



THE BUZZ



UC RIVERSIDE - DEPARTMENT OF ENTOMOLOGY
NEWSLETTER

WINTER 2001

Urban Entomology - A UC Connection

By Michael Rust, Professor of Entomology

Urban entomology as a research approach and now a sub-discipline of entomology owes much of its development to a strong UC connection. One of its first proponents, Arnold Mallis, author of the classic Handbook of Pest Control, spent his formative research years in the 1930s and 40s in the pest control operations at UCLA. Probably the single most significant and seminal contribution to urban entomology was UCLA professor Walter Ebeling's Urban Entomology text in 1975. Dr. Ebeling's classic text permanently established urban entomology as a distinct research area. Upon Walter's retirement in 1975, his urban entomology program moved from UCLA to UC Riverside. At UCR the program has emphasized integrated pest management (IPM) of the four major structural pests in California, namely ants, cockroaches, fleas, and termites.

To appreciate the evolution of urban entomology and its current directions of research it is necessary to understand some of the historical background. With the advent of synthetic chemicals such as chlordane and chlorpyrifos in the 1940s and 1950s, the pest control industry had inexpensive and readily accessible chemicals that effectively controlled ants, cockroaches, fleas, and termites. These chemicals, the equipment used to apply them, and their use patterns would dictate the control practices and philosophy of the pest control industry and public for the next 40 years. However, major developments in the 1980s changed this picture and created a revolution that helped establish the science of urban entomology. Widespread ecological effects associated with the use of mirex and chlordane to control red imported fire ants and termites began to change public attitudes concerning what had been benign neglect. The discovery of a slow-acting metabolic poison, hydramethylnon, resulted in effective ant and cockroach baits. Lastly, the cancellation of chlordane's registration for ant and termite control stimulated research into alternative control strategies. The 1990's signified a search for least toxic approaches to pest control.

In recent years one of the focuses of the urban entomology research at UCR has been trying to develop baits to control ants,

cockroaches, and termites. Baits have advantages including safety and specificity, and are generally much more environmentally compatible. Even though there are numerous commercial ant baits, most are ineffective because they are not attractive or the toxicant works too quickly. Dr. Linda Hooper-Bui (now Assistant Professor at LSU) explored how various foods and toxicants are transferred from one ant to another. This process of social feeding, referred to as trophallaxis, is one of the major social characteristics in the life of ant and termite colonies. By altering the composition of sugars and proteins, she was able

to alter the route that food was passed among workers, larvae, and queens.

Termites, like ants also feed one another. While he was student at UCR, Dr. Brian Cabrera, now an Assistant Extension Specialist at Univ. of Florida, determined that the food flow in drywood termite colonies was considerably slower and less efficient than that found in ants. Termite workers fed both soldiers and reproductives, but less

than about 5-10% of the food was transferred. Does this occur in subterranean termites? How important is trophallaxis in subterranean termites and can toxicants effectively spread throughout a colony? These are some of the areas of research that graduate student Karl Haagsma is pursuing. A better understanding of the social interaction and feeding in subterranean termites will permit us to develop better baits and control strategies.

Under the direction of Eileen Paine and Don Reiersen, we are conducting insecticide degradation studies to minimize pesticide use and understand how best to use soil treatments to control subterranean termites. Factors such as soil type, irrigation, and the species of subterranean termite are being tested in this study. This applied research is extremely important because it is likely that homeowners in the arid southwest will continue to use soil treatments to protect their homes for the foreseeable future.

Ants, especially invasive species such as the Argentine and red imported fire ant, are major threats to urban, natural, and



agricultural areas in California. Some ant species pose a threat to ground nesting sea birds such as the California least tern (CLT). Don and Eileen have spearheaded the project around San Diego harbor to protect nesting California least terns from predatory ants. Argentine ants, fire ants, and certain field ants attack eggs and chicks and are believed to be one of the major threats to this endangered seabird. They found that suppressing problem species during critical times during the tern breeding season rather than colony elimination may not only be sufficient for optimal development of the birds, but may also be desirable in maintaining species diversity, including the offending ants. This spring Vanessa Higbee (future MS candidate) will also join the team to look at effects of disturbing native vegetation for CLT nesting sites on the ants and the impact of the plant communities on ants. By physically altering the site, the composition of the plants, and possible food sources for the ants, we can hopefully protect the birds without the use of insecticides.

