Spring 2005 Vol. 24, No. 1

NEWSLETTER OF THE BIOLOGICAL SURVEY OF CANADA (TERRESTRIAL ARTHROPODS)

Table of Contents

Canadian Museum of Nature / Musée canadien de la NATURE

General Information

The Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) appears twice yearly. All material without other accreditation is prepared by the Secretariat for the Biological Survey.

Editor: H.V. Danks
Head, Biological Survey of Canada
(Terrestrial Arthropods)
Canadian Museum of Nature
P.O. Box 3443, Station "D"
Ottawa, ON K1P 6P4
Tel. 613-566-4787
Fax. 613-364-4022
Email: hdanks@mus-nature.ca

Queries, comments, and contributions to the Newsletter are welcomed by the editor. Deadline for material for the Fall 2005 issue is July 15, 2005.

Editorial Notes

The Biological Survey of Canada (Terrestrial Arthropods) develops and coordinates national initiatives in taxonomic and ecological entomology on behalf of the Canadian Museum of Nature and the Entomological Society of Canada. The Newsletter communicates information about systematic and faunistic entomology that may be of interest in Canada, and reports especially on activities relevant to the Biological Survey.

This newsletter will also be available soon on the Survey's website at:

http://www.biology.ualberta.ca/bsc/bschome.htm

News and Notes

Bio-Blitz 2005

The 2005 Biological Survey of Canada Bio-Blitz will occur in Waterton Lakes National Park (WLNP), Alberta from 7-12 July. This provides an exciting opportunity to collect in one of Canada's most scenic and biologically-interesting natural areas, which is also a UNESCO Biosphere Reserve. The park's four Natural Subregions embrace 45 different vegetation types, including grasslands, shrublands, wetlands, lakes, spruce-fir, pine and aspen forests, and alpine areas. This rich collection of vegetation types in a small geographic area means that WLNP has an unusually rich and varied number of plants for its size, with more than 970 vascular plant species, 182 bryophytes and 218 lichen species. The park's variety of vegetation communities provides homes for many animals, including more than 60 species of mammals, over 250 species of birds, 24 species of fish,10 species of reptiles and amphibians, and thousands of species of terrestrial arthropods. Although recent collecting has contributed greatly to our knowledge of some groups, in general the arthropod fauna of WLNP is not well known. Many arthropod species found in WLNP are found nowhere else in Canada; some of these may be endemic and, for others, WLNP represents the northernmost limit of their distribution in North America. Thus, Bio-Blitz 2005 offers a unique opportunity to collect in the varied habitats of one of Canada's biologically rich areas. The Parks Canada staff is enthusiastic about and highly supportive of this event. They have offered the use of their research house, which has sleeping facilities for 8 and space for sorting and examination of samples and specimens. As well, group camping facilities will be provided. For those who prefer hotels, these are in abundant supply at the Waterton town site.

Subalpine and alpine habitats in
Waterton Lakes National Park
(photo by Cyndi Smith, Parks Canada)

If you are interested in participating in Bio-Blitz 2005, or would like more details, please contact David Langor (dlangor@nrcan.gc.ca).

World taxonomist database

ETI, The Expert Center for Taxonomic Information, is a non-governmental organisation (NGO) in operational relations with UNESCO. Its stated mission is "to develop and produce scientific and educational computer-aided information systems, to improve the general access to and promote the broad use of taxonomic and biodiversity knowledge worldwide."

ETI is attempting to build a world taxonomic database. See http://www.eti.uva.nl/Database/WTD.html to search the database or to submit your own information.

Activities at the Entomological Societies' meeting

The 2004 joint annual meeting of the Entomological Society of Canada and the Acadian Entomological Society took place in Charlottetown, P.E.I., 15-18 October 2004. The meeting was attended by about 235 people. Many of these were student members and there were a large number of entrants for the student presentations competition. Items in the program or associated with it included:

A plenary symposium, in accordance with the meeting theme, on Insects in the Landscape.

Symposia on "Insect Population Dynamics", "Insect Vectors and Human Health", "Insects of the Canadian Central Barrens".

Workshops on "Advances in Potato Pest Management" and "Modern Trends in Orchard Pest Management".

Submitted papers in several sessions.

A student presentation competition, in several sessions, Biological Control (pest management and biodiversity), Behaviour and Population Ecology, for the President's Prize of the Entomological Society of Canada.

An extensive poster session, including a student competition for the President's Prize.

The ESC Heritage Lecture given by Dr. Neil Holliday entitled "Norman Criddle: Pioneer Entomologist of the Prairies".

The ESC Gold Medal Address given by Dr. Judy Myers.

Associated meetings of the Agriculture and Agri-Food working group on Biological Control and the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods).

Governing Board and Annual General Meetings also took place, the Gold medal and other honours were awarded, and there were many opportunities for informal exchange of information, including opening mixers and a banquet.

Symposium on Insects of the Canadian Central Barrens.

The Biological Survey symposium on arctic insects, introduced by organizer D. J. Giberson reported a variety of detailed information gathered about the insects of this previously little known area (and see also Giberson, D.J. and D.C. Currie. 2004. Update on the "Insects of the Arctic" project: field collecting in 2003 and 2004. *Newsletter of the Biological Survey of Canada (Terrestrial Arthropods)* 23(2): 72-79; Giberson, D.J. and H.V. Shaverdo. 2003. Update on the survey of aquatic insects from Keewatin and Mackenzie project: The predaceous water beetles (Coleoptera: Adephaga: Dytiscidae and Gyrinidae). *Newsletter of the Biological Survey of Canada (Terrestrial Arthropods)* 22(2): 61-65; Project Update: Insects of Keewatin and Mackenzie. *Newsletter of the Biological Survey of Canada (Terrestrial Arthropods)* 2003. 23(1): 12-13]; Currie, D.C., D.J. Giberson and P.H. Adler. 2002. Insect biodiversity in the Thelon Wildlife Sanctuary. *Newsletter of the Biological Survey of Canada (Terrestrial Arthropods)* 21(2): 59-66.; Currie, D.C., D.J. Giberson, and B.V. Brown. 2000. Insects of Keewatin and Mackenzie. *Newsletter of the Biological Survey of Canada (Terrestrial Arthropods)* 19(2): 48-51; Currie, D.C. and P.H. Adler. 2000. Update on a survey of the black flies (Diptera: Simuliidae) from the Northwest Territories and Nunavut project. *Arctic Insect News* No. 11: 6-9.)

Insects in the northern Landscape. **R.A. Ring**

Diversity and biogeography of the Central Barrens black flies (Diptera: Simuliidae). **D.C. Currie, P.H. Adler, D.J. Giberson.**

Higher Diptera in the Canadian Arctic: past studies, present patterns and future needs. **T.A. Wheeler, S. Boucher**

Northern water beetles: patterns of distribution and opportunities for study. **R.E. Roughley**

Filling in some gaps: Mayflies, Stoneflies, and Caddisflies of the central barrens of the Canadian Arctic. **D.J. Giberson**

Summary and general discussion. **R.E. Roughley**

Papers on systematics and related themes

Many presentations were made in contributed sessions on biodiversity. The following titles include some of the papers of faunal interest that were presented in these and various other scientific sessions, including posters. (Interesting treatments on a range of other subjects were presented in the various sessions.)

The influence of landscape of the larval ecology of Newfoundland Hydropsychidae (Trichoptera). **C-L. Fietsch, M. Colbo**.

The ground-dwelling spider fauna from two vineyards in southern Quebec. **E. Bolduc, C. Buddle, N. Bostanian, C. Vincent.**

Spiders associated with fallen logs in Forillon National Park, Quebec. **H. Varady-Szabo, C.M. Buddle**.

Diversity patterns of saproxylic Coleoptera in mechanically-killed trees and natural snags of the main tree species of the eastern boreal mixedwood forest. **M. Saint-Germain, C.M. Buddle, P. Drapeau**

Ground beetles (Coleoptera: Carabidae) diversity and community structure in relation to disturbance gradients. **A. Mercado, C.M. Buddle**

Effect of forest management on the diversity of carabid beetles (Coleoptera: Carabidae) in jack pine (*Pinus banksiana*) forests in southeastern Manitoba. **K. Ryan, N.J. Holliday, A.R. Westwood**.

The effects of urbanization on ant assemblages (Hymenoptera: Formicidae) associated with the Molson Nature Reserve, Quebec. **J-P. Lessard, C.M. Buddle**

A morphological analysis of higher-level phylogenetic relationships among nitiduid beetles (Coleoptera, Nitiduidae). **C. Condy**

Ontogeny, variation, and synonymy in North American *Cybaeus* spiders (Araneae, Cybaeidae). **R.G. Bennett**

Molecular phylogeny of salticid spiders. **W. Maddison, M. Hedin, and K Needham**

Systematics of the tribe Azeliini (Diptera: Muscidae). **J. Savage**

Phylogeny and distributional patterns of scarab beetles in the southern hemisphere. **A.B.T. Smith**

Larval morphology of Aspidytidae (Coleoptera: Adephaga) and its phylogenetic implications. **Y. Alarie, D.T. Bilton.**

Weevils of the subfamily Ceutorhynchinae (Coleoptera: Curculionidae) in Canada. **P. Bouchard**

Tribal-level phylogeny of the Tortricidae, based on three DNA sequence regions. **F. Sperling, M Horak, F. FitzGibbon**

Using the occurrence of Ephemeroptera, Plecoptera and Trichoptera to characterize Newfoundland streams. **M. Colbo, D. Cote, V. Kendall**

Parasitoids (Hymenoptera: Chalcidoidea) of the cabbage seepod weevil, *Ceutorynchus obstrictus* (Coleoptera: Curculionidae) in North America, a case of mistaken identity. **G. Gibson, B. Ulmer, H. Bauer**

Conservation of biodiversity in Swedish managed boreal forests. **B. Ekbom, M. Schroeder, S. Larsson, M.A. McGeoch**

Testing biodiversity theory with ground-dwelling spiders: the role of disturbance and productivity. **C.M. Buddle**

Effects of single-tree selection harvesting on hymenopteran biodiversity in the canopy & understorey of mature maple-dominated forests. **S. Smith, N. Islam, J. Sousa, J. Huber**

Pyrophiles and carabophiles: phoretic mite assemblages colonizing burnt areas on pyrophilous carabid beetles (*Sericoda* spp.) (Coleoptera: Carabidae). **D.E. Walter, A. Dechene, H. Proctor**.

Feather mites of birds in Canada: a wealth of undescribed diversity. **S. Mironov, T. Galloway, H. Proctor**

Seasonal variation of ground beetle and rove beetle assemblages, and a quest for an optimal sampling strategy. **G. Pohl, D.W. Langor**

Summary of the Meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 2004

The Scientific Committee met in Charlottetown on October 18-19, 2004.

