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A taxonomic review of the genus *Psephenops* Grouvelle
of the Lesser Antilles with description of
new species *Psephenops trini*, and reassignment
of Peruvian species *Psephenus robacki* Spangler
(Coleoptera: Psephenidae: Psepheninae)

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A taxonomic review of the genus *Psephenops* Grouvelle of the Lesser Antilles with description of new species *Psephenops trini*, and reassignment of Peruvian species *Psephenus robacki* Spangler (Coleoptera: Psephenidae: Psepheninae)

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Abstract. An overview of the genus *Psephenops* Grouvelle (Coleoptera: Psephenidae: Psepheninae) is provided with geographic distributions of the species. The taxonomic history of *Psephenops smithi* Grouvelle, the type species from Grenada and St. Vincent, and junior synonym *Xexanchorinus latus* Grouvelle from Grenada, is discussed, and lectotypes and paralectotypes are designated for both. Photographs of the type series and a non-type specimen with illustrated male genitalia, along with new distributional information for the species, are provided. The male, female, and associated larva of *Psephenops trini* Barr and Shepard, **new species**, are described and illustrated, as is the habitat of this species in Trinidad and Tobago. The Peruvian species *Psephenus robacki* Spangler is transferred from *Psephenus* Haldeman to *Psephenops* as *Psephenops robacki* (Spangler) **new combination**. Photographs of the female holotype are included, and possible new distributional records from Peru are reported.

Key words. Water penny beetles, Caribbean, West Indies, South America, lectotype.

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Introduction

In the Western Hemisphere, the psephenid subfamily Psepheninae currently includes six genera: *Belicinus* Arce-Pérez and Shepard, *Pheneps* Darlington, *Psephenopalpus* Arce-Pérez, *Psephenops* Grouvelle, *Psephenotarsis* Arce-Pérez and Novelo-Gutiérrez, and *Psephenus* Haldeman (Lee et al. 2016). *Bertrandia* Pic is a junior synonym of *Pheneps* (W. D. Shepard, unpublished). *Psephenus* has both North and Central American species; species in the remaining genera occur from Mexico through South America, and in the West Indies (Lee et al. 2016).

Psephenops was described in 1898 by Grouvelle for the species *P. smithi* Grouvelle from the Caribbean islands of Grenada and St. Vincent (Grouvelle 1898). In the same paper, Grouvelle described the genus *Xexanchorinus* for the species *X. latus* Grouvelle, also from Grenada. Darlington (1936) compared Grouvelle's specimens, concluded that *P. smithi* and *X. latus* represented males and females, respectively, of the same species, and declared them synonyms, with *P. smithi* as the valid name. Since then, 12 other species have been described, for a total of 13 species and one subspecies:

P. argentinensis Delève, 1967; Argentina

P. bifidus Arce-Pérez and Novelo-Gutiérrez, 2017; Panama

P. grouvellei Champion, 1913; Guatemala

P. haitianus Darlington, 1936; Haiti

P. lupita Arce-Pérez, 2002; Mexico
P. maculicollis Darlington, 1936; Colombia, Costa Rica, Mexico, Panama
P. mexicanus Arce-Pérez and Novelo-Gutiérrez, 2000; Mexico
P. panamaensis Arce-Pérez, Novelo-Gutiérrez and Cornejo, 2015; Panama
P. prestonae Spangler, 1990; Costa Rica
P. shepardii Arce-Pérez and Novelo-Gutiérrez, 2013; Belize
P. smithi Grouvelle, 1898; Grenada, St. Vincent
P. smithi guadeloupensis Bameul, 2001; Guadeloupe
P. spiniparameri Arce-Pérez and Novelo-Gutiérrez, 2013; Belize
P. triangularis Arce-Pérez and Novelo-Gutiérrez, 2017; Panama

Most described species of *Psephenops* are from Mexico (Arce-Pérez and Novelo-Gutiérrez 2000; Arce-Pérez 2002), Central America (Champion 1913; Spangler 1990; Arce-Pérez and Novelo-Gutiérrez 2013, 2017; Arce-Pérez et al. 2015), and the West Indies (Grouvelle 1898; Darlington 1936), and just two are described from South America, *P. argentinensis* (Delève 1967) and *P. maculicollis* (Darlington 1936). Some other South American psephenine species have been misplaced generically, including a few that belong in *Psephenops*.

A phylogenetic analysis based on morphological adult and larval characters by Lee et al. (2007) indicated that the genus and the subfamily Psepheninae are monophyletic. Lee stated that “...the purpose of the study was not to expose the sister-group relationships of Psephenidae, but to root cladograms...”. No phylogenetic study has been done using molecular techniques.

Psephenops adults are semiaquatic, and the larvae, called water penny beetles or water pennies, are fully aquatic on rocky substrates in streams and rivers. Adults are present seasonally for a short time, whereas larvae of all stages are present year round. Adult males and females are sexually dimorphic, most strikingly in the structure of the tarsi, although the shape of the pronotum also differs. The modified tarsi of the males enable easy recognition of the genus if males are available. Darlington (1936) provided a detailed description of several secondary sexual characters for the genus.

The only published descriptions of *Psephenops* larvae are those of *P. smithi guadeloupensis* by Bameul (2001) and of *P. robacki* (as *Psephenus robacki*) by Spangler (1966). Larvae are not mentioned in any of the other species descriptions although they are much more commonly collected than adults, perhaps because it is difficult to identify psephenine larvae to genus.

The invertebrate fauna of many islands of the Lesser Antilles, West Indies (Fig. 1) has been catalogued in recent years from field surveys, publication records, and museum specimens, particularly by Bass (2000, 2003a, 2003b, 2004a, 2004b, 2005, 2006, 2007, 2008, 2009), Peck (2006, 2009a, 2009b, 2010, 2011a, 2011b, 2016), and Peck et al. (2002, 2014). In common usage the term “Lesser Antilles” often includes Trinidad and Tobago although they are of different geologic origin than the island chain to the northwest (Frost and Snoke 1989; Bouysse et al. 1990).

Psephenidae have been recorded from Dominica (larvae) (Bass 2007; Peck 2016), Grenada (Grouvelle 1898; Bass 2004a, 2004b), Guadeloupe (Peck 2016; Meurgey and Ramage 2020), Martinique (larvae) (Bameul 2001), St. Vincent (Grouvelle 1898), and Tobago (Bass 2003a), but have not been found on Anguilla (Peck 2011a), Antigua (Bass 2005; Peck 2011a), Barbados (Bass 2003b; Peck 2009a), Barbuda (Peck 2011a), the Cayman Islands (Bass 2009), Saba (Bass 2008; Peck 2011a), St. Barthélemy (Peck 2011a), St. Eustatius (Peck 2011a), St. Martin-St. Maarten (Peck 2011a), St. Kitts and Nevis (Bass 2000, 2006; Peck 2011a), or St. Lucia (Peck 2009b).

Specific groups of aquatic insects that have been surveyed and studied in Trinidad and Tobago include: Elmidae (Coleoptera) (Hinton 1971), Odonata (Michalski 1988), Hemiptera: Heteroptera (Hynes 1948; Nieser and Alkins-Koo 1991), Plecoptera (Stark 1994), and Trichoptera (Botosaneanu and Sakal 1992; Botosaneanu and Alkins-Koo 1993; Flint 1996). Aquatic insects are listed in surveys and/or studies in Trinidad by Alkins-Koo (1990), and in Tobago by Peck et al. (2002) and Bass (2003a).

We discovered a new species of *Psephenops* in 2005 during aquatic sampling in Trinidad and Tobago. Our goal in this article is to provide new information about the Lesser Antillean type species, *P. smithi*, to describe the new species, and to reassign a South American species of *Psephenus* to *Psephenops*.

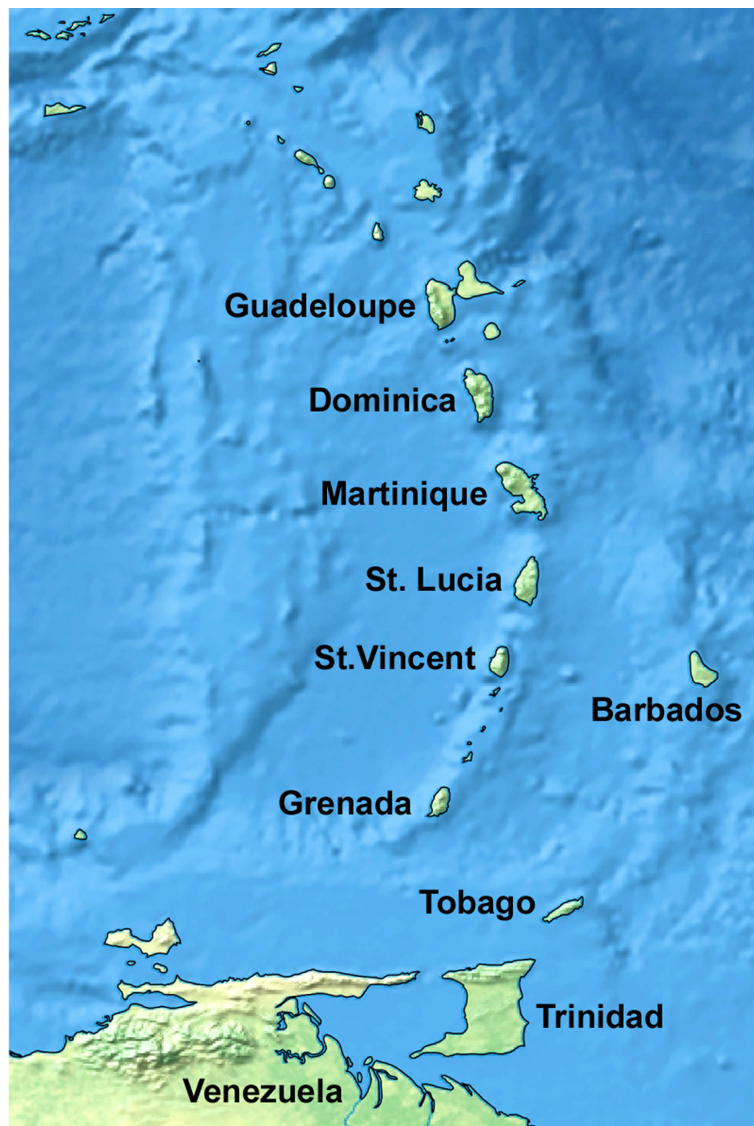


Figure 1. Map of the southern West Indies: the Lesser Antilles, Barbados, Tobago, and Trinidad.

