Narceus woodruffi Causey, a forgotten milliped species (Spirobolida: Spirobolidae)

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Abstract. Previous treatments of the east-Nearctic spirobolid genus *Narceus* Rafinesque have overlooked the name, *N. woodruffi* Causey. The holotype is lost, but examinations of a non-typical male and two paratype and three non-typical females show it to be a valid species, perhaps endemic to north Florida, distinguished by its small size and the configurations of the gonopods and coxal lobes of legs 3-6 in males. Supplemental anatomical notes are presented on the non-typical male along with comparative drawings of the lobes and gonopods of *N. woodruffi, N. americanus* (Beauvois), and *N. annularis* (Rafinesque); distributions of species of *Narceus* in Florida are depicted on a map. Substantial size differences between ostensibly conspecific males of *N. americanus* in Texas and Arkansas suggest that *Narceus* may be more complex than the current concept of four species.

Key words. *Narceus, N. woodruffi, N. americanus.*

Introduction

The reddish-brown, cylindrical millipeds of the genus *Narceus* Rafinesque are the largest millipeds, and among the most recognizable terrestrial invertebrates, in eastern North America. They range from southern Québec, Canada, to Key West, Florida, and, east-west, from the Atlantic Coast to Osage County, Kansas, and Williamsburg County, Texas (Keeton, 1960; Shelley, 1988, 2001; Hoffman, 1999; plus unpublished samples examined by the author). In the first continental checklist, Chamberlin and Hoffman (1958) recognized 14 nominal species, but Keeton (1960) reduced the composition to three species — *americanus* (Beauvois, 1805), *annularis* (Rafinesque, 1820), and *gordanus* (Chamberlin, 1943) — placing the remaining names in synonymy under one of these species. Shelley (1988) reduced *annularis* to subspecific status under *americanus*, but Hoffman (1999) and Shelley (2001) did not recognize subspecies.

In all the treatments of *Narceus*, one nominal species, *N. woodruffi* Causey, 1959, has been overlooked. It was proposed for a small-bodied male and two females from Putnam and Alachua counties, Florida, respectively (Causey 1959), the former being collected by R. E. Woodruff for whom the milliped is named; the last two body segments and the first two podomeres on legs 3-5 on the right side were illustrated but not the gonopods. This species was proposed while Keeton's revision (1960) of the family Spirobolidae was in press, as noted in footnote 4, p. 65, so he did not attempt to evaluate it. Hoffman (1999) and Shelley (2001) missed *N. woodruffi* in their checklists (Hoffman, Shelley, and Rice (in press), in an update of the former, do mention it), so this species has never been assessed and remains valid today. To evaluate its status, I borrowed the female paratypes from the Florida State Collection of Arthropods, Gainesville (FSCA). According to Causey (1959), the male holotype was deposited in the American Museum of Natural History, but it is not there today (N. I. Platnick, in litt.), and two searches in the general holdings at the FSCA, where Causey's personal collection was transferred after her death in 1979, failed to produce it. The FSCA does house four other samples from Florida labeled as *N. woodruffi* — three from Alachua County, with one female apiece, and one with a male from Columbia County, whose coxal lobes on legs 3-5 conform to Causey's illustration (1959, fig. 2). Causey dismissed the gonopods by claiming they are uniform throughout *Narceus* and of little value for specific determinations, which she based primarily on the configurations of the aforementioned coxal lobes. However, Keeton (1960, figs. 23-34) showed clear gonopodal differences among the species he recognized, and there are still more differences in *N. woodruffi*. Coupled with the small size and the simple, elongated coxal lobes, I believe these reflect reproductive isolation and that *N. woodruffi* is a valid species, the fourth component of *Narceus*. I present the following notes on the new material, comparative illustrations of *N.*

woodruffi, americanus, and *annularis*, and a map of occurrences of *Narceus* spp. in Florida to supplement Causey's description. The enlarged collum, which overhangs the ocellaria, and the deep antennal grooves readily diagnose *N. gordanus*, which is also distinguished by gonopodal features.

Narceus woodruffi Causey
Figs. 1-3

Narceus woodruffi Causey, 1959:136-137, figs. 1-2.

Type specimens. Male holotype lost; it was collected by R. E. Woodruff on an unknown date, 4.2 mi (6.7 km) S Hawthorn, Putnam County, Florida. Two female paratypes (FSCA), housed in separate vials, collected by "Oliver," 1-8 May 1949, in "Trap 4," at an unknown location in Alachua County, Florida. Causey (1959) recorded the collection dates as 16-19 June 1949, but the vial labels state May 1-8.

