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The Anthicidae and Ischaliidae (Coleoptera) of Atlantic Canada

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ABSTRACT

The present paper surveys the ant-like flower beetles (Coleoptera: Anthicidae) and false fire-colored beetles (Coleoptera: Ischaliidae) of Atlantic Canada. Seventeen new provincial records are reported including two species, *Amblyderus granularis* and *Anthicus cervinus*, which are newly recorded in the region. Fifteen species have now been recorded in Atlantic Canada, 13 of which have been found in New Brunswick, 14 in Nova Scotia, seven in Prince Edward Island, and three on insular Newfoundland. Distribution maps, keys to the identification of species, and colour habitus photographs are provided. Ecologically, the species fall into three categories: anthropophilic species (*Omonadus floralis* and *Omonadus formicarius*); saproxylic species (*Ischalia costata*); and beetles associated with beach drift and other sandy environments (all other species). The comparative dearth of historical collecting in such habitats suggests the distribution and abundance of many Atlantic Canadian species may be poorly documented, and the possibility exists that additional, undocumented species may be present.

RÉSUMÉ

Cet article recense les Anthicidés (Coleoptera: Anthicidae) et les Ischaliidés (Coleoptera: Ischaliidae) du Canada Atlantique. Dix-sept additions à la faune provinciale sont rapportées, incluant Amblyderus granularis et Anthicus cervinus, deux espèces décrites pour la première fois dans la région. Quinze espèces ont maintenant été enregistrées au Canada Atlantique, dont 13 ont été trouvées au Nouveau Brunswick, 14 en Nouvelle-Écosse, sept à l'Île-du-Prince-Édouard et trois sur l'île de Terre-Neuve. Des cartes de distribution, des clés d'identification des espèces et des photographies couleurs de l'habitus sont fournies. D'un point de vue écologique, les espèces se répartissent en trois catégories : les espèces anthropophiliques (Omonadus floralis et Omonadus formicarius); les espèces saproxyliques (Ischalia costata); et les coléoptères associés à la dérive littorale et les autres environnements sableux (toutes les autres espèces). La rareté comparative de l'échantillonnage dans ces habitats suggère que la distribution et l'abondance de plusieurs espèces du Canada Atlantique soient mal documentées, et qu'il est possible que d'autres espèces non-documentées soient présentes.

INTRODUCTION

Anthicidae, the ant-like flower beetles, is a diverse family of beetles with over 3,000 species worldwide (Chandler 2002). In North America there are 31 genera with 228 species, almost half of these in the genera *Anthicus* and *Notoxus*. In Canada Bousquet (1991) reported 55 species in 13 genera, with 11 species being reported from Atlantic Canada (Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island).

The unusual genus, *Ischalia* Pascoe, has, at various times, been placed in either the Pyrochroidae or the Anthicidae (Young 1985, 2007; Chandler 2002). Recent taxonomic studies (Nikitsky and Egorov 1992; Young 2007, 2011) have treated it within the Ischaliidae; the false fire-colored beetles, a placement that is followed herein. There are three species of *Ischalia* found in North America, all in the subgenus *Eupleurida*, two of which have been

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recorded in Canada (Campbell 1991; Chandler 2002).

Anthicids are scavengers and opportunistic predators of small arthropods, also feeding on pollen, plant exudates, and fungal hyphae and spores (Chandler 2002). All the species of Anthicinae found in Atlantic Canada are ground-dwelling and found on exposed soil or sand where they typically shelter beneath prostrate plants, debris, flotsam, stones, or clumps of litter. Species of *Notoxus* are typically found on vegetation in open areas with sandy soil (Blatchley 1910; Chandler 1982). Species in the Ischaliidae, by contrast, are found in forested habitats where they feed on fungi and slime molds in rotting wood (Chandler 2002).

The present study, based on an examination of specimens in collections in Atlantic Canada, surveys the Anthicidae and Ischaliidae of the region.

METHODS AND CONVENTIONS

The taxonomy and nomenclature employed in this study follows that of Chandler (2002) except that the genus *Ischalia* is treated within a distinct family, the Ischaliidae, following Nikitsky and Egorov (1992). Specimens of Anthicidae and Ischaliidae originating from Atlantic Canada were examined and identified. A total of 353 specimens were included; 140 from Nova Scotia, 65 from New Brunswick, 40 from Prince Edward Island, and 108 from Newfoundland and Labrador. Abbreviations of collections (largely following Evenhuis 2011) referred to in the accounts below 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 and Labrador, 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 (now at the New Brunswick Museum, Saint John, New Brunswick, Canada)
JOC	Jeffrey Ogden Collection, Truro, Nova Scotia, 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 Insectary, Shubenacadie, Nova Scotia, Canada
RWC	Reginald Webster Collection, Charters Settlement, New Brunswick, Canada
UMNB	Université de Moncton, Moncton, New Brunswick, Canada

IDENTIFICATION

A key to species of Anthicidae and Ischaliidae found in Atlantic Canada is provided below and is adapted from Chandler (1999, 2002), Werner (1962, 1964), and Downie and Arnett (1996) is provided on pages 52-54.

RESULTS

As a result of an examination of specimens of Anthicidae and Ischaliidae in collections in Atlantic Canada, 17 new provincial records are reported including two species, *Amblyderus granularis* (LeConte) and *Anthicus cervinus* LaFerté-Sénectère, that are newly recorded in the region (Table 1). Specific details follow.

