

Ants, Bees and Wasps

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Although my first love has always been arachnology, I am a great fan of the Hymenoptera. I even went so far as to attend a meeting of the International Society of Hymenopterists in Davis, California, earlier in my career. At the time I thought that I would be shifting my research interests from spiders to parasitic wasps (I had taken a course at the University of Maryland in parasitic Hymenoptera and was directing a master's student in the study of these natural enemies.) The best-laid plans go often awry and when I returned to the university from Davis I was presented with a grant to study SPIDERS!

In any case, the Hymenoptera are worthy subjects for study (as Howard Ensign Evans said of wasps in his fascinating book "Wasp Farm") and there are plenty of problems to solve and interesting observations to make. An example of this is my discovery, a few years ago, of a small spider wasp (family Pompilidae) dragging a spider across a sidewalk in Las Cruces, New Mexico. For some stupid reason I did not have my usual plastic vial in my pocket, so I ran to the museum (where I curated) to get one. On returning I had a difficult time finding the wasp, as it had moved further than I thought it would. When I did find it I was amazed! The spider, which had all eight legs when I first saw it, now had none! I caught the wasp, with its spider, and further search disclosed the spider's legs in a neat pile a meter or so away on the sidewalk. I picked these up as well and sent the whole collection (wasp, spider and spider legs) to a specialist. The wasp had apparently found the legs to be an encumbrance and neatly snipped them off, most likely with her mandibles. Such observations are open to anyone who pays attention and serious amateurs can easily add to our knowledge

in this (to me at least) fascinating field of ethology. It only takes some effort to get to know you local species and patience.

The Hymenoptera contain well over 130,000 known species and probably hundreds of thousands (up to at least 1 million!) more still undescribed. The order includes two suborders – the sawflies in the Symphyta (which may or may not be monophyletic – that is all descendents of the same original ancestor) and the ants, bees, wasps and parasitoids in the Apocrita. The Apocrita can be further divided into to the “Parasitica” and the one certain monophyletic large grouping, the Aculeata (ants, bees and wasps). I will concentrate on the latter in this essay, but even so I can only skim over such a complex taxon.

Ants are, of course, quite irritating to many people. The iconic ants at the picnic are celebrated in cartoons and stories. Some sting (fire ants come to mind) and they get into any food items (and not just sweets; we used tuna fish to trap ants in Florida and Puerto Rico). I still remember the conical nests of the southwestern leafcutter ants (*Acromyrmex versicolor*) that I discovered in the Gila Mountains and later along the Camino del Diablo, both in southern Yuma County, Arizona. I was surprised to find the workers along the Devil's Highway hauling creosote leaves as I thought creosote to be too high in nasty chemicals to serve as compost for the ant's fungus gardens (they do not eat the leaves, but use them for compost!) When walking along the river path in Austin, Texas, I discovered the larger leafcutters (*Atta texana*) defoliating shrubs in mid-winter! This made my visit to Austin much more interesting as I had not really expected such tropical insects in winter. I would not see the big leafcutters until I disembarked from a van at the Arena Forest in central Trinidad, a few years later. There the leafcutters were so numerous that I could not avoid stepping on them.

One other ant I observed in Trinidad was one of the army

ant species (*Eciton* sp.) It was near the end of my stay in Trinidad. A group of us who had been attending the International Meeting of the American Arachnological Society made arrangements to visit the Asa Wright Nature Center in the Northern Range rain forest. We were returning from a bird walk when I spied a column of the ants, with their characteristic huge-mandibled soldiers moving down the same trail. I unfortunately had little time to observe them. The closely related army ant genus *Neivamyrmex* was fairly well-known to me as I had seen several raiding parties of at least three species in New Mexico and caught examples of the "sausage fly" males at lights at the Gray Ranch in the boot heel of the state.

One of the *Neivamyrmex* raids I witnessed occurred in my front yard near the campus of New Mexico State University in Las Cruces. I noticed a knot of reddish ants on one of the mint plants in our window box and collected a sample. I took them to the museum and examined them under a microscope only to discover they were army ants! I had not seen this species before and so I sent specimens to an expert in the group. It was identified as *Neivamyrmex fallax*, which has since proven to be a junior synonym of *N. swainsoni* (previously known only from males.) The next evening after my first encounter I discovered a column exiting an underground tunnel and climbing a nearby tree! In the morning I found the remains of one column trapped in my daughters' little red wagon. Most were dead. Suddenly I had no dolichoderine ants in the house, where they had been pests the week before. As we were in the process of moving I am not sure how long that lasted. The other two raids I witnessed were of *N. nigrescens* during a cloudy day in the Robledo Mountains northwest of Las Cruces and of a column of *N. texanus* along the road to Aguirre Springs in the Organ Mountains in the early morning. I had stepped in the middle of the column and just looked down to see the ants scurrying in all directions.

