

# BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA

ISSN 1066-0712

Published by the Virginia Natural History Society

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## RESEARCH ARTICLE

# AN ANNOTATED CHECKLIST OF THE COLEOPTERA OF THE SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER: MISCELLANEOUS FAMILIES

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Editor: T. Fredericksen | Received 6 March 2021 | Accepted 6 April 2021 | Published 12 April 2021

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<https://virginianaturalhistorysociety.com/banisteria/banisteria.htm#ban55>

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**Citation:** Staines, C. L. and S. L. Staines. 2021. An annotated checklist of the Coleoptera of the Smithsonian Environmental Research Center: miscellaneous families. *Banisteria* 55: 101–111.

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## ABSTRACT

A three year (2017-2020) inventory at the Smithsonian Environmental Research Center, Edgewater, Anne Arundel County, Maryland resulted in 23 species in nine families: Buprestidae- 6, Callirhiphidae- 1, Cleridae- 3, Dermestidae- 2, Eucinetidae- 2, Histeridae- 2, Melyridae- 1, Ptinidae- 5, and Trogossitidae- 1. *Eucinetus morio* LeConte and *Nycteus testaceus* (LeConte) (Eucinetidae) are reported for the first time in Maryland.

**Keywords:** Biodiversity, insects, Maryland.

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## INTRODUCTION

This section of the annotated checklist contains the species from a miscellaneous group of Coleoptera families in various superfamilies and functional groups which were not speciose enough to warrant separate treatment.

Buprestidae, metallic wood boring or jewel beetles, larvae burrow in roots and logs, within the bark or cambium layers of trees and shrubs or are leaf or stem miners of herbaceous or woody plants. Most species attack dead or dying branches while a few attack healthy wood. There are more than 14,600 described species worldwide with 762 species from the United States & Canada (Bellamy & Nelson, 2002). Steury & MacRae (2012) reported 25 species from a six year inventory at the George Washington Memorial Parkway (Fairfax, Virginia). The Maryland Biodiversity Project (MBP) (2021) reports 98 species from Maryland.

Callirhipidae is a small family of 16 species worldwide with one species, *Zenoa picea* (Beauvois), known from the United States. Larvae are found in rotting wood usually with fungi. Adults are short-lived, active at night, and are attracted to lights (Young, 2002b). Staines (1983) reported *Z. picea* from three counties in Maryland. The Maryland Biodiversity Project (MBP) (2021) reports this species from six Maryland counties.

Cleridae, checkered beetles, are mostly predaceous as larvae and adults. They are often found on woody plants or under bark, in galls, or on plant foliage. Some species are important predators of bark beetles. There are 3366 described species worldwide with 291 in the United States and Canada (Opitz, 2002). Steury & Leavengood (2019) reported 18 species from a 19 year inventory at the George Washington Memorial Parkway (Virginia). The Maryland Biodiversity Project (MBP) (2021) reports 23 species from Maryland.

Dermestidae, skin beetles, are scavengers on dried animal or plant material with a high protein content. Larger species are found on carrion in the late (butyric) stage, while smaller species are found in bee and wasp nests feeding on pollen stores. Some species are serious pests of stored products. There are approximately 700 species known worldwide with 123 species in the United States (Kingsolver, 2002). The Maryland Biodiversity Project (MBP) (2021) reports six species from Maryland.

Eucinetidae, plate-thigh beetles, live in detritus or under fungus-covered bark of trees. Larvae feed on fungi, slime molds, or mushrooms. There are 37 known species worldwide with 11 species known from the United States and Canada (Young, 2002a). The Maryland Biodiversity Project (MBP) (2021) does not report species from Maryland.

Histeridae, clown beetles, are mainly predators on soft-bodied insects and eggs, especially of flies (Diptera). Beetles are found in substrates on which flies develop in numbers, the dung of mammals, mammal and reptile burrows, carrion, rotting vegetation, rotting fungi, and fermenting phloem and cambium of dead hardwoods. There are about 3900 species known worldwide and 435 from the United States and Canada (Kovarik & Caterino, 2000). The Maryland Biodiversity Project (MBP) (2021) reports 17 species from Maryland.

