Chapter 22

False darkling beetles (Coleoptera: Melandryidae) and allies of the Atlantic Maritime Ecozone

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Abstract: The Tetratomidae, Melandryidae, Synchroidae, and Scraptiidae are a diverse group of saproxylic beetles found throughout the Atlantic Maritime Ecozone. Forty-two species are recorded for this region. The systematics of some groups are well known; others (e.g., *Hallomenus* and *Canifa*) require further study. The Tetratomidae and the Orchesiini (in the Melandryidae) are bolitophagous, while members of other groups are variously xylophagous and mycetophagous. Early historical records of these species are sparse. Recent collecting techniques and contemporary interests in forest species have resulted in many more records in the past decade, particularly in Nova Scotia. Distributional information suggests that there are somewhat distinct faunas in the different ecodistricts of the Atlantic Maritime Ecozone. Finally, as members of the saproxylic fauna, there is some evidence that these beetles play important roles in the decay processes of wood in forests in the Atlantic Maritime Ecozone. Unknown is the precise impact of past and contemporary forest management practices on this suite of beetles. Five species in the Atlantic Maritime Ecozone have been very rarely collected, a possible consequence of the paucity of remaining old-growth stands in the Acadian forest.

Résumé: Les Tetratomidae, Melandryidae, Synchroidae et Scraptiidae sont un groupe diversifié de coléoptères saproxyliques trouvés sur tout le territoire de l'écozone maritime de l'Atlantique. Quarante-deux espèces ont été répertoriées dans cette région. La systématique de certains groupes est bien connue, tandis que d'autres (p. ex. : *Hallomenus* et *Canifa*) nécessitent une étude plus approfondie. Les membres de la famille des Tetratomidae et de la tribu des Orchesiini (dans la famille Melandryidae) sont bolitophages, tandis que les membres des autres groupes sont diversement xylophages et mycétophages. Les premiers relevés historiques se rapportant à ces espèces sont incomplets. Les plus récentes techniques de collecte et l'intérêt contemporain pour les espèces forestières ont donné lieu à de nombreux relevés supplémentaires au cours de la dernière décennie, en particulier en Nouvelle-Écosse. Les données relatives à la répartition géographique laissent entendre que des faunes sensiblement distinctes sont présentes dans les divers écodistricts de l'écozone maritime de l'Atlantique. Enfin, il est attesté que ces coléoptères, en tant que membres de la faune saproxylique, jouent un rôle important dans les processus de dégradation du bois forestier dans l'écozone maritime de l'Atlantique. L'impact précis des pratiques de gestion forestière passée et contemporaine sur cet ensemble de coléoptères demeure toutefois inconnu. Cinq espèces de l'écozone maritime de l'Atlantique ont été très rarement collectées; une conséquence possible de la raréfaction des peuplements anciens au sein de la forêt acadienne.

Introduction

The suite of beetles under consideration in this chapter, the Tetratomidae, Melandryidae, Synchroidae, and Scraptiidae, are a diverse assemblage of saproxylic species that are found in forested communities across the Atlantic Maritime Ecozone (AME), a region that includes the Maritime Provinces, and the Îles de Madeleine, Gaspé, and Eastern Townships of Quebec. Until recently, they have been little studied, and much still remains to be understood about their systematics, biology, ecology, and their role in the processes of decay in forest ecosystems. Majka and Pollock (2006) surveyed the regional fauna and reported 38 new provincial records, including 14 species newly recorded in the Maritime Provinces. In the past, some authors (i.e., Downie and Arnett 1996) treated them all within the family Melandryidae. Recent treatments (Pollock 2002*a*, *b*; Young 2002; Young and Pollock 2002) have considered them as distinct families.

Ten species in the Tetratomidae, 24 in the Melandryidae, 2 in the Synchroidae, and 5 in the Scraptiidae are recorded from the AME. Knowledge about their systematics, biology,

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and bionomics is uneven; some groups have been well studied, while others are imperfectly known.

Collection techniques

Members of the Tetratomidae, Melandryidae, and Synchroidae are found exclusively in forested habitats; Scraptiidae are found in forested as well as in more open areas. Sweep-netting and beating foliage and dead limbs of trees will yield some specimens, but the most successful techniques are flight-intercept or malaise traps. Unfortunately, these collecting methods, while yielding many specimens, provide limited "biocontext" for the specimens collected. Individuals of many species fly readily and frequently, and many are active nocturnally, so such passive devices that capture flying insects in forested habitats are very effective. Some are attracted to baited (ethanol and (or) turpentine) Lindgren funnel traps, as well as to ultraviolet light traps. Manual examination of decomposing polypores is a particularly effective method to collect specimens of Tetratomidae, particularly genera such as *Penthe*, which appear seldom to fly.