Scientific projects

1. Grasslands

Five chapters for the first grasslands volume, on ecology and interactions in grasslands habitats, have been submitted and are ready for external review. Two more chapters are currently in the final stages and should be submitted in a couple of weeks. Five other chapters have been promised soon. Planning is ongoing for volume 2 on arthropods in human altered grasslands and for volume 3, on faunistics.

The grasslands focus site and field trip was held successfully in 2004 at Aweme, Manitoba in conjunction with a bioblitz for all taxa. Planning is underway for a similar effort in 2005, as a joint effort of the grasslands and forest arthropod projects, at Waterton Lakes National Park. That area has a wonderful selection of natural forests and grasslands and covers a number of different subregions such as alpine, montane and boreal forests and Parks Canada supports the idea.

2. Family keys

Dr. Scudder reported that the B.C. family keys should be finished this fiscal year. The Canadian key to exopterygotes can be completed shortly after the BC key is done. Discussions about the format and audience for the Canadian key, and the endopterygote key, led into the following item.

3. Arthropods of Canada – a modular e-journal of the BSC

Dr. Marshall introduced this idea for a project to make the fauna more identifiable. The BSC could profitably integrate various regional efforts into a high profile, centrally organized but modular Biological Survey project to facilitate the identification of Canadian arthropods. Because of the way digital technology has changed in recent years and because of the increased ease and decreased cost with which anyone can make good digital images of habitus but also of characters, many people can put together a key for specific regional groups, which would be placed as reviewed contributions in a national forum endorsed by the BSC. After extended discussion about the scope and requirements of such a project, the idea was strongly endorsed, and a subcommittee will carry it forward.

4. Terrestrial arthropods of Newfoundland and Labrador

Databases and keys continue to be developed for this project; work on the beetles is relatively advanced. A database of entomological literature dealing with NF/LB as well as a database of NF/LB taxa and collection localities continues to be developed. Publication options are under consideration.

5. Forest arthropods

The first issue of the Arthropods of Canadian Forests Newsletter will be published in February 2005. The first issue will contain an introduction to the BSC Forest Arthropods Project, project updates, feature articles, new publication listings, news and opportunities, and other items including information about the 2005 Waterton grasslands-forests field trip. The Newsletter will be distributed in electronic format.

A symposium tentatively entitled ‘Arthropods as Ecological Indicators in Forests’ will take place at the 2005 ESC-ESAlberta meeting. The plan at this stage is to have a full-day symposium that will feature a set of synthesis papers. It is hoped to publish these papers, supplemented by other solicited articles, as a unit.

A project on the Cerambycidae of Canada and Alaska was recently initiated, including taxonomic and database work.

6. Insects of the arctic

Some background information about arctic science was provided. Dr. Giberson noted

that no arthropod projects received an NSERC northern supplement in 2004 even though some people had applied. In 2004, arctic collections had been made in western Alaska and a Malaise trap was run during the summer in a river 30 km outside Rankin Inlet. Travels to the Rankin area and to Siberia are likely in 2005 in the context of this project.

7. Seasonal adaptations

Dr. Danks reported on symposium presentations and published papers relevant to this project. Some other papers prepared as contributions to proceedings or as compilations have been delayed by the tardiness of other authors. Other papers on insect life cycles are being planned, and Dr. Danks will spend several months in Japan as a visiting professor at the Research Institute for Bioresources of Okayama University where research on seasonal adaptations takes place.

Other scientific priorities

1. Invasions and reductions

Extensive consultations with a range of interested parties (including government representatives as well as Committee members and non-insect as well as insect specialists) had been held about the possible scope of a symposium on invasive species. The key need is for a scientific synthesis. The BSC therefore considered whether a broad stand-alone symposium over several days including other terrestrial taxa and with a follow-up workshop component (aiming at national profile and products of broader scope) or a smaller arthropod-focused symposium is preferable. The Committee concluded that an arthropod symposium, focused on key science issues rather than policy, should be developed. The focus of the symposium will be considered further so that detailed planning can begin.

Work on the coccinellid project continues with databasing of collection records and other activities. The Committee discussed especially the needs for web-based data storage and availability, and the needed structure will be explored further by project participants.

2. Survey web site

A number of changes have been made to the BSC web site, including added pages and information especially about the forest arthropods project, and the Biological Survey of Canada Postgraduate Scholarship. Some translations had been added too. Other additions are planned. A new web site counter was installed, providing some interesting information about visitors and page visits. For example, over four months the BSC site had 12,448 unique visitors, averaging more than 100 per day and the number of visitors continues to increase up to 200 unique visitors per day. During recent periods articles on spiders were the most frequently visited items, coming from a variety of search terms for spiders. The majority of visitors reach the BSC web pages via search engines, but some other websites have unsolicited links to the BSC pages. About half of the users originate in Canada and the remainder come from all over the world.

3. Survey publicity

The Survey poster was shown at the meeting of the North American Benthological Society. A short introduction to the BSC was given at the ESC/AES symposium on the Insects of the Canadian Arctic Central Barrens. Ways to formalize Survey symposia at the ESC meetings were discussed.

4. Arthropods and fire

A symposium on fire and arthropods will be held at the ESC/ESA 2005 joint annual meeting in Canmore.

5. Arthropods of the Gulf of St. Lawrence Islands

This recently launched project has now begun with some collecting in a few places and consideration of protocols for trapping methods and so on.

6. BSC award

The ESC had received donations covering the first award, just made in 2004. Donations for the first 2 years of this award from the H.V. Danks trust fund have ensured that this award is now fully funded for the foresee-

able future. However, further donations will be solicited to allow for inflation and to allow the award to be given more frequently. Also, efforts will be made before the next award to advertise it more widely and thus ensure that there are numerous suitable applications. A specific award certificate will be designed for future BSC awards.

7. Biodiversity sampling brief

The Committee agreed that an update of the 1994 BSC brief on biodiversity sampling would be useful. However, this material might best be included in an update of the first volume of the Handbook series, and this possibility will first be pursued by discussion with the relevant people.

8. Databasing

The Committee considered various updates and information. For example, two recent large CFI proposals for databasing work were rejected. Projects in various places are succeeding in databasing specimens and making that information available. The Committee established a subcommittee to develop ideas for a simple list of geographic coordinates for common and/or historic collecting localities.

9. Monitoring of continuing priorities

Some other Survey interests were reviewed, including arthropod fauna of soils (a symposium on invertebrates of soils will be held at the 2005 Joint Annual meeting), arthropods of aquatic habitats (the North American Benthological Society meeting was held in Vancouver in 2004 and was attended by about 850 people, and there seems to be a particular resurgence of aquatic research in the Maritimes), the Queen Charlotte Islands (Haida Gwaii) (a paper on the insular black flies of North America will soon be published), arthropod ectoparasites of vertebrates, agroecosystems (including a major Agriculture Canada initiative, the National Land and Water Information System, bringing together georeferenced data sets), projects on spiders, and a developing project on the Lepidoptera of Quebec.

10. Other priorities

The Committee also considered actions and information about dissemination of Survey briefs (two recently translated briefs “Normes d'étiquetage pour les arthropodes terrestres” and “Le rôle des spécimens de référence pour valider les recherches faunistiques et écologiques” were distributed with Antennae, the bulletin of the Société d’entomologie du Québec, and widely distributed in other ways), endangered species (including current expansion of the COSEWIC arthropod species specialist subcommittee), and the faunal analysis project.

Liaison and exchange of information

1. Canadian Museum of Nature

A report from Mr. Roger Baird, Director of Collection Services, noted that full-scale construction has commenced on the Victoria Memorial Museum Building. A major renovation of this historic heritage building is now fully underway and will be finished in 2009, including architectural changes to the building, upgrades to the infrastructure, relocation, refurbishment and redevelopment of galleries and exhibitions, and their supporting programmes and changes to visitor amenities and grounds landscaping.

Mr. Baird had participated in two important meetings held in Washington DC. The inaugural meeting of the Consortium of the Barcode of Life (CBOL) established the organizational structures required to meet future goals for this international collaboration of natural history museums, herbaria, molecular systematics laboratories, and conservation sites. The CBOL is seeking to advance the completion of DNA barcoding for millions of species, by pursuing DNA barcoding activities in collaboration with major related initiatives such as the Global Biodiversity Information Facility, GenBank, and the Census of Marine Life. Mr. Baird noted that DNA barcoding is not intended to supplant or otherwise invalidate existing taxonomic practice; it is not "DNA-based taxonomy" but is an extension of the existing taxonomic system. The first Inter-

national Conference for the Barcoding of Life in February 2005 will be hosted by the Natural History Museum, London (NHM).

The annual general meeting of the Natural Science Collections Alliance (formerly the Association of Systematics Collections) was held at the National Museum of Natural History, Smithsonian Institution in May 2004. A key element of the meeting was the pursuit of a communication strategy that emphasizes the value of collections, systematics and taxonomy. Mr. Baird noted parallels between this collaboration and that of the Alliance of Natural History Museums of Canada (ANHMC), which joins together institutions from across Canada that share similar and potentially overlapping mandates focusing on the natural history of our country. Natural history museums can provide better service, and be better served, through a coordinated approach to educating general and special audiences about the value of their collections. Pilot projects underway include communications strategies and an examination of the degree to which the alliance is aware of the collections and taxonomic expertise distributed within (and even absent from) its membership. Members of the Committee commented that the Alliance of Natural History Museums of Canada is weakened by excluding university natural history collections and by confining consultation and structural planning to a restricted group.

2. Agriculture and Agri-Food Canada

Dr. Landry reported that there have been few major developments at the Ottawa centre in the last 6 months, although the department remains under reorganization. Systematics and taxonomy in the CNC are part of the Biodiversity Science Program. All invertebrate systematists are part of the Invertebrate Biodiversity Study and Dr. Peter Mason is the study leader. This program is part of a larger national program called Environmental Health which has been in place for a couple of years but the management structure for the programs is still undecided. Currently Science Directors are responsible for the programs on a national basis and Site Directors manage the research stations. At the CNC the newly hired scientists are settling in and have received resources to set up laboratories and begin research programs. The Identification Service is being rejuvenated and is undergoing a transition from a paper-based system to a more efficient computer-based system.

Dr. Landry provided an update about the revised Handbooks series including publications planned in the near future. Some earlier handbooks that are no longer in print will also be reprinted. An update of the volume on collecting techniques is being considered.

