Focus Group monthly meetings, along with information gathered via expert consultants and educational field trips, a strategy for mealybug biocontrol in Crush District 11 was established. This simple strategy is:

1. Don't kill the good insects.
2. Control the ants.
3. Use pheromone mating disruption.

In Lodi, we are still generally in phase 1 where we are teaching growers how to keep their beneficial insects alive through distribution of an easy-to-read chart based upon UC IPM guidelines and local experience (available at [lodigrowers.com](http://lodigrowers.com)). In August 2017 at a Mealybug ID Field Day, about 120 growers had a fun time learning how to identify mealybugs which have been parasitized by the *Anagyrus* wasp, one of the two main biocontrol agents in our region. During the April 2018 Mealybug & Virus Outreach Meeting, about 150 growers learned the significant role of ants in the vine mealybug and leafroll virus story. The Focus Group has planned ant bait experiments for 2018 after finding that there is no economical, efficient ant control method available for large acres of vineyards. While pheromone mating disruption is being used with success in our region to decrease mealybug populations and to attract beneficial insects, it is still cost-prohibitive for many growers. Growers were given mealybug traps donated by Sutterra at the April 2018 meeting, which they will bring back in May 2018 for a follow-up Mealybug Trap Workshop. Thus, they are learning whether the male mealybug is present in their field and how to use the traps, which is the first step towards neighborhood coordinated pheromone mating disruption.

By taking the time to fully assess the current mealybug biocontrol management options in the region and to learn more about the pathogen itself, future priorities for more targeted research on a larger scale were best determined. Priorities include but are not limited to: discovering an efficient and cost-effective ant control method for large acreage in Crush District 11, learning how to release *Cryptolaemus* beetles in our vineyards, and learning how to eliminate underground vine mealybugs following a leafroll virus infected vineyard rip-out.

## 2. FINAL REPORT

### 3. Formation of a Mealybug Biocontrol Research Focus Group for Crush District 11: 2017-2125

**4. Principal Investigator:** Stephanie L. Bolton, PhD  
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#### **Cooperators:**

All nine listed Cooperators below enthusiastically served on the Mealybug Biocontrol Research Focus Group. Collectively, they shared decades of real-world experiences with mealybug challenges and biocontrol efforts, and ensured that outreach materials were pertinent to current, regional farming conditions. In addition, they conducted mealybug-related preliminary research in their vineyard(s), hosted educational outreach events, and gathered mealybug-related information from outside sources.

Dawn Brunmeier, BASF (has since moved to Helena Chemical)  
Matt Kassis, Pest Control Advisor  
Mark Shimosaki, Pest Control Advisor  
Larry Whitted, Pest Control Advisor  
Mike Klouda, Viticultural Manager, Michael David Winery  
Chris Storm, Viticultural Manager, Vino Farms  
Jay Leone, Crush District 11 Grower, Leone Vineyards, USDA NOP-certified  
Jeff Perlegos, Crush District 11 Grower  
Paul Verdegaal, UCCE Farm Advisor (now Emeritus), San Joaquin County

#### **5. Objectives and Actions Conducted to Meet Stated Objectives:**

**The overall objective is to learn how to best adopt mealybug biocontrol practices in Crush District 11.** This main objective was accomplished by the following sub-objectives:

1. To determine which mealybug biocontrol agents and methods are providing some level of control in the region.
2. To learn how to best encourage the growth and use of these effective biocontrol agents as part of an IPM strategy.
3. To formulate a long-term management plan for establishing economically feasible and impactful mealybug biocontrol agents/methods in Crush District 11.
4. To develop and deliver timely, relevant educational materials and workshops for best mealybug management practices which incorporate effective biocontrol options for Crush District 11 growers.
5. To establish priorities for further mealybug research projects.

### **Actions Conducted to Meet Stated Objectives:**

The Lodi Mealybug Biocontrol Research Focus Group met in person once per month for at least two hours each time to accomplish the project objectives. In true grower style, we meet at the Richmaid Diner on the third Tuesday of every month and will continue our meetings through the 2018 growing season, at which time the successful Mealybug Group will merge with the Lodi Grapevine Virus Research Focus Group (itself formed in November 2017).

### **6. Summary of Major Research Accomplishments and Results by Objective:**

#### **To determine which mealybug biocontrol agents and methods are providing some level of control in the region.**

Cooperators on the Mealybug Biocontrol Research Focus Group led the conversation in discussing which mealybug biocontrol agents are present in the region. The experiences of Cooperators (representing several types and sizes of vineyards) established a baseline knowledge of which predators/parasites are present locally and which are thought to be most effective under different conditions. Together, we gathered all relevant information on these agents and methods – tapping into both published literature and real-world experiences to learn as much as possible about the available control options, how they are best used, as well as the pathogen system.



It has been determined that the *Anagyrus* wasp (*Anagyrus psuedococci*) and the Mealybug Destroyer beetle (*Cryptolaemus montrouzieri*) appear to offer the greatest levels of biocontrol in Crush District 11, but that there are several other vine mealybug predators and parasites in our region, as seen through careful observations by our Group. *Pictured left: parasitized mealybugs with ant activity.*

Local growers are also seeing benefits from pheromone mating disruption using the hanging tag application, and some of our Cooperators are testing a new flowable mating disruption product this season.

#### **To learn how to best encourage the growth and use of these effective biocontrol agents as part of an IPM strategy.**

The collective experience of the Research Focus Group includes farming thousands of winegrape acres over the past 40 years in various regions. As extension personnel, growers, and PCAs, we also had an extensive knowledge of grower attitudes towards mealybug biocontrol. We have also heavily relied on the knowledge and experiences of our two expert consultants, Dr. Kent Daane (UCCE) and Brett Chandler (Associates Insectary).

Based on what we learned, we have formulated the following simple strategy for our region:

**Step One: Don't kill the good insects.** It was concluded that our first and most crucial step towards increasing mealybug biocontrol in Crush District 11 was to encourage growers to stop killing the beneficial insects with their spray programs through education. We still have a sizeable number of growers unknowingly using spray applications which harm the beneficial insects.

**Step Two: Control the ants.** Through the experience of an educational field trip to Associate's Insectary in Santa Paula, we learned of the importance of ant control in an effective biocontrol program for vine mealybugs. The role of the ant is to protect and farm vine mealybugs for their honeydew. Ants herd the mealybugs, moving them along the vine throughout the season – including underneath the soil and into the roots, where the grower cannot eradicate them with any current methods. Ants also fend off natural predators and parasites of vine mealybugs. We learned that the main ant species present in Crush District 11 is the Argentine ant, a very aggressive super organism which we have no effective way to control in the vineyards. Other ant species – both protein feeding and sugar feeding – were also found tending mealybugs during our Mealybug ID Field Day outreach program.

**Step Three: Use pheromone mating disruption.** Finally, we learned that pheromone mating disruption, if the cost can become lower, can be an excellent tool for our region. The mating disruption technique not only decreases levels of mating in a vineyard, but it also attracts beneficial insects to that area. We are currently working with two different mating disruption companies, both of which have representatives who are invited to our monthly meetings.

**To formulate a long-term management plan for establishing economically feasible and impactful mealybug biocontrol agents/methods in Crush District 11.**

Through the establishment of the Mealybug Biocontrol Research Focus Group, there now exists a core group of individuals with a breadth of knowledge about mealybug biocontrol. This Focus Group has reinvigorated mealybug research in our region and we are helping to guide future studies by providing test plots and grower input. Our long-term management plan is to continue outreach on the importance of keeping beneficial insects alive (especially in terms of their role in decreasing the spread of leafroll virus), to conduct ant bait experiments to find an economically feasible ant control method, and to continue education and coordination for pheromone mating disruption. Furthermore, the Lodi Grapevine Virus Research Focus Group (which the PI and three Cooperators are part of) is actively trialing methods to eliminate vine mealybugs underground following a vineyard rip-out.

**To develop and deliver timely, relevant educational materials and workshops for best mealybug management practices which incorporate effective biocontrol options for Crush District 11 growers.**

The Lodi Winegrape Commission has multiple channels for educating and communicating with Crush District 11 growers. Thus, the 750 growers and 200 supporting members of the Lodi winegrowing community (as well as the additional LODI RULES Sustainable Winegrowing Community, reaching ten other Crush Districts and Israel) are receiving educational benefits from the lessons learned and outreach material created throughout the course of the Mealybug Biocontrol Research Focus Group.

