Zootaxa 1168: 21–30 (2006)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

1168

Adventive and native Byrrhidae (Coleoptera) newly recorded from Prince Edward Island, Canada

CHRISTOPHER G. MAJKA[1], CHRISTINE NORONHA[2] & MARY SMITH[2]

[1]*Nova Scotia Museum of Natural History, 1747 Summer Street, Halifax, Nova Scotia, Canada B3H 3A6. E-mail: c.majka@ns.sympatico.ca*

[2]*Agriculture and Agri-food Canada, 440 University Avenue, Charlottetown, Prince Edward Island, Canada C1A 4N6*

Abstract

The Palearctic byrrhids *Chaetophora spinosa* (Rossi) and *Simplocaria semistriata* (F.) are reported for the first time from Prince Edward Island (PEI), the former species for the first time from Atlantic Canada from specimens collected in 2003–05. Their presence is discussed both in light of the history of introductions of exotic species in Atlantic Canada in general, and on PEI in particular, and also in the context of the effect of adventive species on native organisms and ecosystems. These discoveries underscore the need for continual monitoring of invertebrate populations to detect on-going introductions of adventive species. The native byrrhid *Cytilus alternatus* (Say) is also reported for the first time from PEI.

Key words: Coleoptera, Byrrhidae, Chaetophora, Simplocaria, Cytilus, Canada, Prince Edward Island, biodiversity, adventive species

Introduction

Atlantic Canada has long been recognized as a point of introduction for many exotic species of Coleoptera. Brown (1940, 1950, 1967) reported 76 Palearctic beetle species from Atlantic Canada. Lindroth (1954, 1955, 1957, 1963) discussed this topic at length and reported many species of Palearctic Carabidae. Johnson (1990), Bousquet (1992), Hoebeke and Wheeler (1996a, 1996b, 2000, 2003), Wheeler & Hoebeke (1994), and Majka & Klimaszewski (2004) all added additional species. Unfortunately the Coleoptera of Prince Edward Island (PEI) have been poorly investigated with Bousquet (1991) reporting only 340 species of beetles from the province.

There have been few published accounts of adventive Coleoptera from PEI: *Coccinella u. undecimpunctata* L. (Coccinellidae), *Geotrupes stercorarius* L.

Accepted by P. Johnson: 28 Feb. 2006; published: 6 Apr. 2006

(Geotrupidae), *Philopedon plagiatus* (Schaller) (Curculionidae), (Brown 1940); *Harpalus rufipes* (DeGeer) (Carabidae) (Morrison 1941); *Tropiphorus terricola* (Newman) (Curculionidae) (Lindroth 1957); *Propylaea quatuordecimpunctata* (L.), *Hippodamia variegata* (Goeze) (Coccinellidae) (Hoebeke & Wheeler 1996b); *Meligethes viridescens* (F.) (Nitidulidae) (Hoebeke & Wheeler 1996a); *Telmatophilus typhae* (Fallén) (Cryptophagidae) (Hoebeke & Wheeler 2000); *Coccinella septempunctata* L., *Harmonia axyridis* Pallas (Coccinellidae) (Majka & McCorquodale, 2006); *Amara communis* (Panzer) (Carabidae) (Majka, 2005); and *Notophilius biguttatus* (F.), *Carabus granulatus hibernicus* Lindroth, and *Ophonus puncticeps* (Stephens) (Carabidae) (Majka et al. in review). The collection of G. stercorarius from Alma and Bedford in 1915 is of particular interest since these were the first North American records of this Palearctic species. This, however, is a very meagre record for PEI, making it difficult to assess if adventive species are continuing to colonize the island and if they are increasing their range within the province.

Leng (1917) first reported *Chaetophora spinosa* (Rossi) in North America from specimens collected in 1917 in New York. This Palearctic species is found throughout much of Europe south to Turkey (Johnson 2004). Johnson (1990) added substantially to the knowledge of its range in North America, reporting records from Ohio north to southern Ontario and Quebec, east across New York State and thence north to southern Maine. A second introduced western population straddles the Idaho — British Columbia border. In the present work, we extend its known range in North America by adding new records from Prince Edward Island based on specimens collected in 2003–05.

Johnson (1990) documents the earliest North American records of *Simplocaria semistriata* (F.) from specimens collected in Nova Scotia in 1913. This Palearctic species is found throughout central and southeastern Europe. It is now found in North America from Newfoundland and Québec south to Maryland and Ohio as well as in Minnesota and British Columbia (Johnson 1990). Herein we extend its range to include Prince Edward Island from specimens collected in 2004. We also report the native byrrhid *Cytilus alternatus* (Say) from PEI for the first time.