3. Entomological Society of Canada

Dr. Bob Lamb, President of the ESC, emphasized that the Society recognizes the importance of the Biological Survey of Canada, and he congratulated the Survey on its first 25 years or so of activity. In particular, the entomological community has been a strong and vibrant force over that time, and the BSC has had many important influences and contributions. Dr. Lamb explained that in coming to this meeting he was prompted to think about what has made the BSC strong and able to contribute to the entomological community. Dr. Lamb thinks that the BSC has helped to guide or coordinate research in a remarkable way. He went on to say that this is why the BSC needs to be associated with the Canadian Museum of Nature. He also recognized the collegial structure of the BSC, and the importance of a strong research presence in the Secretariat. He looked forward to learning more and helping to promote the Survey's efforts.

4. Parks Canada

A representative of the Atlantic office of Parks Canada was expected to attend the meeting but in the end was unable to do so. Nevertheless, the Survey undertook to acknowledge this interest and encourage the continuance of regional cooperation.

5. Regulation of classical biocontrol agents

Dr. Peter Mason, Agriculture and Agri-Food Canada and Canadian Biocontrol Review Committee explained developments about

the regulation of biocontrol agents for which there were no regulations before 1990. He reported on the process now. A process is in place through the initiative of the biocontrol community, which is steadily being implemented. The Committee discussed some of these issues at length with Dr. Mason.

Other items

1. Regional developments

Information of potential interest from different parts of the country was reported. For example, in British Columbia, the BC Wildlife Act has been modified to include more than birds and mammals but does not specifically list what else is covered. Fires in the south Okanagan (in the Behr's hairstreak antelope brush community) were first thought to be caused by an osprey's nest that fell on to electrical wires but apparently what really happened was a fire in Okanagan Mountain Park, caused when the power was rerouted and overloaded the system. A power substation will be installed in the south Okanagan in an antelope brush community, with financial compensation for loss of some of this habitat, which the Nature Trust has used to purchase antelope brush property. Recent climate change scenarios for British Columbia show that grasslands will be much more extensive in the future. There is much concern in B.C. currently about the mountain pine beetle, which is expanding rapidly, and attacking y ounger stands. The chief forester has increased the allowable cut by 10% and there is now concern for the long-term social and economic impacts because there will be no logs to harvest in future.

In the Prairies, a major project was noted looking at the interface between Agriculture and Forestry across the country, with study sites in Saskatchewan (canola crop), Ontario (alfalfa and soy bean) and Nova Scotia (blueberry). All sites are being monitored the same way with pitfall traps, pan traps and sweep samples, using a split plot design to look at the impact of agriculture without shelter belts or forested areas and comparing them to forested areas. Results will be compared over the next three years. The specimens are sorted on location and some groups of interest will be sent to the CNC in Ottawa. Graduate student projects and databasing efforts in various places on the prairies were also noted together with some other biodiversity-related projects.

In Ontario, a variety of staffing actions and student projects were noted.

In Quebec, government and university projects were outlined, including work on various taxa and work on forest biodiversity. The Université de Montréal has advertised for a faculty position in invertebrate systematics and biodiversity for the third time. The university has a good collection that needs work. The annual meeting of the Société d'entomologie du Québec will be in Montreal, November 4-5. The value of regional journals in Quebec such as Fabreries, the journal of the Association des entomologistes amateurs du Québec, for publishing baseline data was highlighted.

In Newfoundland and Labrador and the Maritimes, projects in forests and elsewhere were described from across the region including surveys of groups such as macrolepidoptera, beetles and dragonflies. A new online journal of the Acadian Entomological Society which will be out soon, is a peer-reviewed regional journal without page charges. A website has been established to assist lay people and researchers interested in beetles in Atlantic Canada: [Beetles of Atlantic Canada website located at: http://chebucto.ca/Environment/NHR/atlantic_coleoptera.html]. At the official opening of the NSERC regional office in Moncton in October (to deal mainly with industrial research partnerships and how to use innovative technology to make jobs and money) there was a striking lack of interest in biodiversity issues.

For the Arctic, the BBC is interested in filming things from habitats around the world, including certain arctic species.

2. General operations of the Biological Survey Secretariat

The regular roles of the Survey were noted, such as the BSC Newsletter and web-

site. The BSC program of visits for discussions and seminars on different subjects continues. Reports now being made from the BSC to the ESC Governing Board highlight items of particular relevance to the ESC, such as the BSC award and the fact that the Committee is meeting in association with the ESC's annual meeting. The Renewal Project at the Canadian Museum of Nature – the refit of the downtown exhibits building and new galleries – continues to put a strain on CMN resources, with significant implications for future budgets. The BSC succession document that was submitted earlier to the Museum was well received and the CMN has been canvassing feedback more widely from various government representatives, professional societies and other individuals, including some positive comments.

3. Other matters

The Survey Committee also considered liaison with other organizations, membership of the Scientific Committee, commentary to the Biodiversity Convention Office, and the annual report to the Canadian Museum of Nature.

Project Update: Forest Arthropods

David W. Langor
Canadian Forest Service, Northern Forestry Centre, 5320 - 122 Street, Edmonton, AB T6H 3S5
dlangor@nrcan.gc.ca

Since its establishment in 2003, the Forest Arthropods Project has continued to expand to include new initiatives and participants. The purpose of this project is to facilitate communication among scientists working on forest arthropod biodiversity issues and undertake syntheses focused on relevant science issues.

Communication:

In March 2005, the Canadian Forest Service and BSC will jointly publish the first issue of a new electronic newsletter, Arthropods of Canadian Forests. This newsletter is being initiated to increase information exchange among scientists involved in arthropod biodiversity work (faunistics, conservation, ecology, systematics, etc.) in Canadian forests. The newsletter will include project updates, feature articles, news, opportunities, new publications, etc. Articles are accepted in either official language. If you have news items, publication, advertisements that you would like to appear in the March 2005 issue, please forward them to David Langor by February 15 (dlangor@nrcan.gc.ca). Initially, one issue will be published per year. The deadline for articles for the next issue is December 31, 2005.

In 2004, a database of projects focused on forest arthropod biodiversity work in Canada was compiled and linked to the BSC website (http://www.biology.ualberta.ca/bsc/english/forestprojectssummary.htm). This database is regularly updated. Please send updates to David Langor. Check the first issue of the Arthropods of Canadian Forests Newsletter for an analysis of the current contents of the database.

Syntheses:

A BSC-sponsored symposium, 'Maintaining Arthropods in Northern Forest Ecosystems', will take place at the ESC-ESAlberta meeting in Canmore, Alberta, 3-6 November 2005. This symposium, organized by John Spence and David Langor is an opportunity to pull together and synthesize what is known about structure and dynamics of selected arthropod assemblages in managed northern forests (mainly boreal and north temperate). The symposium will include 6 papers that synthesize available information about specific

arthropod groups (Carabidae, Staphylinidae, Spiders, saproxylic arthropods, Lepidoptera, and aquatic arthropods). Some of the topics covered by these syntheses are: the spatial/temporal patterns in species richness and assemblage composition, as influenced by geography, forest type, forest succession, etc.; how assemblages respond to anthropogenic disturbances (especially harvesting) and natural disturbances (e.g., wildfire); analysis of species or kinds of species (e.g., dispersal ability, trophic group) most threatened by forest management; adaptive forest management measures needed to ensure that these organisms are maintained on forested landscapes; critical gaps that need to be addressed next. It is planned that these papers will be published in The Canadian Entomologist.

A group of BSC members (David McCorquodale, Serge LaPlante, Jim Hammond and David Langor) have now teamed up to write a handbook on "The Cerambycidae of Canada and Alaska". This work aims to solve some existing taxonomic problems with the Canadian fauna, produce a handbook for this family (profusely illustrated and with color photos of all species), and build a database of specimens in Canadian collections. Considerable effort has been made with databasing, especially collections in eastern Canada. This project has received generous funding from the USDA Forest Service and Canadian Forest Service.

Profile of Entomologists in Survey's Annotated List of Workers

In 1997 the Survey had just published an update to the "Annotated List of Workers on Systematics and Faunistics of Canadian Insects and Certain Related Groups" and Volume 16, No. 2 issue of this newsletter highlighted a few statistics from that list.

The list is no longer published in paper format but the information is available from a searchable database on the Survey's web site (see List of Workers, http://www.biology.ualberta.ca/bsc/english/listofworkers.htm). A few comparisons from then and now.

Number of entries 1997: 465

Number of entries 2005: 392

Taxonomic interests:

The tables below show the number of entomologists who declared an interest in one or more of the noted orders. Orders that had fewer than 20 people with an interest are not shown.

1997

Order	% of entries
Lepidoptera	30%
Diptera	30%
Hymenoptera	24%
Coleoptera	18%
Homoptera	8%
Acari	7%
Heteroptera	5%
Orthopteroidea	5%
Trichoptera	5%

2005

Order	% of entries
Coleoptera	55%
Diptera	45%
Lepidoptera	43%
Hymenoptera	38%
Homoptera	10%
Heteroptera	8%
Trichoptera	6%
Orthoptera	6%
Ephemeroptera	6%
Araneae	5%
Odonata	5%

The Quiz Page

—test your knowledge of Canada and its fauna—

1. Some insect species living on sea shores show periodicities that accord with the tides. What is the mean tidal interval, and what is the significance of this value?

2. Name 3 families of insects that contain many wing-dimorphic species.

3. In some cool temperate species, the life cycle always lasts for one year. Name one of these strictly univoltine kinds of insects characteristic of boreal Canada and describe its life cycle.

4. What stages are the eonymph, nymph, nymphe, pronymph and protonymph?

5. A beetle flies in still air for 200 metres. Another of the same species walks the same distance. If both travel in a straight line, which one uses the most energy?

[Answers on p. 25]

A primer on pseudoscorpions and taxonomic status in Canada

Chris Buddle
Department of Natural Resource Sciences, McGill University, Macdonald Campus, 21,111 Lakeshore Rd., Ste Anne de Bellevue, QC, H9X 3V9
chris.buddle@mcgill.ca

Introduction

The arachnid order Pseudoscorpiones, commonly known as pseudoscorpions, false scorpions, or book scorpions, represent an important yet understudied Arachnid order. Harvey (2002) placed the order among a list of 'neglected cousins' of the Arachnida, in an attempt to highlight the need for more intensive research on the smaller arachnid orders. The pseudoscorpions comprise about 3.3% of the described arachnid species (Harvey 2002), with just over 3,000 known species, globally (Harvey 1990), and about 350 species are known from North America north or Mexico (Coddington et al. 1990). Although this diversity pales in comparison to many other arthropod orders, pseudoscorpions are nevertheless ecologically important, morphologically and taxonomically distinct, and efforts are required to better understand the biology, ecology, and taxonomy of these curious arachnids. In North America, despite incredible work by some arachnologists in the mid- to late 1900s (e.g. E. Benedict, C. Hoff, S. Nelson, W. Muchmore), we know embarrassingly little about the distribution, ecology and taxonomy of pseudoscorpions in much of the northern half of the continent. I have begun a long-term inventory of pseudoscorpions in Canada, and the first step, reported here, is to document what species are presently known to occur in the country, and to speculate on their distributions. Future efforts will be directed at producing an identification guide to pseudoscorpions of Canada, and subsequent taxonomic and ecological studies. This is especially important now, since William Muchmore, the current expert on Pseudoscorpiones in North America, has been retired for many years, and personal communications with him have indicated he has almost completely wrapped up his life's work on this group.

