

NEWSLETTER OF THE BIOLOGICAL SURVEY OF CANADA (TERRESTRIAL ARTHROPODS)

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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.

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Queries, comments, and contributions to the Newsletter are welcomed by the editor. Deadline for material for the Fall 2002 issue is July 15, 2002.

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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 (formerly the National Museum of Natural Sciences) and the Entomological Society of Canada. This 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

Activities at the Entomological Societies' Meeting

The 2001 Joint Annual Meeting of the Entomological Society of Canada and the Entomological Society of Ontario took place in Niagara Falls, 20-24 October 2001. The meeting was attended by more than 250 people. Many student members presented papers, with 39 entrants for the student paper competition. Items in the program or associated with it included:

A plenary session on "2001: An Insect Odyssey".

Symposia on "Emerging Technologies in Pest Management" and "Tree Fruit Entomology"

Workshops on "Entomology in Parks and Protected Spaces", "Bringing Insects to the Public", "Dealing with New Insect Introductions", "Entomology of Vineyards in Canada", and "Spatial Analysis in Applied Entomology"

Submitted papers in 5 sessions

An extensive poster session

A student paper competition, in four sessions, for the President's prize of the Entomological Society of Canada and the student paper prize of the Entomological Society of Ontario.

The ESC Heritage Lecture, given by Dr. Freeman McEwen, entitled "Milestones in Canadian Entomology" (including mention of the Biological Survey of Canada)

The ESC Gold Medal Address given by Dr. John Spence

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 an opening reception and a banquet.

Papers on systematics and related themes

The following titles include some of the papers of faunal interest that were presented in the various scientific sessions, including posters. (Interesting treatments on a range of other subjects also were presented in the various sessions.)

Entomology in parks: general values and needs. **H.V. Danks**

The state of entomological inventory, monitoring, and systematic research in Ontario's protected areas system. **W.J. Crins** and **D.A. Sutherland**

Arthropod diversity studies in southern Ontario parks. **S.A. Marshall**

Perspectives on the role of entomological information in designing and sustaining Canada's network of conservation lands. **G.J. Umphrey**

Entomology and Canada's national parks. **D. Rivard**

Linking the functional roles of airborne insects with their peatland black spruce habitats: a justification for boreal forest ecosystem preservation. **A.M. Deans**, **S.M. Smith** and **J.R. Malcolm**

The effects of burn season (spring, summer, fall) on the spider fauna of a tallgrass prairie in southern Manitoba. **D. Wade**

Untangling the threads of boreal spider bioindication. **D.P. Shorthouse**, **J.R. Spence** and **W.J.A. Volney**

Influence of pea aphid sex pheromone on natural enemy populations in alfalfa fields. **M.J. Uddin**, **N.J. Holliday**, **P.A. MacKay**, **W. Powell**, **J.A. Pickett** and **S. Graves**

Zoogeography and gall specificity of *Torymus* (Hymenoptera: Torymidae) parasitoids inhabiting rose galls induced by *Diplolepis* (Hymenoptera: Cynipidae) in Canada. **S. J. Rempel** and **J.D. Shorthouse**

Abundance and species richness of Dytiscidae (Coleoptera) in prairie ponds of southern Manitoba. **M. Alperyn** and **R. Roughley**

Diptera diversity in a Quebec old growth forest. **E. Fast**

Biodiversity of canopy arthropods in eastern temperate forests. **C. Vance**, **S. Smith** and **J. Malcolm**

A new genus of parathalassiine flies from Baltic amber, with a cladistic analysis of the

- Microphorinae + Dolichopodidae lineage (Diptera: Empidoidea). **S.E. Brooks** and **J.M. Cumming**
- Classification, reconstructed phylogeny, and biogeography of Nearctic *Brychius* Thomson (Coleoptera: Halipilidae). **T. Mousseau** and **R. Roughley**
- Coevolution of *Heliconius* spp. and their *Passiflora* host-plants: a phylogenetic comparison. **A. Ossowski** and **F.F. Hunter**
- Physical gene mapping on blackfly polytene chromosomes by fluorescence *in situ* hybridization (FISH). **M. Spironello** and **F. Hunter**
- A phylogenetic investigation of Nearctic *Simulium* s.s. (Diptera: Simuliidae) using cytochrome b, cytochrome oxidase II and elongation factor 1-alpha. **M. Smith** and **D. Currie**
- Metabolic cold adaptation and its hemispheric asymmetry in insects. **A. Addo-Bediako**
- Genetic relatedness and aggression within and among populations of the western thatch ant, *Formica obscuripes* Forel. **R. Hepburn**, **B. S. Lindgren** and **D. Heath**
- Carnivorous plants: A dual role for arthropods? **G.L. Murza** and **A.R. Davis**
- Recruitment of natural enemies to an introduced bark beetle. **N. Rudzik** and **S.M. Smith**
- Parasitoid guild of *Delia radicum* (L.), in canola in Prairie Provinces. **K.S. Hemachandra** and **N.J. Holliday**
- Parasitoid communities of concealed insect pests: a case study of the cherry bark tortrix. **W. Jenner**, **U. Kuhlmann**, **J. Cossentine** and **B. Roitberg**
- Seasonal abundance and distribution of *Mamestra brassicae* L. (Lepidoptera: Noctuidae) and its parasitoids in organic vegetable fields in Switzerland. **N. Lauro**, **U. Kuhlmann**, **P. Mason** and **N. Holliday**
- Molecular taxonomy of two cryptic cricket species: *Gryllus rubens* and *G. texensis*. **M. Seifried**, **P. Barnfield**, **D. Gray** and **M.H. Richards**
- Systematics of the Nearctic species of *Cerodontha* (*Cerodontha*) (Diptera: Agromyzidae). **S. Boucher**
- Microsatellite analyses of relationship in eusocial sweat bees. **R. Beattie**, **R. Paxton** and **M.H. Richards**
- Responses in arthropod diversity to sugar maple decomposition. **S. Murray**, **S. Smith** and **T. Wheeler**
- Investigating apple aphid genotypes using microsatellites. **R.G. Footitt**, **G. Lushai** and **T. Lowery**
- Carabid fauna of vineyards. **H. Goulet**, **L. Lesage**, **N.J. Bostanian** and **C. Vincent**
- Insects of vineyards in British Columbia. **T. Lowery**
- Entomology of New York vineyards. **G.E. Loeb**
- Woodnesting aculeates for teaching and research. **P. Hallett**
- Carabid beetles in aspen forest along an urban-rural gradient. **D. Hartley** and **J.R. Spence**
- Larval morphology of *Agabetes* Crotch (Coleoptera: Adephaga: Dytiscidae): the hypothesis of sister-group relationship with subfamily Laccophilinae revisited. **Y. Alarie**
- Holarctic distributions in Diptera: the role of the researcher. **T.A. Wheeler**
- Long-term changes in grasshopper species composition on fescue grassland at Stavely, Alberta, and dry mixed (short grass) grassland at Onefour, Alberta, in response to grazing and weather. **D.L. Johnson**
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Summary of the meeting of the Scientific Committee of the Biological Survey of Canada (Terrestrial Arthropods), October 2001

The Scientific Committee met in Ottawa on October 11-12, 2001.

Scientific projects

The various scientific projects of the Survey were discussed, including the following progress.

1. Grasslands

The draft of a grasslands prospectus was discussed. It is intended to support the project by outlining the scientific concept and other information, to help get other people interested in the project as well as support funding applications. The current draft expands the review of existing knowledge on grasslands and adds a section on procedures. The final document would be posted on the Biological Survey website and its Executive Summary included in the next Grasslands Newsletter. The maps are still in draft and some decisions remain about which grasslands and how much detail should be included.

The Committee endorsed the draft, appreciating especially the thorough coverage of work to date and concluding that the document nicely shows a plan, an organization and some proposed projects, that will help to persuade co-operators across the country of the merits of the project. Some possible ways to supplement the draft and its conceptual framework, and reference to the role of the Biological Survey, were also suggested. It was agreed that a final document would be produced, including photographs, for posting on the web and for a limited print run.

An update was provided about the grassland project collecting expedition at the Onefour substation, held with the assistance of Agriculture and Agri-Food Canada in June / July 2001, and designed to bring people together to collect and share information. The Onefour area is of interest because it is the northernmost extension for a number of species from the U.S. and there has been a lot of insect collecting there. The expedition was well at-

tended and successful. A second expedition will be run next summer, probably for one week in a different grassland site. Details would be announced later. Potential sites, components, and timing were discussed.

A proposal for a symposium on the grasslands project has been accepted by the program committee for the 2002 ESC joint Annual Meeting in Winnipeg and this symposium is intended as the driving force behind the first volume planned from the project, focussing on habitat-based studies.

2. Seasonal adaptations

This project on seasonal adaptations continues to progress on several fronts, with papers published or submitted on dormancy responses in insects and related themes, as well as conference presentations. Some interesting results have come from student work on mitochondrial status during winter and a manuscript is being drafted. Additional invited contributions on seasonal adaptations are being prepared.

3. Arctic invertebrate biology

Dr. James Kruse, museum curator of entomology at the University of Alaska, Fairbanks, is trying to set up an Alaska insect survey, modelled in part after the Biological Survey of Canada. He is seeking co-operators as well as funds for the project [see p. 22]. Dr. Shorthouse reported on his travel to the Fort Severn area of Ontario, the most southern tundra, and collected interesting arthropod material including new records and one new species.

