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***Dinoxyleborus* Smith, a new genus of Neotropical xyleborine ambrosia beetle (Coleoptera, Curculionidae: Scolytinae)**

SARAH M. SMITH

Michigan State University, Department of Entomology, 288 Farm Lane, room 243, East Lansing, MI 48824, USA.

E-mail: smith462@msu.edu

Abstract

An ongoing review of Neotropical Xyleborini (Coleoptera, Curculionidae, Scolytinae) has revealed a new genus, *Dinoxyleborus* **gen. nov.** (type species *Dinoxyleborus cognatoi* **sp. nov.**), from South America. Two new species are described and one new combination is proposed: *Dinoxyleborus cognatoi*, **sp. nov.**, *D. infernus* **sp. nov.**, and *D. sexnotatus* (Schedl), 1970. A modification of Wood's 2007 key to Neotropical Xyleborini genera and a key to *Dinoxyleborus* species are given.

Key words: ambrosia beetle, taxonomy, new species, Suriname, Brazil, Peru

Introduction

Xyleborine ambrosia beetles (Curculionidae: Scolytinae) represent the most diverse and abundant clade of scolytine beetles, reaching their greatest diversity in tropical rainforests (Hulcr *et al.* 2015; Smith & Hulcr 2015). Their great diversity is likely due to their haplodiploid mating system and ambrosial feeding habit. Xyleborines tunnel directly into the sapwood of their host and cultivate a symbiotic fungus stored in specialized mycangia. Xyleborines consume the fungus rather than feed directly on host tissue allowing xyleborines to have large host breadths (Smith & Hulcr 2015).

The xyleborine faunas of the Oriental and Oceanian regions have recently been the subject of considerable recent taxonomic attention (e.g., Hulcr *et al.* 2007; Hulcr and Cognato 2009, 2010, 2013; Dole and Cognato 2010; Dole *et al.* 2010; Cognato *et al.* 2011; Smith *et al.* in prep.). However, the Neotropical fauna has not yet received similar attention. This publication represents the first of a series of taxonomic studies on Neotropical xyleborines that will build upon the foundation laid by S.L. Wood's 2007 monograph of the South American fauna.

During an ongoing review of the diversity of Neotropical xyleborines, a new genus was discovered. Recent collections in Peru, and pinned museum specimens from Brazil and Suriname revealed a total of three species belonging to this new genus. Each species is only represented by one or two specimens suggesting that the species in the new genus are not often captured by either general or scolytine specific collecting methods. Such rarity has been reported for other xyleborine taxa (Smith & Hulcr 2015).

Methods

Specimens were examined using either a Leica (Wetzlar, Germany) MZ6 or MZ125 stereo microscope and illuminated with an Ikea Jansjö LED work lamp (Delft, Netherlands). Images were taken with a Visionary Digital Passport II system (Palmyra, VA) using a Canon EOS 5D Mark II, 65.0 mm Canon Macro photo lens, Canon Speedlite transmitter ST-E2, two Canon Speedlite 4303X II flashes, and a Stack Shot (Cognisys, Inc, Kingsley, MI). Montage images were assembled using Helicon Focus Mac Pro 6.7.1 (Helicon Soft, Kharkov, Ukraine). Length was measured from pronotum apex to longest declivital spine. Pedicel is not included in the number of funicle segments, following Hulcr & Smith (2010). Declivital spines were counted from declivity base to apex with that closest to the base being spine 1. Relative size of elytral disc and declivity does not include spine length.

Abbreviations used for cited collections are as follows:

CASC	California Academy of Sciences, San Francisco, CA, USA
DEB	Donald E. Bright Collection, Fort Collins, CO, USA (to be housed in Canadian National Collection)
NMNH	National Museum of Natural History, Washington, D.C., USA
MUSM	Universidad Nacional Mayor de San Marcos, Lima, Peru.

***Dinoxyleborus*, gen. nov.**

(Figs 1–2)

Type species. *Dinoxyleborus cognatoi* sp. nov.

Description. Female. Length 2.2–3.5 mm and 3.1–3.7 times as long as wide. Body color ferruginous apically and transitioning to dark red brown posteriorly with the elytral declivity and spines the darkest. Legs and antennae ferruginous.

