University of California, Riverside

No. 39, Winter 2015

Friends of the Entomology Research Museum

Newsletter

Editor: D. Yanega; Proofing Editors: A. Mayor

FERM: Friends of the Entomology Research Museum is a UCR campus sponsored support group whose membership is open to students, faculty, staff, and the general public. Annual dues are ten dollars. Membership privileges include the annual meeting, newsletter, and other occasional meetings and events including field trips and lectures by entomologists and other naturalists.

Newsletters Online!

Back issues of the FERM newsletter are now available for online viewing! They can be accessed at the following URL:

http://entmuseum.ucr.edu/join_us_ferm.htm

The FERM Newsletter is published annually and contains articles written by FERM members. If you would like to submit an article, please send it as a Word or RTF file using one of the following two methods: (1) an attachment via email to the editor (see below) or (2) a hard copy version on disk. Submissions will be published in the order they are received in accordance with space availability and relevancy to the FERM general readership. If you have questions please contact the FERM Newsletter editor, Doug Yanega: dyanega@ucr.edu

2016 FERM ANNUAL MEETING

Saturday, February 6, 6 PM

The 2015 Annual FERM meeting and Potluck Dinner will be held on February 6th, at the U.C.R. Entomology Bldg. foyer and large conference room, on the ground floor.

Setup starts at 5:15 pm

Dinner at 6:00

Lecture at 7:00

What to bring: something for yourself and 3 others. FERM will provide cups, plates, utensils, some snacks, and drinks.

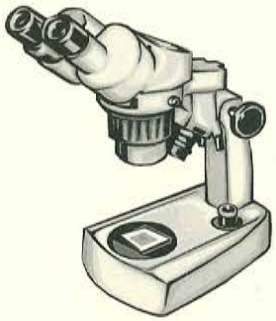
This year's guest speaker is **Emily Hartop**, from the LACM. The title for the talk is:

"BioSCAN and the bugs of L.A."

Emily Hartop, UCR Entomology alumnus and staff on the BioSCAN project at the LACM, talks about the discoveries and delights of putting your city under the microscope. The largest urban inventory of insects in the world is happening right here in Southern California. Currently in its second phase, BioSCAN has already collected millions, and identified tens of thousands, of insects from the urban core of Los Angeles to the foothills of the San Gabriel Mountains. In its current phase, sampling is ongoing from the ocean to the Inland Empire. She describes her talk as "the bugs of Los Angeles, the lunatics that love them, and her insatiable love for fly genitalia. Stunning insect portraiture, wacky and wonderful tales, and a perhaps a touch of (entomological) indecency: urban biodiversity has never been so stimulating." Naturally, we expect to have some diverse and interesting discussions before and after the presentation. See you all there!

NEWS FROM THE MUSEUM

by Doug Yanega, Senior Museum Scientist



For the first half of 2015, Mariana Romo was doing HMDS dehydration and point-mounting, while Amit Tsanhani was doing labeling. Cole Watson was still occasionally volunteering, and helped with the curation and re-integration of a large loan return of syrphid flies. In addition to labeling all of the material Mariana processed, Amit labeled many donations to the museum, including specimens from Gevin Kenney, John Pinto, and Greg Ballmer. Amit also helped with relaxing and spreading of lepidopterans, primarily a large donated backlog of papered material from Dave Hawks. For the latter half of the year, we've had two non-entomology undergraduates, Stephanie Kim and Kristine Ziadie, taking over these duties, with Stephanie doing the mounting and dehydration, and Kristine doing the labeling. All told, we added over 7000 specimens, from either recent donations or processed backlog, in the past year.

Several significant loan returns came in this year; notable were large numbers of syrphids and mutillids, as well as curation of *Anthophora* by Michael Orr. We have also managed to retrieve about 2/3rds of our ant collection from the LACM, where some 14000 of our specimens had been residing for the last few decades. We are hopeful we can finish the process in 2016, and then begin repatriation of our former primary type collection from the California Academy of Sciences, which has been on indefinite loan for several decades. A few more old delinquent loans came back over the past year, and these have been fully incorporated back into the collection. This year, as last, a few potential loans were avoided by sending database information or photographs instead of physical specimens, or tissue samples only. An increasing frequency of new loans are being generated by non-targeted requests via social media (mailing lists, FaceBook, etc.), rather than direct solicitation. Aside from increasing numbers of information requests from researchers, the number of such requests from the public have been skyrocketing; in 2015 I gave several newspaper and two TV interviews, a streaming podcast, several tours, a guest blog, and have been helping to contend with increasing traffic in the FaceBook groups that involve insect ID services. The era when the only valuable resources a museum had to offer were its specimens has passed, and we are clearly now in an information age; we're dealing with data sharing, crowdsourcing, social media, and remote ID, and that trend is certain to continue.