4. Insects of Keewatin and Mackenzie

A northern canoe trip like the one in 2000 had not been possible in 2001. Instead there was a very successful collecting trip in the Great Slave Lake area. Plans are proceeding for a trip to the Thelon River in the summer of 2002. This will necessitate numerous permits. Several participants are already committed, potentially for 2 ½ weeks in early July. Very inter-

esting results have already come from the material collected in 2000 from the Horton River. Other northern areas will be visited in future years. A possible synthesis of results from the Horton River expedition is being discussed.

Other scientific priorities

1. *Arthropod fauna of soils*

An update on the project appeared in the fall newsletter [Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 20(2): 51-57, 2001.]. Information on conferences and publications was circulated (e.g. The Soil Ecology Society Conference, 2001 A Soil Odyssey, May 20-23, 2001; the draft document on "Soil Biodiversity, Issues for Canadian Agriculture" will be published in a special issue of the *Canadian Journal of Soil Science* in 2002). Various collaborative projects on arthropods from grasslands soils and other habitats continue. A digitized version of the catalogue of oribatids of North America (originally published as a memoir in 1987) has been posted at <http://www.earthworksresearch.com/ergdownload.htm>.

2. *Invasions and reductions*

A workshop on "Dealing with new insect introductions" was organized for the ESC annual meeting, and a continuing event is being considered, with specialized workshops on various aspects of dealing with new introductions and invasions. The year 2001 was conspicuous for new introduced pests. A national workshop on invasive alien species is taking place in November, and the topic is attracting a lot of attention at both scientific and managerial levels.

New problems and new species are received regularly by the pest diagnostic clinic for the province of Quebec. However, it is sometimes difficult to identify taxonomists who can identify difficult insects. This shortage of expertise is an area of growing concern for the clinic and many other groups such as growers. It was pointed out that the key to solving some of these problems is also having documentation about the past situation in the form of speci-

mens in collections. Various examples of recently introduced or recently spread introduced species were given.

3. *Survey website*

A detailed report on progress with and problems of the Survey website was given, in order to illustrate that the amount of time required to put something on the web is often underestimated. The process of not only getting content but also dealing with other necessary details uses up a lot of energy and resources. Even simple adjustments (e.g. to links) are very time consuming. On the positive side the site seems to be well received and contains useful content. Three potential problems are being addressed. One continuing problem is the delayed posting of new material and changes because of the need to work through the Entomological Society of Canada. Also, the ESC plans to reorganize its web site and probably to serve it elsewhere (i.e. not at the University of Alberta), so that the Survey is trying to keep updated on the ESC issue, while at the same time exploring other options. Finally, the Survey's database needs to be refined to get proper functionality on the web, but first decisions are needed about the structure and the long-term stability of the website platform. It is hoped that all of these issues will soon be clarified, so that appropriate adjustments to the website can be implemented [and see p. 12].

4. *Brief on standards for specimen data labels*

The brief had been produced and well received [Wheeler, T.A., J.T. Huber and D.C. Currie. 2001. Label data standards for terrestrial arthropods. A brief prepared by the Biological Survey of Canada (Terrestrial Arthropods). Biological Survey of Canada (Terrestrial Arthropods) Document Series No. 8, ISBN 0-9689321-0-X. 20 pp.]. Ways to make this and other Survey briefs available in French were discussed and such possibilities will be investigated further.

5. *Publication of systematic and faunistic papers*

Given the need for outlets for systematic and faunistic works, especially a niche for species descriptions, faunal inventories, checklists, descriptions of life stages, descriptive ecological papers, and so on, the Lyman publication series will be revitalized by Dr. Wheeler, primarily through publication online with pdf files posted on the web. However, there will be simultaneous publication of hard copies for those who do not have sufficient technical resources, to honour standing subscriptions and exchange agreements and to satisfy the requirements of the international commission to validate new names. Page charges would be probably be free for students, amateurs and retired entomologists and low even for those with institutional funds. The next step in revitalizing the series will be to secure enough manuscripts. An editorial board would have associate editors for each of the major taxa. The publication would continue to come out irregularly as it does now until the number of manuscripts warrants more regular publication, but turn-around time for manuscripts would be faster than most current outlets. The difficulty in finding publication outlets is not a problem just for entomologists, but also for botanists and other zoologists.

6. *Voucher specimens*

The Committee discussed how best to put forward the recommendations that: 1. Granting agencies should make it explicit that depositing voucher specimens is as important as other requirements; 2. The editorial policy of journals should require – not just recommend – that vouchers be deposited; and 3. Collections have to be encouraged to accept vouchers and provide guidance to those who wish to deposit voucher specimens. For example, a one-page article that repeats the message already found in other papers could be prepared, as could a longer document describing what can happen if recommended procedures are not followed (such as studies that are now useless because vouchers were not deposited), as well as positive examples (such as older studies that are still current because the vouchers remain available).

The Committee discussed various questions, such as the numbers of vouchers and who would house them. A one-page article to alert people would be useful (because the people who need to be informed do not read the existing literature). However, a well-documented brief would be more powerful to other audiences because of the examples. These possibilities would be pursued by the subcommittee chaired by Dr. Wheeler.

7. *The cost of insect identifications*

The Committee discussed a draft document to consider the real cost of insect identification, how the societal cost of identifications can be minimized, and guidelines for fair payments, including a tabulation of costs for insect identifications as given on various web sites. The Committee is especially interested in identifications from diversity surveys, involving a large diverse fauna from a particular area. Recently, identifications have been solicited through electronic images. The Committee discussed ways to arrive at the fair costs for such work. For example, the fees charged by institutions may not reflect the true cost. Moreover, there are costs such as those to voucher the specimen. Prices charged may depend on the nature of the client, as well as the diversity of species and the speed of identification. Some Committee members focussed on the time required (and even including processing time for samples as well as time for identification). It was also suggested that data on the time required could be solicited, e.g. by questionnaire. The subcommittee (chaired by Dr. Behan-Pelletier) agreed to consider such possibilities further, including both the content of the document and whether it should be a brief, a Bulletin article or some sort of other publication.

8. *Systematics and NSERC*

Members of the Committee had attempted to help Dr. Packer in trying to raise the profile for systematics during the GSC18 reallocations exercise. However, little support had been forthcoming from the remainder of the committee and even less from external review-

ers, so that Dr. Packer was frustrated by the results of his efforts. The Committee recognized that reallocation involves a relatively small proportion of the total budget. Nevertheless, there is relatively little systematics representation on the GSC, and moreover existing members tend to recommend their replacements. This process results in a similar make-up of the committee from one year to the next. NSERC appears to believe that more representation for systematists is unlikely. To offset these tendencies, and because there is always a systematics component and a connection to evolution in grant applications to GSC18. Dr. Shorthouse and Dr. Wheeler volunteered to work on an initiative to see if all the relevant biological societies could recommend a potential systematics-minded member of the grant selection committee. It would also be good to identify to NSERC how many systematists there really are in the various disciplines.

9. Monitoring of continuing priorities

Updated information on earlier or currently less active Survey projects on the Canadian fauna was reviewed, including arthropods of peatlands, aquatic insects of freshwater wetlands, arthropod fauna of large rivers (see abstracts about work in large northern Canadian rivers at <http://www.wkap.nl/jrnltoctoc.htm/1386-1980>), arthropod ectoparasites of vertebrates, arthropods of the Yukon (including a recent paper on agromyzid diversity in *The Canadian Entomologist* 133(5): 593-621], arthropods of special habitats, climate change (Natural Resources Canada has recently published a new plant bioclimatic zone map for Canada at <http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/intro.html>), environmental appraisal (including recent work using the reference condition approach), and agroecosystems (including work on the biocontrol network, on *Wolbachia*, and on dung beetles).

10. Other priorities

The Committee also discussed priorities such as old-growth forests, endangered species, damaged ecosystems, the faunal analysis pro-

ject, funding for biodiversity projects, and arthropods and fire.

Liaison and exchange of information

1. Canadian Museum of Nature

Dr. Robert Anderson, Project Leader - Issues in Biodiversity, Canadian Museum of Nature reported, on behalf of Dr. Mark Graham, that the Museum is creating a new 5-year strategic plan for fiscal years 2003/04 to 2007/08. Renovations of the Victoria Memorial Museum Building are underway. Architectural plans and capital fundraising for new exhibits have begun. The current focus is on a new fossil gallery. The Museum has received funds to replace and update scientific equipment, including a Philips scanning electron microscope, electron microprobe and x-ray facility, a DNA sequencer, updated microscopy facilities and equipment and software for a multi-media computer room. As part of the Canadian delegation, Dr. Graham attended a recent Governing Board meeting for the Global Biodiversity Information Facility (GBIF). Dr. James Edwards is the Chief Executive and the Secretariat office is being established at the University of Copenhagen.

Dr. Anderson noted that NSERC has finalized a guide for grantees to consider when acquiring research collections. The guide can be found on the NSERC website and clearly lays out basic responsibilities for the disposition of specimens. He also noted some new considerations for those doing work in the north. For example, field support from the Polar Continental Shelf Project may be limited in the future. The Museum has received a number of good applications for its visiting fellowship program. A draft CMN Collection Development Plan has been circulated among interested parties including some members of the Scientific Committee and comments are encouraged. Finally Dr. Anderson noted that Dr. Irwin Brodo's excellent book on *The Lichens of North America* has been published [see <http://www.lichen.com/book.html>].

Members of the Committee requested an overview of the key points of the Museum's collection development plan. Dr. Anderson explained that the Museum has limited resources and therefore needs to set priorities in considering such issues as: Will the user community outside the museum make good use of the collections database being developed and at what level? Should the Museum be developing collections in areas where there is no research staff and if so why? Should the Museum continue to work on the recognized strengths of the collection? If there are other good collections in Canada should the CMN's policy be to pass relevant material to those collections?