Head. Epistoma entire, transverse, lined with a row of hair-like setae. Frons slightly convex from epistoma to upper level of eyes; surface shagreened, dull, punctate; punctures above epistoma small, coarse, shallow, punctures increasing in size, coarseness, and depth from epistoma to upper level of eyes. Eyes moderately emarginated above level of antennal insertion, upper portion of eyes smaller than lower part. Submentum flat, slightly impressed below genae, broadly triangular. Scape narrow, elongate, about 3/4 length of club. Antennal funicle four segmented, segments equal in size. Pedicle longer than funicle. Club approximately circular, club type 4 (Hulcr *et al.* 2007), flattened, round; segments 1 and 2 strongly procurved, corneous, segment 3 slightly procurved, corneous, visible on both sides of club.

Pronotum. Pronotum prolonged posteriorly (Type 8a, Hulcr *et al.* 2007), 1.1–1.4 times as long as wide. Anterior margin basic, elongate, parallel-sided, rounded when viewed dorsally (Type 9, Hulcr *et al.* 2007), lacking a row of serrations. Surface shagreened, anterior half finely asperate, asperities close, arranged in concentric rings from midpoint of pronotum to anterior and anteriolateral areas; disc finely and evenly punctate. Lateral margins rounded, slightly carinate on basal quarter. Base transverse.

Legs. Procoxae contiguous, prosternal posterocoxal piece short, triangular. Protibia slender, broadest at apical third, posterior face inflated, tuberculate; three small denticles present on outer margin of apical third. Meso- and metatibia with evenly rounded outer margin, flattened, posterior face unarmed.

Elytra. 2.0–2.3 times as long as wide. Elytral base transverse, humeral angles rounded. Scutellum small, triangular, flat, flush with elytra. Sides straight from base to apical half of declivity; apex entire. Disc at least as long as declivity. Disc smooth, shining, finely punctate; each interstrial puncture bearing a single erect, fine, golden, hair-like seta 1.5–3.0 times the distance between punctures (may be abraded); interstriae two times width of striae. Interstriae parallel near base and broadened towards elytral apex. Declivity deeply sulcate, separated from disc by large elevated margin bearing denticles and spines. Declivital face densely shagreened, dull, sparsely, shallowly punctate, glabrous or setose. Declivital margin armed by at least three large spines. Declivital interstriae armed with granules dorsad to the margin of the sulcate area.

Diagnosis. *Dinoxyleborus* can be distinguished from all other Xyleborini genera by the following combination of characters: posterior face of protibia inflated and tuberculate (Fig. 1), the antennal club flattened, sutures 1 and 2 strongly procurved (Fig. 2), pronotum prolonged posteriorly (Type 8a, Hulcr *et al.* 2007), anterior margin of pronotum basic, elongate, parallel-sided, rounded when viewed dorsally (Type 9, Hulcr *et al.* 2007), anterior half finely asperate, lateral margin only carinate near base, and by the anterior margin lacking ~~two~~ a row of serrations.

Dinoxyleborus most closely resembles *Sampsonius* Eggers, 1935 with which it shares the same protibia, antennal club and pronotal shape. It can be distinguished by the lateral margin of the pronotum only carinate near base rather than the entire length and by the anterior margin of pronotum lacking the two coarse serrations which are present in most *Sampsonius*.

Etymology. *Dino* (G) = terrible, *xyleborus* (G) = woodborer.

Comments. A five gene molecular phylogenetic analysis recovered *Dinoxyleborus* as sister to *Sampsonius* and *Dryocoetoides* Hopkins 1915, both of which also exhibit the protibia inflated and tuberculate on posterior face (Fig. 1) (Cognato and Smith *in prep*).