Adriean Mayor, a retired former UCR grad, is back again in SoCal, plowing through our melyrid beetles. He recently visited the Smithsonian to examine types, allowing him to match up morphospecies to published names, and finding a lot of things that don't appear to have names – in other words, discovering a rather large number of new undescribed species (though many were collected decades ago), which he will name as part of his revisionary work and deposit here. The Museum's regular database has grown to roughly 510,000 records, with an impressive 170,000 that are IDed to genus-level or better, georeferenced, and available online as part of the Discover Life website dataset. I have been on a few significant collecting trips this past year, some of them with BEUSA students and Field Entomology, plus a major trip to Guatemala, and found new species on several of these trips.

SoCal's Sneaky Assassins

By Paul Masonick

Throughout much of the summer and fall, ambush bugs (Hemiptera: Reduviidae) conceal themselves among blooming flowers in the mountains and deserts of Southern California. These patient, sit-and-wait predators are usually between 6-10 mm in length and rely on the element of surprise to capture faster moving prey. Once another flower visiting insect gets within striking distance, an ambush bug will quickly grab hold of its prey with powerful raptorial fore legs and then pierce it with sharp, sucking mouthparts. Shortly after inserting its stylets, their victims cease to struggle and the ambush bug may proceed to feed. Between meals, some bugs will even nectar feed from the flowers they use as ambush sites.

Many species of ambush bugs are sexually dimorphic in which males and females exhibit different coloration and body shape. Males are usually smaller and much darker than females and are easier to spot in the field. However, the cryptic color patterning exhibited by these bugs allows them to blend in very well with the surrounding vegetation and they can be easily overlooked. Males are often found perched on the dorsum of females where they can remain for extended periods of time. Many people believe that these pairs are mating, but in fact, copulation only occurs when males approach a female from her side. Together, males and females have been observed to take down prey much larger than themselves, such as sphinx moths and bumble bees. Ambush bugs can stridulate (a type of chirping noise) by drawing the tip of their proboscis along fine ridges in their prosternal stridulatory groove. This behavior is often observed between mating pairs or when a bug is disturbed. Immature ambush bugs are also predatory and closely resemble adults with the exception that they lack wings and developed reproductive organs. **(see this month's Bug of the Month color insert for more)**

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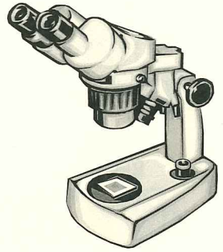

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(see this month's Bug of the Month color insert for more)

Wasps Across the Lone Star State

By Austin Baker

In the summer of 2014 I wanted to travel to as many places across the US as possible where I could potentially find *Orasema coloradensis* (Hymenoptera: Eucharitidae), a parasitoid wasp that I wrote about in a past year's FERM newsletter. I left Riverside eastbound for Texas late in June along with my undergraduate colleague, Scott Heacox. We decided to spend our first day visiting the Grand Canyon since it was close to one of my target collecting localities in Northern Arizona and I had never seen it before. The Grand Canyon was beautiful and worth the small detour, but the collecting locality nearby ended up being fruitless.

We drove straight through the rest of Northern Arizona into Northern New Mexico. The highway followed beautiful painted mountains to the north and was dotted with fireworks stands and Native American souvenir shops along the south. We drove straight through most of New Mexico, but we stopped near White Sands, an Army missile test range, to collect wasps. This was our first success in finding *Orasema*. It wasn't my target species, and I didn't think it was anything special until I sequenced its DNA after the trip was over. This species turned out to be related to a very different-looking species of *Orasema*. It seems that this species is either undescribed, or it will change the relationships in this genus that we previously believed to be true.

We left New Mexico and arrived in Texas, the center of diversity for *Orasema coloradensis* in the southwest. I wanted to collect in Texas because museum collections led me to believe that there could be at least three undescribed species there in the coloradensis species group, and getting specimens for DNA analysis could be essential to revising the group. I had been attempting to contact the Texas State Park services to get collecting permits for about a month before we had left Riverside and had gotten no reply. Finally, the day we drive into Texas I got a call back and actually began the permitting process. Unfortunately that would be the last communication that I would get from them for about a week.