Materials and Methods

The following institutional codens are used in the text:

ANSP	Academy of Natural Sciences, Philadelphia, PA, USA
CASC	California Academy of Sciences, San Francisco, CA, USA
EMEC	Essig Museum of Entomology, University of California, Berkeley, CA, USA
MUSM	Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru
NHMUK	The Natural History Museum, London, UK
OMNH	Sam Noble Museum, University of Oklahoma, Norman, OK, USA
RBINS	Royal Belgian Institute of Natural Sciences, Brussels, Belgium
UCB	University of California, Berkeley, CA, USA
UCOCI	University of Central Oklahoma Natural History Museum, Edmond, OK, USA
USNM	United States National Museum of Natural History, Washington, D.C., USA
UWIZM	University of the West Indies Zoology Museum, St. Augustine, Trinidad and Tobago

The following abbreviations are used in the text: AB = larval abdominal segment; MYBP = million years before present; UCONHM = University of Central Oklahoma Natural History Museum (accession/database acronym); WDS = William D. Shepard.

Terminology used in the larval description is from Lee et al. (2007) and Lawrence and Ślipiński (2013).

Aquatic sampling. Nearly all of the specimens used in this study were collected by the authors during a survey of the aquatic Dryopoidea of Trinidad and Tobago in July 2005. A total of 30 streams and rivers were sampled, 21 on Trinidad and nine on Tobago. Psephenid larvae were collected from bottom substrates, particularly submerged rocks, using aquatic nets. The adults, which fly readily, were collected from emergent parts of rocks by stealthily approaching and holding a net closely downstream, then quickly splashing water on the rocks to dislodge the beetles which are then swept by the current into the net. All specimens were immediately preserved in ethanol.

Geographic coordinates and elevations were recorded in the field using a hand-held GPS unit, and may be somewhat inaccurate.

Study material. During this study we examined a total of 33 adults and about 230 larvae of *Psephenops* from Trinidad and Tobago. Thirty-two of the adults and all of the larvae were collected by the authors and exported under Ministry of Agriculture, Land and Marine Resources, Forestry Division Permit No. 000532. Another adult specimen from Tobago was loaned by David Bass (UCOCI) for the study. The holotype of *Psephenops trini* **new species** will be deposited in the EMEC; paratypes will be deposited in the EMEC, NHMUK, USNM, and UWIZM. All larvae will be placed in the EMEC and UWIZM.

Psephenops smithi and *X. latus* were assessed by studying photographs of five specimens from the type series which were provided by the NHMUK, plus a photograph of a non-type specimen from the USNM.

Photographs of the holotype of *Psephenops robacki* from the USNM and specimens from our own collections were used in our study of that species. Our fieldwork in Peru was authorized by Gestión Forestal y de Fauna Silvestre, Ministerio de Agricultura, under No. 384-2012-AG-DGFFS-DGEFFS, and exported under No. 000296-MINAGRI-DGFFS. Specimens will be deposited in the EMEC and MUSM.

Laboratory procedures. A Leica MZ 125 stereomicroscope fitted with a micrometer and an American Optical Spencer stereomicroscope with a calibrated ocular grid were used for examination and measurement of specimens. Measurements of total body length include only the pronotum and elytra (excluding the variable space between) plus the portion of the abdomen that extends past the elytral apices; the length of the head is excluded. Measurements of total body width include both elytra at the widest point. Genitalia from selected male and female specimens were dissected, placed in genitalia vials each with a drop of glycerin, and the vials then pinned below the pin-mounted, labeled specimens. Larvae were stored with data labels in vials of ethanol.

Specimen label data. Label data are cited verbatim in the material examined sections. A slash “/” separates lines on one label and a double slash “//” separates different labels. Clarifying information not appearing on the label is enclosed within brackets “[]”. Some of the geographic coordinates and elevations which appear on the locality labels, taken in the field using a hand-held GPS unit, were later found to be somewhat inaccurate.

Specimen imaging and map. Habitus images of the new species were taken with a Visionary Digital BK Plus Lab System fitted with a Canon EOS 7D camera; the genitalia images were taken using a Syncroscopy AutoMontage system. Photographs of the type series of *P. smithi* and *X. latus* were provided by the NHMUK; photographs of a non-type *P. smithi* and the holotype of *P. robacki* were provided by the USNM. The map illustrating the Lesser Antilles and nearby landforms (Fig. 1) was created using SimpleMappr, a free internet program (Shorthouse 2010). The photographs were edited and the plates assembled using Adobe PhotoShop Elements®.

Taxonomy

Psephenidae Lacordaire, 1854

Psepheninae Lacordaire, 1854

Psephenops Grouvelle, 1898

Psephenops smithi Grouvelle, 1898

(= *Xexanchorinus latus* Grouvelle, 1898, junior synonym)

(Fig. 2–8)

Type localities. Grenada: Mt. Maitland and Chantilly Estate, St. Vincent; Lesser Antilles, West Indies.

Diagnosis. The greatly enlarged apical maxillary palpomeres of the male *P. smithi* have been considered diagnostic. Specifically, the apical maxillary palpomere is very long, nearly 2× as long as the width of an eye and nearly 2× longer than palpomeres 1–3; and is stout, about 3× wider than palpomeres 1–3, appearing inflated. There is another species (undescribed) with an enlarged terminal palpomere, although it not nearly as pronounced. The *P.*



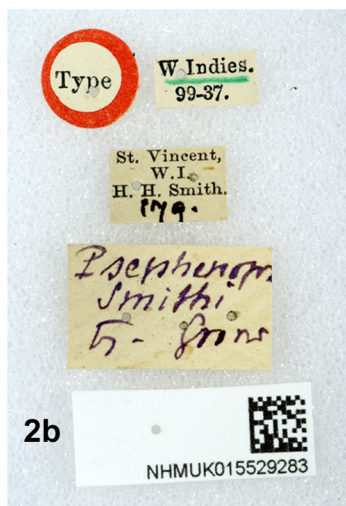
2a



3a

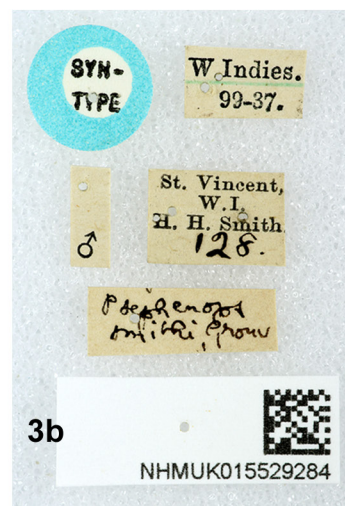


4a



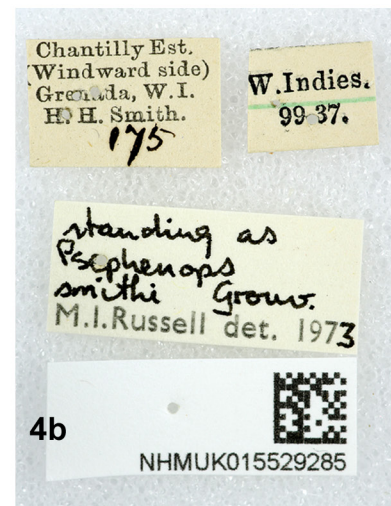
2b

NHMUK015529283



3b

NHMUK015529284



4b

NHMUK015529285

Figures 2–4. *Psephenops smithi* Grouvelle, adult males. 2) Lectotype from St. Vincent. a) Dorsal habitus. b) Specimen labels. 3) Paralectotype from St. Vincent. a) Ventral habitus with dissected maxillary and labial palpi. b) Specimen labels. 4) Paralectotype from Grenada. a) Ventral habitus. b) Specimen labels. Photographs courtesy of Keita Matsumoto, NHMUK.

smithi female lacks the enlarged palpomere and cannot be morphologically diagnosed with confidence. *Psephenops smithi* is compared in detail with *P. trini* **new species** in its diagnosis.

Historical perspective. The type series of both *P. smithi* (Fig. 2–4) and *X. latus* (Fig. 7, 8) were collected by H. H. Smith. Herbert Huntingdon Smith (21 January 1851–22 March 1919) was an American naturalist contracted by the West Indian Commission (West India Committee, K. Matsumoto, in litt.) of The Royal Society to do a biological survey of Trinidad and the Windward Islands from 1890–1895 (Holland 1919). The specimens he collected were deposited in the British Museum of Natural History (NHMUK) and were subsequently loaned to numerous European entomologists who then described new species from the material. The *Psephenops* and *Xexanchorinus* specimens were accessioned by the British Museum as donation “99-37” [1899-37] (K. Matsumoto, in litt.).

In his generic description of *Psephenops*, Grouvelle (1898) included a striking diagnostic character: greatly enlarged apical maxillary palpomeres. Conversely, the maxillary palpi of *Xexanchorinus* were termed “filiformes” in his description of that genus. Neither the species descriptions of *P. smithi* nor *X. latus* mentions the palpi, or the highly modified tarsi which are now regarded as a key generic character in males. Grouvelle’s descriptions of *P. smithi* and *X. latus*, like many descriptions of his time, are inadequate to clearly define and separate these taxa from others subsequently described. Grouvelle listed three collection localities for his series of *P. smithi* and one for *X. latus*, but did not state the number of specimens on hand or designate specific types. The type locality of *X. latus* (Grenada, Chantilly Estate) is the same as one of his *P. smithi* localities.

