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INTRODUCED APIONIDAE AND BRENTIDAE (COLEOPTERA: CURCULIONOIDEA) IN THE MARITIME PROVINCES OF CANADA

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Abstract.—The introduced Apionidae and Brentidae in the Maritime Provinces of Canada are surveyed. *Perapion curtirostre* (Germar) is recorded for the first time in Canada from specimens collected in New Brunswick, Nova Scotia, and Prince Edward Island. *Rhopalapion longirostre* (Olivier) is recorded for the first time in Nova Scotia and Atlantic Canada. Changes in the range of *Omphalapion hookerorum* (Kirby) in Nova Scotia are discussed, and a Nova Scotia record of an intercepted specimen of *Arrenodes minutus* (Drury) is noted. All records are briefly discussed in the context of introduced Coleoptera in the region.

Key Words: Coleoptera, Apionidae, Brentidae, *Perapion*, *Rhopalapion*, *Omphalapion*, *Arrenodes*, Maritime Provinces, introduced species, new records, biodiversity

The literature pertaining to introduced species found in Atlantic Canada continues to grow. Brown (1940, 1950, 1967), Lindroth (1957), Johnson (1990), Wheeler and Hoebeke (1994), Hoebeke and Wheeler (1996a, 1996b, 2000, 2003, 2005a, 2005b), Majka (2005), Majka and Klimaszewski (2004), Majka and LeSage (2006), and Majka et al. (2006b) are some of the studies that have contributed to this topic. Although the treatments by Brown and Lindroth dealt with introduced weevils in the region, comparatively little attention has been given to introduced and adventive Apionidae and Brentidae. In this paper we discuss recent records of four adventive species in the region – *Arrenodes minutus* (Drury), *Perapion curtirostre* (Germar), *Omphalapion hookerorum* (Kirby), and *Rhopalapion longirostre* (Olivier) – within the larger context of introduced insects in North America.

Conventions

Abbreviations of collections referred to in this study are:

ACNS	Agriculture and Agri-Food Canada, Kentville, Nova Scotia.
CBU	Cape Breton University, Sydney, Nova Scotia.
CUIC	Cornell University Insect Collection, Ithaca, New York.
CGMC	Christopher G. Majka collection, Halifax, Nova Scotia.
JOC	Jeffrey Ogden Collection, Truro, Nova Scotia.

NSAC Nova Scotia Agricultural College, Bible Hill, Nova Scotia.
NSMC Nova Scotia Museum, Halifax, Nova Scotia.
NSNR Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia.
RPWC Reginald P. Webster collection, Charter's Settlement, New Brunswick.

The number of specimens is noted in parentheses. If not specified, it is assumed to be one.

Results

Brentidae

Arrenodes minutus (Drury 1770)

NOVA SCOTIA: Halifax Co.: Haliburton, 10.ii.2005, M. Knapp, NSMC.

A specimen of this species was intercepted after it emerged from wooden furniture imported to Nova Scotia from Indiana, U.S.A. Although a Nearctic species, it is not native to Atlantic Canada. Generally distributed in the eastern United States (Anderson and Kissinger 2002), it ranges north into southern Ontario and Québec (McNamara 1991). Adults are found under the bark of oaks (*Quercus* spp.) (Fagaceae); larvae bore into the wood (Buchanan 1960).

Apionidae

Perapion curtirostre (Germar 1817)