After driving through El Paso, our first target destination was Davis Mountains State Park in Fort Davis. Scott and I took the exit off the freeway with about a quarter tank of gas figuring that there would be a gas station on the way to Fort Davis. We were wrong. I don't know how we didn't run out of gas; it seemed like the empty tank light was on for the last 10-15 miles, but fortunately we made it to town on fumes. I was anxious getting into the state park because we still didn't have permits. We met the park biological expert, who worked for the State Park department, and he was nice enough to fill out and file all of our permits for the rest of the trip. When the State Park department finally got back to me halfway through the trip, they were a bit confused when I told them that we already got it taken care of.

We didn't find any *Orasema* in Fort Davis, so we moved on to our next target, Monahan's Sandhills State Park. This was an interesting area of sand dunes that seemed out of place in the middle of Texas. We met another entomologist here who studied solifugids. She had just finished her research at Texas Tech and was taking a vacation. We had a good conversation, then went on our way collecting. There were museum specimens from this area that were the largest *coloradensis* group specimens in the entire collection, but unfortunately we didn't find them (or much of anything) in the sand dunes.

Our next stop was at the Kerrville-Schreiner Park in Texas hill country. This area had the most beautiful fields of wildflowers that I had seen on our journey. I figured with all of the flowers there must surely be a diverse fauna of parasitoid wasps, and there was. We were able to catch another species of *Orasema* which appeared to be laying eggs in the sage. Unknown to me at the time, this was another undescribed species. We baited the ants in the area to try to track down their nests and see if they were parasitized, but that proved difficult and unrewarding. What I received for my efforts were hundreds of chigger bites up my legs. We visited the nearby Enchanted Rock State Park before moving on. We didn't find any *Orasema* but had a nice hike to the top of the rock.

We headed to Lake Corpus Christi State Park next, but on the way we decided to stop in San Antonio for some Texas BBQ. I had brisket, ribs, cream corn, and baked beans, with some white bread to soak up all the juices; it was the best meal of the trip. When we got to Lake Corpus Christi near the Gulf Coast and stepped out of the car, it was like being hit by a wall of humidity. We soon discovered the ornamental mesquite trees planted around the park were *Orasema* goldmines. This still was not the species I was looking for, but I could instantly see that it was a rarely collected species. We collected our fill but had difficulty finding an ant host because there were so many ant species living in close proximity, including some very large *Atta* nests. We found one other species of *Orasema* at a nearby wildlife refuge, but were quickly chased away by swarms of hungry mosquitoes.

After this point of success in the trip, we were met by a series of failures. We went down to Brownsville, the southernmost city in Texas, and found nothing. We drove up along the border heading west and stopped at a couple of places, but everything in this area was so dry that we found very few insects at all (except mosquitoes). The last place we wanted to stop and collect was Seminole Canyon State Park. This was a very beautiful canyon in western Texas. The cliff walls had very old Native American artwork on them, and some of the stones in the basin had fossilized shells embedded in them. We didn't find any wasps of interest here, but it was a nice place to make our last stop.

The next day we decided to drive home to Riverside in one straight shot. It was about 18 continuous hours of driving, and by the time we got home, we were exhausted. We never ended up catching a single *Orasema coloradensis* on the entire trip, but we did get several other interesting species and had a heck of a time doing it.

Our Undergraduate Experience on Project ADMAC

by Krissy Dominguez and Scott Heacox

As UCR undergraduates, we had a chance to present our research on the eucharitid wasps of Madagascar, at the 2014 ESA meeting in Portland. When we were first introduced to Dr. Jack Longino at the conference ESA 2014 in Portland, neither of us could begin to anticipate the ambitious journey that we would soon be a part of. In June of the following year, we shipped off to Costa Rica with a singular goal: ants. This was to be the inaugural leg of the Ant Diversity of the MesoAmerican Corridor (ADMAC) project, led by Dr. Longino and Dr. Michael Branstetter of the University of Utah, as well as Dr. Phil Ward of UC Davis. The ultimate goal of the project was to perform a massive sweep of Central America and catalogue all ants found, and utilize cutting-edge next-generation molecular sequencing techniques to tease apart their unique evolutionary lineages. We were joined by two other undergraduate students from the U.S.: Mac Pierce and Josh Kouri, as well as four students from the University of Costa Rica: Josue Corrales, Irene (Nene) Calderon, Irene Mata, and Marianela (Nela) Solis. From the beginning of June to Mid July, our jungle trek brought us to eight collecting sites, spread across the cloud forests of the Talamanca Mountains of South-Central Costa Rica. Our living conditions were as diverse as the ants we collected, ranging from the comfortable ecotourism lodge at Tapanti National Park, to the active dairy farm of Finca Naranjo, to the bare-bones "tarp city" constructed to shelter our expedition personnel and equipment from the harsh elements of the secluded Cerro Platano. The latter quickly became infamous for its week-long rainstorms that turned trails into rivers, apocalyptic swarms of winged termites, and clouds of painfully biting horse flies. Venomous snakes were never in short supply.