Champion (1913) briefly mentioned *P. smithi*, making note of its very large apical maxillary palpomere, in his paper describing a second species of *Psephenops*, *P. grouvellei* Champion.

Darlington (1936) synonymized *P. smithi* and *X. latus*, with *X. latus* becoming the junior synonym. He declared them different sexes of the same genus and species and noted that all of the *P. smithi* syntypes are males (Darlington 1936: 69), and the *X. latus* are females. Also, one of the males was from the type locality of *X. latus*. As justification for the synonymy, he cited several sexually dimorphic characteristics of *Psephenops*, including tarsal differences. Surprisingly, however, he failed to note the unusual male maxillary palpi of *P. smithi*.

Delève (1967) provided the first illustrations of *P. smithi* and *X. latus*: line drawings of the pronota of both, and of the maxillary palpus and aedeagus of *P. smithi*. He examined one specimen of each species, which he believed to be from the type series, but did not mention where they were collected. He apparently disagreed with Darlington’s (1936) synonymy because he thought the pronota of the two taxa were too different to represent the same species (Delève 1967; Bameul 2001).

Bameul (2001) described the subspecies *P. smithi guadeloupensis* Bameul from the island of Guadeloupe, which is approximately 455 km (283 mi.) distant from Grenada and St. Vincent. In addition to the adult, he described and illustrated the associated larva, gave a brief history of the description of psephenine larvae, and provided a brief key to separate the larvae of *Psephenops* and *Psephenus*. Bameul summarized the controversy regarding the synonymy, and considered *Xexanchorinus* to be poorly defined and requiring further study.

Current assessment. Two of the *P. smithi* specimens are from St. Vincent; the third specimen, from Grenada (Chantilly Estate), is the only known male specimen of *P. smithi* collected at the type locality of *X. latus*. The photographs are sufficient to conclude that the *P. smithi* series consists of males and the *X. latus* series are all females. As mentioned previously, the tarsal modification is a secondary sexual dimorphism present only in male *Psephenops*, and the enlarged apical maxillary palpomeres are a secondary sexual dimorphism currently known only in males of *P. smithi*. Because both sexes were collected together in Grenada, those specimens are almost certainly conspecific. Darlington’s (1936) opinion that the genera are synonymous is now widely accepted (Lee et al. 2016).

An excellent illustration of the aedeagus of *P. smithi* (Fig. 6), drawn for Paul Spangler (USNM) by Y. Sohn (USNM) and never published, is included here to further clarify the species. The aedeagus was taken from the St. Vincent specimen shown in Fig. 5. Delève (1967) previously illustrated the aedeagus, but his drawing is less detailed.

Lectotype and paralectotype designations. The NHMUK in London has three specimens of *P. smithi*, all males (Fig. 2–4): one specimen has a round Type label and a determination label, “Psephenops smithi ty. Grouv”, in Grouvelle’s handwriting (Fig. 2b); one has a round Syntype label with a determination label not in Grouvelle’s handwriting (Fig. 3b); the last has no type label, but has a determination label from 1973 saying “standing as *P.*

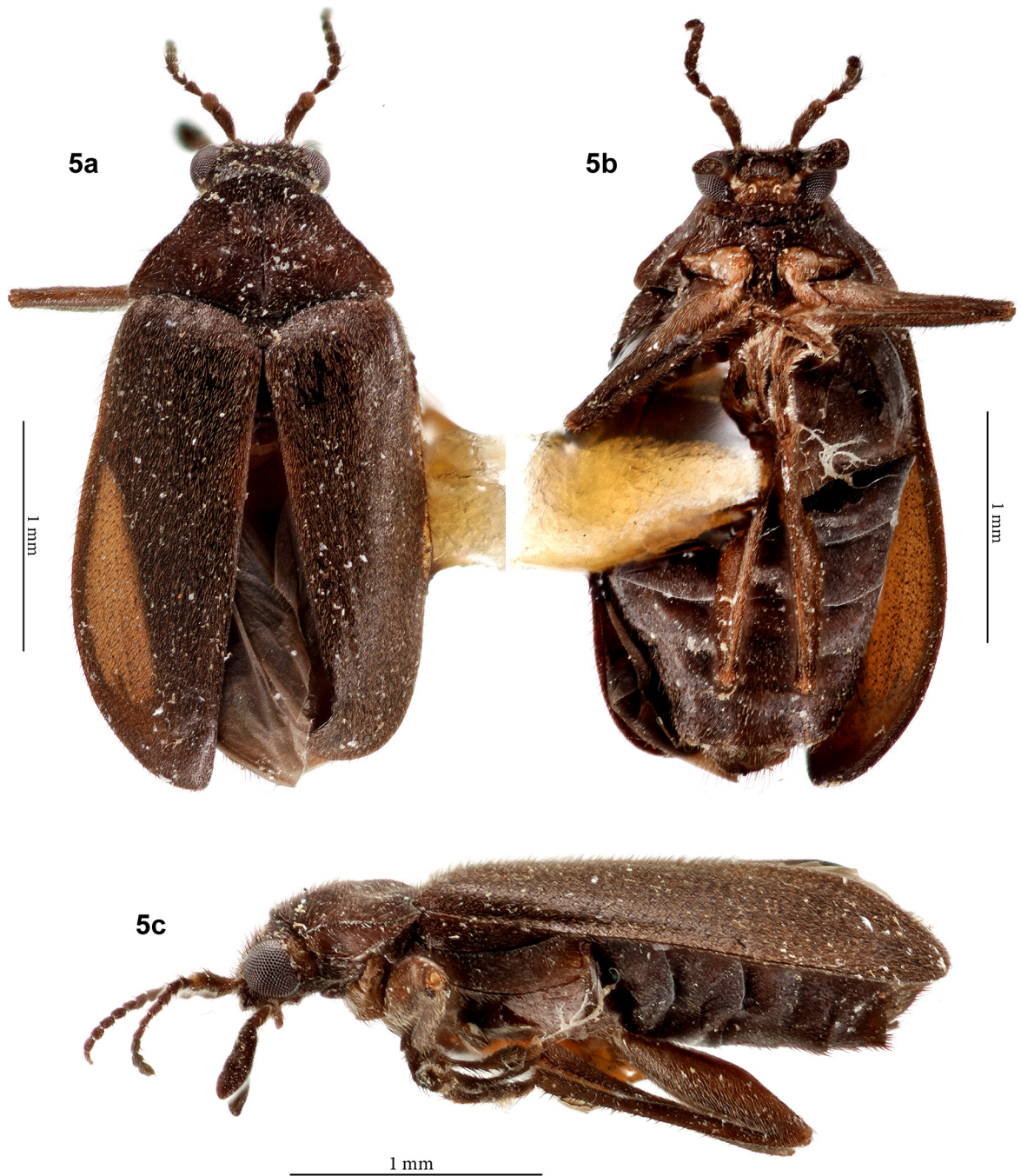


Figure 5. *Psephenops smithi* Grouvelle, adult male from St. Vincent. a) Dorsal habitus. b) Ventral habitus. c) Lateral habitus. d) Specimen labels. Photographs courtesy of Karolyn Darrow, USNM.