Ischaliidae

Ischalia costata (LeConte, 1861)

NEW BRUNSWICK: **Albert County**: Germantown, May 5, 2004, R.P. Webster, spruce-fir forest in leaf litter (1, RWC). **Victoria County**: 7 July 2003, A.S. Bertrand, spruce plantation, pitfall trap (1, RWC); **Westmorland County**: Moncton, 1 June 1987, 8 June 1987, 13 July 1987, P. Maltais (6, UMNB); Moncton, 1 June 1987, 22 June 1987, 6 July 1987, 13 July 1987, P. Maltais (6, CNC); St. Anselme, 9 June 1986, P. Maltais (1, CNC). **NOVA SCOTIA**: **Annapolis County**: Channel Lake, 6-17 July 2005, S. Poirier, maple oak birch forest (1, CGMC); **Halifax County**: Eastern Passage, 7-17 June 2003, T. Rossolimo, 40 year old coniferous forest, pitfall trap (1, NSMC); **Inverness County**: MacKenzies Mt., Cape Breton Highlands National Park, 8 June 1984, H. Goulet, birch-fir forest (1, CNC): MacKenzies Mt., Cape Breton Highlands National Park, 19 June 1983, Y. Bousquet, forest, pan trap (1, CNC); MacKenzies Mt., Cape Breton Highlands National Park, 20 August 1983, M. Sharkey, pan trap (1, CNC); Lone Sheiling, Cape Breton Highlands National Park, 1 July 1983, J.R. Vockeroth, pan trap (1, CNC); Lone Sheiling, Cape Breton Highlands National Park, D.E. & J.E. Bright, flight intercept trap (1, CNC); **Lunenburg County**: Bridgewater, 1964, Dept. of Natural Resources (3, NSMC); Bridgewater, 10 July 1967, D. Embree (1, CNC); **Richmond County**: Irish Cove, 13-16 July 2004, C.W. D'Orsay, mixed forest, pitfall trap (1, CBU); Irish Cove, 2 July 1996, P.A. Rankin (1, CBU).

Ischalia costata (Figure 1) is newly recorded in New Brunswick. It was reported from Nova Scotia by Lafontaine et al. (1987) and Campbell (1991). There are scattered records in New Brunswick and Nova Scotia (Figure 2). Larvae and the flightless adults feed on fungal mycelia and slime molds in rotting wood (Young 1985;

1. Elytra with prominent lateral and epipleural ridges extending to or near apices; pronotum with lateral margins parallel from middle to base, base strongly angulate at basolateral angles and at middle (Figure 1) (Ischaliidae) [4.5–5.0 mm] ..... *Ischalia costata*
– Elytra convex, lacking any strong ridges; pronotum with lateral margins converging in basal half, basal margin gently convex to subtruncate (Anthicidae) 2

2(1). Pronotum with prominent dorso-apical horn extending anteriorly, and covering head; head closely articulated with pronotum, neck very short (Figure 18) (Notoxinae) [3.0–4.4 mm] .. .. *Notoxus anchora*
– Pronotum bluntly to smoothly rounded on anterior margin, head completely exposed; neck clearly exposed (Anthicinae) 3

3(2). Postero-lateral margins of mesepisterna with thick fringe of setae overlying obliquely impressed mesepimera, impression densely setose, with fovea from depressed portion of mesepimera projecting internally anterior to mesocoxae; elytra with dense layer of appressed to decumbent under-setae mixed with or beneath setae, in many with erect to suberect tactile setae; under-setae in many directed obliquely (*Sapintus*) 4
– Mesepisterna with very short fringe of setae on postero-lateral margins; narrow mesepimera forming nude oblique sulcus, lacking foveae; elytra lacking under-setae, with at most setae and tactile setae present 5

4(3). Head densely, distinctly punctate; body pale ferruginous (Figure 16) [2.2–2.7 mm] .... *Sapintus pusillus*
– Head finely punctate; body ferruginous to piceous (Figure 15) [2.3–2.7 mm] .. *Sapintus fulvipes*

5(3). Body with setae sparse and appressed, erect tactile setae short and inconspicuous; head and pronotum with reticulate microsculpture; elytra brown to dark brown, reddish across base (*Omonadus*) 6
– Most species with distinct tactile setae or longer setae; if not then coloration different and lacking microreticulation on head and pronotum 7

6(5). Pronotal disk with a pair of small, sub-median bumps on apical 1/4; mesosternum with sides bowed outwards and fringed with fine setae, appressed towards mesepisterna (Figure 13) [3.0–3.5 mm] ..... *Omonadus floralis*
– Pronotal disk without small, sub-median bumps; sides of mesosternum bowed slightly, but not fringed with setae (Figure 14) [3.2 mm] ..... *Omonadus formicarius*

7(5). Pronotum with antebasal constriction deeply indicated on lateral margins, continuing very shallowly across dorsum; elytra with long erect tactile setae; large dark species with pale postbasal band on elytra (Figure 17) [3.2–4.0 mm] ..... *Malporus formicarius*
– Lateral pronotal margins either lacking distinct constriction, or when present antebasal constriction not continuing across dorsum; different color and setation patterns 8

8(7). Pronotum widest very near anterior margin, abruptly declivous and flattened on anterior face; head strongly triangular (Figures 3–4) (*Amblyderus*).....9
– Pronotum evenly convex on anterior margin, mostly widest in apical third; head subquadrate to oval (Figures 5,7,8,10–12) (*Anthicus*).....10

9(8). Pronotum with distinct neck at base, lateral margins parallel for 15% or more of pronotal length in dorsal view; elytra shining, setae sparser and shorter, setae extending at most to about half length beyond next posterior puncture (Figure 3) [3.0–4.0 mm]..... *Amblyderus granularis*
– Pronotum with neck at base shorter, 10% or less of total pronotal length in dorsal view; elytra microreticulate and dull, setae appearing denser and longer, reaching at least to second puncture posterior to setal origin (Figure 4) [2.6–2.8 mm]..... *Amblyderus pallens*

10(8). Head and pronotum with distinct microsculpture between punctures over entire dorsal surface; male pygidium with deep, longitudinal oval pit in middle (Figure 7) [3.2–4.5 mm]..... ..... *Anthicus coracinus*
– Entire dorsal surface of head and pronotum smooth and shiny between punctures.....11

11(10). Pronotum with tubercles or longitudinal short, smooth ridges (rugae) between punctures 12
– Pronotal surface flat or evenly rounded between punctures 13

12(11). Head and pronotum with small tubercles between punctures; front portion of prosternum with dense plush-like pubescence; rufous to brown, elytra paler, usually with dark, median band (Figure 12) [2.4-2.8 mm] .....*Anthicus scabriceps* (in part)
– Pronotum with short longitudinal rugae, surface of head flat between punctures; luteous to brown, elytra usually with enclosed spot each side behind middle (Figure 8) [2.4-3.1 mm] .... *Anthicus flavicans*