NEW BRUNSWICK: Albert Co.: Mary's Point, 8.ix.2002, C.G. Majka, (2), CGMC; Mary's Point, 13.ix.2006, C.G. Majka, (2), CGMC. Queens Co.: Canning: Scotchtown near Indian Point, 5.vi.2004, R.P. Webster, margin of lake: oak-maple forest on sandy soil, RPWC. NOVA SCOTIA: Annapolis Co.: Annapolis Royal, 30.vi.2002, C.G. Majka, CGMC; Granville Ferry, 30.vi.2002, C.G. Majka, (7), CGMC; Hampton, 7.viii.2005, C.G. Majka, CGMC; Middleton, 5.viii.2001, E.R. Hoebeke and A.G. Wheeler, CUIC; Bridgetown, 5.viii.2001, E.R. Hoebeke and A.G. Wheeler, (24), CUIC. Colchester Co.: Bible Hill, 29.vii.2003, E.R. Hoebeke and A.G. Wheeler, (8), CUIC; Bible Hill, 3.viii.2003, E.R. Hoebeke and A.G. Wheeler, (61), CUIC; Bible Hill, 10.vi.2004, K. Aikens, (2), CBU; Bible Hill, 14.v.2005 & 31.v.2005, S. Townsend, (44), CBU. Digby Co.: Brier Island, 22.vi.2003, J. Ogden & K. Goodwin, (2), JOC. Halifax Co.: Point Pleasant Park, 7.vi.2001 & 15.xi.2001, C.G. Majka, CGMC; south-end Halifax, 20.v.2002, 23.v.2002, & 21.vi.2002, C.G. Majka, (18), CGMC; Herring Cove, 11.viii.2002, C.G. Majka, (2), CGMC; West Dover, 7.ix.2003, C.G. Majka, (7), CGMC; Dartmouth, 27–28.vii.2003, E.R. Hoebeke and A.G. Wheeler, (35), CUIC. Hants Co.: Ellershouse, 30.vi.2002, C.G. Majka, CGMC; Noel Shore, 2.vii.2002, A.J. Hebda, (3), NSMC. Inverness Co.: Port Hawkesbury, 31.vii.2003, E.R. Hoebeke and A.G. Wheeler, CUIC. Kings Co.: Sheffield Mills, 26.vi.2002, K. Neal, NSMC; Sheffield Mills, 19.vi.2005 & 3.vii.2005, S. Westby, ACNS; Upper Canard, 10.viii.2004, C. Sheffield, (5), ACNS. Lunenburg Co.: Elmwood, 1.xi.2005, Moore & LeBlanc, (3), NSNR. Pictou Co.: Pictou, 30.vii.2003, E.R. Hoebeke and A.G. Wheeler, (2), CUIC. PRINCE EDWARD ISLAND: Kings Co.: Caledonia, 12.vii.2002, C.G. Majka, CGMC; Woodville Mills, 25.viii.2003, C.G. Majka, (3), CGMC. Queens Co.: St. Patricks, 14.vii.2002, C.G. Majka, CGMC; Princeton-Warburton Rd., 27.vi.2003, C.G. Majka, CGMC.

Whitehead (1980) first reported this Palearctic species from specimens collected in 1968, northwest of Bar Harbor, Maine, and from Suffolk County, New York. Until recently it had not been further reported in North America. Downie and Arnett (1996) listed it from

