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NEW *NOTIODES* SEMIAQUATIC WEEVIL (CURCULIONIDAE)
FROM SPOROCARPS OF *MARSILEA MOLLIS* (MARSILEACEAE)
IN SOUTHERN ARIZONA, USA

Charles W. O'Brien¹

ABSTRACT.—A new species from the semiaquatic weevil genus, *Notiodes sporocarpicus*, which develops and pupates in the sporocarps of the water fern *Marsilea mollis* B.L. Rob. & Fernald, is described from cattle tanks in southeastern Arizona. This new species can be separated readily from the majority of the known species by its nearly straight rostrum, with its distinctive dorsally swollen base and attenuated apex. Its elongate and slender body will separate *N. sporocarpicus* from most species in the genus except *N. aeratus*, which lacks the characters above. The Texas species *N. celatus* resembles the new species but has strongly developed suberect curved setae that are not present in *N. sporocarpicus*. Included are habitus photos and line drawings of the male and female genitalia of the new species.

Key words: *Notiodes sporocarpicus*, new species, Curculionidae, Erihrinae, Marsilea mollis, Arizona.

The New World weevil genus *Notiodes* Schoenherr (Curculionidae) had 13 species north of Mexico (O'Brien and Wibmer 1982) but now has 14, with the addition of the new species, *Notiodes sporocarpicus* O'Brien, described herein. The *Notiodes* species are associated with 2 plant families, Marsileaceae (*Marsilea* spp.) and Cyperaceae (genera including *Eleocharis*, *Scirpus*, and *Rhynchospora*). The widespread species *Notiodes aeratus* (LeConte) develops as a miner in leaves, petioles, and rhizomes of *Marsilea mollis* B.L. Rob. & Fernald (reported as *Marsilea mexicana* A. Braun; see Johnson 1986 for discussion) and *M. vestita* Hook. & Grev. (reported as *M. mucronata* A. Braun and *M. uncinata* A. Braun ex A. Braun; see Johnson 1993) and pupates in the soil near its host plants (Board 1972). The Texas species *Notiodes celatus* (Burke) develops and pupates in the sporocarps of *M. vestita* (reported as *M. mucronata*; Board and Burke 1971). The new species *N. sporocarpicus* described herein develops and pupates in the sporocarps of *M. mollis*.

Members of the *Notiodes ovalis-laticollis* complex develop in seed heads and fruits of the Cyperaceae taxa listed above. Several species, such as *N. aeratus*, *N. setosus* (LeConte), and *N. robustus* (Schaeffer), are frequently taken at lights, but the species known to develop in *Marsilea* sporocarps have never been taken at

lights. Even at the type locality of *N. sporocarpicus*, more than 200 *N. aeratus* were collected in one night on light sheets, yet no *N. sporocarpicus* were collected. In contrast, more than 100 of each species were collected from *Marsilea* and under dry cow dung during the same day at this site.

Adults of the semiaquatic species associated with *Marsilea* have a dense, ventral coating of hydrofuge scales, also present on the tarsi, which allows them to walk or run on the water surface. They possess a plastron (a physical gill), which enables the adults to breathe underwater for many hours. They are able to walk underwater, holding to their host plants and feeding during the day, and they come to the surface at night to feed, find mates, and obtain a fresh air supply. The larvae develop inside the host plant and obtain their oxygen from the plant.

In addition to *N. sporocarpicus*, 3 other species of *Notiodes* new to Arizona were collected from the same ponds in association with *M. mollis*: *N. aeratus*, which is widespread from Kansas and Texas west to California and north to Washington and Montana; *N. setosus* from Louisiana, Texas, and northern Mexico; and *N. robustus* from Texas and northern Mexico. The reproductive biology of the latter 2 species is not known, but the species have been found in association with *Marsilea* species.

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METHODS

Several special techniques were used to collect the adults of this new species. Some specimens were taken from the sporocarps by cutting off the tip of the sporocarp underwater with a razor blade and allowing the weevil to emerge through the opening. In addition, collections were made at night by taking adults from the depauperate overwintering plants of *M. mollis* in the dry area above the water level in the cattle tank. The adults climbed up from the plant mass on the individual petioles to the leaves and there were taken by hand as they fed. Using a trowel, 2 mats of the *Marsilea* were scraped up along with their roots and soil (1 cm deep, ca. 20 cm²) and placed in white cloth sacks. A number of weevils climbed up on the inside of the sacks at night and could be aspirated readily. The majority of the type series of the new species was collected in this manner. A small number of individuals were obtained by subsequently submersing the soil and plant material in water in white plastic pans. The adults slowly came to the surface of the water and climbed onto the floating plant material, where they could be collected with fine forceps. A few individuals of the new species were taken from submersed dry cow dung. From the same samples of dry cow dung, several hundred individuals of *N. aeratus* were collected. The GPS coordinates for the 3 localities were obtained using a Garmin eTrex Legend personal navigator.