Diagnosis. A small-bodied species of *Narceus* characterized by simple, elongated coxal lobes on legs 3-5 in males; paraprocts with margins not elevated or thickened; anterior gonopod sternum broadly rounded in midline, terminating well below level of distal extremities of coxae; prefemoral endite of posterior gonopod relatively long and apically rounded, extending to level of distal extremity of telopodite; latter not apically sublinear, outer margin prolonged into lobe overhanging inner margin.

Columbia County male. Length 40.6 mm, maximum width 3.3 mm, W/L ratio 8.1%; 47 segments.

Epicranial suture short but distinct, terminating well above interantennal region. Ocellaria separated by around five times their diameters, nearly round; ocelli about 22, arranged in six rows. Antennnal groove relatively shallow, antennae not completely submerged; antennae short and stout, sparsely hirsute except for fifth-seventh articles, antennomere 1 subglobose, 2-6 clavate, 7 short and truncate with four terminal sensory cones; relative lengths of antennomeres 2>1>3=4=5=6>7. Labral groove continuing onto interantennal region. Genae unmargined, extending slightly beyond adjacent cranial margins, slightly exceeded by second antennomeres. Clypeal setae 5-5, labral about 8-8.

Collum moderately broad, terminating above ventral margin of 2nd pleurotergite, extending forward to level of dorsal margins of ocellaria. 2nd pleurotergite extending below levels of other pleurotergites, corners rounded, angling slightly anteriad. Remaining pleurotergites subsimilar, with ventrolateral striae on meso- and metazonites, ozopores beginning on pleurotergite 6 and continuing through 45, located on inner margin of metazonite. Epiproct very slightly extended apically, terminating well short of distal margins of paraprocts; latter smoothly rounded, margins not elevated; hypoproct short and inconspicuous, semilunar.

Legs 1-4 with five podomeres, remaining legs with six; pregonopodal legs (legs 1-7) crassate. 1st legs short; 2nd legs longer, coxae slightly thickened caudad but not expanded into lobes. Coxae of 3rd legs greatly expanded into long, narrow, subparallel lobes (Fig. 1), narrow basally and expanding slightly distad, apically rounded. Coxae of legs 4-6 with progressively shorter and broader lobes, apically sublinear on 6th legs. 7th and remaining coxae without lobes. 8th and subsequent legs not thickened, terminating on segment 46.

Anterior gonopod sternum (Fig. 2) slightly elevated in midline, broadly rounded, terminating well below level of distal extremities of coxae; medial margins of latter subtruncate, detached from sternum slightly proximad; telopodites distally uncinate. Posterior gonopod prefemoral endite (Fig. 3) relatively long and apically rounded, extending to level of distal extremity of telopodite; latter not apically sublinear, outer margin prolonged into lobe overhanging inner margin, extending proximad into lightly serrate ridge.

Female paratypes. The female paratypes have 46 and 49 segments. The label with the latter states "female larva," but the number of segments and the absence of legless, caudal segments show it to be an adult.

