Biodiversity, Biosystematics, and Ecology of Canadian Coleoptera

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EDITORIAL

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How far have we come: 170 years of research on Canadian Coleoptera

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Abstract

A brief history of the research on Coleoptera in Canada is recounted. The Canadian fauna was first studied by Kirby (1837) from specimens collected during the first two Franklin expeditions to the Canadian Arctic. Over the next 170 years many investigators have turned their attention to Canadian beetles. In 1991, 7,436 species had been documented to occur in the country. Since then there have been many taxonomic, faunistic, ecological, and other studies. Despite this long history of research, it is evident that much still remains to be done. It is important to recognize that taxonomic research is the foundation for understanding the biological diversity of the natural world.

Keywords

Coleoptera, taxonomy, ecology, research, history, Canada

Beetles have long been a subject of interest and curiosity in Canada. A map of Halifax, Nova Scotia drawn by Moses Harris in 1749, the year of the settlement's foundation, illustrates "The Musk Beetle", an indeterminate species of longhorn beetle. In 1837, William Kirby (1759-1850), a British entomologist, published a compendium of insects collected in northern Canada by John Richardson, the naturalist on the first (1819-1822) and second (1825-1827) Arctic expeditions of Sir John Franklin. Also included were insects collected in the 1820's in Nova Scotia by Captain Basil Hall (a renowned explorer and author) and the Reverend Thomas McCulloch (the first president of Dalhousie University). Three hundred and thirty-one species of Coleoptera were treated, including many new species described by Kirby. Thomas Say (1787-1834), often called the "father of American entomology", published many papers on

Coleoptera. Subsequently, between 1844 and 1896, most families of North American beetles received initial treatments in publications by John Lawrence LeConte (1825-1883) and George Henry Horn (1840-1897). All three were entomologists from the United States, but many of the species they described were also found in Canada.

The Reverend Charles J.S. Bethune (1838-1932) played a key role in the development of Canadian entomology when in 1863, together with William Saunders (1809-1879), he co-founded the Entomological Society of Canada. For 30 years Bethune served as the editor of The Canadian Entomologist, a pioneering journal that published, and continues to publish, many valuable studies about Canadian Coleoptera. Philip H. Gosse (1840) pioneered the study of Coleoptera in the province of Québec (then known as Lower Canada). In the late 19th and early 20th century many more entomologists turned their attention to Coleoptera. Gustave Chagnon, W.J. Brown, William Couper, William S. M. D'Urbain, J.D. Evans, R.P. Gorham, W. Hague Harrington, J. Matthew Jones, William McIntosh, A.S. Packard, l'abbé Léon Provancher (founder of the Le Naturaliste canadien), and H. F. Wickham are just some of the entomologists who made important contributions to the study of Coleoptera during this era.

In the history of Canadian Coleoptera, Carl H. Lindroth (1905-1979) deserves special mention. A Swedish researcher at the University of Lund, Lindroth's (1961-1969) sixpart series on the ground beetles (Carabidae) of Canada and Alaska set a standard for excellence in scholarship that subsequent authors have worked to emulate. Lindroth was also a seminal figure in the study of the zoogeography of the northern hemisphere and volumes such as Lindroth (1955, 1957, 1963) were major contributions to this discipline. Other important contributions during this era were Chagnon (1940) on the fauna of Québec and Hatch (1953-1971), a five-part series on the beetles of the Pacific Northwest, which included the fauna of British Columbia.

The creation of the Biosystematic Research Institute and the Canadian National Collection of Insects, Arachnids, and Nematodes (CNC) had profound impacts on Coleoptera research in the country. The CNC was formed between 1914 and 1918 by the amalgamation of the collections of the Biological Division of the Geological Survey, Department of Mines, and that of the Entomological Branch of the Department of Agriculture (Ruette 1970). The CNC Coleoptera collection is global in its coverage but has an extensive coverage of Canadian material and now contains approximately 2 million specimens. This institution created a critical mass of insect taxonomists who contributed to rapid growth of the collection and of collections-based research. It has been and continues to be a major contributor to the inventory of Canadian fauna. Under the stewardship of this Institute (now within Agriculture and Agri-Food Canada, Biodiversity, Systematic Entomology), many important works on Canadian beetles were published by E. Becker, D. Bright, W.J. Brown, J.M. Campbell, H.F. Howden, and A. Smetana, and later Y. Bousquet, A. Goulet, L. LeSage, and recently P. Bouchard. The second author started his career there in 1973 and later continued in 1980-1982 as a postdoctoral fellow.

In this regard the efforts of the late Edward Becker deserve special mention. A taxonomist who specialized in the Elateridae, Becker was also an editor of the Coleopterist's Bulletin (1983-1990) and president of the Coleopterist's Society (1971-1972).

However, perhaps his greatest contribution to entomology was through the CanaColl Foundation, a non-profit organization that Ed helped create and almost single-handedly nurtured for the past 36 years. The foundation promotes taxonomic research at CNC by providing funds to visiting entomologists who curate the collection.

This 140-year history of studies was summarized by Campbell et al. (1978) who reported that 6,742 species of beetles were then known in Canada, further estimating that 2,368 additional species were unreported or undescribed in the country. Despite this, Campbell et al. (1978) noted that the only comprehensive treatments of beetles in Canada were Lindroth's work on Carabidae, Bright (1976) on the Scolytinae, and Barron (1971) on the Trogositidae. This summary actually understated the research which had been conducted since investigators such as John Milton Campbell (1973, 1976) had revised *Tachinus* and *Sepidophilus* (Staphylinidae) in North and Central America; Edward C. Becker (1971, 1974) had revised the Nearctic species of *Agriotes* and *Athous* (Elateridae); W.J. Brown (1934, 1935a, 1935b, 1935c, 1936a, 1936b, 1936c, 1936d) had revised the genus *Dalopius* and substantial portions of the genus *Ctenicera (senus lato)*, then known as *Ludius* (Elateridae); Ales Smetana (1971) had revised the Quediini (Staphylinidae) in North America; Henry F. Howden (1964, 1968) had revised the Geotrupidae and the Trichiinae of North and Central America; J.B. Wallis (1961) had surveyed the Cicindelinae of Canada; and A.R. Brooks (1960) had delineated the elaterid fauna of southern Alberta, Saskatchewan, and Manitoba.

Campbell et al. (1978) was an important benchmark, however, and perhaps spurred by their call that "future students and workers should be encouraged to undertake faunal studies of neglected families or subfamilies of beetles for all of Canada or all of North America", the following dozen years saw an explosion of interest in Canadian Coleoptera. Smetana (1982, 1985, 1988, 1995) revised the Xantholinini (Staphylinidae), Helophorinae, Hydrophilidae, and Philonthina (Staphylinidae); Campbell (1979, 1982, 1991) continued his work on the staphylinids with important revisions of *Tachyporus*, *Lordithon*, and *Mycetoporus*; Donald Bright (1981, 1987) reviewed the complicated bark-beetle genus *Pityophthorus,* and the Canadian Buprestidae; Robert S. Anderson and Stewart Peck (1985) reviewed the Canadian Silphidae and Agyrtidae; Jan Klimaszewski (1979, 1984) revised the Gymnusini, Deinopsini, and the genus *Aleochara* (Staphylinidae: Aleocharinae); Laurent LeSage (1986) revised *Ophraella* (Chrysomelidae); and there were many other revisions of individual genera.

In 1991 when the Checklist of Beetles of Canada and Alaska (Bousquet 1991) was published, the Canadian fauna was listed as 7,436 species, an increase of 694 in a span of 13 years. Since that time, the pace of work in Canada has continued to increase. Many additional families, subfamilies, tribes, and genera have been revised, and there have been a large number of faunistic studies and regional treatments. Bright (1993) treated the Anthribidae, Nemonychidae, Brentidae, Apionidae, Ithyceridae, Attelabidae, and Platypodidae of Canada and Alaska. Larson et al. (2000) comprehensively surveyed the Dytiscidae of North America, focusing particularly on the Canadian fauna. Pearson et al. (2006) and Leonard and Bell (1999) published important guides to North American tiger beetles (Cicindelinae) while Acorn (2001, 2007) wrote field guides to the Alberta Cicindelinae and Coccinellidae. Bousquet and Laplante (2006) revised the Histeridae of Canada and Alaska, Gouix and Klimaszewski (2007) compiled a catalogue of the Canadian Aleocharinae which was preceded by numerous generic revisions of aleocharine genera (Klimaszewski et al. 2001, 2002, 2003, 2004, 2006a,b, Klimaszewski and Pelletier 2004, Maruyama and Klimaszewski 2004a,b, 2006), and recently Bright and Bouchard (2008) published a fauna and revision of the Entiminae (Curculionidae) of Canada and Alaska.

Following the trail blazed by Lindroth, George Ball and Yves Bousquet have published many studies of the North American Carabidae, not least of which being their chapter on this family in American Beetles (2000). George Ball, an academic at the University of Alberta, with his extensive knowledge, energy, dedication, and magnetic personality has had an enormous impact on studies on Canadian and world Carabidae and other Coleoptera, as well as on the education of entire generations of Canadian and American Coleopterists. Some most prominent among them are Terry Erwin, David Kavanaugh, Henri Goulet, J. Steve Ashe, and many others. Stewart Peck, who specializes in the Leiodidae and in cave faunas has made extensive contributions to the knowledge of these groups; and Henry Howden, a former colleague at Carleton University, now working through the Canadian Museum of Nature, is one of the world's foremost authorities on the Scarabaeidae. Together with Robert Anderson and colleagues they have helped make the Canadian Museum of Nature a major national and international institution in the study of Coleoptera.

Robert Roughley (2000a, 2000b, 2000c) has comprehensively surveyed the Canadian water beetle fauna, contributing three chapters on the Gyrinidae, Haliplidae, and Noteridae, for American Beetles and collaborating with David Larson on the Dytiscidae (2000). Canadian entomologist Darren Pollock has made extensive contributions to the knowledge of saproxylic beetles, writing chapters on the Tetratomidae, Melandryidae, Mycteridae, Boridae, Pythidae, Salpingidae, and Scraptidae for the second volume of American Beetles (2002a, 2002b, 2002c, 2002d, 2002e, 2002f; Young and Pollock 2002); and Robert Anderson has revised many groups of Canadian and North American weevils and contributed chapters on the Nemonychidae, Brentidae, Ithyceridae, and Curculionidae to the second volume of American Beetles (2002a, 2002b, 2002c; Anderson and Kissinger 2002). Many other studies have been published, some dealing with aspects of the Canadian fauna, others examining the Nearctic fauna as a whole.

In addition to taxonomic and faunistic works, many ecological studies have started to appear, particularly in the past couple of decades. An important focus of interest, given the extensive forested areas of Canada, have been saproxylic beetles and the role that they play in forest dynamics and ecology. Studies by James Hammond, David Langor, Greg Pohl, and John Spence in Alberta and their colleagues and associates, have drawn important attention to this functional group of insects. Larochelle and Larivière (2003) published a comprehensive natural history of the Carabidae of North America. Canada also has an extensive coastline and there has been a recent interest in coastal and island faunas. Since publications by Brown (1940) and Lindroth (1957), there has also been a very considerable interest in adventive species in Canada, on both the Atlantic and Pacific coasts, and many recent studies have focused on documenting the large spectrum of introduced species found in the country.

However, despite this long history of observation, investigation, and scholarship, many of us involved in the field feel we have only begun to scratch the surface. For every question that has been answered there appear to be a dozen that require investigation. The more we learn about a species, the more we realize there are a host of taxonomic, behavioral, physiological, developmental, zoogeographic, evolutionary, historical, and ecological dimensions that we know little or nothing about.

The papers compiled in this volume are an illustration of how much still remains to be discerned. Many groups still require taxonomic revision and species need to be described. Basic parameters of the distribution, dispersal, zoogeographic status, phenology, and bionomics of many species have yet to be understood. There are many Canadian beetles whose bionomics have never been investigated or whose distribution is almost completely unknown. New historical timelines of adventive species are continually being discovered. Furthermore, the synecological dimensions of communities of beetles within habitats like forests are just starting to receive attention in Canada. Details of how they contribute to nutrient, energy, and carbon cycling in forests, and interact with communities of predators and prey, are key in understanding the ecological dynamics of forests. There are similar interests in relation to the beetle communities of lakes, rivers, seashores, fields, bogs, marshes, and other habitats in which beetles are important ecological components.

The answers to these questions are not only of interest for academic reasons, but for economic and environmental ones as well. Many beetles play prominent roles in forestry and agricultural settings, sometimes as beneficial species, at other times as "pests". Invasive species are a cause of considerable concern in Canada, and comprehensive faunal inventories and ongoing monitoring are important in safeguarding our environment from "bio-invaders". In an era when there are concerns relating to pollution and climate change, an interest in using Coleoptera as bio-indicators of ecological change has developed. Beetles are widespread, numerous, species-rich, and easily sampled. They exhibit greater site specificity than vertebrates, and respond to environmental changes more rapidly than vascular plants or vertebrates. For all these reasons it behooves us to continue to develop our knowledge of this important group of invertebrates.

In compiling this volume, in part a celebration of the launch of ZooKeys – an important new venue for scientific research that embraces excellence, diversity, and inclusiveness, and reaches out to the scientific community with its policy of open electronic access – we must express our thanks to many people. First of all, to the many authors who responded to our requests to contribute their work to this volume. Also to the many coleopterists, who for reasons of timing or other commitments, were unable to participate, but who nonetheless expressed their support and wished us well in the venture. Thanks also to Pamela Cheers for her attentive copy editing. And finally to Lyubomir Penev, Terry Erwin, and their entire editorial team at ZooKeys. Their vision and commitment in launching the journal, their infectious energy, enthusiastic support, constantly helpful ideas, tireless energy, and the trust they extended to us in this venture were outstanding. For all this, we express our warmest thanks.

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Species review of the genus *Gnypeta* Thomson from Canada, Alaska and Greenland (Coleoptera, Staphylinidae, Aleocharinae): systematics, bionomics and distribution

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Abstract

A review of the rove beetle species of the genus *Gnypeta* Thomson from Canada, Alaska and Greenland is presented. Eighteen species are reported from Canada of which 6 are described as new to science, 3 species described from the Palaearctic region are reported in North America for the first time: *G. brincki* Palm, *G. carbonaria* (Mannerheim), *G. sellmani* Brundin; 5 species, *G. atrolucens* Casey, *G. crebrepunctata* (Casey), *G. groenlandica* Lohse, *G. nigrella* (LeConte), *G. uteana* (Casey), represent new distribution records for Canada, and one, *G. caerulea* (C.R. Sahlberg), represents a new province and territory record. New species are: *G. ashei* Klimaszewski, sp. nov., *G. dentata* Klimaszewski, sp. nov., *G. lohsei* Klimaszewski sp. nov.; *G. minuta* Klimaszewski & Webster, sp. nov., *G. canadensis* Klimaszewski, sp. nov., and *G. saccharina* Klimaszewski & Webster, sp. nov. The lectotypes are here designated for the following species from the syntype series: *Gnypeta atrolucens* Casey, *G. baltifera* (LeConte), *G. bockiana* Casey, *G. brevicollis* Casey, *G. boulderensis* Casey, *G. brunnescens* Casey, *G. crebrepunctata* (Casey), *G. manitobae* Casey, *G. nigrella* (LeConte), *G. oblata* Casey, *G. punctatula* Casey, *G. uteana* (Casey), and *G. wickhami* Casey. The following new synonyms are established (first name being valid): *G. uteana* Casey (= *G. boulderensis* Casey, = *G. punctatula* Casey), *G. crebrepunctata* Casey (= *G. oblata* Casey), and *G. laticollis* Casey (= *G. wickhami* Casey). The species are classified into five new species groups reflecting their presumed relationships. All treated species are illustrated, and distribution maps are provided. New data on collection, habitat, and distribution are presented. A key to the identification of Canadian and Alaskan species is provided.

Keywords
Coleoptera, Aleocharinae, *Gnypeta*, Nearctic, taxonomy

Introduction

Paśnik (2002) reported that the genus *Gnypeta* Thomson contains more than 70 species distributed throughout all zoogeographical regions. Our estimate indicates that there are at least 113 nominal species in the world fauna. Seevers (1978) considered the genus *Gnypeta* to be widespread. Thirty-five valid species of the genus are recognized in the Palaearctic region (Smetana 2004), 40 nominal species in the Nearctic region with two additional species described from Mexico (Ashe 2001), 11 in the Neotropical region, 27 species in the Oriental region (Pasnik 2002), and a few scattered species are known from Africa. Eighteen species are here reported from Canada, Alaska and Greenland. Before this review was published, the Canadian species of *Gnypeta* were very poorly known and practically unidentifiable. In recent catalogues, 3 species, *G. brevicornis* Casey, *G. caerulea* (C.R. Sahlberg), and *G. manitobae* Casey, were listed from Canada (Campbell and Davies 1991; Gouix and Klimaszewski 2007). The knowledge on this group in Canada and all of North America consisted of scattered original descriptions (Casey 1886, 1906, 1910, 1911; LeConte 1863; Bland 1865). These papers were lacking any external or genital illustrations and had limited value for species identification. The present treatment is the first published document reviewing all Canadian, Alaskan and Greenlandian species of the genus. We provide here detailed diagnoses and descriptions of the species concerned, external and genital images, new data on relationships, collection, habitat and distribution.

Many of the Nearctic *Gnypeta* species have a broad and not localized distribution as assumed by Casey (1886, 1906, 1910, 1911). Four of the Canadian species are Holarctic and circumpolar in distribution (*G. brincki*, *G. caerulea*, *G. carbonaria*, *G. sellmani*); 3 species are transcontinental in northern Canada (*G. groenlandica*, *G. ashei*, *G. dentata*), 7 species are known only east of the Rocky Mountains (*G. saccharina*, *G. atrolucens*, *G. manitobae*, *G. nigrella*, *G. canadensis*, *G. uteana, G. minuta*), and 4 are western in distribution (*G. brevicornis*, *G. crebrepunctata*, *G. helenae*, *G. lohsei*).

A revision of the Nearctic *Gnypeta* was initiated about two decades ago by the late S. Ashe (University of Kansas, U.S.A.), and a review of Canadian species of *Gnypeta* was advanced by the late G.A. Lohse (Hamburg, Germany). However, neither of them was able to complete and publish their findings. This review includes all the material studied by them from Canada, Alaska and Greenland. Some of Ashe's "new species" (manuscript names) represent misidentifications of species previously described from the Palaearctic region but occurring in North America (e.g., *G. brincki*, *G. sellmani*), and some species designated by G.A. Lohse as new were also misidentified. All corrections are included in the present review and are discussed in the comments sections under the relevant species.

Material examined

Over 1000 adult specimens of *Gnypeta* from Canada, Greenland, Alaska, and some other American states were examined. These include non-type specimens of Nearctic species, type specimens of nominal species described from North America (Casey 1886, 1906, 1910, 1911), and some Palaearctic species recently discovered in North America (Muona 1984). Almost all specimens were dissected. The genital structures were dehydrated in absolute alcohol, transferred to xylene, mounted in Canada balsam on celluloid microslides and pinned with the specimens from which they originated. The external images of adults and the genital structures were obtained from an image processing system (Nikon SMZ1500 microscope, Nikon DXM 1200F digital camera, computer with Nikon View 5, Adobe Photoshop and CombineZ5 software). The habitus images were generated by taking photos of separate images of the antenna, head, pronotum, elytra and abdomen in the horizontal plane and then enhancing these structures in Adobe Photoshop and assembling them. Unfortunately we were not able to cut contours of all individual setae outside external body outlines and therefore the setae protruding outside the body lateral margin are not shown.

Terminology mainly follows that used by Seevers (1978), Klimaszewski (1984), and Ashe (2001). The ventral part of the median lobe of the aedeagus is considered that which bears the foramen mediale of the bulbus (exit for the ductus ejaculatorius from the median lobe), and the opposite side bearing the compressor plate is considered as the dorsal part.

The following general references were used for the studied taxa (some not mentioned further in the text except for the reference list): Casey 1886, 1906, 1910, 1911; Downie and Arnett 1996 Lohse 1974; Seevers 1978; Moore and Legner 1975; and Paśnik 2006 a, b.

Eight lectotypes were here designated for the following species: *Gnypeta atrolucens* Casey, *G. bockiana* Casey, *G. baltifera* (LeConte); *G. brevicollis* Casey, *G. crebrepunctata* (Casey), *G. manitobae* Casey, *G. nigrella* (LeConte); and *G. uteana* (Casey). These species were described from syntypes and without holotype designation in the original descriptions.

The holotypes/type material of the *Gnypeta* species described from Europe (*G. brincki*, *G. caerulea*, *G. carbonaria*, *G. sellmani*) have not been examined because these species are well documented, including illustrations, and the concept of these species is well established. However, we have compared the specimens of these species from Europe and Canada for confirmation of their status.

All genital images in this publication range in size from 0.2 to 0.4 mm.

All the species groups proposed in this publication are new.

Conventions

Authorship of new taxa. Authorship of the new taxa is attributed to the senior author alone, unless specified otherwise.

Localities and specimen data. All information relating to primary types is provided under each species, except for the long lists of paratypes of new species. These are listed together with the non-type material in Appendix A. Canadian localities are listed under province or territory. Additional data on specimens examined from Greenland and the United States, particularly from Alaska, are included in Appendix A whenever appropriate.

Repository abbreviations:

CBU Cape Breton University, Sydney, Nova Scotia, Canada
CGMC Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CNC Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada
GGC Gösta Gillerfors private collection, Varberg, Sweden
LFC Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre, Quebec City, Quebec, Canada
LUC Lund University Collection, Lund, Sweden
MCZ Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MZL Museum of Zoology, Lund University, Lund, Sweden
NSM Nova Scotia Museum of Natural History, Halifax, Nova Scotia, Canada
RWC Reginald Webster collection, Fredericton, New Brunswick, Canada
USNM United States National Museum, Washington, D.C., USA

Systematics

Tribe Oxypodini Thomson, 1859

Oxypodides Thomson 1859: 36 (ICZN, 1957: Name No. 150). Oxypodini: Seevers 1978: 14; Newton and Thayer 1992: 53; Ashe 2001: 360; Klimaszewski and Winchester 2002: 54; Klimaszewski and Pelletier 2004: 447; Klimaszewski *et al.* 2005: 9. Type genus: *Oxypoda* Mannerheim 1830: 69 (ICZN, 1957: Name No. 1078).

Diagnosis

Adults. Structurally diverse group of aleocharine beetles that may be recognized by the following combination of characters: tarsal formula usually 5-5-5 but in some taxa 4-5-5 or 4-4-4, mouthparts generalized, mesocoxae moderately to narrowly separated and with slender and often sharply pointed mesoventral process; acetabula usually margined; pronotal hypomera not visible laterally in some genera (e.g. *Oxypoda* and close allies); abdominal tergite 9 narrowly subdivided at base (Seevers 1978); median lobe of aedeagus with an elongate compressor plate and without an “athetine bridge” (Seevers 1978); paramerite usually with elongate apical lobe and striated velum. There are 48 genera in 5 subtribes in North America (Ashe 2001) and 24 genera in 3 subtribes in Canada and Alaska (Gouix and Klimaszewski 2007).

At the present time the placement of the genus *Gnypeta* in the tribe Oxypodini should be considered as a tentative arrangement due to existing controversy between different authors and the lack of comprehensive analysis at the tribal level (see discussion under Phylogenetic affiliations).

Genus *Gnypeta* Thomson

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Gnypeta Thomson 1858: 33; Moore and Legner 1975: 421; Seevers 1978: 83; Blackwelder 1952: 173; Ashe 2001: 363; Smetana 2004: 489. Type species: *Homalota labilis* Erichson 1839 (=*Bolitochara carbonaria* Mannerheim 1830).

Euliusa Casey 1906: 215; Moore and Legner 1975: 421; Seevers 1978: 83; Ashe 2001: 363; Smetana 2004: 489. Synonymized by Blackwelder 1952: 173. Type species: *Gnypeta lucens* Bernhauer 1905.

Gnypetoma Casey 1906: 196; Moore and Legner 1975: 421; Seevers 1978: 83; Ashe 2001: 363; Smetana 2004: 489. Synonymized by Blackwelder 1952: 173. Type species: *Tachyusa baltifera* LeConte 1863.

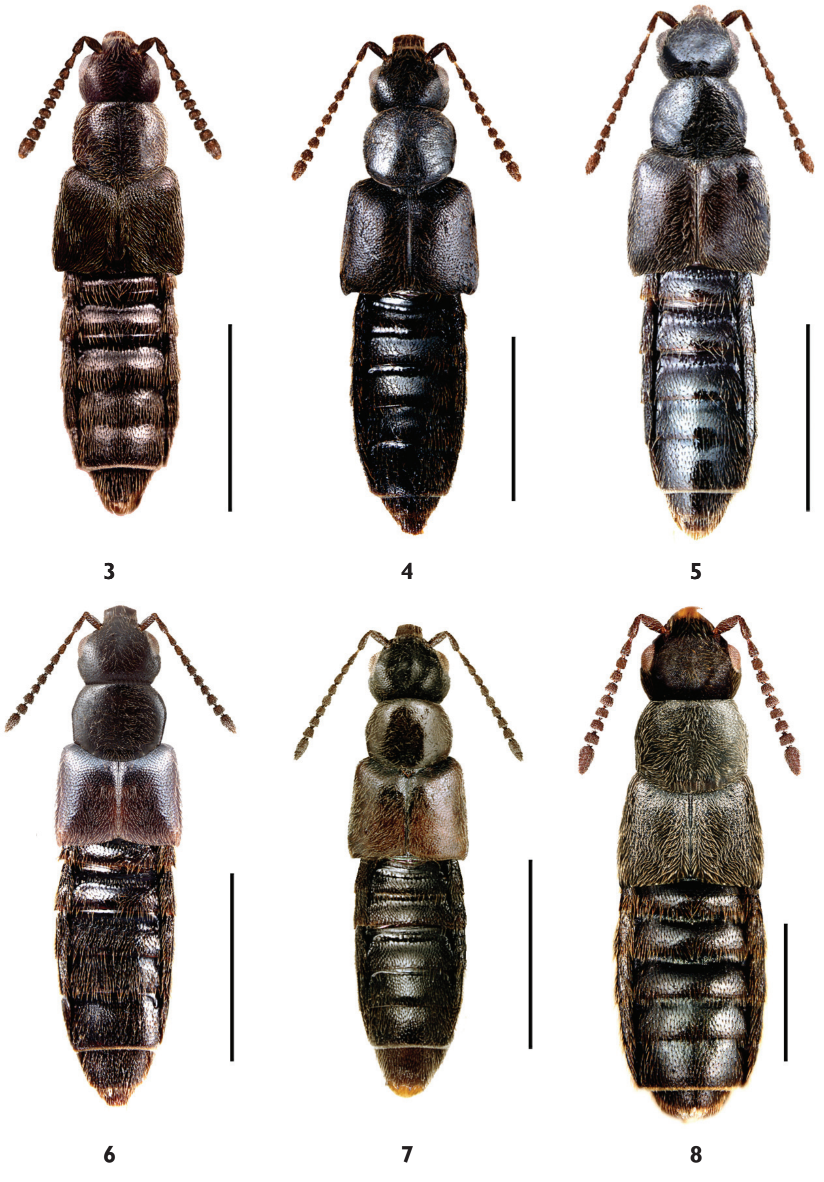
Diagnosis

Members of this genus may be distinguished by the following combination of characters: tarsi 4, 5, 5-articulated (Figs 1, 2); body medium sized, length 2.3-3.6 mm, moderately to strongly glossy, integument finely punctate and pubescent, pubescence moderately long and often silky in appearance; head and pronotum distinctly narrower than elytra (Figs 1-20); abdomen as broad as elytra at base or moderately narrower (Figs 1-20), subparallel (Figs 3-7), or broadening apically (Figs 9, 18 20), first three visible tergites with deep basal impressions bearing coarse punctures but without pronounced longitudinal ridges (Fig. 1); postgenal carinae incomplete or absent (Seevers 1978); pronotum broadest in apical third or in the middle of the disc, and converging apically and basally (Fig. 1), pubescence distributed postero-laterad from the midline of the disc (Figs 1-20); elytra much broader than both head or pronotum, and often with wavy pubescence pattern on both sides (Figs 1-20); mesoventral process moderately broad, attaining middle of mesocoxae, its apex truncate (Fig. 2); metaventral process broadly rounded (Fig. 2); first visible three tergites with deep basal impressions bearing coarse punctures; legs long and slender; basal article of metatarsus moderately elongate and usually shorter than the two following articles combined (Fig. 1). GENITAL STRUCTURES: median lobe of aedeagus consists of an enlarged, swollen bulbus and short, triangularly produced tubus (Figs 40, 41, 49, 58, 67, 68, 76, 84, 92, 100, 109, 110, 118, 131, 132, 140, 141, 149, 157, 165, 173, 182), crista apicalis of bulbus large and subtriangular in shape laterally (Figs 39, 48, 57, 56); paramere broad with short apical lobe bearing three long subapical and one short apical macrosetae (Figs 60, 77, 85, 119, 142, 150); male tergite 8 truncate, or rarely emarginated apically, its apical

Fig. 1. *Gnypeta nigrella* (LeConte), in dorsal view. Scale = 1 mm.

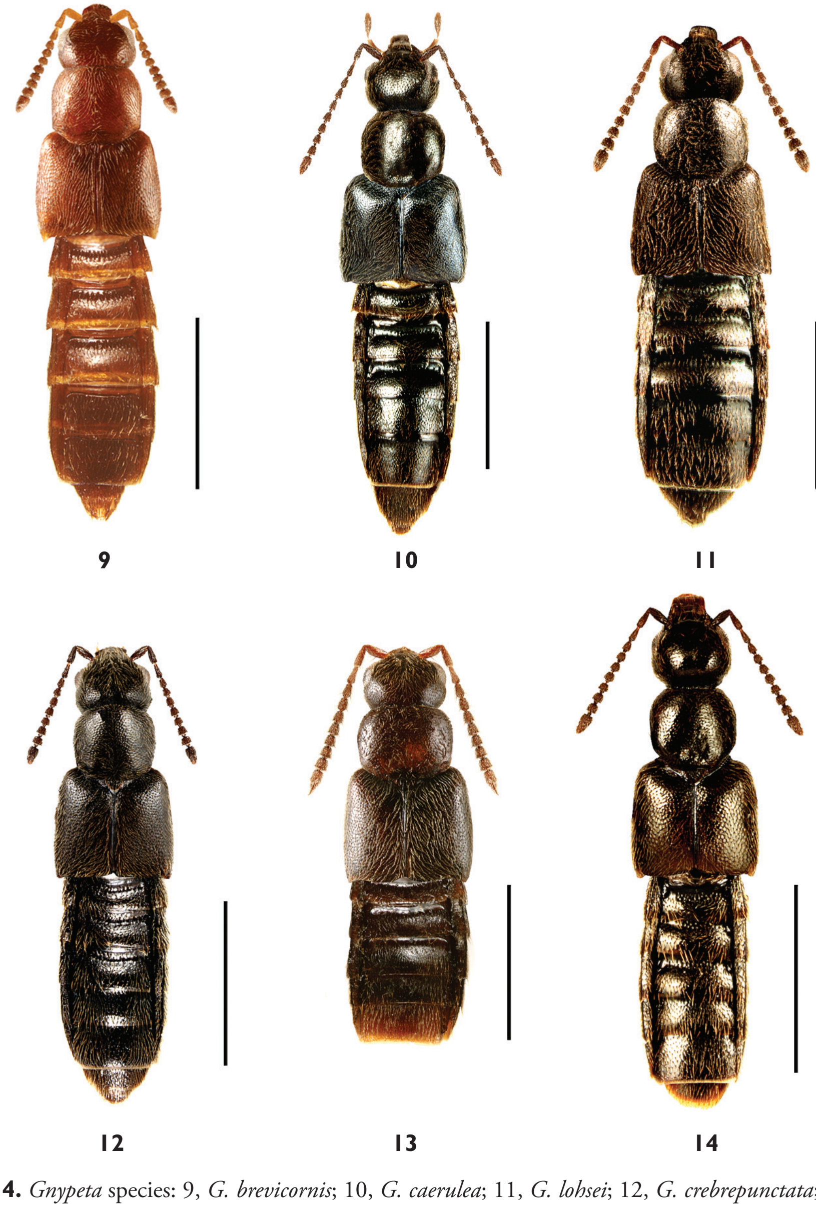
Fig. 2. *Gnypeta nigrella* (LeConte), in ventral view. Scale = 1 mm.

margin smooth or with small 2-4 dents (Figs 43, 52, 61, 78, 103, 112, 167); spermatheca of four types: S-shaped (Figs 105, 114, 153, 161), C-shaped (Figs 122, 127-129, 136), hatchet-shaped (Figs 45, 54, 63, 72, 80, 88, 96), or club-shaped (Figs 169, 178, 186, 187); capsule tubular with apical part approximately spherical (Figs 145, 169, 178, 186, 187), tubular (Figs 122, 127,153, 161), or funnel-shaped (Figs 45, 54, 63, 72); stem tubular, elongate, more or less sinuate and moderately swollen basally.



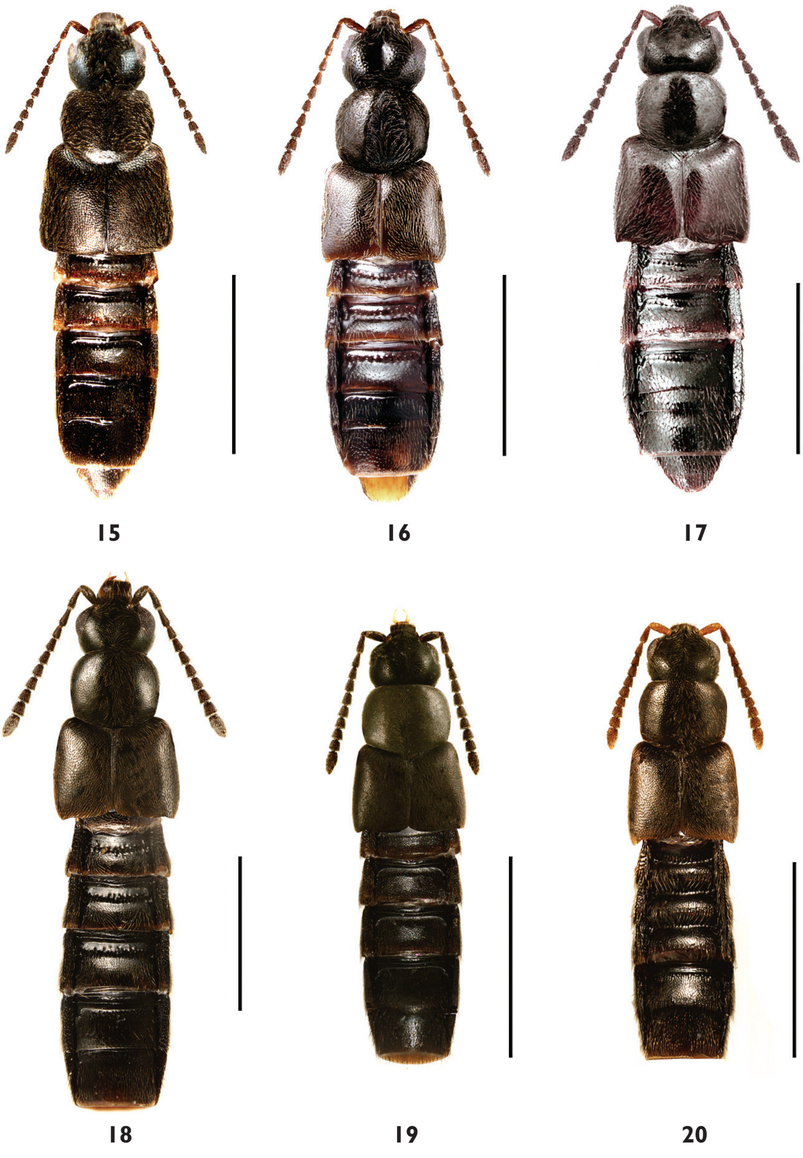
Figs 3-8. *Gnypeta* species: 3, *G. ashei*; 4, *G. brincki*; 5, *G. atrolucens*; 6, *G. sellmani*: 7, *G. dentata*; and 8, *G. groenlandica*. Scale = 1 mm

Sternite 8 of male and female with broad space between basal margin and antecostal suture (Figs 44, 47, 53, 56, 62, 65). *Gnypeta* is readily distinguished from most genera of Oxypodini by having 4, 5, 5-articulated tarsi and from closely related *Tachyusa* by robust body (slender in *Tachyusa*), abdomen at base as broad as elytra or only slightly narrower (much narrower in *Tachyusa*), lack of distinctive ridges in abdominal tergal impressions, and by less elongate basal article of metatarsus (usually shorter than the

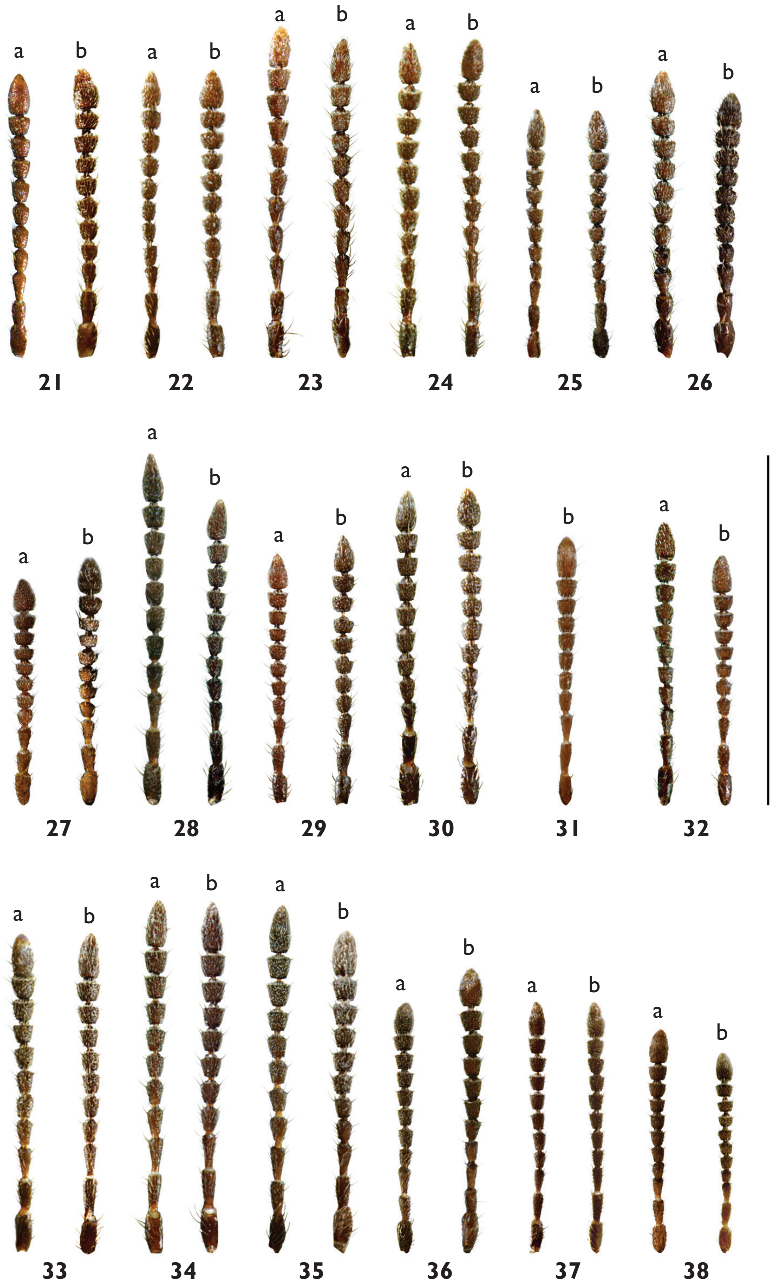


Figs 9-14. *Gnypeta* species: 9, *G. brevicornis*; 10, *G. caerulea*; 11, *G. lohsei*; 12, *G. crebrepunctata*; 13, *G. manitobae* [apical part of abdomen removed]; 14, *G. uteana*. Scale = 1 mm

two following articles combined). *Ischnopoda* Stephens is another related genus to *Gnypeta*, which differs externally by parallel-sided body, and extremely elongate metatarsus, exceeding 4/5 length of metatibia, and with basal article at least as long as the two following articles combined (Fig. 1). According to Paśnik (2007) the genus *Gnypeta* is closely related to *Tachyusa*, *Ischnopoderona* (Scheerpeltz) and *Ischnopoda*. The key for these four genera is provided by Paśnik (2007).



Figs 15-20. *Gnypeta* species: 15, *G. carbonaria*; 16, *G. helenae*; 17, *G. canadensis*; 18, *G. nigrella*; 19, *G. saccharina*; and 20, *G. minuta* [18-20, apical part of abdomen removed]. Scale = 1 mm



Figs 21-38. Antennae of *Gnypeta* species: *G. ashei*: 21a. male, 21b. female; *G. brincki*: 22a. male, 22b. female; *G. atrolucens*: 23a. male, 23b. female; *G. sellmani*: 24a. male, 24b. female; *G. dentata*: 25a. male, 25b. female; *G. groenlandica*: 26a. male, 26b. female: *G. brevicornis*: 27a. male, 27b. female; *G. caerulea*: 28a. male, 28b. female; *G. lohsei*: 29a. male, 29b. female; *G. crebrepunctata*: 30a. male, 30b. female; *G. manitobae*: 31b. female; *G. uteana*: 32a. male, 32b. female; *G. carbonaria*: 33a. male, 33b. female; *G. helenae*: 34a. male, 34b. female; *G. canadensis*: 35a. male, 35b. female; *G. nigrella*: 36a. male, 36b. female; *G. saccharina*: 37a. male, 37b. female; *G. minuta*: 38a. male, 38b. female. Scale = 1 mm

Collection and habitat data

Adults are associated with riparian habitats and debris along the margins of marshes, ponds, lakes, and streams (Ashe 2001). Some Canadian species were found in cold wet moss alongside streams. They may also occur in vegetation and litter along edges of streams, river, and lakes, in grass tussocks on mud flats, in gravel, wooded bogs, beaver lodges, and decaying fungi.

Phylogenetic affiliations

Seevers (1978) classified the genus *Gnypeta* in the tribe Oxypodini and the subtribe Tachyusae (=Tachyusina Thomson), together with the genera *Tachyusa* Erichson, *Trachyota* Casey, *Teliusa* Casey, *Gnypetella* Casey, *Meronera* Sharp, and *Brachyusa* Mulsant and Rey. He was tempted to consider Tachyusae as a distinct tribe on the grounds of 4, 5, 5-articulated tarsi and the genital features but he was afraid that this arrangement would obscure the relationship of *Gnypeta* to some related oxypodine genera. Bernhauer and Scheerpeltz (1926) did not separate genera of Tachyusina from Falagriini and grouped them together in the subtribe Falagriae of the tribe Myrmedoniini Ganglbauer. Lohse (1974) placed *Gnypeta* together with *Falagria* Leach, *Cordalia* Jacobs, *Myrmecopora* Saulcy and allied genera of the Falagriini. We agree with Seevers (1978) that grouping Tachyusae and Falagriae together, mainly on the grounds of 4, 5, 5-articulated tarsi and some superficial external similarities, was artificial and unwarranted. According to Seevers (1978) and confirmed here by us, the Tachyusae lack the following specialized features of the Falagriini: paramere with codylite velum separated from the paramerite velum; pronotum much narrower at base than apex and with distinct (at least one) median sulcus (sometimes two lateral sulci present); peritremes enlarged, and contiguous with or fused to elongate prosternum; procoxal cavities closed by peritremes, prosternum and inflexed hypomera. In addition the Falagriini have a basal abdominal impression bearing a median ridge, a very distinct shape of the median lobe of the aedeagus (ovoid bulbus and tubular broad tubus), small and narrowly elongate crista apicalis of bulbus, extremely long and coiled flagellum of the internal sac of the median lobe, and the spermatheca is of a different type with a small spherical capsule connected to a thin stem (Figs 165, 166, 169 in Klimaszewski and Winchester 2002). For diagnostic features of Tachyusina, see Seevers (1978). In his worldwide treatment of *Ischnopoda* Stephens, Paśnik (2006b) considered this genus to be closely related to *Tachyusa* and *Gnypeta*. Based on a comparative study of mouthparts and the body chaetotaxy, Yosii and Sawada (1976) suggested a restricted concept of *Tachyusa*-related genera and placed *Tachyusa* together with *Gnypeta,* and *Dacrila* Mulsant and Rey in the Tachyusa series of the Athetae. Their tribal affiliation of the *Tachyusa*-related genera with athetines is strongly questionable because of the differences in the genital features of the two groups e.g., lack of the "athetine bridge" in the median lobe of the aedeagus in genera of Tachyusini. Lohse (1989) excluded *Tachyusa*, *Gnypeta*, and *Dasygnypeta* Lohse from Falagriini and transferred them together with *Brachyusa* and *Dacrila* to the separate tribe Tachyusini. Paśnik (2006b), in his revision of the world species of *Tachyusa*, did not provide his view on the higher classification of *Tachyusa*-related genera but did not contradict the classification proposed by Lohse (1989). Paśnik (2007) published a revision of the African genus *Ischnopoderona* (Scheerpeltz), with cladistic analysis of the species. He included there the outgroup taxa of the genera *Gnypeta*, *Ischnopoda*, and *Tachyusa*. On his single most parsimonious cladogram the *Ischnopoderona* branched off as a sisiter taxon of *Tachyusa* and both of them combined formed a sister taxon of *Gnypeta*. The *Ischnopoderona* was the most basal branch of this tree.We believe that more research is needed before tribal classification of this group becomes clear and stable.

Checklist of *Gnypeta* species occurring in Canada, Alaska and Greenland

Conventions. Junior synonyms are indented. Some United States records, particularly from the states bordering Canada, are also included. The countries, states and provinces in bold represent new records. Species names are followed by the author only in the case of the new species described here and by the author with the original and some subsequent reference data for the species already described.

Review of Canadian, Alaskan and Greenlandian species

I. *Gnypeta sellmani* species group

1. *Gnypeta ashei* Klimaszewski **sp. nov.** (**CANADA: Manitoba, Northwest Territories, Yukon Territory; UNITED STATES: Alaska**).
2. *Gnypeta brincki* Palm 1966: 139; Smetana 2004: 489. (**CANADA: Quebec, Yukon Territory, Northwest Territories; UNITED STATES: Alaska;** EUROPE: Finland, Norway, Sweden).
3. *Gnypeta atrolucens* Casey 1894: 346, 1906: 197; Moore and Legner 1975: 421 (**CANADA: Newfoundland, Quebec;** UNITED STATES: New Hampshire, New York, Vermont).
4. *Gnypeta sellmani* Brundin 1929: 14; Palm 1966: 139; Smetana 2004: 490. (**CANADA: Quebec, Manitoba, Saskatchewan, Yukon Territory, Northwest Territories; UNITED STATES: Alaska**; EUROPE: Finland, Norway, Sweden, Russia).
5. *Gnypeta dentata* Klimaszewski **sp. nov.** (**CANADA: Saskatchewan, Alberta, Northwest Territories**).
6. *Gnypeta groenlandica* Lohse 1989: 58 (**CANADA: Manitoba, Northwest Territories, Nunavut; UNITED STATES: Alaska;** GREENLAND).
7. *Gnypeta brevicornis* Casey 1906: 196; Moore and Legner 1975: 421. (CANADA: British Columbia).

II. *Gnypeta caerulea* species group

8. *Gnypeta caerulea* (C.R. Sahlberg 1830: 351); Bernhauer and Scheerpeltz 1926: 587; Palm 1966: 138; Muona 1984: 228; Campbell and Davies 1991: 100; Smetana 2004: 489.

(**CANADA:** Newfoundland, Nova Scotia, **New Brunswick**, Prince Edward Island, **Quebec, Ontario, Manitoba, Saskatchewan, Alberta, Yukon Territory, Northwest Territories; UNITED STATES: Alaska**; EUROPE, ASIA).

9. *Gnypeta lohsei* Klimaszewski **sp. nov.** (**CANADA: Alberta, British Columbia; UNITED STATES: Alaska, Washington**).

III. *Gnypeta crebrepunctata* species group

10. *Gnypeta crebrepunctata* (Casey 1886: 203); Casey 1906: 194; Moore and Legner 1975: 421.
    (**CANADA: British Columbia**; UNITED STATES: California, Oregon).
    Gnypeta oblata Casey 1911: 168. As synonym of *G. helenae*: Moore and Legner 1975: 422. (UNITED STATES: California). **New synonymy**.
11. *Gnypeta manitobae* Casey 1906: 196. As *G. bockiana* Casey: Moore and Legner 1975: 421. (Canada, Manitoba, Winnipeg).
12. *Gnypeta uteana* (Casey 1911: 169); Moore and Legner 1975: 422. (**CANADA: Alberta**; UNITED STATES: California, Colorado, Utah).
    Gnypeta boulderensis Casey 1911: 167. As synonym of *G. helenae*: Moore and Legner 1975: 422. (UNITED STATES: Colorado). **New synonymy**.
    Gnypeta punctatula Casey 1906: 194. As synonym of *G. helenae*: Moore and Legner 1975: 422. (UNITED STATES: California). **New synonymy**.
13. *Gnypeta carbonaria* (Mannerheim 1830: 75); Smetana 2004: 489. (**CANADA: New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, Northwest Territories**; **UNITED STATES: Alaska**; EUROPE, NORTH AFRICA, ASIA).

IV. *Gnypeta helenae* species group

14. *Gnypeta helenae* Casey 1906: 193; Moore and Legner 1975: 422 (**CANADA: Alberta, British Columbia**; UNITED STATES: Arizona, Montana, Oregon).
    Gnypeta deserticola Casey 1906: 193. Synonymized by Moore and Legner 1975: 422. Synonymy confirmed.
    Gnypeta oregona Casey 1906: 199. Synonymized by Moore and Legner 1975: 422. Synonymy confirmed.
15. *Gnypeta canadensis* Klimaszewski, sp. nov. (**CANADA: Alberta, Ontario**).

V. *Gnypeta nigrella* species group

16. *Gnypeta nigrella* (LeConte 1863: 29); Bland 1865: 412; Moore and Legner 1975: 422. (**CANADA: New Brunswick**; UNITED STATES: Massachusetts, Pennsylvania, Maryland, **Vermont**).
17. *Gnypeta saccharina* Klimaszewski and Webster, sp. nov. (**CANADA: New Brunswick**).
18. *Gnypeta minuta* Klimaszewski and Webster, sp. nov. (**CANADA: New Brunswick**).

Species excluded from *Gnypeta*

Tachyusa harfordi Casey 1885: 304. Transferred to *Gnypeta*: Casey 1906: 202. Reinstated to the original combination, *Tachyusa harfordi* Casey (Paśnik 2006a: 118).

Key to *Gnypeta* species occurring in Canada, Alaska and Greenland

1. Basal article of metatarsus longer than two following articles combined...... 2
– Basal article of metatarsus at most as long as two following articles combined (Fig. 1).. 3
2. Antennal articles 8-10 strongly transverse (Figs 27 a, b); median lobe of aedeagus with narrowly triangular apical part in lateral view (Fig. 91), and bulbus with two lateral projections in dorsal view (Fig. 92); spermatheca with capsule pitcher-shaped (Fig. 96); female sternite 8 rounded apically (Fig. 98) ....***G. brevicornis* Casey**
– Antennal articles 8-10 quadrate or slightly elongate (Figs 32 a, b); median lobe of aedeagus with broadly triangular apical part in lateral view (Fig. 130); spermatheca C-shaped, capsule mushroom-formed (Fig. 136); female sternite 8 emarginate apically (Fig. 138) .... ***G. uteana* (Casey)**
3. Body broad and robust (Fig. 8), pronotum at base about as broad as elytra (Fig. 8), abdomen swollen medially and at base as broad as elytra (Fig. 8); median lobe of aedeagus and spermatheca as illustrated (Figs 83, 84, 88) .... ***G. groenlandica* Lohse**
– Body narrow and less robust (Figs 3, 5, 6, 9, 14, 15), pronotum at base narrower than elytra, abdomen subparallel and at base narrower than elytra (Figs 3, 7, 9-15); genitalia differently shaped 4
4. Elytra at suture approximately as long as pronotum (Figs 3, 6, 7, 10, 15-19) 5
– Elytra at suture distinctly longer than pronotum (Figs 4, 5, 11-13, 20).... 13
5. Antennal articles 7-10 strongly transverse (Figs 21 a, b); median lobe of aedeagus and spermatheca as illustrated (Figs 39, 40, 41, 45) .... ***G. ashei* sp. nov.**
– Antennal articles 7-10 elongate, subquadrate or slightly transverse (Figs 23-25 a, b, 28 a, b, 31 b, 33-37 a, b); genitalia differently shaped (Figs 75, 76, 80, 99-101, 105, 139-141, 145, 148, 149, 153, 156, 157, 161, 164, 165, 169, 172-174, 178)..... 6
6. Antennal articles 7-10 slightly transverse (Figs 24 a, b, 25 a, b, 33 a, b); female sternite 8 without deep median emargination (Figs 74, 82, 147) 7
– Antennal articles 7-10 elongate or subquadrate (Figs 28 a, b, 34-37 a, b); female sternite 8, except for *G. caerulea*, with deep apical emargination (Figs 107, 155, 163, 171, 180).. 9
7. Body length 3.0-3.4 mm; median lobe of the aedeagus with apical part narrowly produced (Fig. 66); spermatheca with capsule funnel-shaped and as wide as long (Fig. 72).. ***G. sellmani* Brundin**

– Body length 2.5-3.0 mm; median lobe of aedeagus and spermatheca differently shaped (Figs 75, 76, 80, 139-141, 145) 8
8. Body length 2.5-2.7 mm; male tergite 8 with four apical dents on apical margin (Fig. 78); spermatheca with capsule funnel-shaped (Fig. 80); median lobe of aedeagus with apical part narrowly triangular with sinuate margins (Fig. 75) .... ***G. dentata* sp. nov.**
– Body length 2.7-3.0 mm; male tergite 8 without teeth and with minute median emargination on apical margin (Fig. 143); spermatheca with apical part of capsule approximately spherical (Fig. 145); median lobe of aedeagus with apical part moderately narrowly triangular, narrowly bottle-shaped (Fig. 139) .... ***G. carbonaria* (Mannerheim)**
9. Integument moderately glossy with minute pubescence (Figs 18, 19); basal three tergal impressions virtually impunctate except for the margins of tergites (Figs 1, 18, 19); body length 2.4-3.0 mm; genitalia as in Figs 164, 165, 169, 172-174, 178 10
– Integument strongly glossy with pubescence moderately long (Figs 10, 16, 17); basal three tergal impressions with dispersed punctation (Figs 10, 16, 17); body length 2.7-3.5 mm; genitalia as illustrated (Figs 99-101, 105, 148, 149, 153, 156, 157, 161) 11
10. Pronotum and abdomen at base distinctly narrower than elytra (Fig. 18); first three visible tergal impressions lacking coarse punctation except for the posterior margin (Fig. 1); median lobe of aedeagus with tubus swollen laterally (Fig. 164), spermatheca club-shaped (Fig. 169) .... ***G. nigrella* (LeConte)**
– Pronotum and abdomen at base slightly narrower than elytra (Fig. 19); first three visible tergal impressions with dispersed coarse punctation; genital structures differently shaped (Figs 172-174, 178) ..... ***G. saccharina* sp. nov.**
11. Body length 3.0-3.5 mm; genitalia as illustrated (Figs 99-101, 105) .... ***G. caerulea* (Sahlberg)**
– Body length 2.5-3.0 mm; genitalia differently shaped (Figs 148, 149, 153, 156, 157, 161) 12
12. Median lobe of aedeagus with moderately broad and slightly produced ventrally apical part (Fig. 148); spermatheca with thin stem (Fig. 153); western Canada .... ***G. helenae* Casey**
– Median lobe of aedeagus narrowly triangular and strongly produced ventrally (Fig. 156); spermatheca with moderately wide stem (Fig. 161); eastern Canada .... ***G. canadensis* sp. nov.**
13. Antennal articles 7-10 strongly elongate (Figs 23 a, b); median lobe of aedeagus and spermatheca as illustrated (Figs 57-59, 63) .... ***G. atrolucens* Casey**
– Antennal articles 7-10 subquadrate to transverse (Figs 22 a, b, 29-31 a, b, 38 a, b); genital structures differently shaped (Figs 48-50, 54, 108-110, 114, 117, 118, 122, 127-129, 181-182, 186, 187) 14
14. Abdomen broad, at base approximately as broad as elytra (Figs 11, 13); genital structures as illustrated (Figs 108-110, 114, 127-129) 15

– Abdomen moderately broad, at base distinctly narrower than elytra (Figs 4, 12, 20); genital structures differently shaped (Figs 48-50, 54, 117, 118, 122, 181, 182, 186, 187) 16

15. Antennal articles 7-10 subquadrate (Fig. 31 b); spermatheca C-shaped (Figs 127-129) .... ***G. manitobae*** **Casey**

– Antennal articles 7-10 transverse (Figs 29 a, b); spermatheca S-shaped (Fig. 114).. ***G. lohsei*** **sp. nov.**

16. Pronotum almost as wide as elytra (Fig. 20); punctures in abdominal impressions very coarse (Fig. 20); abdomen strongly narrowed at base (Fig. 20); genital structures as illustrated (Figs 181, 182, 186, 187)............................. ....***G. minuta*** **sp. nov.**

– Pronotum distinctly narrower than elytra (Figs 4, 12); punctures in abdominal impressions fine or moderately coarse (Figs 4, 12); genital structures differently shaped (Figs 48-50, 54, 117, 118, 122)....................................... 17

17. Body small, length 2.7-3.0 mm (Fig. 12); median lobe of aedeagus with apical part narrowly produced ventrally (Fig. 117); spermatheca C-shaped, tubular (Fig. 122)... ***G. crebrepunctata*** **(Casey)**

– Body large, length 3.2-3.6 mm (Fig. 4); median lobe of aedeagus with apical part broadly triangular in lateral view (Fig. 48); spermatheca with funnel-shaped capsule and thin and sinuate stem (Fig. 54) ....***G. brincki*** **Palm**

I. *Gnypeta sellmani* species group

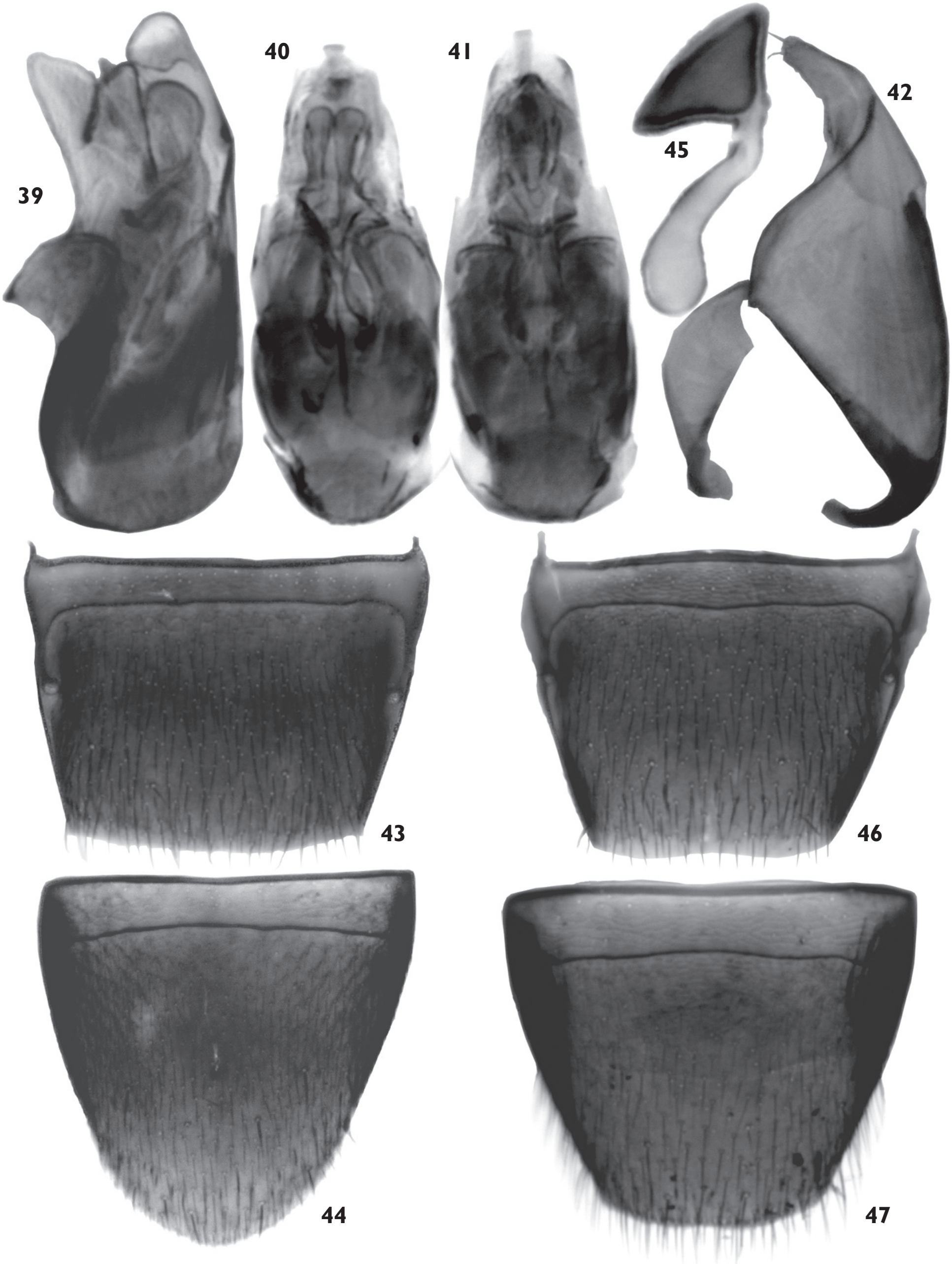
The *sellmani* species group may be characterized by the following combination of characters: spermatheca with pitcher-shaped capsule bearing broad invagination, and club-shaped stem (Figs 45, 54, 63, 72, 80, 88, 96); median lobe of aedeagus with short tubus, narrowly or broadly triangular in lateral view (Figs 39, 48, 57, 66, 75, 83, 91).

Species included: *G. brevicornis* Casey, *G. ashei* Klimaszewski, sp. nov., *G. brincki* Palm, *G. atrolucens* Casey, *G. dentata* Klimaszewski, sp. nov., *G. groenlandica* Lohse; and *G. sellmani* Brundin.

1. *Gnypeta ashei* Klimaszewski, sp. nov.

urn:lsid:zoobank.org:act:C0AC9EAB-C95F-481E-BCD9-C3046CBEEA33
(Figs 3, 21 a, b, 39-47, 190)

HOLOTYPE (male): CANADA, Northwest Territories, Hazen Camp, Ellesmere I., [81°49'00" N, 71°20'00" W] 10.VIII.1961, D.R. Olivier; paratype *Gnypeta larifuga* Ashe [manuscript name], det. Ashe 1987, CNC No. 23676 (CNC). **PARATYPES**: listed in Appendix A.



Figs 39-47. Genital structures of *Gnypeta ashei*: 39, median lobe of the aedeagus in lateral view, 40, dorsal view, 41, ventral view; 42, paramere; 43, male tergite 8; 44, male sternite 8; 45, spermatheca; 46, female tergite 8; 47, female sternite 8.

Etymology

This species is named after the late Steve Ashe of the University of Kansas who discovered this species but did not publish it. The CNC specimens, which he examined, bear his identification labels as the manuscript – unpublished name "*Gnypeta larifuga* Ashe".

Diagnosis

This species can be recognized by the following combination of characters: body length 2.5-2.8 mm (Fig. 3); elytra (at suture) about as long as pronotum and 1/4 wider than maximum width of pronotum (Fig. 3); abdomen at base slightly narrower than elytra (Fig. 3); antennal articles 4-6 subquadrate, and 7-9 transverse (Fig. 3); median lobe of aedeagus with apex broadly triangular (Fig. 39); spermatheca with capsule wider than long and broadly funnel-shaped (Fig. 45); stem sinuate and slightly swollen basally (Fig. 45).

Description

Body length 2.5-2.8 mm; dark brown to black, sometimes central part of elytra and tarsi reddish brown (Fig. 3); integument strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 slightly shorter than preceding article, articles 4-6 subquadrate to slightly elongate in male, and 7-9 transverse (Fig. 21 a, b); head and pronotum of about the same width (Fig. 3); elytra and abdomen wider than either head or pronotum; elytra small and short (Fig. 3); head rounded basally; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra (at suture) about as long as pronotum and 1/4 broader than maximum width of pronotum (Fig. 3), pubescence directed obliquely postero-laterad, with wavy pattern on medial part of disc; abdomen subparallel, slightly narrower than elytra at base (Fig. 3); metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically (Fig. 43). Sternite 8 about as long as wide and slightly produced posteriorly (Fig. 44). Median lobe of aedeagus with broadly triangular apical part of tubus in lateral view (Fig. 39); bulbus moderately sized (Figs 40, 41); internal sac with structures as illustrated (Figs 39-41). **Female**. Tergite 8 similar to that of male (Fig. 46). Sternite 8 broadly rounded posteriorly (Fig. 47). Spermatheca with capsule wider than long and broadly funnel-shaped (Fig. 45), stem sinuate and swollen basally (Fig. 45).

Distribution (Fig. 190)

Gnypeta ashei is a Nearctic species recorded here from Manitoba, Yukon Territory, Northwest Territories, and Alaska.

Collection and habitat data

Adults were collected in June, July and August from marsh, by treading sedges around edge of a pond, and by sifting litter at the shore of a lagoon. One specimen was taken on snow on Devon Island.

Comments

The late Steve Ashe (University of Kansas) worked on a revision of Nearctic *Gnypeta* but was not able to complete it. Some specimens of this species that he studied were returned to CNC with his 1987 identification labels as "*G. larifuga* Ashe" [manuscript name – unpublished].

2. *Gnypeta brincki* Palm

(Figs 4, 22 a, b, 48-56, 191)

TYPE LOCALITY: SWEDEN, Torne Lappmark, Abisco, 1947 (LUC). Holotype not examined.

Material examined

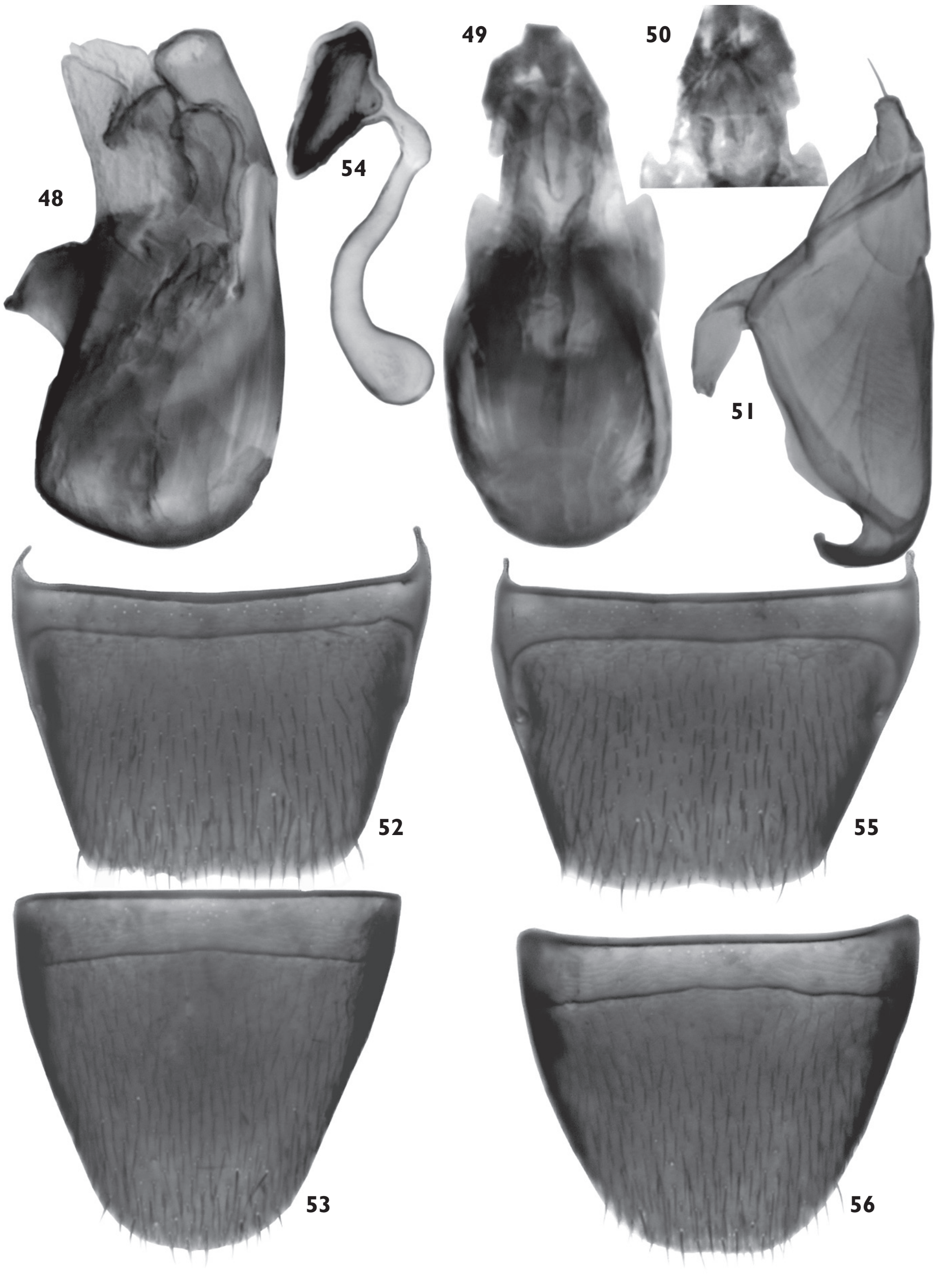
Specimens are listed in Appendix A.

Diagnosis

This species can be recognized by the following combination of characters: body length 3.2-3.6 mm (Fig. 4); elytra (at suture) slightly longer than pronotum and 1/3 wider than maximum width of pronotum (Fig. 4); abdomen at base distinctly narrower than elytra (Fig. 4); antennal articles 4-6 elongate in males and subquadrate in females, articles 7-9 transverse (Figs 22 a, b); median lobe of aedeagus with apical part broadly triangular in lateral view (Fig. 48); spermatheca with capsule wider than long and funnel-shaped (Fig. 54); stem sinuate and slightly swollen basally (Fig. 54).

Description

Body length 3.2-3.6 mm; black, sometimes central part of elytra and tarsi reddish brown (Fig. 4); integument strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 slightly shorter than preceding one, 4-6 elongate in males and subquadrate in females, articles 7-9 transverse (Figs 22 a, b); head and pronotum of about the same width, abdomen wider than either head or pronotum; elytra large and distinctly broader than remainder of body (Fig. 4); head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra (at suture) slightly longer than pronotum and 1/3 broader than maximum width of pronotum (Fig. 4), pubescence directed obliquely laterad; abdomen subparallel; metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically (Fig. 52). Sternite 8 slightly transverse and rounded posteriorly (Fig. 53). Median lobe of aedeagus with broadly triangular apical part of tubus in lateral view (Fig. 48), bulbus enlarged and bearing two small angular anterior projections in dorsal view (Fig. 49), internal sac with structures as illustrated (Figs 48-50). **Female**. Tergite 8 similar to that of male (Fig. 55). Sternite 8 broadly rounded posteriorly (Fig. 56). Spermatheca with capsule wider than long and funnel-shaped (Fig. 54); stem sinuate and slightly swollen basally (Fig. 54).



Figs 48-56. Genital structures of *Gnypeta brincki*: 48, median lobe of the aedeagus in lateral view, 49, dorsal view, 50, apical part of median lobe in ventral view; 51, paramere; 52, male tergite 8; 53, male sternite 8; 54, spermatheca; 55, female tergite 8; 56, female sternite 8.

Distribution (Fig. 191)

Gnypeta brincki is a Holarctic species with probably circumpolar distribution. In the Palaearctic region it was recorded from Norway, Sweden and Finland (Palm 1966; Smetana 2004). Here, it is recorded for the first time in North America from Quebec, Yukon Territory, Northwest Territories and Alaska.

Collection and habitat data

Adults were collected in June, July, and August. The Quebec specimen was found in an estuary of a river, 1-2 m above high tide line in organic mat on sand and gravel. The Yukon and Northwest Territories specimens were captured at altitudes ranging from 1005-1280 m.

3. *Gnypeta atrolucens* Casey

(Figs 5, 23 a, b, 57-65, 192)

Casey 1894: 346, 1906: 197; Moore and Legner 1975: 421. **LECTOTYPE** (male): UNITED STATES: New York [in original description], *Gnypeta atrolucens* Casey [Casey's handwriting]; Type USNM 38867; Casey bequest 1925; *Gnypeta atrolucens* Lectotypus Lohse des. 1989 [designation not published]; present lectotype designation label by Klimaszewski 2008 (USNM). Examined.

Material examined

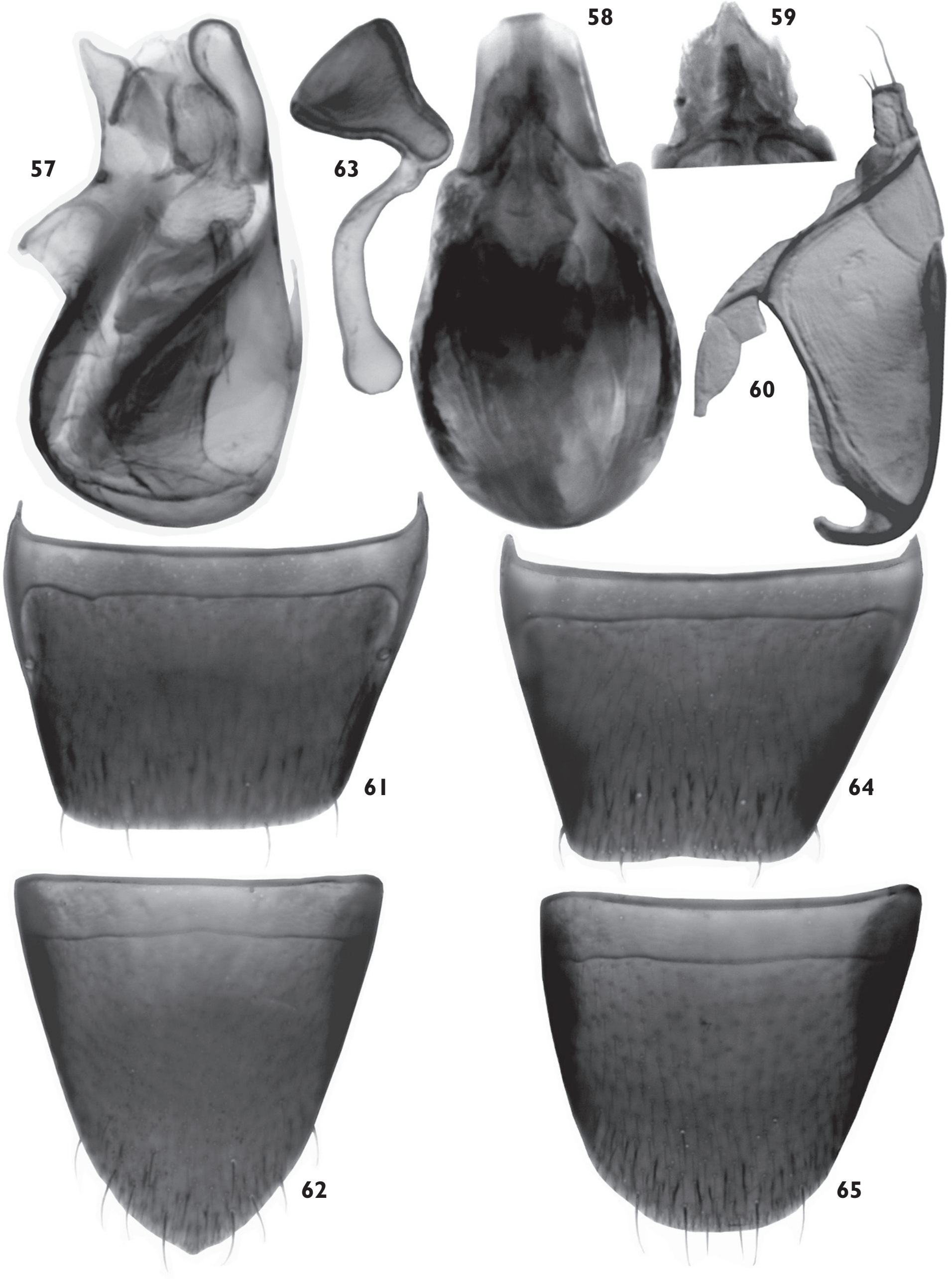
Specimens are listed in Appendix A.

Diagnosis

This species can be recognized by the following combination of characters: body length 3.2-3.4 mm (Fig. 5); elytra (at suture) about 1/5 longer and 1/3 wider than maximum width of pronotum (Fig. 5); abdomen at base distinctly narrower than elytra (Fig. 5); antennal articles 4-7 strongly elongate (Fig. 23 a, b); median lobe of aedeagus with triangular and constricted subapically in lateral view (Fig. 57); spermatheca with capsule longer than wide and funnel-shaped (Fig. 63), stem approximately straight or slightly curved and slightly swollen basally (Fig. 63).

Description

Body length 3.2-3.4 mm; dark brown to black, central part of elytra and tarsi or entire legs reddish brown (Fig. 5); integument strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 slightly shorter than preceding article, 5-7 elongate, 8-9 subquadrate or slightly elongate (Figs 23 a, b); head, pronotum and abdomen of about the same width, elytra large and distinctly broader than remainder of body (Fig. 5); head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra (at suture) about 1/5 longer and 1/3 broader than maximum width of pronotum (Fig. 5), pubescence directed obliquely postero-laterad; abdomen subparal-



Figs 57-65. Genital structures of *Gnypeta atrolucens*: 57, median lobe of the aedeagus in lateral view, 58, dorsal view, 59, apical part of median lobe in ventral view; 60, paramere; 61, male tergite 8; 62, male sternite 8; 63, spermatheca; 64, female tergite 8; 65, female sternite 8.

lel; metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically (Fig. 61). Sternite 8 elongate and pointing medially (Fig. 62). Median lobe of aedeagus with triangular and produced apical part of tubus in lateral view (Fig. 57); bulbus enlarged and bearing two angular anterior projections in dorsal view (Fig. 58); internal sac with structures as illustrated (Figs 58, 59). **Female**. Tergite 8 similar to that of male (Fig. 64). Sternite 8 broadly rounded apically (Fig. 65). Spermatheca with capsule longer than wide and funnel-shaped (Fig. 63), stem slightly curved and slightly swollen basally (Fig. 63).

Distribution (Fig. 192)

Gnypeta atrolucens was described from New York (Casey 1894), and it was later reported from the Catskill Mts., New York (Casey 1906: 197). We report this species for the first time from Canada in Quebec and southeastern Labrador.

Collection and habitat data

Adults were captured from July through August at altitudes from 61 m to 853 m.

Comments

In the original description, Casey (1894) did not specify the number of specimens on which the description was based and therefore we have designated the only male in Casey's type collection as the lectotype.

4. *Gnypeta sellmani* Brundin

(Figs 6, 24 a, b, 66-74, 193)

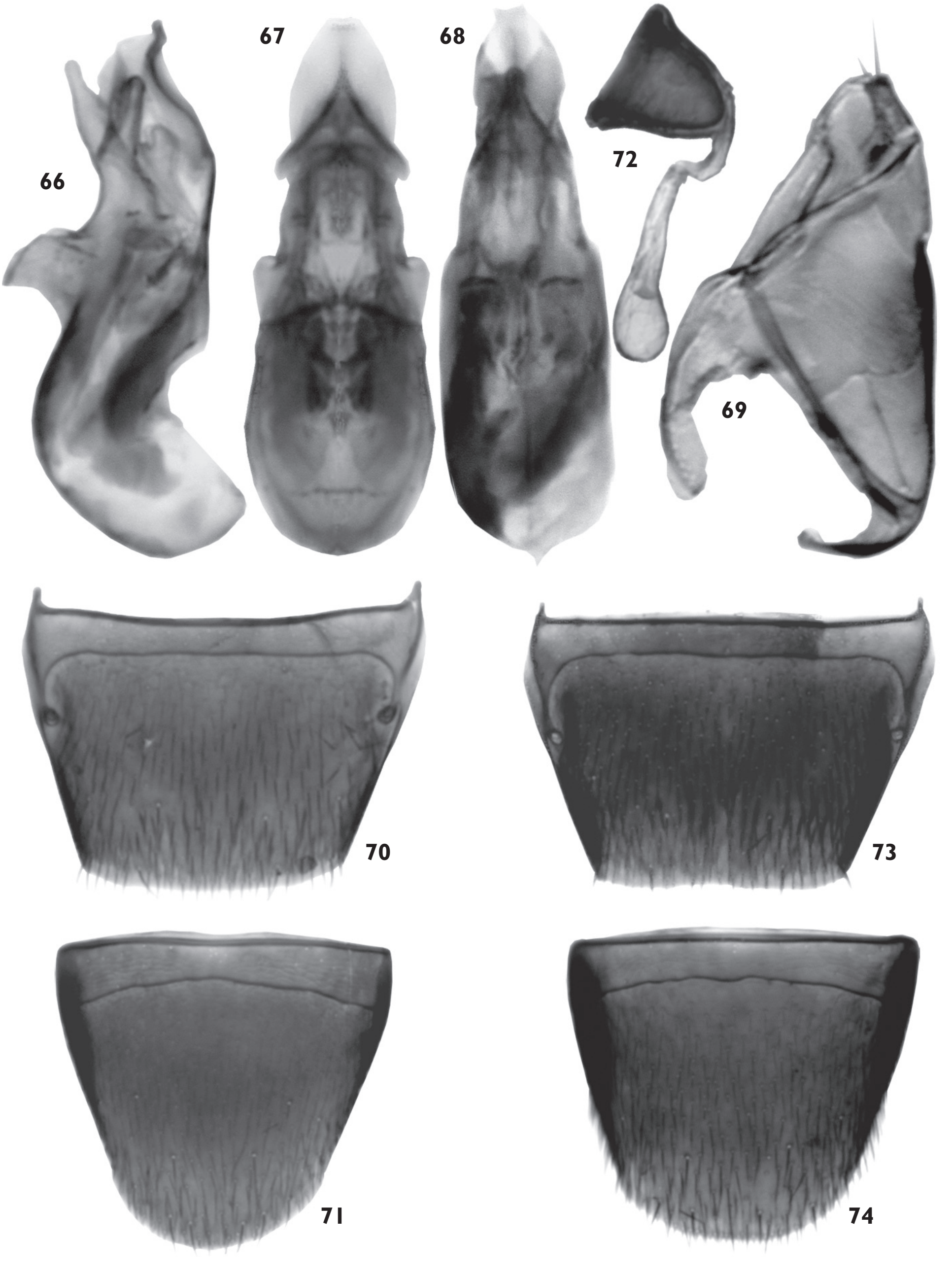
Gnypeta sellmani Brundin 1929: 14; Palm 1966: 139; Smetana 2004: 490. **TYPE LOCALITY**: SWEDEN, "Bei dem Bahnhof Torneträsk, 13.VIII.1927, Regio subarctica". Holotype not examined.

Material examined

Specimens are listed in Appendix A.

Diagnosis

This species can be recognized by the following combination of characters: body length 3.0-3.4 mm (Fig. 6); elytra (at suture) about as long as pronotum and about 1/4 wider than maximum width pronotum (Fig. 6); abdomen at base about as wide as elytra (Fig. 6); antennal articles 4-6 moderately elongate, 7-9 about as long as wide or slightly transverse (Figs 24 a, b); median lobe of aedeagus with apex narrowly triangular and strongly produced (Fig. 66); spermatheca with capsule about as wide as long and funnel-shaped (Fig. 72); stem sinuate and slightly swollen basally (Fig. 72).



Figs 66-74. Genital structures of *Gnypeta sellmani*: 66, median lobe of the aedeagus in lateral view, 67, dorsal view, 68, apical part of median lobe in ventral view; 69, paramere; 70, male tergite 8; 71, male sternite 8; 72, spermatheca; 73, female tergite 8; 74, female sternite 8.

Description

Body length 3.0-3.4 mm; dark brown to black, sometimes central part of elytra and tarsi reddish brown (Fig. 6); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 slightly shorter than preceding article, 4-6 elongate, and 7-9 about as long as wide to slightly transverse (Figs 24 a, b); head and pronotum of about the same width; elytra and abdomen wider than either head or pronotum; elytra small and short (Fig. 6); head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra (at suture) about as long as pronotum and 1/4 broader than maximum width of pronotum (Fig. 6), pubescence directed obliquely postero-laterad; abdomen subparallel, about as wide as elytra at base (Fig. 6); metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically (Fig. 70). Sternite 8 elongate and rounded posteriorly (Fig. 71). Median lobe of aedeagus with narrowly produced apical part of tubus in lateral view (Fig. 66); bulbus enlarged and bearing two angular anterior projections in dorsal view (Fig. 67); internal sac with structures as illustrated (Figs 67, 68). **Female**. Tergite 8 similar to that of male (Fig. 73). Sternite 8 broadly rounded apically (Fig. 74). Spermatheca with capsule about as wide as long and funnel-shaped (Fig. 72), stem sinuate and slightly swollen basally (Fig. 72).

Distribution (Fig. 193)

Gnypeta sellmani is a Holarctic species with a likely circumpolar distribution. In the Palaearctic region it is recorded from Norway, Sweden, Finland and the north European territory of Russia (Smetana 2004). Here, it is recorded for the first time in North America from Quebec, Manitoba, Saskatchewan, Yukon Territory, Northwest Territories and Alaska. In Quebec several specimens were captured from Mont Albert (1233 m) and Mont Jacques Cartier (1333 m) where other insect species with a northern distribution pattern are known to occur.

Collection and habitat data

Adults were collected in June, July and August from moss, near body of water, or by treading sedges around edge of temporary pond. Collecting sites ranged in altitude from 66 m to 1333 m.

Comments

The late Steve Ashe (University of Kansas) worked on the revision of Nearctic *Gnypeta* but was not able to complete it. Some specimens of this species that he studied were returned to CNC with his 1987 identification labels as two new species, *G. tintinnabula* Ashe and *G. dialepta* Ashe [manuscript – unpublished names]. His specimens were misidentified and belong to *G. sellmani* Brundin.

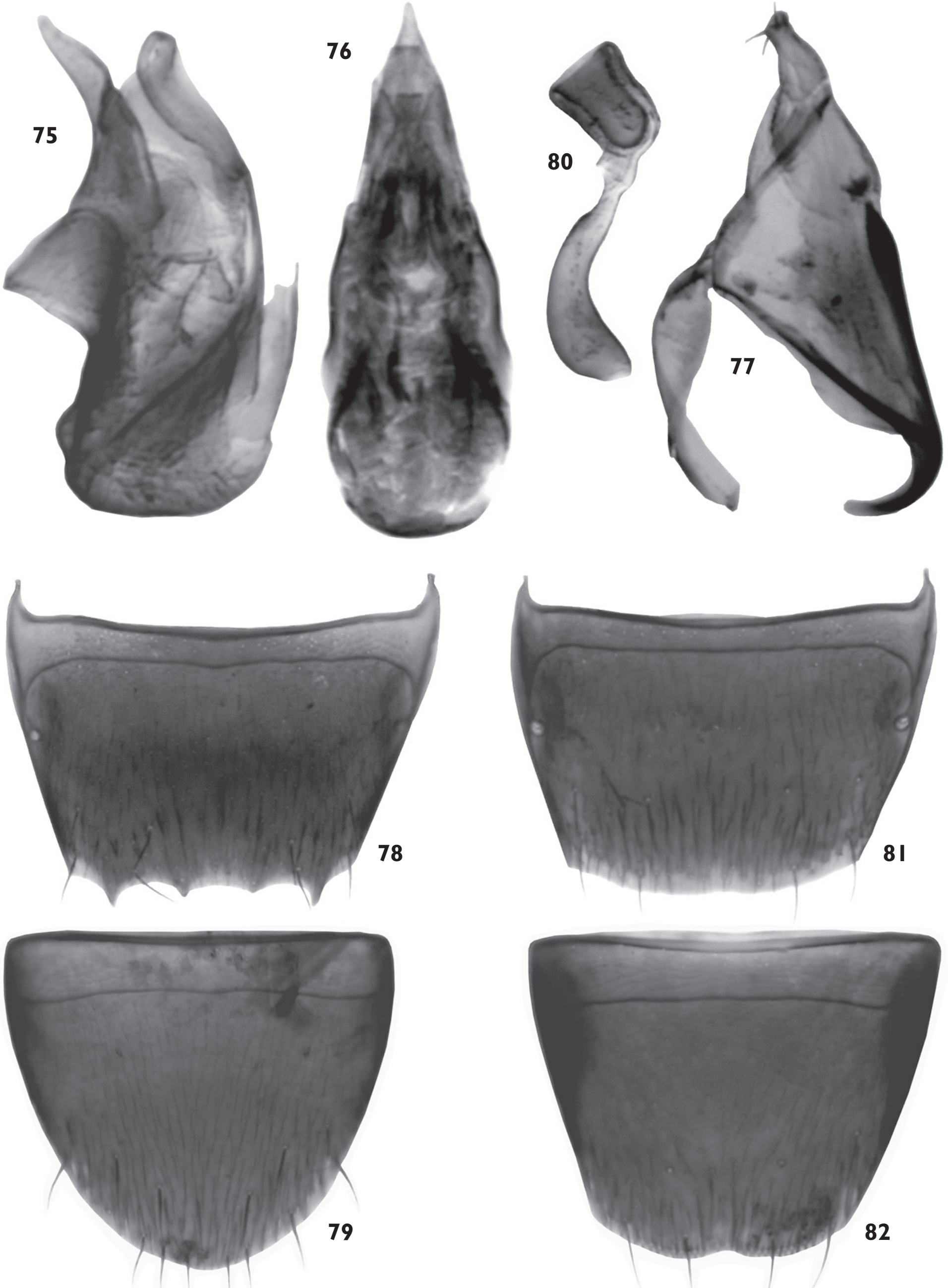
5. *Gnypeta dentata* Klimaszewski, sp. nov.
urn:lsid:zoobank.org:act:F1457DAA-A6BF-4814-A8BF-BEE50404EB1F
(Figs 7, 25 a, b, 75-82, 194)

HOLOTYPE (male): CANADA, Northwest Territories, Unnamed Lake, 18 mi NW Inuvik, via East Channel, [≈ 68°21' N, 133°43' W] 26.VI.1972, A. Smetana, CNC No. 23677 (CNC). **PARATYPES**: listed in Appendix A.

Etymology
This species is named for distinct dents on male tergite 8.

Diagnosis
This species can be recognized by the following combination of characters: body length 2.5-2.7 mm (Fig. 7); elytra (at suture) about as long as pronotum and 1/4 wider than maximum width of pronotum (Fig. 7); abdomen at base slightly narrower than elytra (Fig. 7); antennal articles 4-6 subquadrate to moderately elongate, articles 7-9 slightly transverse (Figs 25 a, b); median lobe of aedeagus with apex narrowly produced with sinuate margins in lateral view (Fig. 75); spermatheca with capsule funnel-shaped and cylindrical (Fig. 80); stem curved and slightly swollen basally (Fig. 80); male tergite 8 with four apical dents (Fig. 78).

Description
Body length 2.5-2.7 mm; dark brown to black, sometimes central part of elytra and legs or tarsi only reddish brown (Fig. 7); integument moderately strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 slightly shorter than preceding article, articles 4-6 quadrate to moderately elongate, and 7-9 slightly transverse (Figs 25 a, b); head and pronotum of about the same width (Fig. 7); elytra and abdomen wider than either head or pronotum; elytra small and short (Fig. 7); head rounded basally; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra (at suture) about as long as pronotum and 1/4 broader than maximum width of pronotum (Fig. 7), pubescence directed obliquely postero-laterad, wavy pattern occurs on each side of disc; abdomen subparallel, slightly narrower than elytra at base (Fig. 7); metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically, with four apical dents (Fig. 78). Sternite 8 transverse and slightly produced posteriorly (Fig. 79). Median lobe of aedeagus with narrowly produced apical part of tubus in lateral view (Fig. 75); bulbus enlarged without pronounced two anterior projections in dorsal view (Fig. 76); internal sac with structures as illustrated (Figs 75, 76). **Female**. Tergite 8 truncate apically (Fig. 81). Sternite 8 broadly rounded posteriorly and bearing median emargination (Fig. 82). Spermatheca with capsule funnel-shaped and cylindrical (Fig. 80); stem curved and swollen basally (Fig. 80).



Figs 75-82. Genital structures of *Gnypeta dentata*: 75, median lobe of the aedeagus in lateral view, 76, dorsal view; 77, paramere; 78, male tergite 8; 79, male sternite 8; 80, spermatheca; 81, female tergite 8; 82, female sternite 8.

Distribution (Fig. 194)
Gnypeta dentata is a Nearctic species recorded here from Saskatchewan, Alberta, and Northwest Territories.

Collection and habitat data
Adults were collected in June, July and August; no habitat data available.

Comments
The late Gustav Adolf Lohse (Hamburg, Germany) worked on a revision of Nearctic *Gnypeta*, but was not able to complete his project. Some CNC specimens of this species bear his identification labels as *G. dentata* Lohse [manuscript – unpublished name].

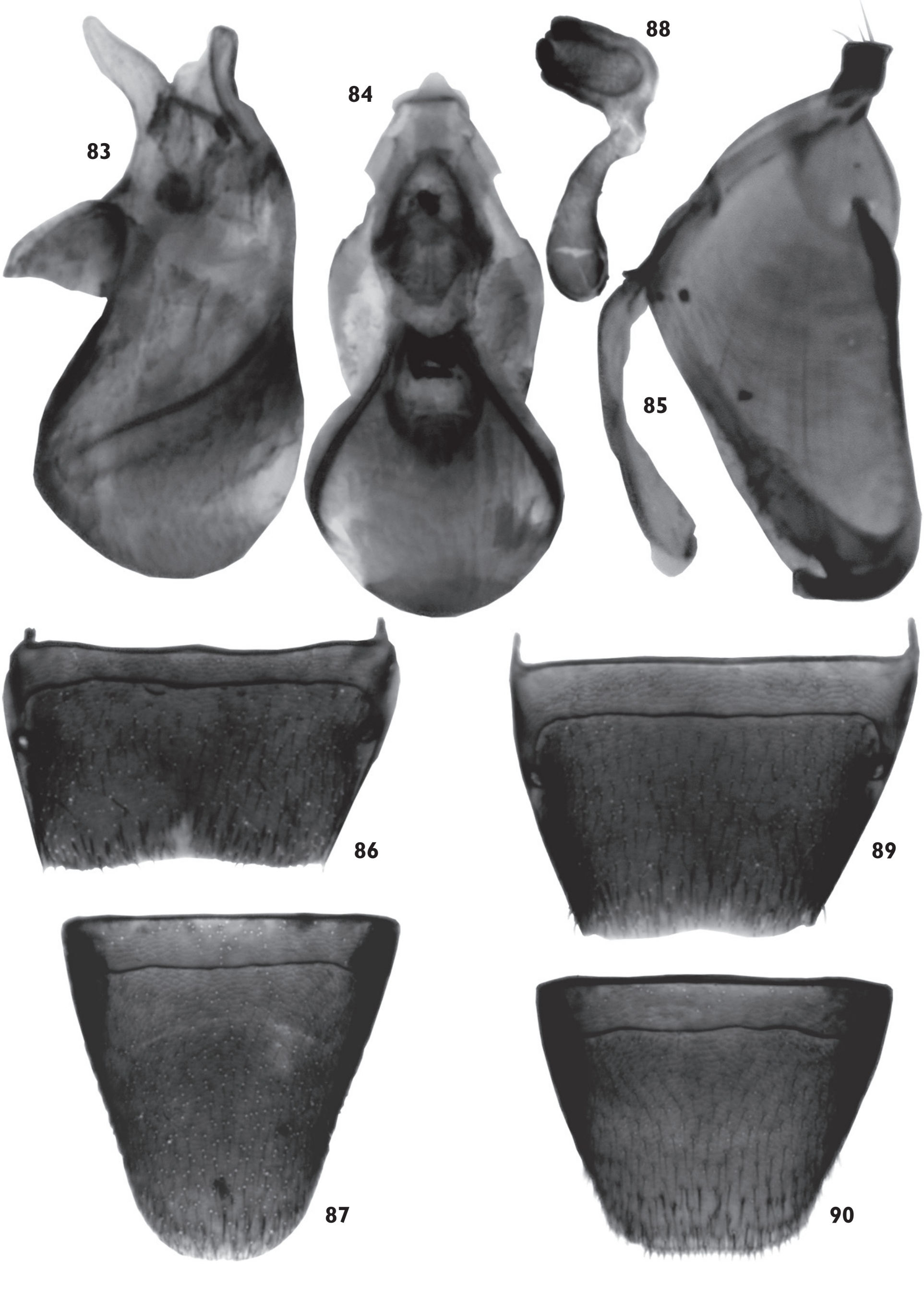
6. *Gnypeta groenlandica* Lohse
(Figs 8, 26 a, b, 83-90, 195)

Gnypeta groenlandica Lohse 1989: 58. **HOLOTYPE** (male): GREENLAND, Nedre Midsommer Sö, 2.VII.1966, Can. Peary Land Expd. [Expedition] (CNC). Examined.

Material examined
Specimens are listed in Appendix A.

Diagnosis
This species can be recognized by the following combination of characters: body robust, length 3.2-3.7 mm (Fig. 8); elytra (at suture) about as long as pronotum and 1/5 wider than maximum width of pronotum (Fig. 8); abdomen at base as broad as elytra and slightly broadening posteriorly (Fig. 8); antennal article 4 subquadrate or slightly elongate, 3-6 slightly to strongly transverse, 7-9 strongly transverse (Figs 26 a, b); median lobe of aedeagus with apical part narrowly produced and sinuate laterally (Fig. 83), bulbus in dorsal view with broad lateral swells (Fig. 84); spermatheca with capsule longer than wide, funnel-shaped, lateral sides subparallel (Fig. 88); stem curved, sinuate apically and slightly swollen basally (Fig. 88); male tergite 8 strongly transverse and truncate apically (Fig. 86).

Description
Body length 3.2-3.7 mm; uniformly dark brown to black (Fig. 8); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 subquadrate or slightly elongate, 5-6 slightly and 7-9 strongly transverse (Figs 26 a, b); head and pronotum of about the same width (Fig. 8); elytra and abdomen wider than either head or pronotum; elytra small and short (Fig. 8); head rounded basally; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra (at suture) about as long as pronotum and 1/5 broader than maximum width of pronotum (Fig. 8), pubescence directed obliquely postero-laterad,



Figs 83-90. Genital structures of *Gnypeta groenlandica*: 83, median lobe of the aedeagus in lateral view, 84, dorsal view; 85, paramere; 86, male tergite 8; 87, male sternite 8; 88, spermatheca; 89, female tergite 8; 90, female sternite 8.

in wavy pattern medially on each side; abdomen swollen medially, as broad as elytra at base (Fig. 8); metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically and slightly concave medially (Fig. 86). Sternite 8 elongate and slightly produced posteriorly (Fig. 87). Median lobe of aedeagus with narrowly produced and sinuate apical part of tubus in lateral view (Fig. 83), sides swollen in dorsal view; bulbus moderately large (Fig. 84); internal sac with structures as illustrated (Figs 83, 84). **Female**. Tergite 8 truncate apically (Fig. 89). Sternite 8 broadly rounded posteriorly (Fig. 90). Spermatheca with capsule elongate, funnel-shaped with sides subparallel (Fig. 88); stem curved, sinuate apically and swollen basally (Fig. 88).

Distribution (Fig. 195)
Gnypeta groenlandica is a Nearctic species recorded here from Greenland, and newly in Canada (Manitoba, Nunavut, Yukon Territory), and the United States (Alaska).

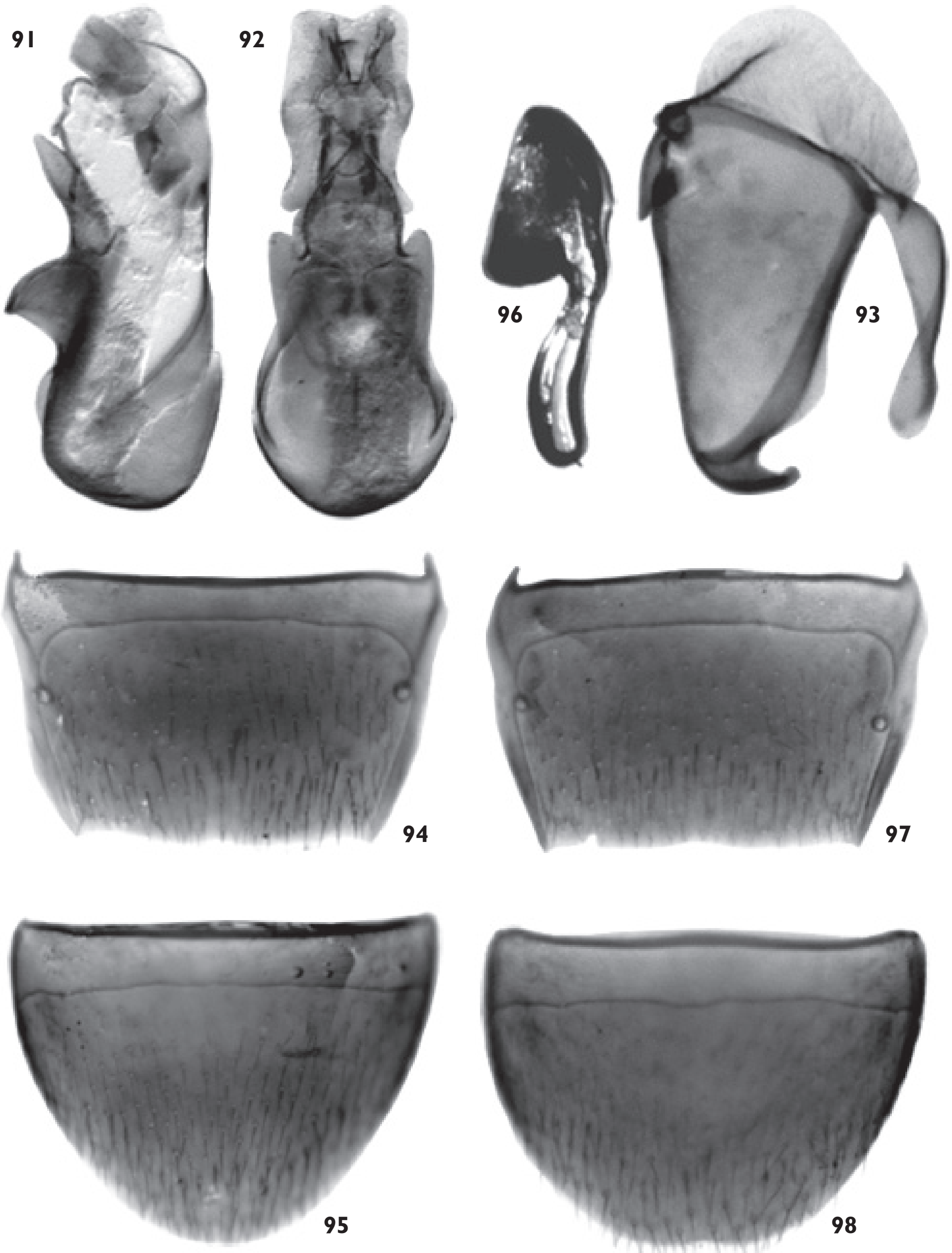
Collection and habitat data
Adults were collected in June, July and August, mainly in alpine habitats from *Salix* litter, litter on shore of a lagoon, and in crown of Ross's Avens (*Geum rossii*), rose family (Rosaceae).

Comments
The late Steve Ashe (University of Kansas) worked on a revision of Nearctic *Gnypeta*, but was not able to complete it. Some CNC specimens of this species bear his identification labels as *G. praeminosa* Ashe, 1987 [manuscript – unpublished name].

7. *Gnypeta brevicornis* Casey
(Figs 9, 27 a, b, 91-98, 196)

Gnypeta brevicornis Casey 1906: 196; Moore and Legner 1975: 421. **LECTOTYPE** (male): CANADA: Br. C. [British Columbia; in original description: Kamloops and Glenora; H.F. Wickham]; *brevicornis* Csy. [Casey]; Type USNM 38865; Casey bequest 1925; present lectotype designation label (USNM). Present designation. Examined. **PARALECTOTYPES:** listed in Appendix A.

Diagnosis
This species can be recognized by the following combination of characters: body slender, length 2.7-2.9 mm, rust brown with darker head and tip of abdomen; elytra (at suture) slightly longer than pronotum and 1/5 wider than maximum width of pronotum (Fig. 9); abdomen at base narrower than elytra and broadening posteriad (Fig. 9); antennal article 4 slightly elongate, 5-6 slightly transverse, articles 7-9 strongly transverse (Figs 27 a, b); median lobe of aedeagus with apical part narrowly triangular laterally (Fig. 91), bulbus in dorsal



Figs 91-98. Genital structures of *Gnypeta brevicornis*: 91, median lobe of the aedeagus in lateral view, 92, ventral view; 93, paramere; 94, male tergite 8; 95, male sternite 8; 96, spermatheca; 97, female tergite 8; 98, female sternite 8.

view with two lateral projections (Fig. 92); spermatheca with capsule wider than long, funnel-shaped, lateral sides arcuate (Fig. 96); stem slightly sinuate and slightly swollen basally (Fig. 96). *Gnypeta brevicornis* is readily distinguishable from all other Canadian and Alaskan species (except for *G. uteana*, see key) by having strongly elongate basal article of metatarsus, which is as long as the two following articles combined.

Description

Body length 2.7-2.9 mm; rust brown with darker head and tip of abdomen (Fig. 9); integument moderately glossy; pubescence yellowish grey and sparse; antennal article 4 elongate, 5-6 slightly and 7-9 strongly transverse (Figs 27 a, b); head and pronotum of about the same width (Fig. 9); elytra and abdomen slightly wider than either head or pronotum; elytra small and moderately elongate (Fig. 9); head rounded posteriorly; pronotum broadest in apical third, pubescence directed postero-laterad from midline of disc; elytra (at suture) slightly longer than pronotum and 1/5 broader than maximum width of pronotum (Fig. 9), pubescence directed obliquely postero-laterad from midline of disc; abdomen swollen posteriorly, as broad as elytra at base (Fig. 9); metatarsus with basal article of about the same length as the two following articles combined. **Male**. Tergite 8 transverse and truncate apically, slightly concave medially (Fig. 94). Sternite 8 elongate and rounded posteriorly (Fig. 95). Median lobe of aedeagus with narrowly triangular apical part of tubus in lateral view (Fig. 91); bulbus moderately large with lateral projections (Fig. 92); internal sac with structures as illustrated (Figs 91, 92). **Female**. Tergite 8 truncate apically (Fig. 97). Sternite 8 broadly rounded posteriorly (Fig. 98). Spermatheca with capsule transverse, funnel-shaped with sides arcuate (Fig. 96); stem slightly sinuate and swollen basally (Fig. 96).

Distribution (Fig. 196)

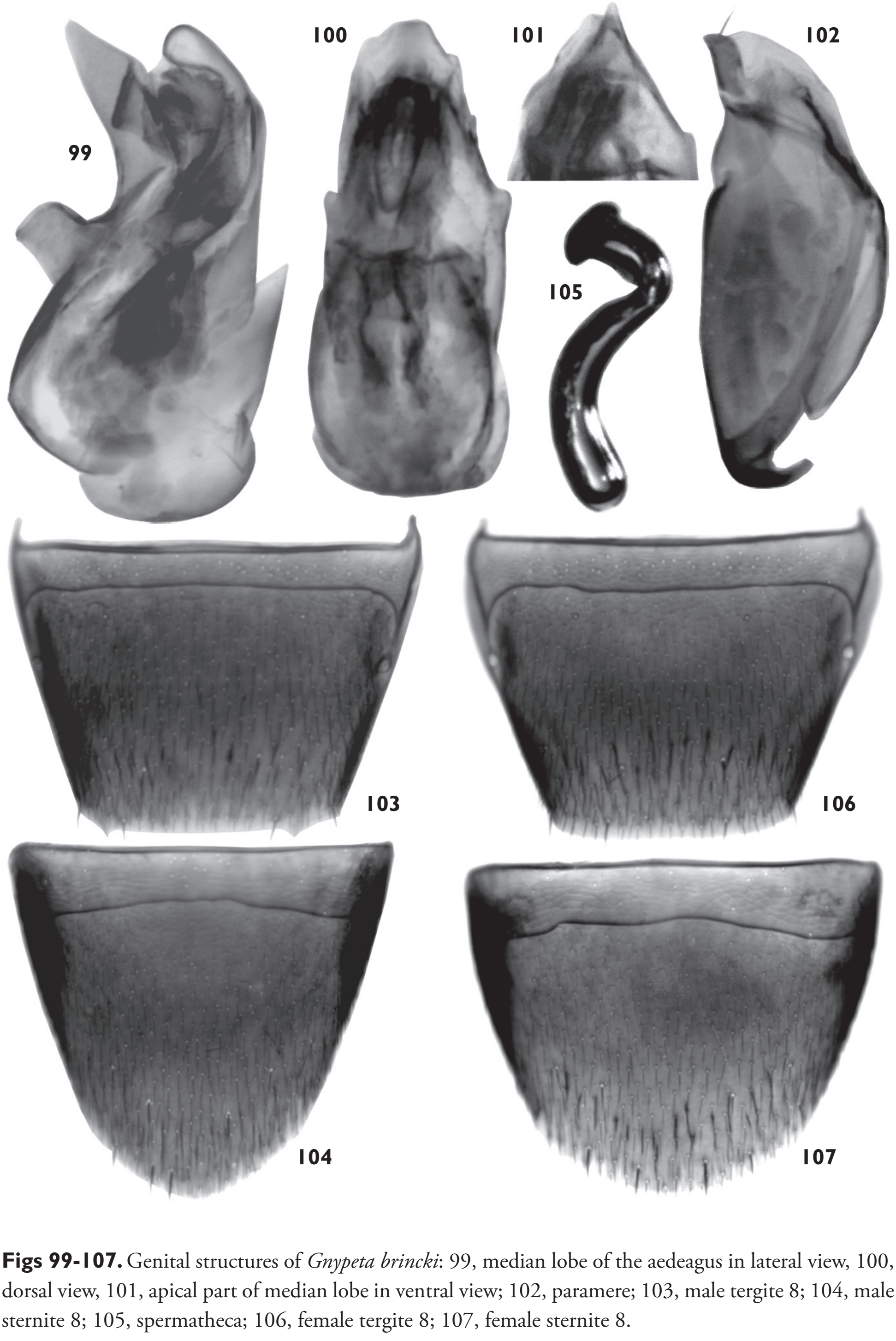
Gnypeta brevicornis is a western Nearctic species recorded from Glenora and Kamloops in British Columbia (Casey 1906).

Collection and habitat data

No data available.

Comments

Gnypeta brevicornis differs from all other Canadian and Alaskan *Gnypeta* species except for *G. uteana* by extremely elongate basal article of the metatarsus, its slender body, distinct pubescence pattern of the pronotum with setae directed posteriorly along the midline of the disc, and extremely coarse punctation in the first three visible tergal impressions. These characters are close to *Tachyusa* species but the genital characters of *G. brevicornis* are consistent with other *Gnypeta* species and the funnel-shaped capsule of the spermatheca is especially typical for the *sellmani* species group of *Gnypeta*. Additional studies are needed at the generic level to clarify the limits of the two close genera.



Figs 99-107. Genital structures of *Gnypeta brincki*: 99, median lobe of the aedeagus in lateral view, 100, dorsal view, 101, apical part of median lobe in ventral view; 102, paramere; 103, male tergite 8; 104, male sternite 8; 105, spermatheca; 106, female tergite 8; 107, female sternite 8.

II. *Gnypeta caerulea* species group

The *caerulea* species group may be characterized by the following combination of characters: spermatheca S-shaped, apical part of capsule mushroom-shaped, and stem narrow and sinuate, slightly swollen basally (Figs 105, 114); median lobe of aedeagus with short tubus broadly triangular apically in lateral view (Figs 99, 108); male tergite 8 with two small lateral dents at apical margin (Figs 103, 112).

Species included: *G. caerulea* (C.R. Sahlberg) and *Gnypeta lohsei* Klimaszewski sp. nov.

8. *Gnypeta caerulea* (Sahlberg)

(Figs 10, 28 a, b, 99-107, 197)

Aleochara caerulea C.R. Sahlberg 1830: 351. As *Gnypeta*: Bernhauer and Scheerpeltz 1926: 587; Palm 1966: 138; Muona 1984: 228; Campbell and Davies 1991: 100; Smetana 2004: 489. **TYPE LOCALITY**: FINLAND, Helsinki [in orig. description: “Ad Helsingforsiam semel tantum capta”]. Holotype not examined.

Material examined

Specimens are listed in Appendix A.

Diagnosis

This species can be recognized by the following combination of characters: body length 3.0-3.5 mm (Fig. 10); elytra (at suture) about as long as pronotum and at least 1/4 wider than maximum width of pronotum (Fig. 10); abdomen at base narrower than elytra and subparallel (Fig. 10); antennal articles 4-10 strongly to moderately elongate and increasingly less so toward the apex of antennae (Figs 28 a, b); median lobe of aedeagus with apical part broadly triangular in lateral view (Fig. 99); spermatheca with capsule mushroom-shaped (Fig. 105); stem sinuate and slightly swollen basally (Fig. 105); male tergite 8 truncate and with two minute lateral dents at apical margin (Fig. 103). *Gnypeta caerulea* is readily distinguishable from *G. lohsei* by larger, slimmer and strongly glossy body and by the elongate antennal articles 6-10, which are quadrate to slightly transverse in *G. lohsei* (Fig. 28).

Description

Body length 3.0-3.5 mm; uniformly dark brown to black, sometimes central part of elytra rust brown, tarsi and sometimes entire legs rust brown (Fig. 10); integument strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 strongly elongate, 5-10 moderately to strongly elongate, and increasingly less so toward the apex of antennae (Figs 28 a, b); head and pronotum of about the same width (Fig. 10); elytra and abdomen wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture slightly longer than pronotum and at least 1/4 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern medially on each side of disc (Fig. 10); abdomen subparallel, narrower than elytra at base (Fig. 10), three basal tergites with deep basal impressions bearing large punctures; metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically, with two minute apical dents (Fig. 103). Sternite 8 about as long as wide and rounded apically (Fig. 104). Median lobe of aedeagus with broadly triangular apical part of tubus and edges approximately straight in lateral view (Fig. 99); bulbus moderately large with two small anterior projections in dorsal view (Fig. 100); internal sac with structures as illustrated (Figs 99, 100). **Female**. Tergite 8 truncate apically (Fig. 106). Sternite 8 broadly rounded apically (Fig. 107). Spermatheca with capsule elongate, mushroom-shaped (Fig. 105); stem sinuate and slightly swollen basally (Fig. 105).

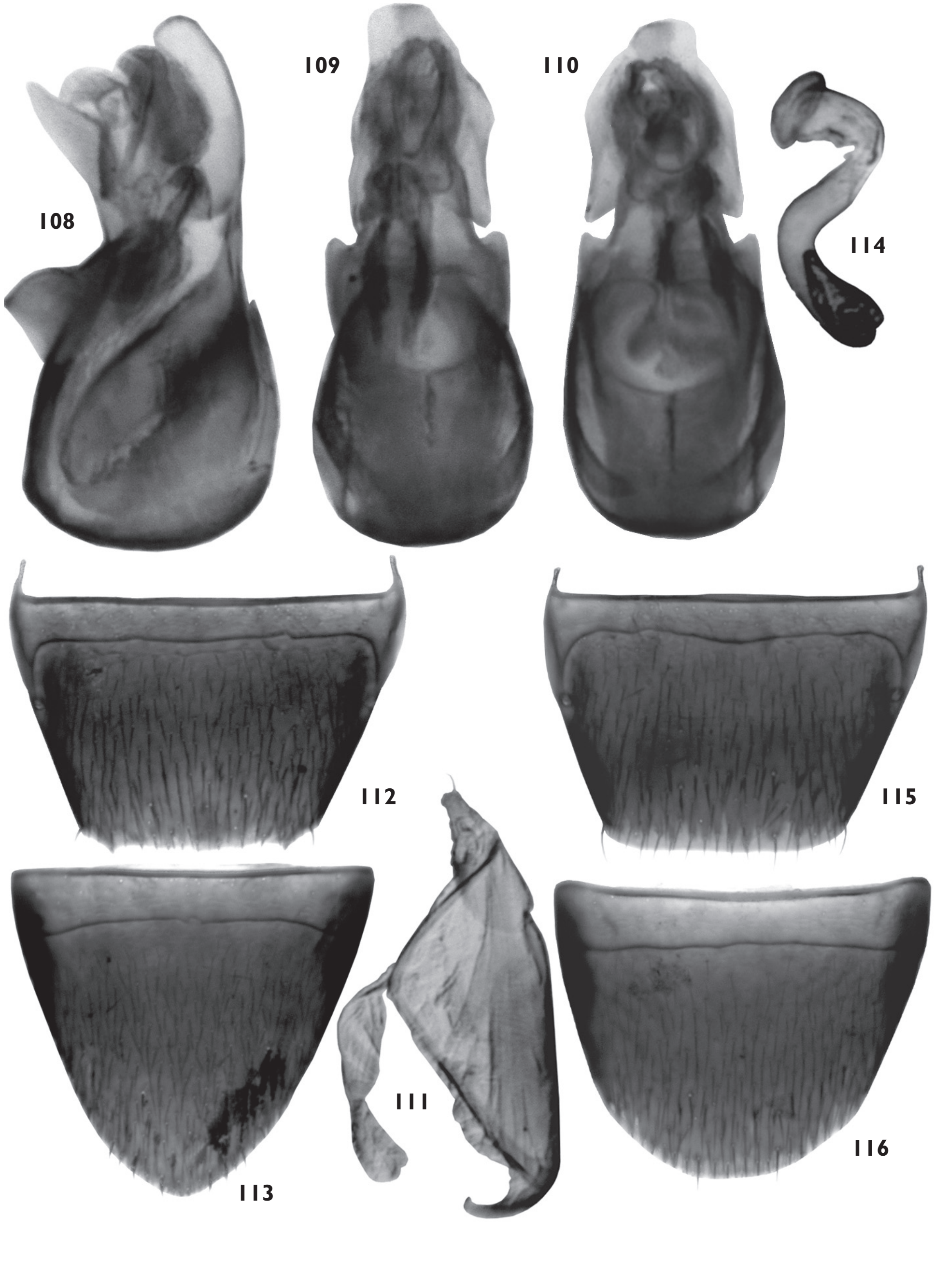
Distribution (Fig. 197)
Gnypeta caerulea is a Holarctic species with circumpolar distribution. Smetana (2004) listed this species from Europe, Asia, and North America. Muona (1984), Campbell and Davies (1991), and Gouix and Klimaszewski (2007) recorded this species from Newfoundland. Majka and Klimaszewski (2008) provided new records for Nova Scotia and Prince Edward Island. We report this species for the first time from New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, Yukon Territory, Northwest Territories and Alaska.

Collection and habitat data
In the United Kingdom, *G. caerulea* was reported from river margins and in wet moss growing on boulders and rocks in rivers, waterfalls and streams (Hyman and Parsons 1994). In Canada, adults were collected in May, June, July, and September in marshy habitats, from vegetation around beaver ponds, from edges of ponds with sphagnum, and from swamp sedges.

Comments
The late Steve Ashe (University of Kansas) worked on a revision of Nearctic *Gnypeta* but was not able to complete it. Some CNC specimens, which belong to this species, bear his misidentification labels as "*G. nebulosa* Ashe" and "*G. dialepta* Ashe" [1987 manuscript – unpublished names].

9. *Gnypeta lohsei* Klimaszewski, sp. nov.
urn:lsid:zoobank.org:act:32E024F3-A2FB-4ACD-90D0-D4A7070241E9
(Figs 11, 29 a, b, 108-116, 198)

HOLOTYPE (male): CANADA, Alberta, Kananaskis F.E.S., [51°04'34" N, 115°07'46" W] 1.VIII.1971, J.M. and B.A. Campbell, CNC No. 23678 (CNC).



Figs 108-116. Genital structures of *Gnypeta lohsei*: 108, median lobe of the aedeagus in lateral view, 109, dorsal view, 110, apical part of median lobe in ventral view; 111, paramere; 112, male tergite 8; 113, male sternite 8; 114, spermatheca; 115, female tergite 8; 116, female sternite 8.

Material examined

Paratypes are listed in Appendix A.

Etymology

This species is named after the late Gustav Adolf Lohse (Hamburg, Germany), who discovered it in CNC material.

Diagnosis

This species can be recognized by the following combination of characters: body length 2.7-3.0 mm (Fig. 11); elytra at suture slightly longer than pronotum and at least 1/3 wider than maximum width of pronotum (Fig. 11); abdomen at base about as wide as elytra and subparallel or slightly swollen medially (Fig. 11); antennal articles 5-7 subquadrate, 8-10 slightly transverse (Figs 29 a, b); median lobe of aedeagus with apical part broadly triangular and edges sinuate in lateral view (Fig. 108); spermatheca S-shaped, capsule mushroom-shaped (Fig. 114); stem more or less sinuate and slightly swollen basally (Fig. 114); male tergite 8 truncate apically and with two minute lateral dents at apical margin (Fig. 112). *Gnypeta lohsei* is readily distinguishable from *G. caerulea* by smaller, robust and less glossy body and subquadrate antennal articles 5-7 (Figs 29 a, b).

Description

Body length 2.7-3.0 mm; uniformly dark brown to black, sometimes central part of elytra and tarsi rust brown (Fig. 11); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 moderately elongate, 5-7 subquadrate, 8-10 slightly transverse (Figs 29 a, b); head and pronotum of about the same width (Fig. 11); elytra and abdomen wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture slightly longer than pronotum and about 1/3 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern on medial parts of disc (Fig. 11); abdomen subparallel, almost as broad as elytra at base (Fig. 11); metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically with two minute apical dents (Fig. 112). Sternite 8 as broad as long and truncate apically (Fig. 113). Median lobe of aedeagus with triangularly produced apical part of tubus and edges sinuate in lateral view (Fig. 108); bulbus moderately enlarged with two anterior projections in dorsal view (Figs 109, 110); internal sac with structures as illustrated (Figs 109, 110). **Female**. Tergite 8 truncate apically (Fig. 115). Sternite 8 broadly rounded posteriorly (Fig. 116). Spermatheca with capsule mushroom-shaped, elongate (Fig. 114); stem sinuate and slightly swollen basally (Fig. 114).

