THE BRODIE CLUB

ROYAL ONTARIO MUSEUM OF ZOOLOGY

THE 1,053rd MEETING OF THE BRODIE CLUB

The 1,053rd meeting of the Brodie Club was held at 7:30 pm on Tuesday, January 17, 2011 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Robert Curry
Secretary: George Bryant

The meeting was attended by 28; 22 members and 6 guests.

Roll Call:
Present: E. Addison, R. Addison, Bertin, Boswell, Bryant, Currie, Curry, Dunn, A. Falls, B. Falls, D. Hussell, J. Hussell, Iron, A. Juhola, H. Juhola, Larsen, Machin, Pittaway, Reading, T. Rising, Seymour, Slessor.
Regrets: Abraham, J. Bendell, Y. Bendell, Bodsworth, Crins, Eadie, Norm Martin, Norma Martin, Pittaway, J. Rising, Sutherland, Strickland.
Guests: Chris Zoladeski, guest of Curry; Adam Sambrowski, Antonio Coral (guest of speaker); Sam Scanga and Fabrizio Mastrourdi, guests of Ellie Larsen; Carmen Rivera, guest of Ken Reading.

Minutes: There were no comments on minutes of the previous meeting. Following the meeting, two corrections for the December minutes were suggested: number in attendance to be amended to 31 and spelling of wood lice to be changed from Socoptera to Psocoptera.

Announcements and New Business:

Program Committee
Bruce Falls confirmed that Brock Fenton will be at the next meeting. Speakers are lined up for the March and April meeting. After some discussion, the date of the May meeting was determined to be May 01. Bruce suggests this should be a member presentation and is therefore seeking for a volunteer.

Archive Committee
Half of Brodie members have submitted mini-bios. Ricky Dunn will pursue the delinquent half.

New Business

Rose Addison recommended that the field trip committee be re-activated to determine date, place, and leader for the annual Brodie field day traditionally held in June. Members will submit suggestions at the next meeting.

SPEAKER:

The speaker, Dr. Megan Frederickson, was introduced by Bruce Falls. Frederickson completed an undergrad Biology program at Harvard University, a PhD at Stanford on plants, and her Post Doc at Harvard in 2001. She is presently an Assistant Professor of biology in the Department of Ecology and Evolutionary Biology, University of Toronto and travels regularly to Peru to further her study of

Ants, Plants and the Tropical Forest

Dr. Frederickson began with an overview of the basic biology of ants. Ants are a social organism and, in her view, the most exciting group of animal unit on the planet. For example, *Cephalotes persimplex* is an arboreal ant living in tree cavities in the Amazon. It is commonly called the turtle ant because in a microscopic view, the head appears big and square. Turtle ants are not aggressive, so when attacked, they arrange their heads so that the hole to the nest is blocked. Another fascinating species is *Dinoponera australis*. These are the largest stinging ants in the world. They live in small colonies. The third species discussed was *Paraponera clarata*, commonly referred to as the bullet ant because of the uniquely painful sting.

In recent years, there has been a great interest in ants by evolutionary biologists. Ants are social and live in colonies. How do they cooperate? e.g. *Atta cephalotes*, leafcutter ants, gather vegetation, tend fungi and eat the specialized substance so formed. There is tremendous variation in size and morphology of leafcutter ants and their colonies are among the most complex insect societies known with some colonies existing for decades.

The life cycle of an ant colony begins with a mating swarm, the nuptial flight. Males are haploid, developing from unfertilized eggs; females develop from fertilized eggs and are diploid. Shortly after the nuptial flight males die, females shed and then eat their wings. A new queen rears the first group of eggs into workers and then, later on in the colony life cycle, she produces virgin queens. Ant pupae vary; some are in cocoons, others are naked. All workers and queens are female. Workers do not mate—only queens mate.

Because male ants are so short-lived very few people recognize them. They look just like a wasp except having smaller heads. Because they are short-lived, they do not need to eat much, thus their mandibles are small and the whole head is small. They have large eyes, long antennae (useful in food location) and long wings.

Ants frequently cooperate with other insects, the best examples being ants with aphids and ants with leafhoppers. The other insects produce sugar honeydew while the ants ward off parasites.

Dr. Frederickson studied an ant-plant association. A common Amazonian plant has hollow stem nodes used by *Allemerus octoarticulatus* for nesting. The plants produce tiny food bodies eaten by the ants. If the ants were removed, the plant would be chewed up by herbivores. (see correspondence for a photo of this ant-plant interaction)

Currently Frederickson is studying the relationship between various ant species and beneficial bacteria found in their guts. The ants depend on their bacteria just like we humans depend on our gut biota. Ants which consume honeydew or extra-floral nectar use the bacteria to aid digestion.