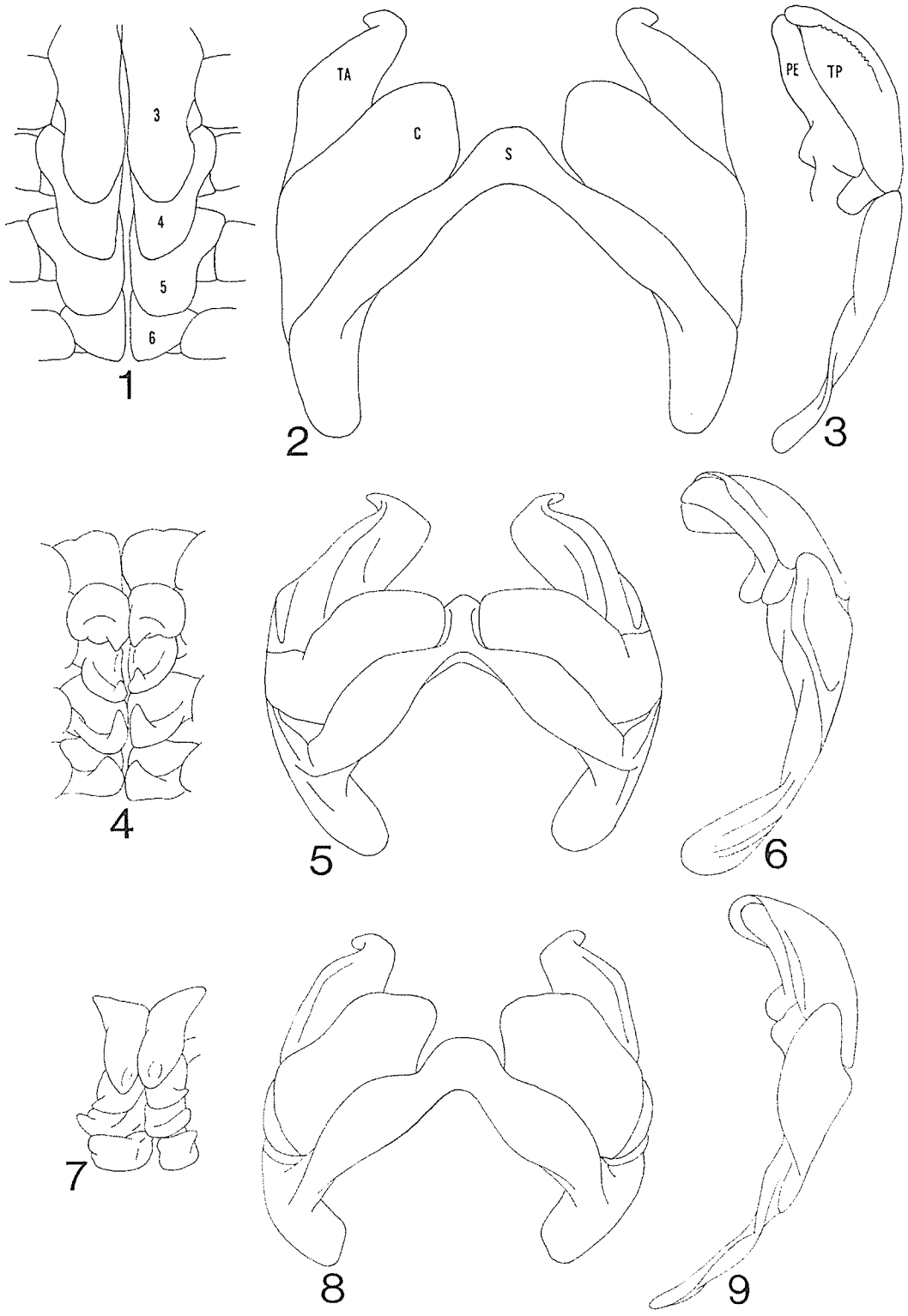
Non-typical females from Alachua County. Measurements and segment numbers as follows; otherwise as characterized by Causey (1959):

near Newnan's Lake, 1 July 1959 - length 39.1 mm, maximum width 3.3 mm, W/L ratio 8.4%; 48 segments.

Gainesville, 20 December 1959 - length 40.7 mm, maximum width 3.4 mm, W/L ratio 8.4%; 51segments.

Gainesville, 8 September 1960 - length 38.4 mm, maximum width 3.8 mm, W/L ratio 9.9%; 49 segments.

Ecology. According to Causey (1959), the holotype was found beneath cow dung in a "high pine-turkey oak" woodland. The Columbia County male was collected from "under bark of *Quercus laevis*," and the two non-typical females from Gainesville



Figures 1-9. 1-3, *N. woodruffi* male from Columbia County, Florida. 1, coxal lobes on legs 3-6, ventral view. 2, anterior gonopods, anterior view. 3, left posterior gonopod, medial view. Figs. 4-6, *N. americanus* male from Halifax County, North Carolina. 4, coxal lobes on legs 3-6, ventral view. 5, anterior gonopods, anterior view. 6, left posterior gonopod, medial view. Figs. 7-9, *N. annularis* male from Chatham County, North Carolina. 7, coxal lobes on legs 3-6, ventral view. 8, anterior gonopods, anterior view. 9, left posterior gonopod, medial view. C, coxa; PE, prefemoral endite; S, sternum; TA, anterior gonopod telopodite; TP, posterior gonopod telopodite.