13(10). Pubescence of at least humeral area of elytra short, distinctly curved, apices of setae curved below horizontal 14
– Pubescence of elytra not distinctly curved; if curved, somewhat shaggy and terminal portions nearly horizontal.....15

14(13). Markedly curved setae confined to basal portion of elytra; luteous to rufous, elytra usually darker beyond basal 2/5 with pale spot beyond middle of each elytron (Figure 5) [2.5-3.2 mm].....*Anthicus cervinus* (in part)
– Markedly curved setae extending nearly to apex of elytra; piceous or darker pale elytral markings as elongate spot on basal 1/3 and sub-quadrate spot on apical 1/3 of each elytron, basal spots not touching suture or base ("dark" form with no visible spots) (Figure10) [2.6-3.6 mm] ... . *Anthicus haldemani*

15(13). Prosternum with dense plush-like pubescence anteriorly, in some this extends laterally along sides of collar (Figure 12) [2.4-2.8 mm] ..... *Anthicus scabriceps* (in part)
– Prosternum normally pubescent 16

16(15). Each elytron with two distinctly defined, elongate pale spots, one at base reaching humeri and narrowly separated at suture, the other rounded at apical 1/3 (Figure 11) [3.6–4.3 mm] .... *Anthicus heroicus*
– Elytra with only posterior spots well defined and distinctly centered (Figure 5) [2.5-3.2 mm] ... . *Anthicus cervinus* (in part)

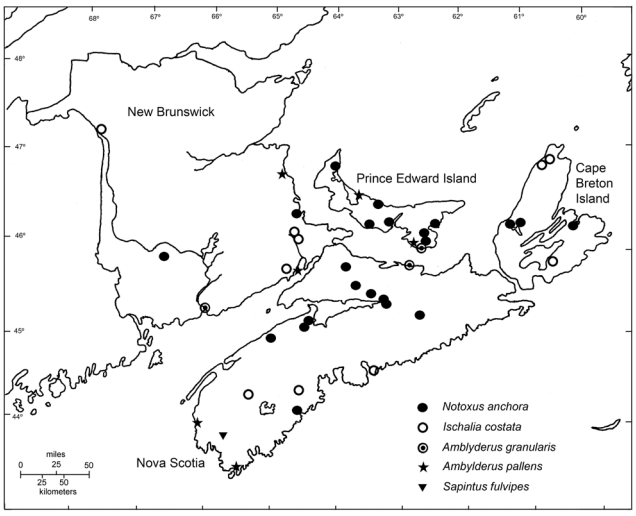
Table 1. Atlantic Canada species of Anthicidae and Ischaliidae.

NB	NS	PE	NF	Distribution in NE North America
Ischaliidae				
Ischalia costata (LeConte)	1	1		CT, MA, ME, NB, NH, NS, NY, ON, QC, RI, VT
Anthicidae				
Anthicinae				
Amblyderus granularis (LeConte)	1	1	1	MA, NB, NS, NY, ON, PE, QC, RI, VT
Amblyderus pallens (LeConte)	1	1	1	MA, ME, NB, NH, NS, NY, ON, PE, QC, RI
Anthicus cervinus LaFerté-Sénectère	1	1		CT, MA, ME, NH, NS, NY, ON, QC, RI
Anthicus coracinus LeConte	1	1		NB, NH, NS, ON, QC
Anthicus flavicans LeConte	1	1	1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI
Anthicus haldemani LeConte		1	1	MA, ME, NF, NH, NS, NY, ON, QC, RI
Anthicus heroicus Casey	1			NB, QC
Anthicus scabriceps LeConte	1	1	1	CT, MA, ME, NB, NF, NH, NS, NY, ON, QC, RI
Omonadus floralis (Linnaeus)*	1	1	1	1 CT, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI
Omonadus formicarius (Goeze)*	1	1	1	CT, MA, ME, NB, NS, NY, ON, PE, QC, RI
Sapintus fulvipes (LaFerté-Sénectère)		1		CT, MA, ME, NH, NS, NY, ON, QC, RI
Sapintus pusillus (LaFerté-Sénectère)	1	1		CT, MA, ME, NB, NH, NS, NY, ON, QC, RI
Malporus formicarius (LaFerté-Sénectère)	1	1	1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI, VT
Notoxinae				
Notoxus anchora Hentz	1	1	1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI, VT
Total	13	14	7	3

NOTE: NB = New Brunswick; PE = Prince Edward Island; NS = Nova Scotia; NF = insular Newfoundland; * = adventive Palaearctic species. Distribution in northeastern North America: ON = Ontario; QC = Québec; LB = Labrador; PM = Saint-Pierre et Miquelon; CT = Connecticut; MA = Massachusetts; ME = Maine; NH = New Hampshire; NY = New York; RI = Rhode Island; and VT = Vermont. Records compiled from the sources cited in this paper.

Figure 1. Habitus image of type specimen of *Ischalia costata* (LeConte). **Photo Credit**: with permission, Museum of Comparative Zoology, Harvard College.

Figure 2. Distribution of *Notoxus anchora*, *Ischalia costata*, *Ambyderus granularis*, *Amblyderus pallens*, and *Sapintus fulvipes* in Atlantic Canada.



Chandler 2002; Kazantsev and Young 2011). All the specimens collected in New Brunswick and Nova Scotia with habitat data were collected in forests (coniferous forest, spruce plantation, mixed forest, old growth deciduous forest, and maple-oak-birch mixed forest). Several were collected in pitfall traps on the forest floor.

Kazantsev and Young (2011) drew attention to the Batesian mimicry exhibited by Palaearctic and Nearctic species of *Ischalia* with respect to members of the Lycidae. Lycids contain two potent compounds, lycidic acid and pyrazines, that forestall predatory attacks (Eisner et al. 2008). Kazantsev and Young (2011) pointed out the resemblance between *Ischalia costata* and the lycids, *Benibotarus thoracicus* (Randall), *Eros humeralis* (Fabricius), and *Leptoceletes basalis* (LeConte), all of which occur in the Maritime Provinces. Species of *Ischalia* are also attracted to cantharidin, raising the possibility that adults may be able to sequester this caustic compound (which also deters predation) as species of *Notoxus* do (see below) (Kazantsev and Young 2011).