Growers in the Lodi AVA have been learning about mealybugs since at least the early 2000's, so it was the goal of the Mealybug Biocontrol Research Focus Group to present the information on mealybug biocontrol and management in a fresh, approachable way. Instead of scientists talking about research projects with graphs and acronyms and wordy PowerPoint presentations, the Mealybug Biocontrol Research Focus Group learned the technical science, read the research papers, and then interpreted the information for the local audience. The results have been very successful, and we seem to be changing people's minds about why they need to start paying closer attention to vine mealybugs, ants, beneficial insects, and grapevine viruses.

On the following pages are descriptions of our main educational material and outreach events.

## AN IMPORTANT FIRST STEP IN BIOCONTROL: DON'T KILL THE GOOD INSECTS!

Your CD11 Mealybug Biocontrol Research Focus Group has put together this regionally-specific chart, based on the UC-IPM Relative Toxicities of Insecticides and Miticides Used in Grapes to Natural Enemies and Honey Bees Table, available online at [ipm.ucanr.edu/PMG/r302900111.html](http://ipm.ucanr.edu/PMG/r302900111.html), and years of real-world experience.



Help the good insects (beneficials, predators, parasites) help you!  
What GOOD insects are we trying to keep ALIVE, anyways?

The *Anagyrus* wasps, *Cryptolaemus* beetles, and Lacewings who attack mealybugs.

The predatory mites, six-spotted thrips, and minute pirate bugs who attack mites.

The *Anagrus* wasps and green lacewings who attack leafhoppers.

The parasitic wasps and flies who attack caterpillars and omnivorous leafrollers.



Trade Name	Common name	MOA	Good insects stay alive	May reduce good insects	Good insects are killed	Notes
Acramite	bifenazate	20D				
Admire Pro (soil)	imidacloprid	4A				
Altacor	chlorantraniliprole	28				

### **Educational Material: AN IMPORTANT FIRST STEP IN BIOCONTROL: DON'T KILL THE GOOD INSECTS!** (pictured above, see full chart in Appendix)

The CD11 Mealybug Biocontrol Research Focus Group put together a regionally-specific “good insect risk” spray chart, based on the UC-IPM Relative Toxicities of Insecticides and Miticides Used in Grapes to Natural Enemies and Honey Bees Table, available online at [ipm.ucanr.edu/PMG/r302900111.html](http://ipm.ucanr.edu/PMG/r302900111.html), and years of real-world experience. Permission was granted from UC-IPM to interpret their chart. Interestingly, it took our Focus Group a few hours and a lot of technical conversations to agree upon what the UC-IPM chart was indicating as far as risk goes, so we believe that in the end our chart makes the UC-IPM information more user-friendly and approachable.

**Distribution:** The chart is available online to download as a PDF at [lodigrowers.com](http://lodigrowers.com), as a hard copy at the Lodi Winegrape Commission office, was handed out at the Lodi Mealybug ID Field Day (120 attendees), was handed out at the Turlock Tree & Vine Expo (35 attendees), was handed out at the Lodi Mealybug & Virus Outreach Meeting (150 attendees), was distributed at the January 2017 LODI RULES Sustainable Winegrowing meeting (70 attendees) and is included in all new LODI RULES Standards binders, is always available at the monthly Lodi Winegrape Commission PCA Network Breakfast Meetings, was distributed in Italy to a sustainability organization in Piacenza and a biodynamic agronomist in Alto Adige, and was passed along to the Central Coast Vineyard Team for distribution.



**Outreach Event: Mealybug ID Field Day, August 8<sup>th</sup>, 2017** (pictured above)

Attendees learned how to identify vine mealybugs, vine mealybugs parasitized by the *Anagyrus* wasp, Argentine ants, grey ants, and other mealybug parasites with experts in a very interactive, hands-on format. The importance of mealybug management (including biocontrol) was discussed as it relates to vineyard virus control. The meeting included talks by Dr. Kent Daane and various Cooperators on this grant, and attendees were given a 16x hand lens (courtesy of the LODI RULES for Sustainable Winegrowing Program), instructions on how to find parasitized mealybugs (*see handout in the Appendix*), and a copy of the good insect risk chart described on page 6. Vineyard rows with *Anagyrus* parasitism were pre-marked the afternoon before, and attendees entered the vines with Cooperators on this grant in small groups to learn how to find parasitized mealybugs. There was a microscope available to look at any beneficial insects or ants up close. Many attendees remarked that they learned something new and had fun! About 120 growers attended this event.

Ted Rieger attended the Mealybug ID Field Day event and wrote a complimentary article for Wines & Vines which was published on August 22, 2017. “Lodi Looks at Biocontrol for Vine Mealybug.” *See Appendix for the article.*



**Outreach Event: Mealybug & Virus Outreach Meeting, April 4<sup>th</sup>, 2018** (pictured above)

This outreach event was the result of intense technical meetings of Lodi’s Mealybug Biocontrol & Grapevine Virus Research Focus Groups, comprised of volunteer growers, PCAs, scientists, extension personnel, and industry leaders who gather monthly to discuss short- and long-term strategies to solve our mealybug and virus challenges. Topics covered with short presentations and panels over a 2 ½ hour morning were: local costs of mealybug & virus management, vine mealybugs, ants, leafroll & red blotch viruses, nursery ordering, and virus testing. There was also a ½-hour period where attendees could “meet with the experts” – who included Brett Chandler from Associates Insectary, Dr. Kent Daane, and Suterra & Pacific Biocontrol (pheromone mating disruption companies). Associates Insectary passed out vials with beneficial insects and had an interactive demonstration which was well received.

We also passed out FREE male mealybug traps (thanks to Suterra) and a draft NURSERY ORDERING 101: VIRUSES booklet, which included information on how to inspect nursery shipments for vine mealybugs.

Attendees were invited to bring their used mealybug traps back at a follow-up workshop on May 1<sup>st</sup>, 2018, to learn how to identify the male mealybugs. A handout accompanied each trap given out so that the attendee could choose how to best use the free traps (see Appendix). The main handout for the meeting also included contact information for companies providing mealybug biocontrol services (see Appendix).

Furthermore, the activities of the Lodi Mealybug Biocontrol Research Focus Group were described in the Lodi Grower Newsletters (mailed to 850 members of the Lodi winegrowing community), on the lodigrowers.com Coffee Shop Blog (“BENEFICIAL INSECTS: why we love them & why you should too!”) reaching an audience in over 50 countries), and on Twitter (@Lodi\_Grower).

**To establish priorities for further mealybug research projects.**

By taking the time to fully assess the current mealybug biocontrol management options in the region and to learn more about the pathogen itself, future priorities for more targeted research on a larger scale were best determined. Priorities include but are not limited to: discovering an efficient and cost-effective ant control method for large acreage in Crush District 11, learning how to release *Cryptolaemus* beetles in our vineyards, and learning how to eliminate underground vine mealybugs following a leafroll virus infected vineyard rip-out.

Following the Mealybug & Virus Outreach Meeting during the morning of April 4<sup>th</sup>, we invited Dr. Kent Daane and Brett Chandler to meet with some of the grant Cooperators to discuss future research projects in our region. Out of this meeting, plans to conduct the following three research projects were made (the first two projects will be funded by the Lodi Winegrape Commission):

- Ant bait control research trials conducted by Paul Verdegaal with the help of Dr. Kent Daane and the Mealybug Biocontrol Research Focus Group
- *Cryptolaemus* vineyard efficacy trials conducted by the Mealybug Biocontrol Research Focus Group with beetles donated by Brett Chandler and Associates Insectary (determining an effective rate of application and timing)
- Determination of how deep the vine mealybugs exist underground when Argentine ants are tending them during the overwintering period (Dr. Kent Daane and the Mealybug Biocontrol Research Focus Group)

## 7. Outside Presentations of Research:

The PI, Dr. Stephanie Bolton, was invited to speak at the Turlock Tree & Vine Expo on November 7, 2017. Dr. Bolton gave a 30-minute talk on Controlling Mealybug in Grapevines (sample slides pictured to the left), where she described the activities of the Mealybug Biocontrol Research Focus Group and used lots of stories and pictures, rather than technical graphs and verbose slides, to interact with the audience of about 35 growers and industry folks. She taught the growers how to look for parasitized mealybugs in their vineyards and some simple steps for managing vine mealybugs in general. She encouraged them to share the cool story about how the *Anagyrus* wasp parasitizes the vine mealybug (by stinging the mealybug to paralyze it, then depositing an egg inside the mealybug body, which grows until it is big enough to chew its way out of the mealybug body, leaving a hole behind) with the children in their lives – YouTube videos available at [lodigrowers.com](http://lodigrowers.com). According to Matthew Malcolm, the Expo host, this presentation received the most questions out of any presentation he has ever seen at these Expos.