Summertime is ant season in Riverside and that means about 100 local homeowners will join forces with our program to control Argentine ants. Argentine ants are the most important pest species in urban areas throughout most of southern California. Stephanie Vega (now with the Coachella Fire Ant Control Program) found that these ants are capable of foraging up to 250 feet and this greatly affected control programs. Another reason that Argentine ants are so difficult to control is that they form numerous satellite colonies. The factors that influence the development of these satellite colonies are the subject of Albert Lee's research (MS candidate). Understanding the factors that promote budding of the colony may lead to novel strategies to control them.

The Urban Entomology program at UCR has always been known for its research program dealing with cat fleas. Currently, Marcella Waggoner and Dr. Nancy Hinkle are directing the UCR portion of an international effort to monitor resistance in cat fleas to Advantage (imidacloprid). There is some indication that

insecticide resistance may be developing to the new topical treatments applied to cats and dogs. Dr. Marco Metzger (California State Department of Public Health) developed some novel nest boxes that permitted the study of fleas of the California ground squirrel. His research provided the first detailed information concerning the biology of *Oropyslla montanus*, the primary vector of plague in California.

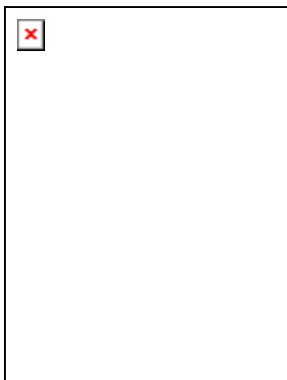
American cockroaches are a major pest of sewers systems in California and Arizona. Their close association with human waste makes them an important mechanical vector of human disease. We are currently conducting a baiting/parasitoid release program for the suppression of cockroaches in the City of Santa Monica while at the same time improving reclaimed or dumped water quality. Baits containing imidacloprid and fipronil have looked very promising.

Some of the challenges ahead for urban entomology include issues related to water quality in our urban wastewater treatment systems, streams, and watersheds. Invasive species such as the red imported fire ant, German yellowjacket, and Africanized honeybee will always be important because of the amount of national and international trade and commerce between large urban centers. For some insects such as the German cockroach, cat flea, and housefly the development of insecticide resistance will be a continuing problem. The urbanization of tropical undeveloped countries is occurring at a rapid pace and this will be a major challenge for urban entomologists in this century. Urban entomology has come a long way in the last 25 years and UC will continue to have a strong connection.

For a complete listing of Entomology faculty, staff, postdocs, graduate students and access to all of the latest news in the department, check out our website: <http://www.entomology.ucr.edu/>

ALUMNUS FEATURE

Dr. Patrick "Pat" Vail is the Director of the USDA-Agricultural Research Service's Horticultural Crops Research Laboratory, Fresno, California, a position he has held since 1982. Pat received his BA and MS degrees from California State



University, Fresno, and his Ph.D from U.C. Riverside in 1967 and was among the first graduate students in Entomology. Pat has been with the USDA since 1962.

Pat is a nationally and internationally recognized authority in the fields of entomology, insect pathology, microbial control of production and postharvest pests, entomogenous viruses, mass rearing, *in vivo* virus production, basic biology, pest management, insect ecology and has also

personally conducted research on other alternative methods of insect control such as induced sterility, pheromones, and cultural practices as they might be used in pest management systems in either the pre or postharvest situation. He discovered the nucleopolyhedrovirus isolated from the alfalfa looper in 1966 while a staff member of the USDA-ARS Boyden Entomology

Laboratory on the U.C. Riverside campus. His research on this virus changed classical views about the specificity of baculoviruses. He also developed *in vitro* methods for its' production and plaque assay. The virus is used in agriculture research and as an expression vector for the production of unique biologically active compounds of importance to human and veterinary medicine and biology. Gross annual revenues from the baculovirus based expression system exceed \$1 billion dollars annually.