By far the best collecting method is inspecting potential substrates at night. These substrates include fresh fungi, old dried fungi, partially dead trees, well-rotted tree boles, etc. These can be scouted and marked during the day and then visited at night. Not only is biocontext immediately evident, but other behaviours, e.g. feeding, mating, etc., can be observed. Many collectors stay close to their blacklight when night collecting; this results in an under-representation of these saproxylic taxa in usual night-collecting efforts.

Systematics

Tetratomidae

The Tetratomidae, as currently constituted (Nikitsky 1998; Young and Pollock 2002), consists of five distinct subfamilies. Members of four of these, the Tetratominae, Penthinae, Hallomeninae, and Eustrophinae, are found in the AME.[1] This is a rather new family composition; the most significant recent changes involved the movement of Hallomeninae and Eustrophinae from Melandryidae to Tetratomidae (Nikitsky 1998). However, Pollock (2002*a*, 2008) drew attention to the fact that a comprehensive phylogenetic study of the lower Tenebrionoidea is needed to ascertain if the Hallomeninae and Eustrophinae are correctly placed within the Tetratomidae. The genus *Hallomenus* is in need of systematic revision. Chantal (1985) has found an undescribed species in Quebec. Twenty-six species of tetratomids are known from North America (Pollock 2002*a*).

Melandryidae

The Melandryidae (false darkling beetles) are a diverse group of forest beetles. The systematics of this family has undergone many changes, and the higher level classification of the family is still in need of revision (Pollock 2002*a*). Historically, the Melandryidae included many other taxa that have been removed to the Tetratomidae, Stenotrachelidae, Pyrochroidae, Scraptiidae, and Synchroidae. Pollock (2002*a*) suggested on the basis of the several distinct larval types found in the family that the group may still be polyphyletic. One species, *Phloiotrya fusca* (LeConte), has in the past been frequently confused with the Palearctic *Phloiotrya vaudoueri* Mulsant. Pollock (unpublished) lists approximately 430 species worldwide, 60 of which are found in North America.

Synchroidae

For many years treated as part of the Melandryidae, *Synchroa* was excluded by Bøving and Craighead (1931) largely on the basis of characters provided by the larvae (Young 2002). Only two genera and eight species are known from Indonesia, Japan, and eastern North America (Young 1991*a*). In the AME, both North American species, *Synchroa punctata* Newman and *Mallodrya subaenea* Horn, have been recorded.

Scraptiidae

This family has had a rather tangled systematic history with two distinct subfamilies. The Anaspidinae have in the past been treated as either a distinct family, a subfamily of the Melandryidae, or as part of the Mordellidae (Liljeblad 1945). The Scraptiinae have historically been treated as part of the Melandryidae (e.g., Downie and Arnett 1996). Recent treatments (Lawrence and Newton 1995; Pollock 2002*b*) place both Anaspidinae and Scraptiinae in the Scraptiidae. The genus *Canifa* LeConte (four described species in North America) is in serious need of revision, since distinctions among species are currently inadequately characterized. In North America, there are 46 described species of Scraptiidae (Pollock 2002*a*).

Bionomics

Known bionomic information is summarized in Table 1. The "Forests and Trees" column lists forest cover types and particular tree species with which the beetles have been associated. The "Hosts" column lists particular species of polypores, which bolitophagous species are associated with on these trees, or in the case of xylophagous beetles, trees that have been recorded as larval host plants.

Tetratomidae

The subfamilies of the Tetratomidae vary widely in appearance; however, ecologically they share the trait of being associated with the fruiting bodies of hymenomycete fungi, particularly those in the Polyporaceae, Tricholomataceae, and other fungi associated with the decay of wood.

[1] *Pisenus humeralis* (Kirby), in the fifth subfamily (Piseninae), has been collected at Quebec City, only a short distance from the AME and could occur in this ecozone as well.

Table 1. Habitat and host associations.