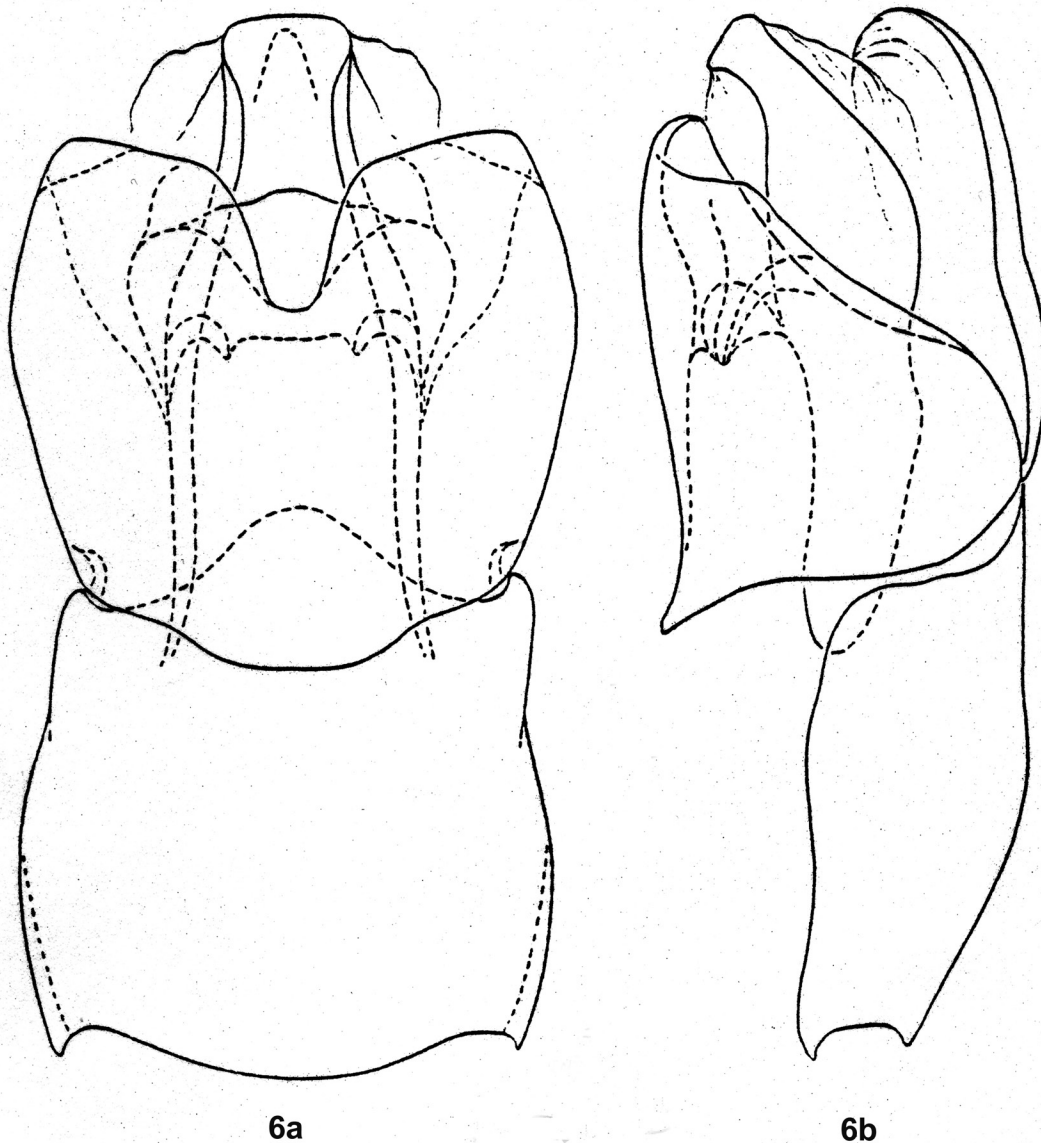
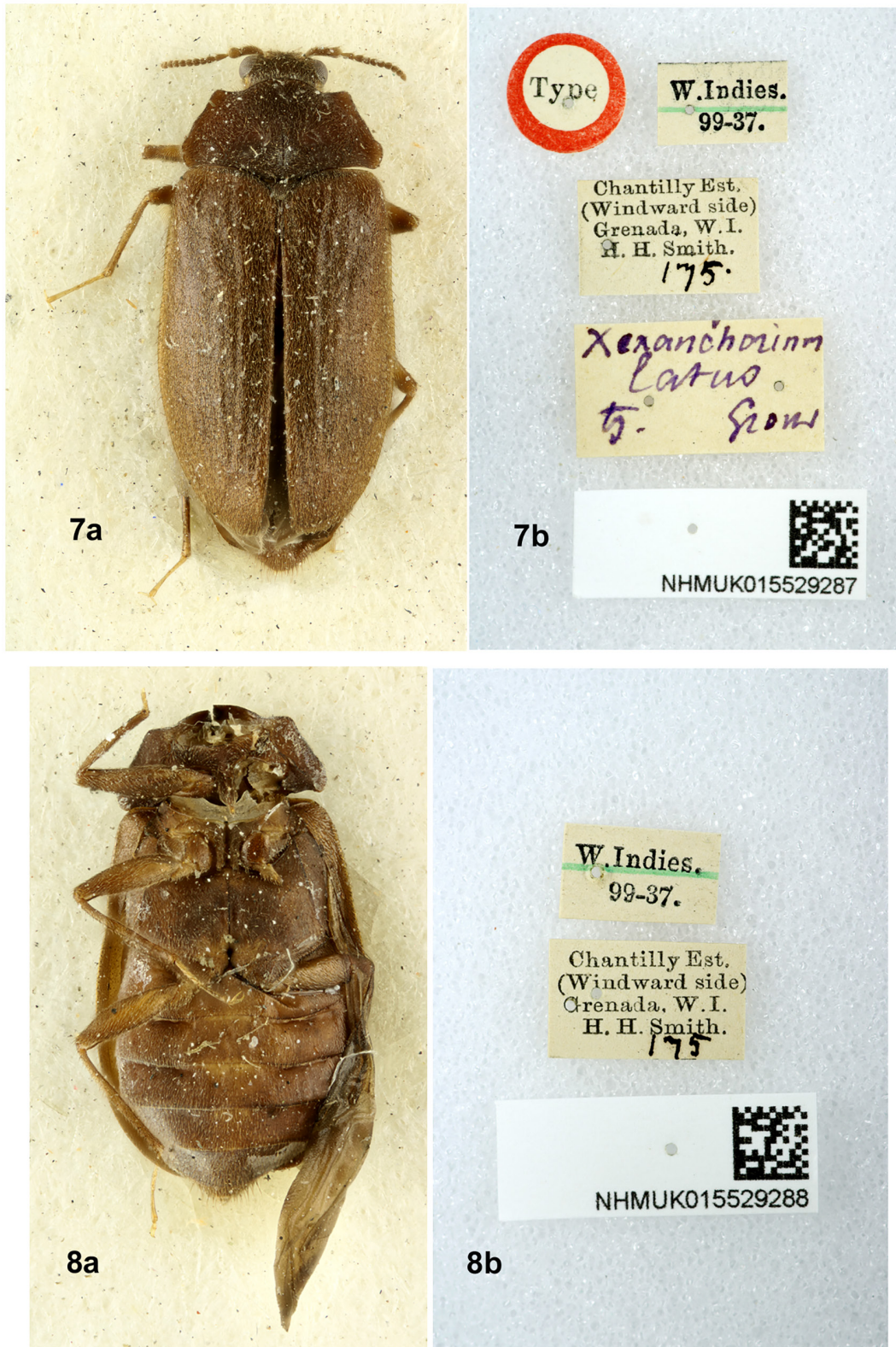


Figure 6. *Psephenops smithi* Grouvelle, aedeagus. **a)** Dorsal view. **b)** Lateral view. Illustrations by Y. Sohn †, courtesy of the USNM.

smithi Grouv. M.I. Russell det. 1973” (Fig. 4b). All three of the specimens have locality and accession labels of the same style, the localities are as stated in Grouvelle (1898), and so are considered to belong to the type series. However, Grouvelle did not designate a type in his description, nor indicate how many specimens he examined.

Likewise, the NHMUK has two specimens of *X. latus*, both females (Fig. 7, 8): one has a round Type label and a determination label, “*Xexanchorinus latus* ty. Grouv”, in Grouvelle’s handwriting (Fig. 7b); the second specimen (Fig. 8) has no type designation. These specimens have locality and accession labels of the same style, matching those of *P. smithi*, and the locality information is as stated in Grouvelle (1898), and so are considered to belong to the type series. As for *P. smithi*, no type was designated for *X. latus* and the number of specimens on hand was not indicated. The round type and syntype labels are not original, and date to the time of World War II when the curators identified and labeled valuable specimens to be relocated for safekeeping (K. Matsumoto, in litt.).



Figures 7–8. *Psephenops smithi* Grouvelle (= *Xexanchorinus latus* Grouvelle, jr. syn.), adult females. 7) Lectotype from Grenada. a) Dorsal habitus. b) Specimen labels. 8) Paralectotype from Grenada. a) Ventral habitus. b) Specimen labels. Photographs courtesy of Keita Matsumoto, NHMUK.

Grouvelle (1898) appears to have intended for the two specimens which bear the round Type labels to be primary types. Both specimens have determination labels in Grouvelle's handwriting with "ty" in the lower left corner, Grouvelle's shorthand for "type." We therefore designate these specimens as lectotypes to fix the concepts of *Psephenops smithi* Grouvelle and *Xexanchorinus latus* Grouvelle. The remaining two specimens of *P. smithi* and the one of *X. latus* are designated as paralectotypes.

Apparently there were additional specimens belonging to the type series of *P. smithi* and *X. latus* whose whereabouts are unknown, including at least one specimen of *P. smithi* from Mt. Maitland, Grenada, as cited in the description. Delève (1967: 421) stated (translated from French): "I have been able to examine, *in the Grouvelle collection* [italics added by the authors for emphasis], one example of *P. smithi* Grouvelle and one example of *Xexan. latus* Grouvelle belonging, in all likelihood, to the series of syntypes seen by Grouvelle. (They also have a "type" label)." Although Delève (1967: 420) published an illustration of the male genitalia of *P. smithi*, none of the three male syntypes held by the NHMUK has had genitalia extracted (K. Matsumoto, in litt.). So, it looks as if Grouvelle, whose collection is in the MNHN in Paris, may have retained specimens from the type series following his descriptions of the species. Nonetheless, a recent search through both the MNHN general collection and Grouvelle's collection for these two specimens was unsuccessful (A. Mantilleri, in litt.). Because of the possibility that Delève borrowed and did not return the specimens after examining them, the general RBINS collection in Brussels, where Delève's collection resides, has been searched also, but no specimens were found (W. Dekoninck, P. Limbourg, in litt.).

Type material examined, photographic. *Psephenops smithi*. Lectotype male (here designated). Type [circular off-white label with red border, printed] // W Indies. / 99-37. // St. Vincent, / W.I. / H. H. Smith. / 179. // *Psephenops / Smithi / ty. Grouv* [handwritten] // NHMUK015529283 [Fig. 2b] // LECTOTYPE / *Psephenops smithi / Grouvelle, 1898* [red, printed label]. **Paralectotype males (here designated).** SYN- / TYPE [circular white label with blue border, printed] // W Indies. / 99-37. // ♂ // St. Vincent, / W.I. / H. H. Smith. / 128. // *Psephenops / smithi, Grouv* [handwritten] // NHMUK015529284 [Fig. 3b] // PARALECTOTYPE / *Psephenops smithi / Grouvelle, 1898* [yellow, printed label]; W. Indies. / 99-37. // Chantilly Est. / (Windward side) / Grenada, W. I. / H. H. Smith. / 175 // standing as / *Psephenops / smithi Grouv.* [handwritten] / M.I.Russell det. 1973 // NHMUK015529285 [Fig. 4b] // PARALECTOTYPE / *Psephenops smithi / Grouvelle, 1898* [yellow, printed label]. ***Xexanchorinus latus*. Lectotype female (here designated).** Type [circular off-white label with red border, printed] // W Indies. / 99-37. // Chantilly Est. / (Windward side) / Grenada, W. I. / H. H. Smith. / 175 // *Xexanchorinus / latus / ty. Grouv* [handwritten] // NHMUK015529287 [Fig. 7b] // LECTOTYPE / *Xexanchorinus latus Grouvelle, 1898* [red, printed label]. **Paralectotype female (here designated).** W. Indies. / 99-37. // Chantilly Est. / (Windward side) / Grenada, W. I. / H. H. Smith. / 175 // NHMUK015529288 [Fig. 8b] // PARALECTOTYPE / *Xexanchorinus latus Grouvelle, 1898* [yellow, printed label]. [Note: The lectotype and paralectotype labels will be added to the specimens after publication of this article.]