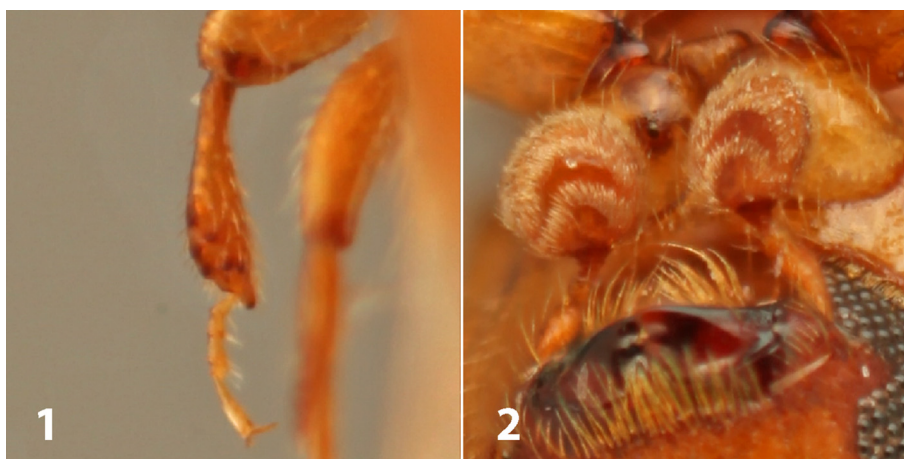


PLATE 1. 1. *Dinoxyleborus cognatoi* **sp. nov.** posterior face of protibia. 2. *Dinoxyleborus sexnotatus* antennal club.

***Dinoxyleborus cognatoi* sp. nov.**

(Figs 3–6)

Type material. Holotype, female, FRENCH GUIANA, [Cayenne], 30 km SE Roura, Kaw Rd, Amazon[e] Nat[ure] Lodge, 4.5595N, 52.2072W, 300m, 5-19.II.2010, J. Eger, UV light (NMNH). Paratype, female, PERU, Madre de Dios, Los Amigos Biological Station, CM2, -12.4492° -70.2517° , 258 m, Smith and Hulcr coll. DNA voucher “Cor peru” (MUSM).

Description. Female. Length 2.5–2.6 mm and 3.6–3.7 times as long as wide. Body color ferruginous apically and transitioning to dark red brown posteriorly with the elytral declivity and spines the darkest. Legs and antennae ferruginous.

Head. Epistoma entire, transverse, lined with a row of hair-like setae. Frons slightly convex from epistoma to upper level of eyes; surface shagreened, dull, punctate; punctures above epistoma small, coarse, shallow, punctures increasing in size, coarseness, and depth from epistoma to upper level of eyes. Eyes moderately emarginated above level of antennal insertion, upper portion of eyes smaller than lower part. Submentum flat, slightly impressed below genae, broadly triangular. Scape narrow, elongate, about 3/4 length of club. Antennal funicle four segmented, segments equal in size. Pedicle longer than funicle. Club approximately circular, club type 4 (Hulcr *et al.* 2007), flattened, round; segments 1 and 2 strongly procurved, corneous, segment 3 slightly procurved, corneous, visible on both sides of club.

Pronotum. Pronotum prolonged posteriorly (Type 8a, Hulcr *et al.* 2007), 1.4 times as long as wide. Anterior margin basic, elongate, parallel-sided, rounded when viewed dorsally (Type 9, Hulcr *et al.* 2007), lacking a row of serrations. Surface shagreened, anterior half finely asperate, asperities close, arranged in concentric rings from midpoint of pronotum to anterior and anteriolateral areas; disc finely and evenly punctate. Lateral margins rounded, slightly carinate on basal quarter. Base transverse.

Legs. Procoxae contiguous, prosternal posterocoxal piece short, triangular. Protibia slender, broadest at apical third, posterior face inflated, tuberculate; three small denticles present on outer margin of apical third. Meso- and metatibia with evenly rounded outer margin, flattened, posterior face unarmed. Mesotibia armed with 7 socketed denticles on outer margin, metatibia armed by 6 socketed denticles on outer margin.

