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RESEARCH ARTICLE

AN ANNOTATED CHECKLIST OF THE COLEOPTERA OF THE SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER: THE STAPHYLINOIDEA

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ABSTRACT

The Staphylinoidea of the Smithsonian Environmental Research Center was inventoried over a two-year period. A total of 35 species were collected- four Silphidae and 31 Staphylinidae. Thirteen Staphylinidae are recorded from Maryland for the first time.

Keywords: Biodiversity, insects, Maryland, new state records.

INTRODUCTION

Staphylinoidea is a very large and diverse group of beetles with a worldwide distribution. It consists of the following families: Agyrtidae C.G. Thomson (primitive carrion beetles), Hydraenidae Mulsant (minute moss beetles), Leiodidae Fleming (round fungus beetles), Ptiliidae Erichson (featherwing beetles), Silphidae Latreille (carrion beetles), and Staphylinidae Latreille (rove beetles) (Bouchard et al., 2011).

The family Silphidae are large beetles, 10-35 mm long, and are frequently associated with decaying organic material. They are most commonly observed on vertebrate carcasses which gives the group the common name of carrion beetles. Adults of the genus *Nicrophorus* bury small vertebrate carcasses that has given them the common name of sexton beetles or burying beetles. There are 30 species in eight genera in North America, north of Mexico (Anderson & Peck, 1985; Peck, 2000).

Maryland Silphidae are fairly well documented. Shubeck & Blank (1982), Staines (1987, 1989, 2008), Dyer & Price (2013), and Fritzler & Strazanac (2012) document 18 species in four genera from Maryland.

The family Staphylinidae (rove beetles) is one of the largest families of beetles with approximately 64,000 species worldwide (Irmeler et al., 2018; Newton, 2019). In North America, there are 568 genera with over 4500 species (Newton et al., 2000, Newton, 2019). Staphylinids are generally recognized by their short, truncate elytra that leaves most of the abdomen exposed. Rove beetles occur in almost every type of habitat and eat almost everything except living tissues of higher plants. Most are predators of other insects and invertebrates, but many feed on fungi or decaying organic matter (Thayer, 2016). Adults of most species are nocturnal but a few genera are diurnal.

The Maryland fauna is poorly studied. Most Maryland specimens are in the unidentified section of various museums and collections. There are 343 species documented from Maryland (Brattain et al., 2019).

MATERIALS AND METHODS

The Smithsonian Environmental Research Center (SERC) [38°33'17.57"N; 76°33'14.29"W] consists of approximately 1,477 ha of hardwood-dominated forest, ponds, creeks, rivers, tidal marshes, and 19.3 km of protected 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 somewhat 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) and other woody vegetation.

Like much of the eastern U.S., 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 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, and their lower order streams. These streams are associated with several swamps, beaver impoundments, and seasonal wetlands that range from small, tannin-rich, ephemeral wetlands, to larger and clear-water permanent ponds.

On the opposite side of the Rhode River the BiodiversiTREE plots are comprised of about 30 acres containing 24,000 trees of 16 species of ecologically important deciduous trees planted in 75 plots. These plots were established over 30 years ago (SERC, 2018). In the annotated species list this area is referred to as Zones 5 and 6.

The goal of this project is to inventory the Coleoptera of the SERC. The primary collecting techniques were visual surveys followed by sweeping or beating the vegetation of the area. Other collecting techniques used were pitfall traps (both baited and unbaited), carrion traps, head lamping, black lighting, and checking lights around building on the main campus.

Field work was conducted from 11 May to 24 October 2018, 30 March to 23 October 2019, and 19-20 March 2020. Voucher specimens are deposited in the SERC and the Department of Entomology Collection, Natural History Museum, Smithsonian Institution.

RESULTS

A total of 35 species were collected, including four Silphidae and 31 Staphylinidae. In the following list of species, each entry contains a general habitat description and details of specific collections on SERC.

Family Silphidae

Nicrophorus orbicollis Say is nocturnal and more commonly found on cold-blooded carrion (Shubeck, 1976). Anderson (1982) found this species more commonly in forested areas and is attracted to light. Specimens were taken on 8 May 2019 at Sellman House on a dead mole (*Scalopus aquaticus* (L.) [Mammalia: Talpidae]) and on 25 July 2019 along Contees Watershed Trail at black light.