Conventions

Abbreviations of collections referred to in the text are: **ACPE**—Agriculture and Agri-Food Canada, Prince Edward Island, Charlottetown, PEI. **CGMC**—Christopher G. Majka Collection, Halifax, Nova Scotia. **UPEI**—University of Prince Edward Island, Charlottetown, PEI.

Results

On 27 June 2003, six specimens of *Chaetophora spinosa* were collected along the Princeton-Wharburton Rd. in St. Patricks, Queens County, PEI (CGMC) (**Figures 1**–**2**). The beetles were found in wet mud adjacent to roadside puddles along an unpaved road, a short distance from agricultural fields. Three additional specimens were collected by C. Majka on 15 August 2004 at Millvale, PEI, (~ 2 kilometers from the previous site) also in wet mud adjacent to a small mill-pond (CGMC). Additional specimens were seen at both sites. On 26 July 2005 a quadrant at the edge of a field planted with timothy (*Phleum pratense* L.), an introduced European grass, in Woodville Mills, Kings County, PEI was investigated. Seventeen specimens of *C. spinosa* were collected (CGMC) at a density of $10/m^2$. Individuals were found on bare mud and associated with the moss *Mnium hornum* Hedw.

FIGURE 1. *Chaetophora spinosa*. Dorsal habitus. Note the clavate bristles.

FIGURE 2. *Chaetophora spinosa*. Ventral habitus. Note the appendages, retractile into deep recesses and flush with the sterna when withdrawn. When contracted the anterior margin of the clypeus meets the anterior margin of the prosternum, hiding the withdrawn eyes, antennae, and mouthparts.

In 2004-05 (14 June, 28 June, 12 July, 26 July, and 9 August, 2004; 30 May 2005), C. Noronha and M. Smith collected 42 specimens of *C. spinosa* in pitfall traps set in barley and soybean fields in Harrington, Queens County, PEI (ACPE). Collection locations are indicated in **Figure 3**. Three specimens of *Simplocaria semistriata* (Fabricius) were also collected on 28 June and 16 September, 2004. The specimens of *C. spinosa* represent the first records of this species from Atlantic Canada while *S. semistriata* is newly recorded from Prince Edward Island.

While investigating the byrrhid fauna of PEI we also examined specimens of the native species, *Cytilus alternatus* (Say) from the following localities: **PEI: Kings County:** Valleyfield, June 1982, L.S. Thompson, 1, (ACPE). **Queens County:**

Charlottetown, 11 June 1957, F.M. Cannon, 1, (ACPE); Charlottetown, 16 June 1983, L.S. Thompson, 1, (ACPE); Charlottetown, 14 May 1981, V. Friesen, 1, (UPEI); West Royalty, 13 June 1983, L.S. Thompson, 1, (ACPE); Wood Islands, 30 June 2003, C.G. Majka, 1, (CGMC); Harrington, 14 June 2004, C. Noronha, 3, (ACPE). These specimens constitute the first records of this species from Prince Edward Island.