Members of the Committee commented on aspects of the plan, for example whether the national collection is physically located in one place or whether it should be considered a dispersed collection that exists in a variety of places. Because the document seems to reflect some diversity of viewpoints from the internal committee, the opinions of outside people on some of the key issues are very valuable. It was pointed out that the document appears to ask what kind of museum the national collection should be, but such a choice will influence how the remainder of the questions are answered. The Museum wishes to be a leader but comes across as very indecisive in the document, despite the wish conveyed to the Museum by public consultations a few years ago that the Museum should provide leadership. In particular, it was not clear what recipients of the document are being asked to do. Mr. Kieran Shepherd (chair of the committee developing the plan) was invited to address the Committee later in the meeting.

Ms. Joanne DiCosimo, President, Canadian Museum of Nature, spoke to the Committee in the afternoon. She explained that the 5-year strategic plan already mentioned is intended to provide a new definition of service for the national museum. The Museum has been intent on developing that vision within the framework of the museum family across the country and therefore particularly in the last few months other natural history museums are being involved in the process. A draft plan was pre-

sent to the staff and Board of Trustees last June and a revised document intended for a broader group of people is now near completion. Ms. DiCosimo explained that many people on the Committee would be asked to help in consultations.

She added that the Collection Development Plan mentioned earlier is one part of the larger look at the Museum's role as a national museum, to allow all to contribute to something larger in a rational way. For the CMN specifically the plan will guide its decisions on what is acquired and held in the collections and what should be placed elsewhere. She encouraged comments of any sort. Ms. DiCosimo said that the architect chosen for the VMMB renovations will be publicly announced in November and that work will begin in 11 months. Work will consist of 3 years of planning and 3 years of construction. Dr. Rodrigo Gamez, the head of INBio, will be visiting the Museum during October. In response to a question from Dr. Marcogliese, Ms. DiCosimo said that the possibility of new modules for the Biological Survey will be considered during discussions of the Museum's national role, and decisions on expansion will be made in 2002/03. The model of the Biological Survey has been touted as the most successful example to date of this sort of cooperation.

Members of the Committee commented further about the draft Collections Development Plan. The document seeks time-consuming comment on large philosophical principles. It was suggested that a follow-up email with a set of clearer questions might elicit a more directed response. An impression is created by the current draft that although a leading institution wishes to solidify its role, questions are asked in such a nebulous way that no leadership is visible. If (as the document implies) the Museum wants to be told what its role should be, such an inquiry duplicates the consultation process of a few years ago. Another questionnaire had been sent about collections and databasing which also was a combination of specific questions at the detailed level but more vague questions at the higher organization level — but Ms. DiCosimo pointed out that this sur-

vey was from the Canadian Museums Association's special interest group on natural history collections rather than from the CMN.

Mr. Kieran Shepherd, Collection Manager of Earth Sciences, Canadian Museum of Nature, spoke to the Committee on Friday morning. The new collections development plan is intended to provide a framework for how the national collections will develop over the next several years. The CMN wants to play a leadership role but also within a partnership. He asked that people look at the recent draft document on its merits and be as critical as necessary, and he offered to answer questions informally or formally by phone, email, etc. Members of the Committee reiterated some of the questions raised earlier. Mr. Shepherd said that the Museum's collections policies have changed over the last 15 years and the Museum is now trying to re-establish its role in a national context. He hoped to get as many comments as possible to help formulate the plan and also to facilitate discussions with other federal and provincial partners. He pointed out that Canada's natural heritage includes many collections across the country. Members of the Committee emphasized that one of the important mandates of the national museum should be a willingness to house voucher specimens. Other members suggested that the Museum should consolidate its own objectives before approaching the community. Mr. Shepherd agreed that it is important to be a leader but he thought that in the past nobody had followed the Museum because it deviated so far from the norm that it was almost unacceptable from a scientific perspective. He maintained that, even if the document seems tentative or unsure, the Museum believes in its fundamental role as a leader in collections development for Canada's natural heritage. In response to the suggestion that such a statement should have been made at the beginning of the document to set a more decisive tone, Mr. Shepherd explained that the CMN did not want to offend others or appear to state that the direction was already established and others must follow it.

Mr. Shepherd encouraged Committee members to put some of these views in writing

and send them to him; he would prepare a follow-up email message. Members of the Committee pointed out that they will assist with the document, and the point of critical comments at the meeting was to provide some focus as to how the Committee can best assist.

2. Eastern Cereal and Oilseed Research Centre

Dr. Lianne Dwyer, Acting Director ECORC, reported that Dr. Jean-Marc Deschênes has a new assignment until at least March 2002 and that she is acting in his position during that period. As a result of the department's transition and desire to refocus resources 3.5% of funds were withdrawn from every unit for everything (including non-discretionary items) for the last half of the fiscal year. Two systematists in entomology will have retired by the end of this year - Dr. Don Bright and Dr. Evert Lindquist. Staffing for a new coleopterist has been requested but because of the reorganization such decisions are on hold. Dr. Dwyer commented that ECORC is very fortunate to have a number of research associates who help to curate the collections. Entomologists from the Canadian Food Inspection Agency and the Canadian Forest Service also collaborate and work on site with ECORC.

Dr. Dwyer reminded the Committee that the Centre's collections are dispersed in several buildings. An estimate to centralize and retrofit collections has been submitted.

Dr. Dwyer explained that the department is currently in a state of flux, because it wants to eliminate the various branch structures to give a very horizontal and inclusive structure. To date 17 teams have been formed to deliver program objectives. Many science initiatives rely heavily on the research branch so that the research branch has developed four national program areas in environmental health (biodiversity has a high profile here, which ties in with biocontrol), sustainable production system, bioproducts and processes, and food safety and quality. The environmental health program is being headed by Dr. Deschênes. For all of the programs, work is continuing on developing

science plans and assembling technical and scientific working groups. Much work since the federal-provincial meeting in Whitehorse this past summer has been developing a memorandum to cabinet to identify areas in the science agenda that require additional funding. The strategy of the biodiversity network was part of that.

In terms of partnerships, ECORC is a member of the Federal Biosystematics Partnership - an advisory body on biosystematics and biodiversity issues. It is also the advisory body for implementation and participation in GBIF, for which Agriculture and Agri-Food Canada is the signatory.

Dr. Dwyer reminded the Committee about the Canadian Biodiversity Network Conference held in Ottawa last March. The strategy for a Biodiversity Knowledge and Innovation Network (BKIN) has recently been released. The strategy accords with the federal government's announcement of plans to double research and development spending by the year 2010, with the life sciences considered a high priority. The document shows how to derive the maximum benefit from the collective acquisition and sharing of knowledge related to biodiversity. Two main activities are ongoing. A website will be launched before the end of 2001. The website is to provide real time research and search capabilities of multiple Canadian institutional collections, with access to data on approximately 500,000 specimens from about 15 Canadian institutions, as the beginning of the first Canadian GBIF node. The other activity that arose from the March meeting is the continued support of ITIS - the Integrated Taxonomic Information System.

The five Natural Resource Departments (5NR) were involved in the Canadian Biodiversity Network Conference and continue to develop biodiversity and to keep that initiative high on the government's agenda. They are emphasizing that the federal government is the largest holder of biodiversity knowledge - both in collections and data. The 5NR propose to establish a secretariat to develop and implement a national biodiversity knowledge network strat-

egy to incorporate Canada's contribution to GBIF. Dr. Dwyer commented that there seems to be a coordinated effort to build on the interest in biodiversity and the stated intention of the government to provide funding for research and development in areas in the public good. In summary, Dr. Dwyer emphasized that the future looks good for biodiversity and biosystematics within the government, although how much security issues will dominate the government agenda remains to be seen.

The importance of library resources, even in the face of cutbacks, was emphasized by the Committee, and indeed the functions of GBIF, BKIN etc. are dependent upon library facilities. Moreover, for much systematic work on insects the only access to relevant literature is through the ECORC library.

A new book on biological control programs in Canada, 1981 - 2000 has just been published. The butterfly node of the Biota of Canada Information Network is going online. The project could move forward with other modules when funding becomes more stabilized at the federal level.

Several Committee members expressed concern that most of the initiatives recently discussed are essentially wheel spinning. Information that is already available through existing collections is being harvested, but little is being done to add to the information, e.g. revision of groups and the expertise to do them. However, the research branch of Agriculture and Agri-Food Canada rearranges its focus and themes every couple of years, whereas the effort put into constructing plans might be better used in implementing a plan. Another regular event appears to be the proliferation of acronyms that do not seem to result in any concrete action. Information is organized and packaged but sooner or later there will be no new information to package and the same subsets of data will be put into numerous websites without an increase of actual knowledge at the basic level. Projects such as the Biota of Canada Network that could be used to do the basic research of what lives in the country, what it does and how it interacts with human activities seem to be de-

ferred in favour of new packaging exercises. Even the initial focus of BKIN seems to be diffusing.

Dr. Dwyer acknowledged the frustration expressed by those members of the Committee. However, she maintained that activities just described as repackaging are necessary to garner enough resources for everything from chairs in universities to maintaining collections to developing the expertise to do research. She noted that at ECORC there are problems finding trained professionals even for replacements, and keeping the existing collections up to date. No individual organization will be able to do everything that should be done. Rather, the work will have to be achieved in collaboration with other institutions in Canada and the United States. Agriculture and Agri-Food Canada cannot have the expertise to address even those organisms important to agriculture and so is looking for expertise around the world. Dr. Dwyer reiterated that new ideas, initiatives, acronyms, etc. are part of what is necessary to convince the government and the population in general that the work is more than an esoteric exercise but is a fundamental need. She added that at ECORC the majority of scientists continue with their scientific work and only 2 or 3 people are working on the "packaging exercise". It was also pointed out that for the first time in the last 20 years at the Agriculture Research branch, the current restructuring exercise is recognizing the concepts of biodiversity (i.e. systematic biology) and the environment and not just commodity-based directions.