There are, of course, many other ants. I've discovered a colony of Amazon ants (*Polyergus* sp.) on the Gray Ranch, complete with their captured workers from another species in the related genus *Formica*. I've seen huge colonies of tropical fire ants (*Solenopsis geminata*) in Puerto Rico, southern fire ants (*Solenopsis xyloni*) in New Mexico, and red imported fire ants (*Solenopsis invicta*) in Florida, been stung by workers from harvester ant (*Pogonomyrmex* spp.) colonies, had my house invaded by sugar ants (*Forelius* sp.), and observed the nighttime foraging of huge carpenter ants (*Camponotus* spp.) In Florida and in the Organ Mountains I've also encountered the weird trap-jawed ants in the genus *Odontomachus*.

All ants are truly social (eusocial), but this is not the case with bees and wasps. The honey bee (*Apis mellifera*) is thought by many to be typical, but there are many more solitary bees than eusocial ones. The honey bee is also thought by many to be native to North America, but the genus *Apis* is originally from South Asia, with seven species being found there. The honey bee is the sole representative in most of Africa and all of Europe, where different subspecies, including the African, Cape, Italian and German forms, have undergone slightly different selection, with the African races becoming the most aggressive. The European honey bees were introduced to North America (and later Australia) by European colonists, with bees becoming wild in New England by the mid 1620s. One of the African subspecies was accidentally released in Brazil in 1957 and reached the United States by 1990 and by 2002 had pretty well established in the Southwest (See: http://en.wikipedia.org/wiki/Africanized_bee.) These are extremely aggressive bees that live in large colonies and were quickly named "killer bees" by the press. The honey bee, with all its subspecies, is by far the best known of all the bees, with multitudes of publications being written on the keeping of bees and on their behavior. Karl Von Frisch won a shared Nobel Prize for his detailed work on the dance language of honey bees. Incidentally, honey bee workers are the only bees

that die when they sting. Other bee species workers can sting multiple times, as can all queens. The males (drones), as in wasps and ants, are stingless.

Bumble bees and some others are truly social (eusocial), but carpenter bees, digger bees, mason bees, leaf-cutting bees and many others are solitary, although they can form loose associations of many females utilizing a choice habitat. This also occurs in some wasps, such as mud-daubers. Of the rest of the bees, aside from the honey bees, there are innumerable species, many of which are yet to be described. Some are quite tiny, such as the *Perdita* bees. Others like the carpenter bees can be quite large. Most bees feed on nectar, pollen and the products thereof.

There are many species of solitary wasps, with one whole family, the Sphecidae, being known as solitary or hunting wasps. In truth few wasps are truly social except for the Vespidae, which also has solitary members. Sphecids have been studied extensively, but much needs to be discovered because their very solitary nature makes them difficult to observe. Spider wasps (family Pompilidae) are also solitary and for the most part use spiders as prey that they feed their larvae (the adults, as in the Sphecidae, feed primarily on nectar) in a manner reminiscent of the early stages of the "Alien." Wasps in general are modified parasitoids as larvae (and the truly parasitoid Hymenoptera would easily require a whole essay just to themselves, even for an introduction.) Some of the Sphecidae are tiny, requiring some microtechnique to even study them whole, but some of the sphecids and pompilids can be fairly huge, with tarantula hawks (subfamily Pepsinae of the Pompilidae) reaching 50 mm. The females of these latter wasps, with their blue-black bodies and often with bright orange wings, have a powerful venom, which they use to paralyze large spiders, especially tarantulas (family Theraphosidae).