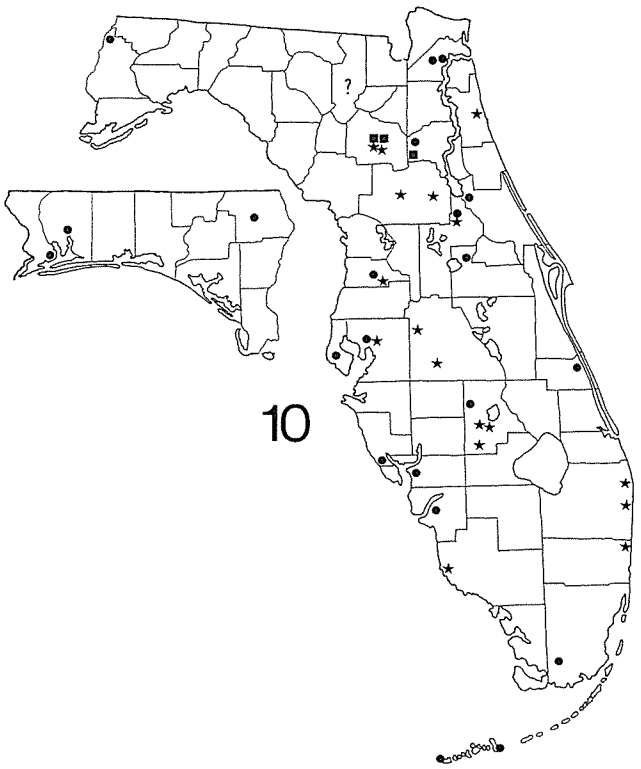


Figure 10. Distributions of species of *Narceus* in Florida. Dots, *N. americanus*; stars, *N. gordanus*; squares, *N. woodruffi*. The question mark denotes the unknown site of the male of *N. woodruffi* from Columbia County.

were encountered in a "rotting pine stump" and a building.

Distribution. *Narceus woodruffi* is known only from three adjoining counties in north Florida — Alachua, Columbia, and Putnam (Fig. 10) — and appears to be localized, in contrast to the other three species. It may even be endemic to this general part of the state; conversely, it may also range northward into Echols, Clinch, and/or Lowndes counties in the southern periphery of Georgia. Other specimens likely sit on museum shelves mislabeled as either *N. americanus* or *annularis*, and when these are discovered, a truer picture of the species' range will emerge. Causey (1959) also reported a male from Hawthorn, Putnam County, collected by R. E. Woodruff on 17 January 1959, but this specimen also cannot be located. The following unreported samples, all in the FSCA, were examined:

FLORIDA: **Alachua Co.**, near Newnan's Lake, female, 1 July 1959, R. E. Woodruff; and Gainesville, female, 20 December 1959, P. Weems, and female, 8 September 1960, W. J. Platt. *Columbia Co.*, locality unknown, male, 18 February 1960, H. V. Weems, Jr.

Remarks. With the discovery that *N. woodruffi* is a valid species, the Florida milliped fauna now comprises 8 orders, 18 families, 34 genera, and 53 species and subspecies (Shelley 2001; Shelley and Edwards 2002). It becomes the 14th species in the category "Florida endemics or species known only from this state."

The small size of *N. woodruffi* is remarkable; it is much smaller than any other representative of the Spirobolidae that I know of. The only smaller spirobolidans in the United States are the representatives of the Arinolinae (Atopetholidae) in the southwest, and globally, *N. woodruffi* is around the size of smaller representatives of the Trigoniulidae. Among North American juliform millipeds, *N. woodruffi* is similar in size to a large-bodied species of the Parajulidae (order Julida); females of *Bollmaniulus* Verhoeff, occurring along the Pacific Coast, can become quite sizeable, and some may actually grow to be larger than *N. woodruffi*.

During a field trip to Texas in October 2001, I observed, but did not collect, a small-bodied adult male of *Narceus* crossing a road in the Angelina National Forest, Angelina County, and a few weeks later I received a large male from Ouachita County, Arkansas, now housed at the Field Museum of Natural History, Chicago. According to Keeton (1960), the only species in these areas is *N. americanus*, but the great size difference between these ostensibly conspecific males suggests otherwise. Milliped size can be influenced by food and habitat (Enghoff 1992) and unusually large or small individuals may represent ecophenotypic variation, but the realization that *N. woodruffi* is valid suggests that some size differences in *N. americanus* and *N. annularis* reflect reproductive isolation. Consequently, some of the names that Keeton placed in synonymy may also represent valid species. *Narceus* may be more complex than the current concept of four species, and a modern revision is in order to investigate this possibility.

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