Distribution (Fig. 198)

Gnypeta lohsei is a Nearctic species known from Alberta, British Columbia, and Alaska and Washington state, United States.

Collection and habitat data

Adults were collected in June, July, and August, from high altitudes of up to 2340 m. No habitat data are available.

Comments

The late Gustav Adolf Lohse (Hamburg, Germany) worked on a revision of Nearctic *Gnypeta* but was not able to complete it. The CNC specimens of this species he studied bear his identification labels as *G. albertae* Lohse and *G. paracareluea* Lohse [manuscript – unpublished names].

III. *Gnypeta crebrepunctata* species group

The *crebrepunctata* species group may be characterized by the following combination of characters: spermatheca C-shaped, capsule and stem short, broad, and tubular or club-shaped (Figs 122, 127-129, 136); median lobe of aedeagus with enlarged bulbus (Figs 117, 118, 130-132); male tergite 8 truncate (Figs 120, 134).

Species included: *G. crebrepunctata* (Casey), *G. manitobae* Casey, *G. uteana* Casey and *G. carbonaria* Mannerheim. The following species belong to this group but do not occur in Canada: *Gnypeta majuscula* Casey (southern United States) and *G. rubrior* Tottenham (Palaearctic).

10. *Gnypeta crebrepunctata* (Casey)

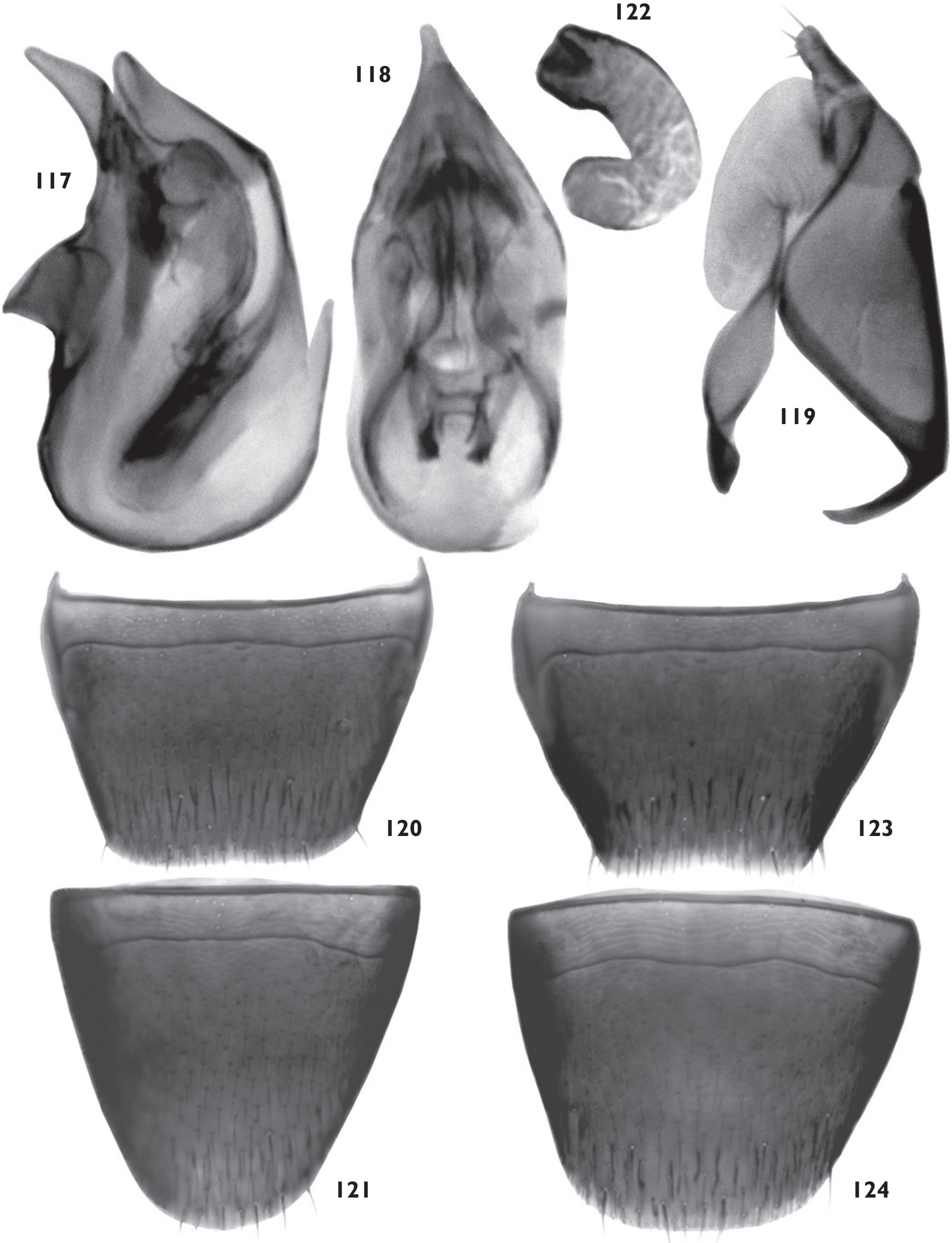
(Figs 12, 30 a, b, 117-124, 194)

Tachyusa crebrepunctata Casey 1886: 203. As *Gnypeta*: Casey 1906: 194; Moore and Legner 1975: 421. **LECTOTYPE** (male): UNITED STATES OF AMERICA: California, [in orig. description: Monterey Co.]; Type USNM 38861, Casey bequest 1925; *Gnypeta crebrepunctata* Csy. [Casey], Lectotypus Lohse des. 1988 [designation not published]; Lectotype, male, *Tachyusa crebrepunctata* Casey [=*Gnypeta*], des. Klimaszewski 2007 (USNM). Present designation. Examined.

Gnypeta oblata Casey 1911: 168. As synonym of *G. helenae*: Moore and Legner 1975: 422. **LECTOTYPE** (female): UNITED STATES OF AMERICA: California, Siskiyou Co; *oblata* Csy [handwritten by Casey]; Type USNM 38881; Casey bequest 1925 (USNM). Present designation. Examined. **PARALECTOTYPE** (sex?): UNITED STATES OF AMERICA: California, Siskiyou Co; *oblata* – 2 Paratype USNM 38881 (USNM). Examined. **New synonymy**.

Material examined

Specimens are listed in Appendix A.



Figs 117-124. Genital structures of *Gnypeta crebrepunctata*: 117, median lobe of the aedeagus in lateral view, 118, dorsal view; 119, paramere; 120, male tergite 8; 121, male sternite 8; 122, spermatheca; 123, female tergite 8; 124, female sternite 8.

Diagnosis

This species can be recognized by the following combination of characters: body length 3.0-3.2 mm, integument moderately glossy (Fig. 12); elytra at suture slightly longer than pronotum and at least 1/3 wider than maximum width of pronotum (Fig. 12); abdomen at base slightly narrower than elytra and subparallel (Fig. 12); antennal articles 4 -7 moderately elongate, 8-10 slightly transverse (Figs 30 a, b); median lobe of aedeagus with apical part narrowly produced (Figs 117, 118); spermatheca C-shaped, with broadly tubular capsule (Fig. 122); stem broadly tubular and short (Fig. 122); male tergite 8 truncate apically (Fig. 120). The shape of the spermathecal capsule and the shape of the apical portion of the median lobe of the aedeagus are the best characters for recognition of this species.

Description

Body length 2.7-3.0 mm; uniformly dark brown to black, with tarsi rust brown (Fig. 12); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal articles 4 -7 moderately elongate, 8-10 slightly transverse (Figs 30 a, b); head and pronotum of about the same width (Fig. 12); elytra and abdomen wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture slightly longer than pronotum and about 1/3 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern medially on each side of disc (Fig. 12); abdomen subparallel, slightly narrower than elytra at base (Fig. 12); metatarsus with two basal articles of about the same length and the third one slightly shorter. **Male**. Tergite 8 transverse and truncate apically with slight median emargination (Fig. 120). Sternite 8 slightly elongate and broadly rounded apically (Fig. 121). Median lobe of aedeagus with narrowly produced apical part of tubus in lateral view (Fig. 117); internal sac with structures as illustrated (Figs 117, 118). **Female**. Tergite 8 truncate apically (Fig. 123). Sternite 8 broadly rounded apically (Fig. 124). Spermatheca C-shaped, capsule tubular and short (Fig. 122); stem short and broadly tubular (Fig. 122).

Distribution (Fig. 194)

Gnypeta crebrepunctata is a western Nearctic species known from Oregon and California (Casey 1886, 1906, 1911). We report this species for the first time from the province of British Columbia.

Collection and habitat data

Adults from British Columbia were collected in July and August, from gravel along the edge of a creek, and from rotting *Boletus* mushrooms.

Comments

The Queen Charlotte Islands specimens had the C-shaped spermatheca typical for this species, but two females had the slightly broadened apical portion of the capsule appearing slightly club-shaped, while the remaining specimens here examined had C-shaped spermatheca with the capsule approximately evenly tubular without broadened apical portion. We regard the slightly broadened apical portion of the capsule as a variable character and within the range variation of *G. crebrepunctata.*

The California specimens are on average slightly smaller than those from British Columbia but have a similar external morphology and shape of genital structures.

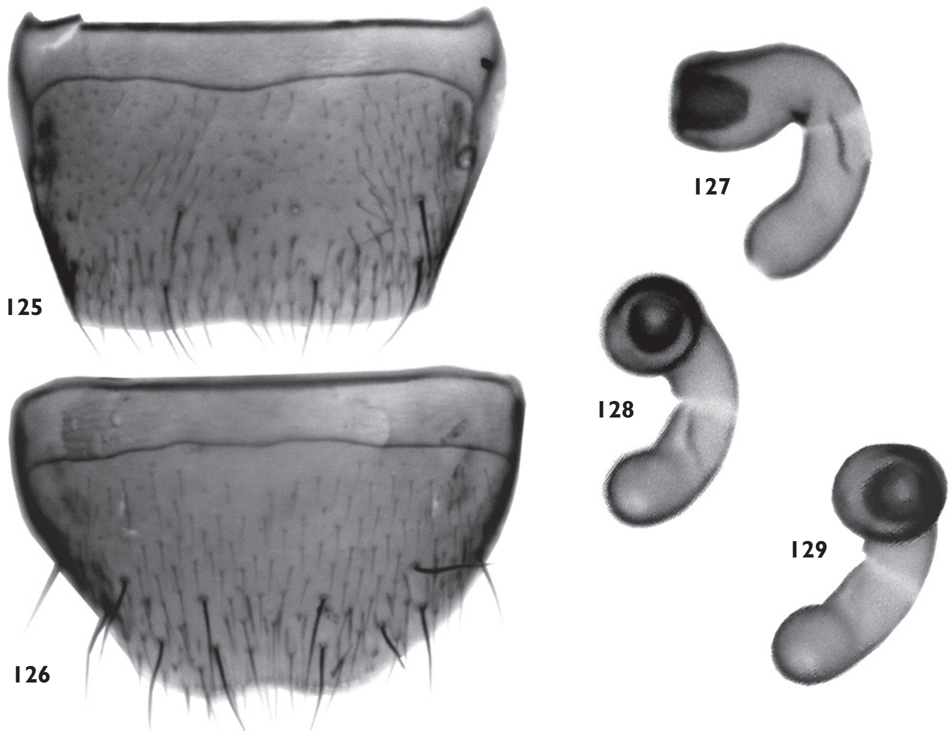
11. *Gnypeta manitobae* Casey

(Figs 13, 31 a, b, 125-129)

Gnypeta manitobae Casey 1906: 196. As synonym of *G. bockiana* Casey: Moore and Legner 1975: 421. Synonymy confirmed here as not valid. **LECTOTYPE** (female): CANADA: Manitoba, Winnipeg; Hanham; Type USNM 38864; *manitobae* Csy. [handwritten by Casey]; Casey bequest 1925; lectotype designation label by Lohse 1988 [designation not published] (USNM). Present designation. Examined.

Material examined

The lectotype only.



Figs 125-129. Genital structures of *Gnypeta manitobae* (lectotype): 125, female tergite 8; 126, female sternite 8; 127-129, spermatheca.

Diagnosis (based on female)

This species is known from a single female and is similar to *G. crebrepunctata*. The two species have a very similar shape of the spermatheca and terminal segments and can be distinguished only by the differences in external morphology and the different geographic ranges. *Gnypeta manitobae*, in comparison with *G. crebrepunctata*, has a more transverse pronotum (Fig. 13), and the base of the abdomen is as broad as the elytra (Fig. 13).

From other Nearctic *Gnypeta* species, it can be distinguished by the following combination of characters: body subparallel (Fig. 13), length 2.6 mm; elytra at suture as long as pronotum and at least 1/4 wider than maximum width of pronotum (Fig. 13); abdomen subparallel and at base about as broad as elytra (Fig. 13); antennal articles 4-7 strongly elongate, 8-10 quadrate to slightly transverse (Fig. 31 b). Spermatheca C-shaped with capsule tubular (Figs 127-129).

Description

Body length 2.6 mm; uniformly dark brown with two basal antennal articles and tarsi rust brown (Fig. 13); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal articles 4-7 strongly elongate, 8-10 quadrate to slightly transverse (Fig. 31 b); head and pronotum of about the same width (Fig. 13); elytra and abdomen wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture about as long as pronotum and about 1/4 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern medially on each side of disc (Fig. 13); abdomen subparallel, at base about as broad as elytra (Fig. 13); metatarsus with basal article slightly longer than second, and the third one slightly shorter than second. **Male**. Unknown. **Female**. Tergite 8 truncate apically (Fig. 125). Sternite 8 broadly rounded apically with shallow median emargination (Fig. 126). Spermatheca C-shaped, capsule tubular and short (Figs 127-129); stem short and broadly tubular (Fig. 127). Spermatheca is similar to that of *G. crebrepunctata*.

Distribution

Gnypeta manitobae is known only from a single type specimen captured in Winnipeg, Manitoba (Casey 1906).

Collection and habitat data

No data available.

Comments

Casey (1906) in the original description of *G. manitobae* mentioned a male specimen from Winnipeg, Manitoba, but did not clearly specify how many specimens he had studied. There is only one specimen in the Casey collection from that locality under *G. manitobae* and it is a female, which was probably misidentified by Casey as a male.

Casey did not designate the holotype in his original description and therefore we designated the only syntype female from Winnipeg as the lectotype.

12. *Gnypeta uteana* (Casey)
(Figs 14, 32 a, b, 131-138, 196)

Tachyusa uteana Casey 1911: 169. As *Gnypeta*: Moore and Legner 1975: 422. **LECTOTYPE** (female): UNITED STATES OF AMERICA: Utah [southwestern Utah], Weidt, *uteana* Csy [Casey]; Type USNM 38883, Casey Bequest 1925; *Gnypeta uteana* Csy. Lectotypus Lohse des.1988 [designation not published]; Lectotype, female, *Tachyusa uteana* Casey [=*Gnypeta*], des. Klimaszewski 2007 (USNM). Present designation. Examined.
Gnypeta boulderensis Casey 1911: 167. As synonym of *G. helenae*: Moore and Legner 1975: 422. **LECTOTYPE** (female): UNITED STATES OF AMERICA: Boulder Co., Boulder Co.; *boulderensis* Csy [Casey's handwriting]; Type USNM, 38870 (USNM). Present designation. Examined. **New synonymy**.
Gnypeta punctatula Casey 1906: 194. As synonym of *G. helenae*: Moore and Legner 1975: 422. **LECTOTYPE** (female): UNITED STATES OF AMERICA: California, Pomona Mts., Sept. [ember]; [in original description: H.C. Fall]; *punctatula* Csy [Casey's handwriting]; Type USNM 38869; Casey bequest 1925 (USNM). Present designation. Examined. **New synonymy**.

Material examined

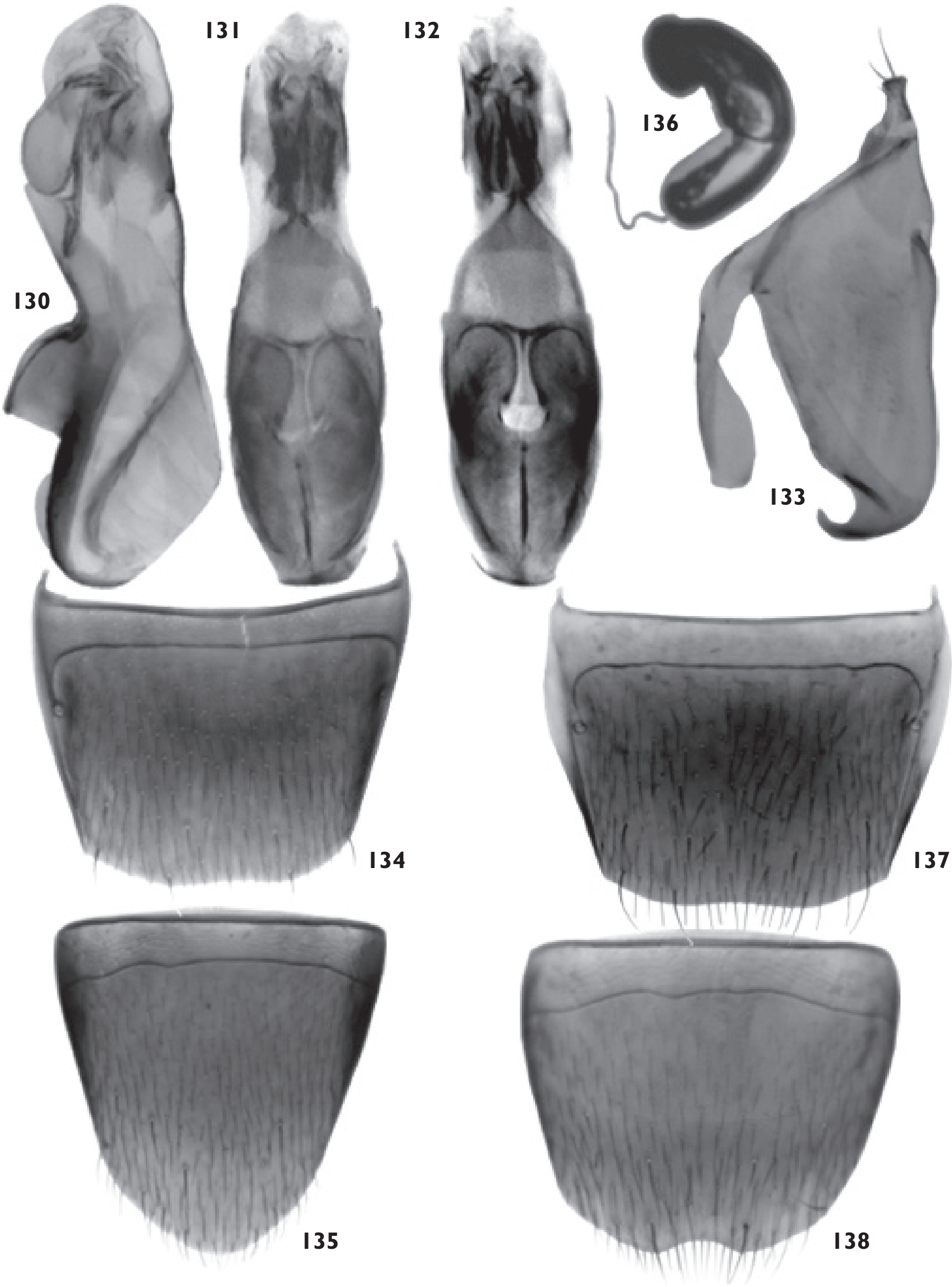
Specimens are listed in Appendix A.

Diagnosis

This species can be recognized by the following combination of characters: body length 2.6-2.8 mm (Fig. 14); elytra at suture slightly longer than pronotum and about 1/3 wider than maximum width of pronotum (Fig. 14); abdomen at base distinctly narrower than elytra and subparallel (Fig. 14); antennal article 4 strongly elongate, 5 subquadrate or slightly elongate, 7-10 slightly transverse (Figs 32 a, b); median lobe of aedeagus with apical part moderately broad and produced in lateral view (Fig. 130); spermatheca C-shaped, with broadly tubular and mushroom-shaped capsule (Fig. 136); stem broadly tubular and short (Fig. 136); male tergite 8 truncate apically and with slight apical emargination (Fig. 134); female sternite 8 with strong median apical emargination (Fig. 138). The slim, strongly glossy body, basal article of metatarsus almost as long as the two following articles combined; distinct shape of spermatheca; medially emarginated female sternite 8, and the shape of the apical portion of the median lobe of the aedeagus are the best characters for recognition of this species.

Description

Body length 2.6-2.8 mm; uniformly dark brown to black, elytra often rust brown medially, and tibiae and/or tarsi rust brown (Fig. 14); integument strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 strongly



Figs 130-138. Genital structures of *Gnypeta uteana*: 130, median lobe of the aedeagus in lateral view, 131, dorsal view, 132, ventral view; 133, paramere; 134, male tergite 8; 135, male sternite 8; 136, spermatheca; 137, female tergite 8; 138, female sternite 8.

elongate, 5 subquadrate or slightly elongate, 7-10 slightly transverse (Fig. 32 a, b); head and pronotum of about the same width (Fig. 14); elytra and abdomen (less so) wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture slightly longer than pronotum and about 1/3 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern medially on each side of disc (Fig. 14); abdomen subparallel, distinctly narrower than elytra at base (Fig. 14); metatarsus with basal article strongly elongate and about as long as the two following articles combined. **Male**. Tergite 8 transverse and truncate apically with slight median emargination (Fig. 134). Sternite 8 elongate and broadly rounded apically (Fig. 135). Median lobe of aedeagus with triangular and moderately broad apical part of tubus in lateral view (Fig. 130); bulbus moderately enlarged in dorsal view (Figs 131, 132); internal sac with structures as illustrated (Figs 130-132). **Female**. Tergite 8 truncate apically (Fig. 137). Sternite 8 broadly rounded posteriorly with deep median emargination (Fig. 138). Spermatheca with tubular and short, mushroom-shaped capsule (Fig. 136); stem short and broadly tubular (Fig. 136).

Distribution (Fig. 196)
Gnypeta uteana is a western Nearctic species known from southwestern Utah, Colorado and California (Casey 1906, 1911). We report this species for the first time from the province of Alberta.

Collection and habitat data
Adults from Alberta were collected in July and August, some from altitudes up to 2040 m. Habitat data not available.

13. *Gnypeta carbonaria* (Mannerheim)
(Figs 15, 33 a, b, 139-147, 199)

Bolitochara carbonaria Mannerheim 1830: 75; Palm 1966: 141; Smetana 2004: 489.
TYPE LOCALITY: FINLAND: in original description: "Ad Willnäs in Finlandia australi semel capta". Holotype not examined.

Material examined
Specimens are listed in Appendix A.

Diagnosis
This species can be recognized by the following combination of characters: body length 2.7-3.0 mm (Fig. 15); elytra at suture slightly longer than pronotum and about 1/4 wider than maximum width of pronotum (Fig. 15); abdomen at base distinctly narrower than elytra and subparallel (Fig. 15); antennal article 4 strongly elongate, 5-7 moderately elongate, 8-10 subquadrate to slightly transverse (Figs 33 a, b); median lobe of aedeagus with apical part triangularly produced with sinuate edges in lateral

Figs 139-147. Genital structures of *Gnypeta brincki*: 139, median lobe of the aedeagus in lateral view, 140, dorsal view, 141, apical part of median lobe in ventral view; 142, paramere; 143, male tergite 8; 144, male sternite 8; 145, spermatheca; 146, female tergite 8; 147, female sternite 8.

view (Fig. 139); spermatheca club-shaped, apical part of capsule approximately spherical connected to narrow and short tubular part (Fig. 145); stem narrow, tubular, short and slightly swollen posteriorly (Fig. 145); male tergite 8 truncate apically and with slight apical emargination (Fig. 143); female sternite 8 with small apical emargination (Fig. 147). The antennal proportions; distinct shape of spermatheca; medially emarginated female sternite 8, and the shape of the apical portion of the median lobe of the aedeagus are the best characters for recognition of this species.

Description

Body length 2.7-3.0 mm; dark brown to black, elytra often rust brown medially, and legs and/or tarsi rust brown (Fig. 15); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 strongly elongate, 5-7 moderately elongate, 8-10 subquadrate to slightly transverse (Figs 33 a, b); head and pronotum of about the same width (Fig. 15); elytra and abdomen (less so) wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture slightly longer than pronotum and about 1/4 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern medially on each side of disc (Fig. 15); abdomen subparallel, distinctly narrower than elytra at base (Fig. 15); metatarsus with basal article slightly longer than the following article. **Male**. Tergite 8 transverse and truncate apically with small median emargination (Fig. 143). Sternite 8 elongate and broadly rounded apically (Fig. 144). Median lobe of aedeagus with triangularly produced apical part of tubus in lateral view (Fig. 139); bulbus moderately large in dorsal view (Fig. 140); internal sac with complex structures as illustrated (Figs 139-141). **Female**. Tergite 8 truncate apically (Fig. 146). Sternite 8 broadly rounded posteriorly with small median emargination (Fig. 147). Spermatheca with tubular and short, club-shaped capsule (Fig. 145); stem short and broadly tubular (Fig. 145).

Distribution (Fig. 199)

Gnypeta carbonaria is a Holarctic species and is here reported from Canada and Alaska for the first time. It was previously known from the Palaearctic region and was recorded from Europe, Northern Africa, and Asia including eastern and western Siberia (Smetana 2004). We discovered this species to be transcontinental in North America with records from Alaska, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and New Brunswick.

Collection and habitat data

In Canada and Alaska, adults were collected in July and August from wet ground near a bog, in rotten fungus, and in a UV light trap.

Comments

We compared North American specimens of *G. carbonaria* with those from Sweden and found no distinct external or genital morphological differences between the two populations. We also compared the newly designated female lectotype of *Gnypeta brunnescens* Casey with Canadian and Swedish specimens of *G. carbonaria* and found no differences between female genital features. However, Casey's type of *G. brunnescens* differs from both populations by the light brown body colour instead of dark brown or black and by a slightly different pubescence pattern on the pronotum, which may be caused by the preparation of the specimen. Due to these differences, we hesitate to formally synonymize *G. brunnescens* with *G. carbonaria*. Additional specimens of *G. brunnescens* are needed from the type locality to confirm its taxonomic status.

IV. *Gnypeta helenae* species group

The *helenae* species group may be characterized by the following combination of characters: spermatheca S-shaped, capsule pipe-shaped and consisting of a small cylindrical apical part angularly connected with a narrow, tubular and sinuate stem (Figs 153, 161); median lobe of aedeagus with narrowly triangular apical portion of tubus in lateral view (Figs 148, 156); male tergite 8 truncate and slightly emarginated medially (Figs 151, 159); and female sternite 8 deeply emarginated medially (Figs 155, 163).

Species included: *G. helenae* Casey, and *G. canadensis* Klimaszewski sp. nov.

14. *Gnypeta helenae* Casey
(Figs 16, 34 a, b, 148-155, 194)

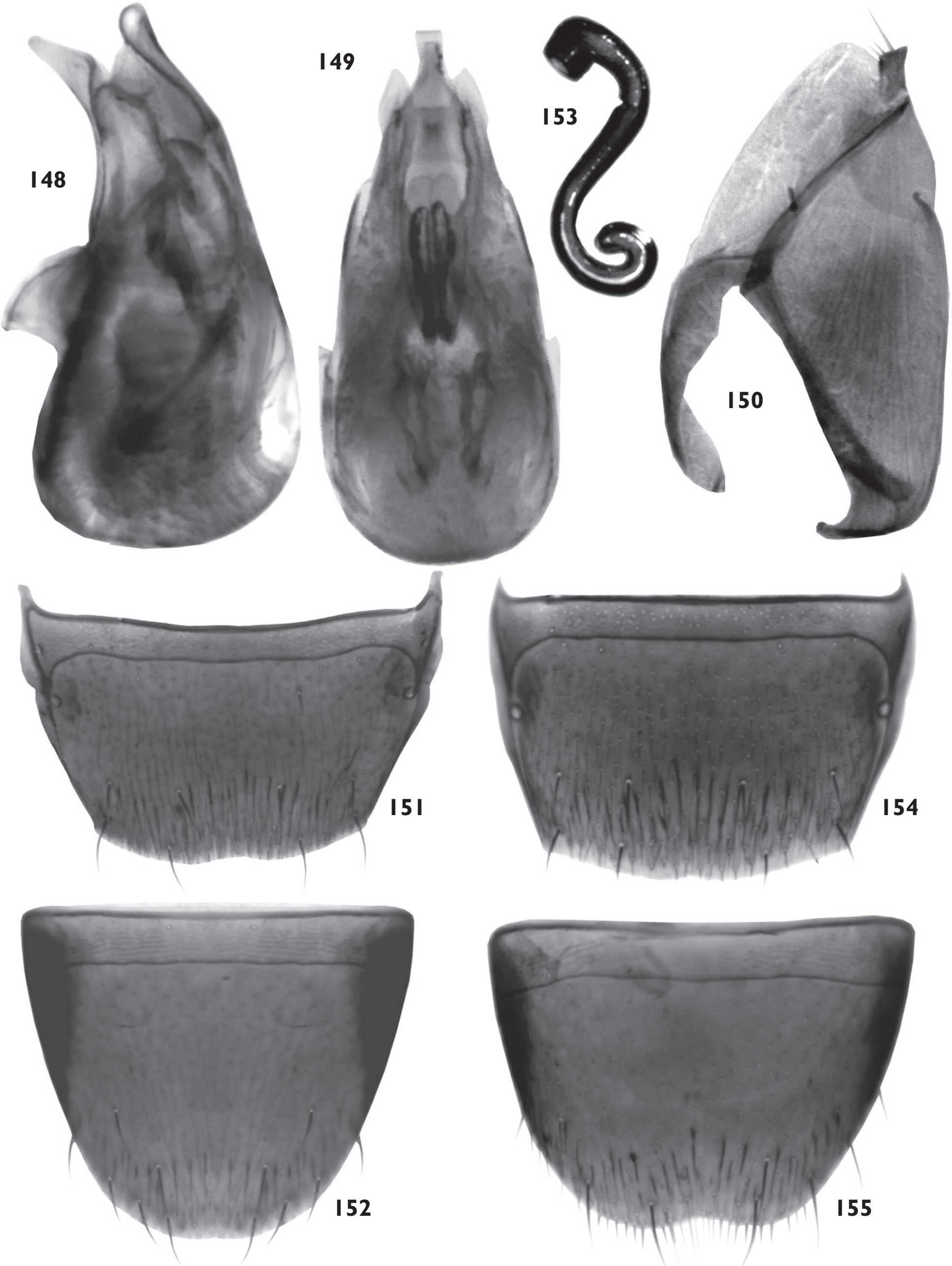
Gnypeta helenae Casey 1906: 193; Moore and Legner 1975: 422. **TYPE LOCALITY:** UNITED STATES OF AMERICA: Montana, Kalispell, H.F. Wickham (USNM). Holotype not examined, type on loan.

Gnypeta deserticola Casey 1906: 193. Synonymized by Moore and Legner 1975: 422. **LECTOTYPE** (male): UNITED STATES OF AMERICA: Ari. [zona]; [in orig. description: Benson, G.W. Dunn]; *deserticola* Csy [Casey's handwriting]; Type USNM, 38860; Casey bequest 1925; Lectotypus, male, *Gnypeta deserticola* Casey, des. V.I. Gusarov 2000 [designation not published] (USNM). Present designation. Examined. Synonymy confirmed.

Gnypeta oregona Casey 1906: 199. Synonymized by Moore and Legner 1975: 422. **LECTOTYPE** (male): UNITED STATES OF AMERICA: Oregon, Portland, [H.F. Wickham]; *oregona* Csy [Casey]; Type USNM 38859; Casey determ. *helenae* 2; Lectotypus *Gnypeta oregona* Casey, V.I. Gusarov des. 2002 [designation not published]; present designation label (USNM). Examined. **PARALECTOTYPES**: Oregon, Portland; [Casey des. male = female]; *oregona* 2, Paratype USNM 38851 (USNM) female; Portland, *oregona* 3, Paratype USNM 38859 (USNM) female. Examined. Synonymy confirmed.

Material examined

Specimens are listed in Appendix A.



Figs 148-155. Genital structures of *Gnypeta helenae*: 148, median lobe of the aedeagus in lateral view, 149, dorsal view; 150, paramere; 151, male tergite 8; 152, male sternite 8; 153, spermatheca; 154, female tergite 8; 155, female sternite 8.

Diagnosis

This species can be recognized by the following combination of characters: body length 2.7-3.0 mm (Fig. 16); elytra at suture as long as pronotum or slightly longer and about 1/4 wider than maximum width of pronotum (Fig. 16); abdomen at base distinctly narrower than elytra and subparallel (Fig. 16); antennal article 4 strongly elongate, 5-10 moderately to strongly elongate (Figs 34 a, b); median lobe of aedeagus with apical part narrowly triangularly produced with sinuate edges in lateral view (Fig. 148); spermatheca S-shaped, capsule pipe-shaped and consisting of a small cylindrical apical part angularly connected with a narrowly elongate sinuate stem (Fig. 153); male tergite 8 truncate apically and with slight apical emargination (Fig. 151); female sternite 8 with large apical emargination (Fig. 155). The elongate antennal articles 1-10; distinct shape of spermatheca; medially emarginated female sternite 8, and the shape of the apical portion of the median lobe of the aedeagus are the best characters for recognition of this species. This species is very similar to *G. canadensis* sp. nov., from which it may be distinguished with certainty by the genital differences: spermatheca with thicker posterior part of capsule and stem, and broader and less ventrally produced apical part of median lobe.

Description

Body length 2.7-3.0 mm; dark brown to black, elytra and legs and/or tarsi often rust brown (Fig. 16); integument strongly glossy; pubescence yellowish grey and moderately long and dense; antennal article 4 strongly elongate, 5-10 moderately to strongly elongate (Figs 34 a, b); head and pronotum of about the same width (Fig. 16); elytra and abdomen (less so) wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed anterad along midline and laterad elsewhere; elytra at suture as long as pronotum or slightly longer and about 1/4 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in wavy pattern medially on each side of disc (Fig. 16); abdomen subparallel, distinctly narrower than elytra at base (Fig. 16); metatarsus with basal article slightly longer than the following article. **Male**. Tergite 8 transverse and truncate apically with small median emargination (Fig. 151). Sternite 8 elongate and broadly rounded apically (Fig. 152). Median lobe of aedeagus with narrowly produced apical part of tubus in lateral view (Fig. 148); bulbus moderately enlarged in dorsal view (Fig. 149); internal sac with structures as illustrated (Figs 148, 149). **Female**. Tergite 8 truncate apically (Fig. 154). Sternite 8 broadly rounded posteriorly with large median emargination (Fig. 155). Spermatheca S-shaped, capsule pipe-shaped and consisting of a small cylindrical apical part angularly connected to a narrow tubular and sinuate stem (Fig. 153).

Distribution (Fig. 194)

Gnypeta helenae is a western Nearctic species recorded from Montana (Casey 1906), and also recorded under two synonymic names from Arizona and Oregon (Casey 1906; Moore and Legner 1975). We report this species for the first time from Canada in Alberta and British Columbia.

Collection and habitat data
Adults were collected in June, July, August and October, some from silt around *Typha* on a river bank.

Comments
The late Gustav Adolf Lohse (Hamburg, Germany) worked on revision of Nearctic *Gnypeta* but was not able to complete his project. One CNC specimen of this species bears his identification label as "*G. glabra* Lohse" [manuscript name].

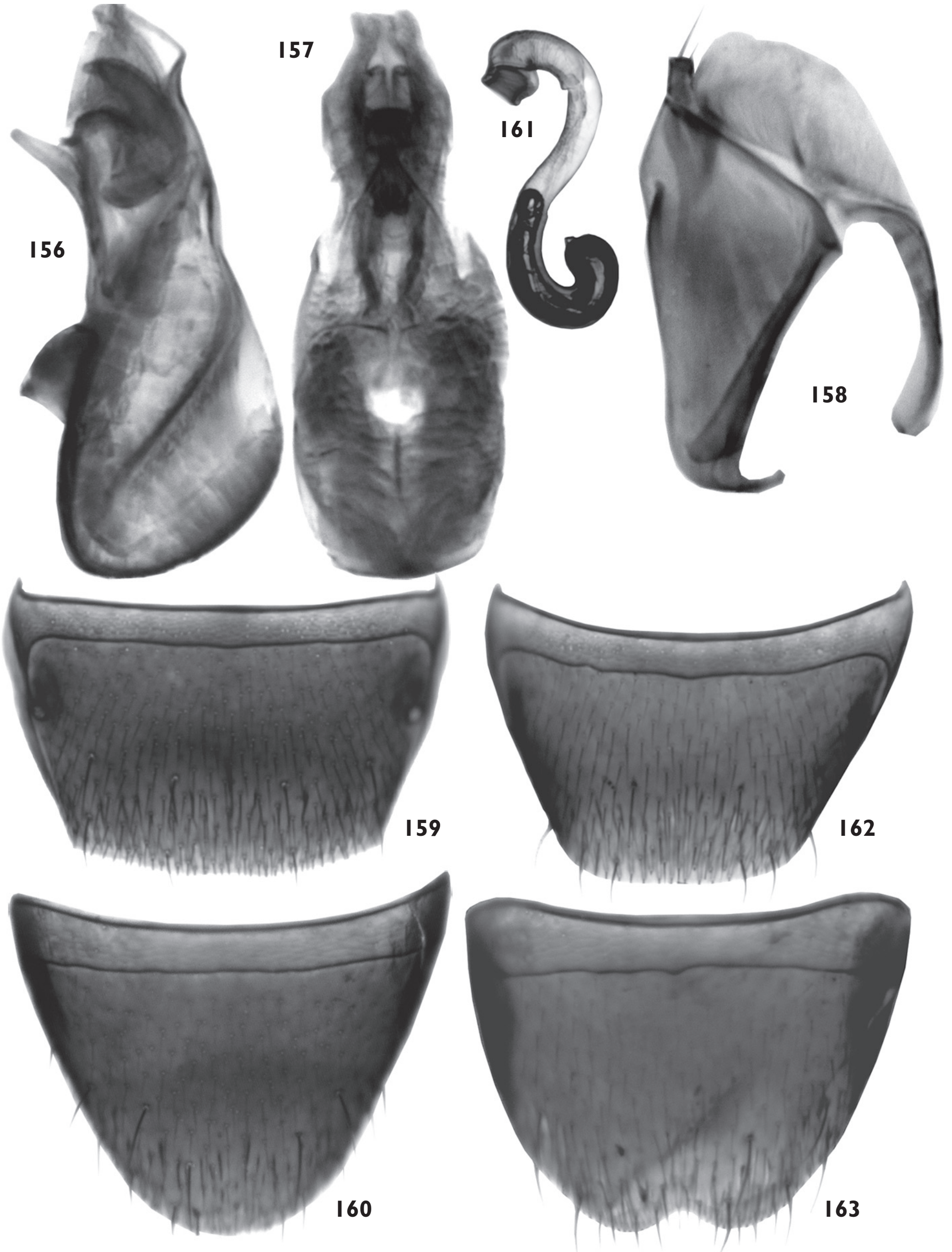
15. *Gnypeta canadensis* Klimaszewski, sp. nov.
urn:lsid:zoobank.org:act:D98C0465-D5D9-4059-A85E-8EB2DE6A2D33
(Figs 17, 35 a, b, 156-163, 198)

HOLOTYPE (male): CANADA, Ontario, Rondeau Provincial Park, South Point, [42°17'00" N, 81°51'00" W] 2.VI.1985, moss on logs in pond, A. Davies and J.M. Campbell, CNC No. 23679 (CNC). **PARATYPES:** listed in Appendix A.

Diagnosis
Gnypeta canadensis is externally similar to *G. helenae*, from which it may be distinguished with certainty by the shape of the narrower and ventrally produced apical portion of the median lobe of the aedeagus (Fig. 156), thicker stem of the spermatheca (Fig. 161), and different geographic distribution. It may be distinguished from the other Nearctic *Gnypeta* species by the following combination of characters: body length 2.7-3.0 mm, integument strongly glossy (Fig. 17); elytra at suture as long as pronotum or slightly longer and about 1/4 wider than maximum width of pronotum (Fig. 17); abdomen subparallel and at base distinctly narrower than elytra (Fig. 17); antennal article 4 strongly elongate, 5-10 moderately to strongly elongate (Figs 35 a, b); median lobe of aedeagus with apical part strongly produced ventrally in lateral view (Fig. 156); spermatheca S-shaped, capsule pipe-shaped and consisting of a small cylindrical apical part angularly connected to a tubular part and the elongate sinuate stem (Fig. 161); male tergite 8 truncate apically and with slight apical emargination (Fig. 159); female sternite 8 with large apical emargination (Fig. 163). The elongate antennal articles 1-10 (1-7 strongly, 8-10 slightly) (Figs 35 a, b); distinct shape of spermatheca; medially emarginated female sternite 8, and the shape of the apical portion of the median lobe of the aedeagus are the best characters for recognition of this species.

Description
As for *G. helenae* except for the characters of the median lobe of the aedeagus and the spermatheca (see above).

Distribution (Fig. 198)
Gnypeta canadensis is known to occur in Ontario and Alberta.



Figs 156-163. Genital structures of *Gnypeta canadensis*: 156, median lobe of the aedeagus in lateral view, 157, ventral view; 158, paramere; 159, male tergite 8; 160, male sternite 8; 161, spermatheca; 162, female tergite 8; 163, female sternite 8.

Collection and habitat data

Adults were captured in March, May and June. Some specimens were collected from an intercept trap in open marsh forest, and the holotype was captured in moss on a log.

Comments

The late Gustav Adolf Lohse (Hamburg, Germany) worked on revision of Nearctic *Gnypeta* but was not able to complete his project. Three CNC specimens of this species bear his identification labels as *G. glabricula* Lohse [manuscript name].

G. canadensis is similar to *G. helenae* and the two cannot be distinguished externally. They may be separated by the width of the spermatheca, the width of the apical portion of the median lobe of the aedeagus in lateral view, and by the different distribution ranges. For details, see the diagnosis and description.

Due to a lack of study material, we did not see a broad geographic variation in genital characters in this species. Should the variations in genital characters prove to be clinal based on a broader sample size in future studies and the geographic ranges overlapping between this species and *G. helenae,* the status of *G. canadensis* should be reconsidered.

V. *Gnypeta nigrella* species group

The *nigrella* species group may be characterized by the following combination of characters: spermatheca club-shaped, capsule approximately spherical and constricted to a narrow duct connected to a narrow, tubular and sinuate stem (Figs 169, 178, 187, 188); median lobe of aedeagus with moderately large bulbus which is streamlined with tubus in dorsal view (Figs 165, 173, 182), the internal sac with two pronounced subapical sclerites (Figs 164, 165, 177, 178, 181, 182); female sternite 8 emarginated medially (Figs 171, 180, 189).

Species included: *G. minuta* Klimaszewski and Webster, *G. nigrella* LeConte, *G. saccharina* Klimaszewski and Webster.

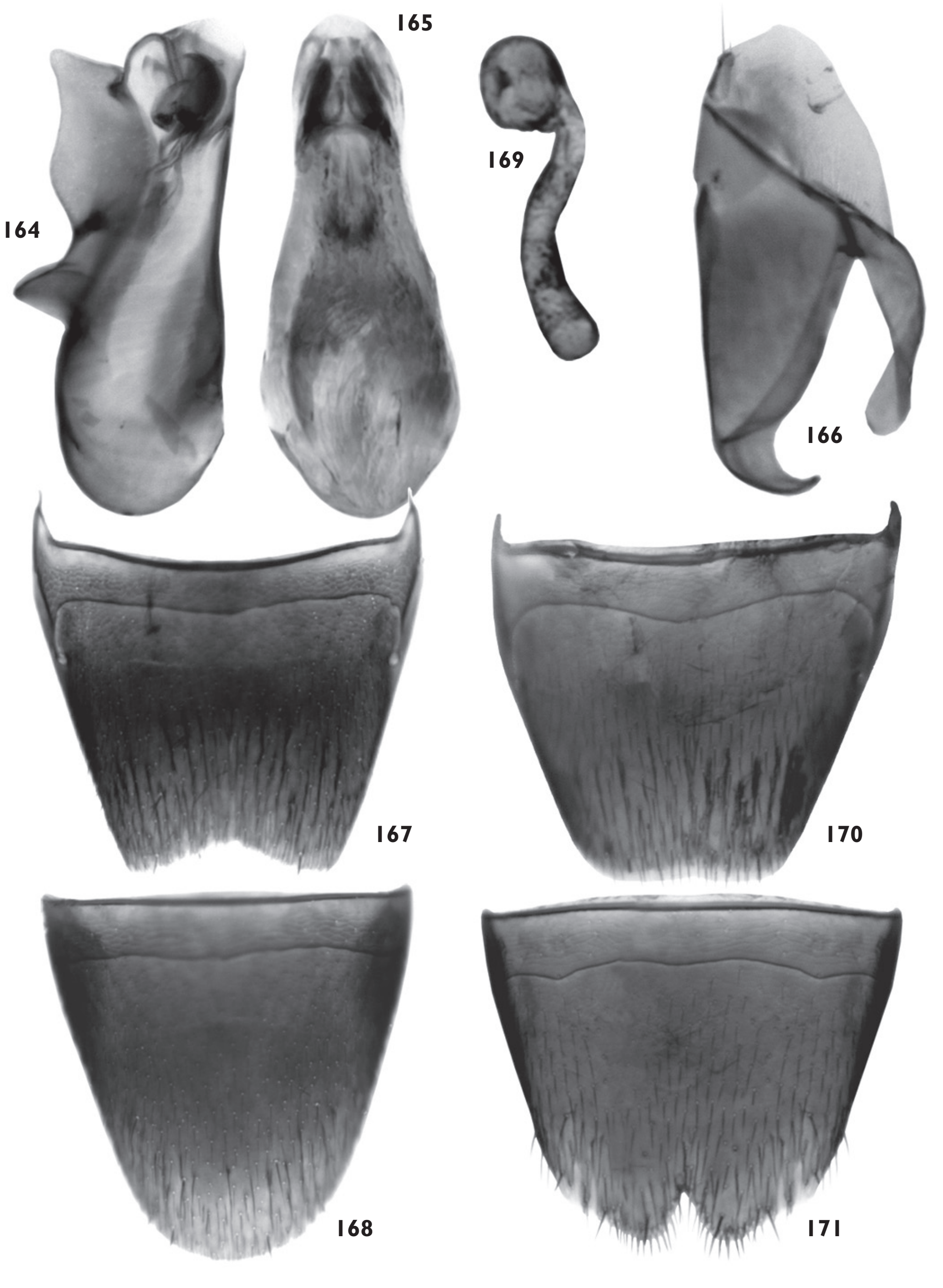
16. *Gnypeta nigrella* (LeConte)

(Figs 1, 2, 18, 36 a, b, 164-171, 192)

Tachyusa nigrella LeConte 1863: 29; Bland 1865: 412; Moore and Legner 1975: 422.
LECTOTYPE (male): UNITED STATES OF AMERICA: "in original description: "middle and Western States"; original labels: male; *nigrella* Lec.; Type 6247; Aug.-Dec., MCZ Image Data Base (MCZ). Present lectotype designation by J. Klimaszewski, 2008. Examined.

Material examined

Specimens are listed in Appendix A.



Figs 164-171. Genital structures of *Gnypeta nigrella*: 164, median lobe of the aedeagus in lateral view, 165, dorsal view; 166, paramere; 167, male tergite 8; 168, male sternite 8; 169, spermatheca; 170, female tergite 8; 171, female sternite 8.

Diagnosis

This species can be recognized by the following combination of characters: body length 2.7-3.0 mm (Figs 1, 2, 18); elytra at suture as long as pronotum or slightly longer and about 1/4 wider than maximum width of pronotum (Figs 1, 2, 18); abdomen at base distinctly narrower than elytra and subparallel (Figs 1, 2, 18); antennal article 4 strongly elongate, 5-10 moderately to strongly elongate (Figs 36 a, b); median lobe of aedeagus with apical part triangularly produced with sinuate edges in lateral view (Fig. 164); spermatheca club-shaped, capsule spherical and connected to a narrowly elongate sinuate stem (Fig. 169); male tergite 8 truncate apically and with slight apical emargination (Fig. 167); female sternite 8 with large apical emargination (Fig. 171). *Gnypeta nigrella* has extremely similar spermatheca, and tergite and sternite 8 are similar to those of *G. minuta* and *G. saccharina*. *Gnypeta nigrella* is distinct by its very short and silky body pubescence and by only a few coarse punctures at the margins of basal tergites (Fig. 1).

Description

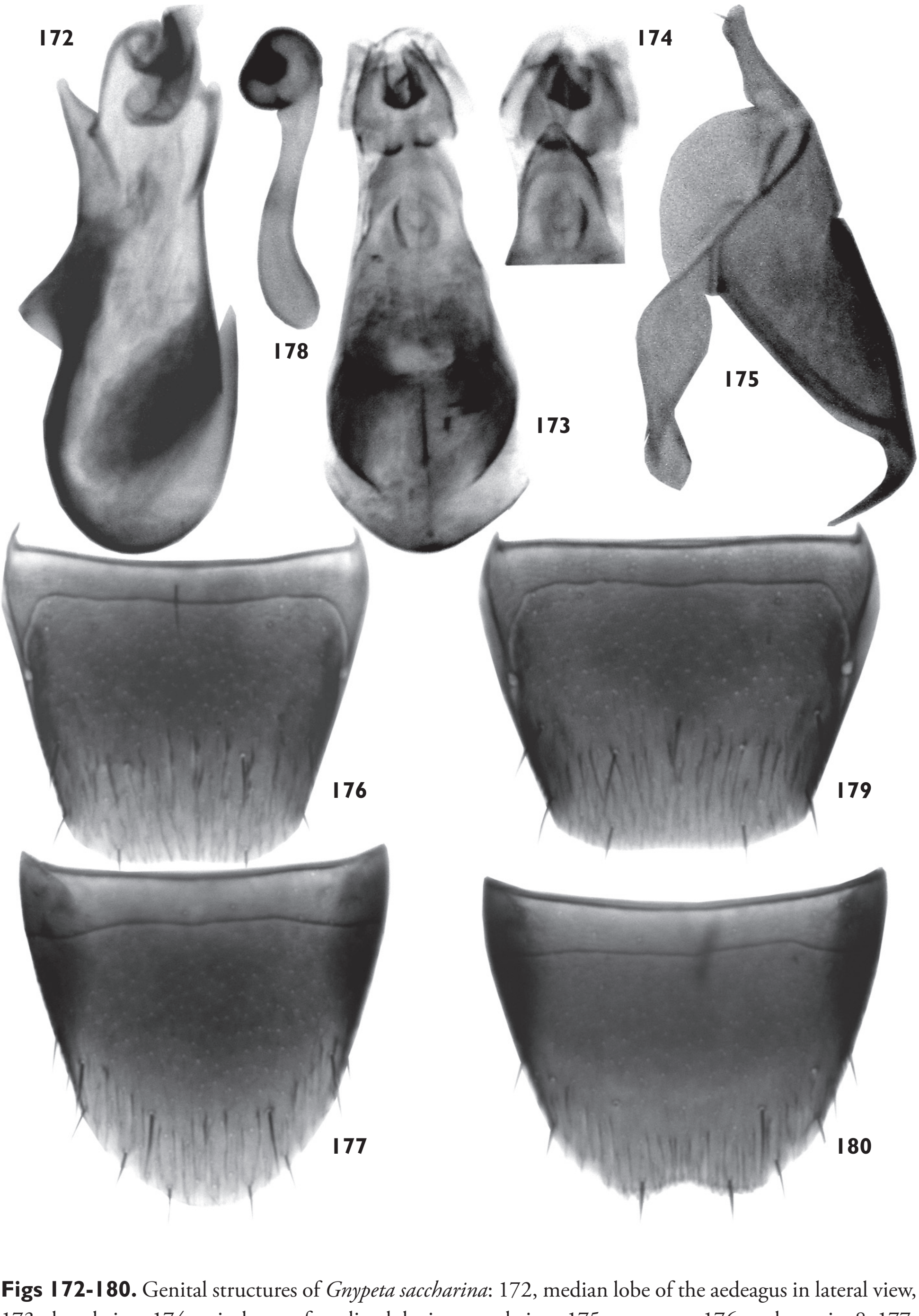
Body length 2.7-3.0 mm; dark brown to almost black, central and/or posterior portion of elytra often rust brown (Figs 1, 2, 18); integument moderately glossy; pubescence yellowish grey and moderately long and dense; antennal articles 4-7 strongly elongate, 8-10 moderately elongate (Figs 36 a, b); head and pronotum of about the same width (Figs 1, 2, 18); elytra and abdomen (less so) wider than either head or pronotum; head rounded posteriorly; pronotum broadest in apical third, pubescence directed posterad along midline and laterad elsewhere; elytra at suture longer than pronotum and about 1/4 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in weak wavy pattern medially on each side of disc (Figs 1, 2, 18); abdomen broadening posteriorly, distinctly narrower than elytra at base (Figs 1, 2, 18); metatarsus with basal article slightly longer than the following article (Fig. 1). **Male**. Tergite 8 emarginate apically (Fig. 167). Sternite 8 elongate and broadly rounded apically (Fig. 168). Median lobe of aedeagus with swollen ventral part of tubus and with produced apex in lateral view (Fig. 164); bulbus moderately large in dorsal view (Fig. 165); internal sac with complex structures as illustrated (Figs 164, 165). **Female**. Tergite 8 truncate apically (Fig. 170). Sternite 8 broadly rounded posteriorly with deep V-shaped apical emargination (Fig. 171). Spermatheca club-shaped, capsule spherical apically and constricted basally, connected to a narrow tubular and sinuate stem (Fig. 169).

Distribution (Fig. 192)

Gnypeta nigrella is an eastern Nearctic species previously recorded from Massachusetts, Pennsylvania, and Maryland (LeConte 1863; Bland 1865; Moore and Legner 1975). We report this species for the first time from Canada (New Brunswick) and from Vermont in the United States.

Collection and habitat data

Adults captured in New Brunswick occurred on bare, sun exposed, fine sand/gravel near margin of a medium-sized stream, others were found on bare mud and among cobblestones



Figs 172-180. Genital structures of *Gnypeta saccharina*: 172, median lobe of the aedeagus in lateral view, 173, dorsal view, 174, apical part of median lobe in ventral view; 175, paramere; 176, male tergite 8; 177, male sternite 8; 178, spermatheca; 179, female tergite 8; 180, female sternite 8.

(also in direct sun) on the shore of the Saint John River, and some from drift material, mostly maple seeds, in the Saint John River. The adults were diurnally active and in company with various *Bembidion* and *Tachyusa* species. Collecting period: May, June and July.

Comments

Gnypeta nigrella differs from *G. brevicornis* and *G. uteana* by moderately elongate basal article of metatarsus, which is extremely elongate in the two latter species. It differs from other *Gnypeta* species by its slender body, and almost total lack of punctation in the first three visible tergal impressions.

17. *Gnypeta saccharina* Klimaszewski and Webster, sp. nov.

urn:lsid:zoobank.org:act:3F61ACAE-3402-4A0B-8464-78A52DF9AEA5
(Figs 19, 37 a, b, 172-180, 199)

HOLOTYPE (male): **CANADA**, New Brunswick, Queens Co., Canning Grand Lake near Scotchtown, 45.8762° N. 66.1817° W., 25.V.2006, R.P. Webster coll.; silver maple swamp near lake margin, margin of vernal pond in moist leaves, IRM No. 1 (LFC). **PARATYPES**: New Brunswick, York Co., Fredericton, at Saint John River, 45.9588° N, 66.6254° W., 7.VI.2005, R.P. Webster coll., margin of river in flood debris (LFC, RWC) 3 females.

Etymology

The specific name "*saccharina*" derives from the Latin specific name of silver maple, *Acer saccharinum* L., in reference to the forest type where the holotype was captured.

Diagnosis

This species can be recognized by the following combination of characters: body length 2.4-2.7 mm (Fig. 19); elytra at suture as long as pronotum and about 1/6 wider than maximum width of pronotum (Fig. 19); abdomen at base slightly narrower than elytra and subparallel, tergal impressions without coarse punctation (Fig. 19); antennal article 4 strongly elongate, 5-7 moderately elongate, 8-10 subquadrate (Figs 37 a, b); median lobe of aedeagus with apical part narrowly triangularly produced with slightly sinuate edges in lateral view (Fig. 172); spermatheca pipe-shaped, capsule spherical with large apical invagination, stem narrowly elongate and sinuate (Fig. 178); male tergite 8 truncate apically (Fig. 176); female sternite 8 with large apical emargination (Fig. 180). The subquadrate antennal articles 7-10; distinct shape of spermatheca; medially emarginated female sternite 8, and the shape of the apical portion of the median lobe of the aedeagus are the best characters for recognition of this species.

Description

Body length 2.4-2.7 mm; dark brown (Fig. 19); integument moderately glossy; pubescence yellowish grey and very short and dense; antennal articles 5-7 moderately elongate, 8-10 subquadrate (Figs 37 a, b); head slightly narrower than pronotum (Fig. 19); elytra and abdomen (less so) wider than either head or pronotum; head rounded posteriorly; pronotum broadest in the middle, pubescence directed obliquely postero-laterad from the midline; elytra at suture as long as pronotum and about 1/6 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in weak wavy pattern medially on each side of disc (Fig. 19); abdomen subparallel, distinctly narrower than elytra at base (Fig. 19); metatarsus with basal article slightly longer than the following article. **Male**. Tergite 8 truncate apically (Fig. 176). Sternite 8 elongate and broadly rounded apically (Fig. 177). Median lobe of aedeagus with narrowly triangular apex in lateral view (Fig. 172); bulbus moderately large in dorsal view (Fig. 173); internal sac with complex structures as illustrated (Figs 172, 173). **Female**. Tergite 8 truncate apically (Fig. 179). Sternite 8 broadly rounded posteriorly with deep V-shaped apical emargination (Fig. 180). Spermatheca club-shaped, capsule spherical apically and constricted basally, connected to a narrow tubular and sinuate stem (Fig. 178).

Distribution (Fig. 199)
Gnypeta saccharinum was described from two localities in New Brunswick and these are the only known localities for this species.

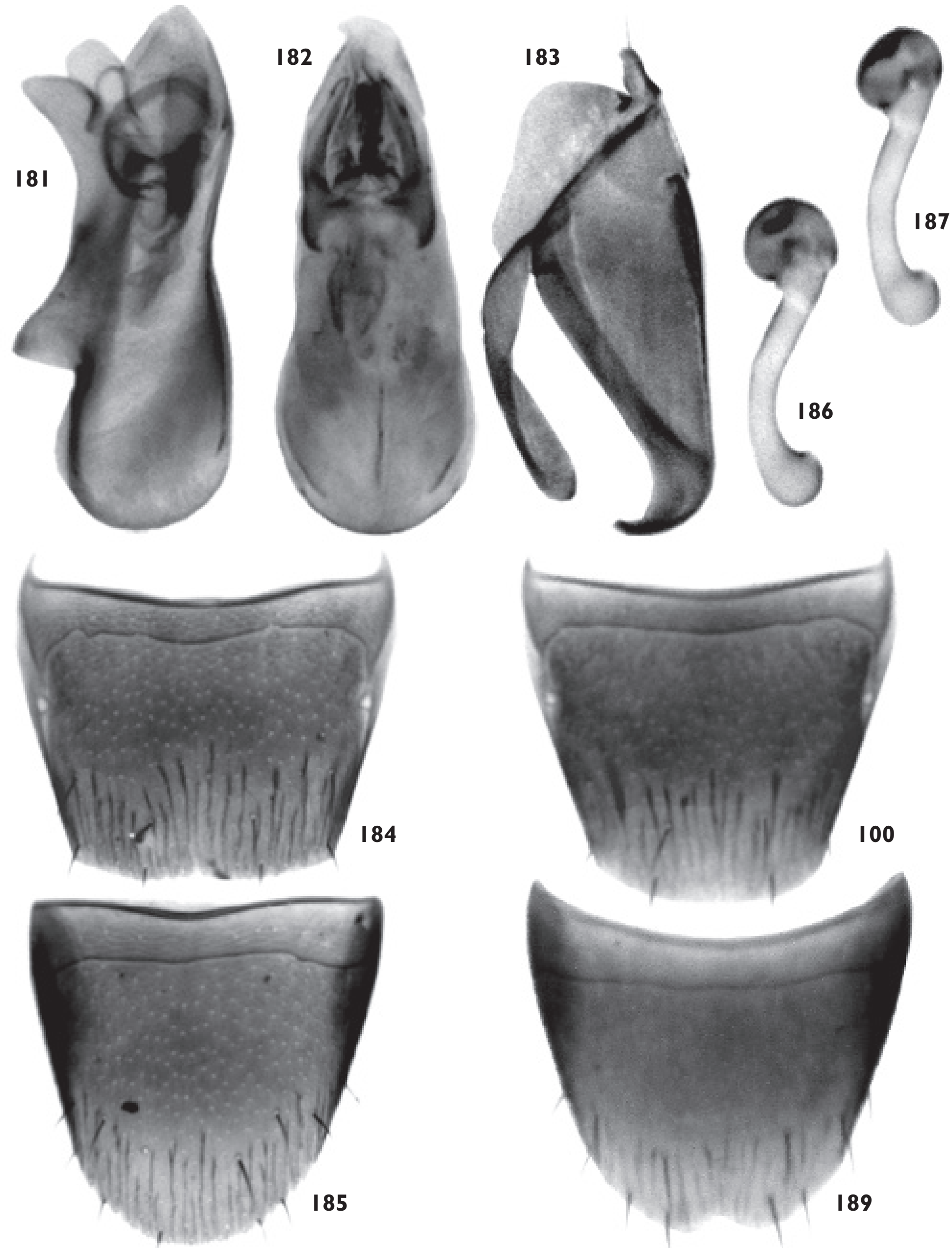
Collection and habitat data
Adults were captured in May from moist leaves near margin of vernal pond in silver maple (*Acer saccharinum* L.) swamp, and in June from flood debris at the margin of the Saint John River.

18. *Gnypeta minuta* Klimaszewski and Webster, sp. nov.
urn:lsid:zoobank.org:act:34D54632-2C6C-426C-8C85-C205C3004FDD
(Figs 20, 38 a, b, 181-189, 193)

HOLOTYPE (male): **CANADA**, New Brunswick, York Co., Douglas, Keswick River at Rt. 105, 45.9943° N., 66.8337° W., 18.06.2004, R.P. Webster coll., silver maple forest, under debris on muddy soil near small pool, IRM No. 2 (LFC). **PARATYPE** (female): **CANADA**: New Brunswick, Restigouche Co., Little Tobique River near Red Brook, 47.4465° N., 67.0689° W., 13.06.2006, R.P. Webster coll., river margin, under debris on clay and sand mix (LFC).

Etymology
The name of this species is the Latin "*minuta*", meaning small, in reference to the small size of this species.

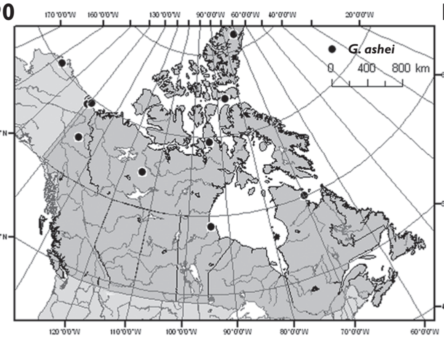
Diagnosis
This species can be recognized by the following combination of characters: body length 2.3 mm (Fig. 20); elytra at suture longer than pronotum and about 1/6 wider than maximum width of pronotum (Fig. 20); abdomen at base distinctly narrower than



Figs 181-189. Genital structures of *Gnypeta minuta*: 181, median lobe of the aedeagus in lateral view, 182, dorsal view; 183, paramere; 184, male tergite 8; 185, male sternite 8; 186, 187, spermatheca; 188, female tergite 8; 189, female sternite 8.

elytra and broadening posteriorly, tergal impressions with coarse punctation (Fig. 20); antennal article 4 strongly elongate, 5-7 moderately elongate, 8-10 subquadrate (Figs 38 a, b); median lobe of aedeagus with apical part broadly triangular in lateral view (Fig. 181); male tergite 8 truncate apically (Fig. 184). The subquadrate antennal articles 7-10, posteriorly broadening abdomen, and distinct shape of the apical portion of the median lobe of the aedeagus, slightly emarginated apex of female sternite 8 and the pipe-shaped spermatheca are the best characters for recognition of this species.

190



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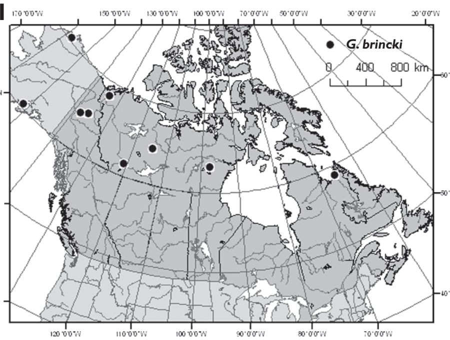

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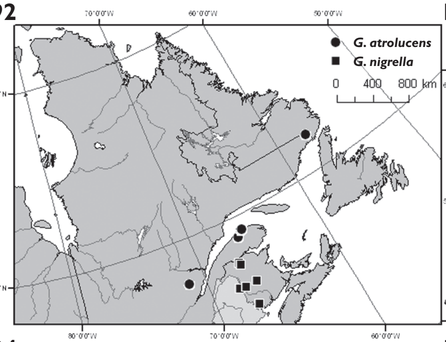
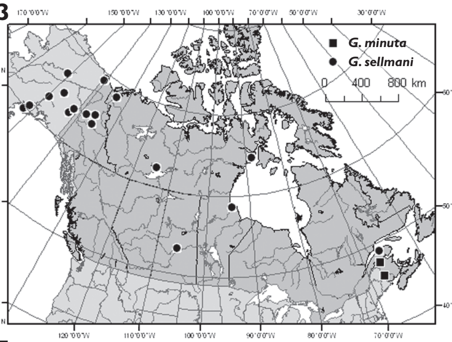
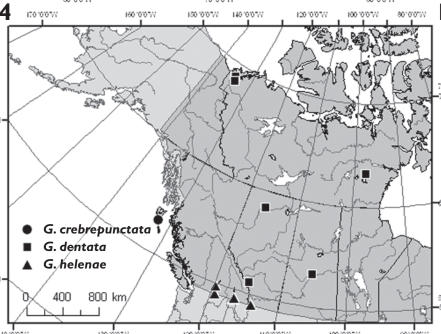


193



194



195

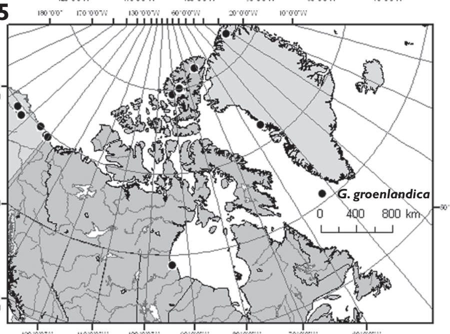
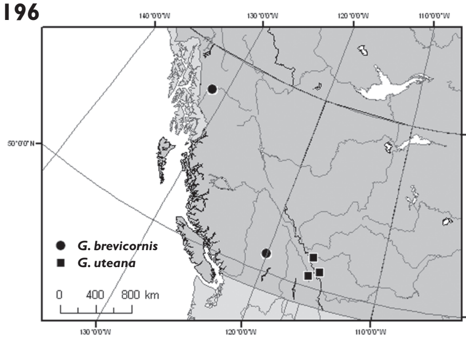
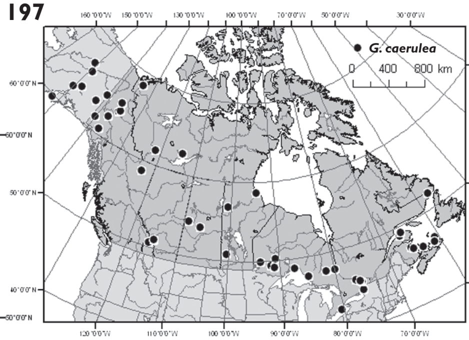


Fig. 190. Collection localities in Canada and Alaska of *G. ashei*.
Fig. 191. Collection localities in Canada and Alaska of *G. brincki*.
Fig. 192. Collection localities in Canada of *G. atrolucens* and *G. nigrella*.
Fig. 193. Collection localities in Canada and Alaska of *G. minuta* and *G. sellmani*.
Fig. 194. Collection localities in Canada of *G. crebrepunctata*, *G. dentata*, and *G. helenae*.
Fig. 195. Collection localities in Canada and Alaska of *G. groenlandica*.

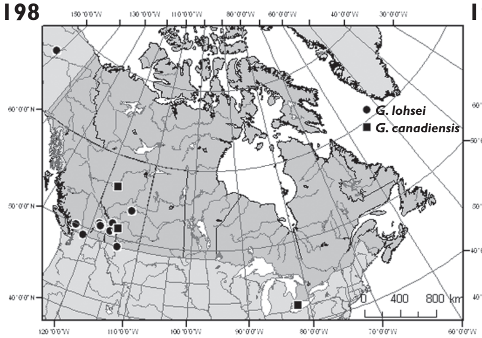
196



197



198



199

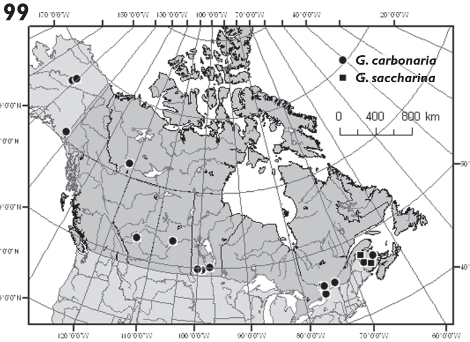


Fig. 196. Collection localities in Canada of *G. brevicornis* and *G. uteana*.
Fig. 197. Collection localities in Canada and Alaska of *G. caerulea*.
Fig. 198. Collection localities in Canada and Alaska of *G. lohsei* and *G. canadiensis*.
Fig. 199. Collection localities in Canada and Alaska of *G. carbonaria* and *G. saccharina.*

Description

Body length 2.3 mm; dark brown (Fig. 20); integument moderately glossy; pubescence yellowish grey and moderately short and dense; antennal articles 5-7 moderately elongate, 8-10 subquadrate (Figs 38 a, b); head slightly narrower than pronotum (Fig. 20); elytra and abdomen (less so) wider than either head or pronotum; head rounded posteriorly; pronotum broadest in the apical third, pubescence directed obliquely postero-laterad from the midline; elytra at suture longer than pronotum and about 1/6 wider than maximum width of pronotum, pubescence directed obliquely postero-laterad, in weak wavy pattern medially on each side of disc (Fig. 20); abdomen broadening posteriorly, distinctly narrower than elytra at base (Fig. 20); metatarsus with basal article slightly longer than the following article. **Male**. Tergite 8 truncate apically (Fig. 184). Sternite 8 elongate and broadly rounded apically (Fig. 185). Median lobe of aedeagus with broadly triangular apex in lateral view (Fig. 181); bulbus moderately large in dorsal view (Fig. 182); internal sac with complex structures as illustrated (Figs 181, 182). **Female**. Tergite 8 broadly rounded apically (Fig. 188); sternite 8 with shallow median emargination at apex (Fig. 189); spermatheca pipe-shaped (Figs 186, 187).

Distribution (Fig. 193)
Gnypeta minuta is known only from New Brunswick, Canada.

Collection and habitat data
The two specimens were captured in June, one from under debris on muddy soil near a small pool in a silver maple forest, and the other from under debris on clay and sand mix at river margin.

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Appendix A. List of specimens examined

Types are listed under each species in the text, except for long lists of paratypes, which are given here. Species are listed in alphabetical order.

A1. *Gnypeta ashei* Klimaszewski, sp. nov.

Paratypes

UNITED STATES: Alaska: Atkasuk, North Slope, 17.VI.1978, B. Vogel (CNC) 9 males, 3 females; (LFC) 2 males, 2 females. **CANADA: Manitoba**: Churchill, 13.VI.1952, J.G. Chillcott (CNC) 1 male. **Northwest Territories:** Spence Bay, 2.VII.1951, J.G. Chillcott (CNC) 1 male, 1 sex?; Ellesmere Island, Hazen Camp, 10.VIII.1961, D.R. Oliver (CNC) 1 male; 10.VIII.1961, D.R. Oliver (CNC) 6 males, 12 females, 1 sex?; (LFC) 1 female; 13.VIII.1961 (CNC) 1 female; 15.VII.1961 (CNC) 5 males, 8 females, 2 sex?; (LFC) 1 female, 1 sex?; 17.VII.1961 (CNC) 2 females; 19.VIII.1961 (CNC) 1 male, 4 females; (LFC) 1 male; Ellesmere Island, Hazen Camp (81°49'N, 71°18'W), 4.VIII.1963, R.E. Leech, (CNC) 3 males, 3 females; 5.VII.1963 (CNC) 3 males, 3 females; 7.VII.1963 (CNC) 2 females; 8.VIII.1963 (CNC) 1 female; 11.VII.1963 (CNC) 1 male, 2 females; 12.VIII.1963 (CNC) 1 female; same data except Trap 20 (CNC) 1 female; 15.VII.1963 (CNC) 1 male, 1 female; 19.VII.1963 (CNC) 4 males; (LFC) 3 females; 19.VIII.1963 (CNC) 11 males, 5 females; same data except Trap 13 (CNC) 1 female; 21.VII.1963 (CNC) 1 male, 1 female; 23.VII.1963 (CNC) 1 male, 1 female; same data except Trap 41 (CNC) 1 female; 27.VII.1963, Trap 11 (CNC) 1 female; 27.VII.1963 Trap 18 (CNC) 1 female; 31.VII.1963 (CNC) 6 males, 2 females; (LFC) 1 male, 1 female; Ellesmere Island, Hazen Camp (81°49'N, 71°18'W), 22.VI.1966, Corbet & Nettleship, marsh (CNC) 1 male, 1 sex?; Salmita Mines (64°05'N, 111°15'W), 20.VI.1953, J.G. Chillcott (CNC) 1 male; Devon Island, 1 mi. S. Camp (75°N, 85°W), 23.VI.1971, J.K. Ryan & C.R. Hergert, I.B.P. Proj., On snow (CNC) 1 male. **Québec:** Payne Bay, 5.VI.1958, E.E. MacDougall (CNC) 1 female. **Yukon:** Komakuk Beach (69°36'N, 140°10'W), 05.VI.1984, J.M. Campbell (CNC) 1 male, 4 females; 15.VI.1984 (CNC) 1 female; Clarence Lagoon (69°38'N, 140°55'W), 05.VII.1984, J.M. Campbell, sifting litter on shore (CNC) 1 female; Dempster Hwy mi. 65, 3300', 13.VII.1968, Campbell & Smetana, (CNC) 1 male; British Mts., Swan Pond, 340 m, 4 km NE Wolf Cr. (69°08'N, 140°14'W), 23.VI.1984, J.M. Campbell, treading sedges around edge of pond (CNC) 1 male, 1 female, 1 sex?; Herschel Island, 27.VII.1971, W.R.M. Mason (CNC) 1 female.

A2. *Gnypeta atrolucens* Casey

Non-type material

CANADA: Québec: Québec, Mont Albert, Parc Gaspésie, 8.VII.1972, J.M. & B.A. Campbell (CNC) 1 male; Gaspésie, Parc Gaspésie, Mont Albert, 1000', 8.VII.1972, J.M. & B.A. Campbell (CNC) 2 males, 1 sex?; 9.VII.1972 (CNC) 1 male, 1 female; (LFC) 1 male, 1 sex?; Gaspésie, Rivière-à-Claude, 4 mi. S., 200', 18.VII.1972, J.M. Campbell (CNC) 1 male, 3 females, 1 sex?; Laurentides, Parc des Laurentides, Bois Vert, 2800', 18.VIII.1970, J.M. & B.A. Campbell (CNC) 2 males; (LFC) 1 female, 2 sex?; Gaspésie, Mont-St-Pierre, 21.VII.1972, J.M. Campbell (CNC) 1 female, 1 sex?; (LFC) 1 male. **Newfoundland and Labrador:** Labrador, SE Labrador, L'Anse au Loup, 17.VII.1951, Lindroth, No. 295 (CNC) 1 male, 1 female.

A3. *Gnypeta brevicornis* Casey

Paralectotypes

CANADA: **British Columbia:** Br. C. [British Columbia]; *brevicornis* – 2, Paratype USNM 38865, Casey bequest 1925 (USNM) 1 sex?; Glenora B.C.; *brevicornis* – 3, Paratype USNM 38865; Casey bequest 1925 (USNM) 1 sex?; Br. C. [British Columbia]; *brevicornis* – 4, Paratype USNM 38865, Casey bequest 1925 (USNM) 1 female; Glenora B.C.; *brevicornis* – 5, Paratype USNM 38865; Casey bequest 1925 (USNM) 1 sex?; Glenora B.C.; *brevicornis* – 6, Paratype USNM 38865; Casey bequest 1925 (USNM) 1 sex?; Kamloops B.C.; *brevicornis* – 7, Paratype USNM 38865; Casey bequest 1925 (USNM) 1 sex?; Kamloops B.C., Wickham; *brevicornis* – 8, Paratype USNM 38865; Casey bequest 1925 (USNM) 1 female; Br. C. [British Columbia]; *brevicornis* – 10, Paratype USNM 38865, Casey bequest 1925 (USNM) 1 sex?; Br. C. [British Columbia]; *brevicornis* – 11, Paratype USNM 38865, Casey bequest 1925 (USNM) 1 male. Present designation.

A4. *Gnypeta brincki* Palm

Non-type material

UNITED STATES: Alaska: Kenai Pen., 6.VI.1978, Clam Gulch, Smetana & Becker (CNC) 1 female; 3 mi. SE Kenai, 7.VI.1978, Smetana & Becker (CNC) 1 male, 1 female, 2 sex?; 8.VI.1978 (CNC) 1 male, 2 females, 1 sex?; Atkasuk, North Slope, 17.VI.1978, B. Vogel (CNC) 1 female. **CANADA: Northwest Territories:** Spence River, 38 mi. SE Fort Simpson, 19.VI.1972, A. Smetana (CNC) 1 sex?; Salmita Mines (64°05'N, 111°15'W), 20.VI.1953, J.G. Chillcott (CNC) 1 female; Ford Lake, 23.VI.-4.VII.1966, G.E. Shewell (CNC) 1 female; Inuvik, 29.VI.1972, A. Smetana (CNC) 1 male. **Québec:** Nunavik, Koroc River, 10.VIII.1986, Estuary 1-2 m above tide, moist/dry substrate of sand-gravel, organic mats., A. & S. Morgan (CNC) 1 female. **Yukon:** Dempster Hwy mi. 65, 3300', 13.VII.1968, Campbell & Smetana (CNC) 1 female; North Fork Pass, Dempster Hwy mi. 53, 4200', 24.VII.1978, A. Smetana & J.M. Campbell (CNC) 11 females, 13 males, 16 sex?; (LFC) 2 males, 5 females, 2 sex?

A5. *Gnypeta caerulea* (C.R. Sahlberg)

Non-type material

UNITED STATES: Alaska: Kenai Pen., 1 mi. N. Anchor Pt., 200', 2.VI.1978, Smetana & Becker (CNC) 1 female; Prudhoe Bay Rd., Bonanza Cr. , 900' (150°40', 66°40') 2.VII.1978, A. Smetana & J.M. Campbell (CNC) 1 female; Prudhoe Bay Rd., 8 mi. N.S. Fork Koyukuk R., 1000' (67°13'N, 150°07'W) 8.VIII.1978, A. Smetana & J.M. Campbell (CNC) 1 female; (LFC) 1 male; Mi. 1252 Alaska Hwy., 7.VII.1968, J.M. Campbell & A. Smetana (CNC) 1 female; Mi. 27, Taylor Hwy., 8.VII.1968, J.M. Campbell & A. Smetana (CNC) 1 sex?; Mi. 123 Taylor Hwy., 9.VII.1968, J.M. Campbell & A. Smetana (CNC) 1 female; Mi. 24 Wales Hwy., Hess Cr, 600' (65°40'N, 149°10'W), 10.VII.1978, J.M. Campbell & A. Smetana (CNC) 2 females; Mi. 110 Denali Hwy., Seattle Cr., 12.VII.1978, J.M. Campbell & A. Smetana (CNC) 4 males, 2 females; same data except 15.VII.1978 (CNC) 1 sex?; Denali St. Pk., Byers Cr., at Hwy 1, 20.VI.1978, A. Smetana & E. Becker (CNC) 1 female; Denali St. Pk., Byers Lk. Cpgd., 26.VI.1978, A. Smetana & E. Becker (CNC) 1 female. **CANADA: Alberta:** Kananaskis F.E.S., 1.VIII.1971, J.M. & B.A. Campbell (CNC) 1 male; (LFC) 1 male; Kananaskis F.E.S., Lust Creek, 20.VI.1971, J.M. & B.A. Campbell (CNC) 1 sex?; Highwood Pass, 35 mi. S. Kananaskis, 7000', 28.VII.1970, E.E. Lindquist (CNC) 1 male; 10 mi. SW. Kananaskis F.E.S., 31.VII.1971, J.M. & B.A. Campbell (CNC) 4 sex?; (LFC) 1 male, 1 female. **British Columbia:** Mile 496, Alaska Hwy., 10.VII.1979, B.F & J.L. Carr, Lot 2 (CNC) 1 female. **Manitoba:** Churchill, 4.VI.1952, J.G. Chillcott (CNC) 1 female; Riding Mtn. N.P, nr. McKinnon Lake, 5.IX.1979, A. Smetana, (CNC) 1 female, 2 sex?; (LFC) 1 female; Riding Mtn. N.P, Swanson Cr. at Hwy. 19, 7.IX.1979, A. Smetana (CNC) 1 sex?; 4 mi. SE North Pole, 30.VI.1978, A. Smetana & J.M. Campbell (CNC) 1 sex?. **New Brunswick:** Kouchibouguac, 21.IX.1977, A. Smetana, Code-6012F (CNC) 1 sex? (LFC) 1 female; 30.V.1977, S.J. Miller, Code-5169a (CNC) 1 sex?; Northumberland Co., N.W. Miramichi R., 24.VI.1962, J. Marshall (CNC) 1 sex?. **Nova Scotia:** Inverness Co., 17.V.1996, J. MacMillan (CBU) 1 sex?; Cape Breton, Lone Shielding, 4.VII.1983, Malaise trough, R. Vockeroth, PG729861 (CNC) 1 male, 2 females; Lone Shielding, 60 m, 15.IX.1984, Moss along stream, J.M. Campbell & A. Davies, PG730860 (CNC) 1 female; H.N.P., 2 km NE Ingonish Bch, 20.IX.1984, tread edge of pond with sphagnum, J.M. Campbell & A. Davies, PG990692 (CNC) 1 female. **Northwest Territories:** Hwy. 4 crossing Cameron R., 19.VII.1981, B.F. & J.L. Carr, Lot 5 (CNC) 1 female; Ft. Simpson, 10.VI.1972, A. Smetana (CNC) 2 males, 2 females; Rabbitskin R. 23 mi. SE Ft. Simpson, 19.VI.1972, A. Smetana (LFC) 1 female; Inuvik, 24.VI.1972, A. Smetana (CNC) 1 female; Inuvik, 25.VI.1972, A. Smetana (CNC) 1 male, 1 female; Unnamed Lake, 18 mi. NW Inuvik via East Channel, 26.VI.1972, A. Smetana (CNC) 2 males, 1 sex?. **Ontario:** Ottawa, Mer Bleue bog, 11.VIII.1982, A. Davies (CNC) 1 sex?; Lk. Superior Prov. Pk., Lake Mijinemungshing, 12.VI.1973, J.M. Campbell & R. Parry (CNC) 1 sex?; 9 mi. E. Terrace Bay, 14.VI.1973, Campbell & Parry (CNC) 1 sex?; Ignac, 16.VI.1973, Campbell & Parry (CNC) 1 sex?; English River, 16.VI.1973, Campbell & Parry (CNC) 5 sex?; (LFC) 1 sex?; Moose Creek, 10 mi. S. Sioux Lookout, 17.VI.1973, Campbell & Parry (CNC) 1 female, 6 sex?; (LFC) 1 male; 16 mi. S. Savant Lake, 23.VI.1973, Campbell & Parry (CNC) 1 female, 3 sex?; 52 mi. S. Armstrong, 27.VI.1973, R. Parry & J.M. Campbell (CNC) 1 female; Turkey Point, 24.VII.1984, Sweeping in marshy area, LL 6, L. LeSage (CNC) 1 sex?; St. Lawrence Is. Nat. Park, Grenadier I. Center, 29.V.1975, Code1-4330, A. Davies (CNC) 1 sex?; Sudbury Co., Mattagami, 28.VIII.1980, R. Baranowski (LUC) 1 female; Carleton Co., Mer Bleue, 17.IX.1980, R. Baranowski (LUC) 1 female. **Prince Edward**

Island: Queens Co., St. Patricks, 21.VII.2001, C.G. Majka, along stream (CGMC) 1 male, 1 female; same data except: 18.VIII.2002 (CGMC) 1 sex?. **Québec:** Gaspésie, Parc Gaspésie, Mont Albert, 1000', 8.VII.1972, J.M. & B.A. Campbell (CNC) 2 females, 4 sex?; Gaspésie, Parc Gaspésie, Lac Ste-Anne, 1500', 12.VII.1972, J.M. & B.A. Campbell (CNC) 1 female; Gaspésie, Rivière-à-Claude, 4 mi. S, 200', 18.VII.1972, J.M. Campbell (CNC) 2 males, 1 female, 2 sex?; Fort Coulonge, 19.VI.1976, J.M. Campbell (CNC) 1 sex?; Gatineau, Gatineau Pk., Ramsay Lk., 20.VII.1982, Davies, Smetana & Vermette (CNC) 1 male, 1 sex?; Gatineau, Gatineau Pk., Ramsay Lake Area., 21.VI.1970, J.M. Campbell (LFC) 1 male; Gatineau, Gatineau Pk., Lac Pinks, 21.VII.1982, veg. beaver pond, L. LeSage (CNC) 5 sex?; (LFC) 1 sex?. **Saskatchewan:** Meadow Lk. Prov. Pk., 20.VII.1972, D.E. Bright (CNC) 3 males, 8 sex?; (LFC) 1 sex?; Prince Albert N.P., 24.VII.1972, D.E. Bright (CNC) 1 sex?. **Newfoundland and Labrador:** Labrador, SE Labrador, L'Anse au Loup, 17.VII.1951, Lindroth, No. 295 (CNC) 1 male. **Yukon:** Alaska Hwy., Edith Creek, 6.VII.1968, Campbell & Smetana (CNC) 1 female; Dempster Hwy mi. 65, 3300', 13.VII.1968, Campbell & Smetana (CNC) 4 males; Dempster Hwy mi. 37, 3000', 14.VII.1968, Campbell & Smetana (CNC) 1 male; Dempster Hwy mi. 154; Ogilvie R., 1900', 20.VII.1978, Campbell & Smetana (CNC) 2 males, 2 females, 1 sex?; Dempster Hwy mi. 136, 1900', 22.VII.1978, Campbell & Smetana (CNC) 1 male, 3 sex?; Hansen Lk., 9 mi. SW Keno, 17.VII.1968, Campbell & Smetana (CNC) 2 males; 11 mi. W Elsa, 18.VII.1968, Campbell & Smetana (CNC) 1 female; (LFC) 1 female; McQuesten Lk., 15 mi. SW Keno, 19.VII.1968, Campbell & Smetana (CNC) 1 female.

A6. *Gnypeta canadensis* Klimaszewski

Paratypes

CANADA. Alberta: Ft. Macleod, 16.III.1980, B.F. & J.L. Carr, PARATYPE, Lot 3 (CNC) 2 females; Ft. Macleod, 16.III.1980, B.F. & J.L. Carr, Lot 3 (CNC) 2 males; Ghost Dam, 28.III.1953, B.F. & J.L. Carr, Lot 1 (CNC) 1 male; **Ontario:** Rondeau Pr. Pk., South Point, 2.VI.1985, A. Davies & J.M. Campbell (CNC) 1 male; Rondeau Pr. Pk., 2-6.VI.1985, L. LeSage & A. Smetana (CNC) 1 sex?; Rondeau Pr. Pk., 2-6. VI.1985, L. LeSage & A. Smetana, int. trap, open marsh forest (LFC) 1 female; Rondeau Pr. Pk., 28.V-2.VI.1985, L. LeSage & A. Smetana (CNC) 1 female.

A7. *Gnypeta carbonaria* Mannerheim

Non-type material

UNITED STATES: Alaska: Prudhoe Bay Rd., Bonanza Cr., 900' (66°40'N, 150°40'W), 2.VII.1978, A. Smetana & J.M. Campbell (CNC) 2 females; Prudhoe Bay Rd. 8 mi. N.S. Fort Koyukuk R., 1000' (67°13'N, 150°07'W), 8.VIII.1978, A. Smetana & J.M. Campbell (CNC) 1 male, 3 females; Mi. 1252 Alaska Hwy., 7.VII.1968, Campbell

& Smetana (CNC) 2 females, 1 sex?. **CANADA: Alberta:** 2 mi. S. Ponaka, Battle R., 6.VIII.1976, J.M. Campbell (CNC) 1 male, 1 female. **Manitoba:** Spruce Woods P.P., 5.VII.1985, Y. Bousquet (CNC) 1 male; Brandon, 12.VIII.1958, R.B. Madge (CNC) 1 female; Stonewall, 18.VIII.1918, in rotten fungus, J.B. Wallis (CNC) 1 female. **New Brunswick:** York Co., Fredericton, at St. John River (45.9588°N, 66.6254°W), 4.VII.2004, R.P. Webster, margin of river in drift material (mostly maple seeds) (RWC) 1 female; same data except: 7.VI.2005, R.P. Webster coll., margin of river in flood debris (RWC) 1 male; same data except: Keswick River at Rt. 105, (45.9943°N, 66.8337°W), 18.VI.2004, R.P. Webster, river margin on clay sand mix on steep bank (splashing) (LFC) 1 male; Kouchibouguac N.P., 17.IX.1977, J.M. Campbell, Code-5977W (CNC) 1 male, 1 sex?; S.J. Miller, Code-6003W (CNC) 1 male, 3 sex?; (LFC) 1 female; A. Smetana, Code-5978W (CNC) 3 males, 1 sex?; 18.IX.1977, J.M. Campbell, Code-59840 (CNC) 1 sex?. **Northwest Territories:** Ft. Simpson, 9.VI.1972, A. Smetana (CNC) 3 males, 1 female, 3 sex?; (LFC) 1 female, 1 sex?; 10.VI.1972, A. Smetana (CNC) 3 males, 4 females, 3 sex?; 14.VI.1972, A. Smetana (CNC) 1 sex?; Ft. Simpson, Harris Riv., 10.VI.1972, A. Smetana (CNC) 1 sex?; 15.VI.1972. A. Smetana (CNC) 1 female, 1 sex?; Ft. Simpson, Manners Cr., 11.VI.1972, A. Smetana (CNC) 1 female; Hwy 3.5 mi. SE Ft. Simpson, 17.VI.1972, A. Smetana (LFC) 1 sex?. **Ontario:** 3 mi. S. Richmond, 2.VII.1878, wet ground calcar. bog, D. Maddison (CNC) 1 sex?; (LFC) 1 female; Ottawa, Mer Bleue bog, 3.VIII.1982, A. Davies (CNC) 1 sex?; 11.VIII.1982 (CNC) 1 sex?; St. Lawrence Island N.P., Grenadier I. Center, 26.V.1975, J.M. Campbell, Code-1-27A (LFC) 1 female; 27.V.1974, A. Davies, Code-1-430 (CNC) 1 sex?; (LFC) 1 female; 27.V.1975, A. Smetana, Code-1-455 (CNC) 1 sex?; 27.V.1975, A. Davies, Code-1-40N (LFC) 1 male. **Québec:** Gatineau, Gatineau Park, Taylor Lk., 06.IX.1973, Smetana & Davies (CNC) 1 female; Pt. Gatineau, 18-19.VI.1974, A. & Z. Smetana (CNC) 1 female; (LFC) 1 sex?; Montréal, 19.VIII.1974, E.J. Kiteley (CNC) 2 sex?; 28.VIII.1972 (CNC) 1 sex?. **Saskatchewan:** Prince Albert N.P., 24.VII.1972, D.E. Bright (CNC) 1 female, 1 sex?

A8. *Gnypeta crebrepunctata* (Casey)

Non-type material

UNITED STATES: California: San Luis Obispo, 25.IX.1950, Cambria Pines Elo, Ian Moore (CNC) 2 males, 1 female; Santa Cruz, 28.IX.1950, Ian Moore (CNC) 1 female. **CANADA: British Columbia:** Queen Charlotte Islands, 1 km W Moresby Camp, Pallant Cr., 3.VIII.1983, Gravel along edge of creek, J.M. Campbell, 83-51 (LFC) 1 female; Tlell R., end Richardson Rd., 17.VII.1983, Rotting Boletus, J.M. Campbell, 84-14 (CNC) 2 males, 1 female; (LFC) 1 male, 1 female.

A9. *Gnypeta dentata* Klimaszewski, sp. nov.

Paratypes

CANADA: Alberta: Kananaskis, F.E.S., 1.VIII.1971, J.M. & B.A. Campbell (CNC) 1 male; Gull Lake, 2.VI.1968, J.H. Franks (LFC) 1 male. **Northwest Territories:** Unnamed Lake, 18 mi. NW Inuvik via East Channel, 26.VI.1972, A. Smetana (CNC) 1 male; Unnamed Lake, 18 mi. NW Inuvik via East Channel, 26.VI.1972, A. Smetana. PARATYPE (CNC) 1 male, 3 females, 1 sex? (LFC) 1 male; Inuvik, 1.VII.1972, A. Smetana (CNC) 1 female; (LFC) 1 female; 25.VI.1972 (CNC) 4 males, 1 female; (LFC) 1 male; Caribou Hills, Reindeer Sta., 2.VII.1972, A. Smetana, (CNC) 1 female; Ford Lake, N. end of Ford Lake, 23.VI-4.VII.1966, E. Shewell (CNC) 1 male. **Saskatchewan:** Prince Albert N.P., 24.VII.1972, D.E. Bright (CNC) 1 male.

A10. *Gnypeta groenlandica* Lohse

UNITED STATES: Alaska: North Slope, Sadlerochit River, 7 km from mouth, 6.VIII.1980, R.E. Nelson (CNC) 1 female; Titaluk R. (69°42'N, 155°12'W), 2-7. VII.1979, R.E. Nelson (CNC) 1 male; Umiat, 10.VIII.1959, *Salix sp.*, R. Madge (CNC) 1 female. **DENMARK: Greenland**: Nedre Midsommer Sö, Can. Peary Land Expd., 2.VII.1966 (CNC) 1 male; 2.VII.1966, (CNC) 1 male, 1 female, 7 sex?; (LFC) 1 sex?; 3.VIII.1966 (CNC) 1 sex?; 6.VII.1966 (CNC) 1 female, 6 sex?; 10.VII.1966 (CNC) 3 males, 1 female, 6 sex?; 11.VII.1966 (CNC) 1 sex?; 12.VI.1966 (CNC) 1 male, 2 females, 6 sex?; 14.VII.1966 (CNC) 2 males, 1 female, 4 sex?; 16.VI.1966 (CNC) 1 female, 8 sex?; 20.VI.1966 (CNC) 2 females, 1 male, 6 sex?; 22.VII.1966 (CNC) 5 sex?; 24.VI.1966 (CNC) 1 male, 1 female, 11 sex?; 25.VI.1966 (CNC) 1 female, 2 sex?; 26.VII.1966 (CNC) 1 male, 1 female, 3 sex?; 28.VI.1966 (CNC) 2 males, 16 sex?. **CANADA: Manitoba**: Churchill, 10.VII.1937, W.J. Brown (CNC) 1 male; 26.VII.1937 (CNC) 1 female. **Nunavut**: Axel Heiberg Island (79°25'N, 90°45'W) H.K. Rutz, 4.VIII.1963, Trap 1 (CNC) 1 female; 8.VIII.1963, Trap 1 (CNC) 2 males; 10.VIII.1963 (CNC) 1 female, 3 males; (LFC) 3 males; 14.VIII.1963 (CNC) 1 male, 3 females; 16.VIII.1963, Trap 1 (CNC) 1 sex?; 19.VIII.1963 (CNC) 1 female, 2 sex?; (LFC) 1 female; 20.VIII.1963 (CNC) 1 sex?; 23.VII.1963, Trap 1 (CNC) 1 sex?; 25.VII.1963 (CNC) 1 female, 3 males, 3 sex?; (LFC) 1 sex?; 27.VII.1963, Trap 1. PARATYPE (CNC) 1 male; Eureka (80°09'N, 86°00'W), 2.VIII.1963, J.R. Vockeroth (CNC) 1 female; Ellesmere Island, Forsheim Pen. Hot Weather Ck. (79°58'N, 84°28'W), 3.VII.1990, Fenja Brodo Slidre R. (CNC) 1 female; 4.VII.1990, Fenja Brodo (CNC) 1 female; 14.VII.1990 (CNC) 1 male, 1 female; 22.VI.1990 (CNC) 1 male; Forsheim Pen., Slidre Fjord, 1100 ft. (80°04'N, 85°36'W), 30.VII.1953, In crown of *Geum rossii*, P.F. Bruggemann (CNC) 1 female; Hazen Camp, 19.VII.1963, Trap 1, R.E. Leech (LFC) 1 male. **Yukon:** Komakuk Beach (69°36'N, 140°10'W), 05.VII.1984, J.M. Campbell (CNC) 1 female; 15.VI.1984 (CNC) 1 male; Clarence Lagoon (69°38'N, 140°55'W), 05.VII.1984, sifting litter on shore, J.M. Campbell (CNC) 1 female; (LFC) 1 male.

A11. *Gnypeta helenae* Casey

Non-type material

UNITED STATES: New Mexico: Truth or Consequences, 29.VII.1954, Ian Moore (CNC) 1 female. **CANADA. Alberta:** Waterton Lk. N.P., Belly R., Chef Mt. Hwy., 4500', 18.VI.1980, J.M. Campbell (CNC) 1 male. **British Columbia:** 19.VI.1957, G. Stace Smith (LFC) 1 female; 13 mi. W. Osoyoos, 5.VI.1968, Campbell & Smetana (CNC) 1 male; Creston, 9.X.1956, G. Stace Smith (LFC) 1 male; 8. mi. W. Creston, 10.VI.1968, Campbell & Smetana (CNC) 1 female; Peachland, 27.VII.1919, J.B. Wallis (CNC) 1 female; West Creston, banks Kootenay R. (49°11'N, 116°38'W), 28.VIII.1980, silt around *Typha*, I. Askevold (LFC) 1 male; Wynndel, Kootenay Lake, 14.VIII.1982, R. Baranowski, BWRS (MZL) 4 males, 3 females.

A12. *Gnypeta lohsei* Klimaszewski, sp. nov.

Paratypes

UNITED STATES: Alaska: Prudhoe Bay Rd. Bonanza Cr., 900'(66°40'N, 150°40'W), 2.VII.1978, A. Smetana & J.M. Campbell (CNC) 1 female. **Washington:** Olympic N.P., Obstruction Peak, 6000', 10.VIII.1979, J.M. & B.A. Campbell (CNC) 1 male, 5 females, 2 sex?; (LFC) 1 male, 1 female. **CANADA: Alberta:** Bruderheim, 1.VII.1982, A. Davies, tread *Carex* and moss (LFC) 1 female; Kananaskis F.E.S., 01.VIII.1972, J.M. & B.A. Campbell (CNC) 1 male, 1 sex?; Highwood Pass, 7600', 2.VIII.1971, J.M. & B.A. Campbell (CNC) 1 female; Highwood Pass, 35 mi. S. Kananaskis F.E.S., 7800', 19.VII.1971, J.M. & B.A. Campbell (CNC) 3 females, 5 sex?; (LFC) 1 female; 20 mi. SW Kananaskis F.E.S., Snow Ridge, 7000', 31.VII.1971, J.M. & B.A. Campbell (CNC) 4 sex?; Banff N.P., Helen Lk., 7800', 11.VIII.1971, J.M. & B.A. Campbell (CNC) 4 males, 2 females, 34 sex?; (LFC) 3 males, 1 female; Banff N.P. Ptarmigan Lk., 7500', 13.VIII.1971, J.M. & B.A. Campbell (CNC) 3 males, 9 sex?; Banff N.P., Redoubt Lk, 7800', 13.VIII.1971, J.M. & B.A. Campbell (CNC) 1 female, 1 sex?; Banff N.P., Eiffel Lk., 7400', 18.VII.1971, J.M. & B.A. Campbell (CNC) 1 sex?; Waterton Lk. N.P., Upper Rowe Lk., 7100', 20.VI.1980, J.M. Campbell (CNC) 1 male, 1 sex?; Waterton Lk. N.P., Crypt Lake, 6500', 22.VI.1980, J.M. Campbell (CNC) 1 sex?; Waterton Lk. N.P., Mi. 3 Red Rock Cny. Rd., 4400', 26.VI.1980, J.M. Campbell (CNC) 1 sex?. **British Columbia:** Garibaldi Prov. Pk., Paul Ridge, 5400', 4.VIII.1975, J.M. & B.A. Campbell (LFC) 1 female; Garibaldi Prov. Pk., Diamond Head Tr., 4000-4500', 19.VII.1973, A. & Z. & D. Smetana (CNC) 2 males, 1 female, 2 sex?; 26.VII.1973 (CNC) 1 sex?; Revelstoke N.P, Mt. Revelstoke, 6500', 18.VIII.1971, J.M. & B.A. Campbell (CNC) 1 male, 1 female, 1 sex?; Revelstoke N.P, Jade Lk., 6000', 19.VIII.1971, J.M. & B.A. Campbell (CNC) 1 male, 3 sex?; (LFC) 1 female; Revelstoke N.P, Millar Lks, 6300', 19.VIII.1971, J.M. & B.A. Campbell (CNC) 3 sex?; Manning Prov. Pk., 20 mi. E. Hope, 21.VI.1968, Campbell & Smetana (CNC) 1 sex?; Manning Prov. Pk., Derek Falls, 4000', 26.VII.1975, J.M.

& B.A. Campbell (CNC) 1 female; Manning Prov. Pk., Three Brothers Mt., 7000', 27.VII.1975, J.M. & B.A. Campbell (CNC) 1 sex?; Manning Prov. Pk., Mt. Frosty, 7200', 29.VII.1975, J.M. & B.A. Campbell (CNC) 1 female; Manning Prov. Pk., Mt. Frosty, 6100', 30.VII.1975, J.M. & B.A. Campbell (CNC) 1 male, 5 females, 2 sex?; Mt. Copeland, 6500', 27.VIII.1971, J.M. Campbell (CNC) 4 males, 8 sex?; Mt. Begbie, 6200', 28-30.VIII.1971, J.M. Campbell (CNC) 1 female, 2 sex?; Mt. Begbie, 7000', 29.VIII.1971, J.M. Campbell (CNC) 1 female, 2 sex?.

A13. *Gnypeta nigrella* (LeConte)

Non-type material

UNITED STATES: Pennsylvania: Easton, 13.V.1915, 5702 (CNC) 1 female. **Vermont:** Manchester, 3.VII.1935 (CNC) 1 male, 1 female. **CANADA: New Brunswick:** Charlotte Co., near New River (45.21176°N, 66.61790°W), 2.VI.2006, R.P. Webster, mixed forest, margin of vernal pond in moist leaf litter (RWC) 1 female; Restigouche Co., Little Tobique River near Red Brook (47.4465°N, 67.0689°W), 13.VI.2006, R.P. Webster, river margin on sand (RWC) 1 male; Sunbury Co., Sheffield, Portobello Creek N.W.A. (45.8952°N, 66.2728°W), 18.VI.2004, R.P. Webster, silver maple forest, black light trap near marsh (RWC) 1 male; Carleton Co. Hartland, Middle Becaguimac Island, margin of St. John R. (46.3028°N, 67.5333°W), 23.VI.2006, R. Capozi & R. Webster, among cobblestones near water (RWC) 1 male; York Co., Fredericton, at St. John River (45.9588°N, 66.6254°W), 4.VII.2004, R.P. Webster, margin of river, in drift material (mostly maple seeds) (RWC) 1 male; York Co., Kingsclear Mazerolle Settlement (45.8729°N, 66.8311°W), 28.IV.2006, R.P. Webster, margin of stream (sun exposed), in fine gravel/sand, near water (RWC) 1 sex?

A14. *Gnypeta sellmani* Brundin

Non-type material

UNITED STATES: Alaska: Alaska Range, Antimony Cr., 2.5 mi. E mi. 181 G. Parks Hwy, 3500', 27.VI.1978, Smetana & Becker (CNC) 1 male; Kenai Pen. 1 mi. Anchor Pt., 200', 2.VI.1978, Smetana & Becker (CNC) 2 males; (LFC) 2 females; Kenai Pen. Anchor R. at Hwy. 1, 450', 4.VI.1978, Smetana & Becker (CNC) 1 female; (LFC) 1 female; Kenai Pen., 3 mi. SE Kenai, 7.VI.1978, Smetana & Becker (CNC) 1 male, 1 sex?; Prudhoe Bay Rd. Bonanza Cr., 900' (66°40'N, 150°40'W), 2.VII.1978, A. Smetana & J.M. Campbell (CNC) 1 male, 1 female; Prudhoe Bay Rd. 2 mi. S Grayling Lk., 1300' (66°55'N, 150°25'W), 9.VII.1978, Smetana & Campbell (CNC) 2 males, 3 females, 1 sex?; Mi. 23 Taylor Hwy., 8.VII.1968, Campbell & Smetana (CNC) 1 male; Mi. 43 Taylor Hwy., 8.VII.1968, Campbell & Smetana (CNC) 1 male; 4 mi. SE North Pole, 30.VI.1978, A. Smetana & J.M. Campbell (CNC) 1 male. **CANADA: Northwest Territories:** Inuvik, 1.VII.1972, A. Smetana (CNC) 2 females; (LFC) 1 male;

24.VI.1972, A. Smetana (CNC) 1 male, 2 females; (LFC) 1 male, 1 sex?; 25.VI.1972, A. Smetana (CNC) 5 males, 12 females, 1 sex?; Shell Lake, 27.VI.1972, A. Smetana (CNC) 2 males, 6 females, 1 sex?; (LFC) 1 female, 1 sex?; Boot Lake, 28.VI.1972, A. Smetana (CNC) 2 males, 1 female; Yellowknife, 20.V.1953, J.G. Chillcott (CNC) 1 female; Unnamed Lake, 18 mi. NW Inuvik via East Channel, 26.VI.1972, A. Smetana (CNC) 3 males, 3 females. **Manitoba:** Churchill, 13.VI.1951, J.G. Chillcott (CNC) 1 male, 1 female; 17.VI.1952 (CNC) 1 male. **Québec:** Gaspésie, Parc Gaspésie, Mont Albert, 3700', 10-11.VII.1972, J.M. Campbell (CNC) 2 males, 1 sex?; Gaspésie, Parc Gaspésie, Mont Jacques Cartier, 4000', 22.VII.1972, J.M. Campbell (CNC) 1 male, 1 female, 2 sex ?; (LFC) 1 female. **Saskatchewan:** Prince Albert N.P., 24.VII.1972, D.E. Bright (CNC) 1 female. **Yukon:** British Mts. Fish Creek, 200 m (69°27'N, 140°23'W), 3.VII.1984, in moss in water in polygon channels, J.M. Campbell, 84-52 (CNC) 1 male; British Mts. Fish Creek, 180 m (69°27'N, 140°19'W), 3.VII.1984, treading edge of temporary pond, J.M. Campbell, 84-48 (CNC) 1 female; British Mts., Swan Pond, 4 km NE Wolf Cr, 340 m (69°08'N, 140°14'W), 23.VI.1984, treading sedges around edge of pond, J.M. Campbell, 84-25a (CNC) 1 male; Mile 237 Dempster Hwy, 4.VII.1979, B.F. & J.L. Carr, Lot 2 (CNC) 1 male, 1 female; Dempster Hwy mi. 65, 3300', 13.VII.1968, J.M. Campbell & A. Smetana (CNC) 9 males, 4 females, 3 sex?; Dempster Hwy. Mi. 152.5, 1900', 20.VII.1978, A. Smetana & J.M. Campbell (LFC) 1 male; Dempster Hwy mi. 136, 1900', 22.VII.1978, J.M. Campbell & A. Smetana (CNC) 2 females; Dempster Hwy mi. 53, 4200', 24.VII.1978, A. Smetana & J.M. Campbell (CNC) 1 male; 11 mi. W. Elsa, 18.VII.1968, J.M. Campbell & A. Smetana (CNC) 1 male.

A15. *Gnypeta uteana* (Casey)

Non-type material

CANADA. Alberta: Banff N.P., Bow Pass, 6800', 10.VIII.1971, J.M. & B.A. Campbell (CNC) 1 female, 2 sex?; (LFC) 1 female, 1 sex?; Banff N.P., Mt. Temple Ski Lodge, 6600', 12.VIII.1971, J.M. Campbell (CNC) 1 male; Marmot Creek, 10 mi. SW Kananaskis F.E.S., 5000', 15.VIII.1971, J.M. Campbell (CNC) 2 females; Highwood Pass, 35 mi. S. Kananaskis F.E.S., 7800', 19.VII.1971, J.M. & B.A. Campbell (LFC) 1 male.

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New records of Canadian Aleocharinae (Coleoptera, Staphylinidae)

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Abstract

New records are reported for 53 species of Canadian aleocharines. Eighty-eight new Canadian provincial records (nine from Alberta, 11 from British Columbia, eight from New Brunswick, 23 from Nova Scotia, one from the Northwest Territories, 27 from Ontario, one from Prince Edward Island, and eight from Québec) are provided as well as six new state records from the United States (three from Alaska, two from Washington, and one from Oregon). Of these, six species including *Aleochara (Xenochara) quadrata* Sharp, *Gnathusa eva* Fenyes, *Phymatura blanchardi* (Casey), *Aloconota sulcifrons* (Stephens), *Myrmedonota aidani* Maruyama and Klimaszewski, and *Pella caliginosa* (Casey) are newly recorded in Canada. These new records are examined in the context of what insights they provide in relation to the distribution and biogeography of the Canadian aleocharine fauna.

Keywords

Coleoptera, Staphylinidae, Aleocharinae, rove beetle, new records, biodiversity, biogeography

Introduction

As the most species-rich subfamily (Ashe (2000) estimated 1,385 described North American aleocharines) of the most species-rich family (Marske and Ivie (2003) reported 4,153 species of North American staphylinids), the Aleocharinae are clearly a very important component of the continent's beetle biodiversity. They are found in forests, caves, along seashores, in bogs, in association with ants, along watercourses, and in many open habitats. They are particularly abundant in forested environments where many species occur in subcortical environments, in various kinds of leaf litter, and in association with many species of living and decaying fungi. Some aleocharines are frequently found on dung and/or carrion; others are common inhabitants of bird and mammal nests. They are abundant in natural and synanthropic environments, and there are many adventive species introduced in North America (Klimaszewski et al. 2007, Majka and Klimaszewski 2008).

Despite their abundance and their obvious ecological importance in many environments, the Aleocharinae have, until relatively recently, frequently been largely ignored in many faunistic, zoogeographic, ecological, and environmental-impact studies. The reasons for this have been manifold, first and foremost of which has been the confused and poorly understood systematics and taxonomy of the group, coupled with their small size and sometimes secretive habits, and the apparent similarity in appearance of many species. The confused taxonomy, the many unrevised groups, the many undescribed species, and the lack of keys to many groups, have meant that even interested researchers have often been frustrated in their attempts at identification. As a consequence, for a long time relatively little progress was made in North America in understanding the distribution, zoogeography, phenology, and ecology of aleocharines and the role these species play in the large variety of environments that they inhabit.

Fortunately, the past couple of decades have seen an explosion of interest in this group. Many revisionary studies have been published, a large number of new species have been described, and the nomenclature, systematics, and taxonomy of many groups are now much better understood. Important distributional and zoogeographic information has been compiled and there now exists at least first-order information on the bionomics of at least some species. As one illustration of the growth of this information on this group, consider the following: Campbell and Davies (1991) in their checklist of Staphylinidae in Canada and Alaska listed 277 species of aleocharines. Seventeen years later Gouix and Klimaszewski (2007) were able to include 392 species, an increase of 115 species in the recorded fauna. For the 277 species that they treated, Campbell and Davies (1991) provided 585 provincial records whereas Gouix and Klimaszewski (2007) reported 938, an increase of over 60% in the known geographical distribution of the aleocharine fauna of Canada and Alaska. In the present paper, we contribute to this growing knowledge base by reporting new jurisdictional records for 53 of species of Canadian aleocharines.

Methods and conventions

Canadian aleocharines in a number of collections were examined and identified. Codens (following Evenhuis 2007) of collections referred to in this study are:

ACNS Agriculture and Agri-food Canada, Kentville, Nova Scotia, Canada
CASS Collection of Volker Assing, Hanover, Germany

CBU Cape Breton University, Sydney, Nova Scotia, Canada
DAL Dalhousie University, Halifax, Nova Scotia, Canada
DHWC David H. Webster collection, Kentville, Nova Scotia, Canada
GDS Gary D. Selig collection, Bridgewater, Nova Scotia, Canada
JCC Joyce Cook collection, North Augusta, Ontario, Canada
JOC Jeffrey Ogden collection, Truro, Nova Scotia, Canada
LFC Laurentian Forestry Centre (Insectarium R. Martineau), Québec City, Québec, Canada
MZLU Museum of Lund University, Lund, Sweden
NFRC Northern Forestry Centre, Edmonton, Alberta, Canada
NSMC Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC Reginald Webster collection, Charters Settlement, New Brunswick, Canada
SMU Saint Mary's University, Halifax, Nova Scotia, Canada
STFX Saint Francis Xavier University, Antigonish, Nova Scotia, Canada

The number of specimens is indicated in parentheses together with the collection coden. Where the sex of specimens was determined this is indicated by either "m" (male) or "f" (female). Specific details follow. The systematic order follows Gouix and Klimaszewski (2007).

Results

The new national, provincial, and state records of the 53 species of aleocharines treated in this study are summarized in Appendix 1. Their reported distribution in North America is given, the new records reported herein being indicated in boldface. Specific details follow.

Tribe Gymnusini Thompson, 1867

Gymnusa grandiceps Casey, 1915

NEW BRUNSWICK: York Co.: New Maryland, 16.IV.2004, R.P. Webster, mixed forest: leaf litter, (1, RPW).

Gymnusa grandiceps is newly recorded in New Brunswick. No specific bionomic information is available for the species but it is believed to be a hydrophilous species similar to *Gymnusa brevicollis* which is found in swamps, swampy edges of lakes and rivers, sphagnum bogs, and similar habitats (Klimaszewski 1979).

Tribe Aleocharini Fleming, 1821

Aleochara (Xenochara) quadrata Sharp, 1883

CANADA: BRITISH COLUMBIA: near Mabel Lake at Squaw Valley, 5.VIII.1982, R. Baranowski, (1f, MZLU).

Aleochara (Xenochara) quadrata is newly recorded in British Columbia and Canada as a whole. The bionomics of the species are unknown.

Tinotus caviceps Casey, 1894

CANADA: ONTARIO: Carleton Co.: Mer Bleue, 19.IX.1980, R. Baranowski, (1f, MZLU).

Tinotus caviceps Casey is newly recorded in Ontario. The bionomics of the species are unknown.

Tribe Oxypodini Thomson, 1859

Gnathusa eva Fenyes, 1909

CANADA: BRITISH COLUMBIA: Monashee Mountain near Cherryville, 12.VIII.1982, R. Baranowski, 1,400-1,600 m, (1f, LFC; 1, MZLU).

Gnathusa eva is newly recorded in Canada. This species has previously only been recorded from California (Moore and Legner 1975). The bionomics of the species are unknown.

Phloeopora arctica Lohse, 1990

CANADA: ONTARIO: Nipissing Co.: Algonquin Provincial Park near Brent, 19.VIII.1980, R. Baranowski, (2m, MZLU; 1m, LFC).

Phloeopora arctica is newly recorded in Ontario. The species is found under bark (Lohse et al. 1990).

Meronera venustula (Erichson, 1839)

NEW BRUNSWICK: York Co.: New Maryland, 12.IV.2004, R.P. Webster, mixed forest: compost, (1, RPW).

Meronera venustula is newly recorded in New Brunswick. Adults and larvae feed on fungal mycelia and live in wet vegetable litter (Ashe 1985).

Tribe Hypocyphtini Laporte, 1835

Cypha inexpectata Klimaszewski and Godin, 2008

CANADA: ONTARIO: Sudbury Co.: 40 km northeast Gogama, Mattagami River, 25.VIII.1980, R. Baranowski, (2m, MZLU).

Cypha inexpectata is newly recorded in Ontario. The bionomics of the species are unknown.

Tribe Homalotini Heer, 1839

Silusida marginella (Casey, 1894)

CANADA: NOVA SCOTIA: Annapolis Co.: Big Dam Lake, Kejimkujik National Park, 12-22.VIII.2004, 25.VI-5.VII.2004, S. Baker, hemlock forest, pitfall trap, (2, DAL); Channel Lake, Kejimkujik National Park, 12-22.VIII.2004, 25.VI-5.VII.2004, 18.IX.-2.X.2004, H. Love and S. Baker, maple/oak/birch forest, pitfall trap, (12, DAL); Durland Lake, 3.VIII.2003, P. Dollin, hemlock/balsam fir/black spruce forest (120 years), in rotting mushroom, (1, NSMC); **Cape Breton Co.:** Scatarie Island, 8-11. VIII.2005, (I, CBU); **Digby Co.:** Pebbleloggitch Lake, Kejimkujik National Park, 28.VI-7.VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (16, NSMC); **Guysborough Co.:** Middle Lake, 25.VIII.1994, D. Kehler, old deciduous forest, (1, NSMC); **Halifax Co.:** Waverley, 10.VIII.1965, B. Wright, mixed forest, pitfall trap, (1, NSMC); **Queens Co.:** Black Duck Lake, 10.VII.2003, 1.VIII.2003, P. Dollin, white pine/red spruce forest (40-80 years), in rotting mushroom, (2, NSMC); Eight Mile Lake, 11.VIII.2003, P. Dollin, red spruce forest (40-80 years), in decaying white birch log, (1, NSMC); Sixth Lake, 14.VII.2003, 4.VIII.2003, P. Dollin, hemlock forest (120+ years), in rotting mushroom, (3, NSMC); Tobeatic Lake, 13.VII.2003, P. Dollin, red spruce forest (80-120 years), on bracket fungus on white birch, (1, NSMC); Canning Field, Kejimkujik National Park, 14-23.VIII.2004, H. Love, hemlock forest, pitfall trap, (3, DAL); Cobreille Lake, Kejimkujik National Park, 27.VI-6. VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (19, DAL); North Cranberry Lake, Kejimkujik National Park, 13-24.VIII.2004, H. Love, hemlock forest, pitfall trap, (16, DAL); Kejimkujik National Park, 5.IX.2001, 11.IX.2001, 19.IX.2001, 29.IX.2001, B. Wright, hemlock forest, pitfall trap, (4, NSMC); **Richmond Co.:** Irish Cove, 12.VII.1996, P.A. Rankin, (1, CBU). **QUÉBEC:** Hull, Gatineau Park, 16.VIII.1980, R. Baranowski, (1m, MZLU); Hull, Gatineau Park, near Ramsey Lake, 17.VIII.1980, R. Baranowski, (1f, MZLU; 2, MZLU).

Silusida marginella is newly recorded in Nova Scotia and Québec. In Nova Scotia specimens have been collected in various coniferous and deciduous forests. Specimens were collected in decaying gill fungi, on a bracket fungus, and in a decaying white birch (*Betula papyrifera* Marshall) log.

Homalota plana (Gyllenhal, 1810)

CANADA: ONTARIO: Algoma Co.: 10 km east of Wawa, 30.VIII.1980, R. Baranowski, (4m, MZLU; 1m, LFC; 1, LFC); Lake Superior Provincial Park, 9.IX.1980, R. Baranowski, (3m, MZLU; 5 MZLU; 1m LFC; 1, LFC).

This adventive, Palaearctic species is newly recorded in Ontario. In the Old World it is widely distributed across Europe, North Africa, and Asia including eastern and western Siberia (Smetana 2004). In Nova Scotia *H. plana* has been found in sub-cortical environments under the bark of white pine (*Pinus strobus* L.) between December and early May where it is active on sunny days when the sun warms this micro-environment (Klimaszewski et al. 2007a).

Leptusa gatineauensis Klimaszewski & Pelletier, 2004

CANADA: ALBERTA: no locality noted, 30.V.1995, H.E.J. Hammond, (1m, NFRC).

Leptusa gatineauensis is newly recorded in Alberta. Many species of Canadian *Leptusa* occur in fungi, under bark, in scolytine burrows, and in forest litter where they apparently feed on fungal hyphae. Some species overwinter as adults in bark-beetle galleries or under bark. Specimens of *L. gatineauensis* have been found in both coniferous [red spruce (*Picea rubens* Sarg.] and eastern hemlock [*Tsuga canadensis* (L.) Carr.] and deciduous forests and on a specimen of *Piptoporus betulinus* (Fr.) Kar. (Klimaszewski et al. 2004).

Leptusa (Adoxopisalia) opaca Casey, 1894

Although not recorded from New Brunswick in Gouix and Klimaszewski (2007), it is worth drawing attention to the records of this species from that province reported in Klimaszewski et al. (2004).

Silusa alternans Sachse, 1852

CANADA: ONTARIO: Nipissing Co.: Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1m, LFC); Algonquin Provincial Park near Brent, 21.VIII.1980, R. Baranowski, (1f, MZLU).

Silusa alternans is newly recorded in Ontario. North American *Silusa* species are predominantly associated with mushrooms and *S. alternans* has been collected in yellow birch (*Betula alleghaniensis* Britt.) and balsam fir (*Abies balsamea* (L.) Mill) dominated forests from *Clavaria* sp., *Russula* sp., and other fungi (Klimaszewski et al. 2003).

Silusa californica Bernhauer, 1905

CANADA: NOVA SCOTIA: Halifax Co.: Waverley, 10.VIII.1965, B. Wright, mixed forest, pitfall trap, (1, NSMC). **ONTARIO: Algoma Co.:** Wawa, 8.IX.1980, R. Baranowski, (1m, MZLU); Lake Superior Provincial Park, 9.IX.1980, R. Baranowski, (2f, MZLU); Michipicoten River (South of Wawa), 8.IX.1980, R. Baranowski, (1f, LFC); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1f, MZLU).

Silusa californica is newly recorded from Ontario and from the Nova Scotia mainland. *Silusa californica* has been collected in mixed boreal forests in forest litter, wet moss, on marten dung, and on mushrooms (Klimaszewski et al. 2003).

Silusa vesperis Casey, 1894

UNITED STATES: OREGON: Benton Co: Mary's Peak, 27.VII.1979, J.M. and B.A. Campbell, 1158 m, (1f, LFC).

