Bohart Museum Society

Winter 2023 **Newsletter** No. 93

In This Issue

I hope you all have had a terrific holiday season!

We are looking forward to new adventures in 2023 and getting back to pre-Covid normality?! It seems strange with Steve Heydon retired and new faces in the museum. Right now the museum staff and students have created fantastic new displays and we are finally ramping up our outreach programs.

Although we have not developed a new Bohart calendar for 2023 we are considering creating a forever calendar showing holidays and other dates of importance.

-Lynn Kimsey

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SPOTLIGHT ON A SPECIES

Stingless Bee Weirdness

by Lynn Kimsey

Trigona muzonensis. Photo by Brittany Kohler.

One thing about working on insects is that it never gets boring. Just when you think there can't be anything odder that insects do there is always something new. Take bees for example. We typically think of bees as being essential to ecosystems as pollinators, only feeding on nectar and pollen. However, it turns out that some bees may serve very different ecosystem roles. In particular, bees in the apid tribe Meliponini, have some very unusual behaviors compared to other social bees.

The Meliponini is a large group of mid-sized to small bodied eusocial bees found in tropical and subtropical regions. There are more than 500 species described in this group, with a large diversity in Central and South America. They are related to honeybees and are also eusocial with a queen and workers. Meliponines are called stingless bees because their stingers are highly reduced and are not used for defense. However, don't assume just because they can't sting they can't defend themselves. They can bite, regurgitate on you, and some species have potent mandibular gland secretions high in formic acid that can raise painful blisters.

Colonies can be large, with between hundreds and tens of thousands of workers. Generally, colonies have a queen and sterile female workers. The female caste is generally dictated by the amount of pollen consumed, although there may be a genetic component in some species. As in other bees and wasps, males are haploid and females diploid making sex determination straightforward. New queens emerge, mate and eventually move into newly constructed colonies built by workers from the original colony. In a twist on this scenario, some colonies produce "dwarf" queens that don't leave the colony and are reproductively active but less so than the large queens. Males can also be relatively abundant in some colonies.

Brazilian stingless bees, *Scaptotrigona depilis*, in nest entrance tube. Photo by Cristiano Menezes.

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Museum News

Award of Distinction

In November Bill Patterson and Doris Brown were awarded the UC Davis College of Agriculture & Environmental Sciences Award of Distinction, Distinguished Friends of the College for their large donation to the Bohart.

Spreading Marathon

In preparation for the new hallway butterfly exhibits Jeff Smith spread the wings of over 100 birdwing butterflies. This is how many butterflies it took to create the Butterfly Made of Butterflies display. All of these specimens came from a donation of commercially raised butterflies.

Spreading boards of birdwing butterflies in in preparation in Jeff Smith's house.

Mia Culpa!

In the fall newsletter we attributed this photo to Bruce Hammock when in fact it was taken by Adrian Shapiro. Adrian, we totally apologize. –Lynn

Panama Grasshopper

In October Veronica Kandl and Sam Suarez, from the Center for Sacramento History, brought a large grasshopper specimen to the museum that needed rehousing. It was in a very old mason jar with bad alcohol. We cleaned it all up in a new bottle for them. It turns out the grasshopper has a very interesting back story. The specimen was originally given to Alan Hardy at the California Department of Food & Agriculture, State Collection of Arthropods possibly by Paul Readinger in Sacramento. The state collection then donated it to the Center for Sacramento History because of its history.

Americans crossing the isthmus of Panama to reach California, National Museum of American History.

The grasshopper, identified as *Titanacris velasquezii* (Nieto), was collected by T.A.C. Nichols in 1852. Like so many others he had sailed from New England to Panama, so he could take a ship to California during the Gold Rush. He found the grasshopper as he walked across the Isthmus of Panama from the Atlantic side to the Pacific, so he could reach California. In 1852 the Panama Canal wasn't even an idea and the railroad crossing wasn't completed for several more years. Travelers had to either walk across or ride a horse, donkey or wagon. T.A.C. Nichols apparently made it to Sacramento and was listed in the 1854 Sacramento City directory, as a drayman at the N.L. Drew Company.

