THE BRODIE CLUB

ROYAL ONTARIO MUSEUM OF ZOOLOGY

THE 1,044th MEETING OF THE BRODIE CLUB

The 1,044th meeting of the Brodie Club was held at 7:30 pm on Tuesday, January 18, 2011 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Ken Abraham
Secretary: Ed Addison

The meeting was attended by 23: 20 members and 3 guests. The weather was not co-operative and many sent regrets because of the driving conditions.

Roll Call:
Present: Abraham, E. Addison, R. Addison, Bertin, Bodsworth, Eadie, A. Falls, B. Falls, Iron, A. Juhola, H. Juhola, Larsen, Lumsden, Machin, Pittaway, Reading, Speakman, Sutherland, Tasker, Tomlinson.
Regrets: Aird, J. Bendall, Y. Bendall, Bousfield, Bryant, Crins, Currie, Dunn, D. Hussell, J. Hussell, Norm Martin, Norma Martin, McAndrews, J. Rising, T. Rising, Seymour, Strickland, Thorpe.
Guests: Peggy Haist, Patricia Galloway and David Strang, guests of Oliver Bertin. Pat and David are the parents of Caroline Strang, who is doing grad work on bees under Brodie Club member David Sherry at UWO.

Minutes:
Correction to December 2010 minutes; Dan Strickland was welcomed as a new member of the club.

Announcements and New Business:

- B. Falls announced the speaker for the February meeting will be Kevin Seymour and that we have speakers arranged through to May. *Please note that since the meeting, there has been a change. Member Ed Addison will talk about The Unique Diverse Flora of West Australia.*
- Don Sutherland was welcomed to the Brodie Club having become a new member a number of meetings ago.
- Sutherland spoke about the Ontario Herpetofaunal Atlas. There are 150,000 – 200,000 records to date. This initiative is led by Ontario Nature and that members

can submit records on Ontario herps through the Ontario Nature website: http://www.ontarionature.org/protect/species/herpetofaunal_atlas.php

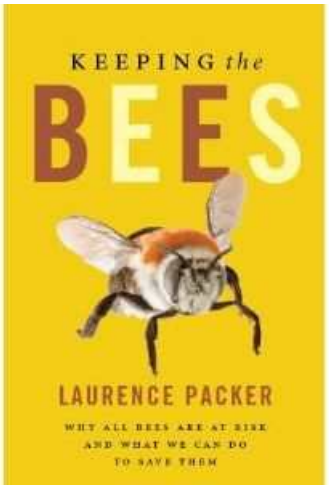
- Iron showed a copy of the French version of the Ontario breeding bird atlas. It became available early in January and can be purchased through the Ontario Nature website for $63.
- Bertin told members that Jim Rising had a fall while traveling in Spain and that he and Trudy had a tough time getting home.
- R Addison noted again that Ontario Nature is encouraging all members to add their support to Ontario Nature's 20/20 Vision: A Biodiversity Charter for Ontario. Through this petition, ON is hoping to continue raising awareness of the importance of biodiversity. The on-line sign up is at http://www.ontarionature.org/protect/campaigns/biodiversity_2020_vision.php Rose will have a paper copy of the petition at the next few meetings.

SPEAKER

The speaker, Dr. Laurence Packer, was introduced by B. Falls. Laurence Packer taught school in Britain for a few years following an Oxford University undergraduate degree. He began a Ph.D. on bees at U of T in 1985 and is now a professor with a very active lab and several graduate students at York University. His work on bees has taken him to work in many parts of the world. The collection at York has specimens from over 90 different countries representing over 60% of the world's bee genera and is probably the most comprehensive collection in Canada.

His website, BugsRUs http://www.yorku.ca/bugsrus/index/index.html provides a wealth of information about his work and that being done by his students, pictures available for non-commercial use at no cost, and links to some identification keys.

Laurence has written a highly readable book titled Keeping the Bees. It was published by Harper Collins in May 2010.