Description

Pseudoscorpions are small (typically less than 5 mm in length) predacious arachnids, with a general similarity to true scorpions, but without the tail. They are generally light tan to reddish brown to black in colour and are typically compressed dorsoventrally. They have two main body parts, divided into an anterior prosoma or cephalothorax and a posterior opisthosoma or abdomen. The dorsal surface of the cephalothorax shows little signs of segmentation, whereas the abdomen is divided by 11 or 12 clearly defined segments. The chelicerae of pseudoscorpions are two-segmented structures attached close together under the anterior margin of the carapace; these are used to grasp and macerate food, and the opening to the silk glands (located in the cephalothorax) are near the end of the movable finger of each chelicera. The first pair of 'leg-like' appendages of pseudoscorpions are the long and conspicuous pedipalps, which each bear the distinctive chela used to grasp prey or defend against predators. The remaining four pairs of appendages are the walking legs.

Life history, ecology, and taxonomy

The life-cycle of pseudoscorpions is straightforward, although the pre-mating courtship routine is highly complex in some species (Weygoldt 1969). Males produce a stalked spermatophore which is attached to a

substrate and subsequently taken up by a female. Fertilized eggs are retained in a secreted pouch attached to the female's abdomen, and young remain in the brood pouch until the first nymphal stage. Pseudoscorpions go though three nymphal stages (the protonymph, deutonymph and tritonymph) before molting to sexually mature adults. Males of some species (e.g., *Microbisium*, see Photograph 1) are rare, causing some speculation that parthenogenesis may occur within the group (Hoff 1949, Muchmore 1990a). Adults are believed to be relatively long-lived in the field (6 months or more) (Hoff 1949), and can survive in captivity for more than one year (Weygoldt 1969).

Pseudoscorpions are cryptic animals, living amongst leaf-litter, under rocks, within

Microbisium brunneum (Hagen) collected from moss in spruce forest in Parc d'Aiguebelle, Québec (region of Abitibi-Témiscamingue) (June 2004, collector: C. Buddle) (photograph by C. Buddle)

compost piles, under bark and within decaying wood, in caves, and in various vertebrate nests. Many species are also phoretic on insects or birds. Species such as *Chelifer cancroides* (L.) (Photograph 2) are cosmopolitan, typically found in houses, barns or other human-made structures. Like many arachnids, pseudoscorpions are believed to be generalist predators, feeding upon small soil invertebrates (e.g., mites, Collembola), various Diptera, ants, and occasionally caterpillars. The general ecology of the group has been vastly understudied (see Muchmore 1973), although two recent papers by Bell et al. (1999) and Yamomoto et al. (2001) suggest the group may be useful biological indicators. These studies support the hypothesis that ground-dwelling pseudoscorpions are dependent on well-developed litter, which means some dependence on older/abandoned forest stands (Yamomoto et al. 2001), or hedgerows in an agricultural setting (Bell et al. 1999). Although the densities of pseudoscorpions are sometimes quite high, I have found their populations to be extraordinarily patchy or clumped. One litter sample, for example, may yield a dozen or more specimens, whereas most may yield none. I suspect this patchy distribution, along with the difficult taxonomy (see below), explains the paucity of ecological studies on the group. Some aspects of pseudoscorpion behaviour, sexual selection, and dispersal, however, have been well-studied in the neotropics (e.g., Zeh and Zeh 1992), and this example has even found its way to popular science writing (Judson 2002).

The most recent phylogenetic treatment of the order was completed by Harvey (1992), and key references for the pseudoscorpions in North America are Muchmore (1990a), Hoff (1949), Nelson (1975), and Chamberlin (1931). Pseudoscorpion taxonomy is difficult; it relies on careful specimen preparation, and the characters are often highly conserved, or depend on size or shape of certain structures (e.g. Nelson 1984). However, it is possible to overcome these obstacles, and Muchmore (1990a) provides a reasonably complete key to genera of pseudoscorpions occurring in North America. This key, however, requires considerable cross referencing with taxonomic publications, and voucher specimens are required to properly assess character states for more difficult couplets.

Collection and Preservation

Pseudoscorpions inhabiting leaf-litter and rotten logs are most easily sampled by collecting litter or dead wood and extracting the invertebrates using a Berlese funnel. I have also had success with litter-sifting directly in the field; here, litter is manually sifted onto a white drop sheet with the aid of a bucket with its bottom replaced with a wire mesh (held with duct tape, of course). Depending on the habitat, about 40 x 40 cm of litter can be sifted at one time, and careful examination of the drop cloth often reveals pseudoscorpions. A combination of the two techniques also works; litter can be collected in the field and later sifted over a drop cloth in a laboratory setting. This technique does not rely on having a Berlese apparatus (with light source, etc.) set-up, yet allows for more careful examination of litter than is often possible under field conditions. Muchmore (1973) also points out that some species may be found deep in the soil (i.e. 20-30 cm depth), and therefore soil extraction may reveal pseudoscorpions. Hoff (1949) reports the interior of stumps, and leaf-litter blown against fallen logs, as being particularly good locations for pseudoscorpions. Species living under bark are collected by careful visual surveys in the field, and rearing arthropods living in dead wood (in a rearing box or cage) can also pick up pseudoscorpions. Other key habitats that can be sampled include bird's nests, beaches or shorelines, and caves.

Pseudoscorpions can be preserved in 70% ethanol, and later studied under a dissection microscope. Some dissection and clearing is required for examination of specimens for taxonomic purposes. In most cases, a chela, pedipalp chelicera and one leg I and one leg IV are removed from the specimen. Temporary slide mounts can be made using lactic acid, but permanent slide mounts are required for voucher specimens. Hoff (1949) and Nelson (2005) provide details about specimen preparation and examination.

Status in Canada

The first synopsis of pseudoscorpion species in Canada was provided by Dondale (1979), who reporting five species in the country based on Hoff (1958) and Kaisila (1964). Sharkey's (1980) unpublished report, together with more recent publications (e.g., Koponen and Sharkey 1988; Muchmore 1990b), keys (Muchmore 1990a) and Harvey's (1990) catalog document 7 families, and 23 valid known species from Canada (Table 1), and at least three undescribed species. Provincial records will rise quickly with additional collections and after identifications of specimens in my collection are complete. For example, the common boreal species *Microbisium brunneum* (Hagen) (Photograph 1) is likely present in all provinces and territories as will be the easily recognized *C. cancroides* (Photograph 2) – most questions from the general public about pseudoscorpions are in reference to this cosmopolitan species, often found crawling on the walls of older homes, particularly in humid locations. At present, only three species have been recorded from higher latitudes: *Syarinus obscurus* (Banks) (Yukon Territory, unpublished record from V. Mahnert), *Wyochernes arcticus* Muchmore (Yukon Territory) (Muchmore 1990b), and *M. brunneum* from northern Québec (Koponen and Sharkey 1988). These records severely under represent the true richness of pseudoscorpions in Canada, as at least 30 species are

Chelifer cancroides (L.) collected in residential property, Peterborough, Ontario (April 2004, collector: D. Hutchinson) (photograph by C. Buddle)

known from locations in the USA adjacent to Canadian provinces (Harvey 1990), and many of these will likely be documented in Canada with future collections and inventory work. I suspect upwards of 50 species will eventually be recorded from Canada.

Conclusions

Pseudoscorpions are remarkable arthropods, well deserving of more research. Taxonomic work is still required for many North American families (Coddington et al. 1990), and regional keys to species will certainly simplify their inclusion in biodiversity studies.

Table. 1. Summary of pseudoscorpion families and species recorded in Canada, with provincial records listed, and general habitat affinities.

Family and species	Province	Habitat (taken primarily from Muchmore 1990a)
Chthoniidae		
Apochthonius moestus (Banks)	ON	Moist litter
Apochthonius minimus R.O. Schuster	BC	Moist litter
Chthonius (Ephippiochthonius) tetrachelatus (Preyssler)	ON	Moist litter and debris
Mundochthonius rossi Hoff	MB	Cool, moist litter
Mundochthonius sp.	BC	—
Pseudogarypidae		
Pseudogarypus banksi Jacot	QC	Dry areas, rocks, frass, tree-holes
Garypidae		
Larca notha Hoff	SK	Litter, frass, mammal nests
Neobisiidae		
Halobisium occidentale Beier	BC	Littoral zones, under rocks, litter
Microbisium brunneum (Hagen)	MB, ON, QC, NF	Bogs, boreal forest litter
Microbisium parvulum (Banks)	MB, ON, QC	Woodland litter
"Microcreagris" sp.	BC	—
Syarinidae		
Syarinus enhuycki Muchmore	ON	Under rocks, damp litter
Syarinus palmeni Kaisila	NF	Under rocks, damp litter
Syarinus obscurus (Banks)	BC, SK, YK	Deep in soil, litter
Cheliferidae		
Chelifer cancroides (L.)	BC, AB, MB, ON, QC, NF, NS	Houses, building, barns
Dactylochelifer copiosus Hoff	NS	Dry litter
Dactylochelifer silvestris Hoff	BC	Dry litter
Paisochelifer callus Hoff	NB	Moist litter, bird nests
Chernetidae		
Americhernes oblongus (Say)	AB	Under bark of trees, logs
Chernes lymphatus (Hoff)	ON	Moist litter
Dendrochernes morosus (Banks)	SK	Under bark, phoretic on insects
Hesperochernes canadensis Hoff	AB	Organic debris, with animals
Hesperochernes tamiae Beier	QC	Organic debris, with animals
Lamprochernes minor Hoff	QC, BC	Moist organic debris, phoretic on insects
Wyochernes arcticus Muchmore	YK	Under stones, rocks
Dinocheirus sp.	AB	—

Ecological work is also desperately needed, but again relies on accessible taxonomy. I will continue working on this group of arachnids, and would greatly appreciate any specimens, along with detailed habitat and locality information.

References

Bell, J.R., S. Gates, A.J. Haughton, D.W. Macdonald, H. Smith, C.P. Wheater, and W.D. Cullen. 1999. Pseudoscorpions in field margins: effects of margin age, management and boundary habitats. *Journal of Arachnology* 27: 236-240.

Chamberlin, J.C. 1931. The arachnid order Chelonethida. *Stanford University Publication of Biological Science* 7: 1-284.