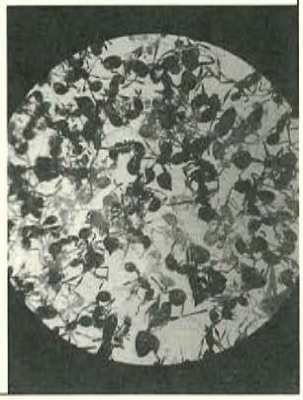
Cerro Platano base camp, aka the "tarp city"

The one constant of the trip, though, was the fierce physical demands to reaching each collecting site, often consisting of long hikes up muddy mountainsides (an 18 kilometer hike into the mountains in the case of Cerro Platano). Once we determined the ideal location, the real challenge began: sifting. Our primary means of acquiring ant specimens was by the methodical sifting of leaf litter within plots that were along transect lines, running through the thick of the forest. Needless to say, good, sharp machetes were our closest allies. The result was 100 bags of leaf litter per site, which then we had to haul back to camp. Each sample was emptied into individual mini-Winkler funnels and hung for three days, which provided time for the bulk of the arthropods in the samples to eventually drop into a whirlpak of ethanol, ready to be examined at a later date.

Mini-Winkler funnels hanging from roof beams

Sifting leaf litter was not the only means of ant procurement. Rounds of "baiting and beating" were also conducted at every site. The act of baiting involved the use of index cards topped with pecan sandies to lure out hungry ants, while beating employed large canvas sheets to catch arboreal ants dislodged after striking an unlucky plant with a wooden pole. Malaise traps were also strategically set up to catch winged alates. All of these collecting techniques resulted in pure ant gold.

After the grueling, yet gratifying and extremely productive fieldwork was concluded, we headed back to the University of Costa Rica for a week of Winkler sample sorting in preparation for shipping the ants back to the States. An incredible feat of its own, we managed to pull all of the ants, as well as a few other groups of arthropods, out of all 800 mini Winkler samples plus a handful of malaise trap samples. It was then time for our final leg of the journey, back in the U.S. at the University of Utah in Salt Lake City. Here we participated in an informative next-generation sequencing workshop where we learned how to extract ant DNA, amplify and sequence ultraconserved element (UCE) regions of their genomes, and how to use the resulting sequence data, spanning thousands of loci, to elucidate the evolutionary relationships between the abundance of species we encountered.



We both brought back a host of scars as souvenirs. We were cut, bruised, bitten and infected by all manner of forest life. Yes, it seems quite dire, but in reality it was a chance to experience something that very few people ever will. The harshness of tropical fieldwork provided an absolutely sublime and unique perspective of the tropical forests of MesoAmerica. We witnessed the unparalleled diversity of life all around us -- often alien, sometimes dangerous, and always incredible. We fought through all the storms, mud, heat, cold, and anything else the forests had to throw at us. Ultimately, we were left not only with scars as souvenirs, but with a new personal strength of character, unforgettable friendships, an omnipotent appreciation of nature, an abundance of rare knowledge, and, of course, ants!

Recent Publications by FERM members:

Aishan, Z., **S.V. Triapitsyn** & H.-y. Hu. 2015. Review of *Tumidiclava* Girault (Hymenoptera: Trichogrammatidae) from Xingjiang, China, with description of two new species and taxonomic notes on other Holarctic taxa. Zootaxa 3949 (3): 393-407.

Burks, R.A., Heraty, J.M. 2015. Subforaminal bridges in Hymenoptera (Insecta), with a focus on Chalcidoidea. Arthropod Structure and Function 44: 173–194.

Burks, R.A., Heraty, J.M., Pinto, J.D., Grimaldi, D. 2015. Small but not ephemeral: newly discovered species of Aphelinidae and Trichogrammatidae (Insecta: Hymenoptera: Chalcidoidea) from Eocene amber. Systematic Entomology. DOI: 10.1111/syen.12124

Burks, R.A., Mottern, J., Heraty, J.M. 2015. Revision of the *Orasema festiva* species group (Hymenoptera: Chalcidoidea: Eucharitidae). Zootaxa 3972 (4): 521–534.