Species	Forests and trees	Hosts	Sources[a]
Tetratomidae		**Bolitophagous species**	
Tetratominae			
Tetratoma tessellata Melsheimer	Deciduous: birch, maple, and oak	*Pleurotus ostreatus* (Jacq.) P. Kumm. and *Laetiporus sulphureus* (Bull.) Murr.	1, 2
Tetratoma variegata (Casey)	Coniferous		1
Penthinae			
Penthe pimelia (Fabricius)	Coniferous and mixed	*Heterobasidion annosum* (Fr.) Bref., *Fomitopsis pinicola* (Sw.) Kar.	3
		Bondarzewia berkeleyi (Fr.) Bondartsev & Sing., *Polyporus squamosus* (Huds.) Fr.,	2
		Piptoporus betulinus ((Bull.) Karst 1881) Kr., *Phaeolus schweinitzii* (Fr.) Pat.	2
Penthe obliquata (Fabricius)	Coniferous and mixed	Same as *Penthe pimelia*	2, 3
Hallomeninae			
Hallomenus scapularis Melsheimer	Coniferous: eastern hemlock	Various polypores	3
Hallomenus punctulatus LeConte	Coniferous: white spruce	*Postia floriformis* (Quél.) Jülich and *Phaeolus schweinitzii*	1
Eustrophinae			
Eustrophopsis confinis (LeConte)	Coniferous: pine	*Dichomitus squalens* (P. Karst.) D.A. Reid	11
Eustrophus tomentosus Say	Elm and red spruce		4–6
Synstrophus repandus (Horn)		Fungi	1
Holostrophus bifasciatus (Say)	White pine, white birch	Polypores; *Piptoporus betulinus*	1, 3
Melandryidae			
Melandryinae			
Orchesiini		**Bolitophagous species**	
Orchesia castanea (Melsheimer)	Coniferous and deciduous	Mildewed wood and polypores (*Coriolus* sp. and *Lenzites* sp.)	2, 5–7
Orchesia cultriformis Laliberté	Deciduous: large-toothed poplar	*Inonotus dryophilus* (Berk.) Murrill	2–4, 6, 7
Orchesia ovata Laliberté	Red maple, cedar, ash	Mildewed and decaying wood and foliage	7, 8
Serropalpini		**Xylophagous species**	
Xylita livida (Sahlberg)	Coniferous: balsam fir		3, 7
Xylita laevigata (Hellenius)	Coniferous		3
Spilotus quadripustulatus (Melsheimer)	Deciduous: red maple		7
Scotochroa atra LeConte	Coniferous: red spruce		3
Scotochroa buprestoides (Kirby)	Coniferous: red spruce		3
Scotochroides antennatus Mank	Coniferous: red spruce and eastern hemlock		3
Enchodes sericea (Haldeman)	Coniferous		7
Serropalpus coxalis Mank	Coniferous: balsam fir and white pine		3, 7
Serropalpus substriatus Haldeman	Coniferous: balsam fir, red and black spruce		7
	White pine and eastern hemlock		3
Dircaea liturata (LeConte)	Deciduous: red oak, red and sugar maple, linden, and beech		7
Phloiotrya fusca (LeConte)	Coniferous: balsam fir, white pine, and red spruce		3, 7
Hypulini		**Xylophagous species?**	
Zilora hispida LeConte	Coniferous		3

Table 1 (*concluded*).

Species	Forests and trees	Hosts	Sources[a]
Hypulus simulator Newman	Coniferous: red spruce and white pine		3
Microtonus sericans LeConte	Coniferous: red spruce and red pine		3
Symphora flavicollis (Haldeman)	Coniferous		3
Symphora rugosa (Haldeman)	Coniferous		3
Melandryini		**Xylophagous species**	
Prothalpia undata LeConte	Coniferous: red spruce		
Melandrya striata Say	Coniferous and deciduous: poplar and birch	Birch	3
Emmesa connectans Newman	Coniferous: red spruce		3
Emmesa labiata (Say)	Coniferous and deciduous	Yellow birch	3, 9
Phryganophilus collaris LeConte	Coniferous		
Synchroidae		**Mycetophagous species**	
Mallodrya subaenea Horn	Spruce and white birch		1, 8
Synchroa punctata Newman	Deciduous	Fungal material and decaying wood	3, 10
Scraptiidae		**Mycetophagous species**	
Scraptiinae			
Scraptiini			
Canifa pallipes (Melsheimer)	Coniferous and deciduous		3–6
Canifa pusilla (Haldeman)	Coniferous: white pine, red and black spruce		3–5
Anaspidinae		**Mycetophagous species**	
Anaspidini			
Anaspis flavipennis Haldeman	Coniferous and deciduous		3–6
Anaspis nigrina Csiki	Coniferous: red spruce and white pine		3, 4, 6
Anaspis rufa Say	Coniferous and deciduous		3–6