SPECIES DESCRIPTION

Notiodes sporocarpicus O'Brien,
new species; Figs. 1–4, 9–12.

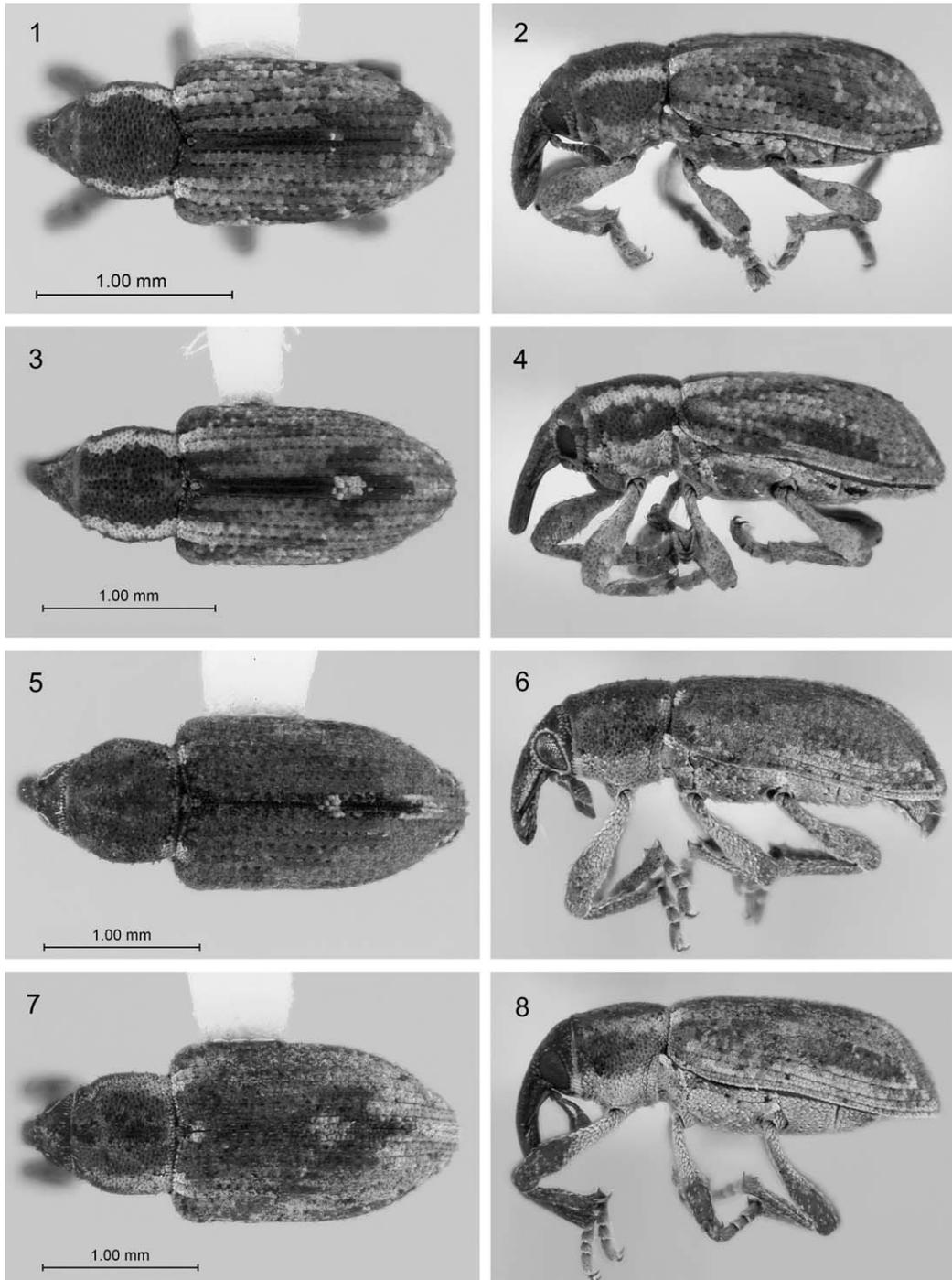
Minute to small (1.6–2.4 mm long), elongate-oval, narrow, widest at elytral humeri; cuticle black, except reddish apex of rostrum and dark reddish brown antennae and tibiae; densely clothed with shiny black to brassy metallic recumbent scales, and vittae of matte whitish recumbent scales; with scarcely evident curved, decumbent, coarse setae; dorsum with incomplete waterproof coating; venter with dense hydrofuge scales predominant.