Additional material examined, photographic. *Psephenops smithi*. ST. VINCENT, B.W.I. / Caratal River / Rocky & torrential / 250ft., 9Mar.1971 / A. D. Harrison // ♂ TAIL DONE BY Y. Sohn // PSEPHENOPS / SMITHI / GROUVELLE / det.PJSpangler // USNMENT / [code] / 01374932 [Fig. 5d].

Etymology. The species is named for the collector, Herbert Huntingdon Smith, an American naturalist. The name "smithi" is a noun in the genitive case. For junior synonym *Xexanchorinus*, the trivial name, *latus* L., is an adjective, meaning "broad." This likely refers to the wide pronotum or the body shape in general.

Distribution. Dominica (?), Grenada, Guadeloupe (subspecies *P. s. guadeloupensis*), Martinique (?), and St. Vincent, Lesser Antilles, West Indies (Fig. 1). [Note: See Remarks; only larval specimens have been found on Dominica and Martinique].

Remarks. The Global Biodiversity Information Facility (GBIF) database lists *P. smithi* from Trinidad and Tobago based on records from OMNH, but we believe these represent new species *P. trini*. Bass (2003a, 2004a, 2007) reported *P. smithi*, identified by Paul Spangler (USMN), from Dominica, Grenada, and Tobago. We examined one of his male specimens from Tobago (the others were retained by Spangler) and found it to be *P. trini*, not *P. smithi*. We suspect that the specimens reported by GBIF and Bass' (2003) Tobago specimens were misidentified because *P. smithi* was the only species known at that time from the Lesser Antilles. Bass' (2007) record from

Dominica is of a larval specimen, which currently is not identifiable, so it should be considered a tentative species identification. On Grenada, from where *P. smithi* was described, Bass (2004) observed that it seemed to be “the most widespread aquatic beetle in mountain streams of this island.” Meurgey and Ramage (2020) listed *P. smithi* from Guadeloupe, as did Peck (2016), but the source of the record(s) is unclear. In addition, Bameul (2001) cited a record of larvae from Martinique which are possibly *P. smithi*. Peck (2006, 2011) did not report any psephenids from either Dominica or Martinique.

We examined an adult male specimen from Venezuela (Districto Federal, Caracas) which was identified as *P. smithi* by the late Harley P. Brown of OMNH. It exhibits enlarged apical maxillary palpomeres, a diagnostic character of the species, however, the morphology of the aedeagus differs from that of *P. smithi* as illustrated by Delève (1967) and by Sohn (Fig. 6). In addition, the apical maxillary palpomere of the types (Fig. 2a, 3a) and the USNM specimen (Fig. 5c) is nearly twice as long as the width of an eye, in contrast, that of the Venezuelan specimen is only about half that long. This specimen does not fit any current species description and it is likely an undescribed species. *Psephenops smithi* is reported from Venezuela on the Global Biodiversity Information Facility (GBIF) website based on the OMNH Recent Invertebrates Collection, but we have not verified these records.

***Psephenops trini* Barr and Shepard, new species**

urn:lsid:zoobank.org:pub:B226E04A-5E95-4576-8BDB-6F35647B6D81

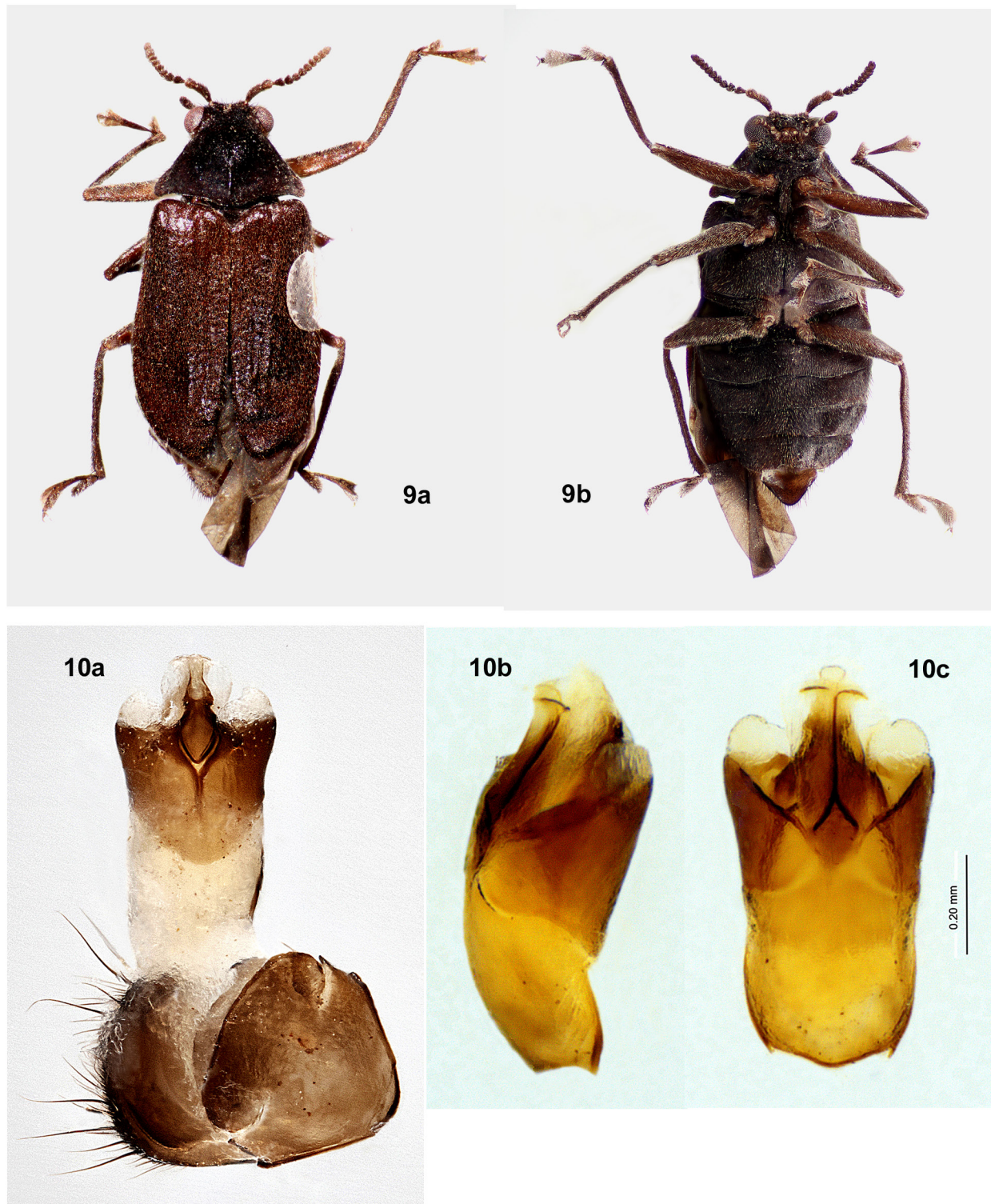
(Fig. 9–12)

Type locality. Trinidad and Tobago: Trinidad, St. George County, Arima River at Verdant Vale; 10.6930°, –61.2928°; elevation 180 m (Fig. 13).

Diagnosis. Of the described species of *Psephenops*, only *Psephenops trini* is geographically close to *P. smithi* from Grenada and St. Vincent. Males of these two species can be separated by characteristics of the maxilla: In *P. trini* (Fig. 9b), the terminal maxillary palpomere is slightly wider than, and about as long as, palpomeres 2 + 3; in *P. smithi* (Fig. 3a, 5c) the terminal maxillary palpomere is much stouter, about 3× wider than, and nearly 2× longer than, palpomeres 1–3. The body shape and proportions of the females differ considerably between the two species: Females of *P. trini* (Fig. 11) are proportionally wider (approximate L/W about 1.8:1); *P. smithi* (= *X. latus*) females (Fig. 7, 8) are more elongate (approximate L/W about 2.2:1). Also, in *P. trini* females the pronotal anterior angles are broadly rounded and the posterior angles are semi-truncate; in *P. smithi* the anterior angles are narrower, and the posterior angles are broadly rounded. Since these observations are based on a small number of *P. smithi* specimens (n = 6; 4♂, 2♀), they do not reflect much variability and are likely somewhat incomplete.

In the key to Mesoamerican *Psephenops* species by Arce-Perez and Novelo (2017), *P. trini* keys to the last couplet (#11) where it fits neither *P. maculicollis* nor *P. triangularis*. The aedeagus of *P. trini* (Fig. 10) bears some resemblance to the aedeagus of *P. smithi* in Delève (1967) and the illustration by Sohn (Fig. 6).

