



# THE BUZZ



UC RIVERSIDE - DEPARTMENT OF ENTOMOLOGY  
NEWSLETTER

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## ANIMAL AGRICULTURE AND NUISANCE FLIES

By Alec C. Gerry

Animal agriculture is big business in California. According to the California Department of Food and Agriculture, the total value of California livestock and poultry alone was over \$30 billion for 2002. In terms of numbers of animals, California ranks 2<sup>nd</sup> in dairy, 2<sup>nd</sup> in poultry, 2<sup>nd</sup> in sheep, and 5<sup>th</sup> in beef of all U.S. states.

Although California continues to experience dramatic increases in our human population, and the subsequent loss of many of our formerly agricultural lands to suburban growth, animal agriculture in California has not declined. The increasing human population and the expansion of our urban boundaries have resulted in new challenges for animal agriculture. Many of the residents moving into housing developments located near or even adjacent to animal facilities have no previous experience with rural life. Nuisances such as odors, dusts, and insects associated with animal agriculture are novel and often unbearable for these new neighbors. The presence of flies in or around their homes is especially worrisome to nearby residents, principally due to nuisance and the perceived risk of disease transmission.

In recent years, nuisance fly complaints registered by county health departments have increased significantly. The reasons for this increase include: (1) the continued encroachment of urban dwellings on preexisting animal agriculture facilities thus increasing human-fly contact; (2) changes in animal agriculture resulting in operations that are more efficient for egg, milk, or meat production but less able to control fly production; (3) a decrease in the fly nuisance threshold (the number of flies considered acceptable) of urban citizens as better sanitation practices have reduced fly numbers in the urban environment; and (4) the development of resistance within nuisance fly species to chemical control products. Regulatory agencies charged with protecting the public health

have responded to citizen complaints with inspections of, and citations against, animal agriculture operations. Yet, the actions of regulatory agencies have not appeared to significantly alter the problem of nuisance flies in urban neighborhoods. This failure may be due to an inadequate understanding of IPM techniques to manage fly production and to prevent the dispersal of flies, and an

over-reliance by both regulatory agencies and producers on chemical control options, many of which are no longer effective due to the development of pesticide resistance. In addition, there may be other non-agricultural fly breeding sources in urban neighborhoods that may be responsible for some citizen complaints.

It has become increasingly clear that flies are also capable of harboring many animal and human pathogens. Wet manure is an excellent breeding environment for several species of nuisance flies (especially *Musca* and *Fannia* spp.), and also likely to support the survival of many disease causing pathogens shed in animal feces. Nuisance flies have been shown to carry several viruses as well as human pathogenic bacteria such as *E. coli* and *Salmonella*. It is well known that flies may disperse up to several miles from their developmental sites, yet their role in disseminating these pathogens is not well understood. There is some evidence to suggest that nuisance fly control efforts may result in a reduction in both animal and human illness within the area of control.

Due to the effectiveness of chemical pesticides used to control flies during the 1950s and 1960s, the physical design of animal facilities and the sanitation practices employed were optimized to maximize production with little concern regarding the management of

nuisance flies. However, in ensuing years nuisance flies have shown a great adaptability, having developed resistance first to DDT and then to most of the chemicals that are available for their control. Assuming the trend of urban expansion will continue, animal agriculture is not likely to persist in California unless we



Urban encroachment of dairy operation in S. California



Poor sanitation: wet manure is a developmental site for house flies

can develop new control technologies to limit the production and dispersal of nuisance flies.

Studies to better understand the dispersal ability of nuisance flies are currently being conducted at UCR in collaboration with the San Bernardino County Vector Control Program. Utilizing fly traps located at residential homes located up to 1 mile away from an egg-layer poultry operation we are sampling nuisance flies to determine species prevalence and nuisance potential. Trap data will be correlated with nuisance surveys completed by area residents and with fly complaints received by the county to determine if trap counts can serve as a relative measure of nuisance. Data that has been generated is being analyzed using geographic information system (GIS) computer modeling by **Marcella Waggoner** (SRA).

