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First record of *Mimogonus fumator* (Fauvel, 1889) (Coleoptera: Staphylinidae: Osoriinae) in the USA, with a synopsis of the Osoriinae of the Southeastern USA

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Abstract

The discovery of *Mimogonus fumator* (Fauvel, 1889) in a suburban area in Central Florida marks the first record of this pantropical species in the United States of America. This finding emphasizes the critical significance of insect monitoring in urban environments, as it unveils the potential for detecting non-native and potentially invasive species accidentally transported through soil and ornamental plants. A taxonomic key and distributional checklist for the known species of the subfamily Osoriinae in the Southeastern United States are also provided. These resources aim to enhance our understanding of the regional insect fauna and provide useful tools for future detection.

Key words: Osoriini, rove beetle, exotic, urban ecology

Introduction

Millions of hectares of land in Florida have undergone substantial transformation from natural lands to the present domain of agricultural landscapes and urban environments of low-density residential areas with large-scale plantings of ornamental plants (Frank & McCoy 1995). This extensive modification of the native ecosystems makes these urban areas susceptible to the introduction of non-native species and secondary release into surrounding natural landscapes (Spence & Spence 1988; Hansen & Clevenger 2005). Some insects (42 species) were introduced in Florida for biological control of pests, including weeds, while the remaining (about 946 species) arrived accidentally through cargo (Frank & McCoy 1995). By far the largest proportion of recent insect immigrants to Florida comes from the Neotropical region (Frank & McCoy 1995). Prolonged growing seasons and a favorable climate are the main means by which introduced species thrive in this environment (Corn *et al*. 2002; Hardin 2007).

Adults and larvae of most Staphylinidae species are facultative or specialist predators, but some are mycophagous or saprophagous or even phytophagous, occasionally damaging flowers and turf (Frank & Thomas 1999). They can be found in moist habitats, soil, decaying organic matter, live and dead plant material, and under rocks (Frank & Thomas 1999). Their historical dispersion across the globe and in North America could be associated with commerce of goods such as soil, rocks, wood (Ødegaard & Tømmeras 2000; Klimaszewski *et al*. 2013).

Staphylinidae are the largest beetle family worldwide and are well represented in North America, with 28 subfamilies, 582 genera and 4702 named species, but many more remain to be discovered and described (A. Newton, pers. comm., 2024).

Osoriinae is a highly diverse and globally distributed subfamily with 2389 species, 118 genera and four tribes, three of them represented in North America: Eleusinini Sharp, 1887, Osoriini Erichson, 1839 and Thoracophorini Reitter, 1909, while a fourth one, Leptochirini Sharp, 1887 is present in the Old World, and South and Central

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America (Newton *et al*. 2000; Newton 2022). Among these, the tribe Osoriini has a world-wide distribution with 70 genera in total (Herman 2001; Irmler 2010a; Irmler 2015a). The genera *Osorius* and *Mimogonia* are restricted to the New World, while *Holotrochus* Erichson, 1839 and *Mimogonus* Fauvel, 1903 are mostly pantropically distributed (Irmler 2015a). Two genera, *Holotrochus* and *Osorius,* were recorded by Newton *et al*. (2000) in the United States. The genus *Molosoma* was split from *Osorius* by Irmler (2014) representing a new genus for the United States.

Over the course of an ecological study of ground active beetle diversity in urban ecosystems in Central Florida in which pitfall traps were deployed in 2022 and 2023, individuals of the pantropical species *Mimogonus fumator* (Fauvel, 1889) were captured. These specimens represent the first records of this species in the United States of America. This discovery adds to the diversity of genera within the tribe Osoriini in the USA, bringing the total count to four.

