In This Issue

It seems like spring has been here for two months already, but now its winter again. It will be interesting to see what effect the warm drought weather will have on insects this year.

The coronavirus is having a major effect on our outreach programs, which are basically shut down. We’re hoping this doesn’t last too long, as I’m sure everyone else is as well.

Next year will be our 75th anniversary! We are in the process of planning events and activities for this seminal year, so if you have ideas and suggestions please let us know. Please send them our way to bmuseum@ucdavis.edu.

We’ve had many students and staff coming and going—leaving for new jobs, doing field work and other adventures.

-Lynn Kimsey

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SPOTLIGHT ON A SPECIES

A Plague of Locusts

By Lynn Kimsey

Over the centuries the term "locust" has been used for a number of different insects that have large population outbreaks, ranging from cicadas to grasshoppers. Actual locusts are a number of species of grasshoppers distinguished by having a periodic swarming phase in both adults and juveniles. These grasshoppers are usually solitary, but under optimal environmental conditions they become abundant and gregarious. When they become gregarious they form large swarms that can pose a major threat to agriculture. Development of large swarms is triggered by rainfall leading to rapid vegetation growth after a period of drought.

Swarming behavior in locusts is triggered by overcrowding. Locust to locust touching increases their serotonin levels, which leads to color changes, and increased eating and breeding in the population. Increased serotonin also leads to increased gregarious behavior and ultimately swarming. The resulting aggregations can increase by orders of magnitude with swarms with as many as 30 billion individuals recorded!

Migrations start with large numbers of flightless juveniles walking away from their birth places. Once the nymphs molt to winged adults, the resulting adults form massive flying swarms. Both life stages can devastate crops. The winged adults can fly considerable distances, consuming vegetation whenever the swarm lands. The nymphs are equally destructive over smaller distances.

Locusts are found on nearly every continent except Antarctica. The best known species is the desert locust (Schistocerca gregaria), which is found across North Africa, the Middle East and the Indian subcontinent. Several species swarm in Africa in addition to the desert locust, including the African rice grasshopper (Hieroglyphus daganensis) and the Senegalese grasshopper (Oedaleus senegalensis). The migratory locust (Locusta migratoria) is the best known species in the genus.

God sent a plague of locusts on Egypt, from the Book of Exodus (Getty images).

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Jessica Gillung, who was a PhD student in the museum, has left a post-doctoral position at Cornell University to become an assistant professor at McGill University in Montreal, Canada.

Andrew Young is leaving his post-doctoral position here where he worked on fruit flies in collaboration with the California Department of Food & Agriculture, for an assistant professor position at the University of Guelph, in Canada.

Brendon Boudinot is completing his Ph.D. this spring and is hoping to continue his research in Germany.

Socrates Letana recently returned from a trip to Costa Rica where he visited the Natural History Museum in San Jose looking for oestrid bot flies.

Iris Bright is a student at Sacramento City College. She has been deeply involved with the Belize insect survey project with Fran Keller and Dave Wyatt.

She volunteers every Wednesday in the museum helping to curate and identify insects collected as part of the Belize survey.

Emily Meineke is the newest professor in the Department of Entomology & Nematology. She studies urban horticultural entomology and looks at the effects of urbanization on trees and their insect associates and pests.

Undergraduates

Three of our undergraduate student employees have graduated and moved on to new jobs on-campus.

Emma Cluff is now working as a technician for Prof. Jay Rosenheim in the Entomology Department.

Lohit Garikipati is now working just down the hall in the arachnid lab for Prof. Jason Bond.

Eliza Litsey is working as a technician in the USDA Honeybee lab located on-campus.

Emma Cluff (top), Lohit Garikipati (middle) and Eliza Litsey (bottom). Photos courtesy of Kathy Keatley Garvey.
The San Francisco Bay Delta is an enormous estuary system, occupying over 75,000 sq. mi. It is the largest estuary on the western coasts of North and South America. The Delta provides drinking water for 25 million Californians, deep water shipping channels connecting Stockton and Sacramento to the San Francisco Bay, irrigation for 2,000 sq. mi. of agriculture and fisheries.

However, the Delta is also one of the most human-modified habitats in the state. Beginning with placer mining during the Gold Rush, and later with intensive agriculture, invasive weeds and construction of levees and canals, essentially no part of the Delta can be considered undisturbed native habitat. Today, many of the Delta islands have sunken well below water level and are only kept from flooding by the levees.

The California Department of Water Resources (DWR) is trying to remediate this in part by restoring native vegetation where possible. The Bohart Museum is collaborating with the UC Davis Museum Wildlife and Fish (MWFB), with 3 years of funding from the DWR, in a project to survey the insects, birds and mammals of six San Francisco Bay Delta restoration sites. DWR asked us to do baseline surveys of insects comparing restored with unrestored habitats. The MWFC staff will be doing a parallel survey of the small mammals and birds at these same sites.