Silusa vesperis is newly recorded in Oregon. It is a mountain species found at elevations between 304 and 944 meters. Species of *Silusa* are associated with various species of fungi (Klimaszewski et al. 2003).

Phymatura blanchardi (Casey, 1894)

CANADA: ALBERTA: Lac la Biche, 20-30 km E Touchwood Lk. Rd., 25.VIII-15.IX.1994, J. Hammond, UTM 12 4695 60785, modified window trap, M2-SI-3-I, (1 m, NFRC).

Phymatura blanchardi is newly recorded in Alberta and Canada as a whole. This species is associated with fungi.

Tribe Placusini Mulsant and Rey, 1871

Placusa vaga Casey, 1911

CANADA: NORTHWEST TERRITORIES: 5 km southeast of Inuvik, 68.32881°N, 133.63556°W, 17.VII-3.VIII.2001, M. Gravel et al., mixed spruce-birch forest, ethanol-baited funnel trap, (1m, LFC).

Placusa vaga is newly recorded from the Northwest Territories. Species of *Placusa* live in subcortical habitats in scolytine burrows where they apparently feed on fungal hyphae. In Québec, specimens were collected in balsam fir (*A. balsamea*), white spruce (*Picea glauca* (Moench) Voss), and mixed white spruce-trembling aspen (*Populus tremuloides* Michx.) stands (Klimaszewski et al. 2001).

Tribe Athetini Casey, 1910

Aloconota sulcifrons (Stephens, 1832)

CANADA: QUÉBEC: Hull, Gatineau Park, 16.VIII.1980, R. Baranowski, (1m, MZLU). **UNITED STATES: WASHINGTON: Skagit Co.:** Birdsview, 28.VII.1982, R. Baranowski, (1m, MZLU).

This adventive, Palaearctic species is newly recorded in Québec and Canada as a whole, and in the state of Washington in the United States. In the Old World it is widely distributed in Europe and North Africa, east through Siberia, the Middle East and Central Asia to China, Korea, and India (Smetana 2004). In North America it has frequently been collected in caves and is considered a troglophile (Klimaszewski and Peck 1986).

Atheta annexa Casey, 1910

CANADA: NEW BRUNSWICK: Albert Co.: Crooked Creek, 22.VIII.2003, C.G. Majka, along stream, decaying fungi, (3, CGMC); Mary's Point, 20.IX.2002, D.S. Christie, white spruce forest, gill fungus, (1, CGMC); Mary's Point, 8.IX.2004, C.G. Majka, white spruce forest, on *Russula virescens* (Schaeff.) Fr., (1, CGMC). **NOVA SCOTIA: Annapolis Co.:** Big Dam Lake, Kejimkujik National Park, 27.VI-7.VII.2004, H. Love, hemlock forest, pitfall trap, (1, DAL); Channel Lake, Kejimkujik National Park, 18.IX.-2.X.2004, H. Love, maple/oak/birch forest, pitfall trap, (6, DAL); **Hants Co.:** Woodville Ice Cave, 3.VIII.2007, M. Moseley, deep threshold of cave, leaf litter, (1, NSMC); **Digby Co.:** Pebbleloggitch Lake, Kejimkujik National Park, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (1, DAL); **Kings Co.:** 10.VIII.2005, D.H. Webster, compost heap, moldy corncobs, (1, DHWC); **Queens Co.:** Canning Field, Kejimkujik National Park, 14-23.VIII.2004, H. Love, hemlock forest, pitfall trap, (1, DAL); Cobreille Lake, Kejimkujik National Park, 27.VI-6.VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (4, DAL); North Cranberry Lake, Kejimkujik National Park, 28.VI-8.VII.2004, H. Love, hemlock forest, pitfall trap, (1, DAL). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 11.IX.1980, R. Baranowski, (1m, MZLU; 1m, LFC; 1f, LFC); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (5m, MZLU; 5f, MZLU; 2m, LFC).

Atheta annexa is newly recorded in New Brunswick, Nova Scotia, and Ontario. It has been collected from organic debris, fungi near cave entrances, raccoon dung, and woodrat (*Neotoma* spp.) nests (Klimaszewski and Peck 1986). In the Maritime Provinces it has been found in decaying fungi, in a cave threshold, and on moldy corncobs.

Atheta brunswickensis Klimaszewski, 2005

CANADA: NOVA SCOTIA: Guysborough Co.: Seloam Lake, 2-15.VI.1997, D.J. Bishop, red spruce forest, flight intercept trap, (1, NSMC); **Halifax Co.:** Point Pleasant Park, 9.IX.2001, C.G. Majka, red spruce forest, on *Amanita gemmata* (Fr.) Gill., (2, CGMC). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 10.IX.1980, 2.IX.1980, R. Baranowski, (1m, LFC; 1f, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1f, MZLU; 1m, LFC); **Sudbury Co.:** Mattagami, 24.VIII.1980, R. Baranowski, (1f, MZLU).

Atheta brunswickensis is newly recorded in Nova Scotia and Ontario. We suspect that this species is continuously distributed in northern Canada and Alaska. It has been found in red spruce (*P. rubens*) forests; two specimens were collected on *Amanita gemmata*.

Atheta novaescotiae Klimaszewski & Majka, 2006

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.V.2007, C.G. Majka, seashore, under dead deer, (4, CGMC).

Atheta novaescotiae is newly recorded in New Brunswick. This species was described by Klimaszewski et al. (2006) from specimens collected in Newfoundland and Nova Scotia in Canada, and the French territory of Saint-Pierre et Miquelon. This species is associated with beach drift and other decomposing environments at the upper end of the littoral zone in sandy and rocky coastline environments (Klimaszewski et al. 2006).

Atheta remulsa Casey, 1910

CANADA: NOVA SCOTIA: Cape Breton Co.: Scatarie Island, Northwest Cove, 10.VIII.2005, K.R. Aikens and A. MacDonald, mixed forest, mushroom on dead wood, (3, CBU); Sydney (CBU campus), 5.X.2003, D.B. McCorquodale, (6, CBU); **Halifax Co.:** Point Pleasant Park, 9.IX.2001, C.G. Majka, red spruce forest, on *Amanita gemmata*, (1, CGMC); Point Pleasant Park, 23.VIII.2002, C.G. Majka, red spruce forest, on gilled fungi, (3, CGMC); Big Indian Lake, 9.VIII.2003, P. Dollin, red spruce forest (80-120 years), in rotting mushroom, (1, NSMC); Waverley, 10.VIII.1965, B. Wright, mixed forest, pitfall trap, (1, NSMC); **Inverness Co.:** Baddeck Forks, 28.X.1996, D.B. McCorquodale, (3, CBU); **Lunenburg Co.:** Bridgewater, 1.VII.1965, B. Wright, (1, NSMC). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 3.IX.1980, 6.IX.1980, R. Baranowski, (1m, LFC; 1f, LFC; 2f, MZLU); Michipicoten River (South of Wawa), 5.IX.1980, 8.IX.1980, R. Baranowski, (3m, LFC; 3m, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, 21.VIII.1980, 22.VIII.1980, R. Baranowski, (8m, MZLU; 6f, MZLU; 1m, LFC); **Sudbury Co.:** Mattagami, 27.VIII.1980, R. Baranowski, (1m, MZLU; 1m, LFC; 1f, LFC); 30 km southwest of Foleyet, 30.VIII.1980, R. Baranowski, (3f, LFC; 2f, MZLU; 2 MZLU). **QUÉBEC:** Hull, Gatineau Park, near Ramsey Lake, 17.VIII.1980, R. Baranowski, (2f, MZLU).

Atheta remulsa is newly recorded in Nova Scotia, Ontario, and Québec. In Nova Scotia it has been found in mixed and red spruce (*P. rubens*) forests on decaying and living gilled fungi including *Amanita gemmata*.

Atheta strigosula Casey, 1910

CANADA: BRITISH COLUMBIA: 13 km north of Nelway, 21.VIII.1982, 19.VIII.1982, R. Baranowski, (1m, LFC; 1f, LFC); near Mabel Lake at Squaw Valley, 5.VIII.1982, R. Baranowski, (1m, LFC; 1m, LFC; 1f, MZLU). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 2.IX.1980, 6.IX.1980, R. Baranowski, (2m, MZLU; 4f, MZLU); Michipicoten River (South of Wawa), 5.IX.1980, 8.IX.1980, R. Baranowski, (3f, MZLU; 2m, MZLU; 1f, LFC; 2, LFC); **Nippising Co.:** Algonquin Provincial Park near Brent, 19.VIII.1980, 20.VIII.1980, R. Baranowski, (4m, MZLU; 4f, MZLU); **Sudbury Co.:** Mattagami, 27.VIII.1980, R. Baranowski, (1m, MZLU); 30 km southwest of Foleyet, 29.VIII.1980, 30.VIII.1980, R. Baranowski, (2f, LFC; 1f, MZLU). **QUÉBEC:** Hull, Gatineau Park, near Ramsey Lake, 17.VIII.1980, R. Baranowski, (1f, MZLU; 1, MZLU; 1m, LFC). **UNITED STATES: ALASKA:** 8-16 miles east of Willow, 7.VIII.1988, R. Baranowski, (1f, LFC).

Atheta strigosula is newly recorded in British Columbia, Ontario, and Québec in Canada and Alaska in the United States. The bionomics of the species are unknown.

Atheta (Alaobia) ventricosa Bernhauer, 1907

CANADA: ALBERTA: 8 km southeast of Sherwood Park, NE 7 Twp., 53°31'N, 113°19'W, 31.VIII.2003, J. Klimaszewski, aspen forest, (3m, LFC; 1f, LFC; 6 LFC). **NOVA SCOTIA: Halifax Co.:** Moser Lake, 2-15.VI.1987, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Kings Co.:** Blomidon Provincial Park, 12.X.1988, B. Wright, (1, NSMC).

Atheta ventricosa is newly recorded in Nova Scotia and Alberta. It has been found in coniferous forests and in forest litter in mixed forests (Gusarov 2003a).

Atheta (Chaetida) longicornis (Gravenhorst, 1802)

CANADA: BRITISH COLUMBIA: near Mabel Lake at Squaw Valley, 6.VIII.1982, R. Baranowski, (1m, MZLU).

This adventive, Palaearctic species is newly recorded in British Columbia. It is found across Europe, Asia, North Africa, and east to the Orient (Smetana 2004). This species is associated with dung and decaying organic matter. North American specimens have been found on cow dung and pig carrion (Klimaszewski et al. 2007a).

Atheta (Datomicra) dadopora Thomson, 1867

CANADA: ALBERTA: 8 km southeast of Sherwood Park, NE 7 Twp., 53°31'N, 113°19'W, 31.VIII.2003, J. Klimaszewski, aspen forest, (5m, LFC; 7f, LRC; 72 LFC).

ONTARIO: Nippising Co.: Algonquin Provincial Park near Brent, 21.VIII.1980, 20.VIII.1980, R. Baranowski, (1m, LFC); **Sudbury Co.:** 30 km southwest of Foleyet, 29.VIII.1980, R. Baranowski, (1m, MZLU). **UNITED STATES: ALASKA:** Anchorage, 13.VII.2007, K. Renner, (1m, CASS).

Atheta dadopora is newly recorded in Alberta, Ontario, and Alaska. It is widely distributed across Europe east to portions of Asia (Smetana 2004). In Europe it is found in decaying fungi, on cow dung, under fallen leaves, and on other kinds of decomposing matter (Burakowski et al. 1981). Although Gusarov (2003a) listed it as an adventive Palaearctic species, the increasingly wide range of its distribution in North America (Table 1) may indicate that it is Holarctic in distribution. Further evidence is still required, however, to determine its zoogeographic status.

Atheta (Dimetrota) burwelli (Lohse, 1990)

NEW BRUNSWICK: Albert Co.: Mary's Point, 9.VIII.2002, C.G. Majka, white spruce forest, on *Russula virescens*, (1, CGMC).

Atheta burwelli is newly recorded in New Brunswick. It was described from a single specimen in northern Québec in Canada by Lohse et al. (1990) and then reported from the Yukon by Klimaszewski et al. (2008). The specimen from New Brunswick was found on a living *Russula virescens* mushroom growing in a white spruce (*P. glauca*) forest. No other information on its bionomics is known.

Atheta (Dimetrota) crenuliventris Bernhauer, 1907

CANADA: ONTARIO: Algoma Co.: Wawa, 18.IX.1980, R. Baranowski, (2m, LFC; 1f, MZLU; 1m MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1fm MZLU; 1f, LFC).

Atheta crenuliventris is newly recorded in Ontario. The bionomics of the species are unknown.

Atheta (Dimetrota) districta Casey, 1911

CANADA: ALBERTA: 8 km southeast of Sherwood Park, NE 7 Twp., 53°31'N, 113°19'W, 31.VIII.2003, J. Klimaszewski, aspen forest, (1m, LFC; 4f, LFC; 1, LFC). **NOVA SCOTIA: Annapolis Co.:** Big Dam Lake, Kejimkujik National Park, 27.VI-7.VII.2004, H. Love, hemlock forest, pitfall trap, (1, DAL); **Halifax Co.:** 12.VII.2003, 16.VII.2003, 21.VII.2003, 29.VII.2003, C. Cormier, mixed forested, on decaying pig, (4, SMU); **Shelburne Co.:** Bon Portage Island, 27.VIII.2002, D.B. McCorquodale, coastal forest, (2, CBU); **Yarmouth Co.:** Wellington, 25.VI-3.VII.1995, J. and F. Cook, mixed coastal forest, flight-intercept trap, (1, JCC). **ONTARIO: Carleton Co.:**

Mer Bleue, 15.VIII.1980, R. Baranowski, (1, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 21.VIII.1980, 22.VIII.1980, R. Baranowski, (6m, MZLU; 10f, MZLU; 1m, LFC); **Sudbury Co.:** 40 km northeast Gogama, Mattagami River, 27.VIII.1980, R. Baranowski, (1m, MZLU; 1f, LFC); Mattagami, 25.VIII.1980, R. Baranowski, (3f, MZLU; 1m LFC).

Atheta districta is newly recorded in Alberta, Nova Scotia, and Ontario. The specimens from Nova Scotia associated with carrion provide the first information on the bionomics of this species. It has been found in coniferous, mixed, coastal, and eastern hemlock (*T. canadensis*) forests.

Atheta (Dimetrota) hampshirensis Bernhauer, 1909

CANADA: NEW BRUNSWICK: Albert Co.: Mary's Point, 9.VIII.2002, 8.IX.2002, C.G. Majka, white spruce forest, in *Russula virescens*, (4, CGMC); Mary's Point, 12.VIII.2004, C.G. Majka, coastal field, in compost, (7, CGMC). **NOVA SCOTIA: Annapolis Co.:** Big Dam Lake, Kejimkujik National Park, 12-22.VIII.2004, 27.VI-7.VII.2004, H. Love & S. Baker, hemlock forest, pitfall trap, (39, DAL); Channel Lake, Kejimkujik National Park, 12-22.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (6, DAL); **Cumberland Co.:** Wentworth, 1.VIII.1965, B. Wright, sugar maple forest, (4, NSMC); **Colchester Co.:** Bible Hill, 31.V.2005, K. Aikens, pasture, (20, CBU); **Digby Co.:** Pebbleloggitch Lake, Kejimkujik National Park, 28.VI-7.VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (8, DAL); South Range, Porters Lake, 27.VII.2003, G.D. Selig, in decaying mushroom, (1, GDS); **Guysborough Co.:** Melopseketch Lake, 14.V-2.VI.1997, D.J. Bishop, young red spruce forest, (1, NSMC); **Halifax Co.:** Long Lake, 25.V.2002, C.G. Majka, meadow in mixed forest, (1, CGMC); Big Indian Lake, 16.VII.2003, P. Dollin, red spruce forest (80-120 yrs), in rotting mushroom, (1, NSMC); Burnside, 12.V.2004, 18.VI.2004, C. Cormier, meadow, on decomposing pig, (2, SMU); **Kings Co.:** Kentville, D.H. Webster, 10.V.2006, on black currant leaf, (1, DHWC); **Lunenburg Co.:** Card Lake, 2-15.VI.1997. D.J. Bishop, old growth red spruce/hemlock forest, flight intercept trap, (1, NSMC); **Queens Co.:** Kejimkujik National Park, 19.IX.2005, 29.IX.2005, B. Wright, deciduous forest, (8, NSMC; Sixth Lake, 4.VIII.2003, P. Dollin, old-growth hemlock forest, in rotting mushroom, (1, NSMC); Kejimkujik National Park, 11.IX.2001, 19.IX.2001, 29.IX.2001, B. Wright, deciduous forest, pitfall trap, (3, NSMC); Canning Field, Kejimkujik National Park, 14-23.VIII.2004, H. Love, hemlock forest, pitfall trap, (5, DAL); Cobreille Lake, Kejimkujik National Park, 27.VI-6.VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (84, DAL); North Cranberry Lake, Kejimkujik National Park, 28.VI-8.VII.2004,13-24.VIII.2004, H. Love, hemlock forest, pitfall trap, (12, DAL). **ONTARIO: Nippising Co.:** Algonquin Provincial Park near Brent, 21.VIII.1980, 22.VIII.1980, R. Baranowski, (3m, MZLU; 8f, MZLU; 1f, LFC); **Sudbury Co.:** 40 km northeast Gogama, Mattagami River, 27.VIII.1980, R. Baranowski, (1m, MZLU; 1f, MZLU); Mattagami, 25.VIII.1980, R. Baranowski, (1m, MZLU; 1f, MZLU; 1m, LFC).

Atheta hampshirensis is newly recorded from New Brunswick [it was mentioned as occurring in New Brunswick by Klimaszewski and Winchester (2002) but no specific locality records were reported], Nova Scotia, and Ontario. *Atheta hampshirensis* was originally described under the preoccupied name of *Homalota moesta* Mäklin from Sitka Island, Alaska (Mäklin 1852). In the Maritime Provinces it has been found in various coniferous and deciduous forests and in open habitats, on living and decaying mushrooms, in compost, and on carrion. It is sometimes found together with superficially similar *Strophogastra penicillata* Fenyes and *Atheta dadopora*.

Atheta (Dimetrota) modesta (Melsheimer, 1844)

CANADA: ALBERTA: 8 km southeast of Sherwood Park, NE 7 Twp., 53°31'N, 113°19'W, 31.VIII.2003, J. Klimaszewski, aspen forest, (4m, LFC; 1f, LFC). **NOVA SCOTIA: Annapolis Co.:** Big Dam Lake, Kejimkujik National Park, 12-22.VIII.2004, 27.VI-7.VII.2004, H. Love, hemlock forest, pitfall trap, (54, DAL); Channel Lake, Kejimkujik National Park, 12-22.VIII.2004, 25.VI-5.VII.2004, 18.IX-2.X.2004, H. Love and S. Baker, maple/oak/birch forest, pitfall trap, (13, DAL); **Cape Breton Co.:** East Bay, 9.IX.2003, D.B. McCorquodale, (1, CBU); **Cumberland Co.:** Wallace, 1.VIII.1965, B. Wright, (1, NSMC); Wentworth, VIII.1965, B. Wright, sugar maple forest, pitfall trap, (1, NSMC); **Digby Co.:** Pebbleloggitch Lake, Kejimkujik National Park, 28.VI-7.VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (14, DAL); **Halifax Co.:** Point Pleasant Park, 28.VII.2001, C.G. Majka, coniferous forest, on *Russula brevipes* Pk., (1, CGMC); Point Pleasant Park, 9.IX.2001, C.G. Majka, coniferous forest, on *Amanita gemmata*, (19, CGMC); Point Pleasant Park, 23.VI.2002, C.G. Majka, coniferous forest, on *Fomitopsis pinicola* (Fr.) Kar. (1, CGMC); Point Pleasant Park, 23.VIII.2002, C.G. Majka, coniferous forest, on gilled fungi (2, CGMC); Waverley, 10.VIII.1965, B. Wright, mixed forest, pitfall trap, (3, NSMC); **Inverness Co.:** Bornish Hills, 14-19.VII.1995, G.R. Macpherson, (1, CBU); **Lunenburg Co.:** Bridgewater, 1-16.VII.1965, B. Wright, red oak forest, pitfall trap, (5, NSMC); **Queens Co.:** Canning Field, Kejimkujik National Park, 14-23.VIII.2004, 26.VI-6.VI.2004, H. Love, hemlock forest, pitfall trap, (13, DAL); North Cranberry Lake, Kejimkujik National Park, 28.VI-8.VII.2004, 13-24.VIII.2004, H. Love, hemlock forest, pitfall trap, (4, DAL); Kejimkujik National Park, 28.VI.1994, 24.VIII.1994, 11.IX.2001, 29.IX.2001, 24.VIII-7.IX.1994, 28.VII-9.VIII.1994, B. Wright, deciduous forest, pitfall trap, (13, NSMC).

Atheta modesta is newly recorded in Alberta and Nova Scotia. It has been found in deciduous, coniferous, and mixed forests [e.g., red spruce dominated forests (Klimaszewski et al. 2005b)]. In Nova Scotia specimens were collected from several species of living gilled fungi and polypores.

Atheta (Dimetrota) picipennis (Mannerheim, 1843)

UNITED STATES: WASHINGTON: Jefferson Co.: Olympic Mountain south of Spruce Mountain, 1.IX.1982, R. Baranowski, (1m, MZLU).

Atheta picipennis is newly recorded in the state of Washington. On Vancouver Island they were found between June and early September in Sitka spruce (*Picea sitchensis* (Bong.) Carr.) forests (Klimaszewski and Winchester 2002).

Atheta (Dimetrota) prudhoensis (Lohse, 1990)

CANADA: NEW BRUNSWICK: Albert Co.: Mary's Point, 8.IX.2002, C.G. Majka, white spruce forest, in *Russula virescens*, (1, CGMC); **NOVA SCOTIA: Cape Breton Co.:** 5.X.2003, Sydney (CBU campus), D.B. McCorquodale, (8, CBU); **Victoria Co.:** North River, 9.X.1995, D.B. McCorquodale, (1, CBU). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 1.IX.1980, 2.IX.1980, 6.IX.1980, 9.IX.1980, R. Baranowski, (2m, MZLU; 1f, MZLU; 1m, LFC; 1f, LFC); Michipicoten River (South of Wawa), 5.IX.1980, R. Baranowski, (2f, MZLU; 1m, MZLU; 3m, LFC); **Carleton Co.:** Mer Bleue, 19.IX.1980, R. Baranowski, (1m, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1m, MZLU); **Sudbury Co.:** Mattagami, 25.VIII.1980, 27.VIII.1980, R. Baranowski, (4m, MZLU; 2f, MZLU; 1f, LFC); 30 km southwest of Foleyet, 30.VIII.1980, R. Baranowski, (1m, MZLU); 40 km northeast Gogama, Mattagami River, 27.VIII.1980, R. Baranowski, (4m, MZLU; 3f, MZLU).

Atheta prudhoensis is newly recorded in New Brunswick, Nova Scotia, and Ontario. In Vermont, Gusarov (2003a) found it in forest litter in a birch/maple/oak/hemlock mixed forest. In New Brunswick it was found in a white spruce (*P. glauca*) forest in a *Russula virescens* gill fungus.

Atheta (Dimetrota) pseudomodesta Klimaszewski, 2007

CANADA: NOVA SCOTIA: Cumberland Co.: Wentworth, VIII.1965, B. Wright, summit of ski slope, sugar maple forest, pitfall trap, (1, NSMC). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 9.IX.1980, R. Baranowski, (1f, MZLU; 1m, LFC).

Atheta pseudomodesta is newly recorded in Nova Scotia and Ontario. In Québec it was very abundant in yellow birch (*B. alleghaniensis*) forests (Klimaszewski et al. 2007b).

Atheta (Microdota) pennsylvanica Bernhauer, 1907

CANADA: NOVA SCOTIA: Annapolis Co.: Big Dam Lake, Kejimkujik National Park, 12-22.VIII.2004, 27.VI-7.VII.2004, 18.IX-2.X.2004, H. Love, hemlock forest, pitfall trap, (13, DAL); Channel Lake, Kejimkujik National Park, 12-22.VIII.2004, 25.VI-5.VII.2004, 18.IX-2.X.2004, H. Love, maple/oak/birch forest, pitfall trap, (9, DAL); **Antigonish Co.:** Pomquet, IV.1996, R.F. Lauff, leaf litter, (1, STFX); **Cape Breton Co.:** Sydney (CBU campus), 15.IX.1990, 4.IX.1996, D.B. McCorquodale, (3, CBU); Scatarie Island, 15.VII.2006, A. MacDonald, in *Boletus* sp. fungus, (1, CBU); **Digby Co.:** Brier Island, Gull Rock Rd., 24.VI.2003, J. Ogden & K. Goodwin, forest, pitfall trap, (1, JOC); **Halifax Co.:** Big St. Margarets Bay, 1-16.VII.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (1, NSMC); Burnside, 15.VIII.2003, C. Cormier, on decomposing pig, (1, SMU); Waverley, 14.V.1965, 8.VI.1965, B. Wright, red oak forest, window trap, (2, NSMC); **Hants Co.:** Armstrong Lake, 15-30.VI.1997, D.J. Bishop, 75 year old red spruce forest, flight-intercept trap, (1, NSMC); **Digby Co.:** Pebbleloggitch Lake, Kejimkujik National Park, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (21, DAL); **Queens Co.:** Canning Field, Kejimkujik National Park, 14-23.VIII.2004, 26.VI-6.VI.2004, H. Love, hemlock forest, pitfall trap, (34, DAL); North Cranberry Lake, Kejimkujik National Park, 28.VI-8.VII.2004, 13-24.VIII.2004, H. Love, hemlock forest, pitfall trap, (2, DAL); Cobreille Lake, Kejimkujik National Park, 27.VI-6.VII.2004, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (13, DAL); Kejimkujik National Park, 24.VIII.1994, 7.IX.1994, 2.X.1994, 5.IX.2001, 29.IX.2001, 13-28.VII.1994, 28.VII-11.VIII.1994, 26.IX-19.X.1994, B. Wright, hemlock forest, leaf litter, (8, NSMC); **Victoria Co.:** Still Brook, 17.VIII.2007, L. Stepanovic, fen, pitfall trap, (1, CGMC).

Atheta pennsylvanica is newly recorded in Nova Scotia. In Nova Scotia it has been found in both coniferous and deciduous forests in leaf litter. One specimen was found on a *Boletus* sp. fungus and another on carrion.

Atheta (Microdota) platanoffi Brundin, 1948

CANADA: BRITISH COLUMBIA: Creston, near Kootenay Pass, 1500-1800 m, 18.VIII.1982, R. Baranowski, (1m, LFC); 20 km northeast of Creston, 14.VIII.1982, R. Baranowski, (1f, LFC). **NOVA SCOTIA: Colchester Co.:** Bible Hill, 8.VII.2007, C.W. D'Orsay, pasture, (1, CBU). **ONTARIO: Algoma Co.:** Michipicoten River (South of Wawa), 5.IX.1980, R. Baranowski, (1f, MZLU); Wawa, 8.IX.1980, R. Baranowski, (1f, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, 21.VIII.1980, 22.VIII.1980, R. Baranowski, (3m, MZLU; 7f, MZLU); **Sudbury Co.:** Mattagami, 25.VIII.1980, R. Baranowski, (3m, MZLU; 2f, MZLU; 2f, LFC); 30 km southwest of Foleyet, 29.VIII.1980, R. Baranowski, (1f, MZLU); 40 km northeast Gogama, Mattagami River, 27.VIII.1980, R. Baranowski, (1f, MZLU).

This Holarctic species is newly recorded in British Columbia, Nova Scotia, and Ontario. In Europe it has been recorded in Finland, Sweden, and northern Russia (Smetana 2004). It is found in forest litter.

Atheta (Pseudota) klagesi Bernhauer, 1909

CANADA: ALBERTA: 8 km southeast of Sherwood Park, NE 7 Twp., 53°31'N, 113°19'W, 31.VIII.2003, J. Klimaszewski, aspen forest, (5m, CFL; 1f, LRC); no locality recorded; 23.V.1995, 6.VI.1995, H.E.J. Hammond, (2m, NFRC). **BRITISH COLUMBIA:** Monashee Mountain near Cherryville, 11.VIII.1982, R. Baranowski, 1,400-1,600 m, (1f, LFC; 1, MZLU); 20 km northeast of Creston, 14.VIII.1982, R. Baranowski, (1f, LFC); 23 km northeast of Creston, 16.VIII.1982, R. Baranowski, (1f, MZLU); 25 km west of Creston, 18.VIII.1982, R. Baranowski, (1m, MZLU; 1f, MZLU; 1, MZLU); 13 km north of Nelway, 21.VIII.1982, 19.VIII.1982, R. Baranowski, (1m, LFC); near Mabel Lake at Squaw Valley, 5.VIII.1982, R. Baranowski, (3f, MZLU; 2, MZLU). **NEW BRUNSWICK: Albert Co.:** Mary's Point, 9.VIII.2002, C.G. Majka, white spruce forest, in *Russula virescens*, (6, CGMC); **York Co.:** New Maryland, 15.IV.2004, R.P. Webster, mixed forest, compost, (2, RWC). **NOVA SCOTIA: Halifax Co.:** Abraham's Lake, 14.V-2.VI.1997, 2-15.VI.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (2, NSMC); Big St. Margaret's Bay, 1-16.VII.1997, 29.VII-13.VIII.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (2, NSMC); Grassy Lake, 29.VII-13.VIII.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); Pockwock Lake, 29.VII-13.VIII.1997, D.J. Bishop, mature red spruce forest, flight-intercept trap, (1, NSMC); Sandy Lake, 29.VII-13.VIII.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (1, NSMC); Ten Mile Lake, 14.V-2.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); Big Indian Lake, 23.VI.2003, 9.VIII.2003, P. Dollin, red spruce forest (80-120 years), in rotting mushroom, (2, NSMC); **Queens Co.:** Fifth Lake Bay, 4.VIII.2003, old growth hemlock forest, in rotting mushroom, (3, NSMC); Sixth Lake, 14.VII.2003, P. Dollin, old growth hemlock forest, orange bracket fungus, (1, NSMC); Tobeatic Lake, 17.VI.2003, red spruce forest (80-120 years), (1, NSMC). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 1.IX.1980, 6.IX.1980, 10.IX.1980, 31.VIII.1980, R. Baranowski, (2m, MZLU; 5f, MZLU); Michipicoten River (South of Wawa), 5.IX.1980, R. Baranowski, (4m, MZLU; 1f, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (2m, MZLU; 4f, MZLU; 1, MZLU; 4m, LFC; 2f, LFC); **Sudbury Co.:** Mattagami, 24.VIII.1980, 26.VIII.1980, 27.VIII.1980, R. Baranowski, (7m, MZLU; 6f, MZLU; 1m, LFC); 30 km southwest of Foleyet, 30.VIII.1980, R. Baranowski, (1m, MZLU). **PRINCE EDWARD ISLAND: Queens Co.:** St. Patricks, 18.VIII.2002, C.G. Majka, along stream, (2, CGMC); St. Patricks, 20.VIII.2002, C.G. Majka, coniferous forest, on *Heterobasidion annosum* (Fr.) Bref., (1, CGMC); St. Patricks, 25.VI.2003, C.G. Majka, coniferous forest, (2, CGMC).

Atheta klagesi is newly recorded in Alberta, British Columbia, New Brunswick, Nova Scotia, Ontario, and Prince Edward Island. In the Maritime Provinces it has frequently been recorded in old-growth and mature red spruce (*P. rubens*) forests in decomposing mushrooms, on bracket fungi, and in compost. In Québec it was recorded in yellow birch (*B. alleghaniensis*) forests by Klimaszewski et al. (2007b).

Atheta (Tetropla) frosti Bernhauer, 1909

CANADA: BRITISH COLUMBIA: Monashee Mountain near Cherryville, 12.VIII. 1982, R. Baranowski, 1,400-1,600 m, (1m, MZLU); 20 km northeast of Creston, 14.VIII.1982, 15.VIII.1982, R. Baranowski, (1m, MZLU; 1f, MZLU; 1f, LFC; 1, LFC); 13 km north of Nelway, 20.VIII.1982, 21.VIII.1982, R. Baranowski, (1f, MZLU; 1m, LFC; 1f, LFC); near Mabel Lake at Squaw Valley, 5.VIII.1982, 6.VIII.1982, R. Baranowski, (3f, MZLU; 2m, MZLU; 2, LFC). **NOVA SCOTIA: Cape Breton Co.:** George's River, 8.X.1995, D.B. McCorquodale, (1, CBU); **Halifax Co.:** Point Pleasant Park, 21.IX.2001, C.G. Majka, coniferous forest, on *Tyromyces* sp. polypore, (1, CGMC); **Lunenburg Co.:** Bridgewater, 1.VII.1965, 1-16.VII.1965, B. Wright, red oak forest, pitfall trap, (9, NSMC); **Queens Co.:** Kejimkujik National Park, 11.IX.2001, B. Wright, deciduous forest, pitfall trap, (1, NSMC). **ONTARIO: Carleton Co.:** Mer Bleue, 16.IX.1980, R. Baranowski, (1f, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (2m, MZLU). **QUÉBEC:** Hull, Gatineau Park, near Ramsey Lake, 17.VIII.1980, R. Baranowski, (2m, MZLU; 1f, MZLU).

Atheta frosti is newly recorded in British Columbia, Nova Scotia, Ontario, and Québec. In Nova Scotia it has been found in both coniferous and deciduous forests and once on a *Tyromyces* sp. polypore.

Clusiota impressicollis (Bernhauer, 1907)

CANADA: ONTARIO: Algoma Co.: 10 km east of Wawa, 8.IX.1980, R. Baranowski, (1f, LFC); **Nipissing Co.:** Algonquin Provincial Park near Brent, 21.VIII.1980, R. Baranowski, (1m, LFC).

Clusiota impressicollis is newly recorded in Ontario. It was originally reported from British Columbia (as *C. claviventris*) by Casey (1910). The bionomics of the species are unknown.

Dinarea angustula (Gyllenhal, 1810)

CANADA: ONTARIO: Renfrew Co.: Pembroke, 14.IX.1980, R. Baranowski, (1m, MZLU).

This adventive, Palaearctic species is newly recorded in Ontario. In the Old World it is widely distributed across Europe, east through western and eastern Siberia (Smetana 2004). It is found in un-forested, arable land; in Canada it has been found in or adjacent to agricultural fields (Klimaszewski et al. 2007a).

Dochmonota rudiventris (Eppelsheim, 1886)

CANADA: QUÉBEC: Hull, Gatineau Park, 16.VIII.1980, R. Baranowski, (1m, MZLU).

This Holarctic or Palaearctic species (its zoogeographic status is still uncertain) is newly recorded in Québec. In the Old World it is found in continental Europe from France north to Fennoscandia, south to Greece, and east across Russia and Siberia to Korea (Smetana 2004). In Europe this species is usually found in floodplain habitats (meadows and leaf litter near water) (Volker Assing, pers. comm.).

Earota dentata (Bernhauer, 1906)

CANADA: NOVA SCOTIA: Colchester Co.: Greenfield, 28.V.1999, J. Ogden, (1, NSNR); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC); **Richmond Co.:** Irish Cove, 1-4.VI.2004, C.W. D'Orsay, (1, CBU). **ONTARIO: Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, 20.VIII.1980, R. Baranowski, (1f, MZLU; 1f, LFC); **Sudbury Co.:** 40 km northeast Gogama, Mattagami River, 27.VIII.1980, R. Baranowski, (1m, MZLU; 1f, MZLU); Mattagami, 25.VIII.1980, 28.VIII.1980, 29.VIII.1980,R. Baranowski, (2m, MZLU; 4f, MZLU; 1m, LFC; 2, LFC).

Earota dentata is newly recorded from Nova Scotia and Ontario. Although not recorded from New Brunswick in Gouix and Klimaszewski (2007), it is worth drawing attention to the records of this species from that province reported in Klimaszewski et al. (2004). It is found in leaf litter, moss, river debris, and pocket gopher (*Geomys* sp.) burrows (Gusarov 2002).

Hydrosmecta pseudodiosica Lohse, 1990

CANADA: ONTARIO: Sudbury Co.: 40 km northeast Gogama, Mattagami River, 25.VIII.1980, R. Baranowski, (1m, MZLU; 1f, MZLU; 1, LFC).

Hydrosmecta pseudodiosica is newly recorded in Ontario. Lohse et al. (1990) reported that it occurs along the edges of streams and running water.

Liogluta aloconotoides Lohse, 1990

CANADA: NOVA SCOTIA: Queens Co.: Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 2.IX.1980, R. Baranowski, (2m, LFC); Michipicoten River (South of Wawa), 5.IX.1980, R. Baranowski, (1f, MZLU); **Sudbury Co.:** 40 km northeast Gogama, Mattagami River, 26.VIII.1980, R. Baranowski, (1f, LFC). **QUEBEC**: Hull, near Kidder Lake, 17.VIII.1980, R. Baranowski, (1f, MZLU).

Liogluta aloconotoides is newly recorded in Nova Scotia, Ontario, and Québec. The bionomics of the species are unknown.

Mocyta breviuscula (Mäklin, 1852)

CANADA: NOVA SCOTIA: Guysborough Co.: Malay Lake, 2-15.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Halifax Co.:** Sable Island, Old Main Station, 24.IV.1976, B. Wright, sand dunes, under boards, (7, NSMC); Moser Lake, 2-15.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC).

Mocyta breviuscula is newly recorded from Nova Scotia. Particularly noteworthy are the specimens collected on Sable Island, a 45 km long sand bar located near the edge of the continental shelf, 160 km from the nearest point of land. In Nova Scotia it has been found in both red spruce (*P. rubens*) forests and on isolated insular sand bars. On the Pacific coast it has also been found in coastal environments in Sitka, Alaska and on the Queen Charlotte Islands, British Columbia (Gusarov 2003a). We suspect that this species is continuously distributed in northern Canada.

Mocyta fungi (Gravenhorst, 1806)

CANADA: ALBERTA: 8 km southeast of Sherwood Park, NE 7 Twp., 53°31'N, 113°19'W, 31.VIII.2003, J. Klimaszewski, aspen forest, (1f, LFC; 10, LFC). **BRITISH COLUMBIA:** Wynndel, Kootenay Lake, 14.VIII.1982, R. Baranowski, (1f, MZLU); near Cherryville at Monashee Summit, 1100-1200 m, 8.VIII.1982, R. Baranowski, (1f, MZLU); near Mabel Lake at Squaw Valley, 4.VIII.1982, 5.VIII.1982, R. Baranowski, (2f, MZLU); 15 km east Denver, Zincton Summit, 13.VIII.1982, R. Baranowski, (1f, LFC).

This adventive, Palaearctic species is newly recorded from Alberta and British Columbia. It is widely distributed across Europe, North Africa, and Asia (Smetana 2004). It is found in fungi, litter (mainly deciduous), rotten wood, in mosses, and in decaying plants (Burakowski et al. 1981).

Philhygra botanicarum Muona, 1983

CANADA: BRITISH COLUMBIA: New Denver, 13.VIII.1982, R. Baranowski, (2m, MZLU; 2f, MZLU; 1m, LFC; 1 LFC). 20 km northeast of Creston, 15.VIII.1982, R. Baranowski, (1m, LFC); 23 km northeast of Creston, 16.VIII.1982, R. Baranowski, (1f, LFC); Monashee Summit near Cherryville, 8.VIII.1982, R. Baranowski, 1,100-1,200 m, (1m, MZLU; 1f, MZLU; 1, MZLU; 1f, LFC; 1, LFC). **ONTARIO: Algoma Co.:** Lake Superior Provincial Park, 4.IX.1980, R. Baranowski, (1f, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1f, MZLU).

Philhygra botanicarum is newly recorded from British Columbia and Ontario. It was described by Muona (1983) from Finland, then reported in North America from Newfoundland by Muona (1984). Although Muona (1984) included this species amongst Palaearctic aleocharines occurring in North America, we consider it a Holarctic species. The bionomics of the species are unknown.

Philhygra clemens (Casey, 1910)

CANADA: BRITISH COLUMBIA: 13 km north of Nelway, 21.VIII.1982, R. Baranowski, (1f, MZLU); between Lumby and Mabel Lake, 4.VIII.1982, R. Baranowski, (1f, MZLU). **NOVA SCOTIA: Cumberland Co.:** Oxford, 6.VIII.1988, 7.VIII.1988, 12.VIII.1988, E. Georgeson, ultra-violet light trap, (3, NSMC). **ONTARIO: Algoma Co.:** Michipicoten River (South of Wawa), 5.IX.1980, R. Baranowski, (2m, MZLU; 2f, MZLU; 1f, LFC); **Carleton Co.:** Mer Bleue, 20.IX.1980, R. Baranowski, (1m, MZLU); **Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, R. Baranowski, (1f, MZLU); **Renfrew Co.:** Pembroke, 14.IX.1980, 14.IX.1980, R. Baranowski, (1f, MZLU; 1 LFC); **Sudbury Co.:** Mattagami, 28.VIII.1980, R. Baranowski, (1m, MZLU).

Philhygra clemens is newly recorded from British Columbia, Nova Scotia, and Ontario. In New Brunswick it was found in red spruce (*P. rubens)* forests, whereas in Québec it was found in yellow birch (*B. alleghaniensis*) forests (Klimaszewski et al. 2007b).

Philhygra "humivaga" [Gusarov, 2001-2003, undescribed]

CANADA: BRITISH COLUMBIA: near Mabel Lake at Squaw Valley, 4.VIII.1982, 6.VIII.1982, R. Baranowski, (2m, MZLU).

Philhygra "humivaga" is newly recorded from British Columbia. This undescribed species is listed in Gusarov (2001-2003) as occurring in Alaska. No information about the bionomics of this species is available.

Philhygra laevicollis (Mäklin, 1852)

CANADA: NOVA SCOTIA: Lunenburg Co.: Bridgewater, 12.V.1965, B. Wright, (1, NSMC).

Philhygra laevicollis is newly recorded in Nova Scotia. In New Brunswick it was found in red spruce forests whereas in British Columbia it was found in Sitka spruce (*P. sitchensis*) forests.

Philhygra rostrifera Lohse, 1990

UNITED STATES: ALASKA: Eureka Summit, Highway 1, 5.VIII.1988, R. Baranowski, 1,000 m, under stone, roadside open ground, (1m, MZLU).

Philhygra rostrifera is newly recorded from Alaska. Except for the information above, nothing further is known about the bionomics of the species.

Seeversiella globicollis (Bernhauer, 1907)

CANADA: NOVA SCOTIA: Victoria Co.: Cape Breton Highlands, 10.VII.2005, J. Ogden, flight-intercept trap, (1, JOC).

Seeversiella globicollis is newly recorded from Nova Scotia. It is found in leaf litter, often near water. In the southern parts of its range it is restricted to mountainous forest, mostly above 2,000 m (Gusarov 2003b).

Strophogastra penicillata Feynes, 1921

CANADA: NOVA SCOTIA: Digby Co.: Pebbleloggitch Lake, Kejimkujik National Park, 13-24.VIII.2004, H. Love, maple/oak/birch forest, pitfall trap, (1, DAL); **Queens Co.:** Kejimkujik National Park, 24.VIII.1994, B. Wright, deciduous forest, pitfall trap, (1, NSMC). **ONTARIO: Nippising Co.:** Algonquin Provincial Park near Brent, 20.VIII.1980, 20.VIII.1980, R. Baranowski, (2f, MZLU; 1f, LFC); **Sudbury Co.:** Mattagami, 25.VIII.1980, R. Baranowski, (1m, LFC). **QUÉBEC**: Hull, Gatineau Park, near Ramsey Lake, 17.VIII.1980, R. Baranowski, (2m, MZLU; 2f, MZLU); Roddick Lake, 20.VIII-12.IX.1982, L. Huggert, pan trap, (1, LFC).

Strophogastra penicillata is newly recorded from Nova Scotia, Ontario, and Québec. In Nova Scotia it was found in deciduous forests.

Tribe Lomechusini Fleming, 1821

Xenodusa reflexa (Walker, 1866)

NOVA SCOTIA: Kings Co.: Berwick, 1.VI.1941, H.T. Stultz, associated with ants under stone, (1, ACNS).

Xenodusa reflexa is newly recorded in Nova Scotia. Adults and larvae are myrmecophilus and live in ant nests. Known hosts of *X. reflexa* include *Camponotus noveboracensis* (Fitch), *Camponotus laevigatus* (Smith), *Camponotus herculeanus modoc* Wheeler, and *Formica subpolita* Mayer (Hoebeke 1976).

Myrmedonota aidani Maruyama and Klimaszewski, 2008

CANADA: ONTARIO: Carleton Co.: Mer Bleue, 16.IX.1980, R. Baranowski, (1m, LFC).

Myrmedonota aidani is newly recorded in Ontario and in Canada as a whole. It was described by Maruyama et al. (2008) from Ohio in the United States. Most species of Lomechusini are considered myrmecophilous and *M. aidani* is no exception. Specimens in the United States were collected in association with 14 species of ants of the genera *Lasius, Brachymyrmex, Prenolepis, Formica, Myrmica, Stenamma, Solenopsis, Aphaenogaster,* and *Ponera* (Maruyama et al. 2008).

Pella caliginosa (Casey, 1993)

CANADA: ALBERTA: Tp. 112, Rge. 20, W. 5 Mer., 14.VII.1981, B.F. and J.L. Carr, lot 5, (1f, LFC).

Pella caliginosa is newly recorded in Alberta and in Canada as a whole. North American species of the genus *Pella* have been associated with ant species of the genus *Lasius* (subgenus *Dendrolasius*) and occasionally with species in the genera *Crematogaster, Formica, Liometopum,* and *Tapinoma* (Klimaszewski et al. 2005a).

Discussion

As a result of the present investigations new jurisdictional records are reported for 53 species of aleocharines. Eighty-eight new Canadian provincial records (nine from Alberta, 11 from British Columbia, eight from New Brunswick, one from the Northwest Territories, 23 from Nova Scotia, 27 from Ontario, one from Prince Edward Island, and eight from Québec) are provided as well as six new state records for the United States (three from Alaska, two from Washington, and one from Oregon). Of these, six species including *Aleochara (Xenochara) quadrata, Gnathusa eva*, *Phymatura blanchardi, Aloconota sulcifrons, Myrmedonota aidani*, and *Pella caliginosa* are newly recorded in Canada. The ninety-one new records (88 from Canada and 3 from Alaska) increase the number of provincial and state records for Canada and Alaska to 1029, an almost 10% increase in distribution of the known fauna. Five species, including *Homalota plana, Aloconota sulcifrons, Atheta (Chaetida) longicornis, Dinaraea angustula,* and *Mocyta fungi* are adventive Palaearctic species; four including *Atheta (Datomicra) dadopora, Atheta (Microdota) platanoffi, Dochmonota rudiventris,* and *Philhygra botanicarum* are Holarctic (or probably Holarctic) species; and the remaining 44 species are native, Nearctic ones.

In many cases these new records dramatically alter our understanding of the range of the species involved. Examples include:

a) Range extensions of *Aleochara quadrata* and *Gnathusa eva,* previously known from the Pacific coast of the United States, show them to occur further northward than previously known;

b) *Phloeopora arctica, Cypha inexpectata, Clusiota impressicollis,* and *Hydrosmecta pseudodiosica,* previously known from the western Canadian arctic, are newly recorded from Ontario in central Canada;
c) *Mocyta breviuscula* previously known from western North America, is newly recorded from Atlantic Canada;
d) *Leptusa gatineauensis, Atheta strigosula, Atheta klagesi, Atheta frosti*, *Atheta modesta,* and *Philhygra botanicarum,* all previously known from eastern North America, are newly recorded in the western portions of the continent;
e) *Atheta burwelli*, previously known from the northeastern and northwestern subarctic, is newly recorded in Atlantic Canada;
f) *Liogluta alconotoides*, previously known from the northeastern and northwestern subarctic, is newly recorded from central and Atlantic Canada;
g) *Philhygra rostrifera*, previously known from the northeastern subarctic, is newly recorded from Alaska in the northwest;
h) *Phymatura blanchardi* and *Pella caliginosa*, previously known from the central United States are newly recorded from Alberta in western Canada;
i) *Myrmedonota aidani,* previously known only from Ohio in the United States, is newly recorded in central Canada;
j) *Meronera venustula, Atheta annexa, Atheta burwelli, Atheta hampshirensis, Atheta prudhoensis*, *Atheta klagesi*, *Atheta frosti*, *Earota dentata*, *Seeversiella globicollis,* and *Xenodusa reflexa* are all newly recorded in Atlantic Canada;
k) The distributions of the adventive species *Aloconota sulcifrons, Atheta longicornis, Dinarea angustula, Homalota plana,* and *Mocyta fungi* are shown to be more extensive than previously known. In particular *A. sulcifrons* is newly recorded in Canada, and both this species and *A. longicornis* are newly recorded in western North America.

In other instances the new records fill in what would appear to be expected distributional gaps which have resulted from insufficient previous collecting effort (i.e., *Gymnusa grandiceps, Tinotus caviceps, Silusida marginella, Silusa alternans, Silusa californica, Silusa vesperis, Atheta brunswickensis, Atheta crenuliventris, Atheta districta, Atheta remulsa, Atheta ventricosa, Atheta picipennis, Atheta pseudomodesta, Atheta pennsylvanica, Atheta platanoffi, Dochmonota rudiventris, Philhygra clemens, Philhygra laevicollis,* and *Strophogastra penicillata*.)

Thus, these new records contribute to an understanding of the biogeography of the Aleocharinae in North America, and hence of the post-glacial historical development and dispersal of the group on the continent.

Even with this new information it is clear that much still remains to be done to establish the composition and distribution of the Canadian aleocharine fauna. With such a knowledge it will be increasingly possible to develop an understanding of the role that these abundant beetles play in the many environments that they inhabit.

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Appendix 1. North American distribution of Aleocharines reported in this study

Species	Distribution	Source
Gymnusini Thompson		
Gymnusa grandiceps Casey	MB, **NB**, NS, ON, QC / IL, MA, MD, MI, NY	K (1979)
Aleocharini Fleming		
Aleochara (Xenochara) quadrata Sharp §	**BC /** CA, NV / MX	K (1984), N-H (2002)
Tinotus caviceps Casey	**ON**, QC / AZ, ID, IN, IA, NJ, NV, NY, PA	M&L (1975), K (2002)
Oxypodini Thomson		
Gnathusa eva Fenyes §	**BC** / CA	M&L (1975)
Phloeopora arctica Lohse	**ON**, NW, YT	L (1990)
Meronera venustula (Erichson)	**NB**, ON, QC / FL, ID, RI, TX, UT	M&L (1975), C&D (1991)
Hypocyphtyni Laporte		
Cypha inexpectata Klimaszewski & Godin	**ON**, YT	K&G (2008)
Tribe Homalotini		
Silusida marginella (Casey	NB, **NS**, ON, **QC** / NY, PA	M&L (1975), K (2005), G&K (2007)
Homalota plana (Gyllenhal) †	AB, NB, NS, **ON** / AK, AZ, CA, ID, IN, FL, NY, TX, WA	K (2004), K (2007a), M&L (1975), G&K (2007)
Leptusa gatineauensis Klimaszewski & Pelletier	**AB**, NS, ON, QC	K (2004)
Leptusa opaca Casey	NB, NS, ON, PE, QC / NC	K (2004)
Silusa alternans Sachse	NB, NS, **ON**, QC / GA, NH, NY	K (2003)
Silusa californica Bernhauer	AB, BC, NB, NS, **ON**, QC / AK, CA, MN	K (2003)
Silusa vesperis Casey	BC / CA, **OR**, WA	K (2003)
Phymatura blanchardi (Casey) §	**AB** / IN, IO, MO, NY	M&L (1975)
Placusini Mulsant and Rey		
Placusa vaga Casey	BC, **NW**, QC, YT / CA	K (2001), K (2008)
Athetini Casey		
Aloconota sulcifrons (Stephens) † §	**QC** / AL, IL, IN, KY, MO, NH, NY, TN, VA, **WA**, WV	K&P (1986), G (2003a)

Species	Distribution	Source
Atheta annexa Casey	**NB**, **NS**, **ON**, QC / AB, FL, GA, IO, IL, IN, KS, KT, LA, MO, MS, ON, NC, NY, TN, VA, WI, WV	K&P (1986), G (2003a)
Atheta brunswickensis Klimaszewski	NB, **NS**, **ON, YT**	K (2005), K (2008)
Atheta novaescotiae Klimaszewski & Majka	**NB**, NF, NS / / PM	K (2006)
Atheta remulsa Casey	AB, BC, NB, **NS**, **ON**, **QC**, YT	K (2005b), G&K (2007)
Atheta strigosula Casey	**BC**, NB, **ON**, **QC**, YT / **AK**, NY	K (2005b), K (2008)
Atheta (Alaobia) ventricosa Bernhauer	BC, **AB**, NB, **NS**, ON, YT / AK, DC, NY, NC, PA, VT	G (2003a), K (2008)
Atheta (Chaetida) longicornis (Gravenhorst) †	**BC**, NS, QC / MN	K (2007a)
Atheta (Datomicra) dadopora Thomson *	**AB**, NF, NB, NS, **ON**, PE, YT / **AK**, RI, PA, NY	G (2003a), K (2005b), K (2008), M&K (2008a), M&K (2008b)
Atheta (Dimetrota) burwelli (Lohse)	**NB**, QC, YT	L (1990), K (2008)
Atheta (Dimetrota) crenuliventris Bernhauer	NB, **ON**, QC / ME	M&L (1975), L (1990)
Atheta (Dimetrota) districta Casey	**AB**, BC, NB, **NS**, **ON**	K (2005)
Atheta (Dimetrota) hampshirensis Bernhauer	BC, **NB**, **NS**, **ON** / AK, CA, NH, NY, NC, OR, PA, RI, WA	K&W (2002), G (2003a)
Atheta (Dimetrota) modesta (Melsheimer)	**AB**, NB, **NS**, ON, QC / CT, DC, MI, NY, PA, RI, VT, WV	G (2003a), K (2005b)
Atheta (Dimetrota) picipennis (Mannerheim)	BC, NW, YT / AK, CA, **WA**	K&W (2002), G (2003a), G&K (2007)
Atheta (Dimetrota) prudhoensis (Lohse)	**NB**, **NS**, **ON**, YT / AK, NY, VT	L (1990), G (2003a)
Atheta (Dimetrota) pseudomodesta Klimaszewski	**NS**, **ON**, QC	K (2007b)
Atheta (Microdota) pennsylvanica Bernhauer	NB, **NS**, ON, QC / MA, MN, NY, PA, VT	G (2003a), K (2005b)
Atheta (Microdota) platanoffi Brundin *	AB, **BC**, NB, **NS**, **ON** / AK	K (2005b)

Species	Distribution	Source
Atheta (Pseudota) klagesi Bernhauer	**AB**, **BC**, **NB**, **NS**, **ON**, **PE**, QC, YT / IA, ME, MN, NJ, NY, PA	G (2003a), G&K (2007), K (2008)
Atheta (Tetropla) frosti Bernhauer,	**BC**, NB, **NS**, **ON**, **QC** / MA, NH, NY, NC, PA, RI, VT	G (2003a), K (2005)
Clusiota impressicollis (Bernhauer)	BC, **ON** / WA	G (2001-2003)
Dinarea angustula (Gyllenhal) †	BC, NS, **ON**, PE, QC / NY	M&L (1975), K (2007a)
Dochmonota rudiventris (Eppelsheim) *	NF, NW, **QC**, YT / MA, ID	G (2003a)
Earota dentata (Bernhauer)	AB, BC, MB, NB, **NS**, **ON**, QC / AK, AL, AZ, CA, CO, DC, IA, ID, IL, IN, KA, MA, MD, ME, MT, NC, NH, NJ, NM, NV, OH, OR, PA, VA, WA	G (2002)
Hydrosmecta pseudodiosica Lohse	**ON**, YT	L (1990)
Liogluta alconotoides Lohse	LB, **NS**, **ON**, **QC**, YT	L (1990), K (2008)
Mocyta breviuscula (Mäklin)	BC, **NS**, YT / AK, CA, NV	G (2003a), K (2008)
Mocyta fungi (Gravenhorst) †	**AB**, **BC**, NB, NF, NS, ON, PE, QC, YT / MA, ME, MN, NY, OR, RI	G (2003a), G&K (2007), M&K (2008a), K (2008)
Philhygra botanicarum Muona *	**BC**, NF, NS, **ON**, YT	M (1984), M&K (2008a), K (2008)
Philhygra clemens (Casey)	**BC**, NB, **NS**, **ON**, QC / IA, NY, PA, RI, WI	G (2001-2003), K (2005b), K (2007b)
Philhygra "humivaga" [Gusarov]	**BC** / AK	G (2001-2003)
Philhygra laevicollis (Mäklin)	BC, NB, **NS**, MB / AK, WA	M&L (1975), K&W (2002), K (2005b), G&K (2007)
Philhygra rostrifera Lohse	LB / **AK**	L (1990)
Seeversiella globicollis (Bernhauer)	AB, BC, NS, ON, QC / AZ, CO, ID, MN, MT, NH, NM, SD, WI / GT, HN, MX	G (2003b)
Strophogastra penicillata Feynes	AB, MB, NB, **NS**, **ON**, **QC**	M&L (1975), K (2005b), G&K (2007)

Species	Distribution	Source
Lomechusini Fleming		
Xenodusa reflexa (Walker)	AB, BC, MB, **NS**, ON, QC, SK / AZ, CA, CO, CT, IA, IL, MA, MD, MI, MN, MT, ND, NE, NH, NM, NV, NY, OR, RI, SC, UT, VT, WA, WI, WY	H (1976)
Myrmedonota aidani Maruyama & Klimaszewski §	**ON** / OH	M (2008)
Pella caliginosa (Casey) §	**AB** / IN, NY	M&L (1975)

Notes: Entries in **boldface** indicate new jurisdictional records reported in the present paper. †, adventive Palaearctic species; *, Holarctic species; §, indicates species newly recorded in Canada. The two-letter state and provincial codens follow postal code abbreviations, except that we employ LB (Labrador) and NF (Newfoundland) to distinguish between the two portions of the province of Newfoundland and Labrador (NL). Canadian provinces are followed by American states, which are then followed by any other jurisdictions. Abbreviations of source citations refer to the appropriate publications cited in the "References" section of the present paper. "Klimaszewski et al." has in all instances been abbreviated to "K".

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The coastal rove beetles (Coleoptera, Staphylinidae) of Atlantic Canada: a survey and new records

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Abstract

The coastline inhabiting rove beetles (Coleoptera: Staphylinidae) of Atlantic Canada are surveyed. Thirty-three species have now been recorded in Atlantic Canada including 26 in New Brunswick, 15 in Newfoundland, 31 in Nova Scotia, and 13 on Prince Edward Island. *Oligota parva* Kraatz, *Acrotona avia* (Casey), *Strigota ambigua* (Erichson), and *Myrmecopora vaga* (LeConte) are all newly recorded in Canada, and *Bledius mandibularis* Erichson is newly recorded in Atlantic Canada. We retain *A. avia* as a species distinct from *A. subpygmaea* Bernhauer and designate a lectotype for *A. avia*. Ten new provincial records are reported, one from New Brunswick, six from Nova Scotia, and three from Prince Edward Island. Four functional groups, halobiont (obligate), halophile (facultative), haloxene (tolerant), and incidental coastal species, are distinguished and the fauna is examined from the perspective of the particular coastline habitats and microhabitats they have been found to inhabit.

Fourteen of the 33 staphylinids are introduced, Palearctic species, and eight of these have been associated with historical dry ballast shipping to the region from Great Britain. A trophic analysis indicates that some species are phytophagous algae feeders, while others are either generalist predators, or predators specializing on particular taxonomic or functional groups of invertebrates. Finally, some attention is devoted to discussing the diminished areas of coastline environments such as coastal marshes, and the various kinds of environmental disturbances and degradations they have experienced. These indicate the potential vulnerability of such coastal habitats and consequently of the communities of beetles that inhabit them.

Keywords

Staphylinidae, coastal environments, ecology, biodiversity, systematics, Atlantic Canada

Introduction

While beetles are species rich and are ubiquitous in terrestrial and freshwater environments, only a relatively small number are found in marine situations. Amongst non-staphylinid beetles, Doyen (1976) listed 11 families (Carabidae, Hydrophilidae, Hydraenidae, Heteroceridae, Limnichidae, Melyridae, Salpingidae, Tenebrionidae, Rhizophagidae, Chrysomelidae, and Curculionidae) some species of which are obligate inhabitants of marine environments. Jeon and Ahn (2007) reported that 442 species of Staphylinidae in 102 genera and 7 subfamilies are known to be confined to seashore habitats, 0.93% of the circa 47, 744 described species of Staphylinidae (Herman 2001), and very close to the approximately 1% of rove beetles that Moore and Legner (1976) said were known to be confined to seashore habitats. Moore and Legner (1976: 521) wrote that, "Since habitat records are not known for the majority of staphylinids, it is not surprising if we are unaware of the marine habitat of some species".

In Europe there has been a considerable degree of attention to coastal Staphylinidae. Hammond (2000) published a thorough review of the British fauna based on extensive data sets. Fifty-eight species of halobiont, halophile, and halotolerant staphylinids are reported, with maps of each species in the British Isles, and 32 additional species occurring in coastal habitats, but not restricted to such environments, are also discussed for a total fauna of 90 species. A considerable degree of attention has also been paid to the coastal Staphylinidae of the Pacific coast of North America (Moore 1975, Moore and Legner 1976), however, comparatively little attention has been paid to the North American Atlantic coastal fauna.

There has been some recent attention in the Maritime Provinces to seashore/coastline inhabiting Staphylinidae with the result that species such as *Atheta novaescotiae* and *Atheta acadiensis* have been newly described from the region, and species such as *Brachygluta abdominalis* have been newly recorded in Canada from such environments. Other characteristic coastline staphylinids such as *Aleochara litoralis*, *Bledius* spp., and *Creophilus maxillosus* have been noted in combination with a variety of other Coleoptera that characteristically inhabit coast-line, beach-drift, and sand dune ecosystems (Herman 1972, 1976; Klimaszewski 1984; Majka and Ogden 2006; Klimaszewski et al. 2006; Klimaszewski and Majka 2007; Majka and Klimaszewski 2008).

Despite these studies of particular species or genera, relatively little research has been done on the Coleoptera of coastal environments in Atlantic Canada in general, and on the Staphylinidae in particular. In the present paper we survey coastline-inhabiting Staphylinidae of Atlantic Canada, newly recording a number of species in New Brunswick, Nova Scotia, Prince Edward Island, Atlantic Canada, and Canada as a whole.

Methods and conventions

A number of collections containing representatives of Staphylinidae collected in Atlantic Canada were examined and records of coastline-inhabiting species were compiled. Codens (following Evenhuis 2007) of collections referred to in this study are:

ACNS Agriculture and Agri-food Canada, Kentville, Nova Scotia, Canada
CBU Cape Breton University, Sydney, Nova Scotia, Canada
CGMC Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
DHWC David H. Webster collection, Kentville, Nova Scotia, Canada
JCC Joyce Cook collection, North Augusta, Ontario, Canada
JOC Jeff Ogden collection, Truro, Nova Scotia, Canada
NSMC Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC Reginald P. Webster collection, Charters Settlement, New Brunswick, Canada
STFX Saint Francis Xavier University, Antigonish, Nova Scotia, Canada
UMNB Université de Moncton, Moncton, New Brunswick, Canada
UPEI University of Prince Edward Island, Charlottetown, Prince Edward Island, Canada
USNM United States National Museum, Washington, District of Columbia, USA

The species included in the survey were both those that had been collected in marine environments in the region, as well as species that have been noted in the literature as occurring in such habitats. For the purposes of this treatment Atlantic Canada has been taken to be comprised of the provinces of New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island, as well the Iles de la Madeleine in the Gulf of St. Lawrence (which are a part of the province of Québec) and the French territories of Saint-Pierre et Miquelon which lie off of the south coast of Newfoundland. The distribution of all species is either shown in Figures 12-15, or else sources of published distribution maps are indicated.

Key to species

The following key to the species of coastal Staphylinidae of Atlantic Canada is provided. It is modified and adapted from Newton et al. (2000), Downie and Arnett (1996), Smetana (1995), and Herman (1972, 1976, 1986) together with additional material.

1 Antennae inserted anterior to a line drawn between the anterior margins of the eyes 2
– Antennae inserted posterior to a line drawn between the anterior margins of the eyes 24
2(1) Head with deep conical foveae on the vertex (Pselaphinae) .... *Brachygluta abdominalis*
– Head without deep conical foveae on the vertex 3

3(2) Head with a pair of ocelli between the posterior margins of the eyes (Omaliinae) .... *Micralymma marinum*
– Head without ocelli 4
4(3) Abdomen with seven visible abdominal sterna (Oxytelinae) 5
– Abdomen with six visible abdominal sterna.. 9
5(4) Labrum entire medially.. 6
– Labrum divided medially 8
6(5) Basal third of lateral pronotal margin markedly sinuate.............................. 7
– Basal third of lateral pronotal margin straight or evenly curved to base .... *Bledius basalis*
7(6) Ratio of elytral length/pronotal length (at midline) 1.58-1.76; elytra brownish-black with sub-scutellar yellowish spot .... *Bledius opaculus*
– Ratio of elytral length/pronotal length (at midline) 1.33-1.50; elytra yellowish with black sutural and basal stripes .... *Bledius neglectus*
8(5) Epipleural ridge of elytron present only on apex............ *Bledius mandibularis*
– Epipleural ridge of elytron present along entire length .... *Bledius politus*
9(4) Head constricted behind eyes so as to form a distinct neck visible from above 10
– Head not constricted behind eyes, no neck visible (Tachyporinae) .... *Sepedophilus marshami*
10(9) Inter-segmental membranes of abdomen with a distinct rectangular "brick wall" pattern; pronotum with large post-coxal process (Paederinae) .... *Ochthephilum fracticorne*
– Inter-segmental membranes of abdomen various (rounded or triangular patterns, or pattern indistinct) but never with a "brick wall" pattern; pronotum without postcoxal process (Staphylininae) 11
11(10) Strongly sclerotized plate (single, or divided medially into two contiguous sclerites) in front of prosternum present (Xantholinini) 12
– Strongly sclerotized plate in front of prosternum absent........................... 13
12(11) Metatibia with apical and sub-apical ctenidia, the latter interrupted medially but extended proximally along outer margin of metatibia .... *Gyrohypnus angustatus*
– Metatibia with apical ctenidium only............................. *Xantholinus linearis*
13(11) Disc of pronotum either densely punctate or glabrous; ligula notched (Staphylinina) 14
– Disc of prontotum generally with two rows of punctures medially; ligula entire, rounded or slightly sinuate apically (Philonthina) 15
14(13) Disc of pronotum glabrous; white pubescence on the anterior angles of the pronotum, across the medial part of the elytra, and on abdominal tergites four and five .... *Creophilus maxillosus villosus*
– Disc of pronotum densely punctate; lacking white pubescence .... *Tasgius ater*

15(13) Largest lateral macrosetal puncture of pronotum separated from the lateral margin by at most little more than the width of the puncture 16
– Largest lateral macrosetal puncture of pronotum separated from the lateral margin by at least three times the width of the puncture ....*Cafius bistriatus*
16(15) Protarsus with basal four tarsomeres more or less dilated, each tarsus bearing modified pale setae on ventral surface in addition to regular marginal setae.. 17
– Protarsus with basal four tarsomeres not dilated, each tarsus bearing only regular marginal setae... *Gabrius astutoides*
17(16) Dorsal rows on pronotum each with four punctures 18
– Dorsal rows on pronotum each with five punctures or more 23
18(17) Lateral margins of pronotum at least slightly sinuate posteriorly in front of basal margin.. 19
– Lateral margins of pronotum evenly arcuate to parallel posteriorly in front of basal margin.. 21
19(18) Posterior basal line on visible abdominal tergites two and three acutely extended posteriad at middle..*Philonthus politus*
– Posterior basal line on visible abdominal tergites two and three not acutely extended posteriad at middle 20
20(19) Small species (6.8-7.8 mm); eyes large; pronotum iridescent........................ ....*Philonthus umbratilis* (in part)
– Large species (8.7 – 13.6 mm); eyes moderately large, pronotum not iridescent.. *Philonthus furvus*
21(17) First antennal article bicolored, dark with underside yellow ....*Philonthus cognatus*
– First antennal article unicolored, dark 22
22(21) Surface of pronotum iridescent ....*Philonthus umbratilis* (in part)
– Surface of pronotum not iridescent........................... *Philonthus carbonarius*
23(17) Dorsal rows on pronotum each with five punctures...........*Philonthus varians*
– Dorsal rows on pronotum each with six punctures.........*Philonthus couleensis*
24(1) Hind coxae separated, small; eyes bulbous covering side of head (Steninae) ....*Stenus erythropus*
– Hind coxae contiguous, large; eyes various but not bulbous and covering side of head (Aleocharinae) 25
25(24) Tarsal formula 5-5-5; maxillary and labial palps each with an apical pseudosegment (Aleocharini) ....*Aleochara litoralis*
Tarsal formula otherwise; maxillary and labial palps without apical pseudosegments 26
26(25) Tarsal formula 4-4-4 (Hypocyphtini) .... *Oligota parva*
– Tarsal formula 4-5-5 27
27 (26) Pronotum broadest subapically, narrowed behind to a base not more than 3/4 of the maximal width of the pronotum (Falagriini) 28

– Pronotal base more than 3/4 of the maximal width of the pronotum (Athetini) 29
28(27) Scutellum bicarinate .... *Falagria dissecta*
– Scutellum not bicarinate .... *Myrmecopora vaga*
29(27) Pronotal hypomeron not at all visible in lateral view 30
Pronotal hypomeron narrowly to moderately visible in lateral view 32
30(29) Body robust, narrowly oval; antennal articles 4-6 slightly elongate and 7-10 quadrate to slightly transverse .... *Mocyta fungi*
– Body fine, subparallel; antennal articles 4-6 quadrate to transverse and 7-10 moderately to strongly transverse 31
31(30) Body glossy; abdominal tergites sparsely to moderately densely punctuate; tergite eight of both sexes with antecostal suture (basal line) subparallel to the base of the disc .... *Acrotona avia*
– Body moderately glossy, appearing somewhat opaque and velvety; abdominal tergites densely punctuate; tergite eight of both sexes with antecostal suture (basal line) arcuate and joining base of the disc before reaching its margin and then reaching downwards toward the apical margin of disc .... *Strigota ambigua*
32(29) Pronotum with setae in midline directed anteriorly; pronotum with asperate punctation .... *Atheta (Datomicra) acadiensis*
– Pronotum with all setae directed posteriorly or posterolaterally; pronotum without asperate punctation 33
33(32) Body opaque; pronotum at mid-length almost as broad as elytra at base; abdomen subparallel and distinctly narrower than elytra along its entire length; apical margin of male tergite 8 with 2 small lateral dents and shallow medial emargination pointed medially .... *Atheta novaescotiae*
– Body glossy; pronotum at mid-length distinctly narrower than elytra at base; abdomen with sides arcuate, broadest in mid-length and about as broad as elytra; apical margin of male tergite 8 truncate and without any dents .... *Atheta (Thinobaena) vestita*

Results

The following species of Staphylinidae associated with coastal habitats have been recorded from Atlantic Canada. There are two main categories of species; a) those that are regular members of coastal environments (halobionts, halophiles, and haloxenes); and b) incidental species that exhibit no specific coastal associations, but are generally attracted to decomposing situations, and hence are incidentally found in coastal environments.

Omaliinae

Micralymma marinum (Ström, 1785)

NOVA SCOTIA: Guysborough Co.: Tor Bay, 6.V.1996, R.F. Lauff, intertidal zone, (1, NSMC).

This species is newly recorded in Nova Scotia and its distribution in Atlantic Canada is shown in Fig. 12. It is a widely distributed Holarctic species found in intertidal habitats throughout Europe, Russia, Iceland, Greenland, Atlantic Canada, and New England in the USA (Larsson and Gígja 1959; Thayer 1985; Böcher 1988; Campbell and Davies 1991; Downie and Arnett 1996; Herman 2001). Böcher (1988, 34) wrote, "*M. marinum* is a true marine insect, presumably spending its entire life cycle in the tidal zone, where it is regularly submerged at high tide. Adults and larvae are generally found together, on vertical parts or the underside of stones and rocks …". Adults and larvae are predaceous, feeding on Collembola such as *Anurida maritima* (Guérin-Méneville, 1836), mites, and Thysanura although it is possible that larvae are, at least in part, also phytophagous feeding on algae (Thayer 1985; Böcher 1988; Hammond 2000).

Pselaphinae

Brachygluta abdominalis (Aubé, 1833)

Brachygluta abdominalis was reported in New Brunswick and Nova Scotia by Majka and Ogden (2006). Its distribution in Atlantic Canada and Maine is shown in Majka and Ogden (2006). The species is found in leaf litter in salt marshes and sand dune areas and in beach drift at the upper margin of the intertidal zone (Majka and Ogden 2006). Species of *Brachygluta* are specialist predators of mites (Hammond 2000).

Tachyporinae

Sepedophilus marshami (Stephens, 1832)

This species was recorded from Nova Scotia by Campbell (1976) and from New Brunswick by Majka and Klimaszewski (2008). Its distribution in North America is shown in Campbell (1976) and in the Maritime Provinces by Majka and Klimaszewski (2008). Davies (1979) found this adventive Palearctic species in seaweed beach wrack in St. Andrews (NB), and Campbell (1976) reported it from "shore refuse". It has also been found in many forested, open, and fresh-water habitats and probably only occurs sporadically in coastline environments. Hammond (2000) includes it as a generalist species regularly reported from saline and intertidal situations in Great Britain.

Aleocharinae

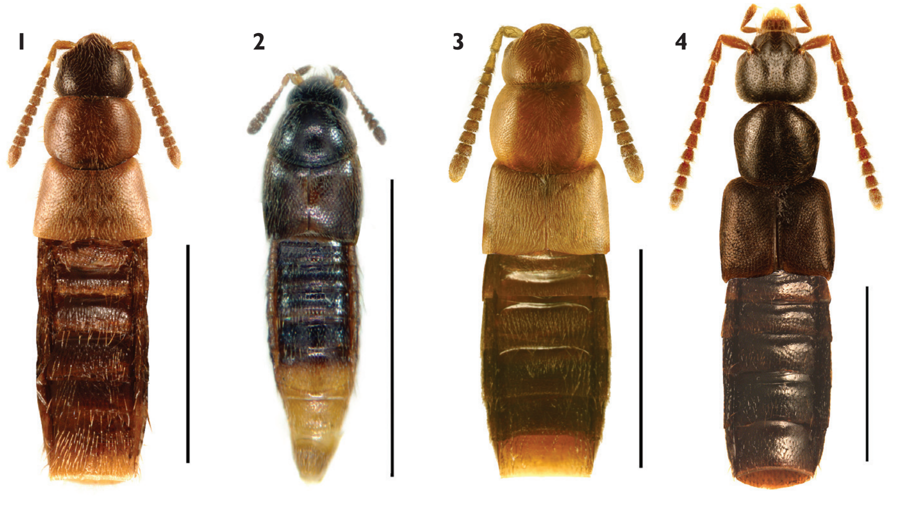
Aleochara (Emplenota) litoralis (Mäklin, 1853)

NEW BRUNSWICK: Albert Co.: Mary's Point, 23.VIII.2003, C.G. Majka, beach drift below sand dunes, (3, CGMC). **NOVA SCOTIA: Cape Breton Co.:** Scatarie Island, N.W. Cove, 8.VIII.2005, 11.VIII.2005, K.R. Aikens, & A. MacDonald, ocean beach, under wrack, (2, CBU); **Richmond Co.:** Framboise, Morrison, 15.VI.1997, D.B. McCorquodale, beach, (3, CBU); **Halifax Co.:** Point Pleasant Park, 23.VII.2002, C.G. Majka, under decaying seaweed on sand beach, (3, CGMC).

Aleochara litoralis was reported from New Brunswick, Newfoundland, and Nova Scotia by Klimaszewski (1984). Additional records are given above. Its distribution in the region of Atlantic Canada is shown in Fig. 12. The adults and larvae are found in decaying seaweed and debris on ocean beaches (Klimaszewski 1984). *Aleochara* adults are predators of larvae and eggs of cyclorrhaphous Diptera and ectoparasitoids of the pupae as larvae (Klimaszewski 1984). The specific hosts of *A. litoralis* have not previously been documented, however, C.G. Majka has collected *Coelopa frigida* (Fabricius, 1805) (Diptera: Coelopidae), a common and widespread Holarctic fly, in Point Pleasant Park in association with *A. litoralis*. Adults, larvae, and pupae of this fly were very numerous in the decomposing seaweed and are presumably the prey species utilized by *A. litoralis*.

Oligota parva Kraatz, 1858

PRINCE EDWARD ISLAND: Kings Co.: Launching, 26.VIII.2003, C.G. Majka, ocean beach: under coastline drift at the top of the littoral zone, (4, CGMC).



Figs 1-4. Dorsal habitus: Fig. 1, *Acrotona avia*; Fig. 2, *Oligota parva*; Fig. 3, *Strigota ambigua*; Fig. 4, *Myrmecopora vaga*.

Oligota parva (Fig. 2) is newly recorded in Canada (Fig. 12). It has been previously recorded from California, Massachusetts, Missouri, and Texas (Moore and Legner 1975). It has been introduced to the western Palearctic and northern Africa and is now widespread there (Horion 1967; Smetana 2004). It is found in compost, on dung, in fermenting materials, in old hay and grass, and in other decomposing situations (Horion 1967). The ecology of *Oligota* species are not well known, however, at least some species prey on mites (Frank et al. 1992). While *O. parva* has not previously been reported as a beach drift species, all the specimens collected on Prince Edward Island were found in this habitat. One European species, *Oligota pusillima* Gravenhorst, 1806 has been recorded in decaying seaweed (Fowler 1888; Moore and Legner 1975).

Other characteristic beach drift species collected together with *O. parva* at Launching (PEI), include *Atheta acadiensis*, *Strigota ambigua* (see below) [Staphylinidae], *Hypocaccus fraternus* (Say, 1825) [Histeridae], *Monotoma producta* LeConte, 1855 [Monotomidae], and *Blapstinus metallicus* (Fabricius, 1801) [Tenebrionidae].

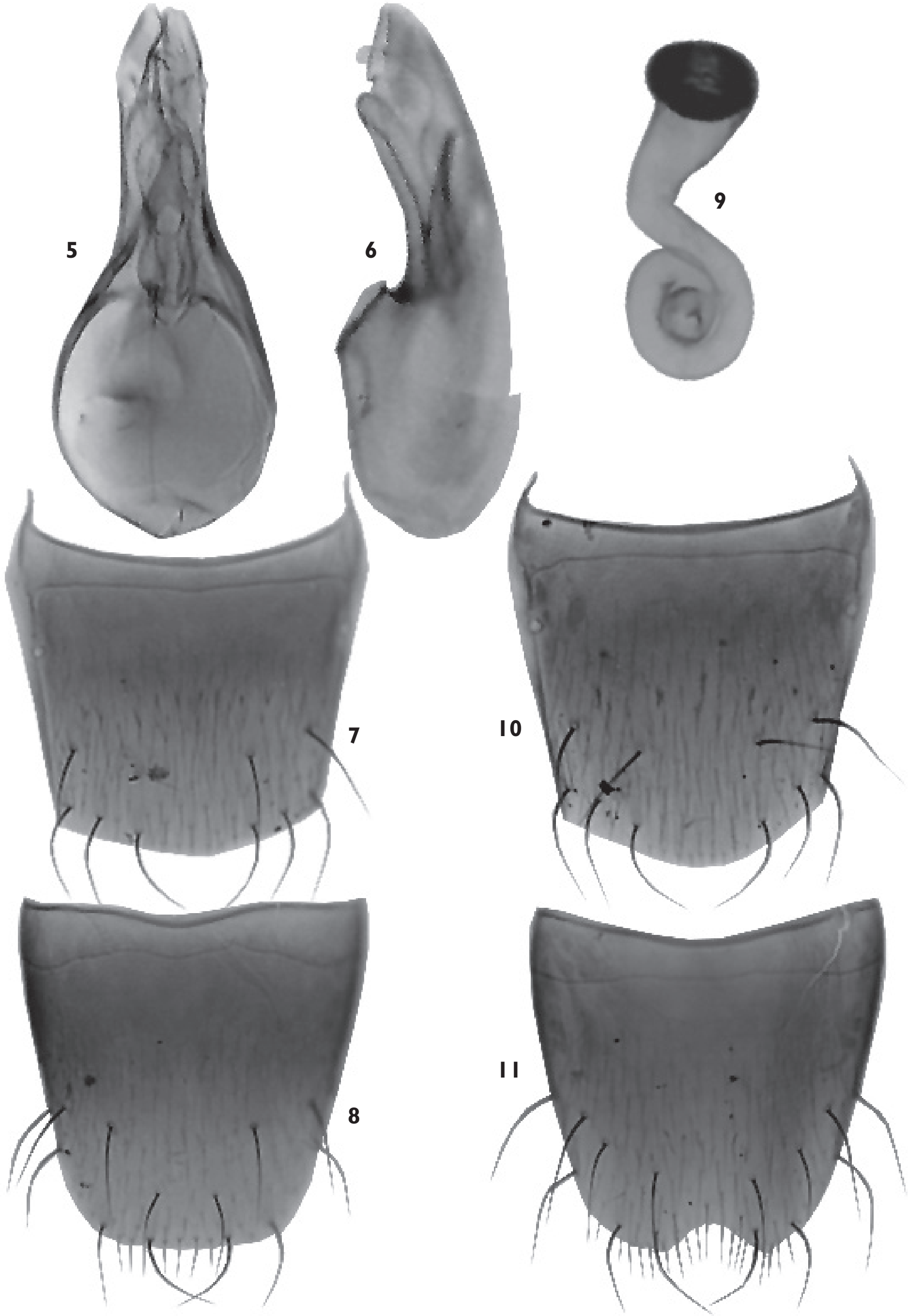
Acrotona avia (Casey, 1910)

NOVA SCOTIA: Antigonish Co.: Pomquet Beach, IV.1996, R.F. Lauff, sand dunes, leaf litter, (1 female; 1 male, NSMC).

Acrotona avia (Fig. 1) is newly recorded in Canada (Fig. 12). *Acrotona avia* was described by Casey (1910) on the basis of specimens collected in Rhode Island. The bionomics of the species are unknown, however, it appears that *A. avia* could be associated with sandy, seacoast environments. Pomquet Beach (45°39’27”N, 61°49’18”W) is a coastal barrier beach that lies between Pomquet Harbour and St. Georges Bay on the Gulf of St. Lawrence in Nova Scotia. The specimens from that locale were collected in a coastal sand dune environment adjacent to a “slack” (a temporary water body lying between two dune crests). Saunderstown (Rhode Island) is located near the mouth of Narragansett Bay where it opens up onto Long Island Sound. The Casey family farm (41°30’44”N, 71°25’23”W), where T.L. Casey lived and carried out collecting (Sikes 2004), is located 0.35 km from the seacoast, immediately adjacent to a barrier beach and coastal lagoon environment very similar to the Pomquet Beach site in Nova Scotia. Although there is no specific information that Casey collected the type specimens from precisely this site, it appears probable that *A. avia* is associated with such coastal environments. *Cercyon litoralis* (Gyllenhal, 1808) [Hydrophilidae] and *Stenus erythropus* Melsheimer, 1844 [Staphylinidae] were collected together with *A. avia* at Pomquet Beach.

Until this present report from Nova Scotia the species has not otherwise been reported from outside Rhode Island. It is likely that it is not as restricted in distribution as these limited records would appear to indicate, but rather as Sikes (2004: 10) pointed out, “…even in well-studied, temperate regions, a great deal of basic taxonomic work remains to be done”.

Gusarov (2001-2003) listed this name as a junior synonym of *Acrotona subpygmaea* Bernhauer, 1909. However, we have specimens at hand from New Brunswick (see Kli-



Figs 5-11. Genital structures of *Acrotona avia*: 5-8 male: Fig. 5, median lobe of aedeagus in dorsal view, and Fig. 6 in lateral view; Fig. 7, tergite VIII, and Fig. 8 sternite VIII; figures 9-11 female: Fig. 9, spermatheca; Fig. 10, tergite VIII; Fig. 11, sternite VIII.

maszewski et al. 2005: 14, 15, 34) examined by him and identified as *A. subpygmaea* Bernhauer, which clearly belong to a different species. For this reason we provisionally retain *A. avia* as a distinct species until proper revisionary studies are finalized. We confirm however, that *A. puritana* (Casey, 1910) [originally *Colpodota*] is a junior synonym of *A. avia* (Casey). We were able to examine four syntypes of *A. avia* from Rhode Island, Boston Neck, housed in the Casey collection in Washington (USNM). We designate here the female bearing the following labels as the lectotype: "R.I., a*via* -3 , paralectotype USNM, 38993, Casey bequest 1925", and Gusarov's unpublished paralectotype label: "paralectotypus, *Colpodota avia* Casey, female, V.I. Gusarov des. 2000" (USNM) [genital structures well preserved]. The remaining three specimens then become paralectotypes: R.I., Casey bequest 1925, *avia*-2, paratype USNM 38993, paralectotypus, *Colpodota avia* Casey, male, V.I. Gusarov des. 2000 (USNM) male [aedeagus missing in the attached vial]; R.I. same labels as the lectotype except, *avia*-1, Type USNM 387993, Gusarov's unpublished lectotype designation label 2000 (USNM) 1 female; and R.I., *avia*-4 (USNM) 1 female. We have designated a female specimen as a lectotype because the female of this species may be easily distinguished by having the apical margin of sternite eight deeply emarginate (Fig. 11) and by the shape of the spermatheca (Fig. 9), and because the male genital structures were missing in the only male specimen in the type series. To avoid potential confusion in identification of this species in the future we pro-

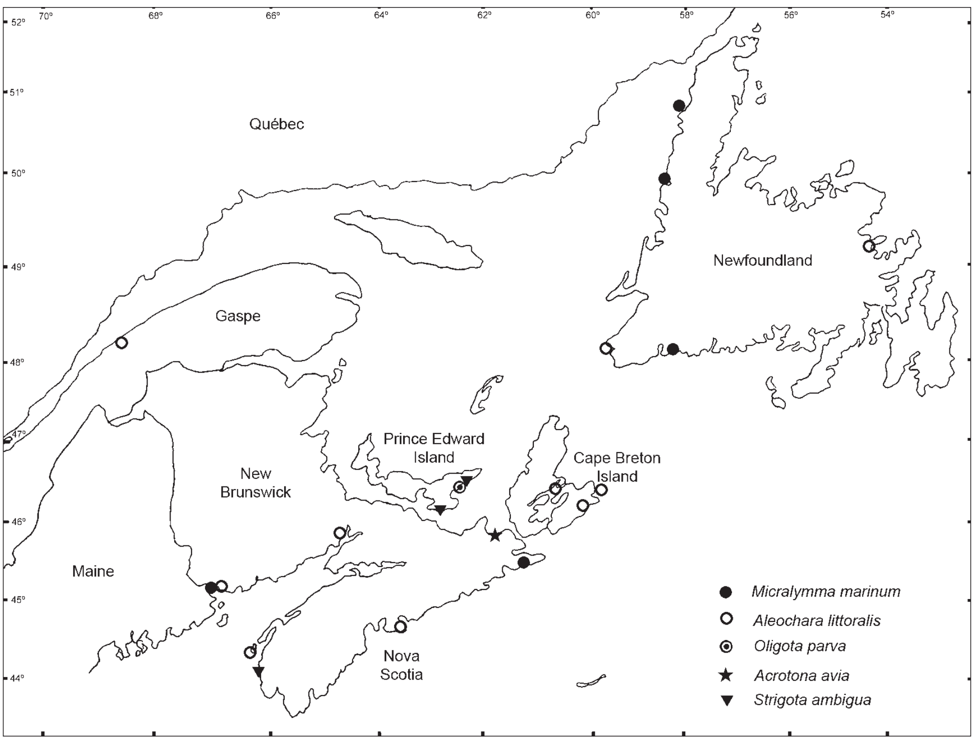


Fig. 12. The distribution of *Micralymma marinum, Aleochara litoralis, Oligota parva, Acrotona avia,* and *Strigota ambigua* in Atlantic Canada.

vide for the first time the images of the body and the genital structures (Figs. 1, 5-11). The body and the genital structures of *A. subpygmaea* (Bernhauer) are published in Figs. 25, 116-119 in Klimaszewski et al. (2005), based on V.I. Gusarov's identification.

Mocyta fungi (Gravenhorst, 1806)

NOVA SCOTIA: Digby Co.: Brier Island, Pond Cove, 10.VIII.2004, J. Ogden and K. Godwin, rocky shore, pitfall trap, (1, JOC); Brier Island, Pond Cove, 15.IX.2004, J. Ogden and K. Godwin, sand dunes, pitfall trap, (1, JOC); **Pictou Co.:** Caribou, 23.VII.2005, C.G. Majka, wet seepage on seashore, (1, CGMC). **PRINCE EDWARD ISLAND: Queens Co.:** Trout River, 28.VI.2003, C.G. Majka, on dung at edge of brackish marsh, (1, CGMC).

Gusarov (2001-2003) reported this species from New Brunswick and Majka and Klimaszewski (2008) reported it from Nova Scotia and Prince Edward Island. Its distribution in the Maritime Provinces is shown in Majka and Klimaszewski (2008). Most of the specimens collected in Atlantic Canada are from agricultural fields, however, there are some records (above) from coastal habitats. Hammond (2000) includes it as a generalist species found in the upper levels of salt marshes in Great Britain.

Strigota ambigua (Erichson, 1839)

NOVA SCOTIA: Digby Co.: Beaver River, 16-23.VII.1993, J. Cook, sand dunes, pitfall trap, (5, JCC). **PRINCE EDWARD ISLAND: Kings Co.:** Launching, 26.VIII.2003, C.G. Majka, coastal barrier beach: beneath coastline drift at the top of the littoral zone, (4, CGMC).

Strigota ambigua (Fig 3.) is newly recorded in Canada (Fig. 12). It is widespread in the United States across a band from Connecticut, New York and New Jersey, south to North Carolina, west through Iowa, Missouri, Kansas, and Texas, to Colorado, New Mexico, Nevada, and California on the Pacific coast (Gusarov 2003). Almost nothing is known of the bionomics of this species. Gusarov (2001-2003) recorded it from along riverbanks and in flood refuse. All the specimens found in the Maritime Provinces have been in sand dune and beach-drift environments. At Beaver River, NS other characteristic coastline species collected with *S. ambigua* include *Hypocaccus fraternus, Stenus erythropus, Aegialia opifex* Horn, 1887, and *Blapstinus metallicus*. For co-occurring coastline species found at Launching (PEI) see the preceding account on *Oligota parva*.

Atheta novaescotiae Klimaszewski and Majka, 2006

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.VIII.2004, C.G. Majka, ocean beach: beneath coastline drift, (3, CGMC).

Atheta novaescotiae was described by Klimaszewski et al. (2006). Its distribution in Nova Scotia, Newfoundland, and the French territory of Saint-Pierre et Miquelon is shown in Klimaszewski et al. (2006). It is herein newly recorded in New Brunswick. It is found only in beach-drift environments at the upper end of the littoral zone on both sandy and rocky oceanic beaches in Atlantic Canada. For further information on co-occurring Coleoptera see Klimaszewski et al. (2006).

Atheta acadiensis Klimaszewski and Majka, 2007

Atheta acadiensis was described by Klimaszewski and Majka (2007) from beach-drift environments on oceanic beaches. Its distribution in New Brunswick, Nova Scotia, Québec, and Prince Edward Island is shown in Klimaszewski and Majka (2007). Majka *et al.* (in press) recorded it from under wrack on sea beaches on Scatarie Island, Nova Scotia. Specimens are found in the narrow and well-defined ecological zone within beach-drift material at the top of the littoral zone. For further information on co-occurring Coleoptera see Klimaszewski and Majka (2007).

Atheta vestita (Gravenhorst, 1806)

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.VIII.2004, C.G. Majka, sandy shore, beach drift, (7, CGMC); Shepody National Wildlife Area, 31.V.2004, R.P. Webster, sea beach, beach drift material, (3, RWC). **NOVA SCOTIA: Cape Breton Co.:** Sydney, South Bar, 20.VI.1996, D.B. McCorquodale, (1, CBU); **Digby Co.:** Brier Island, Pond Cove, 22.VI.2003, J. Ogden and K. Goodwin, rocky shore, pitfall trap, (1, JOC).

Atheta vestita is a Palearctic species newly recorded in North America from New Brunswick by Klimaszewski et al. (2006) in beach drift material. Its distribution in North America is shown in Fig. 13. In Scandinavia, the Baltic region, Great Britain, Greenland, Iceland, and the Faroe Islands this macropterous species is found almost exclusively on sandy and gravelly seashores where it occurs beneath decaying seaweed on the strand line (Lindroth 1931; Larsson and Gígja 1959; Böcher 1988), however, in the Faroe Islands it has also been reported from grassland and waste land environments close to the seashore (Bengtson 1981). Given the maritime biology of this species, and the distribution of this species around the margins of the North Atlantic, further investigations should be conducted in Atlantic Canada and New England to determine the extent of its distribution and to examine whether it might be a naturally-occurring Holarctic species.

Falagria dissecta Erichson, 1839

Hoebeke (1985) recorded this species from New Brunswick and Nova Scotia. Davies (1979) found it in seaweed beach wrack in St. Andrews, New Brunswick. Howden (1970) and Wright (1989) recorded it from pond-edge debris on Sable Island, NS, and Hoebeke (1985) noted that it occurs in beach debris. Its distribution in Atlantic Canada is shown in Fig. 13. Hoebeke (1985) erroneously plotted the Sable Island (160 km off the Atlantic coast of Nova Scotia) records as being from Cape Sable Island (in southwestern Nova Scotia). It is a species found in many decompositional situations (Hoebeke 1985) that only occurs sporadically in coastline environments.

Myrmecopora vaga (LeConte, 1866)

NOVA SCOTIA: Halifax Co.: Point Pleasant Park, 23.VI.2002, C.G. Majka, small beach, in flotsam, (1 female, CGMC).

Myrmecopora vaga (Fig. 4) is newly recorded in Canada (Fig. 13). The specimen was collected on a small sandy beach along the Northwest Arm in Point Pleasant Park. Several individuals were observed in the vicinity of beach-drift detritus accumulated at the top of the strand line. They were, however, quick to take flight and agile on the wing, and only one specimen was captured. Other characteristic co-inhabiting coastline species of beetles collected together with *M. vaga* at this site were *Cercyon litoralis*, *Dermestes undulatus* Brahm, 1790 [Dermestidae], and *Blapstinus metallicus*.

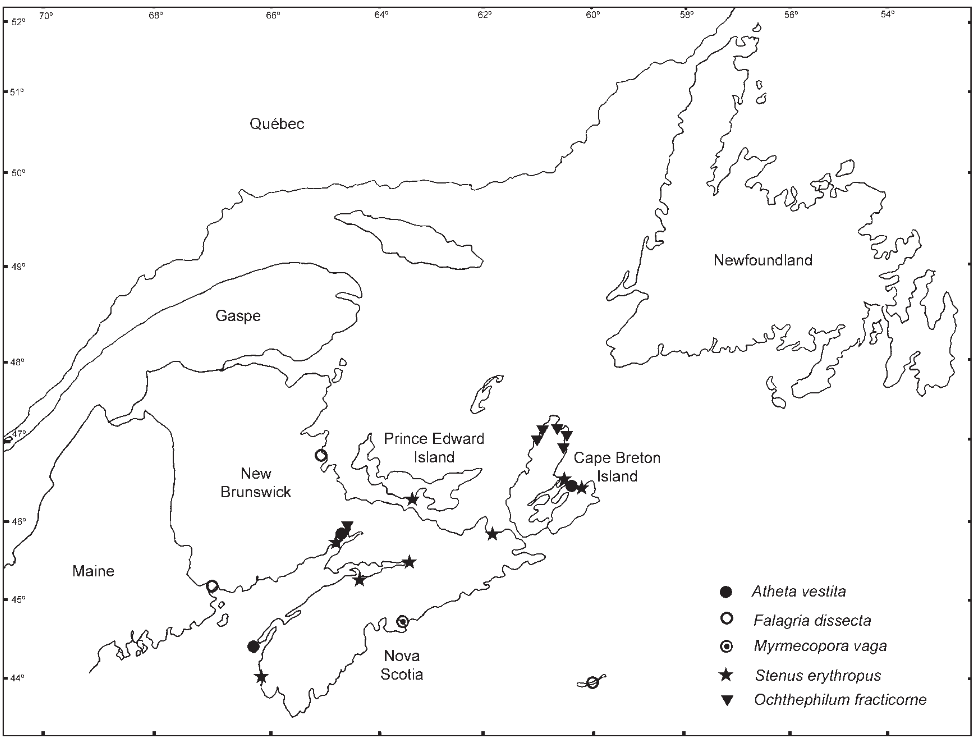


Fig. 13. The distribution of *Atheta vestita, Falagria dissecta, Myrmecopora vaga, Stenus erythropus,* and *Ochthephilum fracticorne* in Atlantic Canada.

Myrmecopora vaga was described by LeConte (1866) from the "Lake Superior" region of the United States where it was found in the riparian areas of lakes and streams (Newton et al. 2000). The present record is the first subsequent record, and the first one from eastern North America. While the species was found in riparian areas in the interior of the continent, it was discovered on the coastline in Nova Scotia. This may be a typical habitat for this little-known species given that many Western Palaearctic species of *Myrmecopora* are known to inhabit coastline, beach-drift, and shingle-beach environments where they are typically found beneath seaweed and other debris accumulated on the strand line (Assing 1997a, 1997b). These include *M. fugax* (Erichson, 1839), *M. laesa* (Erichson, 1839), *M. uvida* (Erichson, 1840), *M. boehmi* Bernhauer, 1910, *M. oweni* Assing, 1997, *M. sulcata* (Kiesenwetter, 1850), *M. simillima* (Wollaston, 1864), *M. maritima* (Wollaston, 1864), *M. minima* Bernhauer, 1900, *M. anatolica* (Fagel, 1969), *M. bernahueri* Koch, 1936, and *M. brevipes* Butler, 1909 (all the species in the subgenera *Iliusa*, *Paraxenusa*, and *Xenusa*); and in the eastern portion of the Palaearctic region, *M. rufescens* (Sharp, 1874), *M. algarum* (Sharp, 1874), *M. reticulata* (Assing, 1997), and *M. chinensis* Cameron, 1944 (all the species in the subgenus *Lamproxenusa*). Consequently this species should be sought more extensively in both riparian and seacoast situations in North America in order to better determine its distribution on the continent.

Oxytelinae

Bledius basalis LeConte, 1877

NEW BRUNSWICK: Queens Co.: Jemseg, 8.VI.2003, R.P. Webster, silver-maple forest, moist bare clay, (1, RWC). **NOVA SCOTIA: Annapolis Co.:** Melveryn Square, 24.VI.1992, E. Georgeson, light trap, (9, NSNR); **Halifax Co.:** Petpeswick, 23.VI.1971, B. Wright, (2, NSMC).

Bledius basalis is newly recorded in New Brunswick. Its distribution in Atlantic Canada is shown in Fig. 14. Herman (1976) indicated that the species was found in coastal habitats from Texas north to Rhode Island. Howden (1970) recorded the species from Sable Island (Nova Scotia), the only previously known Canadian location. The above specimens collected from Petpeswick and Melveryn Square establish the occurrence of this species on the mainland of Nova Scotia.

All the sites where this species has been recorded in the United States are coastal and most are slightly moist, slightly vegetated sand flats adjacent to the ocean (Herman 1976). This is true of Petpeswick, a sandy inlet on the Atlantic coast of Nova Scotia. Melveryn Square, however, lies in the Annapolis Valley of Nova Scotia, although it is only 9 km from "Sand Banks", a sandy coastal beach on the Bay of Fundy, and *B. basalis* is macropterous and a capable flier. Jemseg (New Brunswick) is 70 km inland from the Bay of Fundy, however, it is located on the shores of Grand Lake, which at 174 km^2, is the largest freshwater body in Atlantic Canada. This would appear to indicate that *B. basalis*, while occurring predominantly in coastal localities, can also be found in appropriate inland sites away from the ocean.

Bledius mandibularis Erichson, 1840

NOVA SCOTIA: Lunenburg Co.: Backmans Beach, 28.VII.1971, B. Wright, (1, NSMC).

Bledius mandibularis is newly recorded in Nova Scotia and Atlantic Canada. Its distribution in Atlantic Canada is shown in Fig. 14. In North America there are two populations; a coastal one occurring from southern Texas to Massachusetts, and an inland one found in the central regions of the United States, north to southern Manitoba (Herman 1972). The coastal population is found on bare, moist ground in saline habitats, generally on the leeward side of islands or peninsulas and behind beach dunes (Herman 1972). Backmans Beach is a small island at the tip of the Second Peninsula in Lunenburg County which is linked to the mainland via a barrier beach. It has six variously sized barrier beach-coastal lagoon areas with associated marshlands and sand flats.

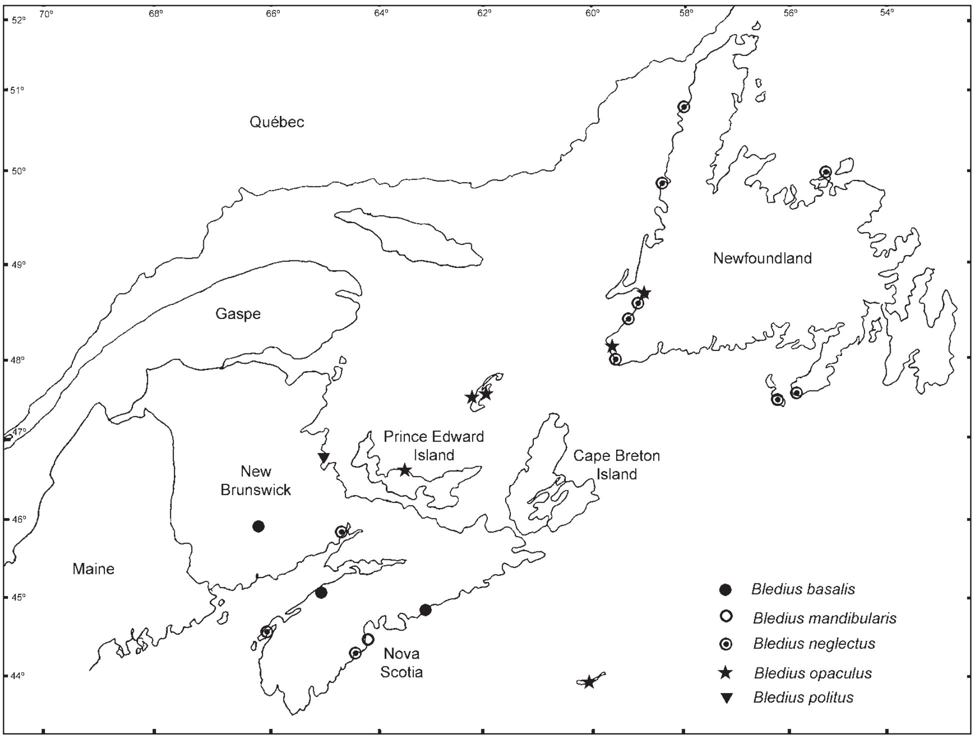


Fig. 14. The distribution of *Bledius basalis, Bledius mandibularis, Bledius neglectus, Bledius opaculus,* and *Bledius politus* in Atlantic Canada.

Bledius neglectus Casey, 1889

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.VIII.2004, C.G. Majka, coastal barrier beach: coastline drift, (4, CGMC). **NOVA SCOTIA: Digby Co.:** Sandy Cove, 4.VIII.1971, B. Wright, (1, NSMC).

Herman (1976) recorded this species from Newfoundland, Nova Scotia (the Atlantic coast), and the French territory of Saint-Pierre et Miquelon. Its distribution in Atlantic Canada is shown in Fig. 14. Campbell and Davies's (1991) checklist included the species from New Brunswick without, however, providing any records. The above records establish its presence in New Brunswick and indicate that the species occurs on both the Nova Scotia and New Brunswick shores of Bay of Fundy. It is found on moist, un-vegetated sand flats on the leeward sides of islands and peninsulas, as well as in the intertidal zone. It has been collected in the region in association with the predaceous carabids *Dyschirius sphaericollis* Say and *Dyschirius pallipennis* Say (Herman 1976).

Bledius opaculus LeConte, 1877

NOVA SCOTIA: Halifax Co.: Sable Island, 22.VII.1976, 13.VI.1977, 14.VI.1977, wet sand at the edges of ponds, B. Wright, (6, NSMC). **PRINCE EDWARD ISLAND: Queens Co.:** Cavendish Beach, 22.VII.1967, H.F. Howden, (1, CNC). **QUÉBEC:** Iles de la Madeleine, 7-9.VII.1992, F. Shaeffer and P. Laporte, 322 specimens, Majka and Shaffer (in press).

Herman (1976) recorded this species from Newfoundland, Nova Scotia (Sable Island), and Prince Edward Island (Fig. 14). In Nova Scotia the species has only been recorded from Sable Island (Howden 1970, Wright 1989). More recently Majka and Shaffer (in press) recorded large numbers in the diet of Piping Plovers in the Iles de la Madeleine, Québec, newly recording the species from that province.

Herman (1976) found the species on moist, un-vegetated sand flats on the leeward side of an island and on algae covered moist sand flats. On Sable Island specimens have been found associated with dead gulls, in large swarming groups along the shores of Wallace Lake, and on wet sand at the edge of small ponds (Wright 1989). In the Iles de la Madeleine they are found on moist sand flats in the lee of large barrier beaches (Majka and Shaffer in press). The species' distribution in Atlantic Canada is shown in Fig. 14.

Bledius politus Erichson, 1840

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 2.VII.1977, J.R. Vockeroth, (1, CNC).

Bledius politus was recorded from New Brunswick by Campbell and Davies (1991) on the basis of the record above (shown in Fig. 14). It is associated with coastal areas, as well as inland swamps and lakes, and is found in slightly moist, heavily vegetated sand (Herman 1976).

Steninae

Stenus (Stenus) erythropus Melsheimer, 1844

NEW BRUNSWICK: Albert Co.: Mary's Point, 12.V.2007, C.G. Majka, coastline, (1, CGMC). **NOVA SCOTIA:** Pomquet Beach, IV.1996, R.F. Lauff, sand dunes, leaf litter, (2 female; 1 male, STFX). **Digby Co.:** Beaver River, 16-23.VII.1993, J. Cook, coastline, pitfall trap, (1, JCC). **PRINCE EDWARD ISLAND: Queens Co.:** Meadowbank, 27.V.1981, E.L. Drake, (1, UPEI).

Stenus erythropus is newly recorded on Prince Edward Island. Its distribution in Atlantic Canada is shown in Fig. 13. It was previously recorded from New Brunswick and Nova Scotia (Campbell and Davies 1991). *Stenus erythropus* is not a species hitherto noted from coastal habitats, and indeed there are a number of specimen records in the Maritime Provinces from inland, non-marine situations (unpublished data). Like many species in this genus they are frequently encountered near streams or in other aquatic situations (Newton et al. 2000). As the above records indicate, in the Maritime Provinces they are occasionally found in coastal marshy and/or sand dune environments.

Paederinae

Ochthephilum fracticorne (Paykull, 1800)

NEW BRUNSWICK: Albert Co.: Mary's Point, 23.VIII.2003, C.G. Majka, coastal dunes; under flotsam, (1, CGMC). **NOVA SCOTIA: Victoria Co.:** South Harbour, 16.VI.1983, Y. Bousquet, sand beach, (1, CNC); Ingonish North Bay, 29.VI.1983, L. LeSage, salt marsh, pile of decaying vegetation, (1, CNC).

Majka and Klimaszewski (2008) reported this species from New Brunswick. Its distribution in Atlantic Canada is shown in Fig. 13. *Ochthephilum fracticorne* has not been noted in Europe as a coastal species but rather is regarded as a synanthropic one found in fields, parks, litter, decomposing hay, and compost (Drugmand 1989). D.S. Chandler (pers. comm.) has recorded it coastal habitats in New Hampshire and the above records from New Brunswick and Nova Scotia indicate that it is at least an occasional inhabitant of such environments (Fig. 13). *Ochthephilum jacquelini* (Boieldieu, 1859), however, is a halobiont found exclusively in salt marshes in Great Britain (Hammond 2000). There is some uncertainty about the zoogeographic status of *O. fracticorne*. Campbell and Davies (1991) listed it as a Holarctic species but Drugmand (1989) treated it as a Palearctic species.

Staphylininae

Gyrohypnus angustatus Stephens, 1832

This species was recorded from New Brunswick, Newfoundland, and Nova Scotia by Smetana (1982). Davies (1979) found this introduced Palearctic species in seaweed beach wrack in St. Andrews, New Brunswick. Its distribution in Atlantic Canada is shown in Fig. 15. Smetana (1982) noted rotting seaweed as one of the habitats where the species has been found in North America and Lindroth (1957) found it at every one of the southern English coastal sites that he surveyed where dry ballast destined for North America originated. This not only indicates habitat preferences, but also a possible mechanism for the introduction of this species to North America.

Xantholinus linearis (Olivier, 1795)

NEW BRUNSWICK: Albert Co.: Mary's Point, 9.VIII.2002, seashore, under beach-drift, (1, CGMC). **NOVA SCOTIA: Inverness Co.:** Inverness Beach, 17.VIII.1994,

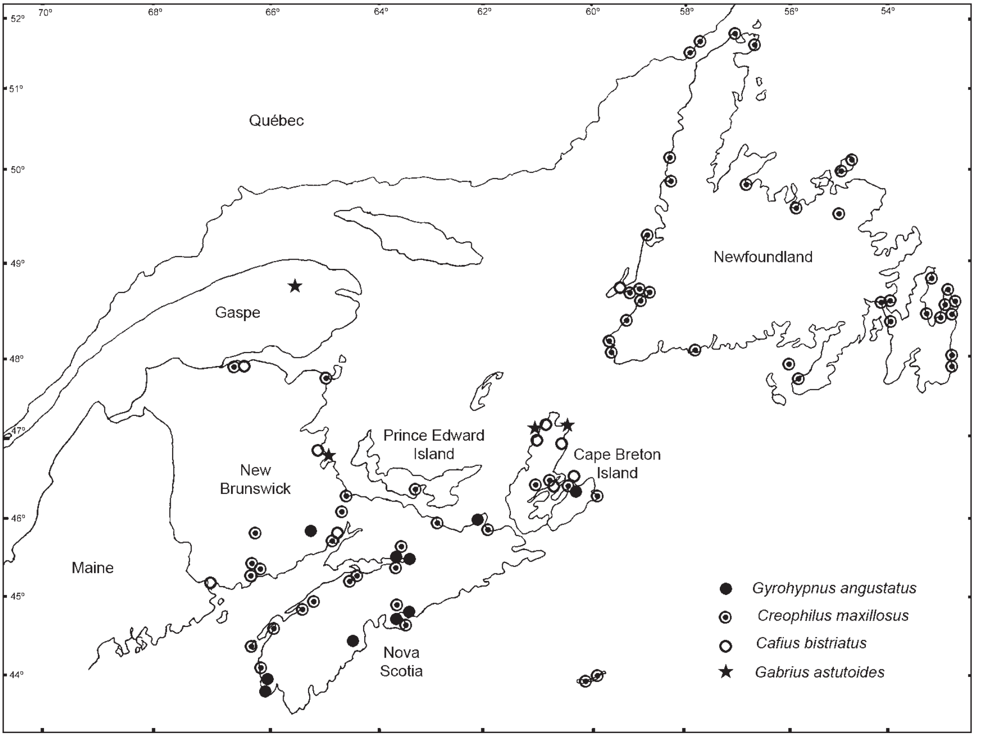


Fig. 15. The distribution of *Gyrohypnus angustatus, Creophilus maxillosus villosus, Cafius bistriatus,* and *Gabrius astutoides* in Atlantic Canada.
Note: Two sites from central Labrador (Goose Bay and Cartwright) are not shown on the map.

J. M. Francis and V. Jessome, (1, CBU); **Kings Co.:** Lyons Cove, 30.VII.2006, D.H. Webster, in weathered wrack, (1, DHWC). **Shelburne Co.:** Lydgate, 6.VII.1968, P.S. Doleman, (1, NSMC); Lockeport, 1.IX.1968, P.S. Doleman, (1, NSMC). **PRINCE EDWARD ISLAND: Queens Co.:** Trout River, 28.VI.2003, C.G. Majka, on dung at edge of brackish marsh, (1, CGMC).

Xantholinus linearis is an abundant and widely distributed species in the Maritime Provinces (Majka and Klimaszewski 2008). Its distribution in the Maritime Provinces is shown in Majka and Klimaszewski (2008). There are many records from both synanthropic and natural inland habitats, however, the above records indicate that it is occasionally found in coastal environments in the region. Hammond (2000) includes it as a generalist species regularly reported from saline and intertidal situations in Great Britain.

Creophilus maxillosus villosus (Gravenhorst, 1802)

NEW BRUNSWICK: Albert Co.: Mary's Point, 7.VI.2006, D.S. Christie, on dead Minke Whale, (2, CGMC). **NOVA SCOTIA: Antigonish Co.:** Pomquet Beach, 29.VIII.2000, H.J. Watts, coastal beach, (1, STFX); Pomquet Beach, 6.V.2004, M.A. Rossong, coastal beach, (1, STFX); Pomquet Beach, 16.V.2001, B.F. Leahey, coastal beach, (1, STFX); **Cape Breton Co.:** Scatarie Island, Savage Cove, 10.VIII.2005, K.R. Aikens, sea beach under wrack, (1, CBU); South Bar, 3.VIII.1995, A. Brown, (1, CBU); **Digby Co.:** Brier Island, Pond Cove, 28.VII.2003, 15.IX.2004, J. Ogden & K. Goodwin, rocky shore, pitfall trap, (3, JOC); Mavilette Beach, 20.VII.1993, J. & T. Cook, beach dune, under driftwood, (1, JCC); **Halifax Co.:** Sable Island, 20.VI.1976, 9.VI.1977, 10.VI.1977, 12.VI.1977, 12.IX.1977, B. Wright, (17, NSMC); **Shelburne Co.:** Cape Sable Island, Daniel's Head Beach, 18.VIII.2007, R. Gorham, on seal carcass, (1, NSMC).

This cosmopolitan species has been known in the Maritime Provinces since 1827-28 from collections made in Nova Scotia by Captain Basil Hall (Kirby 1837) and Prévost and Bain (2007) found it in deposits dated 1620 in Newfoundland. Its distribution in the Maritime Provinces is shown in Fig. 15. As the above records indicate, it is frequently encountered in coastal situations (where adults and larvae feed on maggots found on various kinds of carrion and decaying matter), however, it also occurs in many kinds of natural habitats and in synanthropic situations (Newton et al. 2000). Newton et al. (2000) pointed out that the North American specimens of the subspecies *C. maxillosus villosus*, are distinguishable from the Palaearctic *C. m. maxillosus*. *Creophilus m. villosus* has a broad pre-human North American distribution, and hence can be considered a native, Nearctic subspecies.

Tasgius (Tasgius) ater (Gravenhorst, 1802)

NEW BRUNSWICK: Albert Co.: Mary's Point, 9.VIII.2002, C.G. Majka, barrier beach, under rock, (1, CGMC); **Gloucester Co.:** Saint Simon, 21.VIII.1983, P. Mallet, (1, UMNB). **NOVA SCOTIA: Antigonish Co.:** Pomquet Beach, 2.IX.1996, R.F. Lauff, (1, STFX); **Halifax Co.:** West Dover, 7.IX.2003, C.G. Majka, seashore, coastal barrens, (1, CGMC); Sable Island, 5.VIII.1969, F.W. Scott, (3, NSMC); Sable Island, 9.IX.1977, 10.IX.1977, B. Wright, under boards, (2, NSMC); **Lunenburg Co.:** Petite Rivière, 3.IX.1954, D.C. Ferguson, (1, NSMC); **Queens Co.:** White Point Beach, 5.VIII.1953, J.H. McDunnough, (1, NSMC); **Shelburne Co.:** Bon Portage Island, 31.VII.1997, R.F. Lauff, (1, STFX); **Yarmouth Co.:** Port Maitland, 9.VIII.1988, J. Cook, beach, (1, JCC). **PRINCE EDWARD ISLAND: Queens Co.:** Cavendish, 14.VII.2002, C.G. Majka, coastal lagoon, under rock, (1, CGMC); North Rustico, 13.VII.2001, C.G. Majka, seashore, under rock, (1, CGMC).

Majka and Klimaszewski (2008) newly recorded *Tasgius ater* in New Brunswick and on Prince Edward Island. Its distribution in the Maritime Provinces is shown in Majka and Klimaszewski (2008). It is also recorded from Newfoundland (Campbell and Davies 1991). As the above records indicate, this introduced species is often found beneath wood and stones at coastal sites, although it is also found in inland locations. It is a widely distributed Palearctic species known in North America since at least 1802 (Majka and Klimaszewski 2008).

Cafius bistriatus (Erichson, 1840)

NEW BRUNSWICK: Albert Co.: Mary's Point, 23.VIII.2003, C.G. Majka, coastal dunes, under flotsam, (1, CGMC); **Charlotte Co.:** Pottery Beach, Passamaquoddy Bay, 29.VII.1976, M.J. Dadswell, (2, CNC); **Kent Co.:** Kouchibouguac National Park, 1.VI.1977, S.J. Miller (1, CNC); Kouchibouguac National Park, 13.IX.1977, J.M. Campbell, (1, CNC); Restigouche Co.: River Charlo, 24.VII.1972, J.M. Campbell. (1, CNC). **NOVA SCOTIA: Cape Breton Co.:** Point Aconi, 13.VII.1972, J.M. and B.A. Campbell, (1, CNC); Big Bras d'Or, 25.VII.1972, J.M. Campbell, (1, CNC); **Inverness Co.:** Cape Breton Highlands National Park: Presqu'île, 13.IX.1984, sifting beach wrack, (40, CNC); 2.5 km SE of Cap Rouge, 14.XI.1984, A. Smetana, (8, CNC); Pleasant Bay, 27.V.1984, L. Masner, sea-beach kelp, (2, CNC); Pleasant Bay, 29.VII.1983, D.E. & J.E. Bright, seashore kelp, (2, CNC); **Victoria Co.:** Big Bras d'Or, 25.VII.1972, J.M. Campbell, (1, CNC); North Bay Ingonish, Cape Breton Highlands National Park, 29.VI.1983, L. LeSage, seashore wrack, (1, CNC).

Cafius bistriatus was recorded in the Maritime Provinces by Frank et al. (1986) and Campbell et al. (1987) and from Newfoundland by Smetana (1965). Its distribution in Atlantic Canada is shown in Fig. 15. It is common in wrack and other debris on marine beaches (Newton et al. 2000). James et al. (1971) reported that *Cafius* species lay their eggs deep in sand where their larvae prey on amphipods, flies of the genus *Fucellia*, and small barnacles. Two abundant amphipods associated with Coleoptera in beach drift environments in the Maritime Provinces are *Talorchestia longicornis* (Say, 1818) in the upper littoral and splash zone, and *Orchestia gammarella* Pallas, 1766 in beach drift slightly lower down on the coastline (Klimaszewski and Majka 2006). *Tal-*

orchestia megalophthalma (Bate, 1862), *O. platensis* Kroyer, 1845, and *O. grillus* (Bosc, 1802) are also present in the region (Gosner 1971).

Gabrius astutoides (A. Strand, 1946)

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 30.V.1977, S.J. Miller, (1, CNC); Kouchibouguac National Park, 16.IX.1977, J.M. Campbell & A. Smetana, (2, CNC). **NOVA SCOTIA: Inverness Co.:** Pleasant Bay, 28.V.1984, H. Goulet, (1, CNC); **Victoria Co.:** White Point, 23.VI.1983, Y. Bousquet, (1, CNC).

Gabrius astutoides was recorded from New Brunswick and Nova Scotia by Smetana (1995). Its distribution in Atlantic Canada is shown in Fig. 15. Although habitat information was not recorded for these specimens, they were all collected at coastal sites (Fig. 15). Hammond (2000) recorded this species in Britain as commonest in coastal habitats.

Philonthus carbonarius (Gravenhorst, 1802)

NOVA SCOTIA: Digby Co.: Brier Island, Pond Cove, 8.VII.2003, J. Ogden and K. Goodwin, sand dunes, (1, JOC); **Halifax Co.:** Sable Island, B. Wright, (2, NSMC); Cow Bay, 21.V.1953, 29.IX.1954, 23.VIII.1955, C.J.S. Fox, (4, ACNS); **Shelburne Co.:** Bon Portage Island, 28.VIII.2002, D.B. McCorquodale, (1, CBU); **Yarmouth Co.:** Chebogue, 1.VIII.1952, 4.VI.1953, 2.V.1954, 24.IX.1954, C.J.S. Fox, (6, ACNS).

Philonthus carbonarius is widely distributed throughout Atlantic Canada (Smetana 1995, Majka and Klimaszewski 2008). Its distribution in North America is shown in Smetana (1995). This introduced Palearctic species was first recorded in Newfoundland in 1905 and Nova Scotia in 1909 (Smetana 1995). It is a common species occurring in a wide variety of synanthropic habitats, but also on sea beaches under decaying seaweed (Smetana 1995) as is evident from the records cited above.

Philonthus cognatus Stephens, 1832

NOVA SCOTIA: Colchester Co.: Five Islands Park, 10.VI.1988, E. Georgeson, UV light trap, (1, NSNR); **Halifax Co.:** Sable Island, 22.IV.1976, 23.VII.1976, B. Wright, under dead grass, boards, & debris, (2, NSMC). **PRINCE EDWARD ISLAND: Queens Co.:** Cavendish, 14.VII.2002, C.G. Majka, coastal lagoon, under rock, (1, CGMC); **Prince Co.:** Belmont Park, 9.VII.1988, Y. Bousquet, (1, CNC).

Philonthus cognatus is an introduced Palearctic species, widely distributed in both eastern and western North America (there are few records from the central portions of the continent). Its distribution in North America is shown in Smetana (1995). Smetana (1995) records it from a wide range of habitats. Hammond (2000) includes it as a generalist species found in the upper levels of salt marshes in Great Britain. It is a common species in Atlantic Canada and there are some records from coastal environments (Wright 1989), however, it is primarily found in synanthropic inland situations.

Philonthus couleensis Hatch, 1957

NOVA SCOTIA: Halifax Co.: Sable Island, 5-12.VII.1967, H. Howden, (1, CNC); **Victoria Co.:** Dingwall, 20.IX.1984, J.M. Campbell and A. Davies, (1, CNC).

Smetana (1995: 331) wrote, "*Philonthus couleensis* is a pronouncedly hygrophilous species, occurring in a wide variety of wet habitats … even in marshy habitats along sea beaches". There are scattered records in New Brunswick, Newfoundland, and Nova Scotia (Smetana 1995) including a few from coastal habitats. Its distribution in North America is shown in Smetana (1995).