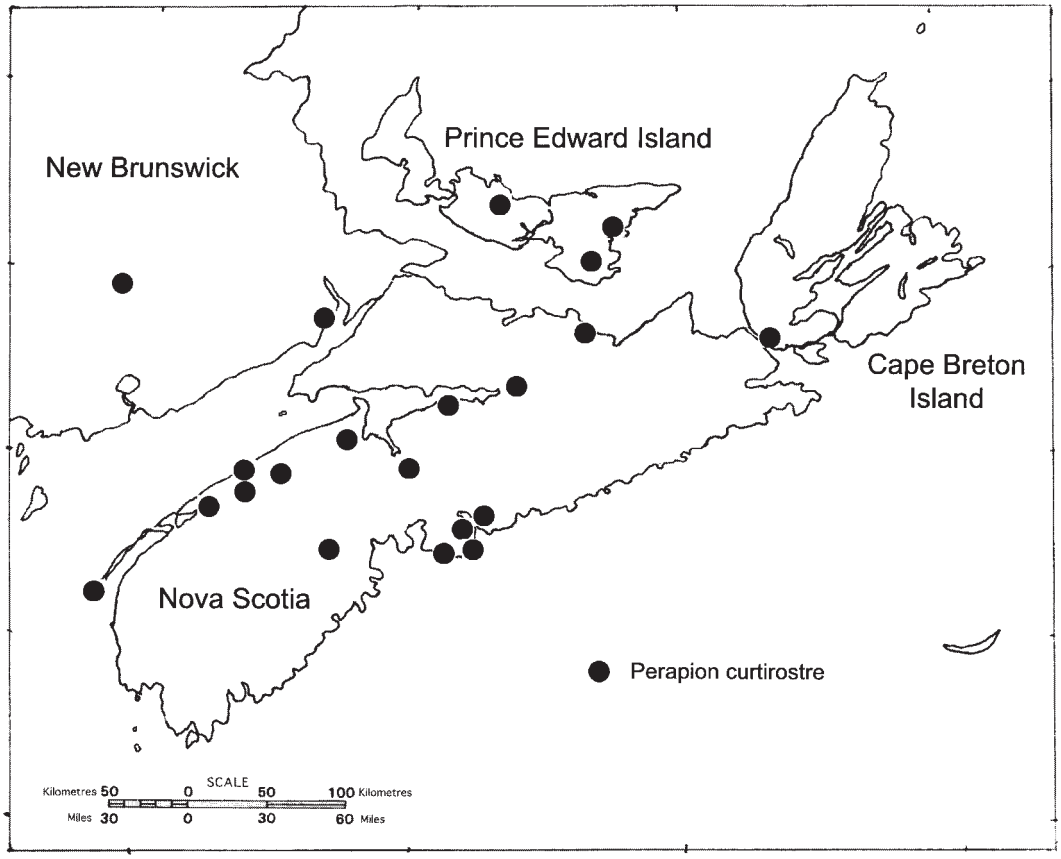

Fig. 1. Distribution of *Perapion curtirostre* in the Maritime Provinces.

Indiana; however, no source is provided for this report and it is almost certainly in error. Recent research in the Maritime Provinces has shown that this species is common and generally distributed except for Cape Breton Island (Fig. 1). In Europe, it is associated with *Rumex* spp., including *R. acetosa* L., *R. acetosella* L., *R. crispus* L., and *R. obtusifolius* L. (Polygonaceae) (Hoffman 1958), all of which have been introduced to the Maritime Provinces. In Bible Hill, Nova Scotia, it has been sweep-netted in fields where *R. acetosella*, *R. crispus*, and *R. obtusifolius* are present. Most specimens collected by E.R. Hoebeke and A.G. Wheeler, Jr. in Nova Scotia were swept from *R. acetosella* although at Bible Hill some were also collected from *R. crispus* (E.R. Hoebeke, pers. com.).

Several specimens of *P. curtirostre* were collected from the foliage of balsam fir (*Abies balsamea* (L.) Mill) (Pinaceae) that had been cut and stored in a field in preparation for export to the United States as Christmas trees. One of us (R.S.A.) also recently received specimens of *P. curtirostre* which had been intercepted in Panama on Canadian balsam firs exported as Christmas trees. This is a hitherto undocumented mode of dispersal for this species. The association may be fortuitous, the weevils having simply climbed into the foliage of trees. Christmas trees are often stored for extended periods lying prone in fields before being shipped to markets. Another possibility may be that adults overwinter in the foliage of *A. balsamea*. In the case of the chrysomelid, *Oulema*

melanopus (Linné), adults beetles sometimes overwinter in the foliage of *Pinus resinosa* Ait., *P. sylvestris* L., and *P. nigra* Arnold, a behavior which has led to a quarantine of Christmas trees of these species in some jurisdictions (Royce and Simko 2000).

The Christmas tree industry, which is sizeable in Nova Scotia, began in 1922–23 and peaked in 1957 when 3.8 million trees were exported (Nova Scotia Department of Natural Resources 2002). Currently (2003 figures) Nova Scotia exports 0.8 million trees and New Brunswick 0.4 million (Natural Resources Canada 2005). The Christmas Tree Council of Nova Scotia (representing 2,500 growers) exports trees to Bermuda, Brazil, Cuba, Mexico, Panama, Puerto Rico, the United States, and Venezuela (Christmas Tree Council of Nova Scotia 2005). Given the abundance and wide distribution of *P. curtirostre* in the Maritime Provinces, the long history of export of trees from this region, and the scale of the past and present export trade, its is possible that the Maine and New York populations might have originated in the Maritime Provinces. In the Old World, *P. curtirostre* is found throughout Europe, east to the Caucasus (Hoffmann 1958).