Gold Rush grasshopper in a new jar.

MORE MUSEUM NEWS

New Displays

This fall we were determined to redo and refresh our hallway exhibits. Plus, we had installed a new display case (shown below with the Spiral Galaxy of Butterflies). This display case was designed and purchased thanks to funds from the Bess Spiva Foundation.

Over the years we've had a large number of insects donated to the museum that had no locality or collector data. Many of the butterflies were in perfect condition and appeared to have come from commercial rearing facilities. We had been waiting to come up with the best ways to use these specimens for display and outreach programs.

Thanks to two very gifted students and collaborators we have found the perfect use for the specimens. Francisco Basso and Brittany Kohler designed the two butterfly displays and assembled them in short order. The displays are fantastic and well worth a trip to the Bohart to see them.

In addition, Design professor, Ann Savageau offered to donate a fantastic sculpture she had made from paper wasp paper and a briefcase. We added a few house guest murder hornets looking out the windows thanks to Chris Looney from the Washington State Department of Agriculture.

Francisco Basso also created several Mexican inspired paper maché Alebrijes sculptures of insectoid creatures that are inside the museum.

Hornet House. Created by Ann Savageau, Professor Emerita of Design (below).

Paper maché insectoid wearing dog face butterfly earrings (left). Sculpture by Francisco Basso.

Francisco Basso.

Birdwing Butterfly Made of Birdwing Butterflies display (above). Created by Francisco Basso and Brittany Kohler.

Brittany Kohler showing off the Spiral Galaxy of Butterflies she created with Francisco Basso. There's a fly hidden in plain sight in the galaxy.

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Trigona hypogea eating a dead lizard. Photo by D. Wittman.

Another truism we hear all the time is that soldier castes only exist in ants and termites, and not bees or wasps. However, at least ten species of stingless bees have been found to have a defensive caste. These "soldier" females are larger than other colony members and may also be differently colored.

Stingless bees generally build their nests in preexisting cavities in trees, rock crevices, and even termite nests. There is usually an entrance tube. Unlike honey bees, they store pollen and honey in egg-shaped pots built of a combination of wax and resin, sometimes called cerumen (the medical term for ear wax!). The horizontally arranged brood combs are often surrounded by these storage pots. Unlike honey bees, stingless bee larvae are not progressively fed. Instead, cells are fully provisioned with larval food, an egg is laid on the food and then the cell is sealed. When the adult emerges from the cell it tends to remain in the nest where it undertakes various nest-related tasks including cell construction. As they age they eventually become nest guards or foragers. Stingless bees generally use pollen excrement and wax to build brood cells and nest lining or covering. Storage pots are usually built from resins collected from local trees. These resins probably contain compounds that suppress spoilage organisms that would contaminate the larval provisions. The entrance tube and nest cavity lining are generally built of a combination of bee's wax, resins and even wonderful materials like mammal feces.

The vast majority of stingless bee species collect nectar and pollen to feed their larvae, like other bees. However, three species of *Trigona* stingless bees, so called "vulture bees", have been found to feed their larvae exclusively with carrion. These bees have lost their pollen baskets and have enlarged mandibles. They apparently do not visit flowers for pollen or nectar, although they do collect carbohydrates from sources like extrafloral nectaries and fruit, to make honey. Instead, these bees feed on rotting meat, and produce protein rich secretions from their hypopharyngeal glands. Foraging workers visit carcasses and enter the body through openings, such as the eyes. Once inside the body they salivate on the meat, gather the resulting fluids, and store it in their crop. Back in the hive they regurgitate the "meat" where it is processed by a worker bee to produce a protein rich glucose laden material that is then placed in storage pots. The sugar and surrounding resins function as a preservative. You can only imagine how these colonies must smell. The stored material is used to feed the larvae, whereas the adults feed on sugar sources.

Researchers at Cornell, UC Riverside and Columbia Universities did a detailed examination of the bees' gut microbiota. They found that vulture bees have lost some of the microbes typically found in other bees, and have new microbial associations with acidophilic bacteria. Evidently, feeding on carrion requires a very different and acidic digestive tract.

