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A third species of the endemic Floridian milliped genus
Floridobolus Causey, 1957
(Spirobolida: Spirobolidae: Floridobolinae)

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A third species of the endemic Floridian milliped genus *Floridobolus* Causey, 1957 (Spirobolida: Spirobolidae: Floridobolinae)

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Abstract. Characterized by small body size, apically rounded/lobed anterior gonopod telopodites, long slender posterior gonopod telopodites, and torsion in the cyphopod receptacles, *Floridobolus floydi*, n. sp., is described from the southern sector of the Brooksville Ridge in northwestern peninsular Florida. It inhabits sandy “Big Scrub” environments like *F. penneri* Causey, 1957, and *F. orini* Shelley, 2014, and is documented from the sector’s center and northern periphery, in Hernando and Citrus Counties, respectively, with a sight record from the eastern periphery. Its discovery supports the thesis that each sand ridge in peninsular Florida may harbor a unique species of this endemic genus.

Key Words. Brooksville, Brooksville Ridge, Citrus Springs, Citrus Co., *Floridobolus floydi*, Hernando Co.

Introduction

The spirobolid milliped genus *Floridobolus* (Spirobolida: Spirobolidae: Floridobolinae) was proposed by Causey (1957) for *F. penneri* in the Lake Wales Ridge, Highlands and Polk Counties (Cos.). It remained monotypic for 57 years, until *F. orini* Shelley, 2014, was described from the Ocala National Forest, Marion Co., some 208 km (130 mi) to the north (Shelley and Floyd 2014). The authors predicted additional species in “Big Scrub” habitats on other sandy ridges, and *F. floydi* n. sp., described herein from the detached southern half of the Brooksville Ridge, supports this contention. We also present new tribal and generic diagnoses to encompass the different features of this species; detailed accounts of all established taxa are available in Shelley and Floyd (2014). Repository acronyms are **FSCA**, Florida State Collection of Arthropods, Gainesville, and **NCSM**, North Carolina State Museum of Natural Sciences, Raleigh.

The Brooksville Ridge (Fig. 1, number 1), in northwestern peninsular Florida, extends from the northern border of Gilchrist/Alachua Cos. to southcentral Pasco Co. near Zephyrhills, a distance of around 176 km (110 mi). It is divided near midlength into northern and southern sectors by the 4.8 km (3 mi) wide “Dunnellon Gap” in southwestern Marion Co. *Floridobolus floydi* is known only from the latter sector, and its projected distribution thus encompasses parts of Citrus, Hernando, and Pasco Cos. Efforts to find *Floridobolus* in the northern sector have not been successful, but separated by so narrow a gap, we suspect that *F. floydi* also inhabits this half of the Ridge, which extends through parts of Gilchrist, Alachua, Levy, and Marion Cos.

Taxonomy

Order Spirobolida Cook, 1895
Suborder Spirobolidea Cook, 1895
Family Spirobolidae Bollman, 1893
Subfamily Floridobolinae Keeton, 1959

Tribe Floridobolini Keeton, 1959

Diagnosis. Adult lengths ranging from 52.0–92.0 mm; body profile transversely ovoid. Gnathochilarial mentum with apical convexity or boss. Paraprocts slightly re-entrant, without marginal rims, not overhung by apically rounded epiproct. Males with distinct lobes on 3rd and 4th coxae, former with small cavity on caudal margin containing short, conical projection. Anterior gonopod coxal endites slightly prolonged mediad; telopodites fused with coxae, demarcated by faint suture lines, apically uncinata, rounded, slightly prolonged with pointed or blunt extensions, or with low rounded lobes. Membrane caudal to anterior gonopods containing sclerotized remnant of posterior gonopod sternum. Posterior gonopod coxal apodeme long, oriented lengthwise in body and extending variable distances caudad up to 10th pleurotergite; telopodite with short, variably rounded/subrhomboid apical lobes on thickened expansions of caudal and anterior surfaces; latter with or without laminate basal process, with strong bifurcate projection at 2/3 length. Cyphopodal receptacle prolonged anteriomediad.