Fly control at older animal facilities still relies heavily on the use of insecticides. Granular fly baits consisting of sugar, fly attractants, and an insecticide

have been very widely used and provided some success in the control of adult flies. However, during the mid to late 1990s, field reports indicated that these fly baits were no longer effective. Studies by **Jon Darbro** (former graduate student of **Brad Mullens**) demonstrated that flies throughout California had developed both physiological as well as behavioral resistance to the insecticide (Methomyl) commonly used in these baits. These studies are being continued by **Sara Butler** (graduate student of Brad Mullens) who is further evaluating the mechanism of fly resistance to these baits. Sara has also recently conducted efficacy studies of two new fly baits containing insecticides to which flies have never been exposed.

New methods for fly management are also being investigated. Proper manure management has always been important to reduce fly numbers. However, with the limited space available to many agricultural operations and the recent development of adjacent homes, traditional techniques of manure management are not adequate to reduce fly numbers sufficiently. Manure composting techniques for fly control are being investigated by **Marcella Waggoner** in cooperation with UCCE farm advisors **Valerie Mellano** (San Diego Co.) and **Doug Kuney** (statewide) that we

hope will provide adequate control of flies as well as a saleable compost product.

We are also taking a look at the role that insects might play in the dispersal and transmission of disease agents from animal operations. Recently begun studies will evaluate whether



*Caged-layer poultry house: note accumulation of poultry manure in cones on the floor beneath elevated cages*

manure-associated insects (flies and beetles) commonly found at egg-layer poultry operations can harbor exotic Newcastle disease (END) virus. This virus has caused considerable economic damage to California during 2003, in part due to the quarantine placed upon southern California poultry, but principally due to the

costs of eradication efforts which included killing over 3 million chickens to prevent the spread of this virus. In collaboration with the Southeast Regional Poultry Laboratory (SERPL - Athens, Georgia) and **Carol Cardona** (Veterinary School at UC Davis), we hope to determine the role that manure associated insects may play in the dispersal and transmission of END virus. Animal operations with infected chickens were visited by **Marcella Waggoner** and myself to collect manure-associated insects to be tested for the presence of END virus. Additional studies conducted in collaboration with SERPL will evaluate whether these insects are simply mechanical carriers of END virus (carrying virus on external body parts) or are capable of harboring the virus internally.

Animal agriculture in California will continue to be threatened by the changing demographics of the state and in particular by the rapid urbanization of formerly rural areas. New techniques for reducing nuisance insect numbers must be conceived and evaluated, especially those that exploit the biology and behavior of nuisance fly species and complement currently practiced IPM techniques. Also needed are studies to understand the dispersal habits of nuisance flies and to determine what environmental, physical, or chemical barriers may prevent the dispersal of flies from agricultural operations into surrounding areas. Furthermore, studies to better understand the role that nuisance insects may play in the maintenance, dispersal, and transmission of disease agents will continue to be important. Studies such as those mentioned above are critical as animal operations strive to coexist peacefully with their residential neighbors.



*Nuisance flies captured on fly tapes are protected with plastic wrap to be counted back at the laboratory*

## HONORS AND AWARDS

**Beth Grafton Cardwell** has won the Entomological Society of America 2003 Distinguished Achievement in Extension Award, which she accepted at the national ESA meeting in Cincinnati Ohio at the end of October. **Don Reierson** won the Entomological Society of America Recognition Award 2003 for Urban Entomology. **Walter Ebeling**, retired

urban entomologist, was elected to the Pest Control Hall of Fame's Class of 2003. This year's class was inducted Oct. 21 in Dallas, the night before the National Pest Management Association's Pest World 2003 Conference. **John Trumble** received the Recognition Award of the Entomological Society of America at the National Meeting in Cincinnati Ohio.