Materials and Methods

Study Site: The study site is located in the Sunbridge development in southwest Orange and northern Osceola counties in Florida (28.330, -81.189) (fig 1). The new development is a 27,000 acre site with plans to build 22,700 single family homes and 13,990 multi-family units. The site is being developed on former ranchlands and is surrounded by large conservation areas and other natural areas. The developer has incorporated a scientific study in the project to verify potential ecological and water conserving benefits of non-conventional landscaping practices for the next phase of the development, including adopting drought-tolerant native plant landscapes. The experimental design was established in January 2022 at the Basecamp and includes 16, 9 x 6 m, experimental plots, which are planted with the same 26 native plant species in approximately equal quantities, although with slightly varying arrangements, and addition of pine needles as ground cover. The experiment is a complete randomized block design with soil and irrigation treatments, including plots with and without Lifesoils® Command compost amendment

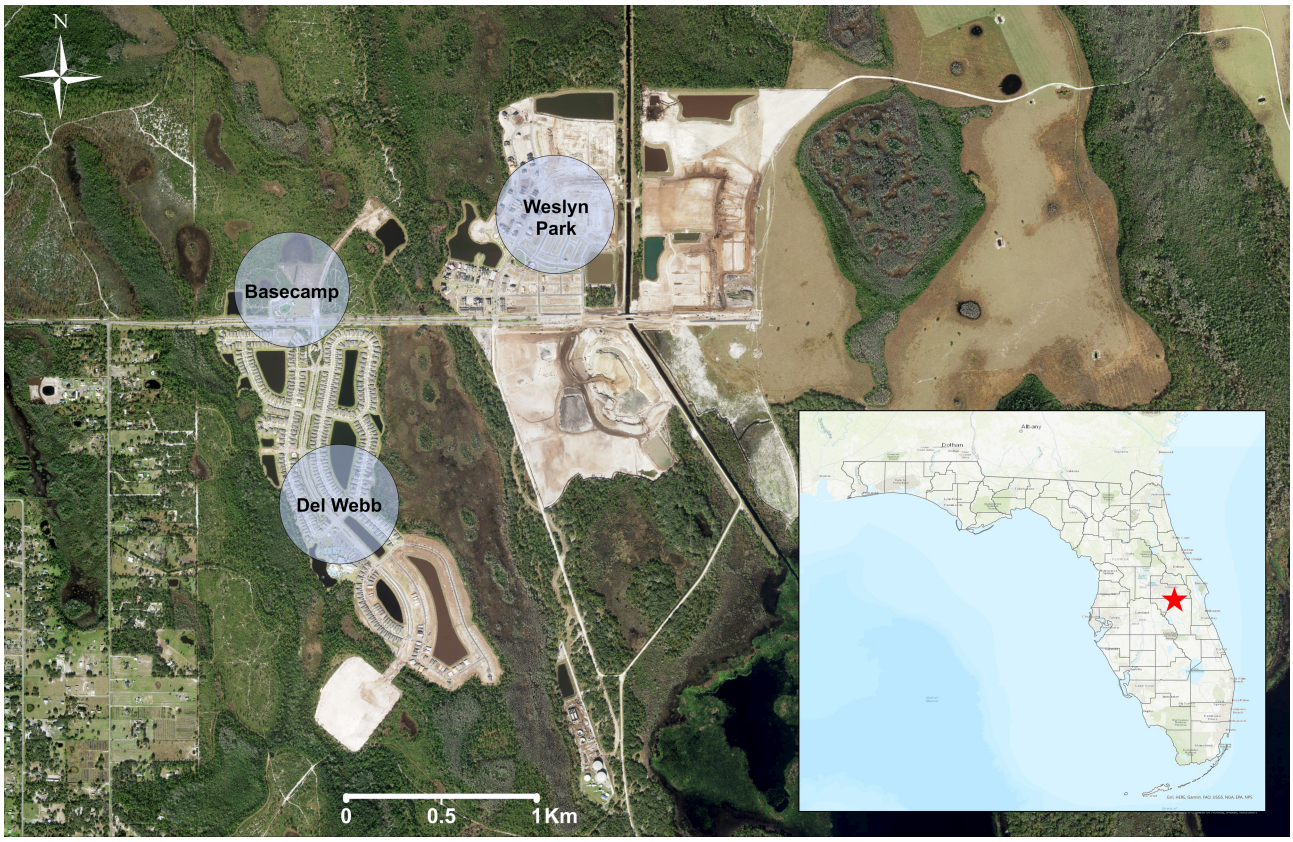

FIGURE 1. The study site is located in Central Florida (red star). Sunbridge Basecamp: experimental plots with native plants; Weslyn Park: neighborhood characterized predominantly by native plants; Del Webb: neighborhood characterized predominantly by turf grass and traditional ornamental plants.

incorporated into the soil, and with regular weekly irrigation versus irrigation only as needed for plant survival. In addition to the experimental plots, the Sunbridge development community currently has two different communities with different landscape designs. The Del Webb community was started in 2019 and follows a traditional landscape design with predominantly turfgrass and non-native ornamental plants. The Weslyn Park community, started in 2022, adopts a landscape design focused on minimizing or eliminating landscape irrigation and fertilization needs by improving soil health with organic compost amendments and using predominantly the same native and drought-tolerant plant species present in the experimental plots with pine needles as ground cover.