Component. *Floridobolus* Causey, 1957.

Distribution (Fig. 1). Endemic to a latitudinal distance of approximately 248 km (155 mi) in peninsular Florida, where it is known from “Big Scrub” habitats in sand ridges in Citrus/ Hernando, Marion, and Highlands/Polk Cos.

Remarks. Females of *F. orini* are not available, but we assume that the similar cyphopodal configurations in *F. penneri* and *F. floydi* (Keeton 1959, herein) depict the general pattern for both the tribe and genus.

Genus *Floridobolus* Causey, 1957

Floridobolus Causey, 1957: 206. Hoffman and Keeton 1960: 14. Jeekel 1971: 198. Hoffman 1980: 77; 1999: 48. Shelley et al. 2000: 20. Shelley 2001: 243. Shelley and Floyd 2014: 14–16.

Type-species. *F. penneri* Causey, 1957, by original designation.

Diagnosis. With the characters of the tribe.

Components. Three species—*F. penneri* Causey, 1957; *F. orini* Shelley 2014; and *F. floydi* n. sp. — are known, but we believe more exist in uninvestigated peninsular ridges.

Distribution (Fig. 1). Same as that of the tribe. *Floridobolus* is known only from the Lake Wales Ridge, Highlands/Polk Cos., the Ocala National Forest, Marion Co., around 208 km (130 mi) to the north, and the southern half of the Brooksville Ridge, Citrus and Hernando Cos., about 101 km (63 mi) northwest of the former and 64 km (40 mi) southwest of the latter.

Key to known species (based on adult males)

1. Caudal surface of posterior gonopod telopodite with extraneous, laminate, basal process; Lake Wales Ridge, Polk and Highlands Cos. ***F. penneri* Causey**
- Caudal surface of posterior gonopod telopodite without basal process. **2**
- 2(1). Anterior gonopod telopodite apically uncinata, terminating well beyond level of coxal endite; Ocala National Forest, Marion Co. ***F. orini* Shelley**
- Anterior gonopod telopodite apically rounded or only slightly prolonged, terminating near level of distal extremity of coxal endite; southern sector of Brooksville Ridge, Citrus and Hernando Cos. ***F. floydi*, new species**

***Floridobolus floydi*, new species.**

Fig. 2–8

Type specimens. M holotype (FSCA) and 2F paratypes (FSCA, NCSM) collected by Samuel D. Floyd, between 9:00–10:00 PM on 8 October 2013, along West Dane Place (Pl.) near the corner of North Travis Drive (Dr.) (28° 59' 0.13" N, 82° 26' 35.54" W), Citrus Springs, Citrus Co., Florida; 7M paratypes (FSCA, NCSM) taken by same collector between 1:00–2:30 AM on 4 August 2014, along North Travis Dr. near West Dane Pl. (28° 59' 11.90" N, 82° 26' 44.20" W). The two sites are only 432.3 m (472.6 yards, 1,418 feet) apart, and both samples were taken after precipitation during the previous daylight hours.

Diagnosis. A short, relatively small-bodied species, adult lengths ranging from 52.0–70.5 mm (median 61.3 mm). Anterior gonopod telopodite short, terminating around level of distal extremity of coxal endite, either smoothly rounded apically, with two low rounded lobes, or slightly prolonged with pointed or blunt tips. Posterior gonopod telopodite long and slender, anterior surface without basal process, prefemoral process not evident, bifurcate projection strong, directed subanteriorly, profile “mitten-like.” Cyphopodal receptacle with torsion.

Color in life. Head dark yellow, blending into brown on genae. Meso-/metazonae varying from dark to light gray, prozonae white, caudal metazonal margins with narrow, yellowish bands, ventral pleurotergal fringes dark yellowish. Collum either concolorous with dark to medium gray pleuroterga and with narrow yellowish bands along anterior margins, or wholly light gray and contrasting with dark pleuroterga. Epiproct dark gray; paraprocts light gray blending into yellowish margins; hypoproct light gray.