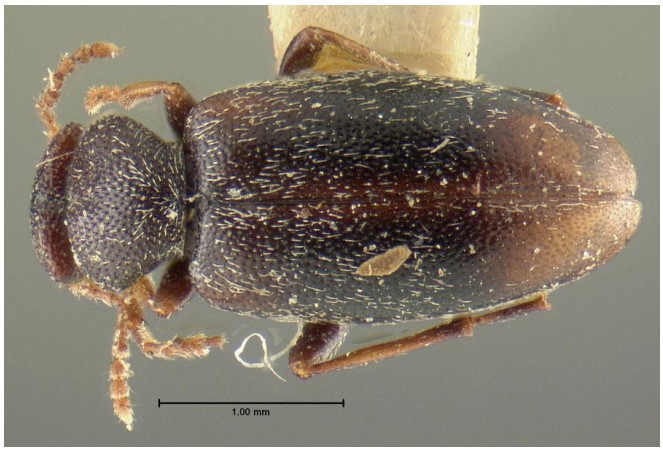
Anthicidae
Anthicinae

Amblyderus granularis (LeConte, 1850)

NEW BRUNSWICK: **Saint John County**: Saint John, 14 June 2002, R.P. Webster, seashore beach, under drift (2, RWC). **NOVA SCOTIA**: **Pictou County**: Caribou Island, 29 August 2003, C.G. Majka, coastal dunes, flotsam on beach (1, CGMC). **PRINCE EDWARD ISLAND**: **Queens County**: Wood Islands, 29 August 2003, C.G. Majka, seashore, under flotsam on beach (3, CGMC).

Amblyderus granularis (Figure 3) is newly recorded in New Brunswick, Nova Scotia, and Prince Edward Island, and consequently in all of Atlantic Canada (Figure 2). Downie and Arnett (1996) reported it as occurring under sandy beaches along water. Chandler (1999) reported it to normally occur under debris on beaches of fresh-water lakes and large rivers, but is also rarely in brackish, coastal habitats. This is true of all the specimens collected in the Maritime Provinces, which were found under beach drift on coastal beaches.

Figure 3. Habitus image of type specimen of *Amblyderus granularis* (LeConte). **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.



Amblyderus pallens (LeConte, 1850)

NEW BRUNSWICK: **Albert County**: Mary's Point, 21 August 2003, C.G. Majka, coastal marsh, under flotsam (6, CGMC); **Kent County**: Kouchibouguac National Park (Chandler 1999). **NOVA SCOTIA**: **Digby County**: Beaver River, 16 July 1993, J. Cook, sand dunes (2, JCC); **Shelburne County**: Sebim Beach, 25 August 1989, J. Cook, (1, JCC). **PRINCE EDWARD ISLAND**: **Prince County**: Lower Darnley, 25 August 2003, C.G. Majka, coastal dunes, under flotsam (2, CGMC); **Queens County**: Wood Islands, 29 August 2003, C.G. Majka, seashore, under flotsam (1, CGMC).

Amblyderus pallens (Figure 4) is newly recorded in Nova Scotia and Prince Edward Island. It was reported from New Brunswick by Bousquet (1991) and Chandler (1999). From limited data it appears generally distributed in the Maritime Provinces in coastal sites (Figure 2). It has been reported as being found in sand beneath sprawling plants, in grass roots 4–8 cm beneath the dune surface, and beneath debris in dune areas and sandy beaches (Blatchley 1910; Downie and Arnett 1996; Chandler 1999). All the specimens found in the Maritime Provinces were found under beach drift and flotsam on coastal beaches.

Figure 4. Habitus image of type specimen of *Amblyderus pallens* (LeConte). **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.

Anthicus cervinus LaFerté-Sénectère, 1849

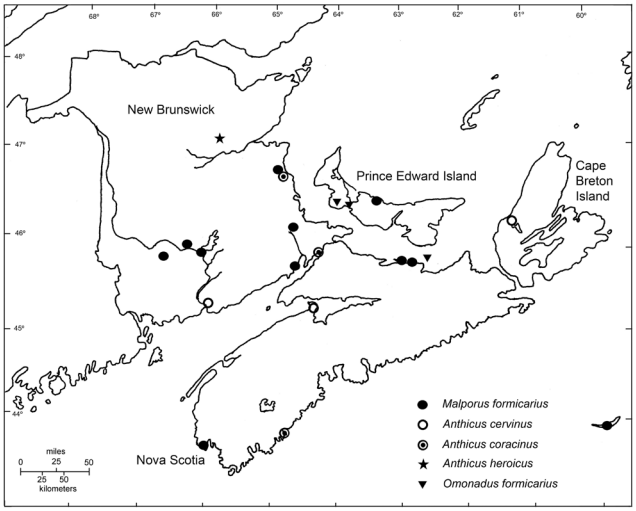
NEW BRUNSWICK: **Saint John County**: Saint John, 2 May 190?, W. McIntosh (2, NBM). **NOVA SCOTIA**: **Inverness County**: Kenlock, 11 August 1994, J.M. Francis & V. Jessome, dump (1, CBU); **Kings County**: Delhaven, July 1962, D.H. Webster, sandy beach (1, DHWC).

Anthicus cervinus (Figure 5) is newly recorded in New Brunswick and Nova Scotia and consequently in all of Atlantic Canada (Figure 6). This species has been found in soybean fields (Bechinski and Pedigo 1982), sunflower fields (Royer and Walgenbach 1991), asparagus fields (Latta 1928), salt marshes (Cameron 1972), freshwater marshes (Williams et al. 1995), cobble

beaches (Eastwood et al. 2009), grasslands (Bulan and Barrett 1971), bat guano (Whitaker et al. 1991); and, occasionally associated with stored grain (Bousquet 1990). In Nova Scotia, one specimen was collected along the shore of a lake and a second one on a coastal beach.