Pitfall traps were deployed in this site to study the soil fauna. Each trap consisted of a 16 oz deli container (7 cm deep with an 11 cm diameter, 540 mL total volume) holding a fluid preservative (70% antifreeze, 30% water) that prevents degradation of collected insects. A square cover (20 x 20 cm) elevated 1.5 cm above the trap entrance protects the container from rain and reduces the risk of accidentally capturing small vertebrates (Levan 2020). Two traps were randomly placed in each of the 16 experimental plots at Basecamp, resulting in a total of 32 traps. Fourteen homes in Del Webb and eleven homes in Weslyn Park were selected from homeowners who volunteered to participate in the study. Four traps were deployed in each home, with two traps placed in the front yard and two in the back yard, resulting in a total of 100 traps across these two communities.

Mapmaking: The map was generated in ArcGIS Pro 3.2.2 using the Orlando Imagery basemap, with coordinates referenced to the World Geodetic System 1984 (WGS84).

Photographs: All photographs used in this paper, except from *Thoracophorus guadalupensis* and *Renardia nigrella*, were taken with a Canon EOS 7D, lens Canon MP-E 65 mm, processed using the Zerene Stacker® software version 1.04, and edited in Adobe PhotoShop® 25.5 (figs 2–4).

Results

Twenty-one specimens of *Mimogonus fumator* were collected from three localities in the Sunbridge development over three seasons, from Fall 2022 to Fall 2023.

Material examined: Specimens of *Mimogonus fumator* are deposited at the University of Central Florida Collection of Arthropods (UCFC) and Florida State Collection of Arthropods (FSCA). Data are as follows: Florida: Osceola Co., St. Cloud, Basecamp Sunbridge, 28.3341, -81.1894, 10–20 Oct 2022, pitfall trap, A. Pandolfi (♂3, UCFC0584189; UCFC0584190; UCFC0584191); Osceola Co., St. Cloud, Basecamp Sunbridge, 28.3341, -81.1894, 03 Mar–06 Apr 2023, pitfall trap, A. Pandolfi (♂2, UCFC0584192; UCFC0584193); Osceola Co., St. Cloud, Basecamp Sunbridge, 28.3341, -81.1894, 06–13 Apr 2023, pitfall trap, A. Pandolfi (♂4/♀3, UCFC0584194; UCFC0584195; UCFC0584196; UCFC0584197; UCFC0584198; UCFC0584199; UCFC0584200); Osceola Co., St. Cloud, Basecamp Sunbridge, 28.3341, -81.1894, 20–27 Jun 2023, pitfall trap, A. Pandolfi (♂1, UCFC0584201); Osceola Co., St. Cloud, Basecamp Sunbridge, 28.3341, -81.1894, 11–18 Oct 2023, pitfall trap, A. Pandolfi (♂1: UCFC0584202); Osceola Co., St. Cloud, Weslyn Park, 28.3352, -81.1826, 13–20 Mar 2023, pitfall trap, V. Cope (♂3, UCFC0584203; UCFC0584204; UCFC0584205); Osceola Co., St. Cloud, Del Webb, 28.3325, -81.1903, 20–27 Jun 2023, pitfall trap, V. Cope (♂1, UCFC0584206); Osceola Co., St. Cloud, Weslyn Park, 28.3352, -81.1826, 20–27 Jun 2023, pitfall trap, V. Cope (♂1, UCFC0584207); Osceola Co., St. Cloud, Del Webb, 28.3325, -81.1903, 19–26 Sept 2023, pitfall trap, V. Cope (♀1, FSCA); Osceola Co., St. Cloud, Weslyn Park, 28.3352, -81.1826, 19–26 Sept 2023, pitfall trap, V. Cope (♂1, FSCA).

