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RESEARCH ARTICLE

THE SAP-FEEDING BEETLES (COLEOPTERA: NITIDULIDAE) OF THE GEORGE WASHINGTON MEMORIAL PARKWAY, VIRGINIA, AND THE DISTRICT OF COLUMBIA

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ABSTRACT

Eighteen years of sporadic sampling effort using 13 collection methods between 1998 and May 2023 was devoted to nine sites in a national park (George Washington Memorial Parkway) in northern Virginia. These collection techniques captured 272 nitidulid specimens. The specimens represent eight subfamilies and 17 genera containing 38 species and one undetermined taxon. Twenty-six nitidulid species are reported for the first time from the Commonwealth of Virginia. Twenty-five species are first records for the Potomac Gorge, an area surveyed for beetles for over 120 years. Periods of adult activity based on dates of capture are given for each species. An assessment of collection techniques is provided.

Keywords: biodiversity, Cucujoidea, insect surveys, national park, new state records, Potomac Gorge.

INTRODUCTION

Nitidulidae are typically dully brownish to blackish, with members of a few genera such as *Glischrochilus* Reitter being glabrous with sharply differentiated color patterns. They are usually somewhat to strongly flattened, with sharply defined three-segmented antennal clubs and prognathous heads. Several genera (such as *Carpophilus* Stephens) have the elytra abbreviated, exposing the pygidium (males) and the apical 1–2 abdominal tergites. Others have the abdomen

completely covered by the elytra. The feeding habits of the adults are varied, ranging from pollen and seed pods (*Meligethes* Stephens), to fungivores (*Pallodes* Erichson and others), to carrion (*Nitidula* Fabricius and others), to pests of sweet corn and stored grain products (some *Caplothorax* Kirejtshuk and *Carpophilus* Stephens), to predators (some larvae of *Glischrochilus*). However, the adults and larvae are generally considered to feed on decaying materials and on fungal fruit bodies. The odors given off by yeasts on rotting fruit and in sap flows can be attractive to a wide variety of species and together with fermenting beer and vinegar in traps serve to present an effective means for surveys of this group (Parsons, 1943; Parsons, 1967; Connell, 1977; Connell, 1981; Downie & Arnett, 1996; Habeck, 2002; Price and Young, 2006; Powell, 2015).

MATERIALS AND METHODS

Study Sites

The study site is in Fairfax and Arlington Counties, Virginia, and in the District of Columbia on lands managed by the National Park Service as units of the George Washington Memorial Parkway (GWMP). The nine park sites where nitidulids were captured are: Arlington Woods in Arlington County, Dyke Marsh Wildlife Preserve, Fort Hunt Park, Fort Marcy, Great Falls Park, Little Hunting Creek, Mount Vernon woodland, and Turkey Run Park in Fairfax County, and Theodore Roosevelt Island in the District of Columbia. These sites comprise approximately 1025 ha (2533 ac). Great Falls and Turkey Run parks and Fort Marcy fall within the Piedmont physiographic province while all other collection sites are on the Coastal Plain, situated within the northern section of an area classified in 2016 as the North American Coastal Plain Global Biodiversity Hotspot (Critical Ecosystem Partnership Fund, 2023). Most sites are situated along the shore of the Potomac River, and Great Falls and Turkey Run Parks border the Potomac Gorge. The Potomac Gorge is a 24 km (15 mi) long, area of the Potomac River located just west of Washington, District of Columbia, and includes a steeply dissected landscape of bluffs, ravines, and floodplains along a high-gradient reach of the river (Fleming, 2007). Most of the study sites are dominated by maturing second growth that consists primarily of upland deciduous woodlands. More open herbaceous-dominated habitats can be found along the shore of the Potomac River and in the freshwater, tidal swamp and marsh habitats at Dyke Marsh. More than 1,300 vascular plant taxa have been documented from the study site (Steury, 2011).

Sampling and specimen records

Specimens were collected during 18 years of a 26-year period (1998–May 2023) using 13 survey methods: beating sheets, blacklight (UV) bucket traps, blacklight shone on white sheets, fruit bait traps, leaf litter samples processed in Berlese funnels, Lindgren funnel traps, Malaise traps, pan traps, panel traps, pit-fall traps, sweep netting, vinegar jug traps and collecting by hand. Hand collecting included searching the dung of white-tailed deer, *Odocoileus virginianus* (Zimmermann), examining flowers, inspecting sap flows on trees, looking under loose bark of dead trees, and splashing water along riverbanks. In 2023, Lindgren funnels and panel traps were baited with distilled turpentine poured into a plastic zip lock bag that was perforated in its upper half multiple times using a fork and hung from near the top of the trap. These traps were used without bait in other years. Vinegar jug traps were constructed as described by Powell (2015). Fruit bait traps were created by staking a wire suet feeder (C&S Ez fill type) to a sheet of white

plastic placed on the forest floor. Fruit scraps (apple cores, banana peels, papaya skins, and strawberry tops) were placed in the feeder. Magnifying lenses were used for examination of the scraps. Nitidulids were removed using soft forceps and placed in vials containing 95% ethanol. Specimens were then sorted and glued on points or pinned.