[a]1, Chantal (1985); 2, Lawrence (1991*a*); 3, C.G. Majka (unpublished data); 4, Dollin et al. (2008); 5, Bishop et al. (2009); 6, Kehler et al. (1996); 7, Laliberte (1966); 8, R.P. Webster (personal observation); 9, C. Chantal (personal observation); 10, Payne (1931); 11, Pollock (2008)

Melandryidae

All Melandryidae live in forested environments and are saproxylic. There are two principal trophic groups: mycetophagous species, which feed on fungal hyphae, and xylophagous species, which feed on decomposing wood. Within the four tribes of melandryids found in the AME, the Orchesiini are mycetophagous, whereas the Serropalpini and the Melandryini are xylophagous (Pollock 2002*a*). Although there is less information about the Hypulini, anecdotal evidence suggests that most are xylophagous as well. It should be noted that xylophagous species may also be ingesting fungi associated with rotting wood (Pollock 2002*a*).

Synchroidae

Synchroa punctata feeds on fungal material and decaying wood and is commonly encountered beneath the bark of dead deciduous trees. According to Young (1991*a*), both fungal and woody matter has been isolated from the guts of larval *S. punctata*. Little is known about the bionomics of *M. subaenea*.

Scraptiidae

Adult *Anaspis* are floricolous and can be readily found on a great variety of flowers and herbaceous vegetation, both in forested habitats and adjacent areas. Adult *Canifa* are not floricolous but can be found on foliage and vegetation in forested environments (C.G. Majka, pers. obs.). Pollock (2002*b*), Young (1991*b*), and Hatch (1965) have all reported larvae of various species under the bark of dead trees, in decaying logs, or in lichens.

Historical collections

There are relatively few early records of these families in this region, in part because many of the earlier collectors in this region lacked some of the current techniques employed to effectively collect them (Lindgren funnel traps, malaise traps, flight intercept traps). As well, early investigations of the Coleoptera of this region were primarily focussed on species of significance to agriculture rather than forestry. Consequently, early records are rare.

New Brunswick

In New Brunswick, William McIntosh and A. Gordon Leavitt made early collections of Melandryidae and Tetratomidae in the area of Saint John between 1900 and 1907. There are specimens collected by A.B. Baird in Fredericton in 1915 and by F.C. Craighead in Bathurst in 1922. William J. Brown, from the Canadian National Biosystematics Unit, on some of his expeditions to this region in the 1930s and 1940s, also collected melandryids. The 1963 Forest Insect Survey found specimens in the province. In recent years, there have been some collecting by C.G. Majka, D.F. McAlpine, and R.P. Webster. Data on Scraptiidae are very sparse.

Prince Edward Island

LeSage (1991*a–d*) listed no records of any of these families on Prince Edward Island prior to 1991. In fieldwork undertaken since 2000, C.G. Majka has found four species of Melandryidae, two of Scraptiidae, and two of Tetratomidae there.

Nova Scotia

In Nova Scotia, the earliest records of melandryids were by H.G. Payne in 1909 and R.P. Gorham in 1923. Subsequent collecting efforts were sporadic and scant. It was not until the 1990s that significant collecting efforts commenced. Since that time, several hundred records have been added primarily by J. Ogden and others at the Nova Scotia Department of Natural Resources: D. Kehler et al. (1996, 2004), in northern Nova Scotia; D. Bishop et al. (2009), in central Nova Scotia; C.G. Majka, in Point Pleasant Park; and J. Cook and P. Dollin et al. (2008), in southwestern Nova Scotia.

These most recently obtained data result from focussed investigations in forested habitats with tools and techniques that effectively capture individuals of flying, nocturnal species. Consequently, the distribution, abundance, habitat preferences, etc., of this group in Nova Scotia are now much more completely known than elsewhere in the region. Collections from Cape Breton Island are still rather modest.

Quebec

In Quebec, Laliberté (1965, 1966, 1981) examined the Orchesiini and Serropalpini of the province, describing both *Orchesia cultriformis* Laliberté and *Orchesia ovata* Laliberté from specimens collected there. His research contributed much valuable knowledge about these groups in the province, including records for a number of species in the AME portions of Quebec. There are early collections in the Gaspé in 1933 by W.J. Brown, R. Gobeil, and E.B. Watson. In the 1950s, there are records from L'Islet by J.-P. Laplante. For several years in the 1970s, J.F. Landry collected Melandryidae in Bellechasse in St-Nerée.