Now I am texting every person I know with the slightest interest in science about parasitized mealybugs.



1. Look for ants and/or wet trunks.
2. Look underneath the leaves.



## 8. Research Success Statements:

This outreach project has provided the California winegrape industry with a fresh approach to grower education and outreach surrounding a specific topic. By creating a Research Focus Group to address a specific concern of economic importance to the winegrape industry, we have shown how great minds can come together to learn, evaluate, and quickly create a plan of action. The model for this successful Research Focus Group is now being utilized to solve the larger challenge of grapevine viruses in California, and there is no doubt that the Virus Focus Group is building upon the organization and skills gained from the Mealybug Biocontrol Research Focus Group. It is our hope that other regions establish similar Focus Groups as they serve as integral structures with which to learn, to engage industry stakeholders and academics, and to bridge communication gaps which may be hindering adoption of sound viticultural practices. Finally, these Focus Groups put in place research, communication, and outreach channels which can be used to meet future unknown challenges which will no doubt arise in our winegrape industry.

## 9. Funds Status:

The Lodi Mealybug Biocontrol Research Focus Group accomplished the overall objectives in a shorter period with more financial support than anticipated. Whereas we planned to have a second large outreach meeting in January 2019, we were able to provide our growers with that meeting in April 2018. Therefore, the budget reflects a slight shift in the use of funds due to the shorter overall time period and a generous donation of red delta pheromone traps by Suterra. The funds anticipated for the traps were used to help offset the cost of the second outreach meeting, called Mealybug & Virus Outreach Meeting, pending approval by AVF. Further information and receipts are available upon request for all expenses.

Professional (PI) at 3% = **\$2100**  
Monthly breakfast meetings at Richmaid Diner = **\$907.38**  
Mealybug ID Field Day Outreach Meeting = **\$809.29**  
Mealybug & Virus Outreach Meeting = **\$2638.80**  
Mealybug Traps = **FREE**  
Educational field trips (travel to Associates Insectary) = **\$934.98**  
Expert consultants (Dr. Kent Daane, Brett Chandler travel) = **\$1220.81**  
Total = **\$8611.26**

It is with sincere gratitude that we thank the American Vineyard Foundation for funding this grant proposal. Your funding and support catapulted our efforts to establish a highly successful Lodi Mealybug Biocontrol Research Focus Group, which continues to provide a wealth of knowledge and experience for our region and to create real-world, applicable outreach materials through collaborations between scientists, industry, and growers. Thank you so very much!

With gratitude,



Stephanie L. Bolton, PhD  
Lodi Winegrape Commission

## APPENDIX

## AN IMPORTANT FIRST STEP IN BIOCONTROL: DON'T KILL THE GOOD INSECTS!

Your **CD11 Mealybug Biocontrol Research Focus Group** has put together this regionally-specific chart, based on the **UC-IPM Relative Toxicities of Insecticides and Miticides Used in Grapes to Natural Enemies and Honey Bees Table**, available online at [ipm.ucanr.edu/PMG/r302900111.html](http://ipm.ucanr.edu/PMG/r302900111.html), and years of real-world experience.



Help the good insects (beneficials, predators, parasites) help you!  
 What GOOD insects are we trying to keep ALIVE, anyways?

The **Anagyrus wasps**, **Cryptolaemus beetles**, and **Lacewings** who attack mealybugs.

The **predatory mites**, **six-spotted thrips**, and **minute pirate bugs** who attack mites.

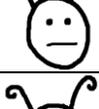
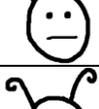
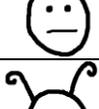
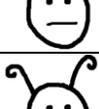
The **Anagrus wasps** and **green lacewings** who attack leafhoppers.

The **parasitic wasps** and **flies** who attack caterpillars and omnivorous leafrollers.



Trade Name	Common name	MOA	Good insects stay alive	May reduce good insects	Good insects are killed	Notes
Acramite	bifenazate	20D				
Admire Pro (soil)	imidacloprid	4A				
Altacor	chlorantraniliprole	28				
Altrevin	metaflumizone bait	22B				
Apollo	clofentezine	10A				
Boric Acid	disodium tetraborate	unknown				

Trade Name	Common name	MOA	Good insects stay alive	May reduce Good insects	Good insects are killed	Notes
Bt	<i>Bacillus thuringiensis</i>	11A				
Envidor	spirodiclofen	23				
Esteem ant bait (soil)	pyriproxyfen	7C				
Intrepid	methoxyfenozide	18				
Movento	spirotetramat	23				
Nealta	cyflumetofen	25A				
Omni Supreme	narrow range oil	contact				
Onager	hexythiazox	10A				
Surround	kaolin clay	-				
Tango	S-methoprene	7A				

Trade Name	Common name	MOA	Good insects stay alive	May reduce good insects	Good insects are killed	notes
Trilogy	neem oil	multiple				broad spectrum but low toxicity to beneficial insects
Actara (foliar)	thiamethoxam	4A				may cause flare-ups of spider mites
Admire Pro (foliar)	imidacloprid	4A				toxic to bees and parasitic wasps
Agri-Mek	abamectin	6				appears to kill six-spotted thrips; moderate toxicity to predatory mites
Applaud	buprofezin	16				kills lady beetles
Assail (foliar)	acetamiprid	4A				toxic to bees and parasitic wasps
Belay (foliar)	clothianidin	4A				toxic to bees and parasitic wasps
M-Pede	insecticidal soap	dehydration				broad spectrum – moderate toxicity to all insects
Success, Entrust	spinosad	5				may kill predatory thrips, flies, lacewings, and beetles
Venom (foliar)	dinotefuran	4A				toxic to bees and parasitic wasps
Zeal	etoxazole	10B				sterilizes female predatory mites

Trade Name	Common name	MOA	Good insects stay alive	May reduce good insects	Good insects are killed	Notes
Danitol	fenpropathin	3A				broad spectrum toxicity to beneficial insects and predatory mites
Delegate	spinetoram	5				moderate toxicity to beneficial predators and parasites
Fujimite	fenpyroximate	21A				high toxicity to predatory mites
Imidan	phosmet	1B				high toxicity to beneficial insects
Lorsban Advanced	chlorpyrifos	1B				high toxicity to beneficial insects
Malathion	malathion	1B				high toxicity to beneficial insects
Pyganic	pyrethrin	3A				moderate toxicity to beneficial predators and parasites
Pyrenone	pyrethrin/piperonyl butoxide	3A				high toxicity to beneficial insects
Sevin	carbaryl	1A				moderate toxicity to beneficial predators and parasites

For the “**May reduce good insects**” category, you may wish to seek further advice from your local Farm Advisor because the risk to beneficials can be dependent on application, timing, and cover crop use. Remember to rotate chemistries and follow label application instructions carefully to delay resistance development. Using **beneficial insects** for **biocontrol** of other insects/mites is an **IMPORTANT** part of **resistance management** in your vineyard.

Please share your personal vineyard experiences with different plant protectants and their effect on beneficial insects! [stephanie@lodiwine.com](mailto:stephanie@lodiwine.com)

# LODI WINEGRAPE COMMISSION

MEALYBUG ID FIELD DAY

August 8<sup>th</sup>, 2017

A special thanks to our host, Jay Leone, and the American Vineyard Foundation for partially funding the Mealybug Biocontrol Research Focus Group's educational outreach.

## AGENDA

**Welcome** by Stephanie Bolton, Lodi Winegrape Commission

**Introduction to the Mealybug Biocontrol Research Focus Group**

**Importance of Mealybug IPM** by Chris Storm, Vino Farms

**Mealybugs and Biocontrol** by Kent Daane, UCCE

**Ant Identification** by Dawn Brunmeier, BASF

**Stations:** This is an interactive field day, where you are welcomed into Jay's organic vineyard to learn how to identify vine mealybugs, vine mealybugs that are parasitized by the *Anagyrus* wasp, and ants. Enter any marked row and find someone there to show you the mealybugs or explore the vineyard for wet trunks and try it on your own. Check out the microscope table for an up-close look at ants and mealybugs!