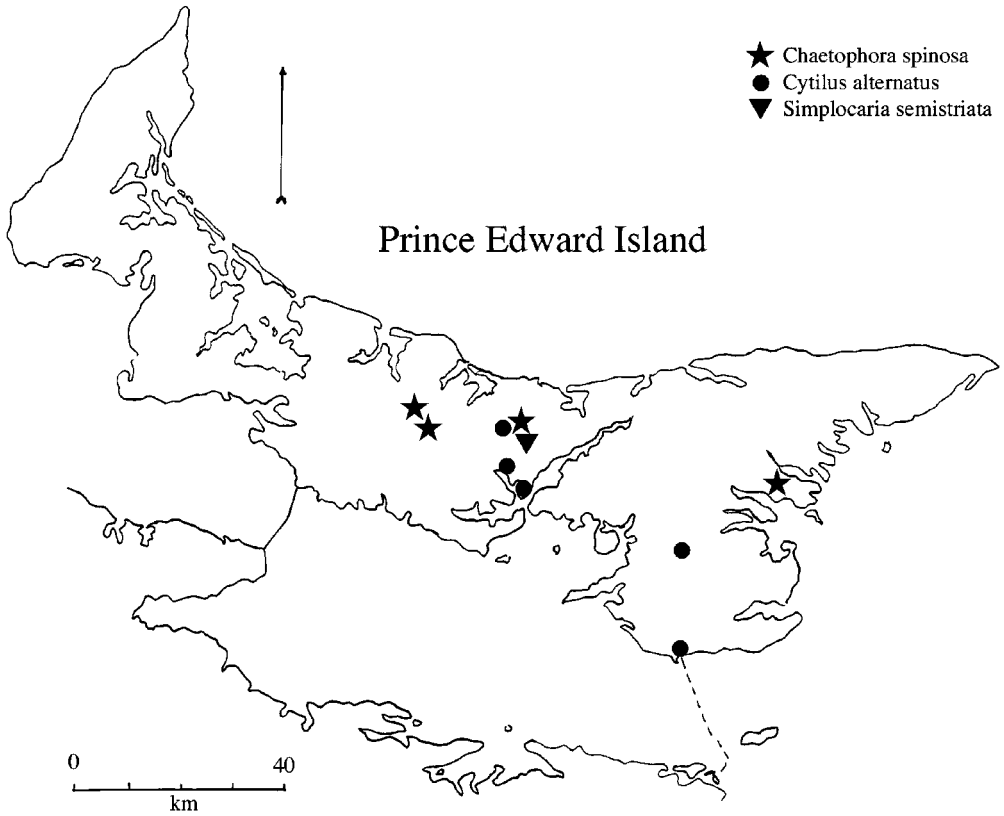

FIGURE 3. Collection localities for species of Byrrhidae on Prince Edward Island.

Discussion

Chaetophora spinosa occurs primarily in disturbed, moist habitats, with silty topsoils or exposures (Johnson 1990). Most North American species of Byrrhidae are obligate moss feeders as both adults and larvae (Johnson 2002). In Idaho, Johnson (1990) found them associated with the mosses *Pohlia atropurpurea* (Wahl.) H. Lind, *Dicranella varia* (Hedw.) Schimp., and *Aloina brevirostris* (Hook. & Grev.) Kind., although only the former two and the alga *Nostoc* sp. were confirmed as hosts. Ireland (1982) lists ten species of *Pohlia* in the Maritime Provinces, seven of which are found on PEI, and eight species of *Dicranella*, four of which are found on the island (*D. rufescens* (With.) Schimp, *D.*

subulata (Hedw.) Schimp, *D. cerviculata* Hedw., and *D. heteromalla* (Hedw.) Schimp.). *Aloina brevirostris* is known from a single site in Nova Scotia.

In North America *Simplocaria semistriata* is known to graze on the pioneer moss *Dicranella heteromalla* (Hedw.) Schimp., while in Scotland it is found on *Mnium hornum* Hedw. (Johnson 1990). Ireland (1982) indicates that there are four species of *Dicranella* known from PEI (above). Five species of *Mnium* are known from the Maritime Provinces, three of which (*M. hornum* Hedw., *M. ambiguum* H. Müll., and *M. spinulosum* B.S.G.) are reported from Prince Edward Island (Ireland 1982).

The beetle fauna of Prince Edward Island includes 152 introduced species, or 18.6% of its beetle fauna (C.G. Majka, unpublished data). In the case of such adventive species the question arises of when they were introduced and the modalities of their transport. Harrington (1891) first put forth the theory that species had been introduced to North America in dry ballast unloaded from ships, an idea which was further developed by Brown (1940, 1950) and more fully by Lindroth (1957). Johnson (1990) showed how this concept applied to both *C. spinosa* and *S. semistriata* and pointed out that they were synanthropic species which inhabit the cultural steppe associated with anthropogenic activities. Lindroth (1957) investigated seven principal sites in the southwestern part of Great Britain where dry ballast destined for Atlantic Canadian ports had originated. While he did not find *C. spinosa* (it does occur in England) he did find *S. semistriata* as well as *Cytilus sericeus* Forster.

Another mode of transport and introduction is via nursery stock, a concept proposed by Spence & Spence (1988) and discussed by Johnson (1990). Shipment of dry ballast came to an end after the First World War while nursery stock importation continues and, until 1965 when quarantine regulations on the importation of soil came into force, there was little to prevent soil-dwelling invertebrates from being accidentally imported along with bedding plants or seedlings. Majka & Klimaszewski (2004) argue that this was the mode of introduction of the Palearctic species *Phloeocharis subtilissima* Mannerheim, *Cephennium gallicum* Ganglbauer, and *Dromius fenestratus* (F.) to Nova Scotia.