Diagnosis: This species can be easily distinguished from the related native species of Osoriinae by the deeply emarginate sides of pronotum in front of the posterior angles and pubescent dorsum (Irmler 2015b), and from the closest genus *Mimogonia* by the larger size (over 3.0 mm), the pronotum laterally margined with distinct pits on the posterior angles, and the dark, red-brown body with the elytra slightly lighter reddish (Irmler 1981)

Remarks: Photos posted on the website BugGuide indicate a specimen resembling *M. fumator*, reported from Rotonda West, Charlotte County, Florida, USA, on June 11, 2011 (record ID: https://bugguide.net/node/view/607963), initially identified as *Mimogonia*. After further examination by Irmler, we confirmed the specimen to be *M. fumator*.

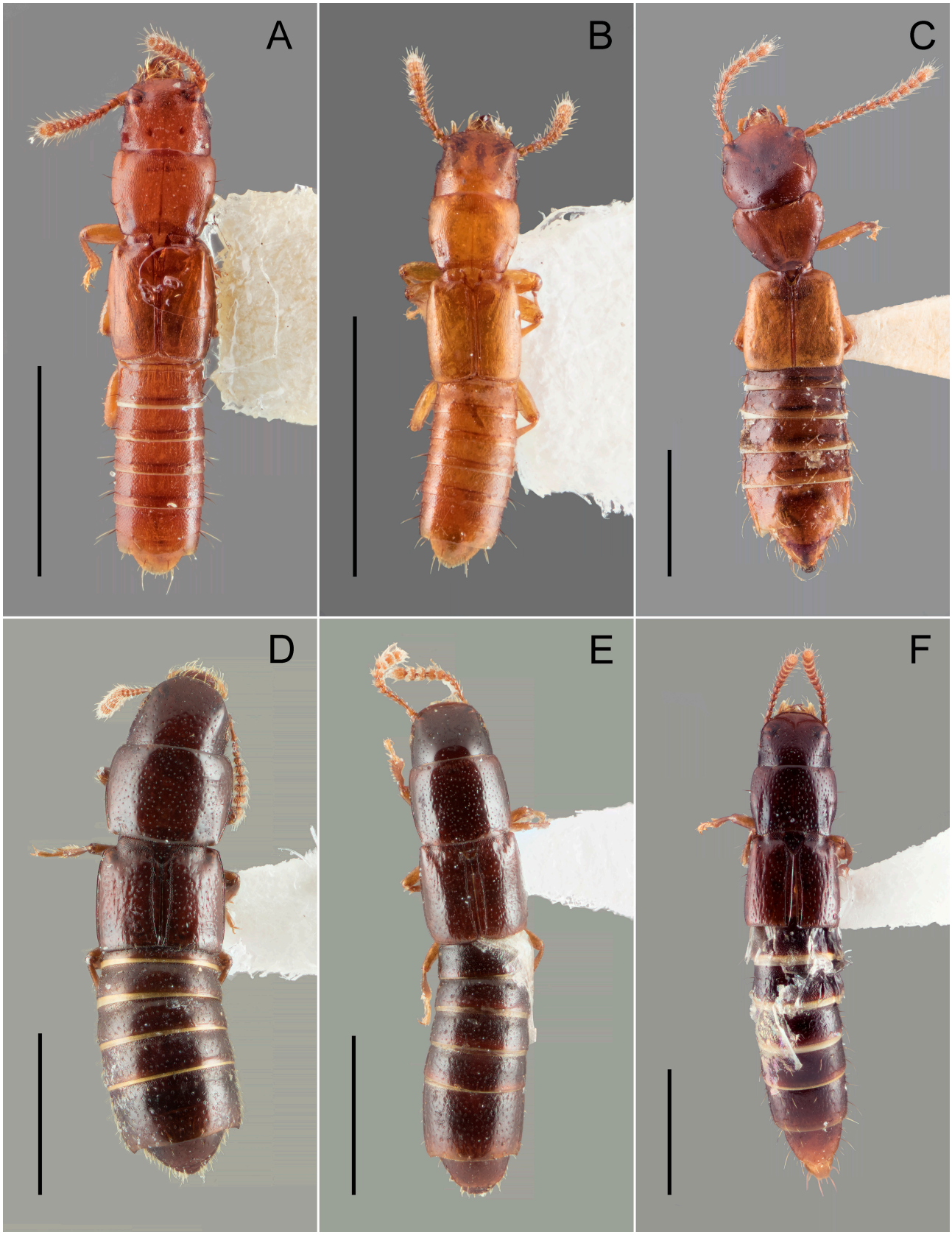

FIGURE 2. Habitus of Osoriinae of the Southeastern USA: (A) *Clavilispinus rufescens* (LeConte, 1863) (B) *Clavilispinus exiguus* (Erichson, 1840) (C) *Eleusis pallida* (LeConte, 1863) (D) *Holotrochus brachypterus* Fauvel, 1905 (E) *Holotrochus parvulus* Chapin, 1928 (F) *Lispinus obscurus* LeConte, 1863. Scale bar = 1 mm.

FIGURE 3. Habitus of Osoriinae of the Southeastern USA: (A) *Mimogonus fumator* (Fauvel, 1889) (B) *Molosoma brevicorne* (Notman, 1920) (C) *Molosoma latipes* (Gravenhorst, 1806) (D) *Nacaeus tenuis* (LeConte, 1863) (E) *Osorius parviceps* Notman, 1925 (F) *Osorius planifrons* LeConte, 1877. Scale bar = 1 mm.