Omphalapion hookerorum (Kirby 1808)

NOVA SCOTIA: Cape Breton Co.: Glace Bay, 1.viii.2003, E.R. Hoebeke and A.G. Wheeler, (19), CUIC; Sydney, 31.vii.2003, E.R. Hoebeke and A.G. Wheeler, (7), CUIC. Colchester Co.: Truro, 29.vii.2003, E.R. Hoebeke and A.G. Wheeler, (15), CUIC; Truro, 3.viii.2003, E.R. Hoebeke and A.G. Wheeler, (43), CUIC; Bible Hill, 25.vi.2004, K. Aikens, CBU; Tatamagouche, viii.1992, G. Sampson, NSAC. Halifax Co.: Point Pleasant Park, 24.viii.2002, C.G. Majka, (4), CGMC. Pictou Co.: Pictou, 22.vii.1994, E.R. Hoebeke and A.G. Wheeler, CUIC. Richmond Co.: Arichat: Isle Madame, viii.1992, G. Sampson, NSAC.

Peschken et al. (1993) and Sampson and McSween (1993) reported this species as new for North America from specimens collected in 1990 in Antigonish, Nova Scotia. Subsequently it was found during 1991 in surveys in northern Nova Scotia (Colchester, Pictou, Antigonish, and Inverness counties) in 13 localities on scentless chamomile, *Tripleurospermum maritima inodorum* (L.) Applequist (Asteraceae) (formerly *Matricaria maritima* (Less.) Porter; see Applequist (2002)) Peschken et al. (1993b). Additional records are reported above and are shown in Fig. 2. This introduction was coincidentally discovered as part of a program to investigate the suitability of this weevil as a biocontrol agent for *T. maritima*; the adults and larvae feed on the flowers and seeds of the plant. Deliberate introductions into the Truro-Bible Hill area, from stock collected in northern Nova Scotia, have also been made (G. Sampson, pers. com.). The specimens collected by E.R. Hoebeke and A.G. Wheeler, Jr. were all collected from stinking mayweed, *Anthemis cotula* L. (Asteraceae).

Peschken et al. (1993) proposed that fishing or pleasure boats calling at the ports of Pictou or Antigonish may have been responsible for the introduction. Another possibility, however, is that this species was introduced via dry-ballast as proposed by Brown (1940, 1950) and Lindroth (1957). In a survey of eight principal sites in Great Britain where dry-ballast destined for Atlantic Canada originated, Lindroth (1957) found *T. maritima* at both Poole and Appledore and collected *O. hookerorum* at the latter site. Although specific historical data are lacking, the important ports of Pictou, Port Hawkesbury, and Sydney all lie within the area where the species has been found, and many other coastal