Ants are arguably the dominant animal in many terrestrial ecosystems. One study claimed their biomass was four times greater than that of all vertebrate animals in many terrestrial ecosystems, including a Brazilian tropical forest. This claim may not hold up but Fredrickson feels ant biomass is probably twice the size of vertebrate biomass.

In Dr. Frederickson's experience it is not really hard to identify ants. As proof, she offered a two-minute primer on the four main ant sub-families found in Ontario;

- Myrmecina (half of all ants we find)—easy to identify with two bumps on the petiole between thorax and gaster (gaster is portion of body after the petiole… the last part of the abdomen); has a true stinger
- Ponerinae— full petiole with a noticeable constriction; reasonably common; has a true stinger
- Formicinae—no bumps—only sub-family producing formic acid, dominate in Ontario; no stinger but a tube, usually fringed with hairs, at apex of abdomen (acidopore)
- Dolichoderinae—very few in Ontario, small, black ants common in dwellings; no stinger or acidopore

Myrmecina

Ponerinae

Formicinae

Dolichoderinae

All photos from antweb.org

Of the ten subfamilies of ants found in Ontario, the above four comprise 85% of the ant population.

Our speaker provided three vignettes of her field work and experiments.

1) In Peru, where Frederickson has done most of her research, there are funny open patches in the rain forest called "Devil's Gardens". Within these gardens there is only one tree species- one which is quite short- while outside there may be hundreds. You can actually see the sky from within these patches and the forest floor is bare. Around the patch are dead and dying trees. Ants nest in hollow stems of trees in these devil's gardens. The local people thought the

gardens were caused by an evil being "Chullachaqui" and warned Frederickson that bad things would happen to her in the gardens. During her PhD studies, she conducted a simple experiment in which she obtained samples of a common timber species from a nursery. She placed plants in pairs in the garden and applied Tanglefoot to one plant of each pair to prevent ants from accessing the plant. Those plants not protected died quickly; it was evident that ants were the architects of the Devil's Gardens. David Attenborough visited and included this in one of his productions. You can view his excellent description of ant-plant interaction at http://www.youtube.com/watch?v=y0M8QSCjcdM

2) Bees and ants are closely related—they are both Hymenoptera, but bees pollinate thousands of plants worldwide while fewer than 20 plant species are pollinated mainly by ants and these only in a few alpine and Mediterranean areas. Why is ant pollination so rare? The traditional explanations were that ants are not hairy so cannot hold pollen and don't fly so can't cover great distances. In actual fact, a lot of ants are hairy and a lot of bees are smooth and some ants can actually cover great distances. An alternative reason has been posited and this is the secretion of an antibiotic substance from the metapleural gland. The ants take the secretions, spreading them across their whole body as a primary defense against fungi and bacteria. Evidence was found to establish that these secretions caused a 17% reduction in pollen germination. Fungal spores and pollen share many characteristics.

3) Just one floor above us in this very building, Dr. Frederickson conducted an experiment to determine whether ants and bees compete for nectar. She used artificial flowers with yellow and red dyes to trace pollen and compared how bumblebees (*Bombus sp*.) and ants behaved. It was clear that ants were harassing any bees endeavouring to take pollen.

QUESTIONS:

Q. Bruce Falls: When we disturb an ant nest and see all the commotion, what is going on?
A. Ants are primarily interested in moving their larva and pupae (more advanced life stages) than the eggs. Larvae have an interesting function in an ant nest. They are thought of as a "social stomach" in that they can digest solid foods, which the workers then obtain from the larvae in a semi-digested form.
Eggs respond very strongly to temperature and humidity and workers must relocate them to suitable areas of the nest.

Q. Ricky Dunn: In a mating swarm are all winged females queens?
A. Yes… Each winged female has enough reserves to lay the first brood of workers. However, only three percent will establish a colony with predation, dessication and competition for nest sites being challenges to the queens.

Q. Ed Addison: In Richard Dawkins' Greatest Show on Earth ants are claimed to have been first to organize agriculture.
A. Yes, ants come in a lot of difference sizes related to different castes. In one species, the large workers with bigger mandibles crush seeds, while the smaller ones transport seed to the nest. There are many examples of different morphology for various specialized tasks.

Q. Kevin Seymour: What species in Ontario are pollinated by ants?

A. Frederickson published a paper suggesting that ant colonies in areas that are hot and dry or cold and dry are less likely to have a problem with bacteria which would discourage pollination. There are no known cases of ants pollinating plants in the tropics. In Ontario, there are about twenty plant species pollinated by ants but she was not sure which ones.
Ed Addison added that there was a M.Sc. study at UofT in the late 60s describing pollination by ants of fringed polygala (*Polygala paucifolia*).