Collectors who contributed specimens to this study were Chris Acosta, Ed Barrows, John Brown, Colin Davis, Arthur Evans, J. Ray Fisher, Deblyn Mead, Eric Oberg, Michael Skvarla, David Smith, Warren Steiner, Jr., Brent Steury, Mireya Stirzaker, and Christopher Wirth.

Existing state records were extracted from the publications of Downie & Arnett (1996), Evans (2008, 2014), Parsons (1943), and Weidner & Powell (2023). Key resources for identification were the revision of the North American species by Parsons (1943) and his subsequent additions to the genus *Epuraea* (Parsons 1967, 1969, 1972), Easton (1955), Connell (1957, 1977, 1984), Ford (1996), the treatment of Northeastern beetles by Downie & Arnett (1996), the online key to *Carpophilus* by DiLorenzo et al. (2021), and by comparisons with identified material in the University of New Hampshire Insect Collection which was largely identified by Andrew Cline (California Department of Food and Agriculture, Sacramento, California).

RESULTS AND DISCUSSION

Evans (2008) provided the first list of nitidulid beetles from GWMP during a three-day Bioblitz of the Potomac Gorge in 2006. During the Bioblitz, four nitidulid species were documented: *Amphicrossus ciliatus* (Olivier) and *Cryptarcha ampla* Erichson from Great Falls Park, *Stelidota geminata* (Say) from Turkey Run Park, and *Epuraea rufa* (Say) from both parks. The current study built upon the Bioblitz results by determining 272 nitidulid specimens captured in GWMP from 1998 through May 2023 at nine sites in GWMP. These specimens comprised eight subfamilies containing 17 genera, 38 species and one undetermined taxon. Very little has been published concerning the Nitidulidae of Virginia. Downie & Arnett (1996) provided distributional information based on records prior to 1996 with the only other published records from Virginia presented by Evans (2008, 2014). Twenty-six species reported from this study (see list of species below) are the first records for Virginia. Since Brown (2008) did not include Nitidulidae in his treatment of invertebrate fauna of the Potomac Gorge, the 25 species in the current study collected from Piedmont Plateau sites along the Potomac Gorge at Great Falls or Turkey Run Parks are first records for the Potomac Gorge. Ten species were based on a single specimen. A substantial southern range extension in North America, from Wisconsin to Virginia, was documented for the European species *Epuraea terminalis* Mannerheim. It was previously documented in North America only from Canada and three northern states (Alaska, Colorado, and Wisconsin). Two other non-native species were documented from the study site, *Carpophilus marginellus* Motschulsky from Southeast Asia, and *Fabogethes nigrescens* (Stephens) from Eurasia. *Epuraea aestiva* (Linnaeus) is a Holarctic species of uncertain origin. *Colopterus niger* (Say) has a broad range extending from Alberta, Canada, into Central and South America. Its exact origin is uncertain.

Few other nitidulid inventories have been conducted that cover small regions such as the scale of this study. However, the 39 taxa documented from GWMP compare well with the documented faunas of larger scale studies such as those conducted for Indiana (70 species; Powell, 2015) or Wisconsin (73 species; Price & Young, 2006). Vogt (1950) documented 33 nitidulid species from tree sap flows at a just a few sites in Maryland.

Species richness was evenly distributed among sites that had approximately equal search effort and there was small variation in species richness between sites in the Piedmont and those on the Coastal Plain. Great Falls Park and Fort Hunt Park each recorded 21 species, followed by Turkey Run (20 species) and Little Hunting Creek (12 species). The most commonly collected species in the park were *Stelidota geminata*, *Caplothorax lugubris* (Murray), *Colopterus truncatus* (Randall), and *Epuraea rufa*.