An additional twist on this behavior can be seen in *Trigona hypogea.* This bee is not only an obligate necrophage but it was found in Panama to prey on the living brood of social wasps.

Then there are the fungus-feeding bees. Ants aren't the only social insects known to cultivate and feed on fungi. The Brazilian stingless bee species, *Scaptotrigona depilis* (Moure), cultures a fungus in its brood cells. The fungus grows on food regurgitated by workers and the larvae eat the fungus and the stored food. The fungus belongs to the genus *Monascus*, which is the same group used to produced fermented "red rice" in Asia. These fungi have been used for centuries in Asia to preserve food. In a way it seems counterproductive for the bees to forage for pollen and nectar, then feed it to the fungus and have the larvae eat the fungus. However, the larvae of these bees survive only if they feed on the fungus. The fungus is apparently found in materials these bees use to construct their nests.

Clearly, stingless bees are a rich source of weird biologies. However, there are probably other groups of social or even solitary insects with equally strange biologies. We need more folks out in the field investigating insect biologies who are intensely curious –*if you don't look, you don't find*!

Trigona stingless bee nest, in traditional modular Brazilian nordestina style nest box, with honey pots in the foreground. Wikipedia.

Plants, Insects and Art: Mary Foley Benson's Scientific Illustrations

by Srđan Tunić (MA student in Art History program and Bohart Museum intern)

"She has been described by her neighbors as the only person who grows vegetables for bugs. Her back yard has a tomato crop, but the tomatoes are grown for insect, rather than human, consumption." This is how a journalist in 1972 referred to Mary Foley Benson (1905-1992), a soon-to-become retired entomological illustrator. She used to sketch insects and plants from live and fresh specimens, creating watercolors and lithographs with an exquisite sense of detail and beauty. UC Davis has more than 100 of her artworks shared between the Shield's library's special collections and the Bohart Museum.

Probably the best known of these is the series was made for Dr. Howard L. McKenzie's 1967 book "Mealybugs of California with Taxonomy, Biology and Control of North American Species". Mary Foley Benson illustrated the book jacket and 21 large color illustrations depicting a variety of mealybugs set in their natural surroundings, depicting host plants, plant damage, and their wider habitat. According to Dr. Lynn Kimsey, "mealybugs never looked so attractive." One illustration on display in Department of Entomology & Nematology's conference room at Briggs Hall, depicts cactus mealybug (*Spilococcus cactearum*) feasting on Texas Nipple Cactus found at the UC Berkeley's Botanical Gardens. It is likely that the artist visited all locations depicted in person, just like she worked with live specimens.

She did similar work for Dr. W. Harry Lange, also in the Department of Entomology, which unfortunately remain unpublished, except for two illustrations on rice pests. In the late 60s and early 70s, Dr. Lange planned to publish on agricultural pests and their lifecycles, including the pest's host plants and habitat. Mary Foley Benson drew about 50 illustrations, from individual insects to complex life cycle scenes. One example of the Alfalfa looper (*Autographa californica*), shows all stages from eggs and larva to pupae and adult moths on lettuce. These were collected in Davis and Salinas in April 1966 and drawn on a background of a lettuce field, with a water tower, barn and tractor, at the location of Gonzales, Monterey County, and can be found in the collection of the Bohart Museum.

After retirement in 1972, she came back to her primary love, illustrations of plants, this time not damaged by insect pests. While most of the previous work has been done in watercolor, these botanical drawings were often made as lithographs, easily reproducible and accessible to the general public. In fact, this might be the work she is mostly associated with in California. She loved drawing Golden lupine, often in combination with California poppy and Dogface butterfly, a power trio of symbols of the City of Davis (lupine), state flower (poppy) and insects (butterfly). One of the original drawings of Golden lupine can be found in the City of Davis' hallway, which she donated in 1983, just before the plant was reaffirmed as the official flower of Davis.