**Nancy Beckage, Jocelyn Millar and Nick Toscano** have been elected as Fellows of the American Association for the Advancement of Science. **Bob Luck** received the International Organization for Biological Control Distinguished Scientist Award, 2003.

## ALUMNUS FEATURE

William “Bill” Moar (MS in Entomology 1986, PhD in Entomology 1990) still cannot believe that he has lived and enjoyed his life in Auburn, Alabama for the last 13 years after having grown up in Oregon and spending 6 years at UC Riverside pursuing his graduate degrees.



Although Bill grew up in the “big city” of Portland, he always had interest in plants. After spending his senior year in high school (1976) in a horticulture program “Operation Green Thumb”, Bill felt that horticulture and landscaping was the way to go. However, although the first college he attended did not offer horticulture, they did offer botany. So Bill enrolled in botany and transferred to Oregon State University (OSU) after two years to finish off his degree. After getting side-tracked studying in Germany for a year, Bill returned to OSU with renewed enthusiasm to finish off his degree. However, in less than two months, Bill would meet the future Mrs. Moar (Susanne), so his enthusiasm for education took a back seat (again) for about six months. Realizing that he was going to get married and that a BS degree in Botany was not the most marketable degree area at the time, Bill decided to pursue a double major in Entomology with the Pest Management Option. Immediately after graduating in 1983, Bill got a job as a scout in the lower Willamette Valley scouting various vegetable and fruit crops.

Bill went to UC Riverside in 1984 with the notion that insect modeling was the future. Unfortunately, he found out that most of these models were missing considerable amounts of biological input, so he set out to fill in some of these gaps by working with Professor John Trumble on Beet Armyworm, *Spodoptera exigua*, in tomatoes. After several projects failed to provide acceptable results, Bill was given a project to develop *Bacillus thuringiensis* (Bt) bioassays against *S. exigua*. After receiving his Masters in 1986 he decided to pursue a PhD at UCR. Dr. Brian Federici suggested research on why one Bt strain was more toxic than another Bt strain against *S. exigua*. Well, Bill sure did not know what he was getting into going from IPM and insect bioassays to micro and molecular biology. So, also under the direction of Professor John Trumble, he continued his studies, but was given the flexibility to work in the labs of several other professors such

as Brian Federici and Natarajan Sivasubramanian. In the middle stages of his PhD, he took several molecular biology courses to help with his research involving cloning and expressing the Cry2Aa2 gene from Bt, and these courses changed his research interests forever, especially since much of the work surrounding Bt has involved molecular biology and genetic engineering.

Bill received his PhD in Entomology in 1990 and moved immediately into a tenure track research/teaching position at Auburn University in Auburn, Alabama. He has been able to continue his research involving different aspects of Bt over the years, especially since the interest in Bt transgenic plants (especially Bt cotton in the southeastern US) has increased. Several of his research accomplishments include expressing a Bt protein (the Cry2 operon) in plant chloroplasts at levels up to 40% total soluble protein (patent submitted), obtaining a patent for a Bt strain that exhibits both insecticidal and fungicidal activity, and publishing the most extensive research to date on Bt resistance in *Spodoptera*. Current research interests include development and characterization of Bt resistance in *Helicoverpa zea*, field monitoring for resistance in Bt transgenic cotton, plant expression of Bt toxins, and the impact of Bt transgenics on non-target organisms. Bill’s teaching responsibilities have included “Insects;” “Economic Entomology” (primarily to Horticulture students); “Insecticides in the Environment;” “Biological and Microbial Control of Insects;” “Intro to Biological Control of Insects, Plant Pathogens, Nematodes and Weeds;” “Biological Control of Insects;” “Insect Pathology.”