Figure 5. Habitus image of *Anthicus cervinus* LaFerté-Sénectère. **Photo credit**: Lynette Schimming, Puyallup, Washington.

Figure 6. Distribution of *Malporus formicarius*, *Anthicus cervinus*, *Anthicus coracinus*, *Anthicus heroicus*, and *Omonadus formicarius* in Atlantic Canada.

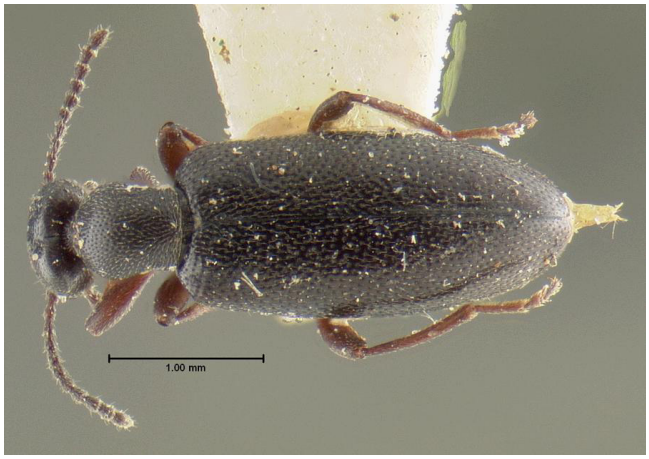


Anthicus coracinus LeConte, 1851

NEW BRUNSWICK: **Kent County**: Kouchibouquac National Park, 7 June 1978, D.B. Lyons (1, CNC); **Westmorland County**: Sackville, 18 August 1982, pitfall trap (1, UMNB). **NOVA SCOTIA**: **Queens County**: vicinity of Port Medway (1, CNC).

Anthicus coracinus (Figure 7) was recorded from Nova Scotia by Werner (1964) and from New Brunswick by Bousquet (1991) (Figure 6). No published bionomic information is available.

Figure 7. Habitus image of type specimen of *Anthicus coracinus* LeConte. **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.



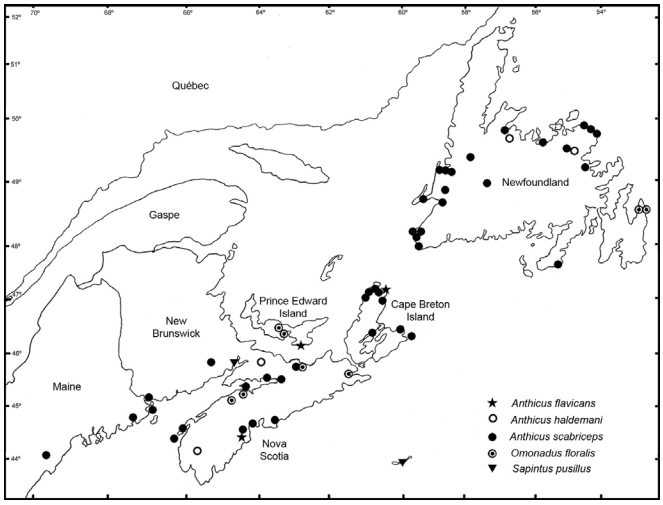
Anthicus flavicans LeConte, 1852

NOVA SCOTIA: **Victoria County**: South Harbour, 28 June 1983, R. Vockeroth, pans, malaise (1, CNC). **PRINCE EDWARD ISLAND**: **Queens County**: Wood Islands, 29 August 2003, C.G. Majka, seashore, under flotsam on beach (7, CGMC); 30 June 2003, C.G. Majka, seashore, under flotsam on beach (4, CGMC).

Anthicus flavicans (Figure 8) is newly recorded in Prince Edward Island. It was first recorded from Nova Scotia by Werner (1964) and from New Brunswick by Bousquet (1990, 1991) (Figure 7); occasionally associated with stored grain (Bousquet 1990). The specimens on Prince Edward Island were found under flotsam on ocean beaches.

Figure 8. Habitus image of type specimen of *Anthicus flavicans* LeConte. **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.

Figure 9. Distribution of *Anthicus flavicans*, *Anthicus haldemani*, *Anthicus scabriceps*, *Omonadus floralis*, and *Sapintus pusillus* in Atlantic Canada.



Anthicus haldemani LeConte, 1852

NEWFOUNDLAND & LABRADOR: South Pond near South Brook, 27 June 1980, Brennan & Larson, drift (5, MUN); Glenwood (1, CNC). **NOVA SCOTIA**: **Cumberland County**: Oxford, 24 July 1988, 9 August 1988, 12 August 1988, UV light trap (3, NSMC); **Yarmouth County**: north from North Kemptville, 23 August 1992, mixed forest, car net (3, JCC).

Anthicus haldemani (Figure 10) is newly recorded in Nova Scotia. It was first recorded from insular Newfoundland by Werner (1964) (Figure 9). Specimens collected on insular Newfoundland were found in beach drift.

Figure 10. Habitus image of type specimen of *Anthicus haldemani* LeConte. **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.

Anthicus heroicus Casey, 1895

NEW BRUNSWICK: **Northumberland County**: NW Miramichi River, 22 July 1962, J. Marshall (6, CNC).

Anthicus heroicus was recorded from New Brunswick by Bousquet (1991) (Figure 6) on the basis of the above specimens (Figure 11). Davidson and Wood (1969) found *Anthicus heroicus* larvae feeding on dobsonfly (Corydalidae) eggs on midstream boulders in a river. It is found in rich mesophytic (moist) habitats (Werner 1964).

Figure 11. Habitus image of specimen of *Anthicus heroicus* Casey collected in New Brunswick. **Photo credit**: Henri Goulet, Ottawa, Ontario.

