SPOTLIGHT ON A SPECIES

Mosquito Oddness

By Lynn Kimsey

Whenever someone mentions mosquitoes we immediately think of how annoying they are, and being bitten by one. It is true that the vast majority of mosquitoes prefer to feed on warm blooded creatures like us, but as with everything else in biology, there are all kinds of exceptions.

First, mosquito basics. Adult insects generally only need sugars to survive. Sources of sugar, like nectar and honeydew, serve as a kind of high energy fuel for adult insects, particularly those that fly. Since they are no longer growing, adults generally do not need proteins, except the females, which need additional protein to mature their eggs. In the case of mosquitoes, only the females feed on blood to acquire much needed protein for their eggs. However, not all female mosquitoes need to do this. Species whose larvae have high protein diets generally do not blood-feed. Proteins stored from the larval stage provide all the protein they need. Two examples of this behavior are found in the large bodied mosquitoes that belong to the genus Toxorhynchites and the rockpool mosquitoes in the genus Opifex.

Toxorhynchites mosquitoes have large, day active adults and equally large, predatory larvae. The adults are brightly colored, with metallic blues, silver and even red. They may have a body up to an inch long. Adult females never blood feed, but they do suck nectar from flowers using their oddly bent proboscis. The larvae are insect versions of crocodiles. They prey on aquatic animals, including other mosquito larvae, found in tree holes and similar sites. Because of this predatory behavior they have been used as biological control agents to control pest mosquitoes in a few regions, including the southern U.S. and a number of Pacific islands.

Mosquitoes in the genus Opifex do something totally different. This genus is restricted to New Zealand, and adjacent islands. They are often called rockpool or salt pool mosquitoes because of the marine habitats where they are found. Their entire life cycle takes place in tidal pools along the coast. In this genus adults do not feed and never appear to leave their tide pool. This adaptation to highly saline

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This is a special year in the Bohart Museum; 2021 marks our 75th anniversary. COVID willing, we hope to have a fun members open house, October 26.

However, we would like to do more fun things this year, so please let us know what ideas you might have for celebrating this special year in the museum!

The museum now has its own tardigrade water bear sculpture. Thanks to support from the museum society members, the Bess Spiva Family Foundation and tardigrade enthusiasts, we raised the funds to engage sculptor, Solomon Bassoff, of Faducci Sculpture, to create our tardigrade. The sculpture weighs more than one ton, and is constructed of concrete and steel with bronze claws. It had to be lifted into place using a heavy duty forklift. It is located at the front of the Academic Surge Building on Crocker Lane.

Many, many thanks to Chancellor Gary May and Dean Helene Dillard for their support, and Rob Scharf for helping us with all the logistics.

Who knows, this might be the only tardigrade sculpture in the world.


The Bohart Museum held its first Robbin Thorp Memorial First-Bumble-Bee-of-The-Year contest in January 2021. This will be an annual competition is to see who can find the earliest bumble bee of the year in Yolo County. This year the first bumble bee was observed by Charlie Nicholson, a postdoctoral researcher in the Williams and Niño labs. He photographed a black-tailed bumble bee, Bombus melanopygus, visiting manzanita in the UC Davis Arboretum, January 14, 2021.

We hope to have these bumble bee coffee mugs and ones with a tardigrade on them available in the museum gift shop in the next month or so.
Insects engage in a lot of different kinds of mimicry, but one of the oddest is imitating animal fecal material, ranging from caterpillar droppings to bird and even bat poo. This mimicry can be found in at least four orders of insects as well as spiders. The running theme seems to be poop with white uric acid.

**Hymenoptera (wasps)**

This kind of mimicry is uncommon in the wasps themselves and is more commonly found in their nests.

**Lepidoptera (moths, butterflies)**

Butterflies and moths exploit many ways to look inedible and imitating various kinds of animal droppings. This appears to be a very successful tactic for both adults and caterpillars. In some species each instar caterpillar may resemble some other animal’s poo, including insect, lizard, bat and even bird droppings.

**Manotodea (Mantises)**

Juvenile mantises in particular often mimic inedible or gross things so they can get close to their prey without being eaten themselves.