Melyridae, soft-winged flower beetles, adults appear to be phytophagous, mainly on pollen. Other species are omnivorous scavengers or predators on small arthropods. Larvae are poorly known. There are about 6000 species worldwide with 520 species in the United States and Canada (Mayor, 2002). The Maryland Biodiversity Project (MBP) (2021) reports six species from Maryland.

Ptinidae, death watch and spider beetles, larvae bore into bark, dry wood, twigs, woody fruits, galls, and fungi. Other species feed on dried animal and plant material and are common in bird or mammal nests. Some species feed on pollen in bee nests (Hymenoptera) or are found in ant nests (Hymenoptera: Formicidae). There are more than 2200 species known worldwide with 464 species in North America (Philips, 2002). The Maryland Biodiversity Project (MBP) (2021) reports 10 species from Maryland.

Trogossitidae, bark-gnawing beetles or cadelles, are predatory or have an unknown biology. They can be found under bark or in the galleries of wood boring beetles. A few species are found in fungi. There are about 600 species known worldwide with 59 species found in the United States and Canada (Leschen, 2002). The Maryland Biodiversity Project (MBP) (2021) reports six species from Maryland.

## MATERIALS AND METHODS

The Smithsonian Environmental Research Center (SERC) [38°53'13"N; 76°32'21"W] consists of approximately 1477 ha of hardwood-dominated forest, ponds, creeks, rivers, tidal marshes, and 19.3 km of shoreline along the Rhode River and upper Chesapeake Bay in Anne Arundel County, Maryland (SERC, 2018). Forests on the main campus of SERC can be broadly classified into three main types: (1) the majority (~85%) is a Tulip-poplar (*Liriodendron tulipifera* L., Magnoliaceae) association; (2) a moist lowland assemblage, comprised of American sycamore (*Platanus occidentalis* L., Platanaceae), ash (*Fraxinus* spp., Oleaceae), elms (*Ulmus* spp., Ulmaceae), river birch (*Betula nigra* L., Betulaceae), and other woody vegetation along freshwater streams; and (3) a semi-xeric assemblage that fringes tidal marshes, consisting of chestnut oak (*Quercus prinus* L.), white oak (*Quercus alba* L., Fagaceae), black gum (*Nyssa sylvatica* Marshall, Nyssaceae), mountain laurel (*Kalmia latifolia* L., Ericaceae), blueberries (*Vaccinium* spp., Ericaceae), American beech (*Fagus grandifolia* Ehrh., Fagaceae), and other woody vegetation (McMahon et al., 2010; Higman et al., 2016).

Like much of the eastern United States, SERC's forest age and structure reflect historical agricultural activities and local history. SERC's main campus was mostly fallow from the end of the Civil War (1865) to approximately 1915, when it was used as a dairy farm with grazing pastures and fields for feed production until 1945. Thus, the majority of SERC's contemporary forests are from 70-150 years old (McMahon et al., 2010; Higman et al., 2016).

Freshwater inputs into the Rhode River are primarily from the North Fork Muddy Creek, South Fork Muddy Creek, Sellman Creek, and their lower order streams. These streams are associated with several swamps, beaver impoundments, and seasonal wetlands which range from small, tannin-rich, ephemeral wetlands, to larger and clear-water permanent ponds.

On the south side of the Rhode River the BiodiversiTREE plots are about 30 acres containing 24,000 trees of 16 species of ecologically important deciduous trees planted in 75 plots. Established in 2013, the trees in these plots are rather stunted probably due to browsing by deer (*Odocoileus virginianus* (Zimmermann), Mammalia: Cervidae) and poor soil nutrients (SERC, 2018). In the annotated species list this area is referred to as Zones 5 and 6.

The goal of this project was to inventory the Coleoptera of the SERC. Collecting techniques include visual survey followed by sweeping or beating the vegetation of the area. Other collecting techniques used were pitfall traps (both baited and unbaited), head lamping, black lighting, and checking lighted areas around buildings and roads on the main campus.

