

THE BRODIE CLUB



ROYAL ONTARIO
MUSEUM OF ZOOLOGY

THE 1007TH MEETING OF THE BRODIE CLUB

The 1007th meeting of The Brodie Club was held on Dec. 12, 2006 at the Ramsay Wright Zoology Laboratories of the University of Toronto.

Chair: Rosemary Addison

Secretary: Ed Addison

There were 23 members and three guests.

Jeremy Hussell, guest of Ed Addison

Sharon Hick, guest of Jock McAndrews

Brenda Gibson, guest of John Sparling

Minutes of the November meeting were approved with minor revisions.

NEW BUSINESS:

- Bob Curry and Glenda Slessor were announced as new members.
- Bruce Falls reported speakers for the January and February meetings:
 - January – Dr. ‘Chip’ Weseloh, CWS: *Cormorants of the Great Lakes*
 - February – David Tomlinson, member: *Landscape gardening and wildlife*
- Our thoughts go out for a good recovery to Helen Juhola who suffered a transitory ischemic attack last week and is recovering.

SPEAKER:

The speaker was Brodie Club member, Marc Johnson. Marc was introduced by Jock McAndrews who noted that Marc had completed his Ph.D. the day of the lecture. Marc’s accomplishment was applauded by the Club members.

THE LONG REACH OF THE GENE:

HOW PLANT GENETIC VARIATION SHAPES INSECT COMMUNITIES

Marc’s doctoral research involved study of the plant, evening primrose (*Oenothera biennis*). Marc’s studies focused on the influence of both genetics and the interactive effects of genetics and environmental factors on insect and spider communities associated with evening primrose (EP). Specifically, Marc addressed the

question: “*Can genetic variation in a single species, evening primrose, affect populations of insects?*”

By introduction, Marc noted that there are lots of interactions between plants and insects when one considers that 75% of biodiversity on our planet is attributable to plants and insects. Plants and insects also comprise a large proportion of the world’s biomass and are of particular importance to economic health (e.g., agricultural crops, long-horned beetle) and human health (e.g., malaria, West Nile Virus).

Since Marc was studying the interaction between plant genetics and insects at the community level, he reviewed how parasitism, predation, mutualistic interactions, disturbance, interspecific and intraspecific interactions, environment and other factors influence distribution, abundance and diversity within communities.

Marc noted that we must study individual (phenotypic) variation to understand communities and that much of phenotypic variation has a genetic basis.

Marc's talk was organized into four topics:

- Natural history of evening primrose
- Techniques
- Findings
- Implications for conservation agriculture.

Natural History

Evening primrose (EP) is extremely common throughout its native range in eastern North America. It germinates in spring and stays as a rosette until 2-3 years of age at which time it matures, flowers and then dies.

Marc reported 177 species of insects on EP. Of the insects, 31% were herbivores, 10% omnivores, about 53% parasitoids and predators and a smaller group of ‘others’. Starting in early spring, a few of the more prominent insects on EP are:

Early spring – May: meadow spittlebug

Next arrives – EP weevil (Tyloderma foveola). EP weevil feeds exclusively on EP and drills a hole in the stem, lays eggs within the hole and then plugs it.

Next arrives – rose chafer. The rose chafer is a generalist herbivore often predated upon by spiders.

Aphids (Aphis oestlundi) arrive and feed just before EP flowers. There are six ant species that defend aphids against predation.

Momphid moths appear post-flowering. Momphids are “micro moths” with a wingspan of 0.5-0.75 cm. They are some of the many post-flowering species on EP. There may only be 10 or fewer species of momphids in North America. Each species of momphid has its own tissue (niche) upon which they feed on EP.

Other insect species were mentioned.

Techniques

To use natural populations to try to differentiate between the effects of genetic variation as compared to environmental variation on plant-insect interactions is not possible using natural populations. For this reason, Marc controlled genetic variation by collecting seed from a limited number of individual mature EP plants. Marc kept the seeds from one plant together and separated from those of other individual plants and then germinated the seeds simultaneously. He raised the seedlings of known genetic origin in a greenhouse and then planted them out in the wild at the Koffler Research Centre (Joker's Hill) immediately west of Newmarket, Ont.

Not only did Marc wish to establish if genetic variation in plant traits of EP affected arthropod communities but he wished to assess the importance of genetic variation relative to other sources of variation on the arthropod community.