The chair of the Committee expressed his appreciation of Dr. Dwyer's explanation but emphasized the need for money, facilities and direction applied towards collecting data, and he hoped that Dr. Dwyer would take that message back to her organization.

3. *Entomological Society of Canada*

Dr. Robert Footitt, President of the Entomological Society of Canada, reported that the Society is in good financial shape due in part to the growth of some investments. The value of the Society's headquarters building also has increased. Membership of the Society

is stable (500 - 600) with a good complement of students. Organization of the 2001 annual meeting to be held in Niagara Falls is complete. The Society is considering setting up its own independent website, although the ESC has been sharing server space with the Survey at the University of Alberta. One of the reasons the ESC is considering this move is because of the increased demands for electronic publishing and other member services and also the Society's desire to have a distinctive website and URL. Dr. Footitt explained that a number of issues have to be considered and the Society wants to be very careful with respect to copyright issues and cost implications, for example. Electronic publishing is not as inexpensive as is sometimes assumed. Dr. Footitt reminded the Committee that the Society is still looking for an editor for the *Canadian Entomologist*. The current editor will retire in a year.

4. *Parasitology module, Canadian Society of Zoologists*

Dr. Marcogliese reported that the Parasitology module has been involved in two main activities. One project is the protocols for monitoring parasites in biodiversity studies. The protocol for fish parasites is complete and has been posted on the EMAN website. The bird and herpetology protocols have been accepted and are currently being translated. An author is also available for the parasites of mammals. The other major initiative by the parasitology module is the national stickleback parasite survey, which is an international IBOY (International Biodiversity Observation Year) project, and is supported by Parks Canada. 26 participants from around the world participated in the first field season. An IBOY meeting in June was attended by people involved in the core projects. IBOY modelled itself after the International Physical Year in 1957 but is not having the same impact. How to maintain the initiative is being discussed.

Various reports and publications of interest to the Survey, including a paper on the importance of submitting specimens after DNA has been extracted, and one on implications of climate change for parasitism of animals in the

aquatic environment. Dr. Marcogliese noted that the major parasitologist Dr. Roy Anderson of the University of Guelph died during 2001. The extensive reprint collection of the late Dr. Leo Margolis on fish parasitology is no longer maintained at the Nanaimo Pacific Biological Station, and its disposition is uncertain. The parasitology symposium at the May 2002 meeting of the Canadian Society of Zoologists is entitled: Parasitism - Evolution and Ecology of Arthropod Host Interactions.

Dr. Marcogliese noted that every federal department is sending cabinet memoranda to Treasury Board concerning the "environment", which seems to be becoming another buzz word without any meaning. He echoed earlier comments that there is little progress in support of concrete work and products, including lack of support for the parasitology module, the decline of the parasitology discipline in Canada (in contrast to some U.S. initiatives), and the lack of appropriate recognition of the systematics crisis, for example even within the Canadian Society of Zoologists.

5. *Other agencies and societies*

The Committee also considered items related to the Coleopterists Society (including a new journal, the Coleopterists Society Monographs), the All-species organization (<http://www.all-species.org/index.html>), the North American Benthological Society (which includes a taxonomy fair at its annual meetings, and publishes an annual bibliography (<http://www.benthos.org>), and Parks Canada (no response had been received to a letter sent by the Survey following discussion with a Parks representative at the last meeting).

Other items

1. *Reports on regional developments of potential interest*

Information of interest to the Survey from different regions of the country was provided. However, in the absence of some members, more information was available from some regions than others.

In British Columbia, Forest Renewal BC funding is on the decline and provincial agencies are also experiencing difficulties. Work continues on some specific projects on Hemiptera, for example, and on endangered species and conservation issues.

On the Prairies, the expanded Lethbridge Research Centre facilities will be operational by the summer of 2002. The University of Lethbridge recently opened a technologically advanced Library Information Network Centre. Dr. Rob Anderson is now at the University of Winnipeg, working on mosquitoes. Dr. Pat Mackay has retired from the Department of Entomology at the University of Manitoba; the department is hoping for a replacement. Databasing of the J.B. Wallis Museum supported by a CFI grant is proceeding slowly. At the University of Alberta systematics work is strong and healthy. The Strickland Museum received funds from CFI and the Alberta government to upgrade the physical structure of the collection. More specimen data have been entered into a database for the Virtual Museum website [see p. 20]. The many other activities include a school outreach project, the Alberta Lepidopterists' Guild, and new graduate students and a postdoctoral fellow. Many other biodiversity projects are proceeding at the University. Two faculty positions are open for entomologists there. The recently published first volume of *American Beetles* contains many chapters by Canadian entomologists.

In Ontario, projects at Laurentian University, the University of Toronto, the Royal Ontario Museum and elsewhere were noted.

In Quebec there are new positions at the Université de Montréal. McGill University has a new chair in forestry. The annual meeting of the Société d'entomologie du Québec takes place the first week of November, preceded by a meeting of an action committee on the promotion of entomology in Quebec, to discuss scientific research, the economic value of entomology, policy issues, promotion, education and training. All provincial government people involved in taxonomy have been relocated to the same building. A committee on the invading

lady beetle has been established with representatives of many provincial ministries, universities and the federal government. The Association des entomologistes amateurs du Québec is very active, and publishes the journal *Fabriques* which is encouraging more biodiversity papers, documentation of range expansions, etc. Annual outings to collect insects at Mt. St. Hilaire (which took place from the late 1800's to the 1920's) have been resurrected this year. Several graduate students are working on systematics projects at the Lyman Museum.

In Newfoundland and the Maritimes, the annual meeting of the Acadian Entomological Society was successful this year, after the

poorly attended event last year. A huge snowfall last winter aided the overwintering success of many insects and the mosquito problem persisted all summer. There was a lot of media coverage and other concerns dealing with these and other species. Some key grant applications and projects in the Maritimes were outlined.

2. Other matters

The Committee also considered recent information on topics such as international liaisons, membership of the Scientific Committee, the timing of the Committee meeting normally held in October, operations of the Biological Survey Secretariat, and recent publications of interest.

Biological Survey Website Update

The website of the Biological Survey of Canada (Terrestrial Arthropods) has moved – but not far. The Department of Biological Sciences at the University of Alberta is still kindly hosting our website but we have a new URL (see below). The Survey continues to update and expand its website. Some of the new or expanded features that invite your participation include:

Faunal Analysis Project. Detailed species lists from *Canada and its Insect Fauna* (Danks 1979) have been posted with links to updated, revised numbers for each group as they become available. Updated information for the Phthiraptera was recently added. Many groups still lack updates, however, and additions are encouraged.

List of Workers (database). This list of personnel is a source of information on individuals interested in the systematics and faunistics of the terrestrial arthropods of Canada. An online form is available to update your information. An updated format for the database is in progress and will be operational soon.

Requests for Material or Information. This list of requests for material or information re-

quired for studies of the Canadian fauna, long a regular feature of this newsletter (see p. 28), is now available on the website and will be updated as new requests are received.

The full text of survey publications such as newsletters and briefs continue to be posted. Recent additions include a brief that provides recommendations on how to prepare data labels for collections of terrestrial arthropods (***Publications - Briefs - Label Data Standards for Terrestrial Arthropods***). Of particular interest to students is a document that provides information on some of the available funding sources for graduate study and research in biodiversity (***Publications - Briefs - Information on Biodiversity funding: Funding sources for graduate students in arthropod biodiversity***).

Those interested in the Survey's major project on Arthropods of Canadian Grasslands should check this area for project updates. A bibliography about prairie, tallgrass prairie, prairie arthropods and/or fire was recently added.

The Survey's website can be found at:

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

The Alberta Lepidopterists' Guild (www.biology.ualberta.ca/uasm/alb.lep.guild.htm)

On October 16, 1999 the Alberta Lepidopterists' Guild (ALG) was formally inaugurated at Olds College, Alberta. The founding group of 16 people comprised a mixture of amateur and professional entomologists with a particular interest in Lepidoptera, or at least with a willingness to encourage and support those of us who do. The stated objectives of the new society are to support and encourage the study and appreciation of Alberta Lepidoptera. We also thought that an official organization would facilitate collecting permits for provincial parks and other protected areas, and wider access to funding for group projects.

Since that time the group has almost tripled in size. Most active members of ALG are interested mainly in particular groups of the Alberta moth fauna, which have received less attention than the butterflies since Ken Bowman stopped collecting some 50 years ago. New technology, such as mini-generators, low-cost UV and MV bulbs, flatbed scanners and the Internet, has contributed to the resurgence of interest in the moth fauna by making it much easier to obtain and identify specimens. The author of "Butterflies of Alberta" and the five co-authors of "Alberta Butterflies" are all members of ALG as well.

Another event that contributed to our growth was the return of Felix Sperling to the University of Alberta, where among other duties he took on the position of Curator of the Strickland Museum of Entomology. The historical Bowman Lepidoptera collection was soon re-energized into a growing, working collection once again. In conjunction with the museum, a Virtual Museum Project was initiated (and see p. 20). Funding was obtained to have the macro-lepidoptera in the collection databased and posted, and to help produce species pages with color images, information on range, host plant and other data, as well as dot-maps that are generated and updated from the database. This is an ongoing project, but already pages for some 200 species of Alberta macro-moths have been completed. The Guild also has a web-page on the Museum's Website, which

will be expanded in the near future. Two other significant and active collections of Alberta Lepidoptera are housed at the Canadian Forest Service's Northern Forestry Centre in Edmonton, and at Old's College in Olds; ALG members curate both. Many members also maintain significant private collections.