Holotype. Length 52.0 mm; maximum width 9.0 mm, W/L ratio 17.3%, 45 rings including collum and epiproct.

Somatic features agreeing closely with those of *F. penneri* (Causey 1957; Keeton 1959, 1960; Shelley and Floyd 2014) with following exceptions:

Clypeal setae 4–4, labral 10–10, merging with clypeal series and continuing for short distances along genal margins. Mandibular stipes with shallow, rounded depressions to accommodate antennae in resting positions. Margins of 2nd pleurotergite rounded, extending slightly below level of collum and directed anteriorly; meso-/metazonae of remaining pleuroterga separated by distinct, light gray suture lines; striae strong and prominent, ridge-like, extending around pleuroterga 1/2 to 2/3 of distances to ozopores. Paraprocts smooth. Legs present on rings 2–44. 1st and 2nd legs short, crassate. 3rd coxal lobe (Fig. 2) with darkened, thickened, and rimmed ventral margin, narrowing and tapering along anterior surface, curving sharply caudad and inward, forming small cavity subtended by angular, conical projection and inserting into narrow gap between enlarged coxae of 4th legs; prefemora of latter swollen angularly ventrad, with terminal, distoventral papillae. 5th and 6th legs with swollen coxae and larger prefemoral papillae. 7th coxae only slightly swollen, prefemora with still larger papillae. Postgonopodal legs with low coxal swellings through about ring 33, prefemoral swellings small and indistinct, without papillae. Anterior gonopod coxal endites (Fig. 3) narrowly segregated in midline, medial corners prolonged into short, rounded lobes; telopodites short, extending to or only slightly beyond levels of distal extremities of endites, apices with two small, rounded lobes. Posterior gonopod telopodite (Fig. 4–5) long and slender, subupright, partly protruding through exoskeletal aperture *in situ*; prefemoral process not evident; stem narrow in proportion to length and narrowing proximally; anterior surface without basal process, with two broadly rounded distal lobes, ventral branch of bifurcate projection (Fig. 4, 6) long and dactyliform, dorsal branch slightly emarginate, with narrow rims, profile “mitten-like”; caudal surface also with two distal lobes, ventral lobe broadly rounded, dorsal one subquadrate.

Female paratypes. Agreeing closely with males somatically except coxae with indistinct swellings and prefemora lacking papillae. Cyphopods (Fig. 7–8) minute, enveloped by membrane and buried in “cup” of membranous folds beside apodemes of 2nd legs, angling dorsolaterally *in situ*, comprising two unequal valves oriented lengthwise with anterior receptacles twisting medially and expanding into rounded, shallowly depressed lobes.

Male paratypes. The collums of four paratypes are light gray, and in three they are distinctly lighter than the succeeding pleuroterga. In the fourth, the entire body is lighter, perhaps indicative of recent molting, so the collum is concolorous with succeeding rings. Other than color, the paratypes agree closely with the holotype somatically. The anterior gonopod coxal endites are subsimilar in breadths and configurations and narrowly separated except in one, where they touch basally. Telopodital apices may be broadly rounded, pointed with acuminate or blunt tips, or bi-lobed with the medial ones slightly prolonged into short, acuminate points. When not lobed, the apical margins tend to be slightly extended and lamellate. The two distal lobes on both posterior gonopod surfaces are subsimilar in all individuals, but the shapes and proportions of the branches of the bifurcate projection vary markedly. The ventral lobes are prolonged in one male, and the dorsal corners of the dorsal lobes are prolonged in three and curve dorsad in two. The bifurcate projections angle strongly anteriorly, diverging from the anterior surfaces such that their edges, rather than profiles, are visible in anterior perspectives.

Variation. As shown in table 1, lengths range from 52.0–70.5 mm; maximal widths, around rings 9–11, vary from 8.2–10.4 mm; and ring numbers, including collums and epiprocts, vary from 45–49, the average being 46.5. The anterior gonopod telopodites in the Brooksville males resemble those of the types except the apical margins in one are prolonged, imparting subuncinate overall configurations. Brooksville males also possess longer posterior gonopod apodemes, extending into ring 10. Telopodital variation differs in that the ventral lobes on the bifurcate projections are longer and broader in two males and overlap the medial telopodital margins.