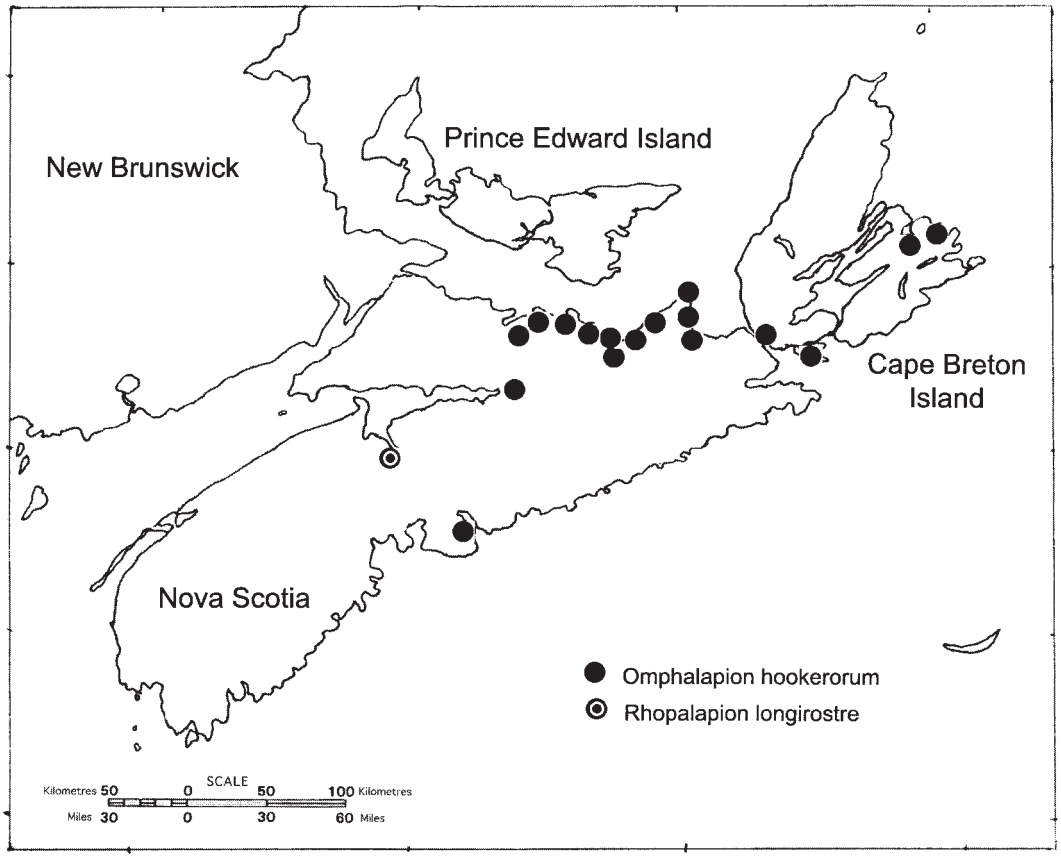

Fig. 2. Distribution of *Omphalapion hookerorum* and *Rhopalapion longirostre* in the Maritime Provinces.

towns in this area had important shipbuilding and timber exporting enterprises during the nineteenth century. Given that Brown (1940, 1950, 1967) and Lindroth (1957) documented many other species of Coleoptera introduced into North America via this pathway, *O. hookerorum* may also be a member of this suite of insects.

Omphalapion hookerorum has been introduced into portions of British Columbia, Alberta, Saskatchewan, and Manitoba (Harris and McClay 2001). It appears to favor a continental climate, and in Alberta has been naturally dispersing at a rate of 2.8 km/year (Harris and McClay 2001). In Nova Scotia the species is abundant in coastal localities on the northern shore of the province, particularly between Cape George and Antigonish (G. Sampson, pers. com.). The records cited above indicate the species is now found further east (Sydney and Glace Bay) and south (Halifax) than reported by Peschken et al. (1993) and occupies a much larger portion of the province. Whether this simply adds to the knowledge of its distribution in the province, or indicates that the species is expanding its range, remains to be determined; however, it appears that the latter may be the case. There has been extensive prior collecting for weevils and other Coleoptera by many researchers interested in adventive species in Sydney (Harrington 1891, Lindroth 1957, Brown 1967, McCorquodale et al. 2005) and Halifax (Brown 1950; Lindroth 1957;

Hoebeke and Wheeler 1996a, 1996b; Majka et al. 2004) and this species had not been found.

Of further interest are the Wheeler and Hoebeke's collections of *O. hookerorum* on *Anthemis cotula*. This differs from previous findings. Peschken et al. (1993) sampled *T. maritima*, *Matricaria matricarioides* (Less.) Porter, *A. cotula*, and *Chrysanthemum leucanthemum* L. (Asteraceae) finding *O. hookerorum* only on *T. maritima*. Peschken and Sawchyn (1993) concluded that only *T. maritima* and *M. matricarioides* would be suitable field hosts for *O. hookerorum*. In Europe, *O. hookerorum* is reported only from *T. maritima* (Dieckmann 1977). Thus it would appear that *O. hookerorum* is diversifying its food-plant preferences in the New World environment. In the Old World, it is found throughout Europe (including Great Britain), east to western Siberia and the Caucasus, and south to Algeria and Morocco (Hoffmann 1958, Peschken et al. 1993).

Rhopalapion longirostre (Olivier 1807)

NOVA SCOTIA: Hants Co.: Windsor, 21.xi.2002, G. Oikle, (10), NSMC.

Sleeper (1953) first reported this Palearctic species from specimens collected in Georgia, U.S.A., in 1914 and 1922. Brown (1967) subsequently reported that it from New York and Ontario, south to Arkansas and North Carolina, and in California. O'Brien and Wibmer (1982) expanded the range to include Massachusetts, Oregon, Washington, and Colorado. Bright (1993) added British Columbia and Québec to the Canadian range. The species is associated with hollyhock, *Althea rosea* L. (Malvaceae), where adults and larvae feed on flowers and seeds. The specimens collected in Nova Scotia (Fig. 2) were found on *A. rosea* growing in a horticultural setting.

