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**Revision of the New World  
Delphacid Planthopper  
Genus *Pissonotus*  
(Hemiptera: Fulgoroidea)**

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Front cover: Fig. 58. Dorsal view. *P. brunneus* Van Duzee (form b).

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## Abstract

The New World genus *Pissonotus* Van Duzee, 1897 is a member of the subfamily Delphacinae and the tribe Delphacini. *Pissonotus* contains 43 species, occurring from southern Canada to Argentina, including the Caribbean. A redescription of the genus is presented with illustrations and notes on morphology. All species are described and illustrated (dorsal view, frontal view, and male genitalia), and all available geographic and host plant records are presented. Most *Pissonotus* records are from host plants in the Asteraceae. Seven appendixes summarize patterns of geographic distribution.

In total, 9,091 *Pissonotus* specimens were examined (3,421 brachypterous and 573 macropterous males, 4,225 brachypterous and 872 macropterous females). Of the 43 species, 30 previously were included with the genus (*P. melanurus* Van Duzee, 1917 is elevated to species level), 2 are moved into *Pissonotus* from other genera, *P. neotropicus* (Muir, 1926) from *Phyllodinus* Van Duzee, 1897, and *P. abdominalis* (Crawford, 1914) from *Dicranotropis* Fieber, 1866 (as *D. bakeri abdominalis*); 11 are described as new by the 1st author (*P. boliviensis*, *P. brevistilus*, *P. canadensis*, *P. concolor*, *P. decussatus*, *P. divergens*, *P. festucae*, *P. jamaicensis*, *P. paraguayensis*, *P. radiolus*, and *P. spatulatus*); 3 are treated as new junior synonyms: *P. exiguus* Morgan and Beamer, 1949 = *P. frontalis* (Crawford, 1914); *Dicranotropis bakeri* Crawford, 1914 = *P. piceus* (Van Duzee, 1894b); *Delphacodes pictifrons* Osborn, 1938 = *P. piceus* (Van Duzee); and 9 are removed from *Pissonotus*, with new combinations as follows: *Euides belemensis* (Muir, 1926), *Euides brazilensis* (Muir, 1926), *Euides equadorensis* (Muir, 1926), *Euides megalostylus* (Muir, 1919) and *Terthron pylaon* (Kirkaldy, 1907). *Pissonotus absenta* Caldwell, 1951, *P. haywardi* Muir, 1929, *P. nigradorsum* Metcalf, 1923 and *P. substitua* (Walker, 1851) are considered unplaced within the Delphacini. Taxonomic keys to brachypterous males of all species, and to species within more limited geographic areas, are presented. Lectotypes are designated for 3 species: *P. crawfordi* Metcalf, 1923; *P. muiri* Metcalf, 1943; and *Phyllodinus koebelei* Osborn, 1903. A group of 4 species (*P. piceus*, *P. dentatus*, *P. abdominalis*, and *P. boliviensis*) is described as the *P. piceus* species complex.

## Introduction

The planthopper family Delphacidae (Hemiptera: Fulgoroidea) contains  $\approx$  2,000 species (Asche 1985, Wilson et al. 1994). Phylogenetically, the Delphacidae are placed near the base of the Fulgoroidea as the sister group to the Cixiidae, according to Asche (1987), or as the sister group to all other Fulgoroidea, except Tettigometridae, according to Emeljanov (1991). Asche (1990) divided the Delphacidae into 7 clades (the polyphyletic Asiracinae consisting of the tribes Ugyopini and Asiracini, and 5 monophyletic subfamilies; for review see Wilson et al. 1994), but Emeljanov (1996) recognized 3 subfamilies (Ugyopinae, Asiracinae, and Delphacinae) and 14 tribes. The genus *Pissonotus* Van Duzee, 1897, is a member of the Delphacinae, the largest and most advanced subfamily, and the tribe Delphacini, the largest delphacid tribe (1,090 species) (Asche and Remane 1982; Asche 1985, 1990; Wilson et al. 1994), according to both Asche (1990) and Emeljanov (1996). Phylogenetic relationships among the genera within the Delphacini have yet to be resolved. The genus *Pissonotus*, as defined here, is restricted to the New World.

Although little information is available on the ecology of *Pissonotus*, the genus is unusual among delphacids with respect to host plant preferences. Most delphacids feed on herbaceous monocots (Denno and Perfect 1994), but *Pissonotus* species feed primarily on dicots, especially Asteraceae, including some woody species (e.g., *Iva frutescens* L. and *Baccharis halimifolia* L.). *Pissonotus piceus* (Van Duzee, 1894b), however, has been confirmed to feed on *Polygonum* sp. (Polygonaceae) and *Ludwigia* sp. (Onagraceae) (Morgan and Beamer 1949). No species of *Pissonotus* is thought to be a significant economic pest, although *P. piceus* originally was described in association with celery (Van Duzee 1894b) and is here reported from celery, chard, and soybeans. Also, *P. binotatus* is recorded from soybeans, *P. dorsalis* from beets and carrots, *P. delicatus* and *P. albovenosus* from cotton, and *P. albovenosus* from radishes; however, some of these host records are likely to be spurious (see *Discussion*, p. 215). Species of *Pissonotus* have not been investigated with regard to the transmission of plant pathogens, but delphacids are known to vector more than 20 plant viruses (Nault 1994).

Members of the genus *Pissonotus* are characteristically brachypterous (Fig. 1), but macropters are known for most species. The uniform occurrence of

wing dimorphism in *Pissonotus* is of considerable interest because the evolutionary ecology and population dynamics of wing dimorphic delphacids has received notable attention in the recent past (e.g., Denno 1976, 1978; McCoy and Rey 1981; Denno et al. 1985, 1986, 1991; Denno and Roderick 1992; Döbel and Denno 1994; and many others). *Pissonotus* has been studied in the context of wing dimorphism (Denno 1978, McCoy and Rey 1981, Denno et al. 1991, Döbel and Denno 1994), although the majority of research has been conducted on *Prokelisia* Osborn, 1905, or on a variety of economic species. The general conclusions are that wing dimorphism is a life history strategy for planthoppers involving trade-offs between dispersal ability and reproductive output (reviewed in Denno 1993, 1994). Environmental factors (particularly crowding and host plant quality) during nymphal instars largely determines the wing form of the adult (e.g., Denno et al. 1985, 1986; Denno and Roderick 1992). A similar model probably holds for members of *Pissonotus*.

Although Wilson and Tsai (1991) have described the immature stages of *P. delicatus*, the immatures of other *Pissonotus* species are poorly known. Kosztarab et al. (1990) estimate that only 1% of North American delphacid nymphs have been described. The nymphal features of North American delphacids are not adequately known to present specific or generic identification features of immatures for *Pissonotus*.

This revision has 4 objectives as follows, (1) to correct ambiguities in the key and descriptions of *Pissonotus* by Morgan and Beamer (1949), (2) to apply the generic definition of Morgan and Beamer (1949) to the world fauna, (3) to address the suspicion that there were undescribed species in the genus, and (4) to present a phylogenetic analysis of the genus. The following treatment will aid identification of this genus and facilitate studies of plant-insect coevolution, wing dimorphism, life history, biology, behavior, and population ecology involving *Pissonotus*.

#### Previous Work

The generic name *Pissonotus* (from Greek: "pissa" = pitch (colored), + "noton" = back; a description of their general color) first appeared as a nomen nudum in a 1894 publication by Van Duzee listing the species of delphacids known from North America (Van Duzee 1894a). In this publication, he mentioned 6 species without giving descriptions (*P. aphidioides*, *P. ater*, *P. basalis*, *P. brunneus*, *P. dorsalis*, and *P. marginatus*). In 1895, *P. pallipes* was listed for Colorado (Gillette and Baker 1895). In 1897, Van Duzee published a generic description, and descriptions of 8 species (*P. aphidioides*, *P. ater*, *P. basalis*, *P. brunneus*, *P. delicatus*, *P. dorsalis*, *P. marginatus*, and *P. pallipes*). Spooner (1912) added 6 more species (*P. binotatus*, *P. divaricatus*, *P. foveatus*, *P. guttatus*, *P. piceus*, and *P. variegatus*). Crawford (1914) revised the New World delphacid fauna with keys to species. Crawford (1914) treated *Pissonotus* as a junior synonym of the primarily Old World genus *Dicranotropis* Fieber, 1866, erroneously synonymized *D. basalis* with *D. delicatus*, and described as new species *D. frontalis*, *D. bakeri*, and *D. bakeri abdominalis*. Van Duzee (1914a) re-

viewed and sharply criticized Crawford's treatment of the delphacids, noting that *Pissonotus* and *Dicranotropis* were distinct genera (Crawford's treatment of *Pissonotus* was listed as an error by Metcalf 1943: 267). Van Duzee (1914b) referred *Dicranotropis frontalis* Crawford to *Pissonotus*. Van Duzee (1916) transferred *Megamelus metzaria* Crawford, 1914, to *Pissonotus* and synonymized *Pissonotus foveatus* Spooner with *Stobaera quadripustulata* Van Duzee, 1909. Later, Van Duzee (1917b) described the subspecies *P. delicatus melanurus*. Muir (1917) moved *Delphax pylaon* Kirkaldy, 1907, to *Pissonotus*, and later (Muir 1919) described *Pissonotus megalostylus*. Van Duzee (1923) provided keys to the Fulgoroidea of Connecticut.

Metcalf (1923) produced keys to the delphacids of the eastern United States. He described 3 new species of *Pissonotus* (*P. nigridorsum*, *P. fulvus*, and *P. speciosus*, all redescribed by Metcalf in 1949), and transferred *Stobaera quadripustulata* Van Duzee, to *Pissonotus*, and *Pissonotus piceus* Spooner to *Phyllodinus* Van Duzee, 1897. Metcalf (1923) synonymized *Pissonotus variegatus* Spooner with *Pissonotus quadripustulatus* (Van Duzee), and erected *P. crawfordi* as a replacement name for the unavailable *Dicranotropis marginatus* Crawford, 1914 (see *Remarks* under *basalis*).

Muir and Giffard (1924) referred *Megamelus albicollis* Crawford, 1914, to *Pissonotus* and *Pissonotus metzaria* (Crawford, 1914) back to *Megamelus* Fieber, 1866. New species were described by Muir (1926: *Pissonotus brazilensis*, *P. equadorensis*, and *P. belemensis*; 1929: *P. haywardi*) and Van Duzee (1925: *P. giffardi*). Osborn (1929) listed *P. albovenosus* as a nomen nudum, but later (1935) described it along with *P. striolus*. Osborn (1938) provided keys to the Fulgoroidea of Ohio. Metcalf's catalog (1943) listed 27 species and 1 subspecies in *Pissonotus*, including *P. muiri* Metcalf, 1943, a new name for the unavailable name *P. albicollis* (Crawford, 1914) (see *Remarks* under *P. muiri*). Oman (1947) designated lectotypes for the early Van Duzee species, synonymized *P. pallipes* with *P. delicatus* and *P. basalis* with *P. marginatus*, and referred *Megamelus piceus* Van Duzee, 1894b, to *Pissonotus*.

In 1949, Morgan and Beamer revised the genera *Pissonotus*, *Phyllodinus* Van Duzee, 1897, and *Phyllodictus* Ball, 1926, for the fauna north of Mexico. Morgan and Beamer (1949) used male genitalia (Fig. 2) as the basis for generic recognition and provided keys to the species. In Morgan and Beamer's (1949) treatment, *Phyllodictus* was considered a subgenus of *Pissonotus*, with *Phyllodinus piceus* (Spooner, 1912) (a junior homonym, renamed *Pissonotus spooneri* Morgan and Beamer, 1949) transferred into the subgenus *Phyllodictus*. The subgeneric definitions were based on the presence (*Phyllodictus*; Figs. 4-6) or absence (*Pissonotus*; Fig. 3) of expanded front tibiae. *Phyllodictus* included the species *P. tessellatus* Ball, 1926 (type species of *Phyllodictus*), *P. nitens* (Van Duzee, 1909), and *P. flabellatus* (Ball, 1903). Morgan and Beamer (1949) synonymized *Pissonotus crawfordi* Metcalf with *P. basalis* Van Duzee (*basalis* was recognized as distinct), *giffardi* Van Duzee with *delicatus* Van Duzee, *fulvus* Metcalf with *piceus* (Van Duzee), *ater* Van Duzee with *marginatus* Van Duzee, *divaricatus* Spooner with *brunneus* Van Duzee, and *speciosus*

Metcalf with *Delphacodes andromeda* (Van Duzee, 1907), and referred *nigradorsum* to incertae sedis. Morgan and Beamer (1949) also described 12 new species (*P. agrestis*, *albivultus*, *aquilonius*, *dentatus*, *exiguus*, *lactofascius*, *merides*, *niger*, *nigriculus*, *paludosus*, *rubrilatus* and *tumidus*). Following Morgan and Beamer's (1949) treatment of *Pissonotus*, there were 7 species in the subgenus *Phyllodictus* (*aphidioides*, *basalis*, *flabellatus*, *nitens*, *spooneri*, *tessellatus* and *tumidus*) and 21 species and 1 subspecies in the subgenus *Pissonotus* north of Mexico.

Caldwell and Martorell (1951) synonymized *Pissonotus striolus* Osborn with *Euidella fasciatella* (Osborn, 1935) and described *Pissonotus absenta* Caldwell, 1951 (all species attributed to the first author), from Puerto Rico based only on hind legs and male genitalia. Beamer (1952) described *minutus* and, finally, Fennah (1967) referred *Delphax substitua* Walker, 1851, to *Pissonotus*.

Recently, Wilson and McPherson (1980a) presented a list and county records of the Fulgoroidea of southern Illinois; they (1980b) also presented keys to the fulgoroid species of Illinois. Furthermore, Wilson and McPherson (1980c) summarized the distribution of planthoppers in United States east of the Mississippi River. Arnett (1985) (reprinted 1993, 1997) incorrectly noted that there were 3 species of *Phyllodictus* and 19 species of *Pissonotus* in America north of Mexico (there were 28 species and 1 subspecies of *Pissonotus*, *Phyllodictus* is a junior synonym); Asche (1985: 303) listed *Pissonotus* as having 38 species worldwide.

Poole and Gentili (1996–1997) published a directory to the scientific names applied to all insect species in America north of Mexico (i.e., a species checklist including synonyms, homonyms, and unavailable names). They disclaimed the purpose of this directory (ICZN 1999, article 8.3; i.e., not intended for permanent scientific record), however, some comments on their listing are warranted. Poole and Gentili (1997) listed 31 species of *Pissonotus* (including *P. nigradorsum*), incorrectly including *Delphacodes andromeda* (Van Duzee, 1907). (They also incorrectly list the original combination and year of publication for *Delphacodes andromeda*). Additionally, they list *Pissonotus delicatus melanurus* Van Duzee, 1917 as a synonym of *P. delicatus* (subspecies were not recognized).

Prior to the present revision, the genus *Pissonotus* contained 37 species and 1 subspecies from the New World, plus *P. pylaon* from Taiwan and Australia and *P. nigradorsum*, incertae sedis.

### Revision of the Genus *Pissonotus*

This revision of *Pissonotus* covers the entire fauna, enhancing and expanding the generic concepts proposed by Morgan and Beamer (1949). All species are described in a consistent manner (including 11 new species), and keys are presented for all species. The descriptions of the new species are attributed to the first author. All recorded host and geographic records are presented (see Table 9, p. 217, and Appendices 1–7). The keys to species

include 1 treating all species (I), as well as 4 keys (II) to more limited geographic areas as follows: (A) eastern and central North America north of Mexico; (B) western North America north of Mexico; (C) the Caribbean; and (D) Mexico, Central, and South America. The 4 regional keys should suffice for most identifications, but the geographic limits of many species are not well established, and the key to all species will be required for some specimens. The keys are designed primarily for brachypterous males, but will permit the identification of some females or macropters.

The best generic and specific diagnostic features of *Pissonotus* are found in the male genitalia, and clearing of the male genitalia is usually necessary (see *Materials and Methods*). Macropters are usually larger than brachypters and are often darker, or at least with reduced white markings, with a larger mesothorax and conspicuous tegulae. Other features of macropters are similar to those of brachypters. Male macropters are identified most reliably by their genitalia.

Female genitalia have proven useful for delphacid identification (e.g., Heady and Wilson 1990), but interspecific differences among female structures in *Pissonotus* seem to be insufficient for distinguishing species. The identification of certain female specimens was problematic even based on coloration; these specimens were omitted from the reported material examined. Females are identified most reliably by associated males from the same collection series.

The first phylogenetic analysis of the genus is presented here. *Megamelus* Fieber, 1866, was used as the outgroup, but as noted earlier, phylogenetic relationships within the tribe Delphacini are unresolved. *Megamelus* was chosen because it resembles *Pissonotus* in the structure of the median carina of the frons and has median processes on the male pygofer. *Megamelus* also lacks an oviduct gland in the female, a character suggested as plesiomorphic in the Delphacini by Strübing (1956a, b) and further discussed by Asche and Remane (1982) and Asche (1985).

### Materials and Methods

Observations were made using a Leitz dissecting microscope at 8–144x magnification. Photographs were taken on a Wild M400 (125x) Photomakroskop, with a Wild MPS45 photoautomat, mostly at the highest magnification (32x). Photographs were taken with TMAX black and white, 100 speed, 35-mm film under the brightest light and smallest aperture setting that gave an exposure time of between 4 and 8 s. Illustrations were prepared with the aid of either a camera lucida mounted on a dissecting scope or a drawing tube on a Nikon compound scope. Most illustrations of the pygofer were made at 100x (except *P. minutus* at 144x, and *P. aquilonius*, *P. canadensis*, *P. concolor*, *P. dorsalis*, and *P. radiolus* at 64x). Most pygofer illustrations were made with reference to whole, pointed specimens. Three illustrations (Figs. 20, 25, 44) were prepared with reference to cleared genitalia. Clearing resulted in the anal segment rotating dorsally, such that the anal processes projected caudally into a position that is not normally observed in whole specimens. Illustrations of the aedeagus were made between 340 and 640x. Measurements were taken using a calibrated

ocular on a dissecting scope or by using the JAVA system (Jandel Scientific 1990), which projects an image from a dissecting scope onto a monitor to allow digital measurements. Measurements throughout this revision are presented in millimeters (mm).

A few measurements and ratios are reported within the descriptions. Appendices 8–11 summarize these and present additional measurements and ratios. These measurements are intended to replace descriptive phrases such as "vertex longer than wide" or "second antennal segment twice as long as first" that can be difficult to evaluate. They also provide characters to differentiate species in addition to those given in the keys, and provide a basis for morphometric discrimination (e.g., Dietrich et al. 1991), although the development of morphometric algorithms was beyond the scope of the current work. Measurements of males and females, macropters, and brachypters are reported separately. In the text descriptions, however, separate measurements for each gender and wing morph are reported only for body length. All other measurements are reported from brachypterous males, unless otherwise specified. A full listing of measurements taken is available in Appendices 8–11. These measurements take the following form: minimum–maximum (mean,  $n$ ); where  $n$  is the sample size. Where available, 5 individuals of each sex and wing morph were selected, and all measurements were taken only from these individuals. In the text descriptions, the sample size is 5 unless otherwise reported.

Measurements reported in the species descriptions are as follows (see also Appendices 8–11):

(1) body length: dorsal midline from the anterior margin of vertex to the abdominal apex, excluding the anal tube, and in macropters, the wings. For macropters, an additional measurement is given (total body length), which measures from the vertex to the apex of the wings; (2) length of antennal segment I; (3) length of antennal segment II; (4) antennal segment I/II ratio: a specimen-specific ratio of the lengths of antennal segment I divided by II; (5) calcar length: the maximum calcar length from base to apex; and (6) front tibia width: the maximum width of the front tibia.

Male genitalia were prepared using the methods of Wilson and McPherson (1980b), described briefly as follows: the entire abdomen (or distal half) was removed, cleared in a 10% solution of KOH for 8–16 h, rinsed in distilled water, transferred to glycerine, and the pygofer removed and examined. It often was necessary to push the aedeagus gently posteriorly to exert it for examination. The pygofer usually was left completely intact. When the aedeagus was illustrated, however, the aedeagus, parameres, anal segment, and associated connectives were removed as a single unit and temporarily mounted on a microscope slide in glycerine. Such temporary mounts rarely were necessary for routine observation. All the removed parts, including the remainder of the abdomen, were transferred to a microvial containing glycerine pinned beneath the specimen for long-term storage.

The DELTA computer program (Dallwitz 1980, Dallwitz et al. 1993) was used to organize and manipulate taxonomic data, including the output of PAUP data

sets (Swofford 1985, 1993) for phylogenetic analysis and natural language descriptions for modification into the species descriptions given below. INTKEY (Dallwitz and Paine 1996) was used to interrogate the data and investigate possibilities for key construction. PAUP version 3.1.1 (Swofford 1993) maximum parsimony analysis was used for the phylogenetic analyses. MacClade (Maddison and Maddison 1992) was used to create the tree graphics presented.

This treatment includes all synonymies but does not attempt to annotate every location where species of *Pissonotus* are mentioned in the literature. Further references to the older literature can be found in Metcalf (1943), although the most useful references are presented here. Synonymies other than original species descriptions are followed by the first reference where that species name was used. All observed spelling errors, or other lapsus calami, are noted in the synonymy and annotated as incorrect. The descriptions of species that we include in the genus *Pissonotus* are presented in the preferred phylogenetic sequence suggested by our cladistic analyses.

Labels of primary type specimens are quoted under material examined with each label quoted separately and a "/" used to designate breaks between lines. For all material examined, including primary types, the number of specimens, wing morph (b, = brachypter; m, = macropter), gender and acronym (see list below) for the collection where the specimen is located are given. Brachypterous males always were designated as holotypes for new species. Bartlett research numbers were assigned to specimens examined in greatest detail during the preparation of the descriptions. The research numbers were designated in the form 96–150a $\sigma$ , where "96" is the year, 150 the Julian day, a is an assigned consecutive letter, and  $\sigma$  is the specimen gender. Research numbers from other studies and information other than locality, date, collector, and host usually are not reported.

Distribution and host records were compiled primarily from specimen labels. Additional records not observed from specimen data are cited where appropriate. It is important to recognize that some host records may be sitting records from nonhost plants or spurious records resulting from sweeping a heterogenous assemblage of plants. Many are in need of independent confirmation, particularly when the host record is from solitary specimens or dispersal (macropterous) forms.

#### Material Examined

In total, 9,091 specimens (including primary types of all species) from 25 collections were examined (Table 1). These specimens consisted of 3,421 brachypterous males, 573 macropterous males, 4,225 brachypterous females, and 872 macropterous females for an overall sex ratio of 0.78 $\sigma$ :1 $\text{♀}$  and a brachypter/macropter ratio (b/m) of 1:0.19. The names of the various collections, institutions, or individuals from which specimens were borrowed are abbreviated as listed below. These acronyms follow Arnett et al. (1993), with the addition of Eastern Illinois University (EIUC) and Central Missouri State University (CMSV).



AMNH	American Museum of Natural History, New York, NY.
ANSP	Academy of Natural Sciences, Philadelphia, PA.
BMNH	The Natural History Museum, London, England.
BPBM	Bernice P. Bishop Museum, University of Hawaii, Honolulu.
CASC	California Academy of Sciences, San Francisco.
CMNH	Carnegie Museum of Natural History, Pittsburgh, PA.
CMSU	Central Missouri State University, Warrensburg (c/o S. W. Wilson).
CNCI	Canadian National Collection of Insects, Ottawa, Ontario.
CUIC	Cornell University Insect Collection, Ithaca, NY.
DENH	University of New Hampshire, Durham.
EIUC	Eastern Illinois University Collection, Charleston (c/o Michael Goodrich).
EMEC	Essig Museum, University of California, Berkeley.
FSCA	Florida State Collection of Arthropods, Gainesville.
INHS	Illinois Natural History Survey, Urbana.
ISUI	Iowa State University, Ames.
LOBC	Lois B. O'Brien Collection, Tallahassee, FL (affiliated with CASC: Arnett et al. 1993).
NCSU	North Carolina State University, Raleigh.
OSUC	Ohio State University Collection of Insects and Spiders, Columbus.
SEMC	Snow Entomological Museum, University of Kansas, Lawrence.
TAMU	Texas A&M University, College Station.
UCDC	University of California at Davis (Bohart Museum), Davis.
UDCC	University of Delaware Insect Reference Collection, Newark.
UMDC	University of Maryland, College Park (c/o R. F. Denno).
USNM	United States National Museum of Natural History, Smithsonian Institution, Washington, DC.
UVCC	University of Vermont, Burlington.

All of the specimens examined and identified with useful locality information, or from historically significant collections, are reported under *Material Examined* and compiled into Table 1. The names of nine especially prolific collectors are abbreviated under *Material Examined* as follows:

RHB	Raymond Hill Beamer
LDB	Lucy Dunbar Beamer
LOB	Lois B. O'Brien
COB	Charles W. O'Brien
L&COB	L. B. & C. W. O'Brien
GBM	G. B. Marshall
KAH	H. G. Andrew Hamilton
EDB	Elmer Darwin Ball
PWO	Paul Wilson Oman

Table 1. Number of *Pissonotus* specimens examined and reported by species

<i>Pissonotus</i> species	b♂	m♂	b♀	m♀
<i>abdominalis</i> (Crawford 1914)	7	30	13	6
<i>agrestis</i> Morgan & Beamer 1949	26		46	
<i>albivultus</i> Morgan & Beamer 1949	96	10	95	6
<i>albovenosus</i> Osborn 1935	202	89	389	78
<i>aphidioides</i> Van Duzee 1897	12	1	12	3
<i>aquilonius</i> Morgan & Beamer 1949	2		2	
<i>basalis</i> Van Duzee 1897	42		71	2
<i>binotatus</i> Spooner 1912	196	39	173	208
<i>boliviensis</i> Bartlett, n. sp.	24	4	64	43
<i>brevistilus</i> Bartlett, n. sp.	2		1	
<i>brunneus</i> Van Duzee 1897	284	33	381	59
<i>canadensis</i> Bartlett, n. sp.	6			
<i>concolor</i> Bartlett, n. sp.	3		2	
<i>decussatus</i> Bartlett, n. sp.	2		2	1
<i>delicatus</i> Van Duzee 1897	664	76	854	149
<i>dentatus</i> Morgan & Beamer 1949	181	19	72	17
<i>divergens</i> Bartlett, n. sp.	1	5	7	6
<i>dorsalis</i> Van Duzee 1897	82	10	82	5
<i>festucae</i> Bartlett, n. sp.	2		2	1
<i>flabellatus</i> (Ball 1902)	131	5	147	24
<i>frontalis</i> (Crawford 1914)	87	6	124	4
<i>guttatus</i> Spooner 1912	64	1	138	4
<i>jamaicensis</i> Bartlett, n. sp.	2		1	2
<i>lactofascius</i> Morgan & Beamer 1949	16		24	1
<i>marginatus</i> Van Duzee 1897	100		150	3
<i>melanurus</i> Van Duzee 1917	28		104	
<i>merides</i> Morgan & Beamer 1949	12		14	
<i>minutus</i> Beamer 1952	36		44	
<i>muiri</i> Metcalf 1943	23	7	39	6
<i>neotropicus</i> (Muir 1926)	11	7	21	4
<i>niger</i> Morgan & Beamer 1949	40		35	
<i>nigriculus</i> Morgan & Beamer 1949	65	1	85	1
<i>nitens</i> (Van Duzee 1909)	5		14	
<i>paludosus</i> Morgan & Beamer 1949	35		36	
<i>paraguayensis</i> Bartlett, n. sp.	2		4	
<i>piceus</i> (Van Duzee, 1894)	493	228	338	235
<i>quadripustulatus</i> (Van Duzee 1909)	240		463	3
<i>radiolus</i> Bartlett, n. sp.	3			
<i>rubrilatus</i> Morgan & Beamer 1949	24	1	9	1
<i>spatulatus</i> Bartlett, n. sp.	5	1	1	
<i>spooneri</i> Morgan & Beamer 1949	93		62	
<i>tessellatus</i> (Ball 1926)	66		95	
<i>tumidus</i> Morgan & Beamer 1949	6		9	
Totals:	3,421	573	4,225	872

Including types and tentatively placed specimens. b, brachypters; m, macropters.

The countries and states reported under *Material Examined* are organized geographically, generally from north to south and east to west.

### Notes on Morphology

Morphological terminology used here follows that of previous workers (e.g., Wilson and McPherson 1980b, Asche 1985). The term *tegmen* (plural *tegmina*) is used to describe brachypterous forewings (Fig. 1). For male genitalia (Fig. 2), the general term *parameres* is used (following Asche 1985) instead of genital styles. The pygofer of *Pissonotus* has 2 pairs of processes on the ventral margin of the posterior opening (Fig. 2), these are termed the lateral and median processes of the pygofer (following Fennah 1945, Morgan and Beamer 1949), although Metcalf (1949: 48–49) termed the median processes the *genital plate* and the lateral processes the *ventral angle*. Kershaw and Muir (1922: 208) claimed the median processes were homologous to the anterior gonapophyses. The term *anal processes* (*analrohr-fortsätze* of Asche 1985: 55) is used instead of *anal styles* to describe the ventrally projecting processes of abdominal segment X. The aedeagus of most species of *Pissonotus* has  $\geq 1$  dorsal, subapical, retrose processes that often are flattened and straplike (*titillators* sensu Nichols 1989). The term *titillator* was not used in association with these structures, however, because the implied function has not been established, and it has been suggested that the male parameres may serve functionally as titillators (Heady and Wilson 1990). In the descriptions, the term *retrose processes* always is used in association with these structures. In referring to a particular retrose process in this revision, the most distal retrose process is referred to as the 1st, the 2nd most distad as the 2nd, and so forth (Fig. 2). For further discussion of the genitalia of the Delphacidae, see Kershaw and Muir (1922), Fennah 1945, Ossiannilsson 1978, or Asche (1985, especially his pages 53–56 and figs. 9a, b; 10a, b).

The degree to which the front tibiae are expanded is an important key feature (Figs. 3–6), occasionally requiring measurement of the tibial width.

## Systematic Treatment

### Genus *Pissonotus* Van Duzee, 1897

*Pissonotus* Van Duzee 1897: 236. Type species: *P. marginatus* Van Duzee, 1897, by original designation.

*Pissonotus* Van Duzee, 1897: Fletcher and Gibson 1907: 102, Moore 1950a: 256, 1950b: 31 (incorrect subsequent spelling).

*Pissonotes* Van Duzee, 1897: Fenton 1918: 189 (incorrect subsequent spelling).

*Phyllodictus* Ball, 1926: 17. Type species: *P. tessellatus* Ball, 1926, by original designation. Genus synonymized by Morgan and Beamer (1949: 97).

**Recognition and Diagnosis.** Male genitalia symmetrical (Fig. 2), pygofer with ventral shelf from which arise characteristically short lateral and conspicuous median processes. Median processes usually simple (unbranched) and angular (or flattened) in cross-section and subequal to parameres. Parameres flattened, simple, usually cupped into medially directed apices. Aedeagus strongly flattened laterally (e.g., Fig. 7), usually with 1–5 dorsal retrose processes. Genital diaphragm weak. Anal segment with pair of simple well-developed processes, widely separated basally, arising from ventrolateral margins.

The combination of symmetrical male genitalia with angular or flattened median processes on the pygofer, a weak diaphragm, a strongly flattened aedeagus (usually with retrose processes), and the anal segment with a pair of well-developed processes, widely separated basally, should distinguish *Pissonotus* from all other delphacid genera.

**Description.** Usually brachypterous (Fig. 1). *Brachypter*. Length b♂ 1.40–3.50 mm, b♀: 1.50–3.60 mm, body very dark brown to light orangish or reddish brown (but *P. quadripustulatus* almost stramineous), often polished; with white or near-white transverse bands at epistomal margin of frons, caudal margin of pronotum and distal margin of tegmina (e.g., Fig. 72); but various combinations of these bands may be absent. Body usually of uniform dark brown coloration, but some species with a variety of whitish maculations, especially on frons or abdomen or both (e.g., Fig. 51).

**Head.** Narrower than pronotum. Frons only slightly narrowed between eyes, broad, somewhat rounded laterally, widest just below eyes. Median carina of frons usually weak and concolorous, forking on frons near ventral margin of eyes, carinal branches closely approximated; but in *P. albivultus* and 3 new species (*P. jamaicensis*, *P. decussatus*, and *P. brevistilus*) stronger (Figs. 85–88), paler than frons, forked near frons–vertex inflection. Vertex subquadrate, usually slightly longer than wide, slightly (*P. piceus* species complex) or not at all projected in front of eyes, with rounded frontal inflection. Face and vertex uniformly colored (e.g., Fig. 59) or marked with paler maculations (e.g., Fig. 51), occasionally extensively marked (e.g., some *P. albovenosus* specimens). Sharply contrasting whitish band on frons along epistomal suture usually present (e.g., Fig. 72), following subgenal suture laterally, often widening behind genal carinae (*wangenkiel* of Ashe 1985: 30) and reaching base of coxae; sometimes reduced or obsolete. Postclypeus dark chestnut-brown (except *P. nitens*, Fig. 76, and rare specimens of *P. delicatus*, *P. piceus*, and apparently *P. paraguayensis*), immaculate, anteclypeus usually paler. Antennae with scape and pedicel (segments I and II) usually subequal, 2 to several times longer than wide, pedicel with distinct sensory fields; usually terete in cross-section but often flattened in *P. tessellatus* and *P. quadripustulatus*.

**Thorax.** Pronotum with lateral carinae not reaching caudal margin, either terminating (parallel apically) or following eyes laterally. Pronotum often with posterior whitish band (e.g., Fig. 72), reduced or obsolete in some species. Tegmina brown or brownish, often with white band on distal margin (e.g., Fig. 72); veins usually concolorous with membrane, becoming obsolete in white band; venation completely obsolete in some specimens; in a few species veins conspicuous and contrasting (e.g., *P. albovenosus*, *P. frontalis*, *P. brunneus*, Figs. 51, 52, and 58), venation usually normal, but reticulate in *P. tessellatus* (Fig. 53) and many specimens of *P. quadripustulatus*. Tegminal veins often with small seta-bearing tubercles on veins of tegmina, tubercles reduced with tegminal venation.

**Legs.** Tibiae quadrate and stramineous to brown (Fig. 3, formerly subgenus *Pissonotus*) or front and middle tibiae expanded (middle tibiae to lesser degree), brown, with indistinct carinae (Figs. 4–6, formerly subgenus *Phyllodictus*). Calcar flattened, moderately foliaceous, falcate in cross-section (more expanded and foliaceous in *P. piceus* species complex, reminiscent of *Megamelus*); usually with 6–14 (up to 18 in *P. piceus* species complex) black-tipped teeth on posterior margin, alternate teeth usually smaller, slightly offset and prone to obsolescence.

**Abdomen.** Usually uniformly colored, some species with dorsolateral maculations (e.g., Fig. 58b), a broad middorsal stripe (e.g., Fig. 64), or both (e.g., Fig. 51). Dorsolateral maculate roundish or elongate and often raised, stramineous to white, usually as follows: 1 sublaterally per side on segment V, 2 on VI (arranged transversely), 3 on VII, and 2 on VIII. If broad dorsal stripe present, usually uniformly wide, occupying entire dorsal half of abdomen, but width may vary (especially in *P. abdominalis*).

**Macropter.** Often darker and larger than brachypter with reduced markings. Mesothorax of macropter more robust than brachypter, with stramineous markings (if any) reduced or obsolete and with distinct tegulae. Pronotum often narrower than in brachypter. Wings clear, brownish near base in some species, with light brown veins bearing inconspicuous seta-bearing tubercles. Some species with seta-bearing tubercles, and some with brown spot near apex of claval vein on trailing edge of forewing.

**Male Genitalia.** Symmetrical (Fig. 2), pygofer subcylindrical or cyphosomatic in cross-section, with ventral shelf from which arise short lateral (long in *P. aphidioides*, Fig. 12) and conspicuous median processes, directed caudally or dorsocaudally (parallel with parameres). Pygofer never with inflated appearance of *Megamelus*. Lateral processes may be obsolete, but median processes always present, usually simple (except *P. nitens* with caudal flange, Fig. 33) and parallel, with an angular base regularly tapering to sharply acute apices; or strongly flattened in transverse plane (e.g., Fig. 17), parallel or slightly converging, with rounded apices and on some species lateral shelves. Parameres flattened, widest near middle, cupped forward into medially or dorsally directed apices; often tightly oppressed to median processes, sometimes with median, rounded, subapical tooth (but not branched as in *Euides* Fieber, 1866). Genital diaphragm always weak, rarely lightly sclerotized dorsally and bearing median bilabiate structure.

Aedeagus strongly flattened laterally, usually with 1–5 (none in *P. albivultus*, *P. aphidioides*, *P. brunneus*, and *P. spooneri*; *P. agrestis* may have more) long, rather flattened and straplike, usually simple, dorsal subapical retrose processes (e.g., Fig. 7), most distad usually strongest, sometimes with stout tooth (e.g., *P. piceus* species complex, Figs. 77–80) or bifid (*P. delicatus*, Fig. 47).

Anal segment with pair of simple, ventrally directed processes extending from dorsolateral margins, widely separated basally, often very long (e.g., *P. marginatus*, *P. dorsalis*, Figs. 21, 22), extending laterad of parameres with distal apices often resting behind lateral processes or in excavation laterad of lateral processes, finely serrulate ventrally in some species.

**Remarks.** The characteristic coloration of *Pissonotus* can be used for recognition at the generic level, although it is not a good technical feature. Particularly helpful for generic recognition is the dark, chestnut-brown postclypeus contrasting with the whitish epistomal margin of the frons; but exceptions exist, and only features of the male genitalia (noted in the diagnosis) are fully reliable for identification. The paired median processes of the male pygofer of *Pissonotus* are an unusual feature within the Delphacini. Within the New World Delphacini, only *Megamelus* and *Perkinsiella* Kirkaldy, 1903, have these processes.

The genus *Megamelus* is the most similar to *Pissonotus*, and its members can have generally similar coloration. *Megamelus* has a male pygofer with a unique lobed appearance (Beamer 1955: 29) and the median processes are cylindrical in cross-section, whereas *Pissonotus* has angular or flattened median processes. *Megamelus* also generally has a produced vertex, a frons narrowed between the eyes, and a large, many-toothed calcar; all features that

are unusual for *Pissonotus*, found only in some of the *P. piceus* species complex.

The genus *Perkinsiella* is represented in the New World only by *Perkinsiella saccharicida* Kirkaldy, 1903, the type species of the genus, recently introduced to the United States (Sosa 1985, Meagher et al. 1991, White et al. 1995). *Perkinsiella saccharicida* is a large planthopper (brachypters 4.0 mm, macropters 5.0–5.9 mm; Kirkaldy 1906), found principally on sugarcane. *Perkinsiella* bears little resemblance to *Pissonotus* in terms of coloration, but has some comparable structural features. Members of *Perkinsiella* differ from *Pissonotus* in having a well-developed genital diaphragm, a rounded aedeagus, and anal processes arising ventrad of the dorsolateral margin of the anal segment (upcurved in *P. saccharicida*).

Other New World genera that superficially resemble *Pissonotus* might include *Phyllodinus* Van Duzee, 1897; *Achorotile* Fieber, 1866; *Laccocera* Van Duzee, 1897; *Stobaera* Stål, 1866; *Euides* Fieber, 1866; and some species currently placed in *Delphacodes* Fieber, 1866. All of these genera lack the median processes of the pygofer and usually have a rounded aedeagus and a strong genital diaphragm. *Phyllodinus* is superficially very similar to *Pissonotus*. Other than the male genitalia, *Phyllodinus* differs from *Pissonotus* in having its head wider than the pronotum (narrower in *Pissonotus*). *Laccocera* and *Achorotile* both have distinct pits on the frons, notum, and abdominal dorsum (Penner 1945, Beamer 1954, Scudder 1963, Anufriev and Emeljanov 1981). Members of *Stobaera* are generally pale-colored, with strongly flattened antennae and veins of forewings with conspicuous dark setae-bearing pustules (Kramer 1973).

Historically, some confusion has existed among species of *Pissonotus* and species currently in *Euides* Fieber, 1866. Members of *Euides* have a strong genital diaphragm, characteristically have branched parameres, and never have median pygofer processes. Most species of *Euides* are uniformly brownish orange in color.

Some species currently placed in the large, polyphyletic genus *Delphacodes* Fieber, 1866, also resemble *Pissonotus* (e.g., *Delphacodes andromeda* (Van Duzee, 1907); *D. livida* Beamer, 1948a; *D. dentipennis* Beamer, 1948b; *D. sucinea* Beamer, 1948c; and others). (Asche (1985: 292) noted that *Delphacodes* s.s. contains only 10 Palearctic species.) None of the New World species currently placed in *Delphacodes* s.l. has median pygofer processes; most species do have a well-developed genital diaphragm and a terete aedeagus. *Delphacodes andromeda*, in particular, approaches *Pissonotus* in coloration, but has a pale postclypeus.

### I. Key to Species of the New World Genus *Pissonotus* (brachypterous males)

1. Front tibiae flattened and expanded laterally (width 0.12–0.33 mm; Figs. 4–6) ..... 2
- 1'. Front tibiae not expanded (width 0.06–0.10 mm; Fig. 3) ..... 9

- 2(1). Frons maculated (spotted; Figs. 53–56) ..... 3
- 2'. Frons immaculate (e.g., Figs. 57, 74–76) ..... 6
- 3(2). Tegmina with white transverse band on distal margin (Fig. 56), veins not reaching distal margin. Widespread, eastern & central US ..... *P. flabellatus* (Ball)
- 3'. Tegmina without white transverse band on distal margin (Figs. 53–55), veins reaching distal margin ..... 4
- 4(3'). Venation reticulate (Fig. 53); body length (b♂) 1.75–2.25 mm; front tibiae 0.15–0.22 mm wide (Fig. 6). Southeastern US ..... *P. tessellatus* (Ball)
- 4'. Venation normal (Figs. 54–55); body length (b♂) 2.35–2.90 mm; front tibiae 0.12–0.16 mm wide (similar to Figs. 4, 5). Northeastern US & southeastern Canada ..... 5
- 5(4'). Tegminal veins pale (Fig. 55); lateral processes of male pygofer very large, subequal to parameres (Fig. 12) ..... *P. aphidioides* Van Duzee
- 5'. Tegminal veins dark (Fig. 54); lateral processes less than half length of parameres (Fig. 11) ..... *P. tumidus* Morgan & Beamer
- 6(2). Frons with transverse white band on epistomal margin (Figs. 57, 75) ..... 7
- 6'. Frons unicolorous (Figs. 74, 76) ..... 8
- 7(6). Tegmina with complete white distal transverse band (Fig. 75); veins concolorous with membrane; vertex and frons coloration similar. Northeastern US ..... *P. spooneri* Morgan & Beamer
- 7'. Tegmina with vestigial transverse band distally (Fig. 57); veins paler than membrane; vertex and dorsum of frons paler. South America ..... *P. neotropicus* (Muir)
- 8(6'). Front tibiae 0.22–0.33 mm wide (similar to Fig. 6); postclypeus and frons concolorous (Fig. 76); median processes of pygofer angular with dorsally and ventrally directed caudal flange (Fig. 33). Southeastern US ..... *P. nitens* (Van Duzee)
- 8'. Front tibiae 0.12–0.15 mm wide (Fig. 4); postclypeus much darker than frons (Fig. 74); median processes broad, flattened, with small lateral shelves (Fig. 31). Northeastern US & southeastern Canada ..... *P. basalis* (Van Duzee)
- 9(1'). Frons maculated (spotted; e.g., Figs. 50–52); tegmina without distal transverse white band, venation pale ..... 10
- 9'. Frons immaculate (e.g., Figs. 70–73); tegmina variable, usually with venation concolorous with membrane ..... 12

- 10(9). Body stramineus, dorsum of abdominal segment VI with 4 conspicuous, dark colored, transversely arranged tubercles (Fig. 50); antennal segment I often flattened. Southeastern US & eastern Mexico ..... *P. quadripustulatus* (Van Duzee)
- 10'. Abdomen with pale maculations, without dark tubercles (Figs. 51, 52); antennae terete. Widespread ..... 11
- 11(10). Vertex with 2 dark, round maculations in foveae (Fig. 52); median processes broad, strongly flattened with rounded apices (Fig. 9). West coast US & British Columbia ..... *P. frontalis* (Crawford)
- 11'. Vertex without round, dark maculations (Fig. 51); median processes angular (Fig. 8) with acute apices. Widespread North America & Greater Antilles ..... *P. albovenosus* Osborn
- 12(9'). Frons and vertex with carinae distinctly and conspicuously pale for entire length (Figs. 86–89); distal margin of tegmina and usually pronotum with transverse white band; veins concolorous with tegmina ..... 13
- 12'. Frons with median carina concolorous for most of length, usually inconspicuous (e.g., Figs. 70–73); other features variable ..... 17
- 13(12). Median processes strongly convergent (Figs. 44, 45) ..... 14
- 13'. Median processes parallel or nearly so (Figs. 42, 43, 46) ..... 15
- 14(13). Median processes closely approximated basally (Fig. 44), crossing in basal third; apices of parameres directed medially. Mexico & Guatemala ..... *P. decussatus* Bartlett, n. sp.
- 14'. Median processes widely separated basally, nearly meeting apically (Fig. 45); apices of parameres strongly hooked, directed ventrally. Southeastern US, Mexico, & Central America ..... *P. albivultus* Morgan & Beamer
- 15(13). Median processes short, 1/4 length of parameres (Fig. 43). Mexico ... ..... *P. brevistilus* Bartlett, n. sp.
- 15'. Median processes at least 1/2 length of parameres (Figs. 42, 46) ... 16
- 16(15'). Aedeagus with 3 retrose processes, distal retrose process with large lateral tooth (Fig. 42); paramere apices dorsally directed; pronotum and mesonotum with carinae conspicuous and pale (Fig. 86). Jamaica ..... *P. jamaicensis* Bartlett, n. sp.
- 16'. Aedeagus with 5 simple retrose processes (Fig. 46); paramere apices medially directed; pronotum and mesonotum with concolorous carinae, at least in part (Fig. 90b). Southeastern US & Bermuda. .... *P. binotatus* Spooner (dark form)

- 17(12). Tegminal veins reaching distal margin (e.g., Figs. 58–63), without white transverse distal band ..... 18
- 17'. Tegminal veins obsolete before reaching distal margin (e.g., Figs. 70–73), with white transverse distal band (e.g., Fig. 1; if band incomplete, e.g. Fig. 79, go to couplet 25; band may be absent in females) ..... 25
- 18(17). Tegminal veins pale (Fig. 58); male pygofer with small median tooth just ventrad of median processes; aedeagus without retrose processes, with series of paired dorsal teeth (Fig. 14). Widespread Eastern US & northern Mexico ..... *P. brunneus* Van Duzee
- 18'. Tegminal veins concolorous with membrane (e.g., Figs. 59–63); pygofer without small median tooth; aedeagus usually with retrose processes (e.g., Figs. 16–19) ..... 19
- 19(18). Median processes broad, strongly flattened with lateral shelves, apices rounded and usually slightly convergent (Figs. 17, 18); anal processes very long, exceeding base of median processes; antennal segment I dark brown; body dark pitchy brown (Fig. 60, 61) ..... 20
- 19'. Median processes angular without lateral shelves, apices sharply acute (Figs. 16, 19, 20 or 49; but if flattened with dorsally directed lateral projections, Fig. 37 and stramineus antennae, go to couplet 21); anal processes usually shorter, reaching base of median processes; antennae and body color variable ..... 21
- 20(19). Pygofer bearing very large, ventral flap with 4 rounded lobes (Fig. 18). Northeastern & central US, adjacent Canada ..... *P. niger* Morgan & Beamer
- 20'. Pygofer without ventral flap, but with ventral C-shaped ridge at base of median processes (Fig. 17). Florida, Texas ..... *P. nigriculus* Morgan & Beamer
- 21(19). Median processes convergent apically; anal processes very long and fine, exceeding base of median processes (Fig. 19, 20) ..... 22
- 21'. Median processes parallel, divergent, or weakly convergent; anal processes not exceeding base of median processes (Figs. 16, 37, 49) ..... 23
- 22(21). Body reddish brown (Fig. 62); antennae brown; retrose processes short and fine (Fig. 19). Northwestern US & adjacent Canada ..... *P. rubrilatus* Morgan & Beamer
- 22'. Body very dark brown (Fig. 63); antennae stramineus; retrose processes of varying lengths, the most distad short and broad (Fig. 20) ..... *P. concolor* Bartlett, n. sp. (dark form)

- 23(21). Apices of median processes divergent (Fig. 16). Southern & central US  
..... *P. divergens* Bartlett, n. sp.
- 23'. Median processes not strongly divergent, usually nearly parallel  
(Fig. 37, 49). South America ..... 24
- 24(23). Antennae stramineus; vertex slightly produced in front of  
eyes, concolorous with dorsal portion of frons; median processes  
usually broad, strongly flattened with dorsally directed lateral  
projections (Fig. 37; but often medially reduced); aedeagus with  
1-3 retrose processes, the most distad with large lateral tooth.  
Bolivia, Brazil, Uruguay, Argentina .....  
..... *P. boliviensis* Bartlett, n. sp. (some)
- 24'. Antennae stramineus with dark longitudinal anterior highlight; vertex  
not produced, often paler than frons; median processes slightly  
flattened with acute apices (Fig. 49); aedeagus with 5 short, simple  
processes. Paraguay, Brazil, ?Bolivia) .....  
..... *P. paraguayensis* Bartlett, n. sp. (some)
- 25(17). Median processes short, approximately 1/3 height of parameres  
or less (Figs. 34, 41, 47, 48) ..... 26
- 25'. Median processes at least 1/2 height of parameres (e.g., Figs.  
36, 46) ..... 29
- 26(25). Apices of parameres expanded and blunt (spatulate, Fig. 41);  
caudal margin of pronotum usually with narrow white transverse band  
(Fig. 85); very dark brown species. Mexico, California  
..... *P. spatulatus* Bartlett, n. sp.
- 26'. Apices of parameres not expanded, either rounded and medially  
directed (Figs. 47, 48) or blunt and dorsally directed (Fig. 34); caudal  
margin of pronotum without white caudal band (Figs. 78, 91, 92);  
body color variable ..... 27
- 27(26). Abdomen usually with broad middorsal band of varying width  
(Fig. 78); antennae stramineus; vertex slightly produced in front  
of eyes, calcar teeth 13-16. Mexico, Central America, &  
Hispaniola ..... *P. abdominalis* (Crawford)
- 27'. Abdomen immaculate dorsally (Figs. 91, 92); antennal segment I  
usually dark brown, II paler with brown anterior highlight; vertex  
not produced anteriorly; calcar teeth 8-13 ..... 28
- 28(27). Aedeagus with distal process bifid (Fig. 47); coloration variable  
but head and body usually brownish orange (Fig. 91); common  
and widespread. North America (especially Western) &  
Jamaica ..... *P. delicatus* Van Duzee
- 28'. Aedeagus with distal process broadly flattened and bladelike

- (Fig. 48); body dark brown (Fig. 92), head and dorsum of pronotum  
usually much paler. California. .... *P. melanurus* Van Duzee
- 29(25). Caudal margin of pronotum with conspicuous white transverse  
band (e.g., Figs. 70-73); vertex not at all produced in front of eyes;  
calcar teeth 6-12 ..... 30
- 29'. Pronotum nearly unicolorous or paler dorsally (e.g., Figs. 64, 65,  
82, 83), if with narrow white band (some *P. piceus*) then vertex slightly  
produced and calcar teeth 13-18 ..... 36
- 30(29). Body brownish orange with head and usually pronotum nearly black,  
strongly contrasting (Fig. 72); median processes convergent apically;  
aedeagus with 2-3 short, simple retrose processes (Fig. 28).  
Central & eastern US ..... *P. guttatus* Spooner
- 30'. Head and body not strongly contrasting as above (e.g., Figs. 70, 72,  
73); other features variable ..... 31
- 31(30). Pygofer with small median tooth just ventrad of median processes  
(Fig. 30; best viewed laterally on cleared pygofer); antennae stramineus;  
body usually very dark brown with head (except postclypeus) paler  
(Fig. 73) Central America ..... *P. muiri* Metcalf
- 31'. Pygofer without small median tooth; antennae color variable; head  
and body of similar coloration (e.g., Figs. 68-70, 72, 84) ..... 32
- 32(31). Parameres broad, flattened with diagonally truncate or curled  
apices (Figs. 25, 26); antennae stramineus ..... 33
- 32'. Parameres angular with acute apices (e.g., Fig. 27); antennal segment  
I usually dark brown ..... 34
- 33(32). Aedeagus with 2 long and 2 short retrose processes (Fig. 25); apices of  
parameres curled. Wisconsin ..... *P. aquilonius* Morgan & Beamer
- 33'. Aedeagus with 2 retrose processes (Fig. 26); distal process broadly  
flattened; apices of parameres diagonally truncate. Southeastern  
US ..... *P. paludosus* Morgan & Beamer
- 34(32). Frons with very narrow or obsolete white band on epistomal  
margin (Fig. 70); body length (b) 1.85-2.20 mm; aedeagus  
(Fig. 27) without lateral flange or lateral retrose process. Southeastern  
US ..... *P. merides* Morgan & Beamer
- 34'. Frons with conspicuous white band on epistomal margin (Figs. 72, 84);  
aedeagus with lateral flange of processes (Fig. 29) or retrose  
process (Fig. 40) ..... 35
- 35(34). Small species, body length (b♂) 1.70-2.00 mm; aedeagus with  
lateral flange of 6-10 processes (Fig. 29) and 5-10 closely set retrose

- processes (but proximal retrose processes may be reduced to teeth). Florida, Georgia, & Connecticut ..... *P. agrestis* Morgan & Beamer
- 35'. Large species, body length (b♂) 2.60 mm; aedeagus without lateral flange of processes; retrose processes 3, most proximad lateral (Fig. 40). Mexico (?Puerto Rico, Arizona) ... *P. festucae* Bartlett, n. sp.
- 36(29). Antennal segment I dark brown ..... 37
- 36'. Antennal segment I stramineus ..... 39
- 37(36). Median processes about half as long as parameres (Fig. 46); body color variable, usually brownish orange (Fig. 90); antennal segment II stramineus with brown longitudinal anterior highlight. South & Central US, Bermuda ..... *P. binotatus* Spooner (most)
- 37'. Median processes as long as or longer than parameres (Figs. 38, 39); body color very dark brown (Figs. 82, 83); antennal segment II antennae dark, without brown anterior highlight. Southwestern US ..... 38
- 38(37). Aedeagus with 3-4 slender, fine, short retrose processes (Fig. 39); legs mostly brown; body length (b♂) 1.46-1.53 mm. Arizona ..... *P. minutus* Beamer
- 38'. Aedeagus with 4-5 retrose processes, most distad expanded and simple, second expanded and bifid near apex (Fig. 38); legs often stramineus; body length (b♂) 1.70-1.96 mm. Colorado, Wyoming, New Mexico, Arizona ..... *P. lactofascius* Morgan & Beamer
- 39(36). Median processes convergent apically (Figs. 20, 21, 23, 24) ..... 40
- 39'. Median processes parallel or divergent (Figs. 22, 35, 36, 37, 49) ..... 43
- 40(39). Aedeagus with 1 retrose process (Figs. 23, 24); abdomen without broad pale middorsal band (Figs. 66, 67). Southeastern & central Canada ..... 41
- 40'. Aedeagus with 4-5 retrose processes (Figs. 20, 21); abdomen variable, usually with broad pale middorsal band (Fig. 64). Southeastern Canada, northeastern US and mountains to North Carolina ..... 42
- 41(40). Anal processes short, reaching midlength of median processes (Fig. 23); pygofer without small midventral tooth ..... *P. radiolus* Bartlett, n. sp.
- 41'. Anal processes very long, exceeding base of median processes (Fig. 24); pygofer with small midventral tooth (best viewed laterally on cleared pygofer) ..... *P. canadensis* Bartlett, n. sp.
- 42(40). Abdomen with broad, pale middorsal band (Fig. 64); aedeagus

- with crenate hump proximad of midlength (Fig. 21) ..... *P. dorsalis* Van Duzee
- 42'. Abdomen immaculate (similar to Fig. 67); aedeagus without crenate hump (Fig. 20) ..... *P. concolor* Bartlett, n. sp. (pale form)
- 43(39). Median processes divergent at apices (Fig. 22); anal processes very long and fine, conspicuous and arcuate in lateral view; lateral margins of pygofer opening with posteriorly directed lobe (Fig. 22, lateral view). Widespread eastern US & Canada ..... *P. marginatus* Van Duzee
- 43'. Median processes parallel or nearly so (Figs. 35, 36, 37, 49), anal processes straight, shorter and mostly hidden in lateral view; margins of pygofer opening without lobes (similar to Fig. 23, lateral view) ..... 44
- 44(43). Parameres apices acute and medially directed (Fig. 49); tegmina with distal white transverse band (Fig. 77); antennae with brown anterior highlight. Paraguay, Brazil, ? Bolivia ..... *P. paraguayensis* Bartlett, n. sp. (some)
- 44'. Paramere apices blunt and dorsally directed (Figs. 35, 36, 37; may converge slightly); tegmina with distal white transverse band weak or incomplete medially (e.g. Figs. 79, 80); antennae without brown anterior highlight ..... 45
- 45(44). Aedeagus with 1-3 retrose processes (Fig. 37); median processes usually broad, strongly flattened with lateral dorsally directed processes, but often medially reduced and laterally enhanced. Bolivia, Brazil, Uruguay, Argentina ..... *P. boliviensis* Bartlett, n. sp. (some)
- 45'. Aedeagus with 3-4 retrose processes (Figs. 35, 36); median processes angular; not as above ..... 46
- 46(45). Aedeagus with 2-3 small, paired lateral teeth in row near apex (Fig. 35); vertex little or not produced in front of eyes; body length (b♂) 1.85-2.25 mm; calcar teeth 10-13; color characteristically brownish orange (Fig. 79). Mostly Greater Antilles & Florida (also North Carolina, Illinois) ..... *P. dentatus* Morgan & Beamer
- 46'. Aedeagus without teeth near apex (Fig. 36); vertex produced in front of eyes; body length (b♂) 2.20-2.35 mm; calcar teeth 13-18; color usually dark brown but highly variable (Fig. 80). Eastern & central US (also Montana), Mexico, Central America, Greater Antilles ..... *P. piceus* (Van Duzee)

## II. Keys to *Pissonotus* Species of Various Regions

### A. Key to *Pissonotus* Species of Eastern and Central United States and Canada (brachypterous males)

1. Front tibiae flattened and expanded laterally (width 0.12–0.33 mm; Figs. 4–6) ..... 2
- 1'. Front tibiae not expanded (width 0.06–0.10 mm; Fig. 3) ..... 8
- 2(1). Frons maculated (spotted; Figs. 53–56) ..... 3
- 2'. Frons immaculate, with or without white transverse band on epistomal margin (Figs. 74–76) ..... 6
- 3(2). Tegmina with white transverse band on distal margin (Fig. 56); veins not reaching distal margin. Widespread, eastern & central US ..... *P. flabellatus* (Ball)
- 3'. Tegmina without white transverse band on distal margin (Figs. 53–55); veins reaching distal margin ..... 4
- 4(3'). Venation reticulate (Figs. 53); body length (b♂) 1.75–2.25 mm; front tibiae 0.15–0.22 mm wide (Fig. 6). Southeastern US, Ohio ..... *P. tessellatus* (Ball)
- 4'. Venation normal (Figs. 54–55); body length (b♂) 2.35–2.90 mm; front tibiae 0.12–0.16 mm wide (similar to Figs. 4, 5). Northeastern US, southeastern Canada ..... 5
- 5(4'). Tegminal veins pale (Fig. 55); male pygofer with lateral processes very large, subequal to parameres (Fig. 12) ..... *P. aphidioides* Van Duzee
- 5'. Tegminal veins dark (Fig. 54); lateral processes less than half length of parameres (Fig. 11) ..... *P. tumidus* Morgan & Beamer
- 6(2'). Frons with distinct transverse white band on epistomal margin (Fig. 75). Northeastern & central US ..... *P. spooneri* Morgan & Beamer
- 6'. Frons unicolorous (Figs. 74, 76) ..... 7
- 7(6'). Front tibiae greatly expanded, 0.22–0.33 mm wide (similar to Fig. 6); post-clypeus and frons concolorous (Fig. 76); pygofer with median processes angular with dorsally and ventrally directed caudal flange. Southeastern US ..... *P. nitens* (Van Duzee)
- 7'. Front tibiae slightly expanded, 0.12–0.15 mm wide (Fig. 4); postclypeus much darker than frons (Fig. 74); median processes broad, flattened with small lateral shelves (Fig. 31). Northeastern US & southeastern Canada ..... *P. basalis* (Van Duzee)

- 8(1). Frons maculated (spotted; e.g., Figs. 50–51); tegminal veins pale, without distal white transverse band ..... 9
- 8'. Frons immaculate, epistomal margin may have white transverse band (e.g., Figs. 70–73); tegmina variable, usually with concolorous venation ..... 10
- 9(8). Body stramineous; dorsum of abdominal segment VI with 4 conspicuous, dark colored, transversely arranged tubercles (Fig. 50); antennal segment I often flattened. Southeastern US ..... *P. quadripustulatus* (Van Duzee)
- 9'. Abdomen with pale maculations, without dark tubercles (Fig. 51); antennae terete. Widespread ..... *P. albovenosus* Osborn
- 10(8'). Tegmina without white distal transverse band, veins reaching distal margin (e.g., Figs. 58–63); epistomal margin of frons with white transverse band weak or obsolete; body usually very dark brown ..... 11
- 10'. Tegmina with white distal transverse band, veins obsolete before reaching distal margin (e.g., Figs. 70–72; if band incomplete, go to couplet 14, band may be absent in females); frons and body color variable ..... 15
- 11(10). Tegminal veins pale (Fig. 58); male pygofer with small median tooth just ventrad of median processes (Fig. 14); aedeagus without retrose processes, with series of paired dorsal teeth. Widespread, eastern US ..... *P. brunneus* Van Duzee
- 11'. Tegminal veins concolorous with membrane (Fig. 59–63); pygofer without small median tooth; aedeagus usually with retrose processes ..... 12
- 12(11'). Median processes broad, strongly flattened with lateral shelves and rounded apices (Figs. 17, 18); anal processes very long, exceeding base of median processes; antennal segment I dark brown ..... 13
- 12'. Median processes angular, without lateral shelves; apices convergent and sharply acute (Fig. 20), or divergent (Fig. 16); anal processes usually just reaching base of median processes; antennae stramineous ..... 14
- 13(12). Male pygofer bearing very large, ventral flap with 4 rounded lobes (Fig. 18). Northeastern & central US, adjacent Canada ..... *P. niger* Morgan & Beamer
- 13'. Male pygofer without ventral flap, but with ventral C-shaped ridge at base of median processes (Fig. 17). Florida, Texas ..... *P. nigriculus* Morgan & Beamer



- 14(12). Median processes strongly convergent apically (Fig. 20). Eastern US ..... *P. concolor* Bartlett, n. sp. (dark form)
- 14'. Median processes divergent apically (Fig. 16). Central US .....  
..... *P. divergens* Bartlett, n. sp.
- 15(10). Body brownish orange, with head and usually pronotum nearly black, strongly contrasting (Fig. 71); median processes convergent (Fig. 28); aedeagus with 2-3 short, simple retrose processes. Central & eastern US ..... *P. guttatus* Spooner
- 15'. Head and body not strongly contrasting as above (e.g., Figs. 70, 72, 89, 91); other features variable ..... 16
- 16(15). Frons and vertex brown with very conspicuous pale carinae (Fig. 89); median processes widely separated basally, strongly convergent to nearly meet apically (Fig. 45); paramere apices hooked, directed ventrally; antennal segment I dark brown. Southeastern US .....  
..... *P. albivultus* Morgan & Beamer
- 16'. Frons and vertex with carinae inconspicuous, concolorous at least in part (e.g., Figs. 64, 65, 70, 72, 80, 91); median processes and parameres not as above; antennal color variable ..... 17
- 17(16). Median processes strongly convergent apically (Figs. 20, 21, 23, 24); most species (except *P. radiolus*) with very long anal processes; exceeding base of median processes; antennae stramineus; frons with epistomal margin paler but well-developed white transverse band absent (e.g., Figs. 64, 66, 67) ..... 18
- 17'. Median processes parallel or slightly convergent apically (e.g., Figs. 22, 36, 45); anal processes usually shorter (except *P. marginatus*); antennae and frons coloration variable (e.g., Figs. 65, 80, 91) ..... 21
- 18(17). Aedeagus with 1 long retrose process (Figs. 23, 24). Southeastern Canada ..... 19
- 18'. Aedeagus with 4-5 retrose processes (Figs. 20, 21) ..... 20
- 19(18). Anal processes short, just exceeding apices of parameres (Fig. 23) ..... *P. radiolus* Bartlett, n. sp.
- 19'. Anal processes very long, exceeding base of parameres (Fig. 24) ..... *P. canadensis* Bartlett, n. sp.
- 20(18). Abdomen with broad middorsal band (Fig. 64); aedeagus with distal retrose process fine, second retrose process long and expanded with lateral tooth, abruptly narrowed beyond midpoint (Fig. 21); aedeagus with serrate or crenate dorsal hump proximad of midpoint. Northeastern US, southeastern Canada ..... *P. dorsalis* Van Duzee
- 20'. Abdomen immaculate (similar to Fig. 67); aedeagus with 4 simple retrose

- processes (Fig. 20), apical retrose process short and expanded, second narrow; aedeagus without dorsal hump near midpoint .....  
..... *P. concolor* Bartlett, n. sp. (pale form)
- 21(17). Median processes conspicuously flattened with diagonally truncate (Fig. 26) or curled (Fig. 25) apices; very dark brown species with conspicuous white transverse bands distally of tegmina and caudally on pronotum (Figs. 68, 69); antennae and legs usually stramineus ..... 22
- 21'. Median processes angular; other features variable (e.g., Figs. 70, 72, 80, 91) ..... 23
- 22(21). Aedeagus with 2 retrose processes (Fig. 26); apices of median processes diagonally truncate. Southeastern US ..... *P. paludosus* Morgan & Beamer
- 22'. Aedeagus with 2 long and 2 short retrose processes (Fig. 25); apices of parameres curled. Wisconsin. .... *P. aquilonius* Morgan & Beamer
- 23(21). Median processes 1/3 height of parameres or less (Fig. 47); aedeagus with distal retrose process bifid; antennae usually with I dark brown; II stramineus with brown anterior longitudinal highlight; body color usually brownish orange (Fig. 91). Common and widespread, especially western North America ..... *P. delicatus* Van Duzee
- 23'. Median processes at least 1/2 height of parameres (e.g., Figs. 36, 46); aedeagus with distal retrose process never bifid; simple or with lateral tooth; other features variable, color usually dark brown (e.g., Figs. 70, 71, 80, 90) ..... 24
- 24(23). Pronotum caudally and tegmina distally with conspicuous white transverse bands (Figs. 70, 72); antennal segment I usually dark brown; body color always very dark brown ..... 25
- 24'. Pronotum without white caudal transverse band (e.g., Figs. 65, 80, 90); tegmina with white distal transverse band variable; antennal segment I often stramineus; body color variable ..... 26
- 25(24). Epistomal margin of frons with white transverse band conspicuous; aedeagus with lateral flange of 6-10 closely set processes (Figs. 29) and 5-10 closely set retrose processes (but proximal retrose processes may be reduced to teeth). Florida, Georgia, Connecticut ..... *P. agrestis* Morgan & Beamer
- 25'. Epistomal margin of frons with white transverse band nearly obsolete; aedeagus without lateral flange of processes; with 3 retrose processes (Fig. 27) ..... *P. merides* Morgan & Beamer
- 26(24). Anal processes very long, arcuate, much exceeding bases of median processes (Fig. 22); pygofer with large caudally directed lobes on

- lateral margin of opening; aedeagus with 1 retrose process; female without white apical transverse bands on tegmina (Fig. 65). Eastern US, southeastern Canada ..... *P. marginatus* Van Duzee
- 26'. Anal processes reaching or just exceeding base of median processes (Figs. 36, 35, 36); pygofer without caudally directed lateral lobes; aedeagus with 4-5 retrose processes; body coloration highly variable (e.g., Fig. 80, 90) ..... 27
- 27(26'). Antennal segment I dark brown, II usually paler with brown anterior longitudinal highlight; aedeagus with 4-5 simple retrose processes (Fig. 46); median processes with apices directed medially, acute or rounded ..... *P. binotatus* Spooner
- 27'. Antennae stramineous; aedeagus with 4 retrose processes, most distal with lateral tooth (Figs. 35, 36); median processes with apices blunt and directed dorsally ..... 28
- 28(27'). Aedeagus with 2-3 small, paired lateral teeth in row near apex (Fig. 35); frons rounded in front of eyes, vertex little or not produced in front of eyes; body length (b♂) 1.85-2.25 mm; calcar teeth 10-13; color characteristically brownish orange (Fig. 79). Mostly Florida; also North Carolina, Illinois ..... *P. dentatus* Morgan & Beamer
- 28'. Aedeagus without lateral teeth near apex (Fig. 26); vertex produced in front of eyes; body length (b♂) 2.20-2.35 mm; calcar teeth 13-18; color usually dark brown but highly variable (Fig. 80). Eastern & central US, Montana ..... *P. piceus* (Van Duzee)

**B. Key to *Pissonotus* Species of Western  
United States and Canada  
(brachypterous males)**

1. Front tibiae flattened and expanded laterally (width 0.12-0.26 mm; Figs. 4, 5). Mostly Central & eastern US, adjacent Canada ..... 2
- 1'. Front tibiae not expanded (width 0.06-0.10 mm; Fig. 3) ..... 3
- 2(1). Frons maculated (spotted; Fig. 56); front tibiae 0.19-0.26 mm (similar to Fig. 5). Widespread, eastern US & Texas, likely west ..... *P. flabellatus* (Ball)
- 2'. Frons immaculate (Fig. 74); front tibiae 0.12-0.15 mm (Fig. 4). Eastern US, Idaho, Nebraska, adjacent Canada ..... *P. basalis* Van Duzee
- 3(1'). Frons maculated (spotted; Figs. 51, 52); tegminal veins white, reaching distal margin; tegmina without white transverse band ..... 4
- 3'. Frons immaculate, may have white transverse band on epistomal margin (e.g., Fig. 1); tegmina variable ..... 5

- 4(3). Vertex with pair of brown round spots in foveae (Fig. 52); male pygofer with median processes broad, strongly flattened with rounded apices (Fig. 9); aedeagus with 4 retrose processes. West coast US, Canada (British Columbia) ..... *P. frontalis* (Crawford)
- 4'. Vertex without spots in foveae in vertex (Fig. 51); median processes angular (Fig. 8), apices acute; aedeagus with 2 retrose processes. Widespread ..... *P. albovenosus* Osborn
- 5(3'). Tegminal veins reaching distal margin (e.g., Figs. 58, 59, 61, 62); without white transverse apical band; dark brown species ..... 6
- 5'. Tegminal veins not extending to distal margin (e.g., Figs. 82, 83, 91, 92); with white transverse apical band (similar to Fig. 1; band may be incomplete); body color variable ..... 9
- 6(5). Tegminal veins paler than membrane (Fig. 58); male pygofer with small median tooth just ventrad of median processes (Fig. 14). Central & eastern US ..... *P. brunneus* Van Duzee
- 6'. Tegminal veins concolorous with membrane (Figs. 59, 61, 62); male pygofer without small median tooth (large flap may be present) ..... 7
- 7(6'). Pygofer bearing very large, ventral flap with 4 rounded lobes (Fig. 18); median processes broad, flattened with rounded apices; aedeagus with 1-2 short retrose processes. Mostly northeastern & central US, adjacent Canada; also South Dakota, ? Montana .....  
..... *P. niger* Morgan & Beamer
- 7'. Pygofer without large ventral flap (Figs. 16, 19); median processes angular; aedeagus with 2 or 4 long retrose processes ..... 8
- 8(7'). Body color reddish brown (Fig. 62); median processes slightly convergent (Fig. 19); aedeagus with 2 long retrose processes. Colorado, Wyoming, Idaho; Canada (British Columbia) .....  
..... *P. rubrilatus* Morgan & Beamer
- 8'. Body very dark brown (Fig. 59); median processes divergent apically (Fig. 16); aedeagus with 4 apical processes. Kansas, New Mexico, ? Colorado, ? Texas ..... *P. divergens* Bartlett, n. sp.
- 9(5'). Median processes 1/3 length of parameres or less (Figs. 41, 47, 48) ..... 10
- 9'. Median processes at least 1/2 length of parameres (e.g., Figs. 36, 46) ..... 12
- 10(9). Apices of parameres expanded and blunt (spatulate; Fig. 41); dorsally directed; body very dark brown (Fig. 85); pronotum dark brown usually with narrow white posterior band. California .... *P. spatulatus* Bartlett, n. sp.

- 10'. Apices of parameres narrowed, acute and medially directed (Figs. 47, 48) or blunt and parallel-sided (Figs. 34); body color variable (Figs. 91, 92); pronotum without posterior caudal white band ..... 11
- 11 (10'). Aedeagus with distal retrose process bifid (Fig. 47); body usually brownish orange (Fig. 91). Common and widespread, especially western North America ..... *P. delicatus* Van Duzee
- 11'. Aedeagus with distal retrose process broadly flattened and bladelike (Fig. 48); body dark brown with head paler (except postclypeus) and pronotum white dorsally (Fig. 92). California ..... *P. melanurus* Van Duzee
- 12 (9'). Antennal segment I dark brown ..... 13
- 12'. Antennae stramineus throughout ..... 15
- 13 (12). Pronotum and epistomal margin of frons with transverse white band; large species (Fig. 84); body length (b♂) 2.60 mm. Mexico, Arizona ...  
..... *P. festucae* Bartlett, n. sp.
- 13'. Pronotum and frons without white bands (Figs. 82, 83); small species body length (b♂) 1.45–2.00 mm ..... 13
- 14 (13'). Aedeagus with 3–4 slender, fine, and relatively short retrose processes (Fig. 39); legs mostly brown. Arizona ..... *P. minutus* Beamer
- 14'. Aedeagus with 4–5 retrose processes, most distad expanded, second expanded and bifid near apex (Fig. 38); legs often stramineus. Colorado, Wyoming, New Mexico, Arizona ..... *P. lactofascius* Morgan & Beamer
- 15 (12'). Body brownish orange with head and usually pronotum strongly contrasting, very dark brown (Fig. 71); aedeagus with 2–3 very short simple retrose processes (Fig. 28). Central & eastern US, likely west  
..... *P. guttatus* Spooner
- 15'. Head and body not strongly contrasting (e.g., Figs. 65, 80); usually dark brown; aedeagus with 1 (Fig. 22) or 4–5 (Fig. 36) long retrose processes. Widespread ..... 16
- 16 (15'). Aedeagus with 1 long retrose process; pygofer with large caudally directed lobes on lateral margins of opening (directed medially on some specimens); anal processes very long, arcuate, much exceeding base of median processes (Fig. 22); vertex not produced (Fig. 65). Eastern & central US, Canada, possibly west ..... *P. marginatus* Van Duzee
- 16'. Aedeagus with 4–5 retrose processes, most distad with large lateral tooth; anal processes reaching, or just exceeding, base of median processes (Fig. 36); vertex produced in front of eyes (Fig. 80); pygofer without lateral lobes. Eastern & central US, Montana ..... *P. piceus* (Van Duzee)

C. Key to *Pissonotus* Species of the Caribbean  
(brachypterous males)

1. Front tibiae flattened and expanded laterally (Figs. 4, 5)  
..... *P. nitens* (Van Duzee)
- 1'. Front tibiae not expanded (Fig. 3) ..... 2
- 2 (1). Tegminal veins paler than membrane, reaching caudal margin (Figs. 51, 58); distal margin of tegmina without transverse band ..... 3
- 2'. Tegminal veins concolorous with membrane, veins becoming obsolete in distal white transverse band (e.g., Figs. 80, 86, 90, 91) ..... 4
- 3 (2). Frons maculated (Fig. 51) ..... *P. albovenosus* Osborn
- 3'. Frons immaculate (Fig. 58) ..... *P. brunneus* Van Duzee
- 4 (2'). Frons with conspicuous pale carinae (Fig. 86) .....  
..... *P. jamaicensis* Bartlett, n. sp.
- 4'. Frons and carinae concolorous (e.g., Figs. 80, 90, 91) ..... 5
- 5 (4'). Male pygofer with median processes 1/3 height of parameres or less (Fig. 34, 47) ..... 6
- Median processes at least 1/2 height of parameres (Figs. 35, 36, 46) 7
- 6 (5). Aedeagus with 1–2 retrose processes, distal retrose process bifid (Fig. 47); paramere apices rounded and medially directed; abdomen dorsally immaculate (Fig. 91) ..... *P. delicatus* Van Duzee
- 6'. Aedeagus with 3 retrose processes, distal retrose process toothed laterally (Fig. 34); paramere apices blunt and dorsally directed; abdomen usually with broad middorsal pale stripe of varying width (Fig. 78).  
..... *P. abdominalis* (Crawford)
- 7 (5'). Antennal segment I dark brown ..... 8
- 7'. Antenna stramineus ..... 9
- 8 (7). Body length (b♂) 2.60 mm; dark brown species with white transverse bands at apices of tegmina, caudal margin of pronotum and epistomal margin of frons (Fig. 84) ..... *P. festucae* Bartlett, n. sp.
- 8'. Body length (b♂) 1.68–1.92 mm; body color variable, pronotum unicolorous, frons without white band on epistomal margin (Fig. 90)  
..... *P. binotatus* Spooner
- 9 (7'). Aedeagus with 2–3 small, paired lateral teeth in row near apex (Fig. 35); frons rounded in front of eyes, vertex little or not produced cephalad; body length (b♂) 1.85–2.25 mm, calcar teeth 10–13; color characteristically brownish orange (Fig. 79) ..... *P. dentatus* Morgan & Beamer

- 9'. Aedeagus without lateral teeth near apex (Fig. 36); vertex produced in front of eyes; body length (b♂) 2.20–2.35 mm; calcar teeth 13–18; color usually dark brown but highly variable (Fig. 80).  
..... *P. piceus* (Van Duzee)

**D. Key to *Pissonotus* Species of Mexico,  
Central and South America  
(brachypterous males)**

1. Front tibiae flattened and expanded laterally (width 0.13–0.18 mm; Fig. 5). South America ..... *P. neotropicus* (Muir)
- 1'. Front tibiae not expanded (width 0.06–0.10 mm; Fig. 3) ..... 2
- 2(1). Frons maculated (spotted; Fig. 51); tegminal veins white, reaching distal margin, tegmina without white transverse band. Mexico .....  
..... *P. albovenosus* Osborn
- 2'. Frons immaculate, epistomal margin may have white transverse band (e.g., Figs. 77, 81, 88); tegmina variable, veins usually concolorous with membrane ..... 3
- 3(2). Frons and vertex with carinae distinctly and conspicuously pale for entire length (Figs. 87–89); distal margin of tegmina and usually caudal margin of pronotum with white transverse band; tegminal veins concolorous with membrane ..... 4
- 3'. Frons with carinae concolorous for most of length, usually inconspicuous (e.g., Figs. 73, 77, 78, 81); other features variable ..... 6
- 4(3). Median processes of male pygofer parallel, 1/4 as long as parameres (Fig. 43). Mexico ..... *P. brevistilus* Bartlett, n. sp.
- 4'. Median processes strongly convergent, at least 1/2 length parameres (Figs. 44, 45) ..... 5
- 5(4). Median processes closely approximated basally, crossing in basal third (Fig. 44); apices of parameres directed medially. Mexico, Guatemala ..  
..... *P. decussatus* Bartlett, n. sp.
- 5'. Median processes widely separated basally, nearly meeting apically (Fig. 45); apices of parameres strongly hooked, directed ventrally. Mexico & Central America ..... *P. albivultus* Morgan & Beamer
- 6(3). Median processes 1/3 length of parameres or shorter (Figs. 34, 41, 47) ..... 7
- 6'. Median processes at least 1/2 length of parameres (Figs. 30, 35, 36, 37, 40, 49) ..... 9
- 7(6). Parameres with apices expanded and blunt (spatulate; Fig. 41); aedeagus with 3 retrose processes, most distad with short lateral branch; body

- dark brown (Fig. 85); tegmina with white apical transverse band. Mexico  
..... *P. spatulatus* Bartlett, n. sp.
- 7'. Apices of parameres narrowed, acute and medially directed (Fig. 47), or blunt and parallel-sided (Fig. 34); aedeagus not as above; body color variable (e.g., Figs. 78, 91). Widespread ..... 8
- 8(7'). Aedeagus with 1–2 retrose processes, most distad bifurcate near midlength (Fig. 47); parameres cupped with apices directed medially; body usually brownish orange (Fig. 91; sometimes darker); antennae usually with segment I dark brown; body length 1.81–2.62 mm. Common and widespread, US & adjacent Canada, northern Mexico ..  
..... *P. delicatus* Van Duzee
- 8'. Aedeagus with 3 retrose processes, most distad with large lateral tooth near midpoint (Fig. 34); parameres with apices dorsally directed; body dark brown variously and usually extensively marked with stramineus (Fig. 78); antennae stramineus; body length 2.25–3.10 mm. Mexico & Central America ..... *P. abdominalis* (Crawford)
- 9(6'). Antennal segment I dark brown; body dark brown with white transverse bands on epistomal margin of frons, caudally on pronotum, and on distal margin of tegmina (Fig. 84); body length (b♂) 2.60 mm. Mexico ..... *P. festucae* Bartlett, n. sp.
- 9'. Antennae stramineus (may have brown longitudinal highlight cephalad); body color variable (e.g., Figs. 73, 77, 79–81); usually smaller, body length (b♂) 1.80–2.63 mm ..... 10
- 10(9'). Male pygofer with small median tooth just ventrad of median processes (Fig. 30; best viewed laterally on cleared pygofer), body color usually dark brown with head (except postclypeus) light brown; pronotum and tegmina with conspicuous white transverse bands (Fig. 73). Central America ..... *P. muiri* Metcalf
- 10'. Male pygofer without small median tooth (Figs. 35, 36, 37, 47); head usually not paler than body (e.g., Figs. 77, 79–81); pronotum usually without caudal transverse band, tegmina variable ..... 11
- 11(10'). Parameres with apices medially directed (Fig. 47), median processes flattened with acute apices; antennae with anterior brown longitudinal highlight; vertex not projected in front of eyes (Fig. 77); small species; body length (b♂) 1.80–2.00 mm. Paraguay, Brazil, ? Bolivia .....  
..... *P. paraguayensis* Bartlett, n. sp.
- 11'. Parameres with apices directed dorsally (Figs. 35, 36, 37), median processes usually angular (except some *boliviensis* with rounded apices and dorsally directed lateral points); antennae stramineus; vertex usually projected in front of eyes (Figs. 79–81); body length (b♂) 2.20–2.63 mm. Widespread ..... *P. piceus* species complex...12

- 12(11). Aedeagus with 1–3 retrose processes; median processes usually broad, greatly flattened with rounded apices and dorsally directed lateral points (Fig. 37). Bolivia, Brazil, Uruguay, Argentina .....
- ..... *P. boliviensis* Bartlett, n. sp.
- 12'. Aedeagus usually with 4 retrose processes (Fig. 36); median processes always angular with sharply acute apices. Venezuela, Peru, Central America, Mexico .....
- ..... *P. piceus* (Van Duzee)

*Pissonotus quadripustulatus*  
(Van Duzee, 1909)  
(Figs. 7, 50)

- Stobaera 4-pustulata* Van Duzee 1909: 200.
- Pissonotus foveatus* Spooner 1912: 234–235. Synonymized by Van Duzee 1916: 84.
- Pissonotus variegatus* Spooner 1912: 235–236. Synonymized by Metcalf 1923: 148.
- Dicranotropis variegatus* (Spooner 1912): Crawford 1914: 600.
- Dicranotropis foveatus* (Spooner 1912): Crawford 1914: 600.
- Stobaera quadripustulata* Van Duzee 1909: Crawford 1914: 572 (key), 576 (transliteration of *Stobaera 4-pustulata* Van Duzee 1909).
- Stobaera foveatus* (Spooner 1912): Van Duzee 1916: 84.
- Pissonotus quadripustulatus* (Van Duzee 1909): Metcalf 1923: 148 (listed), 170 (key).
- Pissonotus 4-pustulatus* (Van Duzee 1909): Morgan and Beamer 1949: 110 (key), 120–121.
- Pissonotus quadripustulatus* (Van Duzee 1909): Stiling 1994: 40 (incorrect subsequent spelling).

**Type Locality.** US: Florida, Lee County, Estero.

**Diagnosis.** *Brachypter.* Body stramineus. Frons and vertex stramineus with brown maculations. Antennae usually flattened. Pronotum and mesonotum mostly stramineus with diffuse darker maculations. Tegmina nearly clear with whitish veins, some specimens with reticulate venation. Abdominal segment VI with 2 pairs of conspicuous, dorsolateral, transversely oriented brown tubercles. Aedeagus with 4–5 simple retrose processes of varying lengths.

**Description.** *Brachypter.* Body length ( $n = 5$ ) ♂ 2.15–2.32 (2.25), ♀ 3.00–3.23 (3.10). Body lustrous, stramineus, variously and obscurely mottled with darker shades (Fig. 50).

Head with frons (Fig. 50) stramineus maculated with dark spots, white band on epistomal margin evident on some specimens, usually obliterated by stramineus frons. Postclypeus brown, anteclypeus paler. Vertex uniformly light, or maculated with a few dark spots. Antennal segment I often flattened, stramineus with dark highlight both caudad and cephalad, length 0.19–0.20 (0.20,  $n = 5$ ); II stramineus

basally, darker distally, 0.30–0.38 (0.34,  $n = 5$ ); ratio I/II 0.53–0.67 (0.59,  $n = 5$ ).

Thorax with pronotum and mesonotum uniformly stramineus or obscurely marked. Veins of tegmina reduced, light on darker (or clear) membrane, venation usually normal (reticulate on some specimens), extending to wing margin; setae-bearing tubercles conspicuous.

Legs with tibiae not expanded (front tibia width 0.09–0.10 (0.09,  $n = 3$ ), stramineus with brown subbasal spots; femora stramineus, obscurely marked, coxae brown basally, dark brown at tarsal claws. Calcar length ♂ 0.27–0.31 (0.29,  $n = 5$ ), ♀ 0.31–0.34 (0.32,  $n = 5$ ), number of calcar teeth ♂ ( $n = 5$ ) 7–11 (9); ♀ ( $n = 4$ ) 9–10 (10).

Abdomen mostly stramineus, obscurely marked. Abdominal segment VI with 2 pairs of conspicuous, dorsolateral, transversely oriented brown tubercles.

**Macropter.** Body length ( $n = 1$  ♀) (excluding wings) 3.13; total length (including wings) 3.69; Mostly stramineus, marked like brachypter with tubercles on abdominal segment VI. Wings clear with faint brown spot near middle of distal margin of forewings; setae-bearing tubercles distinct.

**Male Genitalia.** Pygofer (Fig. 7) subcylindrical in cross-section, mostly brown, slightly excavated laterad of lateral processes at apices of anal processes. Median processes angular, simple, subequal to parameres (slightly less); more or less parallel, sharply acute apically. Lateral processes very small, wider than tall, stramineus, lighter than pygofer. Parameres widest beyond middle, slightly diverging, cupped and narrowed into medially directed apices; with blunt subapical tooth medially. Genital diaphragm vestigial. Aedeagus (Fig. 7) strongly flattened laterally, widest near base; with 4–5 simple retrose processes, 2 long, 3 short. Anal processes nearly reaching base of parameres.

**Remarks.** The stramineus body color and dark brown tubercles on abdominal segment VI are unique to *P. quadripustulatus*. The slightly flattened antennae and often reticulate venation (of brachypter) also are distinctive, but are shared by *P. tessellatus*, which is darker and has greatly expanded front and middle tibiae. *Pissonotus quadripustulatus* is found in southeastern coastal salt marshes on *Borrichia frutescens*.

This species was originally described in the genus *Stobaera* and given the specific name *4-pustulata* for its brown abdominal tubercles. Döbel and Denno (1994: 387–389) noted the high incidence of brachyptery (“>99%” for *P. quadripustulatus*) in this and other delphacid species and suggested an evolutionary mechanism based on long-term habitat stability and predator–planthopper interactions. For the specimens examined and recorded in this study, the percentage brachyptery for *P. quadripustulatus* was 99.6% (see Table 12).

Stiling (1994) studied the effects of local environmental variation and host plant genotype on population densities of *P. quadripustulatus*, and a cecidomyiid gall midge, on *Borrichia frutescens*. *P. quadripustulatus* has been shown to breed continually throughout the year (Stiling 1994, Döbel and Denno 1994).

**Recorded Hosts.** *Borrichia frutescens* (L.) DC (Asteraceae) is a confirmed host. Also reported are *Flaveria linearis* Lag. (Asteraceae) and *Monarda pectinata* L. (Lamiaceae).

**Distribution.** Coastal southeastern United States and northeastern Mexico. UNITED STATES: Alabama, Florida, Georgia, Louisiana, Texas. MEXICO: Tamaulipas.

**Type Material.** *Stobaera 4-pustulata* Van Duzee, 1909, lectotype (♂, CASC #3068, designated by Morgan and Beamer 1949: 121) and allolectotype (♂, CASC #3068; designated by Morgan and Beamer 1949: 121): "Estero, Fla/ My.6-12.08/Van Duzee." The USNM has a ♀ in their type collection with the labels "Estero, Fla/ My.6-12.08/Van Duzee" "co-type" "type # 12310 USNM" "*Stobaera/ 4-pustulata* V. D." Paratypes: Florida: same as lectotype (CASC, 1♂, 1♂ broken).

*Pissonotus foveatus* Spooner, 1912, holotype (♀, USNM): "CorpChr/ V/19 Tex" "CSSpooner/Collector." Reported as collected in 1907 (Spooner 1912: 235). Paratypes: Texas: Corpus Christi, V-19 (1907) (CASC, 1♂, 1♂; USNM, 2♂, 4♂). Synonymized by Van Duzee 1916: 84.

*Pissonotus variegatus* Spooner, 1912, holotype (♀, USNM): "CorpChr/ V/19 Tex" "CSSpooner/Collector." Synonymized by Metcalf 1923: 148.