The parasitoids (Parasitica) of the Hymenoptera are so complex and speciose that I can only give them the barest mention. A parasitoid, unlike a parasite, usually kills its host when it emerges. Literally tens of thousands of species are known and undescribed species can easily be discovered even in fairly well-known habitats. Almost every insect and probably most, if not all, spiders, have at least one species associated with them. I collected three ichneumon wasps and two chalcidid wasps just from the pupae of one species of giant silkworm moth! Some are not too picky of their host and may attack several species, sometimes in several orders, but others are very specific. The egg parasitoid family Trichogrammatidae can only be studied on microscope slides. I took a course in their identification at the University of California – Riverside, and I can say that mounting them so the taxonomic feature can be examined is an art in itself, taking more than a year to master by the technician who instructed us!

Finally there are the sawflies and horntails, a collection of “primitive” Hymenoptera that are mostly plant-feeders. These, while not as speciose as the “Parasitica” are complex enough to be daunting.

This has been a bit of a whirlwind tour of the Hymenoptera, but I hope it has whetted your appetite for the exploration of a very alien world.

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All photos by David B. Richman

References:

There are numerous publications on Hymenoptera, including several books by J. Henri Fabre (Hunting Wasps, More Hunting Wasps, Mason Wasps, Mason Bees), as well as several books on wasps by early entomologists in North America such as George and Elizabeth Peckham, Phil and Nellie Rau, and Edward G. Reinhard. William

Morton Wheeler and others wrote extensively on ants.

More modern references are listed below, but the classic, antique, books by the authors mentioned are well worth examining. Only Grissell discusses parasitoids very much, but his book is an excellent summary of the order, including some on sawflies.

Evans, Howard Ensign. 1963. Wasp Farm. Natural History Press, New York. An engaging book on the habits of solitary and social wasps by a master of the science.

Fisher, Brian L., and Stefan P. Cover. 2007. Ants of North America: A Guide to the Genera. University of California Press, Berkeley. A neat manual for those who want to get to know their local ant fauna in the United States and Canada.

Grissell, Eric. 2010. Bees, Wasps, and Ants; The Indispensable Role of Hymenoptera in Gardens. Timber Press, Portland. A beautifully written and illustrated book on Hymenoptera in the garden by one of my instructors in the course on parasitic Hymenoptera at the University of Maryland.

Hölldobler, Bert, and Edward O. Wilson. 1990. The Ants. Belknap Press of Harvard University Press, Cambridge, Massachusetts. This is simply a huge book and the magnum opus on world ants. Fairly technical, but written by two of the major authorities on ants on the planet. Several other books have spun off of this or are related – “Journey to the Ants”, “The Superorganism” and “The Leafcutter Ants”, all by the same authors, and Mark Moffett’s “Adventure Among the Ants.”

Hunt. James H. 2007. The Evolution of Social Wasps. Oxford University Press, New York. A modern summary of what is known and theorized about the evolution of sociality in the wasps.

Mader, Eric, Matthew Shepherd, Mace Vaughn, Scott Hoffman Black, and Gretchen LaBuhn. 2011. Attracting Native Pollinators. The Xerces Society, Storey Publishing, North Adams, Massachusetts.

Morley, Derek Wragge. 1953. The Ant World. Pelican Books, London. The first book that I read on ants, it is certainly dated, but does

contain some very interesting material and is easy to read.

O'Neill, Kevin M. 2001. Solitary Wasps: Behavior and Natural History. Cornell University Press, Ithaca, NY. A modern summary of the research on solitary wasps.

There are MANY more publications, especially on honey bees, but this will get anybody who is interested in probing beyond my very superficial treatment (this is a huge subject!) started.



Harvester ants (*Pogonomyrmex* sp.) at Mesilla Valley Bosque State Park, New Mexico.



Honey bee worker (*Apis mellifera*) on blooming seepwillow, Mesilla Valley Bosque State Park, New Mexico.



Carpenter bee (*Xylocopa* sp.) on prickly poppy, Organ Mountains, New Mexico



Leaf-cutting bee (*Megachile* sp.) on *Coreopsis*.



Tarantula Hawk (*Pepsis* sp.) on mesquite, Mesilla Valley Bosque State Park, New Mexico.



Sphecid wasp in the genus *Podalonia* on blooming seepwillow, Mesilla Valley Bosque State Park, New Mexico.



Another species of *Podalonia* on blooming seepwillow, Mesilla Valley Bosque State Park, New Mexico.



Yellow jacket (*Vespula*) nest along trail in Snoqualmie, Washington.



Female ichneumon wasp, Mesilla Park, New Mexico.

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