We hope that you will go into your own vineyards and look for the parasitized mealybugs! If you find them, please let us know as we want to keep track of how widespread the parasitic wasps are in our region.

[stephanie@lodiwine.com](mailto:stephanie@lodiwine.com) or 209.367.4727.

## **HOW TO FIND MEALYBUGS PARASITIZED BY THE ANAGYRUS WASP:**

1. Look for wet trunks in the vineyard.
2. Check the bottoms of leaves near the wet spots for mealybugs.
3. A *healthy* mealybug will appear flat. *Parasitized* mealybugs will either be puffy and yellow (these ones still have the wasp egg inside of them) or puffy with an exit hole (the wasp egg hatched and the larvae ate its way out of the mealybug's body).





### **VINE MEALYBUG & VIRUS FACTS (aka why we care so much about these mealybugs)**

- vine mealybugs can infect a grapevine with LEAFROLL VIRUS in just one hour
- each female vine mealybug can produce HUNDREDS of eggs
- vine mealybugs have SEVERAL generations each growing season
- vine mealybug mating in the late summer – fall determines the population for the next growing season
- vine mealybugs move into the lower trunk and roots during the Winter, then move up the vine in the Spring when the weather warms up
- vine mealybugs can live underground on the roots, and currently there is no method to destroy them down there → which means that even if you plant 100% certified virus-tested 2010 protocol rootstock cultivated on separate, virgin ground at the nursery, mealybugs underground at your planting site could quickly infect the new grapevines with virus
- vine mealybugs are especially hard to eradicate because they live underneath the trunk bark, where pesticides cannot reach
- grapevines infected with leafroll virus may experience lower yields, inefficient photosynthesis, higher acidity levels, and delayed ripening
- virus-infected vines are more susceptible to water stress and have a harder time reaching desired sugar levels

### **VINE MEALYBUG BIOCONTROL 101**

- *Anagyrus* wasps lay an egg inside the female mealybugs, killing her
- *Cryptolaemus* beetles eat female mealybugs and are called the “mealybug destroyer” (if you haven’t watched a YouTube video of this yet, do it asap)
- the more mealybugs that are destroyed by natural insects, the better: biocontrol helps DELAY pesticide resistance in your vineyard
- pheromone mating disruption is becoming more economical and some growers have had success with it
- it’s very important that you think about beneficial insects when planning a spray program, and choose pesticides which only kill the bad insects, not the good ones (see “DON’T KILL THE GOOD INSECTS” chart, attached)
- some ant species will tend to the mealybugs because they feed off of their honeydew (the sticky material which makes trunks, leaves, and even fruit wet) → why ant control needs to be part of mealybug management

Read more on the lodigrowers.com blog – search “mealybug.”

## **BIOCONTROL**

Associates Insectary  
PO Box 969, Santa Paula CA 93061  
Brett Chandler | info@associatesinsectary.com  
805.933.1301 | associatesinsectary.com

FAR, Inc.  
550 Foothill Pkwy, Corona CA 92882  
Joe Barcinas | farinc@att.net  
951.371.0120 | far-inc.com

## **MEALYBUG BIOCONTROL RESEARCH FOCUS GROUP**

Lodi Winegrape Commission  
2545 W Turner Rd, Lodi CA 95242  
**Stephanie Bolton\*** | stephanie@lodiwine.com  
209.367.4727 | lodigrowers.com

**Dawn Brunmeier\*** | dawn.brunmeier@basf.com  
Technical Services Representative, BASF | basf.com

**Matt Kassis\*** | mkassis@wilburellis.com  
Agribusiness Division, Wilbur Ellis | wilburellis.com

**Mike Klouda\*** | mklouda@michaeldavidwinery.com  
Viticulturist, Michael David Winery

**Jay Leone\*** | jayleone@juno.com  
Crush District 11 Organic Winegrape Grower

**Jeff Perlegos\*** | perlegos@yahoo.com  
Crush District 11 Grape Grower

Viticultural Services  
14085 N Vintage Rd, Lodi CA 95220  
**Mark Shimozaki\*** | vitserv56@gmail.com  
209.329.3391

**Chris Storm\*** | cstorm@vinofarms.net  
Viticulturist, Vino Farms

UC Cooperative Extension - San Joaquin County  
2101 E Earhart Ave, Suite 200, Stockton CA 95206  
**Paul Verdegaal\*** | psverdegaal@ucanr.edu  
209.953.6119 | cesanjoaquin.ucanr.edu

**Larry Whitted\*** | lrwhitted@aol.com  
209.327.6472 | mediate.com/lwhitted

## **UCCE**

UC Cooperative Extension Specialist –  
Kearney Agricultural Research and Education Center  
9240 S Riverbend Ave, Parlier CA 93648  
**Kent Daane\*** | kdaane@ucanr.edu  
559.646.6522 | ucanr.edu/?facultyid=481

\* These companies or individuals were somehow involved in today's MEALYBUG ID FIELD DAY - thank you!!

Also a VERY SPECIAL thanks to Jay Leone for hosting everyone, the LWC Research, Education, & Communications Committee, and Melissa Macho and Stuart Spencer (Lodi Winegrape Commission) for helping set everything up!

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**Interested in joining our GRAPEVINE VIRUS RESEARCH FOCUS GROUP?** Contact **Charlie Starr\***, [cstarriv@gmail.com](mailto:cstarriv@gmail.com).

**Interested in joining our GRAPEVINE ROOTSTOCK RESEARCH FOCUS GROUP?** Contact **Stephanie Bolton\***, [stephanie@lodiwine.com](mailto:stephanie@lodiwine.com).

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**Want to participate in a UC Davis Grapevine Virus Survey?** "Hello, I am Kari Arnold. I work with Deborah Golino, the Director of Foundation Plant Services at UC Davis, and Neil McRoberts, the UC Davis Plant Pathology Epidemiologist. I am surveying new, certified material (both rootstock and scion) which has been planted in the current year, or the past year or two, for viruses. I would prefer both the scion and rootstock be certified, but may be interested in material not provided via the certification program, ie you collected the scion wood from a neighbor or your own blocks. The survey will run from August 4th to the end of October and consists of no cost to the grower, so please reach out to me as soon as you can so we can schedule a visit!"

**Kari Arnold\*** | 402.763.7518  
Post Doctoral Researcher, UC Davis Plant Pathology Dept.

08.22.2017

## Lodi Looks at Biocontrol for Vine Mealybug

Field day and research group encourage programs to protect beneficial insects

by Ted Rieger



Pest Control Advisor Larry Whitted and organic grower Jay Leone examine a grapevine leaf for parasitized mealybugs in Leone's Lodi vineyard during the Lodi Winegrape Commission's mealybug biocontrol field day. Photo: Ted Rieger.

**Lodi, Calif.**—Management of vine mealybug (*Planococcus ficus*) in California vineyards has been problematic because of this pest's high reproduction potential with multiple generations, and its year-round presence with life stages that overwinter under vine bark where it is difficult to apply treatments.

The vine mealybug (VMB) causes damage by feeding on grape clusters and vine parts where it produces honeydew that provides a medium for mold growth, and makes grapes unmarketable. In addition, the VMB is a vector of grapevine leafroll-associated viruses.

When the VMB became an issue in California vineyards in the 1990s, common advice was to use strong insecticides, such as Lorsban (chlorpyrifos) to eliminate the pest. In some cases, this later led to more mite and leafhopper problems as beneficial predators of those pests were also killed. Over time, other chemicals and control methods became available.

Now growers are taking a more integrated approach to VMB control.

The Lodi Winegrape Commission's (LWC) recently formed the Mealybug Biocontrol Research Focus Group, which held a field day Aug. 8 to educate growers in field identification and management of the VMB, and the identification of parasitized mealybugs and insects that are effective mealybug predators. LWC research and education director, Dr. Stephanie Bolton, coordinates the focus group's activities as the principal investigator for a two-year project funded by the American Vineyard Foundation. "A primary objective for the research focus group is to educate growers on what we can do to integrate more biocontrol into our normal integrated pest management (IPM) programs and spraying activities," Bolton said.

The field day was hosted by organic grower Jay Leone, in a 30-acre block of Cabernet Sauvignon that has a high endemic population of the parasitic wasp (*Anagyrus pseudococci*). This wasp was imported and introduced into California in 1934 by the citrus industry for control of the citrus mealybug. Releases of the wasp have also been made in California vineyards for VMB control, and it has established populations in many vineyard regions. Other wasp species are found in California that are VMB parasitoids, but *A. pseudococci* is the dominant parasitoid throughout the state.