Since our establishment group members have been involved in a number of Lepidoptera-related projects. Alberta provincial government personnel (several of whom are members of the group) have been very co-operative in providing permission to collect in provincial parks and other protected areas in return for information on the Lepidoptera fauna found there. This co-operation has culminated in members of ALG being invited to join in faunal surveys of a number of newly established Wilderness Parks in extreme northern Alberta in both 2000 and 2001 (and planned for 2002-2004). All costs are covered, and funding is provided to ALG to prepare reports of the Lepidoptera taken during these surveys. Members of the group have also been invited to give talks or put on "Moth Nights," complete with sheets and lights, for a number of Natural History and Conservation groups. ALG Members have also been active in participating in or organizing many of the record number of butterfly counts that are done in Alberta each season. But perhaps most importantly we have done a lot of collecting in the hitherto largely ignored areas of the province, including the Grasslands and Boreal Forest regions.

The most ambitious project in our short history is planned for the summer of 2003, when we will host the Annual Meeting of the Lepidopterists' Society at Olds College. Olds is close to both the mountains and the arid grasslands, and is an ideal location for a wide variety of Lepidoptera.

If you would like more information about the group, or are interested in joining (\$10.00 Canadian for annual membership), contact the Treasurer, Greg Pohl, at gpohl@nrca.gc.ca.

Gary Anweiler, gganweiler@sprint.ca

Project Update - Arthropods of Canadian Grasslands

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The Grasslands Project continues to gather momentum (I will resist the use of prairie fire metaphors). Since the last Project Update (Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 20 (1): 14-15) there has been progress on various aspects of the Project.

Grasslands Prospectus

The Grasslands Prospectus will soon be posted on the Project web page. This document is the framework for ongoing development of the Grasslands Project and describes the scope, objectives, rationale and anticipated products of the project. The prospectus also contains an overview of grassland habitats in Canada and a

brief review of research to date on the arthropods of Canadian grasslands.

Grasslands Publication Planning

The first major product of the Grasslands Project will be a volume entitled (tentatively) *Arthropods of Canadian grasslands: ecology and interactions in grassland habitats*. The focus of the chapters in the volume will be the ecological relationships and interactions of arthropods in selected grassland habitats. This ecological approach is intended as a complement to the taxonomic inventory-based approach such as that taken in the Biological Survey of Canada's *Insects of the Yukon*. Taxonomic inventories and species level analyses



Collecting at Onefour (photo by J.D. Shorthouse)

will be the focus of a planned subsequent volume arising from this project. A final list of chapters and authors for the ecological volume is currently being compiled. For more information on this volume please contact Terry Wheeler.

Grasslands Symposium 2002

Some of the chapters to be published in the above volume will be presented as invited papers at a formal symposium on Ecology of Arthropods in Canadian Grasslands at the Joint Annual Meeting of the Entomological Societies of Canada and Manitoba, to be held in Winnipeg, Manitoba on 08 October 2002. As for the volume described above, the focus of the symposium will be ecological and habitat based studies on selected grasslands or taxa. Although some symposium contributors have already been confirmed, final organization continues. For more information contact the symposium organizer, Terry Wheeler.

Ongoing Research and Fieldwork

A list of recent and ongoing research projects in Canadian grasslands is maintained on the Grasslands Project web page and sum-

maries of recent research are published annually in the Arthropods of Canadian Grasslands Newsletter.

Field research by individual collaborators continues on several taxa in grassland sites across the west. In addition to individual fieldwork, a series of annual group field meetings in key grassland habitats is planned. The first of these meetings was organized by Rob Roughley and Kevin Floate at the Agriculture and Agri-Food Canada substation near Onefour, Alberta in 2001. A detailed summary of the field meeting will appear in the next issue of the Arthropods of Canadian Grasslands Newsletter (Issue 8). The tentative habitat for the 2002 collecting expedition is the tallgrass prairie of southern Manitoba. This trip will provide the opportunity to collect in one of the most geographically restricted, threatened and perhaps the most species-rich of Canada's grassland types. In addition, a variety of other grassland habitats (oak savanna, fescue prairie) are within driving distance of the tallgrass prairie sites. For more information on this year's field trip contact Rob Roughley
(Rob_Roughley@umanitoba.ca)

Canadian Perspectives: The Study of Insect Dormancies and Life Cycles

H.V. Danks

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Adaptations of insects in terms of life-cycle patterns and how these are controlled are especially striking and significant in northern countries such as Canada.

Dormancies are one of the key adaptations of insects to seasonal events and have attracted a great deal of study. But dormancies are only one component in the timing of insect life

cycles, and recent syntheses suggest that a wider view of how life cycles evolve and are controlled is desirable. This perspective, explained in more detail by Danks (1987, 1991, 1992, 1993, 1994a, b, 1999b, 2001, 2002) is summarized here. A very similar summary in French is available in Danks (1999a).

Dormancies

There are two main kinds of dormancy, quiescence and diapause. During quiescence, development stops due to currently adverse conditions such as low temperatures. During diapause, morphological development is suppressed through a form of central control and not simply by the direct action of environmental factors. Many of the complexities of insect life cycles stem from forms of diapause. However, attempts to classify diapause into discrete categories are unsatisfactory, because the developmental programmes of different species represent a continuum of adaptations to a variety of circumstances, and so are extraordinarily diverse.

Control of development

Some factors act directly as simple regulators. For example, temperature plays this role in normal circumstances, because metabolism and hence development is typically faster at higher temperatures within the usual range. Development may also be controlled by cues or environmental tokens that act indirectly rather than as regulators. For example, the diapause of many species is influenced by photoperiod. In addition, some life-cycle stages respond to short-term stimuli, such as the specific conditions that prompt hatching of the eggs of mosquitoes and other species.

The life cycles of a few species are controlled entirely by direct effects, especially in sheltered habitats where conditions change regularly and predictably. However, patterns of development of most species include control by cues. Even when cues exert a dominant influence on how the life cycle is controlled, dormancy is only one element of the control, because growth rates and other elements are involved. For example, photoperiod and crowding can modify growth as well as development by their indirect action. Table 1 shows the wide range of environmental factors that have so far been reported to influence diapause and growth rate.

Table 1. Synopsis of environmental factors influencing seasonal development in insects (from Danks 1994a). + acts indirectly, as a cue or seasonal token; x acts directly, as a regulator; * can act either indirectly or directly.

Factor	Stage of development influenced		
	Diapause Induction	Diapause Development	Growth Rate
Photoperiod	+	+	+
Light intensity	+	+	x
Temperature level	+	+	*
Thermoperiod	+		?
Food	+	+	x
Moisture/Humidity	+	(+)	x
Density	+		*
Mates/mating	+	+	
Chemicals	+	+	x

Life-cycle pathways

Viewing the life cycle as a series of alternative pathways (for several examples see Danks 1987, 1991, 1994a) helps to visualize the effects of all of these possible influences. The alternatives are chosen during the development of each individual by a variety of internal (genetically programmed) mechanisms linked with various external or environmental controls.

The complexity of such pathways suggests that insect life cycles should be analysed not by static assessment of particular dormancies, but rather by means of flow charts that identify the options available to a given species and show how the individual elements are governed. Even complex life-cycle patterns can nonetheless be understood through concepts of ordinary development. Diapause and

its completion are simply special forms of development, although sometimes they have long-term requirements for particular levels of environmental conditions or for changes in those conditions. Concepts such as regulation (continuous control of rates), switches (choices among set alternatives), gates (limits), potentiation (on-off switches) and successive requirements (a given stage must be reached before a subsequent development is feasible) apply to both dormant and non-dormant developmental pathways.

By examining life-cycle pathways in this way, entomologists can identify key decision points that govern the flow of the life cycle of a given species. Phenological variations among individuals and years, and other factors, can then be understood. Without such an approach, many entomologists will instead continue to monitor the incidence of diapause at a few temperatures and a few photoperiods, or to classify diapause into arbitrary types. Such procedures contribute little to our understanding of life cycles in nature because for most species they seriously underestimate environmental and genetic complexity.

Levels of complexity

Different species have life cycles of different complexity, of course. More complex control systems typically generate more precise developmental responses or allow for adaptive flexibility and variability. Complex systems tend to include a large rather than a small number of dormant stages, multiple possible routes of development within a single dormant period rather than a single fixed pathway, a wider variety of environmental controls used to time the stages, and the control of growth as well as development by environmental cues. Many experiments on diapause have not been designed to take account of such possibilities.

Integration of responses

From a broad perspective, therefore, dormancy and other responses to the environment are integrated throughout the life cycle. The wide range of adaptations includes arrested, retarded or accelerated development,

sensitivity and response to a wide range of environmental cues in almost any stage, and variation in the extent and duration of sensitivity. However, even a relatively small number of successive developmental choices can generate many different routes of development.

Trade-offs

Because resources of time, space and energy are finite, any species survives by maximizing fitness though multiple trade-offs between competing demands for the resources. For example, a given species is unlikely to be able to reach a very large size very quickly, because of constraints of food or physiology. It could complete the life cycle quickly but not at a huge size, or it could grow very large (and hence be able to deposit many eggs) but relatively slowly. Traits that depend on common elements tend to be correlated, and the developmental pathway may make certain trade-offs unfeasible.