One specimen of *Epuraea* Erichson (Fig. 1) remains unidentified to species. It is perhaps best placed in the species near *E. corticina* Erichson (see Parsons 1969) but differs by the acute apex of the preapical tubercle on the mesal margin of the mesotibiae, the truncate apex of the metatibiae, the posterolateral angles of the pronotum being greater than 90º, the apical emargination of the pronotum being deeper, and the internal sclerotization at the apex of the median lobe of the aedeagus being more widely and broadly emarginate. As figured by Parsons (1969) *E. corticina* has a sinuate mesal margin of the mesotibiae and blunt apex of the preapical tubercle, the metatibiae have the mesal apex prolonged, the posterolateral angles of the pronotum are less than 90º, the apical margin of the pronotum is shallow (less than 0.1 mm), and the internal sclerotization at the apex of the median lobe is roughly transverse. In addition, the specimen is larger (4.3 mm compared to 3.0–3.9 mm for *E. corticina*) and it possesses a color pattern that is different from those detailed by Parsons (1943, 1969) or Downie & Arnett (1996). This specimen does not key to any North American species and cannot be found by examination of photographs of the European species. It may be undescribed or a species of Asian or African origin that has not been previously reported from North America.

Figure 1. *Epuraea* Erichson sp. 1. **Left:** dorsal habitus; **right:** median lobe of the aedeagus. Captured in a vinegar jug trap set at Fort Hunt Park from 27–30 March in deciduous woodland. Collector B. Steury. Body length 4.3 mm.

Collection methods that produced the highest number of species were Malaise traps (n=22), fruit bait (18), vinegar trap (14), Lindgren funnel (some baited with turpentine) (8), collecting by hand (7), black light bucket trap and panel trap (6 each). All other methods captured five or fewer species.

The only sites surveyed where no nitidulid beetles were collected were Collingwood Picnic Area in Fairfax County, and Daingerfield Island and Roaches Run Waterfowl Sanctuary in The City of Alexandria. The only capture method utilized that failed to capture any nitidulid beetles was sweep netting.

LIST OF SPECIES

Species are listed alphabetically within subfamilies following Kirejtshuk (2008) and Cline et al. (2014). The 26 nitidulid species new to the Commonwealth of Virginia are marked by an exclamation point (!). Species newly recorded from the Potomac Gorge are indicated with an asterisk (*). Non-native species are marked by a dagger (†). The number of specimens in the collection is indicated in parentheses after each taxon. Sites where specimens were collected are given for Virginia: Arlington County: Arlington Woods (at Arlington House) (AW); Fairfax County: Dyke Marsh Wildlife Preserve (DM), Fort Hunt Park (FH), Fort Marcy (FM), Great Falls Park (GF), Little Hunting Creek (LH), Mount Vernon Woodland (MV), and Turkey Run Park (TR) and the District of Columbia: Theodore Roosevelt Island (RI). Collection methods that captured nitidulid beetles are listed using the following abbreviations: leaf litter samples processed in Berlese funnels (bf), UV black light sheet (bl), beating sheet (bs), blacklight bucket trap (bt), fruit bait trap (fb), hand collected (hc), Lindgren funnel trap (lf), Malaise trap (mt), panel trap (pa), pit-fall trap (pf), pan trap (pt), and vinegar jug trap (vt). The periods of adult activity are given based on dates when taxa were captured in the GWMP. Dates separated by an en dash (–) indicate that the taxon was documented on at least one day during each month within this continuum of months, whereas dates separated by a comma represent individual observation dates. For traps set over multiple weeks, the first day of the set is used as the earliest date and the last day of the set as the latest date. Habitats of taxa collected by hand are provided when given on specimen labels.

Family Nitidulidae (sap-feeding beetles)

Subfamily Cryptarchinae Thomas, 1859
Cryptarcha ampla Erichson – (6); FH, GF; 24 Apr, 23–30 Jun, 3 Aug; bt, fb.
!**Glischrochilus confluentus* (Say) – (3); FH, GF, TR; 23-30 Mar, 15 Dec; hc, pa, vt. Under bark of large, fallen trunk of *Liriodendron tulipifera* L. (Magnoliaceae).
!**Glischrochilus fasciatus* (Olivier) – (8); FH, GF, LH, TR; 23 Mar–28 Jun, 23 Sep–5 Oct; fb, lf, mt, pf, vt.
!**Glischrochilus quadrisignatus* (Say) – (15); AW, DM, FH, GF, TR; 23 Mar–30 June, 5–25 Aug; bf, fb, lf, mt, pf, vt.
!**Glischrochilus sanguinolentus* (Olivier) – (19); FH, GF, LH, TR; 23 Mar–18 Sep; fb, hc, lf, mt, pa, vt. On sapping tree trunk.
!**Glischrochilus siepmanni* Brown – (4); DM, FH, TR; 4–24 Apr; fb, mt, vt.