Field work was conducted from 11 May to 24 October 2018, 30 March to 23 October 2019, 19-20 March 2020, and 26 August to 31 October 2020. Two Malaise traps were operated for 72 hour periods in May and June 2020.

Identifications were made by the senior author using published and on-line resources. Voucher specimens are deposited in the SERC collection and in the Department of Entomology Collection, Natural History Museum, Smithsonian Institution.

## RESULTS

### Family Buprestidae

*Acmaeodera tubulus* (Fabricius) breeds in hickory (*Carya* spp., Juglandaceae), white oak (*Quercus alba*), redbud (*Cercis canadensis* L., Fabaceae) (Knull, 1925), and hawthorn (*Crataegus* spp.,

Rosaceae) (Westcott et al., 1979). Westcott et al. (1979) reported that it has been reared from *Cercis reniformis* Engelm. *Betula nigra*, *Carya glabra* (Mill.) Sweet, *C. illinoensis* (Wangenh.) K. Koch, *C. ovata* (Mill.) K. Koch, *C. tomentosa* (Lam.) Nutt., *Celtis occidentalis* L., *Crataegus viridis* L., *Gleditsia triacanthos* L. (Fabaceae), *Juglans nigra* L. (Juglandaceae), *Ostrya virginiana* (Mill.) K. Koch (Betulaceae), *Quercus alba*, *Salix* sp. (Salicaceae), *Ulmus crassifolia* Nutt., and *Ulmus rubra* Muhl. (Wellso, 1973; MacRae, 1991; MacRae & Nelson, 2003; MacRae, 2006; Nelson et al., 2008). Carlton et al. (2018) reported adults on *Quercus velutina* Lam.; collected by hand, by beating, using flight intercept, Lindgren funnel, Malaise, and sticky traps, and sweeping *Aster* sp. (Asteraceae). MacRae & Nelson (2003) added *Carya alba* (L.) Nutt. ex Ell. Adults are often collected on the flowers of numerous herbaceous plants (Nelson et al., 2008). SERC specimens were taken sweeping vegetation on 16 May 2019 along Contees Wharf Road.

*Agrilus egenus* Gory breeds in dead *Robinia pseudoacacia* L. (Fabaceae) (Knull, 1925). Adults have been collected at light, by beating vegetation (Carlton et al., 2018), and in green funnel traps (Hansen et al., 2019). SERC specimens were taken on 23 April 2019 sweeping vegetation in Zone 5.

*Chrysobothris scabripennis* Gory & Laporte larvae have been recorded from white spruce (*Picea glauca* (Moench.) Voss), eastern white pine (*Pinus strobus* L.), and eastern hemlock (*Tsuga canadensis* (L.) Carr.) (Pinaceae) (Paiero et al., 2012). A single specimen was taken at SERC in a Malaise trap in the grassy field opposite Sellman House from 30 May–2 June 2020.

*Taphrocerus agriloides* Crotch adults have been collected on *Eleocharis* sp. (Cyperaceae) and *Nemastylis geminiflora* Nutt. (Iridoideae) (Nelson & MacRae, 1990; MacRae, 1991); and sawgrass (*Cladium*, Aroideae) (Paiero et al., 2012). No larval hosts are recorded. A single specimen was taken at SERC sweeping vegetation on 31 August 2020 around the Java House ruins.

*Taphrocerus gracilis* (Say) breeds in the leaves of bulrush (*Scirpus fvlviatilis* (Torr.) A. Gray, Cyperaceae) (Knull, 1925) and shortbristle hornedrush (*Rhynchospora corniculata* Lam.) (MacRae, 2004); observed feeding on *Carex hyalinolepis* Steud. (Cyperaceae) (MacRae, 2004). SERC specimens were taken sweeping vegetation on 24 May 2018 along Contees Wharf Road and on 30 April 2019 along Contee Watershed Trail.

