THE BUZZ

UC RIVERSIDE – DEPARTMENT OF ENTOMOLOGY
NEWSLETTER

Spring 2003

INTEGRATED PEST MANAGEMENT

By Beth Grafton-Cardwell

A few short years ago, choosing a strategy for citrus pest management in the San Joaquin Valley was a fairly straightforward decision. Growers either followed biologically-based citrus IPM or they used organophosphate and carbamate insecticides without regard to survival of natural enemies. The broad spectrum insecticide tactic was most commonly used because these insecticides were cheap and effective. Growers practicing biologically-based IPM released the parasitoid wasp *Aphytis melinus* for California red scale, *Aonidiella aurantii*, control and they used selective insecticides for other pests. Citrus thrips, *Scirtothrips citri*, were controlled with the botanical sabadilla or abamectin. Lepidopteran pests were controlled with Kryocide or *Bacillus thuringiensis*. Citrus red mites, *Panonychus citri*, were generally controlled by predacious mites and an occasional oil treatment. The most difficult pests to control in the biologically-based program were katydids, *Scuddaria furcata*, and citricola scale, *Coccus pseudomagnoliarum*, because these pests have ineffective biological control. However, both of these pests are very susceptible to organophosphate insecticides and very low rates could be used to modify their populations. Key natural enemies had been exposed to organophosphates for so many years that they had developed sufficient levels of resistance to tolerate occasional sprays of low rates of organophosphates, especially Lorsban (chlorpyrifos).

Sooty mold caused by cottony cushion scale infestation

During the 1990s, **Yuling Ouyang** (SRA) determined that many of the California red scale populations had developed resistance to organophosphate and carbamate insecticides. **Joseph Morse** had documented a similar resistance problem in citrus thrips. In the mid 1990s, California red scale resistance became so severe that a number of growers treated 3 of 4 generations of red scale per year with all available insecticides at a cost of $160/acre/application and still did not obtain adequate control. The high cost of resistance and the loss of fruit quality caused a number of growers to shift to the biologically-based program. The remainder of the growers waited for new insecticides to be registered. A large number of new insecticide registrations occurred between 1997 and 2002 as a result of pesticide trials conducted by **Chris Reagan** (SRA) and **Alan Urena** (SRA for Joseph Morse) at the Lindcove Research and Extension Center. The insect growth regulators (IGRs) Esteem (pyriproxifen) and Applaud (buprofezin) are used for California red scale and the pyrethroids Baythriod (cyfluthrin), Danitol (fenpropathrin), and Success (spinosad) are used for citrus thrips control. The neonicotinoid class of insecticides including Provado (foliar imidacloprid), Admire (systemic imidacloprid) and Assail (acetamiprid) are effective against citricola scale. Many of the new insecticides (Esteem, Applaud, Success, and Assail) are considered 'reduced risk' because they have very low mammalian toxicity. The benefits are enormous for worker safety. However, we are learning that reduced risk insecticides are not always fully selective for arthropod natural enemies. The IGRs have been shown to be fairly soft on Hymenopterous parasitoids, but are very toxic to predatory beetles such as vedalia beetle, *Rodolia cardinalis*. When these insecticides were first introduced in 1998, vedalia disappeared from the San Joaquin Valley for 9 months. The neonicotinoids are fairly broad spectrum, killing most natural enemies for 1-3 months.

Vedalia beetle feeding on cottony cushion scale infestation

The vedalia beetle seems to be especially sensitive to all of the new insecticides except Success. If vedalia beetle is eliminated by insecticides, the insecticides available to control cottony cushion scale, *Icerya purchasi*, include three of the most broad spectrum insecticides Supracide (methidation), Malathion, and Sevin (carbaryl). Vedalia beetle is usually more effective in reducing cottony cushion scale than these insecticides. **Ping Gu** (Lab Assistant) is studying the population development of cottony cushion scale and the temperature and insecticide tolerance of vedalia beetle. We have developed a method of preserving vedalia by avoiding disruptive insecticides early in the season and moving vedalia beetles to orchards where they are needed. We are in the process of developing sampling methods and economic thresholds for cottony cushion scale, because we can see that insecticide disruption of vedalia is likely to continue and it will cause sporadic, severe outbreaks of cottony cushion scale.

Mining of a Fukumoto orange by citrus peelminer

In large plot trials conducted in commercial citrus, **Janine Lee** (Lab Assistant) has been monitoring the effects of insect growth regulators and neonicotinoids on pests and natural enemies. We have found that these groups of insecticides do not control the various scale species (California red scale, citricola scale, cottony cushion scale) equally well. Thus, pest management using insecticides is much more complicated than it used to be. Growers must know more about the precise species and densities of scale in their orchards to make the appropriate insecticide choice.

The main result of the shift to new insecticides in San Joaquin Valley has been to exchange key pests. Previously, California red scale and citrus thrips were the primary pests. With the advent of IGRs and Success, these insect pests are now fairly well controlled. However, these insecticides are not effective against katydids, citricola scale and cottony cushion scale. These pests are rising to primary pest status in a number of orchards.