**Other Material Examined.** United States: GEORGIA: Tybee Beach, 26-VII-1913 (CUIC, 1♂); same, 20-IV-1911 (NCSU, 1♂); same, 11-XI-1943, on *Borrichia frutescens* (USNM, 8♂, 1♂). FLORIDA: Hillsborough, Tampa Bay, VI-1993, ex: *Borrichia frutescens*, P. Stiling (CMSU, 2♂, 2♀, plus about 25 in capsule); Key Largo, 19-VII-1939, P. B. Lawson (SEMC, 1♂); same, PWO (USNM, 3♂, 1♂); Tampa, 20-VII-1934, RHB (SEMC, 4♂, 1♂); Tampa, 15-II-1926(?), EDB (FSCA, 2♂, 2♀); same, 10-IX-1927 (USNM, 4♂, 2♂ 2 pins); same, 8-VII-1927 (USNM, 1♂, 1♀ on 1 pin); Lower Matecumbe Key, 14-III-1947, RHB (SEMC, 2♂, 2♀; 96-38a♂); Cedar Keys, 12-VII-1939, RHB (SEMC, 2♂, 2♀; 95-151p♀, 95-151j♂); same, PWO (FSCA, 3♂, 2♀; USNM, 12♂, 24♀, 1 nymph); Key West, 29-XII-1954, on *Flaveria linearis*, H. V. Weems (FSCA, 1♂); Key West, 20-VII-1939, P. B. Lawson (SEMC, 1♂); same, D. E. Hardy (SEMC, 1♂); same, PWO (FSCA, 1♂; USNM, 8♂, 3♂); Yankeetown, 7-VII-1978, RHB (SEMC, 1♂); same, 9-III-1947 (SEMC, 1♂); Yankeetown, 7-VII-1948, B. T. McDermott (SEMC, 3♂); Yankeetown, 9-III-1947, LDB (SEMC, 3♂, 1♂; 95-211♂); Punta Gorda, 12-III-1947, RHB (SEMC, 1♂, 1♂ broken); Homestead, 19-VII-1939, P. B. Lawson (SEMC, 1♂); 17 mi S Homestead, 14-III-1947, RHB (SEMC, 1♂); Miami Beach, IV-1937 (NCSU, 3♂, 2♂); Newberry, 19-XI-1911 (NCSU, 1♂); Manatee Co., Terra Ceia, I-IV-1991, M. Runnals (FSCA, 1♂, 2♀, 1 nymph); Monroe Co., Fleming Key, 11-III-1980, flight trap, H. E. Williams & H. V. Weems, Jr. (FSCA, 1♂); same, 21-II-1980, J. A. Acree & H. V. Weems, Jr. (FSCA, 1♂); same, (15-17)-II-1980 (FSCA, 2♂) same, 6-II-1980 (FSCA, 1♂); same, 19-III-1980, H. E. Williams & H. V. Weems, Jr. (FSCA, 1♂); same, 29-V-1979, Acree & Weems (FSCA, 1♂); same, 10-VIII-1979 (FSCA, 1♂); same, (8-10)-VI-1979 (FSCA, 1♂); Monroe Co., Big Pine Key, 17-II-1975, night, LOB (LOBC, 1♂); same, 26-III-1973, L&COB & Kaplan (LOBC, 6♂); Big Pine Key, 26-I-1950, J. S. Caldwell (USNM, 1♂); Big Pine Key, (24-26)-IV-1961, L. A. Kelton (CNCL, 5♂, 2♂); Loggerhead Key, 1.9 mi S Cudjoe Key, (15-17)-II-1973, R. Thorington, J. Layne, P. Cone (USNM, 1♂); Everglades NP, Flamingo Prairie, 25-III-1973, night, sweeping *Borrichia frutescens*, COB (LOBC,

11♂); same (day, no host, LOBC, 7♂, 1♂); Everglades NP, 23-IV-1961, L. A. Kelton (CNCL, 5♂); Monroe Co., Flamingo Prairie, 10-IX-1972, L&COB (LOBC, 1♂, 12♂); same, 20-VII-1973, night, COB (LOBC, 2♂); same, GBM (LOBC, 2♂); same, 27-III-1973, night, L&COB & Kaplan (LOBC, 1♂); Flamingo, 24-IV-1961, L. A. Kelton (CNCL, 1♂); Monroe Co., Upper Key Largo, 10-XI-1972, sweeping *Borrichia frutescens*, L&COB (LOBC, 12♂); same, 25-III-1973, sweeping *Borrichia frutescens*, L&COB & Kaplan (LOBC, 11♂, 18♂); Indian River, 5 mi S Vero Beach, 28-III-1976, night, L&COB & Wibmer (LOBC, 2♂); same, 28-III-1976, night (LOBC, 2♂, 1♂); Collier Co., Collier Seminole SP, 13-XI-1972, L&COB (LOBC, 29♂, 52♂); Collier Co., 8 mi W Ochopee, 15-VI-1977, night, L&COB & Wibmer (LOBC, 3♂); Franklin Co., Alligator Point, 26-VI-1987, GBM (LOBC, 13♂, 13♂, 3 nymphs); Jacksonville, 20-VI-1926, EDB (USNM, 5♂, 4♂ on 2 pins); Daytona, 22-V-1926, EDB (USNM, 4♂, 3♂); same, 23-V-1926 (USNM, 2♂, 2♀ on 2 pins); same, 5-XII-1926 (USNM, 2♂, 2♂ on 1 pin); same, 5-IX-1926 (USNM, 1♂); same, 28-II-1926 (USNM, 1♂, 3♂); Fort Meyers, 28-VII-1927 (USNM, 2♂ on 1 pin); Jacksonville, 30-III-1928, EDB (USNM, 1♂ + 3♂ *albovenosus* on 1 pin); same, 29-III-1928 (USNM, 1♂ + 3 *albovenosus*); Cape Sable, 31-III-1953, W. R. M. Mason (CNCL, 1♂); Tomoka Pk., 9-IV-1959, J. F. Brimley (CNCL, 1♂, 1♂); Placida, 11-IV-1952, J. R. McGillis (CNCL, 7♂, 2♂); Coconut Grove, 9-VIII-1930, RHB (SEMC, 1♂; 95-151h♂); St. John's Co., 1 mi W Crescent Beach, 7-VIII-1976, on *Borrichia frutescens*, E. E. Grissell (UMDC, 13♂, 21♂); Volusia Co., vic. Turtle Mound Hist. Memorial, 18-X-1976, on *Borrichia frutescens*, E. E. Grissell (UMDC, 4♂); Flagler Co., vic. Flagler Beach SP, 18-X-1976, on *Borrichia frutescens* (UMDC, 2♂, 3♂); Gulf Co., Indian Pass Beach, 12-VI-1975, on *Borrichia frutescens*, R. F. Denno & E. E. Grissell (UMDC, 15♂, 23♂). ALABAMA: Mobile Co., Dauphin Island, 8-XII-1990 (SEMC, 1♂); Inglis, 7-VII-1948, B. T. McDermott (SEMC, 1♂). LOUISIANA: Cameron, 17-VI-1948, RHB (SEMC, 1♂). TEXAS: Bay City, 4-V-1953, RHB (SEMC, 3♂, 2♀); Brazoria Co., 10-VIII-1928, RHB (SEMC, 1♂); San Bunito(?), 28-III-1951, LDB (SEMC, 1♂); Rockport, 2-I-1946, RHB (SEMC, 1♂); Matagordo, 5-V-1953, RHB (SEMC, 3♂, 6♀, 1 with host label *Monarda pectinata*; 95-151n♀); same, LDB (SEMC, 1♂); Aransas Pass, 2-I-1946, RHB (SEMC, 2♂, 2♀); Aransas Co., Goosels SP, 30-XI-1973, L&COB & GBM (LOBC, 37♂, 14♂, two CWT); Brownsville, 13-IV-1950, RHB (SEMC, 7♂, 17♀, 1m♀; 95-151q♀, 95-151k♂, 95-151r♀); same, 27-XII-1945 (SEMC, 2♂, 2♀); Brownsville, 31-V-1933, PWO (FSCA, 1♂; USNM 1♂); same, 1-VI-1933 (USNM, 4♂, 6♀); Brownsville, V-1921, J. C. Bridwell (USNM, 11♂, 3♂); Brownsville, 8-IV-1945, D. E. Hardy (USNM, 1♂); Corpus Christi, 1-I-1946, RHB (SEMC, 1♂, 5♂; 95-151m♀, 95-151g♂); Sinton, 25-XII-1945, RHB (SEMC, 2♂, 3♀; 95-151h♂); Sinton, GL89, 12-IV-1955, Ross & Ross (CNCL, 3♂, 14♂; 95-212a♂); 25 mi S Sarita, 25-XII-1945, RHB (SEMC, 2♂, 2♀); Boca Chica, 30-VI-1938, R. I. Sailer, (SEMC, 1♂); same, RHB (SEMC, 3♂); Boca Chica, 30-V-1933, PWO (USNM, 8♂, 3♀ on 8 pins); Boca Chica, GL338, 7-II-1959, Ross & Stannard (CNCL, 1♂, 4♀ in capsule); Lake Lomalta, 27-XI-1910 (NCSU, 1♂); South end Padre Id., 12-XII-1910 (NCSU, 1♂); Laguna Madre, 25 mi

SE Harlington, 10-II-1945, D. E. Hardy (USNM, 2b♀; SEMC, 1b♂, 1b♀, 1m♀); same, 17-II-1945 (USNM, 1b♀); San Patricio Co., Welder Wildlife Ref., 29-XI-1973, night, COB (LOBC, 8b♀); same, 27-VIII-1970 (LOBC, 2b♀); same (day, LOBC, 2b♀); same, 2-IV-1971 (LOBC, 1b♀). **Mexico:** TAMAULIPAS: 18 mi SW Matamoros, 24-V-1974, L&COB & GBM (LOBC, 13b♀, 3b♂, 1b broken); Tampico, Tamps, 26-III-1951 (SEMC, 2b♀).

*Pissonotus albovenosus* Osborn, 1935

(Figs. 8, 51)

*Pissonotus albovenosus* Osborn 1929: 110 (nomen nudum).

*Pissonotus albovenosus* Osborn 1935: 247-248.

*Prokelisia albovenosus* Osborn 1935: McCoy and Rey 1981: 289 (error).

**Type Locality.** US: Louisiana, Cameron County, Cameron.

**Diagnosis.** *Brachypter*. Body light brown variegated with stramineus, variable in extent. Frons maculated, carinae concolorous with frons. Vertex carinae paler, without distinct dark round spots in foveae. Antennal segment I dark brown, II paler. Tibiae not expanded. Tegmina with stramineus venation, reaching distal margin. Abdomen brown with maculae and broad pale middorsal band. Male pygofer with median processes rather flattened with acute apices. Aedeagus with 1-2 retrose processes: 1st broad and straplike, 2nd hairlike.

**Description.** *Brachypter*. Body length ♂ 2.17-2.42 (2.29,  $n=5$ ), ♀ 2.43-3.02 (2.75,  $n=5$ ); Body lustrous, variegated stramineus and brown (Fig. 51).

Head with frons (Fig. 51) and vertex mottled, highly variable in extent: from few white spots to mostly white with dark patches; epistomal margin with broad stramineus band (unless obliterated by pale frons), following subgenal sulci laterally, extending onto procoxae. Carinae concolorous with frons, paler on vertex. Foveae of vertex dark, without distinct round spots of *P. frontalis*. Postclypeus dark brown, immaculate; anteclypeus paler. Antennal segment I dark brown, 0.13-0.17 (0.16,  $n=5$ ); II paler, often with brown highlight anteriorly, 0.29-0.35 (0.32,  $n=5$ ); ratio I/II 0.46-0.55 (0.51,  $n=5$ ).

Thorax with pronotum and mesonotum coloration variable; usually dark brown laterally and stramineus with diffuse dark markings dorsally; may be darker with pale carinae and scattered pale maculations. Veins of tegmina stramineus on hyaline (or clear) membrane; venation normal (not reticulate), extending to distal margin; distal margin without white transverse band.

Legs with front and middle tibiae not expanded, front tibia width 0.08-0.10 (0.09,  $n=4$ ); all legs with brown foveae, stramineus carinae, variable in extent; coxae brown proximally, stramineus distally. Tarsi stramineus, brown at tarsal claws. Calcar length 0.28-0.34 (0.30,  $n=5$ ), number of calcar teeth 9-13 (11,  $n=3$ ).

Abdomen brown with paler maculations and broad longitudinal middorsal stripe; 3 spots each side of abdominal segment VI. Middorsal stripe variable in width and intensity.

**Macropter.** Body length ( $n=5$ ) ♂ (excluding wings) 1.87-2.38 (2.19); total length (including wings) 2.60-3.35 (3.05); ♀ (excluding wings) 2.65-3.03 (2.82);

total length (including wings) 3.17-3.63 (3.40). Darker than brachypters, with reduced maculations. Pronotum with carinae and posterior margin paler, usually with additional pale maculations in foveae and laterally. Mesonotum uniform brown, usually with carinae and hind margin paler. Abdominal middorsal stripe often obsolete, with only middorsal carina pale. Wings clear, with narrow fuscous spot near apex of clavus of forewing, bordered ventrally by A1+A2 veins. Legs brown, usually with paler carinae.

**Male Genitalia.** Pygofer (Fig. 8) subcylindrical in cross-section, mostly brown with posterior margin, ventral aspect (including lateral processes) and anal segment paler; excavated laterad of lateral processes. Median processes parallel, rather flattened, tapered into acute apices, subequal to parameres. Lateral processes about as tall as wide, stramineus. Parameres flattened, broadest near middle, abruptly narrowed apically; with apices cupped forward into medially directed blunt apices. Genital diaphragm vestigial. Aedeagus (Fig. 8) strongly flattened laterally, with 1-2 retrose processes, most distad flattened, expanded, bladelike and twisted; 2nd fine or hairlike. Some specimens with small tooth near base of distal retrose process. Anal processes reaching base of median processes, received in excavations laterad of lateral processes.

**Remarks.** *Pissonotus albovenosus*, *P. frontalis*, and *P. quadripustulatus* are the only species of *Pissonotus* with a maculated frons and without expanded tibiae. *Pissonotus frontalis*, the most similar to *P. albovenosus*, can be identified by the presence of round brown spots in the posterior foveae of the vertex (these appear consistent even in macropters) and the male pygofer having median processes greatly flattened, with rounded apices. *Pissonotus quadripustulatus* can be identified by the 4 large brown tubercles on the dorsum of abdominal segment VI. Other species similar to *P. albovenosus* (*P. tessellatus*, *P. tumidus*, *P. aphidioides*) have expanded front tibiae, although only slightly in *P. aphidioides* and *P. tumidus*. *Pissonotus aphidioides* and *P. tumidus* are larger species (combined: b♂: 2.36-2.90, b♀: 2.87-3.63) with distinctive male genitalia.

*Pissonotus albovenosus* has great variation in the maculations of the frons and abdomen, and also some variation in head structure. Western specimens, in particular, have a relatively abrupt inflection between frons and vertex, giving the head a rather pointed appearance. Specimens from the CASC have a manuscript name by Van Duzee, which evidently refers to this feature of the head.

*Pissonotus albovenosus* is most abundant in coastal tidal marshes, but is commonly collected far inland. Davis and Gray (1966) reported *P. albovenosus* in salt marshes in both *Juncus roemerianus* and *Distichlis spicata* plant communities in North Carolina, but did not consider it to be a characteristic species of either community. Davis and Gray (1966: 292) reported *P. albovenosus* present in the North Carolina *Distichlis* community from May 11 to November 13, and in the *Juncus* community in all months except March. McCoy and Rey (1981), in a similar study of 4 salt marsh habitats in Florida ("*Spartina alterniflora*," "*Juncus roemerianus*," "*Distichlis spicata*," and "halophytic shrub zone"), found *albovenosus* in all except the *Juncus* habitat. *Pissonotus albovenosus* occurred most frequently in the halophytic shrub zone (101 adults, 100% brachyptery),

followed by *Distichlis* (81 adults, 100% brachyptery), and *Spartina* (9 adults, 56% brachyptery). McCoy and Rey (1981: 289-290) noted that the few individuals in *Spartina* were likely to be dispersing. Denno (1978) reported a 89-93% rate of brachyptery in *P. albovenosus* from tidal salt marshes on *Iva frutescens* and *Borrchia frutescens*.

Specimens from Massachusetts and New Mexico described by Crawford (1914) as *P. aphidioides* were *P. albovenosus*. A specimen reported by Osborn (1935: 248) tentatively as *albovenosus* labeled "Jamaica/L. ID. 8.2.'04" is not *P. albovenosus*, but apparently *P. brunneus*.

**Recorded Hosts.** *Iva frutescens* L. (Asteraceae) is a confirmed host, *Lygodesmia grandiflora* (Nutt.) (reported by Morgan and Beamer 1949), *Borrchia frutescens* (L.), and *Aster spinos(us)* Benth. (?) (Asteraceae) also are likely. Also reported: *Baccharis halimifolia* L., *Ambrosia psilostachya* DC (Asteraceae), *Mimosa fragrans* Gray (Fabaceae), *Monarda pectinata* Nutt. (Lamiaceae), *Gossypium hirsutum* L. (as cotton) (Malvaceae), *Raphanus sativus* L. (as radishes) (Brassicaceae), and "Acadia."

**Distribution.** Eastern and southern United States, Mexico, Dominican Republic, Puerto Rico, and Jamaica. UNITED STATES: Alabama, Arizona, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Louisiana, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New Mexico, New York, North Carolina, South Carolina, Texas, Virginia. MEXICO: Chiapas, Durango, Jalisco, Mexico, Oaxaca, Sinaloa, Sonora, Tamaulipas.

**Type Material.** *Pissonotus albovenosus* Osborn, 1935, holotype (♀b, OSUC): "Cameron, La/Aug.14-28, 1903" "Herbert/Osborn/Collection" "Holotype/*Pissonotus/ albovenosus/* Osborn." Paratypes: Louisiana: Cameron, (20-30)-VI-1905 (NCSU, 1b♀, 1b♂, 93-229b♂). Puerto Rico: Rio Piedras, Exp. Sta. Garden, II-1929, H. Osborn (OSUC, 1b♂).

**Other Material Examined.** United States: NEW HAMPSHIRE: Durham, 1-IX-1922 (NCSU, 1b♂, 93-229a♂); Durham, 1-IX-1922, saltmarsh grass (NCSU, 1b♀, 1b♂); Rock Co., Seabrook backdunes, 25-VII-1989, J. F. Burger (DENH, 1m♂); same, 23-VIII-1989, sweep, dune vegetation, D. S. Chandler (DENH, 1m♂, 1b♂). NEW YORK: E. Marion, L. I., 12-VII-1946, R. Latham (CUIC, 1m♂); Sea Cliff, L. I. (no date, CUIC, 1b♂, 5b♀; CASC, 1b♀); Hamburg, 20-V-1900, E. P. Van Duzee (CASC, 1b♀); Staten Id., VI-1920 (NCSU, 1m♀; USNM, 1b♀, 4m♀). MASSACHUSETTS: "MASS/1603," C. F. Baker Coll. (det. and described by Crawford, 1914 as *aphidioides*, CASC, 4b♀, 1b♂, Giffard slide #10a, ser. VII); Madison Co., 8-VIII-1937, Turner et al. (USNM, 1m♂, 2m♀). CONNECTICUT: Stratford, 9-VII-1920, B. H. Walden (NCSU, 1b♀). NEW JERSEY: Ocean Co., Tuckerton, Great Bay Blvd, 24-VI-1976, on *Iva frutescens*, R. F. Denno (UMDC, 3b♂, 4b♀, 1m♀). MARYLAND: Piney Point, 26-VIII-1946, RHB (SEMC, 1b♂, 1b♀); 2.3 mi E Piney Point, 12-VII-1931, H. S. Barber (USNM, 1b♂); Dorchester Co., Taylor's Isd., 6-VIII-1986, W. E. Steiner & J. M. Hill (USNM, 1b♂, 2b♀). DELAWARE: Kent Co., Pickering Beach, 7-VI-1993, sweeping, C. R. Bartlett (NCSU, 1b♂, 2m♀); Sussex Co., nr. Lewes, Oyster Rocks Road (rd 264), 6-VII-1994, C. R. Bartlett (NCSU, 1b♀); New Castle Co., nr. Woodland Beach, 7-

VI-1993, sweeping marsh, C. R. Bartlett (NCSU, 23b♀, 1b♂); New Castle Co., N of Odessa @US Rt 13, 7-VI-1993, sweep, C. Bartlett (NCSU, 1b broken). VIRGINIA: Mayo Beach, 30-VIII-1944, Chapin, Jones, Anderson & Caldwell (USNM, 1b♀). NORTH CAROLINA: Durham, 12-VIII-1946, RHB (SEMC, 1b♂, 1b♀; 95-13f♀, 95-13e♂); Carolina Beach, V-1934, Z. P. Metcalf (NCSU, 1b♂); Carolina Beach (no date, NCSU, 1b broken); Burgaw, Big Savannah, roadside (no date, NCSU, 1b♀); Burgaw, 28-VI-1957, D. A. Young (NCSU, 1b♂); Southport, 1-V-1954, D. A. Young (NCSU, 1m♂); Southport, 28-VII-1919, Osborn & Metcalf (NCSU, 1b♂); Bladen Co., Bladen Lakes S. F., CR1510, 18-IX-1994, sweep, C. R. Bartlett (NCSU, 1b♂, 3m♂; 95-13g♂); Onslow Co., Ashe Island, 19-VIII-1975, J. C. Dukes (NCSU, 1b♂, 1b♀); same, 2-IX-1976, T. D. Edwards, emergence trap (NCSU, 1b♂, 3b♀); same, 27-X-1976 (NCSU, 1b♂, 1b♀); same, 14-X-1976 (NCSU, 1b♀, 1b♂); same, 9-XI-1976 (NCSU, 1b♂); same, 13-VII-1976 (NCSU, 1b♂); Carteret Co., nr. Atlantic, 19-VIII-1975, N. Newton, Drum Inlet (NCSU, 2b♂); Carteret Co., Bogue Island, 7-V-1975, G. C. Steyskal (USNM, 1b♂); Brunswick Co., nr. Sunset Beach, 7-V-1995, sweeping marsh, C. R. Bartlett (NCSU, 2b♂, 3b♀); Carteret Co., Bettie at hwy 70, 25-VI-1997, L. L. Deitz, sweeping wetlands (NCSU, 5b♀, 2b♂; UDCC 6b♀, 2b♂, 1m♂). SOUTH CAROLINA: Charleston, 4-V-1932, F. W. Poos (USNM, 1m♀); Georgetown Co., Pawley's Island, 25-VIII-1976, on *Borrchia frutescens*, R. F. Denno & E. E. Grissell (UMDC, 6b♂, 19b♀, 1m♂, 1m♀). GEORGIA: Okefenokee Swamp, 25-VII-1939, RHB (SEMC, 1b♀); Montgomery 27-VII-1913, J. C. Bradley (CUIC, 2b♂). FLORIDA: Sanford, 19-V-1927, EDB (FSCA, 1b♀, 1b♂ on 1 pin); Sanford, 11-III-1947, LDB (SEMC, 1m♂); Hillsborough, Tampa Bay, VI-1993, ex: *Iva frutescens*, P. Stiling (CMSU, 3b♂, 3b♀, plus capsule); Tampa, 10-IX-1927, E. D. Ball (USNM, 7b♂, 15b♀, 1m♂ on 5 pins); same, 12-VI-1928 (USNM, 1b♂); Yankeetown, 9-III-1947, RHB (SEMC, 2b♂, 1m♂; 95-13h♂); same 7-VII-1948 (SEMC, 2b♂); Okeechobee, 17-III-1947, RHB (SEMC, 1b♂, 1b♀); Okeechobee Co., 5 mi W Okeechobee, 16-VII-1973, COB & GBM (LOBC, 1b♀); Otter Creek, 9-III-1947, RHB (SEMC, 1b♂); Cedar Keys, 12-VII-1939, RHB (SEMC, 2b♀, 1b♂); same, PWO (FSCA, 1b♀; USNM, 3b♀); Hibernia, 7-VIII-1939, RHB (SEMC, 1b♂); Mims, 18-III-1948, RHB (SEMC, 1b♀); Lacochee, 7-VII-1948, RHB (SEMC, 8b♂, 2m♂, 25b♀; 95-13c♂, 95-13i♂, 95-13d♀); La Belle, 19-VII-1948, RHB (SEMC, 16m♂, 1b♂, 7m♀; 95-13m♀); La Belle, 19-VII-1948, B. T. McDermott (SEMC, 1m♀); La Belle, 16-VII-1939, Oman (FSCA, 3b♂); Zolfo Springs, 26-XII-50, RHB (SEMC, 1b♂); same, 12-III-1947 (SEMC, 1b♂); Fort Meyers, 5-III-1908, Van Duzee (USNM, 1m♂); same, 27-VII-1927 (USNM, 6b♀, 3b♂, 3m♂ on 4 pins); Cocoa, 22-V-1927, EDB (USNM, 1b♀); Volusia Co., Tiger Bay WMA rt. 92, 24-II-1991 (NCSU, 1b♀); Collier Co., 12 mi SW Immokalee, 22-VII-1973, COB & GBM (LOBC, 1b♀); Jefferson Co., 10 mi S Wacissa, 16-VI-1987, COB (LOBC, 3b♂, 2b♀); Jacksonville, 30-III-1928, EDB (USNM, 3b♂ + 1b♀ *quadripustulatus* on 1 pin); same, 20-VI-1926 (USNM, 5b♂, 1b♀ on 3 pins); same, 8-V-1927 (USNM, 1m♀, 2b♀ on 1 pin); same, 29-III-1928 (USNM, 1b♂, 2b♀ + 1b♂ *quadripustulatus*); De Soto Co., Arcadia, light, 16-VIII-1968, G. F. Hevel (USNM, 1m♂); Ormond Beach, 22-II-1961, J. F. Brimley (CNCI, 1b♀); Wilbur, 27-II-1961, J. F. Brimley (CNCI, 1b♂); Crystal Beach, 18-



IV-1952, J. R. Vockeroth (CNCL, 1b♀); St. John's Co., 1 mi W Crescent Beach, 7-VIII-1976, on *Iva frutescens*, R. F. Denno (UMDC, 3b♀); Dixie Co., Steward City, W of Jena, 1-VIII-1976, *Iva frutescens*, R. F. Denno & E. E. Grissell (UMDC, 9b♂, 27b♀, 4m♂); Plant City, 15-VIII-1930, J. O. Nottingham (SEMC, 1b♂). ALABAMA: Mobile Co., Saraland, (26-27)-X-1916 (AMNH, 1m♂; 95-13k♂). MISSISSIPPI: Tupelo, 1-VII-1921 (ISUI, 1b♀); Columbus, 24-VI-1921, C. J. Drake (ISUI, 1b♂, 1b♀); Hancock Co., Ansley, 25-VIII-1965, H. R. Hepburn (LOBC, 2m♂); Hancock Co., 1 mi SSW Lakeshore, 25-VI-1986, on *Baccharis halimifolia*, P. K. Lago (CMSU, 2b♂, 2b♀); N. Clinton, GL535, 20-V-1959, Ross & Stannard (CNCL, 1b♀); Monroe Co., Prairie GL361, 21-V-1959, Ross & Stannard (CNCL, 1b♂); Port Gibson, 21-VII-1921, C. J. Drake (CNCL, 1b♀). ARKANSAS: Polk Co., 21-VIII-1928, RHB (SEMC, 2m♂; 95-13j♂); Calhoun Co., 22-VIII-1955, A. & J. Alcorn (SEMC, 5b♀, 2 nymphs); Washington Co., 30-VI-1940, M. W. Sanderson (SEMC, 1b♀). LOUISIANA: Baton Rouge Par., 8 mi W Pt. Allen, 4-XII-1973, L&COB & GBM (CMSU, 2m♀; 95-13n♀; LOBC, 5m♂, 2m♀); Port Sulfur, 22-VI-1948, RHB (SEMC, 1b♂, 2b♀); same, H. W. Crowder (SEMC, 1b♂); Beauregard Co., 16-VIII-1928, RHB (SEMC, 1b♀); Caddo Co., 19-VIII-1938, RHB (SEMC, 1b♂); Creole, 17-VI-1948, RHB (SEMC, 4b♂, 1b♀); Hammond, 22-VI-1948, RHB (SEMC, 1b♀); Slidell, 31-XII-1950, LDB (SEMC, 1m♂); Alexandria, 1-II-1941, L. W. Hepner (SEMC, 1b♂); Caddo Par., 2 mi N Oil City, 8-VI-1970, COB (LOBC, 2b♂, 5b♀); Tallulah Airpl., 1556 (no date, USNM, 1m♂); Lake Chas., 24-VII-1906, J. D. Mitchell (USNM, 1b♂); Madison Parish, 7-VII-1970, R. W. Bunn (SEMC, 1m♀). ILLINOIS: Pulaski Co., Wetaug, 5-VIII-1935 (FSCA, 1b♀; USNM, 2m♂, 12b♀); Gorham, GL894, 8-VII-1955, Ross & Moore (CNCL, 1m♂). TEXAS: S. Patricio Co., Welder Wildlife Ref., 27-VIII-1970, at night, L&COB (LOBC, 1b♂); same, 30-XI-1973, GBM (LOBC, 5b♂, 10b♀); same, COB (LOBC, 2b♀); same, 29-XI-1973 (LOBC, 8b♂, 14b♀); same, Pollito Lake, 27-VIII-1970, night, COB (LOBC, 1b♀, 1b♂); same, 23-V-1974 (LOBC, 2b♀); same, LOB (LOBC, 4b♂, 9b♀); same, L&COB & GBM (LOBC, 7b♂, 1b♀); same, 2-XII-1973, COB & GBM (LOBC, 1m♀); S. Patricio Co., Welder Wildlife R., Gator Pond 1-XII-1973, L&COB (CMSU, 2b♀; LOBC, 2b♀); same, 29-X-1973, at night, COB (CMSU, 1b♀); same, Hackberry Motte, 28-VI-1984, J. C. Schaffner (TAMU, 1b♀); Dallas, 5-XII-1945 (SEMC, 1b♂); Jefferson, 21-VI-1938, RHB (SEMC, 1m♀); Sutton Co., 16-VII-1928, RHB (SEMC, 1b♂; 95-195j♂); Brownsville, 1-VI-1933, PWO (FSCA, 1b♀); Brownsville, 29-VI-1938, R. I. Sailer (SEMC, 1m♂); Hidalgo, 28-XII-1945, RHB (SEMC, 2b♂, 1b♀, 1m♀); Hidalgo Co., Benston-Rio Grande Valley SP, 15-XII-1983, Woolley & Browning (TAMU, 1b♀); Aransas Pass, 2-I-1946, RHB (SEMC, 1b♀; 95-12e♀); Gonzales, 27-VI-1928, river bank, Z. P. Metcalf (NCSU, 3b♀); Brazos Co., 13-I-1928, R. F. K. (TAMU, 1m♀); College Station (no date, TAMU, 1m♀); Waco, 8-IX-1939, cotton, P. A. Glick (TAMU, 1m♀); Sugarland, 11-VI-1938, Christenson #9940 (FSCA, 1m♀; USNM 32b♂, 15b♀, 3m♀); Waller Co., Waller, 3-III-1987, on *Baccharis halimifolia*, T. O. Robbins (USNM, 1m♂); Cotulla, 8-IV-1908, *Mimosa fragrans*, J. D. Mitchell (USNM, 1b♀, 1m♀); Catarina, 3-VI-1933, PWO (USNM, 1b♂); Brazos Co., 5-V-1969, M. Sweet (LOBC, 1m♂); Jim Wells Co., 22 mi N Alice, Lagarro Creek, 2-X-

1986, E. G. Riley & J. Negron (LOBC, 1b♂); Hale Co., Plainview, 14-VI-1970, swept from aquatic plants, COB (LOBC, 1b♂); Big Bend NP, Rio Grand Vill. Cp., 18-IV-1970, COB (LOBC, 1b♀); Victoria, 8-VII-1907, J. D. Mitchell, Acadia (USNM, 1m♂); same, 23-IV-1907, on *Ambrosia psilostachya*, W. E. Hinds (USNM, 1m♀); Laredo, 6-XII-1938, J. S. Caldwell Coll. (USNM, 1m♀); same, 31-X-1938 (USNM, 1m♂); El Campo, 10-XII-1954, Ross & Ross, GL70 (CNCL, 1b♀); Lincoln, 13-IV-1953, LDB (SEMC, 1m♀); Matagorda, 5-V-1953, on *Monarda pectinata*, RHB (SEMC, 1m♂); same, LDB (no host, SEMC, 2b♂). NEW MEXICO: Salem, 2-VII-1947, RHB (SEMC, 1b♀, 1b♂; 95-12g♀, 95-12f♂); Albuquerque (no date, determined by D. L. Crawford as *aphidioides*, USNM, 1m♀); Mesilla, 15-VII-1952, RHB & LDB, C. Liang, W. LaBerge (SEMC, 1b♂, 1m♀). ARIZONA: Gila Co., 6-VIII-1927, RHB (SEMC, 1m♂); Wickenburg, 5-VII-1950, RHB (SEMC, 3m♂, 2m♀); Yuma, 20-IV-1940, PWO (USNM, 2b♂, 5m♂, 4b♀, 12m♀; 95-131♀); Yuma, 26-IV-1935, EDB (USNM, 1b♀); Tuscon, S(an) Xavier Mission, 18-V-1939, E. P. Van Duzee (CASC, 1b♀); San Xavier Mission, 15-X-1936 (CASC, 2b♀); Tuscon, 9-IV-1906, Koebele (CASC, 2b♀); "Ariz 1873" C. F. Baker Coll. (USNM, 1m♀, 1m♂, 93-230a♂); same, #2571 (USNM, 1m♀); same, #2058 (USNM, 1b♀); same, #1856 (USNM, 1m♂); same, #2557 (USNM, 1b♀); same, #2073 (USNM, 2b♂, 4b♀, 2m♀); same, #2064 (USNM, 2b♀); Santa Cruz R., nr. Tubac, 23-X-1937, PWO (FSCA, 1b♀; USNM, 4b♂, 2b♀, 1m♂); Santa Cruz R., 4-IV-1937, EDB (USNM, 1b♀); Cruz Co., White Rock Cp., Pena Blanca Lake Sta., 10-IX-1965, L&COB (LOBC, 2b♀); Baboquivari Mtns, 16-X-1937, PWO (USNM, 1b♀, 1m♀); Br't Angel, Col. Canyon, 2300', 5-X-1903, H. S. Barber (USNM, 2m♂, 4m♀ on 4 pins); Huachuca, 5-IX-1936, EDB (USNM, 2b♀); Huachuca Mtns, Sierra Vista, X-1963, R. F. Sternitzky (CNCL, 1b♀); Sabino Canyon, 27-X-1937, PWO (USNM, 1b♀); same, 29(?) -IV-1940 (USNM, 1b♂); Mescal, 28-VII-1927, RHB (USNM, 1b♀). CALIFORNIA: Potrero, 21-VII-1947, RHB (SEMC, 1b♀, 1b♂; 95-13a♂, 95-13a♀); San Mateo Co., 16-VII-1919 (CASC, 1b♀, marked as holotype of Van Duzee manuscript species); S. L. Obispo Co., Nr. Paso Roblo, 720', 29-V-1919, W. M. Giffard (CASC, 1m♀); San Diego Co., 7-V-1913 (Giffard slide 6<sup>d</sup>, ser VII, CASC, 1b♂); Colton, (26-28)-V-1917, E. P. Van Duzee (CASC, 3b♀); Needles, 27-XI-1921, J. A. Kusche (CASC, 1b♀); Imperial Co., Ft. Yuma, 15-IV-1923, ex: *Aster spinos(us)*, E. P. Van Duzee (CASC, 7b♂, 3m♂, 24b♀, 4m♀ plus 4m♂, 4m♀, 6b♂, 19b♀, 2 broken, 1 nymph on 17 pins); Los Angeles (no date, 1 with Uhler manuscript name, 2b♀); Los Angeles, Coquillett (Collector, no date, USNM, 3b♀, 1 nymph, 1 with Uhler manuscript name, plus pair in copula); Compton, 18-VI-1908 (USNM, 1b♀); Imperial, 18-VI-1909, EDB (USNM, 1b♀); W of Bringame, 13-VI-1935, PWO (USNM, 1m♀); W of Holtville (USNM, 1b♀); Felton, 18-VI-1952, RHB (SEMC, 1b♂). MEXICO: SONORA: Rio Yaqui, 12 mi W Cd. Obregon, Son., 15-V-1961, Howden & Martin (CNCL, 1m♂, 1b♀). TAMAULIPAS: "ex: Mexico, 6-II-1937//on radishes//Brownsville Tex." (USNM, 1m♂). JALISCO: 15 mi WNW Guadalajara, 13-IX-1938, L. J. Lipovsky (SEMC, 1b♀); 15 mi E Guadalajara, 10-IX-1938, L. J. Lipovsky (SEMC, 2b♀). SINALOA: Villa Roblo, 26-V-1925, H. H. Keifer (CASC, 1m♂). DURANGO: 13 mi N Durango, 5900', 24-VII-1953 (SEMC, 1m♂). OAXACA: 4.3 mi N San P. y San P. Teposcolula, 3-VII-1976

(TAMU, 1b♀); Ixmiquilpan, 27-VIII-1936, EDB (USNM, 4b♂, 4b♀ on 2 pins). MEXICO: Tepexpan, 6900', 12-VIII-1954, J. G. Chillcott (CNCL, 1b♀). CHIAPAS: Teopisca, 12-VIII-1969, L. Kelton (CNCL, 1b♂). **Dominican Republic:** Peravia, 21 km NW San Jose de Ocoa, 9-VIII-1979, COB (LOBC, 1m♀, 1b♂, 1b♀); La Vega, 10 km NE Constanza, 25-V-1978, L&COB & GBM (LOBC, 1b♀); La Vega, 23 km SW, Jarabacoa 25-V-1978, L&COB & GBM (LOBC, 1m♀); La Vega, 29 km SE Constanza, 4-VIII-1979, LOB (LOBC, 1b♀); Constanza, VII-1969, J. Maldonado (USNM, 1m♀). **Puerto Rico:** Luguillo Bch., 22-VIII-1947, J. S. Caldwell (USNM, 1b♀, 1b♂). **Jamaica:** Tr(elawn)ly (Parish), Duncans, 5-VIII-1966, Howden & Becker (CNCL, 1b♀).

*Pissonotus frontalis* (Crawford, 1914)

(Figs. 9, 52)

*Dicranotropis frontalis* Crawford 1914: 597, 592 (key).

*Pissonotus frontalis* (Crawford 1914): Van Duzee 1914: 44.

*Pissonotus exiguus* Morgan and Beamer 1949: 113–114, 110 (key).

**New synonymy.**

**Type Locality.** US: Oregon.

**Diagnosis.** *Brachypter.* Body brown maculated with white. Frons brown maculated with paler spots, epistomal margin with narrow white band. Vertex mostly stramineus, 2 round brown spots in posterior foveae. Tegmina with stramineus veins on clear to brownish membrane, lacking distal transverse band. Abdomen brown with white maculations. Male pygofer with median processes strongly flattened, apices rounded; lateral processes conspicuous. Parameres terminating in flattened, well sclerotized, roughly triangular plate with laterally and medially directed apices.

**Description.** *Brachypter.* Body length ♂ 2.01–2.70 (2.24,  $n = 10$ ), ♀ 2.55–3.12 (2.93,  $n = 9$ ); Body lustrous, brown with pale maculations (Fig. 52).

Head with frons light brown with stramineus maculations (Fig. 52), carinae concolorous with frons; epistomal margin with stramineus transverse band, following subgenal sulci laterally, broader behind genal carinae, reaching procoxae. Postclypeus dark brown, anteclypeus stramineus. Vertex mostly stramineus, including carinae, with brown maculations; posterior foveae with pair of round spots. Antennal segment I dark brown with variable paler markings (paler in some specimens), length 0.10–0.23 (0.18,  $n = 11$ ); II stramineus with dark brown anterior highlight, length 0.32–0.38 (0.34,  $n = 11$ ); ratio I/II 0.47–0.64 (0.54,  $n = 11$ ).

Thorax with pronotum and mesonotum dark brown with stramineus markings laterally; medially stramineus, including carinae, with diffuse dark markings. Tegminal veins pale on light brown membrane; venation normal (not reticulate), extending to distal margin of tegmina, distal margin without distinct transverse band.

Legs with tibiae not expanded, width 0.08–0.10 (0.09,  $n = 8$ ); coxae dark brown basally, stramineus distally, femora and tibiae dark brown with light

carinae; hind tibiae often paler with dark carinae, light foveae; tarsi and apices of tibiae stramineus; dark brown at claws. Calcar length 0.25–0.32 (0.28,  $n = 10$ ), number of calcar teeth 7–11 (10,  $n = 10$ ).

Abdomen brown with maculations, segment VI with 2–3 spots each side (occasionally weak) in addition to more diffuse markings and paler middorsal carina.

*Macropter.* Body length ♂ (excluding wings) 2.18–2.63 (2.49,  $n = 5$ ); total length (including wings) 3.50–3.94 (3.75,  $n = 4$ ); ♀ Body length (excluding wings) 3.17–3.50 (3.29); total length (including wings) 4.00 ( $n = 2$ ). Darker than brachypters but with same markings, with round spots in posterior foveae of vertex. Pronotum with broadly stramineus carinae, dark foveae; mesonotum dark brown with paler carinae and posterior margin; legs and abdomen similar to brachypter. Wings clear.

*Male Genitalia.* Pygofer (Fig. 9) cyphosomatic in cross-section, narrowly excavated laterad of lateral processes; dark brown with posterior margin and anal segment paler. Median processes closely associated, slightly shorter than parameres; parallel, simple, strongly flattened with rounded apices. Lateral processes 1–2 times as tall as wide, stramineus, contrasting with pygofer. Parameres flattened, parallel-sided, diverging, bent forward and laterad into flattened, well sclerotized, roughly triangular plates with laterally and medially directed apices. Genital diaphragm complete, weak, broadly emarginate dorsomedially. Aedeagus (Fig. 9) strongly flattened laterally, slender, curving ventrally with 4 well-spaced retrose processes. Anal processes stout, extending laterad of parameres, usually not reaching paramere bases.

**Remarks.** *Pissonotus frontalis* most resembles *P. albovenosus*, but can be identified by the round markings in the posterior foveae of the vertex, and males with strongly flattened median processes and 4 aedeagal retrose processes.

The holotype of *P. frontalis* is a very pallid female specimen with weak markings from Oregon. Morgan and Beamer (1949) claimed that the male allotype from California was another species, *P. exiguus*. The putative differences between *P. frontalis* and *P. exiguus* were that *P. exiguus* was smaller, with "the crown longer than wide" (Morgan and Beamer 1949: 112) (versus as broad as long in *P. frontalis*) and the male pygofer with lateral processes "about as wide as long" (Morgan and Beamer 1949: 114) in *P. exiguus* versus "twice as long as wide" (Morgan and Beamer 1949: 112) in *P. frontalis*. Although (based on paratypes of *P. exiguus* and specimens identified as *P. frontalis* by Morgan and Beamer) specimens of *P. exiguus* were smaller (*P. exiguus* ♂b 2.01–2.25 [2.14,  $n = 6$ ], ♀b 2.55–2.95 [2.75,  $n = 4$ ], *P. frontalis* ♂b 2.24–2.70 [2.38,  $n = 5$ ], ♀b 3.00–3.12 [3.07,  $n = 5$ ]), the vertex length/width ratio overlapped substantially (*P. exiguus* ♂b 0.76–0.95 [0.83,  $n = 6$ ], ♀b 0.73–0.76 [0.75,  $n = 4$ ]; *P. frontalis* ♂b 0.82–1.04 [0.95,  $n = 5$ ], ♀b 0.84–1.00 [0.90,  $n = 5$ ]). The relative length of the lateral processes is the only characteristic that may distinguish these putative species. Unfortunately, the holotype of *P. frontalis* is a female. The lack of discrete characters between *P. exiguus* and *P. frontalis* and a completely sympatric range indicate that they represent a single species.

Kershaw and Muir (1922: 208, fig. 20) illustrated and briefly commented on the male genitalia of *P. frontalis* within a discussion of homology in

auchenorrhynchous homopteran genitalia.

**Recorded Hosts.** *Artemisia furcata heterophylla* (Bess.) Hulten (as *Artemisia heterophylla*, "wormwood"), *Artemisia* sp. (Asteraceae).

**Distribution.** Pacific United States and British Columbia. CANADA: British Columbia. UNITED STATES: California, Oregon.

**Type Material.** *Dicranotropis frontalis* Crawford, 1914, holotype ( $\sigma^b$ , USNM): "Oreg./2376" "Collection/C. F. Baker" "type/No. 15980/ USNM" "*Dicranotropis/ frontalis/* DLC Crawford."

*Pissonotus exiguus* Morgan and Beamer, 1949, holotype ( $b\sigma$ , SEMC) and allotype ( $b\eta$ , SEMC): "Potrero, Calif./7-21-1947/R. H. Beamer." Paratypes: California: same data (SEMC 14 $\sigma^b$ ; 5 $\eta$ b, 95-69n $\eta$ , 95-196b $\sigma$ , 95-69h $\sigma$ , 95-69m $\eta$ , 95-69l $\eta$ , 95-69k $\eta$ , 95-69j $\sigma$ , 95-69i $\sigma$ , 95-69f $\sigma$ , 95-69g $\sigma$ , 96-19a $\sigma$ ).

**Other Material Examined.** Canada: BRITISH COLUMBIA: Chilliwack, 19-VII-1925 (NCSU, 1m $\sigma$ ). United States: CALIFORNIA: Monterey, 22-VII-1935, RHB (SEMC, 1b $\eta$ ; 95-70d $\eta$ ); Alameda Co., Niles Canyon, V-1916, W. M. Giffard (CASC, 9b $\sigma$ , 17b $\eta$ , 1m $\sigma$ , 1m $\eta$ ; 95-70b $\eta$ , 95-69w $\sigma$ , 95-69r $\sigma$ , "wormwood" on 1 specimen); same, 21-VI-1919 (CASC, 1b $\sigma$ , 2b $\eta$ ; 96-31a $\sigma$ ); same, VII-1916 (CASC, 2b $\eta$ ; 95-69x $\eta$ ); same, 13-VI-1917 (CASC, 17b $\sigma$ , 20b $\eta$ , 1m $\sigma$ , 1m $\eta$  on 23 pins; 95-159a $\sigma$ ); same, 23-V-1917 (CASC, 2b $\sigma$ , Giffard slide #1 ser. VII ex: wormwood); Santa Clara Co., Los Altos, 27-V-1920, ex: *Artemisia heterophylla*, W. M. Giffard (CASC, 8b $\sigma$ , 6b $\eta$ , 1 nymph; 95-146q $\eta$ ); same, 24-VII-1919 (no host, CASC, 1b $\eta$ ); Santa Clara Co., Los Altos, 24-VII-1919, W. M. Giffard (CASC, 1b $\eta$ , Giffard Slide #6<sup>a</sup> ser. VII); Santa Cruz Co., 7-VI-1917, ex: *Artemisia*, W. M. Giffard (CASC, 8b $\sigma$ , 1m $\sigma$ , 13b $\eta$ , 1 nymph, 1 broken on 15 pins; 95-70g $\eta$ , 95-69v $\sigma$ , Giffard slides #4 ser. VII, #5 ser. VII; SEMC, 1m $\sigma$ , 1m $\eta$ ; 95-69v $\eta$ , 95-69t $\sigma$ ; SEMC, 2b $\sigma$ , 2b $\eta$ ; 95-69o $\sigma$ , 95-69p $\eta$ , 95-70c $\eta$ , 95-70c $\eta$ ); Santa Cruz Co., 1500', 22-VI-1921, W. M. Giffard (CASC, 3b $\sigma$ , 10b $\eta$ ; 95-70a $\eta$ , 95-70f $\eta$ , 95-196c $\sigma$ ); San Joaquin Co., 25-V-1917, W. M. Giffard (CASC, 5b $\sigma$ , 5b $\eta$ , 1b broken on 6 pins; 95-69s $\sigma$ , Giffard slide #3 ser. VII; SEMC, 1m $\eta$ ; 95-69z $\sigma$ ); same, 30-V-1917 (CASC, 3b $\sigma$ , 1m $\sigma$ , 3b $\eta$  on 6 pins; 95-69q $\sigma$ , 95-69u $\sigma$ ); same, 3-V-1917, W. M. Giffard (CASC, 4b $\eta$ ); San Mateo Co., Crystal Lake, 21-VI-1921, ex: wormwood, W. M. Giffard (*Artemisia* sp., CASC, 6b $\eta$ , 5b $\sigma$ , Giffard slides #6<sup>c</sup>, ser. VII, #2 ser. VII); San Mateo Co., 21-VI-1921, W. M. Giffard (CASC, 1b $\sigma$ ); San Mateo Co., 500', 20-VI-1917, W. M. Giffard (CASC, 3b $\eta$ , 4b $\sigma$ , Giffard slide #6<sup>b</sup> ser. VII, ex: wormwood); Contra Costa Co., 14-VI-1917, W. M. Giffard (CASC, 1b $\sigma$ , 3b $\eta$ ); San Diego Co., 24-V-1913, E. P. Van Duzee (CASC, 1b $\eta$ ); same, 7-V-1913 (CASC, 1b $\eta$ , 1b $\sigma$ , Giffard slide #6, ser. VII); same, 22-IV-1913 (CASC, 1b $\eta$ ); Stockton, 21-VIII-1919, E. P. Van Duzee (CASC, 2b $\eta$ ); Millbrae, 17-VIII-1919, E. P. Van Duzee (CASC, 2b $\eta$ ); Marion Co., Taylorville, 26-VII-1931, E. P. Van Duzee (CASC, 1b $\eta$ ); Willits, 3-VII-1948, W. F. Chamberlain (TAMU, 1b $\eta$ ); Los Angeles, P. R. Uhler coll. (no date, with manuscript name, USNM, 1b $\sigma$ , 1b $\eta$ ; 93-230b $\sigma$ ); Los Angeles Co., (D. W.) Coquillett (no date, USNM, 1b $\eta$ , 1b $\sigma$ ); Muir Woods, 17-VI-1934, EDB (USNM, 1b $\eta$ ); Alameda Co., W. M. Giffard (no date, CASC, 4b $\eta$ ); Lower Santa Anna Co., Green River Camp, V-11(?)-1933, Van Duzee (CASC, 1b $\eta$ ); Mammoth Lake, 29-VII-1940, D. H. Hardy (SEMC, 1b $\eta$ ).

*Pissonotus tessellatus* (Ball, 1926)

(Figs. 10, 53)

*Phyllodictus tessellatus* Ball 1926: 19.

*Pissonotus tessellatus* (Ball 1926): Morgan and Beamer 1949: 100.

**Type locality.** US: Florida, Seminole County, Sanford.

**Diagnosis.** *Brachypter*. Body dark brown maculated with stramineus. Frons brown, carinae concolorous, with stramineus maculations and epistomal margin with white transverse band. Antennal segment I dark brown, II paler. Pronotum and mesonotum dark brown laterally, stramineus with brown maculations dorsally. Front tibiae greatly enlarged. Tegmina light brown with pale veins, venation reticulate. Abdomen dark brown with elongate white maculations. Male pygofer with conspicuous, flattened lateral processes. Aedeagus with 3-4 simple retrose processes.

**Description.** *Brachypter*. Body length ( $n=5$ )  $\sigma$  1.76-2.22 (2.00),  $\eta$  2.24-2.68 (2.44); Body lustrous, brown with reddish tinge, maculated with white (Fig. 53).

Head with frons rather quadrate (Fig. 53), brown, maculated with few pale spots, especially dorsally, carinae pale; epistomal margin with transverse stramineus band, following subgenal sulci laterally, becoming broader posterior of genal carinae, reaching procoxae. Postclypeus dark brown, anteclypeus stramineus marked with brown. Vertex brown with stramineus carinae, posterior foveae with round brown markings. Antennal segment I mostly dark brown, often weakly flattened (flattened in types), with paler longitudinal markings laterally, length 0.10-0.13 (0.12,  $n=5$ ); segment II paler, length 0.26-0.41 (0.35,  $n=5$ ); ratio I/II 0.31-0.38 (0.34).

Thorax with pronotum and mesonotum brown laterally, stramineus dorsally with brown maculations; or brown with stramineus carinae and maculations. Tegmina venation densely reticulate, veins stramineus on light brown membrane, veins reaching distal margin. Pinkish markings visible through tegmina on some specimens (including types).

Legs with front tibiae greatly expanded, width 0.15-0.22 (0.20,  $n=5$ ), middle less so, dark brown; legs otherwise brown with paler carinae, tarsi stramineus, dark brown at claws. Calcar length 0.20-0.26 (0.22,  $n=5$ ), number of calcar teeth 9-11 (10,  $n=4$ ).

Abdomen brown with slightly raised, elongate stramineus maculations, 3-4 each side on segment VI, middorsal carina paler.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 10) cyphosomatic in cross-section, dark brown with paler posterior margin, excavated laterad of lateral processes. Median processes more than half height of parameres, angular, slightly converging and arcuate; narrowed to blunt dorsally, or slightly medially, directed apices. Lateral processes ventrad to median processes, about as tall as wide; concolorous with pygofer. Parameres broadest near apex, strongly cupped

forward to rounded, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 10) strongly flattened laterally with 3–4 long, flattened, simple retrose processes; apical tooth present in some specimens. Anal processes rather fine, arcuate, received in excavations laterad of lateral processes; exceeding base of median processes.

**Remarks.** *Pissonotus tessellatus* is a very distinctive species with reticulate tegminal venation and greatly expanded front tibiae. *Pissonotus tessellatus* (b♂ 1.76–2.22 mm) is smaller than *P. flabellatus* (b♂ 2.17–2.61 mm), *P. tumidus* (b♂ 2.36–2.62 mm), and *P. aphidioides* (b♂ 2.83–2.90 mm), lacks the white transverse tegminal band of *flabellatus*, and has the tibiae more expanded than in *tumidus* and *aphidioides*.

*Pissonotus tessellatus* is the type species of the genus *Phyllodictus* Ball, 1926, a genus synonymized with *Pissonotus* by Morgan and Beamer (1949: 97).

**Recorded Hosts.** None.

**Distribution.** Southeastern United States, especially Georgia and Florida. UNITED STATES: Florida, Georgia, Mississippi, North Carolina, Ohio.

**Type Material.** *Phyllodictus tessellatus* Ball, 1926, holotype (b♀, USNM) and allotype (b♂, USNM): "Sanford, Fla/11-22-'25/E. D. Ball." Paratypes: Mississippi: Meridian, 14-VIII-1921, C. J. Drake (ISUI, empty point). Florida: Sanford, 22-IX-1925, EDB (USNM, 1b♀); same, 18-IX-1925 (USNM, 1b♀); pencil labels, date only (reported as collected in Sanford [Ball 1926: 19]): 19-V-(1925?) (USNM, 1b♀); 25-III-1926 (USNM, 1b♂); 10-V-(1925) (USNM, 1b♂).

**Other Material Examined.** UNITED STATES: OHIO: Barberton, 23-VIII-30, L. J. Lipovsky (SEMC, 1b♀). NORTH CAROLINA: Burgaw, V-1925, open pine woods (NCSU, 2b♀); Burgaw, Big Savannah, 17-VIII (a longleaf pine savannah, NCSU, 1b♂). MISSISSIPPI: Ocean Springs, 5-III-1947, RHB (SEMC, 8b♀, 5b♂; 95-152c♂, 95-152j♀, 95-152d♂, 95-152g♀); same, LDB (SEMC, 1b♂, 1b♀). GEORGIA: Thompsonville, 23-V-1915, C. S. Spooner (FSCA, 1b♂; USNM, 1b♀); same, all USNM as follows: 5-VI-1914 (1b♀), 13-V-1914 (1b♀), 21-VI-1914 (1b♀), 10-V-1915 (1b♀), 30-V-1914 (1b♀), 20-VI-1915 (1b♀), 29-IV-1915 (1b♀), 12-V-1915 (1b♀), 15-IV-1915 (1b♂), 4-V-1915 (1b♀), 19-IV-1915 (1b♀), 6-IV-1915 (1b♀), 17-V-1915 (1b♀), 31-V-1914 (1b♂; 95-222a♂); Tifton, 8-I-1948, RHB (SEMC, 1b♂); Hinesville, 4-X-1938, PWO (USNM, 2b♀). FLORIDA: Sanford, 20-III-1926, EDB (BPBM, 1b♂); same, 19-V-1926 (BPBM, 1b♀; FSCA, 1b♀); same, 20-III-1926 (FSCA, 1b♀); same, 21-IV-1926 (USNM, 1b♀); same, 5-V-1927 (USNM, 1b♀); same, 13-V-1926 (USNM, 1b♀); same, 19-VIII-1926 (USNM, 1b♂); same, 31-VIII-1926 (USNM, 1b♀); same, 1-X-1926 (USNM, 1b♀); same, 22-X-1926 (USNM, 1b♀); Sanford, EDB, all USNM as follows: 4-VI-1926 (2b♀), 19-V-1926 (5b♀), 30-III-1926 (1b♀), 5-V-1927 (2b♀), 9-XI-1926 (2b♂ on 1 pin), 3-VII-1926 (1b♂, 3b♀ on 1 pin), 19-V-1927 (3b♂ on 1 pin), 22-IX-1926 (2b♀), 7-VIII-1926 (1b♀); Sanford, 11-III-1947, RHB (SEMC, 1b♂); Stark, 23-XII-1950, RHB (SEMC, 3b♀); Hilliard, 5-X-1938, PWO (FSCA, 3b♂, 2b♀ on 4 pins; USNM, 10b♂, 4b♀; 93-201b♂); Hilliard, 6-VIII-1939, RHB (SEMC, 1b♂); Collier Co., 6 mi E Ochopee, 21-VII-1973, night, GBM (LOBC, 1b♀); same, COB (LOBC, 1b♂); same, 14-VI-1977, COB & G. Wibmer (LOBC, 1b♀); Gulf Co., 1 mi N White City, 25-IX-1980,

night, COB & GBM (LOBC, 1b♂); Jefferson Co., 5 mi SW Wacissa, 16-IX-1976, GBM (LOBC, 1b♀); Monroe Co., Everglades NP, nr. Ro(y?)al Palm Hammock, sawgrass area, 18-II-1975, night (LOBC, 1b♀); Hudson, 13-VII-1939, RHB (SEMC, 2b♀); Okeechobee, 17-III-1947, RHB (SEMC, 1b♀); Marianna, 7-III-1947, LDB (SEMC, 1b♂); same, RHB (SEMC, 6b♂, 1b♀; 95-152e♂, 95-212e♂, 95-152h♀); Mims, 18-III-1947, RHB (SEMC, 5b♂, 3b♀; 95-152a♂, 95-152f♀); Palatka, 24-XII-1950, LDB (SEMC, 1b♀); Yankeetown, 9-III-1947, LDB (SEMC, 1b♂, 1b♀); same, RHB (SEMC, 9b♀, 11b♂; 95-152b♂, 95-152i♀); same, 7-VII-1948 (SEMC, 1b♀); New Port Ritchey, 7-X-1938, PWO (USNM, 1b♀); Childs, 10-VI-1928 (Ball, USNM, 4b♀, 1b♂ on 2 pins); Jacksonville, 30-III-1928, EDB (USNM, 1b♂); Orlando, 11-IV-1967, L. A. Kelton (USNM, 2b♀).

### *Pissonotus tumidus* Morgan and Beamer, 1949

(Figs. 11, 54)

*Pissonotus tumidus* Morgan and Beamer 1949: 102–103, 100 (key).

**Type Locality.** CANADA: Manitoba, Keld.

**Diagnosis.** *Brachypter*. Large, light brown species, extensively maculated with stramineus. Frons and vertex light brown, maculated with stramineus. Pronotum and mesonotum brown with stramineus carinae. Front tibiae slightly expanded. Tegmina clear or light brown with dark veins. Abdomen light brown, segment VI with or without 2–3 dorsal maculae. Male pygofer with lateral processes 0.5 times height of median processes. Aedeagus with 3–4 dorsal and 1–2 ventral retrose processes.

**Description.** *Brachypter*. Body length ♂ 2.36–2.62 (2.49,  $n=2$ ), ♀ 2.87–3.51 (3.26,  $n=5$ ). Body dull, light brown, maculated with stramineus (Fig. 54).

Head with frons brown, with stramineus maculations (Fig. 54), epistomal margin with stramineus band (variable in width), extending laterally along subgenal suture, broadening to include most of subgenae. Postclypeus and anteclypeus dark brown. Vertex stramineus with brown maculations in foveae. Antennae deep stramineus with diffuse longitudinal brown markings. Antennal segment I 0.23 ( $n=2$ ); II 0.38–0.48 (0.43); ratio I/II 0.48–0.61 (0.55,  $n=2$ ).

Thorax with pronotum and mesonotum mostly brown with broadly stramineus carinae. Tegmina clear to light brown, veins brown; venation normal (not reticulate), reaching distal margin.

Legs with front tibiae slightly expanded. Front tibia width 0.12–0.13 (0.13,  $n=2$ ), legs mostly brown, carinae paler. Calcar length 0.28–0.32 (0.30,  $n=2$ ), number of calcar teeth 7–8 (8,  $n=2$ ).

Abdomen light brown with diffuse paler markings and pale middorsal carina, segment VI with or without 3 stramineus maculae on each side.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 11) cyphosomatic in cross-section, narrowly

concave laterad of lateral processes; light brown, paler posteriorly, ventrally and on anal segment. Median processes subequal to parameres, slightly converging, simple; with angular base narrowed to sharply acute apices. Lateral processes taller than wide, half as tall as median processes, concolorous with pygofer. Parameres flattened, parallel-sided, diverging; cupped forward into rounded, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 11) strongly flattened laterally, widest near base, slightly constricted in apical third; 3–4 short dorsal and 1–2 short ventral retrose processes. Anal processes short and stout.

**Remarks.** *Pissonotus tumidus* most resembles *P. aphidioides*. The dark tegminal veins of *P. tumidus* appear to identify this species consistently. *Pissonotus tumidus* also has a darker pronotum and mesonotum than *P. aphidioides*. The male pygofer of *P. aphidioides* have lateral processes subequal to or longer than the median processes. *Pissonotus tumidus* is the only species of *Pissonotus* with an aedeagus having ventral retrose processes. The front tibiae of *P. tumidus* are only slightly expanded and could easily be misdiagnosed.

**Recorded Hosts.** None.

**Distribution.** Northcentral and northeastern United States and adjacent Canada, south in mountains to Virginia. CANADA: Manitoba; also reported Ontario (Kontkanen 1958). UNITED STATES: Michigan, Minnesota, New York, Pennsylvania, Virginia; also reported Connecticut, New Hampshire (Morgan and Beamer 1949).

**Type Material.** *Pissonotus tumidus* Morgan and Beamer, 1949, holotype (b♂, SEMC): "Keld, Man./ 8-8-1937/R. H. Beamer;" allotype (b♀, SEMC): "Red Deer R/Man. 8-3-1937/R. H. Beamer." Paratypes: Manitoba: Mafeking, 3-VIII-1937, RHB (SEMC, 1b♀; 95-151s♀). Michigan: Cedar River, 26-VIII-1937, RHB (SEMC, 1b♀; 95-151u♀). New York: Boston, 28-VII-1907, Van Duzee (CASC, 1b♀; 95-159b♀). Pennsylvania: Dingman's Ferry, 20-VIII-1946, RHB (SEMC, 1b♀; 95-151t♀).

**Other Material Examined.** UNITED STATES: MINNESOTA: Itasca Pk., 4-VIII-1938, L. D. Tuthill (ISUI, 1b♂). NEW YORK: Sabael, Indian L., 25-VIII-1927 (NCSU, 1b♂; 93-224b♂). PENNSYLVANIA: Patton, 9-VII-1906, M. Wirtner (CMNH, 1b♂; 95-221a♂); Patton, IX-1906, M. Wirtner (CMNH, 2b♂, 1b♀ on 1 pin); same, 22-VII-1904 (CMNH, 1b♀); "Del. Water Gap" (NY or NJ), A. T. Slosson collection (AMNH, 1b♀; 95-151v♀). VIRGINIA: Giles Co., Mt. Lake Biol. Stn., 1-VIII-1967, G. W. Byers (SEMC, 1b♀).

#### *Pissonotus aphidioides* Van Duzee, 1897

(Figs. 12, 55)

*Pissonotus aphidioides* Van Duzee 1894a: 190 (nomen nudum).

*Pissonotus aphidioides* Van Duzee 1897: 236, 239.

*Pissonotus aphidioides* Van Duzee 1897: Osborn 1904: 100; Oman 1947: 216–217, 226 (incorrect subsequent spelling).

*Dicranotropis aphidioides* (Van Duzee 1897): Crawford 1914: 594 (key), 597–598.

*Pissonotus aphidioides* Van Duzee 1897: Strickland 1940: 88 (incorrect subsequent spelling).

**Type Locality.** US: New York, Cattaraugus County, Salamanca.

**Diagnosis.** *Brachypter*. Large and robust, body light brown maculated with stramineous. Frons brown with stramineous maculations. Antennae stramineous. Front tibiae slightly expanded. Tegmina with white veins, reaching hind margin. Abdomen light brown, with diffuse pale markings. Male pygofer with lateral processes greatly enlarged, longer than median processes.

**Description.** *Brachypter*. Body length ♂ 2.83–2.90 (2.86,  $n=3$ ), 3.31–3.63 (3.46,  $n=5$ ). Body robust, dull, light brown (Fig. 55).

Head with frons light brown maculated with white (Fig. 55), carinae pale; epistomal margin with stramineous transverse band, variable in width; gena mostly stramineous with brown spot below antennae. Postclypeus dark brown, anteclypeus paler. Vertex light brown with paler carinae and diffuse light spots. Antennae stramineous, antennal segment I 0.25–0.32 (0.28), II 0.46–0.53 (0.49); ratio I/II 0.50–0.66 (0.57,  $n=5$ ).

Thorax with pronotum mostly stramineous, light brown spots caudally in foveae, carinae light. Mesonotum stramineous with obscure dark markings especially caudally. Tegminal veins stramineous on light brown (or clear) membrane, distal margin of tegmina without transverse band. Venation normal (not reticulate), extending to distal margin.

Legs with front tibiae slightly expanded, width 0.15–0.16 (0.15,  $n=4$ ), dark brown, carinae often paler; tarsi and apices of tibiae of front and middle legs white, dark brown at tarsal claws; otherwise deep stramineous or light brown with femora, distal half of coxae brown. Calcar length 0.33–0.40 (0.37), number of calcar teeth 6–9 (7,  $n=5$ ).

Abdomen light brown with obscure stramineous markings.

**Macropter.** ♂ total length (including wings) 3.93 ( $n=1$ ). ♀ Body length (excluding wings) 3.28 ( $n=2$ ); total length (including wings) 4.25–4.48 (4.37,  $n=2$ ). Generally darker than brachypter, frons dark brown maculated with white, epistomal margin with narrow transverse white band, extending laterally along subgenal sulci, broadening behind genal carinae, reaching base of front coxae. Antennae stramineous. Carinae concolorous with frons, paler on vertex. Pronotum dark brown with paler carinae, mesonotum dark brown with pale markings along lateral carinae and caudal apex. Wings slightly brownish.

**Male Genitalia.** Pygofer (Fig. 12) cyphosomatic in cross-section, uniformly brown, paler on posterior margin and ental surface. Median processes approximately half length of parameres, parallel, simple and sharply acute apically with angular base. Lateral processes greatly enlarged, stout; nearly equal to parameres, broadest near apex, tapering to acute point, concolorous with pygofer. Parameres stout, widest near middle; narrowed, flattened and cupped into acute, medially directed, black-tipped apices. Genital diaphragm weak. Aedeagus (Fig. 12) strongly flattened laterally, widest near base, regularly tapering, with diagonal row of lateral teeth subapically on both sides. Anal processes short, just reaching paramere apices.

**Remarks.** *Pissonotus aphidioides* superficially resembles *P. tumidus*, but *P. tumidus* has dark tegmina veins and a male pygofer with much shorter lateral processes. Vein color appears to be consistent, but few males of *P. tumidus* were available. *Pissonotus tumidus* also has more extensive dark markings, especially on the nota. The front tibiae of *P. aphidioides* may be more expanded than *P. tumidus*. *Pissonotus aphidioides* also is similar to *P. albovenosus* except for size (body length *P. albovenosus* ♂ = 2.17–2.42, ♀ = 2.43–3.02), and *P. albovenosus* lacks the expanded front tibiae and has very short lateral processes. The very large lateral processes of *P. aphidioides* are unique in *Pissonotus*.

Crawford (1914) based his description of this species at least partially on misidentified specimens of *P. albovenosus* from Massachusetts and New Mexico. All of the specimens determined by Crawford as *P. aphidioides* that were located in this study were *P. albovenosus*, although not all of his specimens were located in this study. Specimens determined by Crawford from Arizona, Colorado, and California also are undoubtedly misidentified.

**Recorded Hosts.** *Castilleja coccinea* (L.) Spreng. (Scrophulariaceae) (Strickland 1940, 1953).

**Distribution.** Northcentral United States and adjacent Canada, south in mountains to Georgia. CANADA: Manitoba, Ontario, Quebec; also reported Alberta (Strickland 1940, 1953). UNITED STATES: Georgia, Iowa, Maryland, Michigan, New Jersey, New York, Pennsylvania; also reported Connecticut (Morgan and Beamer 1949), Ohio (Swezey 1904; Osborn 1904, 1938), Illinois (Wilson and McPherson 1980b).

**Type Material.** *Pissonotus aphidioides* Van Duzee, 1897, lectotype (♀b, designated by Oman 1947: 216–217, USNM #100433), "Salamanca/ 8/2 N. Y. 89" "♀" "type" "E. P. Van Duzee/ Collector."

**Other Material Examined.** Canada: QUEBEC: Laniel, (24–25)–VII–1963, W. Gagne (CNCI, 1m♂, 2m♀). ONTARIO: Dundas (Dunelas?), 16–VII–(?), L. A. Kelton (CNCI, 1b♂); One-sided Lake, (4–5)–VIII–1960, Kelton & Whitney (CNCI, 1b♂). MANITOBA: Int. Peace Gardens, Turtle Mtn. For. Res., 7–VIII–1958, J. G. Chillcott (CNCI, 1b♀). United States: MICHIGAN: Douglas Lake, 23–VIII–1937 (SEMC, 1b♀; 95–14d♀). NEW YORK: Otter Lake, 25–VII–1946, RHB (SEMC, 3b♂, 1b♀; 95–14f♂, 95–14b♀, 95–14g♂, 94–180d♂); Blue Mt. Lake, 27–VII–1946, RHB (SEMC, 1b♂; 95–14a♂); Ithaca, 9–VIII–1884 (CUIC, 1b♀; 95–14i♀); Taughannock, 22–VII–1905 (USNM, 1b♀; 95–14h♀); Middletown, 18–VII–1910, C. S. Spooner (USNM, 1b♂; 95–14e♂); Greene Co., Onteora, 28–VII–1929, L. O. Howard (USNM, 1m♀); Sabael, Indian L., 13–VIII–1921, H. G. Barber (USNM, 1b♀); 7 km W Woodgale, 19–VIII–1990, KAH (CNCI, 1b♂). NEW JERSEY: Chatam, VIII–1913, E. L. Dickerson (AMNH, 1b♀). PENNSYLVANIA: Monroe Co., Ross Township, site 13, trap 13, 24–VII–1969, C. L. Semmel (USNM, 1b♂; 95–14c♂). MARYLAND: Bowie, 22–VI–1945 (USNM, 1b♂; 93–201c♂); Pr(ince) Georges Co., Oxon Hill, 30–VI–1971, G. F. Hevel (USNM, 1b♀). IOWA: Ames, 17–VI–1896 (USNM, 1b♀; 93–251c♀); Ames, 24–VI–1925 (CNCI, 1b♀). GEORGIA: Rabun Bald, 4200', 16–VII–1958, floodplain community nr. Tamarack Bog, J. G. Chillcott (CNCI, 1b♀).

*Pissonotus flabellatus* (Ball, 1903)

(Figs. 13, 56)

*Phyllocladus flabellatus* Ball 1903: 232.

*Phyllocladus koebeli* Osborn 1903: 44–45. Synonymized by Metcalf 1923: 148, also Ball 1926: 19–20; similarity noted by Crawford 1914: 585; Van Duzee 1923: 51.

*Phyllocladus fuscous* Osborn 1903: 46. Synonymized by Ball 1926: 19–20, similarity noted by Crawford 1914: 585.

*Phyllocladus fuscus* Osborn 1903: Osborn 1904: 100; Crawford 1914: 585 (incorrect subsequent spellings).

*Phyllocladus flabellatus* (Ball 1903): Ball 1926: 19.

*Phyllocladus koebeli* Osborn 1903: Brimley 1938: 102 (incorrect subsequent spelling).

*Pissonotus flabellatus* (Ball 1903): Morgan and Beamer 1949: 100 (key), 103–105.

**Type Locality.** US: District of Columbia.

**Diagnosis.** *Brachypter*. Robust, body dark brown, maculated with white. Frons dark brown, maculated with white, epistomal margin with white transverse band. Pronotum and mesonotum mostly white dorsally. Tegmina with distinct white transverse band distally. Front tibiae greatly expanded. Abdomen dark brown with distinct pale maculations. Aedeagus with 3 simple retrose processes: 2 very long, 1 shorter.

**Description.** *Brachypter*. Body length ♂ 2.17–2.61 (2.36,  $n=5$ ), ♀ 2.85–3.49 (3.10,  $n=5$ ). Body robust, lustrous, dark brown variegated with white (Fig. 56); females larger than males.

Head with frons and vertex brown maculated with white (Fig. 56), carinae concolorous; epistomal margin of frons with white transverse band, extending laterad along subgenal sulci, broadening behind genal carinae to base of front coxae. Postclypeus uniformly dark brown, anteclypeus paler. Antennae stramineous, segment I 0.13–0.18 (0.16,  $n=5$ ), II 0.35–0.41 (0.37); ratio I/II 0.33–0.50 (0.42,  $n=5$ ).

Thorax with pronotum brown cephalad, white caudad. Mesonotum mostly white, with obscure darker markings. Tegminal veins concolorous with membrane, venation normal (not reticulate), indistinct; becoming obsolete before distal margin. Distal margin of tegmina with distinct white transverse band.

Legs with front and middle tibiae greatly expanded, front tibia width 0.20–0.23 (0.22,  $n=5$ ), dark brown; femora and coxae dark brown with obscure light markings; tarsi basally stramineous, brown near claws. Calcar length 0.30–0.33 (0.31,  $n=5$ ), number of calcar teeth 6–10 (8,  $n=5$ ).

Abdomen brown maculated with elongate, slightly raised white maculae, 3 spots each side of segment VI, and light middorsal carina.

*Macropter*. Body length (excluding wings) ♂ 2.47–2.80 (2.63,  $n=2$ ), ♀ 2.87–3.17 (3.09,  $n=5$ ); total length (including wings) ♂ 3.44–3.63 (3.54,  $n=2$ ), ♀ 3.50–3.88 (3.74,  $n=5$ ). Darker than *brachypter*, with less extensive pale markings.

Mesonotum brown with white caudal apex. Wings clear, often with dark spot near apex of clavus of forewing. Legs with more extensive dark markings. Abdomen with stramineous markings in tympanic area.

**Male Genitalia.** Pygofer (Fig. 13) cyphosomatic in cross-section, mostly brown with posterior margin, anal segment and venter at base of median processes paler; distinctly concave laterad of lateral processes. Median processes subequal to parameres, simple, angular, parallel, wide at base narrowing evenly to sharp, medially bent apices; parallel, converging apically. Parameres flattened, parallel-sided, diverging, with rounded apices, appearing to embrace median processes. Genital diaphragm vestigial. Aedeagus (Fig. 13) broad, strongly flattened laterally; 3 simple retrose processes, 2 distal retrose processes very long, somewhat twisted, most proximad shorter; large tooth near base of most proximad retrose process. Anal processes short, not reaching base of median processes.

**Remarks.** *Pissonotus flabellatus* resembles *P. tessellatus*, *P. tumidus*, and *P. aphidioides* but differs in having a white caudal band on the tegmina. *Pissonotus flabellatus* also has more distinctly expanded front tibiae than do *P. aphidioides* and *P. tumidus*, and lacks the reticulate tegminal venation of *P. tessellatus*. *Pissonotus spooneri* Morgan and Beamer, 1949 (as *Pissonotus piceus* Spooner 1912), was incorrectly synonymized with *P. flabellatus* by Ball (1926: 19).

Wilson et al. (1993a) reported collecting specimens of *P. flabellatus* in a Missouri tallgrass prairie from Sept. 20 to Oct. 14.

**Recorded Hosts.** *Schrankia*(?) sp. (Fabaceae).

**Distribution.** Eastern and central United States and adjacent Canada. CANADA: Ontario. UNITED STATES: Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Maryland, Massachusetts, Mississippi, Missouri, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, West Virginia; also reported New Jersey (Ball 1903, Swezey 1904).

**Type Material.** *Phylloctenus flabellatus* Ball, 1903, lectotype (b♀, USNM, designated by Morgan and Beamer 1949: 104): "Washing/ton D.C." "type" from Otto Heidemann collection. Paratype: New York: Riverton, "VIII 9" (1b♀, USNM).

*Phylloctenus koebelei* Osborn, 1903, lectotype (b♂, OSUC, here designated) "Columbus/O. Sep. 1903" "type" "cotype (red paper)" "Herbert/ Osborn/ Collection" "*Phylloctenus/ koebelei* Osb." "*=Pissonotus/(phylloctenus)/ flabellatus/(Ball) det./ R. H. Beamer.*" Paratypes: Ohio: Columbus, IX-1903, H. Osborn Collection (1b♀, 1b, OSUC); same, 190(?) (reported IX-1903, Osborn, 1903: 45, 1b♀, OSUC). District of Columbia: H. Osborn collection (no date, reported May, Osborn 1903: 45, 1m♀, OSUC). Specimens from the Osborn collection associated with the type series, not noted in Osborn (1903), from Staten Island, NY; Marietta, OH; and Duncan, OH are noted below. Synonymy by Metcalf 1923: 148, also Ball 1926: 19-20, similarity noted by Van Duzee 1923: 51.

*Phylloctenus fuscous* Osborn, 1903, holotype (b♀, OSUC, by monotypy): "Columbus/ O. Sept." "type" "type (red paper)" "Herbert/ Osborn/ Collection" "*Phylloctenus/ fuscous/ Osb. type*" "*=Pissonotus/(phylloctenus)/ flabellatus/*

(Ball) Det./ R. H. Beamer." A specimen collected at MS, Natchez, 22-VII-1921, C. J. Drake (1b♀, OSUC) was associated with the holotype, but not noted (Osborn 1903). Synonymy by Ball 1926: 19-20.

**Other Material Examined.** Canada: ONTARIO: 5 mi N Eire View, 8-IX-1977, KAH (CNCL, 1b♀); Thamesville, 1-IX-1977, KAH (CNCL, 1m♂). United States: NEW YORK, Lancaster, 25-VII-1946, RHB (SEMC, 2b♂, 1b♀; 95-136e♂, 95-136h♀); Staten Isd., 20-VIII-1904, Van Duzee (CASC, 1b♀); West Nyack, 13-X-1919, C. E. Olsen (NCSU, 1b♂); Ithaca, Savage Farm, 11-VII-1968, A. G. Wheeler (USNM, 1m♀); Staten Isl'd, 20-VIII-1904, N. Y. S. Coll. H. Osborn Collection (OSUC, 3b♀, 1b♂). MASSACHUSETTS: "Boston Mass" (NCSU, 1m♀); Tunica Co., 13-VI-1951, P. Munsoniana (USNM, 1m♀). CONNECTICUT: Storrs, 5-IX-1952, RHB (SEMC, 1b♀); Bridgeport, 20-IX-1920, B. H. Walden (NCSU, 1m♂); Orange, 6-IX-1922, B. H. Walden (NCSU, 1b♀); Prospect, 13-VI-1966, COB (LOBC, 1b♂). PENNSYLVANIA: "Penns. Sta." (Pittsburgh), 3-VII-1905 (Wirtner, CASC, 1b♂); same, 15-IX-1904 (CASC, 1b♀); same, 4-VII-1904 (CASC, 1b♂, Giffard slide #10, ser. VIII); same, 11-VII-1906 (CMNH, 1b♀); same, 4-VII-1904 (CMNH, 1b♀); same, 9-IX-1908 (CMNH, 2b♂ on 1 pin); same, 18-IX-1904 (CMNH, 5b♂, 1b♀ on 1 pin); same, 7-VII-1907 (CMNH, 4b♀ on 1 pin); same, 4-IX-1904 (CMNH, 6b♂, 8b♀ on 2 pins); Pittsburgh, 26-VI-1907 (Wirtner, CMNH, 1b♀); same, 24-VII-1905 (CMNH, 1b♀); Greensburg (Wirtner, no date, CASC, 1b broken); same, VIII-1904 (NCSU, 1b♂); same, "Sep. 25" (CMNH, 13b♂, 10b♀, 1m♀, 2 nymphs on 8 pins; USNM 1b♀, 2b♂, 1m♀ on 2 pins). DELAWARE: New Castle Co., Newark, 4-VIII-1990, C. R. Bartlett (NCSU, 1m♀); New Castle Co., nr. Woodland Beach, c. 1 mi W rt. 6, 6-VIII-1994, C. R. Bartlett (NCSU, 1b♀); New Castle Co., nr. Newark, White Clay Creek nr. Thompson's Bridge, 20-IX-1997, C. R. Bartlett, sweeping (UDCC, 1b♂). MARYLAND: Bay Ridge, 7-VII-1889, Heidemann Coll. (CUIC, 1b♂); S. Riv., 4 mi S Annapolis, 7-X-1934, PWO (SEMC, 1b♀; USNM, 2b♂, 1b♀); same, 30-IX-1934 (FSCA, 1b♂; USNM, 1b♂, 7b♀); Ashton, 13-VIII-1938, PWO (USNM, 1b♀); Plummer's I., 25-X-1902, Barber & Schwarz (USNM, 1b♀); Plummer's I., 29-VI-1913, W. L. McAtee (USNM, 1b♂); same, 5-X-1913 (USNM, 1b♀); nr. Chevy Chase Lake, 6-VI-1913, W. L. McAtee (USNM, 1b♂, 1b♀). DISTRICT OF COLUMBIA: 26-X-1941, PWO (FSCA, 2b♂); 28-X-1941 (USNM, 2b♀, 2b♂); 30-IV-1933, PWO (USNM, 1b♀); 13-IX-1924, EDB (USNM, 1b♂); 27-VI-1886 (Heidemann, USNM, 1b♀); same, "6-10" (USNM, 1m♀). OHIO: Barberton, 23-VIII-1936, L. J. Lipovsky (SEMC, 2b♂; 95-136c♂); Columbus, 1903, A. Koebele (CASC, 1m♂, 3b♂ Giffard slide #10, ser. VII and #2 ser. VIII); same, no date (CASC, 4b♂, 1b♀); Sugar Grove, 8-II(?) 1903 (CASC, 1b♂); Marietta, 13-IX-1905, H. Osborn (OSUC, 1b♂); Marietta, "VII-22," H. Osborn Collection (OSUC, 1b♂). ILLINOIS: Riverside, Des Plaines R., 2-IX-1949, W. Tietz Jr. (INHS, 1m♀); Cave-in-Rock, 2-X-1934, Frison & Ross (INHS, 1b♀); Marshall, 27-IX-1934, Frison & Ross (INHS, 1b♂); Shawneetown, 14-VI-1934, Ross & DeLong (INHS, 1b♀); Elizabethtown, (27-31)-V-1932, H. L. Dozier (INHS, 1m♀); same, 4-VIII-1932 (INHS, 2b♂, 4b♀); Serena, 18-IX-1953, Ross & Sand. (INHS, 1b♀); Cook Co., Riverside Woods, 9-IX-1949, W. Tietz Jr. (INHS, 1b♀); Marengo, 13-VII-1955, M. W. Sanders (CNCL,

2b♀); Urbana, 14-VII-1946, RHB (SEMC, 1b♀; 95-136r♀); Gibsonia, 2-X-1934, Frison & Ross (INHS, 1m♂). INDIANA: Albion, 10-VII-1935, H. E. Brown (NCSU, 1b♀); Tippecanoe Co., 3 mi NE Pettit, 14-VIII-1969, COB (LOBC, 1b♀); Allen Co., Ft. Wayne, 29-VIII-1966, L&COB (LOBC, 2b♀). MISSOURI: Johnson Co., Warrensburg, Belshe Farm, 14-IX-1990 (CMSU, 2b♂). KANSAS: Douglas Co., 9-VIII-1944, RHB (SEMC, 8b♂, 9b♀, 1m♀; 95-136b♂, 94-179a♀, 95-136i♀); same, 8-VIII-1945 (SEMC, 1b♀); same, 3-X-1945 (SEMC, 1m♀); same, 18-X-1944 (SEMC, 3b♂, 5b♀); same, 24-X-1944 (SEMC, 3b♂, 3b♀); same, 23-VII-1945 (SEMC, 1b♂); same, 14-X-1926 (SEMC, 1b♀); same, 19-X-1946 (SEMC, 1b♂); same, 2-XI-1944 (SEMC, 1b♂); Douglas Co., P. B. Lawson (no date, SEMC, 1b♂); Lawrence, 4-IX-1944, RHB (SEMC, 1m♀, 3b♂; 94-173a♀); same, 23-VIII-1944 (SEMC, 3b♂, 3b♀); same, 1-IX-1944 (SEMC, 1b♂); same, 20-IX-1944 (SEMC, 2b♂, 1b♀, 1m♀; 94-179b♀); Burbon Co., 12-X-1924, E. P. Breakey (SEMC, 1m♀, 1b♀; 95-136m♀); La Cygne, 21-V-1946, RHB (SEMC, 1b♂); Riley Co., 21-IX-1929, D. A. Wilbur (USNM, 1b♂). KENTUCKY: McCracken Co., 17-IX-1938, Turner (USNM, 1m♂, 1b♀). WEST VIRGINIA: Morgan Co., Largent, 30-VI-1990, sweeping, A. G. Wheeler (USNM, 1b♂). VIRGINIA: Arlington, 24-VIII-1946 (SEMC, 1b♂, 1b♀); Woolvine, 1-IX-1946, RHB (SEMC, 2b♂, 2b♀; 95-136d♂, 95-136g♀); Vienna, 2-IX-1946, PWO (FSCA, 1b♀); Bluemont, 31-VIII-1913, W. L. McAtee (USNM, 2b♂); Bluemont, 13-VIII-1913, W. L. McAtee (USNM, 1b♀); Fairfax Co., 1-VIII-1943, Sailer (USNM, 1b♀); Blacksburg, 15-X-1940 (USNM, 1m♀, 1b♀); Albemarle Co., 3-X-1938, Turner #12998 (USNM, 1b♂). NORTH CAROLINA: Bladen Co., Bladen Lakes SF, 5.5 km S Ammon, rd 1508 @Turnbull Cr., 11-IX-1987, blacklight, P. A. Follett (NCSU, 2b♀); Bladen Co., Bladen Lakes SF, CR1508 @Turnbull Cr., 16-IX-1994, C. R. Bartlett (NCSU, 6b♂, 2b♀, 1m♂, 3 nymphs; 95-136n♂); same, 17-IX-1994 (NCSU, 1b♀); same, Bladen Lakes School Road (NCSU, 1b♀); Hyde Co., 26-VIII-1959, D. A. Young (NCSU, 1b♀); Johnston Co., 24-VII-1962, L. H. Herman (NCSU, 1m♀); Raleigh, early Aug., F. Sherman (NCSU, 1b♂); same, late July (NCSU, 1b♂); Highlands, 29-VIII-1957 (CNCI, 1b♂). TENNESSEE: Nashville, 23-VII-1946, G&W (FSCA, 1b♀). GEORGIA: Mitchell Co., De Witt, 30-VII-1912, C. S. Spooner (FSCA, 1b♂, 1m broken, 1 nymph; USNM, 7b♂, 2b♀, 2m♀, 6 nymphs; 93-202a♂); same, 23-VII-1912 (USNM, 1b♀); Okefenokee Swamp, (28-V)-(2-VI)-1912 (USNM, 1b♀); Augusta, 14-X-1938, PWO (USNM, 2b♂, 2b♀). FLORIDA: Gainesville, 25-XII-1950, RHB (SEMC, 1b♂); Ponce De Leon, 7-III-1947, RHB (SEMC, 1b♂); same, LDB (SEMC, 1b♂); Palatka, 24-XII-1950, RHB (SEMC, 1b♂); same, 10-III-1947 (SEMC, 1b♂; 95-136f♂); Dade Co., 26-II-1988, K. E. Jenkins (FSCA, 1b♂); Sanford, 10-IX-1925, EDB (FSCA, 1m♀); same, 17-VI-1927 (USNM, 1b♀); Leon Co., Tall Timbers Res. Sta. Bird Window, 26-VI-1973, GBM (LOBC, 1m♀, 1b♀); Indian River, 16 mi W Vero Beach, 28-III-1976, COB & GBM (LOBC, 1b♂). ALABAMA: "Alab./2497," C. F. Baker Coll. (USNM, 1b♀). MISSISSIPPI: Shuqualak, 16-VII-1930, RHB (SEMC, 2b♂, 1b♀); Prairie, 27-VII-1921, C. J. Drake (ISUI, 1b♀); Natchez, 5-VII-1965, L&COB (LOBC, 1b♀). ARKANSAS: Howard Co., 13-V-1938, W. R. Turner #11626 (USNM, 1m♀, 1b♀). TEXAS: Brownsville, 27-XII-1945, RHB (SEMC, 3b♀; 95-136j♀); Crosby, 27-IV-1953, RHB (SEMC, 1m♀, 2b♀;

95-136l♀); Travis Co., Austin, Zilker Park, 8-X-1993, J. B. Woolley (TAMU, 1b♀); College Station, 23-IV-1933, H. J. Reinhard (TAMU, 1b♂); Brazos Co., College Station, 1-V-1974, R. R. Murray (TAMU, 1b♀); Columbus, "30-7," prob. on *Schrankia* (?) (USNM, 1b♀); S. Patricio Co., Welder Wildlife R., 23-V-1974, L&COB & GBM (LOBC, 1b♂); same, Pecan Motte, 2-XII-1972 (LOBC, 1b♀); same, Big Lake, 27-VIII-1970, L&COB, night (LOBC, 1b♀); same, 26-III-1970 (LOBC, 2b♀); Dickinson, VI-1929 (CNCI, 1b♀); Harlington, 23-II-1945, D. E. Hardy (SEMC, 1b♂).

*Pissonotus brunneus* Van Duzee, 1897

(Figs. 14, 58)

*Pissonotus brunneus* Van Duzee 1894a: 190 (nomen nudum).

*Pissonotus brunneus* Van Duzee 1897: 236, 239–240.

*Pissonotus divaricatus* Spooner 1912: 236–237. Synonymized by Morgan and Beamer 1949: 115–117.

*Dicranotropis brunneus* (Van Duzee 1897): Crawford 1914: 594 (key), 599.

*Dicranotropis divaricatus* (Spooner 1912): Crawford 1914: 600.

**Type locality.** US: New York, Erie County, Grand Island.

**Diagnosis.** *Brachypter*. Body dark brown. Frons immaculate, with narrow transverse band at epistomal suture, carinae often paler. Vertex dark brown with paler carinae. Pronotum and mesonotum dark brown with paler carinae. Tegminal veins extending to distal margin, paler than membrane. Tegmina without white distal transverse band. Abdomen with or without maculations or broad middorsal band. Male pygofer with small median tooth just ventrad of median processes. Aedeagus without retrose processes, with paired row of subdorsal teeth.

**Description.** *Brachypter*. Body length ♂ 2.06–2.40 (2.25,  $n=5$ ), ♀ 2.52–2.92 (2.71,  $n=5$ ). Body slightly lustrous, dark brown (Fig. 58).

Head with frons and vertex brown (Fig. 58), immaculate, carinae often paler, especially on vertex. Epistomal margin of frons with very narrow transverse band, following subgenal suture, broadening behind genal carinae. Postclypeus dark brown, anteclypeus stramineus. Antennal segment I dark brown, 0.10–0.15 (0.12,  $n=5$ ); II paler, 0.27–0.30 (0.28,  $n=5$ ); ratio I/II 0.34–0.50 (0.41,  $n=5$ ).

Thorax with pronotum and mesonotum dark brown, carinae paler. Tegminal veins paler than membrane, venation normal (not reticulate), conspicuous; extending to distal margin.

Legs with tibiae not expanded, front tibia width 0.07–0.08 (0.08,  $n=5$ ); legs usually brown with paler carinae, but variable; tarsi stramineus, dark at claws. Calcar length 0.26–0.30 (0.28,  $n=5$ ), number of calcar teeth 7–11 (9,  $n=5$ ).

Abdomen dark brown, dorsolateral maculae present or absent (present on holotype), usually small when present, 3 on each side of segment VI, most evident in paler specimens; some specimens with broad middorsal stripe in addition to maculations.

*Macropter*. Body length (excluding wings) ♂ 2.06–2.27 (2.18,  $n=5$ ), ♀ 2.63–



3.81 (2.99,  $n=5$ ); total length (including wings)  $\sigma$  3.22–3.23 (3.23,  $n=2$ ),  $\text{♀}$  3.25–3.75 (3.50,  $n=5$ ). Darker than brachypter, with similar markings; caudal tip of mesonotum often stramineous. Legs and abdomen similar. Wings clear.

**Male Genitalia.** Pygofer (Fig. 14) subcylindrical in cross-section, excavated laterad of lateral processes at apices of anal processes; brown with posterior margin and anal segment paler. Median processes angular, simple, narrow and parallel, just shorter than parameres. Small, blunt tooth present between median processes. Lateral processes vestigial. Parameres flattened, parallel, widest above middle with blunt median tooth; strongly cupped and narrowed into medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 14) strongly flattened laterally, widest near base; regularly tapering toward apex with paired subdorsal row of large teeth beyond midlength. Anal processes fine, exceeding base of parameres.

**Remarks.** *Pissonotus brunneus* most resembles *P. albovenosus* and *P. frontalis*, but the latter 2 species have frontal maculations. *Pissonotus brunneus* also resembles *P. nigriculus*, *P. niger*, and *P. rubrilatus* but has the tegminal veins paler than the membrane and often has abdominal maculations. The aedeagus of *P. brunneus*, which lacks retrose processes, but has a row of large, subdorsal paired teeth, and the small, midventral pygofer tooth, separate *P. brunneus* from all similar species. Pale specimens of *P. brunneus* (Fig. 58c) may have a broad, middorsal abdominal stripe in addition to spots.