Guzmán-Larralde, A.J., **S.V. Triapitsyn,** J.T. Huber & A. González-Hernández. 2015. Review of the Mexican species of *Erythmelus* (Hymenoptera: Mymaridae), with description of two new species. Zootaxa 3956 (1): 121-130.

Heraty, J.M., Mottern, J. and Peeters, C. 2015. A new species of *Schizaspidia*, with discussion of the phylogenetic utility of immature stages for assessing relationships among eucharitid parasitoids of ants. Annals of the Entomological Society of America DOI: 10.1093/aesa/sav062

Hespenheide, H.A. 2015. Striking new species of *Brachys* Dejean, 1833 (Coleoptera: Buprestidae) from New Mexico, Texas and Mexico. Coleopterists Bulletin 69 (2): 221-224.

Hespenheide, H.A. and C.S. Chaboo. 2015. Beetles (Coleoptera) of Peru: A Survey of the Families. Buprestidae. Journal of the Kansas Entomological Society 88 (2): 211–214.

Huber, J.T. & **S. Triapitsyn.** 2015. Redescription of *Chrysoctonus* and description of *Chrysoctonoides* (Hymenoptera, Mymaridae), a new genus from the Australian Region. ZooKeys 505: 79-101.

Marie, J. and **R.S. Vetter**. 2015. Establishment of the brown widow spider (Araneae: Theridiidae) and infestation of its egg sacs by a parasitoid, *Philolema latrodecti* (Hymenoptera: Eurytomidae) in French Polynesia and the Cook Islands. J. Med. Entomol. 52: 1291-1298.

Mayor, A., & C.S. Chaboo. 2015. Beetles (Coleoptera) of Peru: A Survey of the Families. Mauroniscidae. Journal of the Kansas Entomological Society 88(2): 215-216.

Moya-Raygoza, G. & **S.V. Triapitsyn**. 2015. Egg parasitoids (Hymenoptera: Mymaridae and Trichogrammatidae) of *Dalbulus quinquenotatus* (Hemiptera: Cicadellidae), with description of a new species of *Anagrus* (Mymaridae) from Mexico. Annals of the Entomological Society of America 108 (3): 289-298.

Palanivel, S., S. Manickavasagam & **S.V. Triapitsyn.** 2015. *Stephanocampta* Mathot (Hymenoptera: Mymaridae): descriptions of two new species and the female of *S. indica* Anwar & Zeya from India and a key to world taxa. Zootaxa 4012 (3): 479-492.

Triapitsyn, S.V. 2015. Taxonomic notes on *Anagrus incarnatus* Haliday and some other fairyflies (Insecta: Hymenoptera: Mymaridae) from the A. H. Haliday collection in the National Museum of Ireland. Bulletin of the Irish Biogeographical Society 39: 215-221.

Triapitsyn, S.V. 2015. The genus *Himopolynema* (Hymenoptera: Mymaridae) in Taiwan and taxonomic comments on some extralimital species. Formosan Entomologist 35 (2): 79-116.

Triapitsyn, S.V. 2015. Taxonomy of the genus *Anagrus* Haliday (Hymenoptera: Mymaridae) of the world: an annotated key to the described species, discussion of the remaining problems, and a checklist. Acta Zoológica Lilloana 59 (1-2): 3-50.

Triapitsyn, S.V. 2015. A new species of the genus *Aprostocetus* Westwood, 1833 (Hymenoptera, Eulophidae: Tetrastichinae) collected by E. S. Sugonyaev in galls on saxauls in Uzbekistan. Entomological Review 95 (5): 643-646.

Triapitsyn, S.V. 2015. Description of the male of *Leptomastidea debachi* Trjapizin and Ruíz Cancino from Baja California Sur, Mexico, with notes on *L. abnormis* (Girault) (Hymenoptera: Encyrtidae). Dugesiana 22 (1): 9-13.

Triapitsyn, S.V. 2015. New records of Eulophidae, Mymaridae, Pteromalidae, and Tetracampidae (Hymenoptera: Chalcidoidea) from Russia, with annotations and description of a new species of *Dicopus* Enock. Far Eastern Entomologist 292: 1-12.

Triapitsyn, S.V., V.V. Berezovskiy & P.S. Tretiakov. 2015. Complex of natural enemies of *Essigella californica* (Essig, 1909) (Hemiptera, Aphididae, Lachninae) in Riverside, California, USA. Boletín de la Asociación española de Entomología 39 (1-2): 175-183.