Necrophila americana (Linnaeus) may be found on carrion or fungi. Cole (1942) found that this species was equally active on carrion in wooded areas and exposed locations. Shubeck (1971) found this species was active during the day. Specimens were taken on 6 June 2018 at Frog Haven sweeping vegetation, on 30 April 2019 along Contees Wharf Road on roadkill racoon (*Procyon lotor* (L.) [Mammalia: Procyonidae]), on 7 September 2019 at Mathias Lab on dead bluefish (*Pomatomus saltatrix* (L.) [Perciformes: Pomatomidae]), and on 26 September 2019 at Mathias Lab at light.

Oiceoptoma inaequale (Fabricius) may be found year-round in carrion. Cole (1942) found this species to be more numerous on carrion in exposed locations. Shubeck (1971) found this to be a diurnal species. Specimens were taken on 30 April 2019 along Contees Wharf Road on roadkill raccoon.

Oiceoptoma noveboracensis (Forster) is usually found on carrion but occasionally can be taken on fungi. Cole (1942) found this species more numerous in wooded areas. Anderson (1982) found that it was the first species active in the spring and was found in all habitats sampled. Shubeck et al. (1981) found this species to be bivoltine in New Jersey and to be a diurnal species. Specimens were collected on a dead goat (*Capra aegagrus hircus* (L.) [Mammalia: Bovidae]) at Mathias Lab on 19 March 2020.

Family Staphylinidae Subfamily Aleocharinae

Aleochara (*Aleochara*) *lata* Gravenhorst is introduced from Europe and is widely distributed in the eastern and southern United States. Adults have been collected from human feces, armadillo dung, and carcasses of animals (deer [*Odocoileus virginianus* (Zimmermann), Mammalia: Cervidae] skunk [*Mephitis mephitis* (Schreber), Mammalia: Mephitidae], opossum [*Didelphis virginiana* (Kerr), Mammalia: Didelphidae], snake, and fish). Some were collected using malaise

traps and carrion-baited pitfall traps. They are predators on various flies (Diptera). (Klimaszewski 1984). Specimens were taken at Sellman House on 11 May 2019 sweeping vegetation, and on 15 June 2019 at Sellman House on dead common carp (*Cyprinus carpio* (L.) [Cypriniformes: Cyprinidae]).

Falagria dissecta Erichson has been collected by sifting (Blatchley, 1910), in cow dung (Valiela, 1969), from cow and sheep dung (Kessler et al., 1974), from decaying vegetation, animal carcasses, in rodent nests, in pitfall traps, and at black lights (Hoebeke 1985). Cervenka & Moon (1991) found this predaceous species in cow dung. Specimens were collected under bark on 12 April 2019 along Back Road and on 9 May 2019 along Java History Trail.

Subfamily Omaliinae

Olophrum obtectum Erichson has been collected from moss along a stream margin, sweeping vegetation along a stream margin, from a Berlese sample of a decayed stump, at light, and from emergent *Carex* (Cyperaceae) in an alder (*Alnus*, Betulaceae) swamp (Campbell, 1983). Single specimens were collected on 3 April 2019 in a stump hole along Discovery Trail and on 16-17 April 2019 in an unbaited pitfall trap near the water tower.

Omaliium rivulare (Paykull) can be collected by sifting litter in forests and along wet areas, in fungi, on flowers, by sweeping, in pan traps placed in grassy areas, and under stones near water (Brunke et al., 2011). A single specimen was taken on 19 March 2020 at the intersection of Contees Wharf and Dock Roads. **NEW STATE RECORD.**

Subfamily Oxytelinae

Carpelimus difficilis (Casey) has an unknown biology. Other members of this genus are found in periaquatic situations and in leaf litter (Newton et al., 2000) Adults were taken in horse dung baited pitfall traps on 17-18 April 2019 near the water tower.

Platystethus americanus Erichson is common in cattle dung (Sanders & Dobson, 1966; Valiela 1969). Smith et al. (1987) found this species to be a predator of the stable fly, *Stomoxys calcitrans* (L.) (Diptera: Muscidae). It prefers open areas and is most active in the afternoon (Hunter et al., 1991). It appears to be a spring species in Florida and requires both dung and fly larvae for females to produce eggs (Hu & Frank, 1995). Specimens were collected sweeping vegetation on 17 May 2019 along Back Road. **NEW STATE RECORD.**

Subfamily Paederinae

Achenomorpha corticinus (Gravenhorst) has been collected under carrion and in pitfall traps in pine forests (Blatchley, 1910; Klipzigtal et al., 2012). Specimens were collected sweeping vegetation on 11 May 2019 near Sellman House, and on 17 May 2019 along Back Road. **NEW STATE RECORDS.**

Homoeotarsus bicolor Gravenhorst is generally riparian and occurs along river margins (Brunke, et al. 2011). They are found under stones, debris, and in fungi (Webster & DeMerchant, 2012).