At least 1 of the specimens (Greensburg, PA) that Crawford (1914) described as *P. pallipes* was *P. brunneus*. A female specimen reported tentatively as *P. albovenosus* by Osborn (1935: 248, the original description of *P. albovenosus*), labeled "Jamaica/ L.ID. 8.2.04," apparently is *P. brunneus*.

*Pissonotus brunneus* is a commonly collected species, particularly from upland, old-field situations.

**Recorded Hosts.** *Erigeron quercifolius* Lam., *Aster (p)uniceus* L. (Asteraceae), *Lespedeza* sp. (Fabaceae), *Agrostis* sp., (as red top) (Poaceae).

**Distribution.** Eastern and central United States and adjacent Canada, Mexico, and Jamaica. CANADA: Nova Scotia, Ontario, Quebec; also reported Alberta (Strickland 1937, 1940, 1953). UNITED STATES: Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Hampshire, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia; also reported New Jersey (Van Duzee 1917a), Wisconsin (Morgan and Beamer 1949). MEXICO: Chiapas, Federal District, Hidalgo, Michoacán, Puebla, San Luis Potosí, Veracruz; ?JAMAICA.

**Type Material.** *Pissonotus brunneus* Van Duzee, 1897, lectotype ( $\text{♀}$ , USNM, designated by Oman 1947: 217, top of 3 specimens on same pin): "Grand Isd., N. Y. 9-11-92" " $\text{♀}$ " "type" "E. P. Van Duzee/ Collector" "*Pissonotus/ brunneus* Van D." A paratype labeled "Clarence/ N. Y. 9-4-(18) '92" with Van Duzee's determination label is represented at the CUIC by an empty point.

*Pissonotus divaricatus* Spooner, 1912, holotype ( $\text{m}\sigma$ , USNM): "Middleton/

7/12/10 N. Y." "C. S. Spooner/ Collector," with additional label "*Pissonotus/ brunneus/ Van D. /Det Beam. + Oman/ 1946.*" Paratype (USNM,  $\text{m}\text{♀}$ ), same date and locality with "type" and "cotype no. (no number) U. S. N. M." labels. Synonymy by Morgan and Beamer (1949: 115-117). Specimens that may be *P. divaricatus* paratypes are reported below.

**Other Material Examined.** CANADA: ONTARIO, Ridgeway, 20-VII-1907, E. P. Van Duzee (CASC, 1 $\text{b}\text{♀}$ ); same, 26-VIII-1898 (USNM, 1 $\text{b}\text{♀}$ ); One-sided Lake, (4-5)-VIII-1960, Kelton & Whitney (CNCI, 1 $\text{b}\text{♀}$ ); Walpole Is., 13-VIII-1974, KAH (CNCI, 1 $\text{b}\text{♀}$ ); Randeau Pk., 29-V-1960, L. A. Kelton (CNCI, 1 $\text{b}\text{♀}$ ); Stittsville, 12-VII-1979, D. Brown (CNCI, 1 $\text{b}\sigma$ ); Pr(ince) Edw(ard) Co., 7-VIII-1962, J. F. Brimley (CNCI, 2 $\text{b}\sigma$  on 1 pin). QUEBEC: Laniel, 10-VIII-1932, W. J. Brown (CNCI, 2 $\text{b}\text{♀}$ ). NOVA SCOTIA: 3 mi E Bible Hill, 3-VIII-1973, KAH (CNCI, 1 $\text{m}\sigma$ ). UNITED STATES: MICHIGAN: Midland Co., 26-VIII-1958, R. R. Dreisbach (USNM, 1 $\text{b}\sigma$ ); Romulus, 29-VII-1985, KAH (CNCI, 1 $\text{b}\sigma$ ); 10 km S Middleville, 27-VII-1994, KAH (CNCI, 2 $\text{b}\sigma$ , 1 $\text{b}\text{♀}$ , 1 nymph all in a capsule). NEW HAMPSHIRE: Durham, 1-VII-1923 (NCSU, 1 $\text{b}\sigma$ ); same, 2-X-1922 (NCSU, 1 $\text{b}\text{♀}$ ); same, 20-IX-1922 (NCSU, 2 $\text{b}\text{♀}$ ); same, 14-VII-1922 (NCSU, 1 $\text{b}\text{♀}$ ); same, 22-IX-1921 (NCSU, 1 $\text{b}\text{♀}$ ); same, 8-IX-1921 (NCSU, 1 $\text{b}\sigma$ ); same, 14-IX-1922 (NCSU, 1 $\text{b}\sigma$ ); same, 18-VII-1922 (NCSU, 1 $\text{b}\text{♀}$ ); same, 28-IX-1922 (NCSU, 1 $\text{b}\text{♀}$ ); same, 7-IX-1927, saltmarsh (NCSU, 1 $\text{b}\text{♀}$ ); Epsom, 1-X-1927 (NCSU, 1 $\text{b}\sigma$ , 1 $\text{b}\text{♀}$ ; 93-237a $\sigma$ ); Rock Co., 1 mi SW Durham, (10-23)-VII-1987, f(light) i(ntercept) t(rap), D. S. Chandler (DENH, 1 $\text{m}\text{♀}$ ). CONNECTICUT: Storrs, 3-VIII-1946, RHB (SEMC, 2 $\text{b}\sigma$ , 3 $\text{b}\text{♀}$ , 1 $\text{m}\sigma$ ; 95-17c $\sigma$ ); same, 4-VIII-1946 (SEMC, 2 $\text{b}\sigma$ , 4 $\text{b}\text{♀}$ ); same, 9-VIII-1946 (SEMC, 2 $\text{b}\text{♀}$ ); same, 5-VIII-1943 (SEMC, 5 $\text{b}\sigma$ , 8 $\text{b}\text{♀}$ ); same, 5-IX-1952 (SEMC, 19 $\text{b}\sigma$ , 4 $\text{b}\text{♀}$ ); same, 15-VIII-1946, RHB (SEMC, 2 $\text{b}\sigma$ ); New Haven, 16-VIII-1946, RHB (SEMC, 2 $\text{m}\sigma$ , 1 $\text{b}\text{♀}$ ; 95-16 $\text{m}\sigma$ , 95-16 $\text{n}\text{♀}$ ); New Haven, 20-VII-1920, B. H. Walden (NCSU, 1 $\text{m}\text{♀}$ ); New Haven, 18-VIII-1934, PWO (USNM, 2 $\text{b}\text{♀}$ ); New Haven, 31-X-1903, H. L. Viereck (NCSU, 1 $\text{b}\sigma$ ); New Haven, 11-VII-1920, B. H. Walden (NCSU, 1 $\text{m}\text{♀}$ ); same, 25-IV-1921 (NCSU, 1 $\text{b}\text{♀}$ ); Mystic, 19-VIII-1934, PWO (USNM, 3 $\text{b}\text{♀}$ ); Danbury, 16-VIII-1946, RHB (SEMC, 1 $\text{b}\sigma$ ); Mt. Carmel, 19-VI-1964, COB (LOBC, 1 $\text{b}\sigma$ , 1 $\text{b}\text{♀}$ ); Canaan, 5-VII-1951, A. Stone (USNM, 2 $\text{m}\text{♀}$ , 1 $\text{b}\text{♀}$ ); Mansfield Twp, Gurleyville, 16-IX-1972, A. Slater (SEMC, 1 $\text{b}\text{♀}$ ). MASSACHUSETTS: Plymouth, 15-VII-1934, M. W. Sanderson (SEMC, 3 $\text{b}\sigma$ , 1 $\text{b}\text{♀}$ ; 95-193b $\sigma$ ); Boston, Arnold Arboretum (no date, NCSU, 1 $\text{b}\text{♀}$ ); Watertown, 2-VII-1920, C. C. Sperry (USNM, 1 $\text{b}\text{♀}$ ). NEW YORK: Holland, 22-VII-1946, RHB (SEMC, 2 $\text{b}\sigma$ , 2 $\text{b}\text{♀}$ ; 95-17b $\text{♀}$ ); Sea Cliff, L. I. (no date, CUIC, 1 $\text{b}\text{♀}$ , 1 $\text{b}\sigma$ ); same, N. Banks (NCSU, 1 $\text{b}\sigma$ ); Ithaca, 4-VII-1936, P. P. Babiy (CUIC, 1 $\text{b}\text{♀}$ , 1 $\text{m}\text{♀}$ ); Ithaca, 28-VI-1936, P. P. Babiy (CUIC 1 $\text{b}\text{♀}$ , 1 $\text{m}\text{♀}$  same point); Ithaca, Campus (Cornell), 28-VII-1937, P. P. Babiy (CUIC, 1 $\text{b}\text{♀}$ ); Ithaca, Savage Farm, 13-XII-1966 (CUIC, 1 $\text{b}\text{♀}$ ); Ithaca, Savage Farm, 7-VI-1969, alfalfa, A. G. Wheeler (USNM, 1 $\text{m}\sigma$ , 1 $\text{m}\text{♀}$ ); Ithaca, 25-VII-1946, RHB (SEMC, 2 $\text{b}\sigma$ , 2 $\text{b}\text{♀}$ ); Ithaca, 4-VIII-1905 (Van Duzee, USNM, 1 $\text{m}\text{♀}$ ); same, 2-VIII-1905 (USNM, 1 $\text{b}\text{♀}$ ); Lancaster, 25-VII-1946, RHB (SEMC, 2 $\text{b}\sigma$ , 2 $\text{b}\text{♀}$ ); Elba, 25-VII-1946, RHB (SEMC, 3 $\text{b}\sigma$ , 1 $\text{b}\text{♀}$ ); "Del. Water Gap," A. T. Slosson (AMNH, 1 $\text{b}\text{♀}$ ); Staten Isd., 20-VIII-1904, Van Duzee (CASC, 1 $\text{b}\sigma$ ); Buffalo, 9-VIII-1905, E. P. Van Duzee (CASC, 1 $\text{b}\text{♀}$ ); same, 24-VIII-1898 (USNM, 3 $\text{b}\sigma$ , 2 $\text{b}\text{♀}$  on 3 pins);

same, 16-VII-1901 (USNM, 1b♀); West Nyack, 11-VI-1920, C. E. Olsen (NCSU, 1b♀, 1m♀); Flushing, L. I., 13-IX-1910, C. R. Plunkett (NCSU, 1m♀); Middletown, 12-VII-1912, C. S. Spooner (INHS, 1b♂; USNM, 5b♀, 1b♂); same, 18-VII-1910 (USNM, 1b♀); same, 11-VII-1910 (USNM, 4b♀, 2b♂); same, 22-VII-1910 (USNM, 1b♀); Johnstown, 8-IX-1910, Alexander (USNM, 1b♀); Gloversville, 23-IV-19(10?) (USNM, 1b♀); L. I., Cold Spring Harbor, 18-VII-1900 (USNM, 1m♀); (New York City), E. D. Southwick (ISUI, 1b♀, paralectotype). PENNSYLVANIA: Peck's Pond, 21-VIII-1946, RHB (SEMC, 1b♂); Ashland, 21-VIII-1946, RHB (SEMC, 1b♂, 1b♀); Greensburg (Wirtner, no date, determined and described by Crawford (1914) as *pallipes*, 2b♂; Giffard slide #9a, ser. VII); Philadelphia, 12-VI-1898, W. J. Gerhard (NCSU, 1m♂); Greensburg, VII-1909 (Wirtner, NCSU, 1b♂); same, "Sep. 25" (CMNH, 1b♂); same, "Jly. 19" (CMNH, 1b♀); same, "Jly. 12" (CMNH, 1b♀); same, 23-VII-1902 (CMNH, 1b♂); "Penns Sta." (Pittsburgh), 3-VII-1905 (Wirtner, CMNH, 6b♂, 6b♀ on 3 pins); same, 20-VI-1904 (CMNH, 1m♂); same, 22-V-1904 (CMNH, 1m♀, 1m♂); Pittsburgh, 26-VI-1907 (Wirtner, CMNH, 1b♂, 4b♀); Allegheny Co., Harmarville, 27-VI-1915, H. Kahl (CMNH, 1b♂); Bustleton, 27-VIII-1920, Horsfall, Sta. Col. Lab. (USNM, 1b♀); State College, 7-VII-1958, R. C. Newton (USNM, 1b♂). DELAWARE: New Castle Co., nr. Newark, White Clay Creek Pres., 3-X-1990, C. R. Bartlett (NCSU, 1b♂); New Castle Co., Newark, UD farm, 29-VI-1995, sweep, C. R. Bartlett (NCSU, 1b♂); New Castle Co., Wilmington, 2-VIII-1995, sweeping, C. R. Bartlett (NCSU, 1b♂). MARYLAND: Plummer's I., 30-VI-1905, Heidemann Coll. (CUIC, 1b♀); Plummer's I., 30-III-1913, W. L. McAtee (USNM, 1b♂); same, 8-VI-1913 (USNM, 1b♀); same, 29-VI-1913 (USNM, 1b♂); same, 3-VIII-1913 (USNM, 1b♂); same, 28-IX-1913 (USNM, 1b♀); same, 30-III-1913 (USNM, 1b♂); same, 5-X-1915 (USNM, 1b♀); Bay Ridge, 4-VII-1889, Heidemann Coll. (CUIC, 1m♀); Piney Point, 26-VIII-1946, RHB (SEMC, 2b♂, 2b♀); S. River, 4 mi S Annapolis, 7-X-1934, PWO (FSCA, 1m♀; USNM, 5b♂, 9b♀); Jackson's Id., 30-VI-1914, light trap, R. C. Shannon (USNM, CWT *divaricatus* by Oman, 1m♂); Beltsville, 15-VI-1913, W. L. McAtee (USNM, 1m♂, 1m♀); Ashton, 13-VIII-1938, PWO (USNM, 1b♀); Mg. Co., 4 mi SW Ashton, 17-VI-1985, G. F. & J. F. Hevel (USNM, 1m♀); Norbeck, 13-V-1934 (USNM, 1b♀); "Branchville to Beltsville," 4-VI-1914, W. L. McAtee (USNM, 2b♀, 1b♂); Plum Point, 9-VIII-1913, W. L. McAtee (USNM, 1b♀); Hyattsville, 18-V-1941, "on leaf *Aster (p)uniceus*," W. H. Anderson (USNM, 1b♀); Prince Georges Co., Camp Springs, 8-VII-1979, G. F. Hevel (USNM, 2b♀, 1b♂); same, 3-IX-1979 (USNM, 1b♀); Chesapeake Bch., 2-VII-1921, J. R. Malloch (USNM, 1b♀). DISTRICT OF COLUMBIA: 6-X-1903, Heidemann (CUIC, 1b♀); same, 3-VII-1904 (CUIC, 1m♀); same, 20-VI-1898 (CUIC, damaged, "Homotype"); same, 2-VIII (no year, CUIC, 1b♀); same, 14-VII (USNM, 1b♂); same, 2-VII-1889 (date on underside of label, CUIC, 1b♀); same, 15-VI-1889, Heidemann (date on underside, CUIC, 1m♀); same, 2-X-1904 (USNM, 1b♀); 25-VI-1905, Van Duzee (CASC, 1b♀); 30-IV-1938, PWO (USNM, 1b♀); 28-IX-1941, PWO (USNM, 9b♂, 5b♀); 14-VIII-1937 (USNM, 1b♂); 13-IX-1913, W. L. McAtee (USNM, 2b♂, 1b♀); 30-VI-1901 (USNM, 1b♀); 28-VI-1925 (USNM, 1b♀); 5-VII-1920 (USNM, 1m♀, 1b♂); 14 mi E, 12-VII-1925, H. S. Barber (USNM, 1b♀).

OHIO: Cleveland, Rocky River Park, 20-V-1975 (CMSU, 2b♀); Barberton, 11-VIII-1936, L. J. Lipovsky (SEMC, 1b♂, 1b♀, 1m♂; 95-17e♂); same, 23-VIII-1936 (SEMC, 2m♂, 2m♀, 1b♀, 1b♂; 95-17a♂, 95-17b♀, 95-17h♀, 95-17g♂, 95-16g♂); same, 8-VII-1936 (SEMC, 3m♀, 1b♀, 1m broken; 95-17i♀, 95-17f♀, 95hb♀); Columbus, 10-VI-1903, O. H. Swezey (CASC, 1b♂, 1b♀); Columbus, 1903, A. Koebele (CASC, 1m♀, 1b♀); Columbus (no date, Koebele?, CASC, 1m♀, 1b♀); Fruit Hill, 13-VIII-1903, O. H. Swezey (CASC, 2b♂, 6b♀ on 2 pins); Dayton, 12-VIII-1903, O. H. Swezey (CASC, 1b♀); Hillsboro, 21-VIII-1903, O. H. Swezey (CASC, 3b♀). ILLINOIS: Farina, 14-V-1946, on red top, W. M. Sanderson (INHS, 1b♂); Metropolis, 20-VIII-1916 (INHS, 2b♂, 2b♀); Elizabeth, 7-VII-1917 (INHS, 1m broken); Havana, 16-XI-1913, river shore (INHS, 3b♀); Paxton, 30-VII-1916 (INHS, 3b♂, 1b♀); Mahomet, 10-X-1915 (INHS, 1b♀); Galena Jn., 8-VII-1917 (INHS, 1b♀); Savanna, 9-VII-1917 (INHS, 1b♀); Dongola, 22-VIII-1916 (INHS, 1b♀); Kampsville, 10-VI-1932, H. L. Dozier (INHS, 1b♀, 1m♀); Urbana, 21-VI-1936, B. D. Burks (INHS, 1b♀, 2m♀, 1m♂); Monticello, 26-VII-1932, H. L. Dozier (INHS, 1b♂); N. Milford, 3-VII-1936, on grass, Ross & Burks (INHS, 1b♀); Elizabethtown, (27-31)-V-1931, H. L. Dozier (INHS, 1m♂); Vienna, 14-VI-1934, floodplain woods, DeLong & Ross (INHS, 1m♀, 1b♀); Pulaski, 25-V-1932, H. L. Dozier (INHS, 1b♀); Billett, 8-VI-1951, W. M. Sanderson (INHS, 1b♀); Shawneetown (INHS, 1m♀, 1m broken); Champaign Co., Champaign, 2-XII-1962, L. K. Gloyde (INHS, 1b♀); Coles Co., 3-X-1968, Barnes (EIUC, 1b♀); Coles Co., 4-VIII-1973, J. O'Rourke (EIUC, 1b♀); Muncie, 10-VI-1916, C. S. Spooner (EIUC, 1b♂); Pulaski Co., Wetaug, 10-VI-1938 (USNM, 3b♀); same, 5-VII-1935 (USNM, 2b♂, 3b♀); Clay Co., Hord, 15-VII-192(3?) (USNM, 2b♀, 1m♀); Charleston, Hall's Ford, 12-VIII-1920, Spooner (USNM, 1m♀); Charleston, 4-VII-1918 (USNM, 1b♀); Clark Co., Cleone, 13-IX-1936 (USNM, 1b♀); Wright Cr., Mason, 15-VII-1925 (USNM, 1b♀); 6 mi SE Charleston, Embarrass R., 15-VI-1936 (USNM, 1m♂). INDIANA: Osborn, 1-VII-1916, Spooner (EIUC, 1m♂); Kosciusko Co., S. Shore Lake, Wawasee, 12-VI-1964, L&COB (LOBC, 1m♀); Tremont, 9-VI-1934, sweeping wood herb, H. E. Brown (NCSU, 1b♀); Allen Co., Ft. Wayne, 29-VIII-1966, L&COB (LOBC, 3b♂, 4b♀); 4 mi NW West Lafayette, 8-VII-1967, COB (LOBC, 4b♀); Tippecanoe Co., 3 mi NE Pettit, 14-VIII-1969, COB (LOBC, 3b♀); W. Lafayette, Old Soldiers Home, 11-VI-1967, COB (LOBC, 1b♀); Miami Co., 6 mi E Peru, 2-VII-1967, COB (LOBC, 1b♀, 1b♂). MISSOURI: Johnson Co., Warrensburg, Belshe Farm, 14-VIII-1990 (CMSU, 1b♂); Johnson Co., Warrensburg, 1-IX-1993, S. Wilson (CMSU, 1m♂); Forrest Park, St. Louis, Heidemann Coll. (CUIC, 1b♀). KANSAS: La Cygne, 28-X-1945, RHB (SEMC, 3b♂, 1b♀); same, 21-V-1946 (SEMC, 1b♂); Douglas Co., 24-X-1944, RHB (SEMC, 4b♂, 2b♀); Douglas Co., Lawrence vicinity, 20-X-1986, B. N. Danforth (SEMC, 1b♀); Cherokee Co., 18-IX-1945, RHB (SEMC, 2b♂, 3b♀); Welda, 17-IX-1945, RHB (SEMC, 1b♂); Ck. Co., 12 mi W, 5 mi S of Columbus, (8-9)-VI-1976, G. F. Hevel (USNM, 1b♀, 1m♂). IOWA: Ames, 31-VIII-1897, Exp. Sta. (ISUI, 1b♂); same, 9-VII-1897 (ISUI, 1b♀); Ames, 15-VII-1895, Ball (USNM, 1m♀). WEST VIRGINIA: Cranberry Gls., 4-VI-1935, H. V. Weems Jr. (FSCA, 4b♀, 3b♂; LOBC, 1b♀). VIRGINIA: Mecklenburg Co., 4-VII-1980, T. Williams (CMSU, 1m♂);

Woodbridge, 28-VIII-1946, RHB (SEMC, 2b♂, 3b♀); N. Alexandria, VII-1907, W. M. Palmer (USNM, 1b♀); Vienna, 16-VIII-1931, PWO (USNM, 2b♂, 1b♀); same, 19-IX-1931 (USNM, 1b♂); Vienna, VIII-1935(?), J. C. Bridwell (USNM, 1b♀); Arlington, 7-V-1938, PWO (USNM, 1b♂, 1b♀); Bluemont, 31-VIII-1913, W. L. McAtee (USNM, 1b♀); same, 21-IX-1913 (USNM, 1b♂); Great Falls, 19-V-1915, W. L. McAtee (USNM, 1b♀); Chain Bridge, 4-IX-1921, J. R. Malloch (USNM, 1b♀); Blacksburg, 15-X-1940 (USNM, 1b♀); same, 23-X-1940 (USNM, 2b♂). NORTH CAROLINA: Chapel Hill, 31-VIII-1946, LDB (SEMC, 1b♀); same, RHB (SEMC, 1b♂); Macon Co., Shope Fork, Coweeto Hydroblo Sta., 3600', 30-V-1983, sweep, D. S. Chandler (DENH, 1m♂); Wilmington, Greenfield Park, V-1935, Z. P. Metcalf (NCSU, 5b♂, 11b♀); Robbinsville, 1-IX-1959, D. A. Young (NCSU, 1b♀); same, 24-VII-1958 (NCSU, 1b♀); Davidson Co., 19-VII-1962, H. D. Blocker (NCSU, 2b♀); Hyde Co., 5-VI-1959 (NCSU, 1b♂); Lewiston, Peanut Res. Sta., 2-VIII-1963, sweeping old field, J. F. Cornell (NCSU, 3b♀); Wake Co., 23-V-1958, D. A. Young (NCSU, 3b♀, 1m♀, 1m♂, 1b♂, 1b broken; 95-15e♂, 95-16f♀, 95-17j♂); Wake Co., Raleigh, NCSU @Centennial Campus, 17-VIII-1994, sweep, C. R. Bartlett (NCSU, 1b♂); Raleigh, VIII-1912, C. L. Metcalf (NCSU, 1m♀); Raleigh, 31-VIII-1909 (NCSU, 1b♀); Raleigh, VI-1909, Z. P. Metcalf (NCSU, 1b♀); Raleigh, VIII-1909, Z. P. Metcalf (NCSU, 1m♀); Wake Co., Auburn, 19-VII-1959, W. P. DuBose (NCSU, 1b♀); Wake Co., Raleigh, 6-VIII-1984, light trap, D. G. Riley (NCSU, 1b♀); Raleigh, 16-X-1938, PWO (FSCA, 1b♀; USNM, 4b♂, 5b♀); Sutton's Corner, 26-V-1964, marsh, J. Cornell (NCSU, 1b♀); Onslow Co., 25-VI-1964, sweeping, J. F. Cornell (NCSU, 1b♀); Burgaw, V-1925, open pine woods (NCSU, 1b♂, 3b♀); Burgaw, Big Savannah (no date, longleaf pine savannah, NCSU, 1b♂); mountains, 1937-1938, Z. P. Metcalf (NCSU, 2b♂); Pisgah NF, 8-VIII-1957, D. H. Habeck (NCSU, 1m♂); Swannanoa, 13-VIII-1919, Osborn & Metcalf (NCSU, 1b♂); same, 23-VIII-1919 (NCSU, 1b♀); same, 11-VIII-1919, 3000-3500' (NCSU, 1b♀); Johnston Co., nr. Clayton, 25-VI-1993, C. R. Bartlett (NCSU, 2b♂, 3b♀); Wake Co., nr. Raleigh, Centennial Campus, 10-IX-1994, C. R. Bartlett (NCSU, 1b♂, 3b♀); New Bern, 5-V-1932, PWO (FSCA, 1b♂; USNM, 1b♂); New Bern, 5-V-1932, PWO (USNM, 1b♂); Lake Junaluska, 10-VI-1956, H. V. Weems Jr. (USNM, 1m♂); Base of Wayah Bald, 11-VIII-1957, W. R. Richards (CNCI, 2b♀); Macon Co., Wayah Gap, 4200', 29-VII-1957, J. G. Chillcott (CNCI, 3b♀, 2b♂); Wayah Gap nr. Franklin, 3500', 16-VIII-1957, J. G. Chillcott (CNCI, 1m♀); Highlands, 27-VIII-1957, L. A. Kelton (CNCI, 3b♀); same, 29-VIII-1957 (CNCI, 2b♀); same, 15-VIII-1957 (CNCI, 1b♂); same, 21-VIII-1957 (CNCI, 2b♀, 1b♂); same, 22-VIII-1957 (CNCI, 1m♀, 1b♂); same, 21-VIII-1957, W. R. Richards (CNCI, 1b♂); Highlands, 3800', 8-V-1957, J. R. Vockerth (CNCI, 1b♂); Highlands, 29-VIII-1957 (CNCI, 1m♀); nr. Highlands, Horse Cave Bog, 2900', 19-VII-1957, J. G. Chillcott (CNCI, 1m♀); Franklin, 16-VIII-1957, L. A. Kelton (CNCI, 1m♀); Clingman's Dome, 5-VIII-1957, W. R. Richards (CNCI, 1m♀, 1b♂); Chestnut Bald, nr. Pisgah Forest, 5900', 2-VIII-1957, J. G. Chillcott (CNCI, 1m♂); Looking Glass Rock, Brevard (Co.?), 19-VII-1959, W. R. Richards (CNCI, 1m♀); GSMNP, Indian Gap to Clingman's Dome, 5200'-6600', 6-VII-1959, J. G. Chillcott (CNCI, 1b♀); Montreat, 25-IX (NCSU, 1b♂, 4b♀); same, 24-IX (NCSU, 1b♀).

TENNESSEE: McNairy Co., 5 mi W Selmer, 4-VII-1965, L&CO (LOBC, 1b♂, 5m♀); Roan Co., 15-XI-1938, W. F. Turner #15582 (USNM, 1b♂); same, 19-III-1939, #13477 (USNM, 1b♂); Memphis, 20-V-1916, W. D. Pierce (USNM, 1b♀); Hamilton Co., 9-XII-1940, W. F. Turner, #17964 (USNM, 1b♂); Collins Gap, nr. Clingman's Dome, GSMNP, 5700', 22-VIII-1957, J. G. Chillcott (CNCI, 1b♂); Indian Gap, GSMNP, 23-VII-1957, W. R. Richards (CNCI, 8b♂, 1b♀; 96-43a♂); same, 6-VIII-1957 (CNCI, 2b♂ plus capsule [4b♀]). KENTUCKY: Kenton Co., Covington, 21-VIII-1918, M. Wirtner (CMNH, 2b♂); Kingston, 22-VIII-1950, G. S. Walley (CNCI, 2b♂). SOUTH CAROLINA: Clemson, 29-IV-1953, Insectory, on *Lespedeza* (USNM, 1m♂); Colleton Co., 5 mi S Canady, Edisto R., 21-V-1968, blacklight, O. L. Cartwright (USNM, 2b♀). GEORGIA: De Witt, 15-IV-1912 (Spooners, FSCA, 1b♂); Mitchell Co., De Witt, 25-VII-1912, C. S. Spooner (USNM, 2b♀, 1b♂ [headless]); Thomasville, 17-V-1915, C. S. Spooner (USNM, 1m♀); Hinesville, 4-X-1938, PWO (USNM, 5b♂, 1b♀); Peach Co., 22-IV-1942, Turner #19402 (USNM, 1m♂); Clayton, 19-V-1965, R. C. Froeschner (USNM, 1b♀, 1b♂); 1 mi E Pine Mtn, 2-VIII-1957, W. R. Richards (CNCI, 2b♂); Rabun Bald, 9-VIII-1957, L. A. Kelton (CNCI, 2b♂, 2b♀). FLORIDA: Marianna, 7-III-1947, RHB (SEMC, 2b♂, 1m♂, 1m♀, 1b broken); Lamont, 7-III-1947, RHB (SEMC, 2b♂, 1b♀); Otter Creek, 9-III-1947, RHB (SEMC, 2b♂, 3b♀); same, 6-VII-1948 (SEMC, 1b♂); Tallahassee, 7-III-1947, RHB (SEMC, 1b♀); Palatka, 10-III-1947, RHB (SEMC, 1b♀); Inmonia, 30-VI-1948, RHB (SEMC, 1b♂); Crescent City, IV-1908, Van Duzee (CASC, 1m♂); Levy Co., 13-IV-1955, "at *Erigeron quercifolius*," H. V. Weems Jr. (FSCA, 1b♀); Alachua Co., 21-IV-1955, sweeping, R. A. Morse (FSCA, 1b♀); Eustes, 6-IV-1926 (USNM, 1m♂); Sanford, EDB USNM, as follows: 13-V-1927, (1b♂, 2b♀); 19-VIII-1926, (1b♀); 17-V-1926, (2b♀, 1b♂); 22-IX-1926, (1b♀); 21-IV-1926, (1b♀, 1b♂); 13-V-1926, (1b♂); 8-VII-1926 (1b♀, 1b♂ on 1 pin); Daytona, 22-V-1926 (USNM, 1b♀); Sarasota, 21-IV-1961, L. A. Kelton (CNCI, 1b♂, 2b♀); Orlando, 11-IV-1961, L. A. Kelton (CNCI, 1b♀). ALABAMA: Semmes, 20-III-1947, RHB (SEMC, 2b♂, 1b♀). MISSISSIPPI: Merrill, 20-III-1947, RHB (SEMC, 2b♂); Vicksburg, 3-VI-1955, D. H. Habeck (NCSU, 1m♂); Okolona, 25-VI-1921, C. J. Drake (ISUI, 1b♂); same, 28-VI-1921 (CNCI, 1b♀); same, 25-VII-1921 (ISUI, 1b♀); Tupelo, 11-IX-1946, G&W (FSCA, 1b♂); Vicksburg, 18-VI-1921, C. J. Drake (USNM, 1b♂); Port Gibson, 21-VII-1921, C. J. Drake (USNM, 1b♀); Monroe Co., Prairie GL361, 21-V-1959, Ross & Stannard (CNCI, 1m♀, 1b♂); Fulton, 14-VII-1930, RHB (SEMC, 1b♂, 1b♀). LOUISIANA: Colfax, 23-XII-1931 (SEMC, 1b♂); Natchitoches, 23-XII-1931, RHB (SEMC, 1b♂); Lafayette, 1-V-1951, O. Bryant (CASC, 1b♀); Vacherie, 16-II-1932, T. F. McGeebee (NCSU, 1b♀); Caddo Par., 2 mi N Oil City, 8-VI-1965, COB (LOBC, 2b♀). ARKANSAS: Rogers, 6-VI-1946, Sanderson (INHS, 1b♂, 1b♀). OKLAHOMA: Blue Bryan Co., 8-VI-1965, L&COB (LOBC, 1b♀). TEXAS: Crosby, 27-IV-1953, RHB (SEMC, 14b♂, 21b♀); Old Ocean, 3-I-1946, RHB (SEMC, 2b♂); Dallas, 5-XII-1945, RHB (SEMC, 2b♂, 2b♀; 95-16k♂, 95-16l♀); Angleton, 15-II-1928, Exp. Sta. Coll. (TAMU, 3b♂); Polk Co., Ace 4 mi N Romayer, Menard Creek, 22-V-1984, J. B. Woolley (TAMU, 1b♀); Gonzales Co., Palmetto SP, 18-IV-1970, V. L. Board (TAMU, 1b♀); Dickinson, VI-1929 (CNCI, 1b♂); Bay City,

4-V-1953, RHB (SEMC, 1m♂). Mexico: SAN LUIS POTOSÍ: Hwy 80, 18 mi E C(uida)d del Miaz, 4100', 23-VII-1982 (LOBC, 2b♀). VERACRUZ: 9 mi NW Jalapa, 31-XII-1949, LDB (SEMC, 6b♂, 5b♀; 95-16i♂, 95-16j♀); same, RHB (SEMC, 1b♀, 1m♂, 2b♂); Veracruz, 3 mi E Huatusco, 22-VII-1995 (TAMU, 2b♂, 1b♀). HIDALGO: 40 mi N Jacala, 18-VIII-1967, G F. Hevel (USNM, 1b♀); Hgo., 25 mi NE Jacala, 5100', 27-V-1974, L&COB & GBM (LOBC, 2b♂, 2b♀; 96-40a♂); same, 29 mi NE, 4500' (LOBC, 1b♀); Hgo. Hwy 85, 18 mi NW Jacala, 5700', 25-VII-1982 (LOBC, 1b♀); same, 24 mi NW, 5400' (LOBC, 1b♀); Hgo., Hwy 105, 2 mi S Tlanchinol, 5050', 31-VII-1982 (LOBC, 2b♀); Hgo., Hwy 105, 3 mi N Tlanchinol, 5000', 8-V-1983 (LOBC, 1b♀); MICHOACÁN: Hwy 15, 23 mi W Cd. Hidalgo, 8700', 7-VIII-1982 (LOBC, 1b♀). FEDERAL DISTRICT(?): Chapultepec, (A.) Koebele (no date; BPBM, 1b♀). PUEBLA: Xicotepec de Juarez, 29-IV-1984 (TAMU, 1b♂); Pue., 27 mi N Zacapoaxtla, 3800', 10-VI-1983 (LOBC, 1b♀). CHIAPAS: 4 mi W San Cristobal de la Casas, 7300', 4-VI-1974, L&COB & GBM (LOBC, 1b♀). Jamaica: "Jamaica/L. ID. 8.2.04" (1b♀, OSUC).

*Pissonotus neotropicus* (Muir, 1926), new combination  
(Figs. 15, 57)

*Phyllodinus neotropicus* Muir 1926: 18-19.

*Phyllodictus neotropicus* (Muir 1926): Metcalf 1943: 146.

**Type Locality.** ECUADOR: Tena.

**Diagnosis.** *Brachypter*. Body dark brown. Frons dark brown to brown, epistomal margin with white transverse band. Vertex usually paler than frons. Antennal segment I dark brown, II stramineous with dark longitudinal anterior highlight. Tegmina with incomplete white distal transverse band, venation normal, veins paler than membrane, becoming obsolete before distal margin. Front and middle tibiae expanded. Abdomen immaculate. Aedeagus with 5 retrose processes of various lengths.

**Description.** *Brachypter*. Body length ♂ 2.03-2.62 (2.35,  $n=5$ ), ♀ 2.44-3.43 (2.93,  $n=5$ ). Body lustrous, dark brown (Fig. 57).

Head with frons dark brown to brown (Fig. 57), immaculate with median carina paler; epistomal margin with white transverse band, following subgenal sulci laterally, becoming broader behind genal carinae, reaching front coxae. Vertex light brown, usually contrasting with frons. Postclypeus dark brown, anteclypeus white. Antennal segment I dark brown, 0.12-0.16 (0.15,  $n=5$ ); II stramineous, usually with dark longitudinal anterior highlight, 0.25-0.28 (0.26,  $n=5$ ); ratio I/II 0.42-0.61 (0.56,  $n=5$ ).

Thorax with pronotum and mesonotum deep stramineous dorsally, dark brown laterally. Tegmina light brown, veins paler, conspicuous; incomplete white transverse band on distal margin, veins reaching distal margin near trailing edge (claval margin), but becoming obsolete in white band on leading edge.

Legs with front and middle tibiae expanded, front tibia width 0.14-0.15

(0.15,  $n=5$ ). Legs mostly dark brown, white proximally on femora and distally on coxae; tarsi and apices of tibiae stramineous, dark brown at tarsal claws. Calcar length 0.32-0.33 (0.30,  $n=5$ ), number of calcar teeth 13-14 (13,  $n=5$ ).

Abdomen dark brown, middorsal carina paler, immaculate.

**Macropter.** Body length (excluding wings) ♂ 1.86-2.03 (1.95,  $n=4$ ), ♀ 2.33 ( $n=2$ ); total length (including wings) ♂ 2.77-3.15 (2.94,  $n=4$ ), ♀ 3.10-3.23 (3.17,  $n=2$ ). Coloration similar to brachypter, mesonotum dark brown with stramineous caudal tip. Wings mostly clear, brownish near base.

**Male Genitalia.** Pygofer (Fig. 15) cyphosomatic in cross-section, deeply excavated laterad of lateral processes, dark brown with posterior margin, lateral processes, anal tube and ental surface paler. Median processes subequal to parameres, parallel, simple, sharply acute apically with angular base. Pygofer usually with inconspicuous midventral tooth, just ventrad of median processes. Lateral processes conspicuous, as tall as wide, stramineous. Parameres robust, parallel-sided, flattened and cupped distally into medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 15) strongly flattened laterally with 5 retrose processes of various lengths; distal-most very long, straplike, with conspicuous lateral tooth; others shorter and simple, 3rd very short. Anal processes received in excavations laterad of lateral processes of pygofer, apices resting behind lateral processes.

**Remarks.** *Pissonotus neotropicus* is the only *Pissonotus* in South America with expanded front tibiae. Usually this species may be identified by the vertex, which is paler than the frons, and the incomplete whitish distal band on the tegmina.

**Recorded Hosts.** None.

**Distribution.** SOUTH AMERICA. ARGENTINA: Misiones; BOLIVIA: Cochabamba, La Paz, Santa Cruz; BRAZIL: Mato Grosso, Parana; ECUADOR: GUYANA; PARAGUAY; PERU; VENEZUELA, Monagas.

**Type Material.** *Phyllodinus neotropicus* Muir, 1926, holotype (b♂, BPBM) "Tena, Ecuador/ March 16, 1923" "F. X. Williams/ Collector" "*Phyllodinus/ neotropicus/♂* Muir/ type no. 1187" "983," determination label with "Holotype," on red paper, glued to right margin. Genitalia on cardboard mount, in balsam between cover slips, on pin with specimen. Cardboard mount labeled "*Phyllodinus/ neotropicus/♂* Muir/ type no. 1187."

**Other Material Examined.** Venezuela: MONAGAS: 7 km N Maturin, 200', 1-VIII-1988 (LOBC, 1b♀; 95-137e♀). Guyana: Demerara Co., "Long Creek," c. 50 km SW of Georgetown-Lindon Highway, c. 50 m., 22-VII-1987 (LOBC, 1m♂). Brazil: MATO GROSSO: Cáceres, EMPA Res. Sta., UV trap, 18-II-1985 (LOBC, 1m♂, 1m♀; 95-137l♂, 95-137q♀); same, 7-II-1985 (LOBC, 1m♂; 95-137n♂); Entr. Transpantanal Hwy., 17 km S Poconé, 24-IV-1981 (LOBC, 3m♂, 1m♀; 95-137m♂, 95-137p♂, 95-137c♀). PARANA: Porto de Cima, 11-I-1969, L&COB (LOBC, 1b♂, 1b♀; 95-137h♂); Para Belem, 26-I-1969, night, L&COB (LOBC, 1b♀). Peru: Tingo Maria, 10-VII-1968, night, L&COB (LOBC, 1b♀). Bolivia: LA PAZ: 3 mi SW Yolosa, 1700m, 9-IV-1978 L&COB (LOBC, 8b♂, 14b♀; 94-34a♂, 95-137d♀, 95-137f♀, 95-137g♀, 95-137j♂, 95-137i♂, 95-137k♂, 95-197a♂); LP, 5 mi NW

Coripata, Nor Yungas, 8-IV-1978, L&COB (LOBC, 2b♀, 94-34b♀). SANTA CRUZ: 10 mi W Portachuelo, 27-III-1978, UV trap, GBM (LOBC, 1m♂); same, 19-IV-1978, L&COB (LOBC, 1b♂, 94-34c♂). COCHABAMBA: Cbb., Pto. S. Farancisco, 19 mi NW Villa Tunari, 1-IV-1978, L&COB & GBM (LOBC, 1m♀). **Paraguay:** Asuncion, 5-VII-1968, night, L&COB (LOBC, 1b♀). **Argentina:** MISIONES: 20 km N Wanda, 22-I-1989 (LOBC, 1m♀).

*Pissonotus divergens* Bartlett, new species  
(Figs. 16, 58)

**Type Locality.** US: New Mexico, Lincoln County, Ruidoso.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, carinae concolorous; epistomal margin with very narrow white transverse band. Vertex, pronotum and mesonotum very dark brown. Antennal segment I dark brown, II paler with brown longitudinal anterior highlight. Tegmina dark brown with veins reaching distal margin. Abdomen very dark brown, immaculate. Male pygofer with median processes angular and apically diverging. Aedeagus with 4 simple retrose processes.

**Description.** *Brachypter*. Body length ♂? (specimen dissected), ♀ 2.50–2.70 (2.62,  $n=3$ ). Body lustrous, very dark brown (Fig. 58).

Head with frons very dark brown (Fig. 58), immaculate, with epistomal margin paler, stramineus caudad of genal carinae. Postclypeus and anteclypeus very dark brown. Vertex very dark brown with portions of carinae and caudal margin paler. Antennal segment I very dark brown, sometimes paler caudally, 0.13 ( $n=1$ ); II paler, stramineus on some specimens, with dark brown anterior highlight, 0.25 ( $n=1$ ); ratio I/II 0.53 ( $n=1$ ) (♀ antennal segment I 0.18–0.20 (0.19,  $n=2$ ), II 0.30–0.34 (0.32,  $n=2$ ); ratio I/II 0.59–0.60 (0.60,  $n=2$ ).

Thorax with pronotum and mesonotum very dark brown with caudal margin paler. Tegmina dark brown, veins concolorous, reaching distal margin, venation normal (not reticulate).

Legs with tibiae not expanded, front tibia width 0.07 ( $n=1$ ) (♀ 0.06–0.08 [0.07,  $n=3$ ]). Legs light brown, carinae paler, tarsi and distal margin of coxae stramineus, dark brown at claws. Calcar length 0.26 ( $n=1$ ), number of calcar teeth 9 ( $n=1$ ) (♀ calcar length 0.25–0.28 [0.27,  $n=3$ ], number of calcar teeth 7–9 [8,  $n=3$ ]).

Abdomen very dark brown, immaculate.

**Macropter.** Body length (excluding wings) ♂ 2.20 ( $n=1$ ), ♀ 2.67–2.83 (2.73,  $n=4$ ); total length (including wings) ♂ 3.25–3.63 (3.46,  $n=3$ ), ♀ 3.63–3.88 (3.77,  $n=3$ ). Similar to brachypter, antennae with more extensive stramineus markings. Wings clear, darkened at base.

**Male Genitalia.** Pygofer (Fig. 16) subcylindrical in cross-section, mostly brown, ental surface and anal tube paler; excavated laterad of median processes receiving apices of anal processes. Median processes just shorter than parameres, slightly flattened, closely approximated at base, apices sharply acute, diverging. Lateral processes small, concolorous or stramineus. Parameres

flattened and diverging, narrowed and strongly bent posteriorly, then dorsally, into cupped medially directed, rounded apices with subapical medial lobe (poorly developed in some specimens). Genital diaphragm vestigial. Aedeagus (Fig. 16) strongly flattened laterally, parallel-sided, with 4 long, simple retrose processes. Anal processes nearly reaching base of parameres, resting in concavities laterad of lateral processes.

**Remarks.** *Pissonotus divergens* resembles *P. niger* and *P. nigriculus*. *Pissonotus divergens* usually has antennal segment II stramineus with a brown anterior longitudinal highlight, that is absent in *P. niger* and *P. nigriculus*. The diverging median processes of *P. divergens* will otherwise identify this species. *Pissonotus divergens* also resembles the dark form of *P. binotatus*, but lacks the distal transverse tegminal band.

The holotype has the subapical lobe on the parameres well-developed, giving the apex of the parameres a bifid appearance. Females from Colorado and Texas are tentatively referred to this species. The specific name *P. divergens*, modern Latin for “diverging,” refers to the strongly divergent median processes.

**Recorded Hosts.** None.

**Distribution.** Southcentral United States: Kansas, New Mexico perhaps also Arizona, Colorado and Texas.

**Type Material.** *Pissonotus divergens*, holotype (♂b, SEMC) and allotype (♀b, SEMC): “Ruidoso, N.M./ VI-26-40/R. H. Beamer.” Paratypes: Kansas: Cherokee Co., 18-IX-1945, RHB (SEMC 1m♂; 95-222d♂); Iola, 13-IX-1945, RHB (SEMC, 1m♂); Douglas Co., 16-IX-1928, trap light, P. B. Lawson (SEMC, 1m♂, 3m♀); same, 17-IX-1928 (SEMC, 1m♀); same, 16-VIII-1928, (SEMC, 1m♂; 96-36a♂); Iola, 13-IX-1945, RHB (SEMC, 1m♂). New Mexico: Ruidoso, 26-VI-1940, RHB (SEMC, 2b♀, 1m♀).

**Other Material Examined.** **United States:** COLORADO: Manitou, 25-VII-1903, Van Duzee (CASC, 1b♀). ARIZONA: Williams, 3-VII-1950, RHB (SEMC, 2b♀). TEXAS: Gonzales Co., Palmetto SP, 25-IV-1971, J. C. Schaffner (TAMU, 1b♀).

*Pissonotus nigriculus* Morgan and Beamer, 1949  
(Figs. 17, 60)

*Pissonotus nigriculus* Morgan and Beamer 1949: 110 (key), 118–120.

**Type Locality.** US: Florida, Seminole County, Sanford.

**Diagnosis.** *Brachypter*. Body very dark chestnut-brown. Frons and vertex very dark brown, immaculate, epistomal margin of frons paler; vertex often with carinae paler. Pronotum and mesonotum very dark brown. Tegmina dark brown, veins concolorous. Antennal segment I dark brown, II paler. Abdomen very dark brown, immaculate. Tibiae not expanded. Male pygofer with distinct ventral ridge extending between lateral margins of medial processes. Median processes flattened, converging, with rounded apices and lateral shelf-like protuberances. Aedeagus with 3 short, simple retrose processes and several large teeth near midpoint of shaft.

**Description.** *Brachypter*. Body length ♂ 1.56–1.66 (1.61,  $n=5$ ), ♀ 1.98–2.32 (2.15,  $n=5$ ). Body lustrous, very dark brown (Fig. 60).

Head with frons (Fig. 60) very dark brown, immaculate, with epistomal margin paler, stramineous posterior to genal carinae. Postclypeus and anteclypeus very dark brown. Vertex very dark brown with portions of carinae and often posterior margin paler. Antennal segment I very dark brown, 0.08 ( $n=5$ ); II slightly paler, 0.22–0.25 (0.24,  $n=5$ ), ratio I/II 0.33–0.38 (0.35,  $n=5$ ).

Thorax with pronotum very dark brown with caudal margin paler, mesonotum very dark brown. Tegmina brown, veins concolorous, reaching caudal margin, venation normal (not reticulate).

Legs with tibiae not expanded, front tibia width 0.06–0.07 (0.07,  $n=4$ ). Legs brown, carinae paler, tarsi stramineous, dark brown at claws. Calcar length 0.20–0.22 (0.21,  $n=5$ ), number of calcar teeth 6–7 (7,  $n=4$ ).

Abdomen very dark brown, immaculate.

**Macropter.** Body length (excluding wings) ♂? (dissected), ♀ 2.63 ( $n=1$ ); total length (including wings) ♂ 3.16 ( $n=1$ ), ♀ 3.25 ( $n=1$ ). Coloration similar to brachypter. Mesonotum with caudal apex paler. Wings clear.

**Male Genitalia.** Pygofer (Fig. 17) subcylindrical in cross-section, mostly brown, paler at posterior margins and anal segment; excavated laterad of median processes receiving apices of anal processes. Distinct ventral ridge extends between lateral margins of medial processes in broad arch. Median processes slightly more than half length of parameres, rather flattened, converging, with rounded apices and lateral shelf-like protuberances near base. Lateral processes obsolete. Parameres flattened, broad, strongly cupped forward with rounded, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 17) strongly flattened laterally, widest near base, narrowed abruptly at retrose processes to sharp apex; 3 short, simple retrose processes and several large teeth beyond midpoint of shaft. Anal processes long, slender, converging, exceeding base of parameres, received posterior to median processes.

**Remarks.** *Pissonotus nigriculus* closely resembles *P. niger* and *P. divergens*, but differs from both species in features of the male genitalia. *Pissonotus nigriculus* lacks the large ventral flap of *P. niger*, and has flattened converging median processes as opposed to the angular diverging processes of *P. divergens*. *Pissonotus divergens* often has antennal segment II stramineous with a brown longitudinal highlight anteriorly. Females of these species may be indistinguishable except by range (*P. nigriculus* has a more southerly distribution).

The individual from Texas is unusual in having reduced retrose processes and an exaggerated ventral pygofer ridge.

The type series were taken "...inside a grove of large palm trees in deep shade. This grove was about 7 miles southeast of the city of Sanford" (Morgan and Beamer 1949: 120).

**Recorded Hosts.** None.

**Distribution.** UNITED STATES: Florida, Texas.

**Type Material.** *Pissonotus nigriculus* Morgan and Beamer, 1949, holotype (♀b, SEMC) and allotype (♂b, SEMC): "Sanford, Fla/3-11-1947/R. H. Beamer."

Paratypes: Florida: same as holotype (SEMC, 54b♂, 58b♀; 95-146i♀, 95-146h♀, 95-146b♂); same, LDB (SEMC, 5b♂, 9b♀; 95-209c♂, 95-146e♂, 95-146k♀, 95-146c♂); Sanford, 25-IV-1926, EDB (USNM, 1b♀); same, 22-II-1926(?) (USNM, 1b♀); Royal Palm State Park, 16-III-1947, RHB (SEMC, 3b♂, 4b♀; 95-146d♂, 95-146g♀, 95-146f♂, 95-146j♀); Mims, 18-III-1947, RHB (SEMC, 1b♂); La Belle, 16-VII-1939, PWO (USNM, 2b♀).

**Other Material Examined.** United States: FLORIDA: Osceola Co., Yeehaw Jcn., 24-III-1976, COB & GBM (LOBC, 1m♀); Collier Co., Copeland Rec. Area, 28-III-1973, L&COB & Kaplan (LOBC, 1b♀); Taylor Co., 20 mi S Perry, 19-IV-1976, sweep, J. Schuh (LOBC, 1b♀); Levy Co., Bronson, 26-III-1976, COB & GBM (LOBC, 1b♀); Sanford, 28-VII-1948, RHB (SEMC, 1b♂, 5b♀); Zolfo Springs, 12-III-1947, LDB (SEMC, 1b♀). TEXAS: Bay City, 4-V-1953, LDB (SEMC, 1m♂).

### *Pissonotus niger* Morgan and Beamer, 1949

(Figs. 18, 61)

*Pissonotus niger* Morgan and Beamer 1949: 110 (key), 117–118.

**Type Locality.** US: Illinois, Cook County, Orland Park.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, carinae concolorous, epistomal margin with very narrow white transverse band. Vertex dark brown with carinae paler. Antennal segment I dark brown, II paler. Pronotum and mesonotum very dark brown. Tegmina brown with veins reaching distal margin. Abdomen very dark brown, immaculate. Male pygofer with large ventral flap terminating in 4 rounded teeth. Aedeagus with 0–2 short, fine retrose processes.

**Description.** *Brachypter*. Body length ♂ 2.14–2.33 (2.22), ♀ 2.48–2.79 (2.63). Body lustrous, very dark brown, nearly black (Fig. 61).

Head with frons immaculate (Fig. 61), deep brown, paler at epistomal margin. Postclypeus and anteclypeus dark brown. Vertex dark brown, often paler cephalad and with paler carinae. Antennal segment I very dark brown, 0.14–0.18 (0.16,  $n=5$ ); II paler, especially posteriorly, 0.30–0.34 (0.32,  $n=5$ ); ratio I/II 0.43–0.61 (0.50,  $n=5$ ).

Thorax with pronotum and mesonotum very dark brown with portions of carinae paler. Tegmina dark brown, veins concolorous, venation normal (not reticulate); extending to wing margin.

Legs with tibiae not expanded, front tibia width 0.07–0.08 (0.07,  $n=3$ ), legs mostly brown with apices of tibiae and tarsi stramineous, dark brown at claws. Calcar length 0.22–0.27 (0.25,  $n=4$ ), number of calcar teeth 6–7 (7,  $n=4$ ).

Abdomen dark brown, immaculate.

**Macropter.** Unknown.

**Male Genitalia.** Pygofer (Fig. 18) cyphosomatic in cross-section, dark brown, paler on caudal margin and anal segment; venter with conspicuous, broad flap, projecting posteriorly, terminating in 4 rounded teeth. Median processes

subequal to parameres, distinctly flattened, turned medially with lateral shelf-like processes and rounded apices. Lateral processes absent. Parameres flattened, strongly cupped forward, widest near apex, with medially projected rounded apices. Genital diaphragm vestigial. Aedeagus (Fig. 18) strongly flattened laterally, widest near base narrowing distally to blunt apex; 1-2 simple retrose processes, short and fine, or reduced to a single tooth. Anal processes conspicuous, very long; stout basally, converging and narrowing to sharp apices, exceeding base of median processes, apices resting cephalad of large flap.

**Remarks.** *Pissonotus niger* resembles *P. nigriculus* and *P. divergens*, differing only in distribution and features of the male genitalia. The large ventral flap of *P. niger* is unique within *Pissonotus*. *Pissonotus divergens* often has antennal segment II stramineous with a brown anterior longitudinal highlight. Females of *P. marginatus* resemble *P. niger*, but have stramineous antennae. Females of *P. niger* and *P. nigriculus* may be indistinguishable except by range (*P. nigriculus* is more southerly distributed).

**Recorded Hosts.** None.

**Distribution.** Northeastern and northcentral United States (Connecticut to South Dakota) and adjacent Canada, south in mountains to North Carolina. CANADA: Manitoba. UNITED STATES: Connecticut, Illinois, Michigan, ?Montana, New York, North Carolina, Pennsylvania, South Dakota, Virginia).

**Type Material.** *Pissonotus niger* Morgan and Beamer, 1949, holotype ( $\sigma^b$ , SEMC) and allotype ( $\text{♀}$ , SEMC): "Orland Park/Ill. 7-13-1946/R. H. Beamer." Paratypes: Manitoba: Keld, 8-VIII-1937, RHB (SEMC, 1b $\text{♀}$ ); Swan River, 2-VIII-1937, RHB (SEMC, 2b $\text{♀}$ ); Deepdale, 1-VIII-1937, RHB (SEMC, 1b $\text{♀}$ ). Michigan: Douglas Lake, 22-VIII-1937, RHB (SEMC, 1b $\text{♀}$ ). Connecticut: Storrs, 15-VIII-1946, RHB (SEMC, 5b $\sigma$ , 3b $\text{♀}$ ; 95-209a $\sigma$ , 95-145t $\sigma$ , 95-145x $\text{♀}$ ). Illinois: Orland Park, 13-VII-1946, RHB (CUIC, [CU #2947.1], 1b $\sigma$ , [CU #2947.2] 1b $\text{♀}$ ; SEMC, 2b $\text{♀}$ , 7b $\sigma$ ; 95-145f $\text{♀}$ , 95-145u $\sigma$ ); Dolson, 24-VII-1936, DeLong & Mohr (INHS, 1b $\sigma$ ); Paxton, 30-VII-1916 (INHS, 1b $\text{♀}$ ).

**Other Material Examined.** United States: CONNECTICUT: Storrs, 5-IX-1952, RHB (SEMC, 2b $\sigma$ , 1b $\text{♀}$ ); same, 24-VIII-1952 (SEMC, 1b $\sigma$ , 1b $\text{♀}$ ). NEW YORK: Phoenicia, 25-VIII-1904, N. Y. S. Coll. (NCSU, 1b $\sigma$ , 1b $\text{♀}$ ; 95-145w $\sigma$ , 95-145z $\text{♀}$ ). PENNSYLVANIA: Allegheny Co., Gibsonia, 2-VII-1955, G. E. Wallace (CMNH, 1b $\text{♀}$ ); Greensburg, "Sep. 25" (Wirtner, 23b $\sigma$ , 18b $\text{♀}$  on 9 pins); same, 2-IX-1901 (CMNH, 3b $\sigma$ , 2b $\text{♀}$  on 1 pin); same, "Jly. 10" (CMNH, 1b $\sigma$ , 1b $\text{♀}$  on 1 pin); same, 28-VIII-1901 (CMNH, 1b $\text{♀}$ ); same, 11-VII-1905 (CMNH, 1b $\text{♀}$ ); same, "10-22" (CMNH, 1b $\sigma$ ); "PA" (no date, USNM, 1b $\text{♀}$ , 1b $\sigma$  on 1 pin; 93-251a $\sigma$ , 93-251b $\sigma$ ). ILLINOIS: Elgin, Prairie Hill, 12-VIII-1945, Ross & DeLong (INHS, 1b $\text{♀}$ ); Kampsville, 8-VI-1949, Sand. & Stannard (INHS, 1b $\text{♀}$ ); 8 mi W Toledo, woods, 3-VII-1932 (USNM, 1b $\text{♀}$ ); Urbana, GL143, 7-IX-1956, Ross (CNCI, 1b $\text{♀}$ ). VIRGINIA: Giles Co., Mt. Lake Biol. Stn., 1-VIII-1967, G. W. Byers (SEMC, 2b $\sigma$ ). NORTH CAROLINA: L. Toxaway, A. T. Slosson (no date, AMNH, 1b $\text{♀}$ ); Mt. Pisgah, 18-VII-1958, D. A. Young (NCSU, 1b $\text{♀}$ ; 95-146a $\text{♀}$ ); "Western N.C." (no date, NCSU, 1b $\sigma$ ; 95-145v $\sigma$ ); Highlands, Whiteside Cove, 18-VIII-1957, W. R. Richards (CNCI, 1b $\text{♀}$ ). SOUTH DAKOTA: Pactola, 10-IX-1948, H. C. Severin

(SEMC, 1b $\sigma$ ; 95-209b $\sigma$ ). MONTANA: Bear P(a?)w Mt., VIII-1926 (USNM, 1b $\text{♀}$ , tentatively placed).

***Pissonotus rubrilatus* Morgan and Beamer, 1949**

(Figs. 19, 62)

*Pissonotus rubrilatus* Morgan and Beamer 1949: 110 (key), 122, 124.

**Type Locality.** US: Colorado, Jackson, Routt & Grand Counties, Rabbit Ear Pass.

**Diagnosis.** *Brachypter*. Body color reddish brown. Frons immaculate with concolorous carinae, paler at epistomal margin. Antennal segment I dark brown, II paler. Vertex, pronotum and mesonotum reddish brown. Tegmina reddish brown, veins reaching distal margin. Legs brown with paler carinae. Abdomen dark brown, immaculate. Male pygofer with median processes converging, angular with sharply acute apices; lateral processes conspicuous, flattened. Anal processes very long and fine. Aedeagus with 4 fine, simple retrose processes.

**Description.** *Brachypter*. Body length  $\sigma$  2.04-2.24 (2.17),  $\text{♀}$  2.68-2.88 (2.76). Body lustrous, reddish brown (Fig. 62).

Head with vertex and frons reddish brown (Fig. 62), immaculate, epistomal margin paler. Postclypeus dark brown, anteclypeus paler. Antennal segment I dark brown, 0.12-0.17 (0.14,  $n=5$ ); II paler, 0.30-0.33 (0.32,  $n=5$ ); ratio I/II 0.39-0.50 (0.44,  $n=5$ ).

Thorax with pronotum and mesonotum reddish brown, often with pinkish tinge. Tegmina reddish brown, venation concolorous; normal (not reticulate), reaching distal margin.

Legs with tibiae not expanded, brown, carinae paler, front tibia width 0.08 ( $n=4$ ); tarsi and apices of tibiae stramineous, dark brown at claws. Calcar length 0.25-0.26 (0.26,  $n=5$ ), number of calcar teeth 6-10 (8,  $n=5$ ).

Abdomen reddish brown, immaculate or with diffuse pale markings.

*Macropter*. Body length (excluding wings)  $\sigma$ ? (dissected),  $\text{♀}$  2.88 ( $n=1$ ); total length (including wings)  $\sigma$  3.30 ( $n=1$ ),  $\text{♀}$  3.69 ( $n=1$ ). Darker than brachypter, reddish hue less conspicuous. Mesonotum dark brown, paler dorsally. Wings clear.

**Male Genitalia.** Pygofer (Fig. 19) cyphosomatic in cross-section, reddish brown, paler at posterior margins and anal segment; narrowly concave laterad of lateral processes. Lateral margins of pygofer opening pinched medially in some specimens. Median processes subequal to parameres, distinctly converging, simple, with angular base narrowed into sharply acute apices. Lateral processes conspicuous, flattened, projecting ventrocaudally. Parameres flattened, slightly diverging, widest above middle; cupped and abruptly narrowed apically into acute dorsomedially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 19) strongly flattened laterally, with 2-4 simple, flattened retrose processes. Anal processes long, fine, converging, exceeding base of parameres, apices received dorsad of lateral processes.

**Remarks.** The reddish brown hue of *P. rubrilatus* is usually distinctive. It most resembles *P. divergens*, *P. niger*, and *P. nigriculus*, and can be separated by the reddish brown hue and male genitalia. The median processes of *P. rubrilatus* is angular and sharply acute apically, lacking lateral shelves; *P. niger* and *P. nigriculus* have lateral shelves and rounded apices. *Pissonotus divergens* has diverging median processes and often has antennal segment II stramineous with a brown anterior longitudinal highlight. *Pissonotus marginatus* females also resemble *P. rubrilatus* but have stramineous antennae.

**Recorded Hosts.** None.

**Distribution.** Northcentral western United States and British Columbia. CANADA: British Columbia. UNITED STATES: Colorado, Idaho, Montana, Wyoming.

**Type Material.** *Pissonotus rubrilatus* Morgan and Beamer, 1949, holotype (♂♂, SEMC) and allotype (♀♀, SEMC): "Rabbit Ear(2)/ Pass Colo/8-3-1947/R. H. Beamer." Paratypes: Colorado: same as holotype (SEMC, 14♂♂, 3♀♀; 95-150n♂, 95-150m♂, 95-150q♂, 95-150u♀, 95-150r♂, 95-150s♀, 95-150t♀, 95-212b♂).

**Other Material Examined.** Canada: BRITISH COLUMBIA: Jesmond, 15-VIII-1938, J. K. Jacob (CNCI, 1m♂). United States: MONTANA: Hamilton, 19-VII-1949, RHB (SEMC, 1m♀). IDAHO: Cassia Co., Bostetter For. Camp, Sawtooth NF, 28-VIII-1963, COB (LOBC, 2♂♂, 4♀♀; 95-151w♀). COLORADO: Rabbit Ear Pass, 3-VIII-1947, LDB (SEMC, 7♂♂; 95-150p♂). WYOMING: Shell Co., Sibley Lake Cmpgd., Bighorn Mtns, 22-VII-1988, sweep, D. S. Chandler (DENH, 1b♀; 95-150v♀).

*Pissonotus concolor* Bartlett, new species  
(Figs. 20, 63)

**Type Locality.** US: North Carolina, Blowing Rock.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate with concolorous carinae, epistomal margin with white transverse band. Antennae stramineous. Pronotum and mesonotum very dark brown. Tegmina dark brown, lacking transverse distal band. Anal processes long and fine, exceeding base of median processes. Aedeagus with 4 simple retrose processes: 3 long, 1 short.

**Description.** *Brachypter*. Body length ♂? (both dissected), ♀ 3.38–3.44 (3.41,  $n=2$ ). Body shiny, very dark brown (Fig. 63).

Head with vertex and frons immaculate (Fig. 63), very dark brown, carinae concolorous. Epistomal margin of frons with transverse white band, following subgenal sulci laterally, becoming broader behind genal carinae, reaching procoxae. Postclypeus very dark brown, anteclypeus paler. Antennae stramineous, segment I 0.17 ( $n=2$ ); II 0.32–0.35 (0.33,  $n=2$ ); ratio I/II 0.48–0.53 (0.51,  $n=2$ ).

Thorax with pronotum and mesonotum very dark brown, caudal margins paler. Tegmina brown, veins concolorous with membrane, obscure, venation normal (not reticulate), reaching distal margin.

Legs with tibiae not expanded, front tibia width 0.08; legs stramineous except basal half of coxae and tarsi at claws. Calcar length 0.26–0.30 (0.27,  $n=2$ ), number of calcar teeth 7–8 (8,  $n=2$ ).

Abdomen apparently dark brown, immaculate (see *Remarks*).

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 20) cyphosomatic in cross-section, lateral margin of pygofer with low, posteriorly projecting lobes; dark brown. Median processes stout, simple, shorter than parameres, angular, very broad basally, strongly narrowed into acute converging apices. Lateral processes small, flattened, concolorous with pygofer. Parameres flattened, diverging, narrowed medially, strongly cupped forward apically into acute, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 20) strongly flattened laterally, with 1 short and 3 long, simple retrose processes; most distad short, very broad and laterally projected; following 2 long and fine with irregular serrations. Anal processes long and fine, exceeding base of median processes.

**Remarks.** *Pissonotus concolor* resembles *P. dorsalis*, *P. marginatus*, and 2 new species, *P. radiolus* and *P. canadensis*. *Pissonotus concolor* is darker than any of these similar species and has 4 retrose processes (*P. marginatus*, *P. radiolus*, and *P. canadensis* have 1 retrose process). Males of *P. marginatus* have diverging median processes. Males of *P. canadensis* have a small midventral tooth. Males of *P. radiolus* have very short anal processes. *Pissonotus dorsalis* has a pale middorsal abdominal stripe.

A male and female from Massachusetts and a female from Connecticut are tentatively included with this species. These specimens are light brown with distal white transverse tegminal bands, but the male genitalia appear similar to *P. concolor*. This male was not included in the measurements. The abdominal color pattern cannot be determined with certainty because the abdomens were discarded when dissected by previous researchers.

The specific name *P. concolor* comes from Latin meaning similar in color, referring to the uniform dorsal coloration of the species.

**Recorded Hosts.** None.

**Distribution.** UNITED STATES: New York, North Carolina; also tentatively Connecticut, Massachusetts.

**Type Material.** *Pissonotus concolor*, holotype (♂♂, SEMC, 95-222b♂): "Blowing Rock / N.C. VII-12-(3?)4 / H. G. Barber / on ground." Paratypes: New York: Keene Valley, 30-VII-1946, RHB (SEMC, 1♂♂).

**Other Material Examined** (tentatively included). United States: CONNECTICUT: Hamden, 4-VII-1921, P. Garman (NCSU, 1b♀). MASSACHUSETTS: Forest Hills, VII-191(9?) (NCSU, 1♂♂, 1♀♀).



*Pissonotus dorsalis* Van Duzee, 1897

(Figs. 21, 64)

*Pissonotus dorsalis* Van Duzee 1894a: 190 (nomen nudum).*Pissonotus dorsalis* Van Duzee 1897: 239.*Dicranotropis dorsalis* (Van Duzee 1897): Crawford 1914: 594 (key), 599–600.**Type Locality.** US: New York, Erie County, Lancaster.

**Diagnosis.** *Brachypter*. Body brown (males darker than females). Frons light brown, immaculate, carinae concolorous, epistomal margin paler. Antennae stramineus. Tegmina with white distal transverse band. Abdomen brown with broad, paler middorsal band. Male genitalia with very long, arcuate anal processes, strongly converging median processes, and strongly cupped parameres. Aedeagus with 4–5 retrose processes, 2nd very long, flattened and twisted, with lateral tooth; crenate or dentate dorsal hump just proximad of midlength.

**Description.** *Brachypter*. Body length ♂ 2.82–3.44 (3.08,  $n=5$ ), ♀ 3.20–3.58 (3.35,  $n=5$ ). Body lustrous, brown to dark brown, with broad light brown longitudinal stripe on abdomen (Fig. 64).

Head with vertex and frons immaculate (Fig. 64), stramineus to light brown, carinae concolorous; epistomal margin paler, transverse band indistinct. Frons rather quadrate and parallel sided. Postclypeus dark, anteclypeus light brown. Antennae stramineus, antennal segment I 0.15–0.20 (0.18,  $n=5$ ); II 0.35–0.39 (0.37,  $n=5$ ), ratio I/II 0.43–0.51 (0.48,  $n=5$ ).

Thorax with pronotum and mesonotum uniformly light brown, or darker laterally, caudal apex of mesonotum paler. Tegminal veins concolorous with membrane, male tegmina brown with well-developed distal transverse band; female tegmina light brown with distal transverse band reduced, often obsolete; venation normal (not reticulate), weak, becoming obsolete before distal margin.

Legs with tibiae not expanded, front tibia width 0.08–0.10 (0.09,  $n=5$ ); legs stramineus, tarsi paler, dark brown at tarsal claws. Calcar length 0.33–0.38 (0.36,  $n=5$ ), number of calcar teeth 9–11 (10,  $n=5$ ).

Abdomen brown with broad light middorsal brown stripe, laterally darker in males than in females; some specimens with poorly defined dorsolateral maculations.

**Macropter.** Body length (excluding wings) ♂ 2.83–3.30 (3.12,  $n=3$ ), ♀ 3.37 ( $n=1$ ); total length (including wings) ♂ 3.75–4.19 (4.05,  $n=4$ ), ♀ 4.04 ( $n=1$ ). Head similar to brachypter. Pronotum and mesonotum dark brown with paler hind margin, legs stramineus with dark brown tarsal claws and last tarsal segment. Abdomen brown with pale middorsal stripe in females, males with stripe reduced to middorsal carina cephalad, broader caudally. Wings clear.

**Male Genitalia.** Pygofer (Fig. 21) cyphosomatic in cross-section, dark brown laterally, paler dorsally and ventrally; lateral margins with weakly developed posteriorly extending lobes; concavity laterad of lateral processes. Median processes stout, arcuate and strongly converging, subequal or longer than parameres; simple, falcate in cross-section with rounded edge directed

medially; sharply acute apically with medial flange at base. Lateral processes conspicuously flattened, as wide as tall, concolorous with pygofer. Parameres flattened, broad, strongly cupped forward into acute, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 21) strongly flattened laterally with 4–5 retrose processes: 2nd very long, flattened, and twisted with lateral tooth; 3rd very long, finer, twisted and simple; remaining processes shorter and fine; crenate or dentate dorsal hump just proximad of midlength. Anal processes very long, arcuate, exceeding base of parameres.

**Remarks.** Although *P. dorsalis* resembles the 3 new species *P. radiolus*, *P. canadensis*, and *P. concolor*, it alone among these has a broad middorsal abdominal stripe (at least on males). Females have not been positively associated with *P. radiolus*, *P. canadensis*, and *P. concolor*. Males of *P. radiolus* have short anal processes and a single aedeagal retrose process. The male pygofer of *P. canadensis* have conspicuous, posteriorly projecting, lateral lobes and a small midventral tooth. *Pissonotus canadensis* also has very long anal processes, and a single aedeagal retrose process. Males of *P. concolor* are very dark brown, without distal tegminal transverse bands and genitalia with low, posteriorly projecting lateral lobes and 4 simple aedeagal retrose processes.

The reported hosts for this species need confirmation.

Fenton (1918:189) reported an undetermined dryinid (Hymenoptera) parasitizing an adult specimen of *P. dorsalis* from Orono, ME.

**Recorded Hosts.** *Beta vulgaris* L. (beet, Chenopodiaceae), *Salix* sp., (Salicaceae), *Agrostis* sp. (Poaceae), *Solidago* sp. (as goldenrod) (Asteraceae), *Daucus carota* L. (as carrot) (Apiaceae). **Distribution.** Northeastern and northcentral United States and adjacent Canada, south in mountains to North Carolina. CANADA: Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Quebec. UNITED STATES: Connecticut, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Wisconsin; also reported ?Illinois (Wilson and McPherson 1980b).

**Type Material.** *Pissonotus dorsalis* Van Duzee, 1897, lectotype (♂b, USNM, designated by Oman 1947: 218): "Lancaster/ 7/12 N.Y 89/ E. P. V. Coll." "type" "E P Van Duzee/ Collector." Dissected by Giffard, 1928, genitalia on "slide" with specimen, tip of aedeagus missing. Allotype (1b♀, ISUI to be deposited at USNM): "Colden N. Y./ 7-31-89" "♀" "type" "E. P. Van Duzee/ Collector" "Allo/ Type (red)."

**Other Material Examined.** Canada: MANITOBA: Swan River, 2-VIII-1937, RHB (SEMC, 2b♂, 1b♀); Deepdale, 1-VIII-1937, RHB (SEMC, 3b♀, 1b♂; 95-68x♀, 95-68w♂); Keld, 8-VIII-1937, RHB (SEMC, 1b♂; 95-196a♂). ONTARIO: Toronto, 8-VIII-1924, EDB (USNM, 1b♂, 1b♀); Pr(ince) Edw(ard) Co., IX-6-1950, J. F. Brimley (LOBC, 1b♂, 2b♀); same, 25-VII-1962 (CNCI, 1m♂); same, 3-VIII-1949 (CNCI, 1b♀); same, 9-VIII-1950, goldenrod (CNCI, 1b♂); 5 mi W Dacre, *Salix* sp., 7-VII-1975, KAH (CNCI, 1m♂); 2 mi S Erin, 22-VIII-1974, KAH (CNCI, 1m♀); South March, 8-VIII-1968, J. R. Vockeroth (CNCI, 1b♀, 1b♂); 5 mi S Goderich, 14-VIII-1974, KAH (CNCI, 1b♀); Dryden, (12-13)-VI-1960, Kelton &

Whitney (CNCI, 2b♀); One-sided Lake, (4-5)-VIII-1960, Kelton & Whitney (CNCI, 1b♀); Ottawa, 7-VIII-1958, carrot, L. N. Chiykowski (CNCI, 1m♀). QUEBEC: Frelighsburg, 30-VII-1985, Framboise D-Vac, N. J. Bostanian (CNCI, 1m♀); Gatineau Pk., Fournane(?), 4-VIII-1981, D. J. E. Brown (CNCI, 1b♀). PRINCE EDWARD ISLAND: N. Bedeque, 13-VIII-1983, KAH (CNCI, 1b♀); PEI NP, Stanhope Campground, 13-VIII-1991, sweep, D. S. Chandler (DENH, 1m♀, 1m♂; 95-69b♀). NOVA SCOTIA: Craigmore, C. B. I., 13-VIII-1973, *Agrostis* sp., KAH (CNCI, 5b♀, 1m♂); Prospect, 7-VIII-1973, KAH (CNCI, 1b♀; 95-69e♀). NEWFOUNDLAND: Pasadena, 1-VIII-1984, D. Langor (CNCI, 1m♂); Agric. Exp. Sta., St. Johns, 31-VII-1967, J. F. McAlpine (CNCI, 1m♂; 95-69a♂). NEW BRUNSWICK: Fundey NP, 9-VIII-1953, J. F. Brimley (CNCI, 1b♀); Rockwood Park, St. John, 7-VIII-1953, J. F. Brimley (CNCI, 1b♂; 95-69c♂). **United States:** WISCONSIN: Brule, 19-VIII-1937, RHB (SEMC, 1b♂, 1b♀; 95-68u♂, 95-68v♀). MINNESOTA: 5 km SSE Slayton, 5-VIII-1993, KAH (CNCI, 1b♀). MICHIGAN: Burr Lk., 24-VII-1930, H. B. Hungerford (SEMC, 1b♂); Cedar River, 26-VIII-1937, RHB (SEMC, 1b♂, 2b♀); Torch Lake, 10 mi N Elk Rapids, 14-VIII-1934, C. S. Spooner (EIUC, 1b♀); same, 30-VII-1934 (USNM, 1b♂); 3 mi E Allenville, 18-VIII-1980, KAH (CNCI, 1b♀; 95-69d♀); Douglas Lake, July (NCSU, 1m♂; 95-159f♂). MAINE: Orono, ME Agr. Exp. Sta., 15-VIII-1918, H. Osborn (NCSU, 1b♂). NEW HAMPSHIRE: Crawford Notch, 3-VIII-1930, sides of wood road (DENH, 1m♂); Grafton Co., Bedell Bridge SP, Oliverian Brook, (3-19)-VIII-1992, f(light) i(ntercept) trap, D. S. Chandler (DENH, 1b♂); same, (20-VIII)-(8-IX)-1992 (DENH, 2b♂). NEW YORK: Raquette Lake, 26-VII-1946, RHB (SEMC, 2b♂, 2b♀); Otter Lake, 25-VII-1946, RHB (SEMC, 16b♂, 11b♀, 1b broken; INHS, 1b♀); Holland, 22-VII-1946, RHB (SEMC, 13b♂, 13b♀, 1b pair in copula); Heart Lake, 30-VII-1946, RHB (SEMC, 2b♂, 2b♀); Fredonia, 21-VII-1946, RHB (SEMC, 1b♂, 4b♀); Blue Mt. Lake, 27-VII-1946, RHB (SEMC, 3b♂, 1b♀; 95-68t♂); Lancaster, 25-VII-1946, RHB (SEMC, 2b♂, 1b♀); Lancaster, 18-IV-1906, Van Duzee (CASC, 1b♀ headless); Elba, 25-VII-1946, RHB (SEMC, 1b♀); Chittenango, 25-VII-1946, RHB (SEMC, 1b♀); Malone, 29-VII-1946, RHB (SEMC, 1b♂); Ithaca, 25-VII-1946, RHB (SEMC, 1b♂, 1b♀); Ithaca, 31-VIII-1894 (CUIC, 1b♂); Ithaca, 12-VIII-1895 (USNM, 1b♂); Ithaca, 28-VIII-1894 (USNM, 2b♀); Ithaca, 16-VII-1904 (USNM, 1b♀); Ithaca, 12-VIII-1928, A. Hartzell (USNM, 1b♀); Ithaca, 9-VII-1904 (USNM, 1b♂; 93-200b♂); Buffalo, 16-VII-1901, E. P. V. Coll. (USNM, 1b♂); U. Brookville, 3-VII-1979, host *Beta vulgaris*, DW 89-79, D. Waters (CUIC, 1b♂); Speculator, 5-VIII-1912, N. Y. S. Coll., D. B. Young (CUIC, 1b♀); New Rochelle, 30-VII-1945, L. Lacey (AMNH, 1b♀); Cranberry Lake, 19-VIII-1920, Osborn & Drake (NCSU, 1b♀); Tompkins Co., 1 mi S McLean, 9-VII-1976, M. J. & C. A. Tauber (CUIC, 1m♂; 95-159i♂). MASSACHUSETTS: Nantucket Island, Andreas Bolter Collection (INHS, 1b♀). CONNECTICUT: Storrs, 3-VIII-1946, RHB (SEMC, 3b♂, 3b♀; 95-68z♀, 95-68y♂); Cornwall, 18-VIII-1921, B. H. Walden (NCSU, 1b♂); New Haven, 31-VII-1920, B. H. Walden (NCSU, 2b♂); same, 24-VII-1920 (NCSU, 1b♂); same, 4-VII-1921 (NCSU, 1b♂); Branford, 21-VIII-1970, B. H. Walden (NCSU, 1m♂; 95-159g♂). MASSACHUSETTS: Boston, Arboretum, July (NCSU, 1b♂). PENNSYLVANIA: Patton, 15-

VII-1902 (Wirtner, CMNH, 1b♀); same, 9-VII-1906 (CMNH, 5b♂, 1b♀ on 3 pins); same, 31-VIII-1908 (CMNH, 1b♀). MARYLAND: Keyser's Ridge, 12-VIII-1986, KAH (CNCI, 1b♂). OHIO: Sandusky, 4-VII-1903, O. H. Swezey (CASC, 1b♂, 1b broken, 2 exuviae on 1 pin; Giffard slide #16, ser. VII). NORTH CAROLINA: Mt. Mitchell, 13-VIII-1957, L. A. Kelton (CNCI, 2b♂); same, 12-VIII-1957 (CNCI, 1m♀).

*Pissonotus marginatus* Van Duzee, 1897

(Figs. 22, 65)

*Pissonotus marginatus* Van Duzee 1894a: 190 (nomen nudum).

*Pissonotus ater* Van Duzee 1894a: 190 (nomen nudum).

*Pissonotus marginatus* Van Duzee 1897: 236-237.

*Pissonotus ater* Van Duzee 1897: 237. Synonymized by Morgan and Beamer 1949: 140-141.

*Dicranotropis ater* (Van Duzee 1897): Crawford 1914: 594 (key), 600.

*Dicranotropis marginatus* (Van Duzee 1897): Crawford 1914: 596 (nec *D. marginatus* Crawford, 1914, see *Remarks*).

**Type Locality.** US: New York, Eire County, Lancaster.

**Diagnosis.** *Brachypter*. Body shiny, reddish brown. Frons light brown, immaculate, carinae concolorous, paler at epistomal margin. Antennae stramineous. Pronotum and mesonotum reddish brown. Tegmina brown, male with narrow white distal transverse band, females unicolorous; venation obscure. Tibiae not expanded. Abdomen immaculate. Male pygofer with lobes on lateral margin of opening, median processes diverging and falcate in cross-section. Anal processes very long. Aedeagus with 1 retrose process.

**Description.** *Brachypter*. Body length ♂ 2.38-2.90 (2.65,  $n=5$ ), ♀ 2.54-3.40 (3.12,  $n=5$ ). Body shiny, dark reddish brown or slightly paler (Fig. 65).

Head with frons brown to dark brown (Fig. 65), immaculate, carinae concolorous, obscure; epistomal margin paler, with poorly defined narrow white band, extending laterally along subgenal sulci; best developed on darker specimens. Postclypeus dark brown, anteclypeus paler. Vertex dark brown, lateral carinae often slightly paler posteriorly. Antennae stramineous, antennal segment I 0.16-0.20 (0.18,  $n=5$ ); II 0.33-0.43 (0.38,  $n=5$ ); ratio I/II 0.42-0.59 (0.47,  $n=5$ ).

Thorax with pronotum dark reddish brown, hind margin paler; mesonotum dark reddish brown. Tegmina veins concolorous with membrane, venation normal (not reticulate), usually obscure; males (usually) with narrow white transverse band on distal margin, veins becoming obsolete before wing margin, tegmina paler than mesonotum; females without white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.08 ( $n=5$ ); legs usually deep stramineous with brown foveae, darker on some specimens; tarsi and

apices of tibiae stramineus, dark brown at tarsal claws. Calcar length 0.25–0.32 (0.30,  $n=5$ ), number of calcar teeth 6–9 (7,  $n=5$ ).

Abdomen dark reddish brown, immaculate.

**Macropter.** Body length (excluding wings) ♀ 3.13–3.30 (3.22,  $n=2$ ); total length (including wings) ♀ 3.81–3.88 (3.85,  $n=2$ ). Coloration similar to brachypter, mesonotum paler posteriorly. Wings clear.

**Male Genitalia.** Pygofer (Fig. 22) subcylindrical in cross-section, with large posteriorly directed lobes on lateral margins (Fig. 22, occasionally pinched medially); pygofer excavated ventrally at apices of anal processes, medially to lateral processes, with transverse ridge ventrad to excavation extending medially ventrad of median processes. Median processes subequal to parameres (shorter on some specimens), diverging, falcate in cross-section, rounded margin directed medially or caudomedially; apices appearing bifid, with medial apices acuminate. Lateral processes at base of lateral lobe, slightly taller than wide, concolorous with pygofer. Parameres flattened, roughly parallel-sided, diverging, cupped forward distally into sharp medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 22) strongly flattened laterally, with 1 long simple retrose process and long proximal row of teeth on dorsal margin near midlength. Anal processes very long, slender, exceeding base of parameres, conspicuous in lateral view.

**Remarks.** *Pissonotus marginatus* resembles *P. basalis*, *P. niger*, *P. nigriculus*, *P. dorsalis*, and 4 new species; *P. divergens*, *P. radiolus*, *P. canadensis*, and *P. concolor*. *Pissonotus basalis* has slightly expanded front tibiae and a transverse posterior band on pronotum. *Pissonotus niger*, *P. nigriculus*, and *P. divergens* have dark antennae and males lack a distal white tegminal band. *Pissonotus dorsalis* has a broad, pale middorsal abdominal band, median processes converging apically, and 4–5 retrose processes. *Pissonotus radiolus* has males with very short anal processes and median processes apically converging. *Pissonotus canadensis* has a small median ventral tooth (but see below) and median processes strongly converging apically. *Pissonotus concolor* is very dark brown, without distal transverse bands on tegmina and with 4 retrose processes.

Some male specimens of *P. marginatus* have a ventral longitudinal ridge at the base of the median processes with a median tooth (or merely the tooth), a feature that Van Duzee (1897: 237) evidently associated with *P. ater*. Keys by Van Duzee (1923) and Osborn (1938) identified females of *P. marginatus* as *P. ater*.

*Pissonotus marginatus*, the type species of *Pissonotus*, was described from a single pair of specimens taken at different times by Van Duzee. Most of the male specimen was lost sometime between 1928, when Giffard dissected it, and 1947, when the remainder of the specimen was designated as the lectotype by Oman (1947: 218–219). The female specimen (labeled "Lancaster, 7–12 N. Y. 89 /E. P. V. Coll.," see Oman, 1947, residing at ISUI) was *P. basalis*. Oman erroneously synonymized *P. basalis* with *P. marginatus* based on an examination of the female holotype of *P. basalis* and the syntypes of *P. marginatus* described by Van Duzee (1897). Morgan and Beamer (1949) retained *P. basalis* without comment.

Crawford 1914: 596 erroneously described specimens of *P. basalis* as *P. marginatus*. Later, Metcalf 1943: 271 applied *P. crawfordi* Metcalf, 1943, as a nom. nov. for the unavailable *Dicranotropis marginatus* Crawford, 1914. *Pissonotus crawfordi* was synonymized with *P. basalis* by Morgan and Beamer 1949: 108–109.

The illustration of *P. marginatus* in Osborn, 1938: 336, does not appear to be the correct species.

**Recorded Hosts.** *Carex* sp. (Cyperaceae), *Solidago* sp. (as goldenrod) (Asteraceae).

**Distribution.** Eastern and central United States and adjacent Canada. CANADA: Manitoba, Ontario, Quebec; also reported Alberta (Strickland 1937, 1940, 1953). UNITED STATES: Arkansas, Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin; also reported California (Van Duzee 1914b, 1917a [error?]).

**Type Material.** *Pissonotus marginatus* Van Duzee, 1897, lectotype (♂b, USNM): "Lancaster/9-3 NY 88/E. P. V. Coll" "type" "E P Van Duzee/Collector," designated by Oman 1947: 218–219. As noted by Oman (1947: 218–219) and Morgan and Beamer (1949: 141), the type material of this species consists only of genitalia mounted in a cardboard "slide" (mounted in balsam between cover slips in a quadrangular card) by W. M. Giffard.

*Pissonotus ater* Van Duzee, 1897, holotype (USNM, b♀, by monotypy Oman 1947: 216): "Grand Isd./N. Y. 9-11-92" "♀" "type" "E. P. Van Duzee/Collector" "*Pissonotus/ater*/Van D." Synonymy by Morgan and Beamer 1949: 140–141.