Pat has been a research scientist and program manager as a Research Leader and Laboratory Director at several ARS locations during the 39 years of his professional career. He has published over 200 articles in scientific journals and other media. During Pat's career he has provided technical leadership for complex, comprehensive, and productive research programs on vegetable, cotton, and postharvest insects (fresh fruits and vegetables and dried fruits and nuts). Under his direction and leadership, outstanding accomplishments and progress have been made in the area of developing new non-chemical alternatives for insect control in both the pre and postharvest areas. Pat was head of the Insect and Pest Control Section of the Food and Agriculture Organization of the United Nations/International Atomic Energy Agency, Vienna, Austria, from 1975-78 with

responsibilities for Agency tsetse fly and tropical fruit fly programs.

Pat has been invited to present the results of research directed by him, as well as provide technical advice regarding the needs, development and initiation of research programs. by international organizations, such as the United Nations International Atomic Energy Agency and Food and Agriculture Organization, the International Center for Insect Physiology and Ecology in Nairobi, as well as the Entomological Society of America (national and branch), American Association for the Advancement of Science, National Science Foundation, U.S.-Israeli Binational Agreement for Research and Development, industry and private agricultural groups, commodity marketing orders, Environmental Protection Agency, USDA-Animal and Plant Health Inspection Service, U.S. Department of Energy, California Department of Food and Agriculture, Department of Defense, National Cotton Council and Cotton Incorporated, postharvest groups, and universities. Pat has held many positions in regional and national societies and was the President of the Pacific Branch of the Entomological Society of America in 1989.

For his efforts on behalf of research and agriculture, Pat received the USDA-ARS Distinguished Scientist of the Year

Award in 1995 "For first isolating and then conducting basic and applied research on a virus exceedingly important to insect pathology/ microbial control, genetic engineering, and human and veterinary medicine" and the United Nations Environmental Programme Certificate of Appreciation in 1995. In 1996 he received the United States Department of Agriculture Award for Personal and Professional Excellence for "Sustained international contributions to entomology, insect pathology/microbial control, and human and veterinary medicine" from the Secretary of Agriculture. In 1997 Pat received the School of Natural Sciences Distinguished Scholar Award from California State University, Fresno. As a member of *The Japan Varietal Testing World Trade Organization Group*, Pat received the Secretary of Agriculture's Honor Award for Personal and Professional Excellence for exceptional performance, creativity, and perseverance in successfully challenging, in the World Trade Organization, Japan's long-standing varietal testing trade restrictions, June 1999.

In his spare time, Pat enjoys traveling with his wife Susan, and visiting his three daughters who live in Miami, Lake Tahoe and Los Angeles. Pat plays tennis, fishes, and constructs large, scale radio controlled airplanes.

CHAIR'S MESSAGE

By Tim Paine, Department Chair



As I mentioned in the last edition of *The Buzz*, we recently completed two successful recruitment efforts. We are very proud and excited to announce the appointments of Dr. Richard Stouthamer and Dr. Alexander Raikhel to our

faculty. Dr. Stouthamer is a proven innovative scientist of remarkable breadth. He will bring a dynamic research program of demonstrated excellence to the Department of Entomology, a program that will strengthen us by filling critical programmatic needs in molecular population genetics and by complementing our existing strengths in programs focusing on parasitic Hymenoptera. Dr. Stouthamer's principal research interests are in population genetics and the evolution of parasitic Hymenoptera, particularly with respect to the role that endosymbionts, particularly *Wolbachia*, play in population structure. These are related fields in which he is pioneering the development and use of molecular methods, including genomics, to study population structure and evolution. Parasitic Hymenoptera comprise the primary arsenal for biological control, a historical and continuing area of major emphasis within our Department, and an important category of exotic and invasive arthropods. Dr. Stouthamer is using parasitic hymenopterans as a model system to study the population genetics and dynamics of invasive species. His research serves as a basis for studying other introduced insect species,

whether they are detrimental pests or beneficial insects brought in as biological control agents. Considering the numerous pest management studies in our Department that incorporate biological control, Dr. Stouthamer's interests and molecular expertise provide a much-needed complement to our current strengths. Moreover, in addition to their utility for developing new knowledge about introduced species, the models and techniques that Dr. Stouthamer is developing can be used to study rare and endangered native species, an important field of conservation biology. Dr. Stouthamer will join the Department on July 1, 2001.