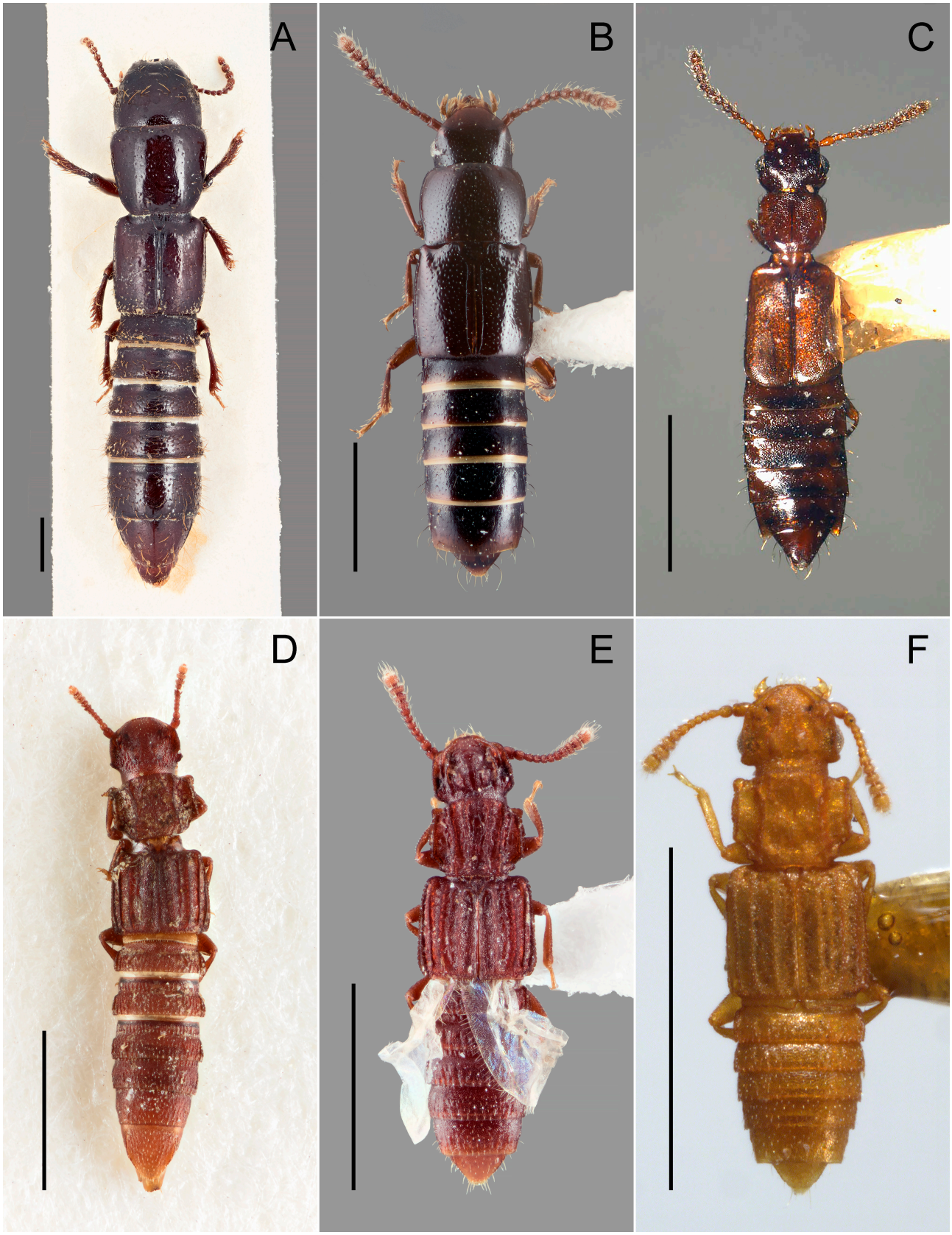

FIGURE 4. Habitus of Osoriinae of the Southeastern USA: (A) *Osorius politus* LeConte, 1877 (B) *Prolibia laevicauda* (LeConte, 1866) (C) *Renardia nigrella* (LeConte, 1863) (D) *Thoracophorus brevicristatus* (Horn, 1871) (E) *Thoracophorus costalis* (Erichson, 1840) (F) *Thoracophorus guadalupensis* Cameron, 1913. Scale bar = 1 mm.

Key to Osoriinae of the Southeastern USA

A key to genera and species is provided and is adapted from Newton *et al*. 2000 (genera), Irmler 2003 (*Clavilispinus*), Notman 1925 and Irmler 2014 (*Osorius* and *Molosoma*), Chapin 1928 (*Holotrochus* and *Mimogonus*), Ferro 2015 (*Thoracophorus*), and Newton 2017 (*Clavilispinus* and *Prolibia*).

1 Membranous suture present between each abdominal tergum and sternum; pronotum gradually but strongly narrowed toward base for basal 1/3 or more (triangle-like shape); body very flat 2

\- Abdominal tergum and sternum of each of segments III–VII fused into complete ring; pronotal shape diverse, rarely gradually and strongly narrowed toward base (trapezoid-like shape); body flat to convex or cylindrical 3

2 Head without groove near dorsal edge of eye; pronotum longer than wide (rarely only as long as wide), with sides subparallel for the anterior 2/3; elytron with sutural stria . . . . . ***Renardia nigrella*** (LeConte, 1863)

\- Head with groove extending posteriorly from dorsal edge of eye; prontum distinctly wider than long, with sides subparallel for at most the anterior 1/2; elytron without sutural stria . . . . . ***Eleusis pallida*** (LeConte, 1863)