**Other Material Examined.** Canada: MANITOBA: Mafeking, 3-VIII-1937, RHB (SEMC, 2b♀). ONTARIO: Pr(ince) Edw(ard) Co., 22-VII-1956, J. F. Brimley (LOBC, 3b♀); same, 26-VII-1956, goldenrod (CNCL, 1b♀; 95-144j♀); Flesherton, 31-VIII-1977, KAH, *Carex* sp. (CNCL, 1b♀); Cedar Springs, 7-IX-1977, KAH (CNCL, 1b♂); Mt. Pleasant, 10-VII-1958, L. A. Kelton (CNCL, 1m♀). QUEBEC: Gatineau Pk. Fourtute(?), 4-VIII-1981, D. J. E. Brown (CNCL, 1b♂; 95-144e♂). United States: WISCONSIN: Grand Rapids, 13-VIII-1917, EDB (USNM, 1b♀). MICHIGAN: Cedar River, 26-VIII-1937, RHB (SEMC, 1b♂, 1b♀; 95-144c♂); Pontiac, 12-IX-1952, RHB (SEMC, 2b♂); Pontiac, 6-VIII-1952, RHB (SEMC, 1b♀); Douglas Lake, July (NCSU, 1b♀); Manistee Co., 5-VII-1957, R. & K. Dreisbach (USNM, 1b♀). VERMONT: Lamoille (Co.), Waterville, 11-IX-1971, M. E. Whalen (UVCC, 1b♀); Colchester, Ethan Allan Farm, 17-IX-1985, P. Barnes (UVCC, 1b♀). NEW HAMPSHIRE: Boscawen, 12-VIII-1946, RHB (SEMC, 1b♂); Notchland, 20-VIII-1934, RHB (SEMC, 1b♂); Dover, 8-X-1966, B. Brownell (with mite, DENH, 1b♂); Rock Co., Seabrook Backdunes, (13-25)-VII-1989, flight intercept trap, D. S. Chandler (DENH, 2b♂, 1b♀); same, (26-VII)-(10-VIII)-1989 (DENH, 1b♂); same, (29-VI)-(12-VII)-1989 (DENH, 2b♂); same, (22-IX)-(12-X)-1989 (DENH, 3b♂); Durham, 14-IX-1922 (NCSU, 1b♂); same, 26-IX-1927 (NCSU,

1b♂); same, 22-IX-1921 (NCSU, 1b♀); same, 14-VII-1922 (NCSU, 1b♀); same, 20-VII-1922 (NCSU, 1b♀). CONNECTICUT: Hamden, 5-VII-1920, P. Garman (NCSU, 1b♀); Prospect, 17-IX-1966, COB (LOBC, 1b♀, 2b♂); same, 16-IX-1966 (LOBC, 3b♀); same, 12-IX-1966 (LOBC, 6b♀); same, 15-IX-1966 (LOBC, 1b♀); same, 13-IX-1966 (LOBC, 3b♀); Storrs, 5-IX-1952, RHB (SEMC, 2b♂). NEW JERSEY: Pemberton, 18-X-1915, H. B. Scammell (USNM, 1b♀); Lakehurst, VIII-1920 (USNM, 1b♀); 2 mi SW New Brunswick, 8-IX-1966, COB (LOBC, 1b♀). NEW YORK: Wells, 26-VII-1923, N. Y. S. Coll., D. B. Young (CUIC, 1b♂); Ithaca, 17-VII-1936, P. P. Babiy (CUIC, 1b♂); Fredonia, 21-VII-1946, RHB (SEMC, 1b♂, 1b♀; 95-144g♀); Hamburg, 20-IX-1903, Van Duzee (CASC, 1b♀); same, 1-VII-1906 (CASC, 1m♀); same, 5-VII-1908 (CASC, 1m♀; CMNH, 1b♀); same, 3-VII-1904 (CASC, 1b♀); same, 28-VI-1896 (USNM, 1b♀, this specimen mentioned by Van Duzee, 1897); Elma, 25-VI-1911, E. P. Van Duzee (CASC, 2b♀ on 1 pin); "Del. Water Gap," A. T. Slosson (no date, AMNH, 1b♀); West Nyack, 11-VI-1920, C. E. Olsen (NCSU, 3b♀, 2b♂); Bayshore, L. I., (4-7)-VII-1912, C. E. Olsen (NCSU, 1b♀); Wanakepa, 12-VIII-1920, Osborn & Drake (USNM, 1b♀); Gloversville, Alexander (collector, no date USNM, 1b♀). PENNSYLVANIA: Greensburg, (Wirtner, no date; CASC, 3b♀ [2 of these in series determined by D. L. Crawford as *pallipes*]); same, "Sep. 25" (CMNH, 3b♀ on 1 pin); same, 3-IX-1903 (CMNH, 2b♂ on 1 pin); same, 18-IX-1914, M. Wirtner (CASC, 1b♀, with determination labels *Dicranotropis pallipes* V. Duz. [Det.] D. L. C [rawford]); Patton, 9-VII-1906, M. Wirtner (CMNH, 4b♂ plus 1b♀ *basalis* on 1 pin); same, 9-VII-1906 (CMNH, 2b♀ on 1 pin); same, 31-VIII-1908 (CMNH, 1b♂); same, 1-VIII-1907 (CMNH, 2b♀ on 1 pin); same, 9-VII-1906 (CMNH, 1b♀); same, 1-VIII-1907 (CMNH, 1b♀, 1b♂ on 1 pin); "Penns. Sta." (Pittsburgh), 16-IX-1904 (CMNH, 2b♀). MARYLAND: Plummer's I., 5-X-1913, W. L. McAtee (FSCA, 1b♀; USNM, 1b♀); Beltsville, 15-VI-1913, W. L. McAtee (USNM, 1b♀); Ashton, 13-VIII-1938, PWO (USNM, 1b♂, 3b♀); Glen Echo, Summer 1922, J. C. Bridwell (USNM, 1b♀, 1b♂). DISTRICT OF COLUMBIA: 28-X-1941, PWO (FSCA, 3b♂; USNM, 3b♂, 7b♀); 28-IX-1941, PWO (USNM, 1b♂); 26-X-1941, PWO (USNM, 5b♂, 1b♀); 19-X-1941, PWO (USNM, 1b♀); 17-VI-1906, D. H. Clemons (USNM, 1b♀); 4-VII-1890, Heidemann Coll. (CUIC, 1b♀); same, 25-IX-1904 (CUIC, 1b♂); same, Rock Creek, 29-VI-1890 (CUIC, 1b♂); 8-X-1888 (on back of label, USNM, 1b♀, 1b♂); 13-IX-1924, EDB (USNM, 1b♂); 4-VII-1924, EDB (USNM, 1b♀). INDIANA: Wabash Co., Salamonie SF, 18-VI-1967, L&COB (LOBC, 1b♂); Pulaski Co., Wetaug, 5-VIII-1935 (USNM, 1b♀). ILLINOIS: Alexander Co., Horseshoe Lake, 12-VIII-1979 (CMSU, 1b♂); Karnak, 14-VI-1934, DeLong & Ross (INHS, 1b♂); Vienna, 14-VI-1934, floodplain woods, DeLong & Ross (INHS, 1b♀); Elizabethtown, (27-31)-V-1932, H. L. Dozier (INHS, 1b♀); Warren Co., Greenbush Twp., 5-IX-1943, R. I. Sailer (USNM, 1b♀). IOWA: Ames, 22-VI(?) 1896, EDB (ISUI, 1b♀). MISSOURI: Carter Co., 2 mi S Big Spring, 26-VI-1992 (CMSU, 1b♂, 1b♀). KANSAS: Douglas Co., 28-VIII-1945, RHB (SEMC, 1b♂); same, 9-VIII-1944 (EMC, 5b♂, 8b♀; 95-144f♀); same, 24-X-1944 (SEMC, 6b♂, 4b♀; 95-144s♂); same, 2-XI-1944 (SEMC, 2b♀); same, 29-VI-1945 (SEMC, 3b♀); same, 15-X-1945 (SEMC, 1b♂, 1b♀; 95-198c♂); La Cygne, 21-V-1946, RHB (SEMC, 1b♀; 95-

144i♀); Lawrence, 23-VIII-1944 (SEMC, 3b♂, 1b♀; 95-144d♂); same, 1-IX-1944 (SEMC, 1b♂); same, 4-IX-1944 (SEMC, 1b♂); Galena, X-1912 (USNM, 1b♂). OHIO: Rome, 19-VII-1946, RHB (SEMC, 1b♀); Barberton, 23-VIII-1936, L. J. Lipovsky (SEMC, 2b♀; 95-144h♀); Summis Co., 30-VI-1936, L. J. Lipovsky (SEMC, 1b♀). WEST VIRGINIA: 6 km NE Grafton, 13-VIII-1986, KAH (CNCL, 1b♂). VIRGINIA: Woolvine, 1-IX-1946, RHB (SEMC, 5b♂, 3b♀; 95-144c♂); Chain Bridge, 23-VI, Banks Coll. (NCSU, 1b♂). NORTH CAROLINA: Caruso, VI-1935, Z. P. Metcalf (NCSU, 1b♂); Magnolia, 26-V-1964, sweeping, J. F. Cornell (NCSU, 1b♀); Swannanoa, 2500-3000', 11-VIII-1919, Osborn & Metcalf (NCSU, 1b♀); Highlands, 22-VIII-1957, W. R. Richards (CNCL, 2b♀). KENTUCKY: Oldham Co., 8 mi E Skylight, 10-VI-1964, L&COB (LOBC, 1b♀); Kingston, 22-VIII-1950, G. S. Walley (CNCL, 1b♀). TENNESSEE: Knoxville, 22-V-1891 (USNM, 1b♂); Clarksville, 11-X-1915 (USNM, 1b♂). GEORGIA: Cuthbert, 16-V-1916, W. D. Pierce (USNM, 1b♀); Thomasville, 10-V-1915, C. S. Spooner (USNM, 1b♀). FLORIDA: Alachua Co., Gainesville, 15-VI-1965, COB (LOBC, 1b♀); Palatka, 10-III-1947, RHB (SEMC, 1b♂); Sanford, 11-III-1947, RHB (SEMC, 1b♀); Sanford, 13-V-1927, EDB (FSCA, 1b♀); same, 13-V-1926 (USNM, 1b♀); same, 18-VII-1927 (USNM, 1b♀); Lamont, 7-III-1947, RHB (SEMC, 9b♂, 5b♀); Polk Co., 6-V-1957, F. W. Mead (FSCA, 2b♀); New Port Ritchey, 7-X-1938, PWO (FSCA, 1b♀); Gadsden Co., 1-VIII-1956, F. W. Mead (FSCA, 1b♀). MISSISSIPPI: Biloxi, 4-VIII-1921, C. J. Drake (USNM, 1b♀). ARKANSAS: Queen Wilhelmina SP, 4-VI-1987 (USNM, 2b♀). LOUISIANA: Baton Rouge, 2-III-1947, RHB (SEMC, 1b♀).

*Pissonotus radiolus* Bartlett, new species

(Figs. 23, 66)

**Type Locality.** CANADA: Ontario, 5 km E Madawaska.

**Diagnosis.** *Brachypter*. Body light brown. Frons immaculate with concolorous carinae. Antennae stramineous. Tegmina with distal transverse band. Abdomen immaculate, brown. Anal segment with short processes, just exceeding apices of parameres. Parameres nearly parallel-sided, diverging, strongly cupped at medially directed apices. Aedeagus with 1 long, flattened retrose process followed by 2 large teeth.

**Description.** *Brachypter*. Body length ♂ 2.78–2.80 (2.79,  $n=2$ ). Body shiny, light brown (Fig. 66).

Head with vertex and frons immaculate (Fig. 66), light brown, carinae concolorous; epistomal margin slightly paler. Frons quadrate and parallel-sided. Postclypeus dark brown, darkest laterally, anteclypeus paler. Antennae stramineous, antennal segment I 0.22–0.26 (0.24,  $n=3$ ); II 0.37–0.40 (0.38,  $n=3$ ); ratio I/II 0.59–0.69 (0.64,  $n=3$ ).

Thorax with pronotum and mesonotum light brown, pronotum paler dorsally. Tegmina light brown, veins obscure, concolorous with membrane; venation normal (not reticulate), becoming obsolete before distal margin, with white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.09–0.10 (0.09,  $n=3$ ); legs stramineus, paler at apices of tibiae and tarsi, dark brown at tarsal claws. Calcar length 0.28–0.30 (0.29,  $n=3$ ), number of calcar teeth 6–7 (6,  $n=3$ ).

Abdomen brown, immaculate, paler dorsally near abdominal apex.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 23) cyphosomatic in cross-section, slightly projecting on lateral margins, with shallow concavity laterad of lateral processes; brown, paler dorsally, on ventral margin of opening, on posterior margin and entally. Median processes stout, simple, angular and broadly associated basally, converging beyond midpoint, just shorter than parameres, acute apically. Lateral processes conspicuously flattened, as wide as tall, stramineus. Parameres flattened, slightly diverging, nearly parallel-sided, slightly wider near apices; strongly cupped forward into rounded, medially directed apices. Genital diaphragm weak with lightly sclerotized, bilabiate process dorsomedially. Aedeagus (Fig. 23) strongly flattened laterally, with 1 retrose process; obscurely crenate dorsal hump just proximad of midlength. Anal processes short, stout, just exceeding apices of parameres.

**Remarks.** *Pissonotus radiolus* resembles *P. dorsalis* and 2 new species, *P. concolor* and *P. canadensis*. Among these, only *P. radiolus* has short anal processes. *P. dorsalis* has a well-developed middorsal band and males with 4–5 aedeagal retrose processes. The male pygofer of *P. canadensis* has conspicuous, caudally projecting lateral lobes and a small median ventral tooth. *Pissonotus concolor* is a darker species having 4 aedeagal retrose processes.

The specific name *P. radiolus* is from the Latin *P. radius*, a spoke or rod, and the diminutive ending *-olus*, referring to the short anal processes. Females were not seen during this study, but females from the Stittsville locality are reportedly at CNCI (K. G. A. Hamilton, *personal communication*).

**Recorded Hosts.** None.

**Distribution.** CANADA: Ontario.

**Type Material.** *Pissonotus radiolus*, holotype ( $\sigma^b$ , CNCI): "Ont. 5 km E/ Madawaska/ 30 July 1989/ KGA Hamilton." Paratypes: Ontario: Stittsville, 12-VII-1979, D. Brown (CNCI, 2 $\sigma^b$ ).

*Pissonotus canadensis* Bartlett, new species  
(Figs. 24, 67)

**Type Locality.** CANADA: Alberta, Jasper National Park.

**Diagnosis.** *Brachypter*. Body dark brown. Frons immaculate with concolorous carinae and transverse white band on epistomal margin. Antennae stramineus. Pronotum with narrow white band on caudal margin. Tegmina with distal transverse band. Abdomen brown, paler middorsally. Male pygofer with a small median tooth just ventrad of median processes. Anal processes very long, exceeding base of median processes. Aedeagus with 1 very long, flattened retrose process.

**Description.** *Brachypter*. Body length  $\sigma^b$  2.63–2.67 (2.65,  $n=2$ ). Body shiny, brown (Fig. 67).

Head with vertex and frons immaculate, brown (Fig. 67). Frons paler ventrally, carinae concolorous; epistomal margin with transverse white band, following subgenal sulci laterally, becoming broader behind genal carinae, reaching procoxae. Frons quadrate and parallel-sided. Postclypeus very dark brown, anteclypeus paler. Antennae stramineus, antennal segment I 0.17–0.22 (0.19,  $n=4$ ); II 0.35–0.40 (0.37,  $n=4$ ); ratio I/II 0.48–0.55 (0.51,  $n=4$ ).

Thorax with pronotum brown, paler dorsally on some specimens; narrow white band on caudal margin. Mesonotum brown, caudal apex paler. Tegmina light brown, veins concolorous with membrane; venation normal (not reticulate), becoming obsolete before distal margin; with distal white transverse band.

Legs with tibiae not expanded, front tibia width 0.08. Legs deep stramineus, darker at tarsal claws. Calcar length 0.30–0.34 (0.32,  $n=5$ ), number of calcar teeth 7–8 (8,  $n=5$ ).

Abdomen brown, paler dorsally.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 24) cyphosomatic in cross-section, brown, paler dorsally and entally. Lateral margins of pygofer with posteriorly projecting lateral lobes (pinched medially in some specimens), with small median tooth just ventrad of median processes. Median processes stout, simple, angular, subequal to parameres, converging apically into acuminate apices. Lateral processes small, flattened, concolorous with pygofer. Parameres flattened, slightly diverging, parallel-sided, narrowed and cupped forward into blunt, medially directed apices. Genital diaphragm vestigial. Aedeagus (fig. 24) strongly flattened laterally, with 1 very long, fine, simple retrose process and row of dorsal teeth proximad of midlength to near base. Anal processes very long, fine, exceeding base of median processes.

**Remarks.** *Pissonotus canadensis* resembles *P. dorsalis*, *P. marginatus*, and 2 new species, *P. radiolus* and *P. concolor*. Only *P. canadensis* has a white transverse band caudally on the pronotum and the male pygofer with a small midventral tooth (but see *Remarks* of *P. marginatus*). The males pygofer of *P. marginatus* has diverging median processes. *Pissonotus dorsalis* has 4–5 long, aedeagal retrose processes. Males of *P. radiolus* are generally paler with very short anal processes and without conspicuous caudally projecting lateral pygofer lobes. *Pissonotus concolor* has an aedeagus with 4 retrose processes.

No females of *P. canadensis* were available, although *P. dorsalis* females (and a male) were collected on the same date and locality as the Deepdale, Manitoba, specimens. The specific name *P. canadensis* refers to the Canadian distribution of this species.

**Recorded Hosts.** None.

**Distribution.** Southern central Canada. CANADA: Alberta, Manitoba, Ontario.

**Type Material.** *Pissonotus canadensis*, holotype ( $\sigma^b$ , CNCI): "Jasper Nat'l. Pk./ Alte. 17 Aug 1978/ KGA Hamilton." Paratypes: Alberta: same as holotype

(CNCL, 1b♂). Manitoba: Deepdale, 1-VIII-1937, C. L. Johnson (SEMC, 1b♂); same, RHB (SEMC, 1b♂); Red Deer R., 3-VIII-1937, C. L. Johnson (SEMC, 1b♂). Ontario: 2 mi S Erin, 22-VIII-1974, KAH (CNCL, 1b♂).

***Pissonotus aquilonius* Morgan and Beamer, 1949**

(Figs. 25, 68)

*Pissonotus aquilonius* Morgan and Beamer 1949: 110 (key), 125–126.

*Pissonotus aquilonius* Morgan and Beamer 1949: Wilson and McPherson 1980c: 10 (incorrect subsequent spelling).

**Type Locality.** US: Wisconsin, Douglas County, Brule.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, carinae concolorous, epistomal margin paler. Pronotum with white caudal transverse band. Tegmina with white distal band. Antennae stramineus, legs mostly stramineus. Male pygofer with median processes strongly flattened, curled forward at apices. Aedeagus with 2 long and 2 short retrose processes.

**Description.** *Brachypter*. Body length ♂ 2.3 (Morgan and Beamer 1949, dissected), ♀ 2.83–3.00 (2.92,  $n=2$ ). Body lustrous, very dark brown (Fig. 68).

Head with frons and vertex very dark brown (Fig. 68), immaculate, epistomal margin with very narrow white transverse band (nearly obsolete), extending laterally along subgenal suture, broadening behind genal carinae. Postclypeus very dark brown, anteclypeus paler. Antennae stramineus, antennal segment I 0.15–0.17 (0.16,  $n=2$ ); II 0.35 ( $n=2$ ); ratio I/II 0.43–0.49 (0.46,  $n=2$ ).

Thorax with pronotum very dark brown cephalad, white caudad. Mesonotum very dark brown. Tegmina dark brown with veins concolorous, venation normal (not reticulate), becoming obsolete before distal margin, distal margin with white transverse band.

Legs with tibiae not expanded, front tibia width 0.08 ( $n=2$ ); legs mostly stramineus, foveae stramineus or brown, coxae dark proximally, brown at tarsal claws. Calcar length 0.26–0.27 (0.27,  $n=2$ ), number of calcar teeth 8 ( $n=2$ ).

Abdomen very dark brown, immaculate.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 25) cyphosomatic in cross-section, dark brown, ental surface and anal tube paler; concave laterad of lateral processes. Median processes more than half length of parameres, parallel and parallel-sided, strongly flattened with apices curled forward. Lateral processes about as tall as wide. Parameres flattened, widest near apices, diverging and strongly cupped forward and narrowed into ventromedially directed blunt apices. Genital diaphragm vestigial. Aedeagus (Fig. 25) strongly laterally flattened, parallel-sided, with 2 long, flattened dorsal and 2 short, fine subdorsal retrose processes. Anal processes very long and slender, with acute apices, exceeding base of parameres.

**Remarks.** *Pissonotus aquilonius* most resembles *P. merides* and *P. paludosus*. The only reliable characters to separate these species involve the

male genitalia. *Pissonotus aquilonius* has strongly flattened, parallel median processes with apices curled; *P. merides* has angular median processes, converging beyond midlength; and *P. paludosus* has median processes flattened with diagonally truncate apices. The aedeagus of *P. aquilonius* has 4 retrose processes (2 long dorsal and 2 short subdorsal), *P. paludosus* has only 2, and *P. merides* has 4 with the most distal flattened and expanded.

Records of *P. aquilonius* in Illinois (Wilson and McPherson 1980a, b, c) are evidently in error. These specimens were *P. basalis*.

**Recorded Hosts.** None.

**Distribution.** UNITED STATES: Wisconsin.

**Type Material.** *Pissonotus aquilonius* Morgan and Beamer, 1949, holotype (♂b, SEMC) and allotype (♀b, SEMC): "Brule, Wis/6-16-37/R. H. Beamer." Paratypes: Wisconsin: same (SEMC, 1b♂, 1b♀).

***Pissonotus paludosus* Morgan and Beamer, 1949**

(Figs. 26, 69)

*Pissonotus paludosus* Morgan and Beamer 1949: 110 (key), 128–130.

**Type Locality.** US: Florida, Jackson County, Marianna.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, carinae concolorous, epistomal margin paler. Antennae deep stramineus. Pronotum very dark brown with distal transverse white band. Mesonotum very dark brown. Legs usually stramineus. Abdomen very dark brown, immaculate. Male pygofer with medial processes strongly flattened. Aedeagus with 2 long retrose processes.

**Description.** *Brachypter*. Body length ♂ 1.70–2.03 (1.88,  $n=5$ ), ♀ 2.11–2.67 (2.41,  $n=5$ ). Body lustrous, very dark brown (Fig. 69).

Head with vertex and frons very dark brown (Fig. 69), immaculate, epistomal margin paler, stramineus caudad of genal carinae. Postclypeus and anteclypeus very dark brown. Antennae stramineus to deep stramineus, antennal segment I 0.10–0.16 (0.12,  $n=5$ ); II 0.27–0.32 (0.29,  $n=5$ ); ratio I/II 0.33–0.50 (0.41,  $n=5$ ).

Thorax with pronotum very dark brown cephalad, white caudad. Mesonotum very dark brown. Tegmina very dark brown with veins concolorous, venation normal (not reticulate), becoming obsolete before wing margin, distal margin with white transverse band.

Legs with tibiae not expanded, mostly stramineus, proximally brown in some specimens, front tibia width 0.07 ( $n=5$ ); coxae dark proximally, tarsi stramineus, dark brown at claws. Calcar length 0.18–0.22 (0.21,  $n=5$ ), number of calcar teeth 8–11 (10,  $n=5$ ).

Abdomen with very dark brown, immaculate.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 26) subcylindrical in cross-section, mostly brown, paler at posterior margins, ental surface and anal tube; concave laterad

of lateral processes, receiving anal processes. Median processes slightly more than half as tall as parameres, parallel, strongly flattened and transversely oriented with apices truncate diagonally and small acute medial projection. Lateral processes as tall as wide, stramineous. Parameres flattened, nearly parallel-sided, diverging and strongly cupped forward and medially into medially directed acute apices. Genital diaphragm vestigial. Aedeagus (Fig. 26) strongly flattened laterally, widest near base, with 2 long, stout, simple retrose processes, most distal broad, flattened and twisted; row of unpaired small lateral teeth and fine dorsal serrations near midlength. Anal processes reaching base of parameres, stout basally, narrowing to acute apices.

**Remarks.** *Pissonotus paludosus* most resembles *P. merides* and *P. aquilonius*. The best features to separate these species involve the male genitalia. *Pissonotus merides* has median processes angular with sharply acute apices. *Pissonotus aquilonius* and *P. paludosus* have pygofer with flattened median processes. In *P. paludosus*, the apices of the median process are diagonally truncate; in *P. aquilonius* they are curled posteriorly. The aedeagus of *P. paludosus* has 2 retrose processes, *P. aquilonius* has 4. The legs and antennae of *P. paludosus* and *P. aquilonius* are usually stramineous, but are darker in *P. merides*. Antennal or leg color may be the only morphological feature to distinguish females of *P. merides* from *P. aquilonius* and *P. paludosus*, but coloration is not always reliable. One female "paratype" of *P. merides* from Marianna, FL, reported below, is *P. paludosus*.

**Recorded Hosts.** "On cane" (*Arundinaria* sp.?) (Poaceae).

**Distribution.** Southeastern United States. UNITED STATES: Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina.

**Type Material.** *Pissonotus paludosus* Morgan and Beamer, 1949, holotype (♂b, SEMC) and allotype (♀b, SEMC, missing abdomen): "Marianna, Fla/3-7-1947/R. H. Beamer." Paratypes: Florida: Marianna, 7-III-1947, RHB (SEMC, 5b♂, 4b♀, 1b broken; 95-211a♂, 95-149n♀); same, LDB (SEMC, 3b♂, 1b♀; 95-149i♂); Melbourne, 17-III-1947, RHB (SEMC, 2b♂, 1b♀); Woodville, 7-III-1947, RHB (SEMC, 3b♂, 2b♀); Ponce de Leon, 7-III-1947, RHB (SEMC, 2b♂); same, LDB (SEMC, 2b♀, 1b♂; 95-149r♀, 95-149l♂); Lamont, 7-III-1947, RHB (SEMC, 1b♀; USNM 1b♀). Alabama: Mobile, 20-III-1947, RHB (SEMC, 1b♀; 95-149p♀). Mississippi: Saucier, 5-III-1947, RHB (SEMC, 2b♂, 2b♀; 95-149h♂, 95-149m♀; USNM, 1b♂); Pearlinton, 3-III-1947, RHB (SEMC, 2b♂). Louisiana: Slidell, 3-III-1947, RHB (SEMC, 1b♂).

**Other Material Examined.** United States: NORTH CAROLINA: L. Toxaway, A. T. Slosson (no date, AMNH, 1b♀); Harnett Co., Riverbank, 30-IX-1933, Z. P. Metcalf (NCSU, 1b♀); same, 28-X-1934, on cane (NCSU, 1b♀). SOUTH CAROLINA: Batesburg, 24-VIII-1930, L. D. Tuthill (SEMC, 1b♀); Charleston, 8-VIII-1934, RHB (SEMC, 1b♀); Plantersville, 3-V-1932, PWO (USNM, 3b♀). GEORGIA: Billy's Id., Okefenokee Swamp, VI-1912 (CUIC, 2b♀, 1b♂); Ware Co., 4 mi SE Waycross, 26-VI-1965, COB (LOBC, 1b♀); Thomasville, 24-VIII-1949, T. W. Haines (SEMC, 1b♀). FLORIDA: Palatka, 24-XII-1950 (SEMC, 1b♂); San Mateo, 23-XII-1950, LDB & RHB (SEMC, 2b♀); New Smyrna, 29-VII-1948, B. T. McDermott (SEMC, 1b♂); Marianna, 7-III-1947, RHB (SEMC, 1b♀, *P. merides*

paratype); Monroe Co., Big Pine Key, 26-III-1973, L&COB & Kaplan (LOBC, 1b♂); Sanford, 5-IX-1925, EDB (USNM, 1b♂); same, 9-II-1926 (USNM, 1b♂); same, 6-IV-1926 (USNM, 1b♀). LOUISIANA: Slidell, 31-XII-1950, RHB (SEMC, 1b♂; 95-149k♂); same, LDB (SEMC, 2b♂, 1b♀; 95-149q♀); Many, 16-VI-1948, RHB (SEMC, 1b♀). ALABAMA: Mobile, 13-VI-1951, Price-Beamers-Wood (SEMC, 4b♂, 1b♀; 94-181c♂, 94-181a♂, 95-149j♂). MISSISSIPPI: Merrill, 20-III-1947, RHB (SEMC, 1b♀); Belmont, 5-VII-1921, C. J. Drake (USNM, 1b♂).

*Pissonotus merides* Morgan and Beamer, 1949

(Figs. 27, 70)

*Pissonotus merides* Morgan and Beamer 1949: 110 (key), 127-128.

**Type Locality.** US: Alabama, Mobile County, Mobile.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, paler on epistomal margin. Antennae light brown. Pronotum very dark brown with white caudal transverse band. Tegmina brown with concolorous veins, white transverse band on distal margin. Tibiae not expanded, legs brown. Abdomen very dark brown, immaculate. Pygofer with angular median processes, converging beyond midpoint to sharply acute apices. Aedeagus with 3 retrose processes, first very long, toothed, and straplike.

**Description.** *Brachypter*. Body length ♂ 1.85–2.18 (2.04,  $n = 5$ ), ♀ 2.09–2.60 (2.32,  $n = 5$ ). Body lustrous, very dark brown (Fig. 70).

Head with vertex and frons very dark brown (Fig. 70); frons immaculate, carinae concolorous, with paler epistomal margin, stramineous caudad of genal carinae, reaching base of front coxae. Postclypeus and anteclypeus dark brown. Antennal segment I light brown (rarely paler), 0.08–0.14 (0.11,  $n = 5$ ); II slightly paler, II 0.29–0.32 (0.30,  $n = 5$ ); ratio I/II 0.26–0.42 (0.37,  $n = 5$ ).

Thorax with pronotum very dark brown cephalad, white caudad. Mesonotum dark brown. Tegmina dark brown, veins concolorous; venation normal (not reticulate), becoming obsolete before distal margin; with broad white transverse band distally.

Legs with tibiae not expanded, front tibia width 0.08 ( $n = 5$ ); legs deep stramineous to brown, apices of tibiae and tarsi paler, brown at tarsal claws. Calcar length 0.25–0.28 (0.27,  $n = 5$ ), number of calcar teeth 8–11 (10,  $n = 5$ ).

Abdomen dark brown, immaculate.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 27) cyphosomatic in cross-section, dark brown with portions of venter, anal tube and ental surface paler; deeply concave laterad of lateral processes. Median processes subequal to parameres, simple, angular; parallel basally and slightly converging beyond midpoint, gradually narrowed into sharply acute apices. Lateral processes about as tall as wide, concolorous with pygofer. Parameres flattened, widest near apex, diverging and cupped, narrowed into medially directed, acute apices. Genital

diaphragm vestigial. Aedeagus (Fig. 27) strongly flattened laterally, widest near apex; 3 retrose processes, most distal very long, straplike, with large lateral tooth; other retrose processes fine and much shorter. Anal processes reaching base of parameres, resting behind lateral processes.

**Remarks.** *Pissonotus merides* resembles *P. agrestis*, *P. paludosus*, and *P. aquilonius*. *Pissonotus agrestis* has a distinct white transverse band on epistomal margin of frons and a lateral aedeagal flange. The male pygofer of *P. paludosus* and *P. aquilonius* possess flattened median processes, and both species have stramineous legs and antennae. Females of *P. merides*, *P. paludosus*, and *P. aquilonius* may not be distinguishable with certainty (but see range of *P. aquilonius*). *Pissonotus merides* characteristically has light brown antennae and brown legs; *P. paludosus* and *P. aquilonius* usually have stramineous legs and antennae. *Pissonotus merides* also resembles *P. lactofasciatus* and *P. minutus*, but these species are western and lack the white transverse band on the caudal margin of the pronotum.

**Recorded Hosts.** None.

**Distribution.** Southeastern United States. UNITED STATES: Alabama, Florida, Georgia, Mississippi, North Carolina.

**Type Material.** *Pissonotus merides* Morgan and Beamer, 1949, holotype ( $\sigma$ b, SEMC) and allotype ( $\rho$ b, SEMC): "Mobile, Ala/3-20-1947/R. H. Beamer." Paratypes: Florida: Marianna, 7-III-1947, RHB (SEMC, 1b $\rho$ , 1b $\sigma$ ; 95-144w $\rho$ , 95-144p $\sigma$ ). Alabama: same as holotype (SEMC, 5b $\sigma$ , 2b $\rho$ ; 95-144n $\sigma$ , 95-144y $\sigma$ , 95-144r $\sigma$ , 95-144t $\rho$ , 95-144x $\rho$ , 95-144v $\sigma$ ; USNM, 1b $\rho$ , 1 $\sigma$  genitalia only). Mississippi: Pearlinton, 3-III-1947, RHB (SEMC, 1b $\sigma$ , 1b $\rho$ ; 95-144s $\sigma$ , 95-144u $\rho$ ).

**Other Material Examined.** UNITED STATES: NORTH CAROLINA: Burgaw, Big Savannah (a longleaf pine savannah), 19 July (no year; NCSU, 1b $\sigma$ ). GEORGIA: St. Simons Is., 4-VIII-1912 (USNM, 1b $\sigma$ ). FLORIDA: Hilliard, 5-X-1938, PWO (USNM, 1b $\sigma$ ; 95-207a $\sigma$ ); Sanford, 2-IX-1926, EDB (FSCA, 1b $\rho$ ; USNM, 3b $\rho$ ); same, 28-IX-1925 (USNM, 1b $\rho$ ); same, 16-IX-1926 (USNM, 1b $\rho$ ); Hudson, 13-VII-1930, PWO (USNM, 1b $\rho$ ); New Port Ritchey, 7-X-1938, PWO (USNM, 1b $\sigma$ ). ALABAMA: Mobile, 13-VI-1951, Price-Beamers-Wood (SEMC, 1b $\sigma$ ; 95-144q $\sigma$ ).

***Pissonotus guttatus* Spooner, 1912**

(Figs, 28, 71)

*Pissonotus guttatus* Spooner 1912: 233-234.

*Dicranotopis guttatus* (Spooner 1912): Crawford 1914: 600.

**Type Locality.** US: New York, Tompkins County, Ithaca.

**Diagnosis.** *Brachypter*. Body polished, brownish orange, head, and usually most of pronotum, nearly black. Frons immaculate, nearly black with narrow white transverse band on epistomal margin, some specimens brownish orange medially. Pronotum with white transverse band on caudal margin. Tegmina orangish, veins obscure, with white distal margin. Abdomen brownish orange, immaculate. Male pygofer with median processes converging. Aedeagus with 2-3 short, simple retrose processes.

**Description.** *Brachypter*. Body length  $\sigma$  1.99-2.22 (2.12,  $n=5$ ),  $\rho$  2.67-2.88 (2.78,  $n=5$ ). Body polished, brownish orange (Fig. 71); head and usually cephalad portion of pronotum very dark brown, nearly black, strongly contrasting with body.

Head with frons very dark brown (Fig. 71), immaculate, carinae concolorous, often brownish orange medially; epistomal margin with narrow white transverse band, following subgenal sulci laterally, widening behind genal carinae, reaching procoxae. Vertex very dark brown, but some specimens orangish caudally, especially on lateral carinae. Postclypeus very dark brown, color extending laterally to procoxae; anteclypeus stramineous. Antennae stramineous, antennal segment I 0.17-0.18 (0.18,  $n=5$ ); II 0.34-0.36 (0.35,  $n=5$ ); ratio I/II 0.47-0.54 (0.51,  $n=5$ ).

Thorax with pronotum usually very dark brown (brownish orange on some specimens) with white transverse band caudally. Mesonotum brownish orange, caudal tip stramineous on some specimens. Tegmina orangish, veins concolorous with membrane; venation normal (not reticulate), not reaching distal margin, often entirely obsolete; tegmina with distal white transverse marking.

Legs with tibiae not expanded, front tibia width 0.07-0.08 (0.07,  $n=5$ ); legs completely brownish orange, or with dark brown foveae; tarsi stramineous, dark brown at claws. Calcar length 0.23-0.27 (0.24,  $n=3$ ), number of calcar teeth 7-8 (8,  $n=3$ ).

Abdomen brownish orange, immaculate.

*Macropter*. Body length (excluding wings)  $\rho$  2.67-2.90 (2.78,  $n=3$ ); total length (including wings)  $\rho$  3.33 ( $n=2$ ). Much darker than brachypters, usually very dark brown. Head similar to brachypter, pronotum nearly black with posterior white transverse band, mesonotum deep brown with caudal tip stramineous; pterothorax laterally with brownish orange area below wings extending to venter. Legs similar to brachypter, often with more extensive brown markings. Abdomen brown dorsally. Wings clear or slightly darkened.

**Male Genitalia.** Pygofer (Fig. 28) cyphosomatic in cross-section, with narrow excavation laterad of lateral processes, brownish orange. Median processes subequal to parameres, simple, angular; converging to sharply acute apices. Lateral processes about as tall as wide, concolorous with pygofer. Parameres flattened, parallel-sided, strongly cupped forward into medially directed rounded apices. Genital diaphragm vestigial. Aedeagus (Fig. 28) strongly flattened laterally, with 2-3 weak, simple retrose processes, longest as long as width of aedeagus; with row of dorsal teeth near midlength. Anal processes short, not reaching ventral margin of pygofer opening.

**Remarks.** *Pissonotus guttatus* is usually easily recognized by the strongly contrasting head and body, a feature unique among *Pissonotus*. The brownish orange ventral and lateral markings on the pterothorax of macropters, along with the pronotum possessing a caudal white transverse band, should distinguish this species from *P. aquilonius* or *P. agrestis*, should macropters of these species be found.

In Metcalf's (1949) redescription of "*Pissonotus*" *nigradorsum*, he mistakenly described and illustrated the genitalia of *P. guttatus*.



**Recorded Hosts.** None.

**Distribution.** Eastern and central United States and adjacent Canada. CANADA: Manitoba, Nova Scotia, Ontario, Quebec, Saskatchewan. UNITED STATES: Alabama, Arkansas, Colorado, Connecticut, District of Columbia, Florida, Kansas, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Michigan, Minnesota, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, Wisconsin.

**Type Material.** *Pissonotus guttatus* Spooner, 1912, holotype (by monotypy, ♀b, USNM): "Ithaca, N. Y./ 1 Aug. 96" "Cotype No. (no number) USNM."

**Other Material Examined.** Canada: MANITOBA: Keld, 8-VIII-1937, RHB (SEMC, 2b♀). SASKATCHEWAN: 5 mi SE Battleford, 17-VIII-1981, KAH (CNCL, 1b♀); Crescent Lake, 31-VII-1981, KAH (CNCL, 1b♀). ONTARIO: 7 km SW Arnprior, 16-IX-1988, KAH (CNCL, 1b♀); 7 km SW Arnprior, 1-X-1991, KAH (CNCL, 1b♀); Ipperwash Beach, 17-VIII-1993, KAH (CNCL, 2b♂, 2b♀); Ipperwash Prov. Park, 2-IX-1977, KAH (USNM, 4b♂, 13b♀); Almonte, 9-IX-1988, KAH (CNCL, 1b♀); 8 km SE Tobermory, 17-VIII-1988, KAH (USNM, 1b♀). QUEBEC: Kazubazua, 17-VIII-1927, G. S. Walley (CNCL, 1m♀; 95-136q♀). NOVA SCOTIA: Mount Uniacke, 20-VIII-1983, KAH (CNCL, 1m♀); Middle R., Cabot Trail, 18-VIII-1973, KAH (CNCL, 1b♂, 2b♀ in capsule); NE Margaree, 18-VIII-1973, KAH (CNCL, 1b♂). United States: MICHIGAN: Pontiac, 6-VIII-1952, RHB (SEMC, 1b♀); same, 12-X-1952 (SEMC, 1b♀); same, 12-IX-1952, RHB (SEMC, 1b♀; 95-136w♀). WISCONSIN: 5 Km NW Spring Green, 29-VII-1993, KAH (CNCL, 1b♀). MINNESOTA: Itasca SP, S. Garthside, IX-1927 (USNM, 1b♂, 1b♀). MAINE: Orono, ME Agr. Exp. Sta., 31-VII-1918, H. Osborn (NCSU, 1b♀, 1b♂). NEW HAMPSHIRE: Boscawen, 12-VIII-1946, RHB (SEMC, 7b♀, 1b broken); Lee, 31-VII-1930, bluegrass meadow, P. R. Lowry (DENH, 1b♀); Lee, 7-VIII-1930, xerophytic grasses nr. lake, P. R. Lowry (DENH, 1b♀); Crawford Notch, 3-VIII-1930, sides of wood road, P. R. Lowry (DENH, 1b♂); Durham, 2-X-1922 (NCSU, 1b♂, 1b♀). NEW YORK: Holland, 22-VII-1946, RHB (SEMC, 1b♀); Lancaster, 25-VII-1946, RHB (SEMC, 4b♂, 5b♀, 1m♀, 1b broken; 95-136u♀, 95-136r♀, 95-136z♂, 95-198a♂); Fredonia, 21-VII-1946, RHB (SEMC, 2b♀, 1m♀; 94-179c♀, 95-136b♀); Dunkirk, 20-VII-1946, RHB (SEMC, 1b♀); Sea Cliff, L. I. (CUIC, 2b♀, 1b♂, 1b broken; CASC, 1b♂); 7 km W Woodgale, 19-VIII-1990, KAH (CNCL, 1b♀). CONNECTICUT: Storrs, 24-VIII-1952, RHB (SEMC, 1b♀); same, 5-IX-1952, RHB (SEMC, 5b♂, 3b♀; 95-136y♂, 95-137a♂); same, 10-VIII-1946, RHB (SEMC, 1b♀); same, 9-VIII-1946 (SEMC, 8b♂, 24b♀; 95-136t♀); New Haven, 31-VII-1920, B. H. Walden (NCSU, 1b♀); Mystic, 19-VIII-1934, PWO (USNM, 1b♀). PENNSYLVANIA: Greensburg "Sep. 25" (Wirtner, CMNH, 16b♀, 17b♂ on 7 pins; USNM 2b♀ on 1 pin); same, 7-IX-1910 (NCSU, 1m♂; 93-224a♂); "Penns. Sta." (Pittsburgh), "Jly. 23" (Wirtner, CMNH, 1b♀). MARYLAND: Annapolis, South River, 24-VI-1937, PWO (USNM, 1b♀, 1b♂); S. Riv., 4 mi S Annapolis, 30-IX-1934, PWO (USNM, 1b♀, 1b♂); same, 10-VII-1932 (USNM, 4b♀); Odenton, 3-IX-1933, PWO (FSCA, 1b♂). DISTRICT OF COLUMBIA: Heidemann Coll., "15-VII" (CUIC, 1b♀); same, 23-VI-1890 (CUIC, 1b♀); 25-VI-1905, Van Duzee (CASC, 1b♀); 28-X-1941, PWO (FSCA, 1b♀; USNM, 1b♂); same, 22-IX-1934

(USNM, 1b♀, 1b♂); 5-VII-1920 (USNM, 1b♀). OHIO: Rome, 19-VII-1946, RHB (SEMC, 8b♀). ILLINOIS: Orland Park, 13-VII-1946, RHB (SEMC, 1b♀); Hopedale, 2-X-1917 (NCSU, 2b♂); Turnbull Wds, Glencoe, 16-IX-1949, W. Tietz Jr. (INHS, 1b♀); 7 mi W Toledo, GL155, 21-VII-1959, Ross & Kingsolve (CNCL, 1b♂). INDIANA: Turkey Run SP, 1-VII-1969, L&COB (LOBC, 1b♀). KANSAS: Douglas Co., 15-X-1945, RHB (SEMC, 1b♂). IOWA: Ames, 16-VII-1896, Exp. Sta. (ISUI, 1b♀); same, 6-VIII-1897 (USNM, 1b♀); same, 1-IX-1896 (USNM, 1b broken); Urbana, 9-VIII-1920, J. R. Mallock (USNM, 1b♀). COLORADO: Trinidad, Stonewall, 9000', 8-VIII-1925, C. J. Drake (USNM, 1b♂). VIRGINIA: Kearney, 4-VII-1936, J. C. Bridwell (USNM, 1b♀). TENNESSEE: Waynesboro, 4-VIII-1946, RHB (SEMC, 1b♀); Sewanee, 3-VIII-1948, RHB (SEMC, 1b♂). NORTH CAROLINA: Raleigh, 31-VIII-1946, RHB (SEMC, 1b♂); Raleigh, 15-VI-1957, D. A. Young (NCSU, 1b♀; 95-136s♀); Great Smokey Mtn. NP, Bone Valley Cr., (21-24)-VII-1964, J. F. Cornell (NCSU, 1b♀); Highlands, 21-VIII-1957, L. A. Kelton (CNCL, 1b♀); Base of Wayah Bald, 10-VIII-1957, W. R. Richards (CNCL, 1b♀). FLORIDA: Sanford, 5-VII(?) -1926, EDB (FSCA, 1b♀). ALABAMA: Elgin, 6-VII-1939, RHB (SEMC, 3b♂; 95-137b♂, 95-136x♂). ARKANSAS: Rogers, 6-VI-1946, M. W. Sanderson (INHS, 2b♀); (?) Mount Graham, 26-VIII-1937, EDB (USNM, 1b♀). LOUISIANA: Delhi, GL352, 20-V-1959, Ross & Stannard (CNCL, 1b♀).

*Pissonotus agrestis* Morgan and Beamer, 1949

(Figs. 29, 72)

*Pissonotus agrestis* Morgan and Beamer 1949: 110 (key), 127.**Type Locality.** US: Florida, Jackson County, Marianna.

**Diagnosis.** *Brachypter*. Body dark chestnut-brown. Frons immaculate with concolorous carinae. Distinct white transverse bands at epistomal margin of frons, posterior margin of pronotum and distal margin of tegmina. Antennal segment I dark brown, II paler. Abdomen immaculate. Tibiae not expanded. Aedeagus with lateral flange of aedeagal processes and 5-10 closely set retrose processes (some may be reduced to teeth, see below).

**Description.** *Brachypter*. Body length ♂ 1.72-1.97 (1.86,  $n=5$ ), ♀ 2.22-2.40 (2.28,  $n=5$ ). Body lustrous, dark chestnut-brown (Fig. 72).

Head with frons dark chestnut-brown (Fig. 72), immaculate, carinae concolorous, epistomal margin with prominent white transverse band, continuing laterally along the subgenal sulci, broadening behind genal carinae, extending onto base of front coxa. Postclypeus dark chestnut-brown, anteclypeus paler. Vertex dark chestnut-brown. Antennal segment I dark brown, 0.08-0.17 (0.12,  $n=6$ ); II paler, 0.21-0.28 (0.25,  $n=6$ ), ratio I/II 0.36-0.61 (0.48,  $n=6$ ).

Thorax with pronotum dark chestnut-brown, broad white band posteriorly. Mesonotum completely dark chestnut-brown. Tegmina dark brown, venation normal (not reticulate), veins concolorous, becoming obsolete in white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.07–0.08 (0.07,  $n=3$ ); legs stramineous from middle of coxae distad to claws, brown in foveae; hind legs darker in some specimens. Calcar length 0.21–0.23 (0.22,  $n=6$ ), number of calcar teeth 6–10 (8,  $n=5$ ).

Abdomen dark chestnut-brown, immaculate.

*Macropter.* Unknown.

**Male Genitalia.** Pygofer (Fig. 29) subcylindrical in cross-section, dark brown with anal segment paler; distinct concavity laterad of lateral processes. Median processes subequal to parameres, very slightly converging, angular with sharp apices. Lateral processes conspicuous, just ventrolaterad of base of median processes, slightly taller than wide, concolorous with pygofer. Parameres moderately narrow, curled forward to medially directed apices. Aedeagus (Fig. 29) with 5–10 closely set, fine retrose processes (but some specimens with many obsolete, represented by teeth; holotype has 1 retrose process followed by teeth); and lateral flange of 5 or more closely-set dorsal processes near midlength. Genital diaphragm vestigial. Processes of anal segment stout, usually reaching base of median processes; apices blunt, resting behind lateral processes.

**Remarks.** *Pissonotus agrestis* resembles *P. aquilonius*, *P. festucae* n. sp., *P. lactofasciatus*, *P. merides*, *P. minutus*, and *P. paludosus*. The frons of *P. merides*, *P. aquilonius*, and *P. paludosus* are without a well-developed white band. *Pissonotus paludosus* and *P. aquilonius* also have flattened median processes. *Pissonotus minutus* and *P. lactofasciatus* are similar to *P. agrestis*, but they both lack the white band on the caudal margin of the pronotum. *Pissonotus festucae*, a larger species (2.60–3.00 mm), has males with large, conspicuous lateral processes and a subapical lateral gibbosity on the median processes. The lateral flange of closely set processes is unique to *P. agrestis*. This flange may be on either the left or right side.

Two specimens with paratype labels, not reported by Morgan and Beamer (1949: SEMC, 1b♀: SC, Batesburg, 8-24-30, L. D. Tuthill; 1b♀: MS, Merrill, 8-20-1947, RHB), are not this species, but probably *P. paludosus*.

**Recorded Hosts.** None.

**Distribution.** UNITED STATES: Georgia, Florida; also reported Connecticut (Morgan and Beamer 1949).

**Type Material.** *Pissonotus agrestis* Morgan and Beamer, 1949, holotype (♂b, SEMC) and allotype (♀b, SEMC) "Marianna, Fla/3-7-1947/R. H. Beamer." Paratypes: Georgia: Waycross 5-X-1938, PWO (USNM, 1b♂; 95-11b♂). Florida: New Port Ritzey, 7-X-1938 (USNM, 2b♂; 95-11c♂); Sanford, 10-IX-1925, EDB (USNM, 1b♀); same, 17-II-1926 (USNM, 1b♀); same, 9-XI-1926 (USNM, 1b♂).

**Other Material Examined.** United States: GEORGIA: Waycross, 5-X-1938, PWO (USNM, 1b♀); Honey Island, Okfenokee Swamp, 1-VI-1912 (CUIC, 1b♂ 95-11a♂, 1b♀; 95-11a♀); Okfenokee Swamp, (V-28)-(VI-2)-1912 (SEMC 3b♂, 3b♀; 94-180a♂, 95-10b♀, 95-10c♀, 95-10d♀, 95-10e♂, 95-10f♂; USNM, 13b♂, 35b♀; FSCA, 2b♂, 2b♀, 1 broken). FLORIDA: Suwannee Springs, 3-VII-1948 (SEMC, 1b♂; 95-10g♂); Lake Placid, 13-VII-1948 (SEMC, 1b♀); New Port Ritzey, 7-X-1938, PWO (SEMC, 1b♂).

***Pissonotus muiri* Metcalf, 1943**

(Figs. 30, 73)

*Megamelus albicollis* Crawford 1914: 613–614 (unavailable name wrongly applied through misidentification of "*albicollis* Melichar, 1903: 99," error for *Delphax albicollis* de Motschulsky 1863).

*Pissonotus albicollis* (Crawford 1914): Muir and Giffard 1924: 11.

*Pissonotus muiri* Metcalf 1943: 271 (applied as nom. nov. for *M. albicollis* Crawford 1914).

**Type Locality.** NICARAGUA: Chinandega

**Diagnosis.** *Brachypter.* Body very dark brown. Frons and vertex paler than body, frons immaculate with narrow white transverse band on epistomal margin. Antennae stramineous. Caudal margin of pronotum and distal margin of tegmina with white transverse band. Legs mostly stramineous. Abdomen usually immaculate. Pygofer of male with small median tooth just ventrad of median processes; apices of median processes bent caudomedially. Parameres flattened and cupped into blunt, caudomedially directed apices. Aedeagus with 4 retrose processes, 2nd enlarged, straplike with subapical tooth.

**Description.** *Brachypter.* Body length ♂ 2.24–2.55 (2.40,  $n=5$ ), ♀ 3.02–3.14 (3.06,  $n=5$ ). Body shiny, dark brown to brown (Fig. 73).

Head with vertex and frons brown (Fig. 73), paler than body; vertex often with darker maculations posteriorly; frons epistomal margin with narrow paler band. Postclypeus dark brown, anteclypeus paler. Antennae brownish orange, antennal segment I 0.23–0.28 (0.26,  $n=5$ ); II 0.33–0.38 (0.35,  $n=5$ ); ratio I/II 0.67–0.85 (0.75,  $n=5$ ).

Thorax with pronotum dark brown cephalad, white transverse band posteriorly. Mesonotum dark brown. Tegmina dark hyaline, veins concolorous; venation normal (not reticulate), becoming obsolete before distal margin; with distal white transverse band.

Legs with tibiae not expanded, front tibia width 0.08 ( $n=5$ ); legs mostly stramineous with dark foveae; coxae dark brown proximally, stramineous distally; apices of tibiae and tarsi stramineous, brown at tarsal claws. Calcar length 0.33–0.38 (0.34,  $n=5$ ), number of calcar teeth 6–10 (8,  $n=5$ ).

Abdomen usually dark brown, immaculate, with middorsal carina paler. Some specimens with variable broad, pale middorsal markings similar to *P. abdominalis*.

*Macropter.* Similar to brachypter, darker; caudal apex of mesonotum stramineous, legs more extensively brown. Wings clear, slightly hyaline at base.

**Male Genitalia.** Pygofer (Fig. 30) subcylindrical in cross-section, mostly brown with posterior margin, anal tube, ental surface and portions of venter paler; excavated laterad of lateral processes. Median processes angular, simple, narrow and parallel; approximately 2/3 length of parameres, with apices acute, bent caudomedially. Small median tooth present just ventrad of median processes. Lateral processes tooth-like, wider than tall; stramineous. Parameres

flattened, turned laterally and cupped; narrowed into blunt caudomedially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 30) strongly flattened laterally, 4 retrose processes; most distad fine and simple, 2nd enlarged and straplike, with subapical tooth; proximal 2 short and simple. Anal processes nearly reaching base of parameres, apices resting behind lateral processes.

**Remarks.** *Pissonotus muiri* most resembles species in the *P. piceus* complex. It can be recognized by the small, median tooth just ventrad of the median processes, the parameres with apices flattened and dorsomedially directed, and by possessing white transverse bands on the distal margin of the tegmina and caudal margin of the pronotum. The head of *P. muiri* is usually paler than the body.

This species was described by Crawford (1914) based on specimens misidentified by Melichar as *Liburnia albicollis* (de Motschulsky 1863) (current combination *Opiconsiva albicollis* (de Motschulsky 1863) (Fennah 1975: 112–113)). Crawford (1914) referred to this species as "*Megamelus albicollis* Melichar '03:99" (sic). Melichar (1903: 99–100) redescribed and illustrated the species *Delphax albicollis* Motschulsky (1863), and referred it to *Liburnia* Stål, 1866, but Melichar did not describe "*Liburnia albicollis*" as a new species. "*Megamelus albicollis* Crawford, 1914," was transferred to *Pissonotus* by Muir and Giffard (1924: 11) (who also noted the identification error), and later renamed *Pissonotus muiri* Metcalf 1943. *Pissonotus muiri* Metcalf is retained following ICZN (1999), Article 49.

Macropters of *muiri* were not available for measurements.

A lectotype of *P. muiri*, described below, is here designated. In addition to the specimens described below, 3 paralectotypes with labels similar to the lectotype are present at the BPBM.

**Recorded Hosts.** *Zexmenia pinetorum* Standley & Steyermark (Asteraceae).

**Distribution.** CENTRAL AMERICA: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama.

**Type Material.** *Pissonotus muiri* Metcalf, 1943, lectotype (USNM, 1m♀, here designated): "Chinandega/Nicaragua/Coll. Baker" "*Megamelus/ albicollis/ Melich. DLC.*" Paralectotypes(?): **Nicaragua:** same as lectotype, with determination label "*Liburnia/ albicollis/ mel.*" (1♀m, CMNH); San Marcos, Coll. Baker (1m♂, CMNH).

**Other Material Examined.** **Belize:** Toledo, Punta Gorda, SW of airstrip, (10-20)-VIII-1978, open grassland and scrub, P. S. Broomfield, (BMNH, 1b♂); same, 2 mi SW of town, (11-16)-VIII-1978, primary/ secondary forest (BMNH, 4b♀); Cayo, mile 61, Western Highway, 10-VIII-1977, L&COB & GBM (LOBC, 1b♀); Cayo, St. Augustine, 21-VIII-1977, L&COB & GBM (LOBC, 1b♂). **Guatemala:** Antigua, 2-V-1926, J. M. Aldrich (USNM, 2b♂, 1b broken; 95-145k♂); Antigua, J. M. Aldrich, "IV-2" (1926?) (USNM, b♂; 93-217c♂); Tikal ruins, 2-IX-1972, G. F. & S. Hevel (USNM, 2b♂; 95-145j♂); 6 mi SE Quezaltepeque, 3000', 25-VII-1974, L&COB & GBM (LOBC, 1m♀). **El Salvador:** Son(sonate), 4 mi NW Acajutla, 8-VI-1974, L&COB & GBM (LOBC, 1b♀); Santa Tecla (partly illegible), 73-19428, 14-X-? (USNM, 1m♂); Santa Tecla, 16-I-1959, P. A. Berry (USNM, 2m♀); San Salvador, (3-4)-V-1958, O. L. Cartwright (USNM, 1b♀); 2 mi from Cerro Verde summit, 20-

VIII-1972, G. F. & S. Hevel (USNM, 1m♂). **Honduras:** Oco(tepeque), 11 mi NE Nueva Ocotepeque, 6900', 25-VII-1974, on *Zexmenia pinetorum* (genus misspelled), L&COB & GBM (LOBC, 17b♂, 29b♀, 3b broken; 95-145n♀, 95-145q♀, 95-145r♀, 95-145p♀, 95-145s♀, 95-207c♂, 95-145m♂, 95-145l♂); Ola(ncho), 6 mi SE Catacamas, 13-VI-1974, L&COB & GBM (LOBC, 1m♂). **Costa Rica:** Puntarenas Prov., Osa Peninsula, 2.5 mi SW Ricon, 08°42'N, 83°29'W, (8-12)-III-1967 (SEMC, 1m♂). **Panama:** Chir(iqui), Boquete, 4000', 24-VI-1974, L&COB & GBM (LOBC, 2b♀); Chir., 10 mi E Rio Serreno, 3800', 8-VII-1974, L&COB & GBM (LOBC, 1m♀); El Valle, XI-1946, N. L. Krauss (USNM, 2m♂); Chiriqui, 5 km W Boquete, road to El Salto, 08°46'N, 82°29'W, 1610 mtms, 18-VI-1973, Erwin & Hevel (USNM, 1b♀).

### *Pissonotus basalis* Van Duzee, 1897

(Figs. 31, 74)

*Pissonotus basalis* Van Duzee 1894a: 190 (nomen nudum).

*Pissonotus basalis* Van Duzee 1897: 236, 238.

*Dicranotropis marginatus* Crawford 1914: 596 (nec Van Duzee, misidentification of *Pissonotus marginatus* Van Duzee 1897: 236–237).

*Dicranotropis basalis* (Van Duzee 1897): Crawford 1914: 600.

*Pissonotus crawfordi* Metcalf 1923: 148 (applied as nom. nov. for *Dicranotropis marginatus* Crawford 1914). Synonymized by Morgan and Beamer 1949: 108–109.

**Type Locality.** US: New York, Eire County, Lancaster.

**Diagnosis.** *Brachypter.* Body shiny, chestnut-brown. Frons light brown, immaculate. Antennae stramineous. Pronotum light brown with caudal white transverse band. Tegmina with white band on distal margin. Front tibiae slightly expanded, dark brown. Abdomen immaculate. Male pygofer with small opening, median processes greatly flattened with rounded apices and lateral shelves; joined medially for most of length. Aedeagus slender with 1 long retrose process.

**Description.** *Brachypter.* Body length ♂ 2.17–2.32 (2.24,  $n=5$ ), ♀ 2.60–3.18 (2.88,  $n=5$ ). Body shiny, chestnut-brown (Fig. 74).

Head with vertex and frons light brown (Fig. 74), carinae concolorous, weak. Postclypeus dark brown, anteclypeus paler. Antennae stramineous, antennal segment I 0.14–0.17 (0.15,  $n=5$ ); II 0.32–0.37 (0.35,  $n=5$ ); ratio I/II 0.41–0.45 (0.43,  $n=5$ ).

Thorax with pronotum light brown cephalad, white caudad. Mesonotum brown, caudal apex paler. Tegmina brown, veins concolorous; venation normal (not reticulate), often weak, becoming obsolete before distal margin; with broad white distal transverse band.

Legs with front and middle tibiae slightly expanded, dark brown, front tibia width 0.12–0.13 (0.12,  $n=4$ ); legs otherwise light brown with apices of tibiae and tarsi stramineous, dark brown at claws. Calcar length 0.28–0.33 (0.29,  $n=4$ ), number of calcar teeth 7–11 (9,  $n=4$ ).

Abdomen dark brown, immaculate.

**Macropter.** Body length (excluding wings) ♀ 2.67 ( $n = 1$ ); total length (including wings) ♀ 3.56 ( $n = 1$ ). Darker than brachypter with similar markings, mesonotum dark brown with stramineous caudal apex. Wings clear.

**Male Genitalia.** Pygofer (Fig. 31) cyphosomatic in cross-section, brown, paler on anal processes and ventrad of median processes. Pygofer opening small, ventrocaudal margin pinched medially and extending ventrally as ridges laterad of shallow concavity. Median processes more than half as tall as parameres, flattened with rounded apices and lateral shelves, broadly joined medially. Lateral processes stout, broader than tall, concolorous with pygofer. Parameres broad, flattened, widest in apical third, narrowed and cupped into rounded, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 31) strongly flattened laterally, very slender, with 1 simple, long retrose process. Anal processes stout, resting in concavities median of lateral ridges, nearly reaching base of median processes.

**Remarks.** *Pissonotus basalis* most closely resembles *P. nitens*, but *P. nitens* has much more expanded tibiae (0.29–0.31 mm wide) and the postclypeus and frons concolorous. *Pissonotus basalis* is often mistaken for *P. marginatus* by misdiagnosing the front tibiae. *Pissonotus marginatus* also lacks the white caudal band on the pronotum.

Metcalf (1923: 148) proposed the name *Pissonotus crawfordi* to replace the unavailable *Dicranotropis marginatus* Crawford, 1914, when he transferred the species to *Pissonotus*. Metcalf illustrated the male genitalia (plate 69, no. 674) and included the species in his key (p. 170), but did not explicitly designate a holotype or describe the specimens in his possession. In Crawford's original description of the species, which he called "*Dicranotropis marginatus* Van Duzee '97: 236" (Crawford 1914: 596), the species was described based on 2♂ and 2♀. Metcalf must have examined  $\geq 1$  of the males examined by Crawford. Morgan and Beamer (1949: 109) stated that they studied the "male holotype of *Pissonotus crawfordi* Metcalf." This statement indicates either that Metcalf labeled a specimen as the "holotype," or (based on ICZN 1999, Article 74.6) that Morgan and Beamer (1949) de facto designated a lectotype. Unfortunately, no labeled holotype (or lectotype) was located for this study, and it is not clear that a specimen has been set aside as the name-bearing type for this species. The specimens from the CASC that were supposed to be the syntypes of *P. crawfordi* Metcalf consisted of 3 females of the wrong species. In order to insure the nomenclatural and conceptual stability of *P. crawfordi* Metcalf, the male from Crawford's original series that was available for this study is here designated as the lectotype of the species (labels described below). *Pissonotus crawfordi* Metcalf was synonymized with *P. basalis* Van Duzee, 1897, by Morgan and Beamer (1949: 108–109).

*Pissonotus basalis* was erroneously synonymized with *delicatus* by Crawford 1914: 596–597, 600, and erroneously synonymized with *P. marginatus* by Oman 1947: 217, 218–220.

The female of the pair of specimens used in Van Duzee's original descrip-

tion of *P. marginatus* (labeled "Lancaster, 7- 12 N. Y. 89 /E. P. V. Coll.") is *P. basalis* (located at ISUI).

**Recorded Hosts.** *Grindelia squarrosa* (Pursh) Dunal. (Asteraceae) (Strickland 1940, 1953).

**Distribution.** Northeastern and northcentral United States and adjacent Canada. CANADA: Nova Scotia, Ontario, Quebec; also reported Alberta (Strickland 1940, 1953), Manitoba (Morgan and Beamer 1949). UNITED STATES: Connecticut, ?Idaho, Illinois, Indiana, Maine, Michigan, Nebraska, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Vermont, Wisconsin; also reported Florida (Barber 1914, Osborn 1921).

**Type Material.** *Pissonotus basalis* Van Duzee, 1897, holotype (by monotypy, Oman 1947: 219, USNM #100435, ♀m): "Lancaster/7-4 N. Y. 88/E. P. V. Coll" "♀" "type" "E. P. Van Duzee/ Collector" "*Pissonotus/ basalis* Van D."

*Pissonotus crawfordi* Metcalf, 1923 (specimen reported by Crawford (1914) as *Dicranotropis marginatus*): lectotype (here designated) (♂b, CASC): "Greensbrg/Pa." "W. M. Giffard/Collection" "Pyg. figd./slide 8 ser. VII" "*(Pissonotus)/Dicranotropis/marginatus/ V. Duz.*" "♂ gen. Slide No. 8/ Series VII (*Pissonotus*)/*Dicranotropis/marginatus*. det. Crawford/ Greensberg (sic)/ Pa." "*Pissonotus/ basalis/ Van Duzee Det./ L. W. Morgan,*" also with notes reading "*Pissonotus (Dicranotropis)/ marginatus V. D./ det. Crawford*" and "not *marginatus*." The specimen has a separate genitalia slide as follows "♂ gen. slide No. 8/ series VII (*Pissonotus Dicranotropis/ marginatus V. D./ det./ Crawford/ Greensberg (sic), Pa./ Gen. complete/ dissd/ Dec 10/19/ W. M. G.*" "*Pissonotus/ basalis/ Van D./ R. H. B.*" Synonymy by Morgan and Beamer (1949: 108–109).

**Other Material Examined.** Canada: ONTARIO: Pr(ince) Edw(ard) Co., 17-X-1956, J. F. Brimley (LOBC, 1b♀); same, 11-VII-1956 (CNCL, 1b♀); same, 4-VII-1962 (CNCL, 1b♀); Cedar Springs, 7-IX-1977, KAH (CNCL, 2b♀, 1b♂); McDonald Island, St. Lawrence Is. NP, 3-X-1976, sweeping, W. Reid (CNCL, 1b♀); Mooretown, 3-IX-1977, KAH (CNCL, 1b♀); 7 mi SE Shawenga, 20-VII-1981, KAH (CNCL, 1b♂). QUEBEC: Gatineau Pk., 30-VI-1981, roadside, D. J. E. Brown (CNCL, 1b♂; 95-195d♂). NOVA SCOTIA: North Mtn. CBHNP, 6-VIII-1984, KAH (CNCL, 2b♀); Green Cove, Cabot Trail, 15-VIII-1973, KAH (CNCL, 1b♀); Leitches Ck. CBI, 7-VIII-1984, KAH (CNCL, 1b♀); Rockwood Park, St. John, 7-VIII-1953, J. F. Brimley (CNCL, 2b♀ on 1 pin); Mapleton, 31-VII-1973, KAH (CNCL, 1b♀). United States: MICHIGAN: Pontiac, 6-VIII-1952, RHB (SEMC, 1b♂; 95-141♂); Liberty, 4-VII-1994, KAH (CNCL, 1b♀). WISCONSIN: 3 mi E Montello, 30-VI-1980, KAH (CNCL, 1b♀); Waukesha Cr., Scuppernong Prairie, GL649, 15-VII-1963, Stannard & Smith (CNCL, 1b♀). MAINE: Bar Harbor, Emery Dist., 21-IX-1966, on white spruce with *Cinara* and ants, A. E. Brower (USNM, 1b♂; 93-217a♂); Orono, 25-VII-1958 (USNM, 1b♀). NEW HAMPSHIRE: Durham, at NCSU as follows: 8-IX-1921 (1b♀; 95-140♀), 11-IX-1923 (1b♂), 21-VII-1922 (1b♀; 95-14r♀), 21-IX-1921 (1b♂; 95-14n♂), 7-VII-1922 (1b♀; 95-14q♀), 8-IX-1922 (1b♀), 14-IX-1922 (1b♂), 28-X-1922 (1b♀), 17-VIII-1922 (1b♀), 20-IX-1922 (1b♂; 95-14p♂); Coos Co., 10 mi N Colebrook, fen on rt. 145, 27-VII-1989,

sweep, J. F. Burger (DENH, 1b♀); Charleston, 25-VI-1964, COB (LOBC, 1b♀). VERMONT: Lowell, 3-IX-1977, KAH (CNCL, 1b♀, 1b♂, 1 nymph). NEW YORK: Fredonia, 21-VII-1946, RHB (SEMC, 3b♂, 16b♀; 95-14k♀; 95-14j♂); Johnston, Alexander (coll.?), EP Van Duzee Coll. (no date, CANS 1m♀; 95-159c♀); Johnston, 8-IX-1910 (USNM, 1b♂); Middletown, 22-VII-1910, C. S. Spooner (USNM, 1b♀); "Del. Water Gap," VII-1912, E. P. Van Duzee Coll. (CASC, 2b♀, 1 point); Lancaster, 12-IX-1889, EPV Coll. (ISUI, 1b♀, with "type" label, a "paratype" of *marginatus*). CONNECTICUT: Storrs, 3-VIII-1946, RHB (SEMC, 1b♀); same, 5-VII-1946 (SEMC, 1b♀). NEW JERSEY: Berkeley Hghts., "IX-9," E. L. Dickerson (AMNH, 1b♀). PENNSYLVANIA: Peck's Pond, 20-VIII-1946, RHB (SEMC, 6b♂, 2b♀; 94-181b♂, 94-181d♂; 95-14m♀); Patton, 9-VII-1906, M. Wirtner (CMNH, 1b♀ plus 4b♂ *marginatus* on 1 pin); same, 9-VII-1906 (CMNH, 3b♂, 2b♀ on 2 pins); same, 19-VI-1903 (CMNH, 1b♀); same, 4-VII-1907 (CMNH, 3b♀); Greensburg, 8-IX-1901 (Wirtner, CMNH, 4b♂ on 1 pin); same, "Sep. 25" (CMNH, 1b♂); "Penns. Sta.," 18-IX-1904 (Wirtner, CMNH, 8b♂, 2b♀ on 2 pins). OHIO: Wood Co., Perrysburg, 16-VI-1964, COB (LOBC, 1b♂, 1b♀); Barberton, 8-VII-1936, L. J. Lipovsky (SEMC, 1b♀). ILLINOIS: Fox Lake, 15-VII-1932, DeLong & Ross (SEMC, 1b♀); Wauconda, 8-VII-1932, Frison et al. (SEMC, 1b♀); Argo, 7-VIII-1910, W. J. Gerhard (NCSU, 1b♀); Vienna, 14-VI-1934, flood-plain woods, DeLong & Ross (INHS, 1b broken). INDIANA: Tremont, 8-VII-1934, low wood herbage, H. E. Brown (NCSU, 1b♀). NEBRASKA: Nance Co., Fullerton, Loup River, 1-VII-1964, LOB (LOBC, 1b♀). IDAHO: Bliss, 7-VII-1931, RHB (SEMC, 2b♀, tentatively included).

*Pissonotus spooneri* Morgan and Beamer, 1949

(Figs. 32, 75)

*Pissonotus piceus* Spooner 1912: 238-239.

*Dicranotropis* (?) *piceus* (Spooner 1912): Crawford 1914: 601.

*Phyllodin* *piceus* (Spooner 1912): Metcalf 1923: 148, 167 (key).

*Pissonotus spooneri* Morgan and Beamer 1949: 100 (key), 104-107 (replacement name for *Pissonotus piceus* Spooner).

**Type Locality.** US: New York, Orange County, Middletown.

**Diagnosis.** *Brachypter*. Small, body shiny brown. Frons brown, carinae concolorous, immaculate, epistomal margin with white transverse band. Antennae deep stramineous. Pronotum mostly white, brown anteriorly. Mesonotum brown. Front tibiae greatly enlarged. Tegmina brown with broad white transverse band posteriorly. Abdomen brown, immaculate. Male pygofer with median processes long and fine, lateral gibbosity near midlength. Aedeagus without retrose processes.

**Description.** *Brachypter*. Body length ♂ 1.73-1.84 (1.77,  $n=5$ ), ♀ 2.24-2.37 (2.30,  $n=5$ ). Body shiny, body dark brown (Fig. 75).

Head with vertex and frons dark brown (Fig. 75), immaculate, carinae

concolorous; epistomal margin with broad white band, following subgenal sulci, broadening caudad of genal carinae, reaching base of front coxae. Postclypeus dark brown, anteclypeus paler. Antennae deep stramineous, antennal segment I 0.09-0.11 (0.10,  $n=5$ ); II 0.27-0.30 (0.28,  $n=5$ ); ratio I/II 0.32-0.39 (0.35,  $n=5$ ).

Thorax with pronotum white, anterior margin brown. Mesonotum dark brown. Tegmina brown, veins obscure; venation normal (not reticulate), concolorous with membrane, not reaching distal margin; with broad white distal transverse band.

Legs with front tibiae greatly expanded, dark brown, tibia width 0.18 ( $n=5$ ); middle tibiae less expanded, brown with paler carinae; hind legs light brown, tarsi and tibiae beyond midpoint stramineous; tarsal claws dark. Calcar length 0.20-0.24 (0.23,  $n=4$ ), number of calcar teeth 6-10 (8,  $n=4$ ).

Abdomen dark brown, immaculate.

**Macropter.** Body length (excluding wings) ♀ 2.37 ( $n=1$ ), total length (including wings) ♀ 3.13 ( $n=1$ ). Similar to brachypter, caudal apex of mesonotum stramineous. Wings clear, hyaline at base, veins light brown.

**Male Genitalia.** Pygofer (Fig. 32) cyphosomatic in cross-section, brown, paler on ental margins and anal tube; concave laterad of lateral processes. Median processes subequal or longer than parameres, slightly arcuate and converging; with angular base and laterally directed lobe near midlength, apices acuminate. Lateral processes obscure, concolorous with pygofer. Parameres flattened, parallel-sided, diverging, narrowed and cupped into rounded, dorsomedially projecting apices. Genital diaphragm vestigial. Aedeagus (Fig. 32) strongly flattened laterally, parallel-sided, abruptly narrowed to falcate apex; retrose processes absent, with scattering of small teeth near midlength. Anal processes fine, short, reaching midpoint of parameres.

**Remarks.** *Pissonotus spooneri* most resembles *P. basalis* and *P. nitens*, but has a broad white frontal band on its epistomal margin and a mostly white pronotum. The greatly expanded front tibiae, less expanded middle tibiae, and white markings on the frons, pronotum, and tegmina make *P. spooneri* easily recognizable.

Wilson et al. (1993a) reported collecting a single specimen of *P. spooneri* from a Missouri tallgrass prairie.

*Pissonotus spooneri* (as *Pissonotus piceus* Spooner 1912) was incorrectly synonymized with *P. flabellatus* by Ball 1926: 19, and is treated as a synonym of *P. flabellatus* by Metcalf 1943. The name *Pissonotus piceus* Spooner was preoccupied by *P. piceus* (Van Duzee) and replaced with *P. spooneri* by Morgan and Beamer 1949.

**Recorded Hosts.** None.

**Distribution.** Eastern United States (southern New England to northern Florida). UNITED STATES: Connecticut, Florida, New Hampshire, New York, Ohio, Pennsylvania; also reported Missouri (Wilson et al. 1993a), North Carolina (Brimley 1938).

**Type Material.** *Pissonotus piceus* Spooner, 1912, holotype (♀b, USNM): "Middletown/ VII/21/10 N. Y." "C. S. Spooner/ Collector" "type" (pencil).

Paratypes: New York: same as holotype: 11-VII-1910 (USNM, 1b♀) and 18-VII-1910 (USNM, 1b♀).

**Other Material Examined.** **United States:** NEW HAMPSHIRE: Durham, 8-IX-1922 (NCSU, 1b♂; 95-150z♂); same, 17-VII-1922 (NCSU, 1b♀; 95-151f♀); same, 23-IX-1922 (NCSU, 1b♂; 93-222c♂). CONNECTICUT: Storrs, 5-IX-1952, RHB (SEMC, 2b♂, 5b♀; 95-150w♂); same, VIII-9-1946 (SEMC, 2b♂, 3b♀; 95-151c♀; 95-212c♂); same, 5-VIII-1946, RHB (SEMC, 2b♂, 3b♀). NEW YORK: Fredonia, 21-VII-1946, LDB (SEMC, 23b♂, 13b♀, 1b broken; 95-151a♀, 95-151b♀, 95-151e♀, 95-150y♂, 95-150x♂); same, RHB (SEMC, 33b♀, 59b♂, 2b broken; 95-151d♀); Lancaster, 25-VII-1946, RHB (SEMC, 1b♂). PENNSYLVANIA: "PennSta" (Pittsburgh), 14-VIII-1906, M. Wirtner (CMNH, 1b♂). OHIO: Rome, 19-VII-1946, RHB (SEMC, 1b♂; 95-212d♂). FLORIDA: Marianna, 7-III-1947, RHB (SEMC, 1b♀).

*Pissonotus nitens* (Van Duzee, 1909)

(Figs. 33, 76)

*Phyllodinus nitens* Van Duzee 1909: 198-199.

*Phyllodictus nitens* (Van Duzee 1909): Ball 1926: 20.

*Pissonotus nitens* (Van Duzee 1909): Morgan and Beamer 1949: 100 (key), 107-108.

**Type Locality.** US: Florida, Pinellas County, St. Petersburg.

**Diagnosis.** *Brachypter*. Body brown to dark brown. Frons, postclypeus and vertex brown, unicolorous. Front tibiae greatly expanded. Pronotum brown with white caudal transverse band. Tegmina light brown with white distal transverse band. Abdomen brown, immaculate. Male pygofer with median processes bearing distinctive posterior flange.

**Description.** *Brachypter*. Body length ♂ 1.90-2.18 (2.04,  $n=2$ ), ♀ 2.21-2.89 (2.56,  $n=5$ ). Body shiny, orangish brown through dark brown (Fig. 76).

Head with vertex and frons brown (Fig. 76), immaculate. Postclypeus and anteclypeus concolorous with frons. Antennae brown, approximately concolorous with frons; antennal segment I 0.15-0.20 (0.18,  $n=3$ ); II 0.28-0.34 (0.31,  $n=3$ ); ratio I/II 0.50-0.71 (0.57,  $n=3$ ).

Thorax with pronotum brown cephalad, white caudad. Mesonotum brown. Tegmina light brown, veins concolorous, simple (not reticulate), nearly obsolete; not extending to distal margin, with white broad transverse band distally.

Legs with front and middle tibiae greatly expanded, dark brown, front tibia width 0.29-0.31 (0.30,  $n=3$ ); femora and hind leg paler. Tarsi stramineous, dark brown at tarsal claws. Calcar length 0.23-0.28 (0.25,  $n=3$ ), number of calcar teeth 8-9 (8,  $n=3$ ).

Abdomen brown, immaculate.

*Macropter*. Unknown, but see *Remarks*.

**Male Genitalia.** Pygofer (Fig. 33) subcylindrical in cross-section, mostly brown, paler at posterior margins and anal segment; excavated laterad of me-

dian processes receiving apices of anal processes. Median processes subequal or longer than parameres, arcuate, with angled base and apices sharply acute, directed dorsally or dorsocephalad; bearing large, posterior flange with dorsal and ventral processes having sharply acute apices, dorsal processes parallel, ventral converging. Lateral processes ridge-like, elongate and flattened. Parameres flattened, broadest above middle; turned medially and cupped forward, abruptly narrowed above middle into acute medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 33) strongly flattened laterally, slender, widest at base, narrowing towards apex, with 1 (or more) short, simple retrose processes. Anal processes stout, reaching nearly to base of parameres, apices blunt and toothed.

**Remarks.** *Pissonotus nitens* most resembles *P. basalis*. *Pissonotus basalis* has only slightly expanded tibiae and a postclypeus much darker than frons. The posterior flange of the median processes of *P. nitens* is unique among *Pissonotus*.

*Pissonotus nitens* was originally described from 2 specimens, the lectotype and a macropterous female from Estero, FL. This (or any other) macropterous specimen of *P. nitens* was not located in this study.

**Recorded Hosts.** *Helianthus* sp. (Asteraceae).

**Distribution.** Southeastern United States. UNITED STATES: Alabama, Florida, Mississippi. Also reported Jamaica (Crawford 1914).

**Type Material.** *Phyllodinus nitens* Van Duzee, 1909, lectotype (♀b, CASC #3057, designated by Morgan and Beamer 1949): "St Petersburg/ Fla. 4.28.08/Van Duzee;" allolectotype (b♂, USNM), designated by Morgan and Beamer 1949: 107-108: "Daytona Fla./5-22-26/E. D. Ball."

**Other Material Examined.** **United States:** FLORIDA: Sanford, 18-VIII-1928, EDB (FSCA, 2b♀ on 1 pin); same, 18-IV-1927 (USNM, 2b♀); same, 28-IX-1925 (USNM, 1b♀); same, 10-III-1927 (USNM, 1b♂, 1b♀; 95-149e♀, 93-217b♀); same, 6-II-1928 (USNM, 1b♂; 95-149b♂); same, 6-IX-1926, (USNM, 1b♂; 95-149g♂); same, 5-V-1927 (USNM, 1b♀; 95-149c♀; FSCA, 2b♀ on 1 pin); same, 22-II-1926 (USNM, 1b♀; 95-149d♀); Venice, 13-V-1928, *Heliant(hus)* (USNM, 4b♀ on 1 pin, 1b♂); same (no host, USNM, 1b♂; 95-149a♂). ALABAMA: Semmes, 20-III-1947, RHB (SEMC, 1b♀; 95-149f♀). MISSISSIPPI: Merrill, 20-III-1947, RHB (SEMC, 1b♀).

**The *Pissonotus piceus* Species Complex**

The *P. piceus* species complex includes *P. piceus*, *P. dentatus*, *P. abdominalis*, and *P. boliviensis* n. sp. These generally common species vary greatly in color. Dissection of male genitalia is necessary for specific identification, but even genitalic features are sometimes equivocal. Females are best identified by association with males and geographic clues. The *P. piceus* species complex was always a monophyletic clade in the cladistic analyses (presented later), but was not consistently resolved internally. Further atten-

tion to this complex, particularly using molecular techniques, seems warranted. The following is a characterization of the complex, based on a usual color form; exceptions and notes are found in the individual species descriptions.

**Species Complex Recognition.** Body lustrous, with or without stramineus dorsal markings (Figs. 78–81).

**Head.** Frons widest below middle, or rather parallel-sided (Figs. 78–81), narrowed between eyes with median carina distinct; immaculate, pale ventrally, gradually becoming darker dorsally (brownish orange to piceus transition generally occurs at level of antennae). Vertex rather projected in front of eyes. Antennae stramineus.

**Thorax.** Pronotum and mesonotum typically dark brown, hind margins paler; tegmina with normal venation; veins concolorous with brown membrane, distally with transverse band (incomplete or weaker medially).

**Legs.** Tibiae not expanded, mostly stramineus. Calcar typically large, foliaceous, with many teeth (13–18).

**Abdomen.** Immaculate in some species, others with highly variable middorsal markings, or dorsolateral maculae, or both.

**Male genitalia.** Pygofer cyphosomatic in cross-section, excavated laterad of lateral processes (Figs. 34–37). Median processes subequal to parameres, simple, parallel or slightly converging; bases angular, gradually narrowed to sharp apices. Lateral processes ventrolateral of median, slightly taller than wide, usually conspicuous. Parameres flattened, widest near middle; slightly cupped, narrowed and bent caudally near midlength, then dorsally into parallel to slightly converging, blunt, dorsally directed apices. Aedeagus strongly flattened laterally with 3–4 long retrose processes (Figs. 34–37), most distad with large lateral tooth. Anal processes reaching base of median processes, finely serrulate beneath; apices often resting behind lateral processes.

***Pissonotus abdominalis* (Crawford, 1914), new combination**  
(Figs. 34, 78)

*Dicranotropis bakeri abdominalis* Crawford 1914: 594 (key), 598–599.

**Type Locality.** BELIZE.

**Diagnosis.** *Brachypter*. Body dark brown, marked with stramineus. Frons stramineus, immaculate, usually darker near dorsum. Antennae stramineus. Pronotum and mesonotum brown, paler dorsally and caudally. Tegmina brown with distal transverse band. Abdomen dark brown with middorsal stramineus band, variable in width. Male pygofer with median processes parallel, 1/4 length of parameres. Paramere apices blunt, dorsally directed. Aedeagus with 3–4 retrose processes, most distad with single large, lateral tooth.

**Description.** *Brachypter*. Body length ♂ 2.25 ( $n=1$ ), ♀ 2.73–3.10 (2.89,  $n=4$ ). Body lustrous, dark brown with extensive middorsal deep stramineus markings (Fig. 78).

Head with frons stramineus (Fig. 78), immaculate, brown dorsally on some specimens, paler ventrally; without well-defined transverse band on epistomal margin; carinae concolorous. Vertex slightly produced anteriorly, deep stramineus with brown maculations variable in extent; some specimens mostly brown with caudal margin and carinae mostly pale. Postclypeus dark chestnut-brown, anteclypeus stramineus. Antennae stramineus, antennal segment I 0.13–0.14 (0.13,  $n=2$ ); II 0.25–0.27 (0.26,  $n=2$ ); ratio I/II 0.50–0.53 (0.52,  $n=2$ ).

Thorax with pronotum and mesonotum dark brown laterally, stramineus medially; hind margin of pronotum stramineus. Tegmina brown with veins concolorous; venation normal (not reticulate), becoming obsolete before distal margin; with white distal transverse band, usually weaker medially.

Legs with tibiae not expanded, front tibia width 0.07 ( $n=2$ ); legs stramineus with brown foveae, coxae brown proximally, stramineus distally; apex of tibiae and tarsi stramineus, brown at claws. Calcar large, length 0.37–0.38 (0.37,  $n=2$ ), number of calcar teeth 13–15 (14,  $n=2$ ).

Abdomen dark brown with broad middorsal stripe, characteristically narrowed on segments VI & VII; some specimens with dorsolateral stramineus maculae.

**Macropter.** Body length (excluding wings) ♀ 2.45–2.67 (2.56,  $n=2$ ), total length (including wings) ♀ 3.37–3.50 (3.41,  $n=2$ ). Head and pronotum similar to brachypter, mesonotum mostly dark brown, paler within lateral carinae or only carinae pale. Abdominal markings often reduced to middorsal carina. Wings clear.

**Male Genitalia.** Pygofer (Fig. 34) cyphosomatic in cross-section, mostly brown, stramineus dorsally, posterior margin and most of anal segment paler; concave laterad of lateral processes. Median processes short (quarter length of parameres), simple, slightly converging; angular with sharply pointed apex. Lateral processes conspicuous, flattened, slightly taller than wide, stramineus. Parameres flattened, slightly cupped, roughly parallel-sided; projecting laterally and posteriorly beyond middle; narrowed and turned dorsally in upper third to blunt, slightly converging, dorsally projecting apices. Genital diaphragm vestigial. Aedeagus (Fig. 34) strongly flattened laterally, with 2 large subterminal lateral teeth and 3–4 retrose processes; most distal long, straplike, with conspicuous lateral tooth near midlength; 2nd similar but simple, 3rd relatively fine and short, 4th hairlike. Anal processes stout, finely serrulate beneath, reaching median processes, resting in concavity laterad of lateral processes.

**Remarks.** The short median processes of the male pygofer readily distinguish *P. abdominalis* from *P. piceus*, *P. dentatus*, and *P. boliviensis* n. sp. *Pissonotus abdominalis* is the only species in the *P. piceus* complex that characteristically has a broad middorsal abdominal stripe, but some individuals of the other species may bear similar features.

Most brachypterous *P. abdominalis* males (including the type) have a dark brown area on their vertex and dorsally on their frons. Some specimens from

the Dominican Republic are darker than usual and are tentatively included; none of these were males, but 1 characteristic male was collected in a series with darker females.

**Recorded Hosts.** *Eupatorium adenophorum* Spreng. (Asteraceae).

**Distribution.** Central America (western Mexico to Costa Rica) and the Dominican Republic. MEXICO: Chiapas, Morelos, Nayarit, Oaxaca, Sinaloa. BELIZE; COSTA RICA; DOMINICAN REPUBLIC; HONDURAS; NICARAGUA.

**Type Material.** *Dicranotropis bakeri abdominalis* Crawford, 1914, holotype (♀, CASC): "Belize" "type" "*Dicranotropis/ bakeri/ abdominalis/* Crawford, D. L. C." Paratypes: Belize: W. M. Giffard Collection (CASC, 1b♂, 1m♀, 1b♀; 95-9a♂, Giffard slide #13, ser. VII; 95-9b♀, 95-9d♀). Nicaragua, Managua, (C. F.) Baker (no date) (CASC, 3b♀, 1m♀; 95-16a♀; 95-16b♀, 95-16c♀, 95-16d♀; CMNH 2b♀ Uhler manuscript name).

**Other Material Examined.** Mexico: SINALOA: Campo El 21, Mun(icipo) Guasave, 4-IX-1978, UV trap, R. E. Woodruff (LOBC, 1m♂); Sin., 8 mi S Escinapa 100', 18-XII-1963, L&COB (LOBC, 1b♂); 12 mi S Mazatlan, 17-XII-1963, blacklight, LOB (LOBC, 1m♂); Campo Meyer, Municipio Guasave, 4-IX-1978, blacklight trap, R. E. Woodruff (LOBC, 1m♀). NAYARIT: San Blas, spring, 100', 19-XII-1963, L&COB (LOBC, 4m♂, 4m♀, 4b♀; 96-43e♂). MORELOS: Cuernavaca, XI-1944, on foliage *Eupatorium adenophorum*, N.L.H. Krauss (USNM, 2m♂, 1b♀, 1m broken). OAXACA: 2 mi E Juchitan, 100', 3-VI-1974, L&COB & GBM (LOBC, 2b♀). CHIAPAS: 3 km S Palenque on Hwy 199, mercury vapor light, (21-22)-V-1987 (LOBC, 1m♀). Belize: S. C., Stann Creek Town, 17-VIII-1977, L&COB & GBM (LOBC, 2b♂; 95-9c♂). Honduras: Ola(ncho), 5 mi SE Catacamas, 13-IV-1974, night, L&COB & GBM (LOBC, 3b♀); Ola., 7 mi SE Catacamas, El Carbon, 13-VI-1974, L&COB & GBM (LOBC, 1m♀); Cho(luteca), 14 mi NW Choluteca, 17-VI-1974, blacklight trap, LOB (LOBC, 1m♀). Nicaragua: Mat(agalpa), 5 mi W Sebaco, 1500', 16-VII-1974, L&COB & GBM (LOBC, 1b♀); Tipitapa, Managua, 20-VII-1970, L. H. Rolston (LOBC, 1m♀). Costa Rica: Rincon (Peninsula de Osa), 100', 11-VIII-1966, SLW (LOBC, 1b♀). Dominican Republic: La Altag., 31 km N Higüey, 1-VIII-1979, COB (LOBC, 1b♂, 4b♀, plus 1b♀ tentatively included); La Estrel., 1 km E Hondo Valle, 7-VIII-1979, L&COB & GBM (LOBC, 1b♀ plus 1m♀ tentative); La Estrel., 10 km E Hondo Valle, 7-VIII-1979, L&COB (LOBC, 1m♀ tentative); San Juan, 6 km W San Juan, 7-VII-1979, GBM (LOBC, 6b♀); same, at night, COB & GBM (LOBC, 3b♀); La Vega, 18 km SE Constanza, 4-VIII-1979, COB (LOBC, 1b♀ tentative); El Seibo, 1 km N El Valle, 2-VIII-1979, COB (LOBC, 1m♀ tentative).

*Pissonotus dentatus* Morgan and Beamer, 1949

(Figs. 35, 79)

*Pissonotus dentatus* Morgan and Beamer 1949: 111 (key), 136–137.

**Type Locality.** US: Florida, Levy County, Inglis.

**Diagnosis.** *Brachypter*. Coloration variable, brown to brownish orange. Frons immaculate, usually stramineous at epistomal margin, becoming darker dorsally. Vertex brown, usually paler caudally, little produced in front of eyes. Pronotum and mesonotum brown, paler caudally. Tegmina light brown with medially incomplete distal transverse band. Calcar with 8–13 teeth. Abdomen immaculate. Paramere apices blunt, dorsally directed. Aedeagus with 3 retrose processes, most distad with large lateral tooth; row of 2–3 small lateral teeth on each side near gonopore.

**Description.** *Brachypter*. Body length ♂ 1.88–2.20 (2.00,  $n=4$ ), ♀ 1.59–2.43 (2.26,  $n=5$ ). Body lustrous, brown to brownish orange, variable (Fig. 79).

Head with frons mostly brownish orange (Fig. 79), immaculate, paler ventrally, becoming darker brown dorsally; carinae concolorous. Postclypeus dark brown, appearing faded in some specimens; anteclypeus paler. Vertex little or not at all produced in front of eyes, color variable, brown to brownish orange, often with hind margin and portion of lateral carinae pale. Antennae stramineous, antennal segment I 0.10–0.15 (0.11,  $n=5$ ), II 0.28–0.32 (0.30,  $n=5$ ); ratio I/II 0.32–0.47 (0.37,  $n=5$ ).

Thorax with pronotum and mesonotum brownish orange to brown, paler on hind margins. Tegmina veins concolorous with membrane; venation normal (not reticulate); becoming obsolete before distal margin; with medially incomplete white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.07–0.08 (0.07,  $n=5$ ); legs stramineous, some with brown foveae and often darker at claws; coxae brown proximally. Calcar length 0.26–0.30 (0.28,  $n=5$ ), number of calcar teeth 11–12 (12,  $n=5$ ).

Abdomen brownish orange to brown, immaculate.

*Macropter*. Body length (excluding wings) ♂ 2.00–2.07 (2.03,  $n=3$ ), ♀ 2.20–2.25 (2.37,  $n=5$ ); total length (including wings) ♂ 2.73–2.86 (2.81,  $n=3$ ), ♀ 3.05–3.22 (3.08,  $n=4$ ). Coloration similar to brachypter with mesonotum darker, stramineous at caudal apex. Wings clear.

**Male Genitalia.** Pygofer (Fig. 35) cyphosomatic in cross-section, brownish orange to brown with paler anal tube and ental surface; excavated laterad of lateral processes. Median processes subequal to parameres, parallel, simple; sharply acute apically with angular base; some specimens with fine lateral serrations at midlength. Lateral processes slightly taller than wide, concolorous with pygofer or paler distad. Parameres flattened, slightly cupped, widest near middle; distally narrowed and bent caudally then dorsally into slightly converging dorsally projecting, truncate apices. Aedeagus (Fig. 35) strongly flattened laterally, with 3 retrose processes, most distad with large lateral tooth;



with a row of 2–3 small lateral teeth each side near gonopore. Genital diaphragm vestigial. Anal processes reaching base of parameres, apices often resting behind lateral processes; finely serrulate beneath.

**Remarks.** The only feature of *P. dentatus* that consistently separates it from *P. piceus* is the presence of the row of 2–3 small lateral teeth near the gonopore of the aedeagus. *Pissonotus dentatus* also is characteristically smaller than *P. piceus*, more often orangish, with a broader, laterally arcuate frons, a less projected vertex, and usually with a smaller calcar (8–13 teeth in *P. dentatus*, 13–18 in *P. piceus*). The same features of *P. dentatus*, along with range (most records of *P. dentatus* are from Florida), distinguish it from the other members of the *P. piceus* species complex (*P. abdominalis* and *P. boliviensis*, n. sp.). Females of *P. dentatus* and *P. piceus* may be indistinguishable.

The paratype series of this species was found to include specimens of both *P. dentatus* and *P. piceus*. Most of the features that separate *P. dentatus* from *P. piceus* seem to intergrade. No host plant is known for *P. dentatus*, but *P. dentatus* and *P. piceus* appear to occur in the same habitat.

**Recorded Hosts.** None.

**Distribution.** UNITED STATES: Florida, Illinois, North Carolina. CUBA.

**Type Material.** *Pissonotus dentatus* Morgan and Beamer, 1949, holotype (b♂, SEMC) and allotype (b♀, SEMC): "Inglis, Fla/3-9-1947/R. H. Beamer." Paratypes: Florida: same as holotype (SEMC 38b♂, 13b♀, 1m♂, 2b broken; 95-153d♂, 95-153e♂, 95-153f♂, 95-153n♂, 95-153g♀, 95-153h♀, 95-153j♀, 95-153k♀, 95-153t♀, 95-153v♀; CUIC 1b♂ [CU #2946.1], 1♀ [CU #2946.2, legs only on point]); same, LDB (SEMC, 13b♂, 5b♀; 95-153c♂, 95-153i♀); Otter Creek, 9-III-1947, LDB (SEMC, 1m♂, 2m♀; 95-153u♀, 95-153r♀, 95-153q♂); same, RHB (SEMC, 5b♂, 1m♀, 1m♂; 95-153s♀, 95-153m♂; USNM, 1b♂); La Belle, 13-III-1947, RHB (SEMC, 2b♂); Mims, 18-III-1947, RHB (SEMC, 1b♂); Lake Placid, 13-VII-1948, RHB (SEMC, 1b♂); Sanford, 11-III-1947, RHB (SEMC, 1b♂); Melbourne, 17-III-1947, RHB (SEMC, 2b♂, 1b♀, 3m♂); Melbourne, 9-VI-1951, Price-Beamers-Wood (SEMC, 1m♂).