Leone is advised by Lodi area consultant Larry Whitted, a licensed pest control adviser (PCA) and a certified crop adviser (CCA). In 2016, Whitted discovered an unusually high level of VMB biocontrol occurring in Leone's vineyard. Although many vine trunks were wet with colonies of VMB under the bark, as the VMB moved off the trunk to leaves, they were heavily parasitized by the Anagyrus wasp. Whitted also found significant VMB parasitism by the wasps in other vineyards in Lodi and Clarksburg. Whitted invited UC Cooperative Extension specialist Dr. Kent Daane, a research entomologist that has studied VMB in California since its arrival in the 1990s, to Leone's vineyard to confirm his observations.

Speaking at the field day, Daane said, "Last year, I couldn't find any live mealybugs in leaves or fruit, and this vineyard had one of the highest degrees of parasitism I have ever seen."

Leone's vineyard is more than 20 years old and was originally farmed conventionally. Leone bought the vineyard seven years ago and converted it to organic production. The vines had minimal powdery mildew this year and no sprays were applied. Many of the vines show Eutypa dieback symptoms, a common issue in older Cabernet vines, but the vineyard still produces 3 tons per acre. With the high populations of parasitic wasps, the VMB is kept in check, mostly confined to lower portions of the vine without causing fruit damage. No leafroll virus problems have been identified in the vineyard to date.

At the field day, attendees took loupe style magnifying hand lenses and walked the vineyard to look for signs of VMBs and parasitic wasps, commonly found on the undersides of grape leaves. Healthy VMBs appear flat, whereas parasitized VMBs can appear puffy and yellow. The female wasp oviposits an egg in the VMB host, either an adult or a nymph. As the wasp larva develops, the VMB host becomes immobilized in about one week and is then mummified. The adult wasps emerge from an exit hole in the mummified VMB in about two to three weeks. As Whitted explained, "If you see an exit hole in the VMB, you know it was parasitized."

Attendees were encouraged to look for parasitized mealybugs in their own vineyards and report finds to the LWC to track the distribution and spread of beneficial insects in the Lodi region.

### **'Don't kill the good insects'**

The LWC research focus group is educating growers to integrate biocontrol into their VMB management. The first step, as Bolton emphasized, "Don't kill the good insects!"

In addition to *Anagyrus* wasps, other VMB predators include *Cryptolaemus montrouzieri*, a type of lady beetle also called the mealybug destroyer, and lacewings. Both of these predators are found in Leone's vineyard and in the Lodi region. *Anagyrus* wasps and lacewings also prey upon leafhoppers. Beneficial insects found in Lodi vineyards that control mites are six-spotted thrips, minute pirate bugs and predatory mites. Parasitic wasps and flies can control caterpillars and omnivorous leafrollers.

Daane also mentioned predaceous midge flies in the family *Cecicomyiidae* are found in some California vineyards that can feed on mealybug eggs and larvae.

To assist growers, the LWC focus group produced and distributed a chart based on the "UC-IPM Relative Toxicities of Insecticides and Miticides Used in Grapes to Natural Enemies and Honey Bees Table." The LWC's simplified table lists the major pesticides registered in California for use in grapes based on their potential effects on beneficial insects divided into three categories: "Good insects stay alive," "May reduce good insects," and "Good insects are killed." The chart is available at the LWC website.

Growers have found Movento (spirotetramat) to be good for VMB control while also being safe for beneficial predators. However, there is concern about the VMB developing resistance over time to Movento. Movento is sometimes rotated with neonicotinoid pesticides, such as Admire Pro (imidacloprid), safe for beneficial insects when used in a soil (dripline) application.

### **Control timing and mating disruption**

Daane emphasized the importance of timing in controlling VMB, related to pesticide applications. The VMB overwinters under bark in the vine trunk and on vine roots underground. VMBs start to move up the vine in spring as temperature increases, vine growth begins, and populations increase. The VMB can produce up to six generations during the growing season in Lodi, and population density increases until harvest. Movento is applied as a foliar treatment taken into the leaves to kill VMBs after feeding. "You want Movento taken up into the vine before the VMBs begin moving up from the trunk," Daane advised.

Suterra, a supplier of biocontrol products for insect control based in Bend, Oregon, first introduced VMB pheromone dispensers (CheckMate VMB-XL) to place in vineyards for mating disruption. The dispensers are placed once per season in the vineyard, timed to coincide with the first significant male VMB flight in May-June, at a rate of 250 per acre.

Suterra more recently introduced a sprayable pheromone product "CheckMate VMB-F" that is more economical to buy and apply by being sprayed on vine foliage. In many cases, it can be applied in combination with regular insecticide or fungicide applications. This product creates more point sources that attract male VMBs and make it more difficult for them to find the female VMBs. Spray applications are recommended at monthly intervals from about late May to early October, depending on location and temperatures that affect VMB development. Mating disruption tends to be more effective when VMB populations are at lower levels.

Daane said mating disruption can also help with biocontrol. “We think we get increased VMB parasitism when mating disruption is used, because we think the pheromone is attracting *Anagyrus*, and it keeps the wasps in the area searching for VMBs,” he said.

### **Ant control**

Some ant species, such as Argentine ants, feed on the sticky, sugary honeydew created on vine parts from VMB feeding activity, and they will protect and tend mealybugs for this reason. When ants are present, ant control must be part of a management program to allow the insect predators to access the VMBs.

### **Focus group activities**

The 11-member LWC focus group meets once a month to plan and implement objectives. The group plans to determine which mealybug biocontrol agents are providing control in the region and educate growers on how to keep existing populations of beneficial insects alive and healthy. The group is working with California biocontrol insectaries to look at cost-effective methods to increase local parasitic wasp populations and the possible use of wasp releases in the area.

Joe Barcinas, manager of Foothill Agricultural Research Insectary in Corona, Calif., visited Lodi and collected samples of wasp specimens from the Leone Vineyard for possible use as breeding stock at his insectary. The focus group intends to formulate a long-term management plan to establish economically feasible and impactful mealybug biocontrol.

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THE LODI WINEGRAPE COMMISSION brings you a

# MEALYBUG & VIRUS OUTREACH MEETING

**ABSOLUTELY NOT** just “another mealybug and virus talk.”

---

Robert Cabral Ag Center, 2101 E. Earhart Ave., Stockton, CA 95206

April 4<sup>th</sup>, 2018

**HIGHLIGHTS OF TODAY.** Grapevine viruses are expensive, complicated, & confusing, but HELP is on the way. Learn REAL-WORLD management tips based on months of discussions in LODI Mealybug Biocontrol & Grapevine Virus Research Focus Groups. At this meeting, you can also: take home a FREE mealybug trap, take home a NURSERY ORDERING 101: VIRUSES draft booklet to review, and sign up for future virus outreach programs. It's imperative that everyone in our industry – growers, PCAs, nurseries, laboratories, wineries, lawmakers, & more – START THE CONVERSATION about the virus situation so that we can continue to produce profitable, quality winegrapes in California.

## AGENDA

- 9:00 – 9:30am**      **CONTINUING EDUCATION CREDITS (DPR & CCA) SIGN-IN.**  
3.0 hours of DPR CE (other) and 2.5 hours of CCA CE (IPM) available
- 9:30 – 9:40am**      **WELCOME & INTRODUCTIONS.**  
Stephanie Bolton, PhD, Lodi Winegrape Commission
- 9:40 – 9:55am**      **CAWG VIRUS BEST MANAGEMENT project update.**  
Karen Suslow, project lead
- 9:55 – 10:10am**      **MEALYBUG & VIRUS TRUE CONFESSIONS.**  
...aka the local ECONOMICS of the challenge
- 10:10 – 10:40am**      **VINE MEALYBUGS.**  
management, biocontrol, trapping, as leafroll virus vectors
- 10:40 – 10:50am**      **ANTS.**  
why you need to pay attention to them, baiting experiments
- 10:50 – 11:15am**      **LEAFROLL VIRUS.**  
the basics, management, rogueing, replanting
- 11:15 – 11:30am**      **RED BLOTCH VIRUS.**  
the basics, management, rogueing, replanting
- 11:30 – 11:45am**      **NURSERY ORDERING 101: viruses.**  
how to order CDFA-certified, virus-tested planting material
- 11:45am – 12:00pm**      **VIRUS TESTING.**  
why test, how to test for grapevine viruses efficiently
- 12:00 – 12:30pm**      **BREAK OUT SESSIONS with the pros:**
- Mealybug biocontrol insects
  - Pheromone mating disruption for vine mealybugs
  - Virus testing laboratories
  - Nursery ordering
  - CDFA Clean Grapevine Program/FPS
- 12:30 – 1:15pm**      **CATERED LUNCH & DESSERT**
- 1:00 – 1:30pm**      **MEALYBUG TRAP & NURSERY ORDERING BOOKLET distribution**