Mary Foley Benson was in love with Davis. In a 1983 interview she said: "This is the greatest place in the world for me… I get such support from the people in Davis. They hang my work all over town." Born in Storm Lake, Iowa, she was a long-term resident of Washington DC area, where she worked for the USDA. After being a pilot during WWII, she moved to California, to Los Angeles. Dr. McKenzie was responsible for her move to Davis, when he offered her a job as senior scientific illustrator in 1964. She stayed in Davis until her death in 1992.

Her work remains in several national archives with limited visibility, but 2022 seems to be a year of change. Forest entomologist Malcolm M. Furniss wrote a biographical article titled "Mary Foley Benson: Master of the Art of Scientific Illustration of Insects and Flowers" earlier this year. Since Spring Quarter 2022, I have been researching her work with an aim to offer several public talks and write an art history article on her two UC Davis series. Her work definitely deserves the overdue analysis and all the attention. It is also just one of many cases of women scientific illustrations from the 20th century, whose work spanning art and science is still under-studied, but highly relevant to our times.

If you would like to know more about her work, follow the Pence Gallery's or the Bohart Museum's websites and social media for a recorded Zoom lecture on January 28th 2023.

Mealy bugs on gladiolus by Mary Foley Benson.

More in the Museum

Hurley Donation

In late November Brennen Dyer and Brittany Kohler traveled to Arcata, CA to pick up a collection from Chris Cabello. The collection belonged to his stepfather, Eugene N. Hurley.

Hurley's collection was housed in 26 Schmidt boxes in two handmade wooden cabinets. The specimens are mostly beetles and butterflies.

According to his stepson, Mr. Hurley was an artist, piping design engineer and nature lover. He served in the US Army and was stationed in Korea just after the armistice. His collection contains specimens from the western and southwestern U.S., Tennessee and Korea.

Collections Work

Fresno physician Val Albu working with Jerry Powell from UC Berkeley. Photo by Kathy Keatley Garvey.

In December Fresno physician and microlepidoptera specialist Val Albu came in to the Bohart to work in collaboration with John DeBenedictis and Jeff Smith to identify our large drawers of unidentified micro moths. We're hoping they can all do this again soon. Thanks to their work we added a large number of new genera and species to the collection.

Triatoma protracta, the commonest kissing bug in northern California. Photo by Brennen Dyer.

Raymond E. Ryckman 1917-2016

In 2013 Prof. Raymond Ryckman, from Loma Linda University donated his impressive collection of triatomine kissing bugs, and many other insects, to the Bohart Museum. He got his PhD at UC Berkeley as a graduate student of Robert L. Usinger, and was hired into a faculty position in the new School of Tropical and Preventive Medicine at Loma Linda University. He was honored by having a species of kissing bug named after him, *Triatoma ryckmani* Zeledón & Ponce.

The collection resulted from his research that spanned nearly half a century. Dr. Ryckman was one of the foremost specialists in blood-feeding kissing bugs and the pathogens they transmit. Kissing bugs vector Chagas' Disease to millions in the Americas.

The collection contained more than 20,000 specimens of 18 species of kissing bugs as well as 11 species of Tsetse fly and other insect vectors.

At the time the family donated $10,000 in support of archiving and databasing the collection.

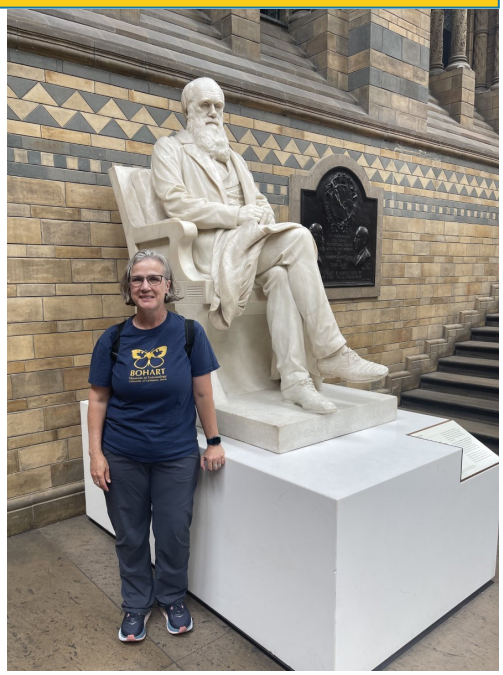
In December 2022 the Ryckman family brought the rest of his research materials, including books, journal articles, field notes and more to archive in the Bohart Museum.