**Other Material Examined.** United States: ILLINOIS: Chicago, 30-IX-1909, J. D. Allen (USNM, 1b♂). NORTH CAROLINA: Raleigh, 16-X-1938, PWO (USNM, 1b♂; 93-200a♂). FLORIDA: Inglis, 9-III-1947, RHB (SEMC, 26b♂, 2m♂, 9b♀, 7m♀); same, LDB (SEMC, 3b♂, 3m♂, 3m♀); Inglis, 7-VII-1948, E. L. Todd (SEMC, 1b♂); Royal Palm Pk., 22-VII-1948, RHB (SEMC, 1m♂, 1b♂); same, 21-VII-1948, LDB (SEMC, 1b♀); Punta Gorda, 12-III-1947, RHB (SEMC, 5b♂, 1b broken); Otter Creek, 6-VII-1948, RHB (SEMC 5b♂, 3m♂ 95-153l♂); same, 9-III-1947 (SEMC, 13b♂, 5b♀, 3m♀); same, LDB (SEMC, 9b♂, 3m♂, 5b♀; 95-42a♂); Zolfo Springs, 12-III-1947, RHB (SEMC 7b♂, 1b♀; 95-153b♂); same, 26-XII-1959 (SEMC, 1b♂); Parish, 9-VII-1948, RHB (SEMC, 1m♂, 1b♀); La Belle, 19-VII-1948, RHB (SEMC, 1b♂); same, 16-VII-1939 (USNM, 1b♀); La Belle, 16-VII-1939, PWO (SEMC, 1b♀; USNM, 3b♀); Homestead, 20-VII-1948, RHB (SEMC, 3b♂, 2b♀); Mims, 18-III-1947, RHB (SEMC, 1b♂, 1m♂, 2b♀); same, 17-III-1947 (SEMC, 1m♂); Lacoochee, 7-VII-1948, RHB (SEMC, 12b♂, 6b♀); Dade Co., 26-II-1988, sweeping, K. E. Jenkins (FSCA, 1m♂, whole specimen cleared);

Sanford, 22-VI-1928, EDB (USNM, 1b♀); same, 19-V-1927 (USNM, 1b♂); same, 5-IV-1928 (USNM, 2b♂, 5b♀ on 2 pins); same, 17-VI-1927 (USNM, 7b♂, 2b♀ on 2 pins); same, 7-VI-1927 (USNM, 3b♂, 2b♀ on 1 pin); Leon Co., Tall Timbers Res. Sta., 5-VII-1972, night, COB (LOBC, 1b♀); Fort Meyer, 27-VII-1927, EDB (USNM, 2b♂, 2b♀); Orlando, 11-IV-1967, L. A. Kelton (CNCI, 3b♂, 1m♀); Jefferson Co., 6 mi S Wacissa, 14-VI-1973, O'Brien, Kaplan & GBM (LOBC, 2b♂, 1b♀). **Cuba:** Sto. Tomás P. de Zapata, (5-9)-V-1927 (NCSU, 4b♂).

*Pissonotus piceus* (Van Duzee, 1894b)

(Figs. 36, 80)

*Megamelus piceus* Van Duzee 1894b: 28–29.

*Megamelus picus* Van Duzee 1894b: Pettit 1905: 25 (incorrect subsequent spelling).

*Dicranotropis bakeri* Crawford 1914: 494 (key), 598. **New synonymy.**

*Pissonotus fulvus* Metcalf 1923: 171 (key), 206. Synonymized by Morgan and Beamer 1949: 137–138.

*Delphacodes pictifrons* Osborn 1938: 342 (ill.), 344. **New synonymy.**

*Pissonotus piceus* (Van Duzee 1894b): Oman 1947: 219 (ill.), 220.

**Type Locality.** US: New York, Eire County, Clarence.

**Diagnosis.** *Brachypter*. Body shiny, usually dark brown. Frons immaculate, pale ventrally, gradually becoming darker dorsally. Vertex piceus, projected in front of eyes. Antennae stramineus. Pronotum and mesonotum dark chestnut brown with paler hind margins. Tegmina brown, venation normal (not reticulate); veins concolorous with membrane, with white distal transverse band, weaker or incomplete medially. Abdomen usually immaculate. Calcar large, foliaceous, with 13–18 teeth. Median processes of pygofer subequal to parameres, simple, parallel or slightly converging, with angular bases and sharply acute apices. Parameres beyond middle dorsally projecting, parallel or slightly converging into blunt apices. Aedeagus with 3–4 retrose processes, most distad with large lateral tooth.

**Description.** *Brachypter*. Body length ♂ 2.20–2.38 (2.31,  $n=5$ ), ♀ 2.81–3.19 (2.98,  $n=5$ ). Body shiny, dark chestnut-brown (Fig. 80).

Head with frons rather narrow and widest below middle (Fig. 80), immaculate, paler ventrally gradually becoming darker dorsally (color transition to dark brown usually at level of antennae); carinae concolorous. Postclypeus dark, anteclypeus paler. Vertex projecting in front of eyes, uniformly dark brown with hind margin often paler. Antennae stramineus, antennal segment I 0.11–0.16 (0.13,  $n=5$ ); II 0.30–0.33 (0.31,  $n=5$ ); ratio I/II 0.33–0.53 (0.42,  $n=5$ ).

Thorax with pronotum and caudal margins paler (some specimens with narrow transverse band on caudal margin). Mesonotum dark chestnut-brown, caudal margin often paler. Tegminal veins concolorous with membrane; venation normal (not reticulate), becoming obsolete before distal margin; with white distal transverse band, usually incomplete medially, absent in some specimens.

Legs with tibiae not expanded, front tibia width 0.07–0.08 (0.08,  $n=5$ ); legs mostly stramineous with dark brown foveae; coxae dark brown proximally, stramineous distally; apices of tibiae and tarsi stramineous, dark brown at tarsal claws. Calcar large, length 0.35–0.40 (0.38,  $n=5$ ), number of calcar teeth 13–18 (14,  $n=5$ ).

Abdomen dark chestnut brown, usually immaculate, or with diffuse paler dorsolateral maculations and poorly developed broad middorsal stripe (the holotype has abdominal markings).

**Macropter.** Body length (excluding wings) ♂ 2.13–2.38 (2.26,  $n=5$ ), ♀ 2.73–3.18 (2.96,  $n=5$ ); total length (including wings) ♂ 3.10–3.37 (3.23,  $n=4$ ), ♀ 3.38–3.81 (3.71,  $n=5$ ). Color similar to brachypter, caudal apex of mesonotum stramineous. Wings clear.

**Male Genitalia.** Pygofer (Fig. 36) cyphosomatic in cross-section, dark brown with paler anal tube and ental surface; excavated laterad of lateral processes. Median processes from 2/3 to subequal parameres; parallel or slightly converging, simple, with angular base and sharply acute apices; some specimens with lateral serrulations near midlength (best viewed in cleared specimens). Lateral processes slightly taller than wide, concolorous with pygofer, or paler distad. Parameres flattened, widest near middle, slightly cupped; bent posteriorly and narrowed near midlength, then dorsally beyond middle into parallel or somewhat converging truncate, dorsally projecting, apices. Aedeagus (Fig. 36) with 3–4 retrose processes, most distad with large lateral tooth, 4th hairlike. Genital diaphragm vestigial. Anal processes reaching base of parameres, apices often behind lateral processes, finely serrulate beneath.

**Remarks.** *Pissonotus piceus* strongly resembles the other members of the *P. piceus* species complex. The only consistent feature to separate *P. piceus* from *P. dentatus* is the presence of 2–3 paired, subapical, lateral teeth on the aedeagus of *P. dentatus*. Other putative features are described in *Remarks* of *P. dentatus*. *Pissonotus abdominalis* has the median processes much shorter than the parameres and usually has a broad middorsal abdominal band of varying width. *Pissonotus boliviensis* n. sp. can be identified by range, by usually having 1–2 retrose processes, and often by the shape of the median processes (see *Remarks* of *P. boliviensis*). *Pissonotus muiri* is also similar, but has a paler head than body and a small central tooth just ventrad of the median processes.

The body coloration of *P. piceus* varies widely from dark chestnut-brown to brownish orange. Metcalf (1923) described a brownish orange specimen as *P. fulvus*, which was synonymized by Morgan and Beamer (1949: 137–138).

*Pissonotus piceus* was the second most commonly collected species of *Pissonotus* (Table 1, p. 12), representing  $\approx 14\%$  of all specimens examined.

Wilson et al. (1993b) found that a portable suction device was far more efficient than sweep netting and a beating-and-aspirating technique in sampling *P. piceus* from *Polygonum hydropiperoides* in Missouri. Wilson et al. (1993b) used the portable suction device to collect 3,732 specimens of *P. piceus* in a single year, used once a week from mid-July to early October. Denno (1994: 200 based on S. Wilson, *personal communication*) noted that *P. piceus* has 2 generations a year. Tsai and Mead (1982) collected *P. piceus* with a rotary flight

trap in coconut and cabbage palm plantations southern Florida. Bickley and Seek (1975: 9) reported this species from a slightly brackish marsh dominated by *Phragmites communis* Trinius and *Pontederia communis* L. in Prince George's County, MD.

*Pissonotus piceus* was originally described by Van Duzee (1894b) in association with celery, but this is apparently not a regular host.

A paratype of *Delphacodes puella* (Van Duzee) (ISUI, m♂), labeled "Miss.," is *P. piceus*.

The tentatively included specimens (listed below) from Trinidad, Canal Zone, and Venezuela have a reduced number of retrose processes.

The holotype of *Dicranotropis bakeri bakeri* Crawford, 1914, is a brachypter of *P. piceus* from Nicaragua with the abdomen missing. The pronotum is dark brown with a narrow transverse white band on the caudal margin. The mesonotum is uniformly dark brown with the caudal margin paler. The tegmina has a white distal transverse band that is slightly weaker medially. The relatively strong white bands of the caudal margin of the pronotum and distal margin of the tegmina is commonly observed on specimens of *P. piceus* from this region, but less often in more northerly regions.

The holotype of *Delphacodes pictifrons* Osborn, 1938, is a macropterous male specimen of *P. piceus* (Van Duzee 1894b) with dissected and cleared genitalia. It is a relatively dark specimen with the extreme hind margins of the vertex and pronotum paler, and the tip of the mesonotum yellow. The distal 2/3 of the frons and gena are yellowish, with the ragged, gradual transition into chestnut-brown that is typical of *P. piceus*.

**Recorded Hosts.** *Polygonum hydropiperoides* Michx., *Polygonum* sp. (Polygonaceae), and *Ludwigia peploides* (H. B. K.) Raven (as *Jussiaea diffusa* Forskal) (Onagraceae) appear to be confirmed hosts. Also reported: *Rumex crispus* L. (Polygonaceae, Morgan and Beamer 1949), *Apium graveolens* L. (as celery) (Apiaceae), *Ludwigia uruguayensis* (Camb.) Hara (Onagraceae), *Solidago* sp. (Asteraceae), *Echinocloa* sp., *Bromis inermis* Leyss. (both Poaceae), *Glycine max* (L.) Merr. (as soybeans) (Fabaceae), and "chard."

**Distribution.** Central and eastern United States, adjacent Canada, Central America, northern South America, Trinidad, Cuba, Jamaica, and Bermuda. CANADA, Ontario; also reported Quebec (Moore 1950a, b). UNITED STATES: Alabama, Arizona, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Missouri, Mississippi, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia. MEXICO: Jalisco, San Luis Potosí, Sinaloa, Veracruz. BELIZE; CANAL ZONE; COSTARICA; HONDURAS; NICARAGUA; PANAMA; PERU; VENEZUELA: Guarico, Zulia; BERMUDA; CUBA; JAMAICA; TRINIDAD.

**Type Material.** *Megamelus piceus* Van Duzee, 1894b, lectotype (♂b, USNM, designated by Oman 1947: 220): (♂ & ♀ on 1 pin, handwritten) "Clarence/N. Y. 9-4-'92" "♀" "♂" "E. P. Van Duzee/ Collector." Paralectotype (1♂, 1♀,

same point, ♀ broken, CUIC [CU #2431]: "Grand Is./Buffalo, NY/Sep. 11 1892."

*Pissonotus fulvus* Metcalf, 1923, holotype (b♂, INHS): "Paxton, Ill./ July 30, '16" "♂" "*Pissonotus/fulvus*/Metcalf." Paratype (1b♀, NCSU): "Metropolis, Ill./ Aug. 19, '16." Specimens with the same label information are located as follows: Paxton, 30-VII-1916 (NCSU, 2b♀; INHS, 3m♂, 1b♂, 4b♀; USNM, 1b broken); Metropolis, 18-VIII-1916 (NCSU, 1m♀, 1b♀; USNM, 1b broken). Synonymized by Morgan and Beamer 1949: 137-138.

*Dicranotropis bakeri bakeri* Crawford, 1914, holotype (b, abdomen missing, CASC): "San Marcos, Nicaragua/ Coll. Baker" "Type" "*Dicranotropis/bakeri*/Crawf D. L. C." Paratypes: Cuba: Havana, (C. F.) Baker, W. M. Giffard Collection (CASC, 2b♀, 1m♀, 1m♂ [95-8a♂, dissected, genitalia on Giffard slide #12, ser. VII]; 95-8b♀; 95-8b♀, 95-8c♀).

*Delphacodes pictifrons* Osborn, 1938, holotype, (m♂, OSUC): "Deer Cr./ Mdsn.Co.O/VIII-26 '20"/P.H. Osborn/Collector" // "Ohio Biol./Survey" "Holotype/Delphacodes/pictifrons/Osb." (red paper) "#1 Delphacodes/s. nov. Caldwell '38."

**Other Material Examined.** Canada: ONTARIO: Toronto, 8-VIII-1924, EDB (USNM, 2m♀); Pr(ince) Edw(ard) Co., 25-VIII-1955, J. F. Brimley (CNCI, 1m♂); Crieff Bog, 3 km W Pulinch, (5-11)-IX-1987, Forest Edge, D. Blades (CNCI, 1m♂). United States: MICHIGAN: Covert township, 2-IX-1938 (FSCA, 2m♂; USNM, 11b♂, 12m♂, 26m♀, 16b♀; 95-149w♂, 95-150b, 95-150g♀, 95-150h♀). NEW HAMPSHIRE: Durham, 20-IX-1922 (NCSU, 5b♂, 4b♀); same, 11-VIII-1923 (NCSU, 1m♂, 1b♂); same, 30-VIII-1922 (NCSU, 1b♂); Hill, 23-VII-1923 (NCSU, 1b♀); Rock Co., 1 mi SW Durham, (7-20)-VIII-1987, f(light) i(ntercept) t(rap), D. S. Chandler (DENH, 1m♂); same, (21-VIII)-(2-IX)-1987 (DENH, 1m♂). VERMONT: 5 km W Cambridge, 3-IX-1988, KAH (CNCI, 1b♂). MASSACHUSETTS: Belmont, 2-IX-1921 (NCSU, 1m♀); Medford, 23-VIII-1921 (NCSU, 1b♂); Boston, Arboretum, July (NCSU, 1m♀). CONNECTICUT: Storrs, 10-VIII-1946, RHB (SEMC, 1b♀); New Haven, 21-X-1903, H. L. Viereck (USNM, 1b♀). NEW YORK: Ithaca, 25-VII-1946, RHB (SEMC, 1b♂); McClean, 25-VII-1946, RHB (SEMC, 1b♂, 2m♀); Riverhead, L. I., 17-VII-1946, RHB (SEMC, 1m♀); Bergan, 24-VII-1946, RHB (SEMC, 1m♀); Ashford, 22-VII-1946, RHB (SEMC, 1b♂, 1b♀; 95-150e♀, 95-149s♂); Fairhaven, 2-IX-1918 (CUIC, 2b♀); Boston, 28-VII-1909, Van Duzee (CASC, 1b♂); Buffalo, 24-VIII-1898, E. P. Van Duzee (CASC, 1m♂); Hamburg, 10-VII-1895 (CASC, 1b♂, 1b♀); Cranberry Lake, 14-VIII-1920, C. J. Drake (NCSU, 1b♀); Phoenicia, 25-VIII-1904, N. Y. S. Coll., Van Duzee (NCSU, 3b♂, 1m♂ on 3 pins); Kingston, 23-VIII-1904, N. Y. S. Coll., Van Duzee (NCSU, 1m♂). NEW JERSEY: Riverton 9-X-(?) (USNM, 1m♀). PENNSYLVANIA: Ashland, 21-VIII-1946, RHB (SEMC, 2b♂, 1b♀); Beaver Co., New Galilee, (7-10)-IX-1909, H. Kahl (CMNH, 1b♂); Greensburg, 22-X-1902 (Wirtner, CMNH, 1b♀); same, 28-VIII-1901 (USNM, 1m♀); "PennSta" (Pittsburgh), 1-VII-1908, M. Wirtner (CMNH, 1b♀); Patton, 3-VIII-1908, M. Wirtner (CMNH, 2b♂, 3b♀ on 1 pin); Philadelphia, Fairmont Park (no date, ANSP, 1m♂). DELAWARE: New Castle Co., Newark, UD Woodlot, 4-VIII-1990, sweep, C. R. Bartlett (NCSU, 1b♀). MARYLAND: Plummer's Id., 22-VIII-1946, RHB (SEMC, 1b♂); Plummer's

I., 27-VII-1913, W. L. McAtee (USNM, 1b♀, 1m♀); same, 14-IX-1913 (USNM, 1b♂); 3-VIII-1913 (USNM, 1m♂, 1b♀); same, 5-X-1913 (USNM, 2b♀, 1b♂); same, 29-VI-1913 (USNM, 1m♀); same, 9-VIII-1914 (USNM, 1m♂); same, 17-VI-1913 (USNM, 1m♂); Harmony Grove, 28-IX-1932, on water cress, F. F. Smith (USNM, 1b♂); Howard Co., 1 mi N, 1.6 mi NW Fulton, 26-VI-1983, G. F. & J. F. Hevel (USNM, 1m♂); Glen Echo, 1-VII-1923, J. R. Malloch (USNM, 1b♂). DISTRICT OF COLUMBIA: 10-X-1904, Heidemann Coll. (CUIC, 2m♂); same, 12-X-1894 (CUIC, 1m♂); same, 4-VII-1886 (CUIC, 1m broken); same, 4-VI-1904 (CUIC, 1b♂); same, 6-VIII-1904 (NCSU, 1b♀; USNM, 2b♀, 1m♂); "Del. Water Gap," A. T. Slosson (no date, AMNH, 1b♀, 1m♀); Anacostia, 22-VII-1913, W. D. Appel (USNM, 1b♀). OHIO: Barberton, 23-VIII-1936, L. J. Lipovsky (SEMC, 1b♂, 2m♂; 95-149x♂, 95-150k♂); same, 11-VIII-1936 (SEMC, 2b♀, 1m♀, 2m♂; 95-150k♀); Columbus, A. Koebele (no date, CASC, 1b♂, 1b♀); same, 1903 (CASC, 2b♀, 1b♂, 3m♀, 1m♂, Giffard slide #9 ser. VII ["*pallipes*"]); same, IX-1903 (CASC, 4b♀, 1m♀); Columbus, 21-XII-1902, O. H. Swezey (CASC, 1b♂, Giffard slide #14 ser. VII [determined as *ater*]); Dayton, 12-VIII-1903, O. H. Swezey (CASC, 1b♂). INDIANA: Tippecanoe Co., Battleground, 12-VIII-1969, COB (LOBC, 2b♀); Noble Co., 13-VII-1935, H. E. Brown (NCSU, 1b♀); Allen Co., Ft. Wayne, 11-VI-1964, L&COB (LOBC, 1b♂). ILLINOIS: Alexander Co., Horseshoe Lake, 12-VIII-1979, S. W. Wilson (CMSU, 1b♂); Dongola, 23-VIII-1916 (NCSU, 1m♀; INHS, 4m♀, 3m♂, 1b♂, 1b♀; USNM, 1b♀); same, 24-VIII-1916, meadow (NCSU, 1b♀); Elgin, Bot. Gardens, 19-IX-1939, H. H. Ross & C. O. Mohr (INHS, 1b♂); Des Plains R. Riverside, 2-IX-1949, W. Tietz Jr. (INHS, 1m♀); same, 27-VIII-1949 (INHS, 1m♀); same, 10-IX-1949 (INHS, 1m♂); Grand Tower, 7-X-1947, H. H. Ross (INHS, 1m♀); Bonnie, 5-IX-1942, H. H. Ross & M. W. Sanderson (INHS, 1m♀); Herod, 7-X-1932, Ross & Burks (INHS, 1b♂); Herod, 24-VI-1932, DeLong & Ross (INHS, 1m♂, 1m♀); Norris City, 3-X-1933, breeding on *Jussiaea diffusa*, Ross & Burks (INHS, 14b♀, 8b♂, 2m♂, 15m♀); Princeton, 7-VII-1934, swamp, DeLong & Ross (INHS, 3b♀); Zion, 25-VII-1934, Frison & DeLong (INHS, 3b♀); Karnak, 14-VI-1934, DeLong & Ross (INHS, 4m♂, 1b♂); Wilmington, 20-VIII-1934 (INHS, 1m♂); Wilmington, 30-VIII-1934, DeLong & Ross (INHS, 1m♀); Metropolis, 18-VI-1934, DeLong & Ross (INHS, 4m♂, 2m♀, 1b♀); Metropolis, 19-VIII-1916 (INHS, 3b♀, 1m♀); Metropolis, 20-VII-1916 (INHS, 2m♂, 3m♀); Seymour, 29-VII-1932, H. H. Ross (INHS, 1m♂); Parker, 4-VI-1913, in woods (INHS, 1m♀); Meredosia, 29-V-1917 (INHS, 1m♀); Mahomet, 17-VII-1932, A. R. Park (INHS, 1m♀); Urbana, 24-IX-1916, in woods (INHS, 5m♂, 6m♀); Urbana, 19-IX-1934, on *Solidago*, DeLong & Ross (INHS, 1m♂); Urbana, 10-XI-1915 (INHS, 3m♂); Urbana, 19-IX-1916, C. S. Spooner (USNM, 1m♂); same, 15-IX-1916 (USNM, 1m♀); White Heath, 24-VI-1916 (INHS, 1m♂); Atlas, 28-VII-1936, Mohr & Burks (INHS, 1m♂); Golconda, 3-VIII-1932, H. L. Dozier (INHS, 1m♀); Monticello, 31-VII-1932, T. H. Frison (INHS, 1m♀); Alton, (19-21)-VII-1932, Ross & Dozier (INHS, 9m♂, 1b♀, 8m♀; USNM, 1b♀); same, 19-VII-1932 (INHS, 6m♂, 2m♀); Hardin, (5-7)-VI-1932, H. L. Dozier (INHS, 1b♀, 2m♀); Elizabethtown, (27-31)-V-1931, H. L. Dozier (INHS, 1m♀); Cave-in-Rock, 2-X-1934, Frison & Ross (INHS, 1m♀); Kampsville, 27-VI-1934, DeLong

& Ross (INHS, 1m♀); Wetaug, Pulaski, (25-27)-VIII-1934, Spooner Coll. (EIUC, 1b♂; USNM, 1m♀); Embarrass R., 6 mi SE Charleston, 15-VI-1936 (USNM, 2m♂, 1m♀); Algonquin, 3-X-1895 (USNM, 1m♂); Watson, 2-IX-1953, *Echinocloa* sp., GL133, Ross (CNCI, 1b♀, 1m♂); Arenzville, 26-IX-1962, ex: *Bromis inermis*, GL164, Ross & Cunningham (CNCI, 1m♂). MISSOURI: Johnson Co., Warrensburg, 30-VIII-1985, S. W. Wilson (CMSU, 1b♂, 1b♀); same, 20-IX-1985 (CMSU, 1b♂); same, 1-IX-1990 (CMSU, 1b♂); same, 29-VIII-1986, L. Flager (CMSU, 1m♀); same (no collector, CMSU, 1b♂). KANSAS: Lawrence, 20-IX-1944, RHB (SEMC, 2b♂, 2b♀); Douglas Co., 28-VIII-1938, trap light, P. B. Lawson (SEMC, 2m♂); same, 30-VIII-1928 (SEMC, 1m♂); Douglas Co., 8-VIII-1944, RHB (SEMC, 1b♀); same, 9-VIII-1944 (SEMC, 1b♀); same, 23-VII-1945 (SEMC, 1b♀); same, 3-X-1945 (SEMC, 1m♂); same, 30-VIII-1945 (SEMC, 1b♀); same, 28-VIII-1945 (SEMC, 1m♂); same, 24-X-1944 (SEMC, 2b♂, 2m♂, 1m♀); same, 2-XI-1944 (SEMC, 2b♂, 1m♂); same, 6-XI-1944 (SEMC, 2m♂); same, 17-X-1944 (SEMC, 1b♂); same, 18-X-1944 (SEMC, 5b♂, 1m♂, 1m♀; 95-149u♂); same, 19-X-1944 (SEMC, 1m♂); same, 25-X-1944 (SEMC, 1b♂, 1b♀); same, 26-X-1944 (SEMC, 2m♂, 1m♀, 5b♂); Garnett, 29-VIII-1939, RHB (SEMC, 1m♂); Leavenworth, 28-V-1946, RHB (SEMC, 14b♀, 15b♂, 2m♀); La Cygne, 28-X-1945, RHB (SEMC, 29b♂, 18m♂, 14b♀, 4m♀; 95-149y♂, 95-150j♀, 95-150d♀); same, 21-V-1946 (SEMC, 1m♂); Cherokee Co., 16-VIII-1920, Hungerford-Beamer (SEMC, 1b♂); Cherokee Co., 18-IX-1945, RHB (SEMC, 5b♂, 4m♂, 3b♀, 4m♀); Liberal, 16-VIII-1945, RHB (SEMC, 1m♀); Crawford Co., 993', 1915 RHB (NCSU, 1m♀, 1m broken); RI Co., Manhattan, KSU campus, 1-IX-1966, to lights, G. F. Hevel (USNM, 1m♀); Newton, 3-VII-1945, RHB (SEMC, 1m♂). MONTANA: Lewiston, 24-VIII-1922, C. C. Sperry (USNM, 1m♂). WEST VIRGINIA: Gauley Bridge, 21-VIII-1986, KAH (CNCL, 1m♀). VIRGINIA: Dismal Swamp, 13-VIII-1931, RHB (SEMC, 1b♂); Mt. Lake, 2-IX-1946, RHB (SEMC, 1m♂); Fairfax, 6-X-1921, F(?) Schott (NCSU, 1m♂); L. Drummond, 10-IX-1933, PWO (USNM, 1m♀); Glencarlyn to mouth 4-mile run, 17-VI-1914, W. L. McAtee (USNM, 1b♀); Rosslyn, 6-X-1912, F. K. Knab (USNM, 1m♂); Chain Bridge, 20-VIII-1922, J. R. Malloch (USNM, 1m♀). TENNESSEE: Martin, VII-1935 (NCSU, 1b♂) Walnut Log, 16-VII-1919, W. L. McAtee (USNM, 1m♀). NORTH CAROLINA: Raleigh, 31-VIII-1946, RHB (SEMC, 1m♂, 1m♀, 4b♂; 95-149z♂, 95-149t♀, 95-150i♀); Raleigh, X-1937, Z. P. Metcalf (NCSU, 1b♀); Raleigh, 16-X-1938, PWO (FSCA, 2b♂; USNM, 5b♂, 1b♀); Chapel Hill, 31-VIII-1946, RHB (SEMC, 3m♂, 1b♀, 1b♂; 95-150c♀); same, LDB (SEMC, 1b♂); Nelson, 31-VIII-1946, LDB (SEMC, 1m♂); Sutton's Corner, 26-V-1964, J. F. Cornell, Marsh (NCSU, 1b♂, 1b♀); Wilkes Co., Wilkesboro, 11-VI-1970, L. L. Deitz (NCSU, 1m♀); Swannanoa, 9-VIII-1919, Osborn & Metcalf (NCSU, 1m♀); Lake Waccamaw, 20-IX-1915, R. W. Leiby (NCSU, 1m♀); Whiteville, 22-VII-1959, W. D. Duckworth (NCSU, 5b♀); Wake, Co., nr. Raleigh, Yates Mill Pond, 26-IX-1994, C. R. Bartlett (NCSU, 1b♀); same, 21-X-1995, sweeping *Polygonum* sp. (NCSU, 2b♂, 1b♀, 1 nymph); Wake Co., Raleigh, 24-VIII-1995, blacklight, R. L. Blinn (NCSU, 1m♀); Wake Co., Raleigh, Centennial Campus, 17-VI-1994, C. R. Bartlett (NCSU, 1m♀); Johnston Co., 7-X-1959, S. Turnipseed (NCSU, 1m♀); Tyrrell Co., NE of Lake Phelps, rd 1118, 3-VIII-1979,

seeping soybeans, E. K. Rawls (NCSU, 1m♂); same, NW of Columbia (NCSU, 1m♂); same, NE Lake Phelps, 26-VI-1979 (NCSU, 1m♀); same, S. of Columbia, rd1105, 30-VIII-1979 (NCSU, 1m♀); Scotland Co., E. of Laurinburg, rd1369, 15-VIII-1979, sweeping soybeans, E. K. Rawls (NCSU, 1m♀); Wayah Gap nr. Franklin, 3500', 16-VIII-1957, J. G. Chillcott (CNCI, 1m♀); Highlands, 29-VIII-1957, L. A. Kelton (CNCI, 1b♀, 1m♀). SOUTH CAROLINA: Charleston, 2-VII-1958, D. A. Young (NCSU, 1b♀); 3 mi N Charleston, 4-V-1932, PWO (USNM, 2m♂); Jacksonboro, 13-VII-1951, Price-Beamers-Wood (SEMC, 14m♂); Clarendon Co., L. Marion, on *Ludwigia uruguayensis*, W. Haller (FSCA, 1b♂). GEORGIA: Okefenokee Swamp, 3-VIII-1934, RHB (SEMC, 1m♂); Thomasville, 30-VI-1948, RHB (SEMC, 3b♂); Thomasville, 31-VII-1915, C. S. Spooner (USNM, 1m♀); same, 21-V-1915 (USNM, 1m♀); same, 24-V-1915 (USNM, 1m♀); Rabun Bald, 9-VIII-1957, L. A. Kelton (CNCI, 1m♀); Brasstown Bald, 4800', 19-VIII-1957, J. G. Chillcott (CNCI, 1m♂). FLORIDA: Broward Co., Ft. Laud., 29-XII-1985 (CMSU, 1b♀); Fort Lauderdale, 18-II-1919, A. Wetmore (USNM, 1m♂); Sanford, 11-III-1947, LDB (SEMC, 15b♂, 2m♀, 15b♀, 2m♂; 95-153b♂); same, RHB (SEMC, 40b♂, 11m♂, 5m♀, 20b♀, 2b broken); Sanford, 4-VIII-1930, PWO (NCSU, 1m♀); Sanford, EDB at USNM as follows: 17-V-1926 (1m♀, 2b♀, 1b♂), 24-X-1926 (1b♂), 12-III-1927 (1b♂), 17-IX-1926 (3b♂ on 1 pin), 29-V-1926 (1b♂), 27-III-1926 (1m♀), 27-X-1925 (1m♀), 20-X-1925 (1m♀, 1m♂, 1b♂), 28-V-1926 (1m♂), 3-VIII-1927 (2b♀ on 1 pin), 23-IX-1926 (2b♀, 1b♂ on 1 pin), 14-III-1927 (1b♂, 2b♀, 1m♀ on 1 pin), 25-IV-1926 (2m♂, 2b♂), 30-X-1925 (1m♀), 13-X-1926 (1b♀, 1m♀), 25-X-1927 (2b♂ on 1 pin), 15-X-1926 (1m♂, 1m♀ on 1 pin), 26-II-1926 (1b♂), 6-II-1928 (3b♂, 1m♀ on 2 pins), 30-X-1926 (3b♀, 2m♀ on 1 pin), 13-X-1927 (2m♀ on 1 pin), 16-VII-1926 (1b♀), 9-V-1926 (3b♀, 1b♂, 1m♂ on 3 pins), 17-V-1926 (1b♂), 17-VI-1926 (2b♂, 4b♀ on 3 pins), 21-IV-1926 (2b♂), 13-XI-1935 (2m♂), 22-XI-1925 (1m♂), 4-XI-1925 (1m♀), 24-V-1927 (3m♀, 1b♂ on 1 pin, celery); De Soto Co., Arcadia, 16-II-1989, K. E. Jenkins (FSCA, 1b♂); De Soto Co., Arcadia, to light, 16-VIII-1968, G. F. Hevel (USNM, 2m♂, 4m♀); Alachua Co., Gainesville, 12-VI-1965, COB (LOBC, 1b♂, 1m♂, 7b♀); same, 27-V-1967, light trap, D. L. Wray (NCSU, 1m♀); same, Austin Cary Forest, 15-VII-1966, UV trap, L. A. Hetrick (NCSU, 5m♂, 4m♀); Ona, E. F. Fagen, VII-1967 (NCSU, 1m♂); Lacoochee, 7-VII-1948, RHB (SEMC, 8b♂, 5b♀, 1m♂); Fort Walton, 27-VI-1948, RHB (SEMC, 5b♂, 3b♀); Farndale, 27-VI-1948, RHB (SEMC, 1m♂); Yankeetown, 7-VII-1948, RHB (SEMC, 1b♂); same, 9-III-1947, LDB (SEMC, 1b♂); Gainesville, 7-VII-1934, P. A. McKinstry (SEMC, 1m♂); Gainesville, 25-VII-1950, RHB (SEMC, 3m♂, 1b♂); same, 17-VII-1934 (SEMC, 2m♀, 2m♂); same, 6-VI-1948 (SEMC, 2b♂); Gainesville, 5-V-1918, C. J. Drake (NCSU, 1m♂); same, 14-VII-1918 (USNM, 1m♂); Gainesville, Doyle Corner Bldg, 10-VI-1978, blacklight trap, F. W. Mead (FSCA, 1m♂); Tallahassee, 7-III-1947, RHB (SEMC, 1m♀, 1b broken); Homestead, 22-VI-1951, Price-Beamers-Wood (SEMC, 4m♂); Homestead, 14-III-1947, LDB (SEMC, 1m♂); same, RHB (SEMC, 1b♂); Homestead, 4-IV-1952, G. S. Walley (CNCI, 2m♂); Orlando, 17-IV-1961, L. A. Kelton (CNCI, 1m♂, 1b♂); Pine Castle, 13-IV-1961, L. A. Kelton (CNCI, 1m♂); Kendell, 28-IV-1961, light, L. A. Kelton (CNCI, 1m♂); Deerfield, 26-VII-1948, LDB (SEMC, 1m♂); same, RHB (SEMC,

1b♀); Sebastian, 27-VII-1948, RHB (SEMC, 1m♀); Okeechobee, 17-III-1947, RHB (SEMC, 1m♂); Palatka, 10-III-1947, RHB (SEMC, 16b♂, 8b♀, 3m♂, 3m♀, 1b broken); same, 24-XII-1950 (SEMC, 1b♂); Lamont, 7-III-1947, RHB (SEMC, 2b♂, 3b♀); Coconut Grove, 9-VIII-1930, RHB (SEMC, 1m♂); same, J. Nottingham (SEMC, 1m♂); Suwannee Spr., (2&3)-VIII-1949, D. E. Hardy (SEMC, 1m♂); Suwannee Sprgs., 3-VII-1948, RHB (SEMC, 1m♂); Zolfo Springs, 12-III-1947, LDB (SEMC, 2m♂, 2b♂, 2b♀); same, RHB (SEMC, 4b♂, 3b♀); same, 26-XII-1950, RHB (SEMC, 1m♂); Lake Placid, 13-VII-1948, RHB (SEMC, 1b♂, 1m♂); Lake Placid, 13-VII-1948, E. L. Todd (SEMC, 1m♂, 2m♀); Melbourne, 17-III-1947, RHB (SEMC, 1b♂, 3m♂, 1m♀, 1b♀); Crescent City, IV-1908, Van Duzee (CASC, 1m♀, 1b♀, 1b broken; CMNH, 1m♀); Fort Meyers, (3-5)-V-1908, Van Duzee (CASC, 2m♀); Sevenoaks, 1-V-1908, Van Duzee (CASC, 2b♀); Miami Beach, IV-1937 (NCSU, 6m♂, 2m♀); Inverness, 28-IV-195(6?), D. H. Habeck (NCSU, 1m♀); Sarasota Co., Myakka R. SP, 5-VI-1954, H. V. Weems Jr. (FSCA, 6b♂, 3b♀; USNM, 1b♂); Sarasota Co., Northport, 17-II-1988, sweeping, K. E. Jenkins (FSCA, 1b♂, 2m♂ whole macropters cleared on 1 pin); Belle Glade, 1-IV-1958, F. W. Mead (FSCA, 1m♂); De Soto Co., Arcadia, 16-II-1989, K. E. Jenkins (FSCA, 1b♂); Highlands Co., Sebring, Arbuckle Creek, 22-VIII-1989, J. Bennett (FSCA, 1b♂); La Belle, 16-VII-1939, PWO (USNM, 1m♀); Baldwin, 6-X-1938, PWO (USNM, 1b♂); Venice, 13-V-1928 (USNM, 1b♂); Daytona, 22-V-1926 (USNM, 1b♀); Silo Spr., 3-XI-1927 (Ball?, USNM, 1b♂, 1m♀ on 1 pin); Jenson, 8-I-1944, on Chard (USNM, 1m♂); Tampa, 10-IX-1927, EDB (USNM, 1m♂, 2m♀ on 1 pin); Clay Co., Gold Head Branch SP, 19-VII-1957, F. W. Mead (USNM, 1m♂); Lk. Worth, 24-II-1940, J. S. Caldwell (USNM, 1m♂, 2m♀); Fort Ogden, 9-IV-1952, J. R. Vockeroth (CNCL, 2b♂, 1b♀, 2m♂); same, 8-IV-1952 (CNCL, 2b♂, 2m♂); same, 10-IV-1952, G. S. Walley (CNCL, 1b♀); same, O. Peck (CNCL, 1m♂); Venice, 8-X-1938, PWO (USNM, 1m♀); Seminole Co., 3 mi W Sanford, 26-I-1974, COB & GBM (LOBC, 2m♂); Taylor Co., 5 mi N jct. Aucilla R. & Hwy 98, 28-X-1973, at night, GBM (LOBC, 2b♂); Levy Co., Bronson, 26-III-1976, COB & GBM (LOBC, 3b♂, 2m♂, 3m♀, 3b♀); Leon Co., Tallahassee, 17-X-1973, GBM (LOBC, 1m♂); Jefferson Co., 4 mi S Wacissa, 29-VI-1973, COB (LOBC, 7b♂, 5b♀); Hillsborough Co., 6 mi S Riverview, 22-VII-1973, O'Brien & GBM (LOBC, 1b♂, 2b♀); Volusia Co., 4 mi SE Barberville, 26-I-1974, COB & GBM (LOBC, 2b♂, 4b♀, 3m♀). ALABAMA: Mobile, 13-VI-1951, Price-Beamers-Wood (SEMC, 1m♂); Auburn, Baker (no date, USNM, 1b♂); 5 mi SW Mobile, 10-VI-1965, L&COB (LOBC, 4b♂, 6b♀). MISSISSIPPI: Hancock Co., 7 air mi NE Gainesville, 6-VII-1965, L&COB (LOBC, 1b♂, 4m♂, 1b♀, 4m♀); Hancock Co., Gainesville, 7-VII-1965, L&COB (LOBC, 2m♂); La Belle, 13-III-1947, RHB (SEMC, 1m♂); Biloxi, 25-VI-1948, RHB (SEMC, 5m♂, 4m♀); Tupelo, 1-VII-1921 (SEMC, 1m♂); Ocean Springs, 3-III-1947, RHB (SEMC, 1b♂); Ocean Springs, 21-VI-1951, Price-Beamers-Wood (SEMC, 1m♂); Pascagonia, 8-VIII-1921, C. J. Drake (USNM, 1m♀). ARKANSAS: Fayetteville, 1938, M. W. Sanderson (SEMC, 1m♂); Rogers, 6-VI-1946, M. W. Sanderson (INHS, 7b♀); Queen Wilhelmina SP, 4-VI-1987, G. F. & J. F. Hevel (USNM, 1m♀); Polk Co., 21-VIII-1928, RHB (SEMC, 1m♂); Scott Co., 23-VIII-1928, RHB (SEMC, 1m♂). LOUISIANA: Baton Rouge,

2-III-1947, RHB (SEMC, 1b♂); Mandeville, 24-VI-1948, RHB (SEMC, 1m♂); Beauregard Co., 16-VIII-1928, A. M. James (SEMC, 1m♀); Buras, 21-VI-1948, RHB (SEMC, 1b♂); Hammond, 22-VI-1948, E. L. Todd (SEMC, 1m♂); Creole, 7-VI-1951, Price-Beamers-Wood (SEMC, 6b♂); 15 mi E Creole, 18-VI-1948, RHB (SEMC, 1b♀); Venice, 22-VI-1948, RHB (SEMC, 1m♂, 1b♂); New Orleans, 1938, W. Benedict (SEMC, 1b♀); Slidell, 25-VI-1948, H. W. Crowder (SEMC, 1m♂); Buckthorn, 29-VII-1937, H. L. Dozier (USNM, 1b♂); Tallulah Airpl. (USNM, 2m♂); Gueydan, E Kalmbach, VII-1925, light (USNM, 1m♂, 3m♀); same, (25-26)-VI-1925 (USNM, 1m♀); same, 5-VIII-1925 (USNM, 1m♀); Evangeline Par. Chicot SP, 8-VI-1965, blacklight trap, L&COB (LOBC, 4m♂, 4m♀). TEXAS: S. Patricio Co., Welder Wildlife R., 1-XII-1973, L&COB & GBM (LOBC, 1m♂); same, Gator Pond, L&COB (LOBC, 1b♀); Bastrop SP, Bastrop Co., 10-VII-1965, L&COB (LOBC, 1b♂, 3b♀, 1m♂, 2m♀); Walker Co., Huntsville SP, 9-VII-1965, COB (LOBC, 1m♂); 4 mi NE Canadian, 23-VI-1970, L&COB (LOBC, 1b♀); Bay City, 4-V-1953, RHB (SEMC, 2m♂); Bowie Co., 16-VIII-1928, LDB (SEMC, 1b♂); Rio Hondo, 31-III-1945, D. E. Hardy (SEMC, 1b♀); Old Ocean, 3-I-1945 (SEMC, 1m♂); Harlington, 23-II-1945, D. E. Hardy (SEMC, 1m♂); same, 13-III-1945 (SEMC, 1m♀); College Station, 23-VI-1938, L. W. Hepner (SEMC, 1m♂); Boogie Co., 20-VIII-1938, RHB (SEMC, 2b♀); Brownsville, 29-XII-1945, RHB (SEMC, 6b♂, 2b♀, 1m♀); College Station, 9-VIII-1930, H. J. Reinhold (NCSU, 1b♀); Brazos Co., 3 mi NE Edge, 21-VI-1984, T. Harrison (TAMU, 1m♀); South end Padre Id, 12-XII-1910 (USNM, 1b♀); Bangs, 23-VIII-1937, L. D. Christenson #3457 (USNM, 1m♂); Cedar Lane, 9-VIII-1928, RHB (SEMC, 1m♀). ARIZONA: Sabino Canyon, 8-VII-1947, RHB (SEMC, 19b♂, 22b♀, 1m♂, 1m♀; 95-150a♂, 95-150f♀, 95-150h♀, 95-149v♂); S. Cruz R. nr. Tubac, 23-X-1937, PWO (USNM, 1m♂). MEXICO: SINALOA: Campo Meyer, Mun. Guasave, 4-IX-1978, UV trap, R. E. Woodruff (LOBC, 1m♀; 96-43f♂); 26 mi N Pericos, 13-VIII-1960, P. H. Arnaud, Jr. E. S. Ross & D. Rentz (CASC, 1m♂). VERACRUZ: 6 mi NW Salinas, 23-IV-1953, E. I. Schilinger (EMEC, 1b♂); Boca del Rio, XII-1960, N.L.H. Krauss (USNM, 1m♂); V. C., 4 mi NE Minatitlan, 11-VI-1965, Burke, Meyer, Schaffner (TAMU, 1m♂). SAN LUIS POTOSÍ: Valles, 1-XII-1938, J. S. Caldwell (USNM, 1b♂); SLP, Tamazunchale, 20 mi N, 1000', 21-VII-1954, J. G. Chillcott (CNCL, 1m♀); S.L.P., Huichihuayan, 25-IX-1938, L. J. Lipovsky (SEMC, 2b♂). JALISCO: 20 mi W Tecolotlan, 15-IX-1938, L. J. Lipovsky (SEMC, 1m♀). BELIZE: Orange Walk, Rio Bravo Res. Sta., (10-13)-VI-1991, blacklight (LOBC, 1m♀); O(orange) W(alk) 3 mi N Orange Walk, 11-VIII-1977, L&COB & GBM (LOBC, 2b♂, 4b♀, 1m♀); Southwest Caye, Glover's Reef, 14-II-1989 (SEMC, 1b♂). HONDURAS: Lancetilla, 3-V-1935, M. Bates (NCSU, 1m♂); same, "Aug." Stadelmann (NCSU, 1m♀). NICARAGUA: Blue Field, VII-1971, J. Maldonado C (USNM, 1b♂). COSTA RICA: Guan(acaste), 3 mi NW Canas (LaPacifica), 12-VII-1974, UV trap, LOB (LOBC, 1m♂); Cachi, 7-III-1910, P. P. Calvert (USNM, 1m♂). PANAMA: Gamboa, Chagas R., 30-IV-1974, UV trap, LOB (LOBC, 1m♂); Prov. of Pan. Tocumen, (22-26)-VI-1970, blacklight trap, D. Navas (LOBC, 1m♂). CANAL ZONE: Gatun Dam, 2-VIII-1974, L&COB & GBM (LOBC, 1b♂, tentatively included). VENEZUELA: GUARICO: 13 km SW Calabozo, 300', 23-VII-1988 (LOBC, 3b♂, 8b♀; 96-41c♂).

ZULIA: Ed. Zulia, Dist. Perija, Tucuco, (26-29)-VI-1984 (LOBC, 1m♀, tentatively included); Zulia Carrasquero, (29-30)-V-1976, A. S. Menke & D. Vincent (USNM, 1m♂, tentatively included). **Trinidad**: St. Andrews, Nr. Valencia, 23-III-1985 (USNM, 1b♂, tentatively included). **Peru**: Tingo Maria, 10-VII-1968, L&COB (1b♂, LOBC); same, 11-VII-1968 (1b♀, LOBC). **Jamaica**: Mandeville, IV-1906, Van Duzee (CASC, 3b♀); Kingston, IV-1906, Van Duzee (CASC, 1m♂, 1b♀ plus 3b♂ on 1 pin, Giffard dissections #7<sup>d</sup> & #7<sup>e</sup>, ser. VII). **Bermuda**: Smiths Parish, Spittal Pond, (14-22)-VII-1988 (CMSU, 1b♂; USNM, 3b♂); Paget Parish, Paget Marsh, (14-22)-VII-1988 (USNM, 2b♀); Devonshire P., Devonshire Marsh, (14-22)-VII-1988 (USNM, 1b♂, 1b♀).

*Pissonotus boliviensis* Bartlett, new species  
(Figs. 37, 81)

**Type Locality.** BOLIVIA: Santa Cruz, Portachuelo.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate with broad transverse band on epistomal margin, nearly to level of antennae. Antennae stramineus. Pronotum and mesonotum very dark brown, caudal margins paler. Tegmina with weak distal transverse band, incomplete medially, or obsolete. Legs stramineus. Abdomen immaculate. Male pygofer distinctive with median processes strongly flattened, fused medially into single structure with rounded apices and small lateral, dorsally directed, projections. Paramere apices blunt, dorsomedially directed. Aedeagus with 1-3 retrose processes, most distad very long, with large lateral tooth.

**Description.** *Brachypter*. Body length ♂ 2.06–2.63 (2.31,  $n=4$ ), ♀ 3.08–3.30 (3.17,  $n=5$ ). Body lustrous, very dark brown (Fig. 81).

Head with frons very dark brown (Fig. 81), immaculate, carinae concolorous; epistomal margin with broad, deep stramineus transverse band (stramineus-to-dark brown transition gradual or abrupt); extending laterally to base of procoxae. Vertex very dark brown, slightly produced in front of eyes. Postclypeus very dark brown, anteclypeus stramineus. Antennae stramineus, antennal segment I 0.13–0.18 (0.16,  $n=5$ ); II 0.25–0.33 (0.28,  $n=5$ ); ratio I/II 0.50–0.63 (0.55,  $n=5$ ).

Thorax with pronotum and mesonotum very dark brown, caudal margins paler. Tegmina dark brown, veins concolorous with membrane, venation normal (not reticulate), nearly reaching distal margin; with or without weak pale, medially incomplete, distal transverse band; setae-bearing tubercles conspicuous.

Legs with tibiae not expanded, front tibia width 0.08 ( $n=5$ ); legs stramineus from apices of coxae to tarsi, brown at claws. Calcar length 0.38–0.44 (0.40,  $n=5$ ), number of calcar teeth 10–14 (12,  $n=5$ ).

Abdomen very dark brown, immaculate or with diffuse markings suggestive of broad middorsal stripe.

*Macropter*. Body length (excluding wings) ♂ 2.40–2.42 (2.41,  $n=2$ ), ♀ 2.73–2.97 (2.87,  $n=5$ ); total length (including wings) ♂ 3.13 ( $n=3$ ), ♀ 3.38–3.63 (3.48,  $n=5$ ). Similar to brachypters, mesonotum with caudal apex stramineus. Wings clear.

**Male Genitalia.** Pygofer (Fig. 37) cyphosomatic in cross-section, excavated laterad of lateral processes; very dark brown, ental surface and anal tube stramineus. Median processes half height of parameres, strongly flattened, medially fused for entire length forming single, bilabiate structure with pair of lateral, dorsally directed, projections (but see *Remarks*). Lateral processes stout, taller than wide, concolorous with pygofer. Parameres flattened, slightly diverging and cupped; distally strongly bent posteriorly, then dorsally, into dorsomedially projecting blunt apices. Aedeagus (Fig. 37) with 1–3 retrose processes, most distad very long, flattened, with large lateral tooth; 2nd similar (sometimes absent), without lateral tooth; most proximal hairlike; 2 large teeth near base of most distad retrose process and several subdorsal teeth along shaft. Genital diaphragm weak, slightly sclerotized dorsally with middorsal bilabiate process. Anal processes nearly reaching base of parameres, finely serrulate ventrally; apices resting behind lateral processes.

**Remarks.** Males of *P. boliviensis*, part of the *P. piceus* species complex, are usually easy to recognize by the strongly flattened and fused median processes. Some specimens, however, have the lateral projections exaggerated and the medial fusion reduced. An assortment of females from Argentina (Entre Rios, Buenos Aires, Tucuman, 27♀, LOBC) probably belong here but are more pallid, often with a broad middorsal abdominal stripe and stronger distal transverse bands on the tegmina. No similar males were available to confirm this identification, and these specimens are not reported below.

**Recorded Hosts.** *Pontederia* sp., *Pontederia rotundifolia* L. f. ("treading") (Pontederiaceae).

**Distribution.** Central South America. ARGENTINA: Chaco, Corrientes, Entre Rios, Tucuman. BOLIVIA: Cochabamba, La Paz, Santa Cruz. BRAZIL: Mato Grosso, Rondonia, Minas Gerais, Rio de Janeiro. URUGUAY.

**Type Material.** *Pissonotus boliviensis*, holotype (♂b, LOBC (affiliated with CASC); 96-43d♂) and allotype (♀b, LOBC): "BOLIVIA, S(anta). C(ruz)., 10/mi. W. Portachuelo/ March 27, 1978 at/ night G. B. Marshall." Paratypes: Bolivia: same as types (LOBC, 5b♀, 1m♀); same, UV trap (LOBC, 3m♀, 1m♂); same, UV light, COB (LOBC, 2m♀); same, 14 mi SW, L&COB (day, LOBC, 1b♂, 1b♀, 1m♀); S. C., 4 mi E Portachuelo 24-III-1978, treading *Pontederia rotundifolia*, L&COB & GBM (LOBC, 6b♂, 3b♀, 4m♀; 96-41b♂, 96-43b♂); same, treading *Pontederia* (LOBC, 3b♂, 1b♀, 1m♀); same, night, GBM (LOBC, 4b♀).

**Other Material Examined.** Bolivia: SANTA CRUZ: 15 mi SW Portachuelo, 24-III-1978, GBM (LOBC, 1m♀); same, 14 mi SW (LOBC, 1b♂, 2m♂, 8m♀); same, L&COB (LOBC, 2b♂, 2m♀, 8b♀; 96-35a♂); same, 27-III-1978 (LOBC, 1b♀, 1m♀); same, 22-III-1978, COB (LOBC, 1b♀, 1m♀); S. C., 10 mi W Portachuelo, 19-IV-1978, night, L&COB & GBM (LOBC, 1b♀); S. Cruz, Saavedra Res. Sta., 27-III-1978, UV trap, C. R. Ward & COB (LOBC 1m♀); S. C., 10 mi W Puerto Banegas, 25-III-1978, night, GBM (LOBC, 2b♀, 1m♀); S. C., 5 mi W Pto. Banegas, 25-III-1978, GBM (LOBC, 1b♀, 1m♀); same, L&COB (LOBC, 3m♀); Sta. Cruz, 4 mi E Sta. Cruz, 21-IV-1978, night, COB & GBM (LOBC, 1b♀, 1b♀; 95-222e♂); S. C., 9 mi N Santa Cruz, 28-III-1978, UV trap, GBM (LOBC, 1m♀); S. C.,

4 mi E Portachuelo, 24-III-1978, night, GBM (LOBC, 1m♀); S. C., 10 mi W Portachuelo, 27-III-1978, UV trap, GBM (LOBC, 2m♀); same, night (LOBC, 4b♀); same, 24-III-1978, night (LOBC, 1b♂, 2b♀); same, 27-III-1978, L&COB (LOBC, 1b♀); S. C., 4 mi E Portachuelo, 24-III-1978, night, GBM (LOBC, 1m♀); S. Cruz, 4 mi E Cotoca, 21-IV-1978, night, COB & GBM (LOBC, 2b♀, 1m♀). COCHABAMBA: Cbb., 10 mi SW Villa Tunari, 1-IV-1978, L&COB (LOBC, 2b♀); Cbb., 43 mi SW Villa Tunari, 2-IV-1978, L&COB & GBM (LOBC, 1m♀); Cbb., Pto. S. Francisco, 19 mi NW Villa Tunari, 1-IV-1978, L&COB & GBM (LOBC, 1m♀). LA PAZ: 25 mi NW Coripata (on high road), 8-IV-1978, L&COB (LOBC, 1m♀). **Brazil:** MATO GROSSO: Cáceres, EMPA Res. Sta., 28-I-1985, UV trap (LOBC, 1m♂; 96-43c♂). RONDONIA: 62 km SW Ariquemes, nr. Fzda. Rancho Grande, (30-III)-(10-IV)-1992 (LOBC, 1m♀). MINAS GERAIS: Carmo do Rio Claro, I-1978 (TAMU, 1b♀). RIO DE JANEIRO: Inst. O. Cruz, 21-I-1969, L&COB (LOBC, 4b♀, 9b♀; 96-41d♂). **Uruguay:** ROCHA: R. 15, 13 km N LaPalma Jcn., 4-II-1989 (LOBC, 1b♂). **Argentina:** CHACO: 2 km N Resistencia, 25-I-1989 (LOBC, 1b♀). TUCUMAN: 12 km S Lules P. Tucuman, 19-X-1968, night, L&COB (LOBC, 1b♂, 7b♀); same, 13 km S, 17-X-1968 (LOBC, 1b♂, 3b♀; 95-222c♂); same, 5 km S, 17-X-1968 (LOBC, 1b♀); same, 19-X-1968 (LOBC, 1m♀). CORRIENTES: 3 km E Corrientes, 17-I-1989, night (LOBC, 1b♂; 96-35b♂); same, Hwy. 5 (LOBC, 1m♀). ENTRE RIOS: 4 mi S Ceibas, Hwy. 12, 14-IV-1978, night, COB (LOBC, 1b♀).

*Pissonotus lactofascius* Morgan and Beamer, 1949

(Figs. 38, 82)

*Pissonotus lactofascius* Morgan and Beamer 1949: 111 (key), 130-131.

**Type Locality.** US: Colorado, Jackson, Routt & Grand Counties, Rabbit Ear Pass.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, carinae concolorous, epistomal margin with very narrow white transverse band. Antennae mostly dark brown. Pronotum and mesonotum very dark brown. Tegmina dark brown with white distal transverse band. Abdomen very dark brown, immaculate. Aedeagus with 4-5 retrose processes: 2 expanded and straplike, 1 with lateral tooth, others simple.

**Description.** *Brachypter*. Body length ♂ 1.70-1.96 (1.83,  $n=5$ ), ♀ 2.04-2.48 (2.30,  $n=5$ ). Body lustrous, very dark brown (Fig. 82).

Head with frons very dark brown (Fig. 82), immaculate, carinae concolorous; with narrow white transverse band epistomal margin, following subgenal sulci, becoming broader caudad of genal carinae, reaching base of front coxae. Postclypeus very dark brown, anteclypeus stramineus. Vertex very dark brown with caudal margin slightly paler. Antennal segment I dark brown, 0.10-0.13 (0.11,  $n=5$ ); II slightly paler, 0.27-0.30 (0.28,  $n=5$ ); ratio I/II 0.35-0.44 (0.40,  $n=5$ ).

Thorax with pronotum and mesonotum very dark brown, caudal margins paler. Tegmina dark brown, veins concolorous with membrane; venation nor-

mal (not reticulate), becoming obsolete before distal margin; with broad white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.07-0.08 (0.07,  $n=4$ ); legs stramineus (darker on some specimens); coxae dark brown proximally, brown at tarsal claws. Calcar length 0.23-0.26 (0.24,  $n=4$ ), number of calcar teeth 9 ( $n=4$ ).

Abdomen dark chestnut-brown, immaculate.

**Macropter.** Body length (excluding wings) ♂ 2.00 ( $n=1$ ); total length (including wings) ♂ 3.13 ( $n=1$ ). Similar to *brachypter*, caudal apex of mesonotum stramineus. Wings clear.

**Male Genitalia.** Pygofer (Fig. 38) cyphosomatic in cross-section, with concavity laterad of median processes; dark brown, paler on posterior margin, anal segment and portions of venter. Median processes exceeding parameres (or subequal), parallel or slightly converging; simple, strongly angular, gradually narrowed to sharply acute apices. Lateral processes small. Parameres flattened, parallel-sided, diverging near middle, abruptly bent and cupped into acute, medially directed apices; small, medially directed tooth subapically. Genital diaphragm weak. Aedeagus strongly flattened laterally (Fig. 38), with 4-5 long retrose processes, distal 2 broad, straplike, 2nd with lateral tooth, others simple. Anal processes stout, resting in concavity laterad of median processes, nearly reaching base of median processes.

**Remarks.** *Pissonotus lactofascius* strongly resembles *P. minutus*, but also resembles *P. agrestis*, *P. merides*, *P. paludosus*, and 2 new species, *P. spatulatus* and *P. paraguayensis*. *Pissonotus minutus* has darker legs and 4 fine, simple retrose processes. *Pissonotus spatulatus* has very short median pygofer processes and spatulate parameres; *P. paraguayensis* has flattened, slightly diverging median processes; and *P. agrestis*, *P. merides*, and *P. paludosus* have a white, caudal transverse pronotal band.

**Recorded Hosts.** None.

**Distribution.** Southcentral United States. UNITED STATES: Arizona, Colorado, New Mexico, Wyoming.

**Type Material.** *Pissonotus lactofascius* Morgan and Beamer, 1949, holotype (♂b, SEMC) and allotype (♀b, SEMC): "Rabbit Ear/Pass Colo/ 8-3-1947/R. H. Beamer." Paratypes: Colorado: same as holotype (SEMC, 2b♀, 4b♂; 95-198b♂, 95-137v♂, 95-137r♂; USNM, 1b♀); Pingree Park, VIII-1925, Beamer-Lawson (SEMC, 3b♀; 95-138a♀, 95-137w♀; USNM, 1b♂); Pingree Park, VIII-1924, Beamer & Lawson (SEMC, 6b♀, 1b♂; 95-137s♂, 95-138y♀, 95-137z♀); Northgate, 20-VIII-1931 (SEMC, 3b♀; 95-137x♀).

**Other Material Examined.** United States: COLORADO: Rabbit Ear Pass, 3-VIII-1947, LDB (SEMC, 3b♂, 1b broken); Rocky Mt. NP, 5-VIII-1947, LDB (SEMC, 1b♂; 95-137t♂); Estes Pk., 5-VIII-1947, LDB (SEMC, 1b♀, 1b♂; 95-137u♂); Pingree Park, 9000', "Aug. 19," D. A. Wilbur (USNM, 1b♀, 1b♂); same, "Aug. 21" (USNM, 1b♀). WYOMING: Laramie, 5-VIII-1949, RHB (SEMC, 1m♂); Yellowstone Pk., 18-VIII-1930, EDB (USNM, 2b♂, 2b♀ on 1 pin). NEW MEXICO: N. Mora Co., Line Rd from Taos to Los Vegas, 13-VIII-1937 (USNM, 1b♂, 1b♀); Carlson NF, 6 mi E Taos, (11-13)-VIII-1937 (USNM, 1b♀). ARIZONA: Long Valley, 5-VIII-1929, EDB (USNM, 2b♀ on 1 pin).

*Pissonotus minutus* Beamer, 1952

(Figs. 39, 83)

*Pissonotus minutus* Beamer 1952: 112-114.**Type Locality.** US: Arizona, Coconino County, San Francisco Mountains.**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, very dark brown with narrow transverse band on epistomal margin. Antennae mostly dark brown. Pronotum very dark brown, paler at caudal margin. Tegmina with broad white transverse band on distal margin. Legs mostly brown. Abdomen dark brown, immaculate. Male pygofer with median processes as long or longer than parameres. Aedeagus with 2-4 short, simple retrose processes.**Description.** *Brachypter*. Body length ♂ 1.46-1.53 (1.51,  $n=5$ ), ♀ 1.81-1.99 (1.89,  $n=5$ ). Body lustrous, dark chestnut-brown (Fig. 83).Head with vertex and frons dark chestnut-brown (Fig. 83); frons immaculate, carinae concolorous; epistomal margin with narrow white transverse band, following subgenal sulci laterally, broadening behind genal carinae, reaching base of front coxae. Postclypeus dark chestnut-brown, anteclypeus paler. Antennal segment I dark brown, 0.08-0.09 (0.09,  $n=5$ ); II slightly paler, 0.21-0.23 (0.22,  $n=5$ ); ratio I/II 0.38-0.44 (0.41,  $n=5$ ).

Thorax with pronotum and mesonotum dark brown, hind margin paler. Tegmina dark brown, veins concolorous; venation normal (not reticulate), obsolete before distal margin; with broad white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.07 ( $n=5$ ); legs mostly brown with apices of tibiae and tarsi stramineous, brown at tarsal claws. Calcar length 0.17-0.19 (0.18,  $n=4$ ), number of calcar teeth 7-9 (8,  $n=4$ ).

Abdomen dark chestnut brown, immaculate.

*Macropter*. Unknown.**Male Genitalia.** Pygofer (Fig. 39) cyphosomatic in cross-section, lateral margins slightly pinched medially; dark brown, anal tube and ental surface paler; with shallow concavity laterad of median processes. Median processes subequal or longer than parameres; simple, angular, distinctly tapering to acute apices, slightly bent medially. Lateral processes inconspicuous. Parameres flattened, widest toward base; diverging, bent forward and dorsally into narrowed, blunt apices; with small, medially directed, subapical tooth. Genital diaphragm weak. Aedeagus (Fig. 39) strongly flattened laterally, with 2-4 simple, short, fine retrose processes. Anal processes arcuate, nearly reaching base of parameres.**Remarks.** *Pissonotus minutus* strongly resembles *P. lactofascius*, but also resembles *P. agrestis*, *P. merides*, *P. paludosus* and 2 new species, *P. spatulatus* and *P. paraguayensis*. *Pissonotus lactofascius* has paler legs and 2 long, broad, straplike aedeagal retrose processes. *Pissonotus spatulatus* has very short median pygofer processes and spatulate parameres; *P. paraguayensis* has flattened, slightly diverging median processes; *P. agrestis*, *P. merides*, and *P. paludosus* have a white, caudal transverse pronotal band.**Recorded Hosts.** None.**Distribution.** UNITED STATES: Arizona.**Type Material.** *Pissonotus minutus* Beamer, 1952, holotype (♂b, SEMC) and allotype (♀b, SEMC): "San Francisco Mts/Ariz. VI-25-1950/R. H. Beamer." Paratypes: Arizona: same as holotype (SEMC, 21b♂, 30b♀, 2b broken; 96-43h♂, 95-145c♂, 95-145f♀, 95-145i♀, 95-144z♂, 95-145e♀, 95-145d♂, 94-208a♂, 94-208b♂, 95-208c♂); Flagstaff, 26-VI-1950, LDB (SEMC, 14b♂, 12b♀; 95-145g♀, 95-145h♀, 95-145a♂, 95-208b♂, 95-208a♂, 95-207b♂, 95-145b♂).**Other Material Examined.** United States: ARIZONA: San Francisco Mtns, 25-VI-1950, J. G. Rozen (SEMC, 1b♀).*Pissonotus festucae* Bartlett, new species

(Figs. 40, 84)

**Type Locality.** MEXICO: Federal District, Mexico City.**Diagnosis.** *Brachypter*. Large, very dark brown. Frons immaculate with carinae concolorous and white transverse bands on epistomal margin. Antennae with segment I dark brown, II paler. Pronotum very dark brown with white transverse band on caudal margin. Mesonotum very dark brown. Tegmina brown (paler than body on some specimens), distal margin with white transverse band. Male pygofer with lateral processes large and conspicuous, median processes parallel with subterminal lateral gibbosity. Aedeagus with 1 long and 2 short retrose processes, most proximad lateral.**Description.** *Brachypter*. Body length ♂ 2.63 ( $n=1$ ), ♀ 2.73-3.02 (2.89,  $n=2$ ). Body lustrous, very dark brown (Fig. 84).Head with frons very dark brown (Fig. 84), immaculate; carinae concolorous, epistomal margin with transverse white band, following subgenal sulci laterally, becoming broader behind genal carinae. Vertex very dark brown, portions of carinae paler. Postclypeus very dark brown, anteclypeus stramineous. Antennal segment I very dark brown, 0.23 ( $n=1$ ); II paler 0.40 ( $n=1$ ); ratio I/II 0.58 ( $n=1$ ).

Thorax with pronotum very dark brown cephalad, white caudad; mesonotum dark brown. Tegmina brown (often paler than body), veins concolorous; venation normal (not reticulate), becoming obsolete before distal margin; distal margin with broad white transverse band.

Legs with tibiae not expanded, front tibia width 0.09 ( $n=1$ ); legs dark brown, carinae paler; tarsi, apices of tibiae and coxae stramineous, dark at tarsal claws. Calcar length 0.37 ( $n=1$ ), number of calcar teeth 12 ( $n=1$ ).

Abdomen very dark brown, immaculate.

*Macropter*. Unknown.**Male Genitalia.** Pygofer (Fig. 40) cyphosomatic in cross-section, very dark brown, paler posteriorly, ental surface and anal tube stramineous; deep excavation laterad of lateral processes. Median processes more than half length parameres; slightly arcuate, parallel, simple, angular at base with lateral gibbosity near apices, narrowed to sharp point. Lateral processes stout, conspicuous, 3



times as tall as wide, concolorous with pygofer. Parameres flattened, widest near apex, parallel, facing medially and cupped, with rounded, dorsally directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 40) strongly flattened laterally, widest near apex, with 3 retrose processes; most distal very long, simple and straplike; 2 others short, most proximad lateral. Anal processes stout, reaching base of median processes, resting in concavities laterad of lateral processes.

**Remarks.** *Pissonotus festucae* is similar to *P. merides*, *P. paludosus*, and *P. aquilonius*, but larger and with conspicuous lateral processes on male pygofer. The subapical lateral gibbositities of the median processes are unique to *P. festucae*. The specific name "*festucae*" refers to the plant genus *Festuca*, from which the holotype was recorded. This host, however, needs independent confirmation.

**Recorded Hosts.** *Festuca amplissima* Ruprecht (Poaceae).

**Distribution.** MEXICO: Federal District, Jalisco, Mexico. UNITED STATES: ?Arizona. ?PUERTO RICO.

**Type Material.** *Pissonotus festucae*, holotype ( $\sigma^b$ , LOBC (affiliated with CASC); 96-36b $\sigma$ ): "MEXICO, D. F., Hwy 95/ 21 km. S. Mexico City/5 Sept. 1982 C. W. & L. O'Brien & G. Wibmer" "On *Festuca amplissima*;" allotype (b $\sigma$ , LOBC): "MEX. Mex. LaMirasol/ 7km. SW. Santiago de/ Tianguistengo 2800m" "XI-2-1973/ C. W. O'Brien." Paratypes: Mexico: Jal(isco), Hwy. 200, 4 mi S El Tuito, 1200', 10-VIII-1982 (LOBC, 1b $\sigma$ ). ?Puerto Rico: Rio Frio, Pue., 10-X-1945, J. S. Caldwell Collection (USNM, 1b $\sigma$ ).

**Other Material Examined.** United States: ARIZONA: Navajo Co., 6800', 6 mi SW ShowLow, 10-IX-1964, L&COB (LOBC, 1m $\sigma$ ).

*Pissonotus spatulatus* Bartlett, new species

(Figs. 41, 85)

**Type Locality.** MEXICO: Durango, El Salto.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate, carinae concolorous, epistomal margin with narrow white transverse band. Antennal segment I very dark brown, II paler. Pronotum and mesonotum very dark brown. Tegmina with distal transverse band. Abdomen dark brown, immaculate. Male pygofer with parameres spatulate apically. Aedeagus with 3 retrose processes, most distad with subbasal bifurcation.

**Description.** *Brachypter*. Body length  $\sigma$  1.90–2.00 (1.93,  $n=3$ ),  $\sigma$  2.37 ( $n=1$ ). Body lustrous, dark chestnut-brown (Fig. 85).

Head with vertex and frons dark chestnut-brown (Fig. 85), frons immaculate, carinae concolorous; epistomal margin with narrow white transverse band, following subgenal sulci laterally, broadening caudad of genal carinae, reaching base of front coxae. Postclypeus dark chestnut-brown, anteclypeus paler. Antennal segment I very dark brown, 0.10–0.14 (0.12,  $n=5$ ); II paler, 0.25–0.29 (0.27,  $n=5$ ); ratio I/II 0.36–0.48 (0.44,  $n=5$ ).

Thorax with pronotum and mesonotum dark chestnut-brown, pronotum

with white transverse caudal band. Tegmina dark brown, veins concolorous; venation normal (not reticulate); becoming obsolete before distal margin; with broad white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.07–0.08 (0.08,  $n=5$ ). Legs brown with paler carinae, apices of tibiae and tarsi stramineous, brown at tarsal claws. Calcar length 0.23 ( $n=5$ ), number of calcar teeth 10–12 (11,  $n=5$ ).

Abdomen dark chestnut-brown, immaculate.

**Macropter.** Body length (excluding wings)  $\sigma$  ? (dissected); total length (including wings)  $\sigma$  3.20. Coloration similar to brachypter. Mesonotum with caudal apex stramineous. Wings clear, brownish at base.

**Male Genitalia.** Pygofer (Fig. 41) cyphosomatic in cross-section, dark brown, anal tube and ental surface paler; shallowly concave laterad of lateral processes. Median processes 1/4 height of parameres, about as wide as tall; simple, flattened, broadly joined basally, distinctly tapering to acute apices. Lateral processes small. Parameres flattened, widest near apices; flattened, slightly diverging into spatulate, slightly backward-cupped apices. Genital diaphragm weak, with middorsal bilabiate process. Aedeagus (Fig. 41) strongly flattened laterally, with lateral tooth near apex and 3 long, flattened retrose processes; most distad longest, with subbasal bifurcation; 2nd shortest, lateral, rather broad; 3rd simple. Anal processes nearly reaching paramere base, apices resting in concavities laterad of lateral processes.

**Remarks.** *Pissonotus spatulatus* most resembles *P. minutus* and *P. lactofascius*. The latter 2 species have longer median processes and acute paramere apices. *Pissonotus spatulatus* is the only species of *Pissonotus* having parameres with spatulate apices. *Pissonotus paraguayensis* n. sp. also is similar, but has stramineous antennae with brown longitudinal anterior highlights and longer median processes.

**Recorded Hosts.** None.

**Distribution.** UNITED STATES: California. MEXICO: Durango, Jalisco.

**Type Material.** *Pissonotus spatulatus*, holotype ( $\sigma^b$ , CNCI, 96-42b $\sigma$ ): "10 mi. w. El Salto Dur., MEXICO 9000' 9-VII-1964/J. F. McAlpine." Paratypes: California: Potrero, 21-VII-1947, RHB (SEMC, 1m $\sigma$ ). Mexico: JALISCO: 15 mi E Guadalajara, 10-IX-1938, L. J. Lipovsky (SEMC, 1b $\sigma$ ); Laguna Zemhoala, 22-VI-47, J. G. Shaw (SEMC, 3b $\sigma$ , 1b $\sigma$ ; 96-153a $\sigma$ ).

*Pissonotus jamaicensis* Bartlett, new species

(Figs. 42, 86)

**Type Locality.** JAMAICA: Saint Catherine, Fort Clarence.

**Diagnosis.** *Brachypter*. Body dark brown. Frons immaculate with conspicuous pale carinae and pale epistomal margin. Vertex brown with conspicuous pale carinae. Pronotum and mesonotum dark brown with carinae and posterior margin pale. Tibiae not expanded. Tegmina brown, veins not reaching distal margin, with white, medially incomplete, distal transverse band. Abdomen dark

brown, immaculate or variably marked with stramineus. Male pygofer with median processes parallel, half length of parameres. Aedeagus with 3 long retrose processes, most distal with large lateral tooth.

**Description.** *Brachypter*. Body length ♂ 2.09–2.21 (2.15,  $n=2$ ), ♀ 2.23 ( $n=1$ ). Body lustrous, very dark brown (Fig. 86).

Head with frons very dark brown, carinae conspicuous, pale (Fig. 86); epistomal margin with narrow white band, following subgenal sulci laterally, becoming broader caudad of genal carinae, reaching base of front coxae. Postclypeus and anteclypeus very dark brown. Vertex very dark brown with conspicuous pale carinae. Antennae very dark brown, antennal segment I 0.13–0.17 (0.15,  $n=2$ ); II with paler markings, 0.27–0.28 (0.28,  $n=2$ ); ratio I/II 0.50–0.59 (0.55,  $n=2$ ).

Thorax with pronotum and mesonotum very dark brown, carinae and caudal margins pale. Tegmina brown, veins concolorous; venation normal (not reticulate), becoming obsolete before distal margin; distal margin with medially incomplete white transverse band.

Legs with tibiae not expanded, front tibia width 0.08 ( $n=2$ ). Legs dark brown with paler carinae, tibiae stramineus, dark at tarsal claws. Calcar length 0.28–0.32 (0.30,  $n=2$ ), number of calcar teeth 10–13 (12,  $n=2$ ).

Abdomen very dark brown, middorsal carina paler, immaculate (holotype) or with markings (allotype); segment VI with 2 small macules on each side and diffuse pale markings caudad of tegmina.

*Macropter*. Body length (excluding wings) ♀ 2.50–2.57 (2.54,  $n=2$ ), total length (including wings) ♀ 3.00–3.33 (3.17,  $n=2$ ). Similar to *brachypter*, mesonotum with caudal apex stramineus. Wings clear, veins light brown.

**Male Genitalia.** Pygofer (Fig. 42) cyphosomatic in cross-section, concave laterad of lateral processes; very dark brown, paler posteriorly, ental surface and anal tube stramineus. Median processes half length of parameres, parallel, simple, flattened; angular base narrowing to acute apices. Lateral processes conspicuous, as tall as wide, stramineus. Parameres flattened, diverging, parallel-sided; narrowed and cupped forward distally into slightly converging, dorsally directed, blunt apices. Genital diaphragm vestigial. Aedeagus (Fig. 42) strongly flattened laterally, parallel-sided with 3 long retrose processes near apex; most distal with large lateral tooth, serrate beneath. Anal processes received in concavities laterad of lateral processes, nearly reaching base of median processes.

**Remarks.** *Pissonotus jamaicensis* resembles *P. albivultus* and 2 new species, *P. brevistilus* and *P. decussatus*, in possessing conspicuous pale frontal and vertex carinae. *Pissonotus jamaicensis* differs from these species having 3 long aedeagal retrose processes (most distad with a lateral tooth); the male pygofer with parallel median processes, half length of parameres; and the pygofer without lateral lobes. *Pissonotus jamaicensis* also differs in lacking a caudal white pronotal transverse band. *Pissonotus decussatus* and *P. albivultus* have strongly converging median processes, and *P. brevistilus* has very short median processes. *Pissonotus brevistilus*, *P. albivultus*, and *P. decussatus* all

have pronota with a white caudal margin, the pygofer with posteriorly directed lobes on lateral margin, and either short, simple retrose processes or no retrose processes.

The genitalia of 1 of the male specimens (95–1461♂) is malformed. The pygofer opening is constricted such that only the anal segment is visible.

The specific name *jamaicensis* refers to the island of Jamaica where this species occurs.

**Recorded Hosts.** None.

**Distribution.** JAMAICA.

**Type Material.** *Pissonotus jamaicensis*, holotype (b♂, LOBC (affiliated with CASC); 95–146n♂): "Jamaica, St. Cath(erine). P./ Fort Clarence/ Dec. 7, 1975C.W.&L./ O'Brien & Marshall;" allotype (b♀, LOBC; 95-146m♀): "Jamaica 1mi/ W. New Hope/ Westmoreland/P. VIII-4-1967" "Collectors:L&/C. W. O'Brien." Paratypes: Jamaica: Bog Walk, 5-VIII-1967, L&COB (LOBC, 1m♀; 95-146p♀); Westmoreland P(arish), 1 mi W New Hope, 4-VIII-1967, L&COB (LOBC, 1b♂; 95-146l♂); Pt. Antonio, IV-1906, Van Duzee (CASC, 1m♀).

*Pissonotus brevistilus* Bartlett, new species

(Figs. 43, 87)

**Type Locality.** MEXICO: Nayarit, San Blas.

**Diagnosis.** *Brachypter*. Body orangish brown. Frons immaculate, carinae conspicuous and pale. Antennal segment I dark brown, II paler. Pronotum with distal transverse white band caudally. Mesonotum light brown. Abdomen immaculate, orangish brown. Male pygofer with very short, parallel median processes, widely separated basally. Aedeagus with series of very short subdorsal processes in apical third.

**Description.** *Brachypter*. Body length ♂ 1.80 ( $n=1$ ). Lustrous, orangish brown (Fig. 87).

Head with frons orangish brown (Fig. 87), darker dorsad, carinae conspicuous, paler; epistomal margin with narrow white band, following subgenal sulci, becoming broader caudad of genal carinae. Postclypeus very dark brown, anteclypeus paler. Vertex dark brown, carinae conspicuous, paler. Antennal segment I very dark brown, 0.11 ( $n=2$ ); II paler, 0.22–0.23 (0.23,  $n=2$ ), ratio I/II 0.46–0.50 (0.48,  $n=2$ ).

Thorax with pronotum orangish brown, white transverse band caudally. Mesonotum orangish brown, caudal margin paler. Tegmina light brown, veins concolorous; venation normal (not reticulate), obscure, becoming obsolete before distal margin; with white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.07 ( $n=2$ ); legs orangish brown; apices of tibiae and tarsi stramineus, dark at claws. Calcar length 0.23–0.24 (0.24,  $n=2$ ), number of calcar teeth 8–10 (9,  $n=2$ ).

Abdomen orangish brown, middorsal carina paler, immaculate.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 43) subcylindrical in cross-section, opening large; lateral margins with posteriorly projecting rounded lobe (Fig. 43); orangish brown, paler posteriorly; slight concavity on ventral base of lateral lobe. Median processes short, 1/4 height of parameres, well separated at base; parallel, simple, flattened, wide at base tapering to sharp apices. Lateral processes short, ridgelike, paler than pygofer. Parameres flattened, broadest near base, cupped distally; abruptly narrowed and sharply bent posteriorly, then dorsally into acute dorsomedially projecting apices. Genital diaphragm vestigial. Aedeagus (Fig. 43) strongly flattened laterally, widest at base, narrowing apically; with series of very short paired subdorsal processes in apical third. Anal processes fine, slightly converging, nearly extending to base of median processes, apices resting in concavity just laterad and cephalad of median processes.

**Remarks.** *Pissonotus brevistilus* strongly resembles *P. albivultus* and 2 new species, *P. jamaicensis* and *P. decussatus*, in having conspicuous, pale frontal carinae. *Pissonotus brevistilus* is paler in color than the other species and males have very short, parallel median processes. *Pissonotus decussatus* has longer, strongly converging processes that cross in their basal third; *P. jamaicensis* has parallel median processes, half as long as the parameres; *P. albivultus* has strongly converging median processes that are widely separated basally.

The specific is Latin (*brevi*-, short; *stilus*, a stake or a pointed instrument used by Romans to write in waxen tablets) and refers to the short median processes of the male pygofer.

A female specimen labeled "Mexico/Koebele" "Chapultepec" (?) from the BPBM is probably this species.

**Recorded Hosts:** None.

**Distribution.** MEXICO: Nayarit.

**Type Material.** *Pissonotus brevistilus*, holotype (b♂, CNCI, 96-43g♂): "San Blas, Nay./MEX. 24-26.IV.61/Howden & Martin/at light." Paratype: MEXICO: Nayarit: same as holotype (CNCI, 1b♂).

***Pissonotus decussatus* Bartlett, new species**

(Figs. 44, 88)

**Type Locality.** MEXICO: Chiapas, Laguna Montebello.

**Diagnosis.** *Brachypter*. Body dark brown. Frons immaculate with conspicuous pale carinae and pale epistomal margin. Vertex brown with conspicuous pale carinae. Pronotum with white transverse band on distal margin. Mesonotum with carinae and caudal margin pale. Tibiae not expanded. Tegmina brown with white transverse band distally. Abdomen dark brown, immaculate or variably marked with stramineus. Male pygofer with median processes fine, closely approximated basally, strongly converging apically; crossing in basal third.

**Description.** *Brachypter*. Body length ♂ 2.00 ( $n = 1$ ), ♀ 2.49–2.59 (2.54,  $n = 2$ ). Body lustrous, very dark brown (Fig. 88).

Head with frons dark brown (Fig. 88), carinae pale and conspicuous,

epistomal margin with narrow white band, following subgenal sulci laterally, becoming broader caudad of genal carinae, reaching base of front coxae. Postclypeus very dark brown, anteclypeus paler. Vertex very dark brown with conspicuous paler carinae. Antennal segment I very dark brown, 0.11–0.13 (0.12,  $n = 2$ ); II paler, 0.23–0.28 (0.26,  $n = 2$ ); ratio I/II 0.48–0.53 (0.51,  $n = 2$ ).

Thorax with pronotum very dark brown, white transverse band caudally. Mesonotum dark brown laterally, dorsally paler to white. Tegmina brown, veins concolorous; venation normal (not reticulate), becoming obsolete before distal margin; distal margin with white transverse band.

Legs with tibiae not expanded, front tibia width 0.07 ( $n = 2$ ); legs brown with paler carinae; apices of tibiae and tarsi stramineus, dark at claws. Calcar length 0.28–0.31 (0.30,  $n = 2$ ), number of calcar teeth 10–11 (11,  $n = 2$ ).

Abdomen very dark brown, middorsal carina paler, immaculate; male with paler area on dorsum of segments VIII and IX.

**Macropter.** Unknown.

**Male Genitalia.** Pygofer (Fig. 44) subcylindrical in cross-section, opening large; very dark brown, paler posteriorly, ental surface and anal tube stramineus; pygofer with posteriorly projecting lobe on each lateral margin (Fig. 44), lobes with slight ventral concavity basally. Median processes fine, simple, half length of parameres, closely approximated at base and strongly converging, crossing in basal 3rd, with sharply acute apices. Lateral processes represented by stramineus ridge from base of posteriorly projecting lobe to base of median processes. Parameres flattened, broadest near base, cupped and narrowed apically, abruptly narrowed and bent medially into acute apices. Genital diaphragm weak. Aedeagus (Fig. 44) strongly flattened laterally, slender, with 3 short simple retrose processes and scattering of small subdorsal teeth near midlength. Anal processes fine, just over half length of parameres, apices resting in concavity at base of lobe.

**Remarks.** *Pissonotus decussatus* most resembles *P. albivultus* and 2 new species, *P. jamaicensis* and *P. brevistilus*, in having the frontal and vertex carinae pale and conspicuous, but differs in the form of the male median processes: in *P. decussatus* they are closely approximated basally, strongly converging and crossing in the basal third; in *P. brevistilus* they are very short and parallel; in *P. jamaicensis* they are parallel and half the length of the parameres; and in *P. albivultus* they are strongly converging and widely separated basally. *Pissonotus jamaicensis* also lacks a white caudal transverse band on the pronotum.

The specific name (Latin, *decussatus*) means crossed "like the letter x" (Brown 1954: 255), referring to the median processes of the male pygofer.

**Recorded Hosts.** None.

**Distribution.** MEXICO: Chiapas. GUATEMALA.

**Type Material.** *Pissonotus decussatus*, holotype (b♂, LOBC (affiliated with CASC); 95-160a♂) and allotype (b♀, LOBC; 95-160b♀): "Mexico, Chi(apa)s. 4700'/Laguna Montebello/at night 7-30-1974/O'Briens & Marshall." Paratypes: Mexico: same as holotype (LOBC; 1b♀; 95-160c♀); same, 5-VI-1974 (LOBC, 1b

no abdomen; 95-160d). Guatemala: Yepocapa, Dec. 1948, H. T. Dalmat (USNM, 1b♂).

**Other Material Examined.** Mexico: CHIAPAS: 4700', Laguna Montebello, 5-VI-1974 (LOBC 1m♀; 95-159p♀, tentatively placed).

*Pissonotus albivultus* Morgan and Beamer, 1949

(Figs. 45, C89)

*Pissonotus albivultus* Morgan and Beamer 1949: 110 (key), 126-127.

**Type Locality.** US: Florida, Levy County, Otter Creek.

**Diagnosis.** *Brachypter*. Body dark brown. Frons and vertex brown, immaculate with distinct pale carinae; epistomal margin with narrow white transverse band. Pronotum mostly white, brown in anterior fourth. Tegmina with distal white transverse band. Male pygofer with large, lateral, posteriorly projecting lobe; median processes widely separated basally, strongly converging to nearly meet apically. Parameres with strongly hooked, acute apices. Aedeagus without retrose processes.

**Description.** *Brachypter*. Body length ♂ 1.70-1.96 (1.82,  $n=5$ ), ♀ 2.07-2.50 (2.26). Body slightly lustrous, deep brown (Fig. 89).

Head with vertex and frons dark brown (Fig. 89), carinae distinct, white; epistomal margin of frons with narrow white transverse band, following subgenal sulci to base of front coxae. Postclypeus dark brown, anteclypeus stramineous, obscurely marked. Antennal segment I dark, 0.08-0.13 (0.12,  $n=5$ ); II mostly paler 0.21-0.25 (0.24,  $n=5$ ); ratio I/II 0.40-0.54 (0.49,  $n=5$ ).

Thorax with pronotum brown, white transverse band caudally. Mesonotum white caudally, or mostly white with obscure markings. Tegmina brown, veins concolorous but distinct; venation normal (not reticulate), becoming obsolete before distal margin, with distinct white distal transverse band.

Legs with tibiae stramineous, darker proximally, not expanded, front tibia width 0.08 ( $n=3$ ); femora mostly brown; tarsi stramineous proximally, brown at claws. Calcar length 0.23-0.27 (0.25,  $n=5$ ), number of calcar teeth 9-11 (10,  $n=5$ ).

Abdomen usually dark brown, immaculate with paler middorsal ridge and slightly paler anal region but some individuals (including allotype) with weak maculae (2-3 per side on segment VI), maculae most apparent in paler specimens.

**Macropter.** Body length (excluding wings) ♂ 2.00-2.06 (2.03,  $n=2$ ), ♀ 2.23 ( $n=1$ ); total length (including wings) ♂ 2.92-3.02 (2.97,  $n=2$ ), ♀ 2.83-3.56 (3.20,  $n=2$ ). Darker than brachypter, head and antennae similar. Pronotum mostly dark brown with white posterior margin, or with white margin nearly obsolete. Mesonotum dark brown with white caudal apex. Legs darker than brachypter. Wings clear. Abdominal markings as above, but stramineous in tympanic area.

**Male Genitalia.** Pygofer (Fig. 45) rounded in cross-section, with large opening; mostly brown with posterior margin, anal segment and parameres

paler; narrowly and shallowly excavated laterad of lateral processes; large, posteriorly directed lobe on lateral margins. Median processes angular, fine and sharply pointed, widely separated at base and strongly converging to nearly meet, enclosing a roughly circular area. Lateral processes small, wider than tall, concolorous with pygofer. Parameres broad, abruptly narrowed apically into converging, strongly hooked apices; usually longer than median processes (but subequal or shorter in some specimens). Diaphragm essentially obsolete. Aedeagus (Fig. 45) slender near apex with slightly irregular series of paired, lateral teeth; wider at base; retrose processes absent. Processes of anal segment short and stout, not reaching ventral margin of pygofer opening.

**Remarks.** *Pissonotus albivultus* resembles 3 new species, *P. decussatus*, *P. brevistilus*, and *P. jamaicensis*, which also have an immaculate frons with conspicuous pale carinae. *Pissonotus brevistilus* is a smaller and paler species, having male genitalia with very short, parallel median processes, and broad parameres with medially pointed apices. *Pissonotus decussatus* has long, strongly converging, median processes, closely approximated basally and crossing about midlength, and the paramere apices directed medially. Females of *P. decussatus* and *P. albivultus* may be indistinguishable. *Pissonotus jamaicensis* has parallel, median processes, only just slightly shorter than the parameres, and apically the parameres are broadly cupped forward. The pronotum of *P. jamaicensis* lacks a well-developed white band on the posterior margin.

**Recorded Hosts.** *Eriobotrya japonica* L. (Rosaceae), *Phaseolus vulgaris* L. (Fabaceae).

**Distribution.** Extreme southeastern United States and throughout Central America. UNITED STATES: Florida, Louisiana, perhaps Texas (see above). MEXICO: Hidalgo, Oaxaca, San Luis Potosí, Veracruz, perhaps Chiapas. BELIZE; COSTA RICA; GUATEMALA; HONDURAS; NICARAGUA; perhaps VENEZUELA: Miranda.

**Type Material.** *Pissonotus albivultus* Morgan and Beamer, 1949, holotype (♂, SEMC) and allotype (♀, SEMC): "Otter Creek/Fla. 3-9-1947/R. H. Beamer." Paratypes: Florida: same as holotype (SEMC 16b♂, 7b♀, plus 1 broken; 95-11f♂, 95-11g♀); same (USNM 2b♀, 1b♂); same (CUIC 1b♂, 1b♀; Cornell University paratype #2945.1 & #2945.2); La Belle, 13-III-1947 (SEMC 25b♂, 12b♀; 94-180b♂, 95-11e♀, 96-52a♀).