Coddington, J.A., S.F. Larcher, and J.C. Cokendolpher. 1990. The systematic status of Arachnida, exclusive of Acari, in North America north of Mexico, pp. 5-20 *in* Kosztarab, M., and C.W. Shaefer (Eds). Systematics of the North American Insects and Arachnids. Virginia Agricultural Experimental Station Information Series 90-1. Virginia Polytechnic Institute and State University, Blacksburg.

Dondale, C.D. 1979. Opiliones, Pseudoscorpionida, Scorpionida, Solfugae. pp. 250-251 *in* Danks H.V., (Ed.) Canada and its insect fauna. *Memoirs of the Entomological Society of Canada* 108.

Harvey M.S. 1990. Catalogue of the Pseudoscorpionida (Mahnert V, Ed.). Manchester University Press.

Harvey, M.S. 1992. The phylogeny and classification of the Pseudoscorpionida (Chelicerate: Arachnida). *Invertebrate Taxonomy* 6: 1373-1435.

Harvey M.S. 2002. The neglected cousins: What do we know about the smaller Arachnid orders? *Journal of Arachnology* 30: 357-372.

Hoff, C.C. 1949. The pseudoscorpions of Illinois. *Bulletin of the Illinois Natural History Survey* 24: 413-498.

Hoff C.C. 1958. List of the Pseudoscorpions of North America North of Mexico. *American Museum Novitates* 1875: 1-50.

Judson, O. 2002. Dr. Tatiana's Sex Advice to all Creation. Henry Holt and Company. New York, New York.

Kaisila J. 1964. Some pseudoscorpions from Newfoundland. *Annales Zoologici Fennici* 1: 52-54.

Koponen S. and M.J. Sharkey. 1988. Northern records of *Microbisium brunneum* (Pseudoscorpionida, Neobisiidae) from eastern Canada. *Journal of Arachnology* 16: 388-390.

Muchmore, W.B. 1973. Ecology of pseudoscorpions: a review. pp. 121-127 *in* Dindal, D.L., (Ed.). Proceedings of the First Soil Microcommunities Conference. Syracuse, New York.

Muchmore, W.B. 1990a. Pseudoscorpionida. pp 503-527 *in* Dindal D.L. (Ed.). Soil Biology Guide. John Wiley & Sons.

Muchmore, W.B. 1990b. A pseudoscorpion from arctic Canada (Pseudoscorpionida: Chernetidae). *Canadian Journal of Zoology* 68: 389-390.

Nelson, S., Jr. 1975. A systematic study of Michigan Pseudoscorpionida (Arachnida). *American Midland Naturalist* 93: 257-301.

Nelson, S., Jr. 1984. The pseudoscorpion genus Microbisium in North and Central America (Pseudoscorpionida, Neobisiidae). *Journal of Arachnology* 12: 341-350.

Nelson, S., Jr. 2005. Pseudoscorpions. Entomology Note #16, Michigan Entomological Society. Published at:http://insects.ummz.lsa.umich.edu/MES/notes/entnote16.html [accessed 13 January 2005].

Sharkey, M.J. 1980. A preliminary report on the pseudoscorpions of Canada. Unpublished Report.

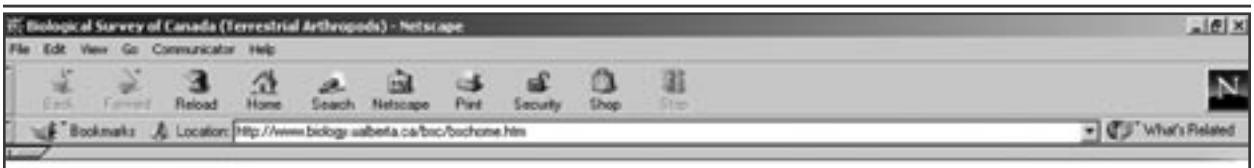
Weygoldt, P. 1969. The Biology of Pseudoscorpions. Harvard University Press, Cambridge, Massachusetts.

Yamamoto, T., N. Nakagoshi, and Y. Touyama. 2001. Ecological study of pseudoscorpion fauna in the soil organic layer in managed and abandoned secondary forests. Ecological Research 16: 593-601.

Zeh, D.W., and J.A. Zeh. 1992. Dispersal-generated sexual selection in a beetle-riding pseudoscorpion. *Behavioral Ecology and Sociobiology* 30: 135-142.

Acknowledgements:

H. Proctor, M. Sharkey, W. Muchmore, and V. Mahnert kindly provided unpublished records. Discussions with J. Bell, W. Muchmore, J. Cokendolpher, M. Harvey, and M. Judson have been inspiring and extremely helpful in this endeavor. Thanks also to numerous people for providing me with pseudoscorpion specimens from across Canada.



Biological Survey of Canada
Terrestrial Arthropods français

Web Site Notes

Newsletters online

The Fall 2003 issue of this newsletter included an index of past newsletter articles. This index is now available as a separate page on the BSC web site. Moreover, selected articles from earlier issues (Vol. 1, No. 1 to Vol. 16, No. 1) have now been posted as searchable pdf files and can be found by clicking on the appropriate links in the index. These articles were scanned from paper originals and may not retain all of the original formatting.

Regularly occurring features such as List of Requests for Material or Information (each Spring issue), The Quiz Page (each issue starting 1988), Quips and Quotes (each issue), Selected Publications (each Fall issue), Selected Future Conferences (each issue starting Fall 1995), and the list of Members of the Scientific Committee (each Fall issue) are not listed in the index.

Requests or suggestions for digitizing other past articles are more than welcome.

Beginning with the Fall 1997 issue (Vol. 16, No. 2) the entire newsletter was posted on the web site in html format. Starting with Volume 18, No. 1, Spring 1999 each issue can now also be opened as a pdf file.

Arctic Insect News was published 1990 (no. 1) to 2000 (no. 11) to support the Survey's aim of encouraging further work on arctic invertebrates. Volumes 9 to 11 have been available electronically for some time and we recently posted Volumes 1 to 10.

All issues of *Arthropods of Canadian Grasslands* are also available on the web site and will continue to be posted annually.

To access any of these newsletters or the selected articles please visit the Publications section of the BSC web site and follow the link to newsletters (http://www.biology.ualberta.ca/bsc/english/publications.htm)

First Biological Survey of Canada Biodiversity Scholarship awarded at ESC Meeting in Charlottetown

Donna J. Giberson
Department of Biology, University of Prince Edward Island, Charlottetown, PE C1A 4P3
giberson@upei.ca

Zoë Lindo, of the University of Victoria, is the first recipient of the Biological Survey Scholarship of the Entomological Society of Canada. The scholarship was set up to help fund students working on biodiversity of terrestrial arthropods in Canada, and will be awarded every two years through the ESC. Zoë is a Ph.D. student working on community ecology of mites in the canopy and forest floors associated with west coast rainforests in British Columbia. She did her Master's research at the University of Calgary, looking at forest floor microarthropods in the boreal forest of northwestern Alberta.

Zoë Lindo
(photograph by G. Needham)

Summary of research

Zoë Lindo
Department of Biology, University of Victoria,
P.O. Box 3020, Victoria BC V8W 3N5,
zlindo@uvic.ca

Forest floors teem with an abundance of arthropods that few humans ever see and, as such, the term "poor man's tropical rainforest" has been used to describe the wealth of species lying in wait of discovery within soil systems. Additionally, here on the west coast of Canada, we have our own rainforests to explore, ancient temperate rainforests, in which suspended soils of the high forest canopy also support diverse microarthropod communities. Mites (Acari) of the suborder Oribatida dominate both forest floor and canopy systems; these oribatid mite communities are distinct from each other, contribute significantly to overall forest biodiversity, and are functionally important components of forest ecosystems.

My M.Sc. research examined the effects of partial and clear-cut harvesting on abundance and community structure of forest floor microarthropods (mites and springtails) in the mixed-wood boreal forest of northwestern Alberta. This research sought to find relationships between abundances of microarthropods and other forest floor variables affected by harvesting. My research showed that total microarthropod abundance was up to 50% lower in clear-cut sites than in undisturbed sites, whereas partial-cut sites had less of an impact on these populations. Decreased microarthropod abundance following forest harvesting was related to decreases in food and habitat availability, and experimental studies suggested that reduced microarthropod abundance can, in turn, indirectly affect other soil parameters like microbial biomass and available phosphate levels.

My current Ph.D. research examines oribatid mite communities in canopy systems (suspended soils) and forest floors associated with ancient Western redcedar trees on the southwest coast of Vancouver Island, British Columbia. The objectives of this study are to compare canopy and forest floor oribatid mite communities and decomposition processes; to

elucidate factors and mechanisms that shape oribatid mite community structure in suspended soils; and to determine whether canopy oribatid mite assemblages are colonized by forest floor source pools or whether the canopy community is a distinct metacommunity linked through dispersal within the canopy system. This study will provide information on the species diversity of oribatid mites in ancient temperate rainforests, and test ecological theories to expand our understanding of patterns of biodiversity. Special emphasis is being placed on the oribatid mite community as this group is dominant in the fauna of these systems and new species descriptions are anticipated. To date, 82 species of oribatid mites have been found in this study, many of which are undescribed.

Oribatid mite from EMEND site in northern Alberta (photograph by Z. Lindo)

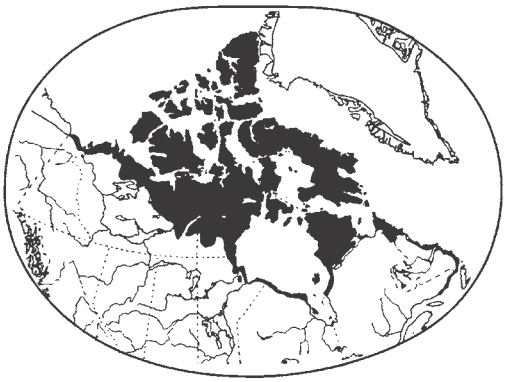
Immature *Eupterotegaeus* (photograph by Z. Lindo)

Exploring the effects of biodiversity on ecosystem processes in forest floor and canopy systems is restricted by our inability to identify species and our limited knowledge of the functional roles of the species present. I am a community ecologist with four years of taxonomic experience in the field of acarology, specializing in the suborder Oribatida. It is my goal to shed light on the amazing diversity of oribatid mites and their contributions to greater ecological processes.

Call for donations to the ESC Biological Survey of Canada Scholarship

The goal of the Biological Survey of Canada Scholarship is to facilitate student research on biodiversity of terrestrial arthropods in Canada. As the fund grows, the value of the award and/or the number of awards that can be offered will also grow.