Description (Fig. 9–10). Holotype male. Body 2.43 mm long, 1.20 mm wide; head, pronotum, scutellum black; antennae, elytra, legs brown; venter brown, pruinose. **Head** with moderately long, erect setae; long curved setae arching over eyes; frons slightly depressed between eyes; interantennal area as wide as eye. Clypeus transverse, wider than long; deflected at 90° to frons; apex widely emarginate; disc densely setose. Labrum transverse, emarginate, disc setose. Maxillary palpus with 4 palpomeres; palpomere 1 very short; palpomere 2 elongate, slightly longer than 3; palpomere 4 wider, 3× as long as wide, as long as 2 + 3, slightly flattened, apex rounded. Labial palpus very short, with 3 palpomeres; palpomere 3 shortest, digitiform. Antenna moderately short, shorter than pronotum; moniliform with 11 setose antennomeres; antennomeres 1 and 2 curved to fit under eye; antennomere 1 longest, about 2× as long as wide; antennomere 2 globular, as wide as antennomere 1 but ½ as long; antennomere 3 triangular, narrow at base, wider apically; antennomeres 4–11 moniliform; antennomere 11 bluntly rounded at tip. Eyes large, hemispherical, finely faceted. **Pronotum** trapezoidal, 0.55 mm long, 0.98 mm wide; covered with velutinous setae and long erect dark setae. Anterior margin weakly arcuate; lateral sides strongly diverging posteriorly; posterior margin bisinuate, straight in antescutellar area; anterior angles almost indistinguishable; posterior angles narrowly rounded, explanate, reflexed. Disc convex in anterior ½, depressed posteriorly, deepest adjacent to midline; median longitudinal carina in basal ½ prominent, glabrous, ending short of basal margin. **Scutellar shield** flat, equilaterally triangular, covered with velutinous setae. **Elytron** shorter than abdomen, 1.6



Figures 9–10. *Psephenops trini* new species, adult male. 9) Habitus, 2.85 mm long. a) Dorsal. b) Ventral. 10) Aedeagus. a) Dorsal view with attached abdominal ventrites. b) Lateral view. c) Ventral view.

mm long, 0.60 mm wide, widest at posterior $\frac{1}{3}$; consistency flexible, leathery; setose with short, fine, recumbent setae and longer, erect setae. Disc flat, weakly striate, impunctate, intervals slightly raised; apex broadly rounded, dehiscent. **Prosternum** much shorter than wide; very setose; slightly depressed except where carinate postero-medially at margin with hypomeron. Prosternal process elongate, extending to middle of mesocoxae, slightly narrowed between procoxae, apex narrowly rounded. **Mesoventrite** very short, wide. **Metaventrite** convex; covered with moderately long, semi-erect setae and short, dense setae; metathoracic discrimen extending from near anterior margin to round pit at posterior margin; metanepisternum inner margin carinate; metepimeron a concave lobe at posterolateral metanepisternal margin. **Legs** similar, heavily setose. Pro- and mesocoxa globose, each with a transverse lateral extension; metacoxa very short, transverse, laterally narrow; trochanter triangular. Femur widest before middle, metafemur widest. Tibia longer than femur, straight, slightly enlarged at apex. Tarsus with 5 tarsomeres; tarsomeres 1 and 2 modified with long, densely setose, ventral laminar expansions underlying the tarsomeres; ventral expansion of tarsomere 1 cylindrical to ovoid; ventral expansion of tarsomere 2 narrow at base, flared apically, concave and partly enclosing tarsomeres 2–5; tarsomeres 3 + 4 shorter than tarsomere 5; tarsomere 5 extending beyond laminar expansion of tarsomere 2; tarsal claws fine, simple. **Abdomen** densely setose; with 7 ventrites, all transverse except ventrite 7, all subequal in length except for ventrite 6; ventrite 1 barely extending beyond metatrochanters; ventrite 6 very short; ventrite 7 small, rectangular, convex [Note: ventrites 6 and 7 were removed during dissection of the aedeagus and are stored in the genitalia vial]. **Aedeagus** (Fig. 10) nearly twice as long as wide. Phallobase slightly longer than parameres, weakly sclerotized. Parameres broad, open ventrally, fused dorsally except for a median, Y-shaped notch; basal $\frac{2}{3}$ sclerotized, apical $\frac{1}{3}$ membranous, translucent; apices broadly but unevenly rounded. Penis extending beyond parameres; broad, at base nearly as wide as phallobase, apical $\frac{1}{3}$ narrowed; membranous laterally, well-sclerotized medially except at apical $\frac{1}{6}$; with ventral, sclerotized, longitudinal sclerite widely bifid basally and apically; apex semi-truncate.

Female description (Fig. 11). **Body** 3.38–3.85 mm long, 1.63–2.00 mm wide ($n = 7$); color similar to male. **Pro-notum** trapezoidal, wider than long, 0.70–0.83 mm long, 1.35–1.63 mm wide, widest at base; laterally explanate; posterior angles concave, produced, explanate, laterally semi-truncate. **Elytron** shorter than abdomen, 2.15–2.63 mm long, 0.81–1.00 mm wide, widest at apical $\frac{1}{3}$; apex broadly rounded, dehiscent. **Prosternal process** broad, sword-shaped, with median longitudinal carina; apex narrowly rounded. **Tarsus** slender, unmodified, lacking ventral laminar expansions; tarsomeres 1–4 together as long as tarsomere 5. **Abdomen** with 6 ventrites. **Ovipositor** short, broad, lightly sclerotized; paraproct $\frac{2}{3}$ length of ovipositor, lateral margin generally parallel-sided, medial margin sinuate; each proximal gonocoxite transverse, short, $\frac{1}{2}$ length of distal gonocoxite, slanting medially to join other proximal gonocoxite at midline; short V-shaped sclerite between coxite bases on dorsum; distal gonocoxite largely unsclerotized; gonostyli very short, as long as wide; ovipositor poorly sclerotized ventrally.

Variation. Females (Fig. 11) are larger than males (Fig. 9). There is a slight overlap in length, but females are much broader: females 3.38–3.85 mm long, 1.63–2.00 mm wide ($n = 7$); males 2.43–3.53 mm long, 1.20–1.40 mm wide ($n = 6$). The sexes are sexually dimorphic; besides size, they differ in pronotal shape, tarsal form, and the number of abdominal ventrites, as noted above in the female description.

Type material. **Holotype male**, pinned, deposited in EMEC, labeled: “TRINIDAD: St. George / Co., Verdant Vale / 9 VII 2005 / Arima River 590 ft [180 m] / 10°41.58'N 61°17.57'W / WDS-A-1654 [on reverse] // William D. / Shepard, leg. // HOLOTYPE / Psephenops trini / Barr & Shepard [red label, handwritten] // UC Berkeley / EMEC / 49614”. **Paratypes** ($n = 29$; 22♂, 7♀). **Trinidad.** TRINIDAD: 6.8 km S / of Blanchisseuse / 6 VII 2005 80 ft [24 m] / Marianne River / 10°46'N 61°18'W / WDS-A-1649 [on reverse] // William D. / Shepard, leg. (1♂ EMEC); TRINIDAD: St. George Co. / Marianne River 6.8 km / S of Blanchisseuse / 6-VII-2005, C. B. Barr // 10°45.9'N, 61°18.2'W / elevation 80 ft. [24 m] (1♀ EMEC); TRINIDAD: just E of / Blanchisseuse / 7 VII 2005 / Marianne River / WDS-A-1650 [on reverse] // William D. / Shepard, leg. (1♀ EMEC); TRINIDAD: 6.8 km S / Blanchisseuse / 8 VII 2005 80 ft [24 m] / Marianne River / 10°46'N 61°18'W / WDS-A-1652 [on reverse] // William D. / Shepard, leg. (1♂, 1♀ EMEC; 1♀ NHMUK; 1♀ USNM; 1♀ UWIZM); TRINIDAD: St. George / Co., Naranjo River / along Waterfall Rd. / 1 km NE Maracas / 10-VII-2005, C.B. Barr // 10°43.05' N / 61°24.42' W / elev. 350 ft. [107 m] (1♂ EMEC); TRINIDAD: 1.5 km E / of Valencia / 11 VII 2005 120 ft [37 m] / Caroni [Quare] River 10°39'N 61°15'W / WDS-A-1658 [on reverse] // William D. / Shepard, leg. (4♂, 1♀ EMEC; 1♂ NHMUK; 1♂ USNM; 3♂ UWIZM); TRINIDAD: St. Andrew / County, Quare [Caroni] River / at Valencia Road / 1.5 km E of Valencia / 11-VII-2005,



Figures 11–12. *Psephenops trini* new species, adult female and larva. 11) Adult female habitus, 3.85 mm long. a) Dorsal view. b) Ventral view. 12) Larva. a) Dorsal habitus. b) Ventral habitus.

C.B. Barr // 10°39.15' N / 61°11.44' W / elevation 120 ft. [37 m] (5♂ EMEC). **Tobago.** TOBAGO: 2.1 km NW / of Whim / 15 VII 2005 36 m / Courland River / 11°13'N 60°44'W / WDS-A-1662 [on reverse] // William D. / Shepard, leg. (1♂ EMEC); TOBAGO: Courland / River at Providence / Rd. 2 km NW Whim / 15-VII-2005, C.B. Barr // 11°12'54.7"N / 60°44'36.1"W (3♂ EMEC); TOBAGO: 1 km E of / Parlatuvier / 16 Vii 2005 / 11°17'N 60°39'W / WDS-A-1664 [on reverse] // William D. / Shepard, leg. (1♂ EMEC).

Other material examined (n = 3♂). **Trinidad.** TRINIDAD: St. Andrew / Co., Rio Seco at Toco / Main Rd. just E Salybia / 12-VII-2005, C.B. Barr // 10°42.4' N / 61°01.4' W / elevation 10 ft. [3 m] (1♂ EMEC, pinned, all legs missing,); TRINIDAD: 5.8 km W / of Blanchisseuse / 7 VII 2005 10 ft [3 m] / Yarra River / 10°48'N 61°21'W / WDS-A-1651 [on reverse] // William D. / Shepard, leg. (1♂ EMEC, in ethanol, damaged). **Tobago.** UCONHM 7424 / Arthropoda / Insecta / Coleoptera / Psephenidae / Psephenops / smithi / Delaford Cr. [Louis d'Or Nurseries], / Delaford, Tobago / 5/31/1996 / D. Bass (1♂ UCOCI, in ethanol).

Larval description (Fig. 12). Late instar. Body 5.0–6.0 mm long; oval, wider anteriorly; dorsally convex; dorsal color greenish-yellow laterally, yellow medially with brown mottling and pale anastomosing lines of brown cuticular beads; outer ½ of the body transparent; entire lateral margin fringed with hair-like, basally sclerotized setae; venter white to pale yellow except paratergites darker laterally. **Dorsally**, thoracic tergites form the anterior half of body; abdominal tergites I–IX form the posterior half of body. Pronotum to AB VII with paratergites; paratergites of AB VII clasping AB VIII and AB IX laterally; lateral margins of paratergites AB VII and AB IX forming a continuous margin. Pronotum to AB VII with tergopleural sutures; median longitudinal suture from pronotum to AB VII; pro- to metathorax with pairs of oblique sulci extending medially from tergopleural sutures; meso- and metathorax with pairs costal lines; AB I with a pair of short, oblique sulci extending from base to tergopleural sutures. Abdominal tergite VIII rectangular, 2.5× wider than long, apicolateral angles with a pair of spiracular tubercles; AB IX subrectangular, 1.6× wider than long, apical margin broadly arcuate.