With the heightened international interest in Bt, Bill has been able to conduct research over the last five years in Switzerland with Dr. Angelika Hilbeck at the Swiss Federal Research Station for Agroecology and Agriculture, Zurich and in the Netherlands with Dr. Ruud Demaagd, at Plant Research International, Wageningen, and has given over 20 international presentations. Currently, Bill is involved with the International Organization of Biological Control (IOBC), Transgenic Plant Working Group.

Bill is a member of the Entomological Society of America (currently associate editor for Journal of Economic Entomology; Insecticide Resistance and Resistance Management), Society for Invertebrate Pathology, American Society for Microbiology: S-301 “Development, Evaluation, and Safety of Entomopathogens for Control of Arthropod Pests; Insecticide Resistance Action Committee; Heliothine Cry1Ac Resistance Monitoring and Mitigation Committee.

In his free time, Bill enjoys traveling with his wife Susanne, and two daughters, Stephanie (15) and Shannon (10).

### ENTOMOLOGY ADMIN STAFF 2003 – The following is a brief run down of the current Entomology Department Admin Staff ©

**Millie Garrison**, Financial and Administrative Officer, Millie’s title pretty much says it all, she administers the departments finances. **Phyllis Crabtree**, Chair’s Assistant, in addition to assisting the chair Phyllis coordinates conferences and is responsible for the faculty merits and promotions, and during summer and fall can be seen tearing her hair out. **Bill Sutton**, Purchasing, again a title that speaks for itself; **Laurie Allen** assists Bill with purchasing and also does travel, reimbursements, and petty cash. **Maria Martin** and **Delisa Provost** are the payroll/personnel people, Maria handles the benefits, staffing and faculty leave requests, just to mention a few things and Delisa mainly payroll and employment does and hopefully not too often work injury reports. **Margaret Fehn** and **Jackie Li** are the department’s two Analysts dealing with contracts and grants, financial statements and making sure the faculty accounts balance, which can’t be easy. **Ralph Fowler** is our facilities, fleet, travel and petty cash person as well as being a motorcycle maniac. Me - **Helen Vega** - I assist Phyllis (not with the tearing the hair out), maintain the web page, word processing, a little petty cash and can usually be found mumbling to myself or nagging somebody for some overdue something.

## Message from the Chair,

No doubt this fall many of you followed with interest (if not mirth) California's political travails and perhaps wondered how our Department and UCR would fare under new state leadership. The short answer is that we do not yet know how our future budgets will be affected, other than we have no particular need to plan on major increases in resources over the next couple of years. The results of California's budget woes, as many of you know, last year cost our department nearly all of our state support for Staff Research Associates, long a major underpinning of faculty research programs. Most SRAs remain, now supported by funds generated by faculty, and by a portion of the resources that once were used for SRA support and that now are allocated to faculty on a competitive basis.

Despite these budget uncertainties and a current UC-wide enrollment cap, the department and the campus continue to plan for a burgeoning student population, which will drive UCR to 25,000 students by 2010. There are immediate expectations of our graduate student population rising to 50, and of replacement positions for retiring faculty and for new positions in areas such as Vector Biology and Invasion Biology. Building across campus continues apace, with construction of a large new Genomics facility to begin this summer. Those who have not been to UCR over the past 10 years are astonished by its growth.

The department remains incredibly productive. Grants received are a reflection of the value of our contributions to insect biology and management, and last year we were first among all departments at UCR, with 9 million dollars. That said, we look to our alumni and friends for support in areas that are not well funded. Scholarships and support for outside speakers would be especially valuable to our educational mission, and we welcome inquiries on how to contribute to these or other activities that you identify.

Replacing Tim Paine as chair was a career challenge for which I did not plan—otherwise I might well have dodged this administrative post. Tim's leadership over the past 6 years has enabled us to add stellar new faculty and move smoothly from planning to occupying the new Entomology Building and the Insectary and Quarantine Facility. Tim deserves our gratitude for managing his administrative duties with aplomb (all the while having a more than full teaching load and productive research program).

Ring Cardé

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ADDRESS CORRECTION REQUESTED

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