*Taphrocerus nicolayi* Obenberger adults have been collected on *Carex emoryi* Dewey, *C. hyalinolepis* and *C. vulpinoidea* Michx. (MacRae & Nelson, 2003). No larval hosts are recorded. SERC specimens were taken sweeping vegetation on 23 April 2019 in Zone 5.

### Family Callirhipidae

*Zenoa picea* Beauvois larvae are found in dead wood and decaying logs (Petersen, 1953), most commonly in dry upland woods (Blatchley, 1910). Adults are attracted to lights (Staines, 1983); they have been collected under driftwood and debris on a sandy beach, in a sassafras log (*Sassafras albidum* (Nutt.) Nees, Lauraceae), on rotten wood at the base of a standing dead *Quercus rubra* L., reared from *Castanea dentata* (Marsh.) Borkh. (Fagaceae) (Hoffman et al., 2002); in a sap flow on mulberry (*Morus*, sp., Moraceae), and in wood at the base of a hollow beech (Freese, 2013). SERC specimens were taken at black light on 25 July 2019 along Contee Watershed Trail.

## Family Cleridae

*Necrobia rufipes* (Fabricius) is an introduced species associated with carrion. Adults and larvae are saprophagous and predaceous (Opitz, 2002). They have been found on the skins and bones of dead animals, as predators of dermestid larvae; and as pests on grain, silk, and stored products (Knull, 1951). SERC specimens were taken on 15 June 2019 in a carrion trap baited with a dead common carp (*Cyprinus carpio* (L.), Cypriniformes: Cyprinidae) at Sellman House.

*Phyllobaenus humeralis* (Say) has been found on various plants (including trees, shrubs and wild flowers) from various habitats (Mawdsley, 2002; Majka, 2006). SERC specimens were taken sweeping vegetation on 23 April 2019 in Zone 6.

*Phyllobaenus rufipes* (Newman) adults have been collected from turkey oak (*Quercus laevis* Walter) and alfalfa (*Medicago sativa* L., Fabaceae) fields, in Malaise traps, in malt bait traps, and at black light (Leavengood, 2008). SERC specimens were taken sweeping vegetation on 15 June 2019 around the Reed Education Center.

## Family Dermestidae

*Anthrenus verbasci* (Linnaeus) is an introduced species that occasionally found in flour mills and warehouses; it is, however, primarily a pest on household goods. Larvae feed on wool, fur, skins, and other materials of animal origin. They also attack insect collections and silkworm cocoons (Bousquet, 1990). In natural settings adults feed on the nectar and pollen of species of *Heracleum*, *Anthriscus*, *Aegopodium*, *Daucus* (Apiaceae), *Achillea*, *Anthemis*, and *Matricaria* (Asteraceae) where they subsequently mate. Eggs are laid and larvae feed in nests of sparrows (Aves: Passaridae), swallows (Aves: Hirundinidae), corvids (Aves: Corvidae), starlings (Aves: Sturnidae), swifts (Aves: Apodidae), and pigeons (Aves: Columbidae) (Woodroffe & Southgate, 1954). SERC specimens were taken sweeping vegetation on 23 April 2019 around Sellman House, on 6 May 2019 along Contees Wharf Road, and on 5 June 2019 inside Mathais Lab.

*Dermestes lardarius* L. is an introduced pest of stored products which feeds on dry animal products (Jacobs & Renner, 1988), such as hair, feathers, skin, dried beef and other materials (Metcalf et al., 1962). A dry human corpse (*Homo sapiens* L., Mammalia: Hominidae) can also serve as a food resource for these beetles (Haskell et al., 1997). SERC specimens were taken in a carrion trap baited with a dead mole (*Scalopus aquaticus* (L.), Mammalia: Talpidae) on 23 May 2019 at Sellman House.