Marc observed that there were 2-4 spittlebugs on individual plants; 1-5 EP weevils (T. foveola) per plant; and 0-6 momphid moths/plant. In each case, genetic variation in the EP plants influenced the number of the above insects on the plants.

In addition to abundance of insects, genetic variation influenced growth of some insects. Using about 20 different genotypes of EP, Marc established that some genotypes of EP supported extensive growth of aphids (A. oestlundii) and some genotypes supported only limited growth of the aphids. In other studies, Marc also noted that EP genetic variation also affected the diversity of the insect community and also its biomass.

At a further level of complexity, Marc established that genetic variation in EP plants affected the number of ants on plants and also the number of predators of ants that then indirectly affected the number of aphids. Thus, genetic variation affected the number of the aphids both directly and then indirectly through the predators of the ants.

Marc introduced how there is at times an interactive effect between plants and the herbivores that feed upon them. In some relationships, damage of a plant by herbivorous insects can result in physical or chemical changes in the plant such that subsequent feeding by insects can result in:

- reduced effect of plants on the insects
- no effect, or an
- increased effect of the plants on the insects.

With his EP-insect system, Marc tested this relationship using 4 genotypes of EP.

In another aspect of the work, Marc designed an experiment to evaluate the relative effects of genetic as compared to environmental effects on the arthropod populations. Marc selected five different habitats that varied from one another by their moisture gradients (mesic, sandy, xeric, mowed and disturbed). At each site, he placed the mixture of genotypes (genetic variation) using about 200-250 EP plants. While Marc again

noticed that plant genetic variation was extremely important in affecting the diversity of the arthropod communities on EP, the extent to which it did so varied greatly between habitats!

Marc also noted that effects of some of the genotypes of EP were annual while others were biennial.

All of these above extensive studies examined the effects of genotype of individual plants on arthropod communities.

However, Marc also wanted to look at the effect of the genetic variation in a patch of EP plants on the arthropods. He did this by establishing patches of 8 plants with a single genotype (from same maternal plant) and compared the arthropod communities on this patch with patches of 8 plants of four different genotypes and patches of 8 plants of eight different genotypes. As the number of genotypes increased, Marc observed increases in both the diversity and the abundance of arthropods. There were especially large increases in omnivorous arthropods.

The implications of this research are that by preserving plant genetic variation, it promotes preservation of arthropod communities and species interactions.

QUESTIONS:

- Charles Elton proposed that complex communities may have increased resistance to invasion by other species. What do you think about his idea? Elton's idea, while out of fashion for some time, has caught on and been embraced in recent times. Indeed, increased genetic variation within local communities can lead to resistance against invading exotics. People are still testing Elton's ideas.
- What sample sizes of insects were encountered? They counted every insect that they could see on plants and this varied from zero to up to 3,000 aphids maximum on a single EP.
- What were the results with respect to presence of native versus non-native insects? The data were not evaluated in that manner.
- Would the revisiting of the same sites throughout the life history of the plant have a cumulative impact on the study site that might affect the occurrence of the arthropod communities? Marc didn't feel that there was a cumulative effect and cited some research in Alberta that documented little effect of visitation on the arthropod communities.
- How do you count insects on the inside of plants? Some insects cannot be seen but for other insects that are internal, evidence such as scars at their point of entry allow an accurate survey.

- Might some of the studies have been accomplished by visiting the study sites and removing individual plants for examination back in the lab? Removal of plants would have adversely affected the remaining community of arthropods.

George Bryant thanked the speaker.

NOTES AND OBSERVATIONS:

- Jeremy Hussell saw an otter in Kanata on 25 November. It has been sighted in the area for about two years.
- Hugh Currie reported a wide variety of avian species in Lambton Woods. He observed Yellow-bellied Sapsucker and Goshawk and others have recently reported Red-bellied and Red-headed Woodpeckers at the Woods.
- Ann and Bruce Falls have had a Fox Sparrow in their yard for a number of days. The Fox Sparrow is uncommon at that location.
- Kevin Seymour has a Fox Sparrow at his place, first observed four days prior and still there today.
- George Bryant noted the Slaty-backed Gull just off Dufferin Island, upstream of the falls in the Niagara River. He recognized it from a photo that Jean Iron had previously taken at the same location of what is presumed to be the same bird.
- Trudy Rising noted that Fiona Reid has just completed a guide to the mammals of North America.
- Glenn Coady noted that Fiona will be giving a lecture at the ROM on Friday (15 December) and that there would be a book signing. Both Trudy and Glenn praised the books highly.
- John Sparling has been surveying about 10 sites for species of fungi over many years and notes an apparent trend of some species from the United States now moving into Ontario and becoming common. One example was the beefsteak fungus, 3-4 specimens of which he has observed this year.
- Jock McAndrews visited a woodlot on the Oak Ridges Moraine that had a red oak and white pine stand with both mature and a gradation of immature plants of both species well represented.
- Ron Pittaway noted that the Razorbill is still at Niagara, having now been there for three weeks. Ron speculated as to the possibilities of the Great Auk, a relative of the Razorbill perhaps having been a visitor to the Niagara area prior to its extinction. Jim Rising noted that the Great Auk was common on the Magdalen Islands at one time.
- Jean Iron was asked of further news of the Black Guillemot on the Spanish River that was reported being pursued by a Bald Eagle when last seen. She reported that someone observed the eagle very close to the guillemot on that occasion and with its claws extended. This suggested a shortly following demise of the alcid!
- Ken Abraham noted a high occurrence of conjunctivitis in House Finches, presumably in Barrie.
- Jean Iron reported that a Barn Owl resided in an old barn near Ancaster last summer and its presence was kept quiet to avoid the anticipated rush of those wishing to view it. The barn burned down last Friday. The owl has not been seen

for some time. Glenn Coady noted that a dead Barn Owl was recovered at Pearson International Airport last summer and since this was during the breeding season, that it was to be included in the breeding bird atlas. Ron Pittaway used to see Barn Owls at Pelee and Lake St. Clair during the 1960s.

The meeting was adjourned at 9:01 P.M.

NEXT MEETING:

Dr. 'Chip' Weseloh of the Canadian Wildlife Service will speak on *Cormorants of the Great Lakes* at the next meeting on Jan. 16, 2007 at 7:30 pm in Room 432 of the Ramsay Wright Zoological Laboratories.

Two New Parks

By Yorke Edwards
Our Western Correspondent

While working in B.C.'s Miracle Beach Park, which is up the east coast from Victoria, I often went there with two young university helpers to make a tent museum for showing people objects in the forest and on the shore. In the evenings, I often walked along the shore looking for its small bits of life and every time, I saw a patch of white far up the shore. Soon I found that the patch was on a small island named Mitlenatch that had a white crowd of nesting Glaucous-winged Gulls. I went to see them with a student, and while there we were soon caught in a growing wind with big white waves. We couldn't leave safely in our small boat so we sat on the quiet side of the island at dusk and had a dinner of delicious raw oysters. At dark, we slept behind the main small hill of rock. Winds roared above us. Hours later, we were awakened by two policemen looking down at us with their big bright lights, who took us home in their boat. A friend in the park had phoned that we needed help. Some months later, Mitlenatch Island became a provincial park, and ever since someone in summer lives there in a small cabin and helps people to see, but not fear, the crowd of nesting gulls, and to show other things like birds, plants, and shore creatures like oysters.



Years later, I often drove to a long beach on the west side of Vancouver Island near the small town of Tofino. It was my wish that the beach should become a park with a small forest beside it. Soon it was named Long Beach, and it became well known as a good place for birds, except in summer when the beach gets crowded with people. Birds don't want the beach in summer anyway.

One April day, I drove north then west across the island to the beach. As was often there, a crowd of gulls was seen to the south. Driving slowly toward them I found that they were the usual Glaucous-winged Gulls with a few Californias. Looking south again, I saw Mew Gulls that had just finished nesting on small islands not far north of Tofino. Looking again, I saw a line of ten Black-legged Kittiwakes. When I got near to them, I was amazed to see that one was a Red-legged Kittiwake, and I got very near to it. The 'red-legs' are rare even to Alaska's mainland shores. They live daily flying about over the sea and nest on the far westward half of Alaska's long row of islands that reach rather near to Russia. In my many bird books only one mentions the 'Red-legs'. The latest 'Birds of Canada' (from Ottawa) says that one was once found dead in the Yukon. We can now add that a live Red-legged Kittiwake was once seen on the shore of central British Columbia. Y