3 Procoxa with deep groove and carina on mesal surface; protibia with inner edge concave and bearing ctenidium; abdominal segment VIII (last visible) with "extra" tergite at apex; body convex, often nearly cylindrical 4

\- Procoxa with or without carina on mesal surface; protibia with inner edge straight, without ctenidium; abdominal segment VIII without "extra" tergite at apex (but part of eversible genital segment may be visible); body generally more or less flat 11

4 Antenna geniculate; scape about as long as or longer than next three antennomeres combined; external edge of protibia strongly convex, strongly spinose 5

\- Antennae not geniculate; scape about as long as next 2 antennomeres combined; external edge of protibia straight to slightly convex, at most with a few slender spines 9

5 Length 6 mm or greater 6

\- Length 5.5 mm or less 8

6 Clypeus strongly emarginate . . . . . ***Osorius politus*** LeConte, 1877

\- Clypeus truncate or subtruncate 7

7 Head distinctly narrower than the pronotum; pronotum and elytra shiny and densely punctured; length 6 mm . . . . . ***Osorius parviceps*** Notman, 1925

\- Head not narrower than the pronotum; pronotum and elytra dull and not densely punctured; length 7–8 mm . . . . . ***Osorius planifrons*** LeConte, 1877

8 Second antennal segment subequal in length to third, following segments approximately quadrate; thoracic and elytral punctures in general coarser and more numerous; length 5–5.5 mm . . . . . ***Molosoma latipes*** (Gravenhorst, 1806)