Triapitsyn, S.V., T.R. Petrice, **M.W. Gates** & L. S. Bauer. 2015. Two new species of *Oobius* Trjapitzin (Hymenoptera, Encyrtidae) egg parasitoids of *Agrilus* spp. (Coleoptera, Buprestidae) from the USA, including a key and taxonomic notes on other congeneric Nearctic taxa. ZooKeys 498: 29-50.

Triapitsyn, S.V. & V.A. Trjapitzin. 2015. Revision of *Moorella* Cameron, 1913 (Hymenoptera: Encyrtidae). Dugesiana 22 (1): 43-50.

Vetter, R.S., R.J. Adams, J.E. Berrian and L.S. Vincent. 2015. The European spider, *Steatoda nobilis* (Araneae: Theridiidae), becoming widespread in California. Pan-Pac. Entomol. 91: 98-100.

Weirauch, C. & **Frankenberg, S.** 2015. From "insect soup" to biodiversity discovery: taxonomic revision of *Peloridinannus* Wygodzinsky, 1951 (Hemiptera: Schizopteridae), with description of six new species. Arth. Systematics & Phylogeny 73: 457-475.

Butterfly Wonderland

by Rick Vetter

During August, I made a one-day trip to Phoenix to use up a travel voucher and serendipitously happened to see Butterfly Wonderland, just off the freeway. As my Phoenix friend and I were doing a catch-as-catch-can day, we stopped for a visit. It is a very wonderful exhibit. The butterfly atrium must have been several thousand square feet. They had many species of butterflies, mostly tropical, flying around in the atrium. Species included Blue Morphos, clearwings, *Charaxes*, *Papilio*, lacewings, *Heliconius*, *Hamadryas*, etc. There were also tropical birds living among the butterflies. Inside, they had butterfly emergence cages, a honey bee observation hive, leaf-cutter ant colony, and a pool with little sting rays that you were allowed to have swim over your fingertips at the edge of the pool. There was also a 3D movie on monarch butterflies that was educational and entertaining. When I was there, they were constructing an aquarium (OdySea) right next to Butterfly Wonderland. It will be weird to have penguins in the desert but it should be open by next summer. Anyway, if you are looking for a fun entomological time in Phoenix, you might try this place. I would suggest a visit when Phoenix cools off a bit. We went on a day when it was 106 degrees or so. It was cooler and almost tolerable in the atrium but also humid with all the misters keeping the place tropically moist. Admission was $20 for adults, and I forgot to ask for a AAA discount (if they even give one). I didn't pay attention to the admission price for kids. And leave your collecting gear at home. **Butterfly Wonderland, 9500 E. Via de Ventura, Scottsdale, AZ 85256,** 480-800-3000, open 7 days a week 9 AM to 5 PM

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While we realize that you have not been hearing much from us (it's been extremely hard to convince people to contribute articles for the newsletter, and even our FaceBook page has seen little activity), we've been careful - as always - not to spend anything we don't need to. Money donated to FERM will get put to good use, and is greatly appreciated.

To those of you who have been kind enough to contribute your dues recently, we are very grateful, and for the rest of you we include below the usual dues renewal form, which we hope you'll send in soon. Thanks very much!