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# MEALYBUG & VIRUS OUTREACH MEETING: AFTERNOON TECHNICAL SESSIONS

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Robert Cabral Agricultural Center, Stockton, CA

April 4<sup>th</sup>, 2018

**1:30 – 4:00pm**

## **TECHNICAL SESSIONS for FOCUS GROUPS & INDUSTRY**

2.5 hours of DPR CE (other) and 2.5 hours of CCA CE available

### **DELTA ROOM: GRAPEVINE VIRUS TESTING in CALIFORNIA**

LODI Grapevine Virus Research Focus Group, all California Virus Testing Laboratories, Dr. Maher Al Rwahnih (FPS), Regional Viticulture Leaders

**1:30 – 1:45pm**

**Introductions & OBJECTIVES of LODI Grapevine  
Virus Research Focus Group**

**1:45 – 2:00pm**

**Review of the INTEGRATED OUTREACH STRATEGY**

**2:00 – 2:45pm**

**Complications in virus testing with leafroll-3 virus**

**2:45 – 3:15pm**

**Review of leafroll-3 testing in CALI laboratories**

**3:15 – 4:00pm**

**How to improve virus testing for CALI grape industry**

### **MOKELUMNE ROOM: MEALYBUG RESEARCH IN CRUSH DISTRICT 11**

LODI Mealybug Biocontrol Research Focus Group, Lodi Winegrape Commission REC Committee Members, Dr. Kent Daane, Brett Chandler (Associates Insectary), Pheromone Mating Disruption Companies (Suterra, Pacific Biocontrol)

**1:30 – 1:45pm**

**Introductions & OBJECTIVES of LODI Mealybug  
Biocontrol Research Focus Group**

**1:45 – 2:15pm**

**Review of current mealybug mgmt. research**

**2:15 – 2:45pm**

**Ant bait experiments**

**2:45 – 3:30pm**

**Ideas for new mealybug mgmt. research**

**3:30 – 4:00pm**

**Coordinating neighborhood initiatives (pheromone  
mating disruption, trapping, biocontrol insects,  
spraying without killing beneficials)**

# OUR CALIFORNIA GRAPEVINE VIRUS STRATEGY.



**Decrease vector populations.**



**Lower virus inoculum.**

**Why? The future of our industry depends on what we do today.**



## We can't beat these viruses alone.



### **Growers**

Education, vector management, and lowering the amount of virus inoculum on each farm.



### **Nurseries**

Providing growers with reliably clean rootstock and scion material.



### **FPS**

Providing nurseries with reliably clean propagation material.



### **CDFA**

Administering an effective Grapevine Certification & Registration Program.



### **Academia**

Scientific research to validate & improve management strategies and new technologies for virus detection & management.



### **Virus Testing Labs**

Providing reliably accurate, efficient, and economical virus testing for plant material.



### **Wineries**

Education and teamwork with growers to beat the virus challenge.



### **Extension**

Virus education outreach and connection to resources needed.



### **IPM Companies**

Vector control that keeps the natural enemies of vine mealybug doing their job.



### **PCAs/Viticulturists**

Education, vector management, virus detection and management.



### **County Ag Commissioners**

Education, vector management, regional organization and leadership.



### **Regional Associations**

Education, vector management, regional organization and leadership.

# LODI WINEGRAPE COMMISSION, *est.* 1991

MEALYBUG & VIRUS OUTREACH MEETING • April 4<sup>th</sup>, 2018 • [lodigrowers.com](http://lodigrowers.com)

*Please note: Thanks to everyone who contributed to today's meeting! The information presented today is intended as educational only. Each person will ultimately manage for mealybugs & viruses on an individual basis according to what makes economic sense for them personally.*

## FURTHER RESOURCES

### VIRUS TESTING LABORATORIES

#### **Agri-Analysis LLC**

950 W Chiles Rd, Davis CA 95618 (sample delivery)

PO Box 285, Davis CA 95616 (mailing address)

**Dr. Alan Wei\*** | [info@agri-analysis.com](mailto:info@agri-analysis.com)

800.506.9852 | [agri-analysis.com](http://agri-analysis.com)

#### **AL & L Crop Solutions**

7769 N Meridian Rd, Vacaville CA 95688

**Dr. Anna-Liisa Fabritius\*** | [info@allcropsolutions.com](mailto:info@allcropsolutions.com)

530.387.3270 | [allcropsolutions.com](http://allcropsolutions.com)

#### **California Seed and Plant**

3556 Sankey Rd, Pleasant Grove, CA 95668

**Dr. Parm Randhawa\*** | [parm.randhawa@csplabs.com](mailto:parm.randhawa@csplabs.com)

**Sukhi Pannu\*** | [sukhi.pannu@csplabs.com](mailto:sukhi.pannu@csplabs.com)

916.655.1581 | [csplabs.com](http://csplabs.com)

#### **eurofins US | EBDI Laboratories**

7240 Holsclaw Rd, Gilroy CA 95020

**Dr. Raquel Salati\*** | [raquelsalati@eurofinsUS.com](mailto:raquelsalati@eurofinsUS.com)

408.846.9964 | [eurofins.com/biodiagnostics](http://eurofins.com/biodiagnostics)

#### **Foundation Plant Services – Virus Diagnostics\***

455 Hopkins Road, Davis CA 95616

530.752.3590 | [fps.ucdavis.edu/custommain.cfm](http://fps.ucdavis.edu/custommain.cfm)

#### **Sunburst Plant Disease Clinic Inc.**

677 E Olive Ave, Turlock CA 95380

**Dr. Bhanu Donda\*** | [bdonda@sunburstpdcinc.com](mailto:bdonda@sunburstpdcinc.com)

Dr. Sam Livingston | [slivingston@sunburstpdcinc.com](mailto:slivingston@sunburstpdcinc.com)

209.667.4442 | [sunburstpdcinc.com](http://sunburstpdcinc.com)

#### **Wonderful Nurseries – Virus Testing Laboratory**

449 N Zerker Rd, Shafter, CA 93263

**Brad Kroeker\*** | 661.406.9919

[brad.kroeker@wonderful.com](mailto:brad.kroeker@wonderful.com) | [wonderful.com](http://wonderful.com)

### CDFA Grapevine Registration & Certification Program

1220 N Street, Room 344, Sacramento CA 95814

916.654.0435 | [nurseryservices@cdfa.ca.gov](mailto:nurseryservices@cdfa.ca.gov)

[cdfa.ca.gov/plant/pe/nsc/nursery/grapevine.html](http://cdfa.ca.gov/plant/pe/nsc/nursery/grapevine.html)

### VINE MEALYBUG MATING DISRUPTION

#### **Pacific Biocontrol (product in development)**

911 Industrial way, Suite A, Lodi CA 95240

**Jeannine Lowrimore\***

[jlowrimore@pacificbiocontrol.com](mailto:jlowrimore@pacificbiocontrol.com)

209.603.9244 | [pacificbiocontrol.com](http://pacificbiocontrol.com)

#### **Suterra (also our VMB trap donators! thank you!)**

2401 E Orangeburg Ave, #675, Modesto CA 95355

20950 NE Talus Pl, Bend OR 97701

**Loraine Lee\*** | [loraine.lee@suterra.com](mailto:loraine.lee@suterra.com)

**Sara Goldman\*** | [sara.goldman@suterra.com](mailto:sara.goldman@suterra.com)

209.595.5254 | [suterra.com](http://suterra.com)

### BENEFICIAL INSECTS

#### **Associates Insectary**

PO Box 969, Santa Paula CA 93061

**Brett Chandler\*** | [info@associatesinsectary.com](mailto:info@associatesinsectary.com)

805.933.1301 | [associatesinsectary.com](http://associatesinsectary.com)

#### **FAR, Inc.**

550 Foothills Pkwy, Corona CA 92882

Joe Barcinas | [farinc@att.net](mailto:farinc@att.net)

951.371.0120 | [far-inc.com](http://far-inc.com)