Brown (1967) remarked that in Eurasia the species is found primarily in warmer climates from Italy, Hungary, and Crimea to Turkistan and Iran, and that consequently its persistence in cooler climates may be transitory. It is not known if the Nova Scotia collections represent an ephemerally adventive population introduced via the horticultural trade or an established population. Windsor does lie within a comparatively warmer portion of the province, one of only three pockets in Nova Scotia where the number of annual degree-days above 5°C exceeds 1,800 (McCalla 1988). Nonetheless, its presence in Nova Scotia indicates that the species is continuing to expand its range, either by dispersion, the assistance of human agency, or a combination of both processes.

Discussion

The above accounts illustrate a broad range of circumstances, which apply to introduced species, including inadvertent and deliberate introductions, a variety of mechanisms of introduction, and a variety of pathways of subsequent dispersal. Both *O. hookerorum* and *P. curtirostre* are well established in large areas of the region and may be increasing their ranges. The status of *R. longirostre* is uncertain. More research is required to determine if it will persist in Nova Scotia. *Arrenodes minutus* was intercepted in Nova Scotia and does not persist.

The situation with introduced Apionidae in the Maritime Provinces parallels that of other groups of Coleoptera in the region. Bousquet (1992) listed 45 taxa of exotic Carabidae established in northeastern North America. Of these, 32 are found in the Maritimes and 15 were first recorded in North America from the region. Overall 12% (35 of 285 species) of carabids in Nova Scotia and 15% (24 of 159 species) on Prince Edward Island are introduced (Majka et al. 2006). Majka et al. (in press) summarize the weevil (Curculionoidea) fauna of the Maritimes and document 59 introduced species,

which comprise 21% of the weevil fauna. In Nova Scotia, 23 of 172 species (13%) of Chrysomelidae are introduced species (C.G. Majka, unpublished data). In the case of Apionidae four of the 13 species (31%) recorded in the region are introduced Majka et al. (in press), double the overall proportion of 14.6% introduced species of Coleoptera in Nova Scotia (C.G. Majka, unpublished data).

Both *O. hookerorum* and *P. curtirostre* can be considered potentially beneficial species; they feed on, and may have biocontrol potential against these introduced weeds. *Rhopalapion longirostre* can itself be considered a ''pest'' because it feeds on a desirable horticultural plant (hollyhock). These categories are, of course, relative to their impact on human activities. The impact of such species on native faunas and environments has been little investigated.

Introduced taxa sometimes have complex impacts on ecosystems. For instance, Maerz et al. (2005) examined the role of introduced invertebrates on populations of red-backed salamanders (*Plethodon cinereus* (Green)). Weevils comprised the largest proportion of food items for salamanders in upland forests and the second largest proportion (after earthworms) in lowland forests. Of these, the introduced weevil *Barypeithes pellucidus* (Boheman) accounted for more than 90% of prey items, leading the authors to conclude that ''the seasonally hyper-abundant *Barypeithes pellucidus* had a strong effect on seasonal fluctuations in *P. cinereus* diet,'' and to further hypothesize that the ''influence of introduced prey on temporal and geographic food resources contributes to temporal and geographic demographic and phenotypic variation among *P. cinereus* populations.'' Any such effects of these introduced weevils in native environments in North America remain to be investigated.

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Literature Cited

Anderson, R. S. and D. G. Kissinger. 2002. Brentidae Billberg 1820, pp. 711–719. *In* Arnett, R. H., Jr, M. C. Thomas, P. E. Skelley, and J. H. Frank, eds. American Beetles, Volume 2: Polyphaga: Scarabaeoidea through Curculionoidea. CRC Press, Boca Raton, U.S.A.

Applequist, W. 2002. A reassessment of the nomenclature of *Matricaria* L. and *Tripleurospermum* Sch. Bip. (Asteraceae). Taxon 51: 757–761.

Bousquet, Y. 1992. *Bembidion femoratum* Sturm and *Amara communis* (Panzer) (Coleoptera: Carabidae) new to North America. Journal of the New York Entomological Society 100: 503–509.