Chantal (1985) produced an excellent compendium on the Tetratomidae of Quebec. Collecting for these groups in the AME portions of Quebec has been meagre, primarily from the 1930s in the Gaspé by W.J. Brown and E.B. Watson. Laplante et al. (1991) listed species records for Quebec in general.

The fauna of the AME

Table 2 summarizes information on the fauna of the AME. Column figures indicate the number of county records. The information is derived largely from examinations of specimens by the authors in the following collections: Cape Breton University (CBU), Agriculture and Agri-Food Canada (Kentville), Nova Scotia Department of Natural Resources Insectary, Nova Scotia Museum, the University of Prince Edward Island, Agriculture and Agri-Food Canada (Charlottetown), Fundy National Park, the New Brunswick Museum, Agriculture and Agri-Food Canada (Fredericton), the Canadian National Collection of Insects, Arachnids, and Nematodes, North Dakota State University (Fargo), Field Museum of Natural History (Chicago), Florida State Collection of Arthropods (Gainesville), Canadian Museum of Nature (Ottawa); also in collections made by students at Dalhousie, Acadia, Carleton, and Cape Breton universities; from the private collections of J. Cook, C.G. Majka, J. Ogden, D.H. Webster, and R.P. Webster. Additional published records from Chantal (1985) and Laliberté (1965, 1966, 1981) were also integrated. For Nova Scotia and Prince Edward Island, the coverage is comparatively thorough; for New Brunswick and the Gaspé, it is less so.

To illustrate a finer level of detail with respect to the distribution of species in the AME, Nova Scotia (the only province for which there are sufficient data) has been additionally partitioned (on a county-by-county basis) into several subregions. These are *Northern Nova Scotia* (Cumberland, Colchester, Pictou, and Antigonish counties), *Cape Breton* (Inverness, Victoria, Cape Breton, and Richmond counties), *Eastern Shore* (Guysborough and Halifax counties), *Southern Shore* (Lunenburg, Queens, Shelburne, and Yarmouth counties), and *Bay of Fundy* (Digby, Annapolis, Kings, and Hants counties). While these are simple approximations, they do allow for a ready way to represent distributions that mirror (albeit imperfectly) some of the physiographic ecodistricts within the Nova Scotia portion of AME.

Different amounts of fieldwork and its heterogeneous nature mean that it is still too early to engage in zoogeographical analyses of the AME fauna. Although the information for Nova Scotia is quite extensive, that for other portions of the AME is much less so. We were able to examine 1196 specimens from Nova Scotia, but only 64 from the AME portions of Quebec, 43 from Prince Edward Island, and 58 from New Brunswick. It is certain that more fieldwork in these latter areas will reveal additional species. For instance, the almost complete lack of records of Tetratomidae in New Brunswick is doubtless due

Table 2. Atlantic Maritime Ecozone Tetratomidae, Melandryidae, Synchroidae, and Scraptiidae