Philonthus furvus Nordman, 1837

NEW BRUNSWICK: Charlotte Co.: St. Andrews, 17.VIII.1955, J.R. Vockeroth, (1, CNC). **NOVA SCOTIA: Digby Co.:** Brier Island, Pond Cove, 28.VII.2003, 15.IX.2004, J. Ogden & K. Goodwin, beach drift on rocky cobble shore, pitfall trap, (4, JOC).

Smetana (1995: 96) wrote, "*Philonthus furvus* is a distinctly hygrophilous species, occurring in all kinds of wet habitats, such as edges of lakes and ponds, marshes and swamps, banks of rivers and creeks, wet forests, seepages, etc." Davies (1979) found this species was apparently well-adapted to, and dependant on, beach-wrack environments in St. Andrews, New Brunswick. The above records from Brier Island (NS) are from a similar environment. Its distribution in North America is shown in Smetana (1995).

Philonthus politus (Linnaeus, 1758)

NOVA SCOTIA: Cape Breton Co.: Scatarie Island, Northwest Cove, 8.VIII.2005, A. MacDonald, under wrack on beach, (1, CBU); Scatarie Island, Northwest Cove, 11.VIII.2005, K.R. Aikens and A. MacDonald, under wrack on beach, (1, CBU); **Digby Co.:** Brier Island, Pond Cove, 15.IX.2005, J. Ogden and K. Goodwin, rocky shore, pitfall trap, (1, JOC); **Halifax Co.:** Sable Island, 10.VI.1977, 15.VI.1977, B. Wright, (4, NSMC).

Philonthus politus is found in all kinds of decaying organic matter (Smetana 1995). It is not particularly associated with coastal habitats. There are scattered records in New Brunswick, Newfoundland, and Nova Scotia (Smetana 1995) including a few (above) from coastal habitats. Its distribution in North America is shown in Smetana (1995).

Philonthus umbratilis (Gravenhorst, 1802)

NOVA SCOTIA: Victoria Co.: Ingonish Beach, 27.IX.1974, A. Davies, (1, CNC).

Smetana (1995) observed that this species is found in a wide range of habitats. Davies (1979) found this species was frequent in coastal beach-wrack habitats, but also found in other environments, in St. Andrews, New Brunswick. It has not been noted as a coastal species in Great Britain (Hammond 2000). Its distribution in North America is shown in Smetana (1995).

Philonthus varians (Paykull, 1789)

PRINCE EDWARD ISLAND: Prince Co.: Belmont Park, 9.VII.1988, Y. Bousquet, (1, CNC).

Davies (1979) found this introduced Palearctic species in seaweed beach wrack in St. Andrews, New Brunswick. According to Smetana (1995: 240) "*Philonthus varians* occurs in all kinds of decaying organic matter … specimens were also collected under rotting seaweeds on sea beaches …". It is abundant in many portions of the Atlantic Provinces (Smetana 1995; unpublished data). Its distribution in North America is shown in Smetana (1995). It was first recorded in the region in New Brunswick in 1900-1907 (Majka and Klimaszewski 2008). Hammond (2000) includes it as a generalist species regularly reported from saline and intertidal situations in Great Britain.

Discussion

Thirty-three species of coastline inhabiting Staphylinidae have now been recorded in Atlantic Canada. These include 26 species recorded in New Brunswick, 15 in Newfoundland, 31 in Nova Scotia, and 13 on Prince Edward Island (Table 1). *Oligota parva, Acrotona avia, Strigota ambigua,* and *Myrmecopora vaga,* are newly recorded in Canada and *Bledius mandibularis* is newly recorded from Atlantic Canada. Ten new provincial records are reported, one from New Brunswick, six from Nova Scotia, and three from Prince Edward Island. They include representatives of eight subfamilies and 21 genera.

Excluded species

Delimiting the composition of coastal staphylinid communities is much more complicated than might first appear to be the case (see below). The biology of many staphylinids is poorly or incompletely known making it difficult to ascertain to what degree they may be members of coastal beetle communities. Many species of rove beetles are attracted to decomposing plant or animal material, and some coastal environments have large quantities of such materials. Others, associated with flood debris, or hygrophilous

Table 1. Coastal Staphylinidae in Atlantic Canada

	NB	NS	PE	NL	Category	Habitat Type	Micro-habitat	Regional Distribution in northeastern North America
Omaliinae								
Micralymma marinum (Ström) *	1	1		1	O	RS	RS	MA, ME, NH, QC
Pselaphinae								
Brachygluta abdominalis Aubé	1	1			O	SM	LL	CT, MA, ME, NH, NY
Tachyporinae								
Sepedophilus marshami (Stephens) †	1	1			I	SE	TD	QC
Aleocharinae								
Aleochara litoralis (Mäklin)	1	1		1	O	SS	TD	MA, NY, ON, RI
Oligota parva Kraatz			1		T	SS	TD	
Acrotona avia (Casey)		1			O?	SS	DS	RI
Mocyta fungi (Gravenhorst) †	1	1	1	1	I	SE	TD	MA, ME, NY, ON, QC, RI
Strigota ambigua (Erichson)		1	1		F	SS	TD	CT, NY
Atheta novaescotiae Klimaszewski & Majka	1	1		1	O	SS	TD	PM
Atheta acadiensis Klimaszewski & Majka	1	1	1		O	SS	TD	QC
Atheta vestita (Gravenhorst) †?	1	1			O	SE	TD	
Falagria dissecta Erichson	1	1			T	SE	TD	CT, MA, ME, NH, NY, ON, QC, RI, VT
Myrmecopora vaga (LeConte)		1			O	SS	TD	
Oxytelinae								
Bledius basalis LeConte	1	1			F	M	B	NY, RI
Bledius mandibularis Erichson		1			F	M	B	CT, MA, NY, RI
Bledius neglectus Casey	1	1		1	O	M	B	MA, ME, NY, PM, RI
Bledius opaculus LeConte		1	1	1	O	M	B	MA
Bledius politus Erichson	1				F	SM	B	NY
Steninae								
Stenus erythropus Melsheimer	1	1	1		I	SE	DS	MA, ON, QC

	NB	NS	PE	NL	Category	Habitat Type	Micro-habitat	Regional Distribution in northeastern North America
Paederinae								
Ochthephilum fracticorne (Paykull) †?	1	1			I	SS	TD	MA, ME, NH, ON, QC
Staphylininae								
Gyrohypnus angustatus Stephens †		1			T	SE	TD	NH, NY
Xantholinus linearis (Olivier) †	1	1	1		I	SE	TD	MA, NH, NY, RI
Creophilus maxillosus villosus (Gravenhorst)	1	1	1	1	F	SE	TD	CT, MA, ME, NH, ON, QC, RI, VT
Tasgius ater (Gravenhorst) †	1	1	1	1	F	SE	O	CT, MA, ME, NH, NY, ON, QC, RI
Cafius bistriatus (Erichson)	1	1		1	O	SS	TD	MA, NY
Gabrius astutoides (A. Strand) †	1	1			F	SE	?	NH, ON, QC
Philonthus carbonarius (Gravenhorst) †	1	1	1	1	T	SS	TD	MA, NH, ON, QC
Philonthus cognatus Stephens †	1	1	1	1	I	SM	TD	CT, MA, ME, NH, NY, ON, QC, RI
Philonthus couleensis Hatch	1	1		1	T	SE	?	MA, NY, ON, QC
Philonthus furvus Nordman	1	1		1	T	SE	TD	ON, QC
Philonthus politus (Linnaeus) †	1	1		1	I	SE	TD	CT, MA, ME, NH, NY, ON, QC, RI, VT
Philonthus umbratilis (Gravenhorst) †	1	1	1		I	SE	TD	MA, ME, NH, NY, ON, QC
Philonthus varians (Paykull) †	1	1	1	1	I	SS	TD	CT, MA, ME, NH, NY, ON, QC, VT
Total	26	31	13	15				

Notes: O, Obligate (Halobiont); F, Facultative (Halophile); T, Tolerant (Haloxene); I, Incidental. NB, New Brunswick; NS, Nova Scotia; PE, Prince Edward Island; NL, Newfoundland and Labrador. *, Holarctic species; †, adventive Palearctic species.

Habitat: M, mud/sand flats; RS, Rocky Shore; SE, Seashore; SM, Salt Marsh, SS, Sandy Shore. Microhabitat: B, Burrows in sand/mud; DS, Dune Slacks; LL, Leaf Litter; O, Other; RS, Rock Surfaces; TD, Tidal Debris.

For the purposes of this treatment, northeastern North America is considered to include (in addition to Atlantic Canadian provinces of NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; PE, Prince Edward Island) of the following jurisdictions: Connecticut (CT), Massachusetts (MA), Maine (ME), New Hampshire (NH), New York (NY), Ontario (ON), Québec (QC), Saint-Pierre et Miquelon (PM), Rhode Island (RI), and Vermont (VT). Only jurisdictions in northeastern North America in addition to the Atlantic Canadian Provinces are listed.

species found in marshes, are not infrequently found in coastal environments, particularly where these grade into inland habitats. Where inland habitats abut directly onto coastal environments, characteristic forest, marsh, bog or species associated with other environments can spill into coastal habitats. Davies (1979) recorded species such as *Anotylus rugosus* (Fabricius, 1775), *Erichsonius nanus* (Horn, 1884), *Gabrius picipennis* (Mäklin, 1852), *Ontholestes cingulatus* (Gravenhorst, 1802), *Tachinus fumipennis* (Say, 1832), and *Tachinus luridus* Erichson, 1840 from seaweed beach wrack in St. Andrews, New Brunswick. Majka and Klimaszewski (2008) reported *Leptacinus intermedius* Donisthorpe, 1936 from beach debris on Prince Edward Island. In the present study specimens of *Phyllodrepa humerosa* (Fauvel, 1878), *Proteinus pseudothomasi* Klimaszewski, 2005, *Tachyporus dispar* (Paykull, 1789), *Tachyporus inornatus* Campbell, 1979, *Tachyporus mexicanus* Sharp, 1883, *Oxytelus laqueatus* (Marsham, 1802), *Lithocharis thoracica* (Casey, 1905), *Paederus littorarius* Gravenhorst, 1806, *Neohypnus hamatus* (Say, 1834), and *Philonthus lomatus* Erichson, 1840 collected in coastal habitats were examined. All these rove beetles are associated with decompositional situations in a variety of inland habitats. They are not species that have been noted in the literature in association with coastal habitats, although, under appropriate circumstances they will evidently venture into such environments.

In Great Britain, Hammond (2000) drew attention to species such as *Amischa analis* (Gravenhorst, 1802), *Atheta longicornis* (Gravenhorst, 1802), *Quedius curtipennis* Bernhauer, 1908, *Quedius molochinus* (Gravenhorst, 1806), and *Bisnius cephalotes* (Gravenhorst, 1802) as incidental species found in salt-marshes and other intertidal habitats. Similarly Moore and Legner (1976) reported *Drusilla canaliculata* (Fabricius, 1787) from under decaying seaweed in Great Britain, Newton et al. (2000) reported *Tasgius melanarius* (Heer, 1839) from under debris near water, including in marine situations, and Smetana (1995) reported *Philonthus concinnus* (Gravenhorst, 1802) from a variety of habitats including under seaweed on sea beaches. All these Palearctic species are found in Atlantic Canada (Majka and Klimaszewski 2008), however, none of them have been recorded in such habitats in the Atlantic Provinces. They are all species generally associated with soil and litter environments and/or decaying material, and therefore only peripheral members of coastal environments. In this preliminary treatment of the coastal rove beetles of Atlantic Canada they have therefore not been included in the coastal fauna, although it is clear that further research is required to fully delineate the faunal composition of coastline environments.

Adaptations to the marine environment

Staphylinids found in coastal environments can be categorized in four functional groups (adapted from Koch 1989-1993 and Hammond 2000):

A) Halobionts: Obligate inhabitants of coastline environments, i.e., species that are largely or completely restricted to such habitats;

B) Halophiles: Facultative inhabitants of coastline environments, i.e., those that regularly occur in coastline habitats but can also be found in non-marine situations;
C) Haloxenes (or halotolerants): species that principally occur in other inland environments, but are also found in coastline habitats and are (in varying degrees) tolerant of conditions in such habitats;
D) Incidentals: species that exhibit no specific coastal associations, but are attracted to decomposing situations or marshy or otherwise wet environments, and which are thus regularly found in coastal environments where such conditions exist.

The delineation between these categories is not without some uncertainty since, as previously mentioned, the bionomics of some species are incompletely known. Based on published information and data from specimens collected in the region a provisional categorization indicates that 11 species found in Atlantic Canada can be categorized as halobionts, seven as halophiles, six as haloxenes, and nine as incidental species.

As previously mentioned, there is no simple delineation between coastal and non-coastal species, given the fact that terrestrial ecosystems grade into marine ecosystems along a continuum (indeed, coastline environments are by definition an ecotone) and contain microhabitats that attract and support terrestrial species. In delimiting the fauna, however, studies such as these by Topp and Ring (1988a,b) are of considerable value. In examining the ecology and physiology of Pacific-coast marine Staphylinidae found on sandy and rocky shorelines, they were able to demonstrate a suite of specific morphological, behavioral, and physiological adaptations to immersion by seawater and desiccation that allowed the marine species to survive in such environments. These include sheltering in burrows or crevices which hold air pockets during inundation (*Bledius* spp., *Liparocephalus cordicollis, Diulota densissima*); taking flight when inundated by seawater (*Bledius monstratus*), holding a bubble of air around the thorax and abdomen with a plastron on fine hairs on the body surface (*B. monstratus*) which acts as a "physical gill" to supply air to the spiracles; floating on the surface film of water when inundated (*Thinopinus pictus*); becoming catatonic in conditions of anoxia, thus slowing physiological processes allowing for longer survival in conditions of immersion (*Cafius canescens, Cafius seminitens, Hadrotes crassus*); and utilizing dissolved oxygen through cutaneous respiration through membraneous portions of the exoskeleton (*L. cordicollis*). Such morphological, behavioral, and physiological adaptations contrast with those of terrestrial species and are reflected in the LT_{50} (median lethal time) values for seawater immersion of such species. At 10°C, LT_{50} values were 12-16 hours for *C. canescens*, 12 hours for *T. pictus*, and 18 hours for *B. monstratus* while rocky-shore species such as *D. densissima* had LT_{50} values of 26 ± 4 days and *L. cordicollis* 25.5 ± 9.5 days. This is in contrast to species such as *T. ater*, which had an LT_{50} value of 2 hours (Topp and Ring 1988a, 1988b). Such research indicates that detailed morphological, behavioral, and physiological studies of coastline inhabiting beetles could be used to distinguish between obligate, facultative, tolerant, and incidental species.

Coastal environments and their staphylinid faunas

Coastal environments are themselves diverse and include a number of discrete habitats and zones. In the Maritime Provinces they include: i) rocky shores, ii) boulder/cobble shores, iii) sandy shores, iv) mud flats, v) tidal marshes, and vi) sand dune systems (Davis and Browne 1996). Some of these environments (such as rocky, boulder, and sandy shores) are further stratified into i) splash zone, ii) upper littoral, iii) mid-littoral, and iv) lower littoral zones; mudflats and tidal marshes sometimes grade into successional sequences and differentiate into high and low salt-marsh areas; and sand dunes are differentiated into i) colonizing zone, ii) yellow dune, and iii) grey dune areas (Davis and Browne 1996). Further variation is created by the intersection of these coastal habitats and the presence of microhabitats (such as brackish-water "slacks" between dune crests). Consequently coastal environments represent a diverse constellation of habitats and microhabitats that can provide for a large number of ecological niches that can be utilized by coastal beetles.

This diversity is reflected in the coastal staphylinid fauna found in Atlantic Canada. *Micralymma marinum* is a true marine species found in the littoral zone on rocky coastlines. Species of *Bledius* inhabit sandy mudflat environments. Large rove beetles such as *C. m. villosus* and *Tasgius* spp. tend to shelter under stones or driftwood in the splash zone or upper littoral areas from where they venture into strand-line areas. *Philonthus* spp. and many aleocharines are primarily found associated with decaying seaweed and other organic materials deposited by tidal action at the upper end of the littoral zone. *Brachygluta abdominalis* is found in leaf litter in salt marsh and sand dune areas, and *Stenus erythropus* inhabits wet, marshy habitats.

An admittedly first-order summary of the habitat types and microhabitats within each of these, that are favoured by the coastal staphylinids found in Atlantic Canada, is presented in Table 1. These categories are derived from those employed by Hammond (2000) in his analysis of the British coastal fauna. In the case of some species such as *M. marinum, B. abdominalis, A. litoralis, A. novascaotiae, A. acadiensis, A. vestita, Bledius* spp., *C. maxillosus, T. ater,* and *C. bistriatus,* there has been sufficient research conducted that at least some elements of the bionomics of these species are comparatively well known. In the case of others such as *O. parva, A. avia, S. ambigua, M. vaga,* and *S. erythropus*, very little is known of the biology of the species so the information in Table 1 is of necessity based on limited data. Nonetheless the compilation is instructive since it illustrates that the coastal staphylinids appear to fall into five ecological groups:

1) rocky shore species (*M. marinus*)
2) salt marsh, leaf-litter species (*B. abdominalis*)
3) species found around dune slacks (*A. avia, S. erythropus*)
4) sand/mud-flat inhabitants (*Bledius* spp.)
5) tidal debris (beach-drift) species (other species)

Amongst the tidal debris species, some appear to favour sandy shores or salt marshes, while others (the "SE" seashore category) are found on sandy, rocky, or cobble shores wherever beach-drift accumulates.

From a trophic perspective, *Bledius* spp. are nocturnal feeders and harvest green algae such as *Oocystis solitaria* Wittr., *Oocystis parva* West., *Anchistrodesmus falcatus* Ralfs, and *Conferva minor* Klebs), blue-green algae such as *Oscilitoria amphibia* Ag. and *Anabaena* sp., and diatoms (species undetermined) from the mud or sand surface, storing them in chambers excavated in the mud where the females lay eggs and rear young (Lengerken 1929; Herman 1986). Other species of coastline staphylinids are (insofar as is known) primarily predaceous, however, the size of the species and the habitats they occupy mean that they utilize a variety of prey species. Most coastal staphylinids feed on amphipods, larvae of seaweed flies such as *Fucellia* sp., or enchytraeid worms such as *Lumbricillius* sp. and *Enchytraeus* (Moore and Legner 1976; Top and Ring 1988a, 1988b). Large Staphylininae such as *C. maxillosus, Tasgius* spp., and *Philonthus* spp. are generalist predators (Smetana 1995; Newton et al. 2000) that in beach drift habitats probably feed on Diptera larvae as well as on other invertebrates. *Aleochara litoralis* is also a predator of larvae and eggs of cyclorrhaphous Diptera (Klimaszewski 1984). *Cafius bistriatus* is predaceous on amphipods, fly larvae, and small barnacles (James et al. 1971). *Micralymma marinum* and species of *Stenus*, such as *S. erythropus,* prey on Collembola and other micro-arthropods (Thayer 1985; Böcher 1988; Newton et al. 2000). *Brachygluta abdominalis* and *Oligota* species are predators of mites (Acari) (Frank et al. 1992; Hammond 2000). While the bionomics of other species of coastline aleocharines are incompletely known, most are believed to be microfauna predators.

Adventive species

The substantial proportion of adventive Palearctic species represented in this ecological group is noteworthy. As many as 13 species (the zoogeographic status of *O. fracticorne* and *A. vestita* are still subject to some questions), or 39% of the coastal species, are adventive species. These are principally the members of the Staphylininae, indeed of the 13 species in this subfamily, only *C. bistriatus, P. couleensis,* and *P. furvus* are native North American species.

Brown (1940, 1950) and Lindroth (1957) both proposed that many species of adventive plants and invertebrates were introduced to Atlantic Canada in dry ballast that was shipped to the region during the Napoleonic wars and subsequently when Great Britain was importing large quantities of timber from the region. Empty ships traveling westward across the Atlantic were ballasted with sand, rocks, rubble, soil, etc., originating from coastal quarries. This dry ballast was subsequently off-loaded on land in Atlantic Canadian ports, and with it a plethora of species that were found in such coastal sites. Of the 13 adventive coastal staphylinids found in Atlantic Canada, eight (*M. fungi, A. vestita, G. angustatus, T. ater, G. astutoides, P. carbonarius, P. cognatus,* and *P. varians*) were found by Lindroth (1957) in quarries in south-western England where dry-ballast destined for Atlantic Canada originated, a suggestive indication that these species may have been introduced to the region via this mechanism. Indeed, all 13 adventive species of staphylinids are found in Great Britain.

Conservation concerns

Coastline beetles inhabit an environment that has been much diminished and is vulnerable to disturbance. Of the estimated 35,700 hectares of coastal marshes present in the Bay of Fundy at the time of European colonization, only 5,000-6,000 (~ 16%) are still extant. Fifty-seven percent of large and medium-sized rivers that flow into the Bay of Fundy have dams, causeways, and other forms of tidal restrictions and coastal wetlands have experienced various other forms of environmental degradation (Percy 1996, 1999). Rantwell (1972) emphasized that coastal sand dunes are a diminishing resource throughout Europe and North America saying, "Not only is their generation limited by what is believed to be a diminishing bank of offshore sand supplies, but their rate of destruction under development of various kinds ... almost certainly (exceeds) their rate of formation". Tyrrell (2005) pointed out that on some beaches, large quantities of seaweed and other detritus are removed from the wrack line to "clean up" beaches for recreation or tourism. Orth et al. (1978) and Frank et al. (1986) have both noted the negative effects of such "beach cleaning" on seashore insect assemblages. All these observations draw attention to the potential vulnerability of such coastal habitats and communities of beetles that inhabit them.

With the discovery of *Oligota parva, Acrotona avia, Strigota ambigua, Myrmecopora vaga,* and *Bledius mandibularis* in Nova Scotia (four of which are newly recorded in Canada) it is apparent that there is much more to learne with respect to the Staphylinidae that inhabit coastline environments in Atlantic Canada.

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Adventive Staphylinidae (Coleoptera) of the Maritime Provinces of Canada: further contributions

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Abstract

Seven species of adventive Palaearctic staphylinids, *Ilyobates bennetti* Donisthorpe, *Meotica exilis* (Knoch), *Meotica "pallens"* (Redtenbacher), *Anotylus insecatus* (Gravenhorst), *Anotylus tetracarinatus* Block, *Oxytelus sculptus* Gravenhorst, and *Lathrobium fulvipenne* (Gravenhorst) are newly recorded in the Maritime Provinces of Canada. One of these, *M. exilis*, a cosmopolitan species, is newly recorded in Canada and represents the first verifiable report of this species from North America. The history of *M. exilis* in North America is examined indicating that previous reports were the result of misidentification or of specimens of uncertain identity that can no longer be located. The confused nomenclature of this species is also discussed. The confused taxonomy of *Meotica "pallens"* is discussed with regard to the identity of the species reported under this name in North America. *Atheta dadopora* Thomson is newly recorded in Prince Edward Island. Records are provided that establish the presence of *L. fulvipenne* in North America in five Canadian provinces. Observations on *A. insecatus* in the field have established that they are predators of dipteran larvae. New early dates of detection are reported for *Quedius curtipennis* Bernhauer, *Tasgius ater* (Gravenhorst), *Philonthus cognatus* Stephens, and *Philonthus rectangulus* Sharp. As a consequence, 87 species of adventive Staphylinidae are now known to occur in the Maritime Provinces, 76 of which have been recorded in Nova Scotia, 61 in New Brunswick, and 29 on Prince Edward Island. The staphylinid fauna is briefly discussed in relation to its zoogeographic components and its regional composition.

Keywords

Coleoptera, Staphylinidae, *Ilyobates*, *Meotica*, *Anotylus*, *Oxytelus*, *Lathrobium*, introduced species, adventive species, new records

Introduction

Introduced insects have been a topic of interest and concern in Atlantic Canada (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland) for almost two centuries. In the first paper on Coleoptera of the region Kirby (1837) included five adventive species (*Philonthus politus, Attagenus pellio, Dermestes lardarius, Gastrophysa polygoni*, and *Tenebrio molitor*) amongst the 42 species reported from Nova Scotia. Throughout the nineteenth century authors such as Jones (1870), Harrington (1891), and Evans (1899) continued to record adventive beetles in Nova Scotia. The collections of Peter Stuwitz made in Newfoundland between 1839 and 1842 are still extant and include specimens of *Bembidion ustulatum, Agonum ruficorne, Agonum muelleri,* and *Harpalus affinis*, four adventive Palaearctic species amongst the 17 species of Carabidae collected by him (Lindroth 1955). Recent archeological studies in Ferryland on the Avalon Peninsula of in Newfoundland Prévost and Bain (2006) revealed the remains of eight Palaearctic beetles including *Quedius mesomelinus, Cercyon analis, Ptinus fur, Tipnus unicolor, Orzaephilus surinamensis, Mycaetaea subterranean, Latridius minutus,* and *Sitophilus granarius* in the excavations of a latrine used between 1621 and 1673. All these studies indicate that adventive beetles have long been components of the fauna of Atlantic Canada.

Brown (1950) and Lindroth (1957) developed the theory that many adventive species, particularly terricolous ones, had been introduced to the New World through the importation of dry ballast. Brown (1950) noted that large quantities of dry ballast (bulky rock, sand, and soil) were unloaded at ports in Atlantic Canada by British vessels that returned to Europe carrying timber. Regulations required that this dry ballast be offloaded onshore, and with it the animals and plants that had been excavated from quarries. Lindroth (1957) investigated this topic further, conducting surveys at eight principal sites in Great Britain known to have been sources of ballast in the trans-Atlantic shipping trade. Twenty species of staphylinids found at these sites are currently known as adventive species in Atlantic Canada.

Atlantic Canada is known as a region that has substantial numbers of adventive species. In a survey of the weevils (Curculionoidea) of the Maritime Provinces Majka et al. (2007a) identified 60 adventive species, 21% of the regional fauna. Majka (2007) found that 37 species of Bostrichiformia (Anobiidae, Bostrichidae, Dermestidae, and Derodontidae) were adventive, 50% of the regional fauna. In a survey of the ground beetles (Carabidae) of the region, Majka et al. (2007b) found that 34 species, 10.3% of the fauna, were adventive. All these studies indicate the importance of adventive beetles in the composition of the region's fauna. Adventive species represent a substantial portion of the known beetle fauna of New Brunswick, Nova Scotia, and Prince Edward Island: 12.3 %, 15.3%, and 21.7%, respectively (unpublished data).

Majka and Klimaszewski (2008) surveyed the adventive Staphylinidae of the Maritime Provinces of Canada (New Brunswick, Nova Scotia, and Prince Edward Island). They reported 79 species as occurring in the region, including 73 that have been found in Nova Scotia, 29 on Prince Edward Island, and 54 in New Brunswick. Since that paper was published, further records of adventive species have come to light and continuing studies have forced a revaluation of the zoogeographic status of some species. In this volume, Klimaszewski et al. (2008a) report two additional adventive species. The discoveries of new voucher specimens in collections have established new early timelines for a number of species. Consequently, in the present study we continue the investigation of this important group of adventive beetles in the Maritime Provinces.

Methods and conventions

Codens (following Evenhuis 2007) of collections referred to in this study are:

CBU	Cape Breton University, Sydney, Nova Scotia, Canada
CFNL	Canadian Forest Service, Corner Brook, Newfoundland and Labrador, Canada
CGMC	Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CLC	Claire Levesque Collection, Fleurimont, Québec, Canada
CNC	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
DHWC	David H. Webster collection, Kentville, Nova Scotia, Canada
FMNH	Field Museum of Natural History, Chicago, Illinois, USA
LFC	Laurentian Forestry Centre, Québec City, Québec, Canada
MUN	Memorial University of Newfoundland collection, St. John's, Newfoundland, Canada (currently on long term loan to the Canadian Forest Service, Edmonton, Alberta)
NBM	New Brunswick Museum, Saint John, New Brunswick, Canada
NSAC	Nova Scotia Agricultural College, Bible Hill, Nova Scotia, Canada
NSMC	Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR	Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC	Reginald Webster Collection, Charters Settlement, New Brunswick, Canada
UASM	Strickland Entomological Museum, University of Alberta, Edmonton, Alberta, Canada

The number of specimens is indicated in brackets. The systematics and taxonomy follow that of Newton et al. (2000); the systematics of the Aleocharinae follow Gouix and Klimaszewski (2007).

Results

Seven species of adventive staphylinids, *Ilyobates bennetti* Donisthorpe, *Meotica exilis* (Knoch), *Meotica "pallens"* (Redtenbacher), *Anotylus insecatus* (Gravenhorst), *Anotylus tetracarinatus* Block, *Oxytelus sculptus* Gravenhorst, and *Lathrobium fulvipenne*

(Gravenhorst) are newly recorded in the Maritime Provinces. *Meotica exilis*, newly recorded in Canada, represents the first verifiable report of this species in North America. Records are provided that establish the presence of *L. fulvipenne* in North America in five Canadian provinces. Observations on *A. insecatus* in the field establish that they are predators of dipteran larvae. *Atheta dadopora* Thomson is newly recorded in Prince Edward Island. New records of both *Leptacinus intermedius* Donisthorpe and *Neobisnius villosulus* (Stephens) are provided that establish the presence of these species in New Brunswick. New early dates of detection are reported for *Quedius curtipennis* Bernhauer, *Tasgius ater* (Gravenhorst), *Philonthus cognatus* Stephens, and *Philonthus rectangulus* Sharp. *Cilea silphoides* (Linnaeus) and *Philonthus jurgans* Tottenham, previously reported from the region, are added to the fauna of adventive species, whereas *Staphylinus ornaticauda* LeConte and *Creophilus maxillosus* (Linnaeus), native staphylinids previously listed as adventive in Majka and Klimaszewski (2008), and *Gnypeta caerulea* (C.R. Sahlberg), now considered a Holarctic species, are removed from the regional fauna of adventive species. As a consequence, 87 species of adventive Staphylinidae are now known to occur in the Maritime Provinces, 76 of which have been recorded in Nova Scotia, 61 in New Brunswick, and 29 on Prince Edward Island (Appendix 1). Specific details follow.

Cilea silphoides (Linnaeus, 1767)

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 25.VII.1978, I. Smith, (1, CNC).

Cilea silphoides is a European species long known in North America. It was first recorded on the continent by Gravenhorst (1802) under the name *Tachinus marginalis* and was later described by Randall (1838) under the name *Tachinus geminatus* from specimens collected in Brookline, Massachusetts. In Canada, Campbell (1975) recorded it from British Columbia, Alberta, Ontario, and Québec. It was reported from New Brunswick by Campbell and Davies (1991) on the basis of the record given above (Fig. 5). *Cilea silphoides* is widely distributed in Europe from France and England east to Bulgaria, the Ukraine, and eastern Russia and north to Fennoscandia (Alonso-Zarazaga 2007). It is also found throughout Africa, from Iran east throughout Southeast Asia and north to China, Korea, and Japan, and in the West Indies (Herman 2001). It is usually found in piles of rotting vegetable matter such as compost heaps, grass cuttings, rotting fruit, haystacks, piles of straw, and in dung and old mushrooms (Horion 1967).

Tachyporus nitidulus (Fabricius, 1781)

Tachyporus nitidulus has been considered an adventive species (i.e., Majka and Klimaszewski 2008). According to Campbell (1979), *T. nitidulus* may represent a species complex of two or more species. He suggested that one species or population (lighter in colour with a shorter elytra having less distinct microsculpture, non-functional wings, and submedian bristles on the fifth and sixth abdominal tergites) may represent an indigenous North American one, whereas another (darker in colour, with a longer elytra with distinct microsculpture, fully developed wings, and lacking submedian bristles on the fifth and sixth abdominal tergites) may represent an adventive Palaearctic one. The ranges of these two forms broadly overlap and there are also occasional specimens with mixed features. Volker Assing (pers. comm.), however, indicates that both forms are found in Europe. Thus, although the status of *T. nitidulus* requires further research, we retain it as a Palaearctic species.

Ilyobates bennetti Donisthorpe, 1914

NOVA SCOTIA: Colchester Co.: Bible Hill, 13-19.VI.2007, C.W. D'Orsay, pasture, pitfall trap, (3, CBU); Bible Hill, 3-9.VII.2007, C.W. D'Orsay, pasture, pitfall trap, (2, CBU); **Hants Co.:** Upper Rawdon, 26.VI.2008, J. Renkema, blueberry field, pitfall trap, (1, CGM).

Ilyobates bennetti is newly recorded for Nova Scotia and in the Maritime Provinces (Fig. 1). Figure 2 provides a dorsal habitus photograph. The only previous records of this species in North America are two specimens from Ste. Clothilde (1981) and

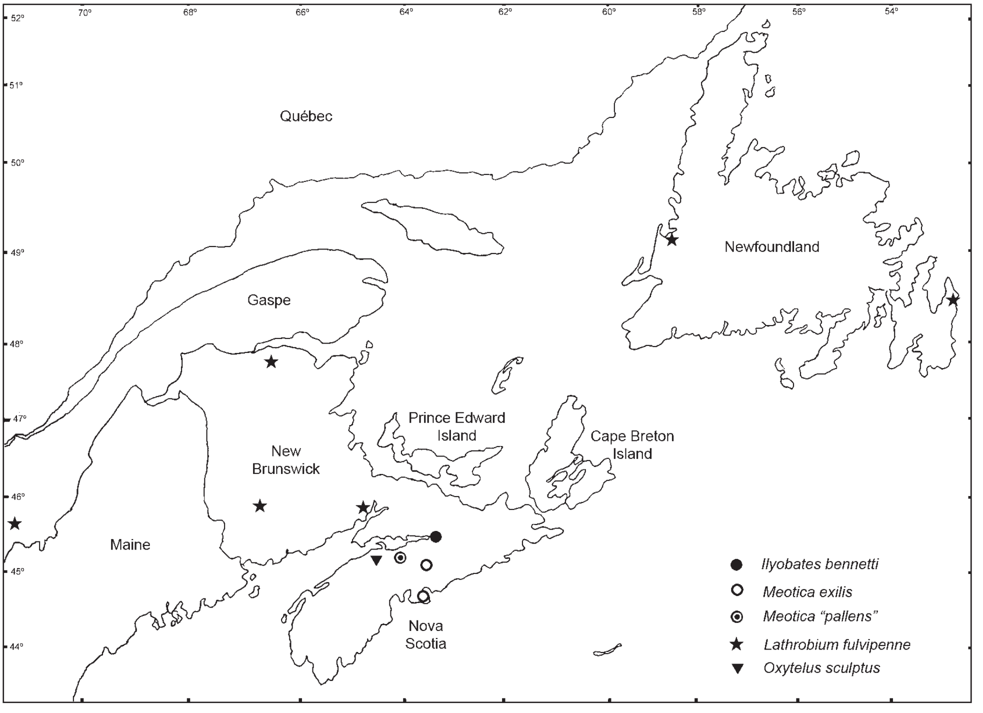

Fig. 1. Distribution of *Ilyobates bennetti, Meotica exilis, Meotica "pallens," Lathrobium fulvipenne,* and *Oxytelus sculptus* in eastern Canada.

Fig. 2. Dorsal habitus photograph of *Ilyobates bennetti* (from Gouix and Klimaszewski 2007).

Frelighsburg (1984) (Québec) (Assing (1999). It is very widely distributed in Europe and in the Caucasus. In Europe it occurs in a variety of open habitats, particularly synanthropic ones, such as urban meadows, lawns, fallow areas, gardens, strip mines, and in pioneer vegetation; it is also found in swamps, bogs, flood plains, riverbanks, meadows, grasslands, in leaf litter, moss, grass, compost, rotting debris, and under reeds and ferns (Assing 1999).

Meotica exilis (Knoch, 1806)

NOVA SCOTIA: Colchester Co.: Shubenacadie, 2.VI.2006, J. Ogden, flight-intercept trap, (1 female, NSNR) (1 male, LFC); **Halifax Co.:** Point Pleasant Park, 6.V.2003, C.G. Majka, coniferous forest, under bark of dead *Pinus strobus*, (1 female, CGMC) (1 male, LFC); **Hants Co.:** Frenchman's Cave, 2.VII.1998, M. Moseley, gypsum sinkhole, (1 male, CGMC).

These represent the first verifiable records of this species in North America (see below) (Fig. 1). The specimens collected in Point Pleasant Park were found in scolytine galleries under the bark of a dead white pine (*Pinus strobus* L., Pinaceae). Co-inhabiting Coleoptera included *Nudobius cephalus* (Say, 1834) (Staphylinidae); and *Polygraphus rufipennis* (Kirby, 1837) and *Pityophthorus cariniceps* LeConte, 1876 (Curculionidae: Scolytinae). The specimen at Frenchman's Cave was collected in a wet, mossy area in a gypsum sinkhole.

Muona (1991, 239) wrote, "Small aleocharine species are often regarded as difficult to identify. However, it is doubtful (whether) there exists a species with a more confused history (than) that of *Meotica exilis*." Prior reports of its presence in North America have proven to be no exception to this rule.

It appears to have first been reported in North America by Leng (1920) followed by Bernhauer and Scheerpeltz (1926). These specimens were examined by Seevers (1978: 79) who wrote, "The record of *Meotica exilis* Erichson (a European species) in Maine (E. Machias, and Wales) is *probably* (emphasis added) a valid one. I examined the specimens in the Bernhauer collection on which the record was based and found that they do belong to *Meotica*, and are *probably* (emphasis added) *exilis*. These specimens *probably* (emphasis added) represent an introduction." Muona (1984: 228) did not accept the validity of this record noting that, "*Meotica* is a difficult genus with many species and Seevers' (1978) statement is quite vague." Muona (1984) also pointed out that specimens identified as *Meotica exilis* by Fenyes from Pasadena, California (deposited in various European collections and at the FMNH), are in fact a species of the genus *Thecturota*, Casey. Despite this tenuous or erroneous evidence, *M. exilis* has continued to be included in the North America fauna in such recent compendiums as Ashe (2000).

The Bernhauer collection is now deposited in the Field Museum of Natural History (FMNH). Margaret Thayer kindly checked the collection and wrote (pers. comm.) that she was able to find one pin with the label: "E. Machias,/ Me.// June//[white circle]//**exilis Grvh./Fenyes**/det. Bernhauer//Chicago NHMus/M.Bernhauer/". The text in boldface is in Bernhauer's writing, apparently relaying Fenyes as the source of the specimen, the identification, or perhaps both. However, there is no longer any specimen on the pin; the card point has been cut off. There is also no specimen from "Wales, Maine" in the FMNH collection and the present disposition of this specimen is unknown.

Fig. 3. Dorsal habitus photograph of *Meotica exilis.* Scale = 1 mm.

Thus, all prior reports of this species in North America appear to have been based on misidentifications, or can no longer be verified because voucher specimens can no longer be located. Therefore, the present specimens from Nova Scotia constitute the first verifiable records of this species on the continent.

The authority of the specific name of *M. exilis* has also been in doubt. It has been referred to as *M. exilis* (Erichson, 1839: 333) (see Leng 1920; Bernhauer and Scheerpeltz 1926; Moore and Legner 1975); and *M. exilis* (Gravenhorst, 1806) (Seevers 1978; Smetana 2004a). Muona (1991), however, argued that the species should be called *M. exilis* (Knoch in Gravenhorst, 1806: 153). Although Gravenhorst cited many Knoch manuscript names without crediting Knoch (thus making Gravenhorst the author), the case of *M. exilis* is an exception to the rule because Gravenhorst explicitly credited Knoch with the description.

Meotica exilis is found throughout Europe and northern Asia. It occurs in many kinds of moist situations, preferring rich soils and frequenting shores with dense vegetation and is abundant in leaf-litter under *Salix* bushes and has been collected in *Sphagnum* bogs (Muona 1991). A dorsal habitus photograph is provided in Fig. 3. For illustrations of the genitalia see Klimaszewski et al. (2007).

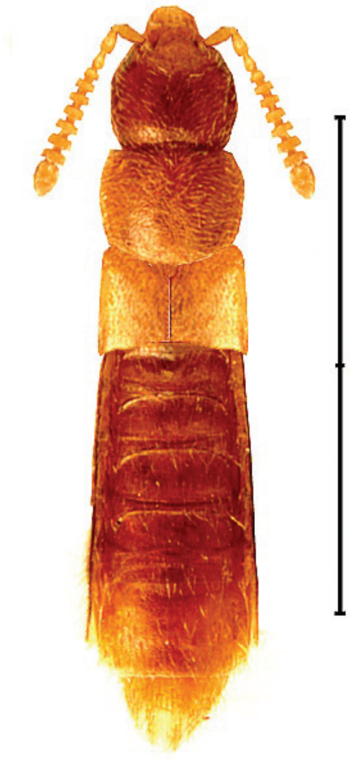

Fig. 4. Dorsal habitus photograph of *Meotica "pallens" sensu* Benick and Lohse (1974)

Meotica "pallens" (Redtenbacher, 1849) *sensu* Benick and Lohse (1974)

NOVA SCOTIA: Hants Co.: St. Croix, 28.VII. 2007, M. Moseley, in wet moss in a gypsum sinkhole, (1 female, NSMC).

This species is newly recorded for Nova Scotia and the Maritime Provinces (Fig. 1). In North America it has previously been recorded from British Columbia, New Jersey, Ontario, and Rhode Island (Gouix and Klimaszewski 2007;Klimaszewski et al. 2007). The earliest North American specimen was collected at the end of the 19th century by Casey in Rhode Island and was described by him as *Sipaliella filaria* Casey, 1911, which was subsequently synonymized with *M. pallens* by Gusarov (2002).

The concept of *Meotica pallens* (Redtenbacher) in Europe is problematic. Canadian specimens are conspecific with the central European specimens cited as *M. pallens* (Redtenbacher) *sensu* Benick and Lohse (1974) (Klimaszewski et al. 2007). According to Muona (1991), *M. pallens* (Redtenbacher) is synonymous with *M. lohsei* Benick, *M. hanseni* Scheerpeltz, *M. strandi* Scheerpeltz, and *M. strandi sensu* Muona (1979), but is a different species from that listed from central Europe by Benick and Lohse (1974) under the same name. Following Klimaszewski et al. (2007) we employ the tentative name *M. "pallens"* (Redtenbacher) *sensu* Benick and Lohse (1974) for this specimen pending revisionary studies in Europe.

Klimaszewski et al. (2007) reported a specimen in Ontario collected in a muskrat nest near a *Sphagnum* bog. The Nova Scotia specimen was collected in wet moss in a gypsum sinkhole. Muona (1991: 231) says that, "This species seems to live more or less subterraneously. It has been taken from burrows of small mammals and can be found by sieving rich soils around trees early in the spring as well as in flood refuse". *Meotica pallens* (Redtenbacher) *sensu* Muona, 1991 is wing-dimorphic, with both brachypterous and macropterous forms. The Nova Scotia specimen is macropterous. A dorsal habitus photograph is provided in Fig. 4. For illustrations of the genitalia see Klimaszewski et al. (2007).

Gnypeta caerulea (C.R. Sahlberg, 1830)

Gnypeta caerulea, hitherto regarded as an adventive Palaearctic species, was newly recorded in Nova Scotia, Prince Edward Island, and the Maritime Provinces as a whole by Majka and Klimaszewski (2008). Subsequently Klimaszewski et al. (2008b) have reviewed the genus *Gnypeta* in Canada, Alaska, and Greenland and concluded that *G. caerulea* represents a Holarctic species. Consequently, it is removed from the list of adventive species of the Maritime Provinces.

Atheta (Datomicra) dadopora Thomson, 1867

PRINCE EDWARD ISLAND: Queens Co.: St. Patricks, 18.VIII.2002, C.G. Majka, along stream, (1, CGMC).

Atheta dadopora is newly recorded on Prince Edward Island (Fig. 5). It has previously been recorded from Rhode Island, Pennsylvania, New York, Newfoundland, New Brunswick, and Nova Scotia (Gusarov 2003, Klimaszewski et al. 2005; Majka and Klimaszewski 2008). It is widely distributed across the Palaearctic region eastward to China and Japan (Smetana 2004a) and is found in decaying fungi, under cow dung, and fallen leaves (Burakowski et al. 1981). Although Gusarov (2003) listed it as an adventive Palaearctic species newly recorded in North America, its zoogeographic

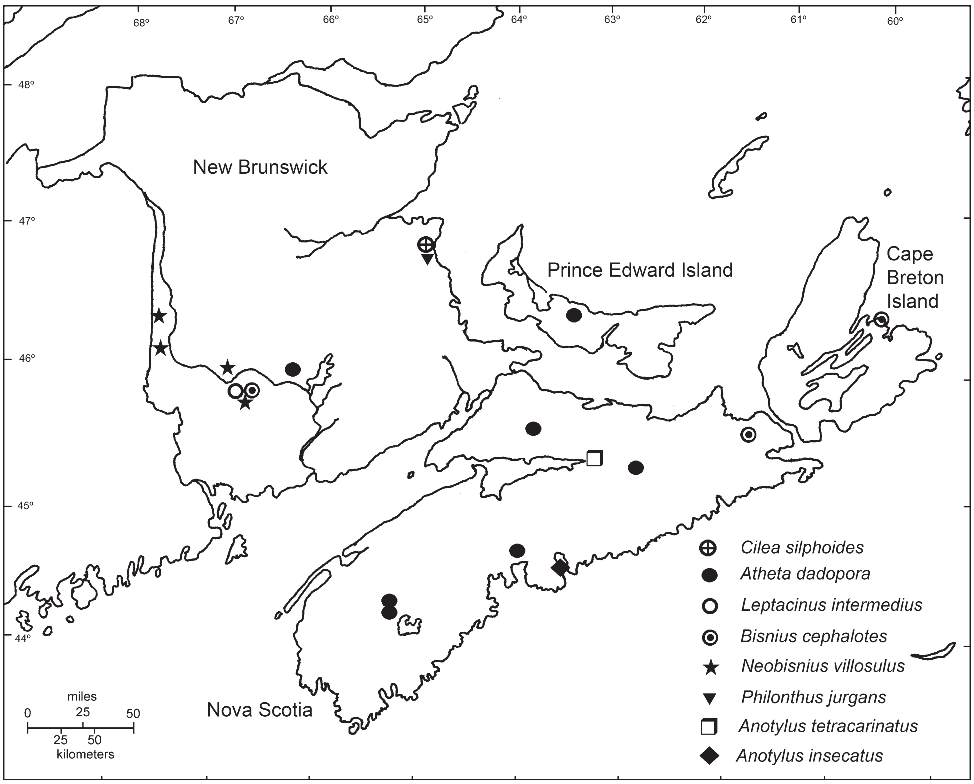

Fig. 5. Distribution of *Cilea silphoides, Atheta dadopora, Leptacinus intermedius, Bisnius cephalotes, Neobisnius villosulus, Philonthus jurgans, Anotylus tetracarinatus,* and *Anotylus insecatus* in the Maritime Provinces of Canada.

status is still unclear. It is possible that it could be Holarctic in distribution. It is provisionally included in this account as a Palaearctic species. The earliest records are from Casey (1910) from specimens collected in New York, Pennsylvania, and Rhode Island (Gusarov 2003).

Anotylus insecatus (Gravenhorst, 1806)

NOVA SCOTIA: Halifax Co.: Halifax, V-VII.2007, C.G. Majka, garden, (many individuals); Halifax, 25.V.2008, C.G. Majka, garden, (2, CGMC); Halifax, 1.VI.2008, C.G. Majka, garden (1, CGMC); Halifax, 7.VII.2008, C.G. Majka, garden, (1, CGMC).

Anotylus insecatus is newly recorded for Nova Scotia and in the Maritime Provinces (Fig. 5). This species was first recorded in North America by Campbell and Tomlin (1983) from specimens collected in Ontario in 1980. It was subsequently reported from Québec by Campbell and Davies (1991). Anthony Davies (pers. comm.) indicates that the CNC also has specimens from Alberta, Manitoba, Saskatchewan, and California and that the earliest records (from Alberta) date from 1954.

Horion (1963) and Campbell and Tomlin (1983) both drew attention to *A. insecatus* as a predator of dipteran larvae in the bulbs of onions and tulips. It has also been found at sap flows and in decaying plant debris (Campbell and Tomlin 1983). Hammond (1976), however, noted that the species is primarily subterranean and believed that, like many species of *Anotylus*, it may be largely saprophagous and a scavenger. He indicated that as an inhabitant of dung and decaying organic matter, its association with dipteran larvae may be incidental. Observations by C.G. Majka in Halifax indicate that they are predators of dipteran larvae. The roots of radish plants (*Raphanus sativus* L., Brassicaceae) infested with the larvae of radish root maggot [*Delia* nr. *floralis* (Fallén) (Diptera: Anthomyiidae)] were examined and adult *A. insecatus* were found preying on larvae in tunnels bored in the roots by the larvae. Adults were also frequently found in subterranean circumstances within soil along with *Gabrius picipennis* (Mäklin) (Staphylinidae).

Anotylus tetracarinatus Block, 1799

NOVA SCOTIA: Colchester Co.: Bible Hill, 8.VII.2007, C.W. D'Orsay, pasture, sweep, (1, CBU).

Anotylus tetracarinatus is newly recorded for Nova Scotia and in the Maritime Provinces (Fig. 5). It was first recorded in North America in Indiana by LeConte (1877). It has subsequently been reported from New York (Notman 1920), British Columbia, Oregon, and Washington (Hatch 1957), and Québec by (Campbell and Davies 1991; Levesque and Levesque 1996). It is widely distributed in Europe east to Russia and south to Algeria, Turkey, and Iran (Herman 2001). In Europe it has been found in dung, mammal nests, caves, and decomposing fungi (Herman 2001).

Oxytelus sculptus Gravenhorst, 1806

NOVA SCOTIA: Kings Co.: Kentville, 27.VII.2007, D.H. Webster, at light, (1, DHWC); Kentville, 12.VIII.2007, D.H. Webster, at light, (1, DHWC).

This species is newly recorded for Nova Scotia and the Maritime Provinces (Fig. 1). In North America it previously has been reported from British Columbia, California, Idaho, Oregon, and Washington on the west coast, and Connecticut, Florida, Indiana, New York, Ontario, and Québec in the eastern portions of the continent (Moore and Legner 1975; Campbell and Davies 1991; Downie and Arnett 1996). Probably originally African in origin, this species is now cosmopolitan being widely distributed in Europe, Africa, North America, temperate south America, Australia, and New Zealand (Herman 2000). Melsheimer (1846: 42) described it under the name of *Oxytelus moerens* from the United States; however, the earliest record of this species in North America is from latrine excavations in Boston, Massachusetts from ca. 1670 (Bain 1998).

It is usually found in open areas such as gardens, pastures, and fields under stones, and in manure and compost (Burakowski et al. 1979). It is abundant in the manure of domestic animals such as cattle, horses, and poultry. It is probable that this cosmopolitan species has been dispersed by human agency in association with the transport of domestic animals (Moore and Legner 1974).

Lathrobium (s. str.) fulvipenne (Gravenhorst, 1806)

BRITISH COLUMBIA: 8 miles west of Creston, VI.1968, J.M. Campbell and A. Smetana, (1, CNC). **ALBERTA: Strathcona Co.:** Edmonton, University Farm, 1984, C.D. Griffiths, canola plot, (1, UASM). **NEWFOUNDLAND**: Corner Brook, Loggers School Road, VII.1992, CFNL; St. John's, 1986, (1, MUN). **NEW BRUNSWICK: Albert Co.:** Shepody National Wildlife Area, V.2004, R.P. Webster, RWC; **Restigouche Co.:** Southeast Upsalquitch River, 16.V.1991, D.F. McAlpine, (1, NBM); **York Co.:** Charters Settlement, IV.2005, R.P. Webster, (1, RWC). **QUÉBEC: Haut-Saint-François**; Scotstown, 15.V.2006, 19.VI.2006, 26.VI.2006, 14.V.2007, C. Levesque, abandoned pasture and mixed woodland, pitfall trap, (5, CLC).

Campbell and Davies (1991) indicated the presence of *Lathrobium fulvipenne* in British Columbia, Alberta, and Newfoundland, however, no specimen records were provided. We, therefore, take the opportunity to document its presence (from as early as 1968) from five Canadian provinces. Records from New Brunswick, Newfoundland, and Québec are shown in Fig. 1. It is widely distributed throughout the Palaearctic region (Alonso-Zarazaga 2007). It has also been recorded once in Greenland, although it is not clear if this represents an accidental introduction or if the species is native there (Böcher 1988).

In Iceland and the Faroe Islands it is found in dry grasslands; however, in the rest of Europe it is found in moister environments, i.e., under fallen leaves in coppices or small woods, in leaf litter in alder groves, and in meadows (Böcher 1988). In continental Europe, it is eurytopic and also common in synantropic habitats (V. Assing, pers. comm). Eyre et al. (2001) found *L. fulvipenne* to be abundant in riverine environments in northern England and Scotland similar to the site where the species was found in New Brunswick.

Leptacinus intermedius Donisthorpe, 1936

NEW BRUNSWICK: York Co.: Charters Settlement, 45.8395 N, 66.7391 W, 26.IX.2005, 2.V.2004, 16.X.2004 (2 specimens), 21.IV.2004, 16.IX.2005, 27.VIII.2005, R.P. Webster, in well-decayed compost, (7, RWC).

Majka and Klimaszewski (2008) removed this species from the New Brunswick faunal list, based on a misidentified specimen reported in Majka and Ogden (2006). However, the above records of R.P. Webster establish the presence of *L. intermedius* in the province (Fig. 5). Consequently, *L. intermedius* is reinstated to the faunal list of New Brunswick. The earliest North American specimens are from 1903 in Québec (Smetana 1982). Widely distributed in Europe and found in North Africa and Turkey (Herman 2001; Smetana 2004b), it has been recorded in a wide variety of decompositional environments including dung, compost, and decaying vegetable matter (Smetana 1982).

Quedius curtipennis Bernhauer, 1908

NOVA SCOTIA: Colchester Co.: Truro, 8.VI.1984, J.A. Adams, (2, NSAC).

This species was detected in the Maritime Provinces (Nova Scotia) in 1997 (Majka and Smetana 2007). The new record above, however, establishes that *Q. curtipennis* has been present in the region from at least 1984. The earliest records in North America are from 1934 in Seattle (Smetana 1971). In the Palaearctic region it is found throughout Europe east through Turkey to Uzbekistan, as well as in Morocco and on the Azores (Herman 2001, Smetana 2004). *Quedius curtipennis* is often found near settlements in various debris and under stones. Some specimens also have been collected in natural environments in moss and under leaf litter (Smetana 1971).

Quedius molochinus (Gravenhorst, 1802)

PRINCE EDWARD ISLAND: Queens Co.: Harrington, 7.IX.2006, C. Noronha, potato field, pitfall trap, (1, CGMC).

Majka and Klimaszewski (2008) neglected to note that *Q. molochinus* also is known on Prince Edward Island (in addition to Nova Scotia) from a specimen collected in 2006 (Majka 2007). Therefore, this species is added to the list of adventive staphylinids found on Prince Edward Island. *Quedius molochinus* was first discovered 1949 in North America in Newfoundland (Smetana 1971). It is widely distributed in Europe and Russia south to North Africa and the Caucasus (Herman 2001; Smetana 2004b). All North American specimens have been found in land affected by cultivation (Smetana 1971; Majka 2007).

Creophilus maxillosus villosus (Gravenhorst, 1802)

Creophilus maxillosus (Linnaeus, 1758) has been treated as an adventive species (Majka and Klimaszewski 2008). Newton et al. (2000), however, pointed out that most North American specimens, often treated as the subspecies *C. maxillosus villosus* (Gravenhorst, 1802), are distinguishable from the Palaearctic *C. m. maxillosus*. *Creophilus m. villosus* has a broad pre-human North American distribution, and hence can be considered a native, Nearctic subspecies. Consequently we remove *C. maxillosus* from the list of adventive species of the region.

Staphylinus ornaticauda LeConte, 1863

Staphylinus ornaticauda was inadvertently included in the table of adventive Staphylinidae given by Majka and Klimaszewski (2008: 72). The species was previously treated in North America as *Staphylinus erythropterus* L., 1758, a Palaearctic species and was accidentally retained on the list of adventive species. *Staphylinus ornaticauda* is a native, Nearctic species.

Tasgius ater (Gravenhorst, 1802)

NEW BRUNSWICK: Westmoreland Co.: Salisbury, 1.VII.1949, E.A.E., (1, NSAC). **NOVA SCOTIA: Annapolis Co.:** Bridgetown, 17.IX.1913, G.E. Saunders, (1, NSAC).

Majka and Klimaszewski (2008) reported the detection of *T. ater* in the Maritime Provinces (Nova Scotia) in 1938. The above record from 1913, however establishes its presence in the region at least 25 years earlier. Similarly, the earliest record from New Brunswick was 1978 (Majka and Klimaszewski 2008) but the above record from Salisbury establishes its presence in 1949. It was first recorded in North America by Gravenhorst (1802). *Tasgius ater* is found throughout Europe, Russia, and North Africa east to Syria and Iran (Herman 2001; Smetana 2004) and occurs beneath stones and wood near water (Downie and Arnett 1996).

Bisnius cephalotes (Gravenhorst, 1802)

NEW BRUNSWICK: York Co.: New Maryland, 15.IV.2004, R.P. Webster, in compost in mixed forest area, (3, RWC).

Bisnius cephalotes is newly recorded from New Brunswick (Fig. 5), previously having been reported from the region from Nova Scotia (Smetana 1995; Majka and Klimaszewski 2008). In the Old World it is widely distributed across the Palaearctic region, south to North Africa and east through Siberia to northeastern China (Herman 2001; Smetana 2004b; Alonso-Zarazaga 2007). In North America, however most records are either from the northeast or the northwest (Smetana 2006). The earliest North American records are from 1860 in Québec (Bain 1999). *Bisnius cephalotes* is a synanthropic species frequently found in various decaying plant or animal material such as carrion, compost, and dung. It is also found in bird and rodent nests (Smetana 1995).

Neobisnius villosulus (Stephens, 1833)

NEW BRUNSWICK: Carleton Co.: Bell Forest Nature Preserve, 46.2152 N, 67.7190 W, 1.VI.2005, M.-A. Giguere and R.P. Webster, upper river margin, collected while in flight on warm afternoon, (1, RWC); Two mile Brook Fen N of Lakeville, 46.3594 N, 67.6800 W, 2.VI.2005, R.P. Webster, near cedar swamp, in flight late afternoon, (1, RWC); **York Co.:** Charters Settlement, 45.8395 N, 66.7391 W, 1.VIII.2007, R.P. Webster, collected at M.V. light, (1, RWC); Keswick River at Rte 105, 45.9943 N, 66.8337 W, 18.VI.2004, R.P. Webster, silver maple forest under debris on muddy soil near small pool, (1, RWC).

Majka and Klimaszewski (2008) reported this species in New Brunswick on the basis of a specimen collected in Hartland by R.P. Webster. This identification was in error and was based on a specimen of *Stictolinus flavipes* Donisthorpe. However, the above specimens collected by R.P. Webster establish the presence of *N. villosulus* in New Brunswick (Fig. 5). The earliest North American records are from 1860 in Québec (Bain 1999). It is widely distributed in Europe east to Russia, the Ukraine, and the Caucasus (Herman 2001; Smetana 2004b). It is found mainly in moist habitats including the margins of rivers, marshes, and lakes (Newton et al. 2000).

Philonthus cognatus Stephens, 1832

NOVA SCOTIA: Kings Co.: Kentville, 5.VI.1949, D. Eidt, (1, NSAC); Kentville, 23.V.1950, V.R. Vickery, (1, NSAC); Kentville, 25.V.1950, P.N. Grainger, (2, NSAC).

Majka and Klimaszewski (2008) reported the detection of this species in the Maritime Provinces (Nova Scotia) in 1951. The above records establish that *P. cognatus* was present in the region from at least 1949. It was first recorded 1884 in North America in North Carolina (Horn 1884). Widely distributed in the Palaearctic across Europe to eastern Siberia and Jilin in China, it is found in a wide range of habitats that include forests, moist meadows, fields, edges of ponds, and marshes, particularly in rotting plant debris (Smetana 1995).

Philonthus jurgans Tottenham, 1937

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 25.VIII.1977, S.J. Miller, (1, CNC).

Philonthus jurgans was inadvertently missed in the compendium of adventive species in Majka and Klimaszewski (2008). It was recorded from New Brunswick by Smetana (1995) on the basis of the record above (Fig. 5). In Europe it is found from France east to Albania and Romania and north to Great Britain and Sweden (Herman 2001; Alonso-Zarazaga 2007). Most North American records are from Pennsylvania to Newfoundland and from California north to British Columbia. The earliest records on the continent are from 1881 in Head Harbour, Maine and it is found in all kinds of decaying organic matter (Smetana 1995).

Philonthus rectangulus Sharp, 1874

NOVA SCOTIA: Kings Co.: Grand Pré, 19.VII.1952, F.L. Trenholm, (1, NSAC).

Majka and Klimaszewski (2008) recorded *P. rectangulus* from Nova Scotia from specimens collected in 2004. The above record establishes the presence of this species in the province in 1952, 52 years earlier than previously reported, and 25 years earlier than the previous earliest record from the Maritime Provinces in 1977 from New Brunswick (Majka and Klimaszewski 2008). It appears to originally have been native to Japan before spreading to China in 1901, arriving in Europe in 1916. The earliest records from North America are from 1908 in Oregon (Smetana 1995). It now is widely distributed across the Palaearctic region, including China and Japan in the east. It is also known from many other parts of the world and is considered a cosmopolitan species (Herman 2001; Smetana 2004b). It is found in all kinds of decaying organic matter, particularly in synanthropic situations, and is particularly common in animal dung, compost, and rotting plant debris (Smetana 1995).

Discussion

Eighty-seven species of adventive Staphylinidae are now known to occur in the Maritime Provinces, 76 of which have been recorded in Nova Scotia, 61 in New Brunswick, and 29 on Prince Edward Island (Appendix 1).

Majka and Klimaszewski (2008) discussed the different modes of introduction and dispersal of adventive Staphylinidae in the region. Seventy-six of the 439 species (17.3%) of rove beetles recorded in Nova Scotia are adventive, as are 61 of 348 (17.5%) recorded in New Brunswick, and 29 of 86 (33.7%) recorded on Prince Edward Island. By comparison, the overall proportion of adventive beetles in Nova Scotia is 15.3%, in New Brunswick 12.5%, and on Prince Edward Island 21.8% (C.G. Majka, unpublished data). The significantly larger proportion of adventive staphylinids on Prince Edward Island, almost double that of New Brunswick and Nova Scotia, appears to reflect in part the extensive disturbance history of the island. Significant cutting of the forests commenced on Prince Edward Island in the early eighteenth century and large areas of the island were burnt. Seventy percent of PEI's forests were cleared in the twentieth century (Loo and Ives 2003). By 1960, 60% of the land on PEI was devoted to agriculture and a further 8% was otherwise open (unimproved waste land, marsh, barren, etc.), leaving only 32% as forest (Erskine 1960). Additionally, what collecting there has been on Prince Edward Island has often focused on disturbed and agricultural biotypes, where adventive species tend to be found, and not on undisturbed and native environments that may harbour more indigenous species.

Table 1 gives the geographical composition of the staphylinid fauna of Atlantic Canada. Although this data is preliminary, the information in Table 1 nonetheless illustrates some noteworthy patterns, particular when compared with the equivalent data pertaining to the Carabidae of Atlantic Canada (Majka et al. 2007b). The Carabidae are another species-rich family of ground-dwelling beetles, one that has been much more thoroughly studied. With 560 species recorded from Atlantic Canada, the Staphylinidae outnumber the 356 species of Carabidae found in the region. There are, however, some striking similarities in the proportionate species compositions. The proportion of native carabids in Atlantic Canada varies from 83.8 to 91.2%, whereas in the Staphylinidae, the proportion of native species varies from 78.9 to 83.6%, except for 66.3% in Prince Edward Island, another indication that PEI's native fauna is strikingly underrepresented in collections.

Furthermore, within the Carabidae of the region, the recorded numbers and proportions of native species on the islands of Cape Breton (170 species, or 53.5% of the total number of native species), Newfoundland (148 species, or 46.5%), and Prince Edward Island (140 species, or 44%) are relatively similar. For the Staphylinidae the equivalent numbers for Cape Breton (169 of 468 species, or 36.0% of the total native fauna) and insular Newfoundland (153 of 468 species, or 32.6% of the total native fauna) are relatively similar, whereas those for Prince Edward Island (57 of 468 species, or 12.2% of the total native fauna) again reveal that the recorded native staphylinid fauna is proportionally much smaller (only 1/3 of the value), indicating that the native rove beetle fauna has not been adequately collected.

Noteworthy as well, is the relatively large proportion of Holarctic staphylinids on insular Newfoundland, which at 14.9% is roughly double that of any other area in Atlantic Canada. This is comparable to the proportion of Holarctic carabids on Newfoundland (21.2%), which is also roughly double that of any other area in Atlantic Canada, illustrating Newfoundland's more northern situation and its greater proximity to Labrador, Greenland, Iceland, etc. with their sizable Holarctic faunas.

Comparing the numbers and proportions of adventive carabids and staphylinids reveals a similar picture. Cape Breton (23 species), Newfoundland (22 species), and Prince Edward Island (27 species) have similar numbers of adventive carabids. The number of adventive staphylinids on Cape Breton (44 species) and Newfoundland (41

Table 1. Zoogeographic composition of the Atlantic Canadian Staphylinidae: Number and proportion of species

	Nearctic	% of total	Holarctic	% of total	Palaearctic	% of total	Native	% of total	Total
Prince Edward Island	50	58.1%	7	8.1%	29	33.7%	57	66.3%	86
Cape Breton Island	160	75.1%	9	4.2%	44	20.7%	169	79.3%	213
insular Newfoundland	124	63.9%	29	14.9%	41	21.1%	153	78.9%	194
Nova Scotia mainland	269	74.7%	18	5.0%	73	20.3%	287	79.7%	360
Nova Scotia	336	76.5%	27	6.2%	76	17.3%	363	82.7%	438
New Brunswick	259	74.4%	28	8.0%	61	17.5%	287	82.5%	348
Maritime Provinces	392	76.7%	32	6.3%	87	17.0%	424	83.0%	511
Atlantic Canada *	430	76.8%	38	6.8%	92	16.4%	468	83.6%	560

* excluding Labrador

Notes: Data derived primarily from Campbell and Davies (1991), Gusarov (2003), Assing (2003), Smetana (2005), Klimaszewski et al. (2005, 2007), Gouix and Klimaszewski (2007), Majka and Klimaszewski (2008), and unpublished information.
The Maritime Provinces include New Brunswick, Nova Scotia and Prince Edward Island. Atlantic Canada additionally includes insular Newfoundland.

species) are very similar, whereas Prince Edward Island (29 species) is a third lower. In relation to both carabids (24 of the total of 38 adventive species, i.e., 63%) and staphylinids (61 of the total of 92 adventive species, i.e., 66%) New Brunswick has a diminished proportion of adventive species in comparison with Nova Scotia (89.5 and 82.6% respectively) and the Maritime Provinces as a whole (89.5 and 94.6% respectively). Presumably this disparity is a result of the lesser role of New Brunswick's seaports in the trans-Atlantic ballast trade.

Conclusion

The new discoveries highlighted in the present study illustrate several trends in our research on adventive species in Atlantic Canada, namely that a) new species continue to be discovered, b) examination of museum specimens continues to yield new early time lines for the detection of species in the region, c) ongoing research on staphylinids continues to result in reevaluations of the zoogeographic status of species, and d) further fieldwork and systematic research are needed to fully understand the composition of the region's fauna, particularly for the Staphylinidae. Although we are continually discovering that the number of adventive species and the extent of their penetration into native habitats is greater than we had anticipated, our knowledge of the composition of staphylinid faunas remains incomplete. Hence our ability to assess the impact that these adventive species may have had on native faunas and habitats is similarly limited.

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Appendix 1. Adventive Staphylinidae of the Maritime Provinces of Canada

Omaliinae
Omaliini
Omalium rivulare (Paykull)
Phyllodrepa floralis (Paykull)

Pselaphinae
Euplectitae
Euplectini
Euplectus karstenii (Reichenbach)

Phloeocharinae
Phloeocharis subtilissima Mannerheim

Tachyporinae
Tachyporini
Cilea silphoides (Linnaeus)
Sepedophilus littoreus (Linnaeus)
Sepedophilus marshami (Stephens)
Sepedophilus testaceus (Fabricius)
Tachinus corticinus Gravenhorst
Tachinus rufipes (Linnaeus)
Tachyporus dispar (Paykull)
Tachyporus nitidulus (Fabricius)

Mycetoporini
Mycetoporus lepidus (Gravenhorst)

Trichophyinae
Trichophya pilicornis (Gyllenhal)

Habrocerinae
Habrocerus capillaricornis (Gravenhorst)

Aleocharinae
Aleocharini
subtribe Aleocharina
Aleochara bilineata Gyllenhal
Aleochara fumata Gravenhorst
Aleochara lanuginosa Gravenhorst
Aleochara tristis Gravenhorst
Aleochara curtula (Goeze)
Tinotus morion (Gravenhorst)

Oxypodini
subtribe Oxypodina
Crataraea suturalis (Mannerheim)
Ilyobates bennetti Donisthorpe
Oxypoda brachyptera (Stephens)
Oxypoda opaca (Gravenhorst)
Oxypoda operta Sjöberg
Meotica exilis (Erichson)
Meotica "pallens" (Redtenbacher)

Dioglottini
Dioglota mersa (Haliday)

Autaliini
Autalia rivularis (Gravenhorst)

Homalotini
subtribe Gyrophaenina
Gyrophaena affinis Mannerheim
subtribe Homalotina
Homalota plana Gyllenhal

Placusini
Placusa incompleta Sjöberg
Placusa tachyporoides (Waltl)

Athetini
subtribe Athetina
Amischa analis (Gravenhorst)
Atheta longicornis (Gravenhorst)
Atheta celata (Erichson)
Atheta dadopora Thomson
Atheta amicula (Stephens)
Atheta vestita (Gravenhorst)
Dinaraea angustula (Gyllenhal)
Halobrecta flavipes Tomson
Mocyta fungi (Gravenhorst)
Nehemitropia lividipennis (Mannerheim)

Falagriini
Cordalia obscura (Gravenhorst)

Lomechusini
subtribe Myrmedoniina
Drusilla canaliculata (Fabricius)

Oxytelinae
Deleasterini
Deleaster dichrous (Gravenhorst)
Coprophilus striatulus (Fabricius)

Thinobiini
Carpelimus obesus (Kiesenwetter)
Carpelimus subtilis (Erichson)

Oxytelini
Anotylus insecatus (Gravenhorst)
Anotylus rugosus (Fabricius)
Anotylus tetracarinatus Block
Oxytelus laqueatus (Marsham)
Oxytelus sculptus Gravenhorst

Steninae
Stenus clavicornis (Scopoli)

Paederinae
Paederini
Lathrobium fulvipenne (Gravenhorst)
Lithocharis ochracea (Gravenhorst)
Rugilus fragilis (Gravenhorst)
Ochthephilum fracticorne (Paykull)

Staphylininae
Xantholinini
Gyrohypnus angustatus Stephens
Gyrohypnus fracticornis (O.F. Müller)
Leptacinus intermedius Donisthorpe
Xantholinus linearis (Olivier)

Staphylinini
Quediina
Quedius curtipennis Bernhauer
Quedius fuliginosus (Gravenhorst)
Quedius mesomelinus (Marsham)
Quedius molochinus (Gravenhorst)

Staphylinina
Tasgius ater (Gravenhorst)
Tasgius melanarius (Heer)

Philonthina
Bisnius cephalotes (Gravenhorst)
Bisnius sordidus (Gravenhorst)
Gabrius appendiculatus Sharp
Gabrius astutoides (Strand)
Neobisnius villosulus (Stephens)
Philonthus carbonarius (Gravenhorst)
Philonthus cognatus Stephens
Philonthus concinnus (Gravenhorst)
Philonthus cruentatus (Gmelin)
Philonthus debilis (Gravenhorst)
Philonthus discoideus (Gravenhorst)
Philonthus jurgans Tottenham
Philonthus longicornis Stephens
Philonthus politus (Linnaeus)
Philonthus rectangulus Sharp
Philonthus umbratilis (Gravenhorst)
Philonthus varians (Paykull)

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Diglotta mersa (Haliday) and *Halobrecta flavipes* Thomson, two new species for the Canadian fauna (Coleoptera, Staphylinidae, Aleocharinae)

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Abstract

Diglotta mersa (Haliday) of the Diglottini, a western Palaearctic species, is reported for the first time from the Atlantic coast of North America (Canada, New Brunswick). It was found in fine gravel under small (10-15 cm diameter) rocks in the intertidal zone, approximately 2 m below the mean high tide mark. A description, and images of the external body, median lobe of aedeagus, spermatheca and terminal segments are provided. New distributional and bionomic data for *Halobrecta flavipes* Thomson, a coastal species of the Athetini Casey, are presented.

Keywords

New records, Canada, Staphylinidae, taxonomy

Introduction

The tribe Diglottini Jacobson, 1909 now includes two genera, *Diglotta* Champion, 1899 and *Paradiglotta* Ashe and Ahn (2004) (Ashe 2001; Caron and Ribeiro-Costa 2008), but is still not well defined. Klimaszewski (1982) also included the genus *Polypea* Fauvel, and Pace (1986) included four additional genera: *Brachypronomaea* Sawada, *Bryothinusa* Casey, *Corallis* Fauvel and *Halorhadinus* Sawada in the Diglottini. Subsequently, the latter genera were transferred to different tribes (Ahn et al. 2003; Ahn and Ashe 2004): *Brachypronomaea* was transferred to the Myllaenini

Ganglbauer, *Halorhadinus* to the Liparocephalini Fenyes, and *Brachypronomaea*, *Bryothinusa*, and *Polypea* to the Myllaenini. Ashe and Ahn (2004) suggested placing the genus *Corallis* in the Myllaenini but Newton and Thayer (2005) placed it in the Phytosini Thomson. *Paradiglotta* includes only one species, *P. nunni* Ashe and Ahn, from New Zealand (Ashe and Ahn 2004), while *Diglotta* includes eight species (Table 1), two in the western Palaearctic (*D. mersa* Haliday, *D. sinuaticollis* Mulsant and Rey), one in Africa (*D. secqi* Pace), one in Brazil (*D. brasiliensis* Caron and Ribeiro-Costa), four in the Nearctic region (*D. mersa* (Haliday) [Atlantic coast], *D. littoralis* (Horn) [Atlantic coast], *D. legneri* Moore and Orth [Pacific coast]), and *D. pacifica* Fenyes [Pacific coast], and one species, *D. maritima* Lea, in the Fiji Islands (Caron and Ribeiro-Costa 2008; Moore and Orth 1979; Haghebaert 1991; Pace 1986; Ashe 2001).

The objective of this paper is to document the first distribution record of *Diglotta mersa* (Haliday) in North America and to provide new distributional and bionomic data on another coastal species, *Halobrecta flavipes*, previously recorded in North America from New York and Virginia (Gusarov 2004).

Material and methods

Thirty-nine adults of *D. mersa* from Dipper Harbour, and fifty-seven specimens of *H. flavipes* from Chance Harbour, New Brunswick, were examined. Twelve specimens of *D. mersa* were dissected. The genital structures were dehydrated in absolute alcohol and mounted in Canada balsam on celluloid microslides and pinned with the specimens from which they originated. The photographs of the entire body and the genital structures were taken using an image processing system (Nikon SMZ 1500 stereoscopic microscope; Nikon Digital Camera DXM 1200F; and Adobe Photoshop software).

Terminology mainly follows that used by Caron and Ribeiro-Costa (2008). The ventral part of the median lobe of the aedeagus is considered to be the part of the bulbus containing the foramen mediale, the entrance of the ductus ejaculatorius, and the adjacent venter of the tubus; the opposite side is referred to as the dorsal part.

Depository abbreviations:

LFC Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre, Insectarium R. Martineau, Quebec City, Quebec, Canada

MCZ Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA

RWC Reginald Webster private collection, 24 Millstream Drive, Fredericton, New Brunswick, Canada

Table 1. World checklist of *Diglotta* species. New record is in bold.

Species	Original combination	Synonyms	Distribution	Source	Tarsal formula
Diglotta mersa (Haliday)	*Diglossa mersa* Haliday, 1837	*Diglotta crassa* (Mulsant & Rey) *Diglotta submarina* (Fairmaire & Laboulbène)	Europe (Albania, Belgium, Denmark, France, Germany, Great Britain, Ireland, Netherlands) **North America (Canada: New Brunswick)**	Haghebaert (1991); Smetana (2004)	4-4-4
Diglotta sinuaticollis (Mulsant & Rey)	*Diglossa sinuaticollis* Mulsant & Rey, 1870		Europe (Belgium, Denmark, France, Great Britain, Germany, Ireland, Netherlands, Norway, Spain, Sweden); North Africa (Algeria)	Smetana (2004)	4-4-4
Diglotta secqi Pace			Africa (Djibouti)	Pace (1989)	4-4-4
Diglotta littoralis (Horn)	*Phytosus littoralis* Horn, 1871		North America (New Jersey)	Horn (1871); Haghebaert (1991)	4-4-5
Diglotta legneri Moore & Orth	*Diglotta legneri* Moore & Orth, 1979		North America (California)	Moore and Orth (1979); Haghebaert (1991)	4-4-5
Diglotta pacifica Fenyes	*Diglotta pacifica* Fenyes, 1921		North America (California, Oregon)	Fenyes (1921); Haghebaert (1991)	4-4-5
Diglotta brasiliensis Caron & Ribeiro-Costa	*Diglotta brasiliensis* Caron & Ribeiro-Costa, 2008		South America (Brazil, Paraná)	Caron and Ribeiro-Costa (2008)	4-4-4
Diglotta maritima Lea	*Diglossa maritima* Lea, 1927		Fiji Islands (Levuka)	Lea (1927); Haghebaert (1991)	4-4-5

Tribe Diglottini Jakobson 1909

Diagnosis

Tarsal formula 4-4-5 (most North American species) or 4-4-4 (European, African and Brazilian species) (Lohse 1974; Haghebaert 1991; Ashe 2001; Caron and Ribeiro-Costa 2008); claws strong, scythe-like; glossae thin and extremely elongate, protruding beyond labrum (*Myllaena*-like); labial palpi thin, strongly elongate, and stylate (Fig. 1); maxillae elongate, maxillary lobes long, with scattered teeth on lacinia (Fig. 1); eyes small (Fig. 1); body form distinct (Fig. 1).

Genus *Diglotta* Champion 1899

Diglotta Champion, 1899: 264. Type species *Diglossa mersa* Haliday, 1837.

Diagnosis

Integument with slightly granulate microsculpture, pubescent, pubescence short and of distinct pattern on pronotum with microsetae forming arcuate lines emerging from midline of the disc outwards (Fig. 1). Body with large, broadly rounded head and protruding mouthparts forming conically-shaped apical projection, head as large as or larger than pronotum (Fig. 1); infraorbital carinae absent; labrum broadly emarginate medially; mandibles slender with rounded blunt apices, prostheca well developed; lacinia and galea of equal length; maxillary palpus with four articles, first and last reduced in size; mentum trapezoidal in shape, anterior margin strongly concave; pronotum strongly narrowed basally (Fig. 1); elytra shorter than pronotum (Fig. 1); hind wings usually reduced to short stubs, but micropterous and macropterous forms within the same species are reported (Good 1998); abdomen broadly oval in dorsal outline and widening posteriorly (Fig. 1). Found in the intertidal zone of beaches (Moore and Orth 1979; Good 1998; Haghebaert 1991; Pace 1989, Ashe 2001).

Key to the *Diglotta* species recorded from the Nearctic region

The following key was modified from Haghebaert (1991). Elytral length was measured from the humeral angle to the hind margin; body length was measured from the apical margin of the labrum to the apex of the abdomen. The body length is given without range for species known only from a holotype (*D. littoralis*), or where such data was not available from the literature. For descriptions and genital illustrations of *D. legneri*, *D. littoralis* and *D. pacifica* see Haghebaert (1991).

1. Metatarsus with 4 articles (tarsal formula 4-4-4); elytra at least as long as pronotum; Atlantic coast of Canada ....*D. mersa* (Haliday) [Figs. 1-11]

– Metatarsus with 5 articles (tarsal formula 4-4-5); elytra shorter than pronotum; Atlantic or Pacific coast of North America 2

2. Body brownish, length 2.6 mm; antennae elongate; Pacific coast ....*D. legneri* Moore & Orth

Fig. 1. *Diglotta mersa* (Haliday) in dorsal view. Scale bar = 1 mm.

– Body brown to light testaceous, length less than 2.0 mm; antennae short; Atlantic or Pacific coast..3
3. Head slightly broader than long; punctation finely asperate; colour light testaceous; body length 1.8 mm; Atlantic coast................*D. littoralis* (Horn)
– Head one third broader than long, punctation coarse and dense; colour brownish; body length 1.5 mm; Pacific coast ....*D. pacifica* Fenyes

Diglotta mersa **(Haliday)**
(Figs. 1-14)

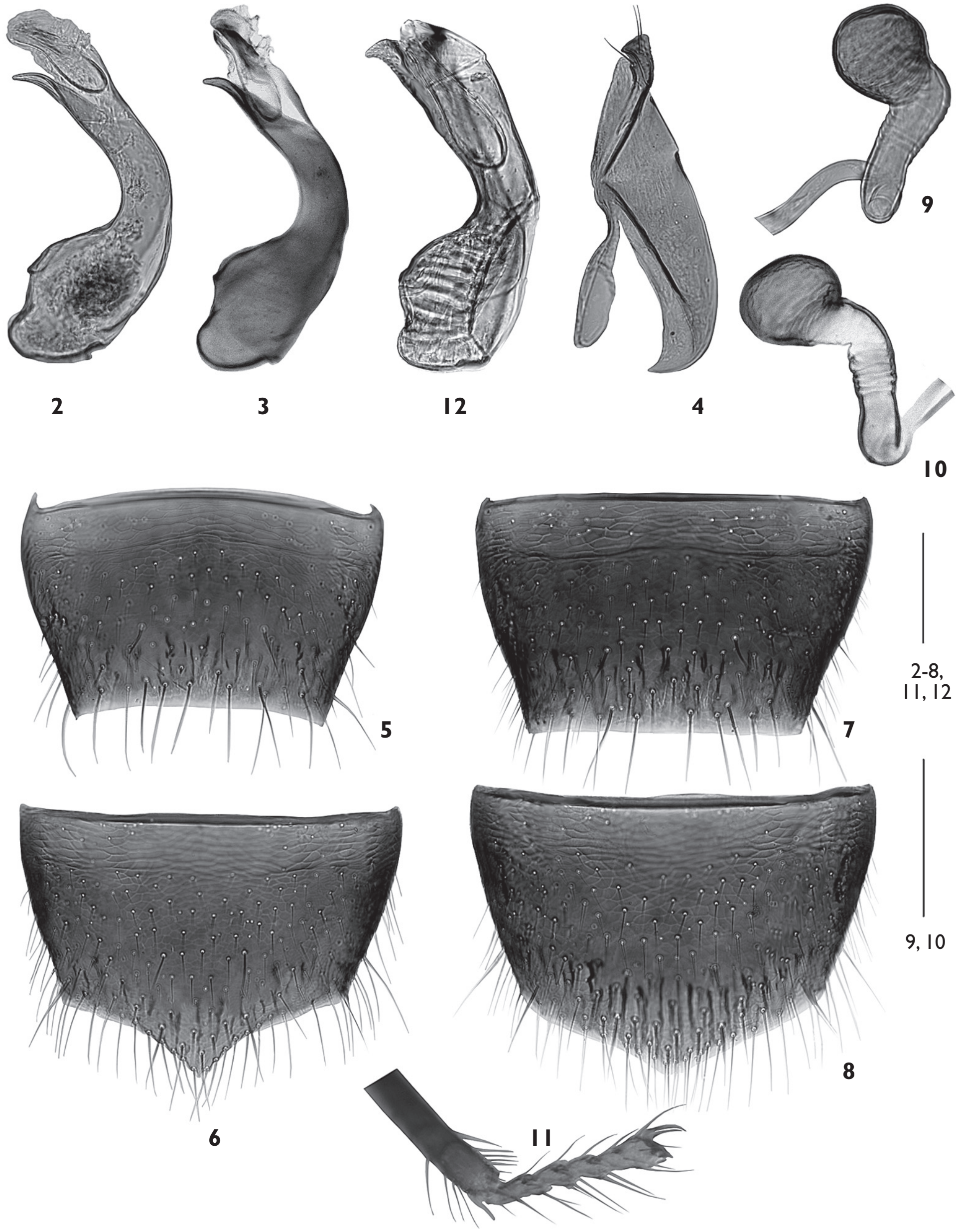
Diglossa mersa Haliday, 1837: 252; Good 1998: 74; Smetana 2004: 421.
Diglossa crassa Mulsant and Rey, 1870: 180; Smetana 2004: 421.
Diglossa submarina (Fairmaire and Laboulbène, 1856: 468). Lohse 1974: 20; Lohse 1985; Lohse and Lucht 1989: 115; Good 1998: 74; Smetana 2004: 421.

Description

Body length 1.9-2.1 mm, body width 0.2-0.3 mm; dark brown to almost black, with tarsi, apical portions of tibiae and apical two articles of maxillary palpi yellowish brown, abdomen slightly darker than remainder of body (Fig. 1); metatarsus with 4 tarsomeres (Fig. 11). Pubescence short and moderately dense, yellowish grey in artificial light. Antennae with scape elongate and as long as pedicel, about 3 times as long as wide, antennomere 3 about twice as long as wide, antennomeres 4-7 approximately subquadrate, 8-10 slightly transverse, and 11 twice as long as preceding article (Fig. 1). MALE. Tergite 8 transverse, truncate apically, antecostal suture slightly pointed medially (Fig. 5). Sternite 8 transverse, strongly produced apically, antecostal suture approximately straight (Fig. 6). Paramere with moderately long apical lobe, its apex rectangular, two macrosetae present in subapical part (Fig. 4). Median lobe of aedeagus with relatively large bulbus bearing narrow crista apicalis, tubus narrowly elongate, arched and with apical part narrow and slightly pointed ventrally, internal sac with subapical sclerites (one visible in lateral view) hooked apically (Figs. 2, 3). FEMALE. Tergite 8 similar to that of male (Fig. 7). Sternite 8 transverse and broadly rounded apically (Fig. 8). Spermatheca with spherical capsule connected to a narrow and slightly elbowed stem (Figs. 9, 11).

Distribution

Diglotta mersa has previously been reported from coastal areas of Europe: Albania, Belgium, Denmark, France, Great Britain, Germany, Ireland, Italy and the Netherlands (Smetana 2004), but due to previous species misinterpretation (Good 1998), the distribution in the Western Palaearctic requires revision. We report this species for the first time from the Atlantic coast of North America (Canada: New Brunswick). *Diglotta mersa* is wing-dimorphic and both winged and wingless forms have been reported in Europe (Good 1998). These observations suggest that the species is capable of long-distance dispersal and may be adventive on the Atlantic coast of North America.



Figs. 2-12. *Diglotta mersa* (Haliday): 2, median lobe of aedeagus in lateral view (New Brunswick); 3, median lobe of aedeagus in lateral view (Europe); 4, paramere (New Brunswick); 5, male tergite 8 (New Brunswick); 6, male sternite 8 (New Brunswick); 7, female tergite 8 (New Brunswick); 8, female sternite 8 (New Brunswick); 9, spermatheca (New Brunswick); 10, spermatheca (Europe); 11, metatarsus with 4 articles (New Brunswick); 12, median lobe of the aedeagus of the holotype of *D. littoralis* in lateral view. Scale bars = 0.1 mm.

Collection data

Sixteen specimens were captured on 12 May 2008 on fine gravel under or adjacent to 10-15 cm rocks in the intertidal zone, approximately 2 m below the mean high tide mark (Figs. 13, 14). Rocks at this site were largely free of algae. An additional 24 specimens were found in July on sea beaches under 10-30 cm diameter rock in sand, about 4.0 m below mean high tide mark, and under 10-80 cm diameter rocks in sand, 2.0 to 5.0 m below mean high tide mark.

Material examined

CANADA, New Brunswick: Charlotte Co., Maces Bay, 45°.1242 N, 66°.4732 W, 11 July 2008, R. P. Webster, coll., sea beach, intertidal zone, under 10 cm diameter rock in sand, about 4.0 m below mean high tide mark (RWC), 1 sex undetermined; Charlotte Co., St. Andrews, 45°.0751 N, 67°.0370 W, 12 July 2008, R. P. Webster, coll., sea beach, intertidal zone, under 30 cm diameter rock in sand, about 4.0 m below mean high tide mark (RWC), 1 sex undetermined; Saint John Co., Dipper Harbour, 45.1154° N, 66.3720° W, 12 May 2008, leg. R.P. Webster, sea beach, intertidal zone, under rock on fine gravel, approximately 2 m below mean high tide mark (LFC, RWC), 6 males, 6 females, 4 sex undetermined; Saint John Co., Chance Harbour off Cranberry Head Road, 45°.1348 N, 66°.3438 W, 6 July 2008, R. P. Webster, coll., sea beach, intertidal zone, under 10-80 cm diameter rocks in sand, 2.0 to 5.0 m below mean high tide mark (LFC, RWC), 21 sex undetermined.

Comments

The median lobe of the aedeagus of the holotype of *Diglotta littoralis* (Horn) is illustrated in Fig. 12. This is the only other species of the genus occurring on the Atlantic coast of North America and it is known only from the holotype, which was collected in New Jersey. The median lobe of this species is presented here for the first time.

Halobrecta flavipes **Thomson, 1861**

(Figs. 13, 14, 15-22)

Description

A description of *Halobrecta flavipes* Thomson is given in Klimaszewski et al. (2002) and Gusarov (2004). This marine littoral species has been previously recorded from the coasts of Europe (Smetana 2004), Inaccessible Islands, Chile, and the United States (New York, Virginia) (Klimaszewski et al. 2002; Gusarov 2004). We report this species for the first time for New Brunswick, Canada, from specimens collected in the intertidal and littoral zones.

Collection data

CANADA, New Brunswick: Charlotte Co., Maces Bay, 45°.1242 N, 66°.4732 W, 11 July 2008, R. P. Webster, coll., sea beach, intertidal zone, under 10-30 cm diameter

Fig. 13. Habitat of *D. mersa* and *H. flavipes* (Chance Harbour, New Brunswick).

Fig. 14. Habitat of *D. mersa* and *H. flavipes* (near Dipper Harbour, New Brunswick).

Fig. 15. *Halobrecta flavipes* Thomson in dorsal view. Scale bar = 1 mm.

rocks in fine gravel/clay mix, about 4.0 m below mean high tide mark (RWC), 2 sex undetermined; Saint John Co., Black Beach, 45°.1539 N, 66°.2282 W, 11 July 2008, R. P. Webster, coll., sea beach, intertidal zone, under 20 cm diameter rock in fine gravel about 3.0 m below mean high tide mark (RWC) 1 sex undetermined; Saint John Co., Chance Harbour off Cranberry Head Road, 45°.1348 N, 66°.3438 W, 6 July 2008, R. P. Webster, coll., sea beach, intertidal zone, under 30-80 cm diameter rocks in fine gravel/clay mix, 3.0 to 5.0 m below mean high tide mark (LFC, RWC), 8 sex undetermined.

Saint John Co., Chance Harbour, 45.1156° N, 66.3610° W, 7 May 2006, leg. M. Giguère and R. Webster, sea beach, in decaying seaweed near mean high tide mark (RWC), 2 females, 1 male; Chance Harbour off Cranberry Head Road, 45.1348° N, 66.3438° W, 12 May 2008, leg. R. P. Webster, sea beach, intertidal zone, under large (30-80 cm) deep-set rocks (covered with *Ascophyllum nodosum* (Linnaeus) Le Jolis, Phaeophyceae, Fucales) in gravel/clay soil about 3 to 3.5 m below mean high tide mark (LFC, RWC), 5 males, 3 females, 40 sex undetermined; Dipper Harbour, 45.1154° N, 66.3720° W, 12 May 2008, leg. R.P. Webster, sea beach, intertidal zone, under deep-set rock on fine gravel, approximately 2 m below mean high tide mark (RWC), 1 male.

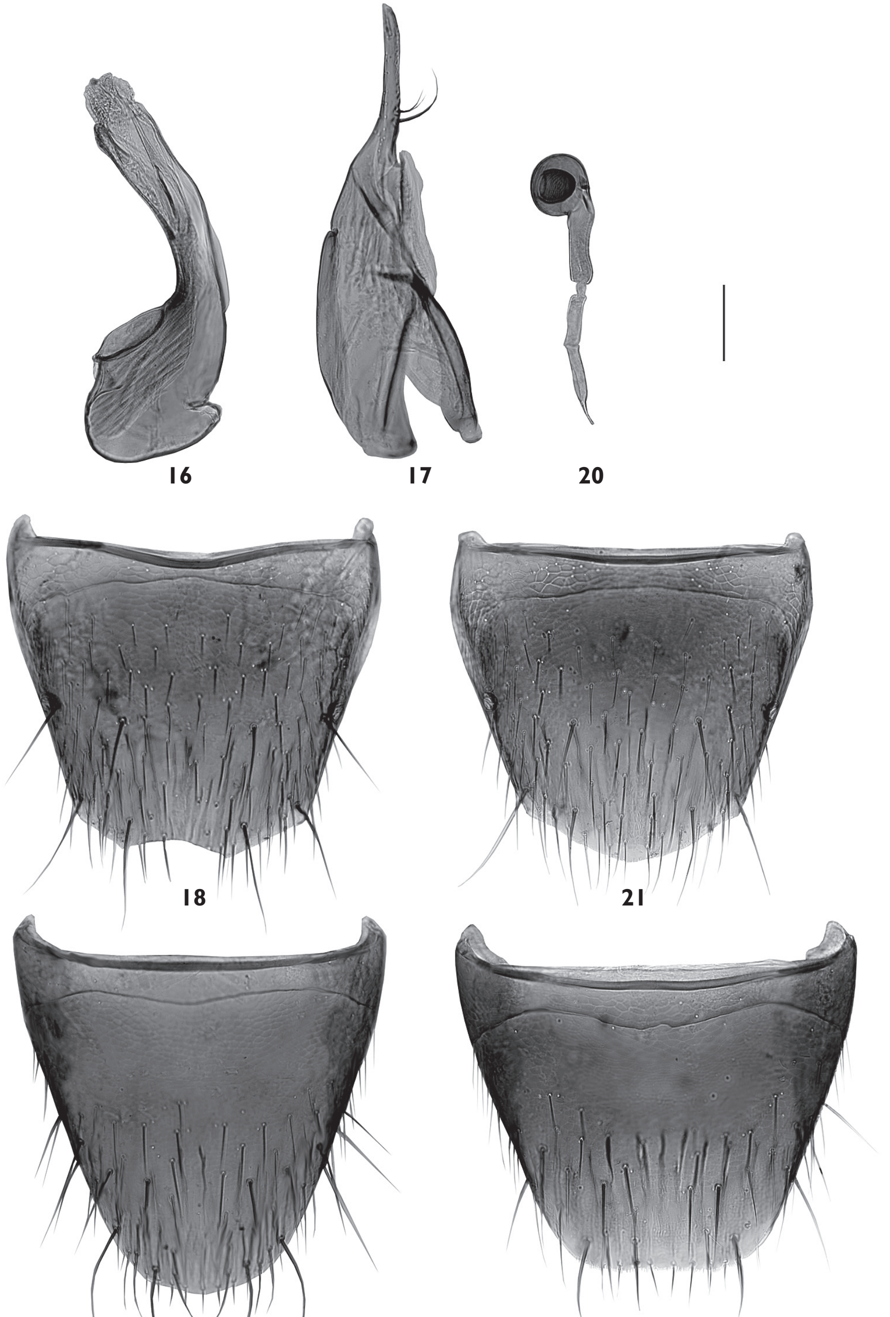
Bionomic notes

Fifty-seven adults of *H. flavipes* were collected from under large deep-set rocks 3.0 to 3.5 m below the mean high tide mark at Chance Harbour in May and July 2008. Many other adults were observed under rocks on these dates. *Micralymma marinum* (Ström) (Staphylinidae, Omalinae) was also common under deep-set rocks at this site, but a few individuals were also observed on the surface of the gravel adjacent to the rocks. Mating pairs of *M. marinum* were also observed under the rocks. Three adults of *H. flavipes* were found under decaying seaweed near the mean high tide mark on 7 May 2006. However, no adults were observed in decaying seaweed or other drift material near the mean high tide mark in 2008.

Discussion

Haghebaert (1991) divided *Diglotta* into two groups based on the tarsal formula, the West Palaearctic species, African species, and Brazilian species (Caron and Ribeiro-Costa 2008) having 4-4-4-articulated tarsi (metatarsus with 4 articles), and the Nearctic and Fiji Islands species having 4-4-5-articulated tarsi (metatarsus with 5 articles). It is noteworthy that the Brazilian species has a tarsal formula of 4-4-4 while all native North American species have 4-4-5-articulated tarsi. The tarsal articulation of all known *Diglotta* species should be reexamined and confirmed. Based on such a reexamination, the two groups will probably warrant distinct taxonomic status.

Based on the available zoogeographic data, an explanation of the presence of *D. mersa* in New Brunswick may seem somewhat speculative. However, because the species is wing-dimorphic (Good 1998), and due to the absence of its previous records



Figs. 16-22. *Halobrecta flavipes* Thomson: 16, median lobe of aedeagus in lateral view (New Brunswick); 17, paramere (New Brunswick); 18, male tergite 8 (New Brunswick); 19, male sternite 8 (New Brunswick); 20, female tergite 8 (New Brunswick); 21, female sternite 8 (New Brunswick); 22, spermatheca (New Brunswick). Scale bar = 0.1 mm.

in North America, it is plausible to believe that the North American population originated in Europe.

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RESEARCH ARTICLE

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Contributions to the knowledge of Atlantic Canadian Histeridae (Coleoptera)

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Abstract

New records of Histeridae from Atlantic Canada are reported. Three species are newly recorded from Prince Edward Island and two from New Brunswick, one of which, the adventive Palearctic *Atholus bimaculatus* (Linnaeus), is newly recorded from Atlantic Canada as a whole. These new records increase the known histerid fauna of the region to 37 species, 30 native and 7 introduced ones. The regional zoogeography of the Histeridae is examined focusing on differences between the faunal composition of the various provinces and the possible reasons responsible for these. The island faunas of Cape Breton, Prince Edward Island, and insular Newfoundland are examined. All have reduced faunas in comparison with the mainland perhaps as a result of island-associated diminutions, an area effect, a paucity of collecting, or a combination of these factors. Those of Cape Breton and Prince Edward Island are proportionately similar to those of other families of Coleoptera, whereas that of Newfoundland (only 10% of the mainland fauna) is significantly less, a circumstance that deserves further investigation.

Seven species of adventive histerids have been recorded in the region. The average dates of first detection of these species are much later than the earliest records of these species in North America and comparatively later than is the case with other suites of adventive species in the Staphylinidae and Carabidae, perhaps as a result of the sparse attention the Histeridae have historically received by coleopterists in the region. Most of the adventive histerids are known to be synanthropic and may have been introduced to the region association with the importation of livestock and materials related to animal husbandry. The Histeridae of the region largely fall into one of several trophic guilds: coastal species and those associated with beach-drift material; species associated with bird nests; species associated with mammal nests; myrmecophilous species; saproxylic species found in sub-cortical environments; and generalist species found in a wide variety of decomposing situations.

Keywords

Coleoptera, Histeridae, Atlantic Canada, biodiversity, zoogeography, introduced species, new records

Introduction

Historically the hister beetles (Histeridae) have been relatively neglected by both taxonomists and ecologists. Many species occur in decaying materials of all kinds, in ant nests, or under the bark of trees, and have received little attention. This has been unfortunate since the family is both economically and ecologically significant. Those species found in decaying organic matter are predaceous, feeding on fly larvae, while the sub-cortical species are predaceous on various wood and bark-boring insects. Other species are myrmecophilous and live in association with ants.

Over 3,800 species are known worldwide of which 435 species have been recorded in North America and 135 in Canada (Kovarik and Caterino 2000; Marske and Ivie 2003; Bousquet and Laplante 2006). Twenty-one species were recorded in Atlantic Canada by Davies (1991), although the records of *Plegaderus transversus* (Say, 1825) and *Paromalus bistriatus* Erichson, 1834 from Newfoundland were apparently in error. They were not included in the comprehensive review and survey of the Canadian fauna by Bousquet and Laplante (2006) that recorded 36 species from the Atlantic Provinces. In their review 22 species are recorded from New Brunswick, 32 from Nova Scotia, 5 from insular Newfoundland, and 11 from Prince Edward Island. The present paper, based on ongoing research on the biodiversity of the Coleoptera of the region, reports new provincial records of five species from Atlantic Canada, including one, *Atholus bimaculatus* (Linnaeus, 1758), newly recorded for the region.

Methods and conventions

Codens (following Evenhuis 2007) of collections examined and referred to in this study are:

ACPE Agriculture and Agri-food Canada, Charlottetown, Prince Edward Island
CGMC Christopher G. Majka collection, Halifax, Nova Scotia
NBM New Brunswick Museum, Saint John, New Brunswick
UPEI University of Prince Edward Island, Charlottetown, Prince Edward Island

The systematics, taxonomy, and nomenclature follow Bousquet and Laplante (2006).

Results

Aeletes politus (LeConte, 1853), *Paromalus teres* LeConte, 1878, and *Margarinotus faedatus* (LeConte, 1845) are newly recorded from Prince Edward Island; *Hister curtatus* LeConte, 1844 and *Atholus bimaculatus* are newly recorded from New Brunswick, the latter species being newly recorded for Atlantic Canada. The

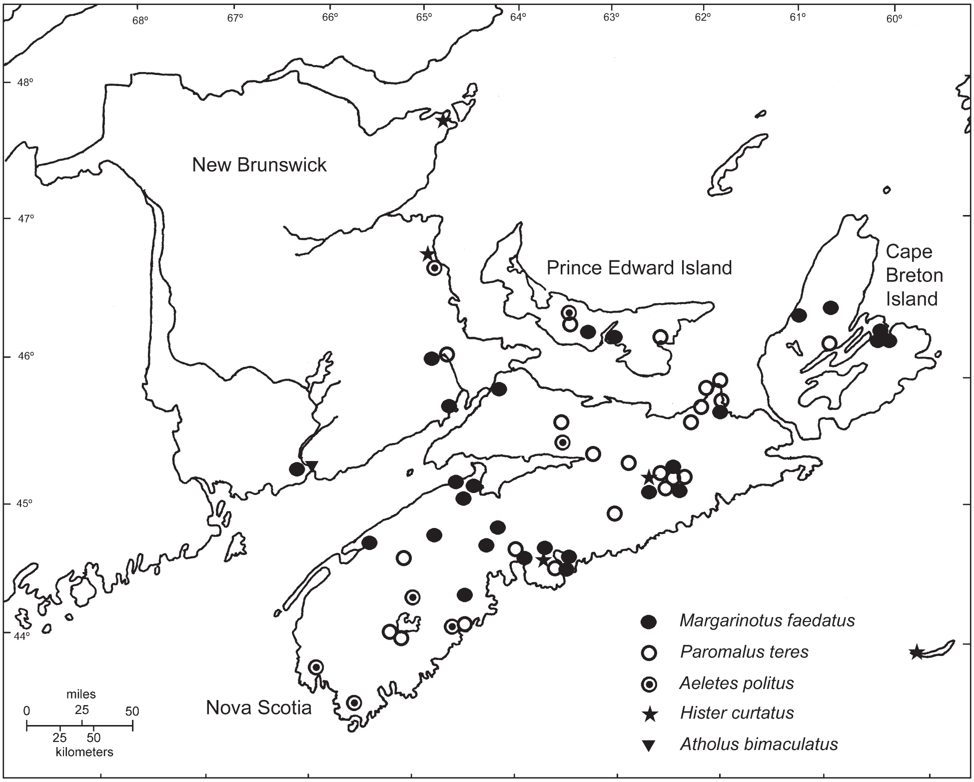

Fig. 1. The distribution of *Margarinotus faedatus, Paromalus teres, Aeletes politus, Hister curtatus,* and *Atholus bimaculatus* in Atlantic Canada.

known distribution of these five species in Atlantic Canada is shown in Figure 1. Specific details follow.

Aeletes politus (LeConte, 1853)

Prince Edward Island: Queens Co.: Trout River, 28.VI.2003, C.G. Majka, brackish marsh, (1, CGMC).

Aeletes politus is newly recorded on Prince Edward Island. There are scattered records from throughout the Maritime Provinces, although it has not been recorded on Cape Breton Island (Fig. 1). It is known in Canada from Ontario, Quebec, New Brunswick, and Nova Scotia (with an isolated record from west-central Alberta), and occurs south to Florida in the United States. It is found in forest floor litter, log litter, bracket fungi, tree holes, and compost (Bousquet and Laplante 2006). The above record from a brackish marsh represents an unusual habitat for this species, possibly attracted to the site by accumulations of decomposing litter.

Paromalus teres LeConte, 1878

Prince Edward Island: Kings Co.: Woodville Mills, 23.VII.2001, C.G. Majka, *Dryocoetes autographus* burrows in *Picea rubens*, (1, CGMC); **Queens Co.:** St. Patricks, 19.VII.2001, 14.VII.2002, 17.VIII.2002, 18.VIII.2002, *Dryocoetes affaber, Ips borealis,* and *Polygraphus rufipennis* burrows in *Picea rubens*, (7, CGMC).

Paromalus teres is newly recorded on Prince Edward Island. The species is generally distributed in the Maritime Provinces, although few records are known from New Brunswick (Fig. 1). It has been recorded in Canada from the Northwest Territories, Alberta, Ontario, Quebec, New Brunswick, and Nova Scotia and occurs in neighbouring states in the United States from Minnesota to New York and Connecticut. It is found under the bark of dead spruces and pines (Bousquet and Laplante 2006).

Margarinotus faedatus (LeConte, 1845)

Prince Edward Island: 1974-1983, (6, UPEI); **Queens Co.:** Harrington, 9.VIII.2004, C. Noronha, barley field, (1, ACPE); Mount Herbert, 1920-1924, J.R. Mutch, (1, UPEI).

Margarinotus faedatus is newly recorded on Prince Edward Island. The species is widely distributed in the Maritime Provinces (Fig. 1). It has been recorded in Canada from Ontario, Quebec, New Brunswick, and Nova Scotia, and occurs south to Texas and Georgia in the United States. It is found in decaying organic matter such as carrion, dung, and rotten mushrooms (Bousquet and Laplante 2006).

Hister curtatus LeConte, 1844

New Brunswick: Gloucester Co.: 9.VIII.1980, G. Gallien, (1, UMNB); **Kent Co.:** Kouchibouguac National Park, 13.VII.1979, Y. Chaisson, (1, UMNB).

Hister curtatus is newly recorded in New Brunswick. This species has been recorded in Canada from southern Manitoba, Ontario, and Quebec as well as from Sable Island and from one site on the mainland (Lake Little, Halifax County) of Nova Scotia (Fig. 1). It is found in leaf litter and carrion (Bousquet and Laplante 2006).

Atholus bimaculatus (Linnaeus, 1758)

New Brunswick: Saint John Co.: Saint John, 27.III.1898, P. R. McIntosh, NBM.

Atholus bimaculatus is newly recorded in New Brunswick and in Atlantic Canada. This introduced, Palearctic hister beetle has been recorded in Canada from British Columbia east to southern Québec (Bousquet and Laplante 2006). In Europe, it is known throughout the continent east to at least southern and central Russia (Yélamos and

Lackner 2007). It is now almost cosmopolitan in distribution and is found in dung and decaying vegetable matter (Bousquet and Laplante 2006).

Discussion

These new records increase the known histerid fauna of New Brunswick to 24 species (20 native and 4 adventive), that of Prince Edward Island to 14 species (12 native and 2 adventive), and that of the Atlantic Canada to 37 species (30 native and 7 adventive) (Table 1).

Regional zoogeography

Examining the composition of the fauna, several trends become apparent. Four native species, *Plegaderus confusus* Bousquet & Laplante, 1999, *Geomysaprinus moniliatus* (Casey, 1916), *Hypocaccus bigener* (LeConte, 1844) and *Hister abbreviatus* Fabricius, 1775, have been found in New Brunswick but not in Nova Scotia. They are candidates for species that have, for climatic or other environmental reasons, reached the limit of their distribution in New Brunswick, or which have found the Northumberland Strait and/or the isthmus of Chignecto as obstacles to geographical dispersal. Alternatively, they could be present but have remained undetected. They represent 13.3% of the native histerid fauna, very similar to the 12.4% of the native elaterid fauna (Majka and Johnson 2008) and 13.5% of the native carabid fauna (Majka *et al.* 2007) found in New Brunswick but not in Nova Scotia.

There are ten native species, *Gnathoncus barbatus* Bousquet & Laplante, 2006, *Platysoma lecontei* Marseul, 1853, *Platysoma deficiens* (Casey, 1924), *Margarinotus cognatus* (LeConte, 1844), *Margarinotus confusus* Wenzel, 1944, *Margarinotus egregius* (Casey, 1916), *Margarinotus marginicollis* (LeConte, 1845), *Margarinotus stygicus* (LeConte, 1845), *Spilodiscus arcuatus* (Say, 1825), and *Atholus perplexus* (LeConte, 1863), which have been found in Nova Scotia and not in New Brunswick. It is probable that many of these occur in New Brunswick but have not been detected as a result of the comparative paucity of collecting effort in the latter province. However, two species, *M. stygicus* and *S. arcuatus*, have not otherwise been recorded in Atlantic Canada nor from Québec. The Nova Scotia populations of both appear to be disjunct and isolated from the balance of the range of these species. *Margarinotus stygicus,* associated with mammal nests, is otherwise found in the United States north to southern Ontario and Rhode Island, whereas *S. arcuatus* is a primarily coastal species ranging from the Florida panhandle north to New Hampshire (Bousquet and Laplante 2006). It is possible that these species may have colonized Nova Scotia from the New England states (northeastern U.S.A.) across post-glacial, emergent land-bridges and island chains that existed between Cape Cod, Georges Bank, and the continental shelf of Nova Scotia from circa 14,500 to 8,000 years

Table 1. Atlantic Canadian Histeridae

Species	NB	NS	CB	PE	NF	Trophic Category	Habitat	Regional Distribution
Abraeinae								
Plegaderini								
Plegaderus confusus Bousquet & Laplante	1					SX	subcortical: deciduous	NH, NY, ON, QC
Plegaderus sayi Marseul	1	1	1			SX	subcortical: conifers	MA, ME, NH, ON, QC
Acritini								
Aeletes politus (LeConte)	1	1	1	1		SP	litter, fungi, tree holes, compost	MA, ME, NH, ON, QC, RI
Saprininae								
Gnathoncus barbatus Bousquet & Laplante		1	1			SP	bird nests	ON, QC
Gnathoncus communis (Marseul) †		1				SP	bird nests	ME, NH, ON, QC
Gnathoncus rotundatus (Kugelann) †	1	1			1	SP	synanthropic: bird nests	ON, QC
Euspilotus assimilis (Paykull)	1	1		1		SP	carrion	MA, ME, NH, ON, QC, RI
Geomysaprinus moniliatus (Casey)	1					SP	mammal nests	ME, NH, ON, QC
Hypocaccus bigener (LeConte)	1					SP	sand pits	NH, ON, QC
Hypocaccus fraternus (Say)	1	1	1	1	1	SP	seashore: beach drift	NH, ON, QC, RI
Baeckmanniolus dimidiatipennis (LeConte)	1	1	1	1	1	SP	seashore: beach drift	CT, ME, NH, NY, QC, RI
Dendrophilinae								
Dendrophilini								
Dendrophilus punctatus (Herbst) †		1				SX ?	deciduous trees Europe synanthropic: granaries, bird nests	NH, ON, QC, RI
Paromalini								
Carcinops pumilo (Erichson) †	1	1	1	1	1	SP	synanthropic: stables, mills, bird nests	MA, ME, NH, ON, QC, RI

Species	NB	NS	CB	PE	NF	Trophic Category	Habitat	Regional Distribution
Paromalus teres LeConte	1	1	1	1	1	SX	subcortical: conifers	CT, NH, NY, ON, QC
Histerinae								
Platysomatini								
Platysoma lecontei Marseul		1				SX	subcortical: deciduous	MA, ME, NH, ON, QC, RI
Platysoma coarctatum LeConte	1	1				SX	subcortical: conifers	MA, ME, NH, ON, QC, RI
Platysoma deficiens (Casey)		1				SX	subcortical: conifers	MA, ON, QC
Platysoma gracile LeConte	1	1				SX	subcortical: deciduous	NH, ON, QC
Histerini								
Margarinotus brunneus (Fabricius) †	1	1	1	1		SP	carrion, decaying vegetation	MA, NH, ON, QC
Margarinotus cognatus (LeConte)		1				SP	?	ME, NH, ON, QC, RI
Margarinotus confusus Wentzel		1				SP	mammal nests	NH, ON, QC
Margarinotus faedatus (LeConte)	1	1	1	1		SP	carrion, dung, fungi	ME, NH, ON, QC
Margarinotus egregius (Casey)		1				SP	mammal nests, dung, carrion	NH, ON, QC
Margarinotus hudsonicus (Casey)	1	1	1			SP	fungi, carrion, dung	ME, NH, ON, QC
Margarinotus immunis (Erichson)	1	1		1		SP	carrion, decaying vegetation	NH, ON, QC, RI
Margarinotus interruptus (de Beauvois)	1	1		1		SP	dung, carrion	NH, ON, QC, RI
Margarinotus lecontei Wenzel	1	1		1		SP	carrion, dung, fungi	MA, ME, NH, ON, QC
Margarinotus merdarius (Hoffman) †		1	1			SP	synanthropic: bird nests, dung, compost	ME, NH, ON, QC, RI
Margarinotus marginicollis (LeConte)		1				SP	mammal nests	MA, NH, ON, QC, RI
Margarinotus stygicus (LeConte)		1				SP	mammal nests	ON, RI
Hister abbreviatus Fabricius	1					SP	carrion, dung, fungi	MA, NH, ON, QC
Hister curtatus LeConte	1	1				SP	leaf litter, carrion	ME, NH, QC
Hister furtivus LeConte	1	1	1	1		SP	carrion, dung, fungi	MA, ME, NH, ON, QC, RI
Spilodiscus arcuatus (Say)		1				SP	seashore: sand dunes	NH, RI
Psiloscelis planipes (LeConte)	1	1	1	1		MY?	ant nests ?	MA, ON, QC, MA, RI

Species	NB	NS	CB	PE	NF	Trophic Category	Habitat	Regional Distribution
Atholus bimaculatus (Linnaeus) †	1					SP	dung, decaying vegetation	NH, ON, QC
Atholus perplexus (LeConte)		1		1		SP	mammal nests, dung	ON, QC, PE
Totals	24	32	13	14	5			

Notes: NB, New Brunswick; NS, Nova Scotia; CB, Cape Breton Island; PE, Prince Edward Island; NF, insular Newfoundland; MY, Myrmecophilous; SP, Saprophytic; SX, Saproxylic; †, adventive Palearctic species.

Regional Distribution: Northeastern North America (in addition to the provinces of Atlantic Canada) is taken to include of the following jurisdictions: CT, Connecticut; MA, Massachusetts; ME, Maine; NH, New Hampshire; NY, New York; ON, Ontario; QC, Québec; RI, Rhode Island; PM, Saint-Pierre et Miquelon; VT, Vermont.

BP (King 1996). This mechanism is well documented in the case of Nova Scotia's coastal-plain flora (Keddy and Wisheu 1989).

Island faunas

The native island faunas of Cape Breton (10 species, i.e., 33% of the native fauna), with a land area of 10,311 km^2 and 1.5 km from the mainland, Prince Edward Island (11 species, i.e., 37%), with a land area of 5,660 km^2 and 13 km from the mainland, and insular Newfoundland (3 species, i.e. 10%), with a land area of 111,390 km^2, 18 km distant from Labrador and 110 km from Cape Breton Island**,** are reduced in comparison with the mainland fauna. This may represent island-associated diminutions, an area effect, a paucity of collecting, or a combination of these factors. In comparison, 58% of native Carabidae and 50% of native Elateridae of the Maritime Provinces have been recorded on Cape Breton, and 47% of the region's native Carabidae and 38% of the Elateridae have been recorded on Prince Edward Island (Majka and Johnson 2008; Majka *et al.* 2007b, 2008). There are no species found on any of these islands that are not also present on the mainland.

The native histerid fauna of insular Newfoundland (3 species, i.e. 10%) appears to be particularly impoverished. In comparison, 47% of the native Carabidae of Atlantic Canada have been recorded on Newfoundland (Majka et al. 2007b). It is unclear if this low representation is as a result of insufficient collecting or if other factors are responsible. Two of the native species, *Hypocaccus fraternus* (Say, 1825) and *Baeckmanniolus dimidiatipennis* (LeConte, 1824), are coastal species associated with beach drift (see below) while *Paromalus teres* is a saproxylic species found under the bark of coniferous trees. It may be that many North American histerids are less tolerant of colder, northern environmental circumstances. Bousquet and Laplante (2006) record only three histerids from the Yukon Territory, four from the Northwest Territories (all native species), and none from Nunavut or Labrador from a Canadian fauna of 135 species. *Hypocaccus fraternus* and *B. dimidiatipennis* have only been recorded in the extreme southwest of Newfoundland whereas *P. teres* is known only from the Avalon peninsula in the southeast of the province.

The beetle faunas of smaller islands in the region have been comparatively little investigated. Majka et al. (in press) reported *H. fraternus* in beach-drift material from Scatarie Island (2 km from the Nova Scotia coast) and Ogden and Majka (unpublished data) have found *H. fraternus* and *B. dimidiatipennis* in beach-drift material on Brier Island (1 km from the Nova Scotia coast). Wright (1989) recorded both species on sand beaches, as well as under carrion and horse dung, on Sable Island (160 km from the Nova Scotia coast). As halo-tolerant beach-drift inhabitants, these two species would appear to be able to disperse readily, either aerially or on floating material, to coastal and island environments. Wright (1989) also recorded *Hister curtatus* as common on Sable Island, a rather surprising discovery given the apparent scarcity of this species in the region as a whole. In discussing the mite (Acari) fauna of Sable Island

Majka et al. (2007a) raise the possibility that such Sable Island "relict species" may have arrived there via post-glacial island chains and land bridges across the continental shelf and have subsequently been isolated by rising sea-levels, a circumstance which may also apply to the population of *H. curtatus* present there.

Adventive species

Seven species of adventive histerids have been recorded in the region (Table 2). The introductions of these species to North America evidently took place a considerable time ago since all seven are known from the continent from dates ranging from 1825 to 1862 with the mean date of first detection being 1839. In contrast, these species in Atlantic Canada have been recorded only much more recently. With the exception of *Atholus bimaculatus,* which was recorded in New Brunswick in 1898, the other six species have only been first detected in the region between 1948 and 1993 (mean = 1960), on average 121 years later than in North America. In contrast, of the 79 species of adventive Staphylinidae known in the Maritime Provinces, the mean date of their first detection in North America is 1904, whereas the mean date of first detection in the region is 1967, on average 63 years later (derived from Majka and Klimaszewski 2008). For the 35 adventive Carabidae found in the Maritime Provinces, the mean date of first detection in North America is 1916 whereas the mean date of first detection in the region is 1943, a difference of only 27 years (derived from Majka et al. 2007b). These differences are probably in

Table 2. Dates of first detection of adventive Histeridae in Atlantic Canada

Species	NB	NS	PEI	NF	North America	Source
Gnathoncus communis (Marseul)		**1967**			1862	Marseul (1862)
Gnathoncus rotundatus (Kugelann)	?	**1965**		1981	1844	LeConte (1844)
Dendrophilus punctatus (Herbst)		**1967**			1825	Say (1825)
Carcinops pumilo (Erichson)	2005	2003	1993	**1974**	1834	Erichson (1834)
Atholus bimaculatus (Linnaeus)	**1898**				1825	Say (1825)
Margarinotus brunneus (Fabricius)	1965	**1948**	1953		1837	Harris (1837)
Margarinotus merdarius (Hoffman)		**1983**			1845	LeConte (1845

Boldface entries signify the earliest dates for a species in the region.

large measure attributable to the different degrees of attention and collecting effort that these families have received in Atlantic Canada. The Carabidae have historically been much more extensively investigated than either the Staphylinidae or the Histeridae.

Lindroth (1957) and Brown (1950) both proposed that dry-ballast shipments commencing in the early 17th century and continuing until the early 19th century, were responsible for the introduction of many Carabidae and other species of Coleoptera frequenting coastal environments. However, in his extensive survey of the seven principal sites in southwestern England where dry ballast originated, Lindroth (1957) found only one histerid, *Margarinotus purpurascens* (Herbst, 1792). This species is known in Canada only from southwestern British Columbia (Bousquet and Laplante 2006).

In contrast, at least four of the adventive histerids found in Atlantic Canada, *Gnathoncus rotundatus* (Kugelann, 1792), *Dendrophilus punctatus* (Herbst, 1792), *Carcinops pumilo* (Erichson, 1834), and *Margarinotus merdarius* (Hoffman, 1803) are synanthropic species associated with stables, hen houses, mills, granaries, and similar areas related to the husbandry of animals, or with the storage of dried products (Bousquet and Laplante 2006). *Atholus bimaculatus*, *M. merdarius*, and *Margarinotus brunneus* (Fabricius, 1775) are associated with dung, carrion, and decaying vegetation while *Gnathoncus communis* (Marseul, 1862) is found in bird nests. The synanthropic habits of these species suggest that they may have been introduced to the region, and to the continent, in association with the importation of livestock and materials related to animal husbandry. In this regard, *D. punctatus* is an apparent anomaly. Although in Europe it is most frequently found in bird nests, granaries, and mills, in North America it seems to be primarily a saproxylic species found under bark and in deciduous tree hollows (Bousquet and Laplante 2006). Possibly, in the New World, it has reverted to ancestral, pre-synanthropic habits.

Habits and habitats

Examining the environment column of Table 1, 28 species of Histeridae are predators found in saprophytic environments (dung, carrion, decaying vegetation, decomposing fungi, etc.); eight are saproxylic species, predators in subcortical or decaying wood environments; and one, *Psiloscelis planipes* (LeConte, 1852), is probably a myrmecophilous species associated with ant nests. The “habitat” column of Table 1 provides further bionomic details with respect to these species, indicating that a variety of habitats are utilized.

Hypocaccus fraternus and *B. dimidiatipennis* are largely associated with coastal beach drift environments and *Hypocaccus bigener* (LeConte, 1844) and *Spilodiscus arcuatus* (Say, 1825) are found in sand dune and sand pit areas. Species such as *Gnathoncus barbatus, G. communis, G. rotundatus, C. pumilo,* and *M. merdarius* are largely or occasionally associated with bird nests while *Geomysaprinus moniliatus, M. confusus, M.*

egregius, M. marginicollis, M. stygicus, and *A. perplexus* are in large measure associated with mammal nests.