Again, trade-offs must be integrated into the life cycle in a general sense, for example to achieve a balance between seasonal synchrony to take advantage of favourable times of year, flexibility to counter unexpected variations, and variability to buffer risk. Nevertheless, time, space and energy are not necessarily limiting in any particular situation. For example, there may be plenty of time for development to be completed before the end of the growing season. Consequently, identifying trade-offs (by modelling and other means) is complex, as for the life-cycle controls themselves. However, it provides another way to understand the structure of the life cycle.

Generalizations

Seasonal conditions vary very widely, so that different demands are placed on different species and on the same species in different places. A review of the many responses studied so far suggests generalizations such as the following.

- Similar environmental challenges can be solved in many different ways. For example, species can avoid unsuitable conditions by moving between habitats or microhabitats,

- reducing the number of annual generations, modifying development, or switching foods.
- Similar responses can evolve independently in different species. Parallel adaptations are very common. For example, winter diapause of many temperate species is induced by short photoperiods and low temperatures, and ended by exposure to cold.
 - Responses evolve in combination. Organisms survive all conditions and selective pressures simultaneously, so that responses are assembled in sets and not separately.
 - A single response may contribute to many functions in one species. For example, slower growth may help to increase survival when food is limited, permit ambiguous environmental signals to be monitored for a longer period, delay entry into the diapause stage and so reduce summer mortality of dormant individuals, allow additional food to be stored, and so on.
 - The same response may serve different functions in different species. For example, large egg size can reduce the duration of subsequent larval development, or resist adverse conditions better, or enhance larval survival, depending on the species.
 - Trade-offs between potentially interdependent traits are not inevitable. For example, resources may not be limiting in some circumstances, and priority needs such as individual survival are met first.

These generalizations confirm the diversity and complexity of the responses as well as their close integration.

Future work

The evolution of dormancies and other life-cycle components is governed largely by the range and predictability of seasonal conditions. Therefore, in order to understand life cycles, we need to assess habitat conditions and their variability in detail at the same time as the biological responses. Insights into life-cycle evolution are possible too by analysing potential selective forces related to the supply of

time, space and energy, because life cycles integrate the use of available resources.

In other words, life cycles respond to broad forces and integrate many factors. Consequently, information from additional elementary experiments on diapause, or yet other examples of already well known responses to particular individual factors, will not be very helpful. Rather, multifaceted studies of insect life cycles as a whole are called for. A wide range of investigations should evaluate the ecological setting and combined responses of well characterized species from well characterized environments. Studying numerous life-cycle elements simultaneously in this way is most likely to reveal the principles underlying the evolution and control of life cycles and of their dormancy components.

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The Quiz Page

— test your knowledge of Canada and its fauna —

1. What is the most westerly point of Canada?
2. How many Canadian place names, including creeks, etc. are based on the common English family name “Smith” [e.g. Smiths Falls, Fort Smith, Smith Sound, Mount Robert Smith]?
3. Name five families of insects that contain several or many species known to aestivate as adults.
4. What are “sand flies”?
5. Name 20 families of Canadian insects containing species of parasitoids that attack other terrestrial arthropods.

[Answers on p. 26]

Virtual Museum of the Strickland Museum of Entomology

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The Strickland Museum of Entomology at the University of Alberta is developing a web-accessible database of its holdings, as well as species pages for many of the represented species. Although there are now many web-accessible museum databases in existence, and even more assemblages of species pages, this site is unique by integrating specimen data with more general species information. The collection and species data reside in Multi MIMSY 2000, an Oracle-based relational database management system. The University of Alberta Department of Museums and Collections (Jim Whittome and Victor Gatnicki) produced the site in collaboration with the Department of Biological Sciences (Felix Sperling and Danny Shpeley).

The Virtual Museum of Entomology site provides a number of tools for searching the Strickland Museum's database. When "Search the Collection" is selected, the system defaults to the "Specimen Search". This allows a search of the individual specimens in the collection and provides a link to the species information associated with each specimen. Alternatively, the "Species Search" allows a search of the species represented in the collection and provides a link to the specimen records of that species. In both cases, the search results can be plotted on an Alberta map (please note that this functionality only applies to specimens collected in Alberta.). Also available is a search tool based on the specimen's Specimen/Sample Number, as well as a hierarchical search function that allows searches via taxonomic classification.

Species pages include images wherever possible, and may include multiple images per species (as is the case for many *Cicindela*). A

graph is calculated for the seasonal distribution of the specimens recorded in the database, with only one increment on the histogram for any unique combination of locality plus date. As of February 2002, the database contains over 20,000 specimen records and over 300 species pages. Currently, the largest numbers of species pages are available for macrolepidoptera (by Gary Anweiler and Chris Schmidt), Trichoptera (by Andy Nimmo), and Coleoptera (Gerry Hilchie and Danny Shpeley). Species pages are avidly solicited from entomologists with expertise in particular taxonomic groups, and we have commitments for pages on grasshoppers (Dan Johnson), thrips (Bruce Heming) and stoneflies (Lloyd Dodsall), among others. Students in my Insect Taxonomy class also write a small number of species pages as term papers, and these will eventually be incorporated into the Virtual Museum after review by specialists. Anyone with entomological expertise who is willing to contribute species pages will be welcomed with open arms.

Search Functions:

Specimen Search

The specimen search is comprised of text boxes and radio buttons. All text boxes, with the exception of the text box for date range collected, allow for multiple values to be entered. A semi-colon must separate each value. Partial search terms may be entered into any text box. (e.g. *astarte* will return *Boloria astarte*). Date Range Collected: Enter a date range in the FROM and TO text boxes. Only 4 digit years may be entered. To search for specimens collected within a particular year, enter

the same year into the FROM and TO text boxes.

Species Search

The species search is comprised of text boxes. All text boxes allow for multiple values to be entered but a semi-colon must separate each value. Partial search terms may be entered into any text box. (e.g. bor will return species with boreal habitats). Habitat: This field includes a freeform of major habitat associations of each species.

Diet Info: This field includes a freeform description of items that each species is known to eat.

Hierarchical Search

The Hierarchical Search is a resource for manipulating an indented tree view of the Linnaean classification system. Using a tree

view of the classification allows the user to dig through the hierarchical layers. The hierarchy starts with Phylum Arthropoda. Click on the icons preceding the taxonomic names to open or close ranks in the hierarchy. Click on the taxonomic name to get listings for included specimens.

FastFind Search

Each object in the Strickland Museum has a unique Specimen/Sample Number. When searching for objects using the Specimen Search, the Specimen/Sample Number of any object(s) of interest can be recorded by the user. During the next visit to this site, the Specimen/Sample Number(s) can be entered to return quickly to specific object record(s). Up to six Specimen/Sample Numbers can be entered at one time using Fast Find. Example: UASM471.

Entomology Collection - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: <http://virtual-museum.sunsite.ualberta.ca/dig/search/ent/> What's Related

species details

specimen search species search hierarchical search fast find help

specimen search results -> *Hyles gallii* -> Species Details

scientific name *Hyles gallii* (Rott.)

common name Galium Sphinx

habitat
Open areas, including clearings, meadows, forest edges and urban gardens, etc.

seasonality
Adults are on the wing from June through early August.

identification
A large (6.5-9.0 cm. wingspan) long-winged and heavy-bodied moth. The forewing is black, with a wide cream-yellow stripe running the length of it and a wide, blue-grey terminal band, all rather sharply separated. The hindwing is black with a wide rose-pink median band and a narrower terminal one, and with a white spot in the anal angle. The similar *H. euphorbiae* has a mainly light brown forewing freckled with dark spots, and with the black costa replaced by two dark brown spots. *H. lineata* has the forewing veins outlined in white scales.

life history
This beautiful moth is the most common and widespread member of the genus in Alberta. It occurs much further north than most of our sphinx moths. It may on occasion be found nectaring at flowers in urban and other gardens in the evening. Like other members of the family, it has a very rapid wingbeat, and can easily be mistaken for a hummingbird. There is one generation per year.

conservation
No concerns.

diet info
No Alberta data; elsewhere Fireweed (*Epilobium*), Bedstraw (*Gallium*) and other herbs.

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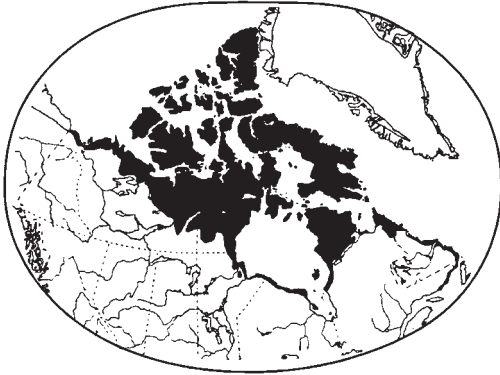
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ARCTIC CORNER

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).

The Alaska Insect Survey Project

James Kruse, University of Alaska Museum, 907 Yukon Drive, Fairbanks, AK 99775-6960 USA,
fnjjk1@uaf.edu

Less is known about the insect fauna of Alaska than about any other major region in the United States and Canada. The identity, biology and wider environmental relationships of many Alaska species remain unknown, making comparisons to partial historical data and neighboring northern areas impossible. No concentrated, coordinated efforts are underway to inventory Alaskan invertebrates. The Alaska Insect Survey (AIS), an indispensable systematic inventory on a powerful, internet-accessible database, is proposed to remedy the incomplete knowledge of Alaskan diversity and biology. The database will make information available on the results of new exploratory collecting, providing a desperately needed baseline to monitor the change in species composition as is predicted to be a result of climate change, and stimulating continued research into systematics, biogeography, and ecology. Managers will have access to an insect faunal inventory to make legitimate geographical comparisons and have the scientific basis required for habitat and species protection.