Ecology. All collections followed rain events and came from xeric, “Big Scrub,” loblolly pine/turkey oak sandhill habitat in partly developed, suburban neighborhoods. The holotype and Citrus Springs paratypes were walking in the open on city streets, those on 8 October 2013 being out between 9:00–10:00 PM and those on 4 August 2014, between 1:00–2:30 AM. The Brooksville specimens were discovered around 7:30 PM in a vacant lot off Hexam Road.

Distribution. Known definitely from two general areas, approximately 56 km (35 mi) apart, in the southern half of the Brooksville Ridge– Citrus Springs, on the northern periphery, and Brooksville, located centrally – suggesting occurrence throughout this half of the Ridge. Mr. Floyd observed *Floridobolus* at Ridge Manor, Hernando Co., on the eastern ridge periphery around 32 km (20 mi) east-southeast of Brooksville. Individuals were subsequently taken there by another collector, but they died and were discarded before Mr. Floyd could retrieve them. Because of their location near Brooksville, we publish a sight record of *F. floydi* from Ridge Manor. Data for non-typical specimens are as follows:

Florida: *Citrus Co.*, Citrus Springs, along West Dane Pl. near North Travis Dr. (28° 59' 0.13" N, 82°26' 35.54" W), F, 2 June 2014, S.D. Floyd (NCSM), and junction of Hillview Dr. and Dane Pl. (29°59' 0.09" N, 82°26' 35.54" W), 2F, 18 August 2014, S.D. Floyd (NCSM). *Hernando Co.*, Brooksville, vacant lot on Hexam Road in partly developed rural neighborhood, 4M, F, August 2013, John D. Anderson (FSCA, NCSM).

Etymology. We are pleased to name this species for Samuel D. Floyd, the amateur naturalist who discovered the secrets of collecting *Floridobolus*, and *F. floydi* and *F. orini* specifically, whereas professional biologists/arthropodologists had collectively missed them.

Remarks. The digestive tracts of the non-typical females from Citrus Springs were removed, dissected, and examined for nematodes and other kleptoparasites and commensals. Hence, they are not designated as paratypes.

The shorter body-size of *F. floydi* is best revealed by comparing median lengths - 79.2 mm for *F. orini* (Shelley and Floyd 2014), 76 mm for *F. penneri* (Keeton 1960), and 61.3 mm for *F. floydi*. At 70.5 mm, the longest individual of *F. floydi* is 5.5 mm shorter than the median length of the smaller established species, and the holotype, the shortest individual of *F. floydi*, is 24 mm (nearly one inch) shorter. The median length of *F. floydi* is approximately 77.4% of that of *F. orini* and 80.7% of that of *F. penneri*.

We use the Brooksville female to illustrate *F. floydi* female cyphopods because RMS could not find them in the female paratypes. They are minute, inconspicuous, buried deeply in the body beside the 2nd

leg apodemes, sunk into membranous cups, and enveloped by still more membrane. Even locating the structures is difficult, and extracting them essentially requires destroying two to four anterior rings. The holotype was preserved with the gonopods partly projecting through the aperture, and it is difficult to imagine how even fully extruded gonopods could contact the cyphopods in their internal positions. The cyphopods must also have to be extruded for successful mating, but it is equally difficult to imagine how this can happen to structures so enveloped by membrane and so deeply buried internally that they may even be closer to the dorsal surface than the ventral. Females of *F. orini* were not available to Shelley and Floyd (2014), and we have not examined the cyphopods in *F. penneri*, but Keeton (1959) characterized them as “simple and slightly elongate” without addressing their internal locations. Small, deeply recessed, and seemingly inaccessible cyphopods also exist in Central/South American platyrhacoideans (Polydesmida: Leptodesmidea). Though his taxonomy did not reflect it, Hoffman (1998) considered minute cyphopods to be an “exceptionally strong synapomorphy” between Platyrhacidae and Ampliniinae (Aphelidesmidae). He noted that the structures are “reduced almost to the point of loss” and that “careful dissection is required to detect small, thin, sclerotic areas at the distal ends of the oviducts.” Shelley (2000) characterized the cyphopods of *Tiroidesmus fimbriatus* (Peters, 1864) (Platyrhacidae) as “minute and buried deep in membrane caudolaterad to 2nd legs,” the same position as in *F. floydi*. Studies of mating behavior in all these millipeds are desirable and would seemingly constitute quality Masters-level research projects. The work on *Aniulus garius* (Chamberlin, 1912) (= *A. bollmani* Causey, 1952) (Julida: Parajulidae) by Mathews and Bultman (1993) could constitute a model.