Anthicus scabriceps LeConte, 1850

NEW BRUNSWICK: **Charlotte County**: St. Andrews, 17 August 1955, J.R. Vockeroth, in rotting seaweed (1, CNC); Campobello Island, 5 July 1988, Y. Bousquet (2, CNC). **NEWFOUNDLAND & LABRADOR**: Red Indian Lake, 25 June 1980, Brennan & Larson, wind-drift (12 MUN; 2 CFNL); Cape Freels, 14 August 2002, S.A. Pardy, sand dune vegetation (1, MUN); Deadman's Bay, July 12 2001, July 18 2001, July-August 2001, S.A. Pardy, sand dune: semi-stable vegetation (12, MUN); Lumsden, 15 August 2001, S.A Pardy, sand dune vegetation (11, MUN); Shalloway Bay, 15 August 2001, July-August 2001, S.A. Pardy, sand dune: semi-stable vegetation (5, MUN); Brachois Provincial Park, 27 June 2010, D. Langor, pond edge (6, MUN); Blow Me Down Mt., 28 June 2010, seashore detritus (5, MUN); Deer Lake, 23 June 2010, D. Langor, lakeshore detritus (17, MUN); J.T. Cheeseman Provincial Park, 14 August 2002, S.A Pardy, sand dune vegetation (3, MUN); Searston, 23 June 2010, D. Langor, under seaweed on sandy beach (1, MUN); York Harbour, 28 June 2010, D. Langor, under seashore detritus (14, MUN); Corner Brook, 29 June 2010, D. Langor, seaside beach (1, MUN); 1 mi E of Traytown,

27 July 1970, D.E. Bright (1, CNC). **NOVA SCOTIA**: **Cape Breton County**: Scatarie Island: Northwest Cove, 15 July 2006, S.M. Townsend, in wrack on beach (1, CBU); Scatarie Island: Savage Cove, 10 August 2005, K.R. Aikens, under wrack on beach (2, CBU); Schooner Pond, 22 September 2007, K.M. Boutilier, in gravel (2, CBU); Schooner Pond, 15 September 2005, D.S. Wadden & N. White (2, CBU); Schooner Pond 6 September 2003, D.B. McCorquodale (1, CBU); **Colchester County**: Portapique, 26 July 1927, C.S. Frost (2, CNC); **Digby County**: Brier Island, Pond Cove, 22 June 2003, 23 June 2003, 10 August 2004, J. Ogden & K. Goodwin, rocky shore, pitfall trap (3, JOC); Sandy Cove, 3 July 1972, B. Wright (12, NSMC); **Inverness County**: 1 km S of Pillar Rock, Cape Breton Highlands National Park, 9 June 1983, Y. Bousquet (1, CNC); La Block beach, Cape Breton Highlands National Park, July 10, 1983, L. LeSage, seashore wrack, Berlese funnel (2, CNC); Pleasant Bay, Cape Breton Highlands National Park, July 29, 1983, D.E. & J.E. Bright, seashore kelp, pans (7, CNC); Pleasant Bay, Cape Breton Highlands National Park, 28 May 1984, 29 May 1984, H. Goulet, moist meadow and wood on sea beach (5, CNC); **Kings County**: Mill Creek, 30 July 2006, D.H. Webster, under weathered wrack (2, DHWC); **Lunenburg County**: Big Mushamush Lake, 24 August 1983, B. Wright (1, NSMC: Chester, 22 June 1969, B. Wright (3, NSMC): **Pictou County**: McLellan's Brook, 5 August 1988, E. Georgeson, UV light trap (5, NSMC); **Victoria County**: Ingonish Centre, 28 May 1996, P.A. Rankin (1, CBU); Clayburn Brook, Cape Breton Highlands National Park, 20 June 1983, Y. Bousquet (1, CNC); South Branch, North Aspy River, Cape Breton Highlands National Park, 7 July 1983, L. LeSage, drift net (1, CNC); Warren Lake, Cape Breton Highlands National Park, 27 June 1984, A. Smetana (1, CNC).

Anthicus scabriceps (Figure 12) was recorded from New Brunswick, Nova Scotia, and insular Newfoundland by Bousquet (1991) (Figure 6). Klimaszewski and Majka (2007) and Majka et al. (2010) noted the presence of this species in coastal beach drift habitats. Almost all specimens collected in Atlantic Canada were found in coastal beach drift environments, except for a small number found in lakeshore drift. It is also occasionally associated with stored grain (Bousquet 1990).

Omonadus floralis (Linnaeus, 1758)

NEWFOUNDLAND & LABRADOR: Portugal Cove, Indian Meal Line, 30 October 1979 (1, MUN); Portugal Cove, Indian Meal Line, 22 June 1981 (1, CNC); St. John's,

Figure 12. Habitus image of type specimen of *Anthicus scabriceps* LeConte. **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.

17 September 1997, Biology 4150 class (1, MUN). **NOVA SCOTIA**: **Guysborough County**: Guysborough, 9 August 1988, E. Georgeson, UV light trap (1, NSMC); **Kings County**: Berwick, 6 October 1961, H.T. Stultz (1, ACNS); Kentville, 26 August 2007, D.H. Webster, at light (1, DHWC); **Pictou County**: McLellan's Brook, 5 August 1988, E. Georgeson, UV light trap (2, NSMC). **PRINCE EDWARD ISLAND**: **Queens County**: Charlottetown, 19 September 1987, J.G. Stewart, in house (1, ACPE); Charlottetown, 24 August 1988, J.G. Stewart, taken from cow (2, ACPE); Harrington, 31 July 1987, M.E.M. Smith, potato field (1, ACPE).

Omonadus floralis (Figure 13) is newly recorded from Nova Scotia and Prince Edward Island. It was reported from New Brunswick and insular Newfoundland by Bousquet (1991) (Figure 9). This adventive Palaearctic species is broadly distributed in Europe from Northern Russia and Fennoscandia, south through the Baltic republics and Belarus to Bulgaria, Greece, Crete, and Cyprus, and west across the Mediterranean (including Sicily, Sardinia, and Corsica) to Spain and Portugal, and north to Great Britain, and Ireland (Nardi 2011). The so-called 'narrow-necked grain beetle" was reported to be a stored product pest associated with grain (Hinton 1945), however, Bousquet (1990) noted that the beetles do not feed directly on grain kernels and appear to be confined mainly to residues. Campbell et al. (1989) reported it in association with oats, wheat, barley, dried fruit, water chestnuts, and straw. It is also found on fungi (Sinha 1961), in dung heaps (Hemp and Dettner 2003), in compost heaps (Hinton 1945), near farms (Klejdysz and Nawrot 2010), on river flood-plains (Telnov 1998), and on sand dune beaches (Wolender and Zych 2007). Habitat data for most specimens collected in Atlantic Canada is lacking, however, at least some have been found on farms. This species was first recorded in

North America prior to 1824 (Campbell et al. 1989); in Atlantic Canada the earliest dates of detection are 1961 in Nova Scotia, 1979 in Newfoundland, 1987 in Prince Edward Island, and prior to 1991 in New Brunswick.