Specimens were collected by visual observation near Reed Education Center on 23 June 2018 and at black light on 25 May 2019 along Back Road. **NEW STATE RECORD.**

Homoeotarsus cribatus LeConte most adults are collected along river margins. Adults were collected from flood debris and drift material, and from under a cobblestone (Webster & DeMerchant, 2012). Specimens were collected at black light on 20 May 2019 at Frog Haven, on 25 May 2019 along Back Road, and on 27 June 2019 at Back Road near the NEON tower. **NEW STATE RECORD.**

Homoeotarsus pallipes (Gravenhorst) is found under stones and debris near water (Webster & DeMerchant, 2012). Specimens were collected at black light on 20 May 2019 at Frog Haven, on 26 June 2019 in the field opposite Sellman House, and on 27 June 2019 at Back Road near the NEON tower.

Lathropinus picipes (Erichson) has an unknown biology. Specimens were collected under bark on 9 April 2019 along Java History Trail and on 10 April 2019 on Hog Island. **NEW STATE RECORD.**

Paederus littorarius Gravenhorst is found under stones in damp areas (Blatchley, 1910) and grasslands (Bulan & Barrett, 1971). Specimens were collected at black light on 26 June 2019 in the field opposite Sellman House.

Pinophilus latipes Gravenhorst is found beneath logs and stones in upland forests (Blatchley, 1910). Specimens were collected sweeping vegetation on 7 May 2019 in the maintenance area near the Mathias Lab.

Subfamily Pselaphinae

Ceophyllus monilis LeConte is found beneath the bark of rotten stumps (Blatchley, 1910); they have been associated with *Lasius umbratus* (Nylander), *L. americanus* Emery, *L. nearcticus* Wheeler, and possibly *L. claviger* (Rodger) (Hymenoptera: Formicidae) (Hamilton 1886; Schwarz, 1890; Wickham, 1894; Park, 1932, 1935). Specimens were taken at black light on 12 August 2019 along Back Road.

Subfamily Scaphidinae

Bacocera falsata Achard is found in fungi (Blatchley 1910). Adults were collected under bark on 17 May 2019 along Back Road. **NEW STATE RECORD.**

Scaphidium piceum Melsheimer is found beneath bark of old, fungus-covered beech (*Fagus*, Fagaceae) logs (Blatchley, 1910). Specimens were collected head lamping on 27 June 2019 and on 12 August 2019 along Back Road.

Scaphisoma suturale LeConte is found under decaying leaves (Blatchley, 1910). Specimens were collected in unbaited pitfall traps on 10-11 May 2019 in the meadow near Mathias Lab. **NEW STATE RECORD.**

Subfamily Staphylininae

Ontholestes cingulatus Gravenhorst is found in dung and decaying fruits (Voris, 1939); cow dung (Sanders & Dobson, 1966); and in fungi and carrion where it feeds on fly larvae (Alcock, 1991). Specimens were collected on 16-17 April 2019 in a horse dung baited pitfall trap near the water tower.

Phinonthus lomatus Erichson is found in dung, fungi, and carrion in low moist areas (Blatchley, 1910; Shea, 2005). Specimens were collected near a carrion trap on 11 May 2019 near Sellman House.

Platydreus violaceus (Gravenhorst) is a common species found in mesic to swampy forests, primarily under the loose bark of dead hardwood trees including oaks (*Quercus*), maples (*Acer*, Aceraceae), basswood (*Tilia*, Malvaceae), horse chestnut (*Aesculus*, Sapindaceae), hackberry (*Celtis*, Ulmaceae), beech (*Fagus*), and hickory (*Carya*, Juglandaceae). It occurs less frequently under the bark of white pine (*Pinus strobus* L., Pinaceae), in rotting wood, and under logs. The few records in rotting fungi, on carrion, or on dung probably do not reflect habitat preferences (Brunke et al., 2011). Two specimens were taken by visual survey on 19 March 2020 at the intersection of Contees Wharf and Dock Roads.

Platydreus zonatus (Gravenhorst) has an unknown biology. Other members of this genus are found in dung, carrion, fungi, ground litter, under bark, and in wet areas (Newton et al., 2000). Specimens were collected sweeping vegetation on 7 May 2019 in the maintenance area near Mathias Lab, and on 9 May 2019 around the Java Farm house ruins.