Ventrally with head completely covered by pronotum; ecdysal line V-shaped, extending from base of head to antennal bases; frons with long seta at base of antenna. Antenna relatively long (*sensu* Lee et al. 2007: 9), reaching much of the way to body margin, with 3 antennomeres; antennomeres 1 and 2 elongate, slender, cylindrical, antennomere 3 peg-like; antennomere 1 longest with two thick subapical setae, antennomere 2 about ⅔ as long as 1 (5× longer than wide) with one very short apical seta, antennomere 3 minute, as long as width of antennomere 2 and as long as its apical seta. Eyespot consisting of a roughly circular cluster of stemmata. Clypeus apically deeply emarginate; labrum and labium covering mandibles; labrum apically truncate with marginal brush of short setae; maxillary palpus short, with 4 palpomeres, terminal palpomere very short; labial palpus short, with 3 palpomeres. Legs each with coxa long, about as long as trochanter + femur; femur narrowest basally, widest apically; tarsungulus shorter than femur, with one short, stout, blunt-tipped claw. Gills ventral, pectinate, 5 pairs on AB II–AB VI. AB IX with basal, oval operculum covering anus ⅓ width of ventrite.

Larval material examined. **Trinidad.** TRINIDAD: Asa / Wright Nat Ctr / 6 VII 2005 1210 ft [369 m] / Unnamed stream / 10°47'N 61°18'W / WDS-A-1648 [on reverse] // William D. / Shepard, leg. (1 EMEC); TRINIDAD: 6.8 km S / Blanchisseuse / 6 VII 2005 80 ft [24 m] / Marianne River / 10°46'N 61°18'W / WDS-A-1649 [on reverse] // William D. / Shepard, leg. (16 EMEC); TRINIDAD: St. George Co. / Marianne River 6.8 km / S of Blanchisseuse / 6-VII-2005, C. B. Barr // 10°45.9'N, 61°18.2'W / elevation 80 ft. [24 m] (3 EMEC); TRINIDAD: 6.8 km S / Blanchisseuse / 8 VII 2005 80 ft [24 m] / Marianne River / 10°46'N 61°18'W / WDS-A-1652 [on reverse] // William D. / Shepard, leg. (65 EMEC, 10 UWIZM); TRINIDAD: Blanchisseuse / 7 VII 2005 / WDS-A-1650 [on reverse] // William D. / Shepard (31 EMEC); TRINIDAD: 5.8 km W / of Blanchisseuse / 7 VII 2005 10 ft [3 m] / Yarra River / 10°48'N 61°21'W / WDS-A-1651 [on reverse] // William D. / Shepard, leg. (3 EMEC); TRINIDAD: St. George / Co., Yarra River at / No. Coast Rd. 5.8 km / W of Blanchisseuse / 7-VII-2005, C.B. Barr // 10°47.6'N, 61°20.8'W / elevation 10 ft. [3 m] (5 EMEC); TRINIDAD: 1 km uphill / Asa Wright Nat Ctr / 9 VII 2005 1360 ft [415 m] / upper Arima River / WDS-A-1653 [on reverse] // William D. / Shepard, leg. (2 EMEC); TRINIDAD: St. George / Co., Verdant Vale / 9 VII 2005 / Arima River 590 ft [180 m] / 10°41.58'N 61°17.57'W / WDS-A-1654 [on reverse] // William D. / Shepard, leg. (67 EMEC); TRINIDAD: St. George / Co., Arima River / at Verdant Vale / 9-VII-2005, C.B. Barr (1 EMEC); TRINIDAD: Asa Wright / Nature Center / 9 VII 2005 / upper Arima River / 10°43'N 61°18'W / WDS-A-1655 [on reverse] // William D. / Shepard, leg. (1 EMEC); TRINIDAD: 1 km NE /

of Maracas / 10 VII 2005 350 ft [107 m] / upper Maracas River / 10°43'N 61°25'W / WDS-A-1656 [on reverse] // William D. / Shepard, leg. (15 EMEC); TRINIDAD: St. George / Co., Naranjo River / Waterfall Rd. NE Maracas / 10-VII-2005, C.B. Barr // 10°43.05' N / 61°24.42' W / elev. 350 ft. [107 m] (1 EMEC); TRINIDAD: 1.5 km E / of Valencia / 11 VII 2005 120 ft [37 m] / Caroni [Quare] River / 10°39'N 61°15'W / WDS-A-1658 [on reverse] // William D. / Shepard (5 EMEC); TRINIDAD: 8.4 km E / of Valencia / 11 VII 2005 100 ft [35 m] / Oropuche River / 10°40'N 61°08'W / WDS-A-1659 [on reverse] // William D. / Shepard, leg. (1 EMEC). **Tobago.** TOBAGO: 2.5 km E / of Castara / 16 VII 2005 / unnamed stream / 11°17'N 60°41'W / WDS-A-1663 [on reverse] // William D. / Shepard (3 EMEC); TOBAGO: unnamed / stream at Northside Rd. / 2.5 km NE Castara / 16-VII-2005, C. B. Barr // 11°17'17.2" N / 60°40'52.4" W (1 EMEC).

Etymology. The trivial name, *trini*, is a Caribbean informal term for Trinidadians, the current inhabitants of Trinidad. It is a gender-neutral noun in apposition.

Distribution. Trinidad, Tobago, Trinidad and Tobago (country), West Indies (Fig. 1).

Habitat. *Psephenops trini* occurs in shallow streams and rivers with substrates composed of rocks, cobbles, gravel, and sand (Fig. 13–16). Larvae are found submerged on rocks, and adults are found on submerged or emergent parts of rocks and on vegetation closely overhanging streams. Larvae and/or adults have been collected at elevations of 3–415 m, the lower of which are close to the coast.



Figures 13–16. *Psephenops trini* new species, stream collection sites in Trinidad. **13)** Arima River at Verdant Vale, type locality. **14)** Quare/Caroni River near Valencia. **15)** Marianne River south of Blanchisseuse. **16)** Lower Marianne River east of Blanchisseuse.

Associated aquatic Dryopoidea. The following taxa were collected in some of the same streams as *P. trini*: Elmiidae: *Heterelmis simplex* Sharp, *Hexacylloepus smithi* (Grouvelle), *Macrelmis clypeata* (Hinton), *Microcyllloepus carinatus* Hinton, *Neoelmis pusio* Hinton, *Phanocerus congener* Grouvelle; Dryopidae: *Dryops* sp.

All of the above elmids were previously reported by Hinton (1971) from Trinidad and Tobago, and by Bass (2003) from Tobago. Hinton did not mention whether or not he also collected psephenids and dryopids during his fieldwork. The OMNH has one specimen from Trinidad identified as *Dryops aequinoxialis* Grouvelle (Dryopidae) in their Recent Invertebrates database.

Remarks. We found no other psephenids but *P. trini* on the islands of Trinidad and Tobago. During our sampling we collected adults at nine of the 30 streams sampled, and larvae at 12 of 30. Although Bass (2003) cited *P. smithi* from Tobago, we examined his adult male specimen and determined it to be *P. trini* rather than *P. smithi*. Records of *P. smithi* from Trinidad and Tobago that appear on the GBIF website also most likely represent *P. trini*.

***Psephenops robacki* (Spangler, 1966), new combination**

Psephenus robacki Spangler, 1966

(Fig. 17)

Type locality. PERU, Huánuco Region, Río Rondos near Tingo María.

Type material examined (photographic). Holotype female. Peru, nr. Tingo / Maria IX-29-55 / Río Rondos / S. S. Roback // *Psephenus* / N. SP. / det. PJSpangler // HOLOTYPE / *Psephenus* / robacki / P.J.Spangler [red label] [Fig. 17e].

Other material examined (n = 7). PERU: Madre de Dios / Manu / July 2005 547 m / Río Salvacion / 12°50'S 71°21'W / F. Montes & J. Chavez // *Psephenops* / robacki / W.D.Shepard (1♀, EMEC); PERU: Cusco Region / 3.7 km N Mamabamba / 13 IX 2013 1844 m / unnamed stream / S13°25.40' W70°54.13' / WDS-A-1925 [on reverse] // William D. / Shepard, leg. (3♀, EMEC); PERU: Cusco Region / 10.3 km NE San Miguel / 13 IX 2013 921 m / unnamed stream / S13°20.57' W70°51.54' / WDS-A-1926 [on reverse] // William D. / Shepard, leg. (1♂, 1♀, EMEC); PERU: Región Cusco / Que. [Quebrada] Cadena at Hwy. / 30C SW Vitobamba / -13.3423, -70.8584 / 3-VIII-2022, C.B.Barr (1♂, EMEC).

Distribution. Peru, South America.

Remarks. *Psephenus robacki* was described by Spangler (1966) from three female specimens from the Río Rondos near Tingo María, Peru (Huánuco Region). The holotype (Fig. 17) and one paratype are at the ANSP; one paratype is at the USNM. Spangler (1966) also described and illustrated a larva, *Psephenus* sp. larva 1, which was collected in association with adults of the species and assumed to be the larva of *P. robacki*. At the time, *Psephenops* was not yet known from South America, and because the type series is female, tarsal modifications particular to *Psephenops* males are absent. The species rightfully belongs to *Psephenops* rather than *Psephenus* based on the morphology of the holotype (Fig. 17) and Spangler's illustrations and description. Differences between females of the two genera include the shape and sculpturing of the pronotum, which in *Psephenops* is more angular laterally and is basally depressed adjacent to a glabrous, shiny median longitudinal carina. We therefore transfer *Psephenus robacki* Spangler to *Psephenops robacki* (Spangler) **new combination**.