**Other Material Examined.** United States: LOUISIANA: Eunice, 24-XII-31 (SEMC 1b♂; 95-11i♂). FLORIDA: Otter Creek, 6-VII-1948 (SEMC 3b♀); Royal Palm Park, 9-X-1938, PWO (USNM 8b♂, 10b♀; 95-12a♂; FSCA 3b♂, 2b♀); same, 22-VII-1948 (SEMC 1b♀; 95-11h♀); Flagler Co., 13 mi W Bunnell, 9-X-1978 (LOBC 4b♀). Mexico: SAN LUIS POTOSÍ: Hulchichuayan, 25-IX-1938, L. J. Lipovsky (NCSU, 4b♂, 1b♀; 95-12d♀; SEMC, 1b♂, 2m♂, 1m♀, 4b♀); SLP, 3 mi E Terrazas, 15-III-1977 (TAMU, 15b♂, 13b♀); Tamazunchale, 28-VIII-1936 (USNM 3b♂, 3b♀ on 3 pins). VERACRUZ: Orizaba, 14-V-1983, at light, L&COB & GBM (LOBC, 1m♂; 95-159k♂); Jalapa, VC, 28-III-1933 (USNM, 1b♂); 3 mi E Huatusco, 22-VII-1995 (TAMU, 1b♂); 9 mi NW Jalapa, 31-XII-1949, LDB (SEMC, 1b♂, 1b broken); 32 km N Catemaco, 3-I-1982 (SEMC, 1b♂, 5b♀). HIDALGO: 40

mi N Jacala, 18-VIII-1967 (USNM 3b♂, 1b broken); Hgo, 24 mi NE Jacala, 5000', 18-VIII-1971 (LOBC 1b♂); Jacala, 28-VIII-36 (USNM 3b♂, 5b♀ on 6 pins). OAXACA: 12.4 mi W Tehuantepec, 4-VIII-1980 (TAMU, 1m♂). **Belize:** Cayo, Xunantunich, 14-VIII-1977 (LOBC 2b♀, 1b♂ [95-159j♂], 1m♀ [95-159m♀]). **Guatemala:** Flores, 22-VII-1970, J. & M. Sedlacek (BPBM, 1b♂); Tikal Ruins, 2-IX-1972 (USNM 2b♀, 3m♂). **Honduras:** Int(ibucá), 15 km N Jesus de Otoro, 15-VIII-1977 (LOBC 2b♂). **Nicaragua:** Mat., 7 mi N Matagalpa, 4900', 15-VII-1974 (LOBC 1b♂, 1b♀). **Costa Rica:** Paso Ancho de San Sebastian, 6-XII-1936, on *Eriobotrya japonica* L., #4185, C. H. Ballou (USNM 1b♀, 1b♂; 95-12b♂); San Pedro de Montes DeOca, 18-X-1935, *Phaseolus vulgaris* L., #4185, C. H. Ballou (USNM 2m♂, 1m♀, 2b♀; 95-12c♀); San José, San Antonio de Escazu, 10-IV-1984, malaise trap (SEMC, 1m♂, 2b♀).

The following are female only records: **United States:** TEXAS: Crosby, 27-IV-1953, RHB (SEMC, 2b♀). **Mexico:** SAN LUIS POTOSÍ: El Naranjo, 2-I-1950, RHB (SEMC, 1b♀); VERACRUZ: Jalapa, 13-VII-1965, N.L.H. Krauss (USNM, 1m♀); VC, Jalapa W, 1959, N.L.H. Krause (USNM, 1b♀). HIDALGO: Hwy. 105, 3 mi N Tianchinol, 5000', 8-V-1983 (LOBC 2b♀), Durango, 24-IX-1938, L. J. Lipovsky (SEMC, 1m♀). CHIAPAS: Monte Bello, 21-VII-1969, L. A. Kelton (CNCI, 1b♀); Guerrero, "349 kl S Mex. City," 27-XII-1949, RHB (SEMC, 1m♀). **Venezuela:** MIRANDA: 2.5 km E Carenero, 26-III-1982 (USNM 2b♀).

*Pissonotus binotatus* Spooner, 1912  
(Figs. 46, 90)

*Pissonotus binotatus* Spooner 1912: 239-240.

*Dicranotropis binotatus* (Spooner 1912): Crawford 1914: 601.

**Type Locality.** US: Georgia, Mitchell County, De Witt.

**Diagnosis.** *Brachypter*. Body polished, usually brownish orange, but variable to dark brown. Frons immaculate, very narrow transverse band at epistomal margin. Antennal segment I dark brown, II paler with brown anterior highlight. Tegmina with distal transverse stramineous band, veins often obsolete. Abdomen immaculate. Male pygofer with median processes half length of parameres or longer, with minute lateral shelf. Aedeagus with 5 simple retrose processes.

**Description.** *Brachypter*. Body length ♂ 1.68-1.92 (1.77,  $n=5$ ), ♀ 2.07-2.53 (2.36,  $n=5$ ). Body polished, color usually brownish orange, but variable to dark brown (Fig. 90; holotype is dark brown).

Head with vertex and frons immaculate (Fig. 90), carinae concolorous (central carina of frons may be paler in dark specimens); epistomal margin with narrow stramineous band, extending laterally along subgenal sulci, becoming broader posterior of genal carinae, reaching front coxae. Postclypeus (and adjacent coxae) usually dark brown, anteclypeus paler; some specimens with postclypeus faded to brownish orange. Antennal segment I dark brown, 0.08-0.15 (0.12,  $n=5$ ); II paler with dark brown longitudinal anterior highlight (occa-

sionally obsolete), 0.25-0.30 (0.28,  $n=5$ ); ratio I/II 0.33-0.51 (0.41,  $n=5$ ).

Thorax with pronotum and mesonotum concolorous with vertex, dark brown specimens with carinae paler. Tegmina brownish to orange, veins concolorous with membrane; distal margin of tegmina with white transverse band (weaker medially on some specimens); venation normal, often completely obsolete, not reaching distal margin.

Legs with tibiae not expanded, front tibia width 0.06-0.08 (0.07,  $n=5$ ); legs mostly stramineous with dark foveae, some specimens darker. Calcar length 0.23-0.29 (0.26,  $n=5$ ), number of calcar teeth 5-8 (7,  $n=5$ ).

Abdomen immaculate, variable in color.

**Macropter.** Body length (excluding wings) ♀ 2.00 ( $n=2$ ), ♂ 2.20-2.60 (2.38,  $n=5$ ); total length (including wings) ♀ 2.66-2.97 (2.84,  $n=5$ ), ♀ 2.93-3.15 (3.07,  $n=5$ ). Color with same variation as brachypter, hind margin of pronotum and mesonotum pale. Legs and abdomen similar to brachypter. Wings clear.

**Male Genitalia.** Pygofer (Fig. 46) cyphosomatic in cross-section (lateral margins pinched medially in some specimens), similar in color to body, paler caudally; parameres, median processes and apices of anal processes often black, strongly contrasting with body color in brownish orange specimens; excavated laterad of lateral processes at apices of anal processes. Median processes often with minute lateral shelf, parallel, angular and sharply acute, half length of parameres (or more). Lateral processes small, wider than tall, concolorous with pygofer. Parameres flattened, widest near base, gradually narrowed and cupped into rounded caudomedially directed apices. Genital diaphragm weak. Aedeagus (Fig. 46) strongly flattened laterally, with 5 retrose processes (rarely 3 or 4); most distad short or mere tooth, next 1-2 very long, simple (some specimens with lateral tooth near midpoint of 2nd process). Anal processes reaching base of parameres, received behind lateral processes.

**Remarks.** *Pissonotus binotatus* (light form) resembles *P. delicatus*, differing only in features of the male genitalia. The median processes of *P. delicatus* are 1/4 as tall as the parameres, and *P. delicatus* has a bifurcate subapical retrose process. Females of these species may be indistinguishable. Males of both species often have the parameres, lateral processes, and the apices of the anal processes black, contrasting with the surrounding pygofer. Dark specimens of *P. binotatus*, especially macropters, may resemble *P. brunneus*, but are more polished, usually with a brown longitudinal anterior highlight on antennal segment II, the abdomen immaculate, and the male pygofer without a small, midventral tooth (present on *P. brunneus*). The aedeagus of *P. brunneus* lacks retrose processes.

Morgan and Beamer (1949: 132) noted, "The body color of this species varies greatly with the season in which they are collected. The summer forms are usually honey-colored and those taken during the winter or early spring are almost black." A long series collected in Bladen Co., NC, in September included both color morphs (for brachypters and macropters), with the lighter morph dominant. The holotype of this species is the dark form.

Some Florida specimens are tentatively included in *P. binotatus* (3b♂ Niceville, NCSU; 1b♂ Pensacola, USNM; complete information listed below).

These specimens have poorly defined pale maculations on the frons, and parameres like *P. delicatus*, but the median processes are longer and the aedeagus has 2 short, simple, straplike retrose processes.

In addition to the range reported below, female specimens that may be this species (or *P. delicatus*) were examined from Maryland, Delaware, and the District of Columbia. These specimens are most likely to be *P. binotatus*. A series of specimens were also collected by Bartlett on *Conyza canadensis* from coastal dunes in Cape May County, New Jersey, but were encountered too late to be considered in the present work.

**Recorded Hosts.** *Eupatorium capillifolium* (Lam.) Small, *Eupatorium* sp., *Helianthus debilis* Nutt., *Conyza canadensis* var. *pusillus* (Nutt.) Cronq. (= *Eriogon canadensis* var. *pusillus* Nutt.) (all Asteraceae).

**Distribution.** Southeastern (and apparently mid-Atlantic) United States and Bermuda. UNITED STATES: Alabama, Arkansas, Delaware, Florida, Georgia, Louisiana, Mississippi, Missouri, North Carolina, Tennessee, Texas, Virginia. BERMUDA.

**Type Material.** *Pissonotus binotatus* Spooner, 1912, holotype (b♂, USNM): "De Witt, Ga/ Apr 6, '12" (handwritten). Paratype: Georgia: same as holotype (♀b, USNM, this specimen may be the allotype).

**Other Material Examined.** United States: DELAWARE: New Castle Co., Newark, VIII-1990, C. R. Bartlett (UDCC, 1b♂). VIRGINIA: Woolvine, 1-IX-1946, RHB (SEMC, 16b♂, 11b♀, 4m♀; 95-15m♀, 95-15h♀, 95-15g♂); Cape Henry, 9-IX-1933, PWO (USNM, 4m♀). NORTH CAROLINA: Raleigh, 31-VIII-1946, RHB (SEMC, 4b♂, 6b♀; 95-15i♂, 95-15j♀; USNM, 1b♂); same, LDB (SEMC, 1b♀); Wake Co., Raleigh, 24-VII-1986, M. R. Wilson (CMSU, 1b♂); Wake Co., nr. Raleigh, Centennial Campus, 10-IX-1994, C. R. Bartlett (NCSU, 3m♀, 4b♀); same, 30-VI-1993 (NCSU, 1b♀); same, Schenck Forest, 8-IX-1994 (NCSU, 1m♀); Wake Co., 7-IX-1972, sweeping, P. S. Southern (NCSU, 2m♀); Wake Co., nr. Raleigh, Schenck Forest, 19-II-1995, sweep, C. R. Bartlett (NCSU, 3m♀, 1b♂); Pender Co., New Topsail Beach, 28-VIII-1963, P. D. Ashlock (LOBC, 1b♀); Johnston Co., Rd 1197, SE of Bentonville, 25-VII-1979, sweeping soybeans, S. E. Smith & W. C. Warrick (NCSU, 1m♂); Johnston Co., W. Cox Mill, rt. 1008, 7-IX-1978, sweeping soybeans, R. K. Sprenkel & W. C. Warrick (NCSU, 1m♀); Warren Co., Vicksboro Rt. 1133x1134, 22-VI-1978, sweeping soybeans, R. K. Sprenkel & W. C. Warrick (NCSU, 1m♀); Warren Co., Ridgeway, Rd 158x1224, 22-VIII-1979, sweeping soybeans, W. C. Warrick (NCSU, 1m♀); Currituck Co., S of Coinjock, rt. 158, 25-VI-1979, sweeping soybeans, E. K. Rawls (NCSU, 1m♀); Mt. Pisgah, 18-VII-1958, D. A. Young (NCSU, 1m♀); Holly Shelter, 3-X-1953, T. B. Mitchell (NCSU, 2m♀); Hyde Co., 26-VIII-1939, D. A. Young (NCSU, 1m♀); Wilmington, VII-1930 (NCSU, 1b♀); Bladen Co., Bladen Lakes S.F., 1 km SW Jones Lake, 12-IX-1992, R. L. Hummel (NCSU, 1b♂); same, 1.3 km E Jones Lake, rd1511 @Turnbull Cr., 11-IX-1992 (NCSU, 1m♀); same, M. Hanzlik (NCSU, 1m♀); same, CR1324xNC242, 17-IX-1994, C. R. Bartlett (NCSU, 1b♂, 1m♂, 1b♀); same, CR1508 @Turnbull Crk. (NCSU, 1m♂); same, 16-IX-1995, sweeping, S. E. O'Reilly (NCSU, 1m♀); Bladen Co., 5.5 km SW Ammon, Rd1325, 7-IX-1991, D.

M. Stout (NCSU, 1m♀); Bladen Co., Bladen Lakes School Road, 17-IX-1994, C. R. Bartlett (NCSU, 10m♂, 30b♀, 41b♂, 18m♀); same, CR1325xNC242 (NCSU, 3b♂, 1m♀, 2b♀); Bladen Co., S of Ammon, SR1325, Gum Springs Rd., 17-IX-1994, C. R. Bartlett (NCSU, 5b♂, 16m♂, 12b♀, 98m♀; 95-159d♂, 95-159e♂); same, 15-IX-1995, ex: *Conyza canadensis* var. *pusillus* (Nutt.) Cronq. (NCSU, 1b♂, 2b♀, 9m♀); Sampson Co., S of Benson, NC 242, 11-IX-1994, sweeping roadside @creek, C. R. Bartlett (NCSU, 1b♀); Transylvania Co., 14-VIII-1957, D. A. Young (NCSU, 1m♀); Clayton, 4-X-1955, T. B. Mitchell (NCSU, 2m♀); Harnett Co., 14-VIII-1959, F. W. Mead (NCSU, 6b♂, 5m♀, 8b♀); Harnett Co., 30-IX-1933, Z. P. Metcalf (NCSU, 4m♀); Southern Pines, 29-IX-1955, T. B. Mitchell (NCSU, 1m♀); Southern Pines, 5-VIII-1957, D. A. Young (NCSU, 1b♀); Caruso, VIII-1935, Z. P. Metcalf (NCSU, 8b♂, 5b♀); Swannanoa, 18-VIII-1919, Osborn & Metcalf (NCSU, 1b♀, 1b♂); same, 16-VIII-1919 (NCSU, 1b♀); Swannanoa R., Hickory, 10-VIII (NCSU, 1b♀); Tyrrell Co., nr. Columbia, 28-VIII-1993, sweep, C. R. Bartlett (NCSU, 1b♂); Henderson, 16-IX-1972, T. Hunt (NCSU, 1m♂, 1m♀); Onslow Co., Ashe Island, 1-X-1975, on *Eupatorium capillifolium*, J. C. Dukes (NCSU, 2b♂, 1 nymph); same, 29-IX-1976, emergence trap, T. D. Edwards (NCSU, 2b♂); Richmond Co., 14-IV-1939, Turner #13562 (USNM, 1b♀); Highlands, White Face Mt., 20-VII-1957, W. R. Richards (CNCL, 1m♂); same, 22-VII-1957 (CNCL, 1m♀); Highlands, 21-VIII-1957, L. A. Kelton (CNCL, 1m♀); Highlands, 4100', 17-VIII-1957, J. G. Chillcott (CNCL, 1b♀); Clingman's Dome, 5-VIII-1957, W. R. Richards (CNCL, 1m♀); Harnett Co., 30-IX-1933, riverbank, Z. P. Metcalf (NCSU, 1b♂, 95-15r♂); Warren Co., T. Dohse (no date, NCSU, 1m♂; 95-15s♂). TENNESSEE: Marion Co., 6 mi E of Guild, 22-VIII-1968, G. F. Hevel (USNM, 1b♂). SOUTH CAROLINA: Batesburg, 24-VIII-1930, L. D. Tuthill (SEMC, 3b♀); Charleston, 10-VII-1958, D. A. Young (NCSU, 1b♀); Columbia, 15-VIII-1917, H. L. Dozier (NCSU, 1m♀); Cheraw, 17-VIII-1949, M. W. Wing (NCSU, 1m♀); Aiken, 200', 24-VIII-1957, J. G. Chillcott (CNCL, 1b♀); Aiken, 24-VIII-1957, W. R. Richards (CNCL, 2b♀, 1m♀). GEORGIA: Billy's Id., Okefenokee Swamp, 27-VII-1939, RHB (SEMC, 1b♀, 1m♀, 1m broken; 95-15n♀); Okefenokee Swamp, B. I., 31-VII-1939, D. E. Hardy (SEMC, 3m♀, 1b♀; 95-13k♀; 95-15o♀); same, P. B. Lawson, 25-VII-1939 (SEMC, 1b♂, 3b♀); same, 27-VII-1939, A. T. Hardy (not B. I., SEMC, 2b♂, 1m♀; 95-15p♀); same, B(illy's) I(sland), E. G. Wegenek (SEMC, 1b♂); Okefenokee Swamp, (28-V)-(2-VI)-1912 (USNM, 2b♀); Okefenokee Swamp, Charlton Co., Floydes Id., 7-VIII-1926, G. C. Sperry (USNM, 1m♂, 2m♀, 3b♀); Blackshear, 5-X-1938, PWO (SEMC, 1b♀; FSCA, 1b♀; USNM, 3b♂, 6b♀, 3m♀); Mitchell Co., De Witt, 23-VII-1912, C. S. Spooner (FSCA, 2b♂; USNM, 1m♀); same, 24-V-1912 (FSCA, 1b♀; USNM, 1m♀); same, 25-VII-1912 (USNM, 1b♀); same, 22-VII-1912 (USNM, 1m♀); same, 22-VIII-1912 (USNM, 1b♀); same, 23-VIII-1912 (USNM, 3b♀, 1b♂); same, 24-VIII-1912 (USNM, 1b♂, 2b♀); same, 25-VIII-1912 (USNM, 4b♀); Thomasville, 30-VII-1915, C. S. Spooner (USNM, 1b♀); same, 30-V-1915 (SEMC, 1m♀); same, 10-VII-1915 (SEMC, 1m♀); Peach Co., 23-VIII-1940, W. F. Turner #17217 (USNM, 1b♂); same, 30-VIII-1937, #6586 (USNM, 1m♂, 7m♀). FLORIDA: La Belle, 16-VII-1939, P. B. Lawson (SEMC, 2m♀, 1b♀, 2b♂; 95-151♀); same, PWO (FSCA, 2b♂, 1b♀; USNM, 2b♂); Suwannee Springs,

(2-3)-VIII-1939, A. T. Hardy (SEMC, 1m♂, 1b♂); same, RHB (SEMC, 1b♀); Coconut Grove, 9-VIII-1930, PWO (SEMC, 1m♂); Compass Lake, 10-VII-1939, RHB (SEMC, 1b♂); Hilliard, 31-VIII-1930 (SEMC, 4b♂, 1b♀); Tallahassee, 31-VIII-1947 (SEMC, 1m♀, 1b♀, 1b♂); Tallahassee, 7-III-1947 LDB (SEMC, 1b♀, 1b♂; 95-15f♀, 95-15e♂); Homestead, 20-VII-1948, RHB (SEMC, 1b♂); Eridn, 11-VII-1939, RHB (SEMC, 1b♀); Fort Walton, 27-VI-1948, RHB (SEMC, 1b♂); Okaloosa Co., Niceville, 1-V-1972, S. Southern (NCSU, 3b♂, tentatively included); Broward Co., Ft. Lauderdale, 21-VII-1923, on *Eupatorium* sp., P. Hornby (FSCA, 2b♀, 1b♂); Sarasota Co., Englewood, 13-IX-1987, on *Helianthus debilis*, K. Jenkins (FSCA, 1b♂, 1b♀); Leon Co., Tall Timbers Res. Sta., 16-VII-1970, D-Vac, D. L. Harris (FSCA, 1b♂, 2b♀); Leon Co., Tall Timbers Res. Sta., 26-IX-1969, W. H. Whitcomb (LOBC, 5b♂, 1m♂); Leon Co., Tall Timbers Res. Sta., Sheep Is., 5-VII-1972, UV trap, COB (LOBC, 1b♂); Santa Rosa Co., Santa Rosa Isl., 7-V-1976, Weems & Schuh (LOBC, 1b♂); Sumter Co., Wildwood, 22-X-1971, railroad yard, T. L. Knapp (FSCA, 1b♂); Manatee Co., Bradenton, 11-X-1987, K. E. Jenkins (FSCA, 1b♂ entire specimen cleared); Pensacola, 31-XII-1931, PWO (USNM, 1b♂, 4b♀ plus 1b♂ tentatively included); Baldwin, 6-X-1938, PWO (USNM, 1b♂); New Port Richey, 7-X-1938, PWO (USNM, 1b♂); Sanford, 4-VI-1926, EDB (USNM, 1b♂); same, 3-VIII-1926 (USNM, 1b♂); Seminole Co., Longwood, 25-IX-1988, G. F. & J. F. Hevel (USNM, 2b♂, 3b♀); Woodville, 7-III-1947, RHB (SEMC, 1m♂; 95-15q♂); Palm Beach, 27-VII-1948, RHB (SEMC, 1b♂); same, H. W. Crowder (SEMC, 3b♀, 3b♂); New Smyrna, 29-VII-1949, H. W. Crowder (SEMC, 1b♂). ALABAMA: Grand Bay, 11-VII-1934, RHB (SEMC, 1b♂, 1b♀); Tuskegee, 22-VII-1930 (USNM, 1b♀); "Alab/2370," C. F. Baker Coll. (USNM, 1b♂); same, #2298 (USNM, 1b♀); same, #1967 (USNM, 1b♀). MISSISSIPPI: Saucier, 5-III-1947, RHB (SEMC, 2b♂; 95-15d♂); "Ag. Coll. Miss. HE Weed" (CASC, 1b♀, 1m♂, 5m♀ on 4 pins); Tupelo, 26-VII-1946, G&W (FSCA, 4b♂, 1b♀). LOUISIANA: Ramsey, 3-III-1947, RHB (SEMC, 13b♂, 11b♀; 95-15c♀, 95-193c♂, 95-15b♂); Gramerey, 7-XI-1919 (FSCA, 1b♂; USNM, 3b♀); Bossier, 28-IX-1937, peach orchard, Turner et al. (USNM, 2m♀, 3b♀); "Louis/2566," C. F. Baker Coll. (USNM, 4b♂, 1b♀). ARKANSAS: Rogers, 6-VI-1946, M. W. Sanderson (INHS, 2b♂, 2b♀). MISSOURI: Taneycomo Park, Branson, 29-VIII-1928 (USNM, 4b♂, 2b♀). TEXAS: Tyler, 24-III-1939, Christenson #8400 (SEMC, CWT, 1b♂; USNM, 1b♂); Crosby, 27-IV-1953, RHB (SEMC, 1b♂). **Bermuda**: Southampton P., Horseshoe Bay, (14-22)-VII-1988, M. R. Wilson & D. J. Hilburn (CMSU, 1b♂; USNM, 1b♀, 1b♂).

*Pissonotus delicatus* Van Duzee, 1897

(Figs. 47, 91)

*Pissonotus pallipes* Gillette and Baker 1895: 69 (nomen nudum).

*Pissonotus delicatus* Van Duzee 1897: 237-238.

*Pissonotus pallipes* Van Duzee 1897: 238-239. Synonymized by Oman 1947: 217-218, 220.

*Dicranotropis delicatus* (Van Duzee 1897): Crawford 1914: 594 (key), 596-597.

*Dicranotropis pallipes* (Van Duzee 1897): Crawford 1914: 594 (key), 599.

*Pissonotus giffardi* Van Duzee 1925: 407-408. Synonymized by Morgan and Beamer 1949: 134-135.

**Type Locality.** US: California, Los Angeles County, nr. Los Angeles.

**Diagnosis.** *Brachypter*. Body polished, color variable, usually brownish orange. Frons immaculate with narrow white band on epistomal margin. Antennal segment I dark brown, II paler with conspicuous dark brown anterior highlight. Pronotum usually uniform brownish orange, caudal margin often paler. Tegmina with distal transverse white band. Abdomen immaculate. Male pygofer with median processes short, 1/4 length of parameres. Aedeagus with most distal process bifid.

**Description.** *Brachypter*. Body length ♂ 1.81-2.14 (1.97,  $n=5$ ), ♀ 2.21-2.62 (2.45,  $n=5$ ). Body polished (Fig. 91), color variable, usually brownish orange, sometimes darker or more pallid.

Head with vertex and frons immaculate (Fig. 91), brownish orange, carinae concolorous; epistomal margin of frons with narrow white transverse band, following subgenal sulci laterally. Postclypeus dark (rarely faded), anteclypeus stramineus. Antennal segment I brown, 0.15-0.17 (0.20,  $n=5$ ); II stramineus with brown anterior highlight, 0.29-0.37 (0.33,  $n=5$ ); ratio I/II 0.45-0.57 (0.51,  $n=5$ ). Occasional specimens with antennae faded to stramineus.

Thorax with pronotum variable, usually uniform brownish orange, caudal margin often paler; some specimens brownish orange (or darker) laterally and paler to nearly white dorsally (similar to *P. melanurus*). Mesonotum brownish orange (or darker). Tegmina light orange, veins concolorous; venation normal (not reticulate), often obscure, becoming obsolete before distal margin; with white distal transverse band, sometimes reduced to white spot on caudolateral margin.

Legs with tibiae not expanded, front tibia width 0.08-0.09 (0.09,  $n=5$ ); legs stramineus with brown foveae and base of coxae, apices of tibiae and tarsi stramineus, dark brown at tarsal claws. Calcar length 0.24-0.28 (0.26,  $n=5$ ), number of calcar teeth 8-10 (9,  $n=3$ ).

Abdomen brownish orange (or darker), immaculate.

**Macropter.** Body length (excluding wings) ♂ 2.17-2.40 (2.27,  $n=5$ ), ♀ 2.50-2.83 (2.69,  $n=5$ ); total length (including wings) ♂ 3.31-3.43 (3.39,  $n=5$ ), ♀ 3.31-3.63 (3.47,  $n=5$ ). Color variation similar to brachypters, usually darker with mesonotum brown; caudal apex of mesonotum stramineus. Legs and abdomen similar to brachypter. Wings clear, usually with dark spot near apex of clavus of forewing.

**Male Genitalia.** Pygofer (Fig. 47) cyphosomatic in cross-section (some specimens with lateral margins pinched medially), brownish orange, paler on posterior margin and anal segment; excavated laterad of lateral processes. Median processes, parameres and apices of anal processes often black, sharply contrasting with pygofer color in brownish orange specimens. Median processes 1/4 length of parameres; very slightly converging, simple, sharply acute

apically with angled base. Lateral processes obscure, wider than tall, concolorous with pygofer. Parameres rather short, widest near middle, flattened, cupped and turned laterally, with acute apices abruptly bent medially. Genital diaphragm vestigial. Aedeagus (Fig. 47) strongly flattened laterally, with 1–3 retrose processes; most distal process long, bifid into roughly equal parts, 1 of these (may be either) often serrulate below; 2nd process hairlike, 3rd hairlike or mere tooth. Anal processes reaching base of median processes.

**Remarks.** *Pissonotus delicatus*, which resembles *P. binotatus* and *P. melanurus*, is best identified by the male genitalia. The short median processes and bifid retrose process of the aedeagus of *P. delicatus* is diagnostic. *Pissonotus binotatus* has 5 simple retrose processes. *Pissonotus delicatus* and *P. melanurus* both have median processes 1/4 the length of the parameres, but *P. melanurus* has a broadly expanded apical retrose process. *Pissonotus delicatus* and *P. melanurus* evidently differ in color. *Pissonotus melanurus* is dark brown except near-white on the pronotum and head (except postclypeus), but some specimens of *P. delicatus* approach the pattern of *P. melanurus*. Females of *P. binotatus* and *P. delicatus* may be indistinguishable (but see range).

*Pissonotus delicatus* is the most frequently collected species of *Pissonotus* north of Mexico (Table 1). This species represented approximately 19% of the *Pissonotus* specimens examined.

Wilson and Tsai (1991) described the nymphs of *P. delicatus* collected from camphorweed (*Heterotheca subaxillaris*) in Florida. These workers suggested that *P. delicatus* may represent a complex of sibling species because of variation of the aedeagal processes and a variety of reported host affinities (they noted *Grindelia* spp., *Haplopappus ciliatus*, and *Heterotheca subaxillaris*). Morgan and Beamer (1949: 133) illustrated variations in the form of the bifid retrose process. Although we considered the possibility of a *P. delicatus* sibling species complex, no variants appear to be sufficiently consistent and distinct to merit subspecific status. Although *P. melanurus* is clearly allied with *P. delicatus*, and also feeds on *Grindelia*, there are sufficient consistent differences in genitalia and color to warrant full species status for *P. melanurus* (see *Remarks* of *P. melanurus*). Wilson and Tsai (1991) also reported a 3rd-instar *P. delicatus* parasitized by a strepsipteran (probably *Elenchus* sp., Elenchidae).

Shelford (1974: 80) noted this species as a component of pinelands in the southern temperate deciduous forest biome of the United States.

The holotype of *P. pallipes* is a macropterous female of *P. delicatus* in very poor condition (see Oman 1947), synonymized with *P. delicatus* by Oman (1947: 217–218, 220). Although the holotype of *P. pallipes* is properly referred to *P. delicatus*, authorities have varied widely in their interpretation and presentation of *P. pallipes*. Specimens of a number of species other than *P. delicatus*, especially macropters, including *P. marginatus*, *P. brunneus*, *P. piceus*, and others have been identified, reported, or described as *P. pallipes*. Because of the wide misunderstanding of *P. pallipes*, records, descriptions, keys, and so forth, attributed to *P. pallipes* (e.g., Swezey 1904: 35, Wirtner 1904: 215, Tucker 1907: 65, Spooner 1912: 235, Barber 1914: 528, Crawford 1914: 594, 599; Van

Duzee 1917a: 767, Metcalf 1923: 170, 673, Johnson 1930: 36, Osborn 1938: 335, Moore 1950a, b) cannot safely be understood as being records of *P. delicatus*.

The record of *P. delicatus* from Bermuda reported by Ogilvie (1928: 20) was recorded as an error by Wilson and Hilburn (1991: 416).

The holotype and allotype of *P. giffardi* are brownish orange specimens of *P. delicatus* with mostly stramineous antennae.

In addition to the range reported below, female specimens that may be this species (or *P. binotatus*) were examined from Maryland and the District of Columbia. These specimens, however, are more likely to be *P. binotatus*.

**Recorded Hosts.** *Grindelia* sp., *Haplopappus ciliatus* (Nutt.) DC (as *Prionopsis ciliata* Nutt.), *Grindelia squarrosa* (Pursh) Dunal. (as *Grindelia perrenis* A. Nels.), *Grindelia aphanactis* Rydb., and *Heterotheca subaxillaris* (Lam.) Britt. & Rusby (all Asteraceae) are confirmed hosts. Also reported: *Helenium* sp., *Gaillardia* sp., *Silphium* sp., *Iva axillaris* Pursh, *Rudbeckia* sp. (Asteraceae), *Agropyron trachycaulum* (Link) Malte (Poaceae), *Sphaeralcea emoryi* Torr., and *Gossypium hirsutum* L. (as cotton) (Malvaceae).

**Distribution.** Principally western and central United States and adjacent Canada and Mexico, but also found in northeastern and southeastern United States and reportedly Jamaica. CANADA: Alberta, British Columbia, Saskatchewan; also reported Quebec (Moore 1950a, b). UNITED STATES: Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Mississippi, Missouri, Montana, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Texas, Utah, Vermont, Washington, Wyoming; also reported Ohio (Osborn 1938). MEXICO: Baja California Norte, Coahuila, Tamaulipas. Reported JAMAICA (Van Duzee 1907).

**Type Material.** *Pissonotus delicatus* Van Duzee, 1897, holotype (by monotypy, Oman 1947: 217; ♀b, USNM #100437): “658” “♀” “type,” reported (Van Duzee 1897: 237) collected near Los Angeles by D. M. Coquillett.

*Pissonotus pallipes* Van Duzee, 1897, lectotype (m♂, ISUI, to be deposited at USNM, designated by Oman: 217–218): “Col.” “Acc. Cat / 155,” reported “taken among the mountains of North Western Colorado (Van Duzee 1897: 138);” genitalia missing; specimen with note by W. Giffard, as reported in full by Oman 1947: 217–218. Paralectotype (m♀, USNM): “Calif” “type” “♀.” This specimen consists only of an abdomen, 2 legs, and a portion of a forewing. Paratype (1m♀, CUIIC #2430); “California/ Coquillett” “paratype (written later)/ *Pissonotus pallipes* V.D.” “♀” “type.” Synonymized by Oman (1947: 217–218, 220).

*Pissonotus giffardi* Van Duzee, 1925, holotype (♂b, CASC, #1777) and allotype (♀b, CASC #1777): “SanDiegoCalif/VI-2-1919” “W. M. Giffard,” reported “taken on tar weed near Grossmont, 17 miles east of San Diego, California” (Van Duzee 1925: 407). Paratypes: California: same data and locality (CASC, 9b♂, 12b♀ plus 8b♀ on 4 pins, Giffard slides #7 ser. III and #7<sup>a</sup> ser. III). Synonymized by Morgan and Beamer (1949: 134–135).

**Other Material Examined.** Canada: SASKATCHEWAN: Swift Current, 16-VIII-1981, *Grindelia squarrosa*, KAH (CNCI, 4b♂); Denholm, 7-VIII-1981, *Agropyron trachycaulum*, KAH (CNCI, 2b♂); Willow Bunch, 26-VII-1955, C. D.



Miller (CNCI, 1m♂, 1b♀, 1m♀); Regina, 9-VII-1975, swept *Grindelia perrenis*, M. G. Maw (CNCI, 1m♀); same, swept *Iva axillaris* (CNCI, 1b♂); 8 km W. Kisbey, 23-VI-1984, KAH (CNCI, 1b♂); Saskatoon, 7-VII-1924, K. M. King (CNCI, 1m♂). ALBERTA: Medicine Hat, 14-VIII-1981, *Grindelia squarrosa*, KAH (CNCI, 23b♂, 22b♀, 1m♀, 2m♂ [5 nymphs, 1b♂, 1b♀ in capsule]); Tilley, 2-IX-1938, R. W. Salt (CNCI, 1m♂). BRITISH COLUMBIA: 4 mi N Oyster Bay, 18-VII-1976, KAH (CNCI, 4b♀); Oliver, 29-IV-1959, L. A. Kelton (CNCI, 1m♂). **United States:** VERMONT: 7 km E Laketown, 13-VI-1992, KAH (CNCI, 1b♀). NEW YORK: Saranac Lake, 26-VIII-1916 (CUIC, 1b♀); Riverhead, L. I., 17-VIII-1946, RHB (SEMC, 2b♀); Montauk, L. I., 17-VIII-1946, RHB (SEMC, 20b♂, 21b♀; 95-68c♂, 95-68d♀, 95-195a♂); same, LDB (SEMC, 4b♂, 9b♀). NEW JERSEY: Riverton, 17-VIII-1902, Van Duzee (CASC, 3b♀ on 2 pins). NORTH CAROLINA: Moore Co., 12-VII-1939, Turner #14672 (USNM, 4b♀, 3b♂); So. Pines, 9-VII-1939, PWO (USNM, 2b♀, 3b♂). GEORGIA: Tybee Isl., 26-VII-1913 (CUIC, 3b♂, 2b♀, 1m♀; EMEC, 1b♂); Millwood, 31-VII-1948, B. T. McDermott (SEMC, 1b♂, 1b♀); Tifton, 8-I-1948, RHB (SEMC, 1b♂); same, E. L. Todd (SEMC, 1b♂); Wrens, 22-VIII-1930, L. D. Tuthill (SEMC, 4b♂, 7b♀, 1m♀); same, LDB (SEMC, 1b♂, 4b♀); Evens Co., 2 mi S Clayton, 26-VI-1965, COB (LOBC, 1b♀). FLORIDA: Broward Co., Ft. Laud. 29-VII-1985 (CMSU, 1b♂); Zolfo Springs, 15-VII-1939, P. B. Lawson (SEMC, 1b♀); Zolfo Springs, 16-VIII-1939, PWO (USNM, 5b♂, 7b♀); same, 15-VII-1939 (USNM, 1b♀); Ft. Walton, 27-VI-1948, RHB (SEMC, 2b♂); Cedar Keys, 12-VII-1949, RHB (SEMC, 1b♂, 1b♀); same, PWO (USNM, 7b♀, 2b♂); same, P. B. Lawson (SEMC, 1b♂; 95-68j♂); La Belle, 16-VII-1939, RHB (SEMC, 5b♂, 7b♀); Monticello, (4-8)-X-1914 (AMNH, 1m♀); Estero, (6-12)-V-1908, Van Duzee (CASC, 1b♂, 1b♀; CMNH 1b♀); Sevenoaks, 1-V-1908, Van Duzee (CASC, 1b♀); Crescent City, IV-1908, Van Duzee (CASC, 1m♀, 1b♂, Giffard slide #7c, ser. VII); St. Augustine, 10-IV-1926, EDB (USNM, 1b♀, 1m♀); Sanford, 3-IX-1925, EDB (ISUI, 1b♀; USNM, 1m♀); Sanford, EDB USNM as follows: 4-VI-1926, (1b♂, 1b♀); 9-IX-1926, (1b♀, 2m♀ on 1 pin); 21-IV-1926, (1b♀); 27-VI-1926, (1b♀); 4-VIII-1926, (2b♀, 2b♂ on 1 pin); 3-XI-1925, (1b♀); 11-V-1926, (1b♀, 1b♂, 1 nymph on 1 pin); 4-VI-1926, (1b♀); 21-II-1926, (1b♂); 9-IX-1925, (1m♀); 17-XI-1926, (1b♀); Palm Beach Co., Riviera Beach, 26-IV-1988, *Heterotheca subaxillaris*, K. B. Nicholson (FSCA, 31b♂, 13b♀); Sarasota Co., Nokomis, 19-VII-1988, sweeping weeds, K. E. Jenkins (FSCA, 1b♂, 1b♀); Tallahassee, 30-VIII-1956, H. V. Weems Jr. (FSCA, 1b♀); Leon Co., Tallahassee, 11-X-1975, GBM (LOBC, 1b♀); Levy Co., 10-IX-1955, R. A. Morse (FSCA, 1b♂); Franklin Co., Alligator Point, 6-X-1988, COB (LOBC, 3b♂, 3b♀, 1m♂, 2m♀); Jefferson Co., 10 mi S Wacissa, 16-VI-1987, COB (LOBC, 1b♀); Indian River Co., Vero Beach, 3-XII-1970, L&COB (LOBC, 1b♀); Columbia Co., 3 mi NW Ft. White, 11-VI-1965, L&COB (LOBC, 1b♀); Coco, 5-V-1926, EDB (USNM, 3b♀, 3b♂, 2 nymphs on 4 pins); same, 3-V-1926 (USNM, 2b♀); Tampa, 10-IX-1929, EDB (USNM, 2b♀, 2b♂); Venice, 13-V-1928 (USNM, 1b♂, 2b♀); La Belle, 16-VII-1939, PWO (USNM, 29b♀, 21b♂, 1m♀); Elfers, 14-VII-1939, PWO (USNM, 3b♂, 1b♀); Wakulla Co., 6-VIII-1954, F. W. Mead (USNM, 1b♂); Fruitville, 11-VIII-1930, L. D. Tuthill (SEMC, 1b♀); Ft. Mead, 13-VIII-1930, L. D. Tuthill (SEMC,

2m♀). ALABAMA: Tuskegee, 22-VII-1930, RHB (SEMC, 1b♂, 2b♀). MISSISSIPPI: "Ag. Coll. Miss. H. E. Weed" (CASC, 4m♀, 1m broken on 2 pins). ARKANSAS: Polk Co., 21-VIII-1928, RHB (SEMC, 2m♀); same, J. G. Shaw (SEMC, 1m♂); Howard Co., 24-IX-1937, peach orchard, Turner et al. (USNM, 6b♀, 1b♂); Grant Co., 5 mi NNE Sheridan, 23-VIII-1955, A. A. Alcorn (SEMC, 1m♀). ILLINOIS: Pulaski Co., Wetaug, 5-VIII-1935 (USNM, 1b♂); Makanda, 4-VI-1919 (USNM, 1m♀). IOWA: Oak Grove SP, 25-VII-1928, G. O. Hendrickson (ISUI, 1m♂, 4b♀, 3b♂; USNM, 1b♂; CNCI, 1b♂); Council Bluffs, 31-VII-1928, G. O. Hendrickson (ISUI, 2b♂, 3b♀); Mt. Pleasant, 27-IX-1939, Throckmorton (USNM, 1m♀). MISSOURI: Johnson Co., Warrensburg, Cave Hollow, 2-X-1991, B. Freund (CMSU, 1b♂); Branson, Taneycomo Pk., 29-VIII-1928 (USNM, 2b♀, 1b♀; 93-197a♂); S. Benton, GL264, 17-VIII-1955, H. H. Ross (CNCI, 1m♀). KANSAS: Hutchinson Co., 5-VIII-1945, RHB (SEMC, 30b♂, 6m♀, 40b♀; 95-68b♀, 95-68m♀, 95-68l♀, 95-68a♂, 65-68n♀); Medora, 5-VIII-1945, RHB (SEMC, 14b♂, 14b♀); Medora, S. Hills, 6-VII-1945, RHB (SEMC, 6b♂, 1m♀, 15b♀); Meade Co., 14-VIII-1945, RHB (SEMC, 1b♂); same, 13-IX-1944 (SEMC, 4m♂, 5m♀); Liberal, 16-VIII-1945, collected from *Prion(opsis) ciliata* determiner Nutt., RHB (SEMC, 18b♂, 16m♂, 25b♀, 12m♀; 95-68p♂, 95-68q♂, 95-68k♀, 95-68r♂, 95-68s♂, 95-68e♀, 95-193a♂, 94-168a♂); Scott Co., S. Pk., 9-VIII-1945, RHB (SEMC, 1b♀); Douglas Co., 18-VIII-1949, on *Heterotheca subaxillaris*, Michener-Beamer (SEMC, 4b♂, 1b♀, 1m♀); Douglas Co., 30-VIII-1928, trap light, P. B. Lawson (SEMC, 2m♂); Dodge City, 5-IX-1949, Michener-Beamer, Taken on *Heterotheca subaxillaris* (SEMC, 3b♂, 8b♀, 1b broken); Pratt Co., VI-1921, RHB (NCSU, 1m♂); Cimasson(?), 26-VIII-1891 (USNM, 1m♂); Manhattan, 2-X-1928, D. A. Wilbur (USNM, 1m♀); same, 20-X-1928 (USNM, 1m♂). OKLAHOMA: Alfalfa Co., 21-VII-1949, S. Coppock, Jr. (NCSU, 2m♀); same, 10-IX-1949 (NCSU, 2m♀); same, 3-X-1948 (NCSU, 1m♀); same, 20-VIII-1949 (NCSU, 3m♀); Blue Bryan Co., 8-VI-1965, L&COB (LOBC, 1b♂); Sequoia Co., Vian, 15-VIII-1955, R. R. Dreisbach (USNM, 1m♂); Sequoyah Co., 12 mi NE Sallisaw, 16-X-1982, G. F. & J. F. Hevel (USNM, 4b♂, 15b♀). NORTH DAKOTA: Oliver Co., T143N, R83W, S6, 15-VIII-1972, P. B. Kannowski (USNM, 1b♂); Medora, 25-VII-1924 (USNM, 3b♂, 3b♀, 2b broken on 3 pins). MONTANA: Poplar, 13-VII-1922, C. C. Sperry (USNM, 1m♀); Garrison, 10-VII-1935, PWO (USNM, 3b♂, 7b♀); Charlo, 19-VIII-1926 (USNM, 1m♂). IDAHO: Cassia Co., 2 mi W Elba, 28-VIII-1963, COB (LOBC, 7b♂, 6b♀); Blaine Co., Little Wood River, 6 mi NW Carey, 30-VI-1966, night, W. Gagne (LOBC, 8b♀, 1b♂, 1m♀); Boise Co., 18 mi NE Boise Hwy 21, 29-VIII-1963, on *Grindelia squarrosa*, COB (LOBC, 1m♂, 1m♀, 6b♀, 4b♂); 5 km S Baker, 4-VI-1992, KAH (CNCI, 1b♂); Cub River Canyon, Thomas Springs, 28-VIII-1954, G. F. Knowlton (SEMC, 2b♂). WASHINGTON: Ritzville, 8-VII-1935 (USNM, 2b♂, 19b♀); S of Spokane, 9-VII-1935, PWO (USNM, 1b♀, 1b♂); Klichitat, 1-VI-1987, KAH (CNCI, 1b♀). OREGON: Lake Co., E. Shore Lake, Abert, 4300', 31-VIII-1963, on *Grindelia squarrosa*, L&COB (LOBC, 23b♂, 21b♂; AMNH, 1b♀; CASC, 1b♂); Baker Co., Lime, 16-VII-1968, K. Grey (AMNH, 1b♀). CALIFORNIA: San Diego, 7-VII-1935, RHB (SEMC, 2b♀); San Diego Co., El Cajon Vallet, 23-IV-1920, ex: *Heterotheca grandiflora*, W. M. Giffard

(CASC, 2m♀, 3b♂, 2b♀); San Diego Co., 3-V-1913, E. P. Van Duzee (CASC, 1b♂); same, 21-VI-1914 (CASC, 1b♀); same, 30-VI-1914 (CASC, 10b♀ on 5 pins); same, 6-VI-1914 (CASC, 1b♀); San Diego, 16-VI-1908 (ISUI, 1b♀; USNM, 8b♀, 2b♂, 1m♀); Monterey, 22-VII-19(3?)5, RHB (SEMC, 1m♀); Bonsall, 6-VIII-1935, RHB (SEMC, 1b♂); Huntington Beach, 30-VII-1932, RHB (SEMC, 4b♀); Los Angeles, 17-VIII-1945, on grass, R. H. Smith (SEMC, 1m♀); Los Angeles Co., Whitter, 31-VIII-1920, Timberlake Coll. (CASC, 1b♂, Giffard slide #17, ser. VII); Los Angeles, IX-1908, J. C. Bradley (CASC, 1b♂, Giffard slide #7<sup>b</sup> ser. III); Carlsbad, 6-VIII-1935, RHB (SEMC, 1b♂, 5b♀); Palm City, 19-VII-1940, RHB (SEMC, 2b♀, CWT *pallipes*); Contra Costa Co., Antioch, 2-IX-1964, COB (LOBC, 1b♂, 6b♀); same, 7-X-1964 (LOBC, 6b♀); Orange Co., 26-IV-1920, ex: *Heterotheca grandiflora*, W. M. Giffard (CASC, 6b♀, 1b♂); La Jolla, 13-VII-1941, B. Hogden (INHS, 1m♀); Ontario, 12-VI-1908, EDB (ISUI, 1b♀; USNM, 5b♀, 1b♂); Ontario, 12-I-1938, L. D. Christenson (USNM, 1b♂); Marion Co., Mendosa Beach, Pt. Reyes Penn., 25-VII-1963, COB (LOBC, 1m♂); Alameda Co., Emeryville, Mud Flats, 8-X-1963, P. A. Rude (LOBC, 1b♂, 1b♀); Pasadena, 21-VI-1909, EDB (USNM, 2b♀, 1b♂, 1m♀); Chino, 11-VI-1908 (USNM, 1b♀, 1m♂, 3m♀); same, 11-VII-1908, EDB (USNM, 3b♀); Oxnard, 19-VI-1908 (USNM, 1b♀); L. Beach, 4-VII-1931 (USNM, 1b♂, 2b♀); Riverside, 10-VI-1908, EDB (USNM, 2b♀ on 1 pin); same (no collector, 1m♂); "Tia Juana," 15-VI-1908 (USNM, 2b♀); Pala, 25-V-1938, Christenson #9557 (USNM, 1m♂); same, 29-VII-1938, #10690 (USNM, 2b♂). WYOMING: Sheridan, Metz, W. M. Giffard Coll. (no date, CASC, 1m♀); Carbon Co., N. Platte River, 7 mi E Sinclair, 6700', 3-VI-1964, LOB (LOBC, 1b♂, 5b♀); Pammel Rapid Creek, VII-1897 (ISUI, 1m♀); 13 km SE Cook City Mtn., 6-VIII-1985, KAH (CNCL, 1m♂). COLORADO: Boulder, 22-VI-1935, RHB (SEMC, 1b♂, 3b♀); Artesia, 2-VIII-1947, RHB (SEMC, 11b♂, 28b♀; 95-68i♀); Ft. Collins, 24-VII-1898 (SEMC, 1b♀); same, 9-VIII-1898 (SEMC, 2m♀); same, 2-VIII-1901 (USNM, 1b♀); same, 13-IX-1901 (USNM, 1b♀); same, 29-VII-1898 (USNM, 2b♂); same, 6-VI-1900 (USNM, 1b♀); Denver, 7-IX-1898 (USNM, 2m♀, 1m♂, 1b♂); Denver, 22-VII-1900 (USNM, 1b♀); Denver, 26-VII-1915, E. C. Jackson (USNM, 1m♀); Durango, 13-VIII-1933, Ball (USNM, 1b♂); Holly, 8-IX-1989 (USNM, 1m♂); Sterling, 26-VIII-1925, C. J. Drake (USNM, 1b♀; CNCL, 1b♂); Colorado Springs, 5915', Aug., E. S. Tucker (SEMC, 1m♀); Pinecliffe, 9-VII-1949, RHB (SEMC, 1b♀); Pueblo, 21-VII-1900, Van Duzee (CASC, 1m♀, 1b♂); same, 22-VII-1900 (CASC, 6b♀, 1b♂ on 2 pins; USNM, 3b♂, 1b♀ on 1 pin); Fort Collins, 9-VIII-1898 (CMNH, 1m♂, 1b♂); same, 27-VII-1898 (CMNH, 1b♂); same, 26-IX-1908 (USNM, 1b♂); Trinidad, 13-VII-1899 (USNM, 1m♀); Grand Junction, 28-VII-1900, Van Duzee (CMNH, 1b♀); "Colo/2084," C. F. Baker Coll. (USNM, 6b♀, 1m♂); same, #2032 (USNM, 14b♀, 1b♂); same, #2059 (USNM, 6b♀, 1b♂); Pleasant Valley, 19-VIII-1906 (USNM, 1b♀). UTAH: Utah Co., 0.5 mi S Springdell, Uinta NF, 4-VII-1964, L&COB (LOBC, 4b♂, 9b♀, 2m♀); same, 22-VIII-1963 (LOBC, 10b♂, 5b♀); Provo, 30-VII-1986 (CMSU, 1b♂, 3b♀); Provo, 9-VIII-1930 (USNM, 2b♂, 1b♀ on 1 pin); Salt Lake City Co., Salt Lake City, 9-IX-1981, E. A. Sugden (UCDC, 1b♂); Gericho, 3-VIII-1954, G. T. Knowlton (SEMC, 3b♂, 13b♀); Summit Co., Rockport Lake, 24-VIII-1963, COB (LOBC,

20b♂, 10b♀, 3m♂, 3m♀); Rich Co., 2 air mi W Bear Lake, 25-VIII-1963, LOB (LOBC, 1b♂); Cache Co., Logan Canyon, 9 mi E Logan, 25-VIII-1963, L&COB (LOBC, 7b♂); Cache Co., Logan Canyon, 9 mi E Logan, 25-VIII-1963, ex: *Grindelia squarrosa*, LOB (LOBC, 23b♀, 36b♂, 22 nymphs); Logan, 7-IX-1906 (USNM, 2m♀, 1m♂); 8-IX-1906 (USNM, 1m♀); Cache Co., Cornish, 7-IX-1968, on *Grindelia squarrosa*, C. D. Michener (SEMC, 1b♀); Emigration Canyon, 17-VI-1933, O. H. Swezey (CASC, 1b♀, 3b♂ on 2 pins); Uintah Co., Bonanza, 30-VIII-1975, on *Grindelia squarrosa*, G. E. Bohart (USNM, 1m♀); same, 8-VIII-1974 (USNM, 1m♂); Am. Fork, 28-VIII-1950, G. F. Knowlton (USNM, 1b♂); Smithfield, 13-VII-1935, PWO (USNM, 2b♂, 7b♀); Duchesne Co., 17 mi E Duchesne, 25-VIII-1966, L&COB (LOBC, 3b♀, 1m♂, plus capsule, nymphs); Price, 13-VII-1954, on *Silphium* sp., G. F. Knowlton (SEMC, 1b♂, 1 nymph); Spanish Walk, 15-VIII-1940, RHB (SEMC, 1b♂, 4b♀, 1m♀); Mendon, 25-VIII-1954, G. F. Knowlton (SEMC, 1b♀); Woodside, 4-X-1938, D. E. & A. Hardy (SEMC, 1m♀). ARIZONA: 4 mi N Prescott, 6-IX-1962, R. L. Macdonald (UCDC, 2b♂); Yavapai Co., 4 mi N Prescott, 6-IX-1962, COB (SEMC, 1b♂, 1m♂); Yavapai Co., 13 mi NW Seligman, 5300', 7-IX-1964, L&COB (LOBC, 3b♀); Yavapai Co., 2 mi SW Prescott, 6100', 7-IX-1964, LOB, ex: *Grindelia aphanactis* (LOBC, 1b♂, 1m♀); Prescott, 12-VII-1947, RHB (SEMC, 12b♂, 13b♀; 95-68i♀, 95-68h♂); Wickenburg, 5-VII-1950, RHB (SEMC, 1b♂, 1b♀); Chino Valley, 3-VII-1950, H. Wright (SEMC, 2b♂); Chino Valley, 3-VII-1950, on *Grindelia aphanactis*, RHB (SEMC, 45b♂, 3b♀, 1b broken); same, on *Sphaeralcea emoryi* (SEMC, 9b♀, 11b♂); Douglas, 19-VII-1950, on *Heterotheca subaxillaris*, RHB (SEMC, 3b♂); Cochise Co., SW Res. Sta., 5 mi NW Portal, 25-VIII-1960, P. H. Arnaud & D. C. Rentz (CASC, 1b♂); Cochise Co., Chiricahua Nat'l. Mon. Entr., 12-IX-1964, LOB (LOBC, 4b♀); Chiric., Cochise Co., Cochise Stronghold, 12-IX-1964, COB (LOBC, 1m♀); Pinal Co., Oracle, 4600', 4-IX-1965, ex: *Heterotheca subaxillaris*, L&COB (LOBC, 1b♂, 1b♀); Pinal Co., 2 mi W Oracle, 4200', 4-IX-1965, COB (LOBC, 1b♂, 1b♀); Pinal Co., 6 mi NE Oracle, 4-IX-1965, L&COB (LOBC, 1b♂); Granite Dells, 10-VIII-1967, D. A. Young (NCSU, 2b♀); Granite Dell, 29-VII-1934, EDB (USNM, 3b♀, 2b♂ on 1 pin); Wilmsn. Val., 28-VII-1934, EDB (USNM, 1b♂, 2b♀ on 1 pin); same, 28-VIII-1935 (USNM, 1m♀); Yauapai Co., Skull Valley, 11-VIII-1967, D. A. Young (NCSU, 1b♂); Pinaleno Mtns., Swift trail, 2 mi E Wet Canyon, 10-IX-1964, on *Heterotheca subaxillaris*, L&COB (LOBC, 2b♂, 4b♀); Coco(nino) Co., Midgely Bridge, Oak Crk. Canyon, 12-IX-1964, L&COB (LOBC, 6b♀, 2b♂); Hwy. 181, 6 mi Jct 666, Cochise Co., 12-IX-1964, L&COB (LOBC, 9b♀); Gila Co., Senica, 4900', 10-IX-1964, ex: *Heterotheca subaxillaris*, COB (LOBC, 11b♂, 14b♀); Swift Trail, 3300', Pinaleno Mtns., 11-IX-1963, ex: *Heterotheca subaxillaris*, L&COB (LOBC, 2m♂, 2m♀, 60b♀, 39b♂, 2 nymphs); Huach. Mtns., 3-X-1932, EDB (USNM, 1b♂, 2b♀); same, 7-X-1932 (USNM, 1b♀, 2b♂, 1m♂); Mesa, 10-IX-1938, Christenson #17814 (USNM, 1b♀, 1b♂). NEW MEXICO: Taos Co., Taos, 20-VIII-1927, RHB (SEMC, 1m♂, 1m♀). TEXAS: 25 mi S Sarita, 25-XII-1945, RHB (SEMC, 1b♂, 3b♀); Sarita, 25-XII-1945, RHB (SEMC, 3b♂, 2m♀, 3b♀); Sarita, 5-XII-1911, sand hills (INHS, 1m♀); Cameron Co., 3-VII-1928, RHB (SEMC, 1b♀); Rockport, 5-VII-1936, RHB (SEMC, 1b♀); Potter Co,

7-VII-1927, RHB (SEMC, 1b♂); Hall Co., 6 mi SE Turkey, 18-VI-1970, COB (SEMC, 1b♀); Wink Co., 2 mi NE Kermit, 10-X-1970, COB (LOBC, 2b♂, 9b♀); S end Padre Island, 28-VI-1908 (NCSU, 1b♀); same, 12-XII-1910 (NCSU, 2b♀, 2b♂; INHS, 2b♂, 3b♀); Waco, 22-IX-1939, cotton, P. A. Glick (TAMU, 1m♀); Robertson Co., 12.1 mi E Jct. Hwys. 6 & OSR, 4-VI-1977, sweep, *Rudbeckia* sp., S. J. Merritt (TAMU, 1m♀); Travis Co., Austin Zilker Park, 8-X-1993, J. B. Woolley (TAMU, 1b♂, 3b♀, 1m♀); Kleberg Co., Rt. 2045E 30 mi E Kingsville, 3-XI-1990, sweeping & beating *Q. virginiana*, T. Carlow (TAMU, 1b♀); College Station, 17-III-1931, H. J. Reinhard (TAMU, 1b♀); Leon Co., 7.6 mi N Normangee, 12-VI-1976, sweep *Gaillardia*, S. J. Merritt (TAMU, 1m♀); Brazos Co., College Station, 26-IX-1981, sweeping *Heterotheca* sp., S. J. Merritt (TAMU, 1m♀); same, 1600 SW Pkwy, 2-X-1976, S. J. Merritt (TAMU, 1m♀); Brazos Co., 4-X-1927, H. G. Johnson (TAMU, 1m♀); San Antonio, 4-V-1905, W. D. Pierce (USNM, 1m♀); Bangs, 16-II-1939, Christenson #8262 (USNM, 1b♂); same, 6-VI-1939 (USNM, 1b♂); same, 16-IX-1938, #7877 (USNM, 7b♀, 2m♀, 4b♂, 1b♂); same, 8-VI-1938, #9631 (USNM, 2b♀, 1b♂); same, 15-IX-1938, #7798 (USNM, 3m♀, 2m♂); same, 16-IX-1938, #7787 (USNM, 1b♀, 3b♂); same, 15-VIII-1938, #7639, 7681, 7680, 7640 (USNM, 5m♀, 4b♀, 2b♂); same, 16-X-1939, #8939, 8941 (USNM, 2b♂, 2m♀, 1b♀); same, 17-X-1939, #8992, 8978 (USNM, 3b♀, 1m♀, 6b♂); same, 9-XI-1939, #18956 (USNM, 4b♂, 2b♀, 1m♀); same, 16-III-1939, #8295, #8273 (USNM, 2b♀, 1b♂); Sugarland, 26-II-1939, Christenson #19372 (USNM, 1m♂); Mineola, 2-X-1906, on *Heterotheca subaxillaris*, F. C. Bishopp (USNM, 1m♀; USNM, 2m♀); Victoria, 28-X-1907, on *Helenium* sp., J. D. Mitchell (USNM, 1m♂); Haskell Co., O'Brien, 6-V-1972, L&COB (LOBC, 2b♀); Jeff Davis Co., 22 mi NE Ft. Davis, 12-VII-1965, on *Grindelia* prob. *squarrosa* (LOBC, 8m♂, 2m♀, 7b♂, 3 nymphs); Winkler Co., 3 mi NE Kermit, 11-X-1970, night, L&COB (LOBC, 2b♂); Bailey Co., 15 mi N Littlefield, 18-X-1970, night, GBM (LOBC, 4b♂, 4b♀); Clarendon, 22-IX-1905, Hunter #1080, W. P. Pierce, on *Grindelia squarrosa* (USNM, 1m♀); Boca Chica, 30-V-1933, PWO (USNM, 1b♀, 2b♂); Tyler, 14-VI-1938, Christenson #7993 (USNM, 2b♀, 4b♂, 1m♀); same, 15-X-1938, #8036 (USNM, 1m♀); same, #29247, on *Heterotheca* sp. (USNM, 1m♂, 5m♀); same, 5-IX-1940, #29249, on *Heterotheca* (USNM, 1b♂); Bexar Co., 12-IX-1940, on *Heterotheca subaxillaris*, W. F. Turner #17318 (USNM, 2m♂, 3m♀, 3b♂); Denison, 16-X-1938, Christenson #8123 (USNM, 1m♂); Gurley, 28-V-1905, (?) C. Morgan (USNM, 1m♀); 5 mi NE Olivia, GL93, 13-IV-1955, Ross & Ross (CNCI, 1b♂, 3b♀, 1m♀). **Mexico:** BAJA CALIFORNIA NORTE: Ensenada, VI-1952, N.L.H. Krauss (CASC, 1b♂); Tijuana, 3-VIII-1912, EDB (USNM, 1b♀); "Tia Juana," 15-VI-1908, EDB (USNM, 1b♂). COAHUILA: 12.4 mi S Saltillo on Hwy 57, 4-VII-1985 (TAMU, 1b♂, 1b♀). TAMAULIPAS: Matamoras, 100', 27-VIII-1954, J. G. Chillcott (CNCI, 1b♀).

*Pissonotus melanurus* Van Duzee, 1917, new status  
(Figs. 48, 92)

*Pissonotus delicatus melanurus* Van Duzee 1917b: 311-312.

**Type Locality.** US: California, San Joaquin County.

**Diagnosis.** *Brachypter*. Body polished, dark brown. Frons immaculate, light brown, epistomal margin with narrow white band. Antennal segment I dark brown, II paler with brown longitudinal anterior highlight. Pronotum dark brown laterally, white dorsally. Mesonotum dark brown with paler hind margin. Tegmina brown, veins concolorous, with broad white distal transverse band. Abdomen immaculate. Male pygofer with median processes short, 1/4 length of parameres. Aedeagus with most distal process expanded and bladelike.

**Description.** *Brachypter*. Body length ♂ 1.84-1.93 (1.89,  $n=2$ ), ♀ 2.36-2.57 (2.46,  $n=2$ ). Body polished, brown to piceus (rarely paler; Fig. 92).

Head with vertex and frons stramineus (Fig. 92; rarely darker), contrasting with dark brown body, immaculate; epistomal margin paler. Postclypeus very dark brown, anteclypeus paler. Antennal segment I dark brown, 0.15-0.22 (0.18,  $n=3$ ); II paler with brown longitudinal anterior highlight, 0.29-0.35 (0.33,  $n=3$ ); ratio I/II 0.48-0.62 (0.54,  $n=3$ ).

Thorax with pronotum dark brown laterally, white dorsally. Mesonotum dark brown with paler caudal margin, some specimens paler dorsally. Tegmina brown, veins concolorous; venation normal (not reticulate), often obsolete; becoming obsolete before distal margin; with broad white distal transverse band.

Legs with tibiae not expanded, front tibia width 0.08-0.09 (0.09,  $n=3$ ); legs mostly deep stramineus, with dark foveae; apices of tibiae and tarsi paler, brown at tarsal claws. Calcar length 0.27-0.29 (0.28,  $n=3$ ), number of calcar teeth 10 ( $n=3$ ).

Abdomen dark brown to piceus, immaculate.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 48) cyphosomatic in cross-section, dark brown, paler on posterior margin, ventrad of median processes and anal segment; excavated laterad of lateral processes. Median processes 1/4 length of parameres, slightly converging, sharply acute apically with angled base. Lateral processes small, wider than tall, just ventrolaterad of median processes. Parameres short, flattened, widest near middle and cupped into acute medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 48) strongly flattened laterally, with 2 retrose processes: distal retrose process expanded broad, flattened, blade-like; 2nd fine. Anal processes reaching base of parameres or nearly so, received in concavities laterad of lateral processes.

**Remarks.** *Pissonotus melanurus* and *P. delicatus* have similar parameres and short median processes. *Pissonotus melanurus* can be identified by its dark brown body with the head and dorsal part of pronotum paler and the aedeagus with the distal retrose process expanded and blade-like (bifid in *P. delicatus*). The coloration of *P. delicatus* varies greatly, and some specimens

have features similar to *P. melanurus*. *Pissonotus abdominalis* and 2 new species, *P. brevistilus* and *P. spatulatus*, are the only other species with very short median processes. *Pissonotus spatulatus* has spatulate parameres, *P. brevistilus* has very conspicuous, pale frontal carinae; *P. abdominalis* has stramineous antennae and usually has a broad, pale middorsal abdominal band (of varying width) and parameres with dorsally directed apices.

Wilson and Tsai (1991: 242) noted that *P. melanurus* and *P. delicatus* both feed on *Grindelia* spp. and may be part of a sibling species complex (see *Remarks* of *P. delicatus*). Wilson et al. (1994) (Appendix 2) incorrectly attributed this species to Morgan and Beamer (1949).

**Recorded Hosts.** *Grindelia camporum* Greene, *Grindelia* sp. (Asteraceae).

**Distribution.** UNITED STATES: California.

**Type Material.** *Pissonotus delicatus melanurus* Van Duzee, 1917b, holotype ( $\sigma^b$ , CASC #378) "San Joaquin/Co. Cal. #2a/30/31-V-17" "W. M. Giffard/Collector." Paratypes (*Pissonotus delicatus melanurus*). **California:** same as holotype (CASC, 13b $\sigma$ , 42b $\rho$  on 35 pins; 95-152m $\sigma$ , 95-152x $\rho$ ; Giffard genitalia mount #7<sup>th</sup> [on pin] and slide #7<sup>th</sup> ser. VII).

**Other Material Examined.** **United States:** CALIFORNIA: San Joaquin Co., Livermore (sic, Alameda Co.); 2-VI-1920, on *Grindelia* sp., W. M. Giffard (CASC, 1b $\sigma$ , 1b $\rho$ ); Dixon, 3-VI-1920, on *Grindelia*, W. M. Giffard & E. P. Van Duzee (CASC, 2b $\rho$ ); Tracy, 2-VI-1920, on *Grindelia* sp. (CASC, 11b $\sigma$ , 12b $\rho$  plus 46b $\rho$  on 12 pins); Contra Costa Co., Antioch, 2-IX-1969, COB (LOBC, 1b $\rho$ , 2b $\sigma$ ; 95-153a $\rho$ , 95-152y $\sigma$ , 95-152z $\sigma$ ).

*Pissonotus paraguayensis* Bartlett, new species  
(Figs. 49, 77)

**Type Locality.** PARAGUAY: Puerto Presidente Stroessner.

**Diagnosis.** *Brachypter*. Body very dark brown. Frons immaculate with concolorous carinae, paler dorsally, epistomal margin with transverse white band. Vertex usually paler than frons, variable in extent. Antennae stramineous, with dark brown anterior highlight. Tegmina brown, venation obscure, with or without distal transverse band. Male pygofer with median processes flattened, apices acute and slightly diverging. Aedeagus with 5 short retrose processes.

**Description.** *Brachypter*. Body length  $\sigma$  1.80–2.00 (1.90,  $n=2$ ),  $\rho$  2.50–2.52 (2.51,  $n=2$ ). Body lustrous, dark brown (Fig. 77).

Head with frons immaculate (Fig. 77), dark brown, usually paler dorsally, carinae concolorous; epistomal margin of frons with transverse white band, following subgenal sulci laterally, reaching procoxae. Vertex color variable, either mostly brown with carinae and anterior margin paler or extensively pale (including portions of frons). Postclypeus very dark brown, anteclypeus paler. Antennae stramineous with dark brown longitudinal anterior highlight, antennal segment I 0.17–0.18 (0.18,  $n=2$ ); II 0.28–0.31 (0.30,  $n=2$ ); ratio I/II 0.59 ( $n=2$ ).

Thorax with pronotum very dark brown, caudal margin paler; mesonotum

very dark brown. Tegmina brown, veins concolorous with membrane, obscure; venation normal (not reticulate), with or without white transverse band on distal margin.

Legs with tibiae not expanded, front tibia width 0.07 ( $n=2$ ); legs stramineous except foveae, basal half of coxae and tarsal claws. Calcar length 0.33 ( $n=2$ ), number of calcar teeth 12–13 (13,  $n=2$ ).

Abdomen dark brown, immaculate, middorsal carina paler.

*Macropter*. Unknown.

**Male Genitalia.** Pygofer (Fig. 49) cyphosomatic in cross-section, with concavity laterad of lateral processes, dark brown, paler dorsally and ventrally. Median processes stout, simple, shorter than parameres; slightly flattened and diverging into acute dorsally projecting apices. Lateral processes vestigial. Parameres flattened, diverging, widest basally, gradually narrowed and cupped forward into rounded, medially directed apices. Genital diaphragm vestigial. Aedeagus (Fig. 49) strongly flattened laterally; with 5 relatively, simple retrose processes. Anal processes reaching base of median processes, received in concavities laterad of lateral processes.

**Remarks.** *Pissonotus paraguayensis* resembles *P. minutus*, *P. lactofascius*, *P. spatulatus* n. sp., *P. agrestis*, *P. merides*, and *P. paludosus*. *Pissonotus minutus*, *P. lactofascius*, and *P. spatulatus* differ in having dark brown antennae and tegmina with a distal white transverse band. *Pissonotus agrestis*, *P. merides*, and *P. paludosus* differ in having a white transverse band on the caudal margin of their pronotum and distal margin of their tegmina.

The Brazilian male has a white transverse band on the distal margin of the tegmina. The male holotype from Paraguay and the female paratype from Brazil both lack this distal band. The Bolivian female, tentatively included here, is generally paler and has a narrow transverse band on the distal margin of the tegmina. Both female specimens from Paraguay have more extensive pallid markings than the holotype. The Paraguayan paratype has the vertex and the dorsal third of the frons brownish orange; the Brazilian female has the vertex, frons and postclypeus brownish orange, but retains the white transverse band on the epistomal margin and the dark brown longitudinal highlight on the anterior of the antennae.

**Recorded Hosts.** None.

**Distribution.** Southcentral South America. BRAZIL: Minas Gerais. PARAGUAY. Also apparently BOLIVIA: Santa Cruz.

**Type Material.** *Pissonotus paraguayensis*, holotype ( $\sigma^b$ , LOBC [affiliated with CASC]; 96-41e $\sigma$ ): "PARAGUAY, Puerto/Pres. Stroessner/ X-8-1968 at night/ C. W. & L. O'Brien." Paratypes: Paraguay: 3 km E Ypacarai, 7-X-1968, at night, L&COB (LOBC, 1b $\rho$ ). **Brazil:** MINAS GERAIS: Carmo do Rio Claro, I-1978 (TAMU, 1b $\rho$ , 1b $\sigma$ ; 96-36c $\sigma$ ).

**Other Material Examined.** Paraguay: 3 km E Ypacarai, 7-X-1968, night, L&COB (LOBC, 1b $\rho$ ). Bolivia: SANTA CRUZ, 10 mi W Portachuelo, 19-IV-1978, night, L&COB (LOBC, 1b $\rho$ ).

### Species Excluded from *Pissonotus*

The following 9 species are removed from the genus *Pissonotus* based on features of the male genitalia—*P. absenta* Caldwell, 1951 (Caldwell and Martorell 1951, species attributed to first author); *P. belemensis* Muir, 1926; *P. equadorensis* Muir, 1926; *P. brazilensis* Muir, 1926; *P. megalostylus* Muir, 1919; *P. haywardi* Muir, 1929; *P. nigradorsum* Metcalf, 1923; *P. substitua* (Walker 1851) and *P. pylaon* (Kirkaldy 1907) (Tables 6–7). These species are removed from *Pissonotus* because none of them has median processes on the male pygofer; most lack anal processes or have these closely approximated, or have an aedeagus that is rounded in cross-section. Specimens of all these species were examined, including the holotypes of *P. absenta*, *P. haywardi*, and *P. nigradorsum*, the lectotype of *Delphax substitua* Walker, 1851, and paratypes of *P. equadorensis* and *P. brazilensis*.

*Pissonotus belemensis*, *P. equadorensis*, *P. brazilensis*, and *P. megalostylus* are better placed in the genus *Euides* Fieber, 1866. *Pissonotus pylaon* is better placed in the genus *Terithron* Fennah, 1965 (based in part on a note by M. Asche with the BPBM specimens). *Pissonotus haywardi*, *P. nigradorsum*, and *P. substitua* are not *Pissonotus* but will not be placed at this time (*P. substitua* also does not belong in *Delphax* Fabricius, 1798 (s.s.) where it was originally described). *Pissonotus nigradorsum* had already been placed in incertae sedis by Morgan and Beamer (1949) on the basis of Metcalf's (1923) description. The holotype of *P. nigradorsum* had been misplaced and was found during this study; this type, now at NCSU, will be placed on indefinite loan to the USNM. The holotypes of *P. belemensis*, *P. megalostylus*, *P. equadorensis*, *P. brazilensis*, and *Delphax pylaon* Kirkaldy, 1907, are at the BPBM; the lectotypes of *Delphax substitua* (and *D. vicaria* Walker, 1851, a synonym) and *P. haywardi* are at the BMNH.

*Pissonotus absenta* was described based only on the hind legs and male genitalia of a single specimen from Puerto Rico (Caldwell and Martorell 1951: 167). A 2nd male from Mexico (San Luis Potosí, El Naranjo, 2-I-1959, RHB, SEMC) was located during this study. Unfortunately, the 2nd specimen was headless and its abdomen, except the genitalia, was discarded by a previous researcher. The pronotum and mesonotum of the specimen are brown with portions of the carinae and hind margins paler. The lateral carinae of the pronotum nearly reach the caudal margin. The specimen is brachypterous with shiny brown tegmina, the veins are concolorous, with seta-bearing tubercles, and the distal and trailing (claval) margin is white, except for a brown spot near the apices of the trailing margins. The anal segment of *P. absenta* lacks processes. The pygofer has 2 pairs of dorsocaudally directed processes on the caudal margin: 1 pair located just ventrad of the anal segment, the 2nd pair on the lateral aspect of the ventral margin. These processes do not appear to be homologous with the median processes of *Megamelus* and *Pissonotus*. This species appears to belong near *Phrictopyga* Caldwell, 1951, but is not part of that genus based on the male genitalia. *Pissonotus absenta* probably belongs in a new genus, but until at least 1 complete specimen is found, we feel it most appropriate to refer this species to incertae sedis. The holotype of *P. absenta* is at the USNM.

## Phylogenetic Analysis of *Pissonotus*

### Taxa, Characters, and Codings

All 43 species of *Pissonotus* plus an outgroup were subjected to maximum parsimony analyses. The 43 species placed in *Pissonotus* by this revision form a monophyletic group supported by the following synapomorphies of the male genitalia: the presence and form of the median processes of the pygofer; the strongly flattened aedeagus; and the anal segment with a pair of long processes that are widely separated basally, arising from the ventrocaudal angles. Other possible synapomorphies of *Pissonotus* include flattened parameres that are cupped into medially directed apices, the lateral processes of the pygofer, a weak genital diaphragm, and a dark chestnut postclypeus; but these features are variable within *Pissonotus*, and their absence would need to be interpreted as a derived feature for them to be considered as generic synapomorphies.

The phylogenetic relationships within the tribe Delphacini are unresolved, precluding the choice of a known close relative as an outgroup. The genus *Megamelus* Fieber, 1866, was chosen because it has median pygofer processes and the median frons carina of structure similar to *Pissonotus*, and lacks an oviduct gland, a feature considered primitive in the Delphacini (Strübing 1956a, b). Based on an examination of *P. binotatus*, *Pissonotus* also lacks the oviduct gland, suggesting that it too is a relatively primitive genus in the Delphacini. Additional outgroups may have been desirable to place *Pissonotus* within the broader context of delphacid phylogeny, but the intended purpose of these analyses was to suggest hypotheses to describe the intrageneric relationships of *Pissonotus*. The use of *Megamelus* as an outgroup provided both a root for *Pissonotus* and character polarization for clearly homologous comparisons between the 2 genera. Homology is less apparent with several possible alternative outgroups within Delphacini.

The data set comprised 46 characters (29 binary, 17 multistate; Table 2). *Megamelus metzaria* Crawford was used as a template to code characters for the genus *Megamelus*, but the coded character states were edited based on specimens of other species and on Beamer's 1955 revision to reflect that genus as a whole. All character states were treated as unordered except those marked

Table 2. Data matrix for cladistic analyses of *Pissonotus*

Taxa	1-10	11-20	21-30	31-40	41-46
<i>Megamelus abdominalis</i>	4121?1(13)112	22?2221(12)	221214??12	2?(12)?22???	??11(12)
<i>abdominalis</i>	211111112	2211221112	?232111211	1321221131	111221
<i>agrestis</i>	211112112	122122112?	?212111211	1121121152	221221
<i>albivultus</i>	2111212122	122222112?	?2(12)1111321	12211212?1	?21221
<i>albovenosus</i>	4111312132	124221221(12)	3212111211	11211211(12)?	221221
<i>aphidoides</i>	4111311132	114221222?	?222111111	11211212?1	?21121
<i>aquilonius</i>	2(12)1111112	122122112?	?222121211	1121121141	221321
<i>basalis</i>	212111112	112122112?	?2(12)3221(24)11	1121121111	12122(12)
<i>binotatus</i>	(23)121112212	121122112?	?222111311	1121121151	2212?1
<i>boliviensis</i>	211111112	221122(12)(12)2?	?2(12)2(12)2121	113212211	(12)1122221
<i>brevistilus</i>	2111212112	122222112?	?232112?21	1221121111	221221
<i>brunneus</i>	2111112122	1232212211	3212112?12	11221212?1	?22321
<i>canadensis</i>	212111112	121122112?	?211111222	1121121111	222322
<i>concolor</i>	211111112	121122222?	?211111221	112(12)?21141	221322
<i>delicatus</i>	3121112212	121122112?	?232111311	11211211(23)1	121221
<i>dentatus</i>	211111112	(12)21122112?	?2(12)2111211	1321221131	(12)11221
<i>decussatus</i>	2111212112	122222112?	?221112?21	12211212?1	?21221
<i>divergens</i>	1321112212	121122222?	?223111211	1122121141	221221
<i>dorsalis</i>	(24)12111112	1211221112	?211121421	1122121141	122322
<i>festucae</i>	2111112112	122122112?	?212111111	1122121131	221321
<i>flabellatus</i>	4111311132	1122221111	321(12)112?11	1121121131	221121
<i>frontalis</i>	4111312231	1242212211	32(12)2121(12)11	1421221141	22122(12)

Table 2. Continued

Taxa	1-10	11-20	21-30	31-40	41-46
<i>guttatus</i>	311111112	122122112?	?211111(23)11	11211211(23)1	222221
<i>jamaicensis</i>	2111212122	123222112?	?222111211	1122121131	121221
<i>lactofascius</i>	2111112112	121122112?	?212111311	11211211(45)1	221221
<i>marginatus</i>	212111112	121122(12)(12)2?	?21313122(12)	1121121111	222322
<i>melanurus</i>	2121112212	121122112?	?232111311	1121121121	221221
<i>merides</i>	21(12)111(12)112	122122112?	?211111211	1121121141	121(23)?1
<i>minutus</i>	2111112112	121122112?	?212111311	11211211(23)1	221321
<i>muri</i>	211111112	(12)22122112?	?2(12)2111412	1121121141	121221
<i>neotropicus</i>	2111112(12)12	114221(12)(12)2?	?212111212	112?121141	121221
<i>niger</i>	13211121(12)2	121122222?	?211222?11	11211111(12)1	221322
<i>nigriculus</i>	13211121(12)2	121122222?	?211222?11	1121121131	221322
<i>nitens</i>	222111112	112122112?	?212311411	1121121111	221221
<i>paludosus</i>	212111112	122122112?	?222121211	1121121121	222221
<i>paraguayensis</i>	211(12)113212	121122(12)(12)2?	?2(12)2111311	1121121151	221221
<i>piceus</i>	211111112	221122111(12)	3212111211	13222211(34)1	121221
<i>quadripustulatus</i>	(34)111321132	1242(12)12211	21(12)2111311	1122121141	221221
<i>radiolus</i>	212111112	121122112?	?211111411	1121121111	222121
<i>rubrilatus</i>	2111112112	121122222?	?211111411	1122121141	22?322
<i>spatulatus</i>	2111112112	122122112?	?232111411	1531121131	111221
<i>spooneri</i>	211111112	112122112?	?212311(23)11	11211212?1	?21221
<i>tessellatus</i>	4111321131	1142112211	42(12)2111211	11211211(34)1	221221
<i>tumidus</i>	4111311131	11422322(12)1	321(12)111111	1121121141	22122?

Missing and inapplicable values are indicated by question marks, multistate values are in parentheses.

with an asterisk below (\*). Taxa that were polymorphic for a character were treated as uncertain with respect to that feature (for example, coded as having states A or B or C, rather than "polymorphic" or having A and B and C, with respect to that feature). Because the genus *Pissonotus* is rather uniform in regard to structural features, many characters coded here pertain to the presence or absence of color patterns. Color is often highly variable, and the use of color patterns (as opposed to structural features) in phylogenetic analyses may be less than ideal. Nevertheless, the distribution of certain color patterns indicated a potentially useful phylogenetic signal, and an adequate number of informative structural features was not available to preclude the use of these characters. Techniques beyond light microscopy (e.g., scanning electron microscopy, cuticular hydrocarbons, or molecular techniques) may prove necessary to provide additional characters to improve phylogenetic resolution, but such techniques were beyond the scope of the current project.

### CHARACTERS

1. General body color: (1) solid dark brown to black; (2) brownish red to dark brown; (3) light brown to stramineus; (4) variegated.

#### Head

2. Color of postclypeus and front coxae: (1) with transverse dark brown band; (2) pale, without dark band; (3) uniformly dark brown.
3. Epistomal margin of frons: (1) with white band; (2) without white band.
4. Color of postclypeus: (1) dark chestnut brown; (2) stramineus to brown; (3) brown with pale carinae.
5. Frons: (1) immaculate (uniformly colored); (2) with conspicuous paler carinae; (3) maculated.
6. Shape of antennal segment I (cross-section): (1) terete; (2) flattened.
7. Color of antennal segment I: (1) uniformly stramineus; (2) uniformly dark brown; (3) mostly stramineus with irregular darker markings; (4) stramineus with brown anterior highlight.
8. Color of antennal segment II: (1) without anterior brown highlight; (2) with anterior brown highlight.
9. Color of vertex: (1) unicolorous; (2) carinae pale; (3) maculated.
10. Posterior foveae of vertex with two distinct, round, brown dots: (1) present; (2) absent.
11. Development of vertex: (1) not produced in front of eyes; (2) produced in front of eyes.

#### Thorax

12. Development of front tibiae: (1) expanded laterally; (2) not expanded.
13. Color of pronotum: (1) unicolorous; (2) with white caudal transverse band; (3) with pale carinae; (4) variegated.
14. Color of mesonotum: (1) unicolorous; (2) variegated.
15. Tegmina venation: (1) densely reticulate; (2) not reticulate.

16. Color of tegminal veins: (1) pale on brown (or clear) membrane; (2) concolorous with membrane; (3) brown on clear membrane.
17. Extent of tegminal veins: (1) not reaching distal margin; (2) extending to distal margin.
18. Distal margin of tegmina: (1) with white transverse bands; (2) without white transverse bands.

#### Abdomen and Male Genitalia

19. Dorsal abdominal markings: (1) present; (2) absent.
20. Form of abdominal marking: (1) maculae (spots); (2) broad middorsal stripe.
21. Number of maculae on each side of abdominal segment VII: (1) one; (2) two; (3) three; (4) four.
22. Abdominal segment VII with 4 dark brown tubercles dorsolaterally: (1) present; (2) absent.
- \*23. Length of median processes: (1) equal to or longer than parameres; (2) one-half length of parameres; (3) one-fourth or less length of parameres.
- \*24. Orientation of median processes: (1) parallel; (2) converging; (3) diverging.
25. Form of median processes: (1) simple; (2) with broad lateral shelf; (3) with median hump or flange.
26. Median processes in cross-section: (1) angular in cross-section, sharply pointed apically; (2) flattened, rounded apically; (3) angular, falcate in cross-section, pointed apically; (4) inflated and apically blunt.
27. Lateral processes: (1) present; (2) absent.
28. Height of lateral processes: (1) twice as tall as wide or more; (2) as tall as wide; (3) wider than tall; (4) wider than tall and conspicuously flattened.
29. Lateral margins of pygofer: (1) without posteriorly directed lobe; (2) with large posteriorly directed lobe.
30. Small central tooth on pygofer: (1) absent; (2) present.
31. Form of parameres: (1) flattened; (2) robust.
32. Apex of parameres: (1) rounded and curled distally; (2) angular (apex abruptly bent medially); (3) blunt (usually dorsally directed); (4) broad with lateral points; (5) spatulate.
33. Curvature of paramere: (1) flat; (2) cupped forward; (3) cupped backward.
34. Inside margin of parameres: (1) without subterminal tooth; (2) with subterminal tooth.
35. Orientation of paramere apices: (1) medially or laterally directed; (2) dorsally directed.
36. Male pygofer with large ventral flap: (1) present; (2) absent.
37. Aedeagus in cross-section: (1) laterally flattened; (2) terete.
38. Retrose processes on aedeagus: (1) present; (2) absent.
39. Number of retrose processes: (1) one; (2) two; (3) three; (4) four; (5) five or more.

40. Aedeagus with lateral flange of retrose processes: (1) absent; (2) present.  
 41. Apical retrose process(es): (1) toothed or bifid; (2) simple.  
 42. Lateral teeth near apex of aedeagus: (1) present; (2) absent.  
 43. Dorsal teeth on aedeagus (near midlength): (1) absent; (2) present.  
 \*44. Length of processes of anal segment: (1) short, not reaching parameres; (2) reaching parameres, but not extending beyond paramere base; (3) extending beyond paramere base.  
 45. Pygofer with concavity laterad of lateral processes: (1) absent; (2) present.  
 46. Curvature of processes of anal segment: (1) straight (or essentially so); (2) curved.

### Methods

The DELTA computer program (Dallwitz 1980, Dallwitz et al. 1993) was used to organize the data, including output of Nexus data sets for use in PAUP version 3.1.1 (Swofford 1993) for maximum parsimony analysis. The phylogenetic analysis was performed using the PAUP heuristic search algorithm option with tree connection re-bisection branch-swapping. Character states were optimized using the accelerated transformation (ACCTRAN) option. In the initial analysis, all characters were treated as having equal weights. In subsequent analyses, the characters were weighted by their consistency index. To do this, PAUP assigns each character a weight from 0 to 1,000 based on the consistency index (CI). The characters were successively weighted and data reanalyzed until the tree topologies and character weights stabilized (Farris 1969). MacClade (Maddison and Maddison 1992) was used to examine the character distribution on selected trees.

### Results and Discussion

A heuristic search with character state changes weighted equally provided 566 equally parsimonious trees (179 steps, CI = 0.385, Retention Index = 0.630). The strict consensus tree is shown in Fig. 93. One example minimum length tree is shown in Fig. 94. Apomorphies supporting the tree in Fig. 94 are listed in Table 3. The consensus tree (Fig. 93) shows the following clades, informally named as follows: (1) the *albivultus* clade, (2) the *piceus* clade, (3) the *marginatus* clade, (4) the *delicatus* clade, (5) the *spooneri* clade, and (6) the *tessellatus* clade.

1. The *albivultus* clade. This clade consists of the species *P. albivultus*, *P. jamaicensis*, *P. brevistilus*, and *P. decussatus*. It is supported principally by the nonhomoplasious character of *frons* with *conspicuous pale carinae* (character 5, state 2), but also by *mesonotum variegated* (14, 2).

2. The *piceus* clade. This clade consists of the *P. piceus* species complex (*P. piceus*, *P. abdominalis*, *P. dentatus* and *P. boliviensis*). It is supported by *vertex produced in front of the eyes* (11, 2), *pronotum unicolorous* (13, 1), the nonhomoplasious character *paramere apices blunt* (32, 3), and *paramere apices directed dorsally* (35, 2).

3. The *marginatus* clade consists of the species *P. radiolus*, *P. canadensis*, *P. marginatus*, *P. dorsalis*, *P. concolor*, *P. rubrilatus*, *P. niger*, *P. nigriculus*,

Table 3. List of apomorphies for Fig. 94 (tree 43 of 566)

Node	Subtending apomorphies	Node	Subtending apomorphies
55	1(2), 7(2), 19(3)	<i>quadripustulatus</i>	6(1), 22(1)*, 28(3)
54	5(3), 9(3), 30(1), 41(2)	<i>tessellatus</i>	6(2), 15(1)*, 21(4)
53	21(3), 34(1)	<i>tumidus</i>	16(3)*
52	7(2)	<i>aphidioides</i>	10(2), 23(2), 38(2), 44(1)
51	12(1)	<i>flabellatus</i>	27(2), 39(3), 44(1)
50	13(2), 16(2)*, 17(1), 18(1)	<i>albivultus</i>	9(2), 27(1)
49	1(2), 5(1), 9(1), 14(1), 19(2), 20(2)*	<i>decussatus</i>	
48	26(3), 39(1)	<i>brevistilus</i>	23(3)
47	3(2), 28(4)	<i>jamaicensis</i>	9(2), 13(3), 34(2)
46	12(2)	<i>spatulatus</i>	23(3), 28(4), 32(5)*, 33(3)*, 42(1)
45	7(2), 39(5)	<i>abdominalis</i>	23(3)
44	13(1), 39(5)	<i>piceus</i>	23(1), 34(2), 42(2)
43	39(3), 44(3)	<i>dentatus</i>	
42		<i>boliviensis</i>	26(2), 39(1,2), 43(2)
41	8(2), 23(2)	<i>muii</i>	28(4), 30(2)
40	3(2)	<i>aquilonius</i>	44(3)
39	23(3), 39(2)	<i>paludosus</i>	3(2), 39(2)
38		<i>radiolus</i>	28(4), 44(1)
37	24(1)	<i>canadensis</i>	
36	39(1), 43(2)	<i>marginatus</i>	24(3), 26(3)
35	3(2), 13(1)	<i>dorsalis</i>	19(1), 26(2), 28(4), 41(1)
34	29(2), 44(3), 46(2)	<i>concolor</i>	
33	34(2), 39(4)	<i>rubrilatus</i>	28(4)
32	3(1), 17(2), 18(2), 43(1)	<i>niger</i>	36(1)*
31	7(2), 29(1)	<i>nigriculus</i>	39(3)
30	1(1), 2(3)*, 3(2)	<i>divergens</i>	8(2), 23(2), 24(3), 44(2), 46(1)
29		<i>guttatus</i>	1(1), 39(2,3)
28	25(2), 26(2), 27(2), 34(1), 39(1)	<i>merides</i>	41(1)
27	30(2)	<i>agrestis</i>	40(2)*
26	23(2)	<i>paraguayensis</i>	7(3)
25	26(2)	<i>binotatus</i>	
24	41(1)	<i>delicatus</i>	1(3), 41(1)
23	39(3)	<i>melanurus</i>	
22	11(2), 13(1), 32(3)*, 35(2)	<i>lactofascius</i>	
21	42(1)	<i>minutus</i>	
20	19(1)	<i>festucae</i>	13(2), 28(1), 34(2)
19	7(2)	<i>basalis</i>	24(3), 25(2), 26(2), 41(1)
18	5(2), 14(2)	<i>nitens</i>	2(2)
17	27(2), 28(3), 29(2), 32(2)*,		
16	39(1), 41(2)	<i>spooneri</i>	38(2)
15	24(1), 38(2)	<i>albovenosus</i>	39(1,2)
14	10(1)	<i>frontalis</i>	8(2), 10(1), 26(2), 32(4)*, 35(2)
13	19(2), 28(1)	<i>neotropicus</i>	19(2), 12(1)
12		<i>brunneus</i>	9(2), 11(3), 27(2), 38(2), 43(2), 44(3)

Characters are listed with states in parentheses; nonhomoplasious changes are marked by an asterisk (\*).



and *P. divergens*. This clade is supported by *epistomal margin of the frons without a white band* (3, 2) and *pronotum unicolorous* (13, 1).

4. The *delicatus* clade consists of *P. delicatus*, *P. binotatus*, *P. melanurus*,

Characters are listed with states in parentheses; nonhomoplasious changes are marked by an asterisk (\*).

and *P. paraguayensis*. This clade is supported by *antennal segment II with brown longitudinal anterior band* (8, 2) and *median processes one-half length of parameres* (23, 2).