Figure 13. Habitus image of *Omonadus floralis* (Linnaeus). **Photo credit**: Joyce Gross, San Leandro, California.

Omonadus formicarius (Goeze, 1777)

NOVA SCOTIA: **Pictou County**: Pictou Island, 13 July 1988, Y. Bousquet (1, CNC). **PRINCE EDWARD ISLAND**: **Prince County**: Summerside, 9 July 1988, Y. Bousquet (3, CNC): Wellington, 9 July 1988, Y. Bousquet (1, CBC).

Omonadus formicarius (Figure 14) is newly recorded from Nova Scotia and Prince Edward Island. It was recorded from New Brunswick by Bousquet (1991) (Figure 6). This adventive Palaearctic species is broadly distributed in Europe from Northern Russia and Fennoscandia, south through the Baltic republics and Belarus to the Ukraine, Bulgaria, Greece, Crete, and Cyprus, and west across the Mediterranean (including Sicily, Sardinia, and Corsica) to Spain and Portugal, and north to Great Britain (Nardi 2011). In terms of bionomics, it has been found along the shore of coastal lagoons (Bucciarelli 1977; Ferenca et al. 2010), in dry meadows near the seacoast (Barsevskis et al. 2004), on coastal cliffs (Telfer 2006), on a river flood plain (Telnov 1998), near farms (Klejdysz and Nawrot 2010), and occasionally associated with stored products such as grain (Bousquet 1990).

Sapintus fulvipes (LaFerté-Sénectère, 1849)

NOVA SCOTIA: **Yarmouth County**: Kegeshook Lake, 29 June 1995, J. & F. Cook, stream (1, JCC).

Figure 14. Habitus image of *Omonadus formicarius* (Goeze). **Photo credit**: Tom Murray, Groton, Massachusetts.

Sapintus fulvipes (Figure 15) is newly recorded in Atlantic Canada from the above collection in Nova Scotia. Werner (1962) reported this species from vegetation, moss roots, under a log, on sand, and on beaches. It has been reported from freshwater marshes (Williams et al. 1995) and mangrove islands (Simberloff 1976).

Figure 15. Habitus image of *Sapintus fulvipes* (LaFerté-Sénectère). **Photo credit**: WonGun Kim, Vienna, Virginia.

Sapintus pusillus (LaFerté-Sénectère, 1849)

NEW BRUNSWICK: **Albert County**: Mary's Point, 12 August 2004, C.G. Majka, beach drift (1, CGMC).

Sapintus pusillus (Figure 16) was recorded from New Brunswick by Majka and Ogden (2006) and from Sable Island, Nova Scotia by Howden (1970). Werner (1962) reported this species from dunes. On Sable Island Howden (1970) found it in dead vegetation around lake margins. Majka and Ogden (2006) noted its association with members of the beach drift fauna.

Figure 16. Habitus image of type specimen of *Sapintus pusillus* (LaFerté-Sénectère). **Photo credit**: with permission, Museum of Comparative Zoology, Harvard College.

Malporus formicarius (LaFerté-Sénectère, 1849)

NEW BRUNSWICK: **Albert County**: Mary's Point, 5 May 2004, 6 June 2004, 9 September 2004, R.P. Webster, sea beach under drift material on upper margin of beach (5, RWC); Mary's Point, 5 May 2004, R.P. Webster, salt marsh near forest, in litter on drift wood (7, RWC); **Queens County**: Black Lake, Scotchtown, 4 May 2000, R.P. Webster, lakeshore under debris (1, RWC); **Sunbury County**: Portabello Creek, National Wildlife Area, 6 June 2004, R.P. Webster, silver maple swamp, margin of slow river in litter (1, RWC); **York County**: Charters Settlement 6 May 2000, R.P. Webster, under debris on beaver lodge (1, RWC); **Kent County**: Kouchibouguac National Park (1, CNC); Westmorland County: Moncton (1, CNC). **NOVA SCOTIA**: **Pictou County**: Caribou Island, 29 August 2003, C.G. Majka, flotsam on beach, coastal dune area (1, CGMC); Seafoam, 11 August 2008, C.G. Majka, beach drift on seashore (7, CGMC); **Yarmouth County**: Yarmouth (1, CNC). **PRINCE EDWARD ISLAND**: **Queens County**: North Rustico, 17 August 2002, C.G. Majka, coastal lagoon (6, CGMC).

Malporus formicarius (Figure 17) is newly reported from Prince Edward Island. It was reported from Sable Island, Nova Scotia by Howden (1970) and from New Brunswick by Bousquet (1991). This species is often found beneath coastal and lake drift; it is particularly common in salt marshes (LeConte 1852; Howden 1970). It has also been found in gopher burrows, in old beaver lodges, on willow, under grass debris, under stones and boards, and in leaf litter (Chandler 1997). All specimens found in Atlantic Canada have been found in beach drift or similar habitats, in both coastal environments and along lakes and rivers.

Figure 17. Habitus image of *Malporus formicarius* (LaFerté-Sénectère). **Photo credit**: Tom Murray, Groton, Massachusetts.