Subfamily Prometopiinae Böving and Craighead, 1931
!**Prometopia sexmaculata* Say– (15); FH, GF, LH, MV, TR; 14 Apr–7 Sep; bt, hc, mt. On sapping tree trunk.

Subfamily Amphicrossinae Kirejtshuk, 1986
Amphicrossus ciliatus (Olivier) – (10); FH, GF; 1–27 Apr, 23 Jun; bt, fb, lf, pa, vt.

Subfamily Carpophilinae Erichson, 1842
!**Caplothorax lugubris* (Murray) – (22); FH, GF, TR; 1–24 Apr; fb, pa, vt.
**Caplothorax sayi* (Parsons) – (2); TR; 5–30 May; fb, mt.
!**Carpophilus antiquus* Melsheimer – (4); RI, TR; 1 May–13 Jun, 18 Aug–4 Sep; lf, mt.
Carpophilus brachypterus (Say) – (1); DM; 1–10 May; mt.
!**Carpophilus corticinus* Erichson – (8); FH, TR; 4–24 Apr, 5 Sep–19 Nov; fb, mt, vt.
!*Carpophilus dimidiatus* (Fabricius) – (2); FH; 17 Apr; fb.
!*Carpophilus marginatus* Erichson – (1); FH; 4 Apr; fb.
!†*Carpophilus marginellus* Motschulsky – (1); LH; 1–17 Aug; mt.

Subfamily Epuraeinae Kirejtshuk, 1986
!**Epuraea aestiva* (Linnaeus) – (1); GF; 14 Apr; bl.
!*Epuraea corticina* Erichson – (3); FH; 4–17 Apr; fb.
!*Epuraea helvola* Erichson – (4); LH, TR; 30 Apr–20 May; mt.
!**Epuraea labilis* Erichson – (2); GF, LH; 1–30 May; mt.
Epuraea rufa (Say) – (21); AW, FM, GF, TR; 15 Apr–4 Sep; bf, bl, bs, bt. hc, mt. Splashed from vegetation along riverbank.
!*†*Epuraea terminalis* Mannerheim – (1); GF; 7 Jun; bl.
**Epuraea truncatella* Mannerheim – (1); TR; 22 Oct–17 Nov; mt.
!*Epuraea umbrosa* Horn – (2); LH; 1 Mar–18 May; mt.
Epuraea Erichson sp. 1 (Figure 1) – (1); FH; 27–30 Mar; vt.

Subfamily Meligethinae Thomas, 1859
!**Brassicogethes simplipes* (Easton) – (1); TR; 22 May; hc. Taken on flowers of *Aruncus dioicus* (Walter) Fernald (Rosaceae).
!†*Fabogethes nigrescens* (Stephens) – (1); DM; 15–24 Jun; mt.

Subfamily Cillaeinae Kirejtshuk and Audisio, 1986
**Colopterus maculatus* (Erichson) – (2); FH, TR; 17–24 Apr; fb, vt.
!*Colopterus niger* (Say) – (3); FH, LH; 1–24 Apr, 19–31 Aug; mt, vt.
**Colopterus truncatus* (Randall) – (22); DM, FH, GF, TR; 1 Mar–30 Apr, 5 Aug–17 Nov; fb, lf, mt, pa, vt. This taxon is likely a species complex containing undescribed species (Watrous, 1980).
**Colopterus unicolor* (Say) – (7); FH, GF; 4 Apr–19 May; fb, lf, pa.
**Conotelus obscurus* (Erichson) – (6); GF, RI; 10 Aug–1 Nov; hc, pt. Taken from corolla tube of *Calystegia sepium* (L.) R. Br. (Convolvulaceae).

Subfamily Nitidulinae Latreille, 1802
!**Lobiopa undulata* (Say) – (1); GF; 12 May; bt.
**Omosita neartica* (Kirejtshuk) – (3); FH, GF; 1–10 Apr, 15 Nov; fb, hc, vt. In dung of white-tailed deer (*Odocoileus virginianus* (Zimmermann).
!**Pallodes pallidus* (Beauvois) – (20); DM, GF, TR; 17 May–21 Oct; pf, mt.
!**Phenolia grossa* (Fabricius) – (5); FH, GF, LH; 23 Apr–15 Jul; mt, pf.
!**Stelidota coenosa* Erichson – (3); DM, LH, TR; 1 Jun–4 Sep; mt.
Stelidota geminata (Say) – (31); FH, GM, LH, GF, TR; 17 Apr–4 Sep; bt, fb, mt, vt.
!**Stelidota octomaculata* (Say) – (10); FH, FM, LH, GF, TR; 11 Apr–11 Aug; bf, fb, lf, pf.

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