## Family Eucinetidae

*Eucinetus morio* LeConte has been found in a variety of forests including mature hardwood, an old red oak (*Quercus rubra* L.), old and mature mixed, an old-growth white spruce (*Picea glauca*) and balsam fir (*Abies balsamea* (L.) Mill., Pinaceae), eastern white cedar (*Thuja occidentalis* L., Cupressaceae), a mature (110-year-old) red spruce (*Picea rubens* Sarg.), and an old red pine (*Pinus resinosa* Sol. ex Aiton); in Lindgren funnel traps deployed in various forest types; collected from moist sphagnum (*Sphagnum* sp., Sphagnaceae) in an eastern white cedar swamp, on polypore fungi on dead standing American beech, on a dead standing *Populus* sp. (Salicaceae), and in powdery

slime mold at the base of a tree (Webster et al., 2012). Lawrence & Newton (1980) reported the slime mold, *Stemonitis axifera* (Bull.) (Stemonitidaceae), as a host for this species. Weiss & West (1921) reported it from a *Trichia* sp. (Trichiaceae). This species has been reported from Canada (New Brunswick, Nova Scotia, Ontario, Quebec) and Georgia, Illinois, Indiana, and Virginia (Young, 2002a; Majka, 2010; Webster et al., 2012). SERC specimens were taken sweeping vegetation on 7 May 2019 in the main maintenance area behind Mathais Lab and in a Malaise trap along the woods margin in the grassy field opposite Sellman House from 1-3 May 2020. **NEW STATE RECORD.**

*Nycteus testaceus* (LeConte) has been collected from gilled mushrooms on the forest floor of a hardwood forest, at an ultraviolet light in a mixed forest, and in Lindgren funnel traps deployed in an old red oak forest (Webster et al., 2012). This species has been reported from Canada (Alberta, British Columbia, Manitoba, New Brunswick, Northwest Territories, Ontario, Quebec, Saskatchewan), Maine, Pennsylvania, and Washington (Young, 2002a; Majka 2010, Webster et al., 2012). SERC specimens were taken from an unidentified mushroom on 26 August 2020 along Discovery Trail. **NEW STATE RECORD.**

### Family Histeridae

*Euspilotus assimilis* (Paykull) is a generalist predator which occurs in many types of decomposition but most frequently in carrion (Majka, 2008). SERC specimens were taken on 30 April 2019 on a roadkill racoon (*Procyon lotor* (L.), Mammalia: Procyonidae) along Contees Wharf Road, on 31 May 2019 in a carrion trap baited with a dead common carp at Sellman House, and on 7 and 10 September 2019 in a carrion trap baited with a dead bluefish (*Pomatomus saltatrix* (L.), Perciformes: Pomatomidae) at Mathais Lab.

*Platysoma lecontei* Marseul is often found under the bark of deciduous trees (Majka, 2008). SERC specimens were taken by visual survey on 9 April 2019 along Java History Trail, on 10 April 2019 on Hog Island; under bark on 12 April 2019 at the intersection of Back Road and dirt road 11-6; on 17 May 2019 along Back Road; and in an unidentified mushroom in the woods around the intersection of Back Road and dirt road 11-6.

### Family Melyridae

*Collops quadrimaculatus* (Fabricius) is a predator on a wide variety of soft-bodied insects such as aphids (Hemiptera: Aphididae), whiteflies (Hemiptera: Aleyrodidae), mites (Archanida: Acari), and eggs and caterpillars (Lepidoptera) (Ellsworth et al., no date). SERC specimens were taken sweeping vegetation on 25 April 2019 in the fields around Sellman House.

### Family Ptinidae

*Hemicoelus carinatus* (Say) is a serious economic pest throughout eastern North America (Ebeling, 1978). This species has been recorded from *Fraxinus* (Oleaceae), *Tilia* (Malvaceae), *Acer*, *Fagus*, and *Ulmus* (White, 1962; Ebeling 1978). Simeone (1960) listed 12 hardwoods and softwoods as larval food, stating that hardwoods are preferred, but softwoods may be utilized in areas of higher humidity. Smith & Whitman (1992) noted *H. carinatus* will attack old as well as

newly cut wood, which suggests a range in tolerance to various starch contents in wood. SERC specimens were taken sweeping vegetation on 18 June 2018 around Mathais Lab.