Bright, D. E. 1993. The Weevils of Canada and Alaska: Volume 1: Coleoptera: Curculionoidea, excluding Scolytidae and Curculionidae. Agriculture Canada: Research Branch, Publication 1882. 217 pp.

Brown, W. J. 1940. Notes on the American distribution of some species of Coleoptera common to the European and North American continents. The Canadian Entomologist 72: 65–78.

———. 1950. The extralimital distribution of some species of Coleoptera. The Canadian Entomologist 82: 197–205.

———. 1967. Notes on the extralimital distribution of some species of Coleoptera. The Canadian Entomologist 99: 85–93.

Buchanan, W. D. 1960. Biology of the oak timberworm, *Arrhenodes minutus*. Journal of Economic Entomology 53: 510–513.

Christmas Tree Council of Nova Scotia. Available from http://www.ctcns.com/ (accessed 14 April 2006).

Dieckmann, L. 1977. Beiträge zur Insektenfauna der DDR: Coleoptera–Curculionidae (Apioninae). Beiträge zur Entomologie (Berlin) 27: 7–143.

Downie, N. M. and R. H. Arnett, Jr. 1996. The Beetles of Northeastern North America. Sandhill Crane Press, Gainesville, Florida. 1721 pp.

Harrington, W. H. 1891. Notes on a few Canadian Rhyncophora. The Canadian Entomologist 23: 21–27, 114.

Harris, P. and A. McClay. 2001. *Omphalapion hookeri* Kirby. Seed-headed weevil. Available from http://res2.agr.ca/lethbridge/weedbio/agents/aomphook_e.htm (accessed 16 April 2006).

Hoebeke, E. R. and A. G. Wheeler, Jr. 1996a. *Meligethes viridescens* (F.) (Coleoptera: Nitidulidae) in Maine, Nova Scotia, and Prince Edward Island: diagnosis, distribution, and bionomics of a Palearctic species new to North America. Proceedings of the Entomological Society of Washington 98: 221–227.

———. 1996b. Adventive lady beetles (Coleoptera: Coccinellidae) in the Canadian Maritime Provinces, with new eastern U.S. records of *Harmonia quadripunctata*. Entomological News 107: 281–290.

———. 2000. *Telmatophilus typhae* (Fallén) (Coleoptera: Cryptophagidae), a Palearctic cattail specialist established in the Canadian Maritime Provinces. Proceedings of the Entomological Society of Washington 102: 398–402.

———. 2003. *Sphaeroderma testaceum* (F.) (Coleoptera: Chrysomelidae), a Palearctic flea beetle new to North America. Proceedings of the Entomological Society of Washington 105: 990–994.

———. 2005a. First records of adventive Hymenoptera (Argidae, Megachilidae, Tenthredinidae, and Vespidae) from the Canadian Maritimes and the United States. Entomological News 116: 159–165.

———. 2005b. Establishment of three European flea beetles in Nova Scotia: *Longitarsus ganglbaueri* Heikertinger, *L. jacobaeae* (Waterhouse), and *L. rubiginosa* (Foudras) (Coleoptera: Chrysomelidae: Alticinae). Proceedings of the Entomological Society of Washington 107: 319–322.

Hoffman, A. 1958. Coléoptères. Curculionoides (Troisième Partie). Faune de France. Vol 62. Fédération Française des Sociétes de Science Naturelles, Paris. pp. 1209–1839.

Johnson, P. J. 1990. Notes on the naturalization of two species of European Byrrhidae (Coleoptera) in North America. Journal of the New York Entomological Society 98: 434–440.

Lindroth, C. H. 1957. The Faunal Connections between Europe and North America. Almqvist & Wiksell, Stockholm, Sweden. 344 pp.

Maerz, J. C., J. M. Karuzas, D. M. Madison, and B. Blossey. 2005. Introduced invertebrates are important prey for a generalist predator. Diversity and Distributions 11(1): 83–90.

Majka, C. G. 2005. The Palearctic species *Bembidion femoratum* and *Amara communis* (Coleoptera: Carabidae): new records and notes on modes of introduction to North America. The Canadian Entomologist 137: 532–538.