Elytra. 2.1–2.3 times as long as wide. Elytral base transverse, humeral angles rounded. Scutellum small, triangular, flat, flush with elytra. Sides straight from base to declivity midpoint; apex entire. Disc longer than declivity. Disc smooth, shining, finely punctate; each interstrial puncture bearing a single erect, fine, golden, hair-like seta 1.5–2.0 times the length between punctures (may be abraded); interstriae equal to width of striae. Interstriae parallel on disc and broadened towards elytral apex. Declivity deeply concave, separated from disc by large elevated sulcus bearing denticles and spines. Declivital face densely shagreened, dull, sparsely, shallowly punctate, setose on basal half; setae long, erect, fine, golden, hair-like; basal third rugose. Declivital margin armed by three spines, 4 denticles and abundantly ornamented with long semi-recumbent setae; spines increasing in size

from base to apex. Two denticles approximately evenly spaced from base to spine 1, one each on interstriae 1 and 2. Single large denticle located at midpoints between spines 1 and 2 (interstriae 4) and 2 and 3 (interstriae 6). Spine 1 originating at basal third, on interstriae 3, 1.5 times as long as basal width, apex acute. Spine 2 equidistant between spines 1 and 3 (Peru) or closer to spine 3 (French Guiana), originating on basal third, on interstriae 5, twice as long as basal width, apex acute. Spine 3 at apical margin, on interstriae 7, twice as long as basal width, thick, apex acute. Declivital interstriae armed with granules dorsad to the margin of the sulcate area.

Diagnosis. *Dinoxyleborus cognatoi* is most closely related to *D. sexnotatus* which both have three declivital spines that increase in size from base to apex. It can be distinguished by the declivity with two denticles approximately evenly spaced from base to spine 1, a single large denticle located at midpoints between spines 1 and 2 and 2 and 3, by the smaller size and more slender body.



PLATE 2. *Dinoxyleborus cognatoi* sp. nov. female. Figure 3. Dorsal view. 4. Lateral view. 5. Frontal view. 6. Declivity.

Etymology. This species is named in honor of my husband, Anthony I. Cognato, who has championed studies in scolytine systematics and taxonomy for more than 20 years.

Distribution. French Guiana (Cayenne), Peru (Madre de Dios).

***Dinoxyleborus infernus* sp. nov.**

(Figs 7–10)

Type material. Holotype, female, SURINAME, [Para], Jodensavane, Kamp 8, 1961, Lichtv., #765, Schulz, ex. light trap (NMNH).

Description. Female. Length 2.2 mm and 3.1 times as long as wide. Body color light brown apically and transitioning to dark red brown posteriorly with the elytral declivity and spines the darkest. Legs and antennae light brown. It is possible that the type is teneral and the mature color similar to that of other *Dinoxyleborus* species.

Head. Frons slightly convex from epistoma to upper level of eyes; surface shagreened, dull, punctate. Eyes moderately emarginated above level of antennal insertion. Scape narrow, elongate, about 3/4 length of club. Antennal funicle four segmented, segments equal in size. Pedicle longer than funicle. Club approximately circular, club type 4 (Hulcr *et al.* 2007), flattened, round; segments 1 and 2 strongly procurved, corneus, segment 3 slightly procurved, corneous, visible on both sides of club.

Pronotum. Pronotum prolonged posteriorly (Type 8a, Hulcr *et al.* 2007), 1.1 times as long as wide. Anterior margin basic, elongate, parallel-sided, rounded when viewed dorsally (Type 9, Hulcr *et al.* 2007), lacking a row of serrations. Surface shagreened, anterior third finely asperate, asperities close, arranged in concentric rings in anterior and anteriolateral areas; disc finely and evenly punctate. Lateral margins rounded, slightly carinate on basal quarter. Base transverse.

Legs. Protibia slender, broadest at apical third, posterior face inflated, tuberculate; three small denticles present on outer margin of apical third. Meso- and metatibia with evenly rounded outer margin, flattened, posterior face unarmed. Mesotibia armed with 6 socketed denticles on outer margin.