Starting in April of this year we will be sampling the insects at six sites, two on Sherman Island, one on Twitchell Island, one near Dutch Slough, one near Walnut Grove, and one in the Cosumnes River Reserve. Brennen Dyer will be taking the lead on this project. At each site, we will run Malaise, blue vane and blacklight bucket traps. One Malaise trap will be deployed in a restored habitat and one in unrestored habitat at each site. The Malaise and blue vane and traps will run continuously during the sampling period. Trapping will be accompanied by hand net collecting.
migratoria) swarms across Africa, Asia, Australia and even in New Zealand. The Australian locust (Chortoicetes terminifera) was a major pest in southeastern Asia until the last plague in the early 1900's.

Historically, North America had two native locust species, the Rocky Mountain locust (Melanoplus spretus) and the High Plains locust (Dissosteira longipennis). During colonial expansion across North America, the Rocky Mountain locust periodically reached plague proportions in the American Midwest, devastating crops. In 1875 the Midwest experienced the largest locust swarm in American history. The swarm covered about 198,000 sq. mi. and was estimated to contain several trillion locusts! By 1902 the Rocky Mountain locust was essentially extinct, and the High Plains locust is now rare. As a result, today North America has no regularly swarming locusts. Although California had no true swarming locusts, there are periodic outbreaks in the Sierra foothills of Schistocerca nitens. Ironically, this species has now become invasive in Central America and Hawaii.

Locusts have had a profound impact on ancient human history in the Old World. Predictably there was much confusion about locust's biology and "divine guidance". They were so important to the ancient Egyptians that they carved and painted locust images on their tombs. Locusts are also mentioned in the Bible. In the book of Exodus locusts were one of the ten plagues, including frogs, boils and hail sent by God to punish the pharaoh for not freeing the Israelites. In the Quran locusts are also sent as punishment for unbelievers.

The early Greek scholars studied locusts and their habits. Homer, in the Iliad, felt that locusts took wing to avoid fire. During the Roman Empire, Livy tied an outbreak of human plague to the locust plague. He apparently associated the human disease with the odor of the rotting locust bodies. It is possible that the large number of dead locusts fed a growing rat population and thus their fleas resulting in plague transmission.

Early on the Chinese also felt that there was an association between locust outbreaks and human disease. In 311 AD in northwestern China a plague outbreak blamed on locusts, killed the majority of the human population. Here too the connection may have been rapidly growing rat populations due to the huge number of locusts available for food.

Perhaps because of their devastation of crops, locusts are considered food and even a delicacy in some cultures. The Torah according to Yemenite tradition finds three types of locust to be edible, but no other insects. Locusts are also Halal. It turns out that locusts are quite nutritious, and have a higher protein content than beef, and are high in fatty acids and minerals.

By the nineteenth century changing agricultural practices and more efficient surveillance of swarms meant that it was possible to start control measures before locust populations became large enough to induce the swarming behavior. Early intervention is critical. By the twentieth century insecticides were applied from the ground or from the air via crop dusters. Insecticides effectively controlled nymphal bands of locusts before the adult phase. However, the collateral damage caused by the insecticides of choice and their longevity in the environment has led to them being banned in most countries.

Biological control has also proven to be successful in some regions. The African fungus Metarhizium acridum was found to kill locusts without affecting local vertebrates. This fungus apparently only infects and kills grasshoppers, which would obviously affect all grasshoppers and not just locusts.

Control efforts have had mixed outcomes. Developed countries have the resources and political will to invest in locust control, but this is not the case in many developing countries.

Ultimately, the majority of situations where locusts have disappeared were unintended. Anthropogenic environmental change - urbanization and intensive modern agriculture - probably led to their extinction in particular.

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In 2020, two Samburu men who work for a county disaster team identifying the location of the locusts were surrounded by a swarm of desert locusts. PATRICK NGUGI/ASSOCIATED PRESS/ASSOCIATED PRESS.
Biodiversity Museum Day—by Tabatha Yang

Biodiversity Museum Day 2020 was a huge success. We had over 2,000 visitors at the Bohart and similar numbers at the other museums and collections. Our visitors came from all over the West Coast, including Washington State!

Paleontology saw the successful passing of the torch between graduate student cohorts who spearhead this event. Visitors to the Yeast Collections enjoyed tours of the beer brewing facilities. The Nematode collection moved from the atrium into a classroom so they could do more with projecting microscopes. Marlene Simon, with the Botanical Conservatory, went live with Good Morning Sacramento at 8 am to promote the event and then worked in the Conservatory the rest of the day.

At the Bohart, Phil Ward, Jason Bond and Santiago Ramirez’s labs joined us, as did three scientists from the California Dept. of Food & Agriculture, and Kady Tauber. We also partnered with the UC Davis Library who were donors, but also created a wonderful display about Mary Foley Benson for our hallway. We are looking forward to more collaborations next year.

Next year is the 10th anniversary and we are looking forward to another great event for the campus museums and visitors.