	Number of county records										
	Quebec				Nova Scotia: regions[a]					Regional	Continental
	Gaspé	NB	PEI	NS	North	CB	East	South	Fundy	distribution[b]	distribution[c]
Tetratomidae											
Tetratominae											
Tetratoma tessellata Melsheimer, 1844				9	3	1	2	2	1	ON, QC, ME, NH, NY	1, 2
Tetratoma variegata (Casey, 1900)	2									QC, NF	1, 3
Penthinae											
Penthe obliquata (Fabricius, 1801)				10	2	3	1	1	3	ON, QC, ME, NH, MA, NY, CT	1–3
Penthe pimelia (Fabricius, 1801)		1	1	6	1		2	2	1	ON, QC, ME, NH, NY, CT	1–3
Hallomeninae											
Hallomenus scapularis Melsheimer, 1846				5			1	3	1	QC, ME, NH, NY	1, 2, 4
Hallomenus punctulatus LeConte, 1866	1									ON, QC, ME	1, 4
Eustrophinae											
Eustrophini											
Eustrophopsis confinis (LeConte, 1866)				1	1					ON, QC	1, 2, 4, 5
Eustrophus tomentosus Say, 1827				3			2	1		ON, QC, MA, NH, NY	1, 2, 4, 5
Synstrophus repandus (Horn, 1888)	1			1						ON, QC, ME, NH, NY	1–5
Holostrophini											
Holostrophus bifasciatus (Say, 1824)				1			1		1	ON, QC, ME, NH, MA, NY	1, 2
Melandryidae											
Melandryinae											
Orchesiini											
Orchesia castanea (Melsheimer, 1846)	1	2		9	2		2	3	2	ON, QC, NF, ME, NH, MA, NY	1, 3–5
Orchesia cultriformis Laliberté, 1967				7	3	1	2		1	QC, NH, NY	1, 2, 5
Orchesia ovata Laliberté, 1967	1	1	1	2		1		1		ON, QC, ME, NH, MA	1
Serropalpini											
Xylita livida (Sahlberg, 1833)	2	3		8	4		1		3	QC, NF, LB, ME, NH	1, 4, 5
Xylita laevigata (Hellenius, 1786)		1		6	1		2	1	2	ON, QC, NF, ME, NH	1, 4, 5
Spilotus quadripustulatus (Melsheimer, 1846)				1					1	QC, NH, NY, CT, RI	1
Scotochroa atra LeConte, 1874[d]		1		3			2	1		QC, NF, LB, ME, NH	1
Scotochroa buprestoides (Kirby, 1837)	3	1		2			2			ON, QC, NF, ME, NH, NY	1
Scotochroides antennatus Mank, 1939				7			2	3	2	QC, NH, MA	1
Enchodes sericea (Haldeman, 1848)	2	1		1		1				ON, QC, ME, NH, VT, MA, NY	1, 4, 5
Serropalpus coxalis Mank, 1939	3	4		8	3	1	2	2		ON, QC, NF, ME, NH, MA, NY	1, 4, 5
Serropalpus substriatus Haldeman, 1848	2	4		13	4	1	2	3	3	ON, QC, NF, LB, ME, NH, MA, NY	1–5
Dircaea liturata (LeConte, 1866)	1	5	1	13	4	1	2	3	3	ON, QC, ME, NH, NY	1, 2, 5
Phloiotrya fusca (LeConte, 1878)			1	2			1	1		QC, NH, NY, RI	1, 2, 5
Hypulini											
Zilora hispida LeConte, 1866				1			1			ON, QC, NH	1, 4, 5
Hypulus simulator Newman, 1838	2	1		8	2	1	2	2	1	ON, QC, NF, NH	1
Microtonus sericans LeConte, 1862				2				1	1	ME, NH, NY, RI	1–3, 5

Table 2 (*concluded*).

	Number of county records									Regional distribution[b]	Continental distribution[c]
	Quebec				Nova Scotia: regions[a]						
	Gaspé	NB	PEI	NS	North	CB	East	South	Fundy		
Symphora flavicollis (Haldeman, 1848)			2	8	1		2	3	2	ON, QC, ME, NH, NY, RI	1–3, 5
Symphora rugosa (Haldeman, 1848)				6			1	3	2	ON, QC, ME	1, 2
Melandryini											
Prothalpia undata LeConte, 1862		1		8	2	1	2	1	2	ON, QC, NF, ME, NH, MA, NY	1, 2
Melandrya striata Say, 1824	2	2	1	4		1	1		2	ON, QC, ME, NH, MA, NY	1, 4, 5
Emmesa connectans Newman, 1838	2	2		7	3	1	2		1	ON, QC, LB, ME, NH, NY	1
Emmesa labiata (Say, 1824)		2		3	2				1	ON, QC, NF, ME, NH, NY, CT	1
Phryganophilus collaris LeConte, 1859		1		1		1				ON, QC, ME, NY	1, 4, 5
Synchroidae											
Mallodrya subaenea Horn, 1888	1									QC, ME	1
Synchroa punctata Newman, 1838		1	1	6	2		1	2	1	ON, QC, ME, NH, NY, CT, RI	1–3
Scraptiidae											
Scraptiinae											
Scraptiini											
Canifa pallipes (Melsheimer, 1846)	1	1	2	13	3	4	2	3	1	ON, QC, NF, ME, NH, RI	1, 2, 4, 5
Canifa pusilla (Haldeman, 1848)		1		8	2		3	3	2	ON, QC, ME, NH, VT, NY, RI	1, 2
Anaspidinae											
Anaspidini											
Anaspis flavipennis Haldeman, 1848	1	1	1	10	3	1	2	2	2	ON, QC, ME, NH, MA, NY	1, 2, 4
Anaspis nigrina Csiki, 1915				6	1		2	2	1	ON, QC, NF, VT, NY	1, 2, 4
Anaspis rufa Say, 1826	1	5	2	18	4	4	2	4	4	ON, QC, NF, ME, NH, NY	1, 3–5
Number of county records	29	42	13	227	53	24	50	53	47		
Number of species	18	22	10	38	22	16	30	25	27		

[a]Nova Scotia distribution: North, Northern Nova Scotia; CB, Cape Breton; East, Eastern Shore; South, Southern Shore; Fundy, Bay of Fundy.