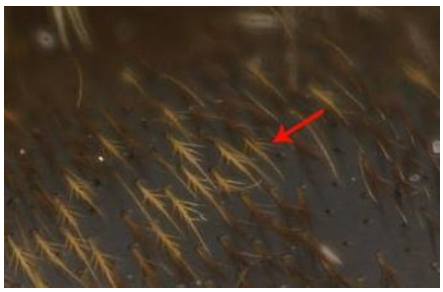
The following review by David Suzuki is from the Amazon.ca website where the book is available for purchase. *"Laurence Packer's wonderful book about the world of bees offers the sheer delight of learning about these diverse animals, their basic biology and the role they play in ecosystems. Keeping the Bees revels in the lives of bees but clearly shows how much more we have yet to learn and therefore makes a powerful case for being far more cautious in the way we exploit the Earth. A world without bees would be a world without people."*

Bridget Stutchbury, author of Silence of the Songbirds and The Bird Detective, and a speaker at the April, 2010 BRODIE Club meeting, wrote the following; *"Keeping the Bees is an entertaining and amazing journey into the world of beautiful and hard-working wild bees. Laurence Packer ... explains with passion and humour why wild bees are so important to our society and how we can help save them even in our own backyards."*

"Bees"

Laurence began by showing the cover of a book entitled Bees of the World. He pointed out that the insect on the front cover looked like a bee but was actually a fly! This example of misidentification illustrated the difficulty in being able to tell which insects are bees and which are not.

The single physical diagnostic feature that distinguishes bees from close relatives is that bees have **branched body hairs** (indicated by red arrow in photo). If the body hairs are not branched, the insect is not a bee. Laurence pointed out that while this diagnostic feature is precise, it is not always an easy feature to observe. Some species of bees and related insects have few body hairs and sometimes these are restricted to limited parts of the body.



Any 'bee-like' insect observed collecting pollen on its legs and/or on ventral side of the abdomen is a bee. As many bees do not collect pollen, not all can be identified this way.

The oldest fossil records of bees have been found in amber and have been dated as approximately 100 million years old. Bees evolved from wasps similar to the vegetarian digger wasp *Melissoides*, and the sand wasp, *Ammophila* that moved to pollen and nectar rather than animal prey for their offspring. Bees are known to be almost as old as the flowering plants.

Many larval bees develop in other organisms, feeding on the paralyzed host. Because they live where they feed, they store their feces and defecate only once (usually over a period of 24 hours!) near the end of the larval stage. The mid-gut and hindgut are not connected until near the end of the larval development.

Laurence addressed some of the common misconceptions about bees.

1. Bees make honey

There are thousands of species of bees and fewer than four percent make honey; of those, nine species produce most of the honey. In fact, even if more bees did make honey, we would perhaps not like the taste of the honey from some bees because they do not get their energy from nectar. For example, there are a number of tropical bee species, including *Triagona necrophaga*, which scavenge only on dead material. A scientist in Thailand is currently claiming that there is a group of bees that obtain all of their protein from the tears of mammals.

2. Bees work hard…"as busy as a bee"

There are several thousand Cuckoo bees that lay their eggs in other bee nests, paralleling the parasitic behaviour of the avian cuckoos. The female cuckoo bee enters the nest of another bee species, and stings and paralyzes the original occupant. The hapless larva becomes the private food source of the cuckoo bee young and the parent bee does not have to collect food.

3. Bees live in hives

Although honey bees and social stingless bees live in hives, most species (75%) of bees do not. Most live in holes in the ground. Laurence told of an area on the Isle of Wight with a density of 250 nests/sq. m.

The remainder nest in stems, beetle burrows or other cavities.

4. Bees are complex social insects

Fewer than eight percent of bees -honey bees, stingless bees, bumble bees, many sweat bees and a few others- are highly social. The majority of species are solitary with the only intraspecific activity for females occurring at time of mating or occasionally when fighting for a nest site.

5. All bees sting

About 15 % of all bee species can sting and, since the stinger is an adaptation of the ovipositor, only females can sting. The venom in stings subdues and paralyzes prey to keep it fresh for the developing larva. In bees that feed on nectar rather than other fauna, the need for venom is gone so the stinger has lost its "bite". The longest stinger belongs to the cuckoo bee. Its stinger can be extended over the back and head to allow it to enter a host nest head-first and sting the occupant egg/larva before laying its own egg.

There are about 20,000 described species of bees in the world, 826 species currently catalogued in Canada, likely 900 species total in Canada and possibly 200 species in Toronto. Laurence showed illustrations of and described seven families of bees.

The **Stenotritidae** is comprised of two genera and 21 species. They are the fastest bees and are found only in Australia.

The **Colletidae** (cellophane and masked bees) line their nests with transparent cellophane-like material. There are 54 genera and about 2000 species, about 50 species of which are known in Canada. An especially interesting colletid, and Laurence's favourite bee, is *Xeromellisa rozeni*, an exotic species with a very long head and tongue. *X. rozeni* lives in desert habitat, feeding upon flowers of the same individual plant of the tomato family within which it nests. This bee is only about 6 mm long but the highly adapted tongue looks to be about three times longer than the body. This species has a mechanism for folding up the tongue apparatus when not feeding.