**Coleoptera (Beetles)**

Beetle adults use the same poo tactics as the Lepidoptera. We found no examples of the larvae doing this, but there are probably some.

**Spiders too!**

For spiders looking like poo protects them from predators and hides them from prey.
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Mosquitoes that blood feed use a number of cues to find their hosts in a very big world. Species that feed on warm-blooded hosts can use body temperature as one obvious method. A recently published study in Science Magazine* found that mosquitoes use temperature receptors on the tip of their antennae to detect heat. Mosquitoes have highly developed eyes and acute visual sensitivity even in low light conditions. They also can detect a wide range of chemical cues our bodies give off including CO₂, lactic acid and carboxylic acid, using sensory structures on the antennae, palps and proboscis.

It is obvious how mosquitoes that feed on warm-blooded hosts find their hosts. What isn’t clear is how mosquitoes find cold-blooded hosts. These hosts are the same body temperature as their environment, so temperature doesn’t work. Reptiles and amphibians produce as much CO₂ as the plants around them, so that won’t work either. So one of the mysteries in mosquito biology revolves around how these mosquitoes find their hosts.

In a final biological twist, one group of mosquitoes is parasitic in a very different way than the rest. Adult mosquitoes in the genus Malaya do not blood-feed, rather they are fed — by ants in the genus Crematogaster. They use their proboscis to tap the ant’s head and mouthparts causing the ant to regurgitate a drop of sugary liquid. The mosquito sucks up the liquid and then leaves. This behavior exploits the nest mate feeding response ant workers have when tapped by another worker.

So far I’ve only focused on adult mosquitoes, but larval mosquitoes can be found living and feeding in some pretty unusual places, though perhaps not quite as unusual as those feeding on seal feces in tide pools. Mosquito larvae have been found in almost any kind of water accumulation ranging from ponds to leaf axils. When we worked in Indonesia, piles of decomposing cacao pod shells were often filled with mosquito larvae. There are tropical mosquitoes with larvae that live in the little pools of water on the top of mushroom caps. Then there is the group of mosquitoes that Tom Zavortink studies, where the larvae live in bamboo internodes. A number of tropical genera do this, including Sabethes. There is always water present in these internodes but the real question is how do the adults manage to leave the internodes to find a mate and lay eggs? At best there might be a small crack or split in the wood.

In conclusion, even in a group of insects, like mosquitoes, that we have studied intensively there are many, many surprises to be discovered. There is still so much that we don’t know about insect biology. Who knows what we’ll discover next?

MORE MUSEUM NEWS

Marius Wasbauer
1928-2021

Long-time museum collaborator and society member Marius S. Wasbauer died suddenly while out on a walk.

Marius had a long career in entomology beginning with his Bachelor’s degree and Ph.D. in Entomology at UC Berkeley. After that, like so many entomologists of his generation, he became an instructor in Preventive Medicine in the U.S. 6th Army Medical Service at Fort Sam Houston, Texas. Following his tour of duty he worked as a systematist for the California Department of Food and Agriculture.

He published nearly 50 papers in wasp taxonomy and the biology of a diversity of insects. His taxonomic research focused on several groups of aculeate wasps, including Pompilidae, nocturnal Tiphidae and myrmosid wasps. Other studies included walnut serpentine leaf miners, tephritid fruit flies, bumble bees, and even craneflies.

He was generous with his time, and worked with many scientists and students around the world. However, aside from his family and wasps, his other greatest love was fishing. We’ll miss you Marius!

Randall G. Blair Donation

In mid January society member Norm Smith visited the museum, and brought with him a personal collection donated to the museum by Dr. Randall Blair.

Dr. Blair’s collection consisted of 21,894 pinned insect specimens in a diversity of orders, and 11 boxes of glass slide-mounted fleas and other ectoparasite specimens in a diversity of species. Included were also nearly 1,000 insect specimens collected in Somalia; certainly our first specimens from this region.

He graduated in Entomology from UC Berkeley. Starting in the 1950’s, after graduation Dr. Blair worked for the San Mateo and Santa Clara County health departments on infectious diseases, which is one reason for all the slides of fleas, and other ectoparasites.