The objectives of the AIS are as follows: (1) Research. The AIS proposes to focus taxonomic expertise on Alaska insects using sites that have been established for both long and short term studies. A focus on historical and LTER sites offer the unique opportunity to integrate ecological and systematics research as well as expand collaborative efforts in entomology. Sites chosen along natural transects in poorly known areas, particularly in boreal Beringia, will optimize the potential for the discovery of new species. The resulting database is expected to enable and invigorate studies in systematics, biogeography and ecology. (2) Training. The AIS will train students in curation, phylogenetic systematics, morphological and molecular investigation, biogeography, entomological field techniques, and databasing. (3) Coordination and Products. The AIS is a plan for long-term and coordinated studies of Alaska insects. Participation by scientists and relevant organizations are actively sought. A yearly Summer Field Workshop will enhance coordination of the project at all levels and encourage collaboration. Results of the in-



ventory will be available on a web-accessible database. Research will be published and keys and other interactive products will become available on the internet as they are completed.

The idea for the AIS was inspired by the Biological Survey of Canada, and the literature concerning it. The early conceptual papers produced by Drs. Danks, Downes, and Ring were highly influential on the strategy outlined in the AIS grant proposed to the U.S. National Science Foundation's Biotic Surveys and Inven-

tories program. Several BSC collaborators have already expressed interest in helping with the AIS project, and I look forward to approaching others with specific needs as they arise. If you would like to volunteer your expertise on a certain group or groups, I would be happy to hear from you by email: fnjjk1@uaf.edu (note the number one, not a small L) or by post: Dr. James Kruse, University of Alaska Museum, 907 Yukon Drive, Fairbanks, AK 99775-6960 USA.

European Workshop of Invertebrate Ecophysiology 2001

The fourth European Workshop of Invertebrate Ecophysiology (EWIE IV) was held in St. Petersburg, Russia, 9-15 September 2001. The meeting was attended by about 100 people, half of them from Russia but many from elsewhere, including delegates from 12 European countries as well as Japan, Canada, the United States and South Africa. The scientific program was very full and included sessions on diapause and life-cycle strategies, variation in ecophysiological traits, overwintering and cold hardiness, the effects of temperature and thermoregulation, and water relations and respiration. The main programme comprised 17 invited and 36 contributed lectures and more than 50 poster presentations. Halfway through the meeting, a social day allowed visits to parts of St. Petersburg State University, Peterhof palace, and the canals of St. Petersburg.

The workshop was dedicated to the memory of the late Prof. Alexander Danilevsky (1911-1969), author of ground-breaking research on insect diapause and of the famous book *Photoperiodism and seasonal development of insects* (1961; English translation 1965), who worked at St. Petersburg State University. It was well organized at that university by Prof. Vladilen Kipyatkov, assisted by Elena Lopatina and others. Many presentations dealt with diapause, so that there was somewhat less emphasis than in earlier workshops on polar and cold-hardiness themes.

Many papers from the workshop have been submitted for publication – they are currently in review for the *European Journal of Entomology* or *Acta Societatis Zoologicae Bohemicae*. (Proceedings of the 1995 and 1998 workshops can be found in *Eur. J. Ent.* 93(3), 1996 and 96(2), 1999.)

The fifth EWIE will be held at Roskilde University, Denmark, during 2004, hosted by Dr. Hans Ramløv [hr@virgil.ruc.dk].

Hugh Danks



Selected Future Conferences

Organization	Date	Place	Contact
Entomological Conferences			
Entomological Society of Canada	2002 , 6-9 Oct.	Winnipeg, MB	(with the Entomological Society of Manitoba) Organizing Committee Chair, Don Dixon (204-945-3861, ddixon@gov.mb.ca); Robert Lamb, Program Subcommittee Chair, rlamb@em.agr.ca
	2003	British Columbia	P. de Groot, pdegroot@nrca.gc.ca
Entomological Society of America	2002 , 17-20 Nov.	Fort Lauderdale, FLA	ESA, 9301 Annapolis Rd., Lanham, MD 20706-3115; meet@entsoc.org
	2003 , 26-30 Oct.	Cincinnati, OH	ESA, see above
5^e Conférence Internationale Francophone d'Entomologie (CIFE) and Société d'entomologie du Québec	2002 , 14-18 July	Montréal, Québec	Dr. Daniel Coderre, Département des Sciences Biologiques, Université du Québec à Montréal, C.P. 888, Succ. Centre-ville, Montréal, Québec, H3C 3P8 coderre.daniel@uqam.ca http://www.seq.qc.ca/CIFE_2002.htm
4th International Conference on Ticks and Tick-borne Pathogens	2002 , 21-26 July	Banff, Alberta	http://www.biology.ualberta.ca/courses.hp/ttp4.hp/nfhome.htm TTP4 Conference Secretariat, Department of Biological Sciences, CW-405 Biological Sciences Building, University of Alberta, Edmonton, AB, T6G 2E9, 780-492-1279, TTP4@biology.ualberta.ca
5th International Conference of Hymenopterists	2002 , 22-26 July	Beijing, China	Chao-dong ZHU, Institute of Zoology, Chinese Academy of Sciences, Beijing, Haidian, Zhongguancun Road 19#, P. R. China; sea@panda.ioz.ac.cn http://www.ioz.ac.cn/zcd/
11th International Auchenorrhyncha Congress	2002 , 5-9 August	Potsdam, Germany	http://www.agric.nsw.gov.au/Hort/as cu/tymbal/meetings.htm Prof. Dr Hannelore Hoch, Museum für Naturkunde, Humboldt-Universität, Institut für Systematische Zoologie, Invalidenstrasse 43, D-10115 Berlin Germany

Organization	Date	Place	Contact
XI International Congress of Acarology	2002, 8-13 Sept.	Merida, Yucatan, Mexico	xi_ica@ibiologia.unam.mx; http://www.ibiologia.unam.mx/xi_ica/Congress.htm
5th International Congress of Dipterology	2002, 29 Sept. - 4 Oct.	Brisbane, Australia	http://www.uq.edu.au/entomology/dipterol/diptconf.html
VIIIth European Congress of Entomology	2002, 7-13 Oct.	Thessaloniki, Greece	Symposium Secretariat: Laboratory of Applied Zoology and Parasitology, Aristotle University of Thessaloniki, 540 06 Thessaloniki Greece; matilda@agro.auth.gr
XXII International Congress of Entomology	2004, 15-20 Aug.	Brisbane, Australia	Jim Cullen, CSIRO Entomology, j.cullen@ento.csiro.au Myron Zalucki, University of Queensland, Australia m.zalucki@mailbox.uq.edu.au
Collections / Museums / Systematics			
Society for the Preservation of Natural History Collections Annual Meeting	2002, 8-13 May	Montreal, Quebec	http://www.spnhc.org/2002/Jean-Marc Gagnon, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, ON K1P 6P4; jmgagnon@mus-nature.ca
Natural Science Collections Alliance Annual Meeting (formerly the Association of Systematics Collections)	2002, 6-9 June	Washington, DC	http://www.ascoll.org/annualmeeting/2002/2002annlmtg.htm Association of Systematics Collections, 1725 K Street NW, Suite 601; Washington, DC 20006-1401; general@nscalliance.org
Other subjects (especially those relevant to Survey projects)			
North American Benthological Society 48th Annual Meeting	2002, 28 May - June 1	Pittsburgh, Pennsylvania	http://www.benthos.org/Meeting/index.htm
41st Annual Meeting of the Canadian Society of Zoologists (includes symposia on "Prairie Biodiversity" and "Parasitism - Evolution and Ecology of Arthropod/Host Interactions")	2002, 8-11 May	Lethbridge, AB	http://home.uleth.ca/~goatcp/csz/english/index.html Cam Goater, goatcp@uleth.ca

Answers to Faunal Quiz

[See page 19]

1. The western border of the Yukon Territory is at 141 ° W, so that the most north-westerly point of Canada is Demarcation Point, YT [note that the Queen Charlotte Islands reach only 133 ° 11' W].
2. Listed in recent gazetteers are 439 Canadian place names based on the family name Smith.
3. Insect families with adults known to aestivate include Noctuidae and other moths and butterflies, Chrysopidae among the lacewings, Limnephilidae among the caddisflies, and several families of beetles such as Coccinellidae, Chrysomelidae, Curculionidae, and Carabidae.
4. The term "sand flies" normally refers to certain Psychodidae, especially the species of *Phlebotomus* in Europe, Asia and Africa, and of *Lutzomyia* and *Brumptomyia* in North, Central and South America (and the Caribbean Islands), that transmit several unpleasant diseases to humans, including leishmaniasis. Some Canadian psychodids bite amphibians or reptiles, but none bites humans. In North America, the term "sand flies" is often used instead or as well to refer to biting midges (Ceratopogonidae) of the genera *Culicoides* and *Leptoconops* that bite humans. And the term is even used occasionally there for black flies (Simuliidae) that attack humans.
5. Many families of Canadian insects contain (or are exclusively) parasitoids, including families such as Braconidae, Ichneumonidae, Mymaridae, Trichogrammatidae, Eulophidae, Aphelinidae, Encyrtidae, Eupelmidae, Eucharitidae, Perilampidae, Torymidae, Pteromalidae, Chalcididae, Eucoilidae, Proctotrupidae, Diapriidae, Scelionidae, Platygasteridae, Ceraphronidae and Bethyidae among the Hymenoptera, and families such as Phoridae, Conopidae, Sarcophagidae, Rhinophoridae and Tachinidae among the Diptera, as well as the Stylopidae.

Corrections: From the quiz in Newsletter 20 (2), pp. 58, 66.