5. The *spooneri* clade is composed of *P. spooneri*, *P. basalis*, and *P. nitens*. This clade is supported by *epistomal margin of frons with a white transverse band* (3, 2), and *lateral processes wider than tall and conspicuously flattened* (28, 4).

6. The *tessellatus* clade consists of *P. tessellatus*, *P. tumidus*, and *P. aphidioides*. It is supported by the character *posterior foveae of vertex with two distinct round brown dots* (10, 1).

A strong feature of this tree is that node 80 (Fig. 94) is supported by the nonhomoplasious character *color of tegminal veins, concolorous with membrane* (16, 2), and the node that follows after the branching of *P. flabellatus* is supported by the phylogenetically strong character *frons pattern immaculate* (5, 1; CI = 0.667). These 2 characters are important in all the analyses.

Weighting by the character consistency index yielded the character weights given in Table 4. A heuristic search gave 54 equally parsimonious trees. The consensus tree is given in Fig. 95 (length 70,130 steps, CI = 0.532, RI = 0.711).

Table 4. Character weights for Figs. 95 and 96 assigned by PAUP consistency index weighting

Char. no.	Wt.	Char. no.	Wt.	Char. no.	Wt.
1	600	17	500	33	1000
2	1000	18	500	34	167
3	167	19	200	35	500
4	1000	20	1000	36	1000
5	667	21	667	37	1000
6	500	22	1000	38	250
7	333	23	222	39	286
8	333	24	286	40	1000
9	400	25	667	41	143
10	500	26	375	42	500
11	500	27	200	43	250
12	333	28	273	44	222
13	429	29	333	45	1000
14	500	30	333	46	500
15	1000	31	1000	—	—
16	1000	32	1000	—	—

Table 5. List of apomorphies for Fig. 96 (tree 2 of 54)

Node	Subtending apomorphies	Node	Subtending apomorphies
85	7(2), 20(3)	<i>quadripustulatus</i>	6(1), 9(3), 22(1)*, 28(3)
84	1(2), 5(1), 19(2), 44(3)	<i>tessellatus</i>	6(2), 15(1)*, 21(4)
83	30(2), 41(1)	<i>tumidus</i>	16(3)*
82	13(1), 14(1), 16(2)*, 20(2)*, 24(1), 46(2)	<i>aphidioides</i>	19(2), 23(2), 38(2)
81	1(1), 2(3)*, 3(2)	<i>flabellatus</i>	13(2), 16(2)*, 17(1), 18(1), 27(2)
80	25(2), 26(2), 27(2), 34(1), 39(1)	<i>albivultus</i>	9(2), 27(1)
79		<i>decussatus</i>	
78	7(1), 29(2)	<i>brevistilus</i>	23(3)
77	3(2), 17(1), 18(1), 43(2)	<i>jamaicensis</i>	9(2), 13(3), 28(2), 34(2)
76	34(1), 39(1)	<i>spatulatus</i>	23(3), 28(4), 32(5)*, 33(3)*, 42(1)
75	30(2)	<i>abdominalis</i>	23(3)
74	29(1), 44(2), 46(1)	<i>piceus</i>	34(2)
73	3(1), 24(2)	<i>dentatus</i>	19(2)
72	11(2), 32(3)*, 35(2), 41(1)	<i>boliviensis</i>	26(2)
71	19(1), 39(3), 43(1)	<i>muiri</i>	28(4), 30(2)
70	23(2), 42(1)	<i>aquilonius</i>	44(3)
69	13(2)	<i>paludosus</i>	3(2), 39(2), 43(2)
68	43(1)	<i>radiohus</i>	28(4), 44(1)
67	12(1), 25(3)	<i>canadensis</i>	
66	3(2), 28(4)	<i>marginatus</i>	24(3), 26(3)
65	39(4)	<i>dorsalis</i>	19(1), 26(2), 28(4), 41(1)
64		<i>concolor</i>	
63	41(1)	<i>rubrilatus</i>	28(4)
62	23(2), 26(2)	<i>niger</i>	36(1)*
61	7(2), 39(5)	<i>nigriculus</i>	39(3)
60	28(3)	<i>divergens</i>	8(2), 23(2), 24(3), 44(2), 46(1)
59	13(1)	<i>guttatus</i>	1(1), 24(1), 39(2,3)
58	8(2), 23(2)	<i>merides</i>	24(1)
57	3(2)	<i>agrestis</i>	40(2)*
56	23(3), 39(2)	<i>paraguayensis</i>	7(3)
55	39(3)	<i>binotatus</i>	
54	44(3)	<i>delicatus</i>	1(3), 41(1)
53	23(2), 41(1)	<i>melanurus</i>	
52	5(2), 14(2)	<i>lactofascius</i>	
51	27(2), 29(2), 32(2)*, 39(1), 41(2)	<i>minutus</i>	13(1)
50	24(1), 38(2)	<i>festucae</i>	28(1), 34(2)
49	9(3), 34(1)	<i>basalis</i>	24(3), 25(2), 26(2), 41(1)

Table 5. Continued

Node	Subtending apomorphies	Node	Subtending apomorphies
48	10(1)	<i>nitens</i>	2(2)*
47	7(1), 12(1)	<i>spooneri</i>	38(2)
46	28(1)	<i>albovenosus</i>	39(1,2)
45	10(2), 39(3), 44(1)	<i>frontalis</i>	8(2), 26(2), 32(4)*, 35(2)
		<i>neotropicus</i>	12(1), 44(2)
		<i>brunneus</i>	9(2), 13(3), 19(1), 27(2), 38(2), 43(2)

Characters are listed with states in parentheses; nonhomoplasious changes are marked by an asterisk (\*).

With weights reset to 1, these trees have lengths of 180. A representative tree from this analysis is given in Fig. 96, with its apomorphy list in Table 5. These trees have better topological resolution than the earlier trees with weights set at 1. The *albivultus*, *delicatus*, *piceus*, and *spooneri* clades were all present with the same taxonomic composition. The *albivultus* and *delicatus* clades also were supported by the same characters. The *piceus* clade lost *pronotum unicolorous* (13, 1) as support, but gained *apical retrose process toothed or bifid* (41, 1). The *spooneri* clade support changed to *front tibiae expanded laterally* (12, 1) and *median processes with median hump or flange* (25, 3). The *marginatus* clade was not supported. The *tessellatus* clade was reorganized to include *P. flabellatus*, *P. frontalis*, and *P. albovenosus*, and was supported by *vertex maculated* (9, 3) and *inside margin of parameres with subterminal tooth* (34, 2).

Also of particular interest, node 84 is supported by *frons immaculate* (CI=0.667) and node 82, which follows after the branching of "*brunneus* + *neotropicus*," is supported by 6 characters, including 2 nonhomoplasious characters *tegmina veins concolorous with membrane* (16, 2) and *abdominal marking, broad middorsal stripe* (20, 2). The tree shown in Fig. 96 is the preferred phylogenetic estimate and is followed for the arrangement of taxa in this work. This tree provides an arrangement that places most morphologically similar species in close proximity on the tree. Minor rearrangements were made in the taxonomic treatment for comparative purposes.

In the analyses presented thus far, the previously recognized subgenera of *Pissonotus* were not monophyletic units. When the subgenera *Pissonotus* and *Phyllodictus* were constrained to be monophyletic, a heuristic search with character weights set at 1 found 25,228 trees of length 187 steps (CI = 0.370, RI = 0.343). A consensus tree of 10,000 of those trees is given in Fig. 97. These trees are 8 steps longer than the trees found without constraining the subgenera to be monophyletic. Successively weighting by consistency indices resulted in 418 trees of length 69,008 steps (189 steps with weights set at 1, CI = 0.522, RI = 0.698). Fig. 98 shows the consensus for the successively weighted analysis.

All the analyses performed provided support for a number of clades and an

overall topology within the genus *Pissonotus*. Near the base of the tree are those taxa with *maculated frons* (5, 2) and *tegmina venation paler than membrane* (16, 1; *P. quadripustulatus*, *P. albovenosus*, *P. frontalis*, *P. tessellatus*, *P. tumidus*, *P. aphidioides*, and *P. flabellatus*), followed by *P. brunneus* and *P. neotropicus*, which have a concolorous frons, but pale venation. A *maculated frons* and *pale tegminal venation* reaching the distal margin of the tegmina would appear to be plesiomorphic character states for the genus *Pissonotus*. *Pissonotus flabellatus*, however, has *tegmina veins concolorous with the membranes* and a *tegmina with white distal tegminal band*. Most of these taxa (*P. tessellatus*, *P. tumidus*, *P. aphidioides*, *P. flabellatus*, and *P. neotropicus*) also have *expanded front tibiae* (12, 1) and this feature may also be a generic plesiomorphy. The apomorphies for the advanced *Pissonotus* include *frons of solid coloration*, *tegmina with veins concolorous*, and *tibiae not expanded*.

In their morphology, the species that are not consistently placed in any clade (*P. aquilonius*, *P. paludosus*, *P. merides*, *P. guttatus*, *P. agrestis*, *P. muiri*, *P. lactofascius*, *P. minutus*, and *P. festucae*) form a remarkably homogenous group. Some of these species are morphologically very similar (e.g., *P. aquilonius*, *P. paludosus*, and *P. merides*; *P. lactofascius* and *P. minutus*), but such morphological similarities are not born out in the phylogenetic analyses. The persistence of the "*minutus* + *festucae*" clade in these analyses is curious given that *P. lactofascius* is morphologically more similar to *P. minutus* than either is to *P. festucae*, and that both are much smaller than *P. festucae* (body length: *P. festucae*  $b\sigma^7=2.63$  mm, *P. minutus*  $b\sigma^7=1.46-1.53$  mm, *P. lactofascius*  $b\sigma^7=1.70-1.96$  mm).

In all trees, the previously recognized subgenera were not retained as monophyletic units. The analyses in which the subgenera were constrained to be monophyletic resulted in equally parsimonious trees that were 8 steps (or more) longer than the equally parsimonious trees without the subgenera constrained. The subgenera *Phyllodictus* and *Pissonotus* are, therefore, not recognized in this study. The consensus tree obtained for the successively weighted analysis (Fig. 98), however, was remarkably similar to the arrangement used in this work (Fig. 96). There were no other sets of distinct monophyletic lineages consistent in the cladistic analyses presented here, so no subgenera are proposed.

## Summary and Discussion

The genus *Pissonotus* contains 43 valid species, occurring from southern Canada to Argentina (Table 6, Appendices 1–7). Of the 43 valid species, 30 were previously placed in the genus (1 subspecies elevated to species level), 2 are moved into *Pissonotus* from other genera, and 11 are described as new. Also, 3 species are treated as junior synonyms – *P. exiguus* Morgan and Beamer synonymized with *P. frontalis* (Crawford); *Dicranotropis bakeri bakeri* Crawford synonymized with *P. piceus* (Van Duzee); and *Delphacodes pictifrons* Osborn synonymized with *P. piceus* (Van Duzee) – and 9 are removed from *Pissonotus* (Tables 6–7). To insure stability of nomenclature, lectotypes are designated for *P. muiri* Metcalf, 1943; *P. crawfordi* Metcalf, 1923 (a synonym of *P. basalis* Van Duzee); and *Phyllodinus koebeli* (Osborn, 1903) (a synonym of *P. flabellatus*). The *P. piceus* species complex is described and defined to include the species *P. piceus*, *P. dentatus*, *P. abdominalis*, and *P. boliviensis*; however, no subgenera are recognized for the genus.

The phylogenetic analyses suggest the presence of 6 clades within *Pissonotus*, which are reflected in the taxonomic arrangement of this revision and the phylogenetic estimate (Fig. 96; the *marginatus* clade forms a ladder in this arrangement). In all the cladistic analyses presented, a *maculated frons* and *pale tegminal venation that reaches the distal wing margin* are plesiomorphic states for the genus *Pissonotus*. *Expanded front tibiae* also may be a plesiomorphic condition.

Derivations within the genus *Pissonotus* suggested by the cladistic analyses include *frons with conspicuous pale carinae*, *tegmina with veins concolorous with membrane*, *distal margin of tegmina with white transverse band*. These analyses also suggest that the color patterns within *Pissonotus* are useful phylogenetic features. The discovery of additional features would be desirable to improve phylogenetic resolution for *Pissonotus*; however, as noted earlier, techniques in addition to light microscopy are needed to provide additional characters. One morphological possibility is that setae on the male parameres, if consistent in occurrence, may provide clues to paramere transformation within *Pissonotus*, and perhaps other Delphacini.

In the preferred phylogenetic tree (Fig. 96), most of the basal species (*P. quadripustulatus* through *P. radiolus*, but not *P. frontalis*, *P. neotropicus*, *P.*

Table 6. Checklist of names proposed or used in *Pissonotus* Van Duzee

- abdominalis** (Crawford, 1914); (*Dicranotropis*, as *D. bakeri abdominalis*); new combination and elevated to specific status.  
**absenta** Caldwell, 1951; here referred to *incertae sedis*.  
**agrestis** Morgan & Beamer, 1949.  
**albivultus** Morgan & Beamer, 1949.  
**albicollis** (Crawford, 1914); (*Megamelus*), name replaced by *muiri* Metcalf, 1943.  
**albovenosus** Osborn, 1935.  
**aphidioides** Van Duzee, 1897.  
**aquilonius** Morgan & Beamer, 1949.  
**ater** Van Duzee, 1897; referred to *marginatus* Van Duzee, 1897 by Morgan and Beamer 1949: 140–141.  
**bakeri** (Crawford, 1914); (*Dicranotropis*); here referred to *piceus* (Van Duzee, 1894b), new synonymy.  
**bakeri abdominalis** (Crawford, 1914); (*Dicranotropis*); here referred to *abdominalis* (Crawford, 1914), new combination and status.  
**basalis** Van Duzee, 1897.  
**belemensis** Muir, 1926; here referred to *Euides*, new combination.  
**binotatus** Spooner, 1912.  
**boliviensis** Bartlett, new species.  
**brazilensis** Muir, 1926; here referred to *Euides*, new combination.  
**brevistilus** Bartlett, new species.  
**brunneus** Van Duzee, 1897.  
**canadensis** Bartlett, new species.  
**concolor** Bartlett, new species.  
**crawfordi** Metcalf, 1923 (replacement name for *Dicranotropis marginatus* (Crawford, 1914); referred to *basalis* Van Duzee, 1897 by Morgan and Beamer 1949: 108–109.  
**decussatus** Bartlett, new species  
**delicatus** Van Duzee, 1897.  
**delicatus melanurus** Van Duzee, 1917b; here elevated to *melanurus* Van Duzee, new status.  
**dentatus** Morgan & Beamer, 1949.  
**divaricatus** Spooner, 1912; referred to *brunneus* Van Duzee, 1897 by Morgan and Beamer 1949: 115–117.  
**divergens** Bartlett, new species.  
**dorsalis** Van Duzee, 1897  
**equadorensis** Muir, 1926; here referred to *Euides*, new combination.  
**exiguus** Morgan & Beamer, 1949; here referred to *frontalis* (Crawford), new synonymy.  
**festucae** Bartlett, new species.  
**flabellatus** (Ball, 1902); (*Phyllodinus*).  
**foveatus** Spooner, 1912; referred to *quadripustulatus* (Van Duzee, 1909) by Metcalf 1923: 148.  
**4-pustulatus** (Van Duzee, 1897); transliterated to *quadripustulatus*.

Table 6. Continued

- frontalis** (Crawford, 1914); (*Dicranotropis*).  
**fulvus** Metcalf, 1923; referred to *piceus* (Van Duzee, 1894b) by Morgan and Beamer 1949: 137-138.  
**fuscous** Osborn, 1903; (*Phyllocladus*); referred to *flabellatus* (Ball, 1903) by Ball 1926: 19-20.  
**giffardi** Van Duzee, 1925; referred to *delicatus* Van Duzee, 1897 by Morgan and Beamer 1949: 134-135.  
**guttatus** Spooner, 1912.  
**haywardi** Muir, 1929; here referred to *incertae sedis*.  
**jamaicensis** Bartlett, new species.  
**koebeleri** Osborn, 1903; (*Phyllocladus*); referred to *flabellatus* (Ball, 1903) by Metcalf 1923: 148.  
**lactofascius** Morgan & Beamer, 1949.  
**marginatus** Van Duzee, 1897.  
**marginatus** (Crawford, 1914); (*Dicranotropis*); nec *P. marginatus* Van Duzee, 1897; replaced by *crawfordi* Metcalf, 1923; referred to *basalis* Van Duzee, 1897, by Morgan and Beamer 1949: 108-109.  
**megalostylus** Muir, 1919; here referred to *Euides*, new combination.  
**melanurus** Van Duzee, 1917b, (as *P. delicatus melanurus*); here elevated to specific status.  
**merides** Morgan & Beamer, 1949.  
**metzaria** (Crawford, 1914); (*Megamelus*); referred to *Megamelus* by Muir and Giffard (1924: 10).  
**minutus** Beamer, 1952.  
**muii** Metcalf, 1943 (replacement name for *P. albicollis* (Crawford)).  
**neotropicus** (Muir, 1926); (*Phyllocladus*); new combination.  
**niger** Morgan & Beamer, 1949.  
**nigriculus** Morgan & Beamer, 1949.  
**nigridorsum** Metcalf, 1923; referred to *incertae sedis* by Morgan and Beamer (1949: 142).  
**nitens** (Van Duzee, 1909); (*Phyllocladus*).  
**pallipes** Van Duzee, 1897; referred to *delicatus* Van Duzee, 1897 by Oman 1947: 217-218.  
**paludosus** Morgan & Beamer, 1949.  
**paraguayensis** Bartlett, new species.  
**piceus** Spooner, 1912; replaced by *spooneri* Morgan & Beamer, 1949: 104-107.  
**piceus** (Van Duzee, 1894b); (*Megamelus*).  
**pictifrons** (Osborn, 1938); (*Delphacodes*) here referred to *P. piceus* (Van Duzee), new synonymy.  
**pylaon** (Kirkaldy, 1907); (*Delphax*); here referred to *Terthron*, new combination.  
**quadripustulatus** (Van Duzee, 1909); (*Stobaera*).  
**radiolus** Bartlett, new species.  
**rubrilatus** Morgan & Beamer, 1949.

Table 6. Continued

- spatulatus** Bartlett, new species.  
**speciosus** Metcalf, 1923; referred to *Delphacodes andromeda* (Van Duzee, 1907) by Morgan and Beamer (1949: 142).  
**spooneri** Morgan & Beamer, 1949 (replacement name for *Pissonotus piceus* Spooner, 1912).  
**striolus** Osborn, 1935; referred to *Euidella fasciatella* (Osborn, 1935) by Caldwell and Martorell 1951: 190. (*Euidella* synonymized with *Euides* by Wagner (1963)).  
**substitua** (Walker, 1851); (*Delphax*) here referred to *incertae sedis*.  
**tessellatus** (Ball, 1926); (*Phyllocladus*).  
**tumidus** Morgan & Beamer, 1949.  
**variegatus** Spooner, 1912; referred to *quadripustulatus* (Van Duzee, 1909) by Metcalf 1923: 148.

Names in bold are currently recognized taxa placed in *Pissonotus*. The original generic placement is given (in parentheses) for species not described in *Pissonotus*. List excludes incorrect subsequent spellings.

Table 7. Nomenclatural changes proposed in this revision

Previous name	New name or placement
<i>Dicranotropis bakeri abdominalis</i> Crawford, 1914	<i>Pissonotus abdominalis</i> (Crawford, 1914)
<i>Pissonotus absenta</i> Caldwell, 1951	<i>Incertae sedis</i>
<i>Pissonotus belemensis</i> Muir, 1926	<i>Euides belemensis</i> (Muir, 1926)
<i>Pissonotus brasiliensis</i> Muir, 1926	<i>Euides brasiliensis</i> (Muir, 1926)
<i>Pissonotus delicatus melanurus</i> Van Duzee, 1917	<i>Pissonotus melanurus</i> Van Duzee, 1917
<i>Pissonotus equadorensis</i> Muir, 1926	<i>Euides equadorensis</i> (Muir, 1926)
<i>Pissonotus haywardi</i> Muir, 1929	<i>Incertae sedis</i>
<i>Pissonotus megalostylus</i> Muir, 1919	<i>Euides megalostylus</i> (Muir, 1919)
<i>Pissonotus pylaon</i> (Kirkaldy, 1907)	<i>Terthron pylaon</i> (Kirkaldy, 1907)
<i>Pissonotus substitua</i> (Walker, 1851)	<i>Incertae sedis</i>

## Synonymies

<i>Delphacodes pictifrons</i> Osborn, 1938	<i>Pissonotus piceus</i> (Van Duzee, 1894b)
<i>Dicranotropis bakeri bakeri</i> Crawford, 1914	<i>Pissonotus piceus</i> (Van Duzee, 1894b)
<i>Pissonotus exiguus</i> Morgan & Beamer, 1949	<i>Pissonotus frontalis</i> (Crawford, 1914)

*divergens*, and *P. rubrilatus*) are restricted to, or at least occur in, the eastern United States and Canada. Additionally, more than half of the total number of *Pissonotus* species occur in eastern North America (Table 8, Appendices 1-7). It appears that both the center of species diversity and the majority of the basal species of *Pissonotus* occur in the eastern (potentially southeastern) United States.

All available host information is summarized in Table 9, although many of these hosts need to be confirmed. As noted previously, however, some host records may be sitting records from nonhost plants or spurious records from sweeping a heterogeneous assemblage of plants. Many are in need of independent confirmation, particularly when the host record is from dispersal (macropterous) forms, solitary specimens, or sweeping.

Generally, host information for species of *Pissonotus* is relatively scanty. Only 20 of the 43 species of *Pissonotus* have recorded hosts (Table 9), and only 9 species have confirmed host records (Table 10) (i.e., multiple records from the same host species, long series from a host, or detailed observational data) (e.g., Denno 1978, Wilson et al. 1993b, Stiling 1994). The few species of *Pissonotus* with confirmed hosts are generally narrowly oligophagous on asteraceous plant species.

There are, however, some confirmed exceptions to the pattern of *Pissonotus* species feeding on asteraceous plants. *Pissonotus delicatus*, which is confirmed to feed on a variety of composites, has a single record of 20 specimens taken from *Sphaeralcea emoryi* (Malvaceae). *Pissonotus piceus* and *P. boliviensis*, both species in the *P. piceus* species complex, have hosts outside of the Asteraceae.

*Pissonotus albovenosus*, *P. quadripustulatus*, and *P. frontalis* are relatively basal species within the genus *Pissonotus*, and all have been confirmed to feed on the Asteraceae. From this, it would appear that composite feeding is a plesiomorphic feature in the genus *Pissonotus*. The genus *Stobaera* also is reported to feed on composites, including some of the same genera that are hosts for *Pissonotus* (e.g., *Haplopappus* and *Baccharis*) (Kramer 1973, Wilson et al. 1994). In contrast, *Megamelus* feed on *Spartina* spp. (Poaceae), *Carex* sp. (Cyperaceae), and *Nuphar* sp. (Nymphaeaceae) (Wilson et al. 1994).

Table 8. Numbers of *Pissonotus* species in various geographic regions

Geographic region	No. species (no. endemics)
North America, north of Mexico	32 species
Eastern, east of Mississippi River	27 species (13 endemic)
Central and Western	16 species (6 endemic)
Mexico	9 species ( <i>P. brevistilus</i> , endemic)
Caribbean	10 species ( <i>P. jamaicensis</i> , endemic)
Central America	5 species ( <i>P. muiri</i> , endemic)
South America	3 species ( <i>P. boliviensis</i> , <i>P. neotropicus</i> , <i>P. paraguayensis</i> , all endemic)

Table 9. Reported hosts of *Pissonotus* species based on specimens examined or literature cited.

<i>Pissonotus</i> species	Reported host plants
<i>abdominalis</i> (Crawford)	<i>Eupatorium adenophorum</i> Spreng. (Asteraceae).
<i>albivultus</i> Morgan & Beamer	<i>Eriobotrya japonica</i> L. (Rosaceae) and <i>Phaseolus vulgaris</i> L. (Fabaceae).
<i>albovenosus</i> Osborn	<i>Iva frutescens</i> L. (Asteraceae) is a confirmed host, <i>Lygodesmia grandiflora</i> (Nutt.) (reported by Morgan and Beamer 1949), <i>Borrchia frutescens</i> (L.) and <i>Aster spinosus</i> Benth. ? (Asteraceae) also are likely. Also reported: <i>Baccharis halimifolia</i> L., <i>Ambrosia psilostachya</i> DC (both Asteraceae), <i>Mimosa fragrans</i> Gray (Fabaceae), <i>Monarda pectinata</i> Nutt. (Lamiaceae), <i>Gossypium hirsutum</i> L. (as cotton) (Malvaceae), <i>Raphanus sativus</i> L. (as radishes) (Brassicaceae), and "Acadia" <i>Castilleja coccinea</i> (L.) Spreng. (Scrophulariaceae) (Strickland 1940, 1953).
<i>aphidioides</i> Van Duzee	<i>Grindelia squarrosa</i> (Pursh) Dunal. (Asteraceae) (Strickland 1940, 1953).
<i>basalis</i> Van Duzee	<i>Eupatorium capillifolium</i> (Lam.) Small, <i>Eupatorium</i> sp., <i>Helianthus debilis</i> Nutt.; <i>Conyza canadensis</i> var. <i>pusillus</i> (Nutt.) Cronq. (= <i>Erigeron canadensis</i> var. <i>pusillus</i> Nutt.) (all Asteraceae).
<i>binotatus</i> Spooner	<i>Pontederia</i> sp. and <i>Pontederia rotundifolia</i> L. f. ("treading") (Pontederiaceae).
<i>boliviensis</i> , n. sp.	<i>Erigeron quercifolius</i> Lam., <i>Aster (p)uniceus</i> L. (both Asteraceae), <i>Lespedeza</i> sp. (Fabaceae), <i>Agrostis</i> sp. (as red top) (Poaceae).
<i>brunneus</i> Van Duzee	<i>Grindelia</i> sp., <i>Grindelia squarrosa</i> (Pursh) Dunal. (as <i>G. perrenis</i> A. Nels.), <i>Grindelia aphanactis</i> Rydb., <i>Haplopappus ciliatus</i> (Nutt.) DC (as <i>Prionopsis ciliata</i> Nutt.), and <i>Heterotheca subaxillaris</i> (Lam.) Britt. & Rusby (all Asteraceae) are confirmed hosts. Also reported: <i>Helenium</i> sp., <i>Gaillardia</i> sp., <i>Silphium</i> sp., <i>Iva axillaris</i> Pursh, <i>Rudbeckia</i> sp. (all Asteraceae); <i>Agropyron trachycaulum</i> (Link) Malte (Poaceae); <i>Sphaeralcea emoryi</i> Torr. and <i>Gossypium hirsutum</i> L. (as cotton) (both Malvaceae).
<i>delicatus</i> Van Duzee	<i>Beta vulgaris</i> L. (beet, Chenopodiaceae), <i>Salix</i> sp. (Salicaceae), <i>Agrostis</i> sp. (Poaceae), <i>Solidago</i> sp. (as goldenrod) (Asteraceae), <i>Daucus carota</i> L. (as carrots) (Apiaceae).
<i>dorsalis</i> Van Duzee	<i>Festuca amplissima</i> Ruprecht (Poaceae).
<i>festuca</i> , n. sp.	

Table 9. Continued

<i>Pissonotus</i> species	Reported host plants
<i>flabellatus</i> (Ball)	<i>Schrankia</i> (?) sp. (Fabaceae).
<i>frontalis</i> (Crawford)	<i>Artemisia furcata heterophylla</i> (Bess.) Hulten (as <i>A. heterophylla</i> ) and <i>Artemisia</i> sp. (Asteraceae).
<i>marginatus</i> Van Duzee	<i>Carex</i> sp. (Cyperaceae), <i>Solidago</i> sp. (as goldenrod) (Asteraceae).
<i>melanurus</i> Van Duzee	<i>Grindelia camporum</i> Greene and <i>Grindelia</i> sp. (Asteraceae).
<i>muii</i> Metcalf	<i>Zexmenia pinetorum</i> Standley & Steyermark (Asteraceae).
<i>nitens</i> (Van Duzee)	<i>Helianthus</i> sp. (Asteraceae).
<i>paludosus</i> Morgan & Beamer	"on cane" ( <i>Arundinaria</i> sp.?) (Poaceae).
<i>piceus</i> (Van Duzee)	<i>Polygonum hydropiperoides</i> Michx., <i>Polygonum</i> sp. (Polygonaceae) and <i>Ludwigia peploides</i> (H.B.K.) Raven (as <i>Jussiaea diffusa</i> Forskal) (Onagraceae) are confirmed hosts. Also reported: <i>Rumex crispus</i> L. (Polygonaceae, Morgan and Beamer 1949), <i>Apium graveolens</i> L. (as celery) (Apiaceae), <i>Ludwigia uruguayensis</i> (Camb.) Hara (Onagraceae), <i>Solidago</i> sp. (Asteraceae), <i>Echinochloa</i> sp., <i>Bromis inermis</i> Leyss. (both Poaceae), <i>Glycine max</i> (L.) Merr. (as soybeans) (Fabaceae) and "chard."
<i>quadripustulatus</i> (Van Duzee)	<i>Borrchia frutescens</i> (L.) DC (Asteraceae) is a confirmed host. Also reported: <i>Flaveria linearis</i> Lag. (Asteraceae) and <i>Monarda pectinata</i> L. (Lamiaceae).

No hosts are reported for *P. agrestis*, *P. aquilonius*, *P. brevistilus*, *P. canadensis*, *P. concolor*, *P. decussatus*, *P. dentatus*, *P. divergens*, *P. guttatus*, *P. jamaicensis*, *P. lactofasciatus*, *P. merides*, *P. minutus*, *P. neotropicus*, *P. niger*, *P. nigriculus*, *P. paraguayensis*, *P. radiolus*, *P. rubrilatus*, *P. spatulatus*, *P. spooneri*, *P. tessellatus*, or *P. tumidus*.

Dicot feeding is an unusual habit among temperate mainland genera of delphacids, where most delphacids feed on herbaceous monocots (although tropical island species have commonly radiated onto dicots; Wilson et al. 1994). Similar host plant preferences between *Pissonotus* and *Stobaera*, and the somewhat flattened antennae in *P. quadripustulatus* and *P. tessellatus* (a generic feature of *Stobaera*) suggest that these taxa may share recent common ancestry. This is a hypothesis that may be addressed in future research on the phylogeny of the Delphacini.

Parasites reported specifically from members of the genus *Pissonotus* appear limited to an undetermined dryinid (Hymenoptera) from an adult *P. dorsalis* (Fenton 1918) and a strepsipteran (prob. *Elenchus* sp., Elenchidae) from a 3rd-instar *P. delicatus* (Wilson and Tsai 1991).

The seasonal distribution of *Pissonotus* is summarized for each species in Table 11. In this summary, each different locality or date was counted as a single record, and all records were tallied for each month (i.e., each different date or locality was tallied, not total number of specimens). For species that appear to show limitations in their seasonal distribution, a range of dates is provided (although in some cases these apparent seasonal limitations may be an artifact of inadequate collecting).

Generally, records of *Pissonotus* are most abundant in July and August. Species with distributions limited to northern North American (e.g., *P. aphidioides*, *P. basalis*, *P. niger*, *P. tumidus*) had records limited to the summer months. Species found farther to the south (*P. quadripustulatus*, *P. tessellatus*) were found throughout the year. *Pissonotus quadripustulatus* has been reported to breed throughout the year (Stiling 1994, Döbel and Denno 1994). The South American species *P. boliviensis* and *P. neotropicus* had most of their seasonal records between January and April. Those species with very wide distributions (e.g., *P. albovenosus*, *P. delicatus*, *P. piceus*) had seasonal records throughout the year, but winter records were found in southern localities only, suggesting that seasonal distribution, and apparently voltinism, varies with latitude. It appears that *Pissonotus* are characteristically polyvoltine. Seasonal migration of *Pissonotus* has not been reported or inferred, although it remains a possibility, at least for species with higher rates of macroptery.

Table 10. Reported hosts of *Pissonotus* species with multiple collection records or long series

<i>Pissonotus</i> species	Reported host plants
<i>albovenosus</i> Osborn	<i>Iva frutescens</i> L., <i>Lygodesmia grandiflora</i> (Nutt.), <i>Borrchia frutescens</i> (L.) (all Asteraceae).
<i>binotatus</i> Spooner	<i>Conyza canadensis</i> var. <i>pusillus</i> (Nutt.) Cronq., <i>Eupatorium</i> sp., (Asteraceae).
<i>boliviensis</i> , n. sp.	<i>Pontederia</i> sp. (Pontederiaceae).
<i>delicatus</i> Van Duzee	<i>Grindelia</i> spp., <i>Haplopappus ciliatus</i> (Nutt.) DC, <i>Heterotheca subaxillaris</i> (Lam.) Britt. & Rusby (all Asteraceae); <i>Sphaeralcea emoryi</i> Torr. (Malvaceae).
<i>frontalis</i> (Crawford)	<i>Artemisia furcata heterophylla</i> (Bess.) Hulten, <i>Artemisia</i> sp. (Asteraceae).
<i>melanurus</i> Van Duzee	<i>Grindelia</i> sp. (Asteraceae).
<i>muii</i> Metcalf	<i>Zexmenia pinetorum</i> Standley & Steyermark (Asteraceae).
<i>piceus</i> (Van Duzee)	<i>Polygonum hydropiperoides</i> Michx., <i>Polygonum</i> sp. (Polygonaceae) and <i>Ludwigia peploides</i> (H.B.K.) Raven (Onagraceae).
<i>quadripustulatus</i> (Van Duzee)	<i>Borrchia frutescens</i> (L.) DC (Asteraceae).

Spooner (1920) noted that *Pissonotus* spp. varied in abundance annually (at the same site and time of year) and spatially (within similar habitats), specifically noting *P. brunneus*, *P. marginatus*, *P. flabellatus*, and *P. binotatus*. The spatial variability is likely tied in with host specificity, especially if the species is monophagous on a widely scattered host plant (Wilson et al. 1993a, 1994). Curiously, for some of the less common species of *Pissonotus*, a very high percentage of specimens collected may stem from 1 or 2 collection events. For example, 131 of 155 (84.5%) of *P. spooneri* specimens reported here were collected at Fredonia, NY, on 21 July, 1946; 61 of 72 specimens (84.7%) of *P. agrestis* were collected in June and July, 1912, at Okefenokee Swamp, GA; 100% of 80 specimens of *P. minutus* were collected at 2 localities in Arizona on 25–26 June, 1950. These records suggest that the less commonly collected species of *Pissonotus* are highly specialized and can be locally abundant, but these species are not necessarily rare in an endangered species sense.

Of the 9,091 specimens examined and reported (Table 1), 3,421 were brachypterous males (37.6%), 573 were macropterous males (6.3%), 4,225 were brachypterous females (46.5%), and 872 were macropterous females (9.6%). The sex ratio for these specimens is slightly female-biased (56.0% of all specimens were females, or a ratio of 0.78♂: 1♀). The ratio of brachypterous to macropterous individuals is very biased toward brachypters (only 15.9% macroptery or 1b: 0.19m). Among the more commonly collected species of *Pissonotus*, the sex ratio varies little (Table 12). The relatively low percentages of females recorded for *P. dentatus* and *P. piceus* result partly from taxonomic difficulties. Some females of these 2 species were not reported here because the characters needed for accurate identification relate to the male genitalia. *Pissonotus albivultus*, however, has a relatively low percentage of females, even though female specimens were attributed to the species that may have been *P. decussatus* (see *Remarks* under *P. albivultus*).

Wing dimorphism as an adaptive life history strategy in *Pissonotus* was suggested by Osborn (1912), who surmised that wing form was related to food supply. More recently, Denno (1978), Denno et al. (1991), and Döbel and Denno (1994) noted a direct correlation between wing morph and habitat stability, specifically citing *P. quadripustulatus*, *P. albovenosus*, and *P. piceus*. Recent research on wing polymorphism has focused largely on the saltmarsh inhabiting delphacids in the genus *Prokelisia* Osborn, 1905, particularly *Prokelisia marginata* (Van Duzee 1897) and *Prokelisia dolus* Wilson, 1982, where environmental factors (particularly crowding and host plant quality) during nymphal instars largely determines the wing form of the adult (e.g., Denno et al. 1985, 1986; Denno and Roderick 1992). If this model generally holds true for *Pissonotus*, then macropters would be expected to occur for all *Pissonotus* species.

Some of the less commonly collected species have not been reported in macropterous form. It seems likely, however, that this is an artifact of a small number of collection records (and that macropters are more difficult to identify), rather than because macropters do not occur in these species. Substanti-

ating macroptery in the less commonly collected species of *Pissonotus* will, of course, be challenging.

The proportion of macropters in *Pissonotus* varies considerably between the most commonly collected species (Table 12), from 0.4% macroptery (*P. quadripustulatus*) to 40.1% (*P. binotatus*). Denno et al. (1991) found that percentage macroptery is correlated with habitat persistence (predictability of habitat occurrence in time and space), such that percentage macroptery decreased as habitat persistence increased. The percentages listed in Table 12 tend to support this hypothesis in that *P. quadripustulatus* occurs in salt marshes, a very persistent habitat (habitat age reported as 3,000 years by Denno et al. 1991), whereas *P. binotatus* is here reported from *Conyza canadensis* var. *pusillus* (Nutt.) Cronq. (collected by Bartlett), an early successional plant persisting in old-field successional habitats for only 4–10 yr in the piedmont of North Carolina (Oosting 1942). Such observations could be extended for other species within *Pissonotus* if habitat persistence estimates could be made for habitats where other species occur. Some candidates might be *P. delicatus* on *Grindelia* spp., *P. frontalis* on *Artemisia* sp., or *P. albovenosus* on *Iva frutescens* L. or *Borrchia frutescens*.

This revision makes clear the need for further biological investigations on the genus *Pissonotus*. There is still need for keys specific for females. Although they are commonly collected and represent one of the larger New World delphacid genera, relatively little is known about the ecology and life history of many species of *Pissonotus*. Further collecting is needed to extend distribution records, and confirmed host plant records would be invaluable to study parallel cladogenesis between *Pissonotus* and the Asteraceae. Molecular studies would be best suited to explore further the phylogeny of *Pissonotus* and investigate further the taxonomy of the *P. piceus* species complex. Nymphal features of *Pissonotus* may be useful, but nymphs have rarely been investigated in the Delphacidae. It is hoped that the keys and descriptions presented here will stimulate further collecting and studies on *Pissonotus* ecology, life history, host plant relationships, acoustic communication, immature stages,

wing dimorphism (and its associated genetics), planthopper-predator interactions, population biology, biogeography, and behavior.

Table 11. Seasonal Distribution of *Pissonotus* species collection records

<i>Pissonotus</i> species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Range
<i>abdominalis</i> (Crawford)				1	1	3	3	7	2		1	3	13 Apr. - 19 Dec.
<i>agrestis</i> Morgan & Beamer		1	1		1	1	2		1	4	1		14 Feb. - 9 Nov.
<i>albivultus</i> Morgan & Beamer	1		4	1	1		5	7	2	3		3	
<i>albovenosus</i> Osborn <sup>a</sup>	2	6	10	10	22	31	34	31	9	12	4	10	
<i>aphidioides</i> Van Duzee						4	9	8					17 June - 23 Aug.
<i>aquilonius</i> Morgan & Beamer						1							16 June
<i>basalis</i> Van Duzee						6	22	10	16	3			16 June - 28 Oct.
<i>binotatus</i> Spooner <sup>a</sup>		1	5	3	5	6	30	35	23	8	1	1	19 Feb. - 31 Dec.
<i>boliviensis</i> Bartlett, n. sp.	5	1	17	8						4			17 Jan. - 21 Apr.; Oct. 24 - 26 Apr.
<i>brevistilus</i> Bartlett, n. sp.				1									
<i>brunneus</i> Van Duzee <sup>a</sup>	1	2	10	16	33	50	75	82	30	17	2	8	
<i>canadensis</i> Bartlett, n. sp.								4					1 - 22 Aug.
<i>concolor</i> Bartlett, n. sp.							4						4 - 30 July
<i>decussatus</i> Bartlett, n. sp.						1	1					1	
<i>delicatus</i> Van Duzee <sup>a</sup>	2	3	2	8	12	39	61	69	44	25	4	5	
<i>dentatus</i> Morgan & Beamer		1	12	2	2	5	13		1	1		1	26 Feb. - 26 Dec.

Table 11. Continued

<i>Pissonotus</i> species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Range
<i>divergens</i> Bartlett, n. sp.				1		2	2	1	5				25 Apr. - 18 Sept.
<i>dorsalis</i> Van Duzee				1		1	31	41	1				18 Apr. - 6 Sept.
<i>festucae</i> Bartlett, n. sp.								1	2	1	1		10 Aug. - 2 Nov.
<i>flabellatus</i> (Ball) <sup>a</sup>		2	4	3	6	11	24	21	33	18	1	4	23 Feb. - 27 Dec.
<i>frontalis</i> (Crawford)				1	9	9	9	2					22 Apr. - 21 Aug.
<i>guttatus</i> Spooner					1	5	21	27	13	6			20 May - 28 Oct.
<i>jamaicensis</i> Bartlett, n. sp.				1				3				1	
<i>lactofascius</i> Morgan & Beamer							14						2 - 21 July
<i>marginatus</i> Van Duzee <sup>a</sup>			4		9	18	24	26	29	12	1		2 Mar. - 2 Nov.
<i>melanurus</i> Van Duzee					1	3			1				31 May - 2 Sept.
<i>merides</i> Morgan & Beamer			3			1	2	1	3	2			3 Mar. - 7 Oct.
<i>minutus</i> Beamer						2							25 - 26 June
<i>muii</i> Metcalf	1		1	1	2	4	3	5	1	1			16 Jan. - 14 Oct.
<i>neotropicus</i> (Muir)	3	2	1	5			3	1					11 Jan. - 1 Aug.
<i>niger</i> Morgan & Beamer						1	9	12	5	1			8 June - 22 Oct.
<i>nigriculus</i> Morgan & Beamer	1	7	2	1		2							22 Feb. - 28 July
<i>nitens</i> (Van Duzee)	2	3	2	3			1	2					6 Feb. - 28 Sept.
<i>paludosus</i> Morgan & Beamer		12		1	5	2	3	2	1		3		3 Mar. - 31 Dec.
<i>paraguayensis</i> Bartlett, n. sp.	1		1						2				



Table 11. Continued

<i>Pissonotus</i> species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Range
<i>piceus</i> (Van Duzee) <sup>a</sup>	4	9	20	17	23	49	66	82	37	38	7	9	
<i>quadripustulatus</i> (Van Duzee)	4	9	17	12	11	9	12	5	3	2	7	7	12-30 July
<i>radiolus</i> Bartlett, n. sp.							2						19 July - 28 Aug.
<i>rubrilatus</i> Morgan & Beamer						1	2	4	1				22 June - 10 Sept.
<i>spatulatus</i> Bartlett, n. sp.	1						7	3	3				Mar. 7 (Florida)
<i>spooneri</i> Morgan & Beamer <sup>a</sup>													11 July - 23 Sept.
<i>tessellatus</i> (Ball)	1	1	11	7	17	6	4	7	5	5	2	2	9 July - ? Sept.
<i>tumidus</i> Morgan & Beamer						3	8	1					
Sum of records	25	41	145	104	161	274	503	506	274	166	32	57	

<sup>a</sup>Winter records from southern localities only.Table 12. Percentage of wing morphs and sexes among more commonly collected *Pissonotus* species

Species (no. specimens)	Macropters	Females	b♂	m♂	b♀	m♀
<i>delicatus</i> (1,743)	12.9	57.5	38.1	4.4	49.0	8.5
<i>piceus</i> (1,294)	35.8	44.3	38.1	17.6	26.1	18.2
<i>albovenosus</i> (758)	22.0	61.6	26.5	11.7	51.3	10.3
<i>brunneus</i> (757)	12.0	58.1	37.5	4.4	50.3	7.8
<i>quadripustulatus</i> (706)	0.4	66.0	34.0	0.0	65.6	0.4
<i>binotatus</i> (616)	40.1	61.9	31.8	6.3	28.1	33.8
<i>flabellatus</i> (307)	9.4	55.7	42.7	1.6	47.9	7.8
<i>dentatus</i> (289)	12.5	30.8	62.6	6.6	24.9	5.9
<i>marginatus</i> (253)	1.2	60.5	39.5	0.0	59.3	1.2
<i>frontalis</i> (221)	4.5	57.9	39.4	2.7	56.1	1.8
<i>albivultus</i> (207)	7.7	48.8	46.4	4.8	45.9	2.9
Average of 43 species (9,091)	15.9	56.0	37.6	6.3	46.5	9.6

Percentages based on numbers presented in Table 1. b, brachypters; m, macropters

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Figures

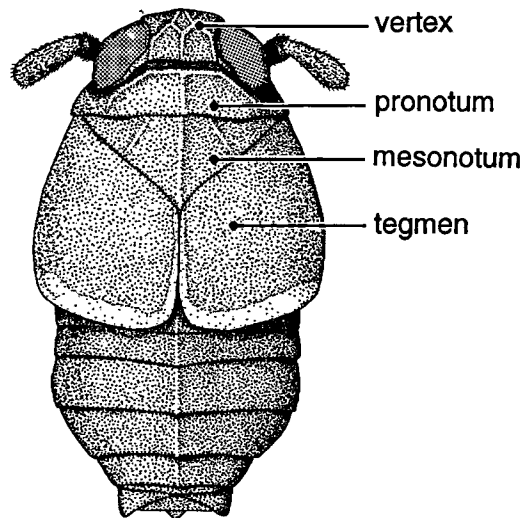


Fig. 1. Dorsal view of *P. binotatus* Spooner.

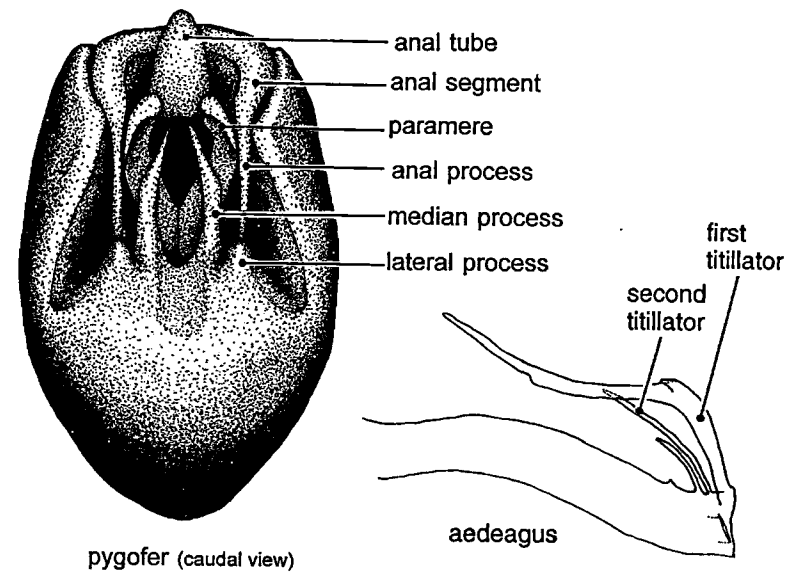
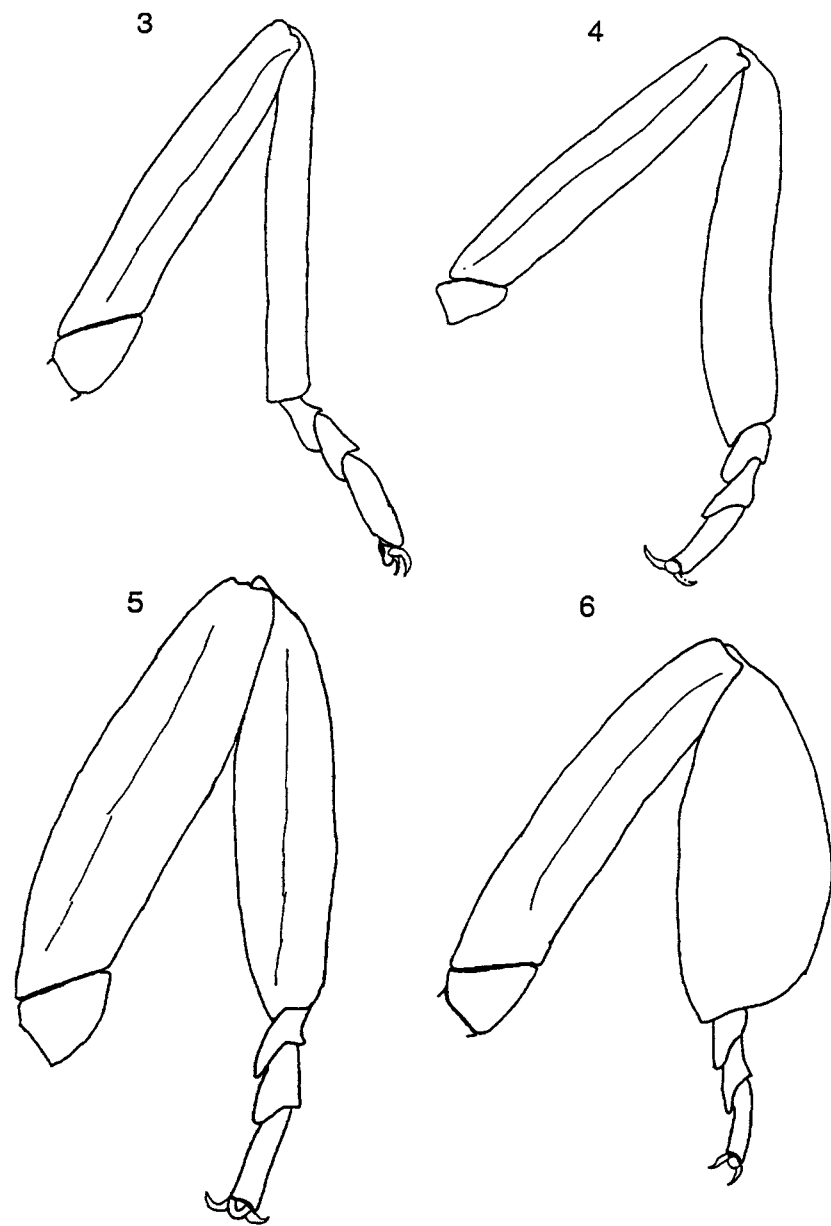
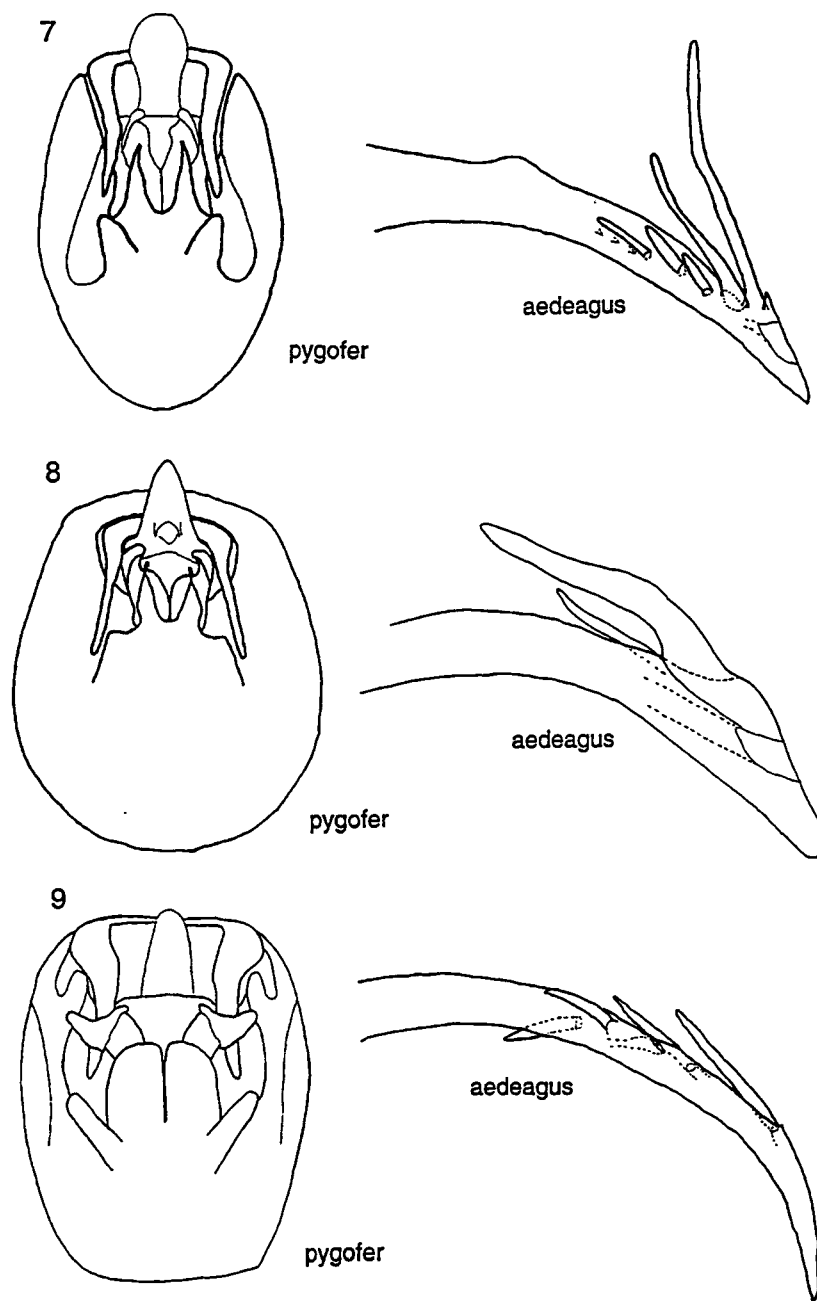


Fig. 2. Morphology of the male genitalia, *P. merides* Morgan and Beamer.

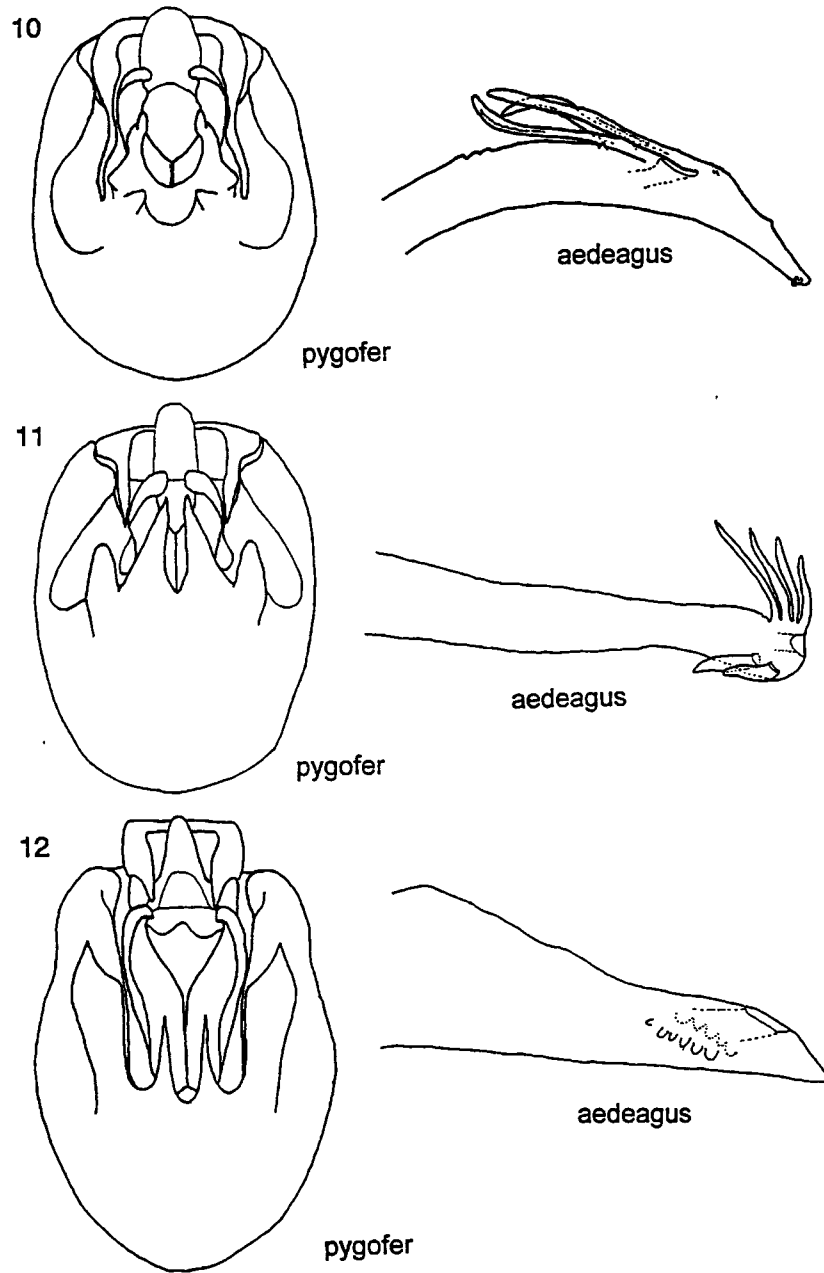


Figs. 3—6. Front legs of *Pissonotus*. (3) Tibia not expanded, *P. albovenosus* Osborn. (4) Tibia slightly expanded, *P. basalis* Van Duzee. (5) Tibia moderately expanded, *P. neotropicus* (Muir). (6) Tibia greatly expanded, *P. tessellatus* (Ball).

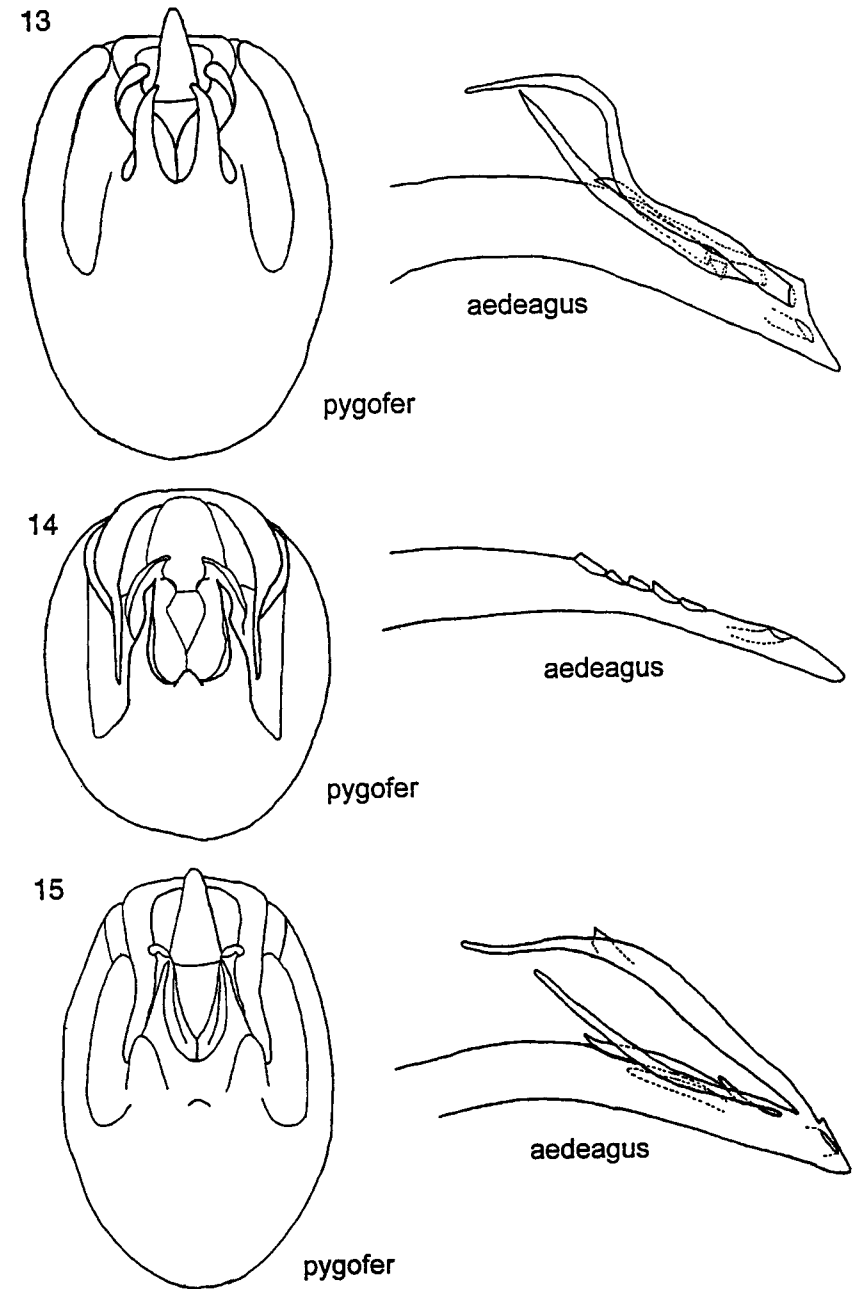


Figs. 7—9. Male genitalia. (7) *P. quadripustulatus* (Van Duzee). (8) *P. albovenosus* Osborn. (9) *P. frontalis* (Crawford).

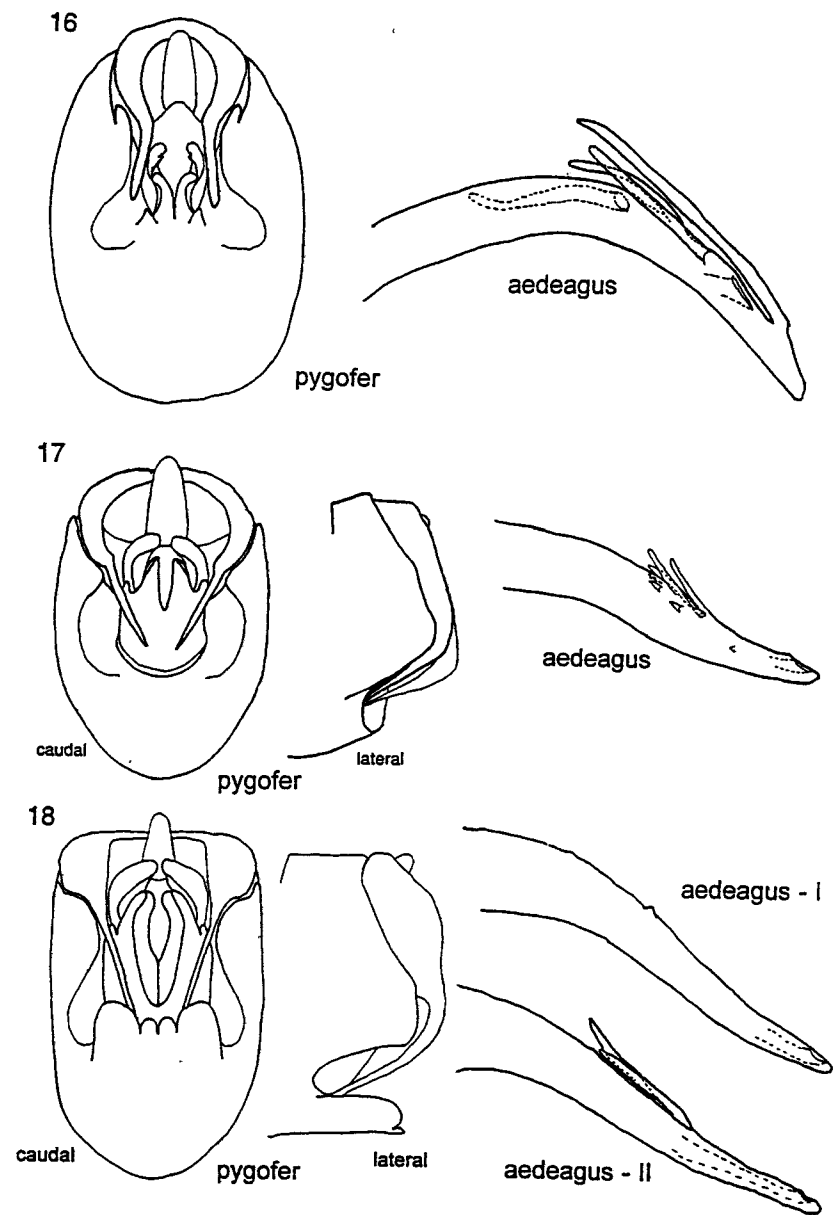




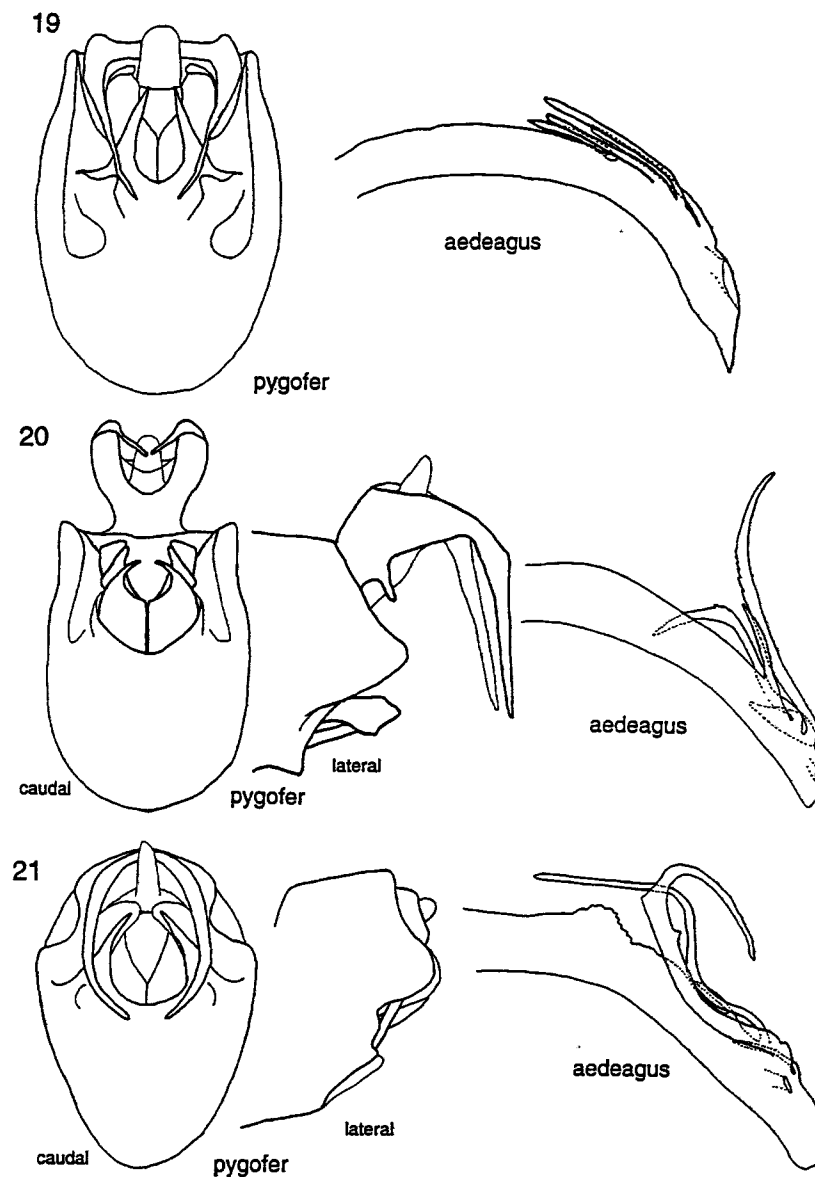
Figs. 10—12. Male genitalia. (10) *P. tessellatus* (Ball). (11) *P. tumidus* Morgan and Beamer. (12) *P. aphidioides* Van Duzee.



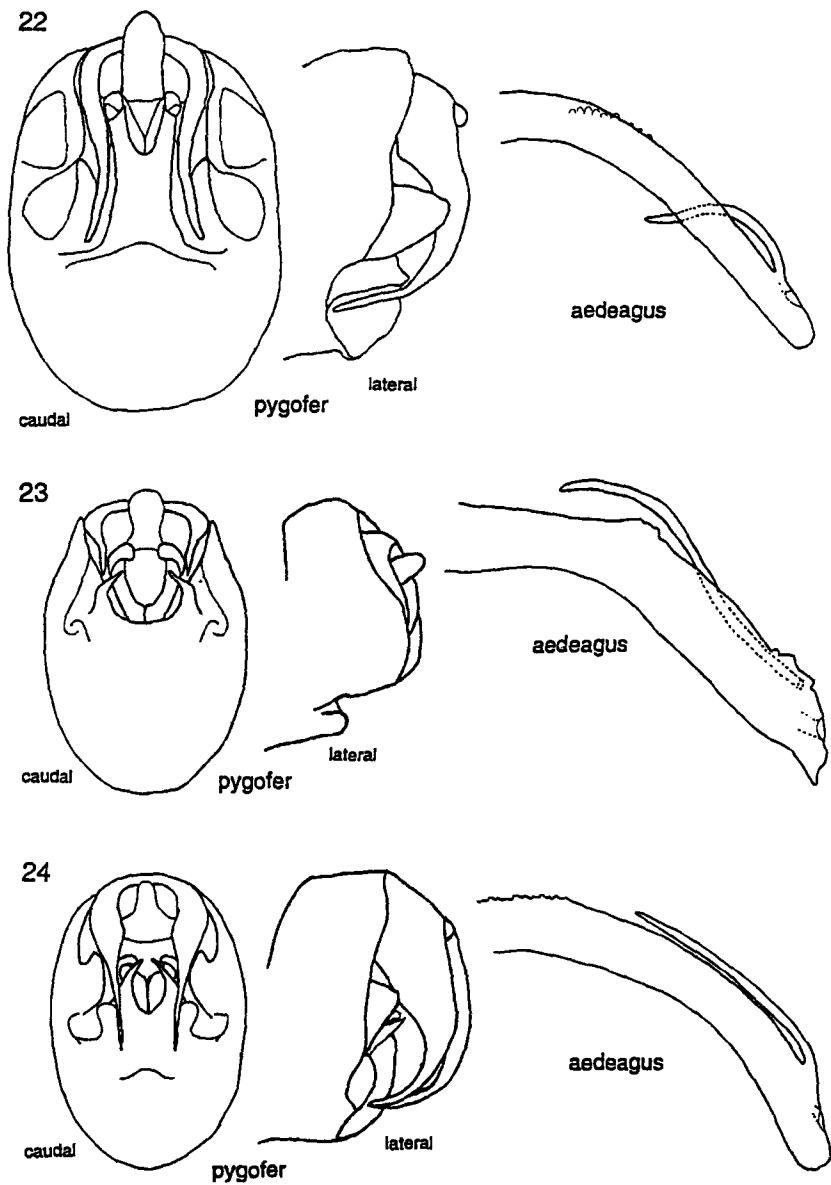
Figs. 13—15. Male genitalia. (13) *P. flabellatus* (Ball). (14) *P. brunneus* Van Duzee. (15) *P. neotropicus* (Muir).



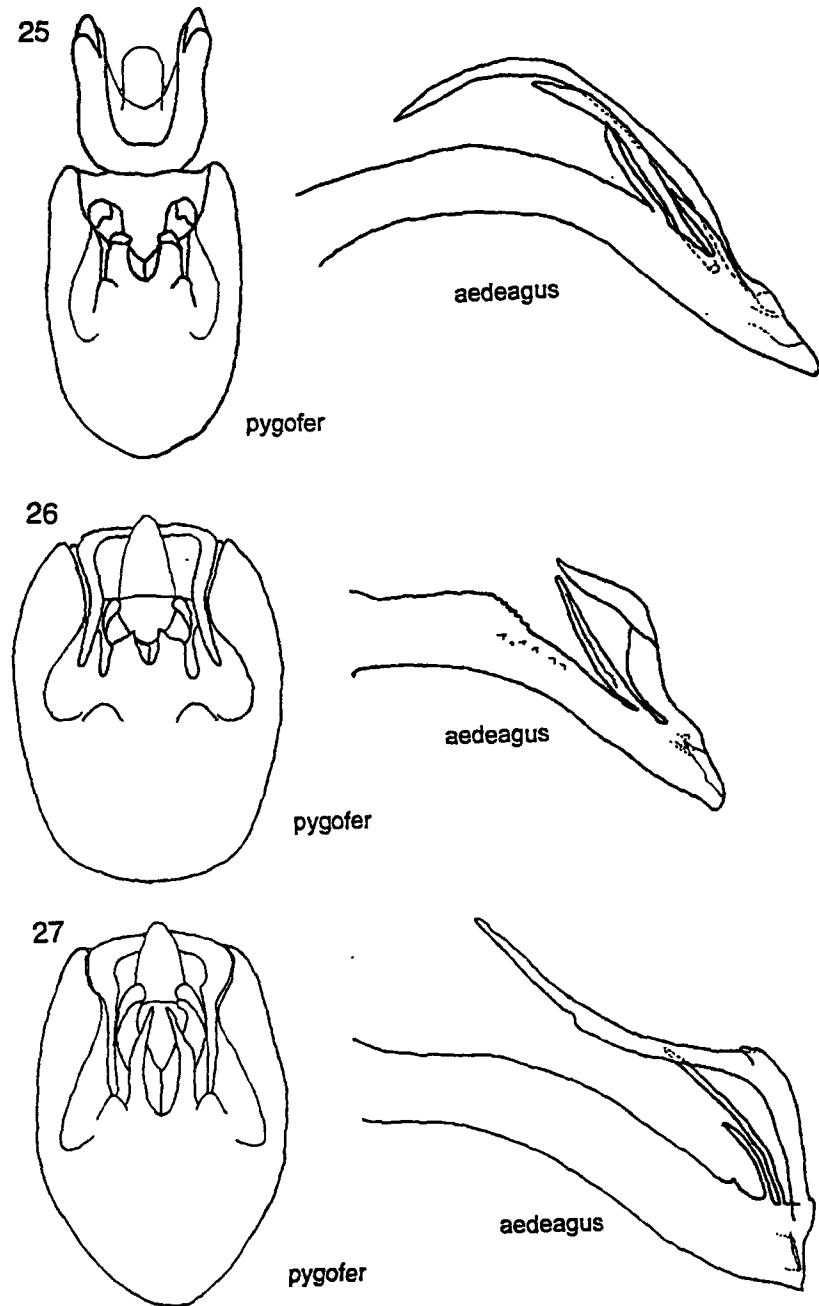
Figs. 16—18. Male genitalia. (16) *P. divergens* Bartlett, n. sp. (holotype). (17) *P. nigriculus* Morgan and Beamer (paratype). (18) *P. niger* Morgan and Beamer.



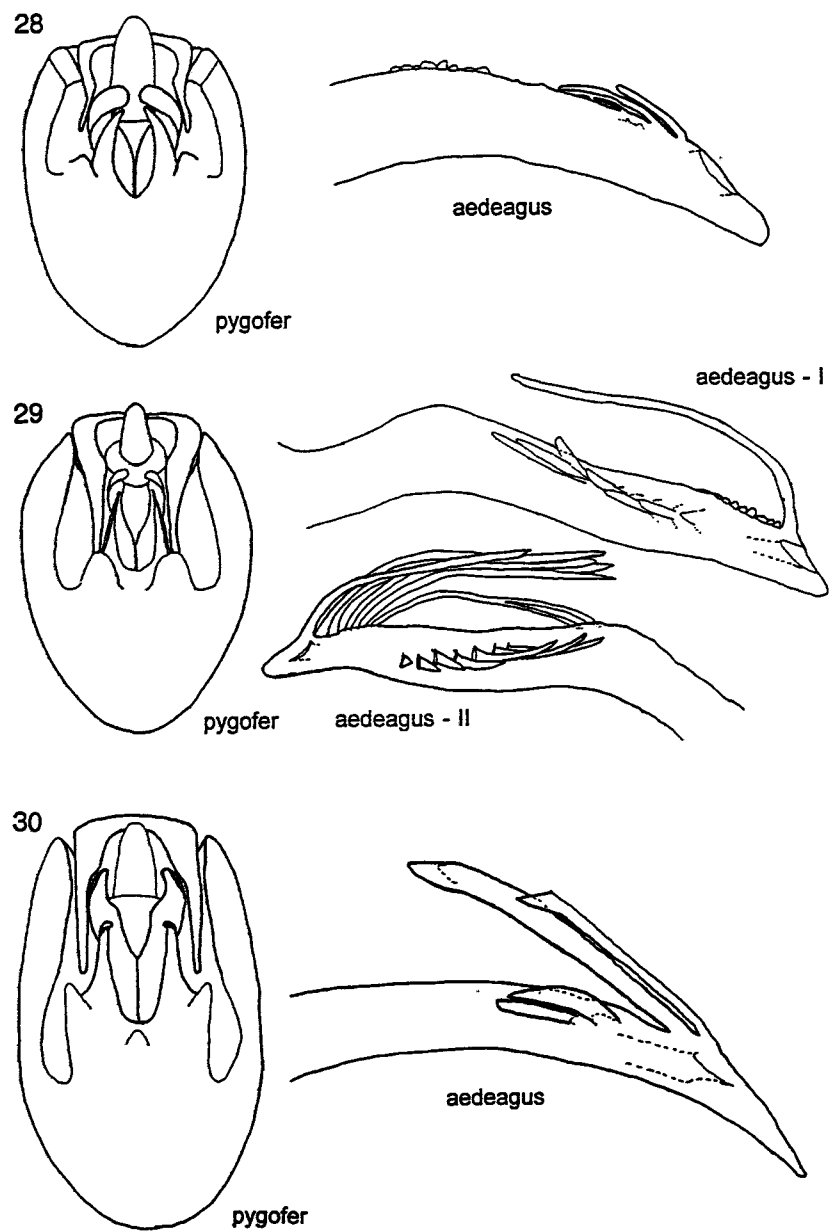
Figs. 19—21. Male genitalia. (19) *P. rubrilatus* Morgan and Beamer. (20) *P. concolor* Bartlett, n. sp. (holotype, cleared specimen, anal segment rotated dorsad by clearing). (21) *P. dorsalis* Van Duzee.



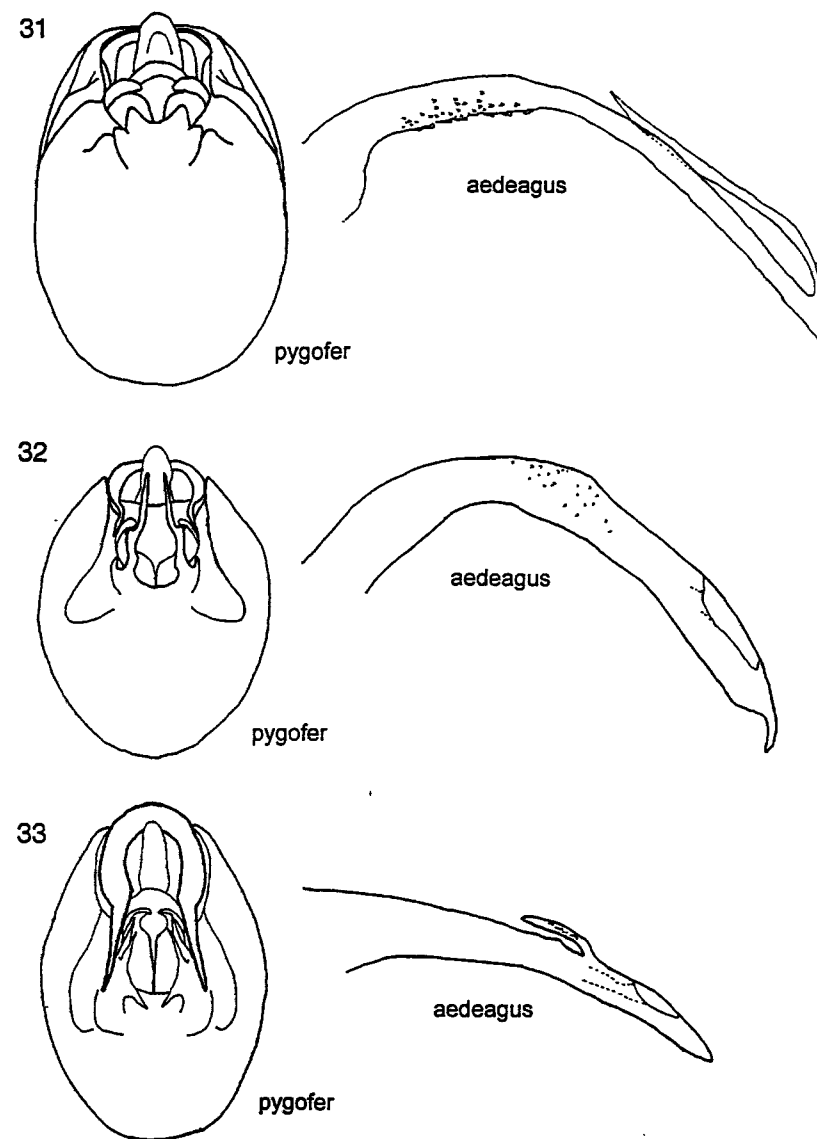
Figs. 22—24. Male genitalia. (22) *P. marginatus* Van Duzee. (23) *P. radiolus* Bartlett, n. sp. (holotype). (24) *P. canadensis* Bartlett, n. sp. (holotype).



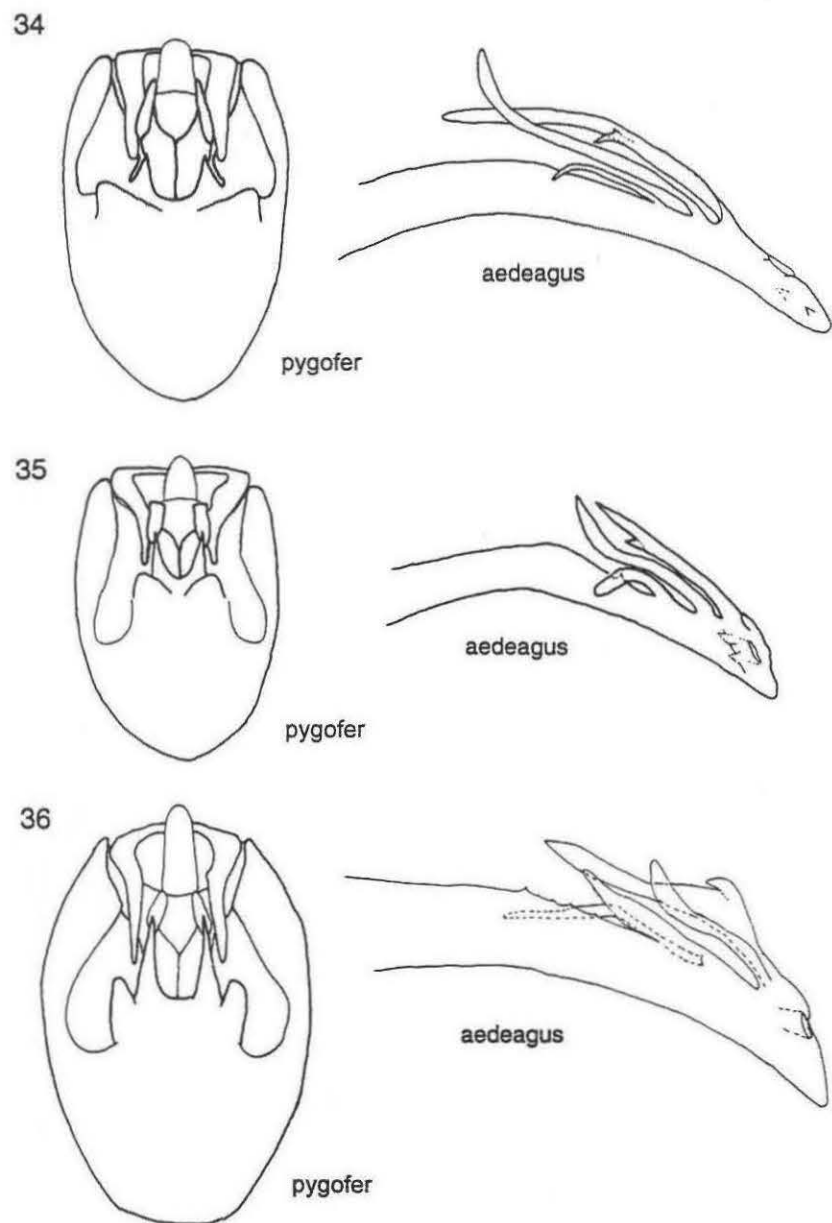
Figs. 25—27. Male genitalia. (25) *P. aquilonius* Morgan and Beamer (paratype, cleared specimen, anal segment rotated dorsad by clearing). (26) *P. paludosus* Morgan and Beamer (paratype). (27) *P. merides* Morgan and Beamer.



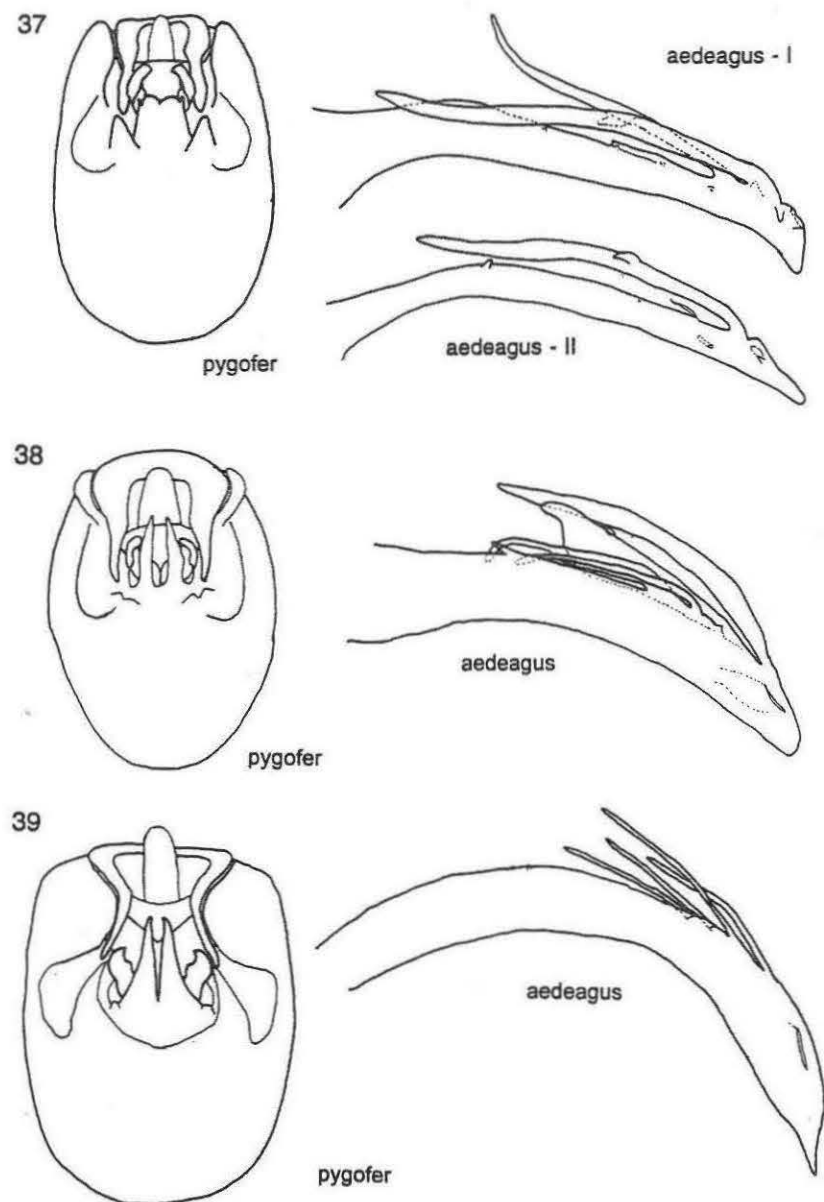
Figs. 28—30. Male genitalia. (28) *P. guttatus* Spooner. (29) *P. agrestis* Morgan and Beamer. (30) *P. muiri* Metcalf.



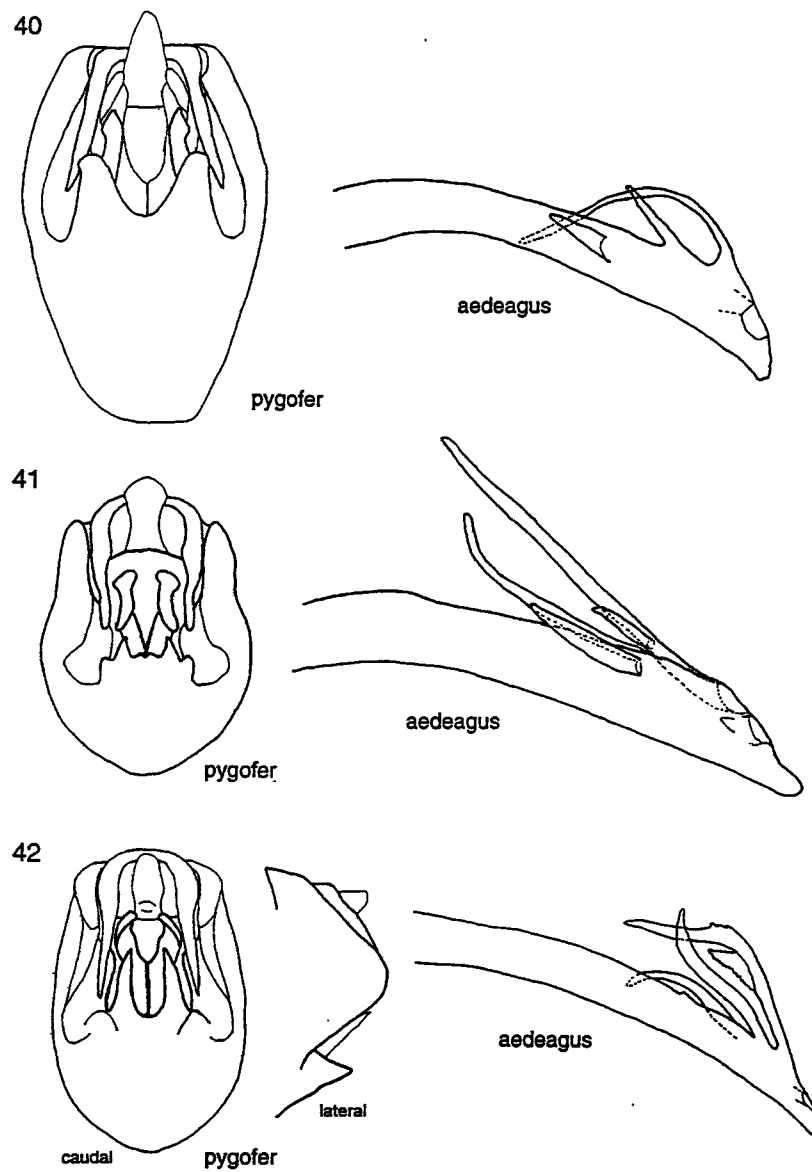
Figs. 31—33. Male genitalia. (31) *P. basalis* Van Duzee. (32) *P. spooneri* Morgan and Beamer. (33) *P. nitens* (Van Duzee).



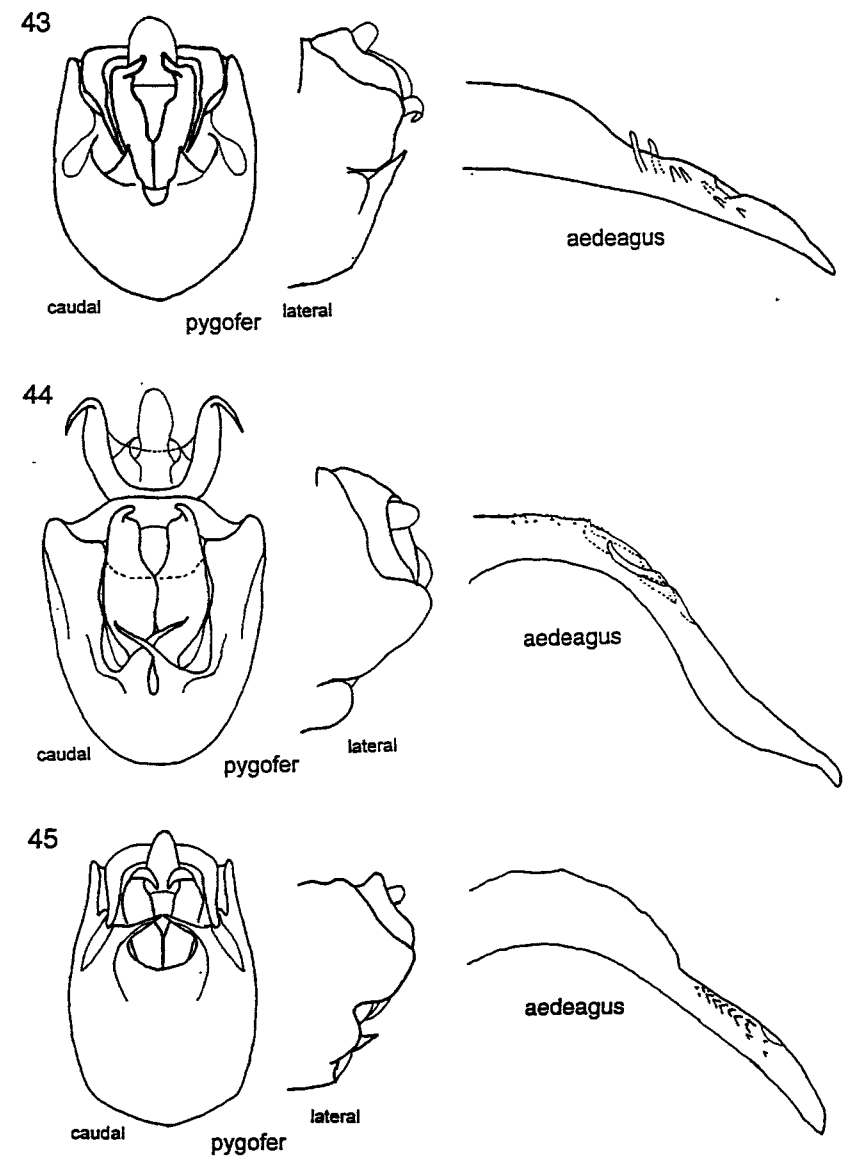
Figs. 34—36. Male genitalia. (34) *P. abdominalis* (Crawford). (35) *P. dentatus* Morgan and Beamer (paratype). (36) *P. piceus* (Van Duzee).