Elytra. 2.0 times as long as wide. Elytral base transverse, humeral angles rounded. Scutellum small, triangular, flat, flush with elytra. Sides straight from base to declivity midpoint; apex entire. Disc longer than declivity. Disc smooth, shining, finely punctate; each interstrial puncture bearing a single erect, fine, golden, hair-like seta 1.5–2.0 times the length between punctures (may be abraded); interstriae equal to width of striae. Interstriae parallel on disc and broadened towards elytral apex. Declivity deeply concave, separated from disc by large elevated sulcus bearing denticles and spines. Declivital face densely shagreened, opaque, sparsely, shallowly punctate, setose on basal half; setae short, erect, fine, golden, hair-like. Declivital margin armed by four spines, three denticles and abundantly ornamented with long semi-recumbent setae; spines roughly similar in size. Two denticles at base, separated from spine 1 by length greater than that of spine 1, on interstriae 1. Single large denticle ventrad to spine 1, between spines 1 and 2, on interstriae 4. Spine 1 originating at basal third, on interstriae 3, 1.5 times as long as basal width, apex acute. Spine 2 dorsal of spine 3, touching its base, originating on basal third, on interstriae 5, 1.5 times as long as basal width, apex acute; spines 2 and 3 may be connected by a tumescence. Spine 3 at basal third, on interstriae 6, as long as basal width, thick, apex acute, touching bases of spines 2 and 4. Spine 4 at apical margin, on interstriae 7, 1.5 times as long as basal width, thick, apex blunt. Area dorsal of declivital margin on interstriae 3 armed with several minute denticles. Declivital interstriae armed with granules dorsad to the margin of the sulcate area.

Diagnosis. *Dinoxyleborus infernus* can be distinguished from all other species by having four equally sized spines on the declivity.

Etymology. *Infernus* = (L.) hellish. In reference to the menacing appearance of the species' declivity ornamented with numerous spines and denticles.

Distribution: Suriname (Para).

Comments. The type specimen is card mounted with an excessive amount of what presumably is shellac. All features from the ventral side, parts of the head and legs were unable to be examined and are thus missing from the description.

The holotype of *D. infernus* was incorrectly identified by Wood (2007: 367) as a specimen of *Premnobius sexnotatus* (Schedl), now *Dinoxyleborus*.



PLATE 3. *Dinoxyleborus infernus* sp. nov. female. Figure 7. Dorsal view. 8. Lateral view. 9. Frontal view. 10. Declivity.

***Dinoxyleborus sexnotatus* (Schedl) comb. nov.**
(Figs 11–14)

Xyleborus sexnotatus Schedl 1970: 95.

Premnobius sexnotatus (Schedl): Wood & Bright 1992: 655.

Diagnosis. *Dinoxyleborus sexnotatus* is most closely related to *D. cognatoi* which both have three declivital spines that increase in size from base to apex. It can be distinguished by having three to five denticles approximately evenly spaced from base to spine 1, 1–2 denticles between spines 1 and 2 and unarmed between spines 2 and 3.

Redescription. Female. Length 3.0–3.5 mm and 3.2–3.5 times as long as wide. Body color ferruginous

apically and transitioning to dark red brown posteriorly with the elytral declivity and spines the darkest. Legs and antennae ferruginous.