Patterson Donation

Over the past few years society member Bill Patterson has been donating parts of his butterfly and moth collection to the Bohart Museum.

So far Bill has donated his butterflies from Africa (Kenya and Zimbabwe), New Guinea and Malaysia. He has also donated swallowtails and many nymphaids from Latin America. In the future he will be bringing the rest of his Latin American nymphaids and his Lycaenidae and Riodinidae.

To date, he’s donated about 35 drawers of pinned and spread butterflies, an estimated 3,000 specimens, which is still a small percentage of his impressive collection.

Bill Patterson in the Bohart. Photo by Kathy Keatley Garvey.

Coronavirus & the Bohart Museum

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Map of visitor origins for Biodiversity Museum Day.

Visitors looking at the desktop scanning electron microscope loaned by for the event, with Zach Griebenow and Steve Heydon looking on.

Martin Hauser from the California Dept. of Food & Agriculture showing visitors live cockroaches.

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Snail Slime and You

The latest thing in skin care is snail slime. This started in Chile but the international market was really launched by the Korean cosmetics industry. Snail mucin has become the foundation for a variety of popular creams, facial masks and serums.

Chilean snail breeders who raised the common garden snail (Cryptomphalus aspersa) for escargot and other uses discovered that handling the snails left their hands feeling unusually soft.

Snail slime apparently seals in moisture and is claimed to have anti-aging properties as well.

Creams based on snail slime.

Spiders do go into ears...

The latest example of this kind of news comes from Jiangsu province in eastern China, where a man recently arrived at a doctor’s office complaining of itching, crawling sensations inside his ear.

When a doctor from the Affiliated Hospital of Yangzhou University first looked in the patient’s ear he did not see anything unusual. But, when he inspected his patient’s ear with an endoscope he discovered a tiny spider deep in the ear canal near the eardrum.

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Attack Katydid

Seven new species of unusually large, heavy-bodied, and very aggressive katydids were recently described by George Beccaloni at London’s Natural History Museum from Madagascar. The katydids average 2.5 inches in length and some of them, like the one shown above, were very brightly colored!
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.

Spotted Lantern Flies
There is increasing concern about the possibility of the spotted lantern fly arriving in California. There is a claim from someone that they found a live individual in Davis. Unfortunately, they didn’t take a photograph or save the specimen. Folks at the California Department of Food and Agriculture have found eleven dead specimens of this insect in cargo jets arriving in Sacramento, Stockton and Ontario airports, all from flights originating in Pennsylvania.

Insects that Eat Plastics
First we had meal worms that ate polystyrene (Styrofoam). Now a newly published study by Federica Bertocciini at the Institute of Biomedicine and Biotechnology in Spain demonstrated that waxworms (Galleria mellonella) can eat polyethylene in the form of plastic bags. The caterpillars can break down the plastic into ethylene glycol. This might be really important since humans create 80 million tons of polyethylene annually!


Rat tailed maggot
Society member Martin Hauser identified the weird creature in the last newsletter as the pupa of a rat-tailed maggot African version.

No Good Deed Goes Unpunished
The brown marmorated stink bug (BMSB) is a major pest in the United States. It was first found in Pennsylvania in 2000, but by 2019 it had reached the West Coast.

To control this pest the parasitoid Samari wasp, Trissolcus japonicus, was successfully introduced from Asia. This tiny wasp parasitizes the stinkbug’s eggs. Unfortunately, at the same time a hyper-parasite was also introduced. This tiny pteromalid wasp, Acroclisoides sinicus, is a parasite of the parasitoid of the BMSB.

West Coast.

Heavy Lifters
It turns out that bumblebees are the heavy lifters of the insect world. A study done by Susan Gagliardi at UC Davis found that they can fly carrying up to 80% of their body weight. They not only fly with that weight, but they have a way of flying with heavy loads that uses less energy than flying unloaded.

Bumblebee foraging. Photo by Tom Roach.

Sound Cancelling Scales
Many species of moth can “hear” bats using eardrums in their abdomens. Some that do not have these structures, like Antherina silk moths, have specialized scales on their thorax that absorb up to 85% of the sound energy from eco-locating bats making them very hard to locate even thought they are large bodied.

Waxmoth caterpillar on plastic bag. Photo by César Hernández/CSIC.

BMSB by Hectonichus https://commons.wikimedia.org.

Female Samari wasp laying eggs in eggs. Photo by Chris Hedstrom, OR Dept. of Agriculture.

Female Acroclisoides sinensis. Photo from Peverieri et al. 2019. J. Hymenoptera Res.


Bumblebee foraging. Photo by Tom Roach.

Antherina suraka. Photo by Shawn Hanrahan, Wikipedia.
Bohart Museum Society
c/o Department of Entomology & Nematology
University of California
One Shields Ave.
Davis, CA 95616

The Bohart Museum’s 75th Anniversary is coming in 2021!

Picnic Day is Cancelled