Both these modes of transport may explain the presence of *C. spinosa* and *S. semistriata* on PEI. Until the opening of the Confederation Bridge in 1997, providing a terrestrial connection between PEI and the mainland, almost all products entering PEI came by ship. There is an extensive history of shipping to the island from the middle of the 18th century on, and the vast majority of ships landing on the island came either from other Maritime ports or from Great Britain (Hunter 2005). Agriculture is also the largest sector of the PEI economy with 646,000 acres of land (46% of the province) under agricultural cultivation (Anonymous 2005). While the discovery of these species on PEI might indicate a recent introduction event, minimal past fieldwork in the province might previously have overlooked them. Having been found at four sites 77 kilometers apart suggests that *C. spinosa* is widely distributed on PEI. Preliminary density data (10 individuals/m^2) indicates that the species may be abundant in appropriate situations.

The presence of at least *C. spinosa* on PEI may represent a separate introduction event from the remainder of its population on the eastern seaboard. Extensive fieldwork in Nova Scotia has not found *C. spinosa* to be present and despite more modest collection efforts in New Brunswick it has not been detected there. Adult *C. spinosa*, however, are fully winged and are frequently captured in flight. Consequently, autonomous wind-borne dispersal of the species from sites in southern Maine cannot be discounted. Whether the PEI populations were established directly from European sources or secondarily from North American populations is unknown; however, it would appear that it is isolated and significantly disjunct from the New England population, which appears to have spread over the last century from initial sites in New York.

This discovery does underscore the importance of on-going monitoring programs which can detect changes in both the distributions of adventive species which may be colonizing new areas and environments, and of native species which may be responding to environmental change. McCorquodale et al. (2005) point out that another necessary requisite for detection is a reservoir of taxonomic expertise and well-curated reference collections which can facilitate the processes of recognition and status assessment of such species.

Although the bionomics of *C. spinosa* and *S. semistriata* do not indicate that they could become pest species, 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 (*Plethedon cinereus* (Green)). Beetles, particularly weevils (Curculionidae) 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 adventive weevil *Barypeithes pellucidus* (Boheman) accounted for over 90% of individuals 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." Whether these adventive byrrhids could have similar effects on native predators remains to be investigated. Red-backed salamanders, which are present at both the St. Patricks and Millvale sites (C.G. Majka, pers. obs.), are considered to have been reduced in numbers and distribution on PEI by deforestation (Cook 1967).

In terms of competitive relations, the native *Cytilus alternatus* (Say) is found on PEI, indeed at some of the same sites where the adventive species are found, and might well be utilizing similar resources. This species has previously been recorded in every province from Manitoba east to Newfoundland and Labrador (Johnson 1991) so these present records eliminate a distributional gap.

In conclusion, meagre environmental monitoring and past collection efforts on PEI make it difficult to ascertain what the status and impact of *C. spinosa* and *S. semistriatus*

might be, underscoring the need for continual monitoring of invertebrate populations to detect such on-going introductions of adventive species.

Acknowledgements

Thanks are extended to David Christie (New Brunswick Federation of Naturalists), Donna Giberson (University of Prince Edward Island), and Paul Johnson (South Dakota State University) for their assistance. Also to Henri Goulet (Agriculture and Agri-food Canada) for executing the photographs of *Chaetophora spinosa*. Alex Wilson (Nova Scotia Museum of Natural History) assisted with the identification of mosses. Richard Hoebeke (Cornell University) and Paul Johnson (South Dakota State University) read earlier drafts of the manuscript and made many constructive suggestions. The first author thanks his colleagues Calum Ewing and Andrew Hebda, for continuing support and encouragement. This work was assisted by a research grant from the Nova Scotia Museum of Natural History.

Literature cited

Anonymous (2005) *Agriculture on Prince Edward Island*. Government of Prince Edward Island. Available from: http://www.gov.pe.ca/af/agweb/index.php3?number=71208&lang=E (accessed 5 June 2005)

Bousquet, Y. (1991) *Checklist of Beetles of Canada and Alaska*. Agriculture Canada: Research Branch, Publication 1861/E, 430 pp.

Bousquet, Y. (1992) *Bembidion femoratum* Sturm and *Amara communis* (Panzer) (Coleoptera: Carabidae) new to North America. *Journal of the New York Entomological Society,* 100(3), 503–509.

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

Brown, W.J. (1950) The extralimital distribution of some species of Coleoptera. *Canadian Entomologist*, 82, 197–205.

Brown, W.J. (1967) Notes on the extralimital distribution of some species of Coleoptera. *Canadian Entomologist*, 99, 85–93.