### USDA Tree Assistance Program (TAP)

USDA San Joaquin Co. Farm Service Agency  
(Red Blotch Virus)

7585 S Longe St, Ste. 10, Stockton CA 95206

**Jeff Torres\*** | [jeff.torres@ca.usda.gov](mailto:jeff.torres@ca.usda.gov)

209.337.2124 x2 | [fsa.usda.gov](http://fsa.usda.gov)

## Some of the NURSERIES selling CDFA-certified material

(contact CDFA for most current, complete list)

### **Casa Cristal Nursery**

1998 Road 152, Delano, CA 93215

**John Moso\*** | [jmoso@casacristal.com](mailto:jmoso@casacristal.com)

**Justin Jackson\*** | [jjackson@casacristal.com](mailto:jjackson@casacristal.com)

661.792.6468 | [casacristal.com](http://casacristal.com)

### **Duarte Nursery, Inc.**

1555 Baldwin Rd, Hughson, CA 95326

**Tia Russell\*** | [tia@duartenursery.com](mailto:tia@duartenursery.com)

209.531.0351 | [duartenursery.com](http://duartenursery.com)

### **Guillaume Grapevine Nursery**

21208 State Route 113, Knights Landing, CA 95645

**Cecil Jack\*** | [cecil@guillaumenurseries.com](mailto:cecil@guillaumenurseries.com)

530.379.5007 | [guillaumenurseries.com](http://guillaumenurseries.com)

### **NovaVine Grapevine Nursery**

6735 Sonoma Hwy, Santa Rosa, CA 95409

**Gene Glaeser\*** | [gglaeser@pacbell.net](mailto:gglaeser@pacbell.net)

916.747.2131 | [novavine.com](http://novavine.com)

### **Sunridge Nurseries**

441 Vineland Rd, Bakersfield, CA 93307

**Julian C. Clymer\*** | [julian@sridge.net](mailto:julian@sridge.net)

707.974-2642 | [sunridgenurseries.com](http://sunridgenurseries.com)

### **Wonderful Nurseries LLC**

27920 McCombs Ave, Wasco, CA 93280

**Nicholas Podsakoff\*** | 209.456.0697

[nicholas.podsakoff@wonderful.com](mailto:nicholas.podsakoff@wonderful.com)

[wonderful.com](http://wonderful.com)

## University of California

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Foundation Plant Services Diagnostics & Research Lab

530.574.5463 | [malrwahnih@ucdavis.edu](mailto:malrwahnih@ucdavis.edu)

### **Dr. Kent Daane\***

Vine Mealybug Expert

Kearney Agricultural Research & Education Center

559.646.6522 | [kdaane@ucanr.edu](mailto:kdaane@ucanr.edu)

### **Dr. Lucia Varela\***

Mealybug & Ant Expert

North Coast IPM Advisor, UCCE

707.565.2621 | [lgvarela@ucanr.edu](mailto:lgvarela@ucanr.edu)

## EDUCATIONAL RESOURCES

Book: *Leafroll 3 Virus and how to manage it*. Edited by Ruby Andrew, Vaughn Bell, Nick Hoskins, Gerhard Pietersen, and Caine Thompson. New Zealand. 2015. (copy available to borrow from the Lodi Winegrape Commission)

Book: *Grapevine Viruses: Molecular Biology, Diagnostics, and Management*. Edited by Baozhong Meng, Giovanni P. Martelli, Deborah A. Golino, and Marc Fuchs. 2017. (copy available to borrow from the Lodi Winegrape Commission)

Institute for Grape and Wine Sciences  
South Africa | Leafroll Virus Management  
**Prof. Gerhard Pietersen\***  
[igws.co.za/content/fact-sheets/leafroll](http://igws.co.za/content/fact-sheets/leafroll)

Leafroll 3 Virus App from New Zealand  
*Find it on your app store*

Lodi Winegrape Commission  
2545 W Turner Rd, Lodi CA 95242

**Dr. Stephanie Bolton\*** | [stephanie@lodiwine.com](mailto:stephanie@lodiwine.com)  
209.367.4727 | [lodigrowers.com](http://lodigrowers.com)

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2101 E Earhart Ave, Suite 200, Stockton CA 95206  
**Paul Verdegaal\*** | [psverdegaal@ucanr.edu](mailto:psverdegaal@ucanr.edu)  
209.953.6119 | [cesanjoaquin.ucanr.edu](http://cesanjoaquin.ucanr.edu)

You can always learn more about viruses and their vectors (like mealybugs!) at our **CD11 LODI PCA NETWORK BREAKFAST MEETINGS**, held on the first Tuesday morning of every month except February from 7:30-9am at Burgundy Hall, Lodi Grape Festival Grounds, 413 E Lockeford St. Everyone is welcome at these meetings!  
RSVP to [lwwc@lodiwine.com](mailto:lwwc@lodiwine.com) or 209.367.4727.

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\* **These companies or individuals were somehow involved in today's Mealybug & Virus Outreach Meeting - thank you!!**

Also a **VERY SPECIAL thanks** to the LWC Research, Education, & Communications Committee and their Mealybug Biocontrol & Grapevine Virus Research Focus Groups, Dr. Marc Fuchs and Prof. Gerhard Pietersen for expert advice, Emily Dunlap and Daniel Meyers (Vino Farms) for volunteering to help with sign-in, and Christina Soto (Lodi Winegrape Commission)!

A very special THANKS to Suterra for donating vine mealybug pheromone traps for today's outreach meeting!

### **THREE WAYS TO USE YOUR NEW TRAPS** (see backside for more specific info):

#### **1. DO I HAVE MEALYBUGS?**

Don't think you have vine mealybugs in a vineyard block? Put a trap out and see! With the widespread populations of mealybugs occurring naturally in our region, you would be hard-pressed to find a vineyard without any at all. The highest flight rates occur later in the season, close to harvest.

#### **2. START YOUR NEIGHBORHOOD CONVERSATION.**

Use the traps to start a conversation about mealybugs and leafroll virus with your neighbors – bring a trap home for your neighbors so you can all see what is going on and learn together.

#### **3. A DECISION-MAKING TOOL.**

Traps can be used as a decision-making tool to know when to begin a pheromone mating disruption program or another treatment. Overwintering mealybugs start coming up from the roots and the base of the trunk in the spring as temperatures become warmer, slowly moving higher up the vine and into the canopy during the growing season. Between May-June are when the males (the only sex that can fly) start flying around in large numbers.

Traps can also help to show you how late in the season you have mealybug mating – you may be surprised to learn that even after harvest the mealybugs are mating, determining your population levels for the next growing season.

Finally, traps can help you monitor mealybug populations over time, from one year to the next, determining how effective your management programs are in different seasonal conditions.



### **FOLLOW-UP MALE MEALYBUG IDENTIFICATION WORKSHOP**

May 1<sup>st</sup>, 2018 • 9:15 – 10:15am • Burgundy Hall, Lodi, CA

Bring your used trap back on May 1<sup>st</sup> to Burgundy Hall at the Grape Festival Grounds (413 E Lockeford St, Lodi), where after our regular CD11 LODI PCA Network Breakfast Meeting (7:30-9am), we will have a special workshop to help you identify the VMB males with a microscope from 9:15-10:15am. Please join us for the Network Breakfast Meeting too – all are welcome! **RSVP to [lwvc@lodiwine.com](mailto:lwvc@lodiwine.com) or 209.367.4727**

### **NEIGHBORHOOD COORDINATION: why it matters**

It's common sense to control mealybugs, viruses, mildews, invasive weeds, and other pests on the vineyard blocks that you manage. However, what may *not* be as intuitive is why it is SO important to coordinate some of your pest/weed management activities with your neighbors. It is much more EFFECTIVE and CHEAPER if we work together when it comes to rotating mildew chemistries, lowering the amount of vine mealybugs and virus inoculum in our region, making sure not to use chemistries which kill off our region's beneficial insects, eradicating invasive weeds, and coordinating VMB mating disruption.