Q. Bob Curry: Queen ants lay eggs that develop into different forms—what determines this and how is it regulated?
A. This is the Holy Grail of ant biology—the most important question! Frederickson would love to know what makes a worker ant and what makes a queen. It is something about the way eggs develop- presumably not genetic. How do queens know to lay fertilized or unfertilized eggs? Is this process controlled by the queens? We know that honey bee workers fed royal jelly produce queens but it is still an unknown with ants. Is it nutrition or temperature or something else? Possibly Dr. Frederickson will provide the answer.

Q. Ken Reading: What is the agent to slow ants down for microscopic study?
A. Put them in a fridge and then they remain immobile for a time and can be marked, counted, etc.

Q. Chris Zoladeski: What is the best way to study ants inside a nest?
A. This is one of the hardest things to do—bees are much easier to study in this way than ants. You can't put a light in the nest as it disturbs ants but you can put them under red plastic. Ants cannot see red.

Q. Bob Curry: When young, I noticed ants crawling all over unopened peony buds- any explanation?
A. They may have been attracted to floral nectar.
Ken Reading added that the buds are always sticky.
In S. A. ants often are present on buds that are opening… perhaps flowers benefit from ants in some way.
Enid Machin: I have heard peony buds will not open without ants.

B. Falls: Is the antibiotic secretion they produce of any use to humans?
A. That is another great question! There is a collection of ants preserved in alcohol at Harvard. A new project is looking at the compounds found in the alcohol of each ant species. There is potentially a large diversity of chemical compounds.

Kevin Seymour thanked the speaker for her stimulating and informative presentation.

NOTES & OBSERVATIONS

D. Hussell on December 30 observed two White-fronted Goose at his neighbourhood Simcoe Park. Were they of the Greenland race or North American, one with a pink bill, the other green? Field guides make these flesh colour differences seem easy but in the field not so obvious.
Hugh Currie visited St. John's, Newfoundland recently and added two species (Dovekie and Yellow-legged Gull) to his North American list putting him over 700. NFLD seems to

be a magnet for rarities, perhaps because there is nowhere for the birds to go—a Blue Grosbeak was attending a feeder and two Hooded Warblers were in a two–foot high spruce forest at Cape Race.
Bruce Falls commented that at times there are a lot of ants around the foundation of his home. The last three years one kind has appeared within a period of a few days as if on some seasonal rhythm. They seem to come out in several different sizes.
Bob Curry discussed the five warbler species, a Blue-grey Gnatcatcher and a Blue-eyed Vireo recently noted at Hamilton's Bayfront Park. This conjunction of 'rare in winter' birds was reminiscent of the equally warm winter of 1979-1980. On that occasion also, a large number of half-hardy lingerers was observed in the Hamilton area and in London Ontario. Is this the "Patagonian picnic table" effect, where a rare bird draws observers and additional rare species are found which may have been there all along?

The *Addisons* noted that the temperature at 7 pm tonight was 8C; when leaving the meeting at approximately 10 pm it was 3C and at 11 pm in Aurora it was -5C; a change of 13 degrees in five hours!!!

Comment from the *Juholas*… both forsythia and japonica were in bloom in their building's garden in December.

CORRESPONDENCE

On 18 Jan. Sharon Hick emailed:
"Fred is now at Livingston Lodge, a retirement home in Scarborough in the Guildwood neighbourhood… he seems to be very comfortable. His health is much improved from when he was in the hospital. How great is that! His daughter Barbara lives only about 10 minutes away, which is so nice for the family. He is in Room 210 and his phone number is 416-546-4369 (it's a direct line to his room). He's hoping to have his computer moved from his home to his new room (which has internet access); he's really looking forward to that! We were all so hugely disappointed when I decided that the drive last night was a little risky. Hopefully, February's meeting will fall on a clear, dry night!"

On Jan. 22nd, the speaker replied to a query re predators of ants: "Interestingly, ants in general do not have many predators (or at least, worker ants don't). Monkeys and birds will make holes in plant stems (bamboo culms, for example) to get access to ant brood (larvae, pupae, etc.), and of course anteaters will do the same (although they mostly eat termites). But vertebrates generally don't eat worker ants, which are well defended and offer little nutrition.
I'm all packed for my trip to Peru tomorrow, … photo.. of an ant-plant (*Cordia nodosa* with *Allomerus octoarticulatus* ants) that I have studied for many years. These are the ants I talked about that destroy the floral buds and other reproductive structures of their host plants."

NEXT MEETING

The next meeting will be held Tuesday, February 20 at 7:30 pm in Room 432 of the Ramsay Wright Zoological Laboratories. Brock Fenton will speak on "The World through the Ears of a Bat" at the next meeting.