Cook, F.R. (1967) An analysis of the herptofauna of Prince Edward Island. *National Museum of Canada Bulletin*, 12, 60 pp.

Harrington, H.H. (1891) Notes on a few Canadian Rhyncophora. *Canadian Entomologist*, 23, 21–27, and 114.

Hoebeke, E.R. & Wheeler, A.G., 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.

Hoebeke, E.R. & Wheeler, A.G., Jr. (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.

Hoebeke, E.R. & Wheeler, A.G., Jr. (2000) *Telmatophilus typhae* (Fallén) (Coleoptera: Cryptoph-

agidae), a Palearctic cattail specialist established in the Canadian Maritime Provinces. *Proceedings of the Entomological Society of Washington*, 102, 398–402.

Hoebeke, E.R. & Wheeler, A.G., Jr. (2003) *Sphaeroderma testaceum* (F.) (Coleoptera: Chrysomelidae), a Palearctic flea beetle new to North America. *Proceedings of the Entomological Society of Washington*, 105, 990–994.

Hunter, D. (2005) *The Island Register, shipping stories, info, and folklore*. Available from http://www.islandregister.com/ships.html (accessed 5 June 2005)

Ireland, R.R. (1982) *Moss Flora of the Maritime Provinces*. National Museum of Canada, Publications in Botany, 13, 738 pp.

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(4), 434–440.

Johnson, P.J. (1991) Family Byrrhidae: pill beetles. *In:* Bousquet, Y. (Ed.), *Checklist of beetles of Canada and Alaska*. Agriculture Canada publication 1861/E, Ottawa, Canada, pp. 158–160.

Johnson, P.J. (2002) Byrrhidae Latreille 1804. *In*: Arnett, R.H., Jr., Thomas, M.C., Skelley, P.E. & Frank, J.H. (Eds.), *American Beetles, Volume 2: Polyphaga: Scarabaeoidea through Curculionoidea*. CRC Press, Boca Raton, USA. pp. 113–116.

Johnson, P.J. (2004) *Checklist of the Byrrhidae of North America*. Available from http://nathist.sdstate.edu/smircol/Byrrhidae/byrrhidae.htm (accessed 5 June 2005)

Leng, C.W. (1917) *Syncalypta spinosa* in North America. *Journal of the New York Entomological Society*, 25, 128–129.

Lindroth, C.H. (1954) Carabid beetles from Nova Scotia. *Canadian Entomologist*, 86, 299–310.

Lindroth, C.H. (1955) The carabid beetles of Newfoundland. *Opuscula Entomologica Supplementum*, 12, 160 pp.

Lindroth, C.H. (1957) *The faunal connections between Europe and North America.* Almqvist & Wiksell, Stockholm, Sweden. 344 pp.

Lindroth, C.H. (1963) The fauna history of Newfoundland illustrated by carabid beetles. *Opuscula Entomologica Supplementum*, 23, 112 pp.

Maertz, J.C., Karuzas, J.M., Madison, D.M., & Blossey, B. (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. *Canadian Entomologist*, 137, 532–538.

Majka, C.G., Cook, J. & Westby, S. (in review) Adventive Carabidae (Coleoptera) from Nova Scotia and Prince Edward Island: new records and ecological perspectives. *Canadian Entomologist.*

Majka, C.G. & Klimaszewski, J. (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*, 78, 1–15.

Majka, C.G. & McCorquodale, D.B. (2006) The Coccinellidae (Coleoptera) of the Maritime Provinces of Canada: new records, biogeographic notes, and conservation concerns. Zootaxa, 1154, 49-68.

McCorquodale, D.B., Musgrave, B.L., Atkins, S., Majka, C., & Anderson, R.S. (2005) New records of native and introduced weevils (Coleoptera: Curculionidae) for Nova Scotia from Cape Breton Island. *Coleopterists Bulletin*, 59(1), 27–34.

Morrison, F.O. (1941) Imported carabid beetle may be a potential pest. *Canadian Entomologist*, 73, 217–218.

Spence, J.R. & Spence, D.H. (1988) Of ground-beetles and men: introduced species and the synanthropic fauna of western Canada. *Memoirs of the Entomological Society of Canada*, 144, 151–168.

Wheeler, A.G., Jr. & Hoebeke, E.R. (1994) First records from the Canadian Maritime provinces of three European insects injurious to ornamental plants. *Proceedings of the Entomological Society of Washington*, 96(4), 749–756.