LODI WINEGRAPE COMMISSION, *est.* 1991 • RESEARCH  EDUCATION  PROMOTION

April 4<sup>th</sup>, 2018 Grower Meeting • [lodigrowers.com](http://lodigrowers.com) • 209.367.4727 • [stephanie@lodiwine.com](mailto:stephanie@lodiwine.com)

## Excerpt from UC IPM Pest Management Guidelines: Vine Mealybug for Grapes

last reviewed 7/2015, accessed on 3.29.18 @ [ipm.ucanr.edu/PMG/r302301911.html](http://ipm.ucanr.edu/PMG/r302301911.html)

Pheromone traps can help determine if vine mealybug is present within or near your vineyard. Place pheromone lures in small red delta traps in and around the vineyard by April 1 in the southern San Joaquin Valley, by May in areas further north, and by June in the North and Central Coast region (*in Lodi traps are going out in late March and early April for 2018*):



- Choose two trap sites for each 20-40 planted acres.
- Put one trap in the center of the block and the other on the edge near a staging area. These traps can attract vine mealybug males from as far away as 1/4 mile.
- Attach traps to the trellis wires so that they are in the cluster area/fruiting zone.
- Label the trap with the block name and row number of its location and the dates it remains in the vineyard.
- Check traps for the presence of male vine mealybug every 2 weeks through November.
- Follow the manufacturer's recommendations for storing and replacing pheromone lures.
- Record observations on a monitoring form.

It is essential to use a dissecting microscope to identify the male mealybug. (Male vine mealybugs are smaller than adult thrips and are very difficult to see even with a hand lens.) The sex pheromone is specific to the vine mealybug, but the traps may also contain other male mealybugs depending on the site. If there are questions as to the identification of the mealybug species, take samples to a farm advisor or county agricultural commissioner or refer to the Male Vine Mealybug Identification Sheet (included in this packet).

The number of males found in a trap depends upon its proximity to the infestation and to the time of year. In the North Coast, new infestations have been located near traps that caught very low numbers in June (5 to 10 males per trap per week) and high numbers in fall (more than 50 males per trap per week). In the San Joaquin Valley, an infested vineyard will have between 20 to 300 or more males per trap per week. In either region, low numbers of male vine mealybugs found in a trap may mean that the infestation is located in an adjacent block or in a more distant vineyard. If males are found, increase the number of traps in the vineyard, and locate the infestation by examining lower leaves for honeydew.

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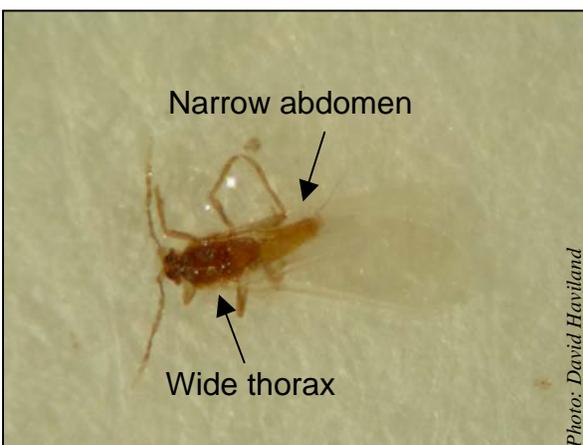
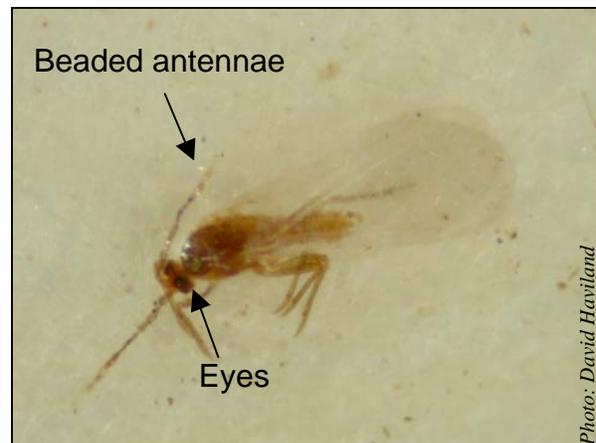
### How long can a trap stay up before I need to replace it?

Cleaner traps are easier to read. Traps may get covered with dust and insects, making them lose their stickiness. The age of the lure is more important than the age of the trap. The lure you were given today by Suterra is called a septa lure and they officially last 4 weeks in the field. Traps are usually checked every 2 weeks. So, if you need to replace a trap while the lure is still viable, remove the lure from the old trap WITH TWEEZERS OR A STICK and place it in the new trap.



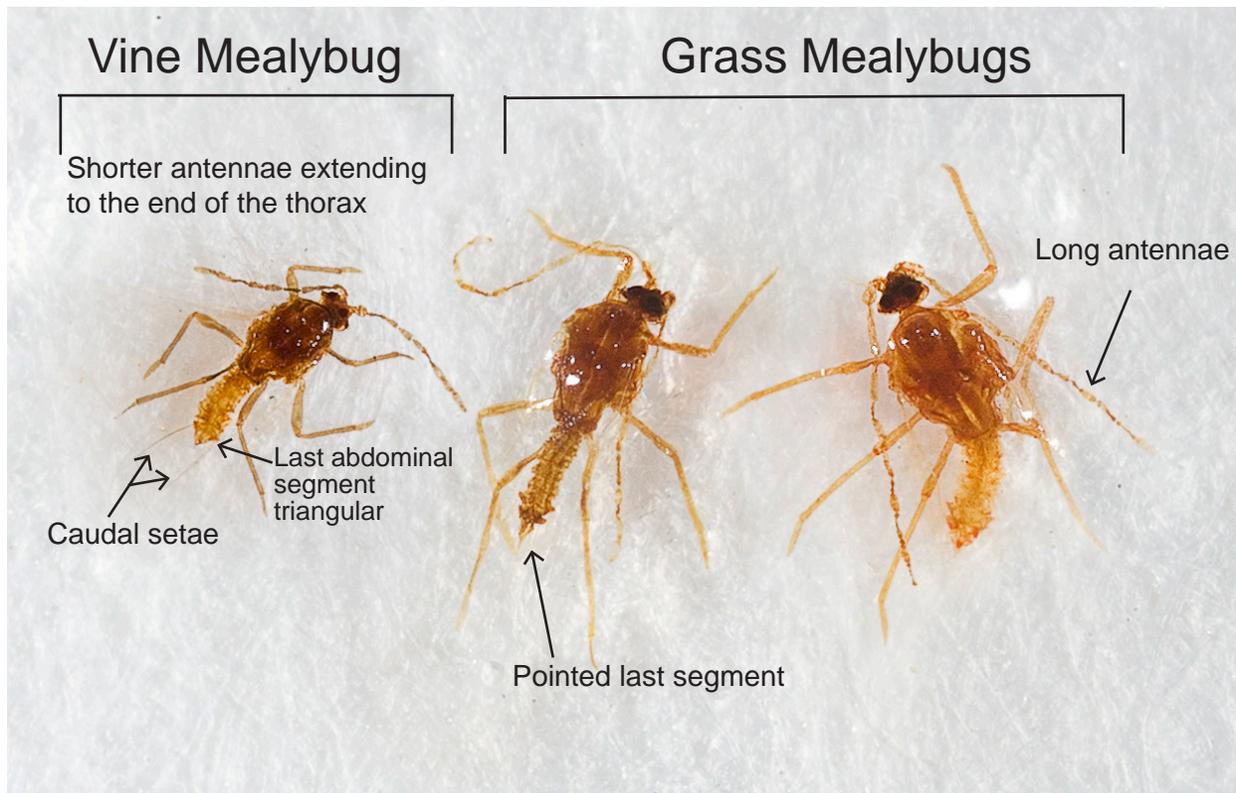
## Male Vine Mealybug Identification Sheet

These photographs are of male vine mealybug (*Planococcus ficus*) as they appear on a sticky trap. Use of a stereo microscope with 30X magnification will greatly aid in identification. The male vine mealybug is small (approximately 0.7 mm long) and amber brown in color. It has one pair of wings, but sometimes they are not visible because they are embedded in the stickum. The antennae are beaded, the trunk (thorax) is wider than the abdomen and there are four caudal setae (tail filaments), which usually appear as only two.



## Male Vine Mealybug (*Planococcus ficus*) and Grass Mealybugs (*Phenacoccus* spp.)

Vine Mealybug Male	Grass Mealybug Male
Smaller in size (approx. 0.7 mm)	Larger in size (approx. 1.0 mm)
Antennae as long as head and thorax	Antennae as long as the body length
Shorter legs	Longer legs
A pair of caudal setae	Caudal setae not visible
Last abdominal segment triangular in shape	Last abdominal segment pointed



## Other Small Insects Caught on Traps

These are examples of other small insects which may be caught on the stickum of vine mealybug pheromone traps and may appear similar to vine mealybug males.