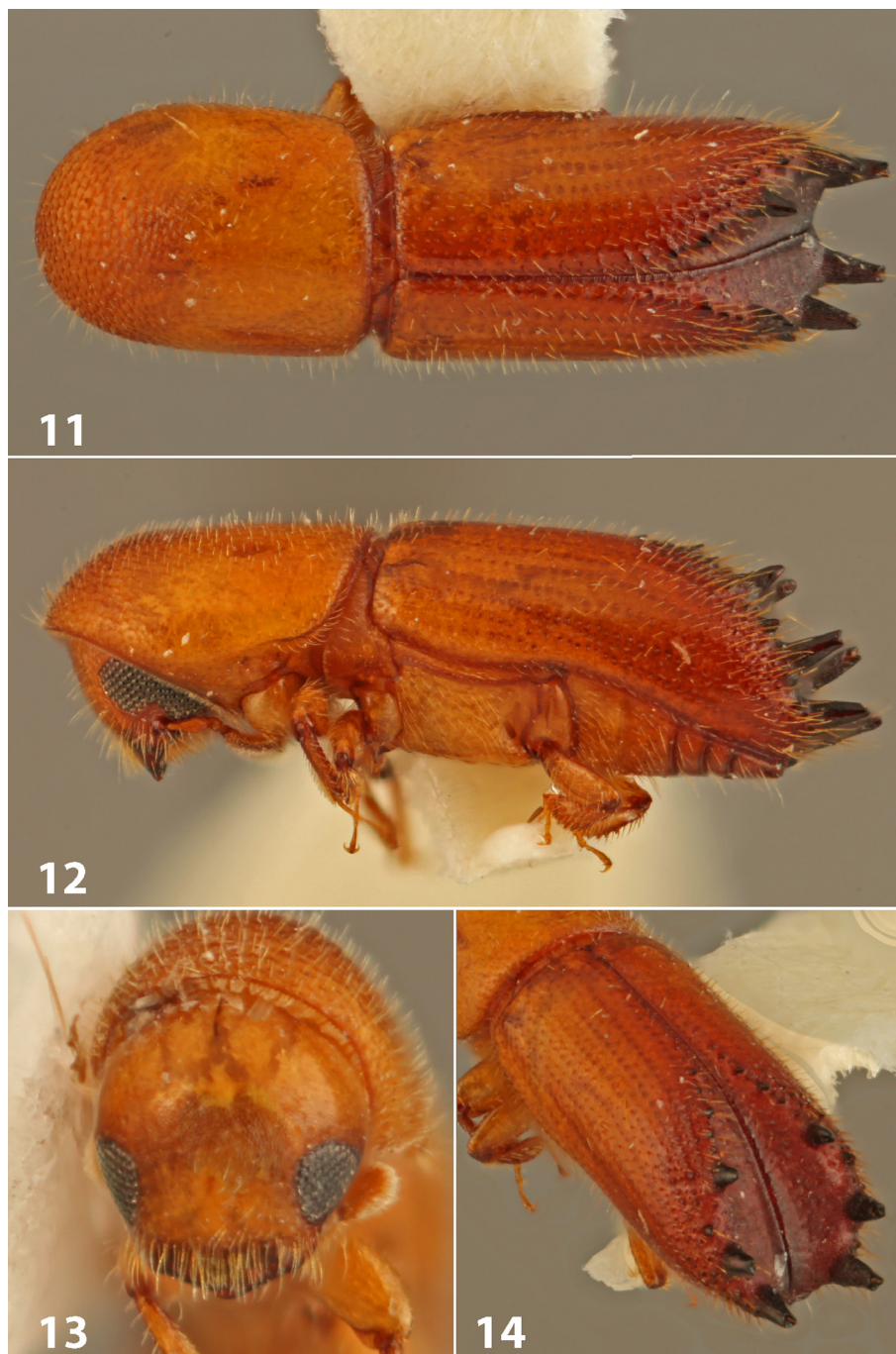


PLATE 4. *Dinoxyleborus sexnotatus* female. Figure 11. Dorsal view. 12. Lateral view. 13. Frontal view. 14. Declivity.

Head. Epistoma entire, transverse, lined with a row of hair-like setae. Frons slightly convex from epistoma to upper level of eyes; surface shagreened, dull, punctate; punctures above epistoma small, coarse, shallow, punctures increasing in size, coarseness, and depth from epistoma to upper level of eyes. Eyes moderately emarginated above level of antennal insertion, upper portion of eyes smaller than lower part. Submentum flat, slightly impressed below genae, broadly triangular. Scape narrow, elongate, about 3/4 length of club. Antennal funicle four segmented, segments equal in size. Pedicle longer than funicle. Club approximately circular, club type 4 (Hulcr *et al.* 2007), flattened, round; segments 1 and 2 strongly procurved, corneous, segment 3 slightly procurved, corneous, visible on both sides of club.

Pronotum. Pronotum prolonged posteriorly (Type 8a, Hulcr *et al.* 2007), 1.1 times as long as wide. Anterior

margin basic, elongate, parallel-sided, rounded when viewed dorsally (Type 9, Hulcr *et al.* 2007), lacking a row of serrations. Surface shagreened, anterior half finely asperate, asperities close, arranged in concentric rings from midpoint of pronotum to anterior and anteriolateral areas; disc finely and evenly punctate. Lateral margins rounded, slightly carinate on basal quarter. Base transverse.

Legs. Procoxae contiguous, prosternal posterocoxal piece short, triangular. Protibia slender, broadest at apical third, posterior face inflated, tuberculate; three small denticles present on outer margin of apical third. Meso- and metatibia with evenly rounded outer margin, flattened, posterior face unarmed. Mesotibia armed with 6 socketed denticles on outer margin, metatibia armed by 8 socketed denticles on outer margin.