MALE.—Figs. 1–2. Rostrum ca. 0.69 as long as prothorax; ventrally nearly straight, dorsally very weakly curved from apex to slight swelling above eyes, distinctly attenuate in frontal view, apex 0.70 as wide as base; entire surface

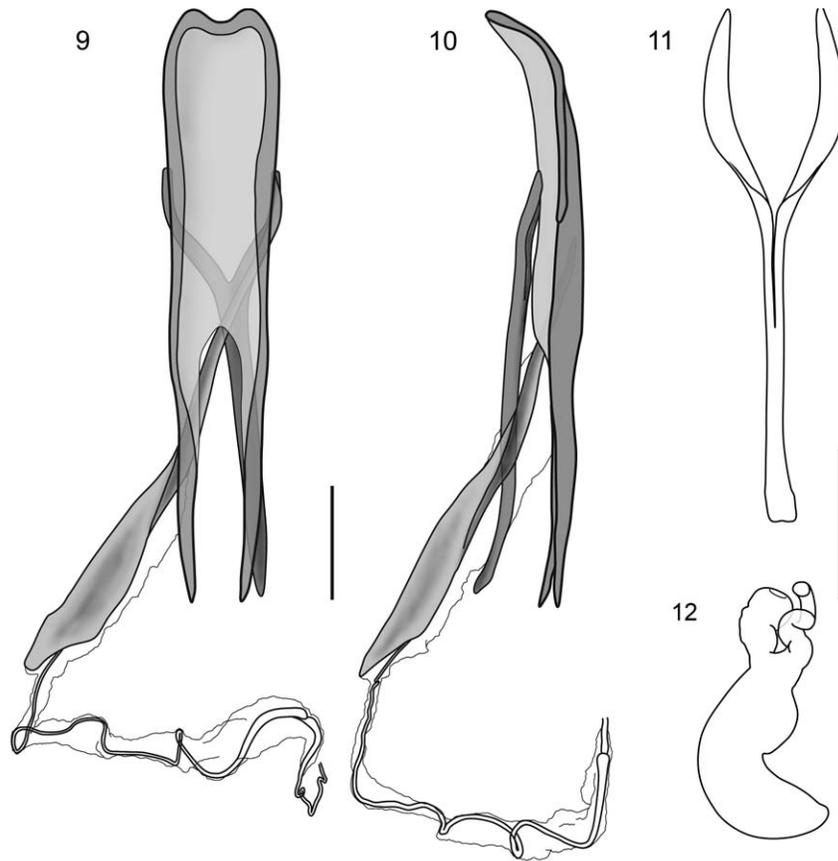
covered with dense, deep, coarse, cribrate punctures; waterproof coating dark brown in color; scrobe clothed with uncoated grayish-white scales. Head with similar punctures and coating, and narrow macula of similar white scales above eye. Antennae inserted just behind apical third of rostrum. Prothorax nearly as long as wide (0.97), widest just behind subtubulate apical constriction at apical eighth, then narrowed in nearly straight line to base; disk with dense, deep, coarse, cribrate punctures, not concealed by dark brown waterproof coating, with distinct narrow sublateral vittae of white scales; curved, decumbent, coarse setae visible along lateral margins. Elytra 1.36 as wide as prothorax; humeri well developed, roundly projecting, sides subparallel behind to declivity, there suddenly narrowed to conjointly rounded apex; striae broad, deep, with deep, elongate punctures, separated by own width; intervals flat, approximately twice as wide as striae, clothed densely with recumbent scales, suture shiny-black except antedeclyvital white-scaled macula, intervals 3 and 4 with basal continuation of prothoracic white vittae, interval 5 with uneven white vittae, lateral areas and declivity with scattered white maculations, remaining area clothed with brassy metallic scales, some covered with waterproof coating. Venter densely clothed with large hydrofuge scales; except metepisternum and main lateral area of metasternum with waterproof brown coating. Legs with moderately slender femora, clothed with dark agglutinate scales; stout tibia with dense, large scales and long, coarse setae; tarsomeres 1–3 short and broad, with 3 subequal in length and width. Length, elytron and pronotum: 2.1 mm. Genitalia and associated structures, see Figures 9 and 10.

FEMALE.—Figs. 3–4. Very similar to male except rostrum ca. 0.74 as long as prothorax; ventrally and dorsally straight, attenuate in lateral and frontal view from distinct swelling above eyes to apex; subglabrous and impunctate in apical half. Head with circumorbital ring of white scales. Antennae inserted just in front of middle (0.48) of rostrum. Prothorax with sides rather evenly rounded behind subtubulate apex, widest just in front of middle. Length, elytron and pronotum: 2.4 mm. Genitalia and associated structures, see Figures 11 and 12.