In lateral view, the twisted anterior half of the cyphopod receptacle appears to be a separate projection arising from the valves. According to Keeton (1959:3, fig. 9), such a structure, which he labeled the “distal lobe,” exists in *F. penneri* but lacks torsion. The cyphopodal condition in *F. orini* is unknown, but we assume that that shown by *F. penneri* and *F. floydi* is the basic arrangement in the genus.

The discovery of *F. floydi* in the Brooksville Ridge, some 101 km (63 mi) northwest of *F. penneri* and 51 km (32 mi) west-southwest of *F. orini*, supports Shelley and Floyd’s (2014) contention that *Floridobolus* is probably widespread in northern peninsular Florida and that additional species await discovery in “Big Scrub” habitat on other ridges. As the present evidence suggests, each sand ridge may indeed harbor its own endemic species.

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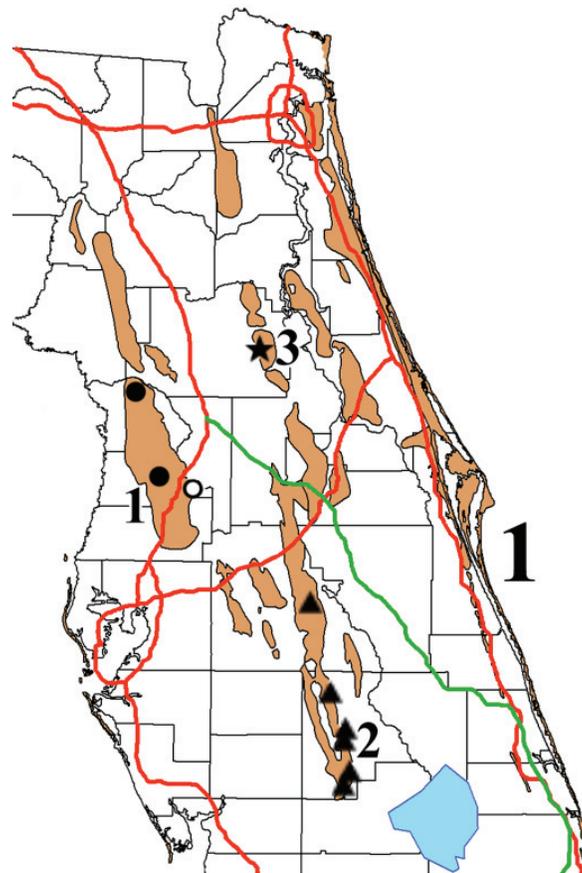
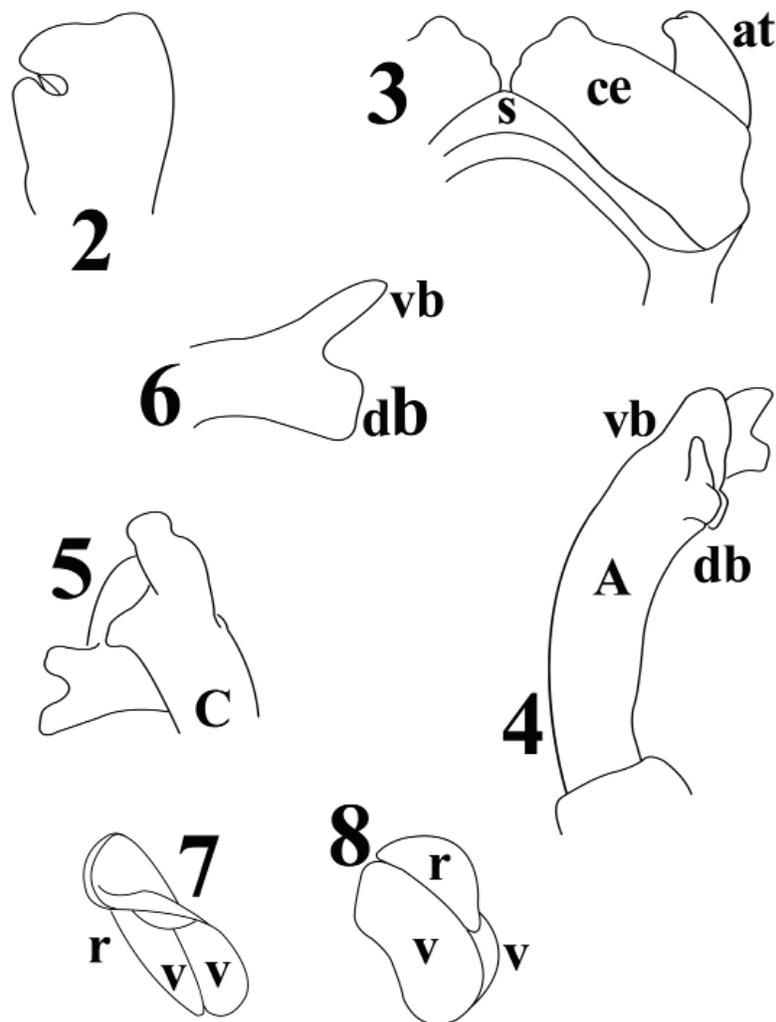