Please consider donating to the Biological Survey award through the ESC scholarship fund. You can donate to the fund (and receive a tax receipt) by checking the appropriate box on your ESC membership renewal, or by writing directly to the Entomological Society of Canada, 393 Winston Avenue Ottawa ON K2A 1Y8. Please specify that you are donating to the Biological Survey Scholarship.



ARCTIC CORNER

News about studies of arctic insects

Introduction

Arctic Corner provides a forum for news of particular arctic interest, replacing the Biological Survey's newsletter *Arctic Insect News* (1990–2000). Contributions to *Arctic Corner* are welcomed by the Editor (see inside front cover).

Arctic and Boreal Entomology Course 2004

Hisatomo Taki[1], Peter G. Kevan[1] and Rob E. Roughley[2]
[1]University of Guelph, Department of Environmental Biology, Guelph, ON N1G 2W1
[2] University of Manitoba, Department of Entomology, Winnipeg, MB R3T 2N2

General

From July 31 to August 14 of 2004, the second Arctic and Boreal Entomology course, provided by the University of the Arctic Field School was organized and run at the Churchill Northern Studies Centre (CNSC) in Churchill, Manitoba. After the great success of the first course, held in 2003, the second Arctic and Boreal Entomology course was implemented and took place at the same time as the University of Guelph's course in Arctic Ecology (Fig. 1).

The instructors for this year's Arctic and Boreal Entomology course were Rob Roughley from Department of Entomology, University of Manitoba and Peter Kevan from Department of Environmental Biology, University of Guelph. The Arctic Ecology course was co-instructed by Paul Hebert of the University of Guelph and Peter Kevan. Participants on the Arctic and Boreal Entomology course were: Sylvie Forest from Fort McMurray, Alberta; Stewart Peck and Jarmila Kukalova-Peck from Ottawa, Ontario; Ian Hogg from Waikato, New Zealand; Ofrit Shavit from Beit Alfa, Israel; Shelley Brule, Sean Murray, Alisha Prater, Tim Rollwagen and Agata Pawlowski are undergraduate students at the University of Guelph. Also participating and helping with instruction was Hisatomo Taki, from Japan and who is presently a graduate student at the University of Guelph. Some of the curriculum, topics and actives of both courses tended to overlap and all participants of both were keen to learn about diversity, abundance and activity of insects in the transitional zone between the southern ex-

Fig. 1. Course participants of the Arctic and Boreal Entomology course and University of Guelph's Arctic Ecology course in Churchill, August 12, 2004. (photograph by H. Taki)

tremes of arctic tundra and the northern reaches of the northern boreal forest (Fig. 2).

Fig. 2. Peter Kevan explaining about the landscape of arctic and boreal zones in Churchill.
(photograph by H. Taki)

The Churchill Northern Studies Centre provided us the wonderful hospitality. In addition to accommodation and meals, the centre also provided the necessary equipment, classroom and laboratory facilities to conduct the field courses. The centre also housed other groups on research projects focusing on various aspects of biological and social sciences. With such a diverse collection of researchers and students, we had many opportunities to gain deeper insights and to be introduced to different views on many topics of importance to the north.

The weather during two weeks was hardly what one would expect when thinking "arctic". It was sunny and warm with temperatures in the mid-20s Celsius, which was high for such a long duration for the time of year at which the course was held. This mild weather provided plenty of opportunities to spend time in the field for insect observation as well as collecting. That was met with an enthusiastic welcome from the local black flies, horse flies and mosquitoes (Fig. 3).

Projects in brief

Some insect groups were extensively sampled. All aquatic beetles (with emphasis on Dytiscidae) were collected by Rob Roughley; in the last two years he has accumulated records of five species not previously recorded from the Churchill area. Carrion beetles (Silphidae) were collected by Stewart Peck, assisted by Tim Rollwagen, who compared the capture rates with pitfall traps baited with chicken or fish. Hisatomo Taki and Peter Kevan concentrated efforts on bees (Apoidea). Fortunately, the timing of the course coincided with the blooming peak of some late-flowering plants in the area, so several flower-insect interactions were studied. Ofrit Shavit made extensive observations on flower visitors to patches of different sizes of Mastodon flower (*Senecio congestus*). Agata Pawlowski also worked on that plant, as well as fireweed (*Epilobium* or *Chamerion angustifolium*), comparing the invertebrate fauna associated with the stems and leaves. Numerous mosquitoes were found with pollinia of Northern bog orchids (*Platanthera obtusata*) (Fig. 4), so Katja Rochacewich initiated some pollination studies. The importance of prey to carnivorous plants was studied by Jean Enneson. She discovered that plants of butterwort (*Pinguicula vulgaris*) growing in different habitats have different chances to capture prey (springtails, mites, and small flies): in drier habitats less prey was captured. Tracy Roy discovered that water mates (Hydracarina) really like to eat *Daphnia*. Several students worked on biodiversity comparing spiders (Alisha Prater) and epigeic invertebrates (Shelley Brule) in burned and unburned forest. Sean Murray found more springtails (Collembola) associated with the bases of cracks in than on

Fig. 3. Student's head welcoming numerous mosquitoes.
(photograph by H. Taki)

Fig. 4. Mosquito with pollinium of Northern bog orchids (*Platanthera obtusata*). (photograph by H. Taki)

top of the eroding peat plateau near CNSC. That result was attributed to the dry, warm conditions atop the plateau versus the damp, cooler, and shaded cracks. Similarly, Megan Becker noted that there was a positive effect of the moisture gradient on invertebrate diversity from the drier forest into fen-lands near Twin Lakes.

Other activities and highlights

Explanation and demonstration of collecting techniques and equipment (e.g. sweep nets, aspirators, killing vials, even baseball hats for collecting specimens!) were included in field lectures. Various trapping methods were described and used, including: malaise traps (Fig. 5), pan traps, fan traps, light traps, pitfall traps, Berlese funnels (Fig. 6) and bottle traps for aquatic insects (Fig. 7). The importance of pinning, preservation and proper labelling of specimens were also stressed at this time. Using the demonstrated techniques, many insect specimens were collected from various locations, including: the kelp strand, saline and shoreline ponds of Hudson Bay, bogs, ponds and streams, salt marshes adjacent to the Churchill River, the northern boreal forest, the forest margin, the willow scrub, boreal forest-tundra transition zones, and tundra zones. All field sites were easily accessible from the CNSC.

Fig. 5. Malaise trap set by Stewart Peck on lichens in spruce forest in Churchill. (photograph by H. Taki)

Fig. 6. Berlese funnels for extracting soil arthropods. (photograph by R. Roughley)

As well as field lectures, evening lectures and discussions addressed a wide range of entomological topics with emphasis on the arctic tundra and boreal forest habitats. Some of these topics included diversity and classification of insects, insect cold hardiness and thermoregulatory behaviours. Also at evening sessions, course participants designed, implemented and reported on their research projects and special interests. Especially valuable were talks on comparison of insect diversity and behaviour in different environments. For example, in a talk about Antarctic entomology by Ian Hogg, a comparison was made of insect faunas from different environments using various insect trapping techniques in the Arctic and Antarctic, and Jarmilla Kukalova-Peck provided a highly entertaining lecture on the origins of insect wings.

Through the participants' research projects and demonstrations of traps, very interesting specimens were collected. Some of the biggest surprises included capture of three large sawflies of the family Cimbicidae, and a tiger beetle (Cicindelidae) which were previously thought not to be present in these areas. These findings suggest an extension of certain insects to a more northerly habitat, perhaps in association with climate change. As the specimens are

Figure 7. Bottle traps for aquatic insects. (photograph by R. Roughley)

catalogued, we expect to list more additions to the insect fauna in the area. Most of the specimens are deposited in the J.B. Wallis Museum of Entomology at the University of Manitoba but many specimens will be incorporated into a reference collection at CNSC.

More information on the Arctic and Boreal Entomology course can be found on the web site, www.uoguelph.ca/~pkevan, under courses. Please feel free to contact Peter Kevan (pkevan@uoguelph.ca) or Rob Roughley (rob_roughley@umanitoba.ca) with any questions regarding further details of the course. The third course will be offered in the summer of 2005.

Impacts of a Warming Arctic

The report "Impacts of a Warming Arctic: Arctic Climate Impact Assessment" is a plain language synthesis of the key findings of the Arctic Climate Impact Assessment (ACIA), designed to make the scientific findings accessible to policymakers and the broader public. The ACIA is a project implemented by the International Arctic Science Committee as well as two of the working groups of the Arctic Council – the Arctic Monitoring and Assessment Programme and the Conservation of Arctic Flora and Fauna.

The key findings include:

1. Arctic climate is now warming rapidly and much larger changes are projected.

2. Arctic warming and its consequences have worldwide implications.

3. Arctic vegetation zones are very likely to shift, causing wide-ranging impacts.

4. Animal species' diversity, ranges, and distribution will change.

5. Many coastal communities and facilities face increasing exposure to storms.

6. Reduced sea ice is very likely to increase marine transport and access to resources.

7. Thawing ground will disrupt transportation, buildings, and other infrastructure.

8. Indigenous communities are facing major economic and cultural impacts.

9. Elevated ultraviolet radiation levels will affect people, plants, and animals.

10. Multiple influences interact to cause impacts to people and ecosystems.

The full report or highlights are available at the web site noted below.

ACIA, Impacts of a Warming Arctic: Arctic Climate Impact Assessment. Cambridge University Press, 2004. http://www.acia.uaf.edu

Call for information on insect research in Canada's arctic

The "Arctic Corner" of the Newsletter of the Biological Survey is a forum to share information about insects and other terrestrial arthropods of the Arctic. I am working on a summary of insect workers in the arctic, with their locations, taxonomic interests, and other details, to publish in an upcoming issue of the Newsletter. If you are working in the arctic (as broadly defined as you like, preferably in but not restricted to Canada), or know someone who is, I would appreciate it if you could contact me at: giberson@upei.ca or write to me at

Donna Giberson
Department of Biology
University of Prince Edward Island
550 University Avenue
Charlottetown PE C1A 4P3

Selected Future Conferences

Organization	Date	Place	Contact
ENTOMOLOGICAL CONFERENCES			
Entomological Society of Canada	**2005,** 3–6 Nov.	Canmore, AB	with the Entomological Society of Alberta http://www.biology.ualberta.ca/courses.hp/esa/2005jam.htm
	2006	Québec	with la Société d'entomologie du Québec
Entomological Society of America	**2005**, 6–9 Nov.	Fort Lauderdale, FL	ESA, 9301 Annapolis Rd., Lanham, MD 20706-3115; meet@entsoc.org
	2006, 10–14 Dec.	Indianapolis, IN	ESA, see above
4th Worldwide Dragonfly Association International Symposium of Odonatology	**2005**, 26-30 July	Pontevedra, Spain	http://webs.uvigo.es/c04/webc04/WDA/
9th International Conference of the Orthopterists' Society	**2005**, 14–19 August	Canmore, AB	http://people.uleth.ca/~dan.johnson/orthoptera.htm
OTHER SUBJECTS (especially those relevant to Survey projects)			
North American Benthological Society	**2005**, 23–27 May	New Orleans, LA	http://www.benthos.org/Meeting/index.htm
Society for the Preservation of Natural History Collections	**2005**, 12–5 June	London, UK	http://www.nhm.ac.uk/spnhc2005/
PROVINCIAL SOCIETIES			
Entomological Society of British Columbia	**2005**, 21 Oct.	Victoria, BC	http://esbc.harbour.com/
Entomological Society of Alberta	**2005**, 3–6 Nov.	Canmore, AB	with the Entomological Society of Canada (see above)
Entomological Society of Ontario	**2005**, 21–23 Oct.	Toronto, ON	http://www.entsocont.com/
Société d'entomologie du Québec	**2005**, 27–28 Oct..	Orford, QC	http://www.seq.qc.ca/
Acadian Entomological Society	**2005**, June	Fredericton, NB	http://www.acadianes.org

Answers to Faunal Quiz

[see page 11]

1. The mean interval between tides is 12.4 hours. This period represents half of the lunar day of 24.8 hours, the time of rotation of the earth with respect to the moon (or the time between successive transits of the moon over a given meridian). The interval arises because tides result chiefly from the attraction exerted by the moon and the sun on ocean water.