Elytra. 2.0–2.1 times as long as wide. Elytral base transverse with oblique edge. Scutellum small, triangular, flat, flush with elytra. Sides straight from base to apical half of declivity; apex entire. Disc as long as declivity. Disc smooth, shining, finely punctate (except interstriae 1); each interstitial puncture bearing a single erect, fine, golden, hair-like seta 1.5–3.0 times the length between punctures (may be abraded); interstriae two times width of striae; interstriae 1 impressed, impunctate, shagreened on apical half. Interstriae parallel near base and broadened towards elytral apex. Declivity deeply concave, separated from disc by large elevated sulcus bearing denticles and spines. Declivital face densely shagreened, dull, sparsely, shallowly punctate, glabrous; basal third rugose. Declivital margin armed by three blunt spines, 4–6 denticles and abundantly ornamented with long semi-recumbent setae; spines increasing in size from base to apex. Three to five denticles approximately evenly spaced from base to spine 1, two of which on interstriae 1 and two to three on interstriae 2; 1–2 denticles at midpoint between spines 1 and 2 on interstriae 4. Spine 1 originating at basal third, on interstriae 3, 1.5 times as long as basal width, apex narrowly rounded. Spine 2 closest to spine 3, originating on basal third, on interstriae 5, twice as long as basal width, apex blunt with an acute point on dorsal edge. Spine 3 at apical margin, on interstriae 7, twice as long as basal width, thick, apex narrowly rounded to blunt apex. Declivital interstriae armed with granules dorsad to the margin of the sulcate area.

Specimens examined. BRAZIL, Rondônia, 62km SW Ariquemes, Fzda. Rancho Grande, CW & LB O'Brien, ex. merc. vap. & UV light (CASC); Mato Grosso, Vera, X.1973, M. Alvarenga (DEB).

Distribution. Brazil (Mato Grosso, Rondônia), Suriname (Para).

Comments. This species is transferred to *Dinoxyleborus* from *Premnobius* because the submentum (pregula *sensu* Wood) is impressed rather than flush with the gena, which places it in Xyleborini, and the species possesses all the diagnostic characters for the genus.

Modification of Wood's (2007) Neotropical Xyleborini key

Note: Wood's Xyleborini key included *Premnobius* Eichhoff, 1879 in couplet 1; however, molecular phylogenetic analysis demonstrates that *Premnobius* belongs in the Ipini clade, where it is currently placed in the subtribe Premnobiina (Cognato 2013).

- | | | |
|-----|---|----------------------------|
| 2. | Antennal club with sutures 1 and 2 rather strongly procurved, both segments 1 and 2 corneous; protibia slender almost cylindrical, posterior face inflated, armed by tubercles, lateral margins of pronotum acutely elevated (at least near base); body very slender | 2a |
| - | Antennal club obliquely truncate or nearly so, sutures (when visible) on or very near margin of corneous area, recurved (except pubescent to base in some Asiatic forms); protibia usually more strongly expanded on apical half; lateral margin of pronotum rounded; habit as domicile parasites unknown | 3 |
| 2a. | Lateral margin of pronotum carinate throughout its length | <i>Sampsonius</i> Eggers |
| - | Lateral margin of pronotum carinate only near base. | <i>Dinoxyleborus</i> Smith |

Key to *Dinoxyleborus* females

- | | | |
|----|--|-------------------------------|
| 1. | Lateral margins of declivity armed by four spines approximately equal in size. | <i>D. infernus</i> Smith |
| - | Lateral margin of declivity armed by three spines increasing in size from base to apex | 2 |
| 2. | Declivity with two denticles approximately evenly spaced from base to spine 1. a single large denticle located at midpoints between spines 1 and 2 and 2 and 3 | <i>D. cognatoi</i> Smith |
| - | Declivity with three to five denticles approximately evenly spaced from base to spine 1; 1–2 denticles between spines 1 and 2 and unarmed between spines 2 and 3 | <i>D. sexnotatus</i> (Schedl) |

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