[b]Includes the following jurisdictions in northeastern North America (excluding the AME): CT, Connecticut; LB, Labrador; MA, Massachusetts; ME, Maine; NF, Newfoundland; NH, New Hampshire; NY, New York; ON, Ontario; QC, Quebec; RI, Rhode Island; VT, Vermont.

[c]Indicates distribution within North America. 1, Northeastern; 2, Southeastern; 3, Southwestern; 4, Northwestern; 5, Central.

[d]Reported from New Brunswick by LeSage (1991*b*), however, voucher specimens from the province could not be located.

to inadequate collecting. Of the 41 species recorded from the AME, 38 have been found in Nova Scotia, 22 in New Brunswick, 18 in Quebec, and 10 on Prince Edward Island.

Even so, several points are worthy of mention. Cape Breton Island, with a land area slightly more than twice the size of Prince Edward Island (10 311 km^2 vs. 5660 km^2), and separated from the mainland by only 1.5 km (in contrast to the 13 km that separate New Brunswick and Prince Edward Island), nonetheless, both have diminished faunas (16 species on Cape Breton vs. 10 species on Prince Edward Island).

Even from this limited data set, it is apparent that both faunas are reduced in comparison to the neighbouring mainland (36 species on the mainland of Nova Scotia).

It is interesting to note that two species recorded on Cape Breton — *Phryganophilus collaris* LeConte and *Enchodes sericea* (Haldeman) — have yet to be found on the mainland of the province. Within Nova Scotia, there is considerable variation in terms of which species have been found within subregions (as defined above). Whether some of these represent real patterns or are artifacts of collecting effort is yet to be determined.

Although limited fieldwork has been done in the Gaspé and other portions of Quebec in the AME, it has yielded some interesting results. Four species (10% of the AME fauna), *Tetratoma variegata* Casey, *Hallomenus punctulatus* LeConte, *Synstrophus repandus* (Horn), and *Mallodrya subaenea*, have been recorded there and not elsewhere in the AME.[2] In comparison, only one species of Coccinellidae (2% of the fauna) has a similar distribution (Majka and McCorquodale 2010). Although this may be an artifact of the inadequate collecting effort in New Brunswick, it may also indicate some differences within ecodistricts in the ecozone.

Thirty-nine species found in the AME are native to the Nearctic region, while only two, *Xylita livida* (Sahlberg) and *Xylita laevigata* (Hellenius), are Holarctic in distribution. We are unaware of any introduced species of the focal families in this region. *Canifa pallipennis* LeConte is reported from Cape Breton Island in Nova Scotia, in Lafontaine et al. (1987); however, given the confused taxonomic status of this genus, and the lack of any other reports of this taxon in the AME, it has not been included in the tabulations.

Influences of human activities

While no species have been introduced, it does seem likely that anthropogenic activities have affected the indigenous fauna of the region. All the species considered in this treatment are saproxylic (as defined by Speight 1989), which is to say dependent during some portion of their life cycle upon the dead or dying wood of moribund or dead trees (standing or fallen), or upon wood-inhabiting fungi, or on the presence of other saproxylics. Speight (1989), Grove (2002), and Dudley and Vallauri (2004) discuss the importance of this class of 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; Swift 1977).

Recent research in Scandinavia and elsewhere has drawn attention to the importance of this group. Forests in these countries have been "managed" for several hundred years and have become patchy in composition; as well, significantly less dead wood exists on the ground of managed forests than in virgin forests (Jonsell and Nordlander 2000). 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 (*Picea*) forest in Finland were saproxylic. Blab et al. (1994) considered that 25% of all species of German beetles were saproxylic. Köhler (2000) considered 56% of all forest-dwelling beetle species in forests in north Rhineland to be saproxylic. In Nova Scotia, C.G. Majka (unpublished data), in a study of a forested park, has found 498 species of beetles (including 2 species of Tetratomidae, 11 of Melandryidae, 1 of Synchroidae, and 5 of Scraptiidae), 259 (52%) of which are saproxylic.