DIAGNOSIS.—*Notiodes sporocarpicus* can be confused with its sympatric relative, *N. aeratus*,



Figs. 1–8. Habitus of *Notiodes* species, dorsal and left-lateral views: 1–2, *N. sporocarpicus* male; 3–4, *N. sporocarpicus* female; 5–6, *N. aeratus* male; 7–8, *N. aeratus* female. Scale bar = 1.0 mm.



Figs. 9–12. Genitalia of *Notiodes sporocarpicus*: 9–10, male median lobe, endophallus and tegmen; 11, female eighth sternum; 12, female spermatheca. Scale bar = 0.1 mm.

which develops as a leaf and petiole miner on *Marsilea* spp. *Notiodes aeratus* tends to be larger, has a distinctly curved rostrum, and lacks a frontobasal hump on the rostrum (Figs. 6, 8). The color pattern of *N. aeratus* differs, with the white pronotal stripe less developed and less strongly extended onto the base of the elytra (Figs. 5, 7). The elytral sutural interval on *N. sporocarpicus* normally has 3 white maculae: postscutellar, antedecivital, and declivital (Figs. 2, 4). No other *Notiodes* species is very similar to *N. sporocarpicus*, including the sister species *N. celatus*, which develops in sporocarps of *M. vestita* in Texas (Board and Burke 1971). The latter species tends to be much larger and has long, evident, erect, curved, coarse setae.

INFRA-SPECIFIC VARIATION.—This relatively uniform species shows differences mainly in the color patterns. The median area of the

pronotal disc is usually nearly black, as is a short to long posthumeral vitta on interval 6. The lateral areas of the elytra are variously mottled with dark maculae or vittae or may be completely clothed with grayish scales. Often many of the scales are brassy or may be coppery metallic, but to various degrees and with various placement.

TYPES.—USA, Arizona, Santa Cruz Co.: margin of pond 2 miles south of Canelo Pass, San Rafael Valley, 31°28'48"N, 110°34'09"W, 1553 m. Holotype male, allotype female, and 303 paratypes: 14 June 2006, C.W. O'Brien, under cow dung (1); 21 June 2006, C.W. O'Brien, submersing cow dung in water (17); 25 June 2006, C.W. & L.B. O'Brien, under cow dung windrows by pond (10); 29 June 2006, C.W. O'Brien, submersing bear dung in water (4); 20 November 2006, C.W. O'Brien, at base of large grass mats (1); 30 May 2007 (holotype,

allotype, and 116 paratypes), 14 March 2008 (42), 27 March 2008 (76), 9 June 2008 (10), C.W. O'Brien, ex dry *Marsilea mollis* B.L. Rob. & Fernald, 17 October 2008 (1), C.W. O'Brien, beating grass over *Marsilea*; 10 May 2006, John R. Reeder and Kathryn Mauz, collected in association with *Marsilea mollis*, emerged from sporocarps (4), 9 May 2007, 31°28'48"N, 110°34'09"W, tank in grassland San Rafael Valley, K. Mauz collector, emerged from sporocarps of *Marsilea mollis* B.L. Rob and Fernald (11) 31°27'49"N, 110°38'54"W, 1547 m, tank in grassland [west side] San Rafael Valley [road to Meadow Valley], K. Mauz collector, emerged from sporocarps of *Marsilea mollis* B.L. Rob and Fernald (3), Little Outfit Ranch, 34°29'32.55"N, 110°34'13.84", 1520 m, cattle tank in wash, III-31-2009, C.W. O'Brien, ex dry *Marsilea mollis* (3); 23-IV-2009, C.W. O'Brien, ex dry mat *Marsilea mollis* (3), T. Hayworth under stone in *Marsilea* mat (1). Holotype and numerous paratypes are in CASC, and allotype and paratypes are in CWOB. Paratypes are also in BMNH, CDAE, CMNC, FSCA, TAMU, UAIC, UNAM, and USNM (see Heppner and Lamas 1982 for codens).

ETYMOLOGY.—This specific epithet is based on the Latin *sporocarpium*, meaning "sporocarp", and *-icus*, meaning "belonging to, pertaining to", referring to the development of the larvae and pupae in the sporocarp of the host plant.

RANGE.—*Notiodes sporocarpicus* is known only from the type locality, the Little Outfit Ranch, and one other dirt cattle tank in the San Rafael Valley, southeastern Arizona.

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