Dr. Ryckman with a student showing off his collection at Loma Linda University. Photo courtesy of Loma Linda University.

Traveling t-shirt

Fran Keller, former graduate student in the museum is now an instructor at Folsom City College. She is also the lead designer for our t-shirts and other gift shop items. Fran took a city college class to the United Kingdom for a fall semester as part of an education abroad program.

Here she's showing off the Bohart t-shirt in front of Darwin's statue in front of the British Museum of Natural History in London.



ASK THE BUG DOCTOR

If you have an insect question, need advice, want an identification of something you've found, or would like to see an article in the newsletter on a particular topic let us know. Email us at bmuseum@ucdavis.edu.

Dotted Paropsine Leaf Beetle

It looks like there's yet another pest of Eucalyptus in California. The dotted paropsine leaf beetle, *Paropsis atomaria* Olivier, was discovered in Los Angeles this past August where it was found feeding on lemon scented gum trees. This is a large beetle, about 1/2 inch long, with bright black and yellow larvae that feed on Eucalyptus leaves.

Dotted paropsine leaf beetle. Photo by Martinlagerwey, Wikipedia.

Weaponized Bees

Rorie S. Woods of Hadley wearing a beekeeping suit while taken into custody by Sheriff's officers, in Longmeadow, MA. Associated Press photo.

A woman in Massachusetts is facing multiple assault and battery charges for releasing a swarm of bees to attack police officers by shaking hives. The officers were trying to serve an eviction notice. Several were stung in the process and one had to be hospitalized.

Halloween Roaches

A suburban neighborhood in Detroit was put off limits for Halloween treat or treating because of a large cockroach infestation in a vacant home. The city was concerned that trick or treaters could spread the cockroaches in their costumes?!?! "Walking the street could help kill the cockroaches, but their eggs still could spread and survive", City Council member Todd Hanna said. There's a bit of entomological misunderstanding in this whole event.

Axayacatl Harvest

Eggs of axayácatl bug eggs on pine needles before harvest from Lake Texococo, near Mexico City. Photo from the Associated Press.

Farmers on the outskirts of Mexico City harvest the eggs of water boatmen, keeping alive a culinary tradition that dates from the Aztec Empire. The eggs are harvested from Lake Texococo, a shallow, saline lake that once covered much of the Mexico City valley.

These tiny eggs, called *ahuautle* or bird fly eggs, are laid by water boatmen (family Corixidae) on pine branches placed in the water for later harvest. The sticks covered with thousands of eggs are removed from the water and are allowed to dry before harvesting. The eggs are used in a variety of dishes, including one mixed with chicken eggs and bread crumbs and fried. They have become a specialty dish for the rich, selling for about $25 per pound.

Public tastes are changing and harvesting these eggs may soon become a thing of the past. In addition, Lake Texcoco is drying out.

Ball-Rolling Bumblebees

Ball rolling bumblebee. Photo courtesy of Richard Rickett.

A study out of Queen Mary University published this fall in the journal *Animal Behavior** found that bumblebees actually play. They discovered that bumblebees would go out of their way to roll wooden balls and the younger the bee the more it rolled the balls. When given the option to take an unobstructed path to a feeding area or to an area with wooden balls they often would go to the area with the balls.

**Glapayage Dona, HS, et al. 2022. Do bumble bees play? Animal Behavior 194:239-251.*

North African Malaria

Anopheles stephensi feeding. Photo courtesy of the Centers for Disease Control and Prevention.

A major outbreak of malaria in Ethiopia is being blamed on an invasive mosquito, *Anopheles stephensi* that is native to India and the Persian Gulf region. It was first discovered in Djibouti in 2012 and since then from Yemen to across central Africa to Nigeria.

This is particularly troubling because unlike native *Anopheles* species in the region, this one breeds in artificial containers and polluted water in urban settings.

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Happy 2023!