To make the situation even more difficult, exotic pests are entering California at an increasingly rapid rate. Often they arrive without natural enemies, and, if they have the potential for heavy damage or disease transmission, then tolerance of these pests is very low. Glassy-winged sharpshooter, *Homalodisca coagulata*, uses citrus as a major ovipositional host. Because this pest transmits the bacterium that causes Pierce's disease in grapes, many areas of California are under a program of sharpshooter suppression. Unhappily, the most effective insecticides are the pyrethroids and neonicotinoids, which are fairly broad spectrum.

Citrus peelminer, *Marmara gulosa*, was an insignificant problem in the San Joaquin Valley until the late 1990s, when it expanded its host range to include many varieties of citrus and a number of different crops including cotton, grapes, ornamentals, and vegetables. Previously it had attacked a low percentage of fruit in grapefruit orchards in a limited area of the valley. **Marta Guillen** (post doc) and **Richard Stouthamer** are studying this biotype to determine if a new strain has arrived. **Jocelyn Millar** is developing a synthetic sex pheromone to trap male moths and determine flight phenology. We have conducted pesticide trials and found insecticides to be fairly ineffective in controlling this pest. **Janet McClain** (Lab Assistant) is releasing *Cirrospilus coachellae* parasites (reared at UCR by **Marta Guillen** and **Neil Smart**) in various locations around the San Joaquin Valley. We have developed an interactive web site and **Greg Montez** (SRA) and **Melissa O'Neal** (Lab Assistant) are monitoring the expansion of the pest in citrus using the GIS software ArcView. This analysis of the distribution of the pest and surrounding cropping systems will provide us with a picture of high risk areas where natural enemy releases can be concentrated.

Citrus IPM is a constantly evolving system because pests, natural enemies, crops, and control tactics change. Recent years have been especially challenging because of pesticide resistance, newly registered insecticides, and introduction of exotic pests.

HONORS AND AWARDS

The Keck Foundation awarded $1,250,000 to UCR in January, to purchase equipment for the Agricultural Genomics Institute. **Michael Clegg** (Botany & Plant Sciences) is the PI on the application and **Natasha Raikhel** (Botany & Plant Sciences) and **Brian Federici** are co-investigators. **Beth Grafton-Cardwell** received the 2003 ESA Pacific Branch award for Distinguished Achievement in Extension. **Alex Raikhel** has been selected Grace Griswold seminar speaker at Cornell University Entomology Department for the upcoming academic year. **Brian Federici** has received a new $1.2 million dollar award entitled "Highly Improved Bacterial Larvicides for Vector Control" from the US National Institutes of Health. In June Brian will travel to Washington DC to receive the U.S. Secretary of Agriculture's Honor Award in the category of "Promoting Health by Providing Access to Safe, Affordable, and Nutritious Food." This award is the most significant recognition the Department of Agriculture bestows to acknowledge outstanding contributions to agriculture, to the consumers of agricultural products, and to the ability of the Department to serve America. The Academy of Sciences of the Czech Republic has awarded **Tom Miller** the G. J. Mendel Honorary Medal for Merit in the Biological Sciences in recognition of his outstanding achievements.

ALUMNUS FEATURE

Dr. Paula Shrewsbury is an Assistant Professor and Extension Specialist in Ornamental and Turf IPM in the Department of Entomology at the University of Maryland. Being brought up in Massachusetts, Paula did her undergraduate studies at the University of Rhode Island (URI). At URI, Paula worked in the lab of Dick Casagrande where her interest in entomology and pest management began. With her BS in Plant Science, Paula moved to Long Island, New York, where she worked for a retail nursery chain, Flower Time, as a horticulturist/ diagnostician for approximately three years. While at the nursery, Paula realized that there were vast voids in knowledge in the field of ornamental pest management and that she needed to make more of a contribution than she could do working at a nursery.

This led her to the lab of Dr. Tim Paine at the University of California, Riverside (UCR) where her Master's research was on an introduced pest, the ash whitefly. Paula's research focused on the biology, host plant suitability, and biological control of ash whitefly. Ultimately, ash whitefly became an example of a successful classical biological program. With Tim Paine as a role model, Paula knew that she wanted to be an Extension Entomologist and conduct applied research on insect pests of ornamentals.

After receiving her MS from UCR in 1991, Paula, along with her Boston accent, moved back to the east coast where she pursued a Ph.D. in Entomology from the University of Maryland. It was here that she expanded her knowledge and experience in Integrated Pest Management (IPM) and Extension Entomology. Paula's research examined the influence of habitat complexity on herbivore (azalea lace bug) distribution and abundance in ornamental landscape systems. She found that greater predation pressure and slower lace bug development in structurally complex landscapes compared to simple ones resulted in lace bug outbreaks in simple landscapes and not complex ones.