Xeromellisa rozeni

The **Andrenidae** (solitary mining) is comprised of 36 genera and about 3,000 species of which six genera and perhaps 150 species are present in Canada. These bees can be seen feeding on pussy willows and goldenrods.

The **Halictidae** are commonly called sweat bees because they are often attracted to and feed on perspiration. They are small bees and quite a few species are social. Some females can give a minor sting. There are 75 genera and about 4,300 species of which 10 genera and more than 160 species can be found in Canada. There are four common species of *Agapostemon* in eastern Canada. They are some very beautiful species with metallic green bodies which can be found swarming on Rose of Sharon flowers and sleeping in Hollyhock flowers.

Agapostemon splendens

The **Melittidae** (oil-collecting) is comprised of 14 genera and about 170 species. Three species from two genera are reported in Canada. Some melittids have long legs with a great diversity of morphological adaptations which allow the transportation of pollen and oil from the long spurs of flowers. *Macropis nuda* is a common mellitid that is adapted to pollinate cranberry flowers.


Macropis nuda

The **Megachilidae** (leaf-cutters) is a large family with 75 genera and approximately 4000 species. In Canada there are 12 genera and about 200 species of megachilids. Species within this family are mainly solitary bees and include mason, leaf cutter, resin, orchard and wool carder bees. These bees line their nests with cut up leaf material; the wool carder bees will chew on sage plants and use the fuzzy debris for lining their nests.

The **Apidae** is comprised of the honey bees, squash, carpenter, cuckoo, bumble and orchid bees. This is a very diverse and large family with 168 genera and approximately 4000 species of which 19 genera and approximately 200 species are known in Canada. Orchid bees are gaudy and spectacular. The male orchid bees pollinate orchids in search of odours that attract females. The diversity of odours are stored in the legs. The greater the diversity and complexity of the odours the greater the attraction of females. The older the male orchid bee, the longer the period to have enhanced the complexity of odours. For this reason, females are generally more attracted to older males. Some young male orchid bees will rub their legs on the legs of dead old males to enhance their accumulation of complex odours.

<u>Importance of Bees to Our Food</u>

There is a wide variety of claims of the extent to which our food supply is dependent on pollination by bees. Many of these claims are exaggerated or unsubstantiated. Laurence mentioned that he has said that “bees provide 30% of our food” but now feels this is likely wrong and the percentage is less. In general, to date our food supply has not been negatively impacted. However, the trend is towards an increased anount of our diets being dependent on pollination and this raises the practical importance to humans of having healthy and diverse bee populations.

Many wild bees [e.g. the apple bee, squash bee] can pollinate flowers effectively in one visit while each flower may need many visits by a honey bee for successful pollination. This makes reliance on honey bees for crop pollination an ineffective strategy. Large numbers of hives are placed amongst a crop during the flowering period to provide enough honey bees for successful crops. A watermelon flower requires at least one thousand pollen grains to produce a large oval watermelon. On organic farms near natural habitats, 42 different species of bees pollinated watermelons and produced economically viable crops. Organic watermelon farms further from natural habitat did not always receive enough pollen from wild bees to produce a good crop. There were not enough wild bees around conventional farms to provide enough pollen for a crop and many hives of honey bees were required to be brought in. This dependence on honey bees for pollination of crops in conventional farms leaves them open to difficulties if there is trouble with the honeybees.

<u>Bees as Indicators of Ecosystem Health</u>

Sex and Death

Sex is determined by genotype at a single gene locus. Females are heterozygous. These and other sexual characteristics are not issues in large populations but begin to comprise a population as it decreases in size.

In many species of bees, females will produce only five or six offspring during their lifetime; in some bee species, only three or four. If the bees are healthy the population can be sustained at this low level of productivity but any comprimize of health of the individuals can rapidly lead to a noticeable impact on the population.

When the proportion of sterile male bee increases, they occupy the time and reproductive opportunities of females, thus leading to more rapid population decline.

Specialist Bees

Because so many species of bees are highly specialized to feed on specific species of plants, changes in the occurrence of those plants will quickly impact those bees. In contrast, species of fauna that are generalists can more likely sustain themselves in the loss of specific flora because they can derive their necessities from other species of plants. The more specialized… the more vulnerable… the quicker the impact on populations!