2. Insect families with many wing dimorphic species include Gerridae, Carabidae, Delphacidae, Gryllidae, Lygaeidae and many others.

3. Many univoltine insects are characteristic of boreal Canada, especially species that overwinter only in a fixed adult or egg overwintering stage. For example, species of Aedes mosquitoes deposit drying- and freezing-resistant overwintering eggs around temporary pools; larvae hatch soon after the eggs are flooded by snowmelt, and then develop rapidly. Other examples come from a wide range of Orders and families.

4. *Eonymph* is the early pupal stage in sawflies; *nymph* is either the larva or immature feeding stage in exopterygote insects, or the developmental stage(s) before the adult (e.g. protonymph and deutonymph) in typical mites; *nymphe* is the French word for pupa; *pronymph* is either the newly hatched nymph of extremely short duration (which has a shining chitinous sheath that gives it a more or less embryonic appearance) in Odonata, Orthoptera, Blattaria, Mantodea, and Aphididae, or the late or pharate pupal stage in certain holometabolous insects, notably sawflies; *protonymph* (in mites) is the first nymphal stage.

5. The walking beetle uses more energy than the flying one, even if its path is smooth and unobstructed.

Quips and Quotes

Good advice is one of those insults that ought to be forgiven
(Anon)

History repeats itself; historians repeat each other
(Philip Guedalia)

A rich man's joke is always funny
(Thomas E. Browne)

The closest to perfection a person ever comes is when he fills out a job application form
(Evan Esar)

Progress

Thanks to the interstate highway system, it is now possible to travel from coast to coast without seeing anything
(Charles Kuralt)

Our national flower is the concrete cloverleaf
Lewis Mumford)

Change is certain. Progress is not
(E.H. Carr)

We tend to meet any new situation by reorganization and attribute to this the illusion that progress is being made
(Petronius Arbiter [AD 66])

No comment

a louse i
used to know
told me that
millionaires and
bums tasted
about alike to him

(Don Marquis [Archy's Life of Mehitabel])

List of Requests for Material or Information Required for Studies of the Canadian Fauna 2005

This list is intended to facilitate cooperation among entomologists by encouraging those who visit suitable areas while engaged in other studies to collect material of particular interest to workers elsewhere. Similar lists that were circulated in previous years prompted the transmission of several useful sets of material, and the efforts of the various coooperators were much appreciated.

This list can also be found on the Survey's website at http://www.biology.ualberta.ca/bsc/english/listofrequests.htm. It is updated there as information is received.

Minimum data requested with all specimens are, of course, locality, date, collector and habitat.

(**denotes address reference; listed from p. 33)

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
1	Acari (free living and parasitic terrestrial and aquatic mites)	Anywhere, but especially subarctic and arctic Canada, Canadian grasslands	Berlese-Tullgren funnel extraction from subaquatic substrates, from grasses and sedges, and from bird and mammal nests, would be especially fruitful (preserve in 75% ethanol +5% glycerine).	V.M. Behan-Pelletier; E.E. Lindquist; I.M. Smith	1
2	Acari from family Uropodidae	Anywhere	Free living and parasitic terrestrial, preserve in 75% ethanol	C. Constantinescu	36
3	Adelgidae (conifer woolly aphids)	Anywhere	Preserve insects and bark, needles or galls in 70% ethanol. Specimen records and host plant records	R. Foottit	1
4	Aleyrodidae (whiteflies)	North America	Preserve insects and host plant material in 70% ethanol. Adults may be dried. Specimen records and host plant records. (Canadian National Collection deficient in all species, including pest species)	R. Foottit	1

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
5	Anthomyiidae	North America	Specimens with biological data (especially reared specimens) in the genera Fucellia (seaweed flies), Chiastochaeta (Trollius flies), and Botanophila in the wide sense (incl. Pegohylemyia) [of diverse life histories, including groups whose larvae are saprophagous, phytophagous (mainly stem-borers or seed-feeders) or fungivorous (especially on Epichloe parasites of grasses).	G.C.D. Griffiths	2
6	Anthomyzidae	New World	Adults from any habitat, but often associated with graminoids. Preservation in 70% ethanol preferred. Malaise and especially pan trap residues are acceptable and valuable. General description of herbaceous cover and soil moisture advantageous.	K.N. Barber	3
7	Aphididae (aphids)	Anywhere	Preserve in 70% ethanol. Specimen records and host plant records.	R. Foottit	1
8	Asilidae (robber flies)	North America	Pinned adults	R.A. Cannings	4
9	Braconidae	Anywhere	Pointed or in ethanol.	M. Sharkey	5
10	Bumble bees	Anywhere in Canada	Include floral host if any. Collect and preserve dry (but specimens that have already been put into ethanol are acceptable).	R.C. Plowright	6
11	Butterflies (see also 32, 33, 34)	Arctic	Preserve papered or pinned (collecting / preserving information supplied on request) [for Alaska Lepidoptera Survey]	K.W. Philip	7
12	Cerambycidae	Canada and Alaska	Adults pinned or in ethanol, host plant data if available	D.B. McCorquodale	37
13	Ceratopogonidae	Anywhere in Canada	Send in fully topped-up vials of 70% ethanol. Reared material is especially valuable; provide type of substrate or habitat if material is reared.	A. Borkent	8
14	Cercopidae (froghoppers, spittlebugs)	Canada and Alaska	Specimens (preferably not in ethanol if possible), records and host records.	K.G.A. Hamilton	1

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
15	Chalcidoids, especially Eupelmidae	Holarctic	Incl. sweep-net samples (see also 43) (collect into ethanol). Reared material is especially useful.	G.A.P. Gibson	1
16	Chironomidae: *Larsia* (Tanypodinae)	Nearctic and Palearctic fresh waters	Reared material preferred but will accept all stages in ethanol or on slides.	B. Bilyj	9
17	Chironomidae: *Eukiefferiella*, *Tvetenia* (Orthocladiinae)	All areas, especially Ontario	Include sampling method, habitat information	W.B. Morton	10
18	Chrysomelidae (leaf beetles)	Anywhere, but especially in Canada	Mounted or unmounted and preserved in acetic alcohol (70 ethanol: 25 water: 5 parts glacial acetic acid). Include accurate (species level) host plant information.	L. LeSage	1
19	Cicadellidae (leafhoppers)	Canada and Alaska	Specimens (preferably not in ethanol), records and host records.	K.G.A. Hamilton	1
20	Coccoidea (scale insects)	North America	Preserve insect and host plant material in 70% ethanol. Specimen records and host plant records.	R. Footit	1
21	Coleoptera (adults or immatures)	Canada	For teaching. Material from mass collections accepted. (Kill larvae in boiling water removed from the heating element, let cool and transfer to 70% ethanol.)	Y.H. Prévost	11
22	Curculionidae (weevils)	Anywhere, but especially northern Canada	Adults can be pinned, pointed, or preserved in ethanol. Record host plant information if possible.	D.E. Bright	1
23	Cynipidae: insect galls from domestic and wild roses	Anywhere	Maturing to mature galls. Remove galls from plants and place in plastic bags. Try to segregate galls of different species. Preserve any emergents in 70% ethanol.	J.D. Shorthouse	12
24	Dermaptera: *Forficula auricularia* (perce-oreille européen / European earwig)	Amérique du Nord et autres régions si possible	A sec ou dans l'alcool	J.C. Tourneur	13

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
25	Diprionidae (diprionid sawflies)	North America	Living diprionid sawflies of any species, identified or unidentified. Record foodplant. Contact in advance about shipping.	L. Packer	14
26	Eupelmidae: *Anastatus*	North America	Reared materials with associated sexes are particularly important, regardless how few in number.	G.A.P. Gibson	1
27	Formicidae (ants)	Anywhere	Record type of habitat and nest site. Include brood if possible (preserve in ethanol).	A. Francoeur	15
28	Fungal pathogens of insects (esp. of deuteromycetes and ascomycetes)	Anywhere	Place any fungus-infected specimens in a vial. (Identification of the fungus available on request.)	D. Strongman	16
29	Halictidae (sweat bees) brown and black spp. only	North America	Particularly from blueberries. Pinned or preserved. Include flower record if available.	L. Packer	14
30	Hemiptera: Heteroptera (bugs)	Anywhere	Aquatic and semi-aquatic Heteroptera from acid waters (an indication of pH would be useful). Terrestrial Heteroptera from bogs. Preserve in ethanol.	G.G.E. Scudder	17
31	Insects on snow	Especially western mountains	*Chionea* (Tipulidae), *Boreus* (Mecoptera), Capniidae (Plecoptera): preserve in 70% ethanol.	S. Cannings	18
32	Isoptera (termites)	N. America incl. Mexico	Preserve in 75% ethanol; try to collect as many soldiers as possible.	T.G. Myles	19
33	Leiodidae (=Leptodiridae)	Northern forest and tundra areas; prairies and grasslands	Most easily collected by window traps or flight intercept traps; and car nets (Can. Ent. 124: 745, 1992) (collect into ethanol).	S.B. Peck	20
34	Lepidoptera (see also 10)	Arctic	For revisionary work on the holarctic fauna	J.D. Lafontaine	1
35	Lepidoptera	Manitoulin and surrounding islands	Records for use in monograph of the region. Information on old records from collections would be particularly welcome.	J.K. Morton	21
36	Lepidoptera	Areas not previously sampled in western Canada	Standard collecting methods	N. Kondla	22