Quedius capucinus Gravenhorst is found underground in litter, moss, compost, and in carrion and dung (Blatchley, 1910; Mank, 1923). This species feeds on *Drosophila melanogaster* Meigen (Diptera: Drosophilidae) (Schmitt 1999), and prefers wooded habitats and is a day flier (Hunter et al., 1991). Specimens were collected at black light on Contees Wharf Trail and on 12 August 2019 along Back Road.

Stenistoderus rubripennis (LeConte) has an unknown biology. Specimens were collected under bark on 12 April 2019 along Back Road.

Sunius confluentus Say is found in fungi, beneath bark, and in decaying vegetation (Blatchley, 1910). Adults run rapidly when disturbed. Specimens were collected under bark on 12 April 2019 along Back Road. **NEW STATE RECORD.**

Subfamily Steninae

Stenus flavicornis Erichson adults feed on insect eggs (Andow, 1990). Other members of this genus are found in sunny spots along muddy or sandy shores of lakes, ponds, and streams (White, 1983). Specimens were collected on 6 June 2018 in the pond at the parking lot at the main compound and on 23 April 2019 at Frog Haven.

Subfamily Tachyporinae

Bolitobius cingulatus Mannerheim is rare in Indiana (Blatchley, 1910) but common in lawns in Kentucky (Cockfield & Potter 1984). Adults were collected sweeping vegetation on 17 May 2019 along Back Road. **NEW STATE RECORD.**

Coproporus laevis LeConte has been collected in dead vegetation along streams, swamps or shallow lakes (Campbell, 1975); and in pitfall traps in pine (*Pinus*) forests (Klipzigtal et al., 2012). Specimens were collected under bark on 10 April 2019 on Hog Island, and on 12 April 2019 and 17 May 2019 along Back Road.

Dinaraea angustula (Gyllenhal) is an introduced species associated with soil and organic debris in agricultural fields and disturbed urban meadows. It is also found in marsh litter, in leaf litter in mixed forests, in compost, under bark of decaying spruce logs, amongst vegetation on a coastal sand dune, in litter in a cattail marsh, in leaf litter along a vernal pond, and in drift material along a lakeshore (Webster et al., 2009, Klimaszewski et al., 2010, 2011). Specimens were collected on 24 May 2018 along Contees Trail. **NEW STATE RECORD.**

Lordithon anticus (Horn) is uncommon in Indiana (Blatchley, 1910); it has been collected by Berlese funnel in deciduous forest leaf litter, in pitfall traps, and from a rotting pine log and nearby leaf litter (Campbell, 1982). Specimens were collected under bark of an unidentified hardwood on 17 May 2019 along Back Road.

Sepedophilus crassus (Gravenhorst) adults are frequently collected from rotten wood, from deep layers of decaying leaves, and from bracket fungi and mushrooms (Campbell, 1976). Specimens were collected off an unidentified shelf fungus on 9 May 2019 along Java History Trail.

Tachyporus jocosus LeConte has been collected in Berlese samples of deciduous leaf litter, from fleshy fungi in deciduous forests, at lights, swept from roadside vegetation, and from fields of alfalfa (*Medicago*, Fabaceae), crimson clover (*Trifolium incarnatum* L., Fabaceae), and Bermuda grass (*Cynodon dactylon* L. Poaceae) (Campbell 1979). It is common in lawns in Kentucky (Cockfield & Potter, 1984). Specimens were collected in an unidentified fungus on 23 October 2018 along Contees Trail. **NEW STATE RECORD.**

DISCUSSION

Four inventories of Maryland silphids have been published. Shubeck & Blank (1982) collected eight species at Cheltenham, Prince George's County. Staines (2008) found seven species collected at Plummers Island, Montgomery County from 1905-2004. Fritzler & Strazanac (2012) collected five species at Catoctin Mountain Park, Frederick County. Dyar & Price (2013) found eight species at Nassawango Creek Preserve, Wicomico County. The four species collected at SERC is slightly lower than the other inventories, but still indicates a healthy silphid fauna.

The 31 staphylinid species found at SERC represents 9.0% of the known Maryland fauna and suggests a diverse and healthy Staphyloidea fauna at SERC. The detection of 13 Staphylinidae new to Maryland highlights the lack of study this group has received from local naturalists. Hopefully, the data reported here will provide a baseline for future monitoring to track changes in populations and species at SERC and encourage others to inventory other areas.

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