A substantial number of species including *A. politus*, *M. brunneus, M. faedatus*, *M. egregius, Margarinotus hudsonicus* (Casey, 1893), *Margarinotus immunis* (Erichson, 1834), *Margarinotus interruptus* (Palisot de Beauvois, 1818), *Margarinotus lecontei* Wenzel, 1944, *M. merdarius, Hister abbreviatus* Fabricius, 1775, *H. curtatus*, *Hister furtivus* LeConte, 1859, and *A. bimaculatus* appear to be generalist predators found in many kinds of decomposing situations, although *Euspilotus assimilis* (Paykull, 1811) appears to favour carrion. The beach drift species, the bird and mammal nest species, and generalist decomposing environment species, are all predators of the larvae and eggs of Diptera (Kovarik and Caterino 2000).

Although specific information with respect to *P. planipes* is lacking, other species in this genus are associated with ants. Adults capture and feed on ants (Kovarik and Caterino 2000).

The guild of subcortical histerids found in Atlantic Canada include *Plegaderus confusus, Plegaderus sayi* Marseul, 1856, *Paromalus teres, Platysoma lecontei* Marseul, 1853, *Platysoma coarctatum* LeConte, 1844, *Platysoma deficiens* (Casey, 1924), *Platysoma gracile* LeConte, 1845, and *D. punctatus*. Of these, *P. confusus, P. lecontei,* and *D. punctatus* are associated with deciduous trees, while the other four species are found under the bark of conifers. Subcortical histerids feed on the larvae of wood-boring beetles, particularly those of the Scolytinae (Curculionidae) (Kovarik and Catarino 2000).

Conclusions

Although Bousquet and Laplante's (2006) survey and revision was a milestone in terms of developing an understanding of the Canadian histerid fauna, it is evident that there is more to be learned with respect to this interesting and important family in Atlantic Canada. The Histeridae of New Brunswick remain relatively little investigated and it is likely that many additional species remain to be found there. The dearth of species recorded from Newfoundland is unusual and further fieldwork is required to ascertain if this is due to a genuine paucity of species, or is an artifact of insufficient collecting.

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RESEARCH ARTICLE

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The genus *Calodera* Mannerheim in Canada (Insecta, Coleoptera, Staphylinidae, Aleocharinae)

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Abstract

The Holarctic genus *Calodera* Mannerheim, 1830 is reported from Canada for the first time. Two species are identified. One of them is probably undescribed; the other, *C. parviceps* (Casey, 1893), is redescribed and illustrated. A key to the North American representatives of the genus is provided.

Keywords

Staphylinidae, Aleocharinae, *Calodera*, taxonomy, biogeography, ecology, diagnosis, first record, Canada

Introduction

The distribution of the oxypodine genus *Calodera* Mannerheim, 1830 appears to be confined to the northern and temperate parts of the Holarctic region. The generic placement of species described and recorded from other zoogeographic regions and currently attributed to *Calodera* is probably incorrect. So far, all the revised species from these regions have proved to refer to other genera (Assing 2003a). At present, nineteen species are known from the Holarctic region, sixteen of them from the Palaearctic (including a species of uncertain status) and three from the Nearctic region. While the Palaearctic representatives have been revised recently (Assing 1996, 2003a, 2003b, 2004), the North American species have never been studied comprehensively. Up until a few years ago, only one Nearctic species had been attributed to *Calodera*, *C. infuscata* Blatchley, 1910 from Indiana. Recently, two additional species were transferred to the genus from *Amarochara* Thomson, 1858, *C. parviceps* (Casey, 1893) from Rhode Island and *C. caseyi* Assing, 2002 – a replacement name for the secondary homonym *C. humilis* (Casey, 1893) – from Pennsylvania (Assing 2002). *Calodera* species were previously unknown from Canada (Gouix and Klimaszewski 2007).

Almost all the *Calodera* species are rare and local. They generally inhabit moist habitats such as swamps, moist leaf litter near water (rivers, streams, lakes, etc.), and floodplain forests. At least the Palaearctic species are mostly collected in early spring. Occasionally, several species may occur syntopically. In Germany, for example, as many as six species have been recorded in the same locality (Assing 1996).

Identification of *Calodera* species is generally difficult. Within most species groups a reliable determination is possible only based on the internal structures of the aedeagus. External characters and the spermatheca are subject to considerable intraspecific and, at the same time, little interspecific variation (Assing 1996).

On the occasion of a recent visit to Laurentian Forestry Centre in Québec, Jan Klimaszewski drew my attention to Oxypodini specimens on loan from the Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa. This material also included specimens of *Calodera*, the first records of the genus from Canada.

Material and methods

The material referred to in this study is deposited in the following collections:

CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Agriculture and Agri-Food Canada, Ottawa, Canada
cAss private collection V. Assing, Hannover, Germany

The morphological studies were carried out using a Stemi SV 11 microscope (Zeiss Germany) and a Jenalab compound microscope (Carl Zeiss Jena). For the photographs a digital camera (Nikon Coolpix 995) was used.

Head length was measured from the anterior margin of the frons to the posterior margin of the head; elytral length at suture from the apex of the scutellum to the posterior margin of the elytra.

The map was generated using the online generic mapping tool (GMT) of the Geomar website at www.aquarius.ifm-geomar.de/omc.

Results

Calodera parviceps (Casey, 1893)

Nasirema parviceps Casey, 1893: 309.
Amarochara parviceps; as synonym of *A. umbrosa*: Bernhauer and Scheerpeltz (1926).
Calodera parviceps: Assing (2002).

Type material examined. See Assing (2002)

Additional material examined. Canada: New Brunswick: 1 ex., Kouchibouguac National Park, 5.VII.1977, leg. Vockeroth (CNC); 1 ex., same data, but 18.VI.1977 (CNC); 1 ex., same data, but 30.VI.1977 (CNC); 1 ex., same data, but 26.VI.1977 (CNC); 1 ex., same data, but 18.IX.1977, leg. Campbell (CNC); 9 exs., same data, but 15.IX.1977, leg. Campbell, Miller, Smetana (CNC, cAss); 1 ex., same data, but 21.IX.1977, leg. Smetana (CNC). **Ontario:** 1♀, Carp, 20.X.1954, leg. Becker (CNC); 1♀, Lanark Co., Mississippi Lake, 22.X.1967, leg. Smetana (CNC); 2♀♀, 22 mi. N Hurkett, Black Sturgeon Lake, 26.VI.1973, leg. Parry & Campbell (CNC); 1♀, Montreal River Harbour, 7.VI.1973, leg. Campbell & Parry (CNC); 12 ♀♀, Ottawa, Shirleys Bay, 2.V.1979, leg. Smetana (CNC, cAss); 2♀♀, Leeds & Greenv. Co., 2 km SE Spencerville, 30.IV.1979, leg. Smetana (CNC, cAss). **Nova Scotia:** 2 exs., Cape Breton Highlands N. P., Warren Lake trail, 12 m, alder litter and moss, 26.IX.1984, leg. Campbell & Davies (CNC); 1 ex., Cape Breton Highlands N. P., near Benjies Lake, 17.VI.1984, leg. Smetana (cAss).

Redescription. In external characters (Fig. 1) such as size, habitus, punctation, microsculpture resembling the European *C. rufescens* Kraatz, 1856. Body length 2.8-3.5 mm. Coloration highly variable: head blackish-brown to black; pronotum and elytra rufous to black; abdomen uniformly blackish or bicoloured with segments III-V and apex reddish to brown; legs and antennae reddish to blackish, usually with the basal 2-3 antennomeres somewhat paler.

Head approximately as long as wide, with a posterior constriction of about 0.6 times the width of head (Fig. 2); eyes approximately as long as postocular region in dorsal view; punctation fine and of variable density; integument with or without shallow microsculpture; antenna as in Fig. 3.

Pronotum approximately as wide as long and approximately 1.15 times as wide as head (Fig. 2); punctation fine and dense, but density subject to pronounced variation; dorsal surface with or without shallow microsculpture.

Elytra approximately 1.4 times as wide as pronotum and at suture slightly shorter than pronotum, with or without microsculpture (Fig. 2); punctation finer than that of pronotum. Hind wings fully developed.

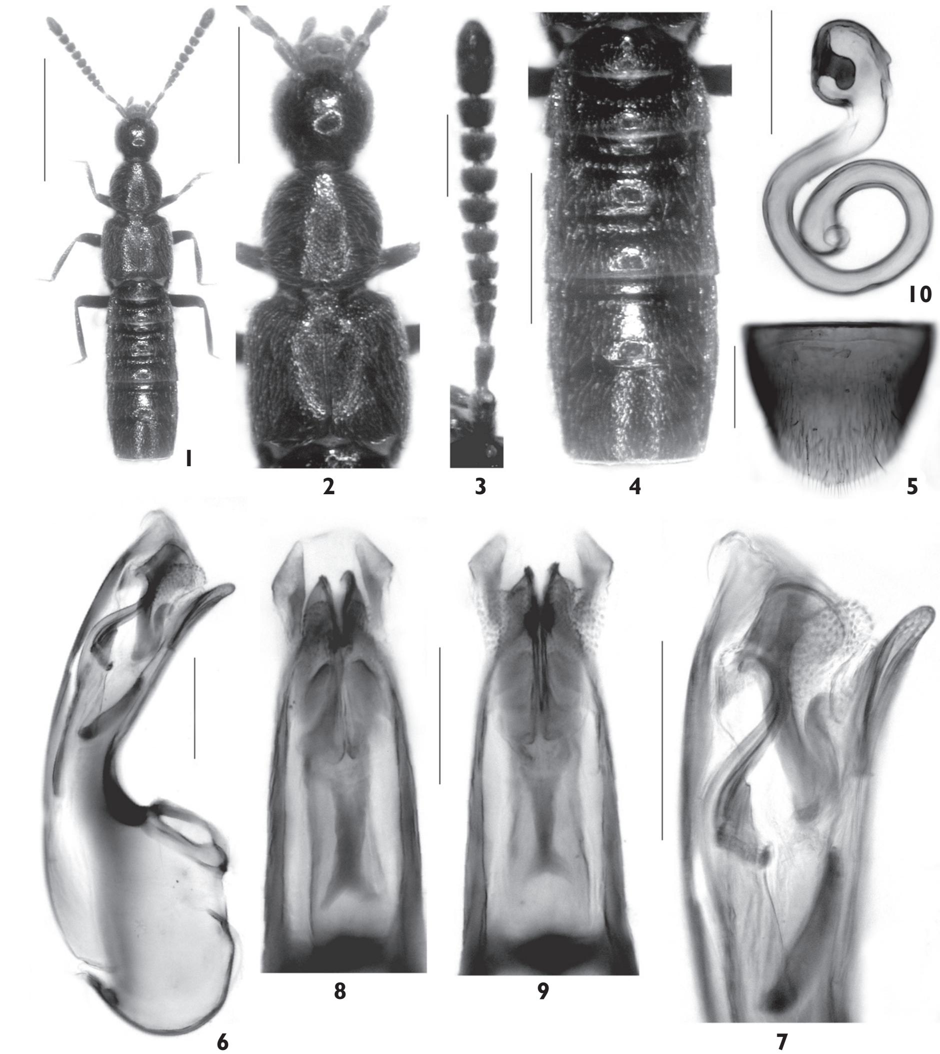
Abdomen approximately as wide as elytra; tergites III-VI with pronounced and coarsely punctate anterior impression; remainder of tergal surfaces with fine and dense punctation (Fig. 4); integument with or without microsculpture.

Male: sternite VIII with posterior margin obtusely angled in the middle (Fig. 5); median lobe of aedeagus as in Figs 6-9.

Female: sternite VIII weakly convex posteriorly; spermatheca as in Fig. 10.

Intraspecific variation. Like *C. rufescens*, *C. parviceps* is subject to pronounced intraspecific variability, especially of coloration, microsculpture, and punctation.

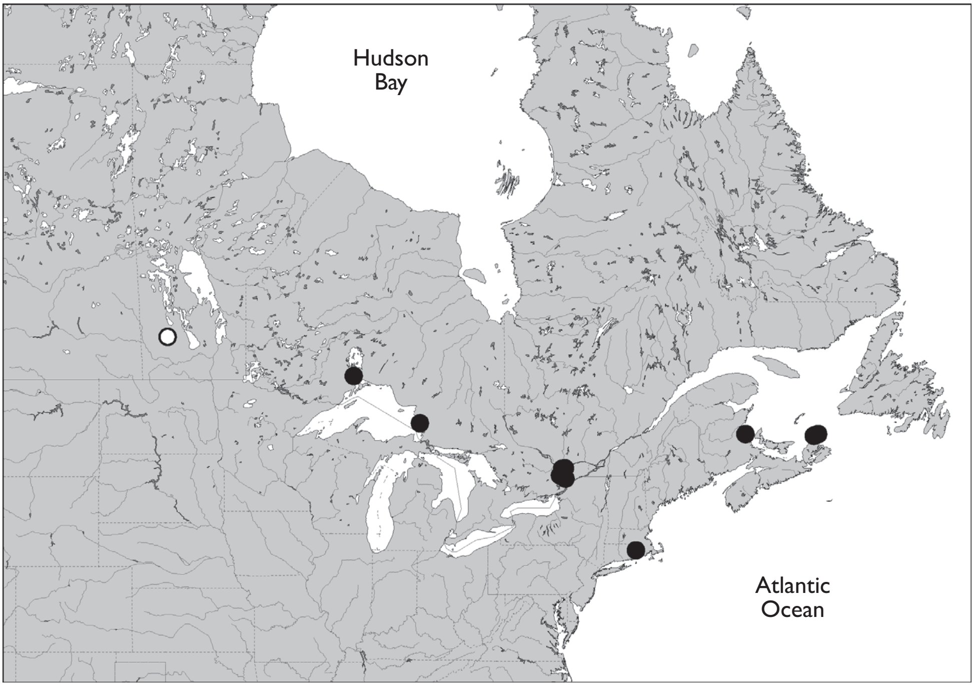
Comparative notes. *Calodera parviceps* is distinguished from *C. rufescens* by the shape of the apical internal structures of the aedeagus, which are somewhat spoon-shaped and apically crossed in *C. rufescens*. For illustrations of the genitalia of *C. rufescens* see Assing (1996). For characters separating *C. parviceps* from other North American representatives of the genus see the key below.



Figs 1-10. *Calodera parviceps*. 1: habitus; 2: forebody; 3: antenna; 4: abdominal segments III-VII; 5: male sternite VIII; 6: median lobe of aedeagus in lateral view; 7: apical part of median lobe of aedeagus in lateral view; 8-9: apical part of median lobe of aedeagus in ventral view; 10: spermatheca. Scales: 1: 1.0 mm; 2, 4: 0.5 mm; 3, 5: 0.2 mm; 6-10: 0.1 mm.

Comment. Unfortunately, the single syntype in the Casey collection is a female (Assing 2002). Therefore, the identification of the additional material listed above, which is based on external characters, must be regarded as somewhat tentative. Males from Rhode Island would be required to verify the specific identity of the Canadian material.

Distribution and bionomics. At present, the species is known from several localities in eastern Canada and from Rhode Island (Map 1). As can be inferred from the labels attached to the above specimens and from the ecological preferences of closely related congeners, *C. parviceps* is probably an inhabitant of the litter layer of moist



Map 1. Distribution of *Calodera parviceps* (filled circles) and *Calodera* sp. (open circle) in eastern North America.

habitats. The examined specimens were collected during the period from April through July, with the majority of records in June, and in autumn (September, October),

Calodera sp.

Material examined. Canada: Manitoba: 2♀♀, Riding Mountain National Park, 6 km E Clear Lake, litter of mixed forest, 3.VII.1979, leg. Lyons (CNC, cAss).

Comment. In external morphology, this probably undescribed species is similar to *C. parviceps*, but is distinguished by somewhat shorter antennae with more transverse antennomeres IV-X. Since only two females are available, however, a description of this species would be premature and inadequate.

Key to the Nearctic species of *Calodera*

Repeated requests for a loan of the type material of *C. infuscata*, which is deposited in the Purdue Entomological Research Collections (Lafayette, Indiana), have remained unanswered, so that the diagnosis of this species relies exclusively on the (few) details specified in the original description. The possibility that *C. infuscata* and *C. caseyi* are, in fact, conspecific cannot be ruled out.

1. Small species; body length < 2.3 mm 2
– Larger species; body length > 2.7 mm 3
2. Head without posterior constriction. Known distribution confined to Pennsylvania (USA) .... *C. caseyi* Assing
– Presence of posterior constriction of head unknown. Recorded only from Indiana (USA) .... *C. infuscata* Blatchley
3. Antennae longer; antennomeres VI-X approximately 1.5 times as wide as long (Fig. 3). Median lobe of aedeagus as in Figs 6-9. Eastern Canada and northeastern USA (Rhode Island) (Map 1) .... *C. parviceps* (Casey)
– Antennae shorter; antennomeres VI-X approximately twice as wide as long. Manitoba (Canada) (Map 1) .... *Calodera* sp.

Acknowledgements

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The Phalacridae (Coleoptera, Cucujoidea) of Canada: new records, distribution, and bionomics with a particular focus on the Atlantic Canadian fauna

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Abstract

The Canadian Phalacridae are briefly surveyed. Two species, *Phalacrus politus* Melsheimer and *Olibrus vittatus* LeConte, are newly recorded in Canada. As a result, eight phalacrids are now known to occur in Canada. Thirteen new provincial records are reported including one from Saskatchewan, two from Manitoba, two from New Brunswick, three from Nova Scotia, two from Prince Edward Island, and three from Newfoundland and Labrador. The four species and ten provincial records of Phalacridae reported from provinces in Atlantic Canada are the first records of this family in the region. Information on the bionomics of these species is briefly summarized. The species include *Phalacrus penicillatus* Say, *Phalacrus politus* Melsheimer (a smut-feeding species associated with corn, sorghum, and other grasses), Olibrus vittatus LeConte, *Olibrus semistriatus* LeConte (an abundant floricolous species found in the heads of several genera of Asteraceae), *Acylomus pugetanus* Casey (an ergot-feeding beetle associated with various grains and wild grasses), and *Stilbus apicalis* (Melsheimer) (an apparently surface-feeding, mold-grazing, facultatively parthenogenic species). The discovery of *P. politus* on insular Newfoundland is particularly noteworthy and represents a range extension of about 1,260 km. The possible origins of this apparently isolated and disjunct population are discussed, focusing on the glacial history of the region.

Keywords

Coleoptera, Phalacridae, *Phalacrus*, *Olibrus*, *Acylomus*, *Stilbus*, *Litochropus*, Atlantic Canada, Canada, biodiversity, disjunct populations

Introduction

The Phalacridae (the shining flower and mold beetles) is a poorly known family, badly in need of taxonomic revision. The last comprehensive treatment of the Nearctic fauna was by Casey (1916). There are 635 described species worldwide, of which 122 are found in North America (Gimmel, unpublished data). Of these only six species were reported in Canada by Campbell (1991), none of which were recorded from Atlantic Canada (New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island). Campbell (1991) characterized the Phalacridae and Ptiliidae as the two most poorly known families of beetles in Canada. Since that time Sörensson (2003) and Majka and Sörensson (2007) have surveyed the ptiliid fauna of Atlantic Canada and recorded many new species. Until now, there has been no commensurate study of the Phalacridae.

Methods and conventions

Codens (following Evenhuis 2007) of collections consulted in this study are:

ACNS	Agriculture and Agri-food Canada, Kentville, Nova Scotia, Canada
ACPE	Agriculture and Agri-food Canada, Charlottetown, Prince Edward Island, Canada
CBU	Cape Breton University, Sydney, Nova Scotia, Canada
CFNL	Canadian Forest Service, Corner Brook, Newfoundland, Canada
CGMC	Christopher G. Majka collection, Halifax, Nova Scotia, Canada
DAL	Dalhousie University, Halifax, Nova Scotia, Canada
DHWC	David H. Webster collection, Kentville, Nova Scotia, Canada
GSC	Gary Selig collection, Bridgewater, Nova Scotia, Canada
JCC	Joyce Cook Collection, North Augusta, Ontario, Canada
JOC	Jeffrey Ogden collection, Truro, Nova Scotia, Canada
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MUN	Memorial University of Newfoundland collection, St. John's, Newfoundland, Canada (currently on long term loan to the Canadian Forest Service, Edmonton, Alberta)
NFRC	Northern Forest Research Centre, Edmonton, Alberta, Canada
NSAC	Nova Scotia Agricultural College, Bible Hill, Nova Scotia, Canada
NSMC	Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR	Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC	Reginald Webster Collection, Charters Settlement, New Brunswick, Canada
UMNB	Université de Moncton, Moncton, New Brunswick, Canada
UNH	University of New Hampshire, Durham, New Hampshire, United States

The taxonomy and nomenclature follows Steiner (2002). Identification of specimens was done by employing the keys of Steiner (2002) to the level of genus, and then to the level of species by using the keys in Downie and Arnett (1996) and by comparisons with authoritatively identified type and non-type specimens.

Results

Eight species of Phalacridae are now known to occur in Canada (Table 1). Specific details follow.

Phalacrus penicillatus Say, 1824

MANITOBA: Division No. 7, Aweme, 16.VII.1917, N. Criddle (1, NFRC). **SASKATCHEWAN**: Division No. 8, Lancer Ferry, 30.VI.1975, (1, NFRC).

Phalacrus penicillatus is newly recorded from Manitoba and Saskatchewan. The species is a western North American one that has been recorded in the United States from Arizona, California, Idaho, Kansas, New Mexico, Nevada, Oregon, and Washington (LeConte 1856; Casey 1916; Snow 1906; Hatch 1962; Bechtel et al. 1983; Caterino 2006) and in Canada from British Columbia (Hatch 1962; Campbell 1991). No specific information on its biology is available, but it is probably associated with smuts like other species in the genus *Phalacrus*.

Table 1. A checklist of Canadian Phalacridae

	Distribution
Phalacrus penicillatus Say	BC, **MB**, **SK** / AZ, CA, CO, ID, KS, NM, NV, OR, WA
Phalacrus politus Melsheimer	**NF** / CT, FL, IN, LA, MA, ME, MI, MO, NC, NH, NY, RI, TN
Olibrus rufipes LeConte	BC / OR
Olibrus semistriatus LeConte	MB, **NB**, **NF**, **NS**, ON, **PE** / AZ, CO, IN, KS, NH, NY, PA, RI
Olibrus vittatus LeConte	**MB** / CO, FL, IL, LA, NM, NY, ND, SD
Acylomus pugetanus Casey	**LB**, MB, **NS**, ON, QC / AR, CT, DC, DE, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MT, NE, NH, NJ, NY, OH, OR, PA, SD, VA, VT, WA, WI, WV
Stilbus apicalis (Melsheimer)	BC, **NB**, **NS**, ON, **PE**, QC / CA, CT, FL, ID, IL, IN, KS, LA, MA, MD, ME, NH, NY, OR, PA, RI, WA, WV
Litochropus scalptus Casey	QC / DC, LA, MN, NC

Notes: Canadian jurisdictions are listed followed by those in the United States. Boldface entries signify new records reported in this paper. **Canada:** BC, British Columbia; LB, Labrador; MB, Manitoba; NB, New Brunswick; NF, insular Newfoundland; NS, Nova Scotia; ON, Ontario; QC, Québec; PE, Prince Edward Island; SK, Saskatchewan; **United States:** AZ, Arizona; CA, California; CO, Colorado; CT, Connecticut; DC, District of Columbia; DE, Delaware; FL, Florida; IA, Iowa; ID, Idaho; IL, Illinois; IN, Indiana; KS, Kansas; KY, Kentucky; LA, Louisiana; MA, Massachusetts; MD, Maryland; ME, Maine; MI, Michigan; MN, Minnesota; MO, Missouri; MT, Montana; NC, North Carolina; ND, North Dakota; NE, Nebraska; NH, New Hampshire; NJ, New Jersey; NM, New Mexico; NV, Nevada; NY, New York; OH, Ohio; OR, Oregon; PA, Pennsylvania; RI, Rhode Island; SD, South Dakota; TN, Tennessee; VA, Virginia; VT, Vermont; WA, Washington; WI, Wisconsin; WV, West Virginia.

Phalacrus politus Melsheimer, 1844

NEWFOUNDLAND: Terra Nova National Park, Salton Brook, 21.VI.1978, (15, MUN); Gander, 20.VI.1981, (1, MUN); South Pond, 27.VI.1980, Brennan and D. Larson, beaver pond, (1, MUN).

Phalacrus politus is newly recorded in Canada (Fig. 1). The species is widely distributed in the eastern United States from Maine south to Florida and west to Louisiana, Missouri, and Michigan (Casey 1916; Leng 1920; Leonard 1928; Downie and Arnett 1996; Chandler 2001; Gimmel 2008). Specimens of *Phalacrus politus* were reported on sorghum (*Sorghum bicolor* (L.) Moench, Poaceae) by Hayes (1920). Steiner (1984) found adults and larvae in the powdery galls of corn smut, *Ustilago maydis* (Dc.) Cda growing on corn, *Zea mays* L., and in an unidentified smut on the panic grass, *Panicum dichotomiflorum* Michx. (Poaceae). Specimens of *Phalacrus politus* have also been collected in western Maine [Augusta, 21.VIII.1943, A.E. Brower, (1, UNH); Brunswick, 17.IX.1939, A.E. Brower, (2, UNH); Gilead, 26.VIII.1956, A.E. Brower, (1, UNH); Lexington, 13.VII.1959, A.E. Brower, (1, UNH)].

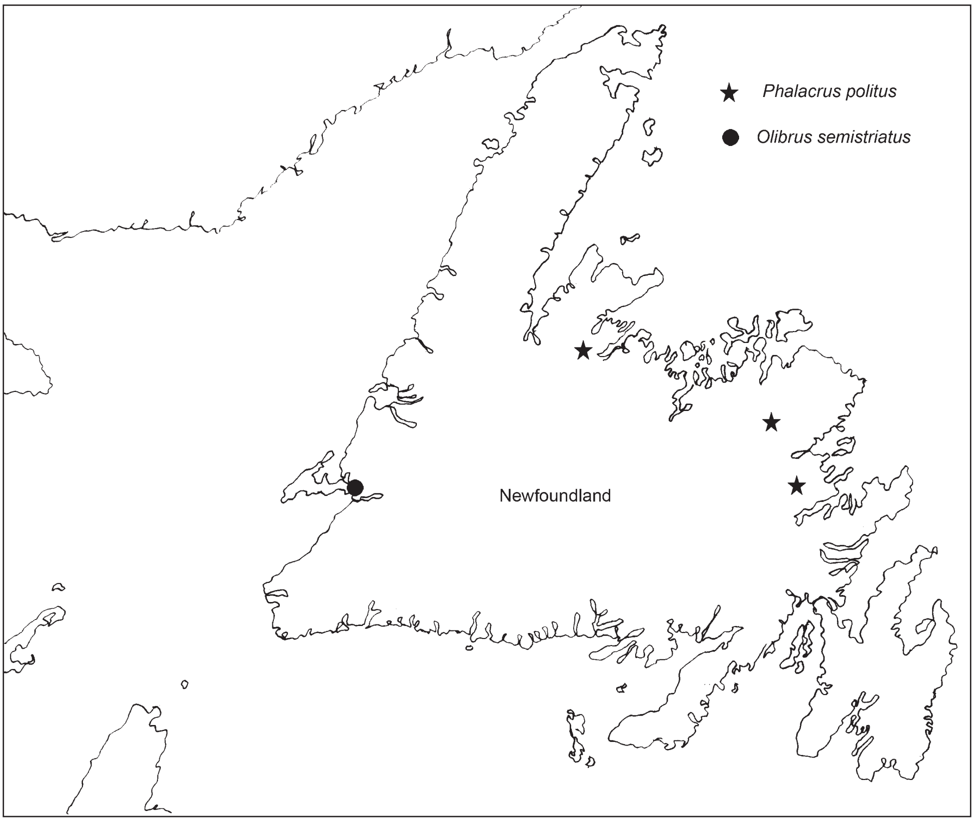

Fig. 1. Distribution of *Phalacrus politus* Melsheimer and *Olibrus semistriatus* LeConte in Newfoundland and Labrador.

Olibrus rufipes LeConte, 1856

Olibrus rufipes has been recorded in Canada from British Columbia (Campbell 1991). In the United States LeConte (1856) recorded it from Oregon. No specific information on its biology is available, however, all known larvae in the genus *Olibrus* live in flower heads of Compositae and the pollen-feeding adults are often abundant on these plants (Steiner 2002).

Olibrus semistriatus LeConte, 1856

NEW BRUNSWICK: Albert Co.: Albert Mines, 9.VII.2002, C.G. Majka, old field, (2, CGMC); Caledonia Mountain, 1965-1971, C.G. Majka, old field, (1, CGMC); Crooked Creek, 22.VIII.2003, C.G. Majka, floodplain, (1, CGMC); Mary's Point, 21.VIII.2003, 23.VIII.2003, 12.VIII.2004, C.G. Majka, seashore, (10, CGMC); **Charlotte Co.:** Deer Island, 9.V.1983, M.E.M. Smith, (7, ACPE); **Westmorland Co.:** Moncton, 15.IX.1978, A. Chenard, (1, UMNB). **NEWFOUNDLAND:** Stephenville, 14.VIII.1985, D. Larson, (1, MUN). **NOVA SCOTIA:** 171 specimens examined from Annapolis, Cape Breton, Colchester, Cumberland, Digby, Halifax, Inverness, Kings, Lunenburg, Pictou, Queens, Shelburne, Victoria, and Yarmouth counties. The earliest records are from 1945 [**Halifax Co.:** St. Margaret's Bay, 9.VIII.1945, 18.VIII.1945, D.C. Ferguson, (10, NSMC); **Kings Co.:** Grand Pre, 12.VIII.1945, D.C. Ferguson, (1, NSMC); Greenwich, 12.VIII.1945, D.C. Ferguson, (1, NSMC)]. **PRINCE EDWARD ISLAND: Kings Co.:** Launching, 26.VIII.2003, C.G. Majka, salt marsh on *Solidago sempervirens* L., (2, CGMC); Woodville Mills, 16.VIII.2002, C.G. Majka, shore of small pond, (4, CGMC); **Prince Co.:** Indian River, 4.IX.2001, C.G. Majka, coastal marsh, (6, CGMC); Lower Darnley, 25.VIII.2003, C.G. Majka, coastal dunes, (4, CGMC); Malpaque, 25.VIII.2003, C.G. Majka, coastal dunes, (1, CGMC); Summerside, 4.IX.2001, C.G. Majka, wet meadow, (6, CGMC); **Queens Co.:** Cavendish, 19.VII.2001, C.G. Majka, sea coast, (1, CGMC); Harrington, 19.VIII.1993, M.E.M. Smith, potato field, (1, ACPE); Millvale, 17.VIII.2002, 15.VIII.2004, 25.VI.2003, C.G. Majka, along river, (8, CGMC); New London Bay, 3.IX.2001, C.G. Majka, seashore on *Solidago sempervirens* L., (4, CGMC); North Rustico, 17.VIII.2002, C.G. Majka, coastal lagoon, (3, CGMC); Pinette, 24.VI.2003, C.G. Majka, seashore, (1, CGMC); Toronto, 19.VIII.2002, C.G. Majka, old field, (1, CGMC); Wood Islands, 23.VII.2001, 6.IX.2001, 20.VIII.2002, 29.VIII.2003, C.G. Majka, seashore, (8, CGMC).

Olibrus semistriatus is newly recorded in New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island (Figs. 1, 2). The species has previously been recorded from New Hampshire south to Pennsylvania and west through Ontario, Indiana, and Kansas to Manitoba, Colorado and Arizona (LeConte 1856; Gibson 1917; Campbell 1991; Downie and Arnett 1996; Chandler 2001; Goertz 2006). The larvae of *Olibrus* species live in the flower heads of species of Asteraceae in genera such as *Ageratina*, *Aster, Bidens, Cirsium, Chrysopsis, Eupatorium, Solidago*, and *Vernonia,*

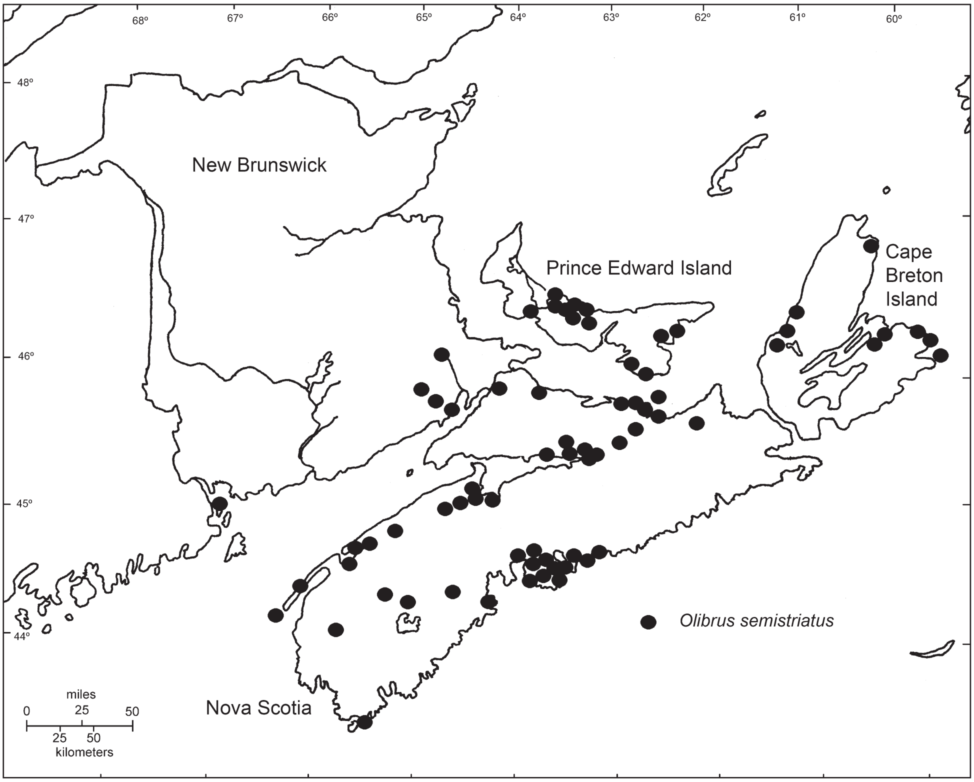

Fig. 2. Distribution of *Olibrus semistriatus* LeConte in New Brunswick, Nova Scotia, and Prince Edward Island.

and the pollen-feeding adults are often abundant on these plants (Lawrence 1991; Steiner 2002). In Nova Scotia specimens have been collected on *Achillea millefolium* L., *Aster novi-belgii* L., *Solidago canadensis* L., and *Solidago rugosa* Ait. (Asteraceae). Adults have also occasionally been found on other flowers such as *Verbascum thapsus* L. (Scrophulariaceae) and *Rosa rugosa* Thunb. (Rosaceae). In New Brunswick and Prince Edward Island soecimens have frequently been collected in coastal localities where they are abundant on *Solidago sempervirens* L.

Olibrus vittatus LeConte, 1863

MANITOBA: Division No. 7, Aweme, 7.VIII.1915, N. Criddle (1, NFRC).

Olibrus vittatus is newly recorded in Canada. The species has previously been recorded in the United States from Colorado, Florida, Illinois, Louisiana, New Mexico, New York, North Dakota, and South Dakota (Snow 1881-1882; Casey 1916; Downie and Arnett 1996; Peck and Thomas 1998; Goertz 2006; Gimmel 2008). No specific information on its biology is available, however, larvae in the genus *Olibrus* live in flower heads of Compositae and the pollen-feeding adults are often abundant of these plants (Steiner 2002).

Acylomus pugetanus Casey, 1916

NEWFOUNDLAND: Labrador (Guillebeau 1894; see note below). **NOVA SCOTIA: Colchester Co.:** Bible Hill, 19.VII.2005, A. Mills, pasture, (1, DAL); Bible Hill, 10.VI.2004, 22.VII.2004, 5.VIII.2004, 31.V.2005, K. Aikens, pasture, (4, CBU); Bible Hill, 18.VIII.2005, S.M. Townsend, pasture, (1, CBU); Truro, no date or collector information, (1, NSAC); **Cumberland Co.:** Westchester-Londonderry, 20.VII.1992, S. and J. Peck, forest road, car net, (7, JCC); **Guysborough Co.:** Trafalgar, 19.VII.1992, S. and J. Peck, car net, (15, JCC); **Halifax Co.:** Upper Tantallon, 17.VII.1992, S. and J. Peck, car net, (1, JCC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (3, JCC); **Shelburne Co.:** Clyde River Rd., 16.VII.1992, J. and T. Cook, forest, car net, (7, JCC); Sebim Beach, 19.vii, 1993, J. and T. Cook, (1, JCC); **Yarmouth Co.:** Carleton, Perry Rd., 22.VIII.1992, 18.VII.1993, J. and T. Cook, car net, (2, JCC); Quinlan, Coldstream Rd., 19.VII.1993, J. and T. Cook, car net, (1, JCC).

Acylomus pugetanus is newly recorded in Atlantic Canada (Fig. 3). In Canada it has previously been recorded from Manitoba east to Québec (Campbell 1991) and

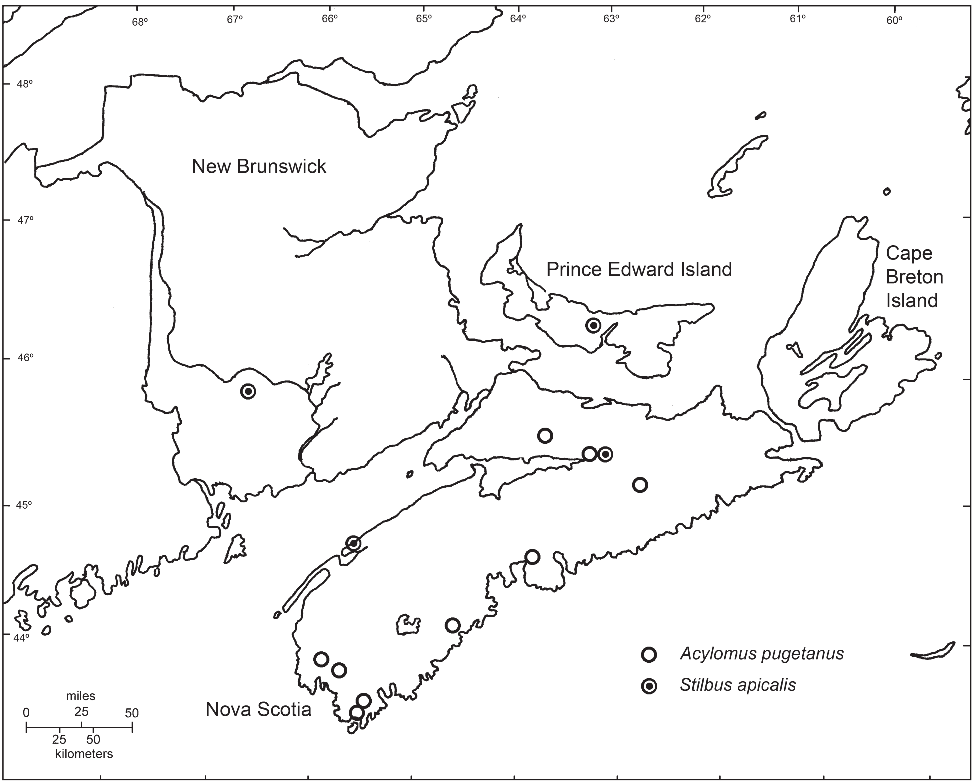

Fig. 3. Distribution of *Acylomus pugetanus* Casey and *Stilbus apicalis* (Melsheimer) in New Brunswick, Nova Scotia, and Prince Edward Island. **Note:** the Labrador record of *A. pugetanus* is not indicated.

in the United States from Maine and Washington state south to Virginia, Arkansas, Utah, and Oregon (Steiner and Singh 1987). Adults and larvae of *A. pugetanus* feed on the sclerotia of ergot fungi (*Claviceps* spp., Clavicipitaceae) found growing on grains and wild grasses such as wheat (*Triticum aestivum* L.), rye (*Secale cereale* L.), quack grass (*Agropyron repens* (L.) Beauv.), meadow fescue (*Festuca pratensis* Huds.), and salt-meadow grass (*Spartina patens* (Ait.) Muhl.) (Poaceae) (Steiner and Singh 1987). Consequently they occur in open habitats where such grasses grow. In Nova Scotia many specimens have been collected in pastures. There has been some interest in this species in relation to agriculture, both as a potential biocontrol agent of ergot, as well as a potential vector of the disease (Steiner and Singh 1987). The many specimens collected by car nets in Nova Scotia indicate that they fly well and actively disperses aerially. This species has not been recorded in New Brunswick but in all probability occurs there.

Note: based on a single specimen, Guillebeau (1894) described *Eustilbus borealis*, whose type locality is "Labrador." Matthew Gimmel has examined this specimen (MNHN) and it is an *Acylomus*, almost certainly *A. pugetanus*. Matthew Gimmel is presently working on a revision of the Phalacridae of North America, and the nomenclatural issue that this specimen raises will be addressed in the context of this larger revision.

Stilbus apicalis (Melsheimer, 1844)

NEW BRUNSWICK: York Co.: New Maryland, 45.83°N 66.73°W, 26.VI.2003, R.P. Webster, mixed forest, at light, (1, RWC). **NOVA SCOTIA: Annapolis Co.:** 19.VI.1995, J. Ogden, (1, NSNR); **Colchester Co.:** Bible Hill, 5.VIII.2004, 14.V.2005, 23.V.2005, 31.V.2005, K. Aikens, pasture, sweep net, (12, CBU). **PRINCE EDWARD ISLAND: Queens Co.:** Harrington, 2.IX.2005, 8.IX.2005, M.E.M. Smith, barley fields, sweep net, (10, ACPE).

Stilbus apicalis is newly recorded in Atlantic Canada (Fig. 3). The species has previously been recorded in eastern North America from Ontario and Maine, south to Florida, and west to Louisiana, Kansas, and Illinois; and in the west from British Columbia south through Idaho to California (Leng 1920; Campbell 1991; Downie and Arnett 1996; Chandler 2001; Gimmel 2008). Little is known about its bionomics except that individuals have been collected by sweeping grasses (Steiner 1984), a habitat and collection mode consistent with most of the specimens collected in Atlantic Canada. Specimens are also commonly collected at lights (White 1983). Dearborn and Donahue (1993) reported individuals from spruce (*Picea* sp.) in Chesuncook and Augusta, Maine. Steiner (1984) noted that populations are almost exclusively comprised of females, and considered that it is likely a surface feeding, mold grazing, facultatively parthenogenic species. The precise hosts of *S. apicalis* are unknown although some adults were found on an unidentified smut growing on panic grass, *P. dichotomiflorum* (Steiner 1984).

Litochropus scalptus Casey, 1890

Litochropus scalptus has been recorded in Canada from Québec (Campbell 1991) and in the United States from the District of Columbia, Louisiana, Minnesota, and North Carolina (Leng 1920; Haarstad 2002; Gimmel 2008). Adults and larvae of the genus *Litochropus* have been reared and collected from fruiting bodies of *Daldinia* (Ascomycota: Xylariaceae) (Steiner 1984).

Discussion

Two species of phalacrids, *Phalacrus politus* and *Olibrus vittatus*, are newly recorded in Canada increasing the known Canadian fauna to eight species. Thirteen new provincial records are reported including one from Saskatchewan, two from Manitoba, two from New Brunswick, three from Nova Scotia, two from Prince Edward Island, and three from Newfoundland and Labrador.

Although previously unrecorded in Atlantic Canada, the family is now known to occur throughout the region (Table 2). Four species are found in Atlantic Canada and ten new provincial records are reported from the region. The pollen feeding species, *Olibrus semistriatus,* is abundant and is widely distributed in the region. *Phalacrus politus*, another species found on flower heads, has been recorded from insular Newfoundland. *Stilbus apicalis*, a poorly known, apparent mold-grazing species, is apparently much less abundant but has been found in widely distributed sites in the Maritime Provinces. *Acylomus pugetanus*, an ergot-feeding phalacrid found in open grassland environments, is widely distributed in Nova Scotia and has been recorded from Labrador. *Litochropus scalptus* has been found in Québec (Campbell 1991) and should be sought in western regions of New Brunswick.

The discovery of *Phalacrus politus* in Newfoundland, the first report of this species in Canada, is particularly noteworthy given that the nearest previous records are from western Maine. Thus the Newfoundland record represents a range extension of about 1,250 km. It is possible that *P. politus* does occur in intervening areas and simply has

Table 2. The Phalacridae of Atlantic Canada

	NB	NS	PE	NF	LB
Phalacrus politus Melsheimer				1	
Olibrus semistriatus LeConte	4	14	3	1	
Acylomus pugetanus Casey		7			1
Stilbus apicalis (Melsheimer)	1	2	1		

Notes: NB, New Brunswick; PE, Prince Edward Island; LB, Labrador; NS, Nova Scotia; NF, insular Newfoundland. Numbers indicate the number of county records. There are 15 counties in New Brunswick, 18 in Nova Scotia, and 3 on Prince Edward Island. County divisions are not employed in the province of Newfoundland and Labrador so numbers from there simply indicate the presence of species.

not been recorded to date, however, this seems improbable given that the substantial collecting effort for grassland dwelling Coleoptera in the Maritime Provinces. With the apparently large distribution gap, and Newfoundland's position as an island over 100 km distant from the nearest point of continental Nova Scotia, the presence of *P. politus* raises some intriguing zoogeographic questions.

Hamilton and Langor (1987) reported similar disjunct distributions for endemic and relict species of leafhoppers in insular Newfoundland including species such as *Idiocerus subnitens* Sanders and DeLong (found in New England north to Vermont) and *Empoasca coccinea* Fitch (found north to Maine). While the Nova Scotia shelf was completely covered by ice during the maximum extent of the Wisconsinan glaciation (King 1996), Hamilton and Langor (1987) postulated that an unglaciated refugium on the St. Pierre banks south of Newfoundland resulted in the post-glacial disjunct distribution of these species. As well, there is evidence for nunataks (unglaciated hill crests) in Newfoundland (Grant 1989). Such glacial refugia are postulated to have been the sites for the survival and/or evolution of the endemic and relict leafhopper faunas found in Newfoundland and Cape Breton Island. *Phalacrus politus* could potentially be a member of this suite of insects that survived the Wisconsinan glaciation in such sites, subsequently re-colonizing Newfoundland after it retreat circa 18,000 years B.P.

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RESEARCH ARTICLE

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The flat bark beetles (Coleoptera, Silvanidae, Cucujidae, Laemophloeidae) of Atlantic Canada

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Abstract

Eighteen species of flat bark beetles are now known in Atlantic Canada, 10 in New Brunswick, 17 in Nova Scotia, four on Prince Edward Island, six on insular Newfoundland, and one in Labrador. Twenty-three new provincial records are reported and nine species, *Uleiota debilis* (LeConte), *Uleiota dubius* (Fabricius), *Nausibius clavicornis* (Kugelann), *Ahasverus advena* (Waltl), *Cryptolestes pusillus* (Schönherr), *Cryptolestes turcicus* (Grouvelle), *Charaphloeus convexulus* (LeConte), *Charaphloeus* species nr. *adustus*, and *Placonotus zimmermanni* (LeConte) are newly recorded in the region, one of which *C.* sp. nr. *adustus*, is newly recorded in Canada. Eight are cosmopolitan species introduced to the region and North America, nine are native Nearctic species, and one, *Pediacus fuscus* Erichson, is Holarctic. All the introduced species except for one *Silvanus bidentatus* (Fabricius), a saproxylic species are found on various stored products, whereas all the native species are saproxylic. *Ahasverus longulus* (Blatchley) is removed from the species list of New Brunswick and *Charaphloeus adustus* (LeConte) is removed from the species list of Nova Scotia. One tropical Asian species, *Cryptamorpha desjardinsi* (Guérin-Méneville), has been intercepted in the region in imported produce, but is not established.

A substantial proportion (44%) of the fauna is comprised of introduced species, almost all of which are synanthropic, associated with various dried stored products. The island faunas of Prince Edward Island, Cape Breton Island, and insular Newfoundland are diminished in comparison to the mainland fauna, that of Prince Edward Island being exceptionally so in comparison to other saproxylic groups found there. Of the ten native species, four can be categorized as "apparently rare" (i.e., comprising ≤ 0.005% of specimens examined from the region). It is possible that the apparent scarcity of these species is related to the long history of forest management in Atlantic Canada. Further research on saproxylic faunas in the region is urged to help determine the impact that forest practices may have had and to seek measures which might lessen or ameliorate such impacts.

Keywords
Coleoptera, Silvanidae, Cucujidae, Laemophloeidae, saproxylic beetles, new records, introduced species, stored product pests, island faunas

Introduction

The flat bark beetles in the superfamily Cucujoidea include the Silvanidae, Passandridae, Cucujidae, and Laemophloeidae. For many years these taxa were treated as subfamilies of the Cucujidae until they were separated by Crowson (1955). They have in common their strongly dorso-ventrally flattened form. Species in the Silvaninae, Brontini, and Laemophloeidae that occur in the wild, feed on ascomycete fungi and are found under the bark of various coniferous and deciduous trees. Species in the Telephanini are found on plants, particularly withered pendant leaves, where they probably feed primarily on fungi. Other species in genera such as *Cryptolestes, Nausibius, Oryzaephilus,* and *Ahasverus* are pests of stored grains and other dried products. Species in the Cucujidae are subcortical saproxylic species that are reported to be predaceous (Thomas 2002a, 2002c, 2002d).

Thomas (2002a, 2002b, 2002c, 200d) reported approximately 1,015 species worldwide of which 90 are found in North America. Bousquet (1991), who surveyed the Canadian fauna, reported 31 species and subspecies in the country, nine of which were reported from Atlantic Canada (New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, and Labrador). Recent investigations of forest beetles, including Kehler et al. (1996), Dollin et al. (2008), Bishop et al. (in press), and others, have revealed that the flat bark fauna of the region is considerably more speciose than previously known. The present study reports the results of these investigations.

Methods and conventions

Codens (following Evenhuis 2007) of collections referred to in this study are:

ACNS	Agriculture and Agri-Food Canada, Kentville, Nova Scotia, Canada
ACPE	Agriculture and Agri-Food Canada, Charlottetown, Prince Edward Island, Canada
CBU	Cape Breton University, Sydney, Nova Scotia, Canada
CGMC	Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CNC	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
DHWC	David H. Webster collection, Kentville, Nova Scotia, Canada
JCC	Joyce Cook Collection, North Augusta, Ontario, Canada
JOC	Jeffrey Ogden collection, Truro, Nova Scotia, Canada
MCZ	Museum of Comparative Zoology, Cambridge, Massachusetts, United States of America

MUN Memorial University of Newfoundland collection, St. John's, Newfoundland, Canada (currently on long term loan to the Canadian Forest Service, Edmonton, Alberta)
NBM New Brunswick Museum, Saint John, New Brunswick, Canada
NSAC Nova Scotia Agricultural College, Bible Hill, Nova Scotia, Canada
NSMC Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC Reginald Webster Collection, Charters Settlement, New Brunswick, Canada
UMNB Université de Moncton, Moncton, New Brunswick, Canada

The taxonomy and nomenclature follow Thomas (2002a, 2002b, 2002c, 2002d).

Results

Eighteen species of flat bark beetles are now known to occur in Atlantic Canada; 10 in New Brunswick, 17 in Nova Scotia, four on Prince Edward Island, six on insular Newfoundland, and one in Labrador (Table 1). The distribution of all species (native and introduced) found in the wild is shown in Figures 1 and 2. These include eight species in the Silvanidae, two species in the Cucujidae, and eight species in the Laemophloeidae. No species of Passandridae have been found in the region although one, *Catogenus rufus* (Fabricius), does occur in neighbouring Québec. Twenty-three new provincial records are reported and nine species, *Uleiota debilis* (LeConte), *Uleiota dubius* (Fabricius), *Nausibius clavicornis* (Kugelann), *Ahasverus advena* (Waltl), *Cryptolestes pusillus* (Schönherr), *Cryptolestes turcicus* (Grouvelle), *Charaphloeus convexulus* (LeConte), *Charaphloeus* species nr. *adustus*, and *Placonotus zimmermanni* (LeConte) are newly recorded in Atlantic Canada, one of which *C.* sp. nr. *adustus*, is newly recorded in Canada. *Ahasverus longulus* (Blatchley) is removed from the species list of New Brunswick and *Charaphloeus adustus* (LeConte) is removed from the species list of Nova Scotia. One tropical Asian species, *Cryptamorpha desjardinsi* (Guérin-Méneville), has been intercepted in the region in imported produce, but is not established. Specific details follow.

Silvanidae Kirby, 1837
Brontinae Erichson, 1845
Brontini Erichson, 1845

Uleiota debilis (LeConte, 1854)

NOVA SCOTIA: Kings Co.: Kentville, 7.VI.1996, D.H. Webster, on white ash, (1, DHWC); Kentville, 9.VI.1997, D.H. Webster, on honey locust, (1, DHWC);

Kentville, 22.V.2000, D.H. Webster, woodpile, (1, DHWC); **Lunenburg Co.:** New Ross, 20.VI.2006, M. Reeves, firewood, (1, NSNR).

Uleiota debilis is newly recorded in Atlantic Canada (Fig. 1). Species of Brontini are found primarily under bark where both adults and larvae probably feed on ascomycete and other fungi (Thomas 1993, 2002a). In Nova Scotia recorded from white ash (*Fraxinus americana* L., Oleaceae), and honey locust (*Gleditsia triacanthos* L., Caesalpiniaceae).

Uleiota dubius (Fabricius, 1801)

NOVA SCOTIA: Kings Co.: Kentville, 1.VIII.1998, D.H. Webster, on maple, (2, DHWC); Kentville, VI.2002, C. Sheffield, in house, (1, ACNS); Cambridge Station, 7.V.1977, D.H. Webster, under bark of rotting apple, (1, DHWC).

Uleiota dubius is newly recorded in Atlantic Canada (Fig. 1). Species of Brontini are found primarily under bark where both adults and larvae probably feed on ascomycete and other fungi (Thomas 1993, 2002a). Common under bark of hardwoods (Downie and Arnett 1996). In Nova Scotia recorded from maple (*Acer* sp., Aceraceae), and apple (*Pyrus malus* L., Rosaceae).

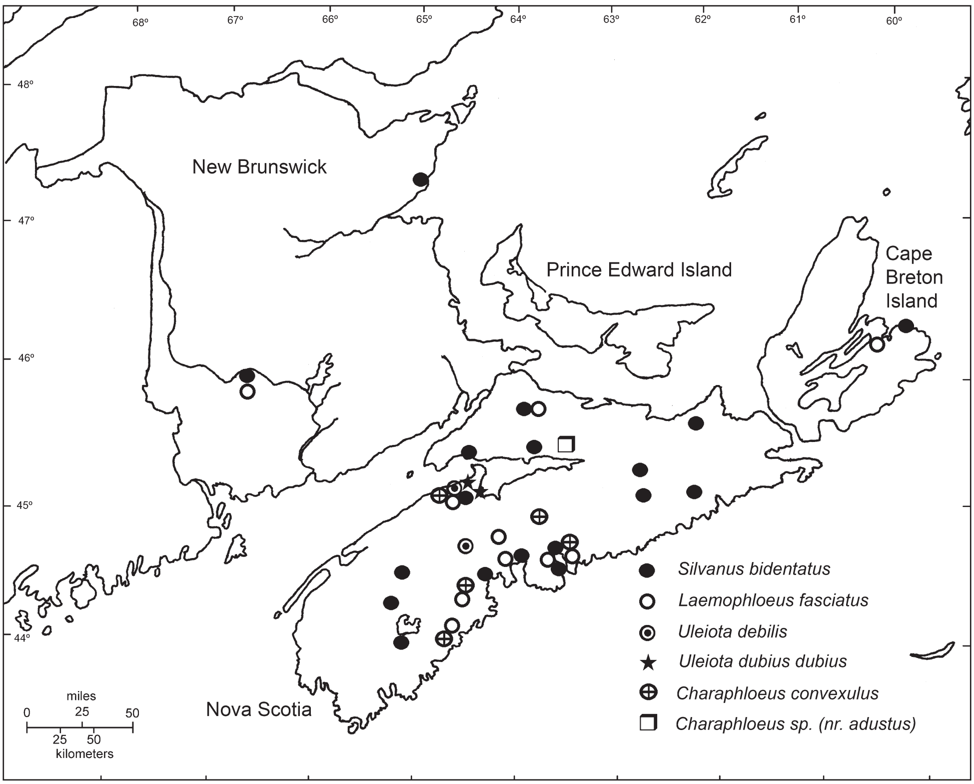

Fig. 1. Distribution of *Silvanus bidentatus, Laemophloeus fasciatus, Uleiota debilis, Uleiota d. dubius, Charaphloeus convexulus,* and *C.* sp. nr. *adustus* in Atlantic Canada.

Dendrophagus cygnaei Mannerheim, 1846

NEW BRUNSWICK: Saint John Co.: Saint John, VI.190?, W. McIntosh, (1, NBM). **NOVA SCOTIA: Antigonish Co.:** Cape George, 5.VII.1993, M. LeBlanc, (1, NSNR); **Cape Breton Co.:** Sydney, 27.IX.1991, C. Billet, (1, CBU); **Colchester Co.:** Nuttby Mt., 18.V.1995, C. Corkum, old deciduous forest, flight-intercept trap, (1, NSMC); **Cumberland Co.:** East Leicester, 3.VI.1995, C. Corkum, old deciduous forest, flight-intercept trap, (1, NSMC); Harrington River, 17.V.1995, 16,VI.1995, C. Corkum, young deciduous forest, flight-intercept trap, (3, NSMC); Moose River, 17.V.1995, C. Corkum, young deciduous forest, flight-intercept trap, (1, NSMC); **Guysborough Co.:** George Lake, 14.v-2.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); Malay Lake, 14.V-2.VI.1997, 2-15.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (2, NSMC); Melopseketch Lake, 2.VI.1995, C. Corkum, young deciduous forest, flight-intercept trap, (1, NSMC); **Halifax Co.:** Big Indian Lake, 11.VI.2003, P. Dollin, red spruce forest, on bracket fungus, (1, NSMC); **Inverness Co.:** Lake Ainslie, 4.VI.1994, V. Jessome, (1, CBU); **Pictou Co.:** Lorne, 1.VI.1995, C. Corkum, old coniferous forest, flight-intercept trap, (1, NSMC); **Queens Co.:** Butler Rd. 21.V.2004, P. Colp, (1, NSNR); Sixth Lake, 19.V.2003, P. Dollin, old growth hemlock forest, (1, NSMC).

Dendrophagus cygnaei is newly recorded in New Brunswick and Nova Scotia (Fig. 2). It was recorded from Newfoundland by Bousquet (1991). Species of Brontini are found primarily under bark where both adults and larvae probably feed on ascomycete and other fungi (Thomas 1993, 2002a). In Nova Scotia recorded from a wide variety of coniferous and deciduous forests.

Telephanini LeConte, 1861

Cryptamorpha desjardinsi (Guérin-Méneville, 1844)

NOVA SCOTIA: Kings Co.: Kentville, 22.III.2002, D.H. Webster, in imported bok choy, (1, DHWC).

In Nova Scotia *Cryptamorpha desjardinsi* was intercepted in bok choy, probably imported from the United States. There is no evidence that the species is established. This species is native to tropical Asia and is now established in Florida and Alabama in the United States (Thomas 1993, 2002a). It is associated with plant molds and is found in sugarcane sheathes, on palmettos, on bananas, pineapples, and similar plants. Adults and larvae feed on sugarcane smut, *Ustilago scitaminea* Syd. (Thomas 1993).

Silvaninae, Kirby, 1837

Nausibius clavicornis (Kugelann, 1794)

NEW BRUNSWICK: Saint John Co.: Saint John, 9.VII.1902, 8.VII.1903, W. McIntosh, (2, NBM). **NOVA SCOTIA: Lunenburg Co.:** Chester, 17.VII.1968, B. Wright, (1, NSMC).

Nausibius clavicornis is newly recorded in Atlantic Canada. Originally a Neotropical species it is now cosmopolitan. Originally subcorticolous (and also reported from old bees' nests) in the field, it is now a pest of stored products, particularly raw or yellow-crystal sugar. It has also been reported from rice, dried apples, ginger, and cassia (Thomas 1993).

Oryzaephilus mercator (Fauvel, 1889)

PRINCE EDWARD ISLAND: Queens Co.: Charlottetown, 23.IV.1985, L.S. Thompson, in house, (3, ACPE).

Oryzaephilus mercator is newly recorded in Prince Edward Island. It was reported from New Brunswick, Nova Scotia, and insular Newfoundland by Bousquet (1991). This cosmopolitan species is one of the most common household pests in Canada.

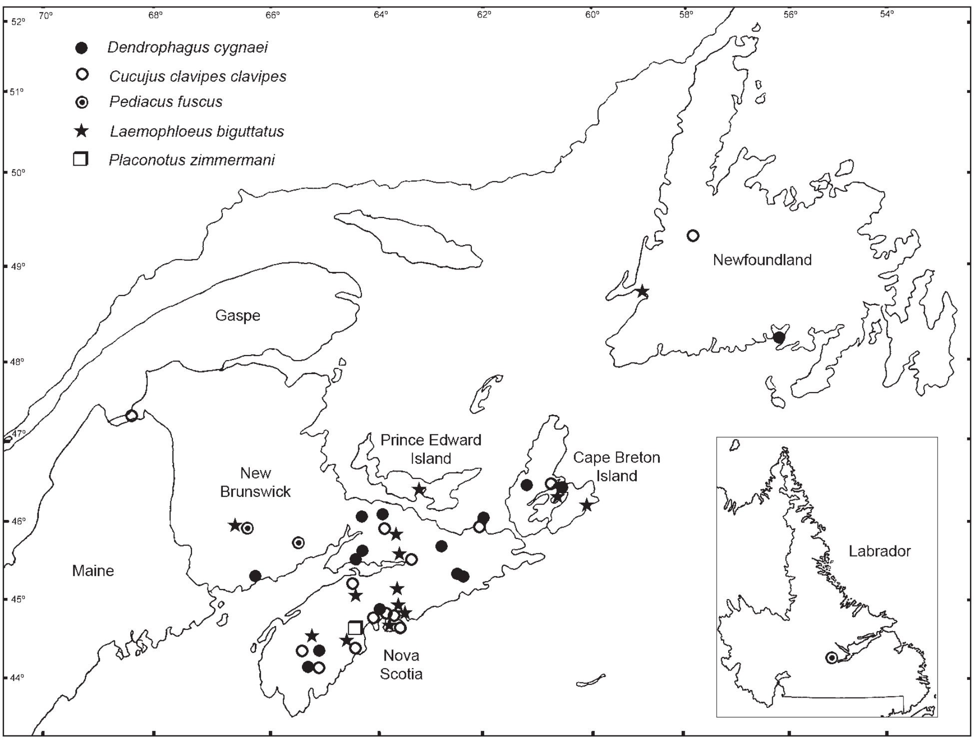

Fig. 2. Distribution of *Dendrophagus cygnaei, Cucujus c. clavipes, Pediacus fuscus, Laemophloeus biguttatus,* and *Placonotus zimmermanni* in Atlantic Canada. Inset map shows records from Labrador.

Adults and larvae feed primarily on cereal products, particularly oatmeal, bran, shelled sunflower seeds, rolled oats, and brown rice (Bousquet 1990).

*Oryzaephilus surinamensi*s (Linnaeus, 1758)

NEW BRUNSWICK: Saint John Co.: Saint John, 5.IX.1902, IX.190?, W. McIntosh, (2, NBM). **NEWFOUNDLAND:** Ferryland (Prévost and Bain 2007). **NOVA SCOTIA: Inverness Co.:** Cheticamp, 11.III.2005, H. David, in house, (1, NSMC); **Kings Co.:** Kentville, 29.IX.1960, Mrs. W.R.C., (12, NSAC); Wolfville, 19.III.1960, H.T. Stultz, storage room, (1, ACNS); **Lunenburg Co.:** Bridgewater, 29.VII.2002, V. Oakley, stored food, (6, NSNR); **Pictou Co.:** Lyons Brook, 23.IV.1996, E. Georgeson, stored grains, (1, NSNR).

*Oryzaephilus surinamensi*s is newly recorded in New Brunswick and Nova Scotia. The records from Newfoundland (Prévost and Bain 2007) are from archeological excavations of a latrine from deposits dated from approximately 1620. This cosmopolitan species is a serious pest of stored grain found primarily in granaries, grain elevators, and flour mills. Adults and larvae attack both damaged grain and processed cereals (Bousquet 1990). It is also found on dried fruit, copra, nuts, and carob (Thomas 1993). Unlike *O. mercator*, it can survive Canadian winter conditions in unheated premises (Bousquet 1990).

Silvanus bidentatus (Fabricius, 1792)

NOVA SCOTIA: Annapolis Co.: Durland Lake, 21.VI.2003, P. Dollin, eastern hemlock/balsam fir/black spruce forest, (1, NSMC); **Cape Breton Co.:** New Waterford, 16.IX.1993, T.N. Kanne, (1, CBU); Colchester Co.: 3.VI.1995, C. Corkum, old deciduous forest, flight-intercept trap, (1, NSMC); **Cumberland Co.:** Diligent River, 27.VII.1988, E. Georgeson, UV light trap, (1, NSMC); Oxford, 9.VIII.1988, E. Georgeson, UV light trap, (1, NSMC); **Guysborough Co.:** Malay Lake, 2-15. VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); Trafalgar, 19.VII.1992, S. and J. Peck, car net, (1, JCC); **Halifax Co.:** Abraham's Lake, 2-15. VI.1997, 15-30.VI.1997, 1-16.VII.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (4, NSMC); Bedford, 22.VIII.1988, B. Pothier, (1, NSMC); Big St. Margaret's Bay, 15-30.VI.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (1, NSMC); Halifax, 29.VII.1991, R. Stuart, (12, NSMC); Point Pleasant Park, 1.IX.2000, 9.IX.2000, 10.VIII.2001, 2.VI.2002, 9.VI.2002, 18.VI.2002, 22.IX.2002, coniferous forest, under bark of *Picea rubens* and *Pinus strobus*, (14, CGMC); **Kings Co.:** Kentville, 1.VIII.1998, D.H. Webster, on maple, (2, DHWC); Lunenburg Co.: Chester, 6.VI.1968, 8.VI.1968, B. Wright, (2, NSMC); **Pictou Co.:** Marshy Hope, 23.VI.1994, M. LeBlanc, (1, JOC); Marshy Hope, 9.VI.1995, M. LeBlanc, (1, NSNR); **Queens Co.:** Kejimkujik National Park, 16.VI.2004, M. LeBlanc, flight-intercept trap, (1, NSNR); Sixth Lake, 18.VI.2003, P. Dollin, old-growth hemlock forest, on red spruce log, (1, NSMC).

This introduced Palearctic species is newly recorded in Nova Scotia (Fig. 1). Bousquet (1991) reported it from New Brunswick. Species of *Silvanus* are found under the bark of logs and dead trees where they are at least partly fungivorous (Thomas 1993). In Nova Scotia they have most frequently been found in coniferous forests, under the bark of red spruce (*Picea rubens* Sarg.) and white pine (*Pinus strobus* L.) (Pinaceae) and on maple (*Acer* sp.).

Ahasverus advena (Waltl, 1832)

NOVA SCOTIA: Halifax Co.: Halifax, 14.IX.1992, C. Stevens, (8, NSMC); Halifax, 13.XI.1986, D. McCarthy, (2, NSMC); Halifax, 1.IX.1989, R. White, (1, NSMC); Halifax, 12.I.1990, collector not recorded, (1, NSMC); Halifax, 9.VII.1991, K. Anthony, (4, NSMC); **Kings Co.:** Kentville, 10.VIII.2005, D.H. Webster, compost heap, on moldy corncobs, (1, DHWC); locality and collector not recorded, (8, NSAC). **PRINCE EDWARD ISLAND: Queens Co.:** Charlottetown, IX.1984, L.S. Thompson, (1, ACPE).

Ahasverus advena is newly recorded in Atlantic Canada. This is a cosmopolitan species that feeds on surface molds such as *Penicillium glaucoma* and *Aspergillus* sp. It has been associated with moldy copra, lima beans, pigeon peas, stored grain, fruit, nuts, corn, dried pears, cereals, on damp flour, rice, figs, and apples, in coffee beans, moldy grass, on cured ham and stored oats and decaying soybeans (Thomas 1993).

Ahasverus longulus (Blatchley, 1910)

No voucher specimens were found in any collection examined and there are no published records of the species from New Brunswick. It was included in Bousquet's (1991) checklist, but it was not recorded from there by Thomas (1993) and M. Thomas (pers. comm.) has no records of the species occurring there. Consequently this species is removed from the faunal list of New Brunswick.

Cucujidae Latreille, 1802

Cucujus clavipes clavipes Fabricius, 1781

NEW BRUNSWICK: Madawaska Co.: Caron Brook, 10.IX.1999, P. Godin, (1, UMNB); Caron Brook, 11.IX.1999, S. Cormier, (1, UMNB).

Cucujus c. clavipes is newly recorded in New Brunswick. It was recorded from Nova Scotia and insular Newfoundland by Bousquet (1991) (Fig. 2). Adults and larvae are found under the bark of dead trees. Larvae are apparently predaceous (Thomas 2002c).

Pediacus fuscus Erichson, 1845

This Holarctic species was recorded from both New Brunswick and Labrador by Bousquet (1991) (Fig. 2). In the Old World the species is found in Estonia, Finland, Latvia, Sweden, northern Russia, and Siberia (Slipinski 2007). In North America they have been recorded from Alaska, the Northwest Territories and British Columbia east across Canada to Labrador and in the United States from Colorado, Maine, Michigan, New Hampshire, and Wisconsin (Thomas 2004). Species in the genus *Pediacus* are predominantly found under the bark of dead conifers (Thomas 2004). In Latvia several specimens were collected under the bark of Scotch pine (*Pinus sylvestris* L., Pinaceae) (Telnov et al. 2007; D. Telnov pers. comm.).

Laemophloeidae Ganglbauer, 1899
Laemophloeinae Ganglbauer, 1899

Cryptolestes ferrugineus (Stephens, 1831)

NOVA SCOTIA: Colchester Co.: Truro, 15.II.1973, G. Townsend, (4, NSAC); **Halifax Co.:** Halifax, 4.XII.1989, (1, NSMC); Halifax, 1.XII.1999, R. White, grain elevators, (6, NSMC); locality not recorded, 27.VI.1973, collector not recorded, (25, NSAC). **PRINCE EDWARD ISLAND: Queens Co.:** Charlottetown, 16.IV.1985, J. Lund, in barley, (2, ACPE); Charlottetown, VIII.1992, J.G. Stewart, grain bin, (3, ACPE).

Cryptolestes ferrugineus is newly recorded in Nova Scotia and Prince Edward Island. It was reported from Newfoundland by Bousquet (1991). This cosmopolitan species is a serious pest of stored grain in Canada where it is found mainly in granaries, grain elevators, and mills (Bousquet 1990).

Cryptolestes pusillus (Schönherr, 1817)

NEW BRUNSWICK: Albert Co.: Mary's Point, 19.X.1988, D.S. Christie, (1, NBM); **NOVA SCOTIA: Colchester Co.:** Bible Hill, 1.V.1996, J. Ogden, (12, NSNR, JOC); **Halifax Co.:** Halifax, 2.XI.1989, 1.XII.1999, 10.XII.1999, R. White, (21, NSMC); **Pictou Co.:** Lyons Brook, 23.IV.1996, E. Georgeson, (1, NSNR).

Cryptolestes pusillus is newly recorded in Atlantic Canada. This cosmopolitan species is found mainly in grain elevators and flour mills where it feeds on damaged grain, preferably wheat (Bousquet 1990).

Cryptolestes turcicus (Grouvelle, 1876)

NOVA SCOTIA: Halifax Co.: Dartmouth, 25.XI.1986, D.S. Davies, (17, NSMC); Halifax, 15.IX.2004, K. Batherson, flour warehouse, (5, NSMC).

Cryptolestes turcicus is newly recorded in Atlantic Canada. This cosmopolitan species is found in feed and flour mills, grain elevators, and warehouses where it feeds on fungi growing on damaged grains (Bousquet 1990).

Laemophloeus biguttatus (Say, 1825)

Laemophloeus biguttatus is widely distributed in New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island (Bousquet 1991) (Fig. 2). They are found under the bark of trees where they feed on ascomycete fungi such as *Hypoxylon* prob. *atropunctatum* (Schweinitz ex Fries) Cooke (Thomas 1993). In Nova Scotia it has been collected in coniferous and mixed forests on both red maple (*Acer rubrum* L., Aceraceae) and red oak (*Quercus rubra* L., Fagaceae).

Laemophloeus fasciatus Melsheimer, 1846

NEW BRUNSWICK: York Co.: New Maryland, 20.VI.2003, R.P. Webster, mixed forest, at light, (1, RWC). **NOVA SCOTIA: Cape Breton Co.:** George's River, 15.VI.2000, D.B. McCorquodale, (1, CBU); **Cumberland Co.:** Oxford, 14.VI.1988, 17.VI.1988, 7.VII.1988, 19.IX.1988, E. Georgeson, UV light rap, (4, NSMC); **Halifax Co.:** Dartmouth, 29.VIII.1990, S. Marr, (1, NSMC); Halifax, 24.IX.1991, E. Boutilier, (3, NSMC); Halifax, 3.X.1991, S. Harrie, (1, NSMC); Hubbards, 3.X.1989, J. Barkhouse, (1, NSMC); **Hants Co.:** Panuke Lake, 2-15.VI.1997, D.J. Bishop, old growth eastern hemlock-red spruce forest, flight-intercept trap, (1, NSMC); **Kings Co.:** Kentville, 3.VIII.1998, D.H. Webster, on basswood, (1, DHWC); **Lunenburg Co.:** 19.VI.1965, B. Wright, (1, NSMC); **Queens Co.:** Medway River, 13.VII.1993, J. & T. Cook, car net, (2, JCC).

Laemophloeus fasciatus is newly recorded in Atlantic Canada (Fig. 1). It is found under bark (Thomas 1993). In Atlantic Canada it has been collected in coniferous and mixed forests and has been found on basswood (*Tilia europea* L., Tiliaceae).

Charaphloeus adustus (LeConte, 1854)

Charaphloeus adustus was reported from Nova Scotia by Bousquet (1991). Subsequent examination of the specimen in the CNC has established that it is actually *C. convexulus*. Consequently this species is removed from the faunal list of Nova Scotia.

Charaphloeus convexulus (LeConte, 1879)

NOVA SCOTIA: Halifax Co.: Halifax, VI.1897, J.D. Evans, Evans (1899); Waverley, 14.V.1965, B. Wright, window trap in red oak, (1, NSMC); **Hants Co.:** Mount Uniake, 16.VI.1947, W.J. Brown, (1, CNC); **Kings Co.:** Aldershot, 15.V.1950, H.T. Stultz, (1, ACNS); **Lunenburg Co.:** Bridgewater, 12.V.1965, 27.V.1965, 19.VI.1965, 30.VI.1965, 16-19.V.1965, 10-14.V.1965, B. Wright, window trap in red oak, (6, NSMC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC).

Charaphloeus convexulus is newly recorded in Atlantic Canada (Fig. 1). Although species was originally reported from Halifax, Nova Scotia by Evans (1899), subsequent authors have overlooked this early record. Found under bark (Thomas 1993).

Charaphloeus undescribed species (nr. *adustus*)

NOVA SCOTIA: Colchester Co.: Debert, 25.VII.1996, J. Ogden, (1, NSNR).

This undescribed species is newly recorded in Canada (Fig. 1). Blatchley (1910) reported this species on beech (*Fagus grandifolia* Ehrh., Fagaceae) logs (Thomas 1993). This undescribed species can be identified with the keys in Downie and Arnett (1996: 1001).

Placonotus zimmermanni (LeConte, 1854)

NOVA SCOTIA: Lunenburg Co.: 30.VI.1965, B. Wright, red oak, window trap, (1, NSMC).

Placonotus zimmermanni is newly recorded in Atlantic Canada (Fig. 2). Thomas (1993) collected this species under the bark of dead hardwoods, especially oaks (*Quercus* spp.) on or near ascomycete fungi. In Nova Scotia it was collected on red oak (*Quercus rubra*).

Discussion

Of the 18 species recorded in the region, eight are adventive cosmopolitan species introduced to the region and North America. Ten are native Nearctic species, and one, *Pediacus fuscus*, is Holarctic. All the introduced species except for *Silvanus bidentatus* (a saproxylic species) are found on various stored products, whereas all the native species are saproxylic (Table 1). One tropical Asian species, *Cryptamorpha desjardinsi*, has been intercepted in imported produce, but is not established here.

Even with the substantial increases in the known fauna of the region (nine new species and 23 new provincial records) it is probable, given the relatively modest collecting effort devoted to this group of beetles in Atlantic Canada, that more species remain to be found. Six additional species have been recorded in Québec and two others in Maine (Bousquet 1991; Chandler 2001), all of which could potentially occur in Atlantic Canada. Although *Ahasverus longulus* has been removed from the New Brunswick faunal list, it has been recorded in Québec and should be looked for in the region.

A substantial proportion of species (44%) are introduced, similar to the 46% of non-native Bostrichiformia (Derodontidae, Dermestidae, Bostrichidae, and Anobiidae) in the Maritime Provinces (New Brunswick, Nova Scotia, and Prince Edward Island) (Majka 2007a). This is almost triple the proportion (15.3%) of introduced Coleoptera in the region overall (C.G. Majka, unpublished data). Seven of these eight species are synanthropic, associated with various dried, stored products. The earliest North

Table 1. The number of county records of Silvanidae, Cucujidae, and Laemophloeidae in Atlantic Canada

	NB	NS	PE	NF	LB	Bio-nomics	Regional Distribution
SILVANIDAE							
Brontinae							
Uleiota debilis (LeConte)		2				SX	ME, NH, NS, NY, ON, QC, RI
Uleiota dubius (Fabricius)		1				SX	NH, NS, NY, ON, QC, RI
Dendrophagus cygnaei Mannerheim	1	9		1		SX	ME, NB, NF, NH, NS, NY, ON, QC
Silvaninae							
Nausibius clavicornis (Kugelann) †	1	1				SP	NB, NS, ON, QC
Oryzaephilus mercator (Fauvel) †	2	6	1	1		SP	ME, NB, NF, NH, NS, ON, PE, QC
Oryzaephilus surinamensis (Linnaeus) †	1	4		1		SP	MA, ME, NB, NF, NH, NS, ON, QC, RI
Silvanus bidentatus (Fabricius) †	2	10				SX	ME, NB, NF, NH, NS, NY, ON, QC, RI
Ahasverus advena (Waltl) †		2	1			SP	MA, ME, NH, NS, ON, PE, QC
CUCUJIDAE							
Cucujus clavipes clavipes Fabricius	1	8		1		SX	MA, ME, NB, NF, NH, NS, ON, QC, RI
Pediacus fuscus Erichson *	2				1	SX	LB, ME, NB, ON, QC
LAEMOPHLOEIDAE							
Laemophloeinae							
Cryptolestes ferrugineus Stephens †		2	1	1		SP	NF, NS, ON, QC, PE
Cryptolestes pusillus (Schönherr) †	1	3				SP	ME, NB, NF, NS, ON, QC
Cryptolestes turcicus (Grouvelle) †		1				SP	NH, NS, ON, QC
Laemophloeus biguttatus (Say)	1	7	1	1		SX	MA, ME, NB, NF, NH, NS, NY, ON, QC, PE, RI
Laemophloeus fasciatus Melsheimer	1	7				SX	MA, ME, NB, NH, NS, NY, ON, QC, RI
Charaphloeus convexulus (LeConte)		5				SX	MA, ME, NH, NS, NY, ON, RI
Charaphloeus undescribed species		1				SX	ME, NH, NS
Placonotus zimmermanni (LeConte)		1				SX	ME, NS, NY, ON, QC, RI, VT
Total counties	13	69	4	6	1		
Total species	10	17	4	6	1		
Intercepted Silvanidae							
Cryptamorpha desjardinsi (Guérin-Méneville) §			1				NH, NS, NY

Notes: NB, New Brunswick; NS, Nova Scotia; PE, Prince Edward Island; NF, insular Newfoundland; LB, Labrador. Numbers indicate the number of county records. There are 15 counties in New Brunswick, 18 in Nova Scotia, and 3 on Prince Edward Island. County divisions are not employed in the province of Newfoundland and Labrador so numbers from there simply indicate the presence of species. SP, Stored Product species; SX, Saproxylic species; †, adventive Palearctic species; *, Holarctic species; §, adventive Asian species.

Regional Distribution: For the purposes of this treatment, northeastern North America is taken to include of the following jurisdictions: CT, Connecticut; LB, Labrador; MA, Massachusetts; ME, Maine; NB, New Brunswick; NF, insular Newfoundland; NH, New Hampshire; NY, New York; ON, Ontario; PE, Prince Edward Island; PM, Saint-Pierre et Miquelon; QC, Québec; RI, Rhode Island; VT, Vermont. Distributional data is compiled from Bousquet (1991), Chandler (2001), Dearborn and Donahue (1993), Downie and Arnett (1996), Sikes (2004), and the present study.

America date of detection (1620) of one, *Oryzaephilus surinamensis,* is from this region, from specimens excavated from a latrine in Newfoundland (Prévost and Bain 2007) (Table 2). Early dates of detection of these introduced species in Atlantic Canada (mean = 1916) are substantially later than in North America as a whole (mean = 1794), probably as a result of a lack of early collecting in this region. In contrast to many adventive terricolous beetles, a large number of which were introduced to North America in association with dry ballast imported to Atlantic Canadian ports (Lindroth 1957), most of

Table 2. Earliest dates of detection of introduced Silvanidae and Laemophloeidae in Atlantic Canada

	NB	NS	PE	NF	NA	Source
SILVANIDAE						
Nausibius clavicornis (Kugelann)	**1902**	1968			1670	Bain (1998)
Oryzaephilus mercator (Fauvel)	1971	**1954**	1985	1962	1670	Bain (1998)
Oryzaephilus surinamensis (Linnaeus)	1902	1960		**1620**	1620	Prévost and Bain (2007)
Silvanus bidentatus (Fabricius)	**1928**	1968			1910	Blatchley (1910)
Ahasverus advena (Waltl)		1986	**1984**		1860	Bain (1999)
LAEMOPHLOEIDAE						
Cryptolestes ferrugineus Stephens		1973	1985	**1965**	1884	Casey (1884)
Cryptolestes pusillus (Schönherr)	**1988**	1989			1854	LeConte (1854)
Cryptolestes turcicus (Grouvelle)		**1986**			1884	Casey (1884)

Notes: NB, New Brunswick; NS, Nova Scotia; PE, Prince Edward Island, NF, insular Newfoundland; NA, North America. Boldface entries signify the earliest dates for a species in the region.

the introduced flat bark beetles are stored product pests introduced to the continent via other mechanisms. One introduced species, *Silvanus bidentatus*, is corticolous, has successfully colonized native habitats, and is now widely-distributed in North America.

As is typically the case with islands, the species richness of the native faunas of Prince Edward Island, Cape Breton Island, and insular Newfoundland are diminished in comparison with that of the neighbouring mainland (Table 3). This may represent an island-associated diminution, a paucity of collecting, an area effect, or a combination of these factors. The fauna of Cape Breton is 40% that of the combined Atlantic Canadian native fauna, that of insular Newfoundland is 30%, and that of Prince Edward Island is 10%. Majka (2007b) reported comparable numbers for 283 native saproxylic species in 18 families, subfamilies and tribes. The overall mean of these numbers on Cape Breton Island was 33% and on insular Newfoundland it was 28%, very similar to the proportions of flat bark beetles. On Prince Edward Island the overall mean was 30%, substantially greater than the 10% of flat bark beetles found on PEI. Either the flat bark beetle fauna of Prince Edward Island is smaller than might otherwise be expected, or else collecting effort there has been insufficient to fully discern the fauna.

Although Labrador is located on the North American mainland it also has an impoverished flat bark beetle fauna consisting solely of the Holarctic species, *Pediacus fuscus.* In part this reflects the fact that substantial portions of Labrador consist of barrens, bogs, sub-arctic, low arctic, and alpine tundra that lack trees and are unsuitable for bark beetles. Furthermore the boreal forests that are found in Labrador are dominated by conifers such as black spruce (*Picea mariana* (Mill.) BSP) and balsam fir (*Abies balsamaea* (L.) Mill, Pinaceae) with only a modest component of deciduous trees such as trembling aspen (*Populus tremuloides* Michx., Salicaceae) and white birch (*Betula papyrifera* Marshall, Betulaceae) (Anonymous 2003). Most flat bark beetles (with the exception of *P. fuscus*), however, are associated largely or exclusively on hardwoods. *Pediacus fuscus* is the only flat bark beetle found in the Yukon Territory, and only it and *Cathartosilvanus imbellis* (LeConte) have been recorded in the Northwest Territories – two other northern jurisdictions dominated by boreal coniferous forests.

Table 3. Numbers and proportions of native flat bark beetle species on islands in Atlantic Canada

	AC	PE	CB	NF
Silvanidae	3	0	1	1
Cucujidae	2	0	1	1
Laemophloeidae	5	1	2	1
Total	10	1 (10%)	4 (40%)	3 (30%)

Notes: AC, Atlantic Canada; PE, Prince Edward Island; CB; Cape Breton Island; NF, insular Newfoundland

Majka (2007b) drew attention to the substantial number of "apparently rare" native saproxylic species found in Atlantic Canada (defined as those comprising ≤ 0.005% of specimens examined from the region). He drew attention to 59 such species from 14 families of beetles that represented 33% of the species in these taxa that fell into the category of "apparently rare." Amongst the flat bark beetles, four of the 10 native species including *Uleiota debilis, Uleiota dubius, Charaphloeus* sp. (nr. *adustus*), and *Placonotus zimmermanni* all fall into this category, and all are associated with hardwoods. Majka (2007b) suggested that the large number of apparently rare species could be related to the long history of forest management practices. For instance, in Nova Scotia although 78% of the land base is forested, less than 1% of that land is composed of old-growth forests (Loo and Ives 2003). Short-rotation, monoculture plantation, forestry practices that have emphasized coniferous trees for fibre production have contributed to an impoverishment of forest diversity, particularly that of long-maturing hardwood forests. It is not unreasonable to suppose that such practices have had a corresponding impact on the invertebrate faunas found in the forests of Atlantic Canada. The most abundant saproxylic species in the region is the introduced *Silvanus bidentatus*, which is principally associated with coniferous trees.

Alexander (2004) draws attention to beetles in Great Britain that are associated with undisturbed forests. Six of the 180 species of beetles used to calculate the Index of Ecological Continuity (an inverse of disturbance) are flat bark beetles including *Silvanus bidentatus, Silvanus unidentatus* (Olivier), *Uleiota planata* (Linnaeus), *Pediacus depressus* (Herbst), *Pediacus dermestoides* (Fabricius), and *Notolaemus unifasciatus* (Latreille) (representing three of the genera found in Atlantic Canada), an indication that some flat-bark beetles are very susceptible to disturbance. With respect to European saproxylics, Grove (2002: 14-15) wrote that, "Many saproxylic species now survive ... only as relictual populations, 'hanging on by the tips of their tarsi' ... In the absence of positive management, the ultimate extinction of some such species (truly the 'living dead') is almost inevitable through stochastic events". Further research needs to be done in Atlantic Canada to determine the impact that forest history and current practices may have had on saproxylic species such as flat bark beetles, and measures which might lessen or ameliorate habitat fragmentation, the disappearance of old-growth forests, and the diminution of coarse woody debris – all parameters of forests significant to this functional group of beetles.

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The aquatic Coleoptera of Prince Edward Island, Canada: new records and faunal composition

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Abstract
The aquatic Coleoptera (Gyrinidae, Haliplidae, Dytiscidae, Hydrophilidae, Elmidae, Dryopidae, Heteroceridae) of Prince Edward Island, Canada is surveyed. Seventy-two species are now known to occur on Prince Edward Island, 26 of which are added to the island's faunal list. Three species, *Gyrinus aquiris* LeConte, *Oulimnius latiusculus* (LeConte), and *Helichus striatus* LeConte, are removed since there are no voucher specimens or published records to substantiate their presence. The name *Dineutus horni* is designated as an incorrect subsequent spelling of *Dineutus hornii* Roberts, 1895. The composition of the fauna is briefly discussed, both from regional and zoogeographic perspectives. There is only one introduced species, *Helophorus grandis* Illiger. Only one third of the aquatic fauna recorded on the neighbouring mainland has been found on Prince Edward Island, perhaps reflecting an island-associated diminution, the paucity of collecting, an area effect, or a combination of all these factors. The island faunas of Prince Edward Island, Cape Breton Island, and insular Newfoundland are compared. Prince Edward Island's is 36% smaller than the others, in contrast with the island's carabid fauna which is almost identical in magnitude with that of Cape Breton. This might reflect dispersal obstacles, the relative paucity of aquatic habitats on the island, or an insufficient collecting effort. Further research would be desirable, both to better discern the composition of the province's fauna, as well as to monitor the health of aquatic ecosystems in relation to anthropogenic activities.

Keywords
Coleoptera, Prince Edward Island, Canada, Gyrinidae, Haliplidae, Dytiscidae, Hydrophilidae, Elmidae, Dryopidae, Heteroceridae, biodiversity, aquatic invertebrates, nomenclature

Introduction

Water beetles are important members of many freshwater aquatic ecosystems. Knowledge of this group of insects in the Maritime Provinces, in general, and on Prince Edward Island, in particular, has been fragmentary. Smetana (1974, 1980, 1985, 1988) made important contributions to knowledge of the Hydrophilidae of the region, Oygur and Wolfe (1991) included information from the Maritime Provinces in their revision of the genus *Gyrinus* (Gyrinidae), and Larson et al. (2000) comprehensively surveyed the Dytiscidae. In the various chapters pertaining to aquatic Coleoptera in Bousquet (1991), 45 species are reported as occurring on the island. Prince Edward Island has, however, been one of the most poorly known jurisdictions in Canada in terms of its beetle fauna. Collecting effort has been sparse, and much of the material extant in historical collections has remained unexamined and unidentified. The present study makes a contribution towards rectifying this situation by reporting the results of recent collecting of water beetles on the island, as well as the examination of existing historical materials in regional collections.

Methods and conventions

Voucher specimens of water beetles collected on Prince Edward Island and deposited in various collections were examined. Codens of collections (following Evenhuis 2007) referred to in the text are:

ACPE Agriculture and Agri-Food Canada, Charlottetown, Prince Edward Island, Canada
CGMC Christopher G. Majka Collection, Halifax, Nova Scotia, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
NSMC Nova Scotia Museum Collection, Halifax, Nova Scotia, Canada
GFC Garth Foster Collection, Ayr, Scotland
UPEI University of Prince Edward Island, Charlottetown, Prince Edward Island, Canada

Note: in some instances specimen records from the UPEI collection are given only for the province as a whole and for the time period 1974-83. These specimens, identified only by catalogue number on their pins, had their detailed collection data recorded in a ledger that was subsequently destroyed by fire. Geo-referenced location coordinates for all collection sites are provided in Appendix 1.

For the purposes of this treatment, northeastern North America is taken to consist of the following jurisdictions: Connecticut, Labrador, Massachusetts, Maine, New Brunswick, Newfoundland, New Hampshire, Nova Scotia, New York, Ontario, Prince Edward Island, Québec, Rhode Island, Saint-Pierre et Miquelon, and Vermont. The classification employed follows that of Katovich (2002), Roughley (2000a, 2000b), Roughley and Larson (2000), Shepard (2002a, 2002b), and Van Tassell (2000).

Results

Seventy-two species of aquatic Coleoptera are known now to occur on Prince Edward Island. Twenty-six species are added to the list of the island's fauna and three species, *Gyrinus aquiris* LeConte, *Oulimnius latiusculus* (LeConte), and *Helichus striatus* LeConte, are removed from the island's faunal list (Table 1). Records for Prince, Queens, and Kings counties (which roughly represent the western, central, and eastern thirds of the island) are indicated. Three species, *Peltodytes edentulus* (LeConte), *Crenitis monticola* (Horn), and *Stictotarsus griseostriatus* (DeGeer), have been recorded only from the province as a whole, thus no further distributional data for them is reported in Table 1. Details of species added to or removed from the island's fauna follow.

Table 1. Aquatic Coleoptera of Prince Edward Island

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
GYRINIDAE				
Gyrininae				
Enhydrini				
Dineutus assimilis Kirby		1		NS, ON, PE, QC, RI
Dineutus hornii Roberts[1]		1	1	NB, NS, NY, ON, PE, QC, RI
Dineutus nigrior Roberts[1]			1	NB, NS, ON, PE, QC, RI
Gyrinini				
Gyrinus affinis Aubé[1]		1	1	LB, ME, NB, NF, NS, NY, ON, PE, QC
Gyrinus bifarius Fall[1]	1	1		LB, ME, NB, NF, NS, NY, ON, PE, QC
Gyrinus confinis LeConte[1]		1		LB, MA, NB, NF, NS, ON, PE, QC
Gyrinus fraternus Couper		1		NS, ON, PE, QC
Gyrinus lecontei (Hope)		1		MA, ME, NB, NS, ON, PE, QC, RI
Gyrinus sayi Aubé	1	1		LB, ME, NB, NF, NS, NY, ON, PE, QC, RI
HALIPLIDAE				
Haliplus canadensis Wallis			1	MA, NS, ON, PE, QC
Haliplus cribrarius LeConte		1	1	CT, LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
Haliplus immaculicollis Harris		1	1	LB, MA, ME, NB, NF, NH, NS, ON, QC, PE, PM, RI
Haliplus longulus LeConte		1		MA, NH, NB, NS, NY, ON, PE, QC, RI
Peltodytes edentulus (LeConte)[1]		•		MA, NB, NH, NS, ON, QC, PE, RI
Peltodytes tortulosus Roberts		1		NH, NS, ON, PE, QC
DYTISCIDAE				
Copelatinae				
Copelatus glyphicus (Say)			1	NF, NS, ON, PE, QC, RI
Laccophilinae				
Laccophilus m. maculosus Say	1	1		MA, NB, NH, NS, ON, QC, PE, RI
Hydroporinae				
Hyphydrini				
Desmopachria convexa (Aubé)		1	1	NB, NS, ON, PE, QC, RI
Bidessini				
Liodessus affinis (Say)			1	ME, NB, NF, NH, NS, ON, PE, QC, RI
Hydroporini				
Hydrocolus stagnalis (G. & H.)		1	1	ME, NB, NF, NH, NS, ON, PE, QC
Hydroporus dentellus Fall		1	1	LB, NB, NH, NS, NY, ON, PE, QC
Hydroporus niger Say		1	1	MA, NB, NF, NH, NS, NY, ON, PE, QC, RI
Hydroporus notabilis LeConte		1		LB, MA, NB, NF, NH, NS, ON, PE, QC
Hydroporus signatus Mannerheim			1	LB, NB, NF, NH, NS, ON, PE, QC, RI
Hygrotus impressopunctatus (Schaller)*	1	1	1	LB, ME, NB, NF, NH, NS, ON, PE, QC
Hygrotus picatus (Kirby)	1	1	1	LB, NB, NF, NS, NY, ON, PE, QC, RI
Hygrotus sayi Balfour-Browne	1		1	LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI, VT
Hygrotus turbidus (LeConte)		1	1	MA, NH, NS, NY, ON, PE, QC, RI

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
Nebrioporus rotundatus (LeConte)	1	1		LB, NB, NF, NS, ON, PE, QC, RI
Neoporus undulatus (Say)	1	1	1	LB, NB, NF, NS, NY, ON, PE, QC, RI
Neoporus dimidiatus (G. & H.)		1	1	LB, MA, ME, NB, NF, NH, NS, ON, PE, QC, RI
Stictotarsus griseostriatus (DeGeer)*		•		LB, ME, NB, NF, NS, ON, PE, QC, RI
Colymbetinae				
Agabini				
Agabus seriatus (Say)[1]		1		LB, MA, ME, NB, NF, NH, NS, ON, PE, QC
Agabus ambiguus (Say)			1	LB, NB, NF, NH, NS, ON, PE, QC, RI
Agabus anthracinus Mannerheim		1	1	LB, NB, NF, NH, NS, ON, PE, QC
Agabus phaeopterus (Kirby)		1		LB, NB, NF, NH, NS, ON, PE, QC
Agabus subfuscatus Sharp		1	1	NB, NS, ON, PE, QC, NF, LB
Agabus discolor (Harris)		1		NB, NS, ON, PE, QC, LB
Ilybius biguttulus (Germar)[1]		1	1	MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI
Ilybius angustior (Gyllenhal)*		1		LB, NB, NF, NS, ON, PE, QC
Ilybius pleuriticus (LeConte)		1		CT, LB, MA, ME, NB, NF, NS, ON, PE, QC, RI, VT
Coptotomini				
Coptotomus longulus lenticus Hilsenhof			1	MA, ME, NH, NS, NY, ON, QC, NB, PE, RI
Colymbetini				
Colymbetes sculptilis Harris		1		LB, NB, NF, NH, NS, NY, ON, PE, QC, RI
Rhantus binotatus (Harris)		1		LB, ME, NB, NF, NH, NS, ON, PE, QC, RI
Rhantus wallisi Hatch[1]		1		LB, NB, NF, NH, NS, ON, PE, QC
Dytiscinae				
Dytiscini				
Dytiscus verticalis Say			1	MA, ME, NB, NH, NS, NY, ON, PE, QC, RI

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
Dytiscus harrisii Kirby[1]	1	1		LB, NB, NF, NH, NS, NY, ON, PE, QC
Dytiscus fasciventris Say[1]			1	LB, ME, NB, NH, NS, ON, PE, QC, RI
Dytiscus dauricus Gebler*	1	1	1	LB, ME, NF, NB, NS, NY, ON, PE, QC
Hydaticini				
Hydaticus aruspex Clark*	1		1	LB, NB, NF, NH, NS, ON, PE, QC
Aciliini				
Acilius mediatus (Say)[1]			1	MA, NB, NH, NS, ON, PE, QC, RI
Acilius semisulcatus Aubé	1	1	1	LB, MA, NB, NF, NH, NS, ON, PE, QC, RI
Graphoderus perplexus Sharp			1	LB, NB, NF, NH, NS, ON, PE, QC
HYDROPHILIDAE				
Helophorinae				
Helophorus grandis Illiger[1]†		1		ME, NB, NH, NS, NY, ON, PE, QC, VT
Helophorus orientalis Motschulsky[1]*	1	1		CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI
Hydrophilinae				
Berosini				
Berosus striatus (Say)[1]			1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI
Anacaenini				
Crenitis digesta (LeConte)[1]			1	MA, NB, NH, NS, NY, ON, PE, QC
Crenitis monticola (Horn)[1]		•		NB, NH, NS, PE, QC
Anacaena limbata (Fabricius)[1]		1		ME, NB, NF, NH, NS, NY, ON, PE, QC
Laccobiini				
Laccobius reflexipennis Cheary[1]		1		NB, NS, ON, PE, QC
Hydrophilini				
Enochrus ochraceus (Melsheimer)[1]		1		MA, ME, NB, NF, NH, NS, ON, PE, QC, RI
Enochrus hamiltoni (Horn)[1]		1	1	MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI

Species	Counties			Distribution in Northeastern North America
	Prince	Queens	Kings	
Hydrobius fuscipes (Linnaeus)[1]*		1		CT, LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI, VT
Hydrobius melaenus (Germar)[1]			1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI, VT
Hydrochara obtusata (Say)[1]	1	1		CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI, VT
Tropisternus glaber Herbst[1]		1	1	MA, NB, NH, NS, NY, ON, PE, QC, RI
Tropisternus mixtus (LeConte)[1]			1	ME, NB, NH, NS, NY, ON, PE, QC, RI
ELMIDAE				
Elminae				
Elmini				
Dubiraphia quadrinotata (Say)	1			ME, NB, NH, NS, NY, ON, PE, QC, PE, RI, VT
Optioservus fastiditus (LeConte)		1	1	NB, NF, NH, NS, NY, ON, PE, QC
Optioservus ovalis (LeConte)		1		CT, LB, ME, NB, NH, NS, NY, ON, PE, QC, VT
Stenelmis crenata (Say)			1	MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI
HETEROCERIDAE				
Heterocerinae				
Heterocerini				
Lantenarius brunneus (Melsheimer)	1			MA, ME, NH, NS, NY, ON, PE, QC, VT, RI
Totals	16	49	39	

Notes: Distributional information is derived from Chandler (2001), Dearborn and Donahue (1993), Downie and Arnett (1996), Larson et al. (2000), Larson and Roughley (1991), LeSage (1991a, 1991b, 1991c), Roughley (1991a, 1991b, 1991c), Sikes (2004), Smetana (1988), and unpublished data.

Regional Distribution: CT, Connecticut; LB, Labrador; MA, Massachusetts; ME, Maine; NB, New Brunswick; NF, insular Newfoundland; NH, New Hampshire; NS, Nova Scotia; NY, New York; ON, Ontario; PE, Prince Edward Island; QC, Québec; RI, Rhode Island; PM, Saint-Pierre et Miquelon; VT, Vermont.

[1], Species newly recorded from Prince Edward Island in the present account; *, Holarctic species; †, introduced Palaearctic species; •, provincial record (no locality or county information available).

Gyrinidae

Adults glide on the surface of ponds, lakes, and slow-moving rivers. They often congregate and swim rapidly in circles when alarmed, giving rise to their common name of whirligig. Adults are scavengers, feeding on dead and dying insects on the water surface, whereas larvae are predaceous on insect larvae and nymphs (Roughley 2000a).

Dineutus hornii Roberts, 1895

Kings Co.: Woodville Mills, 16.IX.2002, C.G. Majka, beaver pond, (3, CGMC). **Queens Co.:** Hillsboro River, 22.VI.1981, V. Friesen, (7, UPEI).

Dineutus hornii is newly recorded on Prince Edward Island. Species of *Dineutus* are found on the surface ponds, streams, lakes and rivers where they often form large rafts of individuals (Roughley 2000a).

Roberts (1895, pp 284) described this species as *Dineutus hornii*, the specific epithet spelled with two "i's". Subsequently some authors (i.e. Leng 1920; Roughley 1991b; Laplante et al. 1991; Dearborn and Donahue 1993; Downie and Arnett 1996; Chandler 2001) dropped the second "i", incorrectly spelling the name "*Dineutus horni*". Accordingly the name *Dineutus horni* is designated as an incorrect subsequent spelling of *Dineutus hornii* Roberts, 1895 (Article 33.3, ICZN 1999).

Dineutus nigrior Roberts, 1895

Kings Co.: Woodville Mills, 16.IX.2002, C.G. Majka, beaver pond, (1, CGMC).

Dineutus nigrior is newly recorded on Prince Edward Island.

Gyrinus aquiris LeConte, 1868

This species was reported from Prince Edward Island by Roughley (1991a), however, there are no voucher specimens from PEI in any collection consulted, nor was the species listed from the province by Fall (1922) or Oygur and Wolfe (1991). Consequently this species is removed from the faunal list of Prince Edward Island.

Gyrinus affinis Aubé, 1838

Kings Co.: Upton, 6.VI.1953, F.M. Cannon, (1, ACPE). **Queens Co.:** Charlottetown, 20.VI.1936, lily pond, UPEI; Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in both lentic (58.8%) and lotic (41.2%) environments (Oygur and Wolfe 1991).

Gyrinus bifarius Fall, 1922

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI). **Prince Co.:** Enmore, 21.V.1981, V. Friesen, (1, UPEI). **Queens Co.:** Mount Herbert, 31.V.1923, J.R. Mutch, (4, UPEI); Officer's Pond, 19.IX.1972, R. Edwards, (1, UPEI); Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in both lentic (25.7%) and lotic (74.3%) environments (Oygur and Wolfe 1991).

Gyrinus confinis LeConte, 1868

Queens Co.: Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found primarily in lentic (91.7%) and occasionally lotic (8.3%) environments (Oygur and Wolfe 1991).

Haliplidae

Species of *Haliplus* and *Peltodytes* are found in small ponds, lakes, and quiet streams where they are frequently observed crawling in algal mats or other vegetation. Adults eat insect eggs, algae, and polyps of Hydrozoa whereas larvae are algophilous (Roughley 2000b).

Haliplus canadensis Wallis, 1933

Kings Co.: Dingwell's Mills, 26.VI.1985, L. LeSage, *Typha* zone along river, (1, CNC).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Haliplus cribrarius LeConte, 1850

Kings Co.: Dingwell's Mills, 26.VI.1985, L. LeSage, *Typha* zone along river, (1, CNC); (no locality recorded), Kings, 13.VII.1988, Y. Bousquet, (1, CNC). **Queens Co.:** Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Haliplus longulus LeConte, 1850

Queens Co.: Brackley Beach, 26.VI.1985, L. LeSage, pond with filamenous algae and rotting vegetation, (1, CNC); Glenroy, 26.VI.1985, L. LeSage and R. Rocho, ditch along railroad, (1, CNC); Harrington, 27.VI.1985, L. LeSage, CNC; north of Pleasant Grove, 27.VI.1985, L. LeSage, (1, CNC).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Peltodytes edentulus (LeConte, 1863)

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI).

Peltodytes edentulus is newly recorded on Prince Edward Island.

Peltodytes tortulosus Roberts, 1913

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI). **Queens Co.:** Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI); Cavendish, duneland trail, 4.IX.1999, T. Huxley, (1, GFC).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Dytiscidae

The Dytiscidae are a diverse and species-rich family of predaceous water beetles. They occur in many aquatic environments.

Agabus seriatus (Say, 1823)

Queens Co.: St. Patricks, 18.VIII.2002, C.G. Majka, along small stream in moss, (4, CGMC).

Newly recorded on Prince Edward Island, this species is found in springs, small, creeks occasionally along the margins of small rivers on mineral substrates or in mats of vegetation at the edge of flowing water (Larson et al. 2000).

Ilybius biguttulus (Germar, 1824)

Prince Edward Island: locality data lost, 1974-1983, (3, UPEI); **Kings Co.:** Valleyfield, 8.VII.1982, V. Friesen, by stream, (1, UPEI); **Queens Co.:** Charlottetown, 25.VI.1978, L.S. Thompson, (1, ACPE); Watervale, 29.VII.1970, R. Wenn, pond edge, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in sun-warmed, permanent lentic habitats in dense aquatic vegetation (Larson et al. 2000).

Rhantus wallisi Hatch, 1963

Queens Co.: locality data lost, VII.1979, L.S. Thompson, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in ponds in wooded areas, in sun-warmed, vegetation-rich margins (Larson et al. 2000).

Dytiscus harrisii Kirby, 1837

Prince Co.: Conway Narrows, 1.VIII.1970, U. Grigg, (1, NSMC); **Queens Co.:** Rice Pt., 12.VII.1983, M.E.M. Smith; Rice Pt., 13.VII.1983, M.E.M. Smith, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in shallow, warm permanent ponds and sedge marshes; specimens have also been taken in beaver ponds and at the edges of slow-moving boreal streams (Larson et al. 2000).

Dytiscus fasciventris Say, 1824

Prince Edward Island: locality data lost, 1974-1983, (5, UPEI); **Kings Co.:** Launching, 26.VIII.2003, C.G. Majka, (1, CGMC).

Newly recorded on Prince Edward Island, this species is found in a variety of ponds and marshes, in particular those with sedges; it is an avid predator of early spring mosquito larvae (Larson et al. 2000).

Acilius mediatus (Say, 1823)

Kings Co.: Souris, 29.VI.1993, L.S. Thompson, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in small forest pools, generally with bare, peaty bottoms; also in pools or adjacent to slow-flowing, brown-water streams (Larson et al. 2000).

Hydrophilidae

The aquatic members of the Hydrophilidae (the present account does not treat terrestrial species in the subfamily Sphaeridiinae) occur in a wide variety of aquatic environments, most of them in standing water and lentic habitats. Most species are scavengers, feeding on various kinds of decaying plant material, or else they feed on living plants such as algae (Smetana 1988).

Helophorus grandis Illiger, 1798

Queens Co.: Harrington, 14.VI.2004, C. Noronha, barley field, pitfall trap, (1, ACPE); Mount Herbert, Orphanage Pond, 30.V.1923, J.R. Mutch, (1, UPEI); West Royalty, 16.V.1983, L.S. Thompson, (1, ACPE); Wood Islands, 30.VI.2003, C.G. Majka, (1, CGMC).

Newly recorded on Prince Edward Island, this species favours temporary pools and muddy or weedy margins of ponds or lakes (Smetana 1988).

This adventive, Palaearctic species was first reported in North America by Darlington (1927). Smetana (1985) examined specimens from as early as 1904 from Montreal, although Brown (1940) noted a specimen from Chicoutimi, Québec, from the "second" collection of Provancher acquired sometime between 1877 and 1892. The earliest records from New Brunswick are in 1926 and from Nova Scotia in 1947 (Smetana 1985) so the collection from 1923 on Prince Edward Island establishes a new early timeline for *H. grandis* in the Maritime Provinces of Canada.

Helophorus orientalis Motschulsky, 1860

Prince Co.: Summerside, 19.VI.1992, M.E.M. Smith, potato field, pitfall trap, (5, ACPE); **Queens Co.:** New Glasgow, 13.VII.2002, C.G. Majka, meadow, (1, CGMC); St. Patricks, 18.VIII.2002, in wet moss beside small stream, (2, CGMC); St. Patricks, 14.VII.2002, in wet moss beside small stream, (9, CGMC).

Newly recorded on Prince Edward Island, this Holarctic species is found in a wide range of lotic and lentic environments, however, shallow temporary pools with plenty of vegetation are preferred (Smetana 1988).

Berosus striatus (Say, 1825)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (1, CGMC).

Newly recorded on Prince Edward Island, the species favours a wide variety of aquatic habitats favouring margins of deeper waters, particularly those with sandy bottoms and lots of debris (Smetana 1988).

Crenitis digesta (LeConte, 1855)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (4, CGMC).

Newly recorded on Prince Edward Island. It is found in both lotic and lentic environments, however, little is known about its habitat preferences (Smetana 1988).

Crenitis monticola (Horn, 1890)

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in both lotic and lentic environments, however, little is known about its habitat preferences (Smetana 1988).

"Anacaena limbata (Fabricius, 1792)"

Queens Co.: Millvale, 25.VI.2003, C.G. Majka, old mill pond, (2, CGMC); Millvale, 15.VIII.2004, C.G. Majka, old mill pond, (7, CGMC); St. Patricks, 18.VIII.2002, C.G. Majka, in wet moss beside small stream, (3, CGMC); St. Patricks, 14.VII.2002, C.G. Majka, in wet moss beside small stream, (3, CGMC); Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, pond, (1, UPEI).

Newly recorded on Prince Edward Island, this species favours shallow standing water or margins of slow-flowing creeks with vegetation. It is also frequently found in semi-aquatic habitats (Smetana 1988).

The zoogeographic status of this species is unclear. Smetana (1988) regarded it as an apparently Palaearctic species introduced to North America. He also drew attention to the fact that it appeared that two species, *A. lutescens* (Stephens 1829) and A. *limbata,* were being confused under the name of *A. limbata* in North America. Albrecht Komarek (pers. comm.), who is revising the genus worldwide, points out that while *A. limbata* and *A. lutescens* are readily separable in Europe, North American specimens cannot unambiguously be assigned to either species. He believes that North American specimens may represent a separate, undescribed "cryptic" species in the *lutescens* complex. Morphological examinations cannot resolve the problem and it may require molecular phylogenetic analysis in order to discern the nature of this "species." Thus, in the present treatment, I provisionally treat it as a Nearctic species in the *lutescens* complex whose status has yet to be fully discerned.

Laccobius reflexipennis Cheary, 1971

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI); **Queens Co.:** St. Patricks, 14.VII.2002, C.G. Majka, in wet moss beside small stream, (1, CGMC).

Laccobius reflexipennis is newly recorded on Prince Edward Island. No information on the bionomics of this species is available. Species of *Laccobius* are found in both lotic and lentic environments (Smetana 1988).

Enochrus ochraceus (Melsheimer, 1846)

Queens Co.: Watervale, 29.VII.1970, R. Wenn, aquatic vegetation, (1, UPEI).

Newly recorded on Prince Edward Island, this species prefers shallow water with abundant organic debris (Smetana 1988).

Enochrus hamiltoni (Horn, 1890)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (4, CGMC); **Queens Co.:** St. Patricks, 18.VIII.2002, C.G. Majka, in wet moss beside small stream, (2, CGMC); Wood Islands, 30.VI.2003, C.G. Majka, (1, CGMC).

Newly recorded on Prince Edward Island, this is a common species, abundant in a wide range of aquatic habitats (Smetana 1988).

Hydrobius fuscipes (Linnaeus, 1758)

Prince Edward Island: locality data lost, 1974-1983, (9, UPEI); **Queens Co.:** Watervale, 29.VII.1970, R. Wenn, aquatic vegetation, (1, UPEI); Harrington, 22.VI.1981, K. MacDonald, pond, (1, UPEI); West Royalty, 25.VI.1970, R. Wenn, light trap, North Rustico, 26.VI.2003, C.G. Majka, seashore, (1, CGMC).

Newly recorded on Prince Edward Island, this species is found in a wide range of aquatic habitats, particularly shallow, stagnant pools with plant debris; also in swampy habitats and *Sphagnum* bogs (Smetana 1988).

Hydrobius melaenus (Germar, 1824)

Kings Co.: Woodville Mills, 23.VII.2001, C.G. Majka, under stone beside small stream, (1, CGMC).

Newly recorded on Prince Edward Island, this species prefers running water habitats in places protected from currents (Smetana 1988).

Hydrochara obtusata (Say, 1823)

Prince Edward Island: locality data lost, 1974-1983, (2, UPEI); **Prince Co.:** Conway Narrows, 23.VIII.1970, U. Grigg, (1, NSMC); **Queens Co.:** Charlottetown, 1952, F.M. Cannon, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in a wide range of aquatic habitats, particularly in shallow water with rich vegetation. It is occasionally found under stones and wood at the edge of water (Smetana 1988).

Tropisternus glaber Herbst, 1797

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI); **Kings Co.:** Woodville Mills, 16.VIII.2003, C.G. Majka, beaver pond, (1, CGMC); **Queens Co.:** Watervale, 29.VII.1970, R. Wenn, vegetation at edge of pond, (1, UPEI); locality data not recorded, VII.1979, L.S. Thompson, (1, ACPE).

Newly recorded on Prince Edward Island, this species frequents a wide-range of aquatic habitats, particularly lentic ones; often in marshes, swamps and bogs (Smetana 1988).

Tropisternus mixtus (LeConte, 1855)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (1, CGMC).

Newly recorded on Prince Edward Island, this species prefers cool and clean aquatic habitats, mostly in standing water; occasionally around the edges of running water (Smetana 1988).

Elmidae

Adults and larvae of the Elmidae are aquatic beetles found attached to rocks and other substrates. All the species on Prince Edward Island inhabit rapid, cool, and well-oxygenated streams where they feed on algae or detritus (Shepard 2002a).

Oulimnius latiusculus (LeConte, 1866)

This species was recorded from Prince Edward Island by LeSage (1991c), however, there are no voucher specimens in any collection consulted, and no published records of this species from the province. It is not listed as occurring in PEI by Brown (1983b). Laurent LeSage (pers. comm.) was unable to determine the source of the original report. Consequently this species is removed from the faunal list of Prince Edward Island.

Dryopidae

The aquatic species of this family found in North America are riparian where they are found crawling on various substrates in streams. Adults and larvae are herbivorous (Shepard 2002b).

Helichus striatus striatus LeConte, 1852

Although this species was recorded from Prince Edward Island by LeSage (1991b) there are no voucher specimens in any collection consulted, nor are there published records of this species from the province. It is not listed as occurring in PEI by Brown (1983a). Laurent LeSage (pers. comm.) was unable to determine the source of the original report. Consequently this species is removed from the faunal list of Prince Edward Island.

Heteroceridae

Adult heterocerids are commonly associated with riparian or other water-edge habitats where they excavate tunnels in sand or mud. They feed on algae, plankton, and organic matter (Katovich 2002).

Lantenarius brunneus (Melsheimer, 1844)

Prince Co.: Scales Pond, 12.VII.1988, Y. Bousquet, (1, CNC).

The species was recorded from Prince Edward Island by LeSage (1991a), however, the collection data for this species has not previously been published.

Discussion

Seventy-two species of water beetles are known from Prince Edward Island: ten gyrinids, six haliplids, 40 dytiscids, 14 hydrophilids, four elmids, and one heterocerid (Table 1). Of these, 26 species are newly recorded from Prince Edward Island: five gyrinids, one haliplid, six dytiscids, and 14 hydrophilids. Three species, *Gyrinus aquiris* LeConte, *Oulimnius latiusculus* (LeConte), and *Helichus striatus* LeConte, have been removed from the faunal list of Prince Edward Island since no voucher specimens or published records of these species on PEI could be located. There are records of 49 species from Queens County, 39 from Kings County and 16 from Prince County. These regional differences may be attributable to variations in collecting effort between these three portions of the province. Alternatively they may reflect anthropogenic influences on the fauna since Prince County is the most heavily farmed portion of the island and in recent years the area has experienced a number of well-documented fish-kills due to pesticide run off.

The composition of the fauna reflects that of the Maritime Provinces as a whole. All the species found on Prince Edward Island have also been recorded in Nova Scotia, and all but six [*Dinetus assimilis* Kirby, *Haliplus canadensis* Wallis, *Peltodytes tortulosus* Roberts, *Copelatus glyphicus* (Say), *Hygrotus turbidus* (LeConte), and *Lantenarius brunneus* (Melsheimer)] have also been recorded in New Brunswick. The absence of these six species in the latter province is likely attributable to a lack of collection effort in New Brunswick, a relatively poorly investigated province within Canada in terms of its beetle fauna. In general, Prince Edward Island's fauna appears to be relatively homogeneous in composition. For example, of the 40 species of Dytiscidae found on Prince Edward Island, all are broadly distributed in the Atlantic Maritime Ecozone and all 40 are also found in the neighbouring Boreal Shield and Mixed Plains Ecozones (Larson et al. 2000).

The Nearctic component of the fauna is made up of 64 species (89%), the Holarctic component of 7 species (10%), and the introduced, Palaearctic component of one species (1%). The proportion of Holarctic Carabidae on Prince Edward Island (10.5%) is very similar (Majka et al. 2008), however, the proportion of adventive aquatic species in comparison to the overall adventive beetle fauna of Prince Edward Island (21.2%, unpublished data) is very slight.

As is typical in the case with island faunas, that of Prince Edward Island is diminished in comparison with that of the neighbouring mainland. Table 2 indicates that the 71 native water beetles found on Prince Edward Island are only 34% of the

Table 2. Composition of the Maritime Provinces aquatic Coleoptera

Family	NB	NS	CB	PEI	SI	MP	N	H	P	NF
Gyrinidae	18	20	9	9	0	24	23	1		10
Haliplidae	10	12	4	6	1	13	12	1		4
Dytiscidae	83	89	62	38	9	104	91	13		80
Hydrophilidae*	38	39	27	14	3	43	35	7	1	13
Hydraenidae	3	2	1	0	0	3	3			1
Elmidae	10	12	7	4	0	13	13			5
Dryopidae	3	2	0	0	0	3	2		1	1
Heteroceridae	5	4	1	1	1	6	6			0
Psephenidae	2	2	0	0	0	2	2			0
Total	172	182	111	72	14	211	187	22	2	114

Notes: NB, New Brunswick; NS, Nova Scotia; CB, Cape Breton; PEI, Prince Edward Island; SI, Sable Island; MP, Maritime Provinces; NF, insular Newfoundland; N, Nearctic; H, Holarctic; P, Palaearctic. Information is derived from Larson et al. (2000), Larson and Roughley (1991), LeSage (1991a, 1991b, 1991c), Roughley (1991a, 1991b, 1991c), Smetana (1988), Vondel (2005), and unpublished data. Information from Newfoundland is provided as a basis of comparison.

* excluding the Sphaeridiinae

total native mainland fauna (209 species) recorded in the Maritime Provinces. This may represent an island-associated diminution, the paucity of collecting, an area effect, or a combination of all these factors. In comparison, Majka and McCorquodale (2006) found that Prince Edward Island had 39% of the native Maritime Provinces fauna of Coccinellidae, Majka and Jackman (2006) found 40% of Maritime species of Mordellidae, Majka et al. (2007) found 32% of the native Maritime Cerambycidae, and Majka et al. (2008) found 49% of the native Maritime Carabidae that occur on Prince Edward Island.

In an examination of the native Carabidae of insular portions of Atlantic Canada, Majka et al. (2008) found that despite significantly different land areas, and different distances to the neighbouring continental mainland, the island faunas of Prince Edward Island (with a land area of 5,660 km^2 and 13 km from the mainland) and insular Newfoundland (with a land area of 111,390 km^2, 18 km distant from Labrador and 110 km from Cape Breton Island), are very similar (144 and 148 species respectively) despite differences in composition. The fauna of Cape Breton Island (with a land area of 10,311 km^2 and 1.5 km from the mainland) was 16% greater consisting of 170 species. In the case of aquatic beetles the situations is reversed. Table 2 indicates that the size of the Cape Breton and Newfoundland faunas are very similar (111 and 114 species respectively), whereas that of Prince Edward Island is 36% smaller consisting of 72 species. This difference could be due to several factors. It could be that the 13+ km wide Northumberland Strait has been a barrier to the dispersal of some species of aquatic Coleoptera; or the comparative lack of certain aquatic habitats on the island (which has only one freshwater lake and only relatively short watersheds); or the comparative lack of collecting on Prince Edward Island; or a combination of all these factors. There are, however, more than 800 millponds and a large number of springs on the island, many of which have been little or not at all investigated in terms of their aquatic beetle fauna. Further research in these habitats may yield additional species for the Prince Edward Island fauna.

As a rather different point of comparison, there have been 14 species of water beetles recorded on Sable Island (Table 2) which is circa 50 km^2 in area and is 160 km from the Nova Scotia mainland, although one of these species, *Hydrophilus triangularis* Say, was recorded only as a stray (Wright 1989).

Helophorus grandis is the only adventive water beetle found on Prince Edward Island and it is noteworthy that the collection from 1923 establishes a new early timeline for this species in the Maritime Provinces. Its collection in pitfall traps in agricultural fields may be indicative of a mode of introduction. Brown (1950) and Lindroth (1957) developed the theory that ships' dry ballast was a probable source of entry of many adventive ground-dwelling Coleoptera. It is possible that *H. grandis* might belong to the suite of adventive beetles that were introduced to North America via this mechanism.

Almost all of the knowledge that we have about the Prince Edward Island aquatic beetle fauna has been acquired recently. Of the 72 species recorded to date, all but eight (*Gyrinus affinis*, *Gyrinus bifarius*, *Laccophilus m. maculosus* Say, *Ilybius angustior*

(Gyllenhal), *Colymbetes sculptilis* Harris, *Rhantus binotatus* (Harris), *Acilius semisulcatus* Aubé, and *Helophorus grandis*) have first been recorded in the last 50 years (and these eight species have also been recorded subsequently). Thus the very limited historical information on these aquatic insects on the island means that it is not possible to determine historical population trends.