Majka, C. G. and J. Klimaszewski. 2004. *Phloeocharis subtilissima* Mannerheim (Staphylinidae: Phloeocharinae) and *Cephennium gallicum* Ganglbauer (Scydmaenidae) new to North America: a case study in the introduction of exotic Coleoptera to the port of Halifax, with new records of other species. Zootaxa 781: 1–15.

Majka, C. G. and L. LeSage. 2006. Introduced leaf beetles of the Maritime Provinces, 1: *Sphaeroderma testaceum* (Fabricius) (Coleoptera: Chrysomelidae). Proceedings of the Entomological Society of Washington 108: 243–247.

Majka, C. G., R. S. Anderson, and D. B. McCorquodale. In press. The weevils of the Maritime Provinces of Canada, II: new records from Nova Scotia and Prince Edward Island (Coleoptera: Curculionoidea). The Canadian Entomologist.

Majka, C. G., J. Cook, and S. Westby. 2006a. Introduced Carabidae (Coleoptera) from Nova Scotia and Prince Edward Island: new records and ecological perspectives. The Canadian Entomologist 138: 602–609.

Majka, C. G., C. Noronha, and M. Smith. 2006b. Adventive and native Byrrhidae (Coleoptera) newly recorded from Prince Edward Island. Zootaxa 1168: 21–30.

McCalla, R. J. 1988. The Maritime Provinces Atlas. Maritext Ltd., Halifax, NS. 96 pp.

McCorquodale, D. B., B. L. Musgrave, S. Atkins, C. Majka, and R. S. Anderson. 2005. New records of native and introduced weevils (Coleoptera: Curculionidae) for Nova Scotia from Cape Breton Island. The Coleopterists Bulletin 59: 27–34.

McNamara, J. 1991. Family Brentidae: brentid beetles. pp. 327. *In* Bousquet, Y. ed. Checklist of Beetles of Canada and Alaska. Agriculture Canada: Research Branch, Publication 1861/E.

Natural Resources Canada. 2005. The State of Canada's Forests 2004–2005. Available from http://www.nrcan-rncan.gc.ca/cfs-scf/national/what-quoi/sof/sof05/statistics_e.html (accessed 14 April 2006).

Nova Scotia Department of Natural Resources. 2002. History of the Nova Scotia Xmas tree Industry. Available from http://www.gov.ns.ca/natr/extension/christmastrees/tradition.htm (accessed 14 April 2006).

O'Brien, C. W. and G. J. Wibmer. 1982. Annotated checklist of the weevils (Curculionidae *sensu lato*) of North America, Central America, and the West Indies (Coleoptera: Curculionoidea). Memoirs of the American Entomological Institute (Gainesville) No. 34. 382 pp.

Peschken, D. P. and K. C. Sawchyn. 1993. Host specificity and suitability of *Apion hookeri* (Coleoptera: Curculionidae), a candidate for the biological control of scentless chamomile, *Matricaria perforata* Mérat (Asteraceae), in Canada. The Canadian Entomologist 125: 619–628.

Peschken, D. P., K. C. Sawchyn, and D. E. Bright. 1993. First record of *Apion hookeri* Kirby (Coleoptera: Curculionidae) in North America. The Canadian Entomologist 125: 629–631.

Royce, L. A. and B. Simko. 2000. Cereal Leaf Beetle: Identification, Control, and California Quarantine Alert. Oregon State University, Extension Service, publication EM8762. Available from http://eesc.orst.edu/agcomwebfile/edmat/EM8762.pdf (accessed 14 April 2006).

Sampson, M. G. and T. MacSween. 1993. Biological control of weeds in Nova Scotia. Nova Scotia Department of Agriculture and Marketing, Final Report TD63. 47 pp.

Sleeper, E. L. 1953. New genera and species of Curculionoidea with a new species of Anthribidae. Ohio Journal of Science 53: 113–120.

Wheeler, A. G., Jr and E. R. Hoebeke. 1994. First records from the Canadian Maritime provinces of three European insects injurious to ornamental plants. Proceedings of the Entomological Society of Washington 96: 749–756.

Whitehead, D. R. 1980. The weevil *Apion (Perapion) curtirostre* Germar in North America, and the systematic position of *Perapion* Wagner with a review of the North American species (Coleoptera: Curculionoidea: Apionidae). The Coleopterists Bulletin 34: 397–400.