Lasioglossum oenotherae is a specialist bee that feeds on evening primrose. The populations of these sundrop sweat bees are more localized and small, hence indicators of local ecological changes. *L. oenotherae* collects almost all of the pollen in a flower in one visit; the first bee visiting in the morning forces its way into the closed flower and rakes up almost all the pollen on its legs, thus precluding that flower as a source of pollen for others.

Lasioglossum oenotherae

Cuckoo bees are sensitive indicators because they have such obligatory relationships with other bee species in whose nests they lay their young. If the other species declines, so does the specific cuckoo bee.

Bombus affinis, the Rusty-patched bumble bee, was the third most common bee in southern Ontario during the 1970s. Now it is locally endangered and known only in Pinery Provincial Park. The vulnerability of this species is due to the fact that different life stages are dependent on the presence of plants in flower from April, when queens are active, through to October, when next year's workers and queens are appearing. Dependence for food over such a long season leads to increased opportunities for disruption of the populations of rusty-patched bumble bees. In contrast, most solitary bees collect pollen for two to three weeks and then are protected underground for the remainder of the year. The rapidity of change in population of the rusty-patched bumble bee makes it of value as an indicator species.

With these reasons for bees to be effective indicators of ecosystem health, why are they not used for this purpose? The short answer is that we have too many species of bees and they are too difficult to differentiate from one another. There are few experts on bee taxonomy in Canada and there is only one expert who can identify most species. Many species remain undescribed; Laurence speculates that he has specimens of perhaps 100 undescribed species in his lab. In addition, the descriptions of many species are incomplete with some based on descriptions of only one sex of the species. Laurence notes that in Africa, there are cases

where the taxonomic knowledge of scientists in differentiating species is less than the indigenous knowledge.

To overcome this 'taxonomic barrier', there are initiatives to construct more 'user friendly' keys. Packer, Genero and Sheffield [2007] have published a user-friendly key in the Canadian Journal of Arthropod Identification that uses illustrations and less specialized terms. (There are links to this key and others through Laurence's website). An excellent tool to distinguish bees is the mitochondrial DNA sequencing of the cytochrome oxidase I gene, the technique that is being employed in the 'DNA Lab' run by Paul Hebert at the University of Guelph. (Paul has previously addressed the Brodie Club on this very well-funded and major worldwide initiative.) Laurence has teamed up with the Guelph DNA lab and in May 2008 he held an inaugural "Barcoding the Bees of the World" conference at York University. There are many cooperators from around the world but none from India, Brazil and North Africa because of the difficulty collecting and/or exporting biological tissues of this nature from those countries. Since the initiative was started, barcoding has been completed for approximately 4,000 of the 20,000 species of bees of the world.

How Can We 'Help' the Bees?

- Reduce/ eliminate the use of insecticides
- Promote native plants
- Promote plants with less complex flowers [e.g. Monkshood are difficult to pollinate, Chrysanthemums easy)
- Leave bare patches of soil [many species nest in soil]
- Minimize mulching [to avoid covering openings to nests]
- Leave some old dead stems around for use as nest structure
- Drill holes in wooden structures for bees to use

Laurence showed a picture of his seeming 'untidy' garden with much diversity and many of the above attributes. He has about 30 species of bees in his garden. One of his students is currently delineating the bee fauna of Toronto. Laurence encourages any of us willing to have artificial bee nest sites in our Toronto yards to get in contact. (Email Rose roseaddison@gmail.com for contact information).

Laurence concluded with the message that bees are beautiful, diverse in behaviour and ecology and at risk.

QUESTIONS:

Q. S. Eadie: Can bees that are from different areas but look the same mate when sympatric?

A. When such bees are together, we cannot tell them apart but they can and do distinguish between one other. Many communicate through smell. When mating is examined in areas of overlap and when mating is promoted, there is upwards of 40% of bees killed. In contrast, in areas where the similar but different bees occupy different ranges, killing during mating may be only four percent.

Bees must be acute in distinguishing between other individual bees, let alone between species. Social bees need to let their nest mates in and keep 'foreign' bees, even of the same species, out. One bee will be the gatekeeper and reject entry of bees by odour from close at hand and yet will let nest mates in.