We have collected associated male and female *Psephenops* from one stream in the Cusco Region, Peru, the females of which agree with the species description and the holotype images (Fig. 17) of *P. robacki*. At two other nearby sites, and one in the Madre de Dios Region, we collected either males or females. Our collection localities are quite far, roughly 700 km straight line distance, from the type locality. Although we think it likely that our specimens are *P. robacki*, we cannot be certain unless associated males and females are collected from the type locality. Alternatively, in the absence of males, DNA barcoding might link females from the type locality to males from other localities. Currently *P. robacki* is the only species of *Psephenops* known from Peru.

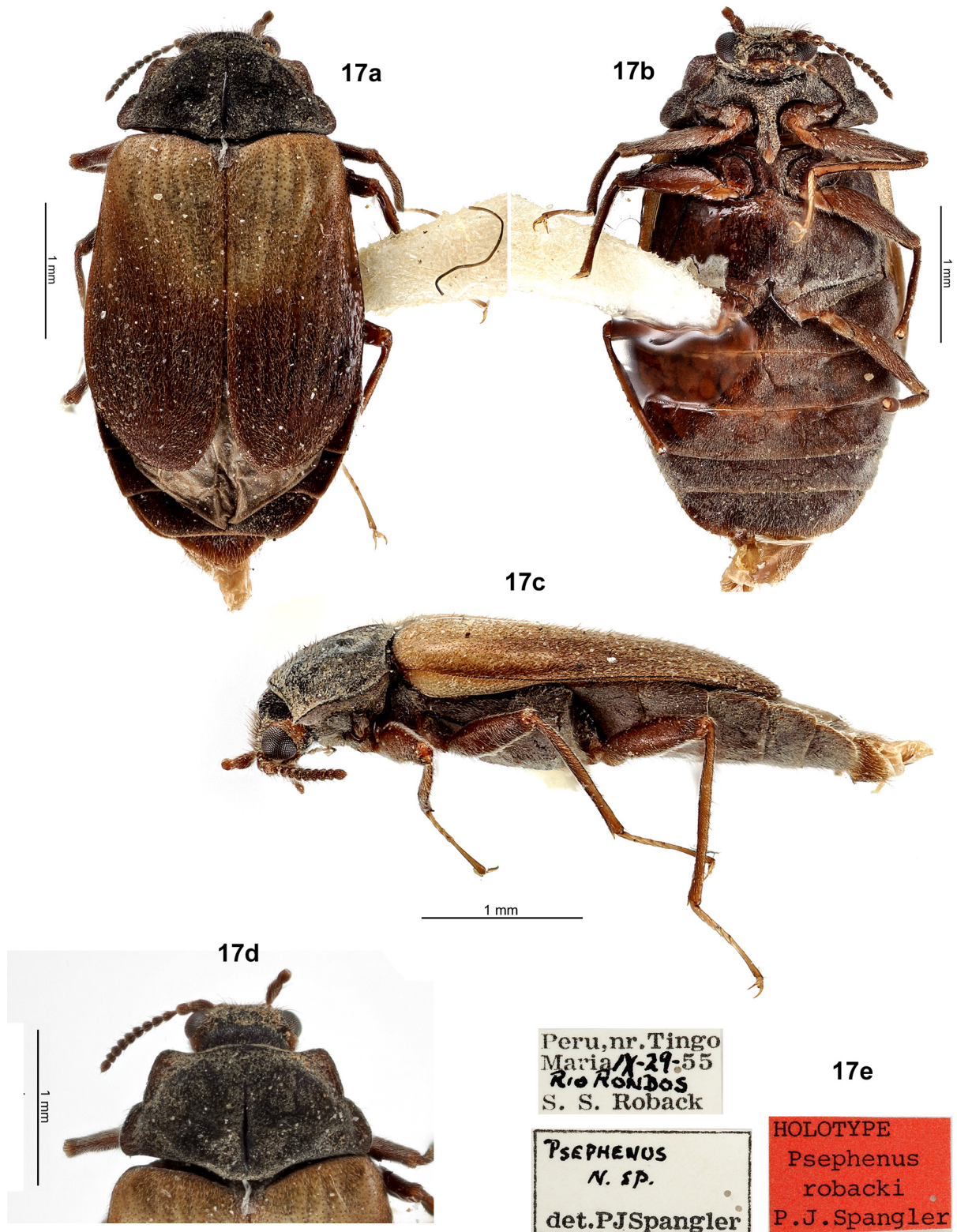


Figure 17. *Psephenops robacki* (Spangler) **new combination**, holotype adult female from Peru. **a)** Dorsal habitus. **b)** Ventral habitus. **c)** Lateral habitus. **d)** Head and pronotum. **e)** Specimen labels. Photographs courtesy of Karolyn Darrow, USNM.

Discussion

Adult male bias in psephenid descriptive taxonomy. The taxonomic literature on Psephenidae is heavily biased towards male specimens. This is due not only to the fact that males putatively have more diagnostic characters, but also because they are more often collected. Males and females are found in different stream microhabitats, and the males are more active and visible. The lack of morphological information about females is a taxonomic impediment that makes their identification difficult, if not impossible. Since we have only once found more than one species of any psephenine genus simultaneously in the same stream, we generally consider males and females collected together as conspecific. As illustrated by the case of *Psephenops smithi* and *Xexanchorinus latus*, secondary sexual dimorphism can lead to erroneous taxonomic conclusions. For these reasons, it is important to collect both male and female specimens whenever possible.

Males are usually on the emergent parts of rocks in a stream or river, on streamside grasses hanging in the water, or on sticks and leaf packs projecting out of the water. They fly readily when disturbed. Putting an aquatic net quickly on the downstream side of their perch and splashing water over them dislodges and washes them into the net. If they are not captured quickly, they will fly out of the net and escape. Females are more often on the submerged parts of rocks where they oviposit. Holding the net downstream of a rock, especially one that had males on it, and then dislodging it from the substrate, either washes the females into the net or exposes them on the wet surface where they can be easily collected. They are sluggish in contrast to the males, and even though they have fully developed flight wings, they are unlikely to escape.

Females are undescribed in half of the *Psephenops* species. If females are collected in conjunction with males, they should also be described. The female pronotum, in particular, merits careful taxonomic consideration. Its shape often varies between species, which can be useful in identifying female specimens. In addition, life history information can be gained if females are dissected to check for eggs, thereby helping to determine the reproductive period. Hopefully, future authors will not describe just the holotype male if associated females are available.

Larval descriptions are also scarce. In the case of *Psephenops*, only the larva of *P. robacki* (as *Psephenus robacki*) and *P. smithi guadeloupensis* were described prior to our description of the larva of *P. trini*. In general, psephenine larvae cannot be identified to genus on the basis of morphology, only to subfamily. However, in streams where adults of only one genus and species are present, describing associated larvae could provide valuable diagnostic information. Larvae are found submerged on rocks like the females.

Geology and island biogeography. That two similar species, *P. trini* and *P. smithi*, would be located in such close geographic proximity (145 km / 90 mi.), yet not overlap, might seem unlikely. Besides the fact that psephenids are weak, long-distance fliers and poor dispersers, this may be explained by the different ages of the islands and the local effects of plate tectonics. The islands of the southeastern West Indies just north of South America consists of two island arcs separated by a subduction zone. The eastward-moving Caribbean plate collides with and subducts the western edge of the North American plate. The islands to the west of the subduction zone are in the Lesser Antilles Island Arc (Bouysse et al. 1990), also called the West Indies Volcanic Arc (Pararas-Carayannis 2010), and are Cenozoic (66–0 MYBP). The volcanic Lesser Antilles are not connected to any continental shelf and likely have been isolated for 29–27 MYBP (Peck 2016). These islands extend from Grenada northward to Anguilla (Sombrero Island), east-southeast of Puerto Rico, and have numerous volcanos resulting from the subduction of the western edge of the North American plate. East of the subduction zone is the Barbados Ridge, a remnant of a Mesozoic (252–66 MYBP) island arc (Frost and Snoke 1989). Three islands remain on the Barbados Ridge—Barbados, Tobago and Trinidad (Speed 1981). Trinidad and Tobago are considered continental shelf islands. Trinidad once had a land connection to mainland South America, as well as to Tobago (Peck et al. 2002, Peck 2016.) See Peck (2016) for a detailed discussion of the geology and biogeography of the Lesser Antilles, and Peck et al. (2002) for a similar examination of Tobago and to a lesser extent, Trinidad.

It is premature to assume that *P. trini* is restricted to Trinidad and Tobago given the affinity of the islands with mainland South America. It is possible, if not likely, that the species also occurs in Venezuela where the Barbados Ridge approaches the continent, just 11 km (6.8 mi.) distant from Trinidad. The unidentified psephenine larvae reported in the literature from Dominica (Bass 2007) and Martinique (Bameul 2001), lying between

Guadeloupe and St. Vincent in the Lesser Antilles chain (Fig. 1), possibly represent populations of *P. smithi*, if not undescribed species. The distributions of these two species illustrates how much more there is to be learned about the psephenids of the Lesser Antilles, the nearby continental islands, and adjacent South America.

The current state of knowledge of the family Psephenidae in South America was summarized in Shepard and Barr (2023). In it, the Brazilian species of *Psephenus* were incorrectly referred to *Psephenops*, a *lapsus*. Instead, *Psephenus darwinii* Waterhouse, *P. brazilianus* Hinton, and *P. plaumanni* Hinton, belong to the genus *Pheneps*. *Psephenops trini* is the fourth species of *Psephenops* to be reported from South America (*P. robacki* is the third), and several other undescribed populations/species are known. With the addition of *P. trini* and the reassignment of *Psephenus robacki* to *Psephenops*, the number of valid *Psephenops* species now totals 15.

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