Conclusions

Despite the many additions to the faunal list of Prince Edward Island, the preceding account clearly represents only a preliminary treatment of the aquatic beetles of the province. The comparative dearth of collecting means that it is likely that additional species remain to be found. As well, the detailed distribution of these species on the island remains to be discerned. Yves Alarie at Laurentian University has been conducting surveys on Prince Edward Island and it is to be expected that the results of his work will yield additional information. As well, D. Giberson and her students at the University of Prince Edward Island, continue to investigate aquatic habitats, programs that will also doubtless yield important comparative information on aquatic insects and invertebrates. Prince Edward Island has experienced a long history of anthropogenic activities, which in the past 60 years has included the extensive use of insecticides and other biocides. Ongoing surveying of populations of aquatic insects such as beetles, may provide avenues of monitoring the health of aquatic ecosystems and of environmental change.

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Appendix 1. Coordinates of collection localities

	North latitude	**West longitude**
Brackley Beach	46º 24’	63º 11’
Cavendish	46º 29’ 48”	63º 23’ 17”
Charlottetown	46º 15’ 38”	63º 08’ 37”
Conway Narrows	46º 39’	63º 59’
Dingwell’s Mills	46º 31’ 27”	62º 26’ 35”
Enmore	46º 35	64º 02’
Glenroy	46º 21’ 10”	62º 34’ 22”
Harrington	46º 21’	63º 10’
Launching	46º 13’ 06”	62º 24’ 46”
Millvale	46º 24’ 35”	63º 25’ 19”
Mount Herbert	46º 13’ 49”	63º 02’ 14”
New Glasgow	46º 24’ 36”	63º 20’ 54”
North Rustico	46º 27’ 25”	63º 17’ 55”
Pleasant Grove	46º 22’ 05”	63º 03’ 37”
Rice Point	46º 08’	63º 15’
St. Patricks	46º 23’ 55”	63º 24’ 18”
Scales Pond	46º 20’	63º 36’
Souris	46º 21’	62º 15’
Summerside	46º 23’	63º 48’
Upton	46º 20’	63º 32’
Valleyfield	46º 08’	62º 44’
Vernon River	46º 12’	62º 51’
Watervale	46º 15’ 47”	62º 53’ 13”
West Royalty	46º 15’ 55”	63º 09’ 27”
Wood Islands	45º 57’ 27”	62º 44’ 55”
Woodville Mills	46º 14’ 26”	62º 30’ 46”

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RESEARCH ARTICLE

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Review of the Canadian Eustrophinae (Coleoptera, Tetratomidae)

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Abstract

Currently, the Canadian fauna of Eustrophinae consists of 7 species in 5 genera, as follows: *Pseudoholostrophus impressicollis* (LeConte), *P. discolor* (Horn); *Holostrophus bifasciatus* (Say); *Eustrophus tomentosus* Say; *Eustrophopsis bicolor* (Fabricius), *E. confinis* (LeConte); *Synstrophus repandus* (Horn). None of these 7 species is restricted to Canada; each has a wider distribution in the United States. Each species (adult stage only) is diagnosed and described with selected morphological features illustrated. A key to Nearctic genera, and Canadian species of Eustrophinae is presented, as well as a checklist of all Nearctic species of the subfamily. Lectotypes are designated for *Holostrophus discolor* Horn and *Eustrophus confinis* LeConte. Neotypes are designated for *Eustrophus bifasciatus* Say and *Eustrophus tomentosus* Say. The Canadian distribution of each species is mapped in detail, as well as a general indication of distribution in the United States. Aspects of the natural history of all species, where known, are included.

Keywords

Tetratomidae, Canada, distribution, natural history, faunistics, identification key

Introduction

The Eustrophinae are a relatively small, structurally and ecologically homogenous group of tenebrionoid beetles. Like many other taxa of the superfamily, these beetles have not had a stable family placement until recently. This instability is due at least partly to the over-reliance on adult characters, which suggested to some authors a relationship between the Eustrophinae and Melandryidae (e.g. Arnett 1968). Other non-North American authors (e.g. Crowson 1964; Hayashi 1975; Viedma 1971) suggested a relationship between Eustrophinae and Tetratomidae, based on both adult and larval characteristics.

Indeed, due to the popularity of Arnett (1968), most North American coleopterists were unfamiliar with the family Tetratomidae, since Arnett chose to incorporate its constituents into a very broad concept of Melandryidae. In the most recent comprehensive family/subfamily-level classification of Coleoptera, Lawrence and Newton (1995) placed the Eustrophinae again within Melandryidae. However, the eustrophines seem to have found a stable family placement within the Tetratomidae, as outlined by Nikitsky (1998). Earlier, Chantal (1985) also placed the eustrophines in Tetratomidae, without giving any detailed explanation. Nikitsky (1998) treated the genera of Tetratomidae worldwide, and combined larval and adult characters into the classification. He also created several new taxa within the subfamily, notably the new tribe Holostrophini and a new subgenus *Holostrophinus*, and synonymized the name *Eustrophinus* Seidlitz with *Eustrophopsis*, the latter of which was formerly restricted to mainly tropical species with a notched prosternal process. No phylogenetic analysis accompanied the treatment of Nikitsky (1998) but placement within Tetratomidae seems well supported.

Like most groups of Coleoptera, relatively little is known about the ecology and habits of members of Eustrophinae, although they are associated with various fungi found in and on coarse woody debris in forest habitats. Most fungal host records are within the Polyporales (e.g. *Polyporus*, *Fomes*, *Trametes*, *Meripilus*, *Panus*, *Spongipellus*, and *Laetiporus*), with several genera of Agaricales also (e.g. *Pleurotus* and *Omphalotus*). Specimens have also been taken from fungi on isolated trees, for example, in urban areas. Host records and habitat associations are given in Chantal (1985), Lawrence (1991) and Majka and Pollock (2006). When observed and/or collected in situ, adult eustrophines are most often found on fruiting bodies of the fungi, or adjacent wood. Larvae are often found deeper within the substrate, where there is a mixture of fungal hyphae and rotting wood. Adult eustrophines are uncommonly collected in long series, except when they are trapped (e.g. in Lindgren funnel traps) or sought at night on fungusy wood. The fact that there are gaps in the distributions of species such as *Eustrophus tomentosus* Say and *Synstrophus repandus* (Horn) may be due more to lack of effective collecting methods than to unsuitable habitat or other barriers. Details of natural history are given below, for individual species; most data are taken directly from specimen labels.

There is presently no comprehensive treatment of any genus of Eustrophinae or of the entire subfamily; for North American components of the group, all that has been published are checklists (e.g. LeSage 1991) or keys to genera (e.g. Arnett 1968; Young and Pollock 2002). Nothing specific has been published regarding the Canadian eustrophines, although Chantal's (1985) "Tetratomidae of Quebec" included six of the seven species of Eustrophinae found in Canada. In fact, southern Quebec is the area of highest diversity of Canadian Eustrophinae. In this work, species are keyed, described briefly, and distributions mapped. Also, data on biology and natural history were presented for each species. The present study, while overlapping considerably at the species level, is an extension of the excellent work done by Chantal (1985), as it enlarges the coverage to the entire country, and also updates the taxonomy, notably at the genus and subgenus levels.

No species of Eustrophinae are restricted to Canada; rather, the Canadian distribution of each represents the northern range limit of an otherwise fairly widespread

U.S. distribution. For example, *Pseudoholostrophus discolor* (Horn) is known from two localities in Canada, while others, such as *Eustrophopsis confinis* (LeConte) are relatively more widespread across the country. One species, *P. impressicollis* (LeConte), is restricted to extreme western Canada. Three species – *Eustrophopsis confinis*, *Eustrophus tomentosus* and *Synstrophus repandus* – are known from British Columbia to Quebec and/or the Maritime provinces, with gaps in Alberta and Saskatchewan (a single record of *E. confinis* is known from Saskatchewan). As mentioned above, these gaps perhaps have more to do with incomplete collecting, rather than some biogeographic artifact. However, there have been, and still are, very keen beetle collectors in Alberta and Saskatchewan. As part of a paper on saproxylic beetles, Majka and Pollock (2006) provided new Canadian Maritime records for several species.

Material and methods

Adult specimens of Eustrophinae collected in Canada were borrowed from the collections below; the collection abbreviations are used in the locality lists. Several thousand specimens of U.S. -collected eustrophines were also examined (as part of a larger study of Nearctic Eustrophinae); these specimens were used to construct the inset maps, showing US distributions for each species known from Canada. Specimens mentioned by Chantal (1985) were not examined in this study; however, the localities mentioned in that work were used in the distribution maps.

AMNH	American Museum of Natural History, New York, NY
CARR	J.B. and A. Carr Collection (now part of CNC)
CGMC	Chris G. Majka Collection (private)
CMNC	Canadian Museum of Nature, Ottawa, ON
CMNH	Carnegie Museum of Natural History, Pittsburgh, PA
CNC	Canadian National Collection of Insects, Ottawa, ON
CUIC	Cornell University, Ithaca, NY
DAPC	Darren A. Pollock Collection (private)
DEBU	University of Guelph, Guelph, ON
FMNH	Field Museum of Natural History, Chicago, IL
FSCA	Florida State Collection of Arthropods, Gainesville, FL
GJHC	Gerald Hilchie Collection (private)
JBWM	J.B. Wallis Museum of Entomology, Winnipeg, MB
MCZ	Museum of Comparative Zoology, Cambridge, MA
PFC	Pacific Forestry Centre, Victoria, BC
RBCM	Royal British Columbia Museum, Vancouver, BC
ROME	Royal Ontario Museum, Toronto, ON
SLC	Serge LaPlante Collection (private)
UAIC	University of Arizona, Tucson, AZ
UBC	University of British Columbia, Vancouver, BC

USNM National Museum of Natural History, Smithsonian Institution, Washington, DC
UWEM University of Wisconsin, Madison, WI

Standard methods of examination and description of specimens were used. Published lists of localities for Canadian Eustrophinae (e.g. Chantal 1985) were used to construct the distribution maps, but specific locality data are not given under the section "material examined".

Due to the regional aspect of this paper and because it is not meant to be a taxonomic revision, full descriptions are not given for genera or species; rather, descriptions are diagnostic in nature, with emphasis on characteristics that will facilitate rapid determination of species. Complete descriptions (of genera and species) will be published elsewhere, as part of a comprehensive review of the entire subfamily Eustrophinae.

Because of the relative rarity of specific life history data, all known information is given for each species, even if taken from specimens collected outside of Canada. The geographic origin of such extralimital information is indicated by the standardized, two-letter postal abbreviation following each datum.

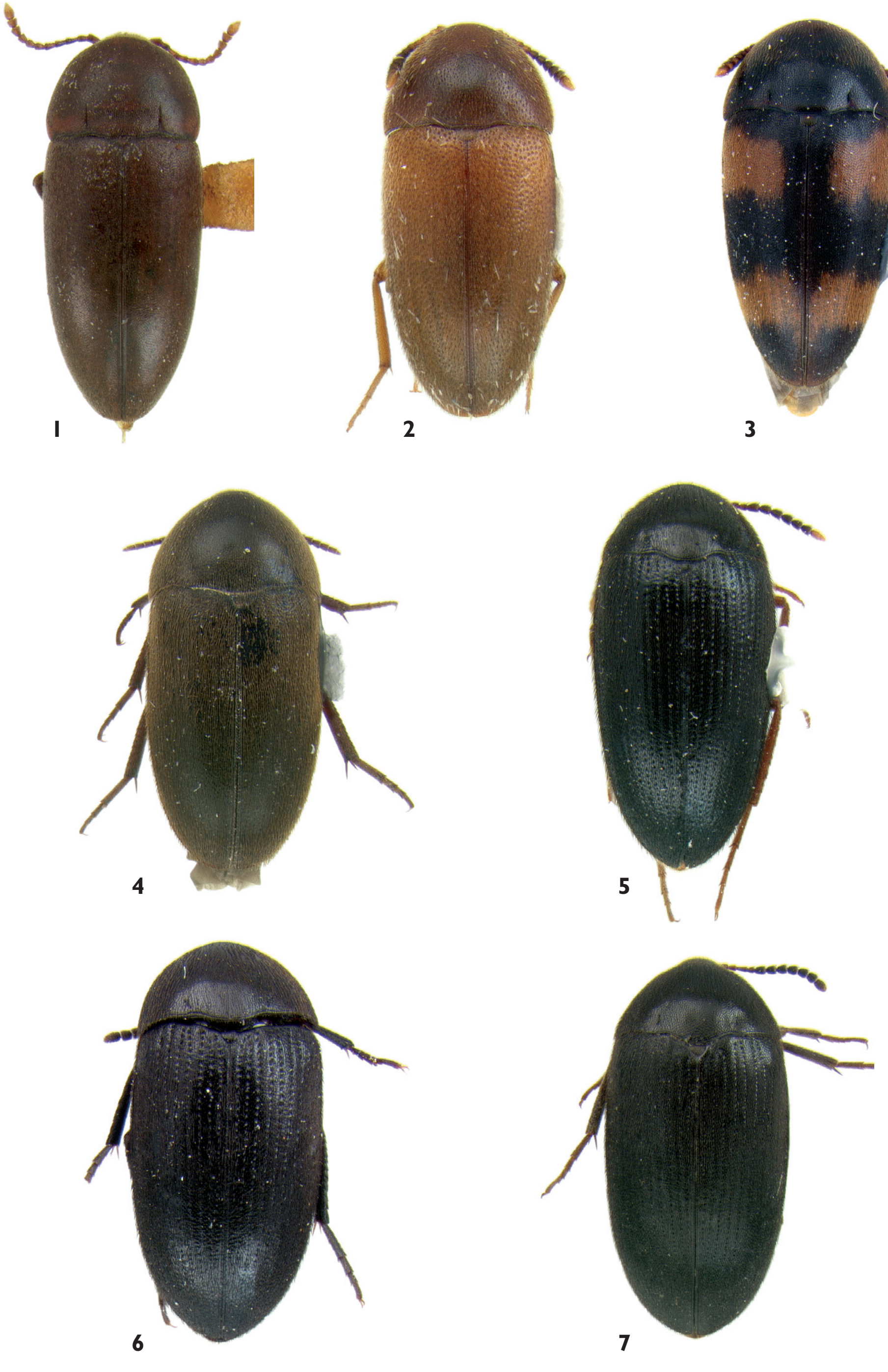
In the descriptions, TL = length from anterior margin of pronotum, to elytral apex along midline. The length of the head was not used, since the head is deflexed and therefore does not contribute to body length. GEW = greatest width across both elytra.

For type specimens, complete verbatim label data are given, enclosed within quotation marks; individual labels are separated by a slash (/).

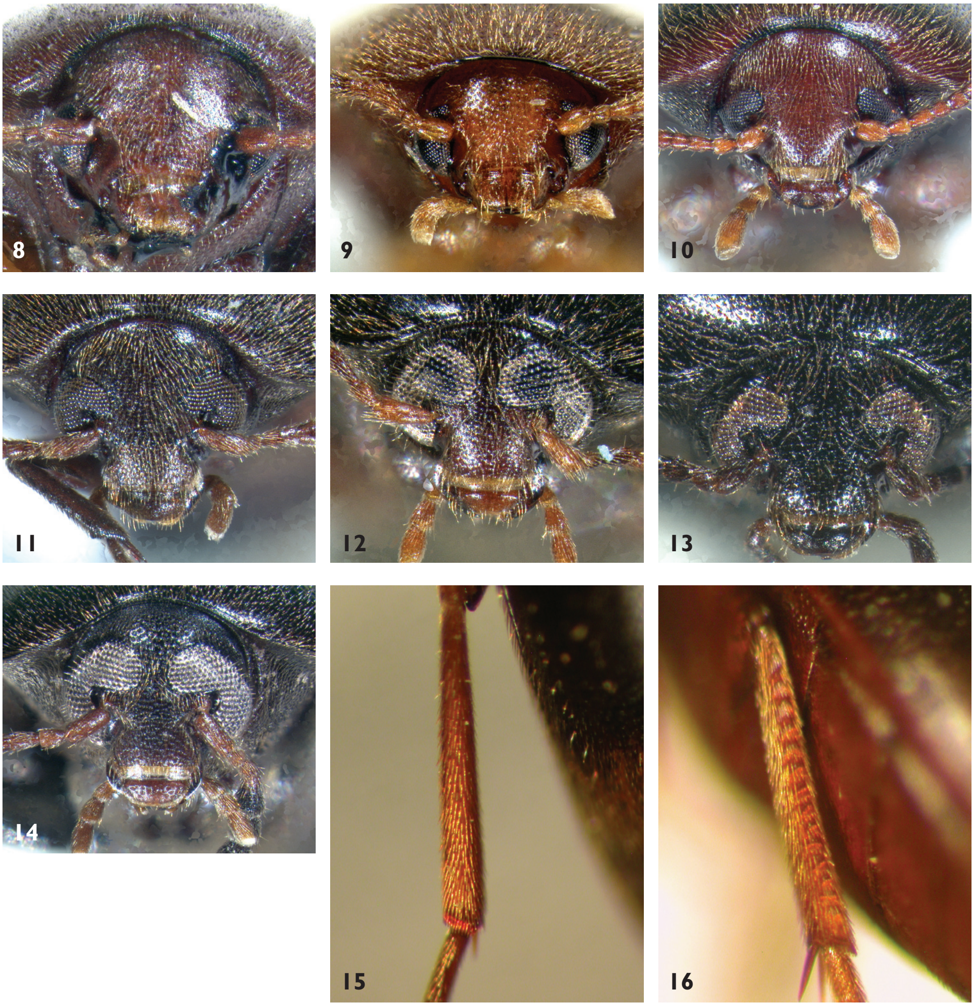
Figures 1-14 were taken with a JVC digital camera KY-F775U attached to a Leica Z16 APO stereoscope. Images were then modified using Auto-Montage Pro version 5.01.0005. Figures 15-16 were taken through a Leica MZ95 stereoscope, using a Nikon CoolPix digital camera; they were not modified further. Figures 17-25 were produced using a camera lucida attached to a Wild stereoscope.

Identification key to Nearctic genera and Canadian species of Eustrophinae

1 Outer faces of meso- and metathoracic tibiae with numerous oblique, comblike ridges (as in Fig. 16) 2
– Outer faces of meso- and metathoracic tibiae with scattered spines but without oblique ridges (Fig. 15) 4
2(1) Prothoracic episterna with distinct, transverse suture; dorsal surface dark piceous to black, without brownish iridescence (*Eustrophopsis* Champion) 3
– Prothoracic episterna without transverse suture; dorsal surface distinctly brown, slightly iridescent .... *Eustrophus tomentosus* Say
3(2) Innermost margins of eyes widely separated by distance greater than length of first antennomere (Fig. 13); entire body dark brown to black, without distinctly contrasting lighter color ventrally or on antennae .... *Eustrophopsis confinis* (LeConte)



Figs 1-7. Dorsal habitus of Canadian eustrophines. Fig. 1. *Pseudoholostrophus impressicollis*, TL = 4.3 mm; Fig. 2. *Pseudoholostrophus discolor*, TL = 4.8 mm; Fig. 3. *Holostrophus bifasciatus*, TL = 5.8 mm; Fig. 4. *Eustrophus tomentosus*, TL = 4.8 mm; Fig. 5. *Eustrophopsis bicolor*, TL = 5.6 mm; Fig. 6. *Eustrophopsis confinis*, TL = 5.4 mm; Fig. 7. *Synstrophus repandus*, TL = 6.8 mm.



Figs 8-16. Features of Canadian eustrophines. Figs. 8-14. Frontal view of head (same specimens as in Figs. 1-7). Fig. 8. *Pseudoholostrophus impressicollis*; Fig. 9. *Pseudoholostrophus discolor*; Fig. 10. *Holostrophus bifasciatus*; Fig. 11. *Eustrophus tomentosus*; Fig. 12. *Eustrophopsis bicolor*; Fig. 13. *Eustrophopsis confinis*; Fig. 14. *Synstrophus repandus*. Figs. 15-16. Hind tibia. Fig. 15. *H. bifasciatus*; Fig. 16. *E. tomentosus*.

– Innermost margins of eyes more narrowly separated (Fig. 12), in some specimens virtually contiguous; if slightly separated, then gap less than length of first antennomere; body dark dorsally, with legs, much of venter and antennomere 11 distinctly contrasting.................. *Eustrophopsis bicolor* (Fabricius)

4(1) Prosternal process narrowed distally, not extending posteriad of prothoracic coxae; elytral punctation coarse, forming distinct striae (Fig. 7) ....*Synstrophus repandus* (Horn)

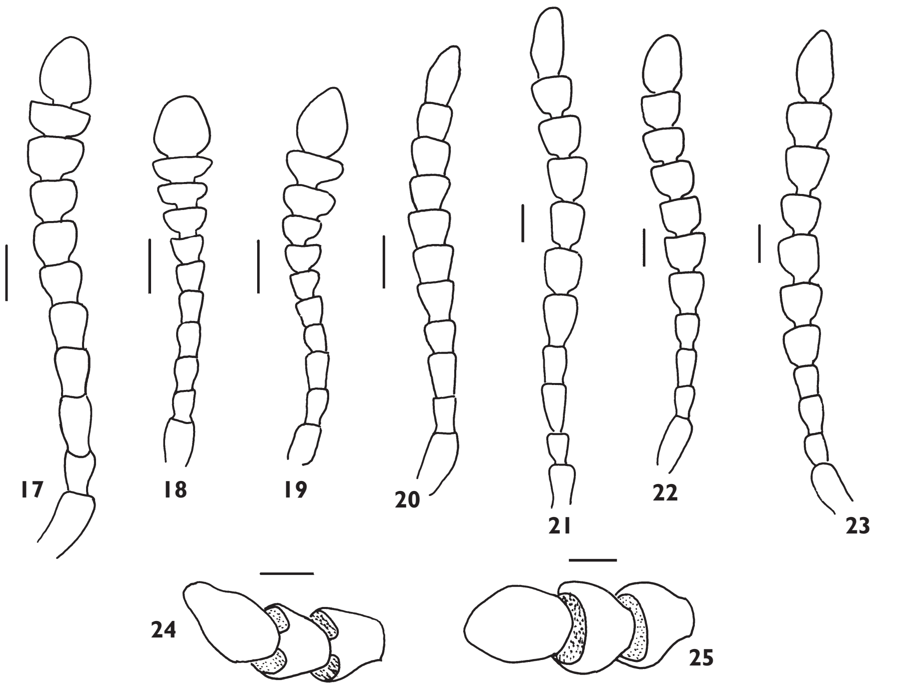
– Prosternal process widened distally, separating prothoracic coxae; elytral punctation fine to coarse, not forming distinct striae (Holostrophini)......... 5

5(4) Eyes distinctly emarginate (Fig. 10); prosternal process longer, protruding behind posterior edge of prothoracic coxae; elytra dark in color, with 4 subquadrate, lighter colored maculae (Fig. 3) ....*Holostrophus bifasciatus* (Say)

– Eyes only indistinctly emarginate (Figs 8-9); prosternal process at most slightly projecting behind posterior edge of prothoracic coxae; elytra uniformly rufous to piceous, without distinctly delimited lighter areas (*Pseudoholostrophus* Nikitsky)... 6

6(5) Dorsal surface finely punctate (Fig. 1), setae short and adpressed against surface; impressions along posterior pronotal margin linear, parallel, distinctly impressed; anterior margin of pronotum not elevated shelf-like above level of head; known only from western North America (in Canada, only British Columbia) .... *Pseudoholostrophus impressicollis* (LeConte)

– Dorsal surface more coarsely punctate (Fig. 2), setae more distinct and at least partly erect; impressions along posterior pronotal margin indistinct; anterior margin of pronotum distinctly elevated above level of head; known only from eastern North America (in Canada, only southern Quebec) ....*Pseudoholostrophus discolor* (Horn)



Figs 17-25. Antennae of Canadian eustrophines. Fig. 17. *Pseudoholostrophus impressicollis*; Fig. 18. *Pseudoholostrophus discolor*; Fig. 19. *Holostrophus bifasciatus*; Fig. 20. *Eustrophus tomentosus*; Fig. 21. *Eustrophopsis bicolor*; Fig. 22. *Eustrophopsis confinis*; Fig. 23. *Synstrophus repandus*; Fig. 24. *E. tomentosus*, antennomeres 9-11 (sensillar field indicated by stippling); Fig. 25. *S. repandus*, antennomeres 9-11 (sensillar field indicated by stippling). Scale bar = 0.25 mm (Figs. 17-23); 0.1 mm (Figs. 24-25).

Species accounts

Tribe **Holostrophini** Nikitsky, 1998

Pseudoholostrophus Nikitsky, 1983

Pseudoholostrophus Nikitsky, 1983: 37.—Type species: *Hallomenus klapperichi* Pic, 1954 (orig. des.); Nikitsky, 1998: 40; Young and Pollock, 2002: 416.

This genus was described by Nikitsky (1983) on the basis of examination of *Hallomenus klapperichi* Pic, which is now included in, and type species of *Pseudoholostrophus*. According to Nikitsky (1998), *Pseudoholostrophus* differs from *Holostrophus* in its smaller and more weakly emarginate eyes, and the prosternal process not extending behind the posterior edge of the procoxae. There are four species in *Pseudoholostrophus* (Nikitsky, 1998), two of which are Nearctic (including Canada) in distribution. The other two species, *P. klapperichi* (Pic) and *P. chinensis* Nikitsky, are known from China. Nikitsky (1998) divided the genus into two subgenera; all species other than *P. discolor* (Horn) are placed in the nominate subgenus. *Holostrophus discolor* (Horn) was transferred to *Pseudoholostrophus* (*Holostrophinus*) by Nikitsky (1998).

Subgenus ***Pseudoholostrophus*** Nikitsky, 1983

Pseudoholostrophus* (*Pseudoholostrophus*) *impressicollis (LeConte, 1874)
(Figs 1, 8, 17, 26)

Eustrophus impressicollis LeConte, 1874: 69; Horn, 1888: 36; Leng, 1920: 238; Csiki, 1924: 10; Poole and Gentili, 1996: 299; LeSage, 1991: 246; Hatch, 1965: 67, Plate IX, fig. 1; Nikitsky, 1998: 47, Plate 7 figs 9-11; Young and Pollock, 2002: 416. Lectotype, sex unknown, labelled "Vanc. / Type 4781 / Eu. impressicollis Lec.", in MCZ.

Diagnosis This distinctive species can be separated from all Nearctic species of Eustrophinae by the combination of the following characteristics: uniform red-brown color, short, inconspicuous dorsal pubescence, widely separated eyes, and smooth meso- and metatibiae.

Description TL 6.0-6.2 mm; GEW 2.1-2.7 mm. Body (Fig. 1) elongate oval, moderately parallel sided. Dorsal and ventral color uniformly dark rufous, including antennae and legs; dorsal pubescence very short, inconspicuous (Fig. 1); eyes (Fig. 8) widely separated (> 3 x length of first antennomere), inner margin of eye slightly emarginate; antennae (Fig. 17) relatively short, antennomeres 7-10 distinctly widened; antennomere 7 triangular, 8-10 wider than long; antennal sensilla completely annular (as in Fig. 25); last maxillary palpomere distinctly widened, securiform; prosternal process elongate, spatulate distally extended past posterior margin of procoxae, bent dorsally at distal end; prothoracic episternal suture absent; elytral punctation fine, punctures not arranged in longitudinal striae; meso- and metatibiae with scattered short spines, without oblique ridges (as in Fig. 15).

Distribution (Fig. 26) This species is restricted to extreme western North America. In Canada, all known records are from Vancouver Island and the adjacent mainland of British Columbia, north to the Queen Charlotte Islands. This is seemingly one of the rarest, or most infrequently collected, species of Nearctic Eustrophinae; most localities are represented by a single specimen. US distribution: WA (Hatch 1965), OR, CA.

Natural history Little is known regarding the habits of *P. impressicollis*. Label data indicate the following: under bark of pine; in rotten log; fungus.

Material examined Specimens were examined from the following Canadian localities: **BRITISH COLUMBIA:** Gabriola, 2.VI.1994, BF & JL Carr, lot 7, (CARR, 1); Qualicum, 16.IX.1962, BF & JL Carr, lot 1, (CARR, 1); Vancouver Island, Kye Bay, nr. Comox, 5 m, 2.VII.1980, H. & A. Howden, (CMNC, 1); Queen Charlotte Islands, Laskeek Bay, Haswell Island, 2-22.VI.2000, 52°51'42"N, 131°41'06"W, Allombert, Sylvain, (RBCM, 1).

Subgenus ***Holostrophinus*** Nikitsky, 1998

Pseudoholostrophus **(*Holostrophinus*)** ***discolor*** (Horn, 1888)
(Figs 2, 9, 18, 26)

Holostrophus discolor Horn, 1888: 36.—Leng, 1920: 238; Csiki, 1924: 10; Poole and Gentili, 1996: 299; LeSage, 1991: 246; Nikitsky, 1998: 43, Plate 7 figs 12-15; Young and Pollock, 2002: 416. Lectotype (here designated), sex unknown, labelled "Va. / Henry Ulke Beetle Coll. CMNH Acc. No. 1645 / Holostrophus discolor Horn / LECTOTYPE Eustrophus discolor Horn design. DA Pollock 2008", in CMNH. Paralectotype in MCZ.

Diagnosis The smooth meso- and metatibiae, widely separated eyes, conspicuous dorsal pubescence, shelf-like anterior pronotal margin, and eastern distribution serve to separate this species from all other Nearctic eustrophines.

Description TL 3.6-5.7 mm; GEW 1.6-2.4 mm; body (Fig. 1) elongate oval, rather parallel-sided; dorsal color rufous, pronotum in most specimens slightly darker than elytra; some specimens with lighter humeral area on elytra; antennomeres 1-5 rufous, 6-10 rufopiceous, 11 light rufous; venter uniformly red-brown; dorsal pubescence relatively long, conspicuous, with some erect hairs; eyes (Fig. 9) widely separated (space > 3x length of antennomere 1), inner eye margin slightly emarginate; antennae (Fig. 18) relatively short, antennomere 7-11 distinctly widened; antennomere 7 triangular, 8-10 distinctly wider than long; antennal sensilla completely annular (as in Fig. 25); last maxillary palpomere slightly widened, subsecuriform; prosternal process elongate, spatulate distally, extended to past posterior margin of procoxae, bent dorsally at distal end; prothoracic episternal suture absent; elytral punctation relatively coarse, punctures not arranged in longitudinal striae; meso- and metatibiae with scattered short spines, oblique ridges absent (as in Fig. 15).

Distribution (Fig. 26) This species is known from the fewest Canadian localities of any Nearctic eustrophine, i.e. only one locality in southern Quebec and one in New Brunswick. The species has a broader eastern distribution in the United States. US distribution: IN, MA, MD, NH, PA, RI, TN, VA.

Natural history Given that specimens of *P. discolor* are rarely collected, there are very few data available on its habits or biology. Label data include the following: in polypore fungus; malaise trap (NH); intercept trap (PA). According to Chantal (1985) specimens are known from small polypores on trees, notably cherry (*Prunus*) and maple (*Acer*). A single specimen from New Brunswick (CNC) bears a label stating "on or near fleshy polypore fungi on beech log".

Material examined Specimens were examined from the following Canadian localities: **QUEBEC**: [or Quebec City], 7.VIII.1962, J.-C. Aubé, (DAPC, 1); same locality, 7.VIII.1962, (FMNH, 2); Ste-Foy Quebec, Co., 31.VII.1962, J.-C. Aube, (AMNH, 2). **NEW BRUNSWICK**: Carelton Co., Wakefield, "Bell Forest Preserve", 46.2200°N 67.7231° W, 16.IX.2006, R.P. Webster, hardwood forest, on or near fleshy polypore fungi on beech log, (CNC, 1).

Holostrophus Horn, 1888

Holostrophus Horn, 1888: 32.—Type species: *Eustrophus bifasciatus* Say, 1824 (subs. des.; Nikitsky, 1998: 48); Blatchley, 1910: 1293; Champion, 1915: 139; Leng, 1920: 238; Hatch,

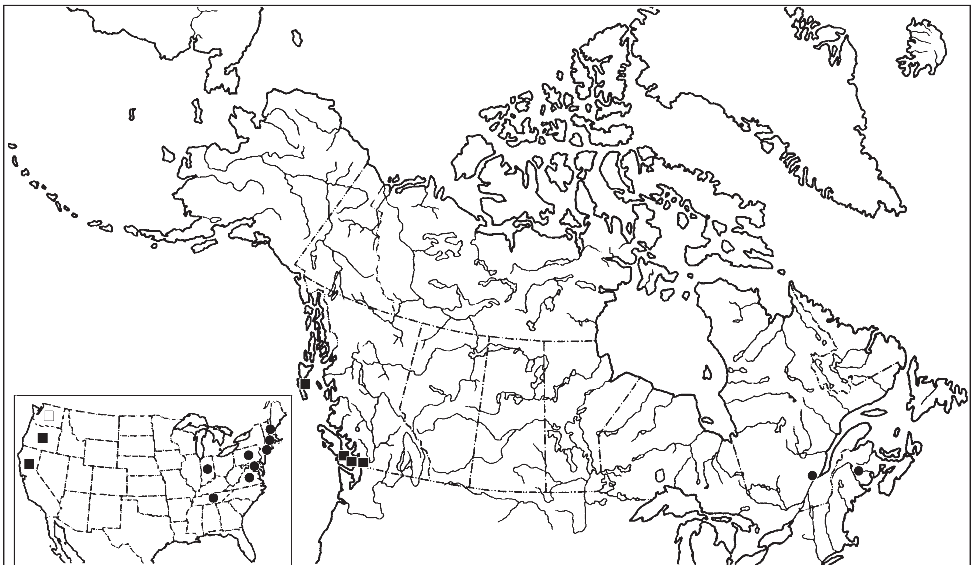


Fig. 26. Canadian distribution of *Pseudoholostrophus impressicollis* (squares) and *P. discolor* (circles). Inset shows US distribution, by state. Open square indicates state record from Hatch (1965)

1965: 66; LeSage, 1991: 246; Poole and Gentili, 1996: 299; Nikitsky, 1998: 48; Young and Pollock, 2002: 416.

According to Nikitsky (1998), this genus comprises 17 species worldwide, distributed in the Russian Far East, Korea, China, Japan, the Orient, and Nearctic regions. In North America, there is the single species *H. bifasciatus* (Say). In further justifying his separation of the genera *Pseudoholostrophus* and *Holostrophus*, Nikitsky (1998: 40) stated that "it seems noteworthy that species of *Pseudoholostrophus* display the elytra either one-color but not black or with a light humeral spot only, or with a clarified diffused transverse fascia in basal part. A more clearly evident reddish-yellow or red spotty pattern of the elytra is characteristic of *Holostrophus*, not *Pseudoholostrophus*".

Holostrophus bifasciatus (Say, 1824)
(Figs 3, 10, 15, 19, 27)

Eustrophus bifasciatus Say, 1824: 282.—Melsheimer, 1853: 143; Blatchley, 1910: 1293; Leng, 1920: 238; Csiki, 1924: 9; Poole and Gentili, 1996: 299; LeSage, 1991: 246; Nikitsky, 1998: plate 9, figs 1-2; Young and Pollock, 2002: 416; Majka and Pollock, 2006: 53. Neotype (here designated), sex unknown, labelled "[faded pink circle] / E. bifasciatus Say 4-maculatus Mels.", in MCZ (LeConte collection).

Eustrophus 4-maculatus Melsheimer, 1846: 58.—Csiki, 1924: 9; Poole and Gentili, 1996: 299; LeSage, 1991: 246.

Diagnosis *Holostrophus bifasciatus* is the only Nearctic species of Eustrophinae with a distinct, quadrimaculate elytral color pattern.

Description TL 4.1-5.5 mm; GEW 1.9-2.5 mm. Body (Fig. 3) elongate oval, distinctly tapered posteriorly; dorsal color dark rufous to almost black; in most specimens, color of pronotum lighter than color of elytra; elytra with 4 yellow-red, subquadrate maculae: anterior pair near humeri and not attaining suture, posterior pair in apical third of elytra, attaining suture in some specimens; antennomeres uniformly rufous in color, antennomere 11 slightly lighter in color than preceding articles; venter uniformly dark rufous; dorsal pubescence relatively short, inconspicuous; eyes (Fig. 10) widely separated (space > 3x length of antennomere 1), inner margin of eye moderately deeply emarginate; antennae (Fig. 19) relatively short, antennomeres 7-11 distinctly widened; antennomere 7 triangular, 8-10 distinctly wider than long; antennal sensilla completely annular (as in Fig. 25); last maxillary palpomere slightly widened, subsecuriform; procoxal process elongate, spatulate distally, extended to past posterior margin of procoxae, bent dorsally at distal end; prothoracic episternal suture absent; elytral punctation fine, not arranged in longitudinal striae; meso- and metatibiae with scattered short spines, oblique ridges absent (Fig. 16).

Distribution (Fig. 27) *Holostrophus bifasciatus* is an eastern species; in Canada, specimens have been collected from west of Lake Superior in northwestern Ontario, east to Nova Scotia and Prince Edward Island. Most Canadian specimens are known from southern Ontario and Quebec. The species is very widespread in the eastern half of the United States, almost entirely east of the Mississippi. US distribution: AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, NC, NH, NJ, NY, OH, PA, SC, TN, TX, VA, WI, WV.

Natural history Label data: *Laetiporus sulphureus* (AR); ex polypore in pine logs (AR); *Trametes versicolor* (AR); *Schizopora paradoxa* (AR); BLT (June, AL); ex polypore on cherry tree (AR); under loose pine bark (DE); under pine bark (GA); Malaise trap (March, June, GA); oak log (IL); sugar trap (May, IL); UV light (April, IL); flight trap (Aug-Sept, IL). According to Chantal (1985), specimens of *H. bifasciatus* have been taken under bark of dead *Pinus strobus* on which was growing polypore fungi, as well as from *Polyporus betulinus*.

Material examined Specimens were examined from the following Canadian localities: **ONTARIO:** Arnprior, 26.V.1935, W.J. Brown, (CNC, 12); Essex Co., Windsor Ojibway Prairie, 7.VIII.2001, S. Paiero, Sweeps, (DEBU, 1); Jeannette Creek, 3.VIII.1965, (FSCA, 1); Ottawa, (CNC, 6); same locality, (CUIC, 1); Peel Co., Port Credit, 10.IV.1966, I.M. Smith, (ROME, 1); Tillsonburg, 11.VII.1958, (CNC, 1); Toronto, 20.XI.1895, R.J. Crew, (CUIC, 1); no other data, (DEBU, 3); London, W. Saunders, (DEBU, 1); Ridgeway, (DEBU, 2). **QUEBEC:** Gatineau, Aylmer, 17.V.1992, Y. Bousquet, in flight, (SLC, 1). **PRINCE EDWARD ISLAND:** Queens Co., St. Patricks, 25.VI.2003, C.G. Majka, coniferous forest, (CGMC, 2). **NOVA SCOTIA:** Halifax Co., Pt. Pleasant Park, 15.VII.2001, C.G. Majka, mixed forest, deciduous vegetation, (CGMC, 1).

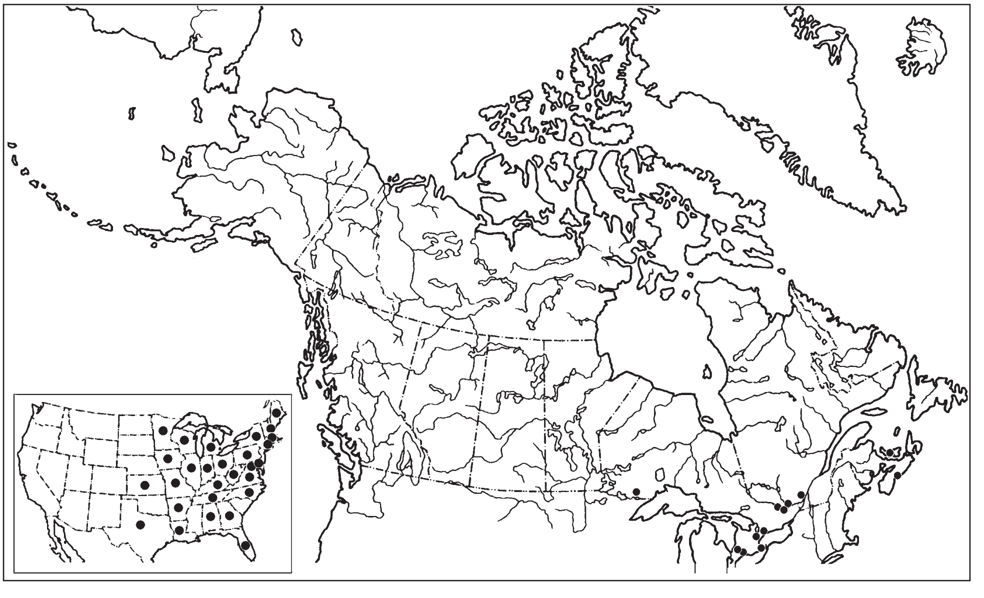


Fig. 27. Canadian distribution of *Holostrophus bifasciatus*. Inset shows US distribution, by state.

Tribe **Eustrophini** Gistel, 1856

Eustrophus Illiger, 1802

Eustrophus Illiger, 1802: 379.—Type species: *Mycetophagus dermestoides* Fabricius, 1792 (monotypy); Melsheimer, 1853: 143 (in part); Horn, 1888: 32; Blatchley, 1910: 1292; Champion, 1915: 138; Champion, 1916: 1; Leng, 1920: 238; LeSage, 1991: 246; Poole and Gentili, 1996: 299; Hatch, 1965: 66; Nikitsky, 1998: 54; Young and Pollock, 2002: 416.

This genus comprises four species, distributed in Europe, Russian Far East, Japan, southern China, and North America (Nikitsky, 1998). As this is the oldest genus-group name available for Eustrophinae, all North American species were at one time included in *Eustrophus*; now only a single Nearctic species is placed in this genus.

Eustrophus tomentosus Say, 1826
(Figs 4, 11, 16, 20, 24, 28)

Eustrophus tomentosus Say, 1826: 239.—Melsheimer, 1853: 143; Provancher, 1877: 466; Horn, 1888: 35; Blatchley, 1910: 1293; Leng, 1920: 238; Csiki, 1924: 9; Hatch, 1965: 66; Poole and Gentili 1996: 299; LeSage, 1991: 246; Young and Pollock, 2002: 416; Majka and Pollock, 2006: 53. Neotype (here designated), sex unknown, labelled "Ill. / E. tomentosus Say. niger Mels.", in MCZ (LeConte collection).

Mycetophagus niger Melsheimer Catalogue; Melsheimer, 1846: 58.

Eustrophus niger Melsheimer, 1846: 58; Leng, 1920: 238; LeSage, 1991: 246; Poole and Gentili, 1996: 299.

Diagnosis Adults of *E. tomentosus* are more parallel-sided than other Nearctic Eustrophinae. Individuals also have the following diagnostic features: eyes widely separated; antennal sensilla only partly annular; dorsal pubescence distinctly golden or brown; meso- and metatibiae with ridges; prothoracic episterna without transverse suture. The only other Nearctic species of Eustrophinae with the combination of ridged tibiae and widely separated eyes is *Eustrophopsis confinis*, which is darker in color and has the transverse suture present on the pro-episterna.

Description TL 4.5-6.0 mm; GEW 2.1-3.0 mm. Body (Fig. 4) oval, parallel-sided; dorsal color dark brown, with golden sheen due to dense pubescence; venter and antennae uniformly dark rufous, lighter than dorsal color; dorsal pubescence relatively short, but dense, giving distinct sheen (almost irridescent); eyes (Fig. 11) widely separated (space ~1.5 x length of first antennomere), inner margins deeply emarginate; antennomeres (Fig. 20) 2-11 only slightly but evenly widened to apex, without distinct change in size between any 2 adjacent antennomeres; distal antennomeres subtriangular to nearly quadrate; antennal sensilla not completely annular, present on short sides of antennomeres only (Fig. 24); last maxillary palpomere slightly securiform; procoxal process triangular, narrowed distally, extended to slightly short of posterior margin of procoxae; prothoracic episternal suture absent; elytral punctation relatively fine, punctures arranged in longitudinal striae; meso- and metatibiae with oblique ridges present (Fig. 15).

Distribution (Fig. 28) The Canadian distribution of this species is fairly broad west to east, although spotty; in the west, specimens are known from British Columbia and southern Manitoba but absent from Alberta and Saskatchewan. In the east, most localities are from southern Ontario and Quebec, with recently documented records from Nova Scotia (Majka and Pollock, 2006). In the United States, the species is distributed primarily east of the Mississippi, but also exhibits the same western gap seen in the Canadian distribution. US distribution: AL, AR, AZ, CA, CT, DC, FL, GA, IA, ID, IL, IN, KS, KY, LA, MD, MI, MN, MO, MS, NC, ND, NH, NJ, NY, OH, OK, OR, PA, SC, TN, TX, VA, VT, WI, WV.

Natural history Label data: *Pseudotsuga taxifolia* (BC), from fungus (BC), evening flight, 4.IX (BC), ex *Populus trichocarpa* (BC), in bark *Larix occidentalis* (BC), fleshy fungus on tree (ON), under bark of pine (ON), under wet moldy bark on dead tree (ON), elm (PQ), UV light trap (PQ), cut surface of stump (PQ), *Ulmus americana* (PQ), under bark of pine (AL), *Spongipellis unicolor* (AR), *Climacodes septentrionale* (AR), *Trametes versicolor* (AR), under pine bark (CA), Lindgren trap with turpentine bait (CA), on *Pinus ponderosa* (CA), ex. *Polyporus* fungus (FL), UV light in oak-maple forest (IA), fungus on dead pine (ID), under bark of old pine stump (MD), in *Peromyscus* nest debris under bark of dead standing *Liriodendron* (MD), fungus on oak (MN), funnel traps (MT), at black light, VI.1970 (NC), malaise trap, VIII-ix (NE), window trap, 8-14.VI (NH), light trap, VI (NY), Lindgren funnel trap, alpha-pinene and ethanol lure (OR), stale molasses trap (SC), at wound on oak trunk (SC), malaise in mature hardwood forest, VI (SC), under bark of old dead deciduous tree (VT), ex dead oak stump (WI), under bark of chestnut oak (WV). Chantal (1985) stated that adult *E. tomentosus* are found under bark of dead trees, particularly elm (*Ulmus americana*), as well as at sap flows ("exudations"); they are also attracted to light.

Material examined Specimens were examined from the following Canadian localities: **BRITISH COLUMBIA:** Canal Flats, 21.VIII.1977, B.F. & J.L. Carr, lot 1, (CARR, 4); same locality, 21.VIII.1977, B.F. & J.L. Carr, lot 1, (DAPC, 1); Creston, 17.V.1931, G. Stace Smith, (CNC, 5); same locality, 19.V.1956, G. Stace Smith, (CNC, 1); same locality, 17.V.1931, G. Stace Smith, (UBC, 11); same locality, 22.VII.1948, G. Stace Smith, from fungus, (UBC, 1); same locality, 12.VII.1946, G. Stace Smith, host: *Pseudotsuga taxifolia*, (UBC, 1); same locality, 3.VIII.1945, G. Stace Smith, in fungi, (UBC, 1); same locality, 5.VIII.1950, G. Stace Smith, from fungus, (UBC, 1); same locality, 17.V.1957, G. Stace Smith, evening flight, (UBC, 1); same locality, 4.IX.1951, G. Stace Smith, evening flight, (UBC, 1); same locality, 17.VI.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 11.IX.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 1.VI.1952, G. Stace Smith, ex fungus, (UBC, 1); same locality, 25.VI.1958, G. Stace Smith, ex fungus, (UBC, 1); same locality, 6.V.1953, G. Stace Smith, evening flight, (UBC, 1); same locality, 18.V.1951,

G. Stace Smith, ex *Populus trichocarpa*, (UBC, 1); same locality, 15.VI.1948, G. Stace Smith, from fungus, (UBC, 1); same locality, 22.VII.1948, G. Stace Smith, from fungus, (UBC, 1); Creston, 1900 ft., 25.V.1933, G. Stace Smith, surface of pond, (UBC, 1); Creston, 2000 ft., 20.II.1932, G. Stace Smith, in bark *Larix occidentalis*, (UBC, 1). Gabriola, 29.IV.1993, B.F. & J.L. Carr, lot 1, (CARR, 5); same locality, 29.VI.1993, B.F. & J.L. Carr, (GJHC, 3). **MANITOBA:** Winnipeg, Univ. of Manitoba campus, forest along Red River, 5-8.VII.1985, D.A. Pollock, suction trap, (DAPC, 1). **ONTARIO:** no other data, (MCZ, 1). Arnprior, 26.V.1935, W.J. Brown, (CNC, 1); same locality, 9.VI.1935, W.J. Brown, (CNC, 1); Bell's Corners, 17.X.1962, D.D. Munroe, (CNC, 3); same locality, 10.VII.1963, D.D. Munroe, (CNC, 1); Chaffeys Locks Biol. Stn., 6.VI.1986, A. Davies, berlese fleshy fungi on tree, (CNC, 1); Constance Lake, 10.VI.1989, G. Hilchie, ex mushroom, (CARR, 1); DeCew Falls, 6.V.1942, S.D. Hicks, (CNC, 1); Hamilton, 15.VI.1982, M. Sanborne, (CNC, 1); same locality, 28.VI-14.VII.1982, M. Sanborne, (CNC, 2); same locality, 30.VI-8.VII.1981, M. Sanborne, (CNC, 1); same locality, 23.VII.1980, M. Sanborne, Malaise trap, (CNC, 1); Lambton Co., Pinery Prov. Park, 15-20.VI.1994, J. Skevington, Malaise Cedar trail oak savanna meadow, (DEBU, 2); same locality, 22.VI.1995, G. Vogg, Visitor Centre, (DEBU, 1); Lanark, 17.IX.1977, S.A. Marshall, (JBWM, 3); Leamington, 18.VI.1940, W.J. Brown, (CNC, 1); Merivale, 4.VI.1935, W.J. Brown, (CNC, 1); Ottawa, 14.VIII.1912, Beaulieu, (CNC, 2); same locality, (CNC, 4); same locality, 17.V, under bk. of pine, (CNC, 3); same locality, 14.VIII.1912, Beaulieu, (MCZ, 2); Prince Edward Co., 15.VI.1947, Brimley, (CARR, 3); same locality, 23.IV.1922, Brimley, (CNC, 1); same locality, 21.VII.1918, Brimley, (CNC, 1); same locality,

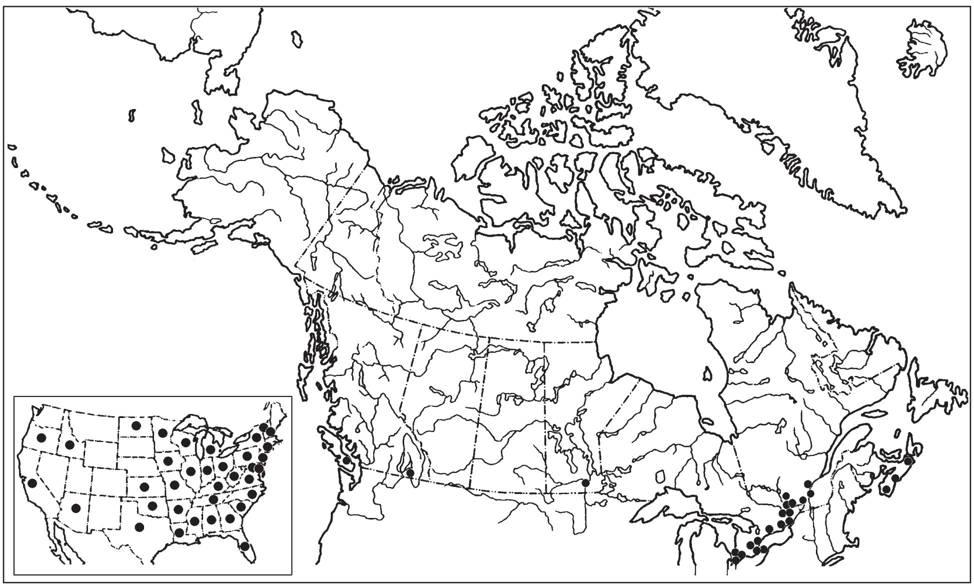


Fig. 28. Canadian distribution of *Eustrophus tomentosus*. Inset shows US distribution, by state.

20.VII.1938, Brimley, (CNC, 1); same locality, 13.VI.1940, Brimley, (CNC, 1); same locality, 16.IX.1923, Brimley, (CNC, 1); same locality, 21.VII.1918, Brimley, (CNC, 1); same locality, Brimley, (UAIC, 3); same locality, Brimley, (UAIC, 3). Rondeau Pk., 2-6.VI.1985, L. LeSage & A. Smetana, flight intercept in white pine stand, (CNC, 3); Rondeau Pk., 2-6.VI.1985, L. LeSage & A. Smetana, int. trap in maple-beech forest, (CNC, 1); same locality, 14.VI-2.VII.1985, L. LeSage & D.M. Wood, (CNC, 1); Rondeau Pr. Pk., Black Oak Trail, 5.VI.1985, A. Davies & J.M. Campbell, under wet moldy bk. on dead tree, (CNC, 1); Toronto, R.J. Crew, (CUIC, 2); same locality, 2.I.1895, R.J. Crew, (CUIC, 4); same locality, III, Crew, (UWEM, 1); Trenton, 25.V.1899, Evans, (CNC, 1); no other data, (DEBU, 2); Ariss, 18.VII.1976, S.A. Marshall, (DEBU, 1); Gananoque, 22.VI.1963, C.J. Edwards, (DEBU, 1); Grimsby, 14.VI.1977, W.A. Attwater, (DEBU, 2); Guelph, 17.VII.1976, S.A. Marshall, (DEBU, 5); same locality, 27.III.1977, Kevin Barber, (DEBU, 10); Lanark, 2.VIII.1976, M.J. Sharkey, (DEBU, 1); London, W. Saunders, (DEBU, 3); same locality, 28.VI.1976, W.A. Attwater, (DEBU, 1); Oakville, 21.VII.1977, W.A. Attwater, (DEBU, 1); Port Credit, 16.V.1993, C. Krupke, rotting wood, (DEBU, 1); Pr. Edw. Co., Brimley, 2.VI.1940, (AMNH, 1); Primrose, 27.VII.1977, W.A. Attwater, (DEBU, 1); Ridgeway, (DEBU, 1); Whitby, 21.IV.1974, G.J. Umphrey, (DEBU, 1). **QUEBEC:** Aylmer, 12.V.1932, W.J. Brown, (CNC, 1); Gatineau Pk., 24.V.1970, J.M. Campbell, (CNC, 1); Montreal, 4.IV.1969, E.J. Kiteley, elm, (CNC, 1); same locality, 27.VIII.1973, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 21.VII.1974, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 25.VI.1980, E.J. Kiteley, cut surface stump, (CNC, 1); same locality, 26.VIII.1973, E.J. Kiteley, UV light trap, (CNC, 1); Old Chelsea, NCC woodpile, 27.V-5.VI.1987, L. Masner, pans, (CNC, 1); Riviera Touraine, 12.IV.1974, R. Sexton, *Ulmus americana*, (CNC, 15); same locality, 14.IV.1974, R. Sexton, *Ulmus americana*, (CNC, 19); Terrebonne, Saint-Hippolyte, 27.V.1978, S. Laplante, UV light, (SLC, 1). LOCALITY UNKNOWN. no other data, (CUIC, 1); Ulke collection, (CMNH, 1); no other data, (USNM, 1). **NOVA SCOTIA:** Guysborough Co., Borneo, 28.VI.1995, C. Corkum, (NSMC, 1); Halifax Co., Big St. Margarets Bay, 29.VII-13.VIII.1997, D.J. Bishop, in old red spruce habitat, (NSMC, 1); Queens Co., Tobeatic Lake, 3.VI.2003, P. Dollin, red spruce habitat (80-120 yrs.), (NSMC, 2)

Eustrophopsis Champion, 1889

Eustrophopsis Champion, 1889: 77.—Type species: *Orchesia quindecimmaculatus* Laporte, 1840; Champion, 1915: 138; Champion, 1916: 1, 138; Csiki, 1924: 7; Blackwelder, 1945: 494; Nikitsky, 1998: 58; Young and Pollock, 2002: 416.

Eustrophinus Seidlitz, 1898: 438, 440.—Type species: *Mycetophagus bicolor* Fabricius, 1798; Champion, 1916: 3; Leng, 1920: 238; Leng and Mutchler, 1933: 36; Csiki, 1924: 8; Blackwelder, 1945: 495; Hatch, 1965: 66; Poole and Gentili, 1996: 299; LeSage, 1991: 246; Nikitsky, 1998: 58; Young and Pollock, 2002: 416.

Eustrophus Champion, 1889: 75, nec. Illiger, 1802.

Champion (1889) erected *Eustrophopsis* to include species of "Eustrophi" that exhibited a deeply emarginate prosternal process to receive a sharply keeled mesosternum. Seidlitz (1898) included in *Eustrophinus*, species that lacked this emarginate prosternal process and keeled mesosternum. However, according to Nikitsky (1998), who has studied this group extensively, these characters exhibit a graded transition without a distinct morphological gap. Therefore, he sunk the name *Eustrophinus* as a junior synonym of *Eustrophopsis* Champion.

Eustrophopsis is the most diverse genus of Eustrophinae, with approximately 55 species known from Afrotropical, Neotropical and Nearctic regions. Nikitsky (1998: 58) stated that it is "remarkable that *Eustrophopsis* seems to be absent both from the Oriental Region and Palearctic. It may be so that it is replaced there by species of the genera *Holostrophus* and *Synstrophus* unknown from the Neotropical and Afrotropical regions".

Eustrophopsis bicolor (Fabricius, 1798)
(Figs 5, 12, 21, 29)

Mycetophagus bicolor Fabricius, 1798: 497 (type(s) not examined); Melsheimer, 1853: 143; LeConte, 1873: 335; Provancher, 1877: 467; Horn, 1888: 35; Weiss, 1919: 133; Leng, 1920: 238; Csiki, 1924: 8; Viedma 1971; Poole and Gentili 1996: 299; LeSage 1991: 246.

According to LeConte (1873: 335) "the proper authority for this species is Say, its first describer; *Mycetophagus bicolor* Fabr. is probably a *Platydema*". I have seen no other such reference, and all sources consulted have listed Fabricius as the author of this species; this was done even by Say (1826).

Diagnosis Members of this species are readily distinguished by the following combination of features: outer surface of meso- and metatibiae with numerous transverse ridges; eyes narrowly separated; much of ventral surface reddish, contrasting darker dorsal color; antennomere 11 yellow-red, exhibiting a distinct contrast to antennomeres 5-10.

Description TL 4.2-6.5 mm; GEW 2.0-3.2 mm. Body (Fig. 5) elongate oval, moderately tapered posteriorly; dorsal color dark piceous to black; antennae tricolored: antennomeres 1-4 red, 5-10 piceous, antennomere 11 yellow-red, distinctly contrasting against preceding darker antennomeres; maxillary palpi similar in color to basal antennomeres; venter a combination of dark (same as dorsum) and lighter colored sclerites (abdominal ventrites in most specimens contrasting darker color of thorax); dorsal pubescence relatively long, conspicuous; eyes narrowly separated (Fig. 12), or almost contiguous (space < length of antennomere 1), inner margin moderately emarginate; antennomeres (Fig. 21) 2-4 short, submoniliform, antennomeres 5-10 widened, becoming more triangular toward antennomeres 9-10; antennal sensilla completely annular (as in Fig. 25); last maxillary palpomere not modified; procoxal process triangular, narrowed distally, extended to slightly short of posterior margin of procoxae; prothoracic episternal suture present; elytral punctation coarse, punctures arranged in longitudinal striae (Fig. 5); meso- and metatibiae with oblique ridges present (as in Fig. 15).

Distribution (Fig. 29) This is one of the most widely distributed Nearctic species of Eustrophinae, with a primarily eastern distribution. In Canada, it has not been collected west of Winnipeg, MB and extends east to Quebec. In the United States, it seems to have a mainly eastern distribution, although specimens have been collected in Arizona, California and Idaho. Specimens are also known from Mexico. US distribution: AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, MI, MN, MO, MS, NC, ND, NE, NJ, NM, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV, WY.

Natural history Chantal (1985: 53) noted the species as occurring under dead tree bark and also gave the following as fungal substrates on which adults were collected: *Pleurotus sapidus*, *Polyporus squamosus*, *P. betulinus*, *P. versicolor*, *P. confragosa*. Adults of *E. bicolor* are known to be often found in the same micro-habitats as *S. repandus* (Chantal 1985; Pollock, pers. observ.). In the summer of 2005, the author found multiple adults of *E. bicolor* and *S. repandus* on and in a rotting fungusy log near Lockport, MB. From 2006 to 2008, specimens were collected on the same log; in the summer of 2008, *E. bicolor* was absent, but *S. repandus* were still present. Label data: underside of fungusy, dead log at night (MB), on piece of cut wood at night (MB), fungusy stump of *Acer negundo* (MB), bracket fungus (ON), in rotting *Pleurotus* (PQ), on trunk of dead *Ulmus americana* (PQ), under bark of dead maple (PQ), under bark of rotting trunk of *Pinus eliottii* with polypore fungi (Bahamas), ex *Fomes* on *Salix* (Bahamas), under bark of *Fagus* (AR), *Trametes versicolor* (AR), *Meripilus giganteus* (AR), polypore tree fungus (AR), under rotting oak bark (CT), in litter at base of dying *Ailanthus* (CT), large orange polypore shelf fungus [? *Polyporus sulphureus*] on standing tree trunk (CT), *Omphalotus olearius* (CT), under bark (DE), shelf fungi (FL), *Griffolia* fungus (FL), *Polyporus hypnoides* (FL), *Polyporus sulphureus* (FL, MA), under bark of dead pine (FL), hibernating under bark (GA), under bands of tar paper on apple trees (IL), *Armillariella mellea* (GA), *Pleurotus ostreatus* (IL), on shelf fungi (KS), in sweetgum stump (LA), *Polyporus adustus* (LA), *Panus rudis* (MA, NJ), under bark of dead *Pinus virginiana* (MA), under bark dead standing *Quercus* (MA), in *Peromyscus* nest debris under bark dead standing *Liriodendron* (MA), under bark of stump of *Prunus serotina* (MA), fungus on bark (MS), injured cypress (NC), oak (NC), under bark dead standing pine (NC), under oak bark (NC), *Pleurotus* sp. (NC, OK), in mushroom (NC), *Trametes hispida* (ND), under hardwood bark (NJ), ex fungus on *Mimosa* stump (NJ), on polypore on dead *Quercus* (TX), polypore fungus (UT), *Polyporus squamosus* (VT), under poplar bark (WI).

Material examined Specimens were examined from the following Canadian localities: **MANITOBA:** Winnipeg, King's Park, D.A. Pollock, sitting on underside of fungusy, dead log at night, (DAPC, 1); same locality, 13.VIII.1998, D.A. Pollock, sitting on piece of cut wood at night, (DAPC, 1); Winnipeg, Univ. of Manitoba campus, nr. apiary, 49°48'30"N, 97°07'35"W, 27.VII.1999, D.A. Pollock, on thin white fungus on underside of small log, (DAPC, 7); Winnipeg, University of Manitoba campus, along Red River, 25-28.VIII.1996, D.A. Pollock, at night, on fungusy stump of *Acer negundo*, (DAPC, 1); Winnipeg, University of Manitoba campus, forest along Red River (south), 11.VII.1999, D.A. Pollock, crawling on fungusy stump of *Acer negun-*

do at night, (DAPC, 1). **ONTARIO:** Bolton, 4.V.1978, R.S. Anderson, (ROME, 1); Chatham, 23.VIII.1929, G.M. Stirrett, (CNC, 1); Dunn Twp, 29.VIII.1971, W.W. Judd, (CNC, 1); Dunnville, 24.VIII.1938, S.D. Hicks, very teneral, (CNC, 2); Grand Bend, 6.VII.1939, T.N. Freeman, (CNC, 1); Guelph, 23.VIII.1990, Heather Dewar, bracket fungus, (DEBU, 4); Lanark, 2.VIII.1979, S.D. Hicks, (CNC, 1); same locality, 4.VII.1976, S.D. Hicks, (CNC, 1); Leamington, 18.VI.1940, W.J. Brown, (CNC, 1); same locality, 24.V.1970, T.D. Galloway, (JBWM, 1); Ottawa, 4.IX.1912, Beaulieu, 1 teneral, (CNC, 3); same locality, 2.X.1912, Beaulieu, (CNC, 1); same locality, 14.VIII.1912, Beaulieu, (CNC, 1); same locality, 9.IX.1912, Beaulieu, (MCZ, 3); Peel Co., Port Credit, 6-11.VIII.1965, I.M. Smith, (ROME, 1); Pelee Is., 3.VII.1931, W.J. Brown, (CNC, 1); Pelee Island, 1.VII.1940, W.J. Brown, slightly teneral, (CNC, 1); Pelee Island, Lake Erie, 17.VII.1981, S.W. Nichols, (CUIC, 4); Pelee Island, marsh on SE shore, 14.VIII.1980, S.W. Nichols, flooding shore of sand spit, (CUIC, 1); Point Pelee, 26.VII-4.VIII.1999, A. Tesolin, malaise & pan trap 41°59'N,82°27.5'W, (DEBU, 2); Prince Edward Co., 21.V.1916, Brimley, (CNC, 1); same locality, 3.VI.1917, Brimley, (CNC, 1); same locality, 31.VII.1938, Brimley, (CNC, 1); same locality, 23.IV.1922, Brimley, (CNC, 1); same locality, 21.V.1916, Brimley, (CNC, 1); same locality, 20.V.1923, Brimley, (CNC, 1); same locality, 7.VII.1946, Brimley, (CNC, 1); same locality, 3.VI.1923, Brimley, (CNC, 1); same locality, 18.IX.1921, Brimley, (CNC, 3); Rondeau Prov. Pk., 2.VIII.1982, L. LeSage, ex. *Polyporus*, (CNC, 9); Toronto, R.J. Crew, (CUIC, 2); same locality, 24.VIII.1895, R.J. Crew, (CUIC, 1); same locality, 12.IX.1908, R.J. Crew, (ROME, 1); Wheatley, 22.VII.1965, (FSCA, 2); Windsor, 2-16.VIII.1982, S. Marshall, (CNC, 1); Essex Co., Point Pelee Natl. Pk. Forested area by W beach, 21.VIII.1999, O. Lonsdale, malaise/pan traps, (DEBU, 1); Pt. Pelee, 18.VII.1978, J.M.

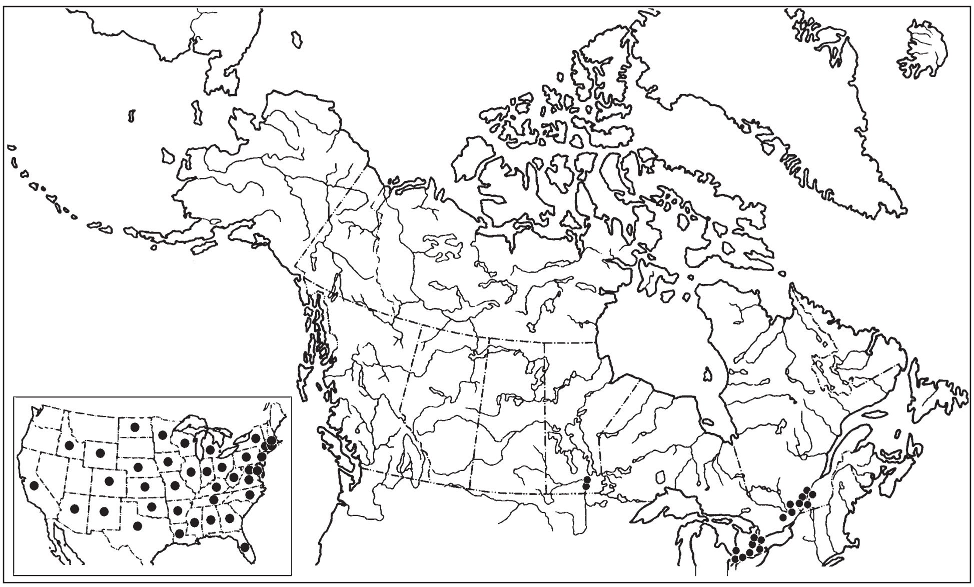


Fig. 29. Canadian distribution of *Eustrophopsis bicolor*. Inset shows US distribution, by state.

Cumming, (DEBU, 1); Dundas, 15.VII.1975, J.M. Cumming, (DEBU, 1); Guelph, 25.VII.1977, A.A. Konecny, (DEBU, 3); same locality, 3.VIII.1976, Paul R. Heels, (DEBU, 1); same locality, 25.IV.1973, R.E. Roughley, (DEBU, 1); London, 19.V.1975, J.M. Heraty, (DEBU, 1); Pr. Edw. Co., Brimley, 2.VI.1940, (AMNH, 1); same locality, 31.VII.1938, (AMNH, 1); Pt. Pelee Nat. Pk., 13.VIII.1983, S. Marshall, C. Logan, & S. Girigsby, (DEBU, 1); Tilbury, 30.IX.1965, Rosenberg collection, (USNM, 1); Toronto, 19.VII.1976, W.A. Attwater, (DEBU, 1); same locality, 10.VII.1977, W.A. Attwater, (DEBU, 1); same locality, 15.VIII.1981, Lonny Coote, (DEBU, 1). **QUEBEC:** Aylmer, 25.V.1934, W.J. Brown, (CNC, 1); Chambly, Longueuil, 14.VIII.1976, S. Laplante, in rotting Pleurote, (SLC, 2); Deux-Montagnes, Parc Paul-Sauvé, 29.IV.1990, S. Laplante, (SLC, 1); Gatineau Pk. nr. Meach L., 1.IX.1982, A. Davies, berlese fleshy fungi on tree, (CNC, 1); Gatineau, Aylmer, 28.V.1991, S. Laplante, on trunk of dead *Ulmus americana* at 22:00, (SLC, 2); Huntingdon, Havelock, 14.V.1981, S. Laplante, (SLC, 1); Lacolle, 10.VIII.1945, W.J. Brown, (CNC, 4); Missisquoi, Scottsmore, 9.VI.1979, S. Laplante, (SLC, 1); Montreal, 5.VIII.1985, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 16.VII.1967, E.J. Kiteley, (CNC, 1); same locality, 13.VI.1984, E.J. Kiteley, UV light trap, (CNC, 2); same locality, 2.IX.1969, E.J. Kiteley, (CNC, 1); same locality, 26.VI.1967, E.J. Kiteley, (CNC, 1); same locality, 28.V.1967, E.J. Kiteley, (CNC, 1); same locality, 17.IX.1972, E.J. Kiteley, (CNC, 1); same locality, 3.VII.1970, E.J. Kiteley, under bark, (CNC, 1); same locality, 6.VII.1976, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 23.VI.1968, E.J. Kiteley, on log, (CNC, 1); same locality, 28.VIII.1972, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 8.VII.1978, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 28.VII.1980, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 17.VII.1977, E.J. Kiteley, UV light trap, (CNC, 1); Rigaud For. at Ottawa River, 11.V.1988, A. & Z. Smetana, (CNC, 2) Vaudreuil, Rigaud, 21.V.1982, P. Bélanger, under bark of dead maple, (CMNC, 1).

Eustrophopsis confinis (LeConte, 1866)
(Figs 6, 13, 22, 30)

Eustrophus confinis LeConte, 1866: 152.—Horn, 1888: 35; Dury, 1906: 260; Leng, 1920: 238; Csiki, 1924: 10; Hatch, 1965: 66; Poole and Gentili, 1996: 299; LeSage, 1991: 246; Majka and Pollock, 2006: 53. Lectotype (here designated), sex unknown, labelled "Wis / Type 4780 / E. confinis Lec", in MCZ.

Diagnosis *Eustrophopsis confinis* is the only Nearctic species of Eustrophinae with a combination of widely separated eyes, and transverse ridges on the outer surface of the meso- and metatibiae. In fact, it may be the only world *Eustrophopsis* with widely separated eyes. Also, its almost uniformly dark color separates *E. confinis* from *E. bicolor*.

Description TL 4.8-6.1 mm; GEW 2.4-3.1 mm. Body (Fig. 6) ovate, subparallel-sided; dorsal and ventral color uniformly dark piceous to black; antennomeres 1-4 and 11 slightly lighter in color than antennomeres 5-10; dorsal pubescence relatively long, conspicuous; eyes (Fig. 13) widely separated (space 1-1.5 x length of antennomere 1), inner margin deeply emarginate; antennomeres (Fig. 22) 5-10 subquadrate; antennal sensilla completely annular (as in Fig. 25); last maxillary palpomere unmodified, fusiform; prosternal process triangular, moderately narrowed distally, extended to slightly short of posterior margin of procoxae; prothoracic episternal suture present; elytral punctation coarse, punctures arranged in longitudinal striae (Fig. 6); meso- and metatibiae with oblique ridges (as in Fig. 16).

Distribution (Fig. 30) Although specimens are seemingly rarely collected, *E. confinis* exhibits one of the broadest west-east ranges. The species is known from western British Columbia to Nova Scotia. The single record from Saskatchewan is the most northerly known specimen of Eustrophinae in North America. US distribution: ID, MI, ME, NE, NH, SD, WI.

Natural history Label data: *Polyporus anceps* (ME). Chantal (1985) stated that no natural history data were known to him, but that *E. confinis* should be similar to other members of the group.

Material examined Specimens were examined from the following Canadian localities: **BRITISH COLUMBIA:** McIntyre Cr., Oliver, 6.VI.1959, R.E. Leech, (CNC, 1); Radium, 4.VI.1953, B.F. & J.L. Carr, lot 5, (CARR, 3); same locality, 4.VI.1953, B.F. & J.L. Carr, lot 5, (DAPC, 2); Trinity Valley, 16.VIII.1927, J.R.L. Howell, (PFC, 1); Vernon, 11.V.1943, H. Leech, on grass, (UBC, 1); Victoria, (MCZ, 1); Tappen, 3.VI.1978, B.F. & J.L. Carr, lot 1, (DAPC, 1). **SASKATCHEWAN:** Road 914, 82 km N. Jct. Hwy. 165, 30.VII.1986, B.F. & J.L. Carr, lot 2, (DAPC, 1). **MANITOBA:** Duck Mtn. Prov. Pk., 19-24.VI.1981, Ashworth, Schwert & Keller, open gravelly mud with sparse vegetation by water's edge, (DAPC, 1); Riding Mt. Pk., 2.VI.1938, W.J.

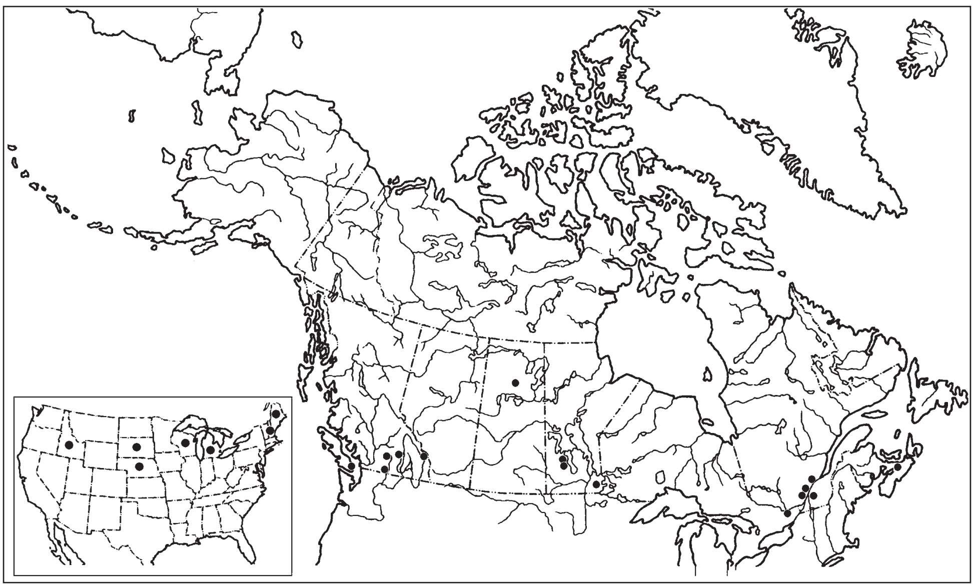


Fig. 30. Canadian distribution of *Eustrophopsis confinis*. Inset shows US distribution, by state.

Brown, (CNC, 1); Sandilands Forest, 15.VIII.1993, N.J. Holliday, (JBWM, 1). **ONTARIO:** Constance Bay, 16.V.1933, W.J. Brown, (CNC, 1). **NOVA SCOTIA:** Cumberland Co., Wentworth, 21.V-5.VII.1965, B. Wright, (NSMC, 2).

Synstrophus Seidlitz, 1898

Synstrophus Seidlitz, 1898: 438.—Type species: *Eustrophus macrophthalmus* Reitter, 1887 (orig. des.); Hatch 1965: 66; LeSage 1991: 246; Poole and Gentili 1996: 300; Nikitsky, 1998: 58; Young and Pollock, 2002: 416.

There are five species of *Synstrophus* (Nikitsky, 1998) distributed in China, Japan, Oriental region, and North America. Nikitsky (1998) mentioned that, based on several characters, *S. repandus* (Horn) might eventually merit placement in a different genus-group taxon.

Synstrophus repandus (Horn, 1888)
(Figs 7, 14, 23, 25, 31)

Eustrophus repandus Horn, 1888: 33.—Csiki, 1924: 9; Hatch, 1965: 66, Plate VIII, fig. 9; LeSage, 1991: 246; Poole and Gentili, 1996: 300; Young and Pollock, 2002: 416. Lectotype, sex unknown, labelled “Pen / LectoTYPE / Eustrophus repandus Horn / MCZ Type 34039”, in MCZ. Paralectotypes (3), in MCZ.

Diagnosis The smooth meso- and metatibiae (no oblique ridges), overall dark body color, and narrowly separated eyes serve to separate this species from all other Nearctic Eustrophinae.

Description TL 5.6-7.0 mm; GEW 2.5-3.4 mm. Body (Fig. 7) ovate, only somewhat tapered posteriorly; dorsal color dark piceous to black; antennae with basal 4 antennomeres dark rufous, distal half of antennomere 11 rufous; venter at least slightly lighter in color than dorsum; mouthparts similar in color to antennomeres 1-4; legs and abdominal ventrites dark rufous to piceous; dorsal pubescence relatively long, conspicuous; eyes (Fig. 14) narrowly separated, or almost contiguous (space < length of antennomere 1), inner margin moderately emarginate; antennomeres (Fig. 23) 2-4 short, submoniliform; antennomeres 5-10 widened, becoming more triangular toward antennomeres 9-10; antennal sensilla completely annular (Fig. 25); last maxillary palpomere unmodified, fusiform; procoxal process triangular, narrowed distally, extended to slightly short of posterior margin of procoxae; prothoracic episternal suture absent; elytral punctation coarse, punctures arranged in longitudinal striae (Fig. 7); meso- and metatibiae with scattered short spines, but distinct ridges absent (as in Fig. 15).

Distribution (Fig. 27) The distribution of this species is very similar to that of *E. tomentosus*, in that most specimens are known from British Columbia and southern Ontario and Quebec, with a few localities in Manitoba. No specimens of this species have been seen from Alberta or Saskatchewan. US distribution: AL, AR, CA, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NY, OH, OK, OR, PA, SC, SD, TX, UT, VA, WA, WI, WV, WY.

Natural history Label data: *Pinus ponderosa* bark (BC), shelf fungus on birch (BC), fungus on cottonwood (BC), *Populus trichocarpa* (BC), ex fungus on *Betula* (BC), underside of *Populus trichocarpa* log (BC), fleshy bracket fungus (ON), under wet moldy bark on dead tree (ON), *Pleurotus ostreatus* (IL, MA, PQ), polypore on branch of old *Quercus rubrus* (PQ), under dead pine bark (AL), *Meripilus giganteus* (AR), ex fungi and under bark (FL), large mushroom on log (IL), *Polyporus adjustus* (IL), *Laetiporus sulphureus* (IL), under *Pinus* bark (LA), ex bracket fungi (NC), in slimey fungus under pine bark (NY), under dead bark (SC), ex. *Polyporus schweinitzii* (VT), under bark of pine (WY).

Material examined Specimens were seen from the following Canadian localities: **BRITISH COLUMBIA:** 5 km SW Radium, 24.VIII.1987, B.F. & J.L. Carr, lot 1, (CARR, 2); same locality, 24.VIII.1987, B.F. & J.L. Carr, lot 1, (DAPC, 3); Radium, 24.VII.1987, B.F. & J.L. Carr, (GJHC, 5); 7 mi E. Terrace, 26-27.VI.1968, Campbell & Smetana, ex river debris, (CNC, 1); Copper Mountain, 21.VIII.1927, G. Stace Smith, (JBWM, 3); Copper Mtn., 21.VIII.1927, G. Stace Smith, *Pinus ponderosa* bark, (UBC, 4); Creston, 11.V.1958, H. & A. Howden, shelf fungus on birch; 1 spec. slightly teneral, (CNC, 8); same locality, 14.V.1958, H. & A. Howden, fungus on cottonwood, (CNC, 1); same locality, 6.IX.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 16.VIII.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 7.IX.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 25.X.1951, G. Stace Smith, under log, (UBC, 1); same locality, 21.V.1951, G. Stace Smith, *Populus trichocarpa*, (UBC, 1); same locality, 12.X.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 17.V.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 20.X.1951, G. Stace Smith, logs, (UBC, 1); same locality, 23.V.1951, G. Stace Smith, ex fungus on *Betula*, (UBC, 1); same locality, 26.V.1951, G. Stace Smith, ex fungus on *Betula*, (UBC, 2); same locality, 9.IX.1951, G. Stace Smith, ex fungus, (UBC, 1); same locality, 22.VII.1933, G. Stace Smith, underside of *Populus trichocarpa* log, (UBC, 1); same locality, 12.X.1946, G. Stace Smith, in fungus, (UBC, 1); same locality, 8.VI.1950, G. Stace Smith, ex fungus *Populus trichocarpa*, (UBC, 1); same locality, 23.VII.1948, G. Stace Smith, from fungus, (UBC, 1); same locality, 18.V.1948, G. Stace Smith, from fungus, (UBC, 2); same locality, 7.XII.1931, G. Stace Smith, on cordwood, (UBC, 1); same locality, 22.VII.1948, G. Stace Smith, from fungus, (UBC, 2); Creston, 2200 ft., 18.III.1933, G. Stace Smith, decaying wood of *Pinus ponderosa*, (UBC, 1); Gabriola, 2.VI.1994, B.F. & J.L. Carr, lot 7, (CARR, 1; GJHC, 1); same locality, 29.IV.1993, B.F. & J.L. Carr, lot 1, (CARR, 1); same locality, 29.V.1994, B.F. & J.L. Carr, lot 8, (CARR, 3); same locality, 10.IX.1992, B.F. & J.L. Carr, lot 2, (CARR, 1); Haney, 2.VII.1962, B.F. & J.L. Carr, lot 1, (CARR, 1); Lockhart Beach, Kootenay Lk., 12.VI.1962, C.W. O'Brien, (MCZ, 1); Midday Val. Merritt, 21.VI.1926, W. Mathers, (CNC, 1); same locality, 20.IV.1926, R. Hopping, old stumps of *P. ponderosa*, (CNC, 1); same locality, 12.VII.1925, K.F. Auden, (CNC, 2); Midday Valley, Merritt, 4-7.VI.1924, K.F. Auden, (INHS, 4); same locality, 7.VI.1924, K.F. Auden, (MCZ, 1); same locality, 4.VI.1924, K.F. Auden, (PFC, 1); same locality, 11.VII.1925, K.F. Auden, (PFC, 1); same locality, 3.IX.1925, W. Mathers, *Pinus ponderosa*, (PFC, 1); same locality, 10.VI.1926, H.H. Thomas, (PFC, 1); Mirror Lake, 10.VI.1984, B.F. & J.L. Carr, lot 2, (CARR, 1); Salmon Arm, 27.III.1929, H.B. Leech, (UBC, 1); same locality, v.1934, D.H. Leech, (UBC, 1); same locality, 22.V.1932, H. Leech, fungus, (UBC, 1); Sanca, 8.VIII.1933, G. Stace Smith, on stone wall, (UBC, 1); Sleeping Beauty Mtn., NE Terrace, 1800 m., 1.VII.1987, D. & K. Larson, (MUNC, 1); Tappen, 3.VI.1978, B.F. & J.L. Carr, lot 1, (CARR, 9; GJHC, 3); same locality, 3.VI.1978, B.F. & J.L. Carr, lot 1, (DAPC, 1); Vancouver, 15.III.1896, (CMNH, 5); Vancouver Island, 15.III.1899, (UMRM, 1); Victoria, (INHS, 2); Wynndel, 13.V.1958, H. & A. Howden, (CNC, 1). **MANITOBA:** Aubigny, 24.VIII.1987, J.E. Blatta, (JBWM, 2); Aweme, 20.VI.1910, E. Criddle, (JBWM, 1); Sandilands Res, 5 J 1938, D.N. Smith, (CNC, 1); Winnipeg, University of Manitoba campus, honey house, 10-17.VI.1991, R.E. Roughley, suction trap, (JBWM, 1). **ONTARIO:** no other data, (MCZ, 1); Bell's Corners, 17.X.1962, D.D. Munroe, (CNC, 1); Brant Co., Pinehurst Cons. Area, Hwy 24A, n. of Paris, 21.V.1971, H. Frania, in fleshy bracket fungus in woods, (ROME, 5); Chalk River, 18.VII.1985, J.V.R. Chenier, (CMNC, 1); Constance Bay, 4.IX.1965, D.D. Munroe, (CNC, 1); Dunn Twp, 1.IX.1971, W.W. Judd, (CNC, 1); Essex Co., Point Pelee Natl. Pk. East beach, 8.VI.2000, E. Reichert, (DEBU, 1); same locality, [8.VI.2000], O. Lonsdale, under bark, (DEBU, 1); Essex Co., Windsor, ~1.5km S Ojibway Prairie , 1-19.VIII.2001, P. Pratt, prairie remnant, forest edge, malaise trap, (DEBU, 1); Fitzroy Hbr, 31.V.1965, D.D. Munroe, (CNC, 1); Grand Bend, 22.VI.1936, A.A. Wood, (CNC, 1); Hamilton, 3-17.VI.1982, M. Sanborne, (CNC, 1); same locality, 31.VII.1980, M. Sanborne, (CNC, 1); same locality, 7.VI.1981, M. Sanborne, (CNC, 4); same locality, 28.VIII.1980, M. Sanborne, (CNC, 3); same locality, 14-19.VII.1981, M. Sanborne, (CNC, 1); same locality, 14-21.VI.1981, M. Sanborne, (CNC, 1); same locality, 9-19.IX.1981, M. Sanborne, (CNC, 1); same locality, 16.VII.1980, M. Sanborne, (CNC, 1); same locality, 28.VI-14.VII.1982, M. Sanborne, (CNC, 1); same locality, 23.VII.1980, M. Sanborne, Malaise trap, (CNC, 1); same locality, 27.VII-9.VIII.1982, M. Sanborne, (CNC, 2); same locality, 23.V-3.VI.1982, M. Sanborne, (CNC, 1); same locality, 14-26.VII.1982, M. Sanborne, (CNC, 1); Lambton Co., Pinery Prov. Park , 20.VI.1994, J. Skevington, malaise Cedar trail oak savanna meadow, (DEBU, 1); same locality, 26.VI.1994, J. Skevington, malaise Cedar trail oak savanna meadow, (DEBU, 1); Ottawa, (CNC, 4); same locality, 4.VIII, fungus, (CNC, 1); same locality, 22.VIII.1912, Beaulieu, (CNC, 1); same locality, 27.VIII.1912, Beaulieu, (MCZ, 4); Peel Co., Bolton, 4.V.1978, R.S. Anderson, under bark, (ROME, 1); Peel Co., Port Credit, 29.IV.1966, I.M. Smith, (ROME, 3); same locality, 18.VII.1965, I.M. Smith, (ROME, 1); same locality, 24.VII.1965, I.M. Smith, (ROME, 1); same locality, 16.IV.1966, I.M. Smith, (ROME, 2); Prince Edward Co., 30.IV.1922, Brimley, (CNC, 1); same locality, 2.VI.1940, Brimley, (CNC, 2) same locality, 1.VI.1930, Brimley, (CNC, 1); same locality, 31.V.1942, Brimley, (CNC, 1); same locality, 12.X.1919, Brimley, (CNC, 1); same locality, 29.VI.1941, J.F. Brimley, (FMNH, 1); Rainy River Dist., 22.VI.1924, J.F. Brimley, (CNC, 1); Reg.Mun. of Ottawa-Carleston Haldiman, 9.VI.1995, Brendon Larson, Twp. 5 km NW Centreton conch on dead Pop. Trem., (DEBU, 1); Rondeau Pr. Pk., Black Oak Trail, 5.VI.1985, A. Davies & J.M.

Campbell, under wet moldy bark on dead tree, (CNC, 23); St. Thomas, 28.VII.1925, James, (CNC, 1); Strathroy, 20.VI.1934, H.F. Hudson, (CNC, 1); Sudbury, 1889, (CNC, 1); Toronto, 20.XI.1895, R.J. Crew, (CUIC, 2); same locality, 24.VIII.1895, R.J. Crew, (CUIC, 5); same locality, 11.XI.1894, R.J. Crew, (CUIC, 1); same locality, 31.VIII.1895, R.J. Crew, (CUIC, 1); same locality, 24.XII.1894, R.J. Crew, (CUIC, 2); same locality, 7.X.1978, R.S. Anderson, (ROME, 2); Dundas, 16.V.1979, Dael Morris, (DEBU, 1); Gananoque, 6.VII.1963, C.J. Edwards, (DEBU, 1); Georgetown, 27.V.1988, R. Gagne, Malaise trap, (DEBU, 1); Guelph, 9.V.1975, J.M. Heraty, (DEBU, 4); same locality, 15.VII.1975, Sandra Allan, (DEBU, 1); same locality, 25.VII.1982, W. Punchihewa, (DEBU, 1); same locality, 17.VII.1976, S.A. Marshall, (DEBU, 1); same locality, 10.V.1975, J. Umphrey, (DEBU, 4); Haulock, 9.VII.1977, Mccreadie, (DEBU, 1); Kingsville, 8.VII.1977, A.A. Konecny, (DEBU, 1); Lanark, 2.VIII.1976, M.J. Sharkey, (DEBU, 1); London, W. Saunders, (DEBU, 1); Norval, 16.V.1980, Kevin Barber, (DEBU, 1); Toronto, 10.VII.1977, W.A. Attwater, (DEBU, 1); Vineland, 20.VIII.1930, W.L. Putman, (DEBU, 1). **QUEBEC:** Aylmer, Queen's Park, 24.X.1923, C.B. Hutchings, (CNC, 1); Chelsea, 25.VI.1912, A. Gibson, (CNC, 1); Deux-Montagnes, Parc Paul-Sauvé, 9.IV.1989, S. Laplante, (SLC, 1); Dorval, 26.IX.1985, LeSage & Smetana, Ex. *Pleurotus ostreatus* in decid. forest, (CNC, 2); Gatineau, Eardley, 11.VI.1994, F. Genier, (CMNC, 1); Ile-de-Mtl, bois de Saraguay, 21.IV.1979, S. Laplante, (SLC, 3); Limbour Touraine, 12.VIII.1974, R. Sexton, (CNC, 1); Masham Twp., Gatineau Co., 27. VIII.1975, D.M. Wood, teneral, (CNC, 3); Meach Lk., Gatineau Park, 11.VIII.1976, J.M. Campbell, (CNC, 1); Missisquoi, le Petit Pinacle, 24.IV.1979, S. Laplante, (SLC, 1); Montreal, 24.VII.1970, E.J. Kiteley, (CNC, 1); same locality, 1.VII.1970, E.J. Kiteley,

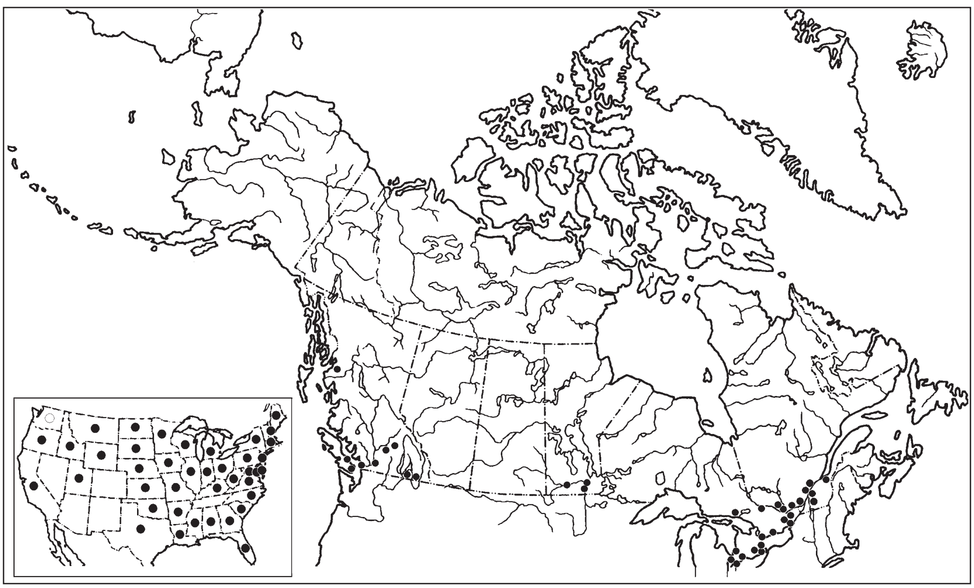


Fig. 31. Canadian distribution of *Synstrophus repandus*. Inset shows US distribution, by state. Open circle indicates state record from Hatch (1965).

fungus on log, (CNC, 1); same locality, 8.VI.1976, E.J. Kiteley, on fungus, stump, (CNC, 4); same locality, 12.VI.1981, E.J. Kiteley, on fungus, stump, (CNC, 1); same locality, 28.VI.1982, E.J. Kiteley, UV light trap, (CNC, 1); same locality, 12.VIII.1972, E.J. Kiteley, on log fungus, (CNC, 2); same locality, 1.IX.1972, E.J. Kiteley, (CNC, 1); same locality, 11.VII.1982, E.J. Kiteley, UV light trap, (CNC, 1); same locality, (MCZ, 1); Pontiac, Eardley, 24.VIII.1991, S. Laplante, polypore on branch of old *Quercus rubrus*, beaten, (SLC, 1); Terrebonne, 17.VIII.1918, F. T. Scott, (LACM, 4); same locality, 17.VIII.1918, (UAIC, 2); Vaudreuil, Rigaud, 16.VI.1990, S. Laplante, (SLC, 2).

Discussion

The Eustrophinae, like many groups of "little brown beetles", are rather obscure, infrequently encountered by general collectors, and without much detailed knowledge of their biology. Their somewhat cryptic habits and habitats, and predominantly nocturnal activity have allowed this obscurity to continue. However, in preferred habitats (i.e. dead trees with wood-rotting fungi), individuals of some species (e.g. *E. bicolor* and *S. repandus*) can be very abundant. One must be willing to visit these habitats after dark, and examine dead wood surfaces and/or associated fungi.

Eustrophines are a small part of the entire group of saproxylic Coleoptera, which includes species that are wood and bark feeders, fungal feeders, and predators (Jonsell, 1999). In forest habitats, saproxylic Coleoptera represent a large component of the beetle fauna (Hammond et al., 2004; Siitonen, 2001). For example, about 25% of Swedish beetles are saproxylic (Jonsell, 1999); these species are partly responsible for the breakdown of coarse woody material, through direct feeding action and transferring fungi among individual logs, snags and stumps (Hammond et al., 2004). Most studies on the importance of saproxylic Coleoptera to forest ecology and management were done in Europe, notably in Scandinavia (e.g. Martikainen, 2001; Siitonen, 2001). European Coleoptera are better known, both taxonomically and ecologically, with habitat associations generally well understood for most species. Studies on saproxylics in North America have lagged somewhat behind, although they have become better known through increased awareness of their importance in forest habitats in Canada and the United States. Indeed, according to Hammond et al. (2004: 16) "in North America, saproxylic assemblages are poorly understood and woefully understudied".

Forest management practices can significantly affect diversity and abundance of saproxylic Coleoptera (Majka and Pollock, 2006), although most considerations of the effects of forest practices focus on vertebrates (Hammond et al., 2004). Some recent studies in Canada (e.g. Hammond, 1997; Hammond et al., 2001; Majka and Pollock, 2006) have revealed a rich fauna of saproxylic Coleoptera, although there is much more to learn about these ecologically important beetles. Although the Canadian Eustrophinae are relatively few in species, they are occasionally very abundant in wood-rotting fungal habitats, and are undoubtedly an integral component of the "coarse woody debris" insect assemblage. As suggested by Majka and Pollock (2006), further work is required to initially identify the saproxylic beetle assemblages, determine their role in forest communities, and then to recommend silvicultural practices that minimize impact on these insects. For the Canadian eustrophines specifically, very little is known about their feeding preferences, life histories, immature stages and other bionomic parameters. Perhaps once these are better known, the ecological importance of these historically obscure beetles will be shown to be greater than previously thought.

Acknowledgements

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Checklist of Nearctic species of Eustrophinae (classification follows Nikitsky 1998)

Eustrophinae Gistel, 1856
- Tribe Holostrophini Nikitsky, 1998
  - *Pseudoholostrophus* Nikitsky, 1983
    - *P.* (*Holostrophinus*) *discolor* (Horn, 1888)
    - *P.* (*Pseudoholostrophus*) *impressicollis* (LeConte, 1874)
  - *Holostrophus* Horn, 1888
    - *H. bifasciatus* (Say, 1824)
- Tribe Eustrophini Gistel, 1856
  - *Eustrophus* Illiger, 1802
    - *E. tomentosus* Say, 1826
  - *Synstrophus* Seidlitz, 1898
    - *S. repandus* (Horn, 1888)
  - *Eustrophopsis* Champion, 1889 (= *Eustrophinus* Seidlitz, 1898)
    - *E. arizonensis* (Horn, 1888)
    - *E. bicolor* (Fabricius, 1798)
    - *E. brunneimarginatus* (Dury, 1906)
    - *E. confinis* (LeConte, 1866)
    - *E. indistinctus* (LeConte, 1851)
    - *E. ornatus* (Van Dyke, 1928)

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Saproxylic beetle (Coleoptera) communities and forest management practices in coniferous stands in southwestern Nova Scotia, Canada

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Abstract
Old-growth forests in Nova Scotia typically exhibit an uneven-aged, multi-layered stand structure and contain significant amounts of coarse woody debris. Many forest species, including invertebrates, depend in various ways on deadwood substrates. The objective of this study was to investigate relationships between forest stand age, silvicultural treatment, dead wood, and invertebrate biodiversity, using saproxylic beetles as an indicator group. Saproxylic beetle communities were also compared in the context of other studies in Nova Scotia. Beetles were gathered using four collection techniques: pitfall traps, funnel traps, sweep-netting, and manual searching. Results show that both stand age and harvest treatment had an effect on species richness and species composition. Younger stands had lower species richness and hosted a significantly different suite of species than medium-aged or older ones. Similarly, harvested stands had lower species richness and were host to a significantly different suite of species than unharvested stands. The results from the investigation of stand age are of particular interest. Forest management that disregards the dependence of different suites of beetles on forest stands of various ages and compositions, emphasizing even-aged single-species stands, may be harmful to the species diversity of Nova Scotia's forest ecosystems.

Keywords
Coleoptera, saproxylic, forest management, coarse woody debris, dead wood, coniferous forests, biodiversity, forest stand age, silvicultural treatment, Nova Scotia, Canada

Introduction

Many indicators have been developed for monitoring forest health and human impacts on forest ecosystems (Noss 1999). Communities of invertebrates are especially useful for monitoring environmental change. Several attributes make them particularly useful indicators including, ease of collection, functional importance, high site specificity, and known taxonomy (Langor and Spence 2006; Oliver and Beattie 1996a). A frequently suggested indicator is the diversity of saproxylic beetles.

Saproxylic beetles are a functional group of Coleoptera that depend, at some point in their life cycle, on dead or decaying wood or fungi associated with deadwood (Speight 1989; Økland et al. 1996). Not only do these insects comprise a large proportion of total forest species richness, but they also play an important role in decomposition and nutrient cycling in forest ecosystems (Siitonen 2001; Grove 2002b). Saproxylic beetles are considered pioneers as they are often the first to colonize dead wood. Early colonization by wood-boring species is thought to precondition the wood for succeeding species (Hammond et al. 2001). Saproxylic beetles are, in large part, responsible for the mechanical breakdown of coarse woody debris (CWD) (Hickin 1963). These beetles also demonstrate sensitivity to timber-harvest practices (Simila et al. 2002).

Nova Scotia forests have been subjected to a long history of human activity (Lynds 1989). This ranges from land clearing by early settlers, to forest "highgrading" between the 17th and 19th centuries, and finally clearcutting by the timber industry (Lynds 1989). Due to intensive management, 91% of the forested landscape is made up of young (less than 100 years) even-aged stands (Stewart et al. 2003). Few examples of really old forests with canopy trees of 250-300+ years old still exist. Although 73% of the land base is forested, no more than 0.6% of that land is comprised of old-growth forests (McMahon 1989; Loo and Ives 2003).

Nova Scotian old-growth forests (defined herein as being dominated by canopy trees over 120 years old) are typically comprised of uneven-aged, multi-layered stand structures and contain large quantities of CWD (Stewart et al. 2003). Thompson (2004) conducted an analysis of the CWD in southwestern Nova Scotia and found that mean stand volumes of CWD were relatively higher in old stands as compared to young and mid-aged stands. CWD volumes were higher in partially-harvested stands than in the unharvested stands of the same age class, but only in young stands.

Although old growth stands are rare in the Acadian forest region, their contribution to biodiversity may be significant (Loo and Ives 2003; Stewart et al. 2003; McMullin et al. 2008). The structural heterogeneity provided by CWD in forest ecosystems also gives rise to a wide range of ecological niches at the small-scale level. CWD and other deadwood materials in forests provide a multitude of habitats for numerous plant and animal species (Speight 1989; Franklin 1990; Grove 2002a). Although the study of saproxylic insects in the Maritime Provinces is relatively young, and old-growth forests have been little investigated in this regard, there are already preliminary indications that these same principals apply to forests in this region. Majka and Pollock (2006) reported the results of four studies of forest beetles that found between 54 and 76% of forest species were saproxylic. Majka (2007b) examined 14 families, subfamilies, and tribes of saproxylic beetles and found 59 apparently rare species that comprise 33% of the 178 species within these groups – a large proportion of the saproxylic fauna. Majka (2007b) proposed that this apparent scarcity might be due to the history of forest management practices in the region. These preliminary indications of the importance of saproxylic beetles, the scarcity of many species, and the very low fraction of old-growth forests in the region, together suggest that the virtual disappearance of microhabitats found in old growth forests may have affected a substantial proportion of Nova Scotia's native saproxylic species.

There are few studies of saproxylic invertebrates in eastern Canada compared to many areas of northern Europe (Jonsell et al. 1998; Kaila et al. 1997; Kolmstrom and Lumatjarvi 2000; Kouki et al. 2000; Martikainen 2001; Martikainen and Kouki 2003; Martikainen et al. 2000; Muona 1999; Økland et al. 1996; Rainius and Jansson 2002; Siitonen 1994, 2001; Simila et al. 2002, 2003; Sverdrup-Thygeson and Ims 2002; Vaisanen et al. 1993). Only in the last decade have serious investigations of the Nova Scotia saproxylic fauna been undertaken. Bishop (1998) and Bishop et al. (in press) highlighted the relationship between forest disturbance and saproxylic beetles. The relationship between forest disturbance, whether anthropogenic or not, and saproxylic beetle diversity is of growing importance. The principal goal of this study was to determine how saproxylic beetle communities vary with forest stand age and silvicultural treatment in mature conifer stands in southwestern Nova Scotia. These relationships were studied indirectly through the relationship between dead wood and beetle diversity. Other objectives were to define habitat for saproxylic species, mainly by qualitative and quantitative examination of CWD, and to contribute to a baseline understanding of the composition of forest-beetle communities in the Maritime Provinces.

Methods

Study area

The present study focused on shade tolerant softwood stands comprised primarily of spruce (*Picea glauca* (Moench) Voss, *Picea mariana* (Mill) BSP, and *Picea rubens* Sarg.), eastern hemlock (*Tsuga canadensis* L.) and white pine (*Pinus strobus* L.) (Pinaceae), but which also include some birch (*Betula papyrifera* Marsh and *B. alleghaniensis* Britt.) (Betulaceae), maple (*Acer saccharum* Marsh. and *Acer rubrum* L.) (Aceraceae), American beech (*Fagus grandifolia* Ehrh.) (Fagaceae), and eastern larch (*Larix laricina* (Du Roi) (Pinaceae). Natural disturbances for this type of forest are typically fine-scale fire, wind, diseases, and insects (Loo and Ives 2003). The study sites were located on the private land of Bowater Mersey Paper Company Limited (Fig. 1).

All 11 study sites fell within the Atlantic Interior theme region (Davis and Browne 1996). A closer examination shows that within the Atlantic Interior region, the sites fall within three distinct units. Sites 1-4, 7, and 9-11 are found in the Lake Rossignol

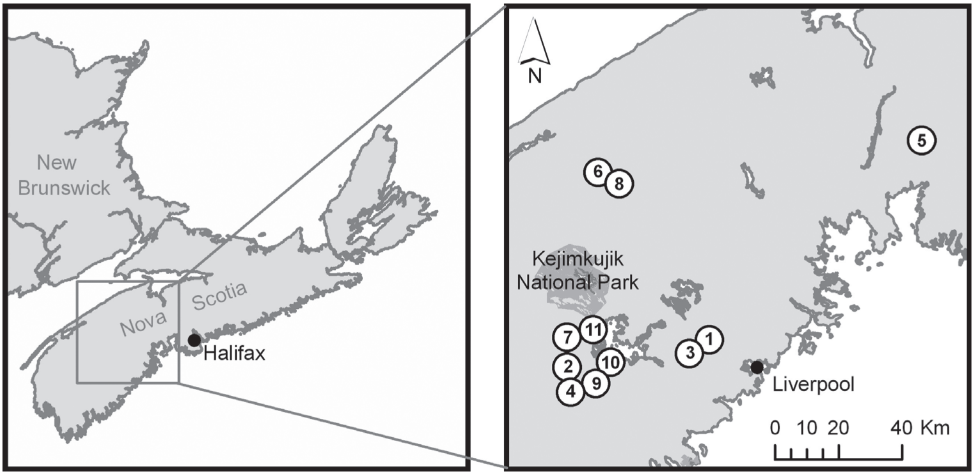

Fig. 1. Map of Bowater Mersey Paper Company Ltd land in Nova Scotia. Bowater Mersey lands highlighted. Site descriptions: 1 & 2 – 40-80 yr, CT; 3 & 4 – 40-80 yr, none; 5 – 80-120 yr, US; 6 & 7 – 80-120, none; 8 – 120+ yr, S; 9 – 120+ yr, S/SH; 10 & 11 – 120+ yr, none.
CT = Commercial thinning; US = Uniform selection harvest; SH = Shelterwood harvest; S = Selection harvest.

sub-unit of the Mersey Meadows unit within the Quarzite Plains district. The Lake Rossignol sub-unit is characterized generally by moderate to coarsely textured soils. The area around the south of Lake Rossignol itself supports eastern hemlock and red spruce, with some shade-tolerant hardwoods such as yellow birch. Culturally, hunting, fishing, and canoeing have been practiced in this area, as the Mersey River was a traditional transport route for the Mi'kmaq and the French. In the 1920s, Lake Rossignol was flooded for hydro power for pulp-and-paper companies, thus affecting the biota and the hunting and fishing of the Mi'kmaq.

Sites 6 and 8 are found in the Alma Lake sub-unit of the Annapolis Drumlins unit within the Drumlins district. The Alma Lake sub-unit is characterized by large granite boulders and well-drained soils. Although these drumlins are made up of granite materials, which are not typical, they do provide very productive forest sites. A mixed forest is common, and include eastern hemlock, red spruce, white pine, sugar maple, yellow birch, as well as some red maple. Tourism is and has been an important activity in this area beginning in the 1870s with American sportsmen who sought out hunting and angling experiences.

Site 5 is found in the South Mountain sub-unit of the Granite Uplands unit within the Granite district. The South Mountain sub-unit is characterized by uniform topographic features, including granite terrain and many large surface boulders. The soil is coarse, well-drained sandy loam, which is usually quite shallow. Characteristic forest trees are red spruce, eastern hemlock, white pine, balsam fir, and red maple with occasional red oak. Fire has played a major role in this area, and regeneration patterns suggest that the area is turning into a coniferous-dominated forest. Forestry activities are the dominant land use in this largely uninhabited area, but mining and tourism are also prevalent.

Study design

Data collection was replicated in four young (40-80 years) stands, three middle-aged (80-120 years) stands and four old-growth (120+ years) stands. Stand age was determined by coring specimens of the dominant tree species. Within each age class, there were two replicates of each of two treatments, harvested and unharvested, with the exception of the middle-aged stand since it was not possible to find two suitable harvested stands for this age class. Treatment for the harvested stands was by commercial thinning or by removal of approximately 30% of the canopy cover by uniform selection harvest and/or shelterwood harvest. All treated stands had been harvested 3-6 years prior to data collection. During the field season, a thorough overstory analysis was completed for each stand. Measurements including age, species, overstory condition, and diameter at breast height (DBH). Relative density, relative dominance and relative frequency of tree species were then calculated to determine the importance value for each species (Roberts-Pichette and Gillespie 1999).

A quantitative analysis of CWD for each site was completed by Thompson (2004). The sampling techniques used for measurement were adapted from the Nova Scotia Department of Natural Resources Forest Inventory Permanent Sample Plot Field Measurement Methods and Specifications (NSDNR 2002). In each of the sites, five plots of 400 m^2 area were designated randomly for measurement. All snags in each plot were recorded by species, decay class, crown class (intact or broken), height (m) and DBH (cm).

Downed CWD was also measured by census, and for each piece species, diameter at mid-point and length were recorded. Each piece was assigned to one of five decay classes ranging from freshly dead to thoroughly rotted [see Table 5 of Thompson 2004, an adaptation of methods by Sollins (1982)]. Total CWD volumes were calculated and averaged over the five plots to obtain the mean volume per stand.

Beetle sampling methods

Between 15 May 2003 and 11 August 2003, five visits were made to each site approximately two weeks apart. In order to collect as wide a spectrum of species as possible, beetles were sampled using four collection techniques: pitfall traps, Lindgren traps, sweep-netting, and manual searching. Approximately four hours of search time was spent in each site for each of the five visits between 08:00 and 16:00 hr. Timing of visits to the sites was rotational, therefore sites were visited at different times of the day on each date. Collection did not take place during inclement weather, or on mornings following rough weather. An attempt was made to sample as many different sizes and species of vegetation as possible to ensure that a maximum number of habitat types was examined. Sweeping covered both ground vegetation and tree branches within reach and was performed for approximately one hour per site.

For each site, five pitfall traps were placed and visited five times over the course of the field season. Pitfall traps consisted of plastic cups buried in the ground and covered with a piece of CWD. The traps were filled 1/3 with a solution of one part ethylene glycol and two parts water. One Lindgren trap was set up at each site and was visited four times during the field season. The eight-funnel Lindgren trap was suspended approximately 1.3 m off the ground in a relatively clear area within the site. The Lindgren traps were baited with a solution of half turpentine and half a 70% ethyl-alcohol solution. The collection jar at the bottom of the trap was filled 1/3 with water. Specimens were collected approximately every two weeks and were in good condition and not disarticulated so as to readily allow for identification.

Beetle analysis methods

All the specimens collected in the study were identified to species by C.G. Majka with the assistance of taxonomic experts (listed in the acknowledgements) with the exception of: a) five species of Aleocharinae (Staphylinidae) (5 individuals) for which determination was possible only to the level of genus or tribe; and b) one species of in the genus *Medon* (Staphylinidae: Paederinae) which was identified as *M.* nr. *rufipenne* (Casey, 1905) by Lee Herman. In the case of some beetles in the genera *Cyphon* (Scirtidae: 3 species) and *Atomaria* (Cryptophagidae: 1 species), the species found in the Maritime Provinces are currently under taxonomic revision (Klausnitzer and Majka, and Johnson and Majka respectively). Present determinations of these species may change as a result of these taxonomic revisions. The species of *Paratenetus* (Tenebrionidae) represents an undescribed species currently being described (P. Bouchard and Y. Bousquet, in preparation). The taxonomy and nomenclature employed follows Arnett and Thomas (2000) and Arnett et al. (2002). The collection of Coleoptera has been deposited with the Nova Scotia Museum (NSMC).

The data collected in the present study were additionally analyzed in relation to those gathered by Bishop (1998), a comparable study of the same trophic group of beetles in similar forest environments in Nova Scotia. Saproxylic species (*sensu lato*) were selected according to the criteria specified by Speight (1989), namely species which depend, at some point in their life cycle, on dead or decaying wood, or fungi associated with deadwood, or on other saproxylics. The inclusion of species in this category was made on a specific or, more commonly, generic basis, consulting a wide variety of published sources (commencing with Arnett and Thomas (2000) and Arnett et al. (2002), followed by family-specific treatments such as Larochelle and Larivière (2003)), or if such information was not readily available in the literature, by consulting with appropriate specialists.

Inclusion in the saproxylic category is always accompanied by some degree of uncertainty, particularly in relation to groups or species that have been little investigated in terms of their bionomics (such as some Elateridae or Aleocharinae). Furthermore, some species, for example large forest-floor predators such as many Carabidae and Staphylininae, while frequently found in or under decomposing wood or logs, and therefore predaceous on other saproxylics, also range widely in the forest floor environment, and consequently may sporadically exit the saproxylic system.

Trophic categories were assigned to all species as a result of information derived from the aforementioned sources. The trophic categories employed were:

Bolitophagous: feeding on the fruiting bodies of fungi (i.e., mushrooms);
Mycetophagous: feeding on fungal hyphae (i.e., mold and mildew feeders);
Myxomycophagous: feeding on slime molds;
Phloeophagous: feeding on phloem of woody vegetation (i.e., cambium feeders);
Phytophagous: feeding on leafy vegetation;
Pollen Feeder: feeding on pollen of vascular plants;
Predaceous: feeding on invertebrates;
Predaceous/Nectarivorous: both predaceous and feeding on nectar;
Rhizophagous: feeding on roots (i.e., plant material growing underground);
Rhizophagous/Predaceous: both rhizophagous and predaceous;
Sap Feeder: feeding on sap;
Saprophagous: feeding on decomposing animal material;
Saprophytic: feeding on decomposing plant material;
Xylophagous: feeding on xylem of woody vegetation.

The categories listed above are general and there are species of Coleoptera that a) overlap between two or more categories, particularly in regard to the different bionomics of adults and larvae; and b) are insufficiently well studied for assignation with acceptable certainty to a particular category. For example, it is not always clear if detritivores are deriving nutrition from decomposing material (i.e., are saprophagous) or from fungal hyphae growing in such a matrix (i.e., are mycetophagous), or a combination of both. Nonetheless, such categorizations are a useful first-order approximation to gain insight into the trophic structure of forest-beetle communities.

Beetle data analysis: statistical techniques

The sampling methods of this study emphasized alpha diversity (species richness). For the purpose of analysis, all species collected, no matter the quantity, were only counted as present or absent in any given site. A two-way analysis of variance (ANOVA) was performed based on species richness (sum of species) because it allows the investigation of interactions. An ANOVA was performed for both age and harvest treatment. To facilitate comparison with the present study, the data from Bishop (1998) (which included quantitative abundance information) were converted to presence/absence data. All subsequent data treatments were identical for both studies.

To analyse the differences in species composition between sites, a SIMPER (similarity percentages) test (Clarke and Warwick 2001) was completed. This test was used to determine which species, from all dates in each site, contributed most to the dissimilarity between sites; those species that provided the strongest discrimination between two sites. The species selected for the modified list were those whose similarity/dissimilarity, divided by the standard deviation, had a value greater than or equal to 1. All subsequent tests were performed using the modified species list.

The presence/absence of all species over all dates in each site was used to calculate the Bray-Curtis similarity measure. A one-way analysis of similarities (ANOSIM) between samples was performed for the factors of age and treatment within each site using the Bray-Curtis similarity measure (Clarke and Warwick 2001). Given the qualitative, presence/absence nature of the data collected, the SIMPER analysis was most applicable. ANOSIM was used for variables such as species richness and trophic category richness (trophic composition). Multi-dimensional scaling (MDS) plots were completed for each of the variables. The MDS plots give a two-dimensional ordination, illustrating relationships between sites.

A test of taxonomic distinctiveness (TAXD) was performed using the following taxonomic levels: species, genus, tribe, subfamily, family, superfamily, series, and suborder. The TAXD measures biodiversity based on the relatedness of species within a sample, thus adding additional statistical sampling properties (Clarke and Warwick 2001).

No standardisation or transformation was performed before analysis. Several qualitative comparisons were made between the two studies, including total number of species, differences in species origin, and trophic categories. A quantitative comparison of species richness between the two studies with differing species and specimen numbers was possible using the EstimateS rarefaction curve (Colwell 2004).

Relationships between beetle communities and CWD

Coarse woody debris volumes were calculated by Thompson (2004) using only pieces where diameter > 7.0 cm. Stand volumes were analyzed with respect to stand age and harvest treatment using a general linear model (GLM) in SPSS 11.5 (SPSS 2002). The effects of age, treatment, and age and treatment combined were tested for their influence on the volume of CWD in each stand. Decay class and CWD diameter across age groups and harvest treatment were plotted to look for trends in the data.

The multivariate patterns arising from the CWD data were compared to those of beetle species data to determine the extent to which CWD affects beetle species diversity. Both an analysis of covariance (ANCOVA) and a correlation analysis were used to test whether CWD volumes were correlated with beetle species richness (Clarke and Warwick 2001).

CWD volume data were then used to assign each stand to one of three volume classes: 1-55 m^3/ha (low), 56-110 m^3/ha (medium) and 111-165 m^3/ha (high). The CWD volume classes were paired with beetle data. CWD was qualified as a factor and analyzed using ANOSIM.

Results

Overview of stand data

The eleven study sites were mainly dominated by red spruce, white pine, and/or eastern hemlock (Fig. 2), ranging in age from 49 years to approximately 160 years (Table 1). Minimum mean diameter at breast height (DBH) was 10.5 cm at site 4 and maximum mean DBH was 24.6 cm at site 10. The mean DBH of dominant species ranged from 10.8 cm for the red spruce, white pine, and balsam fir in site 4, to 28.4 cm for the eastern hemlock and red spruce in site 10. Stand density ranged from 510 stems/ha in site 9 to 4,320 stems/ha in site 4.

Using data collected by Thompson (2004), volume of CWD for each decay class was plotted for each of the 11 forest stands. Volumes of CWD varied from > 160 m^3/ha to < 40 m^3/ha. CWD total volumes were clearly higher in the oldest stands sampled (Fig. 3). Tree species composition also varied across the sites (Fig. 4), but with no clear pattern associated with stand age or treatment. Site 5 in particular had a large proportion of red maple, and site 8 had a large proportion of eastern hemlock. Sites 1, 2, 4, and 7 have no white birch CWD.

Table 1. Summary of characteristics of eleven study sites on Bowater land in southwestern Nova Scotia including mean age, mean height, mean diameter at breast height (DBH), dominant species and density.

Site	Harvest treatment[1]	Dominant overstory species[2]	Age class (years)	Mean Age (years)[3]	Total Basal Area (m^2/ha)	Mean Height (m)	Mean DBH (cm)	Mean DBH of Dominant Species (cm)	Density (stems/ha)
1	CT	rS	40-80	67	38.4	18.7	12.9	14.4	2055
2	CT	wP/rS	40-80	59	35.6	20.9	18.2	20.0	1080
3	None	rS/eH	40-80	58	45.3	19.0	14.7	11.5	1930
4	None	rS/wP-bF	40-80	55	46.4	15.9	10.5	10.8	4320
5	US	rS	80-120	100	26.7	20.0	13.9	16.6	1220
6	None	rS/wP	80-120	95	37.6	19.0	15.1	20.4	1410
7	None	rS	80-120	90	52.3	21.3	18.3	17.8	1405
8	S	eH/rS	120+	ca. 160	39.4	20.6	16.5	21.3	1050
9	S/Sh	eH/rS	120+	126	34.9	25.8	22.2	22.8	510
10	None	eH/rS	120+	190	57.8	25.5	24.6	28.4	895
11	None	eH/rS	120+	190	47.1	25.0	20.3	20.5	1105

[1] CT = Commercial thinning; US = Uniform selection harvest; Sh = Shelterwood harvest; S = Selection harvest.

[2] rS = red spruce; wP = white pine; eH = eastern hemlock; bF = balsam fir

[3] Age determined by cores of dominant tree species.

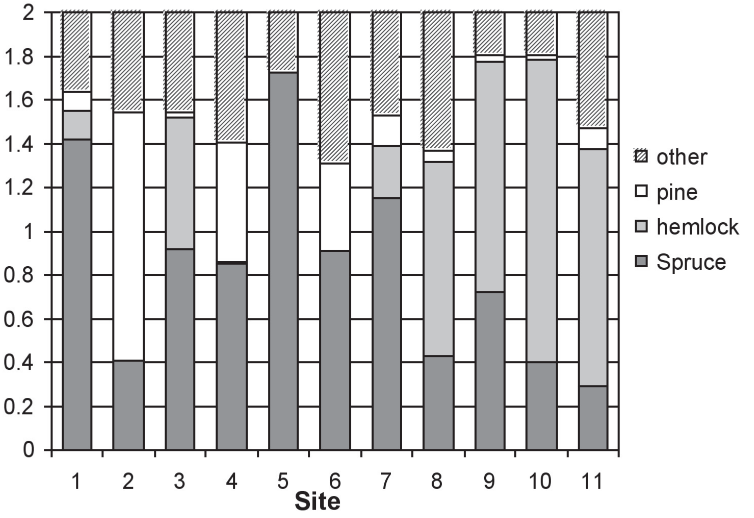

Fig. 2. Overstory composition for dominant tree species based on importance value (Importance Value = Relative Density + Relative Dominance + Relative Frequency). Site descriptions: 1 & 2 – 40-80 yr, CT; 3 & 4 – 40-80 yr, none; 5 – 80-120 yr, US; 6 & 7 – 80-120, none; 8 – 120+ yr, S; 9 – 120+ yr, S/SH; 10 & 11 – 120+ yr, none.
CT = Commercial thinning; US = Uniform selection harvest; SH = Shelterwood harvest; S = Selection harvest.