\- Second antennal segment distinctly longer than third, following segments transverse; thoracic and elytral punctures in general sparser and finer; length 3.5–4 mm . . . . . ***Molosoma brevicorne*** (Notman, 1920)

9 Pronotum in front of posterior edge deeply emarginate, posterior angles with depression; pronotum and elytra pubescent; body reddish-brown, elytra slightly lighter reddish; introduced in Florida . . . . . ***Mimogonus fumator*** (Fauvel, 1889)

\- Pronotum in front of posterior edge not emarginate, posterior angles without depression; pronotum and elytra glabrous; body dark brown, elytra same color of the rest of the body 10

10 Length of pronotum greater than length of elytral suture, sides explanate; elytra rugose-punctate; body relatively robust, length 2.7 mm . . . . . ***Holotrochus brachypterus*** Fauvel, 1905

\- Length of pronotum equal to length of elytral suture, sides narrow, not explanate; elytra simply punctate; body relatively slender, length 2.5 mm . . . . . ***Holotrochus parvulus*** Chapin, 1928

11 Procoxae separated ventrally by a flat or convex process of prosternum 12

\- Procoxae contiguous 13

12 Abdominal segments with coarse diagonal to nearly longitudinal strigae, at least ventrally . . .***Lispinus obscurus*** LeConte, 1863

\- Abdominal segments without coarse strigae . . . . . ***Nacaeus tenuis*** (LeConte, 1863)

13 Procoxal fissure open, trochantin exposed 14

\- Procoxal fissure closed, trochantin concealed 16

14 Head (including eyes) about 2/3 as wide as combined elytral width; pronotum widest in middle third; pronotosternal suture solid, present as a fine external carina; abdominal tergum VIII (last visible) entire, separated laterally from sternum VIII by suture . . . . . ***Prolibia laevicauda*** (LeConte, 1866)

\- Head (including eyes) more than 4/5 as wide as combined elytral width; pronotum widest in anterior third; pronotosternal suture absent; abdominal sternum VIII extended dorsally in front of tergum VIII and fused to it near midline 15

15 Red; dorsal microsculpture deep and distinct, microsculpture on abdomen as deep and distinct as that of elytra; length greater than 2.5 mm . . . . . ***Clavilispinus rufescens*** (LeConte, 1863)

\- Yellow; dorsal microsculpture relatively less deep and distinct, microsculpture on abdomen not as deep and distinct as that of elytra; length 1.9–2.1 mm . . . . . ***Clavilispinus exiguus*** (Erichson, 1840)

16 Elytra (sometimes also head or pronotum) costate; body surfaces generally roughly sculptured and microsculptured, dull; abdominal sternum VIII extended dorsally in front of tergum VIII 17

\- Elytra not costate; body coarsely punctate or not, with or without depressions along midline of pronotum but otherwise without rough sculpture, more or less shining; abdominal sternum VIII normal, not visible from above . . . . . ***Espeson*** Schaufuss, L. W., 1882 (undescribed sp.)

17 Eyes visible from above; combined length of pronotum and elytra <0.7 mm; pronotal disc with 2 sublateral ridges; restricted in

	the US to Florida	***Thoracophorus guadalupensis*** Cameron, 1913
-	Eyes not visible from above; combined length of pronotum and elytra >0.8 mm; pronotal disc with 2 apically bifurcated, sublateral ridges, or pronotal disc with 4 ridges; widespread	18
18	Pronotal disc with 2 apically bifurcated, longitudinal ridges; vertex of head with 2 irregular carinae	***Thoracophorus brevicristatus*** (Horn, 1871)
-	Pronotal disc with 4 longitudinal ridges; vertex of head with 4 complete carinae.	***Thoracophorus costalis*** (Erichson, 1840)

Checklist and distribution of Osoriinae of the Southeastern USA

The distribution of Osoriinae of the Southeastern United States (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee) follows Herman (2001) and Newton (2022).