Question 2: Typical developmental stages of mites should include the tritonymph (third nymphal instar), because it is the plesiomorphic state among the Acari even though it has been lost in many groups [contributed by Evert Lindquist].

Question 4: The dipteran family Corethrellidae (formerly part of Chaoboridae) also begins with the letter C [contributed by Art Borkent].

Quips and Quotes

Good enough isn't good enough. (Anon.)

There are two kinds of people: those who don't know and those who don't know they don't know. (Robert B. Reich)

The specialist learns more and more about less and less until, finally, he knows everything about nothing; whereas the generalist learns less and less about more and more until, finally, he knows nothing about everything. ("Dawson's Law")

Dead men tell no tales — and many who are alive aren't very informative either. (Anon.)

Two views of ants

At high tide fish eat ants; at low tide ants eat fish. (Thai proverb)

The ant has made himself illustrious
Through constant industry industrious.
So what?
Would you be calm and placid
If you were full of formic acid?
(Ogden Nash)

List of Requests for Material or Information Required for Studies of the Canadian Fauna 2002

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 cooperators were much appreciated.

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

(**denotes address reference; listed on page 37)

	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	Adelgidae (conifer woolly aphids)	Anywhere	Preserve insects and bark, needles or galls in 70% ethanol. Specimen records and host plant records.	R. Foottit	1
3	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
4	Anthomyiidae	North America	Specimens with biological data (especially reared specimens) in the genera <i>Strobilomyia</i> (conifer cone maggots), <i>Lasiomma</i> (larvae mainly in dung or bird nests), <i>Egle</i> (larvae in willow and poplar catkins), <i>Chirosia</i> (incl. <i>Pycnoglossa</i>) (larvae phytophagous in ferns), and <i>Acrostilpna</i> (biology unknown).	G.C.D. Griffiths	2

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
5	Anthomyzidae	New World	Adults from any habitat, but often associated with graminoids. Preservation in 70% ethanol preferred. Maliase and especially pan trap residues are acceptable and valuable. General description of herbaceous cover and soil moisture advantageous.	K.N. Barber	3
6	Aphididae (aphids)	Anywhere	Preserve in 70% ethanol. Specimen records and host plant records.	R. Footitt	1
7	Asilidae (robber flies)	North America	Pinned adults.	R.A. Cannings	4
8	Braconidae	Anywhere	Pointed or in ethanol.	M. Sharkey	5
9	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
10	Butterflies (see also 34)	Arctic	Preserve papered or pinned (collecting / preserving information supplied on request) [for Alaska Lepidoptera Survey]	K.W. Philip	7
11	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
12	Cercopidae (froghoppers, spittlebugs)	Canada and Alaska	Specimens (preferably not in ethanol if possible), records and host records.	K.G.A. Hamilton	1
13	Chalcidoids, especially Eupelmidae	Holarctic	Incl. sweep-net samples (see also 43) (collect into ethanol). Reared material is especially useful.	G.A.P. Gibson	1
14	Chironomidae: <i>Larsia</i> (Tanypodinae)	Nearctic and Palearctic fresh waters	Reared material preferred but will accept all stages in ethanol or on slides.	B. Bilyj	9
15	Chironomidae: <i>Eukiefferiella</i> , <i>Tvetenia</i> (Orthoclaadiinae)	All areas, especially Ontario	Include sampling method, habitat information.	W.B. Morton	10

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
16	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
17	Cicadellidae (leafhoppers)	Canada and Alaska	Specimens (preferably not in ethanol), records and host records.	K.G.A. Hamilton	1
18	Coccoidea (scale insects)	North America	Preserve insect and host plant material in 70% ethanol. Specimen records and host plant records.	R. Footitt	1
19	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
20	Coleoptera (identified)	Northern Canada	Will collect S. Ont. in exchange; has N.W.T. duplicates to exchange for identification.	A. Morgan	12
21	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
22	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	13
23	Dermaptera: <i>Forficula auricularia</i> (perce-oreille européen / European earwig)	Amérique du Nord et autres régions si possible	A sec ou dans l'alcool.	J.C. Tourneur	14
24	Diprionidae (diprionid sawflies)	North America	Living diprionid sawflies of any species, identified or unidentified. Record foodplant. Contact in advance about shipping.	L. Packer	15
25	Dytiscidae (predaceous diving beetles)	Canada, Alaska and northern USA	Adults and larvae; adults should be pinned or if in ethanol preliminarily sorted.	D.J. Larson	16
26	Eupelmidae: <i>Anastatus</i>	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	17

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
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	18
29	Halictidae (sweat bees) brown and black spp. only	North America	Particularly from blueberries. Pinned or preserved. Include flower record if available.	L. Packer	15
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	19
31	Insects on snow	Especially western mountains	<i>Chionea</i> (Tipulidae), <i>Boreus</i> (Mecoptera), Capniidae (Plecoptera): preserve in 70% ethanol.	S. Cannings	20
32	Isoptera (termites)	N. America incl. Mexico	Preserve in 75% ethanol; try to collect as many soldiers as possible.	T.G. Myles	21
33	Leioididae (=Leptodiridae)	Northern forest and tundra areas; prairies and grasslands	Most easily collected by window traps or flight intercept traps; and car nets (<i>Can. Ent.</i> 124: 745, 1992) (collect into ethanol).	S.B. Peck	22
34	Lepidoptera (see also 10)	Arctic	For revisionary work on the holarctic fauna.	J.D. Lafontaine	1
35	Lepidoptera	Manitoulin Island and surrounding islands	Records for use in monograph of the region. Information on old records from collections would be particularly welcome.	J.K. Morton	23
36	Lygaeidae	Anywhere	Material can be collected in ethanol.	G.G.E. Scudder	19
37	Mallophaga	Anywhere	Preserve specimens in 70% ethanol; host species is extremely important.	T.D. Galloway	24

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
38	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
39	Milichiidae	Anywhere	Malaise traps are particularly productive; also any found in association with ant nests extremely appreciated. Preserve in 70% ethanol.	J. Swann	25
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	Opiliones (harvestmen)	Canada and adjacent states	Preserve in 75% ethanol, especially adults with notes on habitats.	R. Holmberg	26
42	Orthoptera	Anywhere		J-T. Yang	27
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	Anywhere; especially boreal	Collect into 70% ethanol: especially interested in Malaise trap samples from boreal forest.	B.V. Brown	28
45	Pipunculidae (big-headed flies)	Anywhere in North America	Adults can be pinned, pointed or preserved in ethanol.	E. Georgeson	29
46	Psyllidae	North America	Preferably preserve in glycerine or dried. Specimen records and host plant records.	R. Footitt	1
47	Pteromalidae: <i>Pachyneuron</i>	North America	Reared materials with associated sexes are particularly important, regardless how few in number.	G.A.P. Gibson	1
48	Salticidae (jumping spiders)	Canada	Adult specimens preserved in 70% ethanol. Include habitat information, specific location of collection, collecting method.	D. Shorthouse, C. Buddle	30
49	Scelionid egg parasites of Orthoptera	Anywhere	Especially from Grylloidea; preserve in ethanol.	L. Masner	1
50	Sciomyzidae	Anywhere	Preferably pinned	L. Knutson	31

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
51	Silphidae	Canada	Include habitat and trapping method. Malaise trap material welcome.	R. Lauff	32
52	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	25
53	Siphonaptera (fleas)	Anywhere	Preserve specimens in 70% ethanol; host species is extremely important.	T.D. Galloway	24
54	Solpugida (sun spiders)	Canada	Preserve in 75% ethanol, especially adults with notes on habitat.	R. Holmberg	26
55	Sphaeroceridae	Anywhere, esp. arctic or high elevations	Collect into ethanol. Acalyprate fraction of trap samples welcomed.	S.A. Marshall	33
56	Symphyla (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
57	Tabanidae	Canada	Include habitat and trapping method. Malaise trap material welcome.	R. Lauff	32
58	Thysanoptera (thrips)	North America	(Preserve in 70% ethanol). Specimen records, habitat, host plant records where applicable.	R. Footitt	1
59	Trichoptera (caddisflies)	Anywhere	Larvae, pupae and adults, especially collections that might lead to species identification of larva through association with adult. Preserve adults dry or in 80% ethanol, larvae and pupae in Kahle's fluid or 80% ethanol.	G.B. Wiggins	25
60	[Identifications]	High Arctic	Specimens of soil animals in return for identifications.	G. Søvik	34
61	Taxonomic expertise for determinations	Alaska	For Alaska Insect Survey project (see article on p. 22). Various taxa, but especially for large and speciose groups of Hymenoptera and Diptera.	J. Kruse	35

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 5, 13, 19, 43, 51, 55, 57 above |
| c. | Field kits or instructions available on request. | See especially entries 38, 43, 52 above. |
| d. | Exchange of specimens. | Several requesters, including entries 7, 20, 40, 53 above. |
| e. | Limited collecting in Coppermine area, N.W.T., if particular material required. | A. Gunn (address 36 below). |
| f. | Soil animals from Ellesmere and Axel Heiberg Island, Island, arctic Canada. | G. Søvik (see entry 60 above) |
| g. | Material in exchange for identifications. | G. Søvik (see entry 60 above) |
| h. | Caterpillars, larval sawflies, aphids and mites available on request from trapnests for solitary bees and wasps [and see <i>Am. Bee J.</i> 2001, pp. 133-136, 441-444]. | P. Hallett (address 37 below) |
| i. | Insect material from grassland and adjacent habitats at Onefour, Alberta, is available for examination. | D.L. Johnson (address 38 below) |
-

List of Known Email Addresses

(by requester name)

Barber, K.N. kbarber@nrca.gc.ca
Behan-Pelletier, V.M. behanpv@em.agr.ca
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