Friends of the Entomology Research Museum
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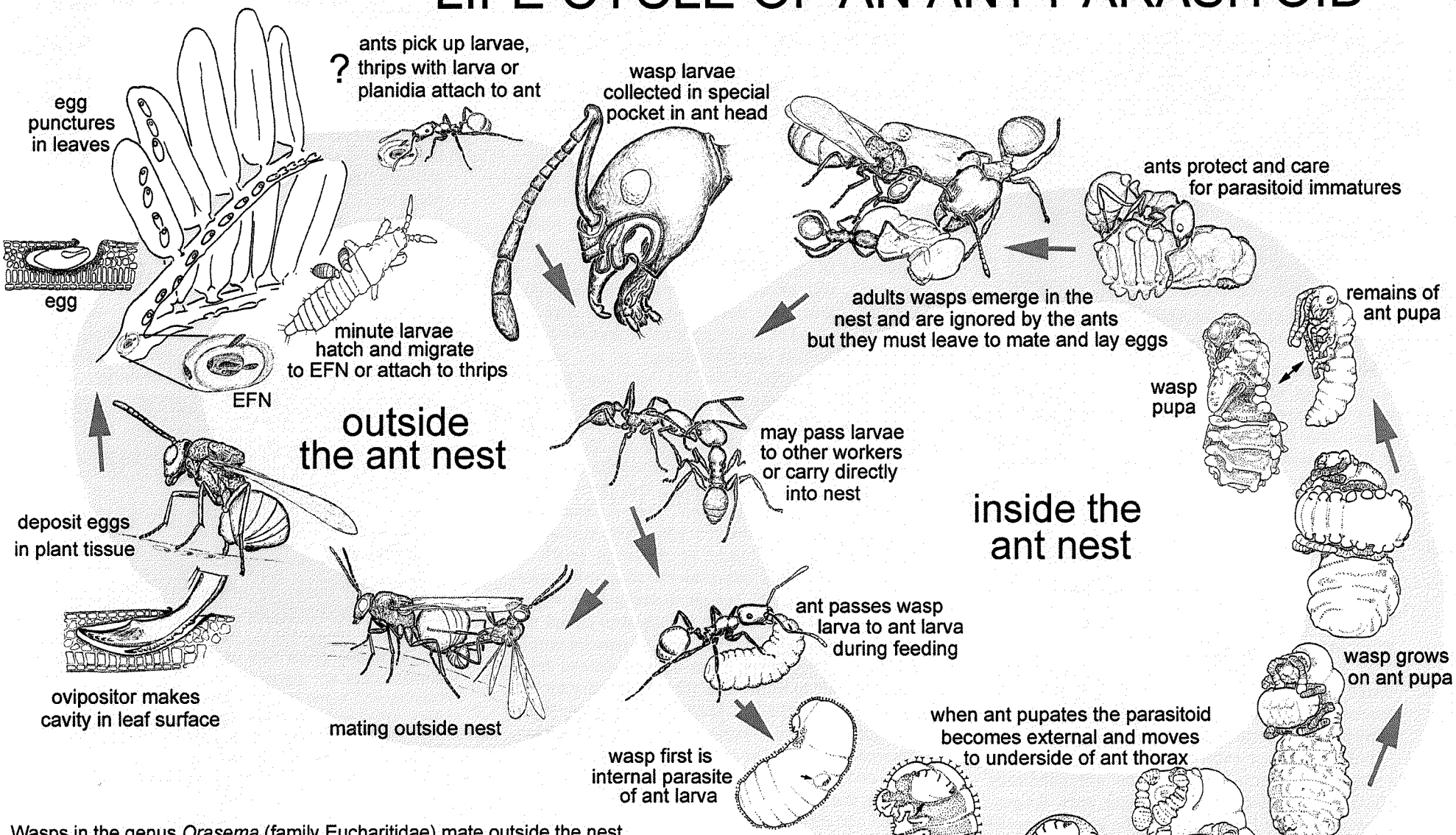
Dues and other contributions are payable by check to the **UCR Foundation,** noting "**Entomology Museum**" on the memo line on your check. (It is **very** important to note "Entomology Museum" in order for your donation to be deposited in the Friends' UCR Foundation account.)

LIFE CYCLE OF AN ANT PARASITOID



Wasps in the genus *Orasema* (family Eucharitidae) mate outside the nest. Females deposit eggs into vegetation using a special expanded ovipositor. Eggs are laid into leaves, bracts of flowers or even the peel of a banana. Eggs are often laid near to an extrafloral nectary (EFN). Ants pick up the hatched larvae (planidia) by feeding at the nectary, direct phoresy or by feeding on thrips with attached planidia. Ants carry the wasp larvae back to the nest where they are transferred to the ant larva. Planidia first attack the ant larva as internal parasitoids but then develop as external parasitoids of the ant pupa. After killing the ant pupa and leaving a living carcass, the wasp pupate and emerge in the nest. Specialized chemicals allow them to live with the ants for a short time, but they must leave the nest to meet their mates and start the cycle again.

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Life History of an Ant Parasitoid

Adult *Orasema* wasp parasitoid in colony of *Pheidole*. Photo courtesy of Alex Wild.

What is a parasitoid?

A parasitoid is an insect that takes nourishment from another insect and eventually kills that insect. True parasitoids are only known in a group of insects with a distinct larval and pupal stage. It is the larva that kills the other arthropod host. Adults are usually do not kill other insects, and instead feed on things very different from the larvae. Because they kill other insects, parasitoids are often considered important for the control of other insects, including those insects considered to be human pests.

What are myrmicine ants?