Eleusinini Sharp, 1887

Eleusis Laporte de Castelnau, 1835
Eleusis pallida (LeConte, 1863) [TN]

Renardia Motschulsky, 1865
Renardia nigrella (LeConte, 1863) [TN]

Osoriini Erichson, 1839

Holotrochus Erichson, 1839
Holotrochus brachypterus Fauvel, 1905 [AL, FL, GA, MS, SC]
Holotrochus parvulus Chapin, 1928 [FL, MS]

Molosoma Say, 1831
Molosoma brevicorne (Notman, 1920) [FL]
Molosoma latipes (Gravenhorst, 1806) [AL, FL, NC, SC]

Mimogonus Fauvel, 1903
Mimogonus fumator (Fauvel, 1889) [introduced, FL]

Osorius Guérin-Méneville, 1829
Osorius parviceps Notman, 1925 [FL]
Osorius planifrons LeConte, 1877 [AL, FL, SC, TN]
Osorius politus LeConte, 1877 [AL, FL, NC, SC]

Thoracophorini Reitter, 1909

Clavilispinus Bernhauer, 1926
Clavilispinus exiguus (Erichson, 1840) [SC, FL]
Clavilispinus rufescens (LeConte, 1863) [AL, FL, MS, SC]

Espeson Schaufuss, 1882
Espeson undescribed sp. [FL]

Lispinus Erichson, 1839
Lispinus obscurus LeConte, 1863 [AL, FL]

Nacaeus Blackwelder, 1942
Nacaeus tenuis (LeConte, 1863) [FL, GA, SC]

Prolibia Newton, 2017

Prolibia laevicauda (LeConte, 1866) [GA]

Thoracophorus Motschulsky, 1837

Thoracophorus brevicristatus (Horn, 1871) [FL]
Thoracophorus costalis (Erichson, 1840) [AL, FL, GA, NC, SC, TN]
Thoracophorus guadalupensis Cameron, 1913 [FL]

Discussion

Most Osoriinae species have well-developed eyes and inhabit decaying wood or leaf litter. A considerable number in the Neotropical region are believed to reside within the rainforest canopy, possibly occupying dead branches or twigs. Interestingly, several genera include species adapted to soil environments, with some exhibiting reduced or absent eyes (Irmler 2015a). Some species belonging to *Neosorius* and *Osorius* show fossorial activity and lay eggs in the first 50 mm of the soil profile creating tunnels and causing soil mounds and damaging the aesthetic of turf grass fields like golf courses (Smith *et al*. 1978; De Graff *et al*. 2003).

In this paper, the first record of the species *Mimogonus fumator* for the USA was found in pitfall traps deployed for an ecological study in the Sunbridge development in Central Florida, in presence of both native and ornamental plantings. The finding of various individuals of this species over three collecting seasons, as well as an image posted to BugGuide from Charlotte County, FL in 2011, confirms its presence and establishment in the continental United States. This species was originally described from New Caledonia and Sumatra by Fauvel (1889) and subsequently recorded from various localities in the Oriental, Afrotropical (including Madagascar), and Neotropical regions (Herman 2001). Irmler (2015b) suggested that it might have presumably immigrated from Africa or via East Asia and subsequently introduced in the Neotropical region by log imports (Irmler 1981; Irmler 2010b), where it is now known from Dominican Republic, Guadeloupe, Haiti, Jamaica, Mexico, Panama, Puerto Rico, and Cuba (Irmler 2015b). Assing & Feldmann (2012) documented the presence of this species in Israel, specifically in areas with moist spots on sandy soils. This suggests a potential for its spread to countries with similar warm climates worldwide and provides insight how far it might spread in the US.

The presented results confirm that non-native species occur at higher abundance and in greater diversity in urban areas because of points of entrance, high levels of disturbance, and lower competition (Gaertner *et al*. 2017). The presence of *Mimogonus fumator* in three different locations of the Sunbridge development raises the possibility that they may have been introduced with the landscape planting material associated with the new development, highlighting the potential role of landscaping practices in the introduction and spread of non-native species. Given that this site is adjacent to a natural reserve, there's uncertainty surrounding the potential range expansion of non-native species into natural lands and how it could affect the native fauna. As such, early detection of new and emerging non-native species in these urbanized landscapes is crucial for monitoring potential founding populations. This proactive approach enhances the spatiotemporal coverage of monitoring efforts, contributing to a more effective and comprehensive understanding of the presence and impact of these emerging species.

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