Figure 1. Distribution of Floridobolini/*Floridobolus*. 1, southern section of the Brooksville Ridge. 2, Lake Wales Ridge. 3, area of the Ocala National Forest. Dots, vouchered records of *F. floydi*; circle, sight record of *F. floydi*. Star, *F. orini*. Triangles, *F. penneri*. Red lines, interstate highways. Green line, Florida Turnpike.



Figures 2–8. *Floridobolus floydi*. 2–6) Holotype. 2) Right 3rd coxal lobe, medial view. 3) Left anterior gonopod, anterior view. 4) Telopodite of right posterior gonopod, anterior view. 5) Distal extremity of the same, caudal view. 6) Bifurcate projection, submedial view. 7–8) Female from Brooksville, Hernando co. 7) Left cyphopod, ventral view. 8) The same, caudal view. A and C, anterior and caudal surfaces, respectively, of posterior gonopod telopodite. at, anterior gonopod telopodite. ce, coxal endite. db, dorsal branch of bifurcate projection. r, receptacle. s, sternum. v, valve. vb, ventral branch of bifurcate projection.

Table 1. Meristic and morphometric comparisons of the 15 individuals of *Floridobolus floydi*.

Locality	Date	Sex	No. Rings (incl. collum and epiproct)	Length (mm)	Maximum Width (mm) (at rings 9-11)	Remarks
Citrus Co., Citrus Springs	8 Oct 2013	M (Holotype)	45	52.0	9.0	
do	do	F	47	58.8	9.5	
do	do	F	47	60.0	9.5	
do	4 Aug 2014	M	47	70.5	10.3	
do	do	M	47	58.3	8.9	Body distorted at ring 7
do	do	M	45	56.8	9.1	Light gray collum
do	do	M	46	63.5	9.7	do
do	do	M	46	62.6	10.4	do
do	do	M	46	55.6	9.1	do
do	do	M	46	57.7	8.2	Collum concolorous with other rings; body lighter gray than other individuals.
Hernando Co., near Brooksville	Aug 2013	M	47	66.9	8.8	
do	do	M	47	54.5	8.2	
do	do	M	46	66.9	9.5	
do	do	M	49	52.3	7.0	
do	do	F	46	56.5	8.7	