More Drawers!

Jeff Smith is still creating new drawers during the Northern California Lepidopterists meeting in the museum. Here he is holding one of his drawers. Jeff has a new toy, and he now stamps each new drawer with his “brand”. As of this newsletter, he has made 2,267 drawers for the museum from scratch!
Western Yellowjackets

Yellowjacket visiting flowers. Photo by Kathy Garvey.

Five years ago the newsletter led with an article on yellowjackets. Now it seems time to do a follow-up.

The western yellowjacket, *Vespula pensylvanica*, is an annoying stinging pest, even here in California where it is native. These grumpy wasps survive and thrive in wildlands as well as urban and suburban landscapes. This species is native to North America west of the Rockies, but has now expanded its range into the major Hawaiian Islands and eastward across the northern states and southern Canada as far as the Great Lakes.

It can be immediately recognized by several characteristics. The most distinctive is the complete yellow eye loop, a yellow band that encircles each eye. The second trait is the discrete triangular black mark in the top middle of the basal abdominal segment.

Their nests consist of stacks of brood combs, covered by a paper envelope. Both comb and brood comb are constructed of plant fibers mixed with saliva. The nests are built underground or in cavities in wall voids, hollow trees and similar situations.

Yellowjackets can be aggressive stingers. However, you are most likely to be stung in the vicinity of their nests.

In the fall, yellowjacket colonies produce virgin queens and males. The new queens and males mate, the males then die, and the mated queens search for protected sites to survive the winter. In the spring the new queens leave their shelters and look for sites to found new colonies. This behavior can lead to them infesting new regions if they happen to over-winter in a cargo container or semi truck trailer.

In California, this wasp generally makes annual nests. Every spring over-wintering queens establish new colonies. But now, the warming climate is allowing some colonies, particularly along the California coast and in Hawaii, to become perennial. Perennial colonies can become enormous, with literally millions of workers. One such colony found in the ground on the island of Maui contained an estimated 3 million workers!

Yellowjackets have a few predators. Individual yellowjackets are preyed on by predators such as assassin flies and spiders, but there are few predators of entire colonies. Bears, skunks and badgers have been observed digging up nests. In some regions shrews and moles may dig into nests and feed on the yellowjacket larvae. Ironically, as much as we dislike them, turkeys will also dig up yellowjacket nests to feed on the larvae and pupae.

Much as we love to hate yellowjackets they do consume large numbers of insects, including pests, like stable flies and cutworms. So there actually is a bright side to these feisty wasps.

Yellowjacket nest entrance. Photo by Andrew Volk.

Distribution map of *Vespula pensylvanica* in North America; dark gray = native range, light grey = expanded range.

Yellowjacket worker.
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.

**Luna Moth Sighting**

Jerrold Franklin photographed this luna moth in Folsom. Luna moths are native to the eastern U.S. The only thing we can figure is that someone was raising these moths and one got loose or was turned loose.

**Casebearing Clothes Moths**

We were recently contacted by a family concerned that they had some kind of worms in their house. Fortunately, or maybe unfortunately, the “worms” were the cases of clothes moths.

**Weird Oak Gall—Nope**

Thanks to John DeBenedictis we now have the correct identification of this odd structure. It is not a leaf gall. In fact it is a so-called pistol case built by a coleophorid moth caterpillar. The adults are tiny moths most of which are undescribed in the western U.S.

**Cicada Brood X**

Parts of the mid-Atlantic region of the U.S. are bracing for a large cicada emergence. Brood X is due to emerge this spring. Fortunately, or perhaps unfortunately, none of the cicadas west of the Rockies have these oddly timed mass emergences.

**Monarch Butterflies**

The number of monarch butterflies arriving at winter roosting sites has dropped precipitously. In central Mexico they have declined by 26% this winter. The Pacific Grove roost in California, which normally hosts thousands of monarchs, had none this winter. This will need to be explored in more detail in a later newsletter.
Come celebrate with us
2021 is the Bohart Museum’s
75th Anniversary!