Dr. Alexander Raikhel is an outstanding scientist and teacher. He is a recognized world leader in the field of insect molecular biology. The focus of Dr. Raikhel's research program is the elucidation of the control of vitellogenesis (the formation of yolk in developing eggs) in insects, specifically mosquito species that are vectors of human disease such as *Aedes aegypti*. Vitellogenesis in mosquitoes is important since it absolutely dictates the need for female mosquitoes to acquire blood meals from human and livestock hosts. The blood meal is broken down in the mosquito gut and the ingested amino acids, fats, and carbohydrates form the developing eggs of the next generation. Vitellogenesis is therefore the ultimate physiological basis of disease transmission in vector mosquitoes. Thus, understanding the genetic basis of vitellogenesis in mosquitoes should lead to the development of new strategies for the control of mosquito-borne human and veterinary disease. Dr. Raikhel has successfully employed contemporary biochemical, genetic, and molecular biological techniques to unravel

the regulatory cascade that controls vitellogenesis in mosquitoes. In the process, he has isolated and characterized numerous mosquito genes involved in this process. These have ranged from the yolk protein genes themselves to genes encoding transcription factors and receptors. His group has successfully utilized genetic transformation techniques in both *Drosophila* and *Aedes* to examine the function and regulation of some of these genes. In a recent major breakthrough, his group developed the first genetically modified strains of *Aedes* that may be resistant to the transmission of avian malaria. They accomplished this by transforming the mosquito to express a defensin gene, which may block the malaria parasite reproduction in the insect host. Expression of the defensin gene has been placed under the control of the vitellogenin promoter, which is activated as part of the hormonal cascade leading to egg production following a mosquito blood meal (the point at which malarial parasites are acquired by the insect vector). Dr. Raikhel's research program is comprehensive, state-of-the-art, and held in the highest esteem amongst his colleagues. He will join the Department January 1, 2002.

IN MEMORIAM

Dr. William H. Ewart passed away February 3, 2001. Dr. Ewart was at the University from 1945-1980 and was Head of the Div. of Econ. Ent. from 1969-1975. Dr. Ewart was 89 years old. He is survived by his wife Alyce Ewart, two sons, and one daughter. He was living in Marietta, Ohio when he passed away.

AWARDS AND HONORS

Dick Goeden received the 2000 International Organization for Biological Control Distinguished Scientist Award at the Joint Annual Meetings of the Entomological Society of Canada and the Entomological Society of America at Montreal, Canada, in December, 2000. This honor is bestowed on individuals who have



made significant contributions to Biological Control. In addition, the tephritids formerly comprising the North American Nearctic species of the genus *Urophora* were redescribed last year, in Dr. Goeden's honor, as belonging to the genus *Goedenia*.

The Carl Strom/Western Exterminator Co. Scholarships in Urban Entomology 2001 will be presented to **John Darbro, Karl Haagsma, Albert Lee, Ryan Williams** (graduate students) and **Vanessa Higbee** (undergraduate) at the 10th UCR Annual Urban Pest Management Conference on March 29, 2001. This scholarship is an ongoing fund in support of both graduate and undergraduate studies relative to urban pest management. This year's recipients will be awarded \$500 each.

Department of Entomology
University of California
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

Dave Hawks and colleague **Ronald Cave** (Pan-Am School of Agriculture in Honduras) were featured in the cover story "jewel scarab" beetles in the February issue of National Geographic. For the full story go to <http://www.nationalgeographic.com/ngm/0102/feature3/index.html>

UCR's Linnaean Team captured their second National Championship at the joint Entomological Society of America / Entomological Society of Canada meeting in Montreal, December 3-6, 2000.

In their first match-up, UCR defeated Missouri to advance to the semi-finals where they trounced Nebraska. In the final game, UCR was quite evenly matched against the University of Massachusetts, but managed to gain the lead and triumph over their Amherst opponents.



In addition to **Kristin Michel, Connell Dunning,** and **Stuart Wooley**, UCR brought back two former players, with remaining eligibility, to compete on this year's team. **Dr. Michael Gates**, who had completed his Ph.D. and assumed a position with the National Museum of Natural History in Washington D.C., rejoined his teammates, as did **Hannah Gould**, currently pursuing a Ph.D. at Yale.

The 2000 Championship team continues UCR's winning tradition, representing the ESA's Pacific Branch in the national Linnaean Games for six years running and having won their first National Championship in 1998.