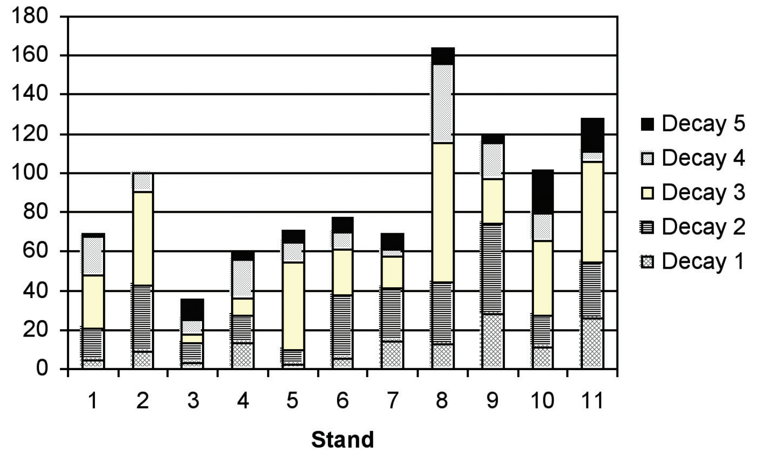

Fig. 3. Volume of coarse woody debris (CWD) by decay class for 11 stands in southwestern Nova Scotia as measured by Thompson (2004). Decay classes are summarized as follows: "1" is freshly dead, little to no rot; in "2", the bole is mostly sound; "3" has well-established rot and significant bark loss; "4" is advanced decay; and "5" is rotted through but still of wood character. Site descriptions: 1 & 2 – 40-80 yr, CT; 3 & 4 – 40-80 yr, none; 5 – 80-120 yr, US; 6 & 7 – 80-120, none; 8 – 120+ yr, S; 9 – 120+ yr, S/SH; 10 & 11 – 120+ yr, none.
CT = Commercial thinning; US = Uniform selection harvest; SH = Shelterwood harvest; S = Selection harvest.

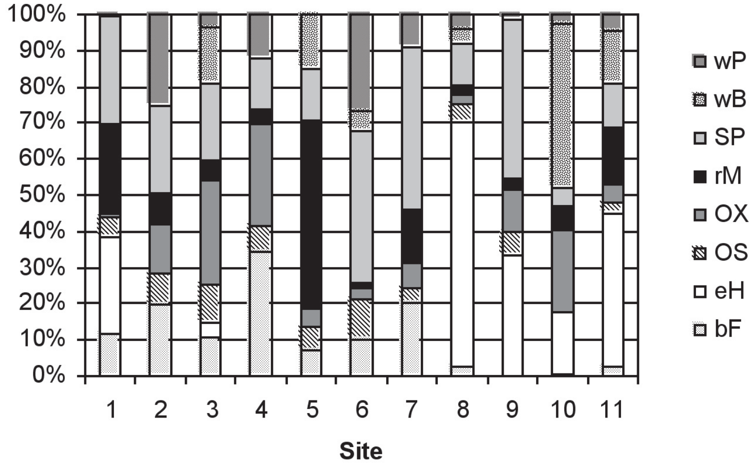

Fig. 4. Percentage of coarse woody debris (CWD) volume by tree species for 11 stands in southwestern Nova Scotia (Thompson 2004). Tree species: wP White Pine; wB White Birch; SP Spruce spp.; rM Red Maple; OX unidentified hardwood; OS unidentified softwood; eH Eastern Hemlock; bF Balsam Fir. Site descriptions: 1 & 2 – 40-80 yr, CT; 3 & 4 – 40-80 yr, none; 5 – 80-120 yr, US; 6 & 7 – 80-120, none; 8 – 120+ yr, S; 9 – 120+ yr, S/SH; 10 & 11 – 120+ yr, none.
CT = Commercial thinning; US = Uniform selection harvest; SH = Shelterwood harvest; S = Selection harvest.

Overview of beetle data

Beetle sampling yielded 2,302 specimens of 346 species from 56 families (Appendix 1). Of the 346 beetle species, 264 were determined to be either facultative or obligatory saproxylics. Fifteen species (4%) were common to all young stands, 25 species (7%) were common to all medium-aged stands, and 16 species (5%) were common to all old stands. Eleven species (3%) were common to all harvested stands and seven species (2%) were common to all unharvested stands. Fifty-one species were caught in only one of the 11 sampling sites. Only three species (*Isomira quadristriata* (Couper), *Platydracus viridanus* (Horn) and *Rhagonycha mandibularis* (Kirby)) were common to all 11 sites.

Results from the SIMPER analysis identified 97 beetles primarily accounting for species assemblage similarities and dissimilarities for factors of age and treatment. These species were used for all subsequent analyses. In comparison, 387 species were collected by Bishop (1998), 76 of which were primarily responsible for species assemblage similarities and dissimilarities and were used in subsequent analysis.

Comparative analysis of beetle communities

Both the present study and Bishop (1998) found relatively similar numbers of beetle species (346 and 387 respectively). However, Bishop (1998) collected over four times the number of specimens collected in the present study (9,881 vs. 2,301 respectively).

The larger number of individuals in Bishop's (1998) study reflects a greater sampling effort (180 flight intercept traps which were continuously in place for 90 days during the spring/summer field season). Similar numbers of beetle species were considered facultative or obligatory saproxylics (264 species in the present study; 297 in Bishop (1998)). One hundred and sixty-four species were common to both studies. Results from a rarefaction analysis (Fig. 5) indicate that, if similar numbers of specimens were collected in the Bishop (1998) study, the number of beetle species would not have been as high as in the present study (Fig. 5). It is also clear that the number of species in the present study has not yet approached an asymptote (Fig. 5). This indicates that the four collecting techniques we employed are sampling a much wider spectrum of the forest beetle community than the single technique employed by Bishop (1998).

For example the present found more species of forest floor beetles in the families Carabidae, Tenebrionidae, and Histeridae than did Bishop (1998) (Fig. 6). Although some of these species are macropterous and are capable of flight, it would appear that many of them fly infrequently. The larger numbers of Curculionidae (Fig. 6) in the present study consist almost entirely of flightless species in the subfamily Entiminae, which are not sampled at all by flight intercept traps. The present study also collected substantial numbers of specimens in the Geotrupidae (*Geotrupes horni* Blanchard, a forest floor species) and Zopheridae (*Phellopsis obcordata* (Kirby), a largely flightless bolitophagous species found on polypore fungi) (Appendix 1), two families not represented in the material collected by Bishop (1998).

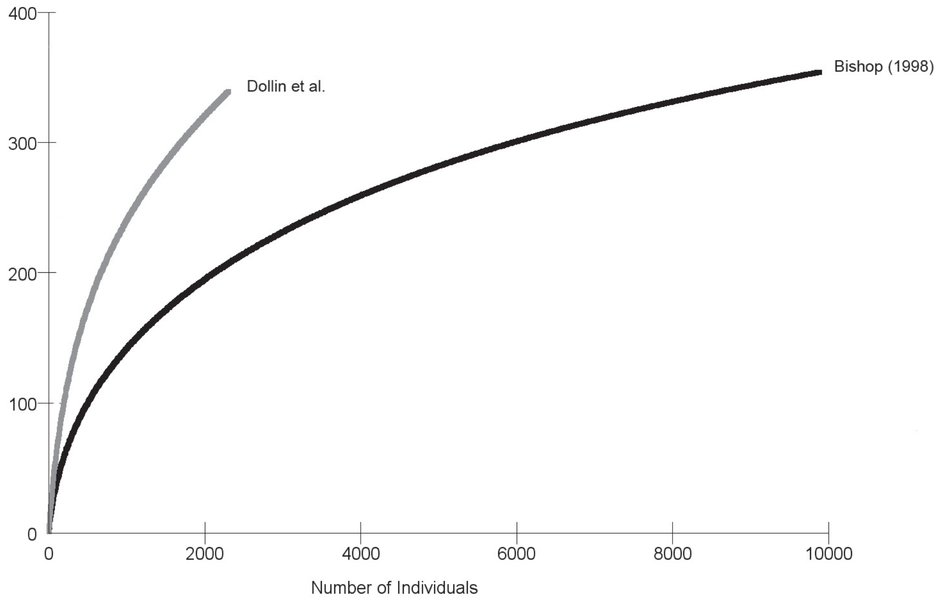

Fig. 5. Rarefaction curve demonstrating projected species richness for number of individuals based on Bishop (1998), and the present study (Dollin et al.) beetle collections.

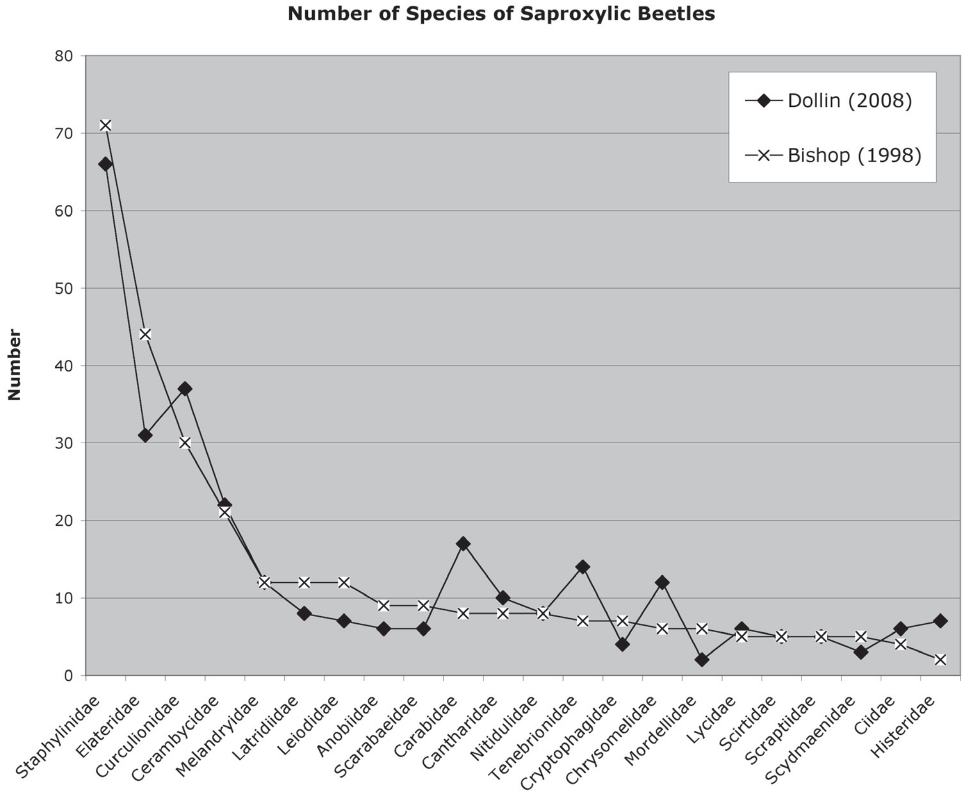

Fig. 6. The number of species of beetles in the 22 most speciose families collected in the present study and in Bishop (1998).

A sizeable number of species were restricted to stands of specific ages: 47 were exclusively found in young stands, 52 species were found only in middle-aged stands and 69 species were exclusively found in old stands. These 69 species are listed in Table 2 along with indications of their abundance and distribution within Nova Scotia. While such categorizations admittedly include a degree of subjective judgment, and are based on a continually evolving base of knowledge of the Coleoptera in the province, they do allow a mechanism for selecting potentially vulnerable species. They include 23 rarely collected and locally distributed species in Nova Scotia (indicated in boldface in Table 2) that may be indicator species of old-growth forests conditions.

Effects of stand age

More species were present in middle-aged and old stands than in young stands ($F = 22.511$; d.f. = 2; $p = 0.003$). Significantly more species were present in middle-aged and old stands than in young stands (Fig. 7).

Table 2. Coleoptera found only in old-growth (120+ years) forests

Family	Species	Abundance	Distribution	Saproxylic	Reference
Carabidae	***Gastrellarius honestus* (Say)**	rare	local	SX	Majka et al. (2007b)
	Harpalus affinis Schrank †	abundant	widespread		Majka et al. (2007b)
Histeridae	*Platysoma coarctatum* LeConte	uncommon	scattered	SX	Majka (2008a)
Leiodidae	***Agathidium oniscoides* Beauvois**	rare	local	SX	unpublished data
	Sciodrepoides terminans (LeConte)	abundant	widespread		unpublished data
Scydmaenidae	***Stenichus badipes* (Casey)**	rare	local	SX	unpublished data
Staphylinidae	***Phloeonomus laesicollis* (Mäklin)**	rare	local	SX	unpublished data
	***Phloeostiba lapponicus* (Zetterstedt)** *	rare	local		unpublished data
	Bibloporus bicanalis (Casey)	common	widespread	SX	unpublished data
	***Pycnoplectus linearis* (LeConte)**	rare	local	SX	unpublished data
	Batrisodes lineaticollis (Aubé)	uncommon	widespread	SX	unpublished data
	Tachinus basalis Erichson *	uncommon	widespread	SX	Campbell (1973)
	Oxypoda amica Casey	common	local	SX	Klimaszewski et al. (2006)
	***Gyrophaena sculptipennis* Casey**	rare	local	SX	unpublished data
	Aleocharine species 4				
	Anaquedius vernix (LeConte)	uncommon	widespread	SX	Smetana (1971)
	Quedius canadensis (Casey)	uncommon	widespread	SX	Smetana (1971)
	***Quedius densiventris* (Casey)**	rare	local	SX	Smetana (1971)
	Gabrius picipennis (Mäklin)	abundant	widespread	SX	Smetana (1995)
Scarabaeidae	*Dialytes striatulus* (Say)	common	widespread		unpublished data
	Dichelonyx albicollis (Burmeister)	common	widespread	SX	unpublished data
	Dichelonyx subvittata (LeConte)	common	widespread	SX	unpublished data
	Osmoderma scabra Beauvois	common	widespread	SX	unpublished data
Buprestidae	*Dicerca punctulata* (Schönherr)	common	widespread	SX	Bright (1987)
Elateridae	*Dalopius fuscipes* Brown	uncommon	widespread	SX	Majka & Johnson (2008)
	***Ampedus protervus* (LeConte)**	rare	local	SX	Majka & Johnson (2008)

Family	Species	Abundance	Distribution	Saproxylic	Reference
	Melanotus similis (Kirby)	common	widespread		Majka & Johnson (2008)
	Liotrichus vulneratus (LeConte)	uncommon	widespread	SX	Majka & Johnson (2008)
	Neohypdonus tumescens (LeConte)	uncommon	widespread	SX	Majka & Johnson (2008)
Lycidae	***Lopheros fraternus* (Randall)**	rare	local	SX	unpublished data
	***Plateros bispiculatus* Green**	rare	local	SX	unpublished data
Cantharidae	*Cantharis rotundicollis* Say	common	widespread		unpublished data
	***Atlantycha bilineata* Say**	rare	local		unpublished data
	Podabrus modestus (Say)	uncommon	scattered		unpublished data
Anobiidae	*Microbregma emarginatum* (Duftschmid) †	common	widespread	SX	Majka (2007a)
	***Dorcatoma falli* White**	rare	local	SX	Majka (2007a)
Nitidulidae	*Colopterus truncatus* (Randall)	common	widespread	SX	Majka & Cline (2006a)
Monotomidae	***Rhizophagus remotus* LeConte**	rare	local	SX	unpublished data
Silvanidae	*Silvanus bidentatus* (Fabricius) †	common	widespread	SX	Majka (2008b)
Cucujidae	*Cucujus clavipes* Fabricius	uncommon	widespread	SX	Majka (2008b)
Laemophloeidae	*Laemophloeus biguttatus* (Say)	uncommon	widespread	SX	Majka (2008b)
Cryptophagidae	*Atomaria ephippiata* Zimmerman	uncommon	widespread	SX	unpublished data
Coccinellidae	*Scymnus lacustris* LeConte	uncommon	widespread		Majka & McCorquodale (2006)
Mycetophagidae	***Mycetophagus serrulatus* Casey**	rare	local	SX	unpublished data
Ciidae	***Ceracis sallei* Mellié**	rare	local	SX	Majka (2007c)
Tetratomidae	*Penthe pimelia* (Fabricius)	uncommon	widespread	SX	Majka & Pollock (2006)
Melandryidae	*Dircaea liturata* (LeConte)	uncommon	widespread	SX	Majka & Pollock (2006)
Mordellidae	*Mordellistena fuscipennis* (Melsheimer)	common	widespread		Majka & Jackman (2006)
Colydiidae	***Lasconotus borealis* Horn**	rare	local	SX	Majka et al. (2006)
Tenebrionidae	***Neomida bicornis* (Fabricius)**	rare	local	SX	Majka et al. (in press)
	Scaphidema aeneolum (LeConte)	common	widespread	SX	Majka et al. (in press)
	Iphthiminus opacus (LeConte)	uncommon	widespread	SX	Majka et al. (in press)

Family	Species	Abundance	Distribution	Saproxylic	Reference
Pyrochroidae	*Dendroides canadensis* Latreille	uncommon	widespread	SX	Majka (2006a)
Cerambycidae	*Pidonia ruficollis* (Say)	common	widespread	SX	unpublished data
	***Pygoleptura nigrella* (Say)**	rare	local	SX	unpublished data
	***Sachalinobia rugipennis* (Newman)**	rare	local	SX	unpublished data
	Stictoleptura canadensis (Olivier)	common	widespread	SX	unpublished data
Chrysomelidae	***Paria fragariae kirki* Balsbaugh**	rare	local		unpublished data
Curculionidae	*Otiorhynchus sulcatus* (Fabricius) †	abundant	widespread		Majka et al. (2007a)
	Polydrusus impressifrons (Gyllenhal) †	uncommon	local		Majka et al. (2007a)
	***Conotrachelus posticatus* Boheman**	rare	local		Majka et al. (2007a)
	Pissodes strobi (Peck)	common	widespread		Majka et al. (2007a)
	Hylurgops rugipennis pinifex (Fitch)	common	widespread	SX	Majka et al. (2007a)
	Dendroctonus simplex LeConte	uncommon	local	SX	Majka et al. (2007a)
	Dendroctonus valens LeConte	common	widespread	SX	Majka et al. (2007a)
	Pityokteines sparsus (LeConte)	common	widespread	SX	Majka et al. (2007a)
	Orthotomicus caelatus (Eichhoff)	common	widespread	SX	Majka et al. (2007a)
	***Pityophthorus cariniceps* LeConte**	rare	local	SX	Majka et al. (2007a)
	Monarthrum mali (Fitch)	common	widespread	SX	Majka et al. (2007a)

Abundance Categories (reflective of collection frequency): abundant, common, uncommon, rare. Distribution categories: widespread, scattered, local. Saproxylic Status: SX, saproxylic species; no entry, non-saproxylic species.

†, adventive Palaearctic species; *, Holarctic species; no symbol, Nearctic species. Entries highlighted in boldface represent rarely collected local species, possibly indicative of old-growth forest conditions.

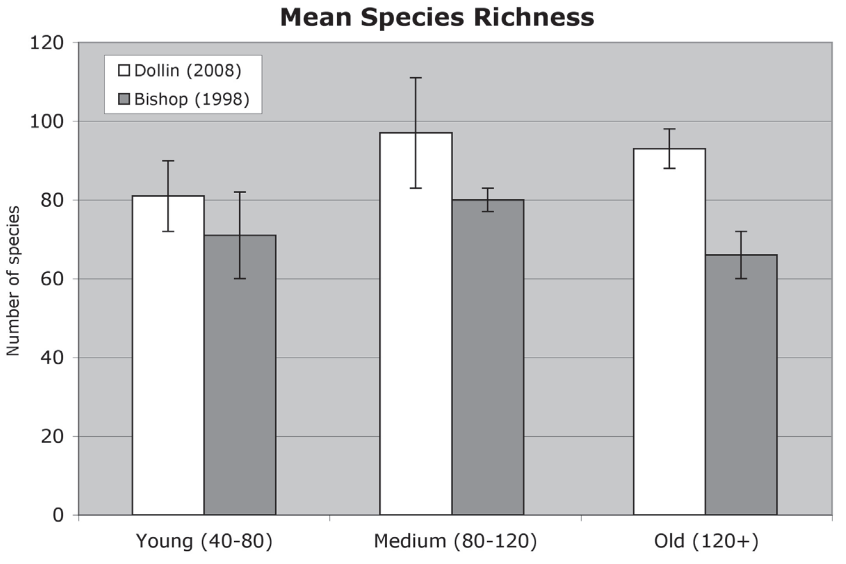

Fig. 7. Mean species richness of beetles in different forest stand age classes, including standard deviation from both the present study and Bishop (1998).

Species composition was significantly affected by stand age. The Global R, ANOSIM was 0.442 with a significance level of 0.7% (the sample statistic is similar to, yet not synonymous with, a p-value of 0.007). Both the young and mid-aged stands were significantly different from the old stands, but there was no significant difference between the young and mid-aged stands. Stand age had a pronounced effect on species composition.

Trophic composition was also affected by stand age (Global R, ANOSIM of 0.503 with a significance level of 0.1%). There were significant differences in the trophic composition of beetle communities between young and both mid-aged and old groups, but not between mid-aged and old groups.

The TAXD test did not show any significant results for age, therefore indicating that there were no differences detected in the taxonomic distinctiveness of species between age groups of stands.

Comparative effects of stand age

Species richness was affected by stand age in this study only. Young unharvested stands had the lowest species richness, and mid-aged harvested stands the highest. All other stand age-treatment combinations had similar species richness. Stand age had no significant effect ($F = 1.632431$; d.f. = 2; $p = 0.217$) on species richness in Bishop (1998). Species composition and trophic composition were significantly affected by stand age only in the present study.

Effects of harvest treatment

Species richness was affected by treatment type. The mean number of species present in harvested sites was significantly higher than in unharvested sites (F = 13.395; d.f. = 1; p = 0.015) (Fig. 8). The interaction between harvest treatment and age was not significant. Species composition was significantly affected by harvest treatment (Global R, ANOSIM of 0.299 with a significance level of 3.7%). Treatment did have a pronounced effect on species composition.

Species trophic composition was not significantly affected by harvest treatment (Global R, ANOSIM of 0.155 with a significance level of 13.4%). The difference was not statistically significant. The TAXD test did not show any results for harvest treatment, thereby indicating that there was no difference in the taxonomic distinctiveness of species between harvested and unharvested sites.

Comparative effects of harvest treatment

Species richness was affected by treatment type in this study only. Harvest treatment had no effect on species richness in Bishop (1998). Species composition was significantly affected by harvest treatment in Bishop (1998) (Global R, ANOSIM of 0.254 with a significance level of 0.1%). Treatment thus had a pronounced effect on species composition. Species trophic composition was not significantly affected by harvest treatment in Bishop (1998).

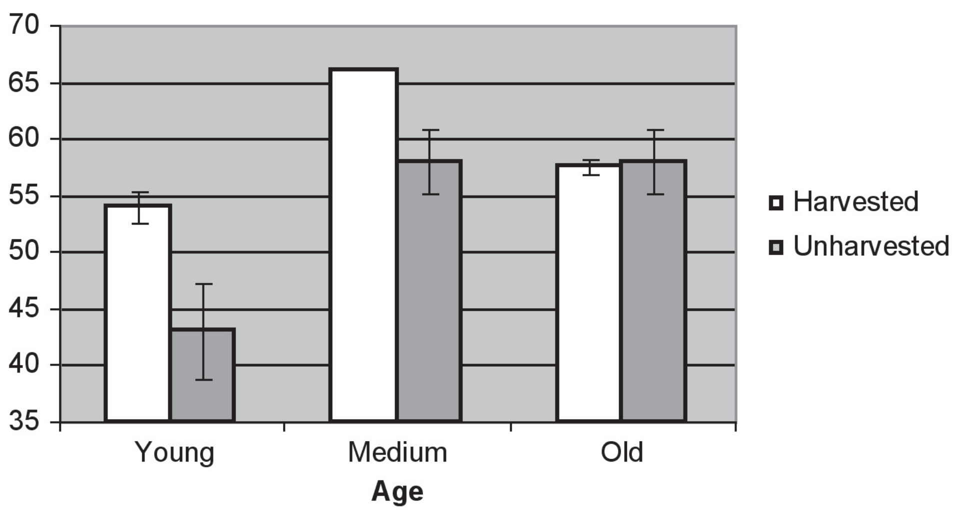

Fig. 8. Mean species richness across harvest treatment, including standard deviation, for 11 stands in southwestern Nova Scotia.

Analysis of relationships

There is a weak positive relationship between volume of CWD and species richness (Fig. 9). An increase in CWD volume is accompanied by an increase in beetle species richness, but the relationship is not statistically significant (F = 2.48; d.f. = 9; p = 0.15).

Species composition was not affected by volume of CWD. This is true even with the use of the modified species list developed through the SIMPER analysis. The Global R, ANOSIM value was 0.234 (p = 0.086). The greatest difference was seen between the group with the lowest volume of CWD (1-55 m3/ha) and the group with the highest volume of CWD (111-165 m3/ha) (R = 0.75, p = 0.10).

Discussion

Beetle Sampling Methods

The methods used to collect beetles in the present study were quite different from those employed by Bishop (1998). Flight intercept traps (FITs), employed by the latter study, were more easily standardized. The use of FITs is much less laborious in the field compared to manual searching (Siitonen 1994). As well, there is ongoing collection even when the researcher is not present. There are several shortcomings associated with the use of FITs or other passive collection methods. Some species or even families of beetles live inside decaying trunks for several generations and would therefore not likely be caught in flight (Siitonen 1994). Given the common trend of abundance of large, poorly dispersing specialists to decrease with increasing disturbance, and like-

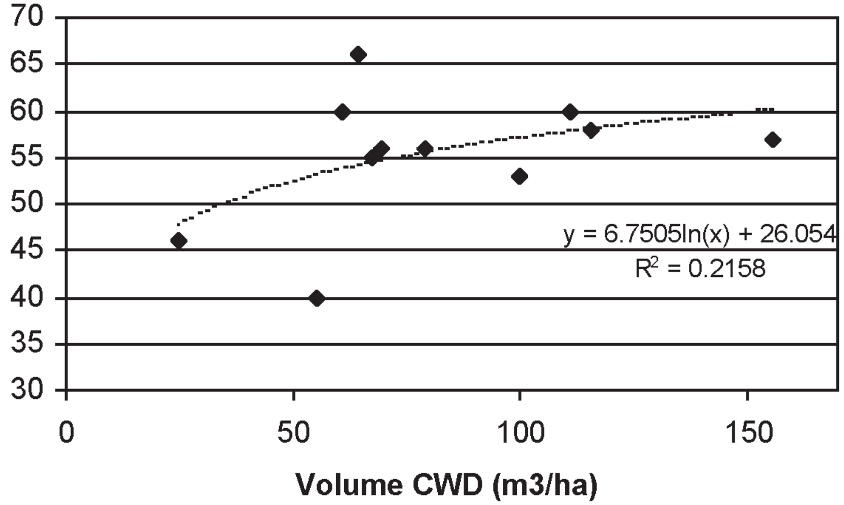

Fig. 9. Scatter plot demonstrating a non-significant positive correlation between beetle species richness and CWD volume. Included are the regression equation and the R^2 value.

wise for small generalists to increase in abundance, the bias of FITs may be significant (Rainio and Niemela 2003). If the presence of specialists goes undetected in disturbed forest ecosystems, an incorrect picture of beetle diversity would emerge for those sites. Additionally, of course, flightless species are not collected at all.

In studies conducted in the Oulanka National Park region of Finland (an area whose beetle fauna is very thoroughly documented) Muona (1999) found that FITs caught 44-48.3% of forest beetle species. A combination of pitfall traps and FITs caught 60.5% of species, and pitfall traps, FITs, and sweep nets taken together collected 91.4% of species. Only 55% of rare species were caught and only 25% of species designated as threatened were collected. Muona (1999) pointed out that the populations of many rare species are small and they may be patchily distributed, making them difficult to detect and sample.

Martikainen and Kouki (2003) found that window traps were the most effective trap type in sampling threatened beetles. However, rarer species were not collected using any other method besides direct searching. Direct searching includes netting, peeling of bark, and other searching methods for beetles by entomologists themselves. As well, the efficacy of the window traps depended largely on the location of the trap, and those located randomly were not as effective.

Manual searching is a more time-intensive process than passive methods like FITs, but the time saved by the latter approach has to be balanced against the time involved in subsequent sorting, pinning, and identification. In the Bishop (1998) study, 4.3 times the number of specimens had to be processed. In designing sampling programs for environmental impact assessment or ecological monitoring in a fiscal climate when both human and financial resources may be limited, such considerations may also have an important bearing on decision-making (Oliver and Beattie 1996b).

Although alpha diversity (species richness) carries less information than quantitative species abundance, it can be less time- and labour-intensive to collect and process such information. Competitive exclusion (*sensu* Hardin 1960) supports the view that measuring alpha diversity is indicative of the presence or absence of microhabitats occupied by respective species. Hence, examining species richness, particularly of hyper-diverse groups such as Coleoptera, allows for an examination of some dimensions of the environment as perceived through a fine ecological mesh (Majka and Bondrup-Nielsen 2006).

Although the number of specimens collected varied considerably between the two studies (2,302 specimens in the present study, and 9,881 by Bishop (1998)), the total number of beetle species was rather similar (346 versus 387, respectively). Rarefaction analysis (Fig. 5) indicates that the expected number of species collected in the present study would be much lower. This higher-than-expected species richness may be a function of using four collection methods as compared with one by Bishop (1998). It is possible that the combination of four collection methods was efficient in sampling many microhabitats and avoiding the collection of high numbers of specimens of the same species. It has been suggested that to maximally sample the species present in a particular environment, several trapping methods should be employed (Økland 1996; Ranius and Jansson 2002; Martikainen and Kouki 2003).

Beetle communities

Beetle communities were similar in both studies in terms of species richness, and proportions of species from different zoogeographic origins (Nearctic, Holarctic, adventive Palaearctic). These similarities support the contention that both approaches are sound with respect to producing accurate (albeit incomplete) representations of forest beetle communities. Not all groups of beetles are thoroughly sampled by either of these approaches. For instance, both studies recorded few species of Buprestidae, even though 39 species of these saproxylic beetles have been recorded in Nova Scotia (C.G. Majka, unpublished data), and some forest-litter species such as those in the Ptiliidae were poorly represented in both studies since litter sifting was not a technique employed in either. Surprisingly, macropterous, litter-dwelling species in the Pselaphinae and Scydmaenidae were well represented in both studies (collected by flight-intercept and funnel traps) (Appendix 1).

Furthermore the combination of techniques employed in the present study better samples forest floor species in the Carabidae, Tenebrionidae, Entiminae, Geotrupidae, and Zopheridae than flight-intercept traps do (Fig. 6). Nevertheless, these approaches, while offering an incomplete representation of forest beetle communities, do provide an apparently consistent index of these communities, something of utility in terms of comparing forests of different ages and compositions, and also in monitoring changes in forest communities over time.

Martikainen and Kouki (2003) suggested that the measurement of the number of species has several advantages compared to other estimates. Advantages include availability and/or ease of measurement and consistency over large geographic areas. They also indicated that the number of trapped species should be over 300-400, corresponding to a number greater than 4,000 individuals, in order to include rare species (Martikainen and Kouki 2003).

The proportion of introduced species of beetles in an environment can frequently be an indicator of disturbance, with anthropogenic or disturbed habitats typically exhibiting much higher proportions of adventive species (Spence and Spence 1988). In the present study, 22 of 346 saproxylic species (6.4%) were introduced, while in Bishop's (1998) work, 20 of 387 species (5.2%) were introduced. In contrast, in a study of Coleoptera of Point Pleasant Park, Nova Scotia, a highly disturbed early successional forest, C.G. Majka found 17.7% of species to be introduced (unpublished data). This compares to the Nova Scotia provincial fauna as a whole which consists of 15.3% of introduced species (C.G. Majka, unpublished data).

The number of species previously unrecorded for Nova Scotia in both studies indicates that knowledge of the baseline biodiversity of saproxylic beetles in Nova Scotia is far from complete. The present study found 135 species of beetles unrecorded from Nova Scotia by Bousquet (1991). Both studies thus contribute to ongoing programs to document the distribution, abundance, origins, and trophic categories of the beetle fauna of the province which are essential for many ecological, zoogeographic, and environmental monitoring studies (McCorquodale et al. 2005). Some specimens derived from this study have already contributed to recent surveys of the Coleoptera fauna of the region (Bousquet and Laplante 2006; Majka 2006a, 2006b, 2007a, 2007b, 2007c, 2008a; Majka and Cline 2006a, 2006b; Majka and Johnson 2008; Majka and Pollock 2006; Majka et al. 2006, 2007a, 2007a, in press).

Stand age

In the present study, stand age was shown to affect both species richness as well as species composition. This agrees with other studies in both Canada and Europe (Kaila et al. 1997, Hammond et al. 2004). In general, as stand age increases, so does species richness. This high level of beetle species richness in old forests is likely related to habitat heterogeneity, often characteristic of old-growth forests (Heinrichs 1983). Old-growth forests typically are more structurally diverse, and have higher concentrations of large-diameter CWD, therefore supporting a wider array of microhabitats suitable for a larger diversity of species (Duchesne 1994). In both the present study and in Bishop (1998) old stands had a lower species richness then medium-aged stands (Fig. 7). Indeed in Bishop (1998) the old stands had a slightly lower species richness than young stands (Fig. 7). These results are counterintuitive. Further investigations should be undertaken in similar northern-temperate forests with extensive disturbance histories to ascertain if the present results are anomalous, or if there are reasons why the species-richness in older forest stands is being underestimated and inadequately sampled by present collection techniques (see the further discussion on this subject in the section below).

Species assemblages of beetles of younger stands do not appear to be entirely similar to those present in older forest stands. Not only were species compositions different, but the trophic category compositions also varied slightly between young and old stands. This may be due to differences in decay class and diameter class of the CWD, and therefore to differences in food and habitat availability present in the different-aged forest stands. A study by Hammond et al. (2004) saw an increase in trophic complexity in older stands.

Harvest treatment

Harvest treatment was shown to affect both beetle species richness and composition. The results from this study diverge from many other studies in that species diversity was higher in the partially harvested sites than in the unharvested sites. Kaila et al. (1997) found that median numbers of species caught did not differ between closed forests and clearcuts, but species assemblages varied greatly. In other European studies, such as those by Økland et al. (1996) and Simila et al. (2003), species richness was significantly higher in semi-natural or unharvested forests than in managed forests. Managed forests in the Scandinavian setting are, however, quite different than those in

Canada (Kimmins 1997). However, a Canadian study by Klimaszewski et al. (2003) measured arthropod abundance and found that clearcut and thinned forest stands have lower beetle abundance than unmanaged stands.

Sverdrup-Thygeson and Ims (2002) suggested that one explanation for higher-than-expected species richness in harvested sites is that there is a possible bias towards collecting higher numbers of individuals in cleared, sun-exposed sites. Beetles tend to be more active and evident in warmer temperatures. There is also the probable preference of saproxylic beetles for sun-exposed CWD, in that both visual cues and wind dispersal favour more open areas for searching out CWD (Jonsell et al. 1998; Kouki et al. 2001; Martikainen 2001). Another possible explanation is that there appears to be a peak in abundance and richness of some families of beetles approximately five years after a disturbance to the forest ecosystem (Wermelinger et al. 2002). In one study, bird species richness also showed a sharp increase 2-6 years after clearcut harvest (Keller et al. 2002). Conversely, it may be that conventional wisdom of equating higher species diversity with older-aged stands requires some refinement, particularly in northern-temperate and boreal forests with extensive disturbance histories.

In the present study, beetle species composition was significantly different between harvested and unharvested sites. There were variations in tree species as well as general stand characteristics between different sites. For example, site 5 had a considerably larger quantity of red maple CWD and much thinner overstory than any other site. The results show that site 5 is responsible for much of the variation among the harvested sites. It is also possible that the differences in species assemblages were related to the proportions of decay classes or sizes of CWD present in harvested versus unharvested sites.

Although freshly killed wood has a lower diversity of habitats for saproxylic beetles than old dead wood, there is a specific trophic group (phloeophagous species) of beetles that feed on the former (Hammond et al. 2004). Kruys and Jonsson (1999) found that fine woody debris was important for species richness of particular taxa of cryptogams in managed boreal spruce forests in northern Sweden. These two aspects could account for the significant difference in species composition between harvested and unharvested sites. They may also be related to differences (although in the present study this measure is not statistically significant) in trophic categories present in harvested and unharvested sites.

Despite a higher number of beetle species in the harvested sites of the present study, both studies showed statistically significant differences in species composition of harvested versus unharvested sites. Many studies have indicated that invertebrates are often more sensitive to environmental change than vascular plants or vertebrates and will therefore respond more quickly to such changes (Rosenberg et al. 1986; Erhardt and Thomas 1991; Moore 1991; Ehrlich 1992; Kremen et al. 1993). In the case of the two present studies, the response to environmental change was more obvious in the differences in species composition.

Analysis of relationships between CWD and beetle communities

A positive correlation between mean volume of CWD and beetle species richness would not have been new or unexpected (Martikainen et al. 2000; Yee et al. 2001; Grove 2002a). This relationship is often highlighted because forest practices have "resulted in a progressive simplification of stand structure and a loss of mature timber habitat" (Grove 2002b). In this study, however, the relationship was not statistically significant. This may be due to sample size, as both CWD volumes and beetle species richness were significant when measured individually for effects of stand age. However, as noted above these relationships may also require some refinement in the context of northern-temperate and boreal forests with extensive disturbance histories.

Many other studies have shown a positive correlation between dead trees of large diameter and high numbers of beetle species, including many rare species (Vaisanen et al. 1993; Kolstrom and Lumatjarvi 2000; Siitonen 2001). In Great Britain, Alexander (2004) identified 180 saproxylic species (of a total of 694 species in Great Britain) that are indicators of ecological continuity (an inverse of disturbance) and hence are characteristic of undisturbed forests. One hundred and sixty-one of these are variously listed as endangered, vulnerable, rare, or scarce in Great Britain. Indeed, of the full 694 species, 354 species (51%) are in some measure endangered, vulnerable, rare, or scarce (Alexander 2004).

In Canada comparatively less attention has been paid to saproxylic fauna and so it is often difficult to distinguish between genuinely rare species, and those that have simply been rarely collected. Majka (2007b) compiled a list of 59 "apparently rare" species of saproxylic beetles (defined as those species constituting ≤ 0.005% of specimens examined from the region) in the Maritime Provinces of Canada from 14 families, subfamilies and tribes of Coleoptera. These 59 represented 33% of the 178 species found in the region within these groups. Majka (2006a, 2006b, 2007) and Majka and Pollock (2006) have all proposed that this apparent scarcity may be due to the history of forest management practices in the region that have greatly diminished old-growth habitat – practices which have dramatically decreased the amount of large diameter CWD.

In the present study a sizeable number of species were restricted to specific stand ages: 47 species were exclusively found in young stands, 52 species were only found in middle-aged stands and 69 species were exclusively found in old stands. In the latter category, 23 of these 69 species are rarely collected and locally distributed species in Nova Scotia (Table 2). These are candidates for species associated with old-growth forest conditions. Nineteen of them are saproxylic species. In relation to species such as *Stenichus badipes* (Casey), *Bibloporus bicanalis* (Casey), *Batrisodes lineaticollis* (Aubé), *Quedius densiventris* (Casey), *Ampedus protervus* (LeConte), *Dorcatoma falli* White, *Rhizophagus remotus* LeConte, *Silvanus bidentatus* (Fabricius), *Mycetophagus serrulatus* Casey, and Mordellistena *fuscipennis* (Melsheimer), it is noteworthy that Alexander (2004) identifies closely related congeners (or in the case of *S. bidentatus*, the same species) in Great Britain as indicator species of ecological continuity, in other words species of beetles associated with old-growth forest conditions.

In several previous studies, it could not be discerned whether stand age or large-diameter CWD was the explanation for higher diversity in older forest stands (Økland et al. 1996; Hammond et al. 2004). Simila et al. (2003) emphasized the importance of considering the effects of diversity and volume of dead wood on survival and richness of saproxylic species.

In the present study, based on mean volumes of CWD for each stand, there appeared to be no significant differences in beetle species composition. It is possible, however, that an examination of decay classes and diameter sizes of CWD would have a different effect. As CWD passes through different stages of decay, it is colonized by a succession of different beetle assemblages (Speight 1989; Grove 2002a). Beetle communities depend on an array of factors including stage of decomposition, tree species, and type of rot (Grove 2002a).

Management implications

In Canada and the United States, intensive silvicultural treatment has not been as complete as in most parts of Europe (Kimmins 1997). The North American forest industry may not have affected the diversity of saproxylic beetles within their forests to the same extent as has occurred in many European countries, nevertheless, ongoing anthropogenic disturbances to Nova Scotian forest ecosystems have the potential for significant impact on saproxylic insect communities. Commercial thinnings in softwood stands in south western Nova Scotia appear, however, not to have the pronounced negative effects that have been demonstrated in clearcuts elsewhere.

Particularly careful attention was paid in this study to species determinations. Informed conservation and management strategies must be based in accurate species- and population-based data. Goldstein (1999) argued forcefully that any ecosystem approach that decouples species- and population-specific requirements from management strategies, risks compromising fundamental conservation objectives. Furthermore, as Wheeler (1995) pointed out, accurate taxonomic work is indispensable to conservation decisions. "'Fast and dirty' taxonomy will not remove the taxonomic roadblock; it will simply add to it" (Wheeler 1995).

In terms of the conservation of beetle species diversity, the results of this study agree with those of Kaila et al. (1997). To conserve the highest proportion of the saproxylic beetle fauna, we should maintain a variety of habitats including both young and old forest stands. For example, in this study, 15 species (4%) were common to all young stands, 25 species (7%) were common to all medium-aged stands, and 16 species (5%) were common to all old stands.

The 23 rarely collected and locally distributed species found in old-growth forests in the present study may be representative of a suite of beetles whose success and survival may depend on the presence of old-growth forests. Some of the 59 species of saproxylic beetles identified by Majka (2007b) may represent species already reduced to "relict" populations in the region by the long history of forest management practices.

Management programs that ignore old-growth forests and the suite of insects dependant on them may impoverish the species diversity of Nova Scotia's forest ecosystems. Considering that saproxylic beetles, as important mechanical wood decomposers, are responsible for substantial amount nutrient cycling and decomposition in forest ecosystems, loss of this diversity may have adverse consequences. For instance, when both saproxylic invertebrates and fungi are present, in northern climates the decomposition phase of wood is in excess of 25 years (Ehnström 1979). An absence of saproxylic invertebrates causes the decomposition phase of wood (mediated solely by fungi) to be doubled in length (Dajoz 1980; Speight 1989). As a result, general forest health and sustainability of forest use, including product extraction, may be at risk.

Further research

Globally, patterns of biodiversity remain poorly documented (Mittermeier et al. 1999). Many studies have used taxonomic groups with large-bodied species, such as birds, mammals, and vascular plants, to infer general patterns (Myers 1988, 1990; Myers et al. 2000). However, these groups make up only a tiny fraction of the world's species richness and although the estimates obtained are useful, it is doubtful that these groups truly reflect the species richness of other groups, which are less well-studied but far more species-rich (May 1988; Heywood 1995; Lawton et al. 1998).

There is an unquestionable need for lists of indicator species of forest health, especially as the demand for forest products increases and silviculture becomes more intense. Nilsson et al. (1995) suggested that forest continuity has important implications for forest condition. Forest continuity, however, is a property that may be difficult to construe from present forest structure (Nilsson et al. 1995).

The role of saproxylic beetles in forest ecosystems, the need for their conservation, and their possible use as indicators, are well documented in Europe (Speight 1989, Wermelinger et al. 2002 Simila et al. 2003; Alexander 2004). However, studies of saproxylic beetles in the Acadian forests (Kehler et al. 2004; Bishop 1998) are still very few in number.

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Appendix 1. Species, trophic categories, and numbers of Coleoptera collected

Family	Subfamily	Species	Trophic Category	SX	#
Carabidae	Nebrinae	*Notiophilus aeneus* (Herbst)	Predaceous	1	1
	Carabinae	*Sphaeroderus canadensis* Chaudoir	Predaceous		8
	Trechinae	*Tachyta angulata* Casey	Predaceous	1	13
	Harpalinae	*Gastrellarius honestus* (Say)	Predaceous	1	1
		Pterostichus adstrictus Eschscholtz*	Predaceous	1	12
		Pterostichus coracinus (Newman)	Predaceous	1	54
		Pterostichus pensylvanicus LeConte	Predaceous	1	96
		Pterostichus tristis (Dejean)	Predaceous	1	143
		Anisodactylus nigerrimus (Dejean)	Predaceous		1
		Harpalus affinis Schrank†	Predaceous		1
		Calathus ingratus Dejean	Predaceous	1	25
		Synuchus impunctatus (Say)	Phytophagous		132
		Agonum fidele Casey	Predaceous		1
		Platynus decentis (Say)	Predaceous	1	1
		Cymindis cribricollis Dejean	Predaceous	1	8
		Cymindis limbatus Dejean	Predaceous	1	17
		Syntomus americanus (Dejean)	Predaceous	1	2
Hydrophilidae	Sphaeridiinae	*Cercyon haemorrhoidalis* (Fabricius)†	Saprophagous		1
		Cercyon minusculus Melsheimer	Saprophagous		2
Histeridae	Abraeinae	*Plegaderus sayi* Marseul	Predaceous	1	6
	Saprininae	*Gnathoncus barbatus* Bousquet & Laplante	Saprophagous		1
	Dendrophilinae	*Paromalus teres* LeConte	Predaceous	1	9
	Histerinae	*Platysoma coarctatum* LeConte	Predaceous	1	1
		Margarinotus cognatus (LeConte)	Saprophagous		1
		Margarinotus lecontei Wenzel	Saprophagous		3
		Hister furtivus LeConte	Saprophagous		1

Family	Subfamily	Species	Trophic Category	SX	#
Ptiliidae	Ptiliinae	*Cylindroselloides dybasi* Hall	Bolitophagous	1	16
Leiodidae	Leiodinae	*Agathidium fawcettae* Miller & Wheeler	Myxomycophagous	1	13
		Agathidium oniscoides Beauvois	Myxomycophagous	1	1
		Anisotoma discolor (Melsheimer)	Myxomycophagous	1	9
		Anisotoma inops Brown	Bolitophagous	1	18
	Cholevinae	*Catops basilaris* Say	Saprophagous		14
		Catops paramericanus Peck & Cook	Saprophagous		10
		Sciodrepoides terminans (LeConte)	Saprophagous		1
Scydmaenidae		*Brachycepsis subpunctatus* (LeConte)	Predaceous	1	2
		Stenichus badius (Casey)	Predaceous	1	1
		Stenichus turbatus (Casey)	Predaceous	1	5
Silphidae	Silphinae	*Necrophila americana* (Linnaeus)	Saprophagous		1
Staphylinidae	Omaliinae	*Phloeonomus laesicollis* (Mäklin)*	Predaceous	1	1
		Phloeostiba lapponicus (Zetterstedt)	Sap Feeder		1
		Pycnoglypta aptera Campbell†	Predaceous	1	1
		Eusphalerum convexum (Fauvel)	Pollen Feeder	1	3
		Eusphalerum pothos (Mannerheim)	Pollen Feeder	1	4
	Proteininae	*Megarthrus americanus* Sachse	Mycetophagous	1	1
	Pselaphinae	*Biblioporus bicanalis* (Casey)	Predaceous	1	1
		Euplectus elongatis Brendel	Predaceous	1	1
		Pycnoplectus linearis (LeConte)	Predaceous	1	1
		Biblioplectus integer (LeConte)	Predaceous	1	1
		Batrisodes lineaticollis (Aubé)	Predaceous	1	6
		Rybaxis conjuncta (LeConte)	Predaceous	1	4
	Phloeocharinae	*Charhyphus picipennis* (LeConte)	Predaceous	1	3
	Tachyporinae	*Sepedophilus crassus* (Gravenhorst)	Mycetophagous	1	8
		Sepedophilus littoreus (Linnaeus)	Mycetophagous	1	2

Family	Subfamily	Species	Trophic Category	SX	#
		Tachinus basalis Erichson*	Predaceous	1	1
		Tachinus fimbriatus Gravenhorst†	Predaceous	1	14
		Tachinus luridus Erichson	Predaceous	1	1
		Tachinus picipes Erichson	Predaceous	1	12
		Tachyporus nitidulus (Fabricius)	Predaceous	1	2
		Lordithon bimaculatus (Couper)	Predaceous	1	1
		Lordithon facilis (Casey)*	Predaceous	1	6
		Lordithon fungicola Campbell†	Predaceous	1	3
		Lordithon t. thoracicus (Fabricius)	Predaceous	1	1
		Mycetoporus consors LeConte	Predaceous	1	1
	Aleocharinae	*Aleochara castaneipennis* Mannerheim	Predaceous	1	3
		Oxypoda amica Casey	Mycetophagous	1	1
		Amarochara species	Mycetophagous	1	3
		Silusida marginella Casey	Mycetophagous	1	9
		Eumicrota socia (Erichson)	Mycetophagous	1	10
		Gyrophaena affinis Sahlberg†	Bolitophagous	1	6
		Gyrophaena flavicornis Melsheimer	Bolitophagous	1	5
		Gyrophaena sculptipennis Casey	Bolitophagous	1	2
		Leptusa brevicollis Casey	Mycetophagous	1	21
		Leptusa canonica Casey	Mycetophagous	1	5
		Leptusa opaca Casey	Mycetophagous	1	1
		Leptusa pseudopaca Klimaszewski & Majka	Mycetophagous	1	2
		Leptusa species	Mycetophagous	1	3
		Placusa tacomae Casey	Mycetophagous	1	1
		Atheta klagesi Bernhauer	Mycetophagous	1	7
		Atheta remulsa Casey	Mycetophagous	1	1
		Atheta (Microdota) pennsylvanica Bernhauer	Mycetophagous	1	8

Family	Subfamily	Species	Trophic Category	SX	#
		Atheta (Datomicra) dadopora Thomson†	Mycetophagous	1	1
		Atheta (Datomicra) hampshirensis (Bernhauer)	Mycetophagous	1	2
		Atheta (Datomicra) inopia Casey	Mycetophagous	1	2
		Atheta (Datomicra) modesta (Melsheimer)	Mycetophagous	1	19
		Aleocharine species 2	Mycetophagous		2
		Aleocharine species 3	Mycetophagous		1
		Aleocharine species 4	Mycetophagous		1
	Scaphidinae	*Baeocera youngi* (Cornell)	Mycetophagous	1	2
		Scaphisoma rubens Casey	Mycetophagous	1	1
	Piestinae	*Siagonium punctatum* LeConte	Mycetophagous	1	3
	Paederinae	*Medon nr. rufipenne* (Casey)	Predaceous	1	1
		Sunius confluentus (Say)	Predaceous	1	6
		Palaminus hudsonicus Casey	Predaceous	1	2
	Staphylininae	*Atrecus americanus* (Casey)	Predaceous	1	28
		Neohypnus obscurus (Erichson)	Predaceous	1	2
		Nudobius cephalus (Say)	Predaceous	1	7
		Anaquedius vernix (LeConte)	Predaceous	1	1
		Quedius canadensis (Casey)	Predaceous	1	4
		Quedius densiventris (Casey)	Predaceous	1	1
		Quedius plagiatus Mannerheim	Predaceous	1	6
		Platydracus viridanus (Horn)	Predaceous	1	74
		Gabrius microphthalmus (Horn)	Predaceous	1	1
		Gabrius picipennis (Mäklin)	Predaceous	1	2
		Philonthus caeruleipennis Mannerheim	Predaceous	1	4
Lucanidae	Syndescinae	*Ceruchus piceus* (Weber)	Xylophagous	1	5
Trogidae		*Trox variolatus* Melsheimer	Saprophagous		6
Geotrupidae	Geotrupinae	*Geotrupes horni* Blanchard	Saprophagous		33

Family	Subfamily	Species	Trophic Category	SX	#
Scarabaeidae	Aphodinae	*Dialytes striatulus* (Say)	Saprophagous		1
	Scarabaeinae	*Onthophagus hecate* (Panzer)	Saprophagous		2
	Melonthinae	*Serica atracapilla* Kirby	Phytophagous		2
		Dichelonyx albicollis (Burmeister)	Phytophagous		3
		Dichelonyx subvittata (LeConte)	Phytophagous		4
	Cetoniinae	*Osmoderma scabra* Beauvois	Xylophagous	1	1
Clambidae		*Clambus pubescens* Redtenbacher*	Mycetophagous	1	2
Scirtidae		*Cyphon collaris* (Guérin-Méneville)	Saprophytic	1	3
		Cyphon confusus Brown[1]	Saprophytic	1	15
		Cyphon obscurus (Guérin-Méneville)[1]	Saprophytic	1	5
		Cyphon ruficollis (Say)	Saprophytic	1	1
		Cyphon variabilis (Thunberg)[1]	Saprophytic	1	9
Buprestidae	Buprestinae	*Dicerca punctulata* (Schönherr)	Phloeophagous	1	2
		Melanophila fulvoguttata (Harris)	Phloeophagous	1	3
Eucnemidae	Melasinae	*Epiphanis cornutus* (Eschscholtz)	Mycetophagous	1	3
	Macraulacinae	*Onichodon canadensis* (Brown)	Mycetophagous	1	2
Throscidae	Throscinae	*Aulonothroscus constrictor* (Say)	Mycetophagous	1	6
		Trixagus carinicollis (Schaeffer)	Mycetophagous	1	1
Elateridae	Elaterinae	*Sericus incongruus* (LeConte)	Rhizophagous		3
		Sericus viridanus (Say)	Rhizophagous		1
		Agriotella debilis (LeConte)	Rhizophagous		1
		Agriotes collaris (LeConte)	Rhizophagous		10
		Agriotes sputator (Linnaeus)†	Rhizophagous		1
		Agriotes stabilis (LeConte)	Rhizophagous		2
		Dalopius fuscipes Brown	Mycetophagous	1	1
		Dalopius gentilis Brown	Mycetophagous	1	10
		Dalopius vagus Brown	Mycetophagous	1	19

Family	**Subfamily**	**Species**	**Trophic Category**	**SX**	**#**
		Ampedus deletus (LeConte)	Xylophagous	1	1
		Ampedus mixtus (Herbst)	Xylophagous	1	3
		Ampedus protervus (LeConte)	Xylophagous	1	1
		Ampedus semicinctus (Randall)	Xylophagous	1	6
		Ampedus subtilis (LeConte)	Xylophagous	1	4
		Melanotus castanipes (Paykull)†	Rhizophagous		8
		Melanotus similis (Kirby)	Rhizophagous		1
	Prosterninae	*Athous acanthus* (Say)	Predaceous	1	1
		Athous brightwelli (Kirby)	Predaceous	1	4
		Athous orvus Becker	Predaceous	1	2
		Limonius aeger LeConte	Rhizophagous		20
		Limonius confusus LeConte	Rhizophagous		13
		Hypoganus sulcicollis (Say)	Predaceous	1	1
		Liotrichus falsificus (LeConte)	Predaceous	1	11
		Liotrichus spinosus (LeConte)	Predaceous	1	31
		Liotrichus vulneratus (LeConte)	Predaceous	1	1
		Pseudanostirus hamatus (Say)	Predaceous	1	3
		Pseudanostirus hieroglyphicus (Say)	Predaceous	1	1
		Pseudanostirus triundulatus (Randall)	Predaceous	1	21
		Setasomus rufopleuralis (Fall)	Predaceous	1	1
		Hypnoidius bicolor (Eschscholtz)*	Rhizophagous		1
	Negastriinae	*Neohypdonus tumescens* (LeConte)	Predaceous		1
Lycidae	Erotinae	*Dictyopterus aurora* (Herbst)	Mycetophagous	1	6
		Eros humeralis (Fabricius)	Mycetophagous	1	6
		Lopheros fraternus (Randall)	Mycetophagous	1	2
	Platoderinae	*Plateros bispiculatus* Green	Mycetophagous	1	1
		Plateros flavoscutellatus Blatchley	Mycetophagous	1	2

Family	Subfamily	Species	Trophic Category	SX	#
		Plateros lictor (Newman)	Mycetophagous	1	3
Lampyridae	Lampyrinae	*Ellychnia corrusca* (Linnaeus)	Predaceous	1	16
		Photinus obscurellus LeConte	Predaceous	1	1
Cantharidae	Cantharinae	*Cantharis rotundicollis* Say	Pred./Nectarivorous		5
		Rhagonycha fraxini (Say)	Pred./Nectarivorous		1
		Rhagonycha mandibularis (Kirby)	Pred./Nectarivorous		25
		Rhagonycha scitula (Say)	Pred./Nectarivorous		18
		Atlantycha bilineata (Say)	Pred./Nectarivorous		1
		Podabrus diadema (Fabricius)	Predaceous		9
		Podabrus modestus (Say)	Predaceous		2
		Podabrus pattoni LeConte	Predaceous		7
		Podabrus puberulus LeConte	Predaceous		12
		Malthodes similis Fender	Predaceous		2
Derodontidae	Laricobiinae	*Laricobius rubidus* LeConte	Predaceous	1	1
Anobiidae	Anobiinae	*Hemicoelus carinatus* (Say)	Xylophagous	1	1
		Microbregma e. emarginatum (Duftschmid)†	Xylophagous	1	1
		Hadrobregmus notatus (Say)	Xylophagous	1	1
	Dorcatominae	*Caenocara oculata* (Say)	Xylophagous	1	2
		Dorcatoma falli White	Xylophagous	1	1
		Dorcatoma pallicornis LeConte	Xylophagous	1	3
Trogossitidae	Trogossitinae	*Airora cylindrica* (Audinet-Serville)	Mycetophagous	1	1
Cleridae	Thaneroclerinae	*Zenodosus sanguineus* (Say)	Predaceous	1	16
	Hydnocerinae	*Phyllobaenus humeralis* (Say)	Predaceous	1	1
	Clerinae	*Thanasimus dubius* (Fabricius)	Predaceous	1	3
		Thanasimus undatulus (Say)	Predaceous	1	23
Sphindidae	Odontosphindinae	*Odontosphindus denticollis* LeConte	Myxomycophagous	1	1
	Sphindinae	*Sphindus americanus* LeConte	Myxomycophagous	1	5

Family	Subfamily	Species	Trophic Category	SX	#
Nitidulidae	Cillaeinae	*Colopterus truncatus* (Randall)	Sap Feeder	1	1
	Epuraeinae	*Epuraea aestiva* (Linnaeus)	Sap Feeder	1	1
		Epuraea planulata Erichson	Sap Feeder	1	2
		Epuraea rufida (Melsheimer)	Sap Feeder	1	1
	Nitidulinae	*Phenolia grossa* (Fabricius)	Bolitophagous	1	4
	Cryptarchinae	*Glischrochilus fasciatus* (Olivier)	Sap Feeder	1	1
		Glischrochilus sanguinolentus (Olivier)	Sap Feeder	1	4
		Glischrochilus siepmanni Brown	Sap Feeder	1	4
Monotomidae	Rhizophaginae	*Rhizophagus remotus* LeConte	Predaceous	1	1
Silvanidae	Brontinae	*Dendrophagus cygnaei* Mannerheim	Mycetophagous	1	2
	Silvaninae	*Silvanus bidentatus* (Fabricius)†	Mycetophagous	1	2
Cucujidae		*Cucujus c. clavipes* Fabricius	Predaceous	1	1
Laemophloeidae	Laemophloeinae	*Laemophloeus biguttatus* (Say)	Mycetophagous	1	2
Cryptophagidae	Cryptophaginae	*Henotiderus obesulus* (Casey)	Mycetophagous	1	1
		Pteryngium crenatum (Gyllenhal)†	Mycetophagous	1	10
	Atomariinae	*Atomaria ephippiata* Zimmerman	Mycetophagous	1	1
		Atomaria ochracea Zimmerman[2]	Mycetophagous	1	5
Erotylidae	Tritominae	*Tritoma pulchra* Say	Bolitophagous	1	1
Cerylonidae	Ceryloninae	*Cerylon castaneum* Say	Mycetophagous	1	8
		Cerylon unicolor (Ziegler)	Mycetophagous	1	12
Endomychidae	Leiestinae	*Phymaphora pulchella* Newman	Mycetophagous	1	3
Coccinellidae	Scymninae	*Stethorus p. punctum* (LeConte)	Predaceous		1
		Scymnus brullei Mulsant	Predaceous		1
		Scymnus lacustris LeConte	Predaceous		4
Corylophidae	Orthoperinae	*Orthoperus suturalis* LeConte	Mycetophagous	1	1
Latridiidae	Latridiinae	*Cartodere constricta* (Gyllenhal)†	Mycetophagous	1	3
		Enicmus tenuicornis LeConte	Mycetophagous	1	1

Family	Subfamily	Species	Trophic Category	SX	#
	Corticariinae	*Corticaria impressa* (Olivier)†	Mycetophagous	1	1
		Corticaria serrata (Paykull)†	Mycetophagous	1	1
		Corticarina cavicollis (Mannerheim)	Mycetophagous	1	1
		Cortinicara gibbosa (Herbst)†	Mycetophagous	1	1
		Melanophthalma americana (Mannerheim)	Mycetophagous	1	4
		Melanophthalma pumila (LeConte)	Mycetophagous	1	11
Mycetophagidae		*Mycetophagus serrulatus* Casey	Bolitophagous	1	1
		Litargus tetraspilotus LeConte	Mycetophagous	1	2
Ciidae	Ciinae	*Ceracis sallei* Mellié	Bolitophagous	1	1
		Cis horridulus Casey	Bolitophagous	1	3
		Cis levettei (Casey)	Bolitophagous	1	26
		Cis pistoria Casey	Bolitophagous	1	8
		Malacocis brevicollis (Casey)	Bolitophagous	1	12
		Orthocis punctatus (Mellié)	Bolitophagous	1	6
Tetratomidae	Penthinae	*Penthe obliquata* (Fabricius)	Bolitophagous	1	8
		Penthe pimelia (Fabricius)	Bolitophagous	1	1
	Eustrophinae	*Eustrophus tomentosus* Say	Bolitophagous	1	2
Melandryidae	Melandryinae	*Orchesia castanea* (Melsheimer)	Xylophagous	1	1
		Xylita laevigata (Hellenius)*	Xylophagous	1	1
		Scotochroa atra LeConte	Xylophagous	1	1
		Scotochroides antennatus Mank	Xylophagous	1	4
		Serropalpus coxalis Mank	Xylophagous	1	1
		Serropalpus substriatus Haldeman	Xylophagous	1	1
		Dircaea liturata (LeConte)	Xylophagous	1	1
		Phloiotrya fusca (LeConte)	Xylophagous	1	1
		Hypulus simulator Newman	Xylophagous	1	1
		Microtonus sericans LeConte	Xylophagous	1	11

Family	Subfamily	Species	Trophic Category	SX	#
		Symphora flavicollis (Haldeman)	Xylophagous	1	3
		Symphora rugosa (Haldeman)	Xylophagous	1	2
Mordellidae		*Mordellistena fuscipennis* (Melsheimer)	Phytophagous		2
		Mordellistena trifasciata (Say)	Phytophagous		1
Colydiidae		*Lasconotus borealis* Horn	Predaceous	1	1
Zopheridae		*Phellopsis obcordata* (Kirby)	Bolitophagous	1	13
Tenebrionidae	Lagriinae	*Arthromacra aenea* (Say)	Mycetophagous	1	2
		Paratenetus undescribed species[3]	Saprophagous	1	4
	Bolitophaginae	*Bolitophagus corticola* Say	Bolitophagous	1	9
		Bolitotherus cornutus (Panzer)	Bolitophagous	1	14
	Diaperinae	*Diaperis maculata* Olivier	Bolitophagous	1	3
		Neomida bicornis (Fabricius)	Bolitophagous	1	1
		Scaphidema aeneolum (LeConte)	Saprophagous	1	3
	Hypophloeinae	*Corticeus praetermissus* (Fall)	Predaceous	1	1
	Tenebrioninae	*Centronopus calcaratus* (Fabricius)	Xylophagous	1	1
	Alleculinae	*Hymenorus niger* (Melsheimer)	Mycetophagous	1	2
		Capnochroa fuliginosa (Melsheimer)	Mycetophagous	1	3
		Isomira quadristriata (Couper)	Mycetophagous	1	52
	Coleometopinae	*Iphthiminus opacus* (LeConte)	Saprophagous	1	1
		Upis ceramboides (Linnaeus)*	Saprophagous	1	5
Stenotrachelidae	Cephaloinae	*Cephaloon lepturides* Newman	Mycetophagous	1	1
Pythidae		*Pytho niger* Kirby	Xylophagous	1	1
		Pytho americanus Kirby	Xylophagous	1	4
		Priognathus monilicornis (Randall)	Xylophagous	1	5
Pyrochroidae	Pyrochroinae	*Dendroides canadensis* Latreille	Mycetophagous	1	1
Aderidae	Aderinae	*Vanonus wickhami* Casey	Xylophagous	1	20
Scraptiidae	Scraptiinae	*Canifa pallipes* (Melsheimer)	Mycetophagous	1	4

Family	Subfamily	Species	Trophic Category	SX	#
		Canifa pusilla (Haldeman)	Mycetophagous	1	9
	Anaspidinae	*Anaspis flavipennis* Haldeman	Mycetophagous	1	11
		Anaspis nigrina Csiki	Mycetophagous	1	1
		Anaspis rufa Say	Mycetophagous	1	27
Cerambycidae	Aseminae	*Asemum striatum* (Linnaeus)	Phloeophagous	1	3
		Tetropium cinnamopterum Kirby	Phloeophagous	1	2
	Lepturinae	*Anthophylax attenuatus* (Haldeman)	Phloeophagous	1	10
		Anthophylax cyaneus (Haldeman)	Phloeophagous	1	3
		Evodinus m. monticola (Randall)	Phloeophagous	1	4
		Idiopidonia pedalis (LeConte)	Phloeophagous	1	2
		Judolia m. montivagans (Couper)	Phloeophagous	1	1
		Lepturopsis biforis (Newman)	Phloeophagous	1	1
		Pidonia ruficollis (Say)	Phloeophagous	1	1
		Pygoleptura n. nigrella (Say)	Phloeophagous	1	1
		Rhagium inquisitor (Linnaeus)	Phloeophagous	1	3
		Sachalinobia r. rugipennis (Newman)	Phloeophagous	1	1
		Stictoleptura c. canadensis (Olivier)	Phloeophagous	1	1
		Strangalepta abbreviata (Germar)	Phloeophagous	1	11
		Trachysida aspera brevifrons (Howden)	Phloeophagous	1	1
	Cerambycinae	*Clytus marginicollis* Castelnau & Gory	Phloeophagous	1	1
		Xylotrechus undulatus (Say)	Phloeophagous	1	3
	Lamiinae	*Microgoes oculatus* (LeConte)	Phloeophagous	1	1
		Monochamus s. scutellatus (Say)	Phloeophagous	1	6
		Pogonocherus penicillatus LeConte	Phloeophagous	1	2
		Psenocerus supernotatus (Say)	Phloeophagous	1	1
		Sternidius variegatus (Haldeman)	Phloeophagous	1	1
Chrysomelidae	Chrysomelinae	*Phratora americana canadensis* Brown	Phytophagous		1

Family	Subfamily	Species	Trophic Category	SX	#
		Phratora p. purpurea Brown	Phytophagous		9
		Chrysomela m. mainensis Bechyné	Phytophagous		1
	Galerucinae	*Scelolyperus cyanellus* (LeConte)	Phytophagous		4
		Altica ambiens LeConte	Phytophagous		4
		Altica kalmiae Melsheimer	Phytophagous		1
	Eumolpinae	*Syneta extorris borealis* Brown	Phytophagous		7
		Syneta ferruginea (Germar)	Phytophagous		13
		Syneta pilosa Brown	Phytophagous		1
		Paria fragariae kirki Balsbaugh	Phytophagous		1
		Xanthonia decemnotata (Say)	Phytophagous		4
	Cryptocephalinae	*Neochlamisus bebbianae* (Brown)	Phytophagous		1
Nemonychidae	Cimberidinae	*Cimberis elongata* (LeConte)	Phytophagous		6
		Cimberis pallipennis (Blatchley)	Phytophagous		1
Curculionidae	Dryophthorinae	*Dryophthorus americanus* Bedel	Xylophagous	1	1
	Curculioninae	*Anthonomus signatus* Say	Phytophagous		1
	Conoderinae	*Lechriops oculata* (Say)	Phytophagous		2
	Cossoninae	*Carphonotus testaceus* Casey	Xylophagous	1	10
		Himatium errans LeConte	Xylophagous	1	12
		Rhyncolus brunneus Mannerheim	Xylophagous	1	18
	Entiminae	*Otiorhynchus singularis* (Linnaeus)†	Rhizophagous		8
		Otiorhynchus sulcatus (Fabricius)†	Rhizophagous		1
		Nemocestes horni Van Dyke	Phytophagous		1
		Polydrusus impressifrons (Gyllenhal)†	Phytophagous		1
		Polydrusus sericeus (Schaller)†	Phytophagous		3
		Sciaphilus asperatus (Bonsdorff)†	Phytophagous		5
	Molytinae	*Conotrachelus posticatus* Boheman	Phytophagous		2
		Hylobius congener Dalla Torre et al.	Rhizophagous		11

Family	Subfamily	Species	Trophic Category	SX	#
		Hylobius pales (Herbst)	Rhizophagous		2
		Pissodes affinis Randall	Phytophagous		3
		Pissodes fiskei Hopkins	Phytophagous		70
		Pissodes striatulus (Fabricius)	Phytophagous		1
		Pissodes strobi (Peck)	Phytophagous		4
	Scolytinae	*Hylurgops rugipennis pinifex* (Fitch)	Phloeophagous	1	4
		Dendroctonus simplex LeConte	Phloeophagous	1	1
		Dendroctonus valens LeConte	Phloeophagous	1	1
		Polygraphus rufipennis (Kirby)	Phloeophagous	1	58
		Pityogenes hopkinsi Swaine	Phloeophagous	1	3
		Pityokteines sparsus (LeConte)	Phloeophagous	1	3
		Orthotomicus caelatus (Eichhoff)	Phloeophagous	1	2
		Ips pini (Say)	Phloeophagous	1	2
		Dryocoetes affaber (Mannerheim)	Phloeophagous	1	18
		Dryocoetes autographus (Ratzeburg)	Phloeophagous	1	19
		Crypturgus borealis Swaine	Phloeophagous	1	37
		Crypturgus pusillus (Gyllenhal)†	Phloeophagous	1	22
		Trypodendron lineatum (Olivier)*	Mycetophagous	1	12
		Xyloterinus politus (Say)	Mycetophagous	1	4
		Conophthorus coniperda (Schwartz)	Phloeophagous	1	2
		Pityophthorus cariniceps LeConte	Phloeophagous	1	1
		Gnathotrichus materarius (Fitch)	Phloeophagous	1	1
		Monarthrum mali (Fitch)	Phloeophagous	1	1
Totals				264	2303

Notes: Families, subfamilies, and species are listed in taxonomic order.†, adventive Palaearctic species; * Holarctic species; no symbol, Nearctic species. Saproxylic (SX column): 1, included as a saproxylic species; no entry, not included. #, number of specimens collected.

[1] The species of *Cyphon* in the Maritime Provinces of Canada are currently being revised by C.G. Majka and B. Klausnitzer (in preparation). The designation and nomenclature of these species may change in that forthcoming revision.

[2] The species of the genus *Atomaria* in the Maritime Provinces of Canada are currently being revised by C.G. Majka and C. Johnson (in preparation). The nomenclature of this species will change in this forthcoming revision.

[3] This undescribed species of *Paratenetus* (previously included within *Paratenetus fuscus* LeConte) will be described in a forthcoming publication by P. Bouchard and Y. Bousquet (in preparation).

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RESEARCH ARTICLE

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New records of Nitidulidae and Kateretidae (Coleoptera) from New Brunswick, Canada

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Abstract
The Nitidulidae (sap beetles) and Kateretidae (short-winged flower beetles) from New Brunswick are surveyed. As a result of recent field work and a survey of museum specimens, 46 species have now been recorded in the province, 32 of which are newly recorded in New Brunswick. *Epuraea obliquus* Hatch is removed from New Brunswick's faunal list. The distribution and bionomics of newly recorded species are summarized. The New Brunswick fauna consist of 33 Nearctic species, four Holarctic species, and nine adventive species. Historical early dates of detection of all nine adventive species found in the province are provided.

Keywords
Coleoptera, Nitidulidae, Kateretidae, New Brunswick, Canada, biodiversity, adventive species

Introduction

The Nitidulidae are an abundant and widespread beetle family (there are circa 2,800 species worldwide and 165 species in North America). Many genera are saprophagous and mycetophagous, although some are anthophilous, carrion feeders, inquilines, and even predators (Habeck 2002b; Cline 2005). In Atlantic Canada, the anthophilous genera *Conotelus*, *Colopterus* (Cillaeinae), and *Meligethes* (Meligethinae) are found in the blossoms of various flowers. Species of *Colopterus* (Cillaeinae), *Carpophilus* (Carpophilinae), *Epuraea* (Epuraeinae), *Cryptarcha*, *Glischrochilus* (Cryptarchinae), *Soro-*

nia, and *Lobiopa* (Nitidulinae) are found at sap flows, decaying fruit, fermenting plant extracts, in subcortical habitats, and other similar decomposing microhabitats. Species of *Phenolia* and *Stelidota* (Nitidulinae), as well as some *Epuraea* are associated with decomposing fungi. Many nitidulids also have been associated with oak wilt fungal mats (Cease and Juzwik 2001). *Carpophilus* often are pests of dried, stored products and can be found in food processing facilities. *Omosita* and *Nitidula* (Nitidulinae) live and breed in carrion. The Kateretidae, in the past frequently treated as a subfamily of the Nitidulidae, are a much smaller family (there are fewer than 100 species worldwide and 11 in North America). Kateretids are phytophagous; larvae feed in seed capsules and adults feed on pollen and flowers of host plants (Kirk-Spriggs 1996; Habeck 2002a).

Despite their economic importance and diversity, Nitidulidae and Kateretidae have received relatively little attention in Atlantic Canada. McNamara (1991) recorded 13 species from New Brunswick, 15 from Nova Scotia, three from Prince Edward Island, and 13 in Newfoundland and Labrador (a total of 28 species in the region) from a total of 101 species then known to occur in Canada. Majka and Cline (2006) surveyed the fauna of Nova Scotia and Prince Edward Island adding 26 species to the Nova Scotia fauna and nine to the Prince Edward Island fauna. As part of continuing efforts to document the beetle biodiversity within Atlantic Canada, we report new records of Nitidulidae and Kateretidae from New Brunswick.

Methods and conventions

Specimens of Nitidulidae and Kateretidae originating in New Brunswick from various collections were examined and identified. Additional published records for species of these families were also integrated into the analysis. Codens of collections referred to in this study include:

CGMC	Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CNC	Canadian National collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
NSAC	Nova Scotia Agricultural College, Bible Hill, Nova Scotia, Canada
NBM	New Brunswick Museum, Saint John, New Brunswick, Canada
RWC	Reginald Webster collection, Charters Settlement, New Brunswick, Canada
UMNB	Université de Moncton, Moncton, New Brunswick, Canada

The taxonomy and nomenclature follows Habeck (2002a, 2002b) and Audisio (1993) except that we employ the name Kateretidae Erichson, 1843 rather than Brachypteridae Erichson, 1845 as in Habeck (2002a) for reasons discussed in Cline (2006) and in conformity with Jelínek (2007a). We also treat *Epuraea* Erichson, 1843 as a member of the subfamily Epuraeinae Kirejtshuk, 1986, in keeping with Jelínek (2007b), rather than retaining it in the Carpophilinae Erichson, 1842 as in Habeck (2002b).

Results

Four species of Kateretidae and 42 species of Nitidulidae are now known from New Brunswick, 32 of which are newly recorded in the province (Table 1). One species, *Epuraea obliquus* Hatch, is removed from New Brunswick's faunal list. Specific details of these records follow. For each species, the location, collection date, collector, habitat and ecological information, number of specimens, and collection coden of all specimens examined is reported. This is followed by a brief summary of the distribution and bionomics of the species and any other pertinent information on the status of the species.

Table 1. New Brunswick Kateretidae and Nitidulidae

KATERETIDAE
Brachypterolus pulicarius (Linnaeus) †
• *Brachypterus urticae* (Fabricius) †
• *Heterhelus abdominalis* (Erichson)
• *Heterhelus sericans* (LeConte)
NITIDULIDAE
Cillaeinae
Conotelus obscurus Erichson
• *Colopterus truncatus* (Randall)
Carpophilinae
• *Carpophilus brachypterus* (Say)
• *Carpophilus hemipterus* (Linnaeus) †
• *Carpophilus marginellus* Motschulsky §
• *Carpophilus sayi* Parsons
Epuraeinae
• *Epuraea aestiva* (Linnaeus) *
Epuraea avara (Randall)
Epuraea erichsoni Reitter
Epuraea flavomaculata Mäklin
Epuraea helvola Erichson
• *Epuraea horni* Crotch
Epuraea labilis Erichson
• *Epuraea obtusicollis* Reitter
• *Epuraea peltoides* Horn
Epuraea planulata Erichson
• *Epuraea rufa* (Say)
• *Epuraea rufida* (Melsheimer)
Epuraea rufomarginata Stephens *
Epuraea terminalis Mannerheim *
• *Epuraea truncatella* Mannerheim
Epuraea umbrosa Horn
Nitidulinae
Omosita colon (Linnaeus) †
• *Omosita discoidea* (Fabricius) †
• *Nitidula bipunctata* (Linnaeus) †
Nitidula rufipes (Linnaeus) †
• *Lobiopa undulata* (Say)
• *Thalycra concolor* (LeConte)
• *Cychramus adustus* Erichson
• *Cyllodes biplagiatus* LeConte
Meligethinae
• *Meligethes nigrescens* Stephens *
• *Meligethes simplipes* Easton
• *Meligethes viridescens* (Fabricius) †
Cryptarchinae
• *Cryptarcha ampla* Erichson
• *Cryptarcha concinna* Melsheimer
• *Glischrochilus confluentus* (Say)
• *Glischrochilus fasciatus* (Olivier)
• *Glischrochilus moratus* Brown
• *Glischrochilus quadrisignatus* (Say)
Glischrochilus sanguinolentus (Olivier)
Glischrochilus siepmanni Brown
• *Glischrochilus vittatus* (Say)

Notes: •, newly recorded in NB; †, Palaearctic species; §, Oriental species; *, Holarctic species; no symbol, Nearctic species.

KATERETIDAE, Erichson, 1843

Brachypterus urticae (Fabricius, 1792)

Carleton Co.: Jackson Falls, Bell Forest, 46.2208°N, 67.7211°W, 13.VII.2004, K. Bredin, J. Edsall, & R. Webster, rich Appalachian hardwood forest, on flowers of nettle, (2, RWC); same locality, 1.VIII.2004, V. and R. Webster, rich Appalachian hardwood forest, on flowers of nettle, (4, RWC).

This adventive Palearctic species has been recorded in Canada from British Columbia west to Québec, Newfoundland, and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States along the Atlantic seaboard south to North Carolina and Tennessee, and west to Missouri, Iowa, and Wisconsin. In the western United States it has been found in Colorado, Washington, and California (Parsons 1943). Erichson (1843) first recognized this species as occurring in the Nearctic by noting that the specimen sent to him from Connecticut by Zimmerman was not different from specimens he possessed that originated from the Palearctic. This note likely was the basis for Melsheimer's (1846, 1853) record of the species. The common host is nettle (*Urtica* spp., Urticaceae) (Kirk-Spriggs 1996); however, it has been reported from elder (Dillon and Dillon 1961) and sifted from sphagnum moss (Blatchley 1910).

Heterhelus abdominalis (Erichson, 1843)

Carleton Co.: Belleville, Meduxnekeeg Valley Nature Preserve, 46.1931°N, 67.6825°W, 8.VI.2007, M.-A. Giguére & R.Webster, flood plain forest, sweeping (5, RWC); same locality, 25.VI.2007, R.P.Webster, flood plain forest, on flowers of *Prunus virginiana*, (1, RWC); Jackson Falls, Bell Forest, 46.2152°N, 67.7190°W, 11.V.2005, M.-A. Giguére & R.Webster, flood plain forest, sweeping (1, RWC).

Heterhelus abdominalis has been recorded in Canada from Manitoba to Québec (McNamara 1991), and in the United States from New Hampshire and New York, south to Georgia and west to Texas, Arkansas, Missouri, Nebraska, Kansas, and Iowa (Parsons 1943; Downie and Arnett 1996; Chandler 2001). Adults have been found on the flowers of wild plum (*Prunus americana* Marsh.), blackberry (*Rubus* spp.) (Rosaceae), common elder (*Sambucus canadensis* L., Caprifoliaceae), bloodroot (*Sanguinaria canadensis* L., Papaveraceae), and water hemlock (*Cicuta maculata* L., Apiaceae) (Parsons 1943; Dillon and Dillon 1961; Price and Young 2006), as well as under the bark of *Quercus* sp. (A. Cline, pers. obs.).

Heterhelus sericans (LeConte, 1869)

Albert Co.: Shepody National Wildlife Area, Mary's Point Section, 45.7320°N, 64.6765°W, 16.VI.2004, R.P. Webster, on flowers in spruce forest, (8, NBM, RWC);

Carleton Co.: Belleville, Meduxnekeeg Valley Nature Preserve, 46.1965°N, 67.6803°W, 31.V.2005, M.-A. Giguére & R.Webster, old field, sweeping (5, NBM, RWC); **York Co.:** Fredericton, 45.9110°N, 66.6686°W, 4.VI.2004, R.P. Webster, sweeping roadside vegetation near black spruce bog, (7, NBM, RWC).

Heterhelus sericans has been recorded in Canada from British Columbia, Ontario, Québec, Nova Scotia, and Newfoundland (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to North Carolina and Tennessee, and west to Kansas and Wisconsin (Parsons 1943; Chandler 2001; Price and Young 2006). In Nova Scotia specimens were principally collected in deciduous forests associated with blossoms of *Sambucus racemosa* L. (Caprifoliaceae), *Diervilla lonicera*, P. Mill. (Caprifoliaceae), *Prunus virginiana* L. (Rosaceae), *Crategus* spp (Rosaceae), and *Cornus alterniflora* L.f. (Cornaceae) (Majka and Cline 2006); also reported from *Aristolochia* sp. (Aristolochiaceae) (A. Cline, pers. obs.).

NITIDULIDAE Latreille, 1802

Cillaeinae Kirejtshuk and Audisio, 1986

Colopterus truncatus (Randall, 1838)

Carleton Co.: Hovey Hill, 46.1115°N, 67.7710°W, 7.IX.2004, R.P. Webster, hardwood forest, under poplar bark, (3, NBM, RWC); near the Hovey Hill, 46.1155°N, 67.7631°W, 10.V.2005, R.P. Webster, clearcut, mixed forest, under bark of *Populus* sp., (15, NBM, RWC); Belleville, Meduxnekeeg Valley Nature Preserve, 46.1890°N, 67.6766°W, 8.VI.2005, M.-A. Giguére & R.Webster, flood plain forest, on flowers of *Prunus virginiana*, (1, RWC); **Sunbury Co.:** 7.5 km W of Tracy off Rt. 645, 45.6861°N, 66.7719°W, 9.V.2007, Mixed forest, in litter at base of cut white birch oozing sap, (1, RWC); Lakeville Corner, 45.9013°N, 66.2565°W, 27.VIII.2006, R. P. Webster, silver maple forest, on corncobs, (1, RWC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 8.IX.2007, Mixed forest, in pile of corncobs and cornhusks, (1, RWC).

Colopterus truncatus has been recorded in Canada from the Yukon east to Nova Scotia (McNamara 1991; Majka and Cline 2006), and it is broadly distributed in the United States south through Central America to Brazil (Parsons 1943). Adults are found under bark and feed on sap (Parsons, 1943) or on molds in subcortical environments (A. Cline, pers. obs.). Price and Young (2006) found the species on large-toothed poplar (*Populus grandidentata* Michx., Salicaceae), and maple (*Acer* sp., Aceraceae).

Carpophilinae Erichson, 1842

Carpophilus brachypterus (Say, 1825)

Sunbury Co.: near Sunpoke Lake, 45.7658°N, 66.5546°W, red oak forest, on flowers of *Viburnum cassinoides*, (3, RWC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 19.VI.2004, R.P. Webster, mixed forest, on mountain ash flowers, (1, RWC); same locality, 29.VIII.2007, mixed forest, in pile of corncobs and cornhusks, (1, RWC); Canterbury, near Browns Mountain Fen, 45.8964°N, 67.6273°W, 8.IX.2007, mixed forest, on flowers of *Aster umbellatus*, (1, RWC).

Carpophilus brachypterus has been recorded in Canada from Manitoba east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from New Hampshire south to North Carolina and west to Texas, Nebraska, Kansas, Iowa, and South Dakota (Parsons 1943; Chandler 2001). Price and Young (2006) found them on flowers of plum (*Prunus americana* Marsh.), choke cherry (*P. virginiana* L.), apple (*Pyrus malus* L.) (Rosaceae), everlasting (*Antennaria neglecta* Greene), and white snakeroot (*Eupatorium rugosum* Houtt.) (Asteraceae), in leaf litter, on rotting fruit, recently cut hardwoods, on driftwood, scotch pine (*Pinus sylvestris* L.), white pine (*Pinus strobus* L.) (Pinaceae), and willow (*Salix* sp., Salicaceae) in a wide variety of forested and open habitats. Dillon and Dillon (1961) list the species from black haw (*Viburnum prunifolium* L., Caprifoliaceae).

Carpophilus hemipterus (Linnaeus, 1758)

York Co.: Charters Settlement, 45.8395°N, 66.7391°W, 29.VIII.2007, 8.IX.2007, R.P. Webster, mixed forest, in pile of corncobs and cornhusks (local corn), (8, RWC).

In Canada this adventive species has been recorded from British Columbia east to Québec (McNamara 1991), and in the United States it is widely distributed from Washington and California east to Texas and Florida and north to Wisconsin and Maine; also in Alaska (Parsons 1943; Downie and Arnett 1996; Chandler 2001). Horn (1879) remarked that the species was "widely distributed over the region east of the Rocky Mountains." The species was reported from Nova Scotia by Majka and Cline (2006) but only as an intercepted species found on imported corn (*Zea mays* L., Poaceae). This cosmopolitan species has been found on a vast assortment of fresh and dried fruits and stored products including dried fruits such as apples, apricots, bananas, figs, prunes and raisins; fresh fruits and vegetables such as apples, apricots, oranges, dates, grapefruits, limes, maize, melons, pineapples, pears, peaches, persimmons, plums, and tomatoes; on grape skins, sugar, honey, grain, bread, biscuits, rice, avocado seeds, cotton seeds, shelled peanuts, corn meal, sorghum, cloves, and other spices (Hinton 1945).

Carpophilus marginellus Motshulsky, 1858

York Co.: Charters Settlement, 45.8395°N, 66.7391°W, 29.VIII.2007, 5.IX.2007, 21.IX.2007, 5.X.2007, R.P. Webster, mixed forest, in pile of corncobs and cornhusks (local corn), (12, NBM, RWC).

This adventive species originates in Southeast Asia and is frequently associated with dried stored products. In Canada it has been recorded from Manitoba east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from California, Florida, Georgia, Nevada, New Hampshire, New Jersey, Ohio, and Vermont (Downie and Arnett 1996; Chandler 2001). In Great Britain and Scandinavia it has successfully adapted from stored dried products to outdoor environments such as compost heaps (Hammond 1974; Ødegaard and Tømmerås 2000) while in Australia it has colonized peach and nectarine orchards (James et al. 2000).

Carpophilus sayi Parsons, 1945

Carleton Co.: Jackson Falls, Bell Forest, 46.2210°N, 67.7210°W, 2.VI.2005, R. P. Webster, rich Appalachian hardwood forest, UV light trap, (1, RWC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 11.VI.2003, R.P. Webster, mixed forest, beating foliage, (1, RWC); same locality, 25.IX.2005, 29.VIII.2007, mixed forest, in pile of corncobs and cornhusks, (4, RWC).

Carpophilus sayi has been recorded in Canada from Manitoba, Québec, and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to Georgia, west to Texas and New Mexico, and north to Iowa and Wisconsin; also in California (Parsons 1943; Chandler 2001; Price and Young 2006). The species is frequently taken at sap flows of large-toothed poplar (*Populus grandidentata*), and maple (*Acer* sp.) and is associated with oak wilt fungus mats (Cease and Juzwik 2001; Price and Young 2006).

Epuraeinae Kirejtshuk, 1986

Epuraea aestiva (Linnaeus, 1758) [syn. *Epuraea depressa* (Illiger, 1798)]

Carleton Co.: Belleville, Meduxnekeeg Valley Nature Preserve, 46.1931°N, 67.6825°W, 31.V.2005, M.-A. Giguère and R.P. Webster, upper river margin (floodplain forest), on bloodroot flowers, (1, RWC); same locality, M.-A. Giguère and R.P. Webster, 8.VI.2005, floodplain forest, on foliage of *Prunus virginiana*, (3, RWC); Jackson Falls, Bell Forest, 46.2210°N, 67.7210°W, 9.VI.2005, 20.VI.2005, M.-A. Giguère and R.P. Webster, rich Appalachian hardwood forest, on flowers of *Prunus virginiana*, (2, RWC); same locality, R. P. Webster, 13.VIII.2007, rich Appalachian hardwood forest, on flowers of *Solidago*, (1, RWC); same locality, 7.VI.2007, on flowers of *Vibur-*

num sp. (Adoxaceae); **York Co.:** Canterbury, near Browns Mountain Fen, 45.8951°N, 67.6333°W, 10.VI.2005, M.-A. Giguère and R.P. Webster, mixed forest, on flowers of *Prunus virginiana*, (1, RWC).

This Holarctic species is widely distributed in Europe, northern Asia, and throughout the United States (Parsons 1943, Downie and Arnett 1996). In Canada it has been recorded from British Columbia east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006). In Nova Scotia it was found in a great variety of forested and open environments on flowers of trees and shrubs, in compost piles, and at sap (Majka and Cline 2006).

Epuraea erichsoni Reitter, 1873

Carleton Co.: Jackson Falls**,** Bell Forest, 46.2208°N, 67.7211°W, 1.VIII.2004, V. and R. Webster, rich Appalachian hardwood forest, on flowers of *Prunus virginiana*, (1, RWC); **Sunbury Co.:** near Sunpoke Lake, 45.7658°N, 66.5546°W, R.P. Webster, red oak forest, on flowers of *Viburnum cassinoides*, (2, RWC); same locality, R.P. Webster, red oak forest, m.v. light, (1, RWC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W,17.VI, 2004, 18.VI.2003, 26.VI.2003, 17.VII.2007, R.P. Webster, mixed forest, m.v light, (3, RWC); same locality, 16.VI.2007, R.P. Webster, mixed forest, on flowers of ornamental *Spiraea* sp., (1, RWC);

Epuraea erichsoni has been recorded in Canada from British Columbia and the Northwest Territories east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to Florida and west to Texas and Nebraska (Parsons 1943; Chandler 2001). The species is associated with old-growth forests (Zeran et al. 2006) and is found at sap, under bark and on flowering trees, shrubs, and plants (Parsons 1943). Price and Young (2006) found it on wounded large-toothed poplar (*Populus grandidentata*), and oak (*Quercus* sp.) and on flowers of *Prunus* spp. and tansy (*Tanacetum vulgare* L., Asteraceae). In Nova Scotia it is found at sap, primarily in deciduous forests (Majka and Cline 2006).

Epuraea horni Crotch, 1874

Carleton Co.: Belleville, Meduxnekeeg Valley Nature Preserve, 46.1888°N, 67.6762°W, 27.VIII.2007, R. P. Webster, upper river margin, on flowers of *Daucus* sp., (1, RWC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 19.VI.2004, R.P. Webster, mixed forest, on mountain ash flowers, (1, RWC).

Epuraea horni has been recorded in Canada from Ontario and Québec (McNamara 1991), and in the United States from Pennsylvania south to North Carolina and west to Illinois (Parsons 1943). No bionomical information is available for this species, but we suspect it to be mycetophagous on various fungal substrata in a similar manner as its close relative *E. helvola*.

Epuraea obliquus Hatch, 1962

This species was reported as occurring in New Brunswick by McNamara (1991). We have not been able to find any specimens or published records of this species collected in New Brunswick. Anthony Davies (pers. comm.) informed us that no specimens from New Brunswick are in the CNC, thus the source of the original report is not established. Consequently, this species is removed from the New Brunswick faunal list.

Epuraea obtusicollis Reitter, 1873

York Co.: Charters Settlement, 45.8430°N, 66.7275°W, 28.VIII.2004, R.P. Webster, regenerating mixed forest, baited with decaying mushrooms, (4, RWC); same locality, 19.IX.2005, R.P. Webster, baited with pile of decaying mushrooms, (1, RWC).

Epuraea obtusicollis has been recorded in Canada from British Columbia east to Québec (McNamara 1991), and in the United States from Maine south to North Carolina and west to Arizona and California (Parsons 1943). The species has been found under the bark of beech (*Fagus* sp., Fagaceae), in fungi, under old leaves, and in humus (Parsons 1943).

Epuraea peltoides Horn, 1879

Albert Co.: Mary's Pt., 45.73°N, 64.67°W, 9.VIII.2002, 12.V.2007, C.G. Majka, compost heap, (2, CGMC); **Carleton Co.:** Jackson Falls**,** Bell Forest, 46.2200°N, 67.7231°W, 18-27.VI.2008, R.P. Webster, rich Appalachian hardwood forest, Lindgren funnel trap, (1, RWC); **Kent Co.:** Kouchibouquac National Park, 30.VIII.1977, S.J. Miller, (1, CNC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W,13.IX, 2007, R.P. Webster, mixed forest, in pile of corncobs and cornhusks, (1, RWC).

Epuraea peltoides has been recorded in Canada from Alberta east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States south to Virginia and west to Indiana and Wisconsin (Parsons 1943). Price and Young (2006) found it on rotting peaches, and at wounded hardwood trees.

Epuraea rufa (Say, 1825)

Queens Co.: Scotchtown near Indian Point, 45.8762°N, 66.1816°W, 5.VI.2004, R.P. Webster, margin of lake, under drift material, (2, NBM, RWC); same locality, 19.IX.2006, oak forest near lake, in decaying polypore fungi, (1, NBM); **Saint John Co.:** Saint John, VII.1900-07, W. McIntosh, (1, NBM); **Sunbury Co.:** near Sunpoke Lake, 45.7658°N, 66.5546°W, 27.VII.2007, R.P. Webster, oak forest, m.v. light, (7, NBM, RWC); Maugerville: Portobello Creek National Wildlife Area, 45.8992°N, 66.4248°W, 7.V.2004, 27.V.2004, silver maple forest, in moist leaves on margin of vernal pond (12, RWC, NBM); same locality, 18.VI.2004, 17.VII.2004, R.P. Webster, silver maple forest, UVlight, (4, RWC); Acadia Research Forest, 45.9816°N, 66.3374°W, 18.VI.2007, R.P. Webster, mixed forest, sifting leaf litter, (2, NBM, RWC); Lakeville Corner, 45.9013°N, 66.2565°W, 27.VIII.2006, R. P. Webster, silver maple forest, on corncobs, (2, NBM); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 28.VI.2005, R.P. Webster, mixed forest, m.v. light, (1, NBM); Douglas, Keswick R. at Rt. 105, 45.9943°N, 66.8337°W, 18.VI.2004, R.P. Webster, silver maple forest, under debris near margin of small pool, (2, RWC); Fredericton, Saint John River, 4.VII.2004, R.P. Webster, margin of river, drift material, (2, RWC).

Epuraea rufa has been recorded in Canada from Ontario and Québec (McNamara 1991), and in the United States from New Hampshire south to Georgia, west to Missouri, Kansas, Nebraska, and Minnesota, and in Washington and Oregon (Parsons 1943; Kirejtshuk and Pakaluk 1996; Chandler 2001). The species is found in leaf litter, at sap, in fungi, on tree bark, and on driftwood and was also reared from fallen seeds of sugar maple (*Acer saccharum* Marsh., Aceraceae) (Parsons 1943; Price and Young 2006).

Epuraea rufida (Melsheimer, 1846)

Carleton Co.: Jackson Falls**,** Bell Forest, 46.2208°N, 67.7211°W, 31.III.2005, R.P. Webster, rich Appalachian hardwood forest, under bark of dead sugar maple, (9, NBM, RWC); **Saint John Co.:** Saint John, 3.VII.1900-07, W. McIntosh, (1, NBM); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 29.VIII.2007, mixed forest, in pile of corncobs and cornhusks, (10, NBM, RWC).

Epuraea rufida has been recorded in Canada from Ontario, Québec, and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to South Carolina, west to Louisiana, and Wisconsin (Parsons 1943; Chandler 2001; Price and Young 2006). The species has been recorded under bark of oak (*Quercus* sp.) and on the flowers of linden (*Tilia* sp., Tiliaceae) (Parsons 1943). The specimen from Saint John collected by W. McIntosh was determined as *E. rufida* by W.H. Harrington. The specimen is now broken and indeterminate.

Epuraea truncatella Mannerheim, 1846

York Co.: Charters Settlement, 45.8395°N, 66.7391°W, 18.IV.2004, 29.IV.2004, 5.V.2004, 9.V.2004, R.P. Webster, mixed forest, in compost, (12, NBM, RWC); same locality, 30.IV.2004, R.P. Webster, mixed forest, m.v. light, (1, RWC); 17.IV.2005, R.P. Webster, mixed forest, in flight, (1, RPW); Charters Settlement, 45.8188°N, 66.7460°W, 27.III.2005, 16.IV.2005, clearcut, under bark of white pine, (12, NBM, RWC).

Epuraea truncatella has been recorded in Canada from British Columbia and the Yukon and Northwest Territories, east to Québec, Nova Scotia, and Newfoundland and Labrador (McNamara 1991; Majka and Cline 2006), and in the United States in Alaska California, Nevada, Colorado, and New Mexico, east to Indiana, West Virginia, Virginia, New Hampshire, and Maine (Parsons 1943; Chandler 2001). The species is found on the bark of recently dead pines (*Pinus* pp.) (Price and Young 2006). In Nova Scotia it was found at sap on trembling aspen (*Populus tremuloides* Michx., Salicaceae), and under bark of fallen white pine (*Pinus strobus* L., Pinaceae) (Majka and Cline 2006).

Nitidulinae Latreille, 1802

Omosita discoidea (Fabricius, 1775)

Kent Co.: Buctouche, V-VII.2007, J.P. Michaud, mixed forest and agricultural fields, on carrion, (many specimens, UMNB); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 17.IV.2005, R.P. Webster, mixed forest, in flight (1, RWC); same locality, 8.IX.2007, 14.IX.2007, 26.IX.2007, mixed forest, in pile of corncobs and cornhusks, (4, RWC).

This adventive Palearctic species is widely distributed in Europe and is recorded in Canada from British Columbia west to Nova Scotia and Newfoundland and is widely distributed in the United States (McNamara 1991; Majka and Cline 2006; Parsons 1943). *Omosita discoidea* is found on dry carrion, bones, hides, fungi, and in decaying vegetation (Downie and Arnett, 1996).

Nitidula bipunctata (Linnaeus, 1758)

Carleton Co.: Jackson Falls**,** Bell Forest, 46.2152°N, 67.7190°W, 11.V.2005, M.-A. Giguère and R.P. Webster, rich Appalachian hardwood forest, in flight, (1, RWC); **Westmorland Co.:** Moncton, 25.X.1977, E. Ouellette, (1, UMNB); **York Co.:** Charters Settlement, 45.8426°N, 66.7276°W, 9.V.2004, R.P. Webster, regenerating mixed forest, in dried carrion, (10, RWC).

Nitidula bipunctata has been recorded in Canada from the Yukon and British Columbia east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to Virginia and Kentucky, west to Texas and north to Michigan, Kansas, Iowa, and Minnesota; also on the Pacific coast from Alaska south to Oregon and Idaho (Parsons 1943; Hatch 1962). Long regarded as an adventive Palearctic species, Majka and Cline (2006) drew attention to the fact that the earliest reports on the continent are from high altitudes in an isolated range of the Rocky Mountains in 1878, a very unlikely location for an introduced species to be found, thus suggesting a possible Holarctic distribution. The species is found on dry carrion (Dillon and Dillon 1961; Downie and Arnett 1996). In Nova Scotia most specimens were found in association with decomposing pigs (*Sus scrofa* Linnaeus) (Suidae) (Majka and Cline 2006).

Lobiopa undulata (Say, 1825)

Kings Co.: Grand Bay, 25.V.2001, D.F. McAlpine, (1, NBM). **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 29.VIII.2007, 8.IX.2007, 26.IX.2007, R.P. Webster, mixed forest, in pile of corncobs and cornhusks, (4, RWC); same locality, 1.VIII.2007, mixed forest, m.v. light, (1, RWC).

Lobiopa undulata has been recorded in Canada from Alberta east to Québec (McNamara 1991), and broadly distributed throughout the United States (Parsons 1943). The species is found at sap, under bark, at lights in the spring and fall, and typically overwinters beneath logs (Parsons 1943; Downie and Arnett 1996), and sometimes gregariously in subcortical spaces (A. Cline, pers. obs.). Price and Young (2006) found it on a recently cut maple (*Acer* sp.) stump.

Thalycra concolor (LeConte, 1850)

York Co.: Charters Settlement, 45.8395°N, 66.7391°W, 5.X.2007, R.P. Webster, mixed forest, in pile of corncobs and cornhusks (1, RWC).

Thalycra concolor has been recorded in Canada from Ontario and Québec (McNamara 1991), and in the United States from the District of Columbia, Michigan, Montana, New York, and Wisconsin (Parsons 1943; Downie and Arnett 1996). The species has been found at sap under bark, in fungi and by sweeping grass and flowers (Parson 1943).

Cychramus adustus Erichson, 1843

York Co.: Charters Settlement, 45.8395°N, 66.7391°W, 17.VIII.2005, G. Pohl and R.P. Webster, mixed forest, m.v. light (1, RWC); same locality, 8.IX.2007, mixed forest, in pile of corncobs and cornhusks, (1, RWC).

Cychramus adustus has been recorded in Canada from Ontario and Québec (McNamara 1991), and in the United States from Maine south to Georgia and west to Texas, Missouri, and Michigan (Parsons 1943; Chandler 2001). The species is found on fungi and is also attracted to lights (Downie and Arnett 1996). Price and Young (2006) found it on black-eyed susan (*Rudebeckia hirta* L., Asteraceae).

Cyllodes biplagiatus LeConte, 1866

Carleton Co.: Belleville, Meduxnekeeg Valley Nature Preserve, 46.1940°N, 67.6800°W, 3.VII.2006, R. P. Webster, mixed forest, on slightly dried *Pleurotus* mushrooms on dead standing *Populus* sp., (2, RWC); **Sunbury Co.:** near Sunpoke Lake, 45.7658°N, 66.5546°W, 27.VI.2007, R.P. Webster, oak forest, on slightly dried *Pleurotus* mushrooms on dead standing *Populus* sp., (7, RWC).

Cyllodes biplagiatus has been recorded in Canada from Manitoba (McNamara 1991), and in the United States from New Hampshire south to New Jersey and west to Minnesota (Parson 1943). The species is associated with oyster mushrooms (*Pleurotus ostreatus* Fr., Tricholomataceae) (Cline and Leschen 2005).

Meligethinae C.G. Thomson, 1859

Meligethes nigrescens Stephens, 1830

Albert Co.: Shepody National Wildlife Area, New Horton Section, 45.6940°N, 64.7000°W, 29.VI.2004, R.P. Webster, sweeping on dike near marsh, (3, RPW); **Gloucester Co.:** Hwy 11 at Nord R., 47.7873°N, 65.0796°W, R.P. Webster, salt marsh, sweeping, (1, RWC); **Kent Co.:** Richibucto, 30.VII.1982, L.H. Lutz, (1, NSAC).

This Holarctic species is found throughout the Old World in the British Isles, Europe, North Africa, the Caucasus, Arabia, and east to central Siberia (Easton 1955; Hatch 1957). In Canada it is recorded from the Yukon and British Columbia east to Nova Scotia and Prince Edward Island (Easton 1955; Majka and Cline 2006), and in the United States from Maine south to Maryland and west to Wisconsin, as well as in Oregon (Easton 1955; Price and Young 2006). The species is associated with a wide variety of plants, particularly *Trifolium pratense* L. (Fabaceae) (Easton 1955); Kirk-Spriggs (1996) also noted the host *Trifolium repens* L. (Fabaceae) in Great Britain, suggesting some specificity of the species on members of *Trifoilum*. Price and Young (2006), however, found it on *Spirea* sp. (Rosaceae) and *Rhus* sp. (Anacardiaceae).

Meligethes simplipes Easton, 1947

Carleton Co.: Jackson Falls, Bell Forest, 46.2210°N, 67.7210°W, 12.VII.2004, K. Bredin, J. Edsall, R.P. Webster, rich Appalachian hardwood forest, (1, RWC); same locality, 22.VII.2004, R.P. Webster, rich Appalachian hardwood forest, on flowers, (9, RPW).

Meligethes simplipes has been recorded in Canada from Ontario east to Prince Edward Island and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from New York south to West Virginia and west to Tennessee and Ohio (Easton 1955). The species is commonly found on flowers of *Rubus canadensis* L. (Rosaceae) and *Syringa* (Oleaceae) (Easton 1955).

Meligethes viridescens (Fabricius, 1797)

Charlotte Co.: near Maces Bay, 45.1245°N, 66.4735°W, 12.VIII.2007, R.P. Webster, Barrier (sea) beach, sweeping vegetation, (14, NBM, RWC).

Majka and Cline (2006) documented the introduction history of this species in North America. The species has previously been reported from Maine, Nova Scotia, Prince Edward Island, and Québec (Hoebeke and Wheeler 1996; Mason et al. 2003), and is found throughout most of Europe, western North Africa, Turkey, the northern Middle East, the Caucasus, and northern Iran east to western Kazakhstan. Larvae feed on many genera of Brassicaceae, particularly *Brassica* spp., *Sinapis* spp., *Cardamine* spp., *Arabis* spp., and *Erucastrum* spp. (Kirk-Spriggs 1996, Majka and Cline 2006). In Europe, it is a widespread and common pest of oilseed rape (*Brassica napus* L. and *Brassica rapa* L.) (Mason et al. 2003). In Nova Scotia it has frequently been found on wild radish (*Raphanus raphanistrum* L., Brassicaceae) (Majka and Cline 2006) and R.P. Webster swept specimens from nettles (*Urtica* sp., Urticaceae) in Maine.

Cryptarchinae C.G. Thomson, 1859

Cryptarcha ampla Erichson, 1843

Carleton Co.: Belleville**,** Meduxnekeeg Valley Nature Preserve, 46.1957°N, 67.6800°W, 14.VII.2004, R.P. Webster, rich Appalachian hardwood forest, UV light trap, (1, RPW); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 25.VI.2003, 26.VI.2003, 19.VII.2005, 26.VII.2005, 12.VII.2006, R.P. Webster, mixed forest, m.v. light, (5, RWC); same locality, 10.VII.2005, mixed forest, at sap flow on *Salix* sp., (1, RWC); **Sunbury Co.:** Lakeville Corner, 45.9013°N, 66.2565°W, 27.VIII.2006, silver maple forest, on corncobs, (1, RWC).

Cryptarcha ampla has been recorded in Canada from British Columbia east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to Florida and Alabama, west to Texas, Missouri, Kansas, Iowa, Wisconsin, Colorado, and California (Parsons 1943; Chandler 2001; Price and Young 2006). The species is found at sap flows on maple, oak, hickory, and willow (Parsons 1943; A. Cline, pers. obs.) as well as in fungi and at lights (Downie and Arnett 1996) and is associated with oak wilt fungus mats (Cease and Juzwik 2001). Price and Young (2006) reared a specimen from the stem of a milkweed (*Asclepias syriaca* L., Asclepiadaceae).

Cryptarcha concinna Melsheimer, 1853

Carleton Co.: Jackson Falls, Bell Forest, 46.2199°N, 67.7232°W, 12.IV.2007, R.P. Webster, hardwood forest, in leaf litter at base of tree (1, RWC); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 20.VII.2006, 23.VII.2007, 1.VIII.2007, R.P. Webster, mixed forest, m.v. light, (3, NBM, RWC).

In Canada this species is recorded from British Columbia east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States from

Massachusetts south to Florida and west to California and Oregon (Parsons 1943). In Nova Scotia it is found associated with red oak (*Quercus rubra* L., Fagaceae) and red maple (*Acer rubrum* L., Aceraceae).

Glischrochilus confluentus (Say, 1823)

Carleton Co.: Jackson Falls, Bell Forest, 46.2200°N, 67.7231°W, 4-12.VI.2008, R.P. Webster, rich Appalachian hardwood forest, Lindgren funnel trap, (1, RWC).

Glischrochilus confluentus has been recorded in Canada from Ontario, Québec, and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States south to Georgia, west through Missouri, Michigan and Wisconsin, to Colorado and Nevada (Parsons 1943; Price and Young 2006). In Nova Scotia the species was found on bark of a dying trembling aspen (*Populus tremuloides*). Price and Young (2006) found it associated with oak (*Quercus* sp.), on moist decaying fungi, and on chicken of the woods (*Laetiporus sulphureus* (Fr.) Murr., Polyporaceae).

Glischrochilus fasciatus (Olivier, 1790)

Albert Co.: Mary's Pt., 45.73°N, 64.67°W, 21.VI.2003, D.S. Christie, C.G. Majka.; same locality, 12.VIII.2004, 12.V.2007, C.G. Majka, old coastal field, compost heap, (3, CGMC); **Carleton Co.:** Jackson Falls, Bell Forest, 46.2210°N, 67.7210°W, 9.VIII.2006, R.P. Webster, rich Appalachian hardwood forest, on slightly dried *Pleurotus* mushroom on dead standing sugar maple (1, RWC); **Kings Co.:** Grand Bay, 26.V.2001, D.F. McAlpine, (5, NBM); **Saint John Co.:** Saint John, 21.V.1900-07, W. McIntosh, (1, NBM); **York Co:** Charters Settlement, 45.8395°N, 66.7391°W, 3.V.2003, 3.VI.2003, 15.IV.2004, 30.IV.2004, 2.V.2004, 5.V.2004, 10.VII.2005, R.P. Webster, mixed forest in compost, (7, RWC).

Glischrochilus fasciatus has been recorded in Canada from British Columbia, Manitoba, Ontario, Québec, Nova Scotia, and Prince Edward Island (McNamara 1991; Majka and Cline 2006) and in the United States from Maine south to Florida, west through Missouri, Kansas, and Iowa to Oregon; also in New Mexico (Parsons 1943; Chandler 2001). The species is common on fungi, flowers, decaying or ripe fruit (Downie and Arnett 1996) and is associated with oak wilt fungus mats (Cease and Juzwik 2001). Price and Young (2006) found it associated with oak (*Quercus* sp.), poplar (*Populus* sp.), and butternut (*Juglans cinerea* L., Juglandaceae).

Glischrochilus moratus Brown, 1932

York Co: Charters Settlement, 45.8331°N, 66.9410°W, 19.V.2007, 29.V.2007, R.P. Webster, mature red spruce forest, under bark of recently fallen *Populus* sp., (3, NBM, RWC).

Glischrochilus moratus has been recorded in Canada from British Columbia east to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States in the state of Washington (Downie and Arnett 1996). In Nova Scotia it was found on red maple (*Acer rubrum*) and sugar maple (*A. saccharum* Marsh., Aceraceae) (Majka and Cline 2006).

Glischrochilus quadrisignatus (Say, 1835)

Albert Co.: Harvey Bank, 45.73°N 64.68°W, 25.IX.2005, D.S. Christie, on apples, (1, CGMC); **Carleton Co.:** Belleville**,** Meduxnekeeg Valley Nature Preserve, 46.1925°N, 67.6825°W, 19.IV.2005, R.P. Webster, hardwood forest, leaf litter, sifting, (1, RPW); **Gloucester Co.:** Beresford, 12.VIII.1980, C.A. Boudreau, (1, UMNB); **Madawaska Co.:** Rivière-Verte, 24.VII.1979, G. Grondin, (1, UMNB); **Saint John Co.:** Saint John, 19.V.1900-07, 23.V.1900-07, W. McIntosh, (2, NBM); **Sunbury Co.:** 7.5 km W of Tracy off Rt. 645, 45.6861°N, 66.7719°W, 9.V.2007, Mixed forest, in litter at base of cut white birch oozing sap, (1, RWC); **Westmorland Co.:** Moncton, 17.IX.1994, P. Turgeon, (1, UMNB); **York Co.:** Charters Settlement, 45.8395°N, 66.7391°W, 3.V.2004, 9.V.2004, 16.X.2004, 17.IV.2005, 29.VIII.2007, R.P. Webster, mixed forest in compost, (6, RWC); Douglas, Keswick R. at Rt. 105, 45.9943°N, 66.8337°W, 14.VI.2004, R.P. Webster, silver maple forest, under debris, (1, RWC).

Glischrochilus quadrisignatus has been found in Canada from British Columbia east to Nova Scotia, Prince Edward Island, and Newfoundland (McNamara 1991; Majka and Cline 2006), and in the United States from Maine south to Florida and west through Kansas to Utah and Wyoming (Parsons 1943; Chandler 2001). The species is abundant throughout much of the Maritime Provinces (Majka and Cline 2006) and is attracted to decaying fruit, vegetables, and the odor of anything sweet (Downie and Arnett 1996). Price and Young (2006) found it associated with rotting fruit, corn, dung, carrion, wounded trees, a polypore fungus, and under the bark of black cherry (*Prunus serotina* Ehrh., Rosaceae).

Glischrochilus vittatus (Say, 1835)

Charlotte Co.: S of Little Pocologan R., 45.1731°N, 66.6141°W, 7.V.2007, R.P. Webster, clearcut, under bark of large white pine, (1, RWC); **York Co.:** Charters Settlement, 45.8188°N, 66.7460°W, 27.III.2005, R.P. Webster, clearcut, under and on bark of white pine, adults active and mating (deep snow-pack present), (7, RPW); Charters Settlement, 45.8395°N, 66.7391°W, 29.IV.2006, R.P. Webster, mixed forest, flight intercept trap adjacent to composter, (1, RWC); same locality, 29.IV.2006, mixed forest, in pile of corncobs and cornhusks, (1, RWC).

Glischrochilus vittatus has been found in Canada from British Columbia to Québec and Nova Scotia (McNamara 1991; Majka and Cline 2006), and in the United States recorded south to California, Nevada, Utah, and Colorado in the west and in North Carolina, New Hampshire, Maine, and Wisconsin (Parsons 1943; Chandler 2001; Price and Young 2006). The species is often found under the bark of pines, *Pinus* spp. (Downie and Arnett 1996). Price and Young (2006) found it associated with red pine (*Pinus resinosa* Ait., Pinaceae).

Discussion

The overall composition of the New Brunswick fauna includes 33 native Nearctic species, four Holarctic species (*Epuraea aestiva*, *E. rufomarginata* (Stephens, 1830), *E. terminalis* Mannerheim, 1843, and *Meligethes nigrescens*), and nine adventive species.

Nine species found in New Brunswick including *Brachypterolus pulicarius*, *Brachypterus urticae*, *Carpophilus hemipterus, C. marginellus, Omosita colon*, *O. discoidea, Nitidula bipunctata, N. rufipes*, and *Meligethes viridescens* are adventive, Palearctic species. These taxa represent nine of the eleven established, introduced species found in Atlantic Canada (19.6% of the fauna). The dates of first detection of these adventive species are summarized in Table 2. The later dates of detection of these species in New Brunswick compared to North America likely reflect a paucity of early collecting for this group in the province.

This research has been conducted in the context of developing better understanding the Coleoptera of the Maritime Provinces of Canada, a fauna which Majka (2008)

Table 2. Dates of first detection of introduced species in New Brunswick

	NB	NA	Source
KATERETIDAE			
Brachypterolus pulicarius (Linnaeus)	1979	1918: NY	Parsons (1943)
Brachypterus urticae (Fabricius)	2004	1843	Erichson (1843)
NITIDULIDAE			
Carpophilinae			
Carpophilus hemipterus (Linnaeus)	2007	1670: MA	Bain (1998)
Carpophilus marginellus Motschulsky	2007	1910: AL	Fall (1910)
Nitidulinae			
Omosita colon (Linnaeus)	1899	1670: MA	Bain (1998)
Omosita discoidea (Fabricius)	2005	1825: NW	Kirby (1837)
Nitidula bipunctata (Linnaeus)	1977	1878: ID	LeConte (1878)
Nitidula rufipes (Linnaeus)	2004	1825: NW	Kirby (1837)
Meligethinae			
Meligethes viridescens (Fabricius)	2007	1945: NS	Majka and Klimaszewski (2004)

Notes: NB, New Brunswick; NA, North America; AL, Alabama; ID, Idaho; MA, Massachusetts; NS, Nova Scotia; NW, Northwest Territories; NY, New York; QC, Québec.

pointed out has been hitherto relatively poorly investigated. In the 17 years since Bousquet (1991) was published, 1,032 species of beetles have been added to the faunal list of Nova Scotia and 555 species to the faunal list of Prince Edward Island (Majka 2008). At least 653 species have been added to the faunal list of New Brunswick (C.G. Majka, unpublished data). All these numbers are indicators of how poorly known the baseline biodiversity of the region has been. The above results add substantially to the known nitidulid and kataretid faunas of New Brunswick. Forty-six species are now known from the province. Although the present study together with that of Majka and Cline (2006) have better defined the nitidulid and kataretid faunas of the region, further research and field work is needed to fully understand the distribution, abundance, and bionomics of this diverse group of beetles in the region.

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The Leiodidae (Coleoptera) of Atlantic Canada: new records, faunal composition, and zoogeography

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Abstract

The Leiodidae (the round fungus beetles, the small carrion beetles, and the mammal nest beetles) of Atlantic Canada (New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island) are surveyed. Twenty five species, including *Colon* (*Colon*) *politum* Peck and Stephan, *Colon* (*Myloechus*) *forceps* Hatch, *Colon* (*Myloechus*) *incisum* Peck and Stephan, *Colon* (*Myloechus*) *schwarzi* Hatch, *Hydnobius arizonensis* Horn, *Anogdus dissimilis* Blatchley, *Anogdus potens* (Brown), *Cyrtusa subtestacea* (Gyllenhal), *Leiodes puncticollis* (Thompson), *Leiodes rufipes* (Gebler), *Agathidium atronitens* Fall, *Agathidium depressum* Fall, *Agathidium difforme* (LeConte), *Agathidium mollinum* Fall, *Agathidium oniscoides* Palisot de Beauvois, *Agathidium pulchrum* LeConte, *Agathidium repentinum* Horn, *Agathidium rusticum* Fall, *Gelae parile* (Fall), *Anisotoma blanchardi* (Horn), *Anisotoma discolor* (Melsheimer), *Anisotoma geminata* (Horn), *Anisotoma globososa* Hatch, and *Prionochaeta opaca* (Say) are newly recorded in Atlantic Canada. One of these, *Hydnobius arizonensis*, is newly recorded in Canada. *Colon* (*Myloechus*) *hubbardi* Horn is newly recorded in the Maritime Provinces. Eight species are newly recorded in New Brunswick, 29 in Nova Scotia, two on Prince Edward Island, 12 on insular Newfoundland, and five in Labrador for a total of 56 new jurisdictional records. *Catops paramericanus* Peck and Cook and *Catops simplex* Say are newly recorded from mainland Nova Scotia, and records are provided to verify the occurrence of *Leiodes impersonata* Brown and *Leiodes punctostriata* Kirby in Nova Scotia, and *Leptinillus validus* (Horn) in insular Newfoundland. Three species, *Agathidium hatchi* Wheeler, *Catops americanus* Hatch, and *Sciodrepoides watsoni* (Spence), are removed from the faunal list of New Brunswick. As a result, 66 species of Leiodidae have now been recorded from Atlantic Canada. The name *Anisotoma obsoleta* (Horn) is revalidated while the name *Anisotoma horni* Wheeler is newly designated a synonym of *A. obsoleta*.

The regional composition and zoogeography of the Leiodidae in Atlantic Canada are examined and species are grouped in six main categories, reflecting their distribution in the region. Island faunas are examined, particularly in regard to the similarities and differences of the faunas of Cape Breton Island, insular Newfoundland, and Prince Edward Island. Lone Shieling, in Cape Breton Highlands National

Park, is highlighted as an apparent biodiversity "hot spot" for this family within the region. Finally, the saproxylic component of the fauna (19 species in the Agathiidini) is briefly discussed, particularly in regard to potentially rare species, and the importance of monitoring populations of saproxylic beetles.

Keywords
Coleoptera, Leiodidae, Coloninae, Leiodinae, Cholevinae, Platypsyllinae, Atlantic Canada, New Brunswick, Nova Scotia, Newfoundland, Labrador, Prince Edward Island, zoogeography, biodiversity, saproxylic, new records

Introduction

The Leiodidae (the round fungus beetles, the small carrion beetles, and the mammal nest beetles) is a diverse family of beetles that includes species at one time placed in as many as eight separate families. The family is ecologically diverse. For example, in Atlantic Canada it includes *Agathidium* Panzer 1797*, Anisotoma* Panzer 1797*,* and *Gelae* Miller and Wheeler, 2004 that feed on the plasmodia and fruiting bodies of slime molds (and to a lesser degree on certain fungi); *Colon* Herbst 1797*, Hydnobius* Schmidt 1847, *Leiodes* Latreille 1796*,* and *Liocyrtusa* Daffner 1982 that are known or believed to be associated with subterranean fungi; *Colenis* Erichson 1845 which is associated with decaying soft fungi; *Catops* Paykull 1798*, Prionochaeta* Horn 1880, and *Sciodrepoides* Hatch 1933 that are scavengers found in various kinds of moist decaying matter, particularly carrion; *Leptinus* Müller 1817 and *Platypsyllus* Ritsema 1869 that are scavengers and ectoparasites associated with aquatic mammals (particularly beavers); and *Nemadus* Thompson 1867 which is a scavenger associated with the nests of harvester ants.

In North America Peck (2001) reported 324 species of Leiodidae. Subsequently Miller and Wheeler (2004, 2005), Peck and Cook (2002, 2007), and Wheeler and Miller (2005) described 32 additional North American species, increasing the total to 356. Peck (1991) recorded 121 species in Canada, 27 of which were known from Atlantic Canada (New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island). Since then Baranowski (1993), Miller and Wheeler (2005), Peck and Cook (2002, 2007), and Peck and Stephan (1996) have added additional records, increasing the known fauna of Atlantic Canada to 42 species. Recent studies on forest beetles in the region, and an examination of reference collections, have made it apparent that the fauna of the Atlantic Provinces is considerably more diverse than has hitherto been known. The present study adds 56 new jurisdictional records to the regional fauna. Twenty-five species are added to the fauna overall, one of which is newly recorded in Canada.