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
37	Lygaeidae	Anywhere	Material can be collected in ethanol.	G.G.E. Scudder	17
38	Mallophaga	Anywhere	Preserve specimens in 70% ethanol; host species is extremely important.	T.D. Galloway	23
39	Microlepidoptera (excluding Pyralidae and Tortricidae)	North America, esp. west in dry/arid habitats and prairies (CNC deficient in all western species)	Include collecting method and time of day collected. Kill with ammonia fumes. Field-pin; instruction leaflet and field kit available on request.	J.F. Landry	1
40	Odonata (dragonflies)	North America	Include 2-3 word habitat description. Adults preferably in envelopes or papered, prepared by immersing in acetone for 24 hours, then dried; larvae in 70% ethanol.	R.A. Cannings	4
41	Odonata (dragonflies and damselflies)	Ontario, Northwest Territories, Nunavut, Canadian prairies	Dried quickly in paper or glassine envelopes with or without prior immersion of envelope in acetone for one day to retain colour. Include habitat and collection notes and numbers observed in pencil on envelopes. Larvae in 70% ethanol.	P.M. Catling	38
42	Opiliones (harvestmen)	Canada and adjacent states	Preserve in 75% ethanol, especially adults with notes on habitats.	R. Holmberg	24
43	Parasitic Hymenoptera	Anywhere	Including selected unsorted Malaise, suction, pan or pitfall trap collections (pan trap kits and instructions supplied free on request).	L. Masner	1
44	Phoridae	Anwhere; especially boreal	Collect into 70% ethanol: especially interested in Malaise trap samples from boreal forest.	B.V. Brown	25
45	Pipunculidae (bigheaded flies)	Anywhere; especially boreal	Adults can be pinned, pointed or preserved in ethanol.	E. Georgeson	26
46	Pseudoscorpions	Canada	Preserved in 90% ethanol is preferrred, please include collection information (method, habitat)	C. Buddle	27
47	Psyllidae	North America	Preferably preserve in glycerine or dried. Specimen records and host plant records	R. Foottit	1

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
48	Pteromalidae: *Pachyneuron*	North America	Reared materials with associated sexes are particularly important, regardless how few in number.	G.A.P. Gibson	1
49	Salticidae (jumping spiders)	Canada	Adult specimens preserved in 70% ethanol. Include habitat information, specific location of collection, collecting method.	D. Shorthouse C. Buddle	28 27
50	Scelionid egg parasites of Orthoptera	Anywhere	Especially from Grylloidea; preserve in ethanol.	L. Masner	1
51	Sciomyzidae	Anywhere	Preferably pinned	L. Knutson	29
52	Silphidae	Canada	Include habitat and trapping method. Malaise trap material welcome.	R. Lauff	30
53	Simuliidae (black flies)	North America, esp. western and northern species	Preserve larvae in Carnoy's solution (1 glacial acetic acid: 3 absolute ethanol). Reared adults with associated pupal exuviae preferred. Instructions available on request.	D.C. Currie	31
54	Siphonaptera (fleas)	Anywhere	Preserve specimens in 70% ethanol; host species is extremely important	T. D. Galloway	23
55	Solpugida (sun spiders)	Canada	Preserve in 75% ethanol, especially adults with notes on habitat.	R. Holmberg	24
56	Sphaeroceridae	Anywhere, esp. arctic or high elevations	Collect into ethanol. Acalyptrate fraction of trap samples welcomed.	S.A. Marshall	32
57	Symphyta (sawflies)	Boreal and arctic Canada	Larvae and adults collected by Malaise trap, sweeping, etc. (collect into 70% ethanol). Identify larval food plant as far as possible.	H. Goulet	1
58	Thysanoptera (thrips)	North America	(Preserve in 70% ethanol). Specimen records, habitat, host plant records where applicable.	R. Foottit	1

Cooperation Offered

a	Identification of groups of interest in return for a sample of duplicate specimens.	Most but not all of entries in list above.
b	Willing to sort material from certain residues, bulk samples, etc.	See entries 6, 15, 21, 43, 52, 56, above
c	Field kits or instructions available on request	See especially entries 39, 43, 53 above
d	Exchange of specimens	Several requesters, including entries 8, 40, 54 above.
e	Limited collecting in Coppermine area, N.W.T., if particular material required.	A. Gunn (address 33 below).
f	Caterpillars, larval sawflies, aphids and mites available on request from trapnests for solitary bees and wasps [and see *Am. Bee. J*. 2001, pp. 133–136, 441–444].	P. Hallett (address 34 below)
g	Insect material from grassland and adjacent habitats at Onefour, Alberta, is available for examination.	D.L. Johnson (address 35 below)

List of Addresses

1. Agriculture and Agri-Food Canada, Central Experimental Farm, KW Neatby Bldg., 960 Carling Ave., Ottawa, ON K1A 0C6
   V.M. Behan-Pelletier . . . . . behanpv@agr.gc.ca
   E.E. Lindquist . . . . . lindquiste@agr.gc.ca
   I.M. Smith . . . . . smithi@agr.gc.ca
   R. Foottit . . . . . foottitrg@agr.gc.ca
   K.G.A. Hamiltion . . . . . hamiltona@agr.gc.ca
   G.A.P. Gibson . . . . . gibsong@agr.gc.ca
   L. LeSage. . . . . lesagel@agr.gc.ca
   D.E. Bright . . . . . brightd@agr.gc.ca
   J.D. Lafontaine . . . . . lafontained@agr.gc.ca
   J.F. Landry. . . . . landryjf@agr.gc.ca
   L. Masner. . . . . (email n/a)
   H. Goulet . . . . . gouleth@agr.gc.ca
2. P.O. Box 1380, Athabasca, AB T9S 2B2; gcdgriff@telusplanet.net
3. Canadian Forest Service, 1219 Queen St. E., Sault Ste. Marie, ON P6A 5M7; kbarber@nrcan.gc.ca

4. Royal British Columbia Museum, P.O. Box 9815, Stn. Prov. Govt., Victoria, BC V8W 9W2; rcannings@royalbcmuseum.bc.ca

5. Department of Entomology, University of Kentucky, 5 - 225 Agricultural Science Center North, Lexington, KY 40546-0091, U.S.A.; msharkey@uky.edu

6. 482 Montée de la Source, Cantley, QC J8V 3H9

7. University of Alaska, Institute of Arctic Biology, P.O. Box 757000, Fairbanks, AK 99775-7000 U.S.A.; fnkwp@uaf.edu

8. 1171 Mallory Road, R1-S20-C43, Enderby, BC V0E 1V0; aborkent@jetstream.net

9. 12 Westroyal Road, Etobicoke, ON M9P 2C3; biotax@interlog.com

10. 3 Woodridge Drive, Guelph, ON N1E 3M2; jkmorton@sciborg.uwaterloo.ca

11. Faculty of Forestry and the Forest Environment, 955 Oliver Rd. Lakehead University, Thunder Bay, ON P7B 5E1; yves.prevost@lakeheadu.ca

12. Department of Biology, Laurentian University, Sudbury, ON P3E 2C6; jshorthouse@nickel.laurentian.ca

13. Département des Sciences biologiques, Université du Québec à Montréal, C.P. 8888, Montréal, QC H3C 3P8; tourneur.jean-claude@uqam.ca

14. Department of Biology, York University, 4700 Keele Street, Downsview, ON M3J 1P3; bugsrus@yorku.ca

15. Département des Sciences fondamentales, Université du Québec à Chicoutimi, 9555 boul. de l'Université, Chicoutimi, QC G7H 2B1; andre_francoeur@uqac.ca

16. Department of Biology, St. Mary's University, 923 Robie St., Halifax, NS B3H 3C3; doug.strongman@smu.ca

17. Department of Zoology, University of British Columbia,Vancouver, BC V6T 1W5; scudder@zoology.ubc.ca

18. NatureServe Yukon, Yukon Territorial Government, Box 2703, Whitehorse, YT Y1A 2C6; syd.cannings@gov.yk.ca

19. Faculty of Forestry, University of Toronto, 33 Willcocks, Toronto, ON M5S 3B3; t.myles@utoronto.ca

20. Department of Biology, Carleton University, Ottawa, ON K1S 5B6; stewart_peck@carleton.ca

21. Department of Biology, University of Waterloo, Waterloo, ON N2L 3G1; jkmorton@sciborg.uwaterloo.ca

22. P.O. Box 244, Genelle, BC V0G 1G0; colias@shaw.ca

23. Department of Entomology, University of Manitoba, Winnipeg, MB R3T 2N2; terry_ galloway@umanitoba.ca

24. Athabasca University, Centre for Science, Athabasca, AB T9S 3A3; robert@athabascau.ca

25. Entomology Section, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007 U.S.A.; bbrown@nhm.org

26. N.S. Department of Natural Resources, P.O. Box 130, Shubenacadie, NS B0N 2H0

27. Department of Natural Resource Sciences, McGill University, Macdonald Campus, 21,111 Lakeshore Road, Ste.Anne-de-Bellevue, QC H9X 3V9; chris.buddle@mcgill.ca

28. Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9; dps1@gpu.srv.ualberta.ca

29. Paluzzo Gioia Piazza Traniello, 8-Int. 26, 04024 Gaeta (LT), Italy; lvknutson@tiseali.it

30. Department of Biology, St. Francis Xavier University, PO Box 5000 Antigonish, NS B2G 2W5; rlauff@stfx.ca

31. Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queen's Park, Toronto, ON M5S 2C6; dcurrie@zoo.utoronto.ca

32. Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1; smarshal@evb.uoguelph.ca

33. Wildlife and Fisheries Division, Resources, Wildlife and Economic Development, Government of the Northwest Territories, Box 1320, Yellowknife, NT X1A 3S8; anne_gunn@gov.nt.ca

34. Department of Physiology and Zoology, University of Toronto, 144 Hendon Avenue, Willowdale, ON M2M 1A7; peter.hallett@utoronto.ca

35. Department of Geography, University of Lethbridge, 4401 University Drive West, Lethbridge, AB, T1K 3M4; dan.johnson@uleth.ca

36. Natural History Museum of District Arges, Armand Calinescu Street, No. 44, Cod: 110047, Arges, Romania; cristinactinescu@yahoo.com

37. Dept. of Biology, University College of Cape Breton, Box 5300, Sydney, NS B1P 6L2; david_ mccorquodale@uccb.ca

38. Agriculture and Agri-Food Canada, Research Branch, Wm. Saunder Bldg., Central Experimental Farm, Ottawa, ON K1A 0C6; catlingp@agr.gc.ca

Index to Taxa (entry nos.)