After receiving her Ph.D. in 1996, Paula was offered an Assistant Professor position at Rutgers University in New Jersey. Paula's research continued in the areas of landscape community ecology and the development of biological control approaches to suppress insect pest populations. She was involved in numerous extension programs training green industry professionals on various aspects of IPM.

In 1998 Paula took a position as an IPM Entomologist at the Smithsonian Institution in Washington, DC. Her responsibilities included development and implementation of IPM programs for insect pests of ornamentals and turf and a new area for her, structural pest management.

Paula began her current position at the University of Maryland in 1999 where she has extension and instructional responsibilities. The major foci of Paula's extension program are: research to develop alternative, less toxic pest management strategies; demonstration projects to evaluate and further the implementation of IPM; development of educational materials to facilitate training; and training activities to further the adoption of IPM practices in schools, ornamental nurseries and greenhouses, and turfgrass systems.

Specifically, her research examines methods to manipulate habitats, a form of conservation biological control, to restore natural enemy communities and increase their impact on herbivore populations. Current studies evaluate the influence of adding flowering plants and bunch grasses, and altering ground covers on herbivore and natural enemy abundance and dispersal and the impact of these natural enemies on herbivorous insects. Other research includes: examining the influence of "bottom up" factors (nitrogen and water stress) on the population dynamics of herbivorous insects and their natural enemies; augmentative releases of predators to suppress key insect pest populations in outdoor environments; and evaluating new products for their efficacy against key insect pests and their impact on beneficial organisms.

Paula teaches an upper level undergraduate course in IPM of Insect Pests of Ornamentals and Turfgrass. In addition she guest lectures in numerous graduate and undergraduate courses. Paula is involved in the mentoring of both undergraduate and graduate students. To date Paula has mentored 10 undergraduate students and currently has 3 graduate students working in her laboratory.

Paula actively serves the green industry professionals in the Northeast region. She is a co-leader of the greenhouse and ornamental nursery IPM commodity working group (GO IPM), part of the Northeast Pest Management Center, which facilitates regional collaborations among growers, extension specialists, and researchers that directly address grower needs and priorities for research and education to further the adoption of IPM.

As an assistant professor there is little time "away from work." Paula occasionally finds time for snow boarding, running, hiking, and, most importantly spending time with family. She can be reached at pshrewsb@umd.edu.

THE CHAIR'S MESSAGE

By Tim Paine

The end of the academic year brings about a change in pace and focus to the Department. This year marked the addition of two new faculty members. Giovanni Galizia joined our faculty from the Free University of Berlin and is a world leader in the area of molecular basis of behavior and integration of sensory input in the insect brain. Alec Gerry returned to the Department after serving as a Senior Public Health Biologist with the California Department of Health Services: Vector Borne Disease Section and is our new Cooperative Extension Specialist in the area of Veterinary Entomology. This year also marked a milestone for student enrollment in Entomology 10, "Natural History of Insects:" there were eight sections offered during the year and enrollment totaled more than 900 students. That effort, combined with high enrollments in our other classes and providing a third of the instructors needed for the three quarter sequence of the basic biology series, has given the Department one of the highest faculty teaching loads in the College.

The most difficult part of the year has been in coping with personal and personnel consequences of the enormous budget cuts imposed on the University of California. I realize that we are not alone in our efforts to deal with a flood of red ink. Departments of Entomology and Colleges of Agriculture all over the country have their own versions of a similar and painful process. Over two years, the cuts to the research budget are expected to total 20% and the cuts to Cooperative Research are projected to reach 30%. Unfortunately, this has meant relinquishing open faculty positions (two in Entomology) and elimination of permanent state funding for staff research associates across the College. Faculty research support is being converted to a merit-based competitive process that is intended to focus on realized and potential contributions of research programs to the mission of the Agricultural Experiment Station. Needless to say, the outcomes of that fundamental change remain to be fully realized. However, there is no doubt that this will mark a watershed for the faculty, staff, and students that comprise the Department and embody its function.

This year also marks the end of my six-year tenure as Department Chair. The experience has been priceless, although I would gladly forego this last year. I have been very fortunate to work with an outstanding faculty that are not only excellent researchers and dedicated teachers, but they are also tremendously collegial. The administrative and research staffs provide the backbone of the Department and their tireless efforts and commitment to excellence allow us to achieve remarkable things. The undergraduate and graduate students provide the constant energy and stimulation that advance to processes of learning and discovery. The outstanding contributions of all three components have made the job of Chair rewarding and humbling. I thank you all. As I step down as Chair, I can look forward to spending more time in the laboratory with the students and overseeing their projects. Now, if I can only get them to stop hiding my keys and let me in, I will be happy.

Enjoy the summer, everyone.

University of California
Department of Entomology
Riverside, CA 92521

ADDRESS CORRECTION REQUESTED

Send address changes, comments or suggestions to Helen Vega (909) 787-5294 or e-mail to helen.vega@ucr.edu