Notoxinae

Notoxus anchora Hentz, 1827

NEW BRUNSWICK: **Kent County**: Cocagne, July 1984, C. Goguen (1, UMNB); **York County**: Charters Settlement: 27 June 2011, R.P. Webster, mixed forest, at light (2, RWC). **NOVA SCOTIA**: **Annapolis County**: Melvern Square, 24 June 1992, E. Georgeson (1, NSNR); **Cape Breton County**: Sydney, 20 July 1994, V. Jessome (1, CBU); **Colchester County**: Bible Hill, 8 July 2004, K.R. Aikens, pasture, sweeping (1, CBU); Debert, 26 July 1995, J. Ogden (1, NSNR); Truro, July 1975, J.A. Hebert (1, NSAC); Truro, 15 July 1952, V. Vickery (1, NSAC); **Cumberland County**: Oxford, 12 July 1988, E. Georgeson, UV light trap (7, NSMC); Westchester-Londonderry, 22 August 1992, S. & J. Peck, forest road, car net (17, JCC); **Guysborough County**: Trafalgar, Liscomb Provincial Sanctuary, 19 July 1992, S. & J. Peck, forest road, car net (2, JCC); **Inverness County**: Kenlock, 18 July 1994, J.M. Francis & V. Jessome (1, CBU); Scotsville, 1 July 1996, D.B. McCorquodale (1, CBU); **Kings County**: Kentville, 5 July 1951, H.T. Stultz (1, ACNS); Sheffield Mills, 24 July 2002, K. Neil, pitfall trap (1, NSMC); **Queens County**: Medway River, 13 July 1993, J. & T. Cook, car net (1, JCC). **PRINCE EDWARD ISLAND**: **Kings County**: Caledonia, 12 July 2002, C.G. Majka, blueberry barrens (2, CGMC); Woodville Mills, 16 August 2002, C.G. Majka, old field (1, CGMC); **Prince County**: Kildare, 18 July 1960, F.M. Cannon, pasture (1, ACPE); **Queens County**: Charlottetown, July 1957, F.M. Cannon (1, ACPE); Crapaud, 26 July 1993, M.E.M. Smith, potato field (1, ACPE); Mount Vernon, 26 July - 1 August 1995, M.E.M. Smith, blueberry field (1, ACPE); North Rustico, 13 July 2001, C.G. Majka, seashore, coastal vegetation (2, CGMC).

Notoxus anchora (Figure 18) is newly recorded in

Nova Scotia. It was reported from New Brunswick and Prince Edward Island by Bousquet (1991) (Figure 2). Chandler (1982) reported it from alfalfa and other grasses and attracted to lights. Rider et al. (2000) found it in native prairie habitats. The pronotal horn is used for burrowing into sand dunes or sandy soils (Chandler 2002). In Atlantic Canada it has been collected in a variety of open habitats such as blueberry and potato fields, pastures, and old fields, but also in mixed forests and along forest roads. Larvae of one *Notoxus* species have been reported as boring in sweet potato tubers (Cuthbert 1967). Adult males are attracted to cantharidin which they absorb and which they pass on to females by secretions on which the females feed. Cantharidin is used as deterrent against potential predators (Chandler 2002).

Figure 18. Habitus image of *Notoxus anchora* Hentz. **Photo credit**: Bill Johnson, Minneapolis, Minnesota.

DISCUSSION

As a result of the present study two species, *Amblyderus granularis* and *Anthicus cervinus*, are newly recorded in Atlantic Canada, and 17 new provincial records are established, almost doubling the number of provincial records to 37. Fifteen species have now been recorded in the region, 13 of which have been found in New Brunswick, 14 Nova Scotia, seven in Prince Edward Island, and three on insular Newfoundland (Table 1).

Nevertheless, knowledge of this family of beetles in Atlantic Canada should be considered in its early stages. Although some species such as *Anthicus scabriceps, Malporus formicarius, Notoxus anchora,* and *Omonadus floralis* are widely distributed in the region and are represented by at a substantial number of records, many other species such as *Ambyderus granularis, Anthicus cervinus, Anthicus coracinus, Anthicus heroicus, Omonadus formicarius, Sapintus fulvipes,* and *S. pusillus* are known from only a small number of localities and/or specimens (Figs. 2, 6, & 9). In part this may represent a comparative dearth of collecting effort in beach drift environments where most of these species are found. Historically, collecting for beetles in Atlantic Canada has been concentrated on species found in agricultural environments, in forest habitats (as pest species or as members of the saproxylic fauna), and those that are dried product pests. Thus, except for *Notoxus anchora*, which is often found in sandy agricultural fields, and *Omonadus floralis,* which is found in stored products, most other species would seldom have been encountered.

Given the modest collecting effort for this family in the region, it is possible that additional, as yet undetected, species may occur in Atlantic Canada. In the neighbouring state of Maine, *Stereopalpus rufipes* Casey, *Macratria confusa* LeConte, *Anthicus ephippium* LaFerté-Sénectère, *Anthicus melancholius* LaFerté-Sénectère, *Sapintus pubescens* (LaFerté-Sénectère), *Stricticollis tobias* (Marseul), *Malporus cinctus* (Say), *Ischyropalpus nitidulus* (LeConte), and *Notoxus desertus* Casey have all been recorded (Majka et al. 2011); while in Québec, *Anthicus ephippium, Anthicus instabilis* Schmidt, *Anthicus lecontei* Champion, *Anthicus melancholius, Sapintus pubescens, Stricticollis tobias, Ischyropalpus obscurus* (LaFerté-Sénectère), and *Ischyropalpus nitidulus* have all been found (Laplante et al. 1991). Some of these species could occur in Atlantic Canada and should be looked for, particularly in western portions of New Brunswick.

From the standpoint of bionomics, as noted in the individual species accounts, species in the genera *Amblyderus, Anthicus, Omonadus, Sapintus,* and *Malporus* found in the region, and for which there is bionomic information, are primarily encountered in beach-drift habitats, either in coastal environments such as beaches, marshes, or sand dunes where flotsam of various kinds accumulates, or (less frequently) in freshwater marshes, or along lakes, rivers, and streams where there are similar accumulations of material. The exception is *Omonadus floralis*, which can be found in stored products, but also occurs widely in a variety of decomposing environments (compost heaps, dung heaps, near farms) as well as in coastal environments. *Notoxus anchora* is found in a variety of sandy open habitats, including coastal beaches, but also in agricultural fields. *Ischalia costata,* placed in the Ischaliidae, is exceptional in being a member of the saproxylic fauna found in a variety of decomposing wood environments in coniferous, deciduous, and mixed forests.

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