*Ptilinus ruficornis* Say is the most abundant species of Ptinidae in North America, breeding in seasoned wood of American beech, sugar maple (*Acer saccharum* Marshall), and many other trees in northern hardwood forests (Acciavatti, 1972). SERC specimens were taken in Malaise traps in the grassy field opposite Sellman House from 10-13 May 2020 and 30 May to 2 June 2020.

*Ptinus villiger* (Reitter) has been considered a serious pest of cereal products in Canada since 1915 (Hatch, 1961) and has been known to infest flour, farina, corn meal, and wheat (Van Ryckeghem, 2004). A single SERC specimen was taken in a Malaise trap along the woods margin in the grassy field opposite Sellman House from 12-15 June 2020.

*Tricorynus castaneus* (Hamilton) has been reared from bullet oak galls formed by the cynipid *Disholcaspis quercus globulus* (Fitch) (Hymenoptera: Cynipidae) on white oak, *Quercus alba* (White, 1965). Specimens have also been reported in Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch., Vitaceae) with *Scolytus* (Coleoptera: Curculionidae), sweeping grass (Poaceae), from oak gall, beating turkey oak (*Quercus laevis* Walter), at night, and on *Vaccinium* (Ericaceae) and other low bushes (White, 1965, 1982); from gall on oak, and from non-wilting *Quercus macrocarpa* Michx. (Arango & Young, 2002). SERC specimens were taken sweeping vegetation on 19 July 2018 along Java History Trail.

*Tricorynus confusus* (Fall) has been reported on tree buds and twigs, oak galls, oak, pecan (*Carya illinoensis*) leaves, under apple (*Malus domestica* L., Rosaceae) bark, on *Quercus imbricaria* Michx. (White, 1982); adults have been taken at mercury vapor lamp, at black light at night, and in a Townes–Malaise trap (Arango & Young, 2002). SERC specimens were taken at black light on 27 June 2019 on Back Road opposite the NEON tower.

### **Family Trogossitidae**

*Tenebroides americanus* Kirby has been found under the bark of many trees, adults are active at night and are attracted to lights (Barron, 1971; White, 1983). Other species in the genus are predaceous (Drooz, 1985). Adults have been collected in baited Lindgren funnel traps (Schoeller & Allison, 2013). SERC specimens were taken under bark on 10 April 2019 on Hog Island; at black light on 12 August 2019 along Back Road, on 20 March 2020 at Mathais Lab; and in a Malaise trap along the woods margin in the grassy field opposite the Sellman House from 1-3 May 2020.

## **DISCUSSION**

The 23 species collected of these nine families is lower than expected. The results are only 13.7% of the 167 reported Maryland species. Except for the Callirhipidae and Ptinidae the number of wood associated species was very low: Buprestidae with six species (6% of Maryland species), Cleridae with three species (13%), and Trogossitidae with one species (16.6%). This is also the case with the Histeridae (two species, 11.8%) and Melytridae (one species, 16.6%).

The Dermestidae species diversity is about what was expected (2 species, 50% of Maryland fauna). However, both species collected are introduced, while no native species were collected. The other positive result was the collection of two Eucinetidae species as the first documented species of the family in Maryland.

We are not sure if the low results are due to collection bias or to an overall decline in insect diversity. The obvious explanation is that much of the SERC campus was farmed from the 1600s until the end of World War II. Much of the surrounding area was farmed until the 1980s or is still farmed. Additional inventory work utilizing other collecting techniques may clarify the situation.

#### ACKNOWLEDGEMENTS

We thank Cha-Chi Fan, Eleanor Cole, Sandy and Luke Nuwar for assistance with field work. Kim Komsatu (SERC) and Kristin Jayd (University of Maryland) for access to the beetle bycatch from her Malaise trap work. Wanda West and the Interlibrary Loan staff at Smithsonian Institution Libraries for their outstanding help in obtaining needed literature.

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