Since the arrival of European civilization in North America, the character and extent of forests have been greatly affected by successive waves of harvesting and silviculture. While the extent of the impact of such activities on saproxylic species in this region still remains to be investigated, researchers such as Speight (1989) and Grove (2002) have documented extinctions, extirpations, and range diminutions of many saproxylic beetles in Europe associated with human impact on forests. Both authors cite many studies that demonstrate the relationships between saproxylic insects and the availability of mature timber environments. Buckland and Dinnin (1993) listed 17 species of saproxylic beetles known from peat deposits dating from 2900 B.C., which are now extinct in the United Kingdom. Hammond (1974) reported the disappearance from the U.K. of 20 species of saproxylic beetles in the past two centuries. Twinn and Harding (1999) reported that one-fifth of the remaining species of Cerambycidae (all saproxylic species) are now considered threatened. This trend of extinction is today primarily driven by intensive forest management (Hanski and Hammond 1995; Siitonen 2001). On the other hand, Jonsell and Nordlander (2000) mentioned that the pine weevil seems to have benefitted from modern forestry practices in Europe.

In the AME, there are a number of species within the families discussed that have been very rarely encountered. As highlighted previously, collecting and fieldwork in some parts of the region has been meagre. Consequently, rarity within collections may represent an inadequate sampling effort. Nonetheless, there are some species that are so seldom collected

[2]In this context, it is worth noting that six specimens of the very rarely collected *M. subaenea* have been found by R.P. Webster in Knox County, Maine, approximately 150 km from the New Brunswick border. Since it has been located in both the Gaspé and Maine, further fieldwork to search for this species in New Brunswick would be worthwhile.

that they merit special consideration. Pooling all the records the present authors have been able to find from the AME, additional records for the rest of Quebec, and published records for Quebec in Chantal (1985) and Laliberté (1965, 1966, 1981), the following five species (12% of the fauna) are known from Eastern Canada from 10 or fewer specimens (for each species):

Eustrophopsis confinis (LeConte)
Holostrophus bifasciatus (Say)
Scotochroa atra LeConte
Zilora hispida LeConte
Mallodrya subaenea Horn

With the exception of *M. subaenea*, all others have been recorded as far east as Nova Scotia (*S. atra* and *Z. hispida* occur east to Newfoundland (LeSage 1991*b*)), indicating that the paucity of records in the AME is not simply indicative of a species reaching the eastern edge of its distribution within western portions of the AME (i.e., an "edge" effect). Consequently, it would be well worth investigating if the apparent scarcity of these saproxylic species is indicative of a diminution of habitat as a result of forest management practices. For instance, in Nova Scotia, although 78% of the land base is forested, less than 1% of that land is comprised of old-growth forests (Loo and Ives 2003). In this context, it is important to bear in mind that diversity of such saproxylic species may depend on subtle variation in habitat characteristics, not apparent at a landscape-level analysis of forest diversity (Hammond et al. 2004; Spence et al. 1997).

In an indicator species analysis done on forest beetle communities in Nova Scotia, Bishop et al. (2009) found that the abundance of 15 species showed significant ($p < 0.05$) relations with various disturbance classes of forests (wind, fire, clear-cut, and clear-cut and thinned). Two of these were *Anaspis flavipennis* Haldeman (with clear-cutting and thinning) and *Canifa pusilla* (Haldeman) (with fire). Hammond et al. (2004), in an indicator species analysis of saproxylic beetles in poplar (*Populus*) forests in Alberta, found *Z. hispida* to be indicative of decay class 2 (intermediate) wood ($p = 0.03$). Jonsell and Nordlander (2000) found that several saproxylic species of Coleoptera were potentially good indicator species of forested areas worthy of conservation, to preserve beetles faunas associated with dead wood. Dollin et al. (2008) conducted a SIMPER (Similarity Percentage) analysis of the 346 species of beetles found in her study to determine which were most influential in contributing to both similarities within and differences among sites. Among the 97 species in this category were *Anaspis rufa* Say, *A. flavipennis*, *Canifa pallipes*, *C. pusilla*, *Symphora flavicollis* (Haldeman), and *S. rugosa* (Haldeman).

While such detailed studies are few, they do indicate that populations of these saproxylic beetles are significantly related to parameters of forest structure and disturbance. Further research of this kind needs to be done in the AME to determine the status of this suite of saproxylic beetles, and the impact of forest management practices on them.

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