Q. O. Bertin:… was in the middle of Lake Ontario, 15 miles from the nearest land, when a bumblebee flew from the southeast, flew one circle around the boat and headed off to the northwest without stopping. Is this unusual and is circling of the boat significant?
A. The speaker said that was a very interesting and rare observation that gave an indication of how far bumblebees can fly. He would like more anecdotal evidence on the subject because those observations would contribute to the collective body of knowledge about long distance flights. In general, the larger the bee, the further they can fly. The greatest distance that Laurence has known of flight by a bee is 18 miles. There are records of bees flying across the English Channel. Yes, circling around the boat was likely of navigational importance [for the bee that is, not the boat! ☺]. When bees emerge from their nest, before making a foraging trip they circle the nest area accumulating information used later for homing back to the nest.

Q. K. Reading: You didn't mention parasites of bees.
A. Tracheal mites are a problem for honey bees… also other mites. *Varroa* mites have eliminated a lot of native North American bees. In addition cuckoo bees can be a big problem. A student of Laurence's was studying a social bee in France. There were about 12 bees/nest and a hard concrete-like barrier to keep out intruders. He came back in the morning and found many of the bees paralyzed and dead around the nest. Cuckoo bees had waited until there was a night with rain, penetrated into the nest in a way that isolated the guard at the door and then paralyzed, killed and hauled out the unsuspecting resident bees one at a time.
Oil beetles are another threat to bees. They cannot gain direct entry into nests, having devised some indirect methods. The oil beetles lay their eggs at the base of the stem of a plant. The larvae hatch and migrate in synchrony up the stem to the end of a twig. Because there are many of them, they form a clump which by size has the general appearance of a female bee. The larval oil beetles emit a pheromone that female bees use to attract males for mating. The males jump on the 'bee' [i.e. the clump of oil beetles] and the larval oil beetles attach to the male bee, later to be transferred with further matings to females of the species. In this manner they gain entry to the nest!

Q. *F. Bodsworth: You didn't mention pesticides much.*
A. When it comes to pesticides, there are lots of lawyers involved. When scientists claim that specific pesticides cause 'colony collapse disorder", it can become very expensive for them! There are some data on this subject, much of it not yet published, that indicate that some pesticides suppress immune systems. However, there are other potential stressors that may singularly or have interactive effects leading to declines in bees. For example, in March, approximately 90% of North American bees controlled by humans are in California to pollinate the almond trees and then they all get transported along to the next monotypic source of pollen to crops like blueberries, etc. Such restricted sources of pollen for generalist bees and all of the transporting around must be stressful.

Q. *J. Speakman: Would you comment on the killer bee problem?*
A. Decades ago, a scientist in Brazil obtained some very aggressive, hard working bees from Africa for cross-breeding experiments with Brazilian bees. However, some of these very aggressive African bees escaped and over the decades have expanded their American range. In North America they have reached the southern United States from east to west.

The African bees likely won't make it to Canada because of our cold winters. They are called "killer bees" because although most bees are reluctant to initiate mass attacks, these African bees have a very low threshold before attacking. The reason for them having this behaviour is that in the African ecosystems where they evolved, there is a larger than usual number of threats to bees.

Don Sutherland has known Laurence for many years and on behalf of the club thanked Laurence for his excellent, informative, and most enjoyable, presentation.

NOTES & OBSERVATIONS

Sandra Eadie spoke of an article in the Toronto star of January 17, outlining that Oakville is planning to ban outside cats.
Fred Bodsworth added that there was a big program on CBC about the feral cats/ bird lover feud. It referred to a bog on Vancouver Island where the Song Sparrow population decreased rapidly. Motion-activated cameras at nests showed that feral cats were a cause of this decline.
Oliver noted that he was down at the Canada Brewing elevators at the foot of Bathurst St. one day when a well-dressed woman drove up in a car and banged a bucket. Suddenly, about 50 feral cats appeared out of nowhere, ate the food she distributed and promptly disappeared again. Bodsworth said they should be shot; Bertin suggested they keep the rats population down.

Jean Iron and Ron Pittaway were at the Niagara River on January 17. There was an ice boom across the river at Fort Erie with some open water. There were thousands of ducks and 170 Tundra swans. There was one that was larger. Jean shared a photo of this bird. Lumsden commented on the difficulty of telling Tundra and Trumpeters apart.

The meeting adjourned at 9:35 pm. and members enjoyed refreshments and conversation.

NEXT MEETING- Please note change of speaker.

The next meeting will be held Tuesday, February 15 at 7:30 pm in Room 432 of the Ramsay Wright Zoological Laboratories. Member Ed Addison will be the speaker.