Ants belong to the insect family **Formicidae.** Based on fossils, we know that the first ants appeared about 100 to 120 million years ago. We currently recognize 16 higher level groups of ants (subfamilies) that evolved relatively early in the evolution of ants. Of these, the ant subfamily Myrmicinae includes the harvester ants, fungus-growing ants and the fire ants. The ant workers of myrmicine ants all have a functional sting that can cause reactions in humans and makes them a direct human pest. They can also have an very negative impact on insect diversity when they are invasive and introduced into a new habitat. Pest ants include the Little Fire Ant, *Wasmannia auropunctata*, the Imported Fire Ant, *Solenopsis invicta*, and the invasive big-headed ant, *Pheidole megacephala*. Both *Solenopsis* and *Wasmannia* are considered among the top 100 most invasive insects.

What are eucharitid wasps?

The wasp family **Eucharitidae** are a diverse of insects known to exclusively attack a group of social insects, the ants. This family belongs to a larger group of wasps, the **Chalcidoidea**, which are an extremely diverse superfamily of mostly insect parasitoids. The chalcidoids are highly diverse, with more than 500,000 species estimated to exist, although relatively few (23,000 species) are known to science. Eucharitidae include about 480 described species, with an estimated 300-500 species yet to be described.

All eucharitids are parasitoids of ant pupae. They mate outside of the ant nest, and deposit their eggs away from their ant host, either in or on plant vegetation. Eggs hatch and the minute active first-instar larvae, termed a planidium, about 0.12 mm in size, must find its way into the ant nest. They do this by various means, but always involving a foraging adult ant worker. The planidia may be associated with fruit, extrafloral nectaries, potential prey of the ants (such as thrips) or may just attach to the wandering ants. Once on the ant, they appear to make their way to a special cavity in the ant mouthparts called the infrabuccal pouch. They are able to survive within the pouch and are able to be transferred from foraging ants to nurse ants (those that care for the ant larvae) to the ant larvae themselves. These planidia must be transferred to the ant larvae. Once on the larva, the planidium burrows into the host and waits for it to pupate. When pupation occurs, the planidium moves to the ventral region of the ant pupal thorax and begins to feed. After consuming most, but not all, of the ant, the wasp finishes develop-ment, pupates and eventually leaves the nest to finish the cycle.

The ants treat the killers very well, and have been observed to protect the wasps when the ant nest is disturbed or threatened. Semiochemicals may help disguise the wasps.

We do not know exactly how the planidium gets into the nest. Does it always get carried in the infrabuccal pouch? Do the ants pick up the planidia while feeding or grooming? Do they transfer the larvae by trophyllaxis (food exchange), or by some other means?

What are extrafloral nectaries?

Some eucharitid wasps place their eggs very close to ExtraFloral Nectaries (EFN). These specialized plant structures secrete a sugary amino-acid rich liquid that is highly attractive to ants and other parasitoid adults. EFN nectar is often released as a result of damage to the plant. We have a theory that the eucharitids may damage the plant to increase nectar production, which in turn increases the possibilty of ants interacting with newly emerged planidia. What do you think? If you have ideas or observations, let us know.

First-instar larvae (=planidia) of *Orasema simulatrix* (Eucharitidae) in an EFN of desert willow, *Chilopsis linearis*. Eggs are placed close to the EFN and larvae emerge and crawl to the nectary. Ants are known to feed at the nectaries. Photo courtesy of Judith Herreid.

What is Biological Control?

Biological Control is the natural control of pest insects using their natural enemies. Introduced pest species often lack the parasitoids that kept them in check in their native country of origin. We can control these pest by carefully selecting, studying and releasing their parasitoids, *including eucharitids*, against these invasive pests.

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Photo by P. Masonick ©

Phymata arctostaphylae (Hemiptera: Reduviidae)

There are over 100 described species of ambush bugs in the genus *Phymata* Latreille, many of which occur in the Nearctic and Neotropics but several species can be found in temperate regions of the Palearctic. The diversity of *Phymata* in the American Southwest is unrivaled elsewhere in the United States. 15 species and numerous subspecies are reported from this region. Among the species most frequently encountered in Southern California are *Phymata pacifica* Evans, *Phymata borica* Evans, and *Phymata americana metcalfi* Evans. These species are typically found on plants that bloom during the summer and fall such as *Eriogonum fasciculatum* (California buckwheat), *Lepidospartum squamatum* (scalebroom), and species of *Ericameria* (rabbitbrush). While most species of *Phymata* are usually yellow or whitish and similar in color to the flowers from which they stalk prey, *Phymata arctostaphylae* Van Duzee is unique among ambush bugs in that it occurs on *Arctostaphylos* (manzanita) and camouflages extremely well with the mahogany red bark of these shrubs. This particularly rare species has recently been collected in chaparral of the San Gabriel Mountains above 7000 feet.