Methods and Conventions

A total of 2,971 specimens of Leiodidae from Atlantic Canada were examined; 86 from Labrador, 1,211 from insular Newfoundland, 183 from New Brunswick, 1,488 from

Nova Scotia, and 3 from Prince Edward Island. Codens (following Evenhuis 2007) of collections referred to in this study are:

CBU Cape Breton University, Sydney, Nova Scotia, Canada
CFNL Canadian Forest Service, Corner Brook, Newfoundland and Labrador, Canada
CGMC Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CMN Canadian Museum of Nature, Ottawa, Ontario, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
DHWC David H. Webster collection, Kentville, Nova Scotia, Canada
JCC Joyce Cook Collection, North Augusta, Ontario, Canada
MUN Memorial University of Newfoundland collection, Saint John's, Newfoundland and Labrador, Canada (currently on long term loan to the Canadian Forest Service, Edmonton, Alberta)
MZHF Zoological Museum, University of Helsinki, Helsinki, Finland
NBM New Brunswick Museum, Saint John, New Brunswick, Canada
NSMC Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC Reginald Webster Collection, Charters Settlement, New Brunswick, Canada
SBP Stewart B. Peck collection, Ottawa, Ontario, Canada
SMU Saint Mary's University, Halifax, Nova Scotia, Canada
STFX Saint Francis Xavier University, Antigonish, Nova Scotia, Canada
UMNB Université de Moncton, Moncton, New Brunswick, Canada
UPEI University of Prince Edward Island, Charlottetown, Prince Edward Island, Canada

Where there are fewer than 40 specimen records, all are given. Where there are more than 40 specimen records, a summary of specimens is provided and the earliest record is given. Where more recent generic treatments and revisions (i.e., Baranowski 1993) for *Leiodes*; Miller and Wheeler (2005) and Wheeler and Miller (2005) for *Agathidium*; Peck and Cook (2002) for *Catops* and *Sciodrepoides*; and Wheeler (1979) for *Anisotoma*) have provided detailed distribution maps and specimen records, except for noteworthy specimens, only new records are listed herein. In the case of the genus *Colon*, Peck and Stephan (1996) did not include range maps and listed specimen records only for newly described species. Similarly for *Colenis,* specimen records were not provided by Peck (1998) and the distribution map for *C. impunctata* did not include most of Nova Scotia. For these two genera, records of all specimens examined are provided since almost all are hitherto unpublished. The distribution of species in New Brunswick, insular Newfoundland, Nova Scotia, and Prince Edward Island (and occasionally surrounding areas) is shown in the accompanying distribution maps. Records from Labrador (except from the southernmost points) are not shown. Labrador records for most species are shown in the distribution maps in Baranowski

(1993) and Peck and Cook (2002). The nomenclature, classification, and taxonomy employed follow Peck (2002).

Results

Sixty-six species of Leiodidae have now been recorded as occurring in Atlantic Canada (Table 1); 51 in Nova Scotia, 33 in New Brunswick, 25 in insular Newfoundland, 14 in Labrador, and 2 on Prince Edward Island. Of the 51 species recorded in Nova Scotia, 38 were recorded on Cape Breton Island and 40 on the Nova Scotia mainland. Twenty five species including *Colon* (*Colon*) *politum* Peck and Stephan, *Colon* (*Myloechus*) *forceps* Hatch, *Colon* (*Myloechus*) *incisum* Peck and Stephan, *Colon* (*Myloechus*) *schwarzi* Hatch, *Hydnobius arizonensis* Horn, *Anogdus dissimilis* Blatchley, *Anogdus potens* (Brown), *Cyrtusa subtestacea* (Gyllenhal), *Leiodes puncticollis* (Thompson), *Leiodes rufipes* (Gebler), *Agathidium atronitens* Fall, *Agathidium depressum* Fall, *Agathidium difforme* (LeConte), *Agathidium mollinum* Fall, *Agathidium oniscoides* Palisot de Beauvois, *Agathidium pulchrum* LeConte, *Agathidium repentinum* Horn, *Agathidium rusticum* Fall, *Gelae parile* (Fall), *Anisotoma blanchardi* (Horn), *Anisotoma discolor* (Melsheimer), *Anisotoma geminata* (Horn), *Anisotoma globososa* Hatch, and *Prionochaeta opaca* (Say) are newly recorded in Atlantic Canada. One, *Hydnobius arizonensis*, is newly recorded in Canada. *Colon* (*Myloechus*) *hubbardi* Horn is newly recorded in the Maritime Provinces (New Brunswick, Nova Scotia, Prince Edward Island). Eight species are newly recorded in New Brunswick, 29 in Nova Scotia, two on Prince Edward Island, 12 on insular Newfoundland, and five in Labrador for a total of 56 new jurisdictional records. *Catops paramericanus* Peck and Cook and *Catops simplex* Say are newly recorded from mainland Nova Scotia, and records are provided to verify the occurrence of *Leiodes impersonata* Brown and *Leiodes punctostriata* Kirby in Nova Scotia, and *Leptinillus validus* (Horn) in insular Newfoundland. Three species, *Agathidium hatchi* Wheeler, *Catops americanus* Hatch and *Sciodrepoides watsoni* (Spence), are removed from the faunal list of New Brunswick,. As a result, 66 species of Leiodidae are now recorded from Atlantic Canada. Specific details follow below.

Coloninae

Colon (Colon) arcum Peck and Stephan, 1996

NOVA SCOTIA: Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, VII.1983, R.J. Vockeroth, malaise trap, (1, CMN).

Colon arcum was recorded from Nova Scotia by Peck and Stephan 1996) based on the above record (Fig. 1). It was collected in mixed forests between June and August. In general, very little is known about the bionomics of species in the genus *Colon*. They are believed to be associated with subterranean fungi (Peck and Stephan 1996).

Table 1. Leiodidae of the Atlantic Provinces of Canada

	NS	NB	PE	NF	LB	Atlantic distribution	Regional distribution in northeastern North America
Coloninae							
Colon (Colon) arcum Peck & Stephan	1					CB	NH
Colon (Colon) asperatum Horn	1	1				MP?	MA, ME, NH, ON, QC, VT
Colon (Colon) bidentatum Sahlberg*	5	3		1		M-NS	MA, ME, NH, NY, ON, QC
Colon (Colon) horni Szymaczakowski	4	3				NS	MA, ME, NH, NY, ON, QC, VT
Colon (Colon) politum Peck & Stephan*					1	LB	
Colon (Eurycolon) magnicolle Mannerheim	3	2		1	1	W	ME, NH, ON, QC, VT
Colon (Eurycolon) oblongum Blatchley	3					M-NS	MA, NH, NY, ON, QC, VT
Colon (Myloechus) boreale Peck & Stephan	1	1				MP?	ME, NH, ON, QC
Colon (Myloechus) forceps Hatch	1					CB	ME, NH, ON, QC
Colon (Myloechus) hubbardi Horn	5			1		W ?	MA, ME, NH, ON, QC, VT
Colon (Myloechus) incisum Peck & Stephan	3					NS	ON, QC
Colon (Myloechus) schwarzi Hatch	1					CB	NH, ON, QC
Leiodinae							
Sogdini							
Hydnobius arizonensis Horn	1					CB	
Hydnobius substriatus LeConte	5			1		W?	NY, QC
Leiodini							
Anogdus dissimilis Blatchley	2			1	1	S-NS	
Anogdus potens (Brown)		1				N-NB	ME, ON
Cyrtusa subtestacea (Gyllenhal)*	3					S-NS	MA, ME, ON, QC
Leiodes assimilis (LeConte)	11	3		1		W	MA, ME, NH, NY, ON, QC, VT

	NS	NB	PE	NF	LB	Atlantic distribution	Regional distribution in northeastern North America
Leiodes collaris (LeConte)		3		1	1	W (not in NS)	MA, ME, NH, ON, QC
Leiodes contaminabilis Baranowski		1				N-NB	CT, MA, ME, NY, ON
Leiodes impersonata Brown	1	1				MP?	MA, ME, NH, ON, QC
Leiodes neglecta Baranowski	1	1				MP?	ME, ON, QC
Leiodes puncticollis (Thompson)*	1					S-NS	NH, ON, QC
Leiodes punctostriata Kirby	3	1		1	1	W	ME, NH, ON, QC, RI
Leiodes rufipes (Gebler)*	1					CB	ON
Leiodes strigata LeConte		1		1	1	N (NB, NF, LB)	MA, NH, NY, ON
Leiodes triepkei (Schmidt)*		1				N-NB	MA, NH, ON, QC, VT
Leiodes valida (Horn)	1	2		1	1	W	ON, QC
Liocyrtusa luggeri (Hatch)		1				N-NB	ON, QC
<u>Pseudoliodini</u>							
Colenis impunctata LeConte	4	1				MP?	CT, MA, ME, NH, NY, ON, QC, VT
<u>Agathiidini</u>							
Agathidium atronitens Fall	1	1				MP?	NH, NY, ON
Agathidium depressum Fall	1					CB	QC
Agathidium difforme (LeConte)	2	1				MP?	NH, ON, QC
Agathidium fawcettae Miller & Wheeler	12	3				MP	MA, NH, ON, QC
Agathidium mollinum Fall	2	1		1		W	ME, NH, ON
Agathidium oniscoides Palisot de Beauvois	2					MP?	MA, ME, NH, ON, QC
Agathidium pulchrum LeConte	1			1		W?	NH, ON, QC
Agathidium repentinum Horn				1		NF	NH
Agathidium rubellum Fall	6	1				MP	MA, NH
Agathidium rusticum Fall	4					NS	NH, NY, ON

	NS	NB	PE	NF	LB	Atlantic distribution	Regional distribution in northeastern North America
Gelae parile (Fall)	2			1		NS	NH, ON, VT
Anisotoma basalis (LeConte)	5	1		1		W	MA, ME, NH, ON, QC, RI
Anisotoma blanchardi (Horn)	8					NS	MA, NH, ON, QC
Anisotoma discolor (Melsheimer)	5					NS	MA, ME, NH, ON, QC, RI
Anisotoma errans Brown	1			1		N (NF & NS)	NH, ON, QC
Anisotoma geminata (Horn)	5					NS	ME, ON, QC, RI
Anisotoma globososa Hatch				1		NF	MA, NH, NY, ON, QC
Anisotoma inops Brown	11	1		1		W	NH, ON, QC
Anisotoma obsoleta (Horn)	7	2		1		W	ME, NH, ON, QC
Cholevinae							
Anemadini							
Nemadus brachyderus (LeConte)	1	1				MP?	MA, ME, NH, NY, ON, QC, VT
Nemadus integer Fall	1					CB	MA, ME, NH
Nemadus triangulum Jeannel	1					M-NS	CT, MA, ME, NH, NY, ON, QC
Cholevini							
Catops alsiosus alsiosus (Horn)	4	1			1	W	MA, ME, NH, NY, ON, QC
Catops americanus Hatch	8					NS	MA, NH, NY, ON, QC
Catops basilaris Say	13	6		1	1	W	MA, ME, NH, NY, ON, QC, RI
Catops egenus (Horn)					1	LB	
Catops gratiosus (Blanchard)	4					NS	ME, NH, ON, QC
Catops luridipennis Mannerheim*					1	LB	ON, QC
Catops luteipes Thomson*					1	LB	
Catops paramericanus Peck & Cook	8	3				MP	ME, NY, ON, QC
Catops simplex Say	5	3		1	1	W	CT, MA, ME, NH, NY, ON, QC, RI, VT

	NS	NB	PE	NF	LB	Atlantic distribution	Regional distribution in northeastern North America
Prionochaeta opaca (Say)	6	1	1			MP	CT, MA, ME, NH, NY, ON, QC, RI
Sciodrepoides terminans (LeConte)	10	7	1	1	1	W	CT, MA, ME, NH, NY, ON, QC, RI, VT
Sciodrepoides watsoni (Spence)*				1		NF	CT, MA, ME, NH, NY, ON, QC, RI, VT
Platypsyllinae							
Leptinillus validus (Horn)		2		1		W (not in NS)	NH, ON, QC
Platypsyllus castoris Ritsema*				1		NF	ON, QC
County Totals	198	62	2	25	14		
Species Totals	51	33	2	25	14		

Notes: Nova Scotia regions: N, Northern Shore; CB, Cape Breton; E, Eastern Shore; S, South Shore; BF, Bay of Fundy; NS, Nova Scotia; NB, New Brunswick; NF, insular Newfoundland; and LB, Labrador.*, Holarctic species.

Numbers in the table refer to the number of county records, except in the case of Newfoundland and Labrador (where counties are not employed) where they simply indicate presence. There are 18 counties in Nova Scotia (NS), 15 counties in New Brunswick (NB), and 3 counties on Prince Edward Island (PEI).

Atlantic Canada distribution: CB, Cape Breton; LB, Labrador; MP, Maritime Provinces; M-NS, Mainland Nova Scotia; N, Northern; N-NB, Northern New Brunswick; NF, Newfoundland; NS, Nova Scotia; S-NS, Southern New Brunswick; W, widespread in Atlantic Canada.

Regional distribution in northeastern North America: for the purposes of this treatment, northeastern North America is taken to consist of the following jurisdictions in addition to the Atlantic Provinces: CT, Connecticut; MA, Massachusetts; ME, Maine; NH, New Hampshire; NY, New York; ON; Ontario; QC, Québec; RI Rhode Island; PM, Saint-Pierre et Miquelon; and VT, Vermont. Only jurisdictions outside of Atlantic Canada are listed in this column.

Regional distributional information is derived from Baranowski (1993), Chandler (2001), Daffner (1988), Downie and Arnett (1996), Miller and Wheeler (2005), Peck (1991), Peck and Cook (2002, 2007), Peck and Stephan (1996), Sikes (2004), Wheeler (1979), Wheeler and Miller (2005), as well as the present study.

Colon (Colon) asperatum Horn, 1880

NEW BRUNSWICK: Kent Co.: northwest of Moncton on Rte. 116, 21.VII.1992, S. and J. Peck, car net, (1, CNC); **Westmorland Co.:** Shediac, 29.VI.1939, W.J. Brown, (1, CNC). **NOVA SCOTIA: Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 1.VII.1983, J.R. Vockeroth, malaise trap, (1, CNC); MacKenzies Mountain, Cape Breton Highlands National Park, 19.VII.1983, Y. Bousquet, pan trap, (1, CNC).

Colon asperatum was recorded from New Brunswick and Nova Scotia by Peck and Stephan (1996) (Fig. 1). It is frequents bogs and other wet places. Collections have been made between May and October (Peck and Stephan 1996).

Colon (Colon) bidentatum Sahlberg, 1834

NEW BRUNSWICK: Gloucester Co.: 7.VII.1939, 11.VII.1939, and 9.VII.1939, W.J. Brown, (4, CNC); **Kent Co.:** 60 km northwest of Moncton, Rte. 116, 21.VII.1992, S. and J. Peck, forest road, car net, (15, SBP); **York Co.:** Fredericton, 30.V.1931, R.P. Gorham, (1, CNC). **NEWFOUNDLAND:** Gander, 29.VI.1949, W.J. Brown, (5, CNC). **NOVA SCOTIA: Guysborough Co.:** Trafalgar, 19.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Halifax Co.:** Indian Lake Rd., northwest of Tantallon, 17.VII.1992, S. and J. Peck, car net, (1, SBP); **Queens Co.:** Caledonia, 25.VII.1992, J. and F. Cook, mixed forest, car net, (2, JCC); Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC); **Shelburne Co.:** Clyde River, 16.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Yarmouth Co.:** North Kemptville, 23.VIII.1992, J. and F. Cook, car net, (1, JCC); Quinan, Coldstream Rd., 19.VII.1993, J. and T. Cook, car net, (1, JCC).

This Holarctic species was recorded from New Brunswick, Newfoundland, and Nova Scotia by Peck and Stephan 1996) (Fig. 1). It is found in northern mixed and coniferous forests and at higher elevation forests in mountains (Peck and Stephan 1996).

Colon (Colon) horni Szymaczakowski, 1981

NEW BRUNSWICK: Carleton Co.: 40 km east of Bristol, Rte. 107, 22.VII.1992, S. and J. Peck, forest road, car net, (3, SBP); **Gloucester Co.:** Bathurst, 7.VII.1939, 9.VII.1939, 11.VII.1939, W.J. Brown, (21, CNC); **Kent Co.:** Kouchibouguac National Park, 21.IX.1977, D.B. Lyons, CNC; 60 km northwest of Moncton, Rte. 116, 21.VII.1992, S. and J. Peck, forest road, car net, (31, SBP). **NOVA SCOTIA: Cumberland Co.:** Wentworth Park, 12.VII.1993, J. and T. Cook, car net, JCC; Westchester-Londonderry Rd., 20.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Guysborough Co.:** Trafalgar, 19.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, vii.1983, J.R. Vockeroth, malaise trap, (1, CNC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (5, JCC); **Victoria Co.:** North Mountain, Cape Breton Highlands National Park, 1.VII.1983, 7.VII.1983 and 11.VII.1983, pan and malaise traps, (6, CNC). **Yarmouth Co.:** Carleton, Perry Rd., 18.VII.1993, J. and T. Cook, car net, (5, JCC); Coldstream Rd. east of Quinan, 19.VII.1993, J. and F. Cook, car net, (1, JCC).

This Holarctic species was recorded from New Brunswick and Nova Scotia by Peck and Stephan (1996) (Fig. 1). It was collected in forests and forested sphagnum bogs between June and August (Peck and Stephan 1996).

Colon (Colon) politum Peck and Stephan, 1996

LABRADOR: Churchill Falls, 18-26.VII.1996, R.J. Penney, pan trap, (1, CBU).

Colon politum is newly recorded in Labrador and in Atlantic Canada. It is a Holarctic species previously recorded from Alaska east to Saskatchewan (Peck and Stephan 1996). This record represents a range extension of 2,700 km to the east within North America. No specific information is available on the bionomics of this species. Many species of *Colon* are believed to be associated with subterranean fungi (Peck and Stephan 1996).

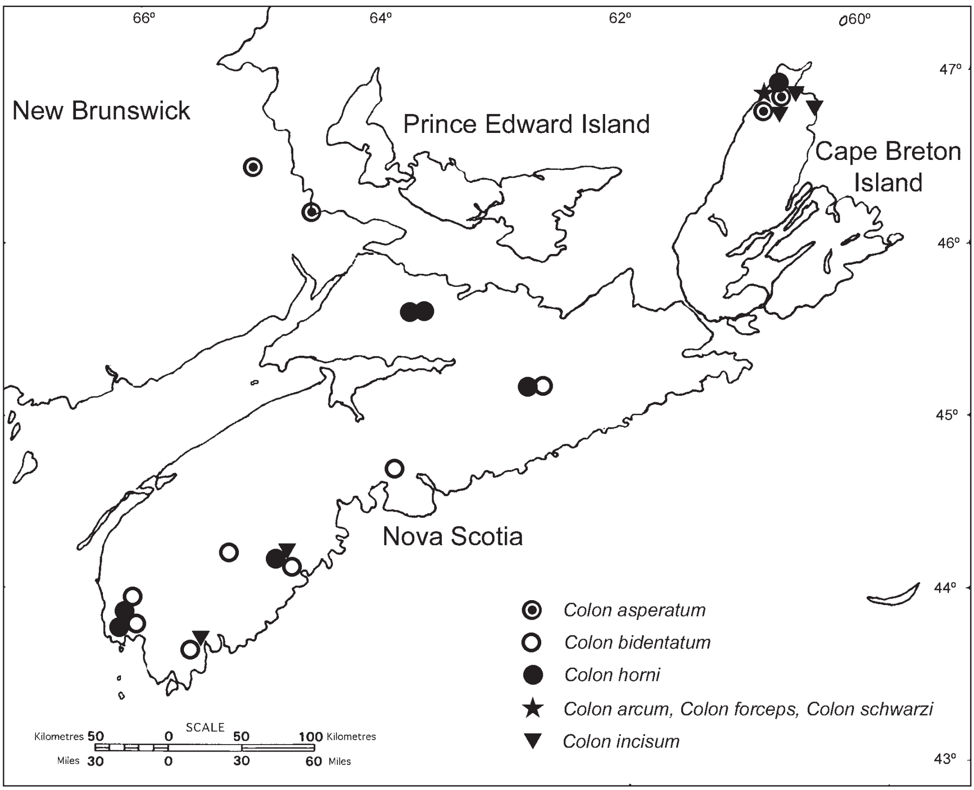

Fig. 1. Distribution of *Colon asperatum, Colon bidentatum, Colon horni, Colon arcum, Colon forceps, Colon schwarzi* and *Colon incisum* in Atlantic Canada.

Colon (Eurycolon) magnicolle Mannerheim, 1853

LABRADOR: Wahnahnish Lake near Wabush, 15-17.VII.1981, M. Colbo and D.J. Larson, (1, MUN). **NEW BRUNSWICK: Gloucester Co.**: Bathurst, 7.VII.1939, W.J. Brown, (1, CNC); **Kent Co.:** Route 116, 21.VII.1992, S. and J. Peck, forest, car net, (7, SBP). **NEWFOUNDLAND:** One hundred and fifty-eight specimens were examined from Corner Brook, Gander, Glide Lake, and St. John's. The earliest records are from 1949 (Gander, 29.VI.1949, W.J. Brown, (16, CNC); St. John's, 12.VII.1949, W.J. Brown, (1, CNC)). **NOVA SCOTIA: Cumberland Co.:** Westchester-Londonderry Rd., 20.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Guysborough Co.:** Trafalgar, 19.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 19.VI.1983, 22.VI.1983, 25.VI.1983, 28.VI.1983, VII.1983, 7.VII.1983, 11.VII.1983, 21-28.VII.1983, and 8.VI.1984, Y. Bousquet, R. Vockeroth, L. Masner, and A. Smetana, pan and malaise traps, (16, CNC).

Colon magnicolle is newly recorded from Labrador. It was previously reported from New Brunswick, insular Newfoundland, and Nova Scotia by Peck and Stephan (1996) (Fig. 2). It was found in mixed and coniferous forests and forest borders, and in leaf litter and moss between May and October (Peck and Stephan 1996).

Colon (Eurycolon) oblongum Blatchley, 1910

NOVA SCOTIA: Cumberland Co.: Wentworth Park, 12.VII.1993, J. and T. Cook, car net, (1, JCC); Westchester-Londonderry Rd., 20.VII.1992, S. and J. Peck, forest, car net, (1, SBP); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (6, JCC); **Yarmouth Co.:** Carleton, Perry Rd., 18.VII.1993, J. and T. Cook, car net, (2, JCC).

Colon oblongum was recorded from Nova Scotia by Peck and Stephan 1996) (Fig. 2). It was collected in mixed and deciduous forests and forest edges between January and October (Peck and Stephan 1996).

Colon (Myloechus) boreale Peck and Stephan, 1996

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 13.IX.1977, J.M. Campbell, CNC. **NOVA SCOTIA: Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 18-21.VII.1983, D.E. and J.E. Bright, flight-intercept trap, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 19.VIII.1983, M. Sharkey, (3, CNC); Lone Shieling, Cape Breton Highlands National Park, 8.VI.1984, A. Smetana, (2, CNC).

Colon boreale is newly recorded in Nova Scotia (Fig.2). It was reported from New Brunswick by Peck and Stephan (1996). It was found in deciduous and coniferous forests between May and December (Peck and Stephan 1996).

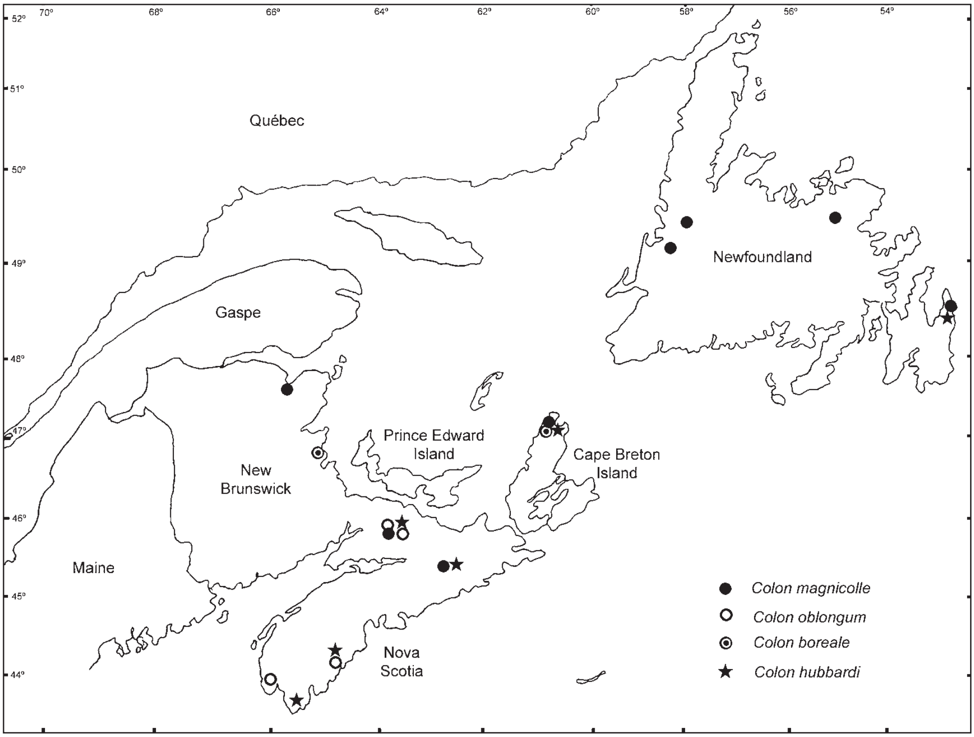

Fig. 2. Distribution of *Colon magnicolle, Colon oblongum, Colon boreale,* and *Colon hubbardi* in Atlantic Canada. Locations in Labrador are not shown.

Colon (Myloechus) forceps Hatch, 1957

NOVA SCOTIA: Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, 29-31.V.1983, L. Masner and H. Goulet, (4, CNC); Lone Shieling, Cape Breton Highlands National Park, 19.VI.193, 22.VI.1983, and 25.VI.1983, pan and malaise traps, (3, CNC); Lone Shieling, Cape Breton Highlands National Park, 28.VI.1983 and 4.VII.1983, J.R. Vockeroth, pan and malaise traps, (2, CNC); Lone Shieling, Cape Breton Highlands National Park, 6-7.VI.1983 and 11-13.VI.1983, H. Goulet, forest, malaise traps, (3, CNC).

Colon forceps is newly recorded in Nova Scotia and Atlantic Canada (Fig 1.). It is found in mixed and coniferous forests between May and November (Peck and Stephan 1996).

Colon (Myloechus) hubbardi Horn, 1880

NEWFOUNDLAND: St. John's, 12.VII.1949, W.J. Brown, (1, CNC). **NOVA SCOTIA: Cumberland Co.:** Wentworth Park, 12.VII.1993, J. and T. Cook, car net, (1, JCC); **Guysborough Co.:** Trafalgar, 19.VII.1992, S. and J. Peck, forest, car net, (1, CUC); **Inverness**

Co.: Lone Shieling, Cape Breton Highlands National Park, 4.VII.1983, J.R. Vockeroth, malaise trap, (1, CNC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC); **Shelburne Co.:** Clyde River, 16.VII.1992, S. and J. Peck, car net, (1, SBP).

Colon hubbardi is newly recorded in Nova Scotia and Atlantic Canada (Fig. 2). It was collected in a variety of open and forested habitats between March and October (Peck and Stephan 1996).

Colon (Myloechus) incisum Peck and Stephens, 1996

NOVA SCOTIA: Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, vii.1983 and 4.VII.1983, J.R. Vockeroth, malaise trap, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 25.VI.1983, Y. Bousquet, pan trap, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 5.VII.1983, L. LeSage, temporary stream in spruce forest, (1, CNC); **Yarmouth Co.:** Carleton, Perry Road, 18.VII.1993, J. and T. Cook, car net, (1, JCC).

Colon incisum is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 1). It was collected in mixed and coniferous forests between June and September (Peck and Stephan 1996).

Colon (Myloechus) schwarzi Hatch, 1933

NOVA SCOTIA: Inverness Co.: MacKenzies Mt., Cape Breton Highlands National Park, 7.VII.1983, J.R. Vockeroth, malaise trap, (1, CNC); MacKenzies Mt., Cape Breton Highlands National Park, 20.VIII.1983, M. Sharkey, pan trap, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 5.VIII.1983, D.E. and J.E. Bright, flight-intercept trap, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 19.VIII.1983 and 18-26.VIII.1983, M. Sharkey, malaise and pan traps, (2, CNC).

Colon schwarzi is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 1). It was collected in deciduous and coniferous forests and open sites between May and September (Peck and Stephan 1996).

Leiodinae

Hydnobius arizonensis Horn, 1885

NOVA SCOTIA: Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, 1.VII.1983 and 4.VII.1983, J.R. Vockeroth, malaise trap, (3, CNC); Lone Shieling, Cape Breton Highlands National Park, 18-21.VII.1983, D.E. and J.E. Bright, flight-intercept trap, (1, CNC).

Hydnobius arizonensis is reported for the first time in Canada (Fig. 3). Species of *Hydnobius* feed on subterranean fungi (Hatch 1957).

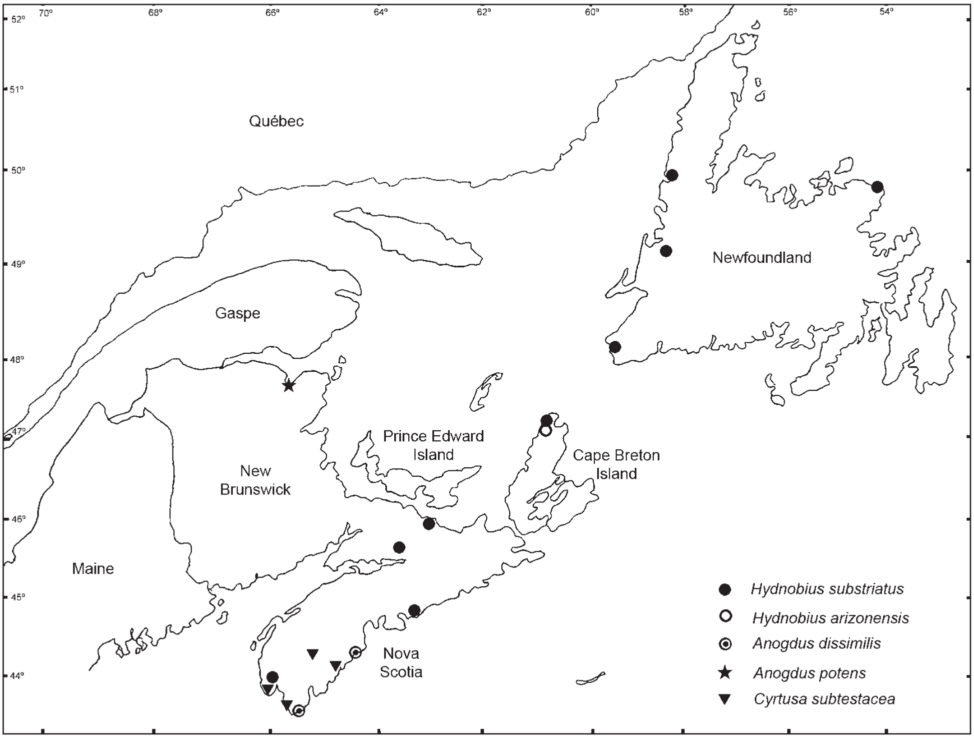

Fig. 3. Distribution of *Hydnobius substriatus, Hydnobius arizonensis, Anogdus dissimilis, Anogdus potens,* and *Cyrtusa subtestacea* in Atlantic Canada. Locations in Labrador are not shown.

Hydnobius substriatus LeConte, 1863

NEWFOUNDLAND: Corner Brook, 16.VIII.1949, E. Palmen, MZHF; Grand Codroy Provincial Park, 15.VI.1979, D.J. Larson and D. Swales, (1, MUN); Rocky Harbour, Gros Morne National Park, 3.VIII-1.IX.2001, W. Coffee, (4, MUN); NE Lumsden, Shalloway Bay, VII-VIII.2001, S.A. Pardy, (1, MUN). **NOVA SCOTIA: Colchester Co.:** Debert, 10.VI.1996, J. Ogden, (1, NSNR); **Halifax Co.:** Porter's Lake, 12.VIII.1987, B. Wright, bog, sweep net, (1, NSMC); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 28.VI.1983, 1.VII.1983, 4.VII.1983, and 11.VII.1983, J.R. Vockeroth, malaise and pan traps, (6, CNC); Lone Shieling, Cape Breton Highlands National Park, 16.VI.1983, 22.VI.1983, and 25.VI.193, Y. Bousquet, pan and flight-intercept traps, (5, CNC). **Pictou Co.:** Lyons Brook, 9.VI.1989, E. Georgeson, light trap, (1, NSNR); **Yarmouth Co.:** North Kemptville, 23.VIII.1992, J. and F. Cook, car net, (1, JCC).

Hydnobius substriatus is newly recorded in Newfoundland. It was recorded from Nova Scotia by Baranowski (1993) (Fig. 3). Species of *Hydnobius* feed on subterranean fungi (Hatch 1957).

Anogdus dissimilis Blatchley, 1916

LABRADOR: Goose Bay, 29-30.VII.1984, D.J. Larson and Morris, MUN. **NEWFOUNDLAND:** Stephenville Crossing, 6.VII.1949, E. Palmen, (1, MZHF); Lumsden, 11.VII.2001 and VII-VIII.2001, S.A. Pardy, sand dunes, (2, MUN); Grand Bay West, VII-VIII.2001, 2.VIII.2002, 4.VIII.2002, 7.VIII.2002, and 14.VIII.2002, S.A. Pardy, sand dunes, (5, MUN); Cape Freels, VII-VIII.2001, 10.VII.2001, 12.VII.2001, 15.VIII.2001, S.A. Pardy, sand dunes, (5, MUN). **NOVA SCOTIA: Lunenburg Co.:** Crescent Beach, 20.VII.1956, E.L. Bousfield, (1, CNC); **Shelburne Co.:** Sebim Beach, 19.VII.1993, J. and T. Cook, (1, JCC).

Anogdus dissimilis is newly recorded in Labrador, Newfoundland, Nova Scotia, and Atlantic Canada (Fig. 3). Little is known about the fungal associations of this genus (Zeran et al. 2007). All the specimens collected in this region were found in sand dunes and other coastal habitats.

Anogdus potens (Brown, 1932)

NEW BRUNSWICK: Gloucester Co.: Bathurst, 7-11.VII.1939, W.J. Brown, (42, CNC).

Anogdus potens is newly recorded in New Brunswick and Atlantic Canada (Fig. 3). These specimens were reported by Daffner (1988), however, the records were erroneously ascribed to Ontario rather than New Brunswick.

Cyrtusa subtestacea (Gyllenhal, 1813)

NOVA SCOTIA: Queens Co.: Caledonia, 25.VII.1992, J. and F. Cook, mixed forest, car net, (1, JCC); Medway River, 13.VII.1993, J. and T. Cook, car net, (14, JCC); Yarmouth Co.: Carleton, Perry Road, 18.VII.1993, J. and T. Cook, car net, (1, JCC); Carleton, Perry Road, 22.VIII.1992, J. and F. Cook, car net, (1, JCC); Yarmouth-Shelburne Co.: Oak Park Road, 27.VIII.1992, J. and F. Cook, car net, (1, JCC).

This Holarctic is species newly recorded in Nova Scotia and Atlantic Canada (Fig. 3). No information on bionomics of this species is available.

Leiodes assimilis (LeConte, 1850)

NEWFOUNDLAND: Cow Head, 9.VIII.1949, E. Palmen, (1, MZHF); Corner Brook, 16.VII.1949, E. Palmen, (1, MZHF); Humber, Steady Brook, 10.VII.1949, E. Palmen, (1, MZHF); Glide Lake, 8.IX.1993, 10.VIII.1994, 23.VIII.1994, 15.IX.1994, W. Bowers, balsam fir burn, (4, CFNL). **NOVA SCOTIA: Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 12.VIII.1983, 11-19.VII.1983, 28.VI.1983, 1.VII.1983, 16.VI.1983, 19,VI.1983, 22.VI.1983, 25.VI.1983, J.E.H.

and R.J. Martin, L. Masner, J.R. Vockeroth, and Y. Bousquet, malaise and pan traps, (15, CNC); MacKenzies Mt., Cape Breton Highlands National Park, 29.VII.1983, 2.VIII.1983, 18-21.VII.1983, and 28.VI.1983, D.E. and J.E. Bright, J.R. Vockeroth, malaise and pan traps, (10, CNC); North Mt., Cape Breton Highlands National Park, 11.VII.1983, J.R. Vockeroth, pan trap, (1, CNC). **Victoria Co.:** North Paquets Lake, Cape Breton Highlands National Park, 25.VI.1983, Y. Bousquet, pan trap, (1, CNC).

Leiodes assimilis was recorded from New Brunswick, Newfoundland, Labrador, and Nova Scotia by Baranowski (1993) (Fig. 4). It is found in open country and forests, especially relatively open deciduous forests, and is a good flyer (Baranowski 1993). In Nova Scotia, it is found in both coniferous and mixed coastal forests. Of particular note is an isolated population on Sable Island that occurs in sand-dune environments (Howden 1970).

Leiodes collaris (LeConte, 1850)

LABRADOR: Wahnahnish Lake near Wabush, 15-17.VII.1981, M. Colbo and D.J. Larson, (11, MUN). **NEWFOUNDLAND:** Gambo, 25.VIII.1949, E. Palmen, (1, MZHF); Kitty's Brook, 18.VIII.1949, E. Palmen, MZHF; Come-by-Chance, 27.VIII.1949, E. Palmen, (1, MZHF).

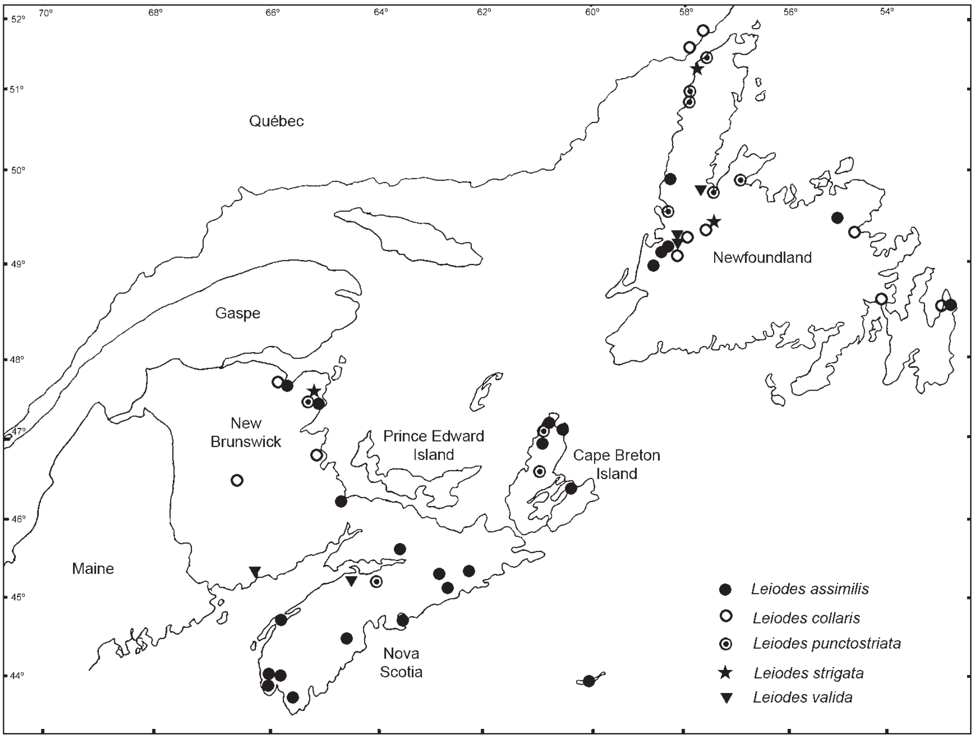

Fig. 4. Distribution of *Leiodes assimilis, Leiodes collaris, Leiodes punctostriata. Leiodes strigata,* and *Leiodes valida* in the Atlantic Provinces. Some locations in Labrador are not shown.

Leiodes collaris was recorded from Labrador, New Brunswick, and Newfoundland by Baranowski (1993) (Fig. 4). It is found in open country, especially on sandy or gravelly soils with low vegetation (Baranowski 1993).

Leiodes contaminabilis Baranowski, 1993

NEW BRUNSWICK: Northumberland Co.: Tabusintac, 20.VI.1939, W.J. Brown, (1, CNC).

Leiodes contaminabilis was recorded from New Brunswick by Baranowski (1993) based on the above record (Fig. 5). The bionomics of the species are completely unknown (Baranowski 1993).

Leiodes impersonata Brown, 1932

NOVA SCOTIA: Victoria Co.: 3 km west of Paquets Lake, Cape Breton Highlands National Park, 17.IX.1984, J.M. Campbell and A. Davies, sifting moss, (3, CNC).

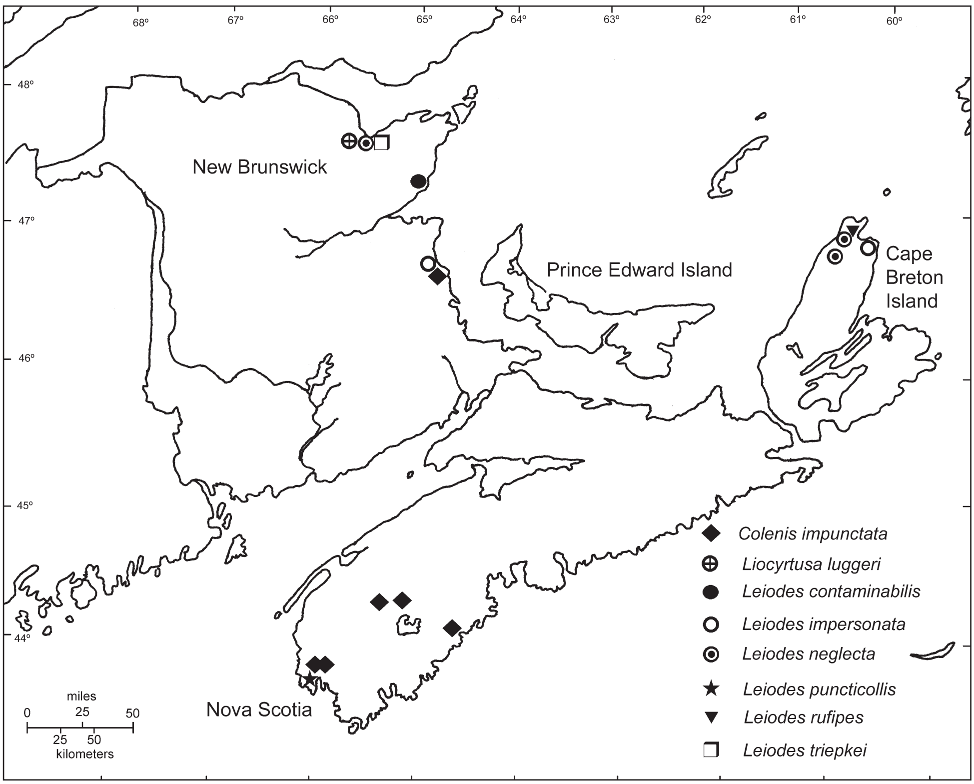

Fig. 5. Distribution of *Colenis impunctata, Liocyrtusa luggeri, Leiodes contaminabilis, Leiodes impersonata, Leiodes neglecta, Leiodes puncticollis, Leiodes rufipes,* and *Leiodes triepkei* in Atlantic Canada.

Although *Leiodes impersonata* was reported for Nova Scotia by Peck (1991), it was not recorded from the province by Baranowski (1993) in his revision of the genus *Leiodes*. The above record establishes the presence of the species in Nova Scotia. It was recorded from New Brunswick by Baranowski (1993) (Fig. 5). Most species of *Leiodes* are believed to feed on subterranean fungi. The identity of these fungi is unknown (Baranowski 1993). It is found along small roads or trails in deciduous forests, especially with rather sandy (but not dry) soil and rich vegetation (Baranowski 1993).

Leiodes neglecta Baranowski, 1993

NOVA SCOTIA: Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, 19.VIII.1983, M. Sharkey, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 21-28.VII.1983, L. Masner, pan trap, (1, CNC); MacKenzies Mt., Cape Breton Highlands National Park, 9.VIII.1983 and 15.VIII.1983, J.E.H. and R.J. Martin, (2, CNC); MacKenzies Mt., Cape Breton Highlands National Park, 20.VIII.1983, M. Sharkey, pan trap, (1, CNC).

Leiodes neglecta is newly recorded from Nova Scotia. It was recorded from New Brunswick by Baranowski (1993) (Fig. 5). A few specimens have been collected in deciduous or mixed forests; otherwise, the bionomics are completely unknown (Baranowski 1993).

Leiodes puncticollis (Thompson, 1862)

NOVA SCOTIA: Yarmouth Co.: Wellington, 12-20.VIII.1991, J. Cook, coastal forest, flight intercept trap, (2, JCC); Wellington, 15-24.VII.1993, J. and T. Cook, mixed coastal forest, (2, JCC).

This Holarctic species is newly recorded in Nova Scotia and Atlantic Canada (Fig. 5). It is predominantly found in mixed forests, in moss and dead leaves. It is an excellent flyer and many have been collected in malaise and flight-intercept traps (Baranowski 1993).

Leiodes punctostriata Kirby, 1837

NEWFOUNDLAND: Daniels Harbour, 22-23.VII.1949, E. Palmen, (4, MZHF); Eddies Cove West, 28.VII.1949, E. Palmen, (3, MZHF); Port au Choix, 4-5.VIII.1949, E. Palmen, MZHF; Port Saunders, 5.VIII.1949, E. Palmen, (10, MZHF); Bonne Bay, Lomond, 15.VII.1949, E. Palmen, (1, MZHF). **NOVA SCOTIA: Hants Co.:** Smiley's Park, 6.VII.2005, J. Ogden, flight-intercept trap, NSNR; Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, 11-18.VII.1983, 19.VI.1983, 18-21. VII.1983, 27-29.VIII.1983, 16.VI.1983, and 11.VII.1983, L. Masner, Y. Bousquet, D.E. and J.E. Bright, M. Sharkey, and J.R. Vockeroth, pan, malaise, and flight-intercept traps, (9, CNC); **Victoria Co.:** Cape Breton Highlands: Kelly Rd., 10.VII.2005, J. Ogden and K. Godwin, (1, NSNR).

Leiodes punctostriata was recorded from Labrador, New Brunswick, and Newfoundland by Baranowski (1993) (Fig. 4). Although it was reported for Nova Scotia by Peck (1991), it was not recorded from the province by Baranowski (1993). The above records establish its presence in Nova Scotia. It is probably a forest species found in deciduous forests (Baranowski 1993).

Leiodes rufipes (Gebler, 1833)

NOVA SCOTIA: Inverness Co.: Lone Shieling, Cape Breton Highlands National Park, 4.VII.1983, R. Vockeroth, pan trap, (1, CNC).

This Holarctic species is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 5). It is found mainly in woodland sites such as forest meadows, along trails and small forest roads, and in shrubbery along riverbanks (Baranowski 1993).

Leiodes strigata LeConte, 1850

LABRADOR: Wahnahnish Lake near Wabush, 15-17.VII.1981, M. Colbo and D.J. Larson, (1, MUN). **NEWFOUNDLAND:** Kittys Brook, 18.VIII.1949, E. Palmen, (1, MZHF); St. Barbe, 26.VII.1949, E. Palmen, (1, MZHF).

Leiodes strigata is newly recorded in Labrador and Newfoundland (Fig. 4). It was found in meadows along small roads or trails in deciduous forests and also in litter along a creek in a mixed forest (Baranowski 1993).

Leiodes triepkei (Schmidt, 1841)

NEW BRUNSWICK: Gloucester Co.: Bathurst, 9-11.VII.1939, W.J. Brown, (4, CNC).

This Holarctic species was recorded from New Brunswick by Baranowski (1993) based on the above record (Fig. 5). It apparently prefers rather sandy habitats, e.g., sandy meadows with low vegetation, clearing, forest plantations, or other open country, and is rarely found in forests (Baranowski 1993).

Leiodes valida (Horn, 1880)

LABRADOR: Otter Creek, 27.VII.1986, K.E. Pardy, (1, CFNL). **NEWFOUNDLAND:** Daniels Harbour, 22-23.VII.1949, E. Palmen, (1, MZHF); Pasedena, 20.VIII.1980, F. Walsh, (1, CFNL); Glide Lake, 31.VIII.1993, 29.IX.1993, 23.VII.1994, 3.VIII.1994, 23.VIII.1994, W. Bowers, balsam fir burn, (11, CFNL). **NOVA SCOTIA:** Kings Co.: Kentville, 25.IX.2002, D.H. Webster, flying in yard, (1, DHWC).

Leiodes valida is newly recorded in Labrador, Newfoundland, and Nova Scotia. It was recorded from New Brunswick by Baranowski (1993) (Fig. 4). It is the largest North American species in the genus *Leiodes*. Nothing is known of its bionomics (Baranowski 1993).

Liocyrtusa luggeri (Hatch, 1927)

NEW BRUNSWICK: Gloucester Co.: Bathurst, 9.VII.1939 and 11.VII.1939, W.J. Brown, (3, CNC).

Liocyrtusa luggeri was reported from New Brunswick by Peck (1991) (Fig. 5). Species of *Liocyrtusa* are found in forest litter but not on fungi on fallen trees. They may be associated with subterranean fungi (Hoshina and Kanno 2002; H. Hoshino, pers. comm.).

Colenis impunctata LeConte, 1853

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 20.IX.1977, J.M. Campbell and A. Smetana, (6, CNC); Kouchibouguac National Park, 21.IX.1977, A. Smetana, (1, CNC). **NOVA SCOTIA: Annapolis Co.:** Big Dam Lake, Cape Breton Highlands National Park, 27.VI-7.VII.2004, H. Love, hemlock forest, pitfall trap, (1, CGMC); **Queens Co.:** Caledonia, 25.VII.1992, J. and F. Cook, mixed forest, car net, (2, JCC); Medway River, 13.VII.1993, J. and T. Cook, mixed forest, car net, (7, JCC); **Yarmouth Co.:** Carleton, Perry Rd., 22.VIII.1992, J. and T. Cook, mixed forest, car net, (2, JCC); Carleton, Perry Rd., 18.VII.1992, J. and T. Cook, mixed forest, car net, (4, JCC); North Kemptville, 23.VIII.1992, J. and F. Cook, mixed forest, car net, (1, JCC).

Colenis impunctata was reported from Nova Scotia and New Brunswick by Peck (1998) (Fig. 5). It is found in forested habitats in leaf or log litter, especially in association with rotting soft fungi. It was collected between March and October (Peck 1998).

Agathidium atronitens Fall, 1934

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 20.IX.1977, J.M. Campbell and A. Smetana, (6, CNC); Kouchibouguac National Park, 21.IX.1977, J.M. Campbell, (1, CNC). **NOVA SCOTIA: Inverness Co.:** MacKenzies Mountain, 25.VI.1983, Y. Bousquet, pan trap, (1, CNC).

Agathidium atronitens is newly recorded in New Brunswick, Nova Scotia, and Atlantic Canada (Fig. 6). It was recorded from both deciduous and coniferous forests. There is a single host record from *Trametes versicolor* (Fr.) Pil. (Polyporaceae) (Miller and Wheeler 2005).

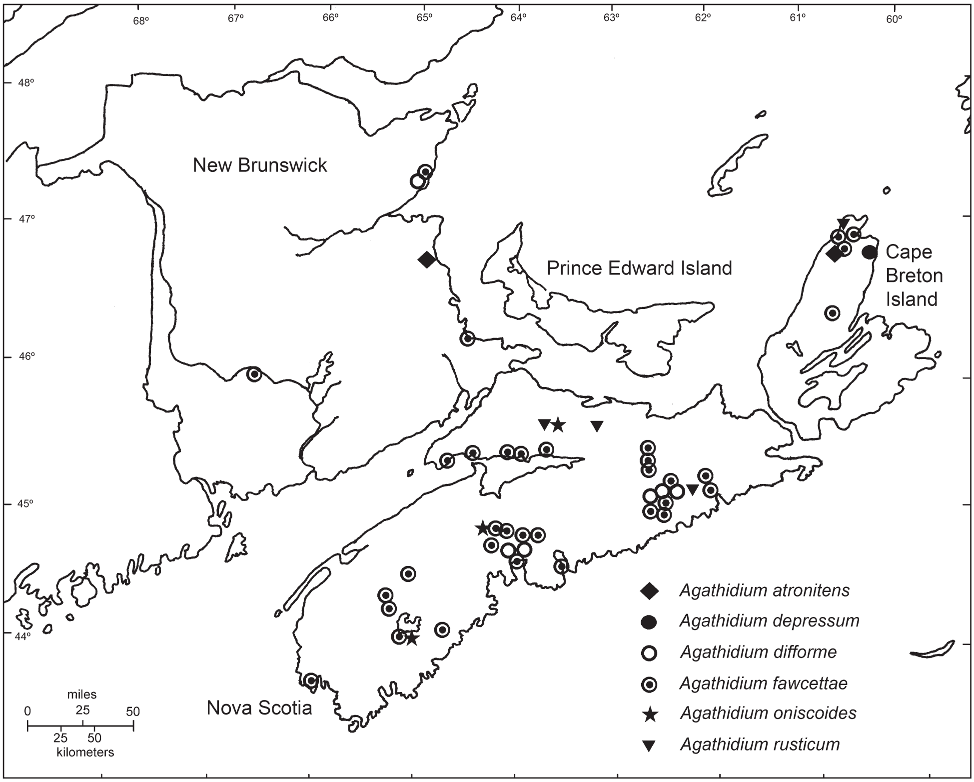

Fig. 6. Distribution of *Agathidium atronitens, Agathidium depressum, Agathidium difforme, Agathidium fawcettae, Agathidium oniscoides,* and *Agathidium rusticum* in Atlantic Canada.

Agathidium depressum Fall, 1934

NOVA SCOTIA: Victoria Co.: Still Brook, Cape Breton Highlands National Park, 5.VII.1983, L. LeSage, temporary stream in spruce forest, (1, CNC).

Agathidium depressum is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 6). It was collected from a variety of litter sources including rotten logs and pine duff. In Alaska, it was collected on the slime molds (myxomycetes) *Stemonitis fusca* Roth and *Badhamia* sp. (Wheeler and Miller 2005).

Agathidium difforme (LeConte, 1850)

NEW BRUNSWICK: Northumberland Co.: Tabusintac, 18.VI.1939, W.J. Brown, (1, CNC). **NOVA SCOTIA: Guysborough Co.:** George Lake, 15-30.VI.1997, D.J. Bishop, red spruce forest, (1, NSMC); **Halifax Co.:** Big St. Margarets Bay, 1-16. VII.1997, D.J. Bishop, red spruce forest, (1, NSMC); Moser Lake, 2-15.VI.1997, D.J. Bishop, red spruce forest, (1, NSMC); Pogwa Lake, 15-30.VI.1987, D.J. Bishop, red spruce forest, (1, NSMC); Ten Mile Lake, 15-30.VI.1997, D.J. Bishop, red spruce forest, (2, NSMC).

Agathidium difforme is newly recorded in New Brunswick, Nova Scotia, and in Atlantic Canada (Fig. 6). It was collected in fir, pine, spruce, birch, maple, and poplar forests. Host records include the slime molds *Stemonitis* sp. and a "red, tubular slime mold" (Miller and Wheeler 2005). All the specimens collected in Nova Scotia were found in red spruce forests.

Agathidium fawcettae Miller and Wheeler, 2005

NEW BRUNSWICK: Northumberland Co.: Tabusintac, 19.VI.1939, 20.VI.1939, W.J. Brown, (2, CNC); **York Co.:** Fredericton, 2.VII.1928, W.J. Brown, (1, CNC); **Westmorland Co.:** Shediac, 4.VII, 1939, W.J. Brown, (1, CNC). **NOVA SCOTIA:** One hundred and forty specimens were examined from Annapolis, Colchester, Cumberland, Guysborough, Halifax, Inverness, Lunenburg, Pictou, Queens, Victoria, and Yarmouth counties. The earliest record is from 1929 (**Colchester Co.:** Portapique, 25.VIII.1929, C.A. Frost, (1, CNC)).

Agathidium fawcettae is newly recorded in New Brunswick. It was reported from Nova Scotia by Miller and Wheeler (2005) (Fig. 6). It was collected throughout the year in coniferous and deciduous forests from a wide variety of litter types. In Nova Scotia, it was found in variously aged deciduous forests (red maple, red oak, birch), in coniferous forests (red spruce, black spruce, hemlock, balsam fir), and in mixed and coastal forests. It was collected with flight-intercept traps, pitfall traps, and by hand collecting. There is one record from leaf litter, and one specimen found in a decomposing red spruce log. Recorded hosts include the slime molds *Fulgio septica* (L.) Wigg., *Physarum viride* (Bull.) Pers., *Leocarpus fragilis* (Dicks.) Rost., *Hemitrichia clavata* (Pers.) Rostaf., and *Badhamia* sp. (Miller and Wheeler 2005).

Prior to the description of this species, several specimens in this series had been identified as *Agathidium exiguum* Melsheimer. These two species can only be reliably separated on the basis of the features of male genitalia. All the males examined and micro-dissected as part of this study proved to be *A. fawcettae*. Accordingly, the present authors conclude that there is no evidence that *A. exiguum* occurs in the region. Miller and Wheeler (2005) reported *A. exiguum* in North America east to Ontario and north to New Hampshire.

Agathidium hatchi Wheeler, 1977

Agathidium hatchi was reported by Miller and Wheeler (2005) from a series of female specimens collected in northwestern Oregon and a single male specimen apparently collected in Frederickton (sic), New Brunswick (20.III.1961, R.C. Clark, Utah State University). Miller and Wheeler (2005: 21) wrote, that "The distribution of the species is unusual in that specimens are known from Oregon and New Brunswick, but from nowhere in between. The Oregon specimens (including the type) are females and the New Brunswick specimen is a male. Therefore, there is some possibility the specimens represent different species ...," and "It is also possible that the New Brunswick specimen is mislabeled."

The preponderance of evidence indicates that the record from New Brunswick is erroneous and resulted from a mislabeled specimen. Several reasons indicate this:

a) for most of his career R.C. Clark worked on control of balsam wooly adelgid [*Adelges piceae* (Ratzeburg)] and he never conducted research on Coleoptera (W. Varty, pers. comm.);

b) the weather conditions on 20 March, 1961 Fredericton were fully winter-like. Temperatures ranged from -12.8°C (low) to -2.2°C (high) and there was 64 cm of snow on the ground (National Climate Archive 2007), highly improbable circumstances in which to find a slime mold beetle such as *Agathidium*;

c) if R.C. Clark (who worked for the Canadian Forestry Service) had collected any *Agathidium* specimens incidentally as part of his research, some specimens would have been deposited in the Atlantic Forestry Centre research collection in Fredericton. There are no such specimens in the collection (G. Smith and J. Sweeney, pers. comm.);

d) R.C. Clark lived in Fredericton for over three decades and it is highly unlikely that he would misspell the name of the capital city of New Brunswick as "Frederickton";

e) in the 1960s there were no scientific exchanges or research programs between Atlantic Forestry Centre and Utah State University (W. Varty, pers. comm.).

Thus, there is no evidence that would indicate that this specimen was actually collected in New Brunswick. Accordingly, we remove this species form the New Brunswick faunal list.

Agathidium mollinum Fall, 1934

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 13.IX.1977, J.M. Campbell, CNC. **NEWFOUNDLAND:** Little Grand Lake, 2 km east of Martin Pond, 15.VII-25.VIII.1992, old fir forest, pitfall trap, (1, MUN). **NOVA SCOTIA: Guysborough Co.:** Seloam Lake, 2-15.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Inverness Co.:** MacKenzies Mtn., 4.VI.1983, R. Vockeroth, pan trap, (1, CNC); MacKenzies Mtn., 27-29.VIII.1983, M. Sharkey, (1, CNC); MacKenzies Mtn., 18.IX.1983, J.M. Campbell and A. Davies, sifting mosses, (1, CNC); **Victoria Co.:** North Mtn., VIII.1983, D.E. and J.E. Bright, (1, CNC); **Yarmouth Co.:** Wellington, 12-20.VIII.1991, J. Cook, coastal forest, flight-intercept trap, (1, JCC).

Agathidium mollinum is newly recorded in New Brunswick, Newfoundland, Nova Scotia, and in Atlantic Canada (Fig. 7). It was recorded from birch, fir, maple, and conifer litter and from a fern rhizome. Host records include the slime molds *Cribraria purpurea* Schrad., *Diderma floriforme* (Bull.) Pers., and *Stemonitis axifera* (Bull.) T. Macabr. (Miller and Wheeler 2005).

Agathidium oniscoides Palisot de Beauvois, 1817

NOVA SCOTIA: Cumberland Co.: Wentworth, 21.V.1965, B. Wright, (1, NSMC); **Queens Co.:** Sixth Lake, 18.VI.2003, P. Dollin, old-growth hemlock forest, pitfall trap, (1, NSMC).

Agathidium oniscoides is newly recorded in Nova Scotia and in Atlantic Canada as a whole (Fig. 6). This species was collected throughout the year (except for January) in various deciduous forest habitats in leaf and log litter samples. Host records include the fungi *Bjerkandera adusta* (Fr.) Kar., and "fleshy fungi," and the slime molds *Fulgio septica*, *Ceratiomyxa fruticulosa* (Müll.) Mac., and other myxomycetes (Miller and Wheeler 2005). The Nova Scotia record in an old-growth hemlock forest is noteworthy.

Agathidium pulchrum LeConte, 1853

NEWFOUNDLAND: Burgeo, Grandy Brook, 24.VI.1949, E. Palmen, (1, MZHF); Stephenville: Barachois Pond Park, 23.VII-19.VIII.1997, S. and J. Peck, fir-deciduous forest, flight-intercept trap, (1, MUN). **NOVA SCOTIA: Yarmouth Co.:** Cape Forchu, West Cape, 28.VI-4.VII.1995, J. and F. Cook, flight-intercept trap, (1, JCC).

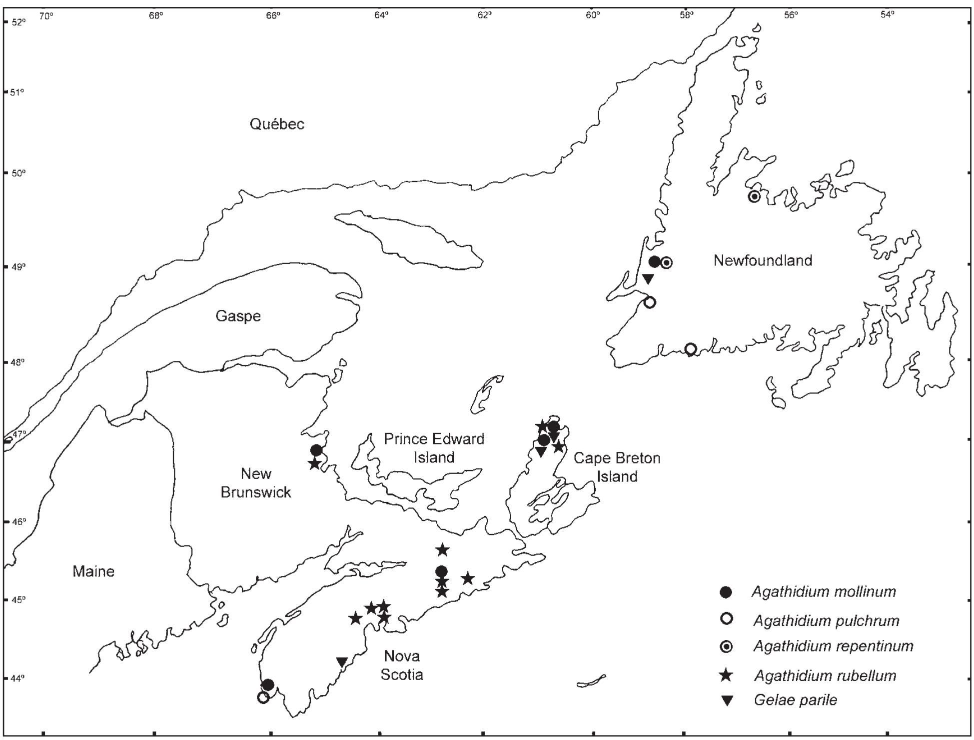

Fig. 7. Distribution of *Agathidium mollinum, Agathidium pulchrum, Agathidium repentinum, Agathidium rubellum,* and *Gelae parile* in Atlantic Canada.

Agathidium pulchrum is newly recorded in Newfoundland, Nova Scotia, and in Atlantic Canada as a whole (Fig. 7). It has been collected in many different coniferous and deciduous forests, from moss duff, and in riparian areas between May and September. Host records include the slime molds *Arcyria nutans* (Bull.) Grev., *Comatrichia* sp., *Stemonitis flavogenita* E. Jahn, *Trichia decipiens* (Meyl.) Y. Yamam, and *Tubifera ferruginosa* (Batsch) J.F. Gmelin, and the fungi *Lenzites betulina* (Fr.) Fr., *Tramates versicolor* (Fr.) Pil., and *Stereum* sp. (Miller and Wheeler 2005).

Agathidium repentinum Horn, 1880

NEWFOUNDLAND: Little Grand Lake, 2 km east of Martin Pond, 24.VI-15.VII.1992 and 15.VII-25.VIII.1992, old fir forest, pitfall trap, (3, MUN); Little Grand Lake, Bakeapple Brook, 24.VI-15.VII.1992 and 15.VII-25.VIII.1992, old fir forest, pitfall trap, (2, MUN); South Pond near South Brook, 11.VI.1979, D.J. Larson and D. Swales, (2, MUN).

Agathidium repentinum is newly recorded in Newfoundland and in Atlantic Canada (Fig. 7). This northern species was collected in conifer, poplar, and taiga-willow forests in leaf litter, *Sphagnum* moss, and on moose dung (Miller and Wheeler 2005).

Agathidium rubellum Fall, 1934

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, 16.VII.1977, I. Smith, (1, CNC). **NOVA SCOTIA: Guysborough Co.:** George Lake, 1-16.VII.1997, D.J. Bishop, red spruce forest (2, NSMC); **Halifax Co.:** Big St. Margarets Bay, 15-30.VII.1997, D.J. Bishop, old-growth red spruce forest, (2, NSMC); Campbell Hill, 15-30.VI.1997 and 1-16.VII.1997, D.J. Bishop, mature red spruce forest, (2, NSMC); Lake Little, 1-16.VII.1997, D.J. Bishop, red spruce forest, (2, NSMC); Pockwock Lake, 1-16.VII.1997, D.J. Bishop, mature red spruce forest, (2, NSMC); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 20.VII.1983, D.E. and J.E. Bright, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 19.VI.1983, Y. Bousquet, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 19.VIII.1983, M. Sharkey, (1, CNC); **Lunenburg Co.:** Card Lake, 15-30.VI.1997 and 1-16.VII.1997, D.J. Bishop, old-growth red spruce/hemlock forest, (2, NSMC); Pictou Co.: 1-16.VII.1997, D.J. Bishop, mature red spruce/hemlock forest, (1, NSMC); **Victoria Co.:** Beulach Ban Falls, Cape Breton Highlands National Park, 13.VI.1983, A. Smetana, (1, CNC).

Agathidium rubellum is newly recorded in New Brunswick. It was reported from Nova Scotia by Miller and Wheeler (2005) (Fig. 7). It was found in eastern hardwood forests in leaf and log litter. There are host records from *Tubifera ferruginea* (Miller and Wheeler 2005). Specimens in Nova Scotia were collected in red spruce, eastern hemlock, and deciduous forests.

Agathidium rusticum Fall, 1934

NOVA SCOTIA: Colchester Co.: Nuttby Mt., 1.VI.1995, C. Corkum, old deciduous forest, flight-intercept trap, (1, NSMC); **Cumberland Co.:** Wentworth, 21.V.1965, B. Wright, (1, NSMC); **Guysborough Co.:** George Lake, 14.V-2.VII.1997, D.J. Bishop, young red spruce forest, flight-intercept trap, (1, NSMC); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 11-18.VII.1983, L. Masner, flight-intercept trap, (1, CNC).

Agathidium rusticum is newly recorded in Nova Scotia, and the Atlantic Provinces (Fig. 6). In Nova Scotia, it was collected in both coniferous and deciduous forests. No other information on the bionomics of the species is available.

Gelae parile (Fall, 1934)

NEWFOUNDLAND: Spruce Brook, 9.VII.1949, E. Palmen, (2, MZHF). **NOVA SCOTIA: Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, vii.1983, R. Vockeroth, malaise trap, (2, CNC); MacKenzies Mtn., Cape Breton Highlands National Park, 11-18.VII.1983, R. Vockeroth, pan trap, (2, CNC); **Queens Co.:** Medway River, 13.VII.1993, J and T. Cook, car net, (2, JCC).

Gelae parile is newly recorded in Newfoundland, Nova Scotia, and in Atlantic Canada as a whole (Fig. 7). It was collected in hemlock, pine, aspen, fir, maple, and other forests from a variety of litter sources such as rotting stumps, and leaf litter. There are host records from the slime molds *Cribraria* sp. and *Dictydium cancellatum* (Batch) McBride (Miller and Wheeler 2004).

Anisotoma basalis (LeConte, 1853)

NEW BRUNSWICK: Charlotte Co.: St. George, 5.VII.1963, R.C. Clarke, window trap, (1, CFNL). **NEWFOUNDLAND:** 30 miles south of Glenwood, 22.VI.1988, (1, MUN); Baie Verte, 20.VI.1988 and 22.VI.1988, P. Dixon, malaise trap, (2, CFNL). **NOVA SCOTIA: Halifax Co.:** Abraham Lake, 16-29.VII.1997, D.J. Bishop, old-growth red spruce forest, flight-intercept trap, (1, NSMC); Pockwock Lake, 15-30. VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 11-13.VI.1983, H. Goulet, forest, malaise trap, (1, CNC); Lone Shieling, Cape Breton Highlands National Park, 11.VII.1983, J.R. Vockeroth, forest, malaise trap, (1, CNC); MacKenzies Mountain, Cape Breton Highlands National Park, 19.VI.1983, Y. Bousquet, pan trap, (1, CNC); MacKenzies Mountain, Cape Breton Highlands National Park, 7.VII.1983, J.R. Vockeroth, malaise trap, (3, CNC); **Lunenburg Co.:** Card Lake, 16-29.VII.1997, D.J. Bishop, old-growth red spruce-hemlock forest, flight-intercept trap, (1, NSMC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC); **Yar-**

mouth Co.: Wellington, 15-24.VII.1993, J. and T. Cook, flight-intercept trap, (1, JCC); Wellington, 1-7.VI.1993, J. and T. Cook, mixed coastal forest, flight-intercept trap, (2, JCC).

Anisotoma basalis is newly recorded in New Brunswick and Newfoundland (Fig. 8). It is listed as occurring in Nova Scotia by Peck (1991). Adults have been found between April and September. Slime mold hosts include *Stemonitis axifera, S. fusca, Stemonitis splendens* Rostaf, and *Fuligo* sp. (Wheeler 1979).

Anisotoma blanchardi (Horn, 1880)

NOVA SCOTIA: Annapolis Co.: Channel Lake, 6-17.VII.2005, S. Poirier, maple-oak-birch forest, (1, CGMC); **Colchester Co.:** Debert, 17.VI.1993, E. Georgeson, (1, NSNR); **Cumberland Co.:** Spencer's Island, 29.VI.1995, C. Corkum, old coniferous forest, flight-intercept trap, (1, NSMC); Westchester-Londonderry, 20.VII.1992, S. and J. Peck, forest road, car net, (1, JCC); **Guysborough Co.:** George Lake, 1-16. VII.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Halifax Co.:** Abraham's Lake, 1-16.VII.1997, D.J. Bishop, old-growth red spruce forest, flight-

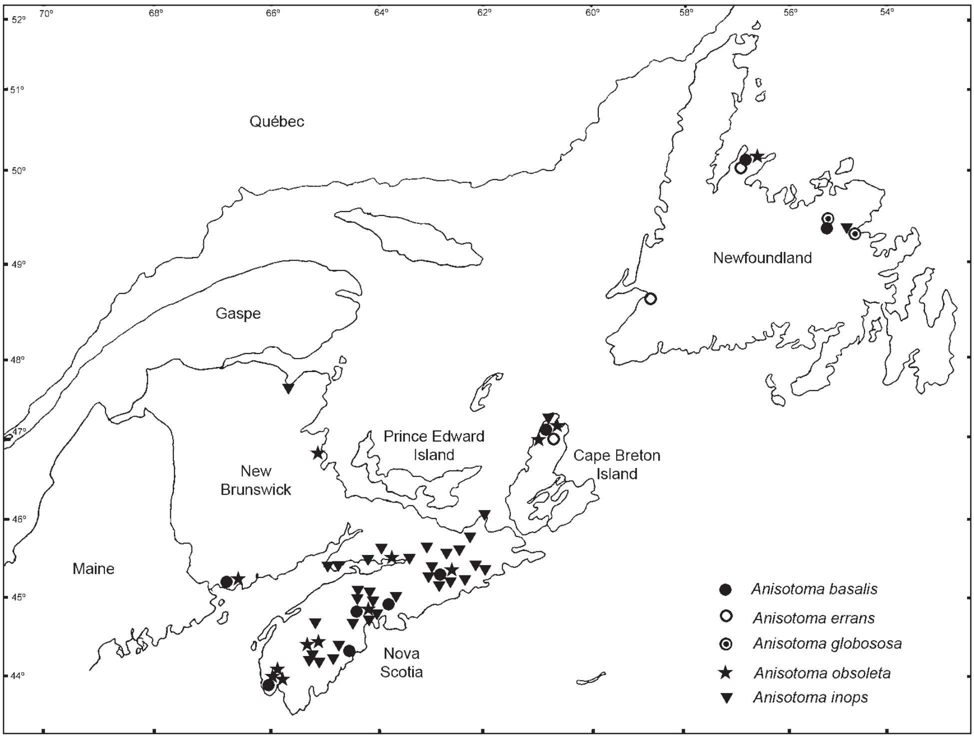

Fig. 8. Distribution of *Anisotoma basalis, Anisotoma errans, Anisotoma globososa, Anisotoma obsoleta,* and *Anisotoma inops* in Atlantic Canada.

intercept trap, (1, NSMC); Pockwock Lake, 20.VII.1970, P. Doleman, in moss in decaying stump, (1, NSMC); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 1.VII.1983, 4.VII.1983, 11.VII.1983, and VII.1983, J.R. Vockeroth, forest, malaise trap, (6, CNC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (4, JCC); **Yarmouth Co.:** Wellington, 1-7.VI.1999, J. Cook, mixed coastal forest, flight-intercept trap, (1, JCC).

Anisotoma blanchardi is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 9). It was collected between May and September in log and forest floor litter. Slime mold hosts include *Stemonitis fusca*, *Metatricha* sp., and *Lycogola* sp. (Wheeler 1979).

Anisotoma discolor (Melsheimer, 1844)

NOVA SCOTIA: Annapolis Co.: Channel Lake, Kejimkujik National Park, 13-21. VIII.2005, R. Ewing, maple-oak-birch forest, pitfall trap, (1, CGMC); Channel Lake, Kejimkujik National Park, 6-17.VII.2005, S. Poirier, maple-oak-birch forest, pitfall trap, (1, CGMC); Durland Lake, 3.VIII.2003, P. Dollin, hemlock-black spruce-balsam fir forest, in decaying red maple log, (1, NSMC); **Digby Co.:** Kejimkujik National Park: Pebbleloggitch Lake, 28.VI-7.VII.2004, H. Love, maple-oak-birch forest, pitfall trap, (1, CGMC); **Inverness Co.:** MacKenzies Mountain, Cape Breton Highlands National Park, 19-21.VII.1983, D.E. and J.E. Bright, pan trap, (1, CNC); **Queens Co.:** Black Duck Lake, 18.VI.2003, P. Dollin, white pine forest, polypore fungus, (2, NSMC); Black Duck Lake, 1.VIII.2003, P. Dollin, white pine-red spruce forest, *Lycoperdon* sp., (2, NSMC); Sixth Lake, 20.VI.2003, P. Dollin, old-growth hemlock forest, "orange ball fungus", (3, NSMC); Tobeatic Lake, 17.VI.2003, P. Dollin, red spruce forest, decomposing red maple log, (2, NSMC); Medway River, 13.VII.1993, J. and T. Cook, car net, (7, JCC).

Anisotoma discolor is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 9). Adults have been collected between February and October from oak and pine bark and in leaf litter. Slime mold hosts include *Stemonitis axifera, S. fusca, S. splendens*, *Fuligo septica*, and *Comatricha nigra* (Pers.) J. Schroet. (Wheeler 1979).

Anisotoma errans Brown, 1937

NEWFOUNDLAND: Lake Ambrose, 23.VI.1988, P. Dixon, malaise trap, (2, CFNL); Baie Verte, 20.VI.1988, P. Dixon, malaise trap, (2, CFNL); Stephenville: Barachois Pond Park, 23.VII-19.VIII.1997, S. and J. Peck, fir-deciduous forest, flight-intercept trap, (3, MUN). **NOVA SCOTIA: Inverness Co.:** MacKenzies Mountain, Cape Breton Highlands National Park, 19.VI.1983, Y. Bousquet, pan trap, (1, CNC).

Anisotoma errans is newly recorded from Newfoundland (Fig. 8). It was reported from Nova Scotia by Peck (1991). Adults have been found between April and July in association with hemlock moss, willow and mixed conifer litter, and on conifer bark. Slime mold hosts include *Stemonitis* sp. and *Fuligo septica* (Wheeler 1979).

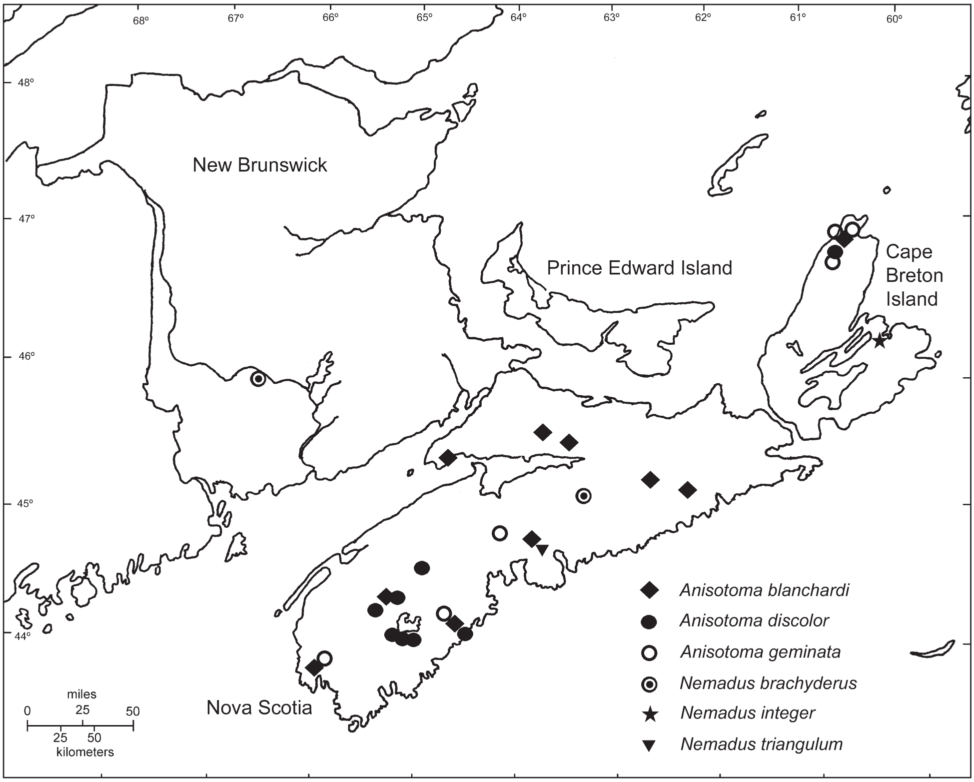

Fig. 9. Distribution of *Anisotoma blanchardi, Anisotoma discolor, Anisotoma geminata, Nemadus brachyderus, Nemadus integer,* and *Nemadus triangulum* in Atlantic Canada.

Anisotoma geminata (Horn, 1880)

NOVA SCOTIA: Hants Co.: Panuke Lake, 16-29.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 19.VI-9.VIII.1983, various collectors, (10 CNC); MacKenzies Mountain, Cape Breton Highlands National Park, 19.VI-9.VIII.1983, various collectors, (9, CNC); MacKenzies Mountain, Cape Breton Highlands National Park, 25.VI.1983, Y. Bousquet, pan trap, (2, CNC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC); **Victoria Co.:** North Mountain, 19.VI-9.VIII.1983, (1, CNC); **Yarmouth Co.:** Wellington, 12-20.VIII.1991, J. Cook, flight-intercept trap, (1, JCC); Wellington, 25.VI-3.VII.1995, J. and F. Cook, mixed forest, flight-intercept trap, (1, JCC); Wellington, 15-24.VII.1993, J. and T. Cook, flight-intercept trap, (3, JCC).

Anisotoma geminata is newly recorded in Nova Scotia and in Atlantic Canada (Fig. 9). Adults have been found between April and December in stump and forest litter. Slime mold hosts include *Stemonitis axifera, S. fusca,* and *Tubifera ferruginosa* (Wheeler 1979).

Anisotoma globososa Hatch, 1929

NEWFOUNDLAND: 3 km east of Gambo, 1.VI.1982, D. Langor and A. Raske, under bark of red pine, (3, MUN); 20 mi south of Glenwood, 22.VI.1988, (1, MUN).

Anisotoma globososa is newly recorded in Newfoundland and in Atlantic Canada (Fig. 8). Adults have been found between March and September on bark, fungi, and slime molds on trees (Wheeler 1979).

Anisotoma inops Brown, 1937

NEW BRUNSWICK: Gloucester Co.: Bathurst, VII.1925, J.N. Knull, (1, CNC). **NEWFOUNDLAND:** 3 km east of Gambo, 1.VI.1982, D. Langor and A. Raske, under bark of red pine, (3, MUN). **NOVA SCOTIA:** One hundred and eighteen specimens from Annapolis, Antigonish, Colchester, Cumberland, Guysborough, Halifax, Hants, Inverness, Lunenburg, Pictou, and Queens counties. The earliest record is from 1993 (**Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (1, JCC)).

Anisotoma inops is newly recorded from Newfoundland and Nova Scotia (Fig. 8). It was listed as occurring in New Brunswick by Peck (1991). Adults have been found between May and September (Wheeler 1979). In Nova Scotia, it was found almost exclusively in coniferous forests in red spruce, black spruce, hemlock, white pine, and balsam fir stands. Specimens were found in a decaying red maple log, in polypore fungi on a red spruce log, in polypore fungi on white birch and balsam fir, in decaying gill fungi, in *Lycoperdon* sp. fungi, in a decaying red spruce, and in an "orange ball mushroom." In Newfoundland, it was found associated with decaying red pine.

Anisotoma obsoleta (Horn, 1880) – **revalidated name**
[syn. nov. *Anisotoma horni* Wheeler, 1979]

NEW BRUNSWICK: Charlotte Co.: St. George, 5.VII.1963, R.C. Clarke, window trap, (1, CFNL); **Kent Co.:** Kouchibouguac National Park, 16.IX.1977, A. Smetana, (1, CNC); Kouchibouguac National Park, 7.VI.1977, J.R. Vockeroth, (1, CNC). **NEWFOUNDLAND:** Baie Verte, 7.IX.1988, P. Dixon, malaise trap, (1, CFNL). **NOVA SCOTIA:** One hundred and sixty-five specimens from Colchester, Guysborough, Halifax, Inverness, Queens, Victoria, and Yarmouth counties were examined. The earliest record is from 1970 (**Colchester Co.:** Glenholm, 3.VI.1970, P. Doleman, (1, NSMC)).

Anisotoma obsoleta is newly recorded from Newfoundland and Nova Scotia (Fig. 8). It was listed as occurring in New Brunswick by Peck (1991). Adults have been found between April and December in stumps and forest litter. Slime mold hosts include *Stemonitis axifera, S. fusca, S. splendens*, *Fuligo septica*, and *Comatricha nigra* (Wheeler 1979). In Nova Scotia, it was collected in red spruce, hemlock, red maple/red oak/birch, and mixed coastal forests.

Wheeler (1979) proposed the name *Anisotoma horni* for *A. obsoleta* (Horn) [described by Horn (1880) in the genus *Leiodes* and later transferred to *Anisotoma* by Brown (1937b)] in the belief that the name was preoccupied by "*Leiodes obsoletus*" (Melsheimer, 1844). Melsheimer (1844), however, described the species as *Pallodes obsoletus* [which was later transferred to *Neocyrtusa* by Brown (1937a) and then to *Anogdus* by Daffner (1988)]. *Pallodes* Melsheimer, 1844, was in turn preoccupied by *Pallodes* Erichson 1843, a genus in the Nitidulidae. Consequently, the two names were not then, and are not now, in the same genus, hence there is no need for a replacement name. Therefore the original name, *Anisotoma obsoleta* (Horn), must be reinstated as per Article 59.4 of the Code of Zoological Nomenclature (ICZN 1999). Consequently *Anisotoma horni* Wheeler is designated as a synonym of *A. obsoleta.*

Cholevinae

Nemadus brachyderus (LeConte, 1863)

In his description of the species, LeConte (1863: 25) published the only locality known to him as "Nova Scotia." There is however, no specimen with this locality in the LeConte Collection in Cambridge, Massachusetts. This prompted Peck and Cook (2006) to designate a lectotype. Sanders (1964) also reported the species to be common in over-wintering nests of *Camponotus herculeanus* (Linnaeus) in New Brunswick. However, Peck and Cook (2006) were unable to examine specimens to confirm these records. Consequently, the status of this species in both New Brunswick and Nova Scotia should be further investigated. It is a myrmecophile associated with nests of *Camponotus noveboracensis* (Fitch) and *Camponotus herculeanus* (Peck and Cook 2006).

Nemadus integer Fall, 1937

NOVA SCOTIA: Cape Breton Co.: Sydney, UCCB campus, 15.IX.1996, J. N. MacGillivray, (1, NSMC).

Nemadus integer was recorded from Nova Scotia by Peck and Cook (2006) based on the above record (Fig. 9). It is a myrmecophile associated with nests of *Formica integra* Nylander (Peck and Cook 2006).

Nemadus triangulum Jeannel, 1936

NOVA SCOTIA: Halifax Co.: Pockwock Lake, 15-30.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC).

Nemadus triangulum was recorded from Nova Scotia by Peck and Cook (2006) based on the above record (Fig. 9). It is a myrmecophile associated with nests of *Camponotus noveboracensis, Camponotus pennsylvanicus* (DeGeer), *Camponotus chromaiodes* Bolton, *Formica exsectoides* Forel, and *Formica nitidiventris* Emery. It is found in litter of logs, stumps, and leaves, and in tree holes (Peck and Cook 2006).

Catops alsiosus alsiosus (Horn, 1885)

NOVA SCOTIA: Annapolis Co.: Big Dam Lake, Kejimkujik National Park, 27.VI-7.VII.2004, H. Love, hemlock forest, pitfall trap, (1, CGMC); **Queens Co.:** Medway River, 13.VII.1993, J. and T. Cook, car net, (2, JCC).

This is a northern, boreal species reported by Peck and Cook (2002) from Labrador, New Brunswick, and Nova Scotia (Fig. 10). It is a rarely collected species, most frequently found in sphagnum bogs, boreal spruce forests, or open-tundra vegetation but occasionally in tall grass prairie, mixed deciduous, and aspen forests It is found at carrion, rotting mushrooms, and in mammal nests (Peck and Cook 2002).

Catops americanus Hatch, 1928

NOVA SCOTIA: Annapolis Co.: Channel Lake, Kejimkujik National Park, 18.IX-2.X.2004, H. Love, red maple-red oak-birch forest, pitfall trap, (1, CGMC); **Antigonish Co.:** Antigonish, 26.V-2.VII.1984, McMillan, flight-intercept trap, (8, CMN); Morar, 29.IV.1993, M. LeBlanc, (1, NSNR); **Halifax Co.:** Burnside, 12.V.2003, 7.V.2004, 10.V.2004, C. Cormier, on dead pig, (4, SMU); **Hants Co.:** Little Armstrong Lake, 14.V-2.VI.1997, D.J. Bishop, red spruce forest, flight-intercept trap, (1, NSMC); **Inverness Co.:** MacKenzies Mountain, Cape Breton Highlands National Park, 17.VI.1983, Y. Bousquet, forest, (1, CNC); **Kings Co.:** Kentville, 12.V.1961, D.H. Webster, on decaying fox, (1, DHWC); **Pictou Co.:** French River, 19-21.VII.1997, S. and J. Peck, flight-intercept trap, (1, SBP); **Queens Co.:** Canning Field, Kejimkujik National Park, 13-21.VIII.2005, R. Ewing, hemlock forest, pitfall trap, (1, CGMC); Cobreille Lake, Kejimkujik National Park, 27.VI-6.VII.2004, H. Love, red maple-red oak-birch forest, pitfall trap, (7, CGMC); Kejimkujik National Park, 26.IX-19.X.1994, B. Wright, hemlock forest, (1, NSMC).

Catops americanus was reported by Peck and Cook (2002) from Nova Scotia, but not from New Brunswick (Fig 10). It was formerly listed as occurring in New Brunswick in Peck (1991), however, this was prior to the description of the very similar *C. paramericanus* (Peck and Cook 2002), which is recorded as occurring in New Brunswick. Presumably, earlier reports of *C. americanus* from New Brunswick are now ascribable to *C. paramericanus*. It is found at carrion and by sifting litter in deciduous forests and in mammal nests (Peck and Cook 2002).

Catops basilaris Say, 1823

LABRADOR: Grand Lake Rd, km 39.7, 24.VII.1992, K. Perrault, (1, CFNL). **NEWFOUNDLAND:** Eight hundred and thirty specimens were examined. The earliest record is from 1977 (Windsor Lake, 30.VIII.1977, D.J. Larson, (1, MUN)). **NOVA SCOTIA:** One hundred and eighty-three specimens were examined from Annapolis, Antigonish, Colchester, Cumberland, Guysborough, Halifax, Inverness, Lunenburg, Pictou, Queens, Shelburne, Victoria, and Yarmouth counties. The earliest record is from 1965 (**Lunenburg Co.:** Bridgewater, 1-16.VII.1965, B. Wright, red oak forest, pitfall trap, (1, NSMC)).

Catops basilaris was reported by Peck and Cook (2002) from Labrador, Newfoundland, New Brunswick, and Nova Scotia including Cape Breton Island (Fig. 11). It is the most widespread and frequently collected species of *Catops* in North America, primarily collected in forested environments at carrion, but also occasionally on decaying mushrooms, in forest litter, in mammal and wasp nests, and on owl pellets. It is found in deciduous, mixed, and coniferous forests and *Sphagnum* bog habitats (Peck and Cook 2002). In Nova Scotia, specimens have been collected in coniferous, deciduous, mixed, and coastal forests.

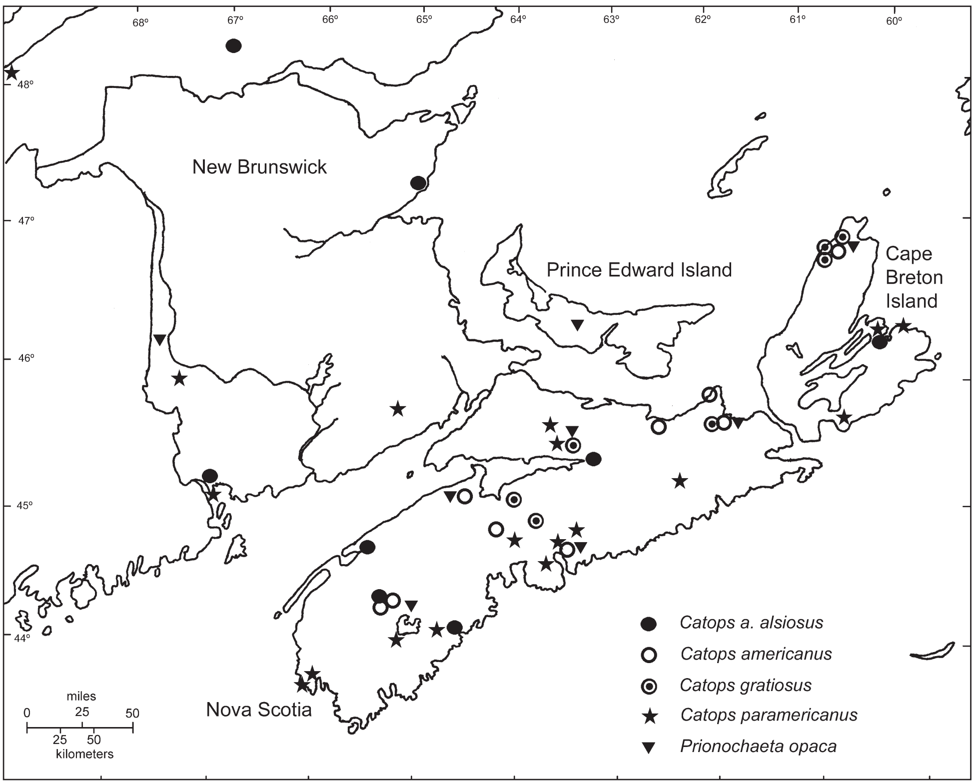

Fig. 10. Distribution of *Catops a. alsiosus, Catops americanus, Catops gratiosus, Catops paramericanus,* and *Prionochaeta opaca* in Atlantic Canada. Locations in Labrador are not shown.

Catops egenus (Horn, 1880)

Catops egenus was reported from central Labrador by Peck and Cook (2002). It was collected at animal carcasses, on dung, and on decaying mushrooms in coniferous or mixed forests (Peck and Cook 2002).

Catops gratiosus (Blanchard, 1915)

NOVA SCOTIA: Antigonish Co.: Antigonish, 28.IV.1997, R. Lauff, (1, NSNR); **Colchester Co.:** Debert, 6.VI.1994, J. Ogden, (1, NSNR); **Hants Co.:** Mount Uniake, 8.V.1979, B. Wright, (1, NSMC); **Inverness Co.:** 1 km west of Lone Shieling, Cape Breton Highlands National Park, 19.IX.1984, J.M. Campbell and A. Davies, sifting *Fagus* litter, (1, CNC); MacKenzies Mountain, Cape Breton Highlands National Park, 4.VII.1983, J.R. Vockeroth, pan trap, (1, CNC); Cheticamp River Trail, Cape Breton Highlands National Park, 22.IX.1984, J.M. Campbell and A. Davies, ex mushrooms, (2, CNC).

Catops gratiosus was reported from mainland Nova Scotia and Cape Breton Island by Peck and Cook (2002) (Fig 10). It is an infrequently collected species. Most of the collections in the southeastern United States are from caves. Specimens collected from northern or upper elevation areas are from deciduous forests and, in smaller numbers, from coniferous forests and old fields where they are found on carrion, decaying fungi, and on mammal dung (Peck and Cook 2002).

Catops luridipennis Mannerheim, 1853

This Holarctic species was reported from central Labrador by Peck and Cook (2002). It has been collected on animal carcasses and dung in coniferous forests (Peck and Cook 2002).

Catops luteipes Thomson, 1884

This Holarctic species was reported from northern Labrador by Peck and Cook (2002). It was collected on animal carcasses and dung in aspen-spruce parkland, tundra, willow-spruce, and taiga habitats (Peck and Cook 2002).

Catops paramericanus Peck and Cook, 2002

NOVA SCOTIA: Cape Breton Co.: New Waterford, 17.V.1996, C.A. Stapleton, (1, CBU); Sydney, 30.V.1996, D.W. Forbes, (2, CBU); Westmount, 2.VI.1996, D.W. Forbes, (1, CBU); **Colchester Co.:** 20.VII.1995, E. Georgeson, (1, NSNR); **Cumberland Co.:** Wentworth, VIII.1965, B. Wright, sugar maple forest, pitfall trap, (1, NSMC); **Guysborough Co.:** Liscomb Game Sanctuary, 24.VI.1998, J. Ogden, malaise trap, (1, NSNR); **Halifax Co.:** Antrim, 2.V.2005, J. Ogden, (1, NSNR); Big Indian Lake, 9.VIII.2003, P. Dollin, pitfall trap, (1, NSMC); Burnside, 8.V.2003, 7.V.2004, 10.V.2004, 12.V.2004, 14.V.2004, C. Cormier, on dead pig, (5, SMU); Halifax Watershed area, 14.IV.1958, J. McDunnough, (1, NSMC); **Queens Co.:** Black Duck Lake, 1.VIII.2003, P. Dollin, white pine forest, pitfall trap, (2, NSMC); Eight Mile Lake, 31.VII.2003, P. Dollin red spruce forest, pitfall trap, (6, NSMC); Fifth Lake, 17.VI.2003, P. Dollin, old-growth hemlock forest, (1, NSMC); **Yarmouth Co.:** Cape Forchu, 28.VI-4.VII.1995, J. and F. Cook, flight-intercept trap, (3, JCC); Wellington, 15-24.VII.1993, J. and T. Cook, mixed coastal forest, flight-intercept trap, (1, JCC); Wellington, 12-20.VIII.1991, J. Cook, coastal forest, flight-intercept trap, (1, JCC).

Catops paramericanus was reported from New Brunswick and two sites on Cape Breton Island, Nova Scotia by Peck and Cook (2002). It is newly reported herein from the mainland of Nova Scotia (Fig 10). It is an abundant and widespread species in boreal forests, primarily collected from animal carrion and occasionally from owl pellets, decaying fungi, and in forest litter (Peck and Cook 2002).

Catops simplex Say, 1825

LABRADOR: Fifty specimens were examined. The earliest record is from 1992 (Grand Lake Road, 39.7 km, 24.VII.1992, I.L. Perrault, field, pan trap, (1, CFNL)). **NEWFOUNDLAND:** Fifty-nine specimens examined. The earliest record is from 1979 (Windsor, 30.VIII.1979, D.J. Larson, (1, MUN)). **NOVA SCOTIA: Annapolis Co.**: Channel Lake, Kejimkujik National Park, 18.IX-2.X.2004, H. Love, red maple-red oak-birch forest, pitfall trap, (1, CGMC); **Antigonish Co.:** Beech Hill, 13.VII.1985, J. Veinot, (1, NSMC); Cape Breton Co.: George's River, 10.VI.1998, D.B. McCorquodale, poplar log, (1, CBU); **Halifax Co.:** Burnside, 31.VII.2003, 26.VI.2003, 29.VI.2003, 12.VII.2003, 14.VII.2003, 10.X.2003, 14.X.2003, 15.X.2003, 17.X.2003, 20.X.2003, 22.X.2003, 24.X.2003, 29.X.2003, C. Cormier, on dead pig, mixed forest and open areas, (32, SMU); York Redoubt, 31.VII.2003, C. Staicer, *Sphagnum* bog, pitfall trap, (1, CGMC); **Victoria Co.:** Baddeck, 16-20. VII.1979, G. Fairchild, flight trap, (1, NSMC).

Catops simplex was reported by Peck and Cook (2002) from Labrador, insular Newfoundland, New Brunswick, and Cape Breton Island in Nova Scotia. The above records newly establish its presence on the mainland of Nova Scotia (Fig. 11). It is frequently collected at carrion in deciduous or mixed forests; also in litter, at bear dung, in mammal nests, in rotten mushrooms, and on dead snails. It was found in coniferous forests and *Sphagnum* bogs (Peck and Cook 2002).

Prionochaeta opaca (Say, 1825)

NEW BRUNSWICK: Carleton Co.: Meduxnekeeg Valley Preserve, 46.19°N, 67.68°W, 7.IX.2004, R.P. Webster, mixed forest, rotting fungi, (1, RWC). **NOVA SCOTIA: Antigonish Co.:** Pomquet, 10-17.VII,1998, R.F. Lauff, malaise trap, (1, STFX); **Colchester Co.:** Debert, 15.VI.1993, 9.VII.1993, 10.V.1994, 21.V.1996, 21.V.1996, J. Ogden, malaise trap, (5, NSNR); Debert, 6.VI.1996, E. Georgeson, malaise trap, (1, NSNR); **Halifax Co.:** Burnside, 22.V.2003, 23.V.2003, 15.VII.2003, C. Cormier, on dead pig, mixed forest and open areas, (3, SMU); **Inverness Co.:** Lone Shieling, Cape Breton Highlands National Park, 18-21.VII.1983, D.E. and J.E. Bright, flight-intercept trap, (1, CNC); **Kings Co.:** Kentville, 11.V.1961, D.H. Webster, on decaying fox, (3, DHWC); **Queens Co.:** Caledonia, 15.V.2002, P. Colp, flight-intercept trap, (1, NSNR). **PRINCE EDWARD ISLAND:** locality information lost, 1974-1983, collector information lost, (2, UPEI).

Prionochaeta opaca is newly recorded in New Brunswick, Nova Scotia, Cape Breton Island, Prince Edward Island, and Atlantic Canada (Fig. 11). In many southern localities in the United States this species is found in caves where adults and larvae feed on the guano of insectivorous bats. In more northern regions, it is found in forested habitats (Peck and Cook 2002). In Nova Scotia, it has been collected on rotten fungi and mammal carrion.

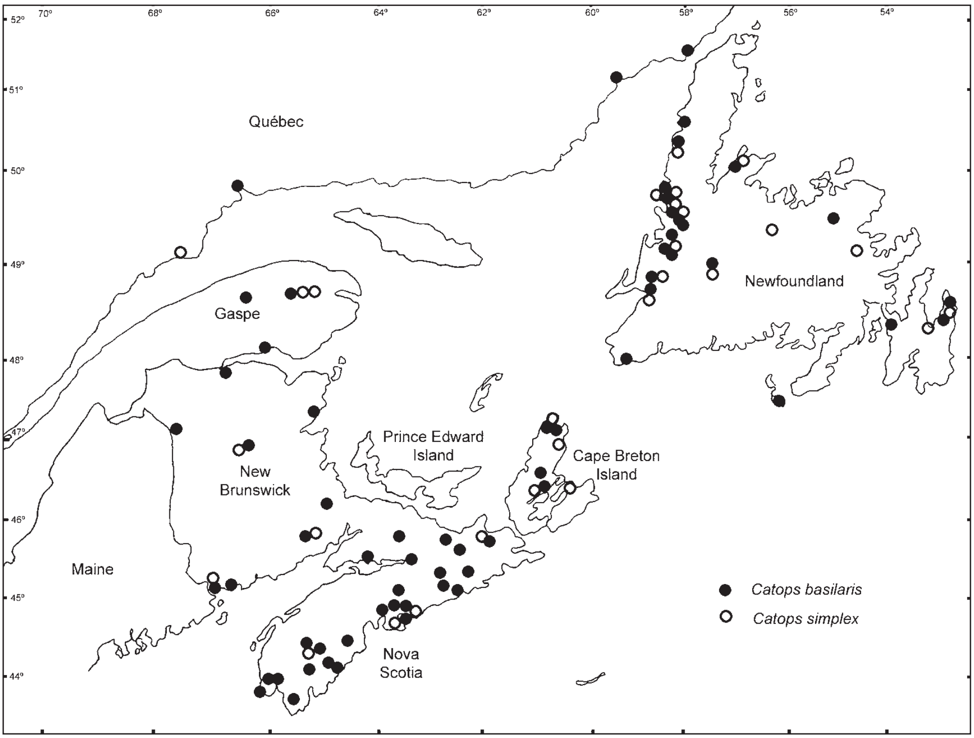

Fig. 11. Distribution of *Catops basilaris* and *Catops simplex* in Atlantic Canada. Some locations in Labrador are not shown.

Sciodrepoides terminans (LeConte, 1850)

NEWFOUNDLAND: St. John's, 16.VII.1981, 20.VII.1981, and 21.IX.1996, (3, MUN); Portugal Cove, 26.VI.1981 and 21.VII.1982, (2, MUN); Gander, VII.1979, (1, MUN). **NEW BRUNSWICK: Saint John Co.**: Saint John, 20.VI.1898, P.R. McIntosh, (1, NBM); Saint John, VI.190?, W. McIntosh, (3, NBM); **Westmorland Co.:** Moncton, 15.X.1982, L. Dorion, (1, UMNB). **NOVA SCOTIA**: Two hundred and eighty-two specimens were examined from Annapolis, Antigonish, Colchester, Cumberland, Guysborough, Halifax, Inverness, Kings, Lunenburg, Queens, Victoria, and Yarmouth counties. The earliest record is from 1961 (**Kings Co.:** Kentville, 28.V.1961, D.H. Webster, on dead fox, (1, DHWC)). **PRINCE EDWARD ISLAND:** locality information lost, 1974-1983, collector information lost, (1, UPEI).

Sciodrepoides terminans is newly recorded from Prince Edward Island. It was reported by Peck and Cook (2002) from Labrador, Newfoundland, New Brunswick, Nova Scotia, and Cape Breton Island (Fig. 12). It has mostly been collected in forested habitats but also in open shrub and grassland sites, in riverside forests, and grassland. It is found primarily on mammal carrion, but also on decaying fish and fungi and in mammal and bird nests (Peck and Cook 2002). Majka et al. (2006) reported it from a

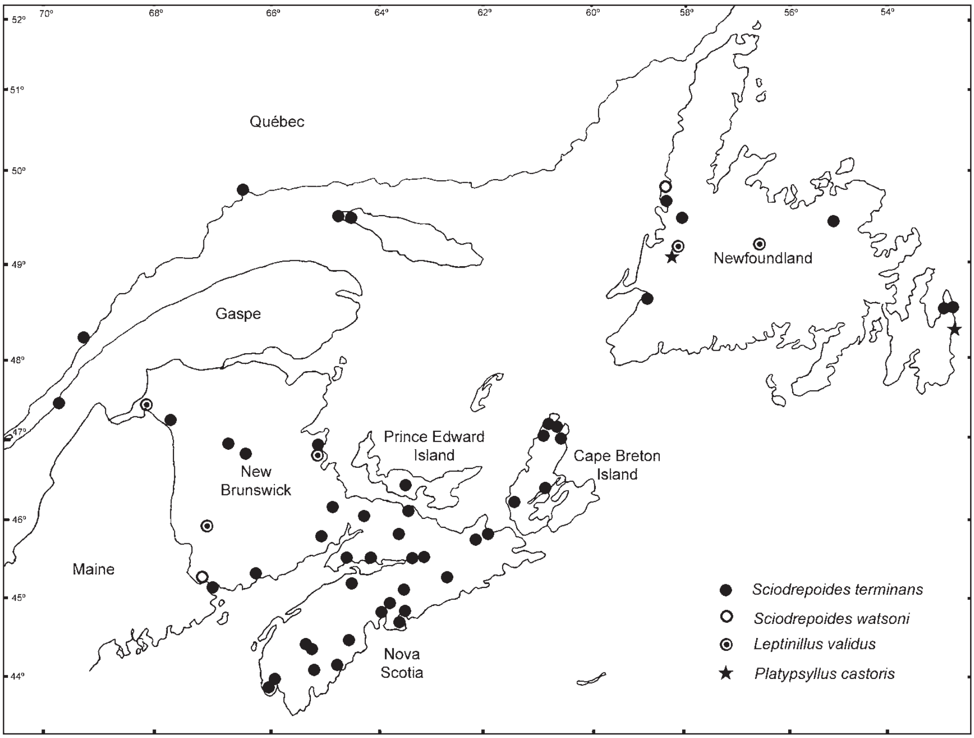

Fig. 12. Distribution of *Sciodrepoides terminans, Sciodrepoides watsoni, Leptinillus validus,* and *Platypsyllus castoris* in Atlantic Canada. Locations in Labrador are not shown.

Boreal Owl [*Aegolius acadicus acadicus* (Gmelin)] nest in Nova Scotia. In Nova Scotia, it was collected on carrion in deciduous, coniferous, and mixed forests.

Sciodrepoides watsoni (Spence, 1815)

NEWFOUNDLAND: Western Brook Pond, Gros Morne National Park, 15-17. VIII.1969, M.J.D. Brendell, secondary forest, (6, BMNH).

This Holarctic species was reported by Peck and Cook (2002) from Newfoundland and New Brunswick (Fig. 12). The source of the New Brunswick record (from the Charlotte County area) could not be determined (S. Peck, pers. comm.), nor were vouchers specimens found in any collection consulted. Consequently it is removed from the New Brunswick faunal list. Its status in Newfoundland should also be further investigated since there are no records in the province apart from the specimens listed above. *Sciodrepoides watsoni* has primarily been collected in forested habitats but it is also tolerant of open old fields and grasslands where it is found on carrion and in mammal nests (Peck and Cook 2002).

Platypsyllinae

Leptinillus validus (Horn, 1872)

NEW BRUNSWICK: Kent Co.: Kouchibouguac National Park, (1, CNC); **Madawaska Co.:** Edmundston, 13.XI.1994, J Bourque, on beaver, (1, UMNB). **York Co.:** Lake George, (1, CNC). **NEWFOUNDLAND**: Pasadena, 15.X.1989, M. Bennett, beaver carcass, (1, MUN); Grand Falls, Island Pond, 12.X.2002, Biology 4150, (1, MUN).

Peck (2007) indicated *Leptinillus validus* as occurring in New Brunswick. Peck (1991) also listed it from Newfoundland, but it is not so indicated in Peck (2007). The above records confirm its presence in insular Newfoundland (Fig. 12). Adults and larvae are ectoparasites of beaver (*Castor canadensis* Kuhl) in the northern part of their range in North America. They are occasionally, and apparently accidentally, also found on muskrats (*Ondatra zibethicus* (Linnaeus)) (Peck 2007).

Platypsyllus castoris Ritsema, 1869

NEWFOUNDLAND: Pasadena, 15.X.1989, M. Bennett, beaver carcass, (4, MUN); Bay Bulls, IX-XI.1999, D. Puddister, (1, MUN).

This Holarctic species is listed as occurring in Newfoundland by Peck (1991) (Fig. 12). It is associated with beaver as an ectoparasite through their range in North America and Eurasia (Wood 1965).

Discussion

Regional Composition and Zoogeography

With 25 species of leiodids being newly recorded in Atlantic Canada, and 56 new jurisdictional records reported, it is clear that the knowledge of the composition of the fauna in the region is still incomplete. In particular, few leiodids have been recorded in Prince Edward Island and the leiodid fauna of northern New Brunswick is still poorly known. Nonetheless, some observations on the zoogeography of the fauna in the region are possible, and some distributional patterns are evident.

1) **Widespread** – There are 17 species that are apparently relatively widespread throughout Atlantic Canada. These include *Colon magnicolle, C. hubbardi, Hydnobius substriatus, Leiodes assimilis, L. collaris, L. punctostriata, L. valida, Agathidium mollinum, A. pulchrum, Anisotoma basalis, A. inops, A. obsoleta, Catops a. alsiosus, C. basilaris, C. simplex, Sciodrepoides terminans,* and *Leptinillus validus*. Records from Prince Edward Island are lacking for most of these species; *L. collaris* and *L. validus* have not been recorded in Nova Scotia; *C. hubbardi* and *H. substriatus* have not been recorded in New Brunswick; and three species (*L. valida, A. pulchrum,* and *L. validus*) have only been recorded from a small number of localities. All the species, however, have been found in both the Maritime Provinces and (except for *Catops a. alsiosus*) insular Newfoundland, and eight have been recorded from Labrador.

2) **Maritime Provinces** – Thirteen species have been found in the Maritime Provinces that have not been recorded from insular Newfoundland or Labrador. These include *Colon asperatum, C. boreale, Leiodes impersonata, L. neglecta, Colenis impunctata, Agathidium atronitens, A. difforme, A. fawcettae, A. oniscoides, A. rubellum, Nemadus brachyderus, Catops paramericanus,* and *Prionochaeta opaca*. Most of these species have not been found on Prince Edward Island; three species (*L. impersonata, C. impunctata,* and *A. difforme*) have not been recorded on Cape Breton Island; and six species (*C. boreale, L. impersonata, L. neglecta, A. atronitens, A. oniscoides,* and *N. brachyderus*) have only been recorded from a small number of localities. The pattern of their distribution in the Maritimes appears to be relatively widespread.

3) **Newfoundland** – Three species have been recorded in the region solely from insular Newfoundland: *Agathidium repentinum, Platypsyllus castoris,* and *Anisotoma globososa. Agathidium repentinum* and *P. castoris* (a Holarctic species) are broadly distributed boreal species in Canada and Alaska (Miller and Wheeler 2005; Peck 1991) that may not be present in the Maritime Provinces. *Anisotoma globososa* is widely distributed in southern Ontario and Quebec and the northern United States from Wisconsin to New Hampshire (Wheeler 1979) and may be present in the Maritime Provinces. Additionally, *Sciodrepoides watsoni* has only been recorded from Newfoundland (and possibly New Brunswick). The status of this species in the region requires further verification and investigation.

4) **Labrador** – Four species have only been recorded in Labrador: *Colon politum, Catops egenus, C. luridipennis,* and *C. luteipes.* Except for *C. egenus,* the other three are

Holarctic species with northern boreal distributions (*C. luridipennis* ranges south in the Rocky Mountains). *Catops egenus* is a western North American species (found from Saskatchewan west to the Pacific in Canada), except for an apparently isolated (and perhaps relict) population in southern Labrador (Peck and Cook 2002).

5) **Northern New Brunswick** – Four species, *Anogdus potens, Leiodes contaminabilis, L. triepkei,* and *Liocyrtusa luggeri,* have been recorded only from northern New Brunswick. Additionally, *Leiodes strigata* was recorded from northern New Brunswick and Newfoundland. Three of these (*L. contaminabilis, L. strigata,* and *L. triepkei*) are widespread in northern New England. All these species warrant further investigation to determine if they occur more widely in the region or if they represent species whose distribution in the region has been attenuated by climatic or geographic factors.

6) **Nova Scotia** – A substantial number of species have been recorded from Nova Scotia only. These include:

a) **Province-wide:** *Colon horni, C. incisum, Agathidium rusticum, Gelae parile, Anisotoma blanchardi, A. discolor, A. geminata, Catops americanus,* and *C. gratiosus*;
b) **Cape Breton:** *Colon arcum, C. forceps, C. schwarzi, Hydnobius arizonensis, Leiodes rufipes, Agathidium depressum,* and *Nemadus integer,* recorded only from Cape Breton Island, and *Anisotoma errans* recorded from Cape Breton Island and insular Newfoundland;
c) **Mainland Nova Scotia:** *Colon bidentatum, C. oblongum,* and *Nemadus triangulum* recorded from mainland Nova Scotia;
d) **Southern Nova Scotia:** *Anogdus dissimilis, Cyrtusa subtestacea,* and *Leiodes puncticollis* recorded from southern Nova Scotia.

It is to be expected that many of species recorded to date only in Nova Scotia occur more widely in the region, particularly in the Maritime Provinces, and that the limited distribution which has been thus far been documented is attributable to limited collection effort. Some may be species that have spread into the region from New England and the George's Bank glacial refugium, via island chains and land bridges following the Wisconsinian Glaciation. This applies particularly to species such as *C. arcum, C. schwarzi, H. arizonensis, L. puncticollis, L. rufipes, A. rusticum, G. parile, A. blanchardi, A. errans,* and *C. americanus* found in New England, and which are unrecorded elsewhere in Atlantic Canada and Maine (see Klimaszewski et al. 2006 for a discussion of this topic). *Leiodes assimilis,* which occurs on Sable Island, a 45 kilometre long sand bar located near the edge of the continental shelf, 160 km from the nearest point of land, an unusual biotype for the species (Howden 1970), is another potential candidate species that has dispersed into the region via this pathway.

Little information is available on many species of Leiodidae and taxonomic revisions of many of the genera found in this region have been published only recently Thus observed distributional patterns are likely incomplete and considerable additional collecting is required.

Island Biogeography

The number of species of leiodids recorded on Prince Edward Island (two, or 3% of the regional fauna) is extraordinarily low. In comparison, 140 of the 332 native species (42%) of Carabidae (perhaps the best-studied family of Coleoptera in Atlantic Canada) are known from Prince Edward Island (Table 2; Majka et al. 2007b). Although the proportion of native species found on Prince Edward Island varies from family to family, it nonetheless appears that either the leiodid fauna of the island is comparatively much smaller than expected, or that collection effort on Prince Edward Island has been insufficient to fully determine its leiodid composition, or a combination of both factors. In further comparison, the proportional composition of native leiodids and carabids are similar in the case of Cape Breton Island, Labrador, Nova Scotia, and the Maritime Provinces as a whole (Table 2). The proportional composition of leiodids known to occur on insular Newfoundland (37.9%), and in New Brunswick (50.0%) are somewhat smaller in comparison to the proportional representation of carabids in these two jurisdictions (44.6% and 75.0% respectively). This is likely also due to insufficient collecting effort in both areas. The proportion of leiodids known from the mainland of Nova Scotia (60.6%) is also somewhat lower.

In the Maritime Provinces the proportion of the leiodid fauna that is Holarctic varies between 8-9% [7-8% in the case of the Carabidae (Majka et al. 2007b)], but on insular Newfoundland the proportion is 13.6% [21.2% in the case of the Carabidae (Majka et al. 2007b)], and in Labrador is 27.3% [36.2% in the case of the Carabidae (Bousquet and Larochelle 1993)]. The greater proportion of Holarctic species, particularly in Labrador, clearly reflects its greater proximity to circumboreal environments and landmasses such as the Canadian arctic, Greenland, and Iceland. The low proportion of Holarctic leiodids recorded on Cape Breton Island (2.7%) is notable given that the corresponding proportion of Holarctic Carabidae is 12.4% (Table 2 and Majka et

Table 2. Geographic composition of Atlantic Canada Leiodidae: number and proportion of species

	Nearctic	%	Holarctic	%	Total	% of fauna	% of native carabid fauna[1]
Prince Edward Island	2	100.0	0	0.0	2	3.0	42.2
Cape Breton Island	37	97.4	1	2.7	38	57.6	51.2
Newfoundland	22	88.0	3	13.6	25	37.9	44.6
Labrador	11	78.6	3	27.3	14	21.2	27.1
Nova Scotia mainland	37	92.5	3	8.1	40	60.6	70.5
Nova Scotia	47	92.2	4	8.5	51	77.3	76.2
New Brunswick	30	90.9	3	10.0	33	50.0	75.0
Maritime Provinces	54	91.5	5	9.3	59	89.4	89.5
Atlantic Canada	57	86.4	9	15.8	66	100.0	100.0

1, Carabidae numbers adapted from Majka et al. (2007) by the inclusion of Labrador data.

al. 2007b). As the Leiodidae of Cape Breton Island is relatively well surveyed, the low proportion of Holarctic species would appear to be real rather than a collecting artifact. The reason for this pattern is unknown.

Several studies of Coleoptera in Atlantic Canada have noted an island-related diminution of fauna on Prince Edward Island, Cape Breton Island, and insular Newfoundland (Majka and McCorquodale 2006; Majka et al. 2007a, 2007b). In the case of the Leiodidae, the comparative lack of attention with respect to this family in general, their secretive habits, the specialized habitats that some species occupy, and the dearth of collection efforts in some areas, means that any conclusions about island faunas in the region are premature.

Biodiversity "Hot Spots"

Particularly noteworthy for the region are the large number of species of leiodids collected at Lone Shieling in Cape Breton Highlands National Park, an apparent biodiversity "hot spot" for this family in the region. Twenty-nine species (57% of the Nova Scotia fauna) were collected there, and 36 species (71% of the Nova Scotia fauna) have been found in the Park as a whole, thanks to survey efforts summarized by Lafontaine et al. (1987). Although the collecting effort at this site was outstanding (a dozen experienced researchers from the Biosystematics Research Center in Ottawa, Canada participated over the course of the 1983-1984 field seasons) the site also happens to be within a 350+ year old sugar maple stand which is one of the largest and most pristine old-growth forest stands in the Maritime Provinces (Greenidge 1961). Other rarely collected species of Coleoptera such as *Acrotrichis cognata* (Matthews) (Ptiliidae) (Majka and Sörensson 2007) and *Epuraea parsoni* Connell (Nitidulidae) (Majka and Cline (2006) have been collected at this site as have several species of rare, localized, and disjunct small mammals (Roscoe and Majka 1976). It is possible that the undisturbed old-growth conditions at this site support a large diversity of species that have otherwise been reduced in many areas of Atlantic Canada by the history of forest management practices (Majka 2007).

In comparison, a similar research program in Kouchibouguac National Park in New Brunswick in 1977 recorded only 10 species of leiodids and a more limited survey in 2004-2005 in Kejimkujiuk National Park in Nova Scotia found only seven species of leiodids (C.G. Majka and T. Rossolimo, unpublished data). Thus, the species diversity of the Leiodidae in Cape Breton Highlands National Park appears to be very high, a topic deserving further research. In this regard, it is fortunate that the Lone Shieling site lies within Cape Breton Highlands National Park where it is afforded a high degree of protection.

Saproxylic Species Diversity and Forest Management

The 19 species of leiodids in the Agathiidini are all forest species associated with fungi and/or slime molds and members of the saproxylic invertebrate community, i.e., those organisms that are dependent during some portion of their life cycle upon the dead or dying wood of moribund or dead trees (standing or fallen), upon wood-inhabiting fungi or upon the presence of other saproxylics (Speight 1989).

Speight (1989), Grove (2002), and Dudley and Vallauri (2004) are three of many studies that have examined the importance of saproxylic insects in the dynamics of forest ecosystems. In general, upwards of 30% of plant biomass produced annually in forests is in the form of woody tissue and the quantity of plant nutrients recycled annually by saproxylics in forests is roughly 50% of that recycled from the annual leaf fall (Speight 1989). A number of studies have drawn attention to the importance of this group in the trophic dynamics of forests. Siitonen (2001) found that 20-25% of all forest-dwelling invertebrates in Fennoscandia were saproxylic; Martikainen et al. (2000) found that 42% of the 553 species of beetles collected in a spruce forest in Finland were saproxylic; and Köhler (2000) considered 56% of all forest-dwelling beetle species in forests in the north Rhineland to be saproxylic.

Majka (2007) identified 59 "apparently rare" species of saproxylic beetles (collected from ≤ 5 specimens representing ≤ 0.005% of specimens examined in the region.) This represented 21% of the 283 species in the 18 saproxylic families, subfamilies, and tribes that were investigated. On that basis, six of the 19 species (32%) including *Agathidium depressum, A. oniscoides, A. pulchrum, A. rusticum, Anisotoma errans,* and *A. globosoa* would qualify as "apparently rare" (i.e., ≤ 5 specimens have been collected in the region). This result is, in all probability due in large measure to the dearth of collecting for many species of leiodids. An increased collecting effort is required to discern if some of these species are actually rare, and hence in need of special attention or conservation measures.

Summary

Sixty-six species of Leiodidae are now known from Atlantic Canada, substantially more than the 27 recorded by Peck (1991). Others, undoubtedly, remain to be discovered since many species are secretive, small and inconspicuous, and are poorly sampled by conventional collecting techniques. A better understanding of this family and other forest and saproxylic beetles will add to our understanding of the ecological well-being of our forests. Such baseline faunistic knowledge will, in turn, help us understand how forests and beetles have been affected by historical forest management practices, and will help us monitor potential future changes in response to anthropogenic factors such as climate change.

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