Figs. 37—39. Male genitalia. (37) *P. boliviensis* Bartlett, n. sp. (paratype). (38) *P. lactofasciatus* Morgan and Beamer (paratype). (39) *P. minutus* Beamer (paratype).

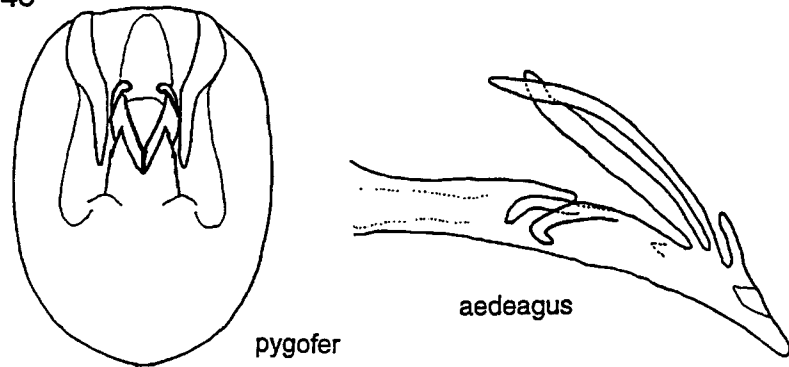


Figs. 40—42. Male genitalia. (40) *P. festucae* Bartlett, n. sp. (paratype). (41) *P. spatulatus* Bartlett, n. sp. (paratype). (42) *P. jamaicensis* Bartlett, n. sp. (holotype).



Figs. 43—45. Male genitalia. (43) *P. brevistilus* Bartlett, n. sp. (holotype). (44) *P. decussatus* Bartlett, n. sp. (holotype, cleared specimen, anal segment rotated dorsad by clearing). (45) *P. albivultus* Morgan and Beamer (paratype).

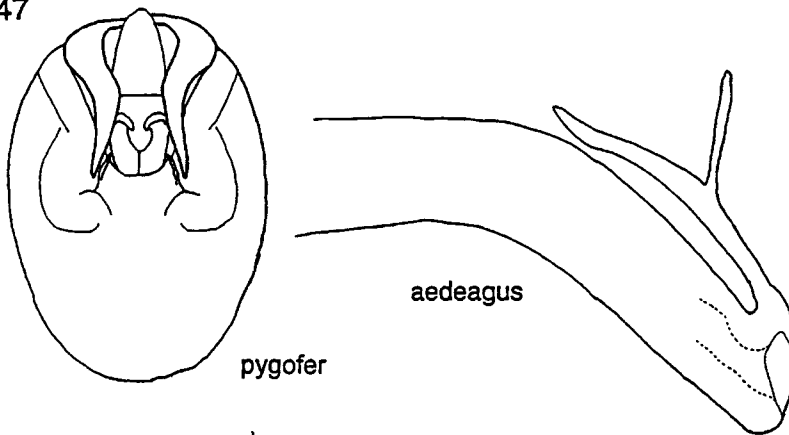
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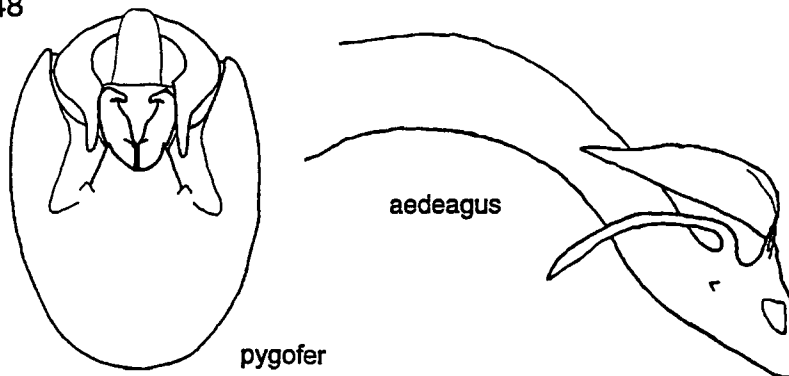
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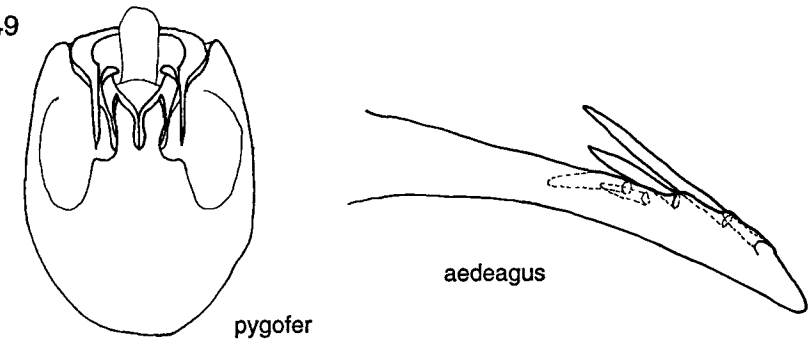


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Figs. 46—48. Male genitalia. (46) *P. binotatus* Spooner. (47) *P. delicatus* Van Duzee. (48) *P. melanurus* Van Duzee.

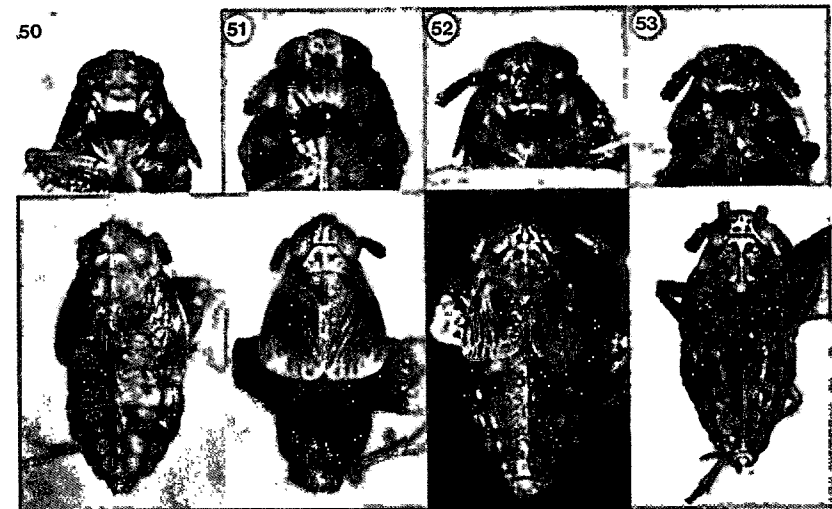
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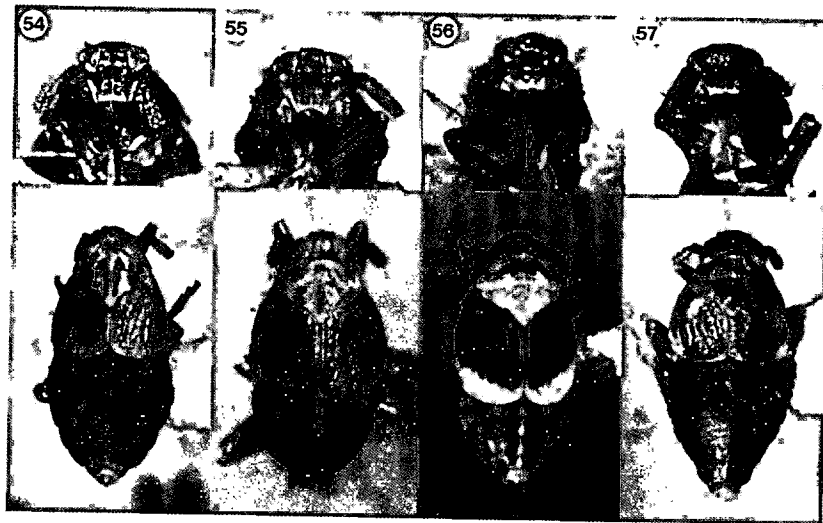
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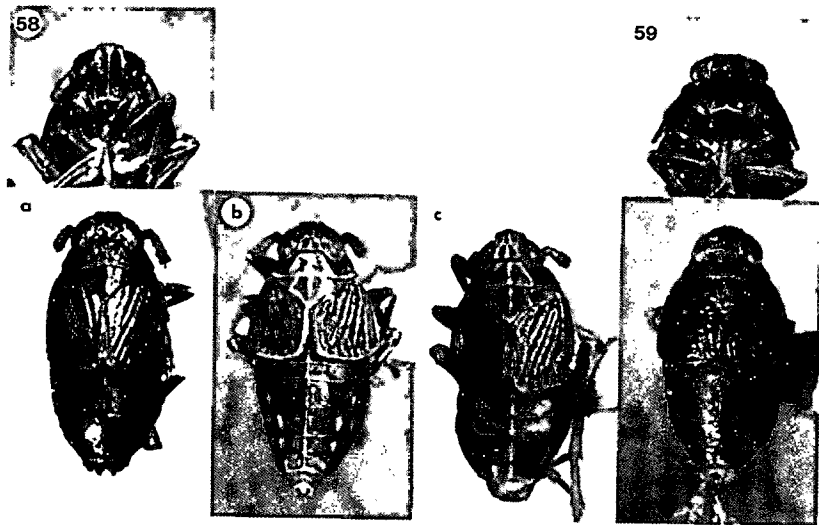
Figure 49. Male genitalia, *P. paraguayensis* Bartlett, n. sp. (holotype).



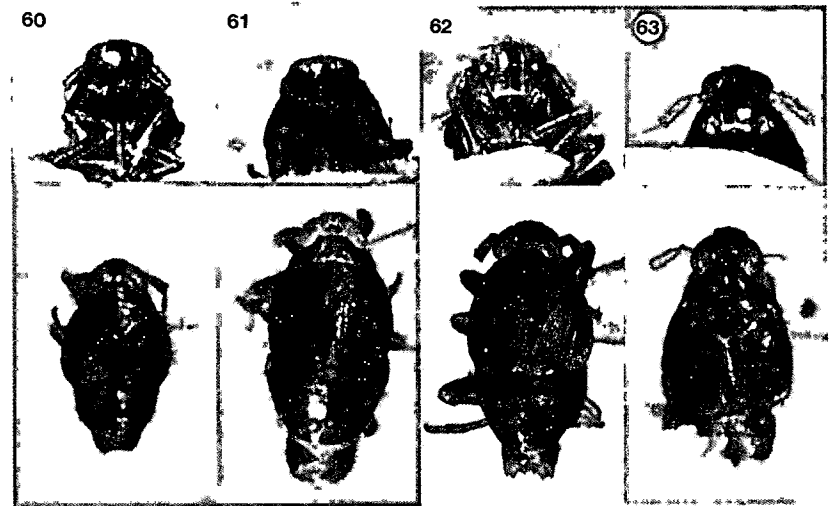
Figs. 50—53. Frontal and dorsal views. (50) *P. quadripustulatus* (Van Duzee). (51) *P. albovenosus* Osborn. (52) *P. frontalis* (Crawford). (53) *P. tessellatus* (Ball)



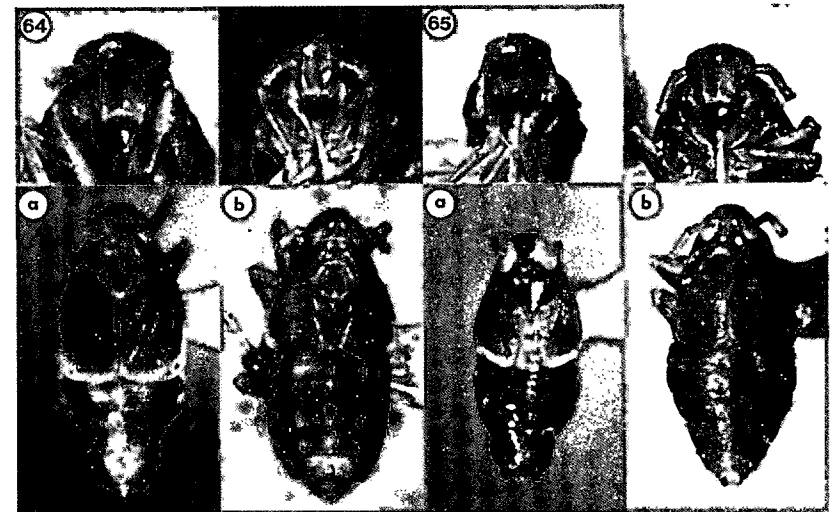
Figs. 54—57. Frontal and dorsal views. (54) *P. tumidus* Morgan and Beamer (paratype). (55) *P. aphidioides* Van Duzee. (56) *P. flabellatus* (Ball). (57) *P. neotropicus* (Muir).



Figs. 58—59. Frontal and dorsal views. (58) *P. brunneus* Van Duzee (forms a—c). (59) *P. divergens* Bartlett, n. sp. (paratype).

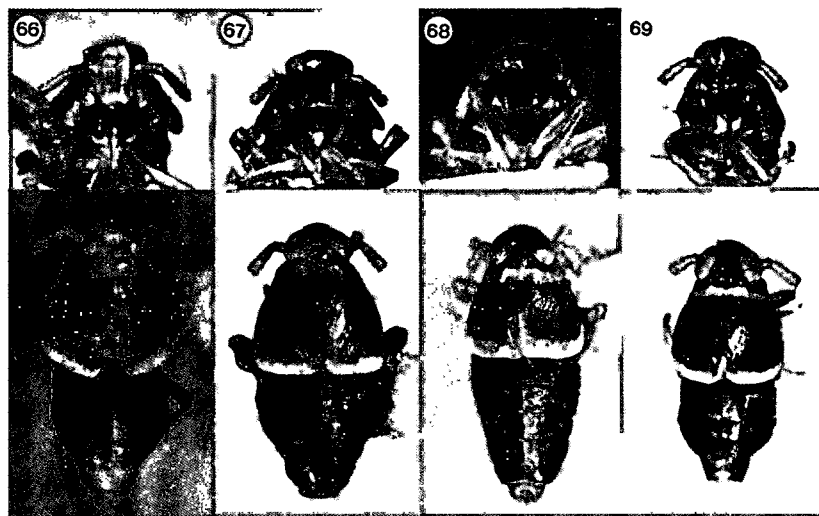


Figs. 60—63. Frontal and dorsal views. (60) *P. nigriculus* Morgan and Beamer (paratype). (61) *P. niger* Morgan and Beamer (paratype). (62) *P. rubrilatus* Morgan and Beamer (paratype). (63) *P. concolor* Bartlett, n. sp. (holotype).

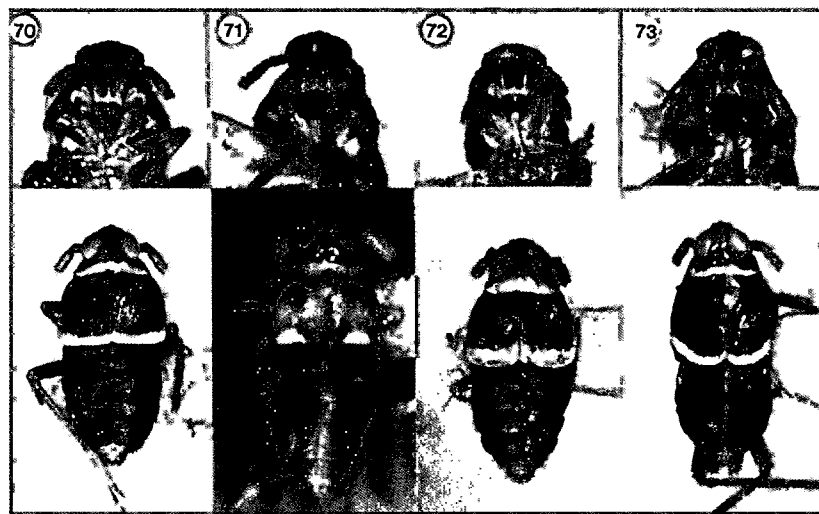


Figs. 64—65. Frontal and dorsal views (male and female). (64a) *P. dorsalis* Van Duzee (male). (64b) *P. dorsalis* Van Duzee (female). (65a) *P. marginatus* Van Duzee (male). (65b) *P. marginatus* Van Duzee (female).

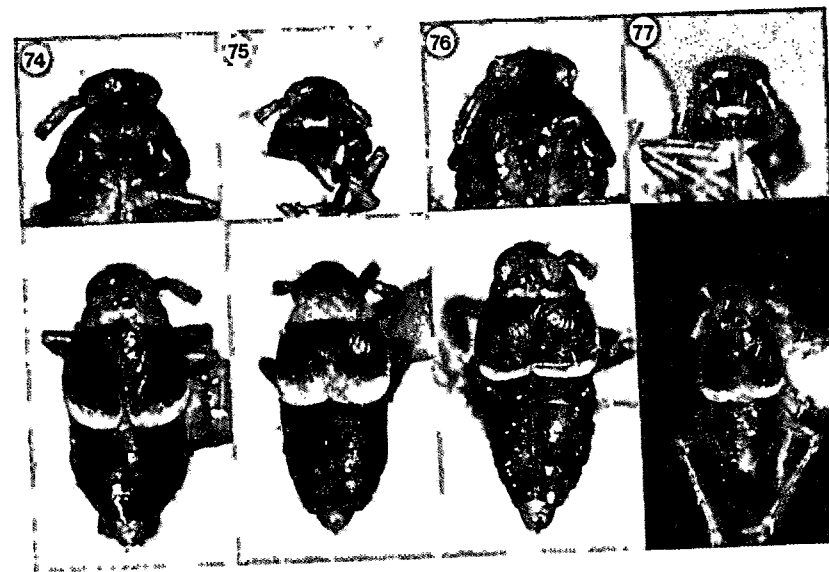




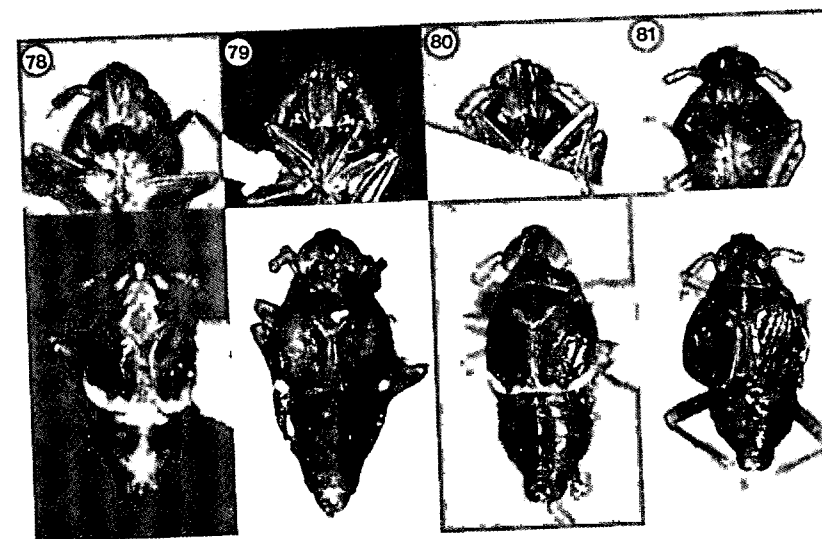
Figs. 66—69. Frontal and dorsal views. (66) *P. radiolus* Bartlett, n. sp. (paratype). (67) *P. canadensis* Bartlett, n. sp. (paratype). (68) *P. aquilonius* Morgan and Beamer (allotype). (69) *P. paludosus* Morgan and Beamer.



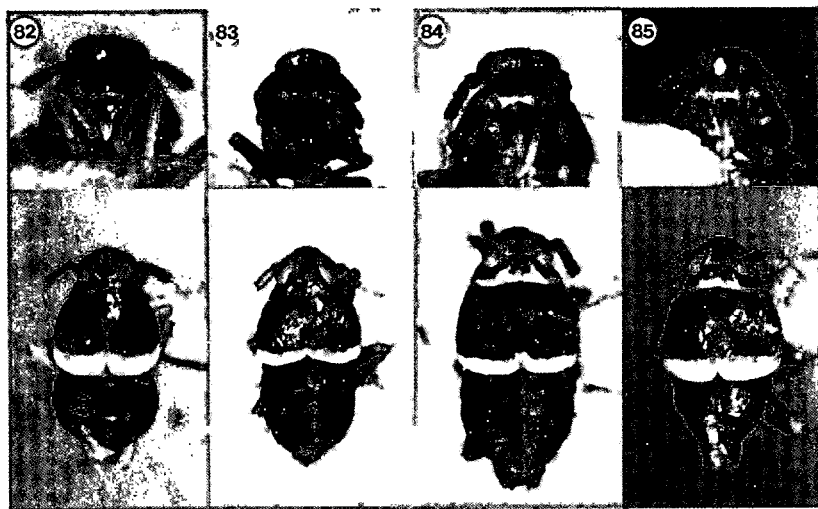
Figs. 70—73. Frontal and dorsal views. (70) *P. merides* Morgan and Beamer. (71) *P. guttatus* Spooner. (72) *P. agrestis* Morgan and Beamer. (73) *P. muii* Metcalf.



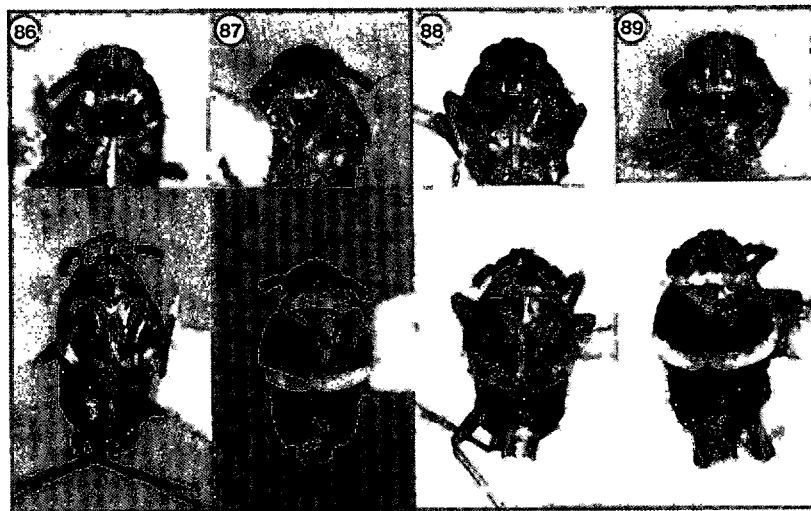
Figs. 74—77. Frontal and dorsal views. (74) *P. basalis* Van Duzee. (75) *P. spooneri* Morgan and Beamer. (76) *P. nitens* (Van Duzee). (77) *P. paraguayensis* Bartlett, n. sp. (paratype).



Figs. 78—81. Frontal and dorsal views. (78) *P. abdominalis* (Crawford). (79) *P. dentatus* Morgan and Beamer (paratype). (80) *P. piceus* (Van Duzee). (81) *P. boliviensis* Bartlett, n. sp.



Figs. 82—85. Frontal and dorsal views. (82) *P. lactofascius* Morgan and Beamer (paratype). (83) *P. minutus* Beamer (paratype). (84) *P. festucae* Bartlett, n. sp. (holotype). (85) *P. spatulatus* Bartlett, n. sp. (paratype).



Figs. 86—89. Frontal and dorsal views. (86) *P. jamaicensis* Bartlett, n. sp. (holotype). (87) *P. brevistilus* Bartlett, n. sp. (paratype). (88) *P. decussatus* Bartlett, n. sp. (paratype). (89) *P. albivultus* Morgan and Beamer.



Figs. 90—92. Frontal and dorsal views. (90) *P. binotatus* Spooner (light and dark forms). (91) *P. delicatus* Van Duzee. (92) *P. melanurus* Van Duzee.

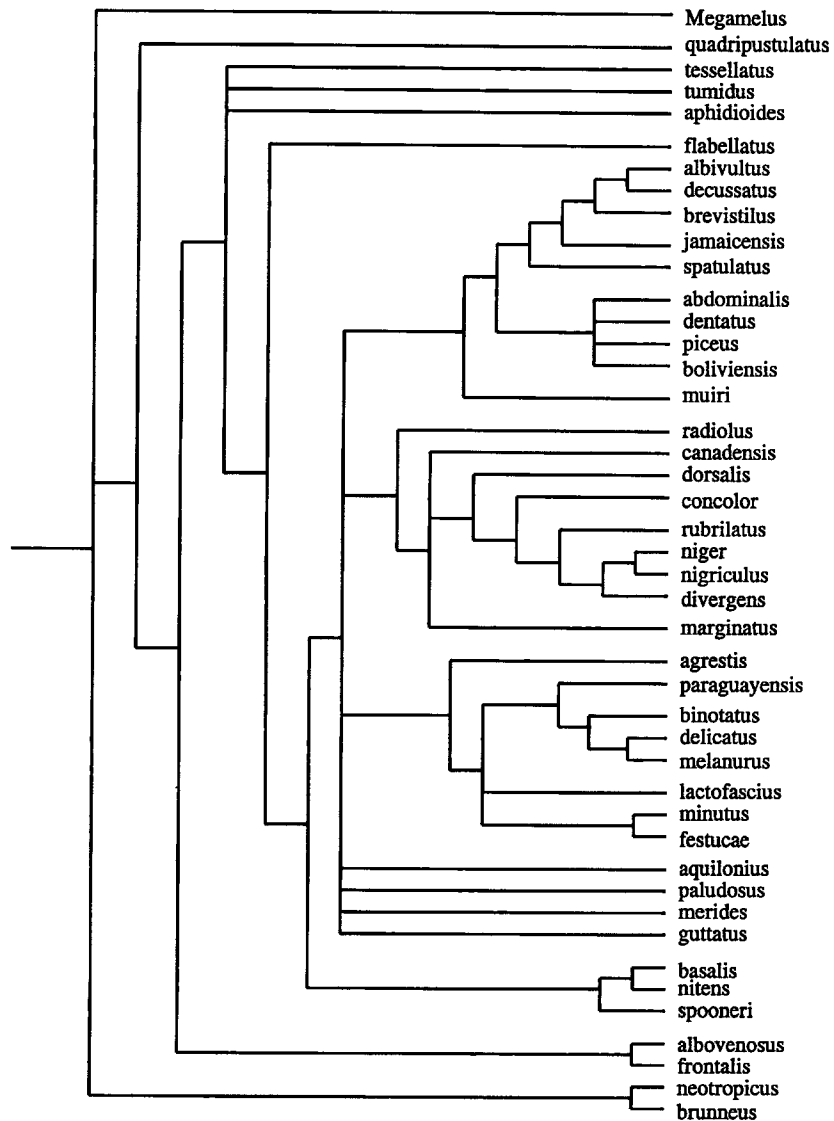


Fig. 93. Cladogram of 43 *Pissonotus* spp. Consensus from 566 equally parsimonious trees (unweighted data). Variation among topologies is indicated by basal polyfurcations.

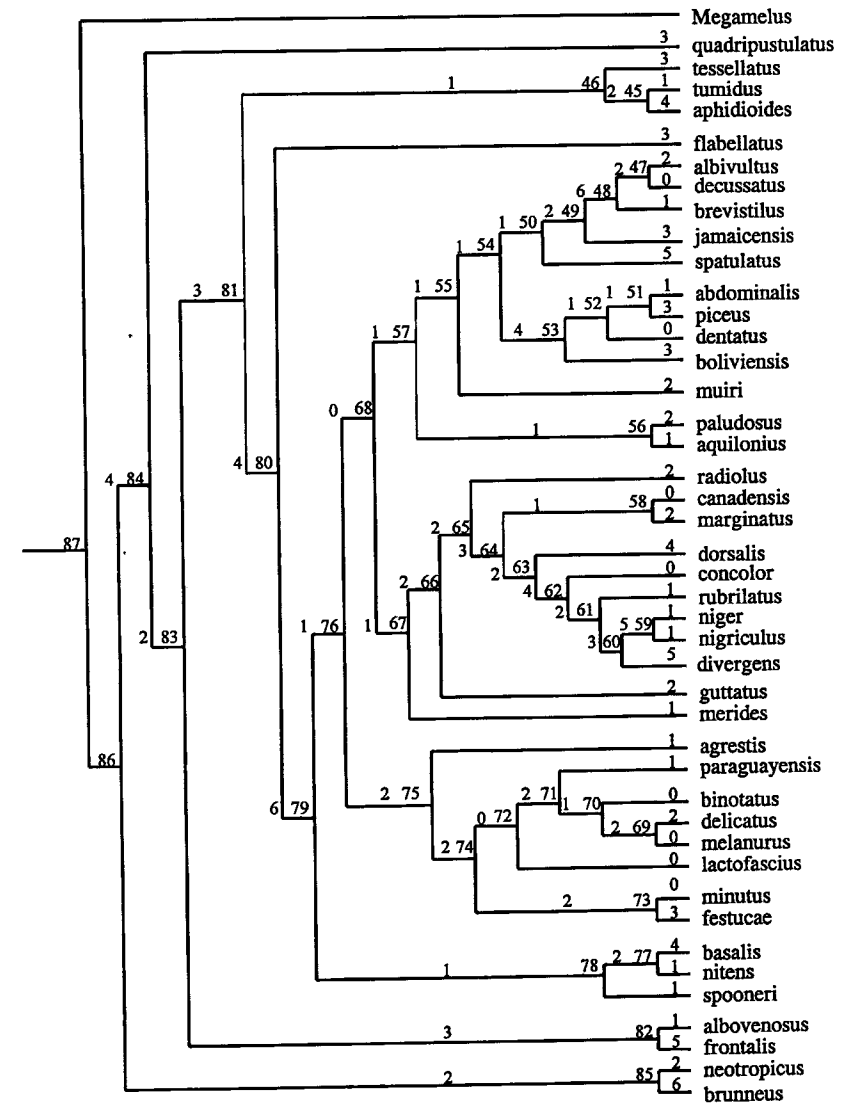


Fig. 94. Cladogram of 43 *Pissonotus* spp. Tree 43 from 566 equally parsimonious trees (unweighted data). Nodes numbered; numbers on internodes indicate numbers of character state changes. Tree statistics: Length = 179 steps, CI = 0.385, RI = 0.630. See Table 3 for list of apomorphies.

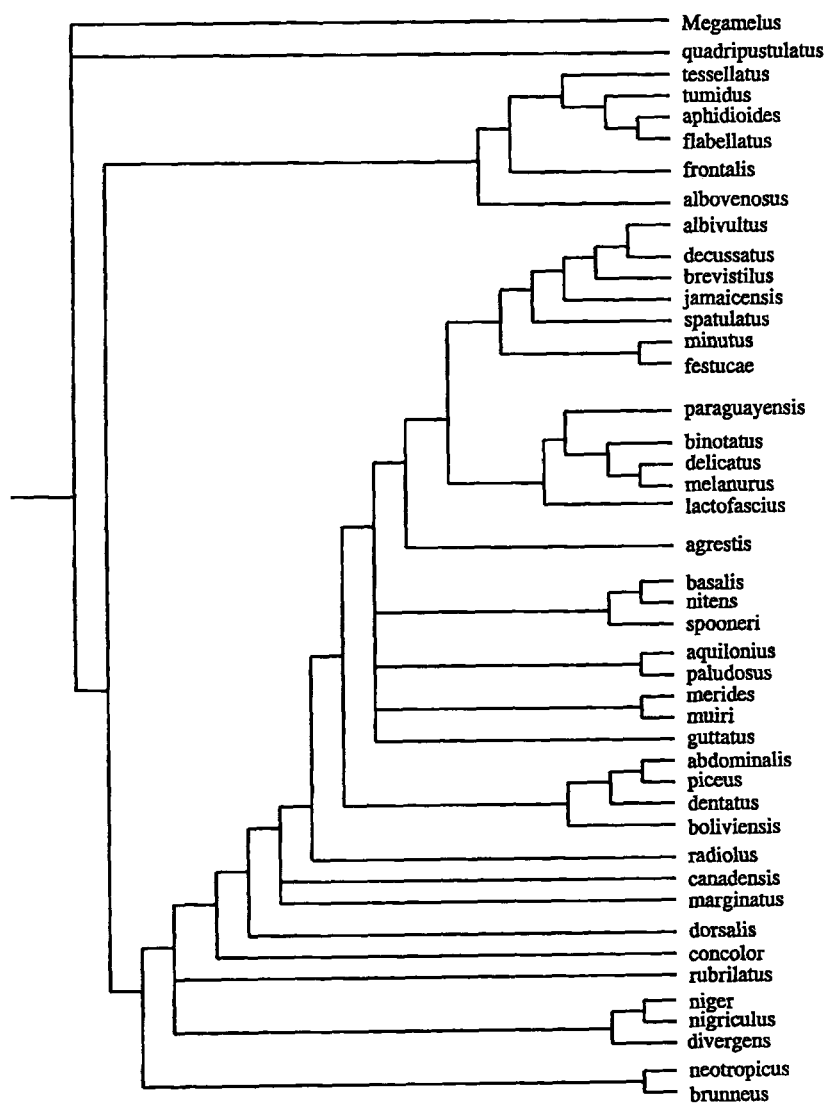


Fig. 95. Cladogram of 43 *Pissonotus* spp. Consensus from 54 equally parsimonious trees (data weighted by CI).

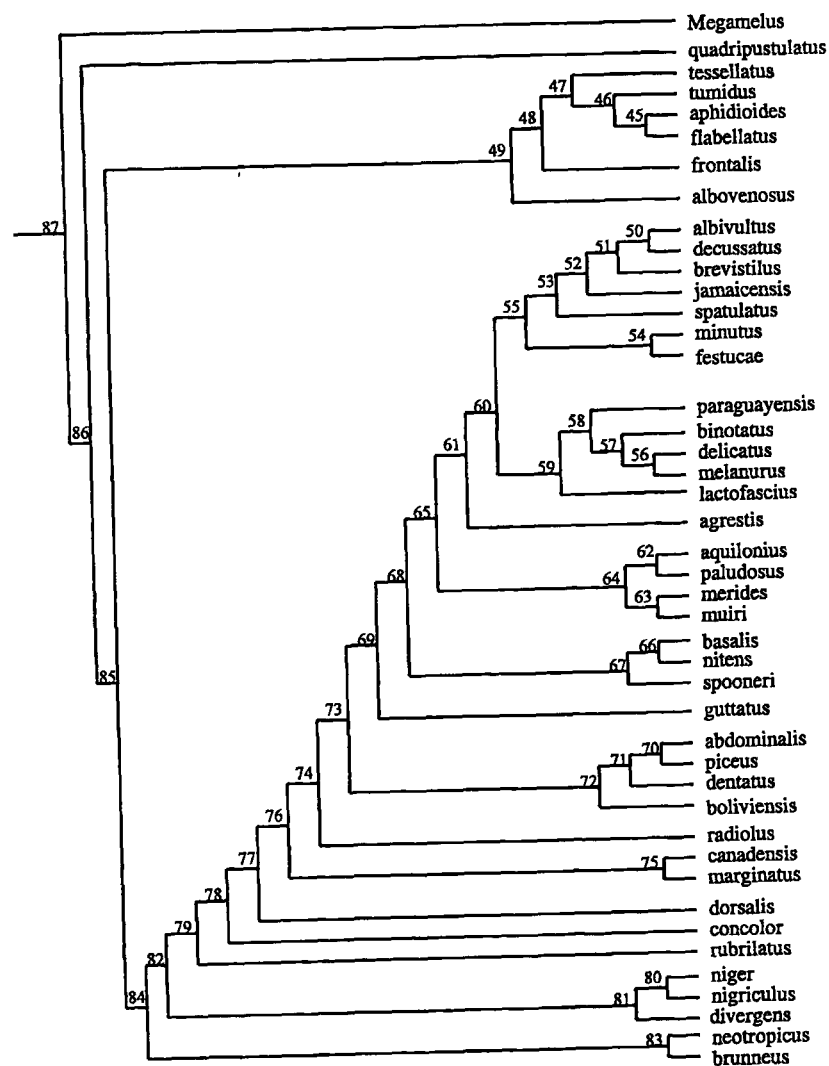


Fig. 96. Preferred phylogenetic estimate of 43 *Pissonotus* spp. Tree 2 from 54 equally parsimonious trees (characters weighted by consistency indices). Nodes numbered. Each branch with number of apomorphies indicated. Tree statistics: Length 70,130 steps (180 at unity), CI = 0.532, RI = 0.711. See Table 5 for list of apomorphies.

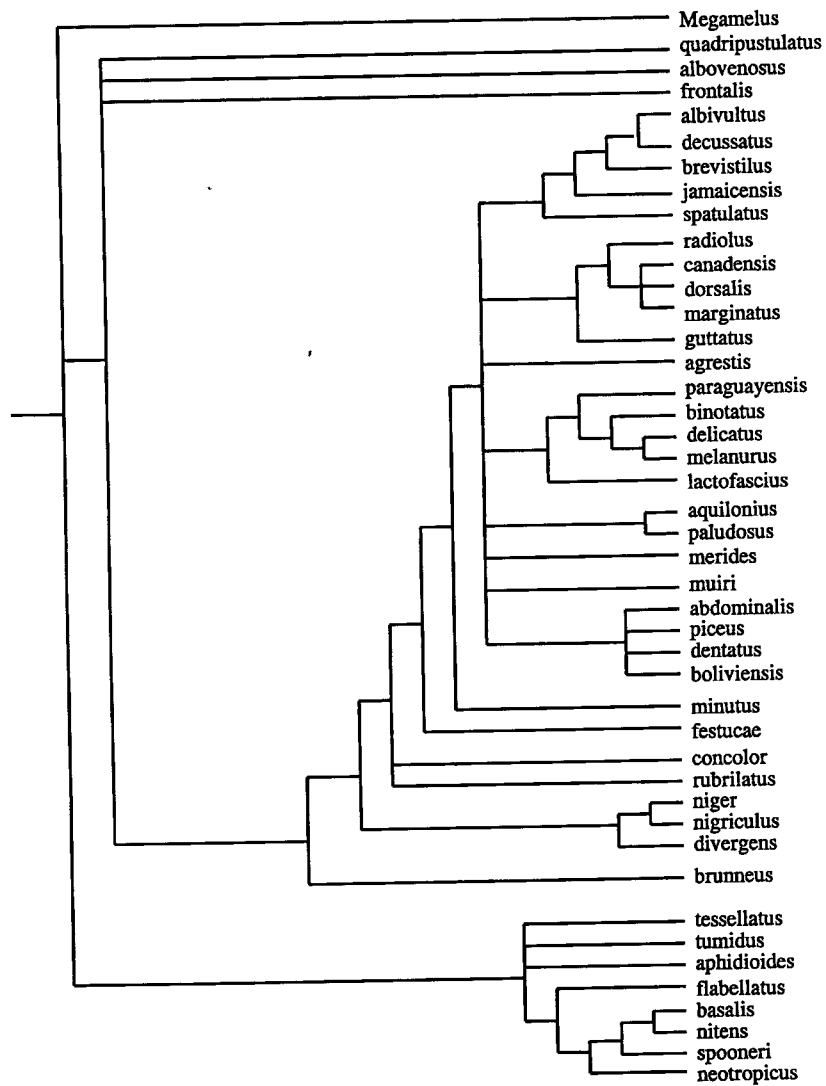


Fig. 97. Cladogram of 43 *Pissonotus* spp. Consensus of 10,000 equally parsimonious trees, subgenera constrained to monophyly (characters unweighted). Data from this analysis are unweighted. Variation among topologies is indicated by basal polyfusions. Tree statistics: Length 187 steps, CI = 0.370, RI = 0.343.

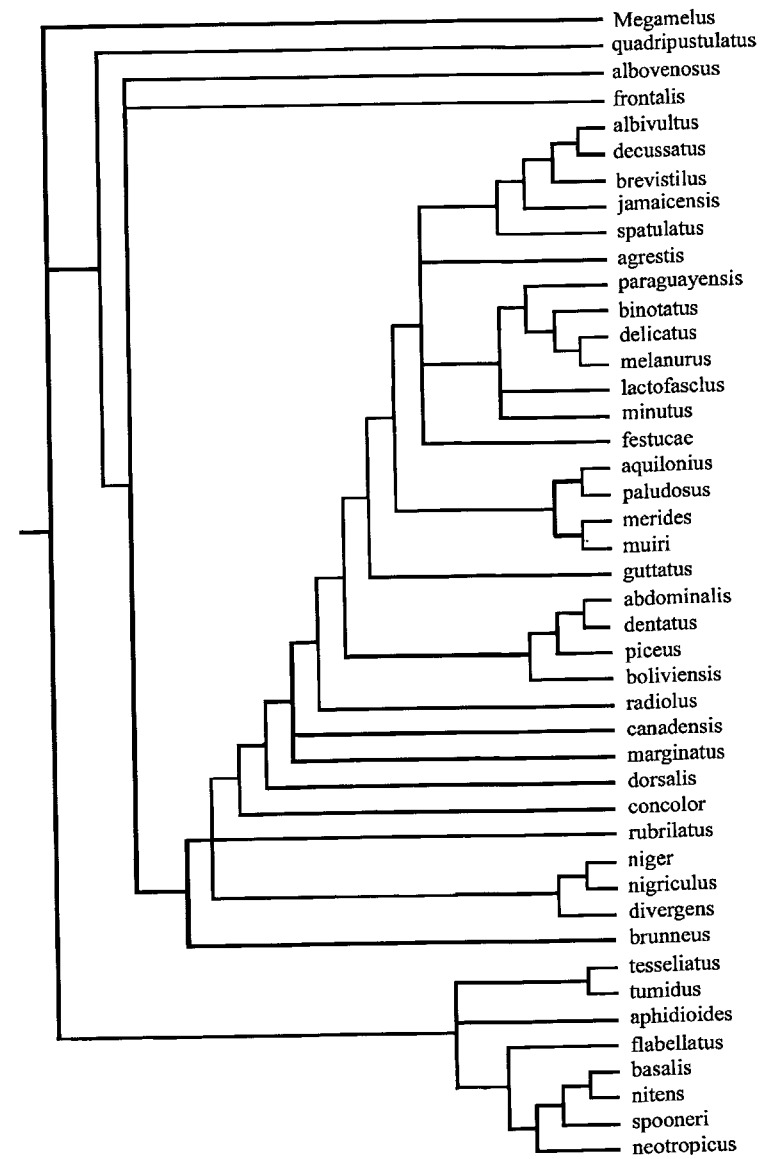


Fig. 98. Cladogram of 43 *Pissonotus* spp. Consensus of 418 equally parsimonious trees, subgenera constrained to monophyly (characters weighted by consistency indices). Variation among topologies is indicated by basal polyfusions. Tree statistics: Length 69,008 steps (189 steps at unity), CI = 0.522, RI = 0.698.



Appendix 2. Canadian records of *Pissonotus* species by province

<i>Pissonotus</i> species	Newfoundland	Nova Scotia	Prince Edward Island	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
<i>aphidioides</i> Van Duzee					X	X	X		X	
<i>basalis</i> Van Duzee		X			X	X	X		X	
<i>brunneus</i> Van Duzee		X			X	X			X	
<i>canadensis</i> , n. sp.					X	X			X	
<i>delicatus</i> Van Duzee					X			X	X	X
<i>dorsalis</i> Van Duzee	X	X	X	X	X	X	X			
<i>flabellatus</i> (Ball)						X				
<i>frontalis</i> (Crawford)										X
<i>guttatus</i> Spooner		X			X	X	X	X		
<i>marginatus</i> Van Duzee					X	X	X		X	
<i>niger</i> Morgan & Beamer							X			
<i>piceus</i> (Van Duzee)					X	X				
<i>radiolus</i> , n. sp.						X				
<i>rubrilatus</i> Morgan & Beamer										X
<i>tumidus</i> Morgan & Beamer							X			

Provinces with no records are omitted.

Appendix 3. Records of *Pissonotus* species: northeastern United States

<i>Pissonotus</i> species	CT	DC	DE	IL	IN	KY	MA	MD	ME	MI	NH	NJ	NY	OH	PA	RI	VA	VT	WV
<i>agressis</i> Morgan & Beamer	X																		
<i>albovenosus</i> Osborn	X		X				X												
<i>aphidioides</i> Van Duzee	X							X											
<i>aquilonius</i> Morgan & Beamer																			
<i>basalis</i> Van Duzee	X								X										
<i>birotatus</i> Spooner								?											
<i>brunneus</i> Van Duzee	X							X											
<i>concolor</i> Bartlett, n. sp.	?																		
<i>delicatus</i> Van Duzee																			
<i>dentatus</i> Morgan & Beamer																			
<i>dorsalis</i> Van Duzee	X								X										
<i>flabellatus</i> (Ball)	X		X				X		X										
<i>guttatus</i> Spooner	X		X				X		X										
<i>marginatus</i> Van Duzee	X		X				X		X										
<i>niger</i> Morgan & Beamer	X		X				X		X										
<i>piceus</i> (Van Duzee)	X		X				X		X										
<i>spooneri</i> Morgan & Beamer	X		X				X		X										
<i>tesellatus</i> (Ball)	X																		
<i>turnizius</i> Morgan & Beamer	X																		

States are indicated by United States postal abbreviations. ? , questionable records.

Appendix 4. Records of *Pissonotus* species: southeastern United States

<i>Pissonotus</i> species	AL	FL	GA	MS	NC	SC	TN
<i>agrestis</i> Morgan & Beamer		X	X				
<i>albivultus</i> Morgan & Beamer		X					
<i>albovenosus</i> Osborn	X	X	X	X	X	X	
<i>aphidioides</i> Van Duzee		X					
<i>basalis</i> Van Duzee		X					
<i>binotatus</i> Spooner	X	X	X	X	X		X
<i>brunneus</i> Van Duzee	X	X	X	X	X	X	X
<i>concolor</i> Bartlett, n. sp.					X		
<i>delicatus</i> Van Duzee	X	X	X	X	X		
<i>dentatus</i> Morgan & Beamer		X			X		
<i>dorsalis</i> Van Duzee					X		
<i>flabellatus</i> (Ball)	X	X	X	X	X		X
<i>guttatus</i> Spooner	X	X			X		X
<i>marginatus</i> Van Duzee		X	X	X	X		X
<i>merides</i> Morgan & Beamer	X	X	X	X	X		
<i>niger</i> Morgan & Beamer					X		
<i>nigriculus</i> Morgan & Beamer		X					
<i>nitens</i> (Van Duzee)	X	X		X			
<i>paludosus</i> Morgan & Beamer	X	X	X	X	X	X	
<i>piceus</i> (Van Duzee)	X	X	X	X	X	X	X
<i>quadripustulatus</i> (Van Duzee)	X	X	X				
<i>spooneri</i> Morgan & Beamer		X			X		
<i>tessellatus</i> (Ball)		X	X	X	X		

States are indicated by United States postal abbreviations.

Appendix 5. Records of *Pissonotus* species: central United States

<i>Pissonotus</i> species	AR	IA	KS	LA	MN	MO	ND	NE	OK	SD	TX
<i>albivultus</i> Morgan & Beamer				X							?
<i>albovenosus</i> Osborn	X			X							X
<i>aphidioides</i> Van Duzee		X									
<i>basalis</i> Van Duzee								X			
<i>binotatus</i> Spooner	X			X		X					
<i>brunneus</i> Van Duzee	X	X	X	X		X			X		X
<i>delicatus</i> Van Duzee	X	X	X			X	X		X		X
<i>divergens</i> Bartlett, n. sp.			X								?
<i>dorsalis</i> Van Duzee					X						
<i>flabellatus</i> (Ball)	X		X			X					X
<i>guttatus</i> Spooner	X	X	X	X	X						
<i>marginatus</i> Van Duzee	X	X	X	X		X					
<i>niger</i> Morgan & Beamer										X	
<i>nigriculus</i> Morgan & Beamer											X
<i>paludosus</i> Morgan & Beamer				X							
<i>piceus</i> (Van Duzee)	X		X	X		X					X
<i>quadripustulatus</i> (Van Duzee)				X							X
<i>spooneri</i> Morgan & Beamer						X					
<i>tumidus</i> Morgan & Beamer					X						

States are indicated by United States postal abbreviations. ?, questionable records.

Appendix 6. Records of *Pissonotus* species: western United States

<i>Pissonotus</i> species	AZ	CA	CO	ID	MT	NM	NV	OR	UT	WA	WY
<i>albovenosus</i> Osborn	X	X				X					
<i>basalis</i> Van Duzee				?							
<i>delicatus</i> Van Duzee	X	X	X	X	X	X		X	X	X	X
<i>divergens</i> Bartlett, n. sp.	?		?			X					
<i>festucae</i> Bartlett, n. sp.	?										
<i>frontalis</i> (Crawford)		X						X			
<i>guttatus</i> Spooner			X								
<i>lactofascius</i> Morgan & Beamer	X		X			X					X
<i>marginatus</i> Van Duzee		?									
<i>melanurus</i> Van Duzee		X									
<i>minutus</i> Beamer	X										
<i>niger</i> Morgan & Beamer					?						
<i>piceus</i> (Van Duzee)	X				X						
<i>rubrilatus</i> Morgan & Beamer			X	X	X						X
<i>spatulatus</i> Bartlett, n. sp.		X									

States are indicated by United States postal abbreviations. ?, questionable records.



Appendix 7. Mexican records of *Pissonotus* by state

<i>Pissonotus</i> species	Baja California Norte	Sonora	Coahuila	Tamaulipas	San Luis Potosi	Durango	Sinaloa	Nayarit	Jalisco	Hidalgo	Veracruz	Puebla	Morales	Mexico	Federal District	Michoacan	Oaxaca	Chiapas
<i>abdominalis</i> (Crawford)							X	X					X				X	X
<i>albivultus</i> Morgan & Beamer					X					X							X	X
<i>albovenosus</i> Osborn		X		X					X					X			X	X
<i>brevistilus</i> Bartlett, n. sp.								X		X								X
<i>brunneus</i> Van Duzee					X					X								X
<i>decussatus</i> Bartlett, n. sp.																		X
<i>delicatus</i> Van Duzee	X		X															X
<i>festucae</i> Bartlett, n. sp.																		X
<i>piceus</i> (Van Duzee)									X	X				X				X
<i>quadripustulatus</i> (Van Duzee)					X													X
<i>spatulatus</i> Bartlett, n. sp.				X														X

States with no records are omitted. ? , questionable records.

## Notes on Appendices 8—11: Measurements and ratios.

In the following appendices, a variety of descriptive measurements and ratios are reported for all of the species of *Pissonotus*. As described under *Materials and Methods*, these measurements are intended to replace subjective descriptive phrases (e.g., "vertex nearly as long as wide") which can be difficult to evaluate. These appendices represent not only summaries of measurements that were presented in the text of the species descriptions, but new measurements that collectively represent a quantitative description of all the species.

Each appendix reports measurements and ratios for a single species and wing morph. Species not available for measurements in a particular gender and wing morph were omitted in that appendix. For each species, 5 individuals of each sex and wing morph were selected (where available), and all measurements were taken only from these individuals. The measurements and ratios reported are described as follows:

1. Body length: dorsal midline from the anterior margin of vertex to the abdominal apex, excluding the anal tube, and in macropters, the wings. For macropters, an additional measurement is given, total body length, which measures from the vertex to the apex of the wings.
2. Body width: the width of the body at the tegulae. For brachypters, this is approximately equal to pronotum width.
3. Frons width: the maximum width of the frons. This is usually at the level of the antennae.
4. Frons height: longitudinally from the epistomal suture to the vertex at midline.
5. Frons width/height ratio: a specimen-specific ratio of the frons width divided by height.
6. Postclypeus height: the length of the postclypeus from the anteclypeus to the epistomal suture at the midline.
7. Vertex length: the longitudinal length of the vertex at the midline.
8. Vertex width: the width of the vertex approximately at midlength.
9. Vertex length/width ratio: a specimen-specific ratio of vertex width divided by vertex length.
10. Head width: the maximum width of the head, including eyes (but not antennae), dorsal view.
11. Length of antennal segment I.
12. Length of antennal segment II.
13. Antennal segment I/II ratio: a specimen-specific ratio of the lengths of antennal segment I divided by II.
14. Pronotum width: the maximum width of the pronotum at the caudal margin.
15. Pronotum length: the length of the pronotum at the median carina.
16. Mesonotum length: the length of the mesonotum at the midline.
17. Tegmina (or wing) length: the maximum distance from the base to the apex of the tegmina or front wing.
18. Calcar length: the maximum calcar length from base to apex.
19. Number of calcar teeth: a tally of the black-tipped teeth on the calcar.
20. Front tibia width: the maximum width of the front tibia.

Appendix 8. Measurements and ratios of *Pissonotus*: male brachypters

<i>Pissonotus</i> spp.	Body length	Body width of at tegulae	Width of frons at antennae	Height of frons at midline	Ratio frons width/height	Length of postclypeus at midline	Length of vertex at midline	Width of vertex	Ratio vertex length/width
<i>abdominalis</i>	Range 2.25	0.70-0.72	0.20-0.21	0.49-0.52	0.40-0.41	0.20-0.22	0.26-0.27	0.16-0.17	0.59-0.61
	Ave. (n) 2.25 (1)	0.71 (2)	0.20 (2)	0.51 (2)	0.41 (2)	0.21 (2)	0.26 (2)	0.16 (2)	0.60 (2)
<i>agrestis</i>	Range 1.72-1.97	0.61-0.71	0.23-0.25	0.40-0.45	0.51-0.59	0.13-0.18	0.20-0.25	0.15-0.19	0.67-0.96
	Ave. (n) 1.86 (5)	0.64 (6)	0.24 (6)	0.43 (6)	0.57 (6)	0.15 (6)	0.22 (6)	0.17 (5)	0.78 (6)
<i>albivultus</i>	Range 1.70-1.96	0.65-0.73	0.23-0.25	0.45-0.50	0.47-0.52	0.15-0.18	0.19-0.25	0.15-0.18	0.63-0.87
	Ave. (n) 1.82 (5)	0.69 (5)	0.24 (5)	0.48 (5)	0.49 (5)	0.17 (5)	0.21 (5)	0.16 (5)	0.77 (5)
<i>albovenosus</i>	Range 2.17-2.42	0.69-0.78	0.23-0.27	0.47-0.53	0.44-0.53	0.18-0.22	0.25-0.28	0.17-0.22	0.58-0.84
	Ave. (n) 2.29 (5)	0.75 (5)	0.24 (5)	0.49 (5)	0.49 (5)	0.20 (5)	0.26 (5)	0.19 (5)	0.74 (5)
<i>aquilonius</i>	Range 2.30a	0.75-0.78	0.27	0.45-0.52	0.52-0.60	0.23-0.26	0.18-0.19	0.18-0.19	1.00
	Ave. (n) 2.30 (1)	0.77 (2)	0.27 (2)	0.49 (2)	0.56 (2)	0.25 (2)	0.19 (2)	0.19 (2)	1.00 (2)
<i>aphidioides</i>	Range 0.83-2.90	1.00-1.13	0.28-0.29	0.60-0.68	0.43-0.46	0.23-0.30	0.23-0.30	0.20-0.22	0.67-0.93
	Ave. (n) 2.86 (3)	1.06 (5)	0.29 (5)	0.65 (5)	0.44 (5)	0.28 (5)	0.28 (5)	0.21 (5)	0.75 (5)
<i>basalis</i>	Range 2.17-2.32	0.73-0.78	0.25-0.28	0.48-0.52	0.48-0.56	0.19-0.23	0.18-0.23	0.20-0.23	0.92-1.09
	Ave. (n) 2.24 (5)	0.75 (5)	0.27 (5)	0.49 (5)	0.54 (5)	0.22 (5)	0.21 (5)	0.21 (5)	1.00 (5)
<i>binotatus</i>	Range 1.68-1.92	0.62-0.68	0.25-0.28	0.43-0.48	0.56-0.59	0.15-0.20	0.17-0.20	0.18-0.20	0.96-1.15
	Ave. (n) 1.77 (5)	0.66 (5)	0.26 (5)	0.46 (5)	0.57 (5)	0.16 (5)	0.18 (5)	0.19 (5)	1.07 (5)
<i>boliviensis</i>	Range 2.06-2.63	0.68-0.72	0.23-0.26	0.48-0.57	0.44-0.52	0.17-0.19	0.25-0.29	0.15-0.18	0.55-0.73
	Ave. (n) 2.31 (4)	0.69 (5)	0.25 (5)	0.51 (5)	0.48 (5)	0.18 (5)	0.28 (5)	0.17 (5)	0.61 (5)
<i>brevistilus</i>	Range 1.80	0.67	0.22	0.47	0.46	0.12-0.13	0.23-0.26	0.17	0.65-0.74
	Ave. (n) 1.80 (1)	0.67 (2)	0.22 (2)	0.47 (2)	0.46 (2)	0.13 (2)	0.24 (2)	0.17 (2)	0.70 (2)
<i>brunneus</i>	Range 2.06-2.40	0.71-0.79	0.25-0.28	0.43-0.52	0.52-0.58	0.18-0.19	0.20-0.23	0.18-0.20	0.79-1.00
	Ave. (n) 2.25 (5)	0.75 (5)	0.26 (5)	0.48 (5)	0.55 (5)	0.19 (5)	0.22 (5)	0.19 (5)	0.88 (5)
<i>canadensis</i>	Range 2.63-2.67	0.78-0.88	0.26-0.30	0.53-0.57	0.47-0.57	0.23-0.25	0.22-0.29	0.18-0.22	0.71-0.92
	Ave. (n) 2.65 (2)	0.83 (5)	0.29 (5)	0.56 (5)	0.52 (5)	0.25 (4)	0.26 (5)	0.21 (5)	0.80 (5)
<i>concolor</i>	Range ---	0.70-0.73	0.26-0.31	0.51-0.54	0.51-0.57	0.23	0.23-0.27	0.18-0.22	0.79-0.81
	Ave. (n) ---	0.72 (2)	0.28 (2)	0.53 (2)	0.54 (2)	0.23 (1)	0.25 (2)	0.20 (2)	0.80 (2)
<i>decussatus</i>	Range 2.00	0.71-0.74	0.23-0.24	0.44-0.49	0.49-0.52	0.18-0.20	0.19-0.23	0.14-0.15	0.65-0.82
	Ave. (n) 2.00 (1)	0.73 (2)	0.24 (2)	0.47 (2)	0.51 (2)	0.19 (2)	0.21 (2)	0.15 (2)	0.74 (2)
<i>delicatus</i>	Range 1.81-2.14	0.66-0.79	0.23-0.26	0.47-0.50	0.47-0.54	0.17-0.21	0.17-0.25	0.15-0.19	0.67-0.91
	Ave. (n) 1.97 (5)	0.72 (5)	0.25 (5)	0.49 (5)	0.50 (5)	0.19 (5)	0.22 (5)	0.17 (5)	0.77 (5)
<i>dentatus</i>	Range 1.88-2.20	0.59-0.69	0.22-0.23	0.48-0.53	0.40-0.48	0.18-0.20	0.21-0.27	0.15-0.19	0.63-0.90
	Ave. (n) 2.00 (4)	0.64 (5)	0.23 (5)	0.51 (5)	0.44 (5)	0.19 (4)	0.23 (5)	0.17 (5)	0.72 (5)
<i>divergens</i>	Range ---	0.67	0.29	0.44	0.66	0.18	0.23	0.22	0.93
	Ave. (n) ---	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>dorsalis</i>	Range 2.82-3.44	0.82-1.01	0.31-0.35	0.59-0.66	0.48-0.54	0.22-0.25	0.22-0.29	0.22-0.25	0.86-1.00
	Ave. (n) 3.08 (5)	0.91 (5)	0.33 (5)	0.63 (5)	0.52 (5)	0.24 (5)	0.26 (5)	0.23 (5)	0.91 (5)
<i>festuca</i>	Range 2.63	0.93	0.28	0.52	0.55	0.25	0.22	0.22	1.00
	Ave. (n) (1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>flabellatus</i>	Range 2.17-2.61	0.74-0.88	0.28-0.30	0.49-0.59	0.49-0.59	0.19-0.25	0.21-0.28	0.18-0.22	0.64-0.92
	Ave. (n) 2.36 (5)	0.81 (5)	0.29 (5)	0.54 (5)	0.55 (5)	0.23 (5)	0.25 (5)	0.20 (5)	0.78 (5)
<i>frontalis</i>	Range 2.01-2.70	0.70-0.94	0.28-0.33	0.44-0.54	0.53-0.64	0.18-0.24	0.20-0.28	0.18-0.26	0.76-1.04
	Ave. (n) 2.24 (11)	0.80 (11)	0.29 (11)	0.49 (11)	0.59 (11)	0.22 (11)	0.24 (11)	0.21 (11)	0.88 (11)
<i>guttatus</i>	Range 1.99-2.22	0.56-0.62	0.24-0.25	0.47-0.48	0.52-0.54	0.17-0.18	0.20-0.25	0.12-0.16	0.57-0.80
	Ave. (n) 2.12 (5)	0.60 (5)	0.25 (5)	0.47 (5)	0.53 (5)	0.18 (5)	0.22 (5)	0.15 (5)	0.65 (5)
<i>jamaicensis</i>	Range 2.09-2.21	0.63	0.21-0.24	0.48-0.52	0.43-0.47	0.20	0.24-0.26	0.13-0.14	0.54
	Ave. (n) 2.15 (2)	0.63 (1)	0.23 (2)	0.50 (2)	0.45 (2)	0.20 (2)	0.25 (2)	0.14 (2)	0.54 (2)
<i>lactofasciatus</i>	Range 1.70-1.96	0.60-0.66	0.24-0.26	0.40-0.45	0.55-0.63	0.16-0.17	0.18-0.24	0.16-0.18	0.71-1.00
	Ave. (n) 1.83 (5)	0.62 (5)	0.26 (5)	0.43 (5)	0.59 (5)	0.17 (5)	0.20 (5)	0.17 (5)	0.86 (5)

Maximum width of head	Length of antennal segment I	Length of antennal segment II	Ratio of antennal segment I/II	Maximum width of pronotum	Length of pronotum at midline	Length of mesonotum at midline	Length of tegmina	Length of calcar	Number of calcar teeth	Width of front tibia
0.55	0.13-0.14	0.25-0.27	0.50-0.53	0.68-0.70	0.20-0.22	0.31-0.33	0.82	0.37-0.38	13-15	0.07
0.55 (2)	0.13 (2)	0.26 (2)	0.52 (2)	0.69 (2)	0.21 (2)	0.32 (2)	0.82 (2)	0.37 (2)	14 (2)	0.07 (2)
0.52-0.63	0.08-0.17	0.21-0.28	0.36-0.61	0.60-0.66	0.18-0.21	0.19-0.25	0.60-0.68	0.21-0.23	6-10	0.07-0.08
0.54 (6)	0.12 (6)	0.25 (6)	0.48 (6)	0.63 (6)	0.18 (6)	0.23 (6)	0.64 (6)	0.22 (6)	8 (5)	0.07 (3)
0.54-0.59	0.08-0.13	0.21-0.25	0.40-0.54	0.65-0.72	0.17-0.18	0.22-0.27	0.64-0.82	0.23-0.27	9-11	0.07-0.08
0.58 (5)	0.12 (5)	0.24 (5)	0.49 (5)	0.68 (5)	0.17 (5)	0.24 (5)	0.73 (5)	0.25 (5)	10 (5)	0.07 (5)
0.62-0.67	0.13-0.17	0.29-0.35	0.46-0.55	0.69-0.77	0.22-0.25	0.29-0.34	0.83-0.88	0.28-0.34	9-13	0.08-0.10
0.64 (5)	0.16 (5)	0.32 (5)	0.51 (5)	0.74 (5)	0.23 (5)	0.32 (5)	0.86 (5)	0.30 (5)	11 (3)	0.09 (4)
0.61-0.63	0.15-0.17	0.35	0.43-0.49	0.75-0.78	0.20-0.21	0.28-0.32	0.78-0.80	0.26-0.27	8	0.08
0.62 (2)	0.16 (2)	0.35 (2)	0.46 (2)	0.77 (2)	0.21 (2)	0.30 (2)	0.79 (2)	0.27 (2)	8 (2)	0.08 (2)
0.73-0.80	0.25-0.32	0.46-0.53	0.50-0.66	1.00-1.07	0.26-0.28	0.33-0.44	1.03-1.17	0.33-0.40	6-9	0.15-0.16
0.77 (5)	0.28 (5)	0.49 (5)	0.57 (5)	1.02 (5)	0.27 (5)	0.38 (5)	1.12 (5)	0.37 (5)	7 (5)	0.15 (4)
0.61-0.64	0.14-0.17	0.32-0.37	0.41-0.45	0.70-0.76	0.18-0.23	0.27-0.32	0.77-0.81	0.28-0.33	7-11	0.12-0.13
0.62 (5)	0.15 (5)	0.35 (5)	0.43 (5)	0.74 (5)	0.22 (5)	0.28 (5)	0.79 (5)	0.29 (4)	9 (4)	0.12 (4)
0.57-0.60	0.08-0.15	0.25-0.30	0.33-0.51	0.58-0.68	0.15-0.18	0.23-0.29	0.62-0.80	0.23-0.29	5-8	0.06-0.08
0.58 (5)	0.12 (5)	0.28 (5)	0.41 (5)	0.65 (5)	0.17 (5)	0.26 (5)	0.70 (5)	0.26 (5)	7 (5)	0.07 (5)
0.50-0.56	0.13-0.18	0.25-0.33	0.50-0.63	0.68-0.72	0.19-0.21	0.28-0.37	0.82-0.88	0.38-0.44	10-14	0.08
0.53 (5)	0.16 (5)	0.28 (5)	0.55 (5)	0.69 (5)	0.20 (5)	0.33 (5)	0.86 (5)	0.40 (5)	12 (5)	0.08 (5)
0.57-0.60	0.11	0.22-0.23	0.46-0.50	0.67-0.68	0.17-0.18	0.19-0.23	0.70-0.73	0.23-0.24	8-10	0.07
0.58 (2)	0.11 (2)	0.23 (2)	0.48 (2)	0.68 (2)	0.17 (2)	0.21 (2)	0.72 (2)	0.24 (2)	9 (2)	0.07 (2)
0.62-0.65	0.10-0.15	0.27-0.30	0.34-0.50	0.72-0.83	0.19-0.21	0.28-0.35	0.68-0.89	0.26-0.30	7-11	0.07-0.08
0.63 (5)	0.12 (5)	0.28 (5)	0.41 (5)	0.74 (5)	0.20 (5)	0.31 (5)	0.80 (5)	0.28 (5)	9 (5)	0.08 (5)
0.62-0.68	0.17-0.22	0.35-0.40	0.48-0.55	0.78-0.88	0.22-0.25	0.32-0.38	0.85-1.00	0.30-0.34	7-8	0.08
0.65 (5)	0.19 (4)	0.37 (4)	0.51 (4)	0.83 (5)	0.23 (5)	0.35 (5)	0.93 (5)	0.32 (5)	8 (5)	0.08 (5)
0.58-0.60	0.17	0.32-0.35	0.48-0.53	0.70-0.73	0.23-0.26	0.33-0.37	0.73-0.93	0.26-0.30	7-8	0.08
0.59 (2)	0.17 (2)	0.33 (2)	0.51 (2)	0.72 (2)	0.24 (2)	0.35 (2)	0.83 (2)	0.27 (2)	8 (2)	0.08 (2)
0.56-0.58	0.11-0.13	0.25-0.28	0.48-0.53	0.66-0.74	0.15-0.17	0.30-0.31	0.72-0.82	0.28-0.31	10-11	0.07
0.57 (2)	0.12 (2)	0.27 (2)	0.51 (2)	0.70 (2)	0.16 (2)	0.31 (2)	0.77 (2)	0.30 (2)	11 (2)	0.07 (2)
0.52-0.60	0.15-0.17	0.29-0.37	0.45-0.57	0.64-0.79	0.16-0.21	0.24-0.31	0.67-0.83	0.24-0.28	8-10	0.08-0.09
0.56 (5)	0.20 (5)	0.33 (5)	0.51 (5)	0.72 (5)	0.19 (5)	0.29 (5)	0.74 (5)	0.26 (5)	9 (3)	0.09 (5)
0.53-0.57	0.10-0.15	0.28-0.32	0.32-0.47	0.59-0.67	0.18-0.22	0.25-0.33	0.67-0.78	0.26-0.30	11-12	0.07-0.08
0.54 (5)	0.11 (5)	0.30 (5)	0.37 (5)	0.63 (5)	0.20 (5)	0.29 (5)	0.74 (5)	0.28 (5)	12 (5)	0.07 (5)
0.63	0.13	0.25	0.53	0.67	0.17	0.30	0.75	0.26	9	0.07
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.68-0.72	0.15-0.20	0.35-0.39	0.43-0.51	0.82-0.92	0.23-0.31	0.35-0.41	0.95-1.09	0.33-0.38	9-11	0.08-0.10
0.70 (5)	0.18 (5)	0.37 (5)	0.48 (5)	0.88 (5)	0.26 (5)	0.38 (5)	1.01 (5)	0.36 (5)	10	

## Appendix 8. Continued

Pissonotus spp.	Body length	Body width of at tegulae	Width of frons at antennae	Height of frons at midline	Ratio frons width/height	Length of postclypeus at midline	Length of vertex at midline	Width of vertex	Ratio vertex length/width
<i>margnatus</i>	Range 2.38-2.90 Ave. (n) 2.65 (5)	0.68-0.89 0.78 (5)	0.26-0.32 0.29 (5)	0.46-0.54 0.50 (5)	0.55-0.58 0.57 (5)	0.18-0.28 0.23 (5)	0.24-0.31 0.27 (5)	0.16-0.22 0.20 (5)	0.64-0.83 0.73 (5)
<i>melanurus</i>	Range 1.84-1.93 Ave. (n) 1.89 (2)	0.77-0.80 0.78 (3)	0.25-0.27 0.26 (3)	0.49-0.53 0.51 (3)	0.50-0.51 0.50 (3)	0.19-0.27 0.23 (3)	0.20-0.28 0.23 (3)	0.19-0.23 0.20 (3)	0.82-0.95 0.89 (3)
<i>merides</i>	Range 1.85-2.18 Ave. (n) 2.04 (5)	0.64-0.71 0.69 (5)	0.26-0.27 0.27 (5)	0.47-0.53 0.50 (5)	0.50-0.57 0.53 (5)	0.19-0.21 0.20 (5)	0.21-0.25 0.23 (5)	0.14-0.18 0.16 (5)	0.61-0.78 0.70 (5)
<i>minutus</i>	Range 1.46-1.53 Ave. (n) 1.51 (5)	0.52-0.58 0.54 (5)	0.23 0.23 (5)	0.35-0.40 0.38 (5)	0.57-0.67 0.61 (5)	0.13-0.16 0.14 (5)	0.17-0.21 0.19 (5)	0.15-0.16 0.16 (5)	0.71-0.94 0.84 (5)
<i>mutri</i>	Range 2.24-2.55 Ave. (n) 2.40 (5)	0.66-0.73 0.69 (5)	0.23 0.23 (5)	0.52-0.57 0.54 (5)	0.41-0.45 0.43 (5)	0.22-0.26 0.24 (5)	0.21-0.28 0.25 (5)	0.15-0.16 0.16 (5)	0.59-0.76 0.64 (5)
<i>neotropicus</i>	Range 2.03-2.62 Ave. (n) 2.35 (5)	0.70-0.82 0.76 (4)	0.30-0.33 0.32 (5)	0.37-0.46 0.41 (5)	0.72-0.83 0.78 (5)	0.17-0.18 0.18 (5)	0.22-0.25 0.24 (5)	0.25-0.28 0.26 (5)	1.04-1.27 1.11 (5)
<i>niger</i>	Range 2.14-2.33 Ave. (n) 2.22 (5)	0.68-0.80 0.72 (5)	0.23-0.32 0.27 (5)	0.41-0.50 0.46 (5)	0.52-0.70 0.59 (5)	0.19-0.20 0.20 (5)	0.21-0.25 0.24 (5)	0.16-0.20 0.17 (5)	0.64-0.80 0.72 (5)
<i>nigriculus</i>	Range 1.56-1.66 Ave. (n) 1.61 (5)	0.58-0.62 0.59 (5)	0.22-0.23 0.23 (5)	0.38-0.42 0.40 (5)	0.54-0.61 0.56 (5)	0.13-0.15 0.14 (4)	0.17-0.19 0.18 (5)	0.12-0.14 0.13 (5)	0.67-0.82 0.71 (5)
<i>nitens</i>	Range 2.24-2.55 Ave. (n) 2.04 (2)	0.66-0.70 0.64 (3)	0.23-0.28 0.26 (3)	0.46-0.52 0.49 (3)	0.48-0.56 0.53 (3)	0.23-0.26 0.19 (3)	0.20-0.22 0.21 (3)	0.15-0.16 0.16 (3)	0.68-0.80 0.75 (3)
<i>paludosus</i>	Range 1.70-2.03 Ave. (n) 1.88 (5)	0.58-0.67 0.62 (5)	0.22-0.25 0.24 (5)	0.39-0.47 0.42 (5)	0.54-0.64 0.57 (5)	0.17-0.19 0.18 (5)	0.21-0.25 0.23 (5)	0.14-0.18 0.16 (5)	0.61-0.81 0.70 (5)
<i>paraguayensis</i>	Range 1.80-2.00 Ave. (n) 1.90 (2)	0.60-0.70 0.65 (2)	0.23-0.25 0.24 (2)	0.42-0.43 0.43 (2)	0.56-0.58 0.57 (2)	0.15-0.18 0.17 (2)	0.23 0.23 (2)	0.16-0.17 0.17 (2)	0.71 0.71 (2)
<i>piceus</i>	Range 2.20-2.38 Ave. (n) 2.31 (5)	0.66-0.72 0.69 (5)	0.23-0.25 0.24 (5)	0.52-0.58 0.55 (5)	0.41-0.45 0.44 (5)	0.18-0.22 0.20 (5)	0.25-0.32 0.28 (5)	0.15-0.18 0.17 (5)	0.54-0.68 0.61 (5)
<i>quadripustulatus</i>	Range 2.15-2.32 Ave. (n) 2.25 (5)	0.73-0.78 0.76 (5)	0.27-0.32 0.29 (5)	0.49-0.55 0.52 (5)	0.52-0.59 0.55 (5)	0.18-0.22 0.20 (5)	0.26-0.29 0.27 (5)	0.20-0.22 0.21 (5)	0.72-0.81 0.77 (5)
<i>radiolus</i>	Range 2.78-2.80 Ave. (n) 2.79 (2)	0.88-0.95 0.92 (3)	0.27-0.28 0.27 (3)	0.58-0.62 0.61 (3)	0.43-0.47 0.45 (3)	0.23 0.23 (3)	0.27-0.28 0.27 (3)	0.22-0.23 0.22 (3)	0.79-0.88 0.83 (3)
<i>rubrilatus</i>	Range 2.04-2.24 Ave. (n) 2.17 (5)	0.71-0.82 0.75 (5)	0.25-0.26 0.26 (5)	0.47-0.52 0.50 (5)	0.48-0.55 0.51 (5)	0.18-0.22 0.20 (5)	0.21-0.24 0.22 (5)	0.18-0.20 0.19 (5)	0.75-0.87 0.83 (5)
<i>spatulatus</i>	Range 1.90-2.00 Ave. (n) 1.93 (3)	0.65-0.70 0.68 (5)	0.25-0.27 0.26 (5)	0.40-0.48 0.43 (5)	0.52-0.63 0.59 (5)	0.17-0.18 0.18 (5)	0.21-0.25 0.23 (5)	0.18-0.20 0.19 (5)	0.76-0.87 0.82 (5)
<i>spooneri</i>	Range 1.73-1.84 Ave. (n) 1.77 (5)	0.60-0.66 0.64 (5)	0.25-0.28 0.26 (5)	0.39-0.43 0.42 (5)	0.59-0.66 0.62 (5)	0.17-0.20 0.18 (4)	0.20-0.24 0.22 (5)	0.18-0.20 0.19 (5)	0.79-0.95 0.87 (5)
<i>tessellatus</i>	Range 1.76-2.22 Ave. (n) 2.00 (5)	0.65-0.70 0.67 (5)	0.23 0.23 (5)	0.38-0.42 0.39 (5)	0.56-0.62 0.60 (5)	0.15-0.18 0.16 (5)	0.18-0.23 0.21 (5)	0.16-0.18 0.17 (5)	0.74-0.89 0.81 (5)
<i>tumidus</i>	Range 2.36-2.62 Ave. (n) 2.49 (2)	0.86-0.90 0.88 (2)	0.27 0.27 (2)	0.54-0.56 0.55 (2)	0.48-0.50 0.49 (2)	0.27-0.28 0.28 (2)	0.25-0.28 0.27 (2)	0.20-0.21 0.21 (2)	0.81-0.80 0.78 (2)

Maximum width of head	Length of antennal segment I	Length of antennal segment II	Ratio of antennal segment I/II	Maximum width of pronotum	Length of pronotum at midline	Length of mesonotum at midline	Length of tegmina	Length of calcar	Number of calcar teeth	Width of front tibia
0.54-0.63 0.59 (5)	0.16-0.20 0.18 (5)	0.33-0.43 0.38 (5)	0.42-0.59 0.47 (5)	0.67-0.77 0.73 (5)	0.19-0.21 0.20 (5)	0.30-0.42 0.37 (5)	0.73-0.90 0.85 (5)	0.25-0.32 0.30 (5)	6-9 7 (5)	0.08 0.08 (5)
0.60-0.62 0.61 (3)	0.15-0.22 0.18 (3)	0.29-0.35 0.33 (3)	0.48-0.62 0.54 (3)	0.73-0.78 0.75 (3)	0.20-0.21 0.21 (3)	0.25-0.29 0.27 (3)	0.70-0.73 0.72 (3)	0.27-0.29 0.28 (3)	10 10 (3)	0.08-0.09 0.09 (3)
0.49-0.54 0.52 (5)	0.08-0.14 0.11 (5)	0.29-0.32 0.30 (5)	0.26-0.42 0.37 (5)	0.61-0.69 0.66 (5)	0.17-0.23 0.19 (5)	0.27-0.32 0.29 (5)	0.63-0.77 0.69 (5)	0.25-0.28 0.27 (5)	8-11 10 (5)	0.08 0.08 (5)
0.47-0.51 0.49 (5)	0.08-0.09 0.09 (5)	0.21-0.23 0.22 (5)	0.38-0.44 0.41 (5)	0.49-0.57 0.53 (5)	0.14-0.16 0.15 (5)	0.24-0.27 0.25 (5)	0.47-0.53 0.51 (5)	0.17-0.19 0.18 (4)	7-9 8 (4)	0.07 0.07 (5)
0.49-0.54 0.51 (5)	0.23-0.28 0.26 (5)	0.33-0.38 0.35 (5)	0.67-0.85 0.75 (5)	0.61-0.68 0.65 (5)	0.20-0.23 0.21 (5)	0.26-0.32 0.30 (5)	0.73-0.83 0.78 (5)	0.33-0.38 0.34 (5)	6-10 8 (5)	0.08 0.08 (5)
0.63-0.68 0.66 (5)	0.12-0.16 0.15 (5)	0.25-0.28 0.26 (5)	0.42-0.61 0.56 (5)	0.68-0.77 0.73 (5)	0.19-0.24 0.21 (5)	0.31-0.38 0.34 (5)	0.76-0.83 0.80 (5)	0.32-0.33 0.33 (5)	13-14 13 (5)	0.14-0.15 0.15 (5)
0.53-0.57 0.55 (5)	0.14-0.18 0.16 (5)	0.30-0.34 0.32 (5)	0.43-0.61 0.50 (5)	0.65-0.77 0.69 (5)	0.18-0.21 0.19 (5)	0.24-0.33 0.28 (5)	0.78-0.88 0.81 (5)	0.22-0.27 0.25 (4)	6-7 7 (4)	0.07-0.08 0.07 (3)
0.48-0.50 0.48 (5)	0.08 0.08 (5)	0.22-0.25 0.24 (5)	0.33-0.38 0.35 (5)	0.52-0.59 0.56 (5)	0.15-0.17 0.16 (5)	0.23-0.26 0.25 (5)	0.58-0.65 0.62 (5)	0.20-0.22 0.21 (5)	6-7 7 (4)	0.06-0.07 0.07 (4)
0.49-0.55 0.53 (3)	0.15-0.20 0.18 (3)	0.28-0.34 0.31 (3)	0.50-0.71 0.62 (3)	0.58-0.68 0.63 (3)	0.16-0.21 0.18 (3)	0.22-0.32 0.27 (3)	0.61-0.75 0.66 (3)	0.23-0.28 0.25 (3)	8-9 8 (3)	0.29-0.31 0.30 (3)
0.48-0.55 0.51 (5)	0.10-0.16 0.12 (5)	0.27-0.32 0.29 (5)	0.33-0.50 0.41 (5)	0.54-0.66 0.60 (5)	0.15-0.20 0.18 (5)	0.20-0.26 0.22 (5)	0.60-0.69 0.63 (5)	0.18-0.22 0.21 (5)	8-11 10 (5)	0.07 0.07 (5)
0.53-0.57 0.55 (2)	0.17-0.18 0.18 (2)	0.28-0.31 0.30 (2)	0.59 0.59 (2)	0.60-0.70 0.65 (2)	0.15-0.17 0.16 (2)	0.27-0.28 0.28 (2)	0.68-0.77 0.73 (2)	0.33 0.33 (2)	12-13 13 (2)	0.07 0.07 (2)
0.52-0.57 0.53 (5)	0.11-0.16 0.13 (5)	0.30-0.33 0.31 (5)	0.33-0.53 0.42 (5)	0.64-0.71 0.67 (5)	0.19-0.22 0.20 (5)	0.32-0.39 0.35 (5)	0.78-0.83 0.81 (5)	0.35-0.40 0.38 (5)	13-18 14 (5)	0.07-0.08 0.08 (5)
0.67-0.74 0.71 (5)	0.19-0.20 0.20 (5)	0.30-0.38 0.34 (5)	0.53-0.67 0.59 (5)	0.72-0.76 0.74 (5)	0.20-0.23 0.22 (5)	0.33-0.37 0.35 (5)	0.75-0.83 0.78 (5)	0.27-0.31 0.29 (5)	7-11 9 (5)	0.09-0.10 0.09 (3)
0.62-0.63 0.63 (3)	0.22-0.26 0.24 (3)	0.37-0.40 0.38 (3)	0.59-0.69 0.64 (3)	0.23-0.25 0.24 (3)	0.88-0.95 0.92 (3)	0.36-0.38 0.37 (3)	0.95-1.07 1.02 (3)	0.28-0.30 0.29 (3)	6-7 6 (3)	0.09-0.10 0.09 (3)
0.55-0.58 0.57 (5)	0.12-0.17 0.14 (5)	0.30-0.33 0.32 (5)	0.39-0.50 0.44 (5)	0.67-0.72 0.69 (5)	0.18-0.22 0.20 (5)	0.29-0.34 0.31 (5)	0.73-0.85 0.79 (5)	0.25-0.26 0.26 (5)	6-10 8 (5)	0.08 0.08 (4)
0.55-0.60 0.57 (5)	0.10-0.14 0.12 (5)	0.25-0.29 0.27 (5)	0.36-0.48 0.44 (5)	0.63-0.70 0.67 (5)	0.18 0.18 (5)	0.29-0.34 0.32 (5)	0.70-0.82 0.76 (5)	0.23-0.27 0.25 (5)	10-12 11 (5)	0.07-0.08 0.08 (5)
0.54-0.57 0.55 (5)	0.09-0.11 0.10 (5)	0.27-0.30 0.28 (5)	0.32-0.39 0.35 (5)	0.60-0.63 0.62 (5)	0.16-0.20 0.18 (5)	0.24-0.26 0.25 (5)	0.63-0.68 0.66 (5)	0.20-0.24 0.23 (4)	6-8 8 (4)	0.18 0.18 (5)
0.50-0.58 0.54 (5)	0.10-0.13 0.12 (5)	0.26-0.41 0.35 (5)	0.31-0.38 0.34 (5)	0.64-0.67 0.66 (5)	0.17-0.20 0.18 (5)	0.24-0.30 0.27 (5)	0.63-0.83 0.74 (5)	0.20-0.26 0.22 (5)	9-11 10 (4)	0.15-0.22 0.20 (5)
0.65-0.68 0.67 (2)	0.23 0.23 (2)	0.38-0.48 0.43 (2)	0.48-0.61 0.55 (2)	0.84-0.90 0.87 (2)	0.22-0.23 0.23 (2)	0.38-0.39 0.39 (2)	0.95-1.03 0.99 (2)	0.28-0.32 0.30 (2)	7-8 8 (2)	0.12-0.13 0.13 (2)

a As reported by Morgan and Beamer, 1949.

Appendix 9. Measurements and ratios of *Pissonotus*: female brachypters

<i>Pissonotus</i> spp.	Body length	Body width of at tegulae	Width of frons at antennae	Height of frons at midline	Ratio frons width/height	Length of postclypeus at midline	Length of vertex at midline	Width of vertex	Ratio vertex length/width
<i>abdominalis</i>	Range 2.73-3.10 Ave. (n) 2.89 (4)	0.78-0.92 0.85 (4)	0.23-0.24 0.24 (4)	0.49-0.65 0.61 (4)	0.38-0.41 0.40 (4)	0.23-0.25 0.24 (4)	0.23-0.33 0.29 (4)	0.18-0.20 0.19 (4)	0.59-0.75 0.66 (4)
<i>agrastis</i>	Range 2.22-2.40 Ave. (n) 2.28 (5)	0.70-0.74 0.80 (5)	0.26-0.28 0.27 (5)	0.40-0.50 0.47 (5)	0.53-0.65 0.57 (5)	0.16-0.18 0.17 (5)	0.26-0.29 0.28 (5)	0.17-0.18 0.18 (5)	0.59-0.71 0.64 (5)
<i>albivittatus</i>	Range 2.07-2.50 Ave. (n) 2.26 (5)	0.73-0.87 0.77 (5)	0.21-0.28 0.25 (5)	0.51-0.58 0.54 (5)	0.38-0.50 0.46 (5)	0.21-0.25 0.23 (5)	0.21-0.29 0.25 (5)	0.17-0.20 0.18 (5)	0.57-0.84 0.73 (5)
<i>albovenosus</i>	Range 2.43-3.02 Ave. (n) 2.75 (5)	0.83-0.93 0.88 (5)	0.27-0.28 0.28 (5)	0.51-0.61 0.55 (5)	0.47-0.54 0.51 (5)	0.22-0.26 0.23 (5)	0.25-0.33 0.30 (5)	0.18-0.22 0.21 (5)	0.58-0.83 0.69 (5)
<i>aquilonius</i>	Range 2.83-3.00 Ave. (n) 2.92 (2)	0.85 0.85 (2)	0.30-0.32 0.31 (2)	0.51-0.64 0.58 (2)	0.59-0.60 0.60 (2)	0.28-0.30 0.29 (2)	0.25-0.27 0.22 (2)	0.21-0.22 0.22 (2)	0.81-0.84 0.83 (2)
<i>aphidionides</i>	Range 3.31-3.63 Ave. (n) 3.46 (5)	1.07-1.21 1.12 (5)	0.33-0.41 0.36 (5)	0.62-0.76 0.70 (5)	0.43-0.57 0.51 (5)	0.30-0.35 0.33 (5)	0.23-0.37 0.28 (5)	0.23-0.26 0.24 (5)	0.64-0.89 0.78 (5)
<i>basalis</i>	Range 2.60-3.18 Ave. (n) 2.88 (5)	0.86-0.95 0.92 (5)	0.29-0.33 0.31 (5)	0.56-0.65 0.60 (5)	0.49-0.54 0.52 (5)	0.25-0.30 0.26 (4)	0.25-0.30 0.27 (5)	0.19-0.31 0.24 (5)	0.77-0.94 0.82 (5)
<i>binotatus</i>	Range 2.07-2.63 Ave. (n) 2.36 (5)	0.72-0.79 0.75 (5)	0.27-0.28 0.28 (5)	0.48-0.54 0.51 (5)	0.52-0.59 0.55 (5)	0.17-0.22 0.20 (5)	0.18-0.23 0.21 (5)	0.20-0.22 0.21 (5)	0.86-1.18 0.97 (5)
<i>bolivianensis</i>	Range 3.08-3.30 Ave. (n) 3.17 (5)	0.80-0.86 0.80 (5)	0.25-0.27 0.26 (5)	0.57-0.63 0.60 (5)	0.39-0.44 0.43 (5)	0.22-0.24 0.23 (5)	0.28-0.35 0.31 (5)	0.18-0.21 0.20 (5)	0.57-0.68 0.63 (5)
<i>brunneus</i>	Range 2.52-2.92 Ave. (n) 2.71 (5)	0.83-0.85 0.84 (5)	0.27-0.31 0.28 (5)	0.52-0.55 0.53 (5)	0.50-0.56 0.53 (5)	0.22-0.25 0.23 (5)	0.25-0.28 0.26 (5)	0.20-0.23 0.22 (5)	0.71-0.90 0.82 (5)
<i>concolor</i>	Range 3.38-3.44 Ave. (n) 3.41 (2)	0.97-1.05 1.01 (2)	0.31 0.31 (2)	0.65-0.68 0.66 (2)	0.46-0.47 0.47 (2)	0.25-0.27 0.26 (2)	0.26-0.29 0.28 (2)	0.22-0.23 0.22 (2)	0.77-0.83 0.80 (2)
<i>decussatus</i>	Range 2.49-2.59 Ave. (n) 2.54 (2)	0.75-0.78 0.76 (3)	0.25-0.26 0.25 (3)	0.53-0.59 0.56 (3)	0.44-0.47 0.45 (3)	0.22-0.23 0.23 (3)	0.27-0.31 0.28 (3)	0.16-0.18 0.17 (3)	0.58-0.63 0.60 (3)
<i>delicatus</i>	Range 2.21-2.62 Ave. (n) 2.45 (5)	0.77-0.93 0.86 (5)	0.25-0.27 0.26 (5)	0.50-0.60 0.55 (5)	0.43-0.48 0.46 (5)	0.19-0.25 0.23 (5)	0.22-0.31 0.28 (5)	0.18-0.25 0.21 (5)	0.65-0.83 0.73 (5)
<i>denticatus</i>	Range 1.59-2.43 Ave. (n) 2.26 (5)	0.68-0.86 0.77 (5)	0.23-0.27 0.25 (5)	0.50-0.60 0.55 (5)	0.42-0.50 0.46 (5)	0.20-0.23 0.22 (4)	0.26-0.29 0.27 (5)	0.19-0.21 0.20 (5)	0.69-0.78 0.74 (5)
<i>divergens</i>	Range 2.50-2.70 Ave. (n) 2.62 (3)	0.83-0.98 0.91 (3)	0.33 0.33 (3)	0.44-0.56 0.50 (3)	0.58-0.75 0.66 (3)	0.21-0.25 0.24 (3)	0.26-0.28 0.27 (3)	0.25-0.27 0.26 (3)	0.89-1.04 0.96 (3)
<i>dorsalis</i>	Range 3.20-3.58 Ave. (n) 3.35 (5)	0.96-1.09 1.04 (5)	0.33-0.37 0.34 (5)	0.65-0.71 0.67 (5)	0.50-0.54 0.51 (5)	0.25-0.33 0.29 (5)	0.30-0.36 0.33 (5)	0.23-0.28 0.25 (5)	0.72-0.83 0.77 (5)
<i>festucae</i>	Range 2.73-3.02 Ave. (n) 2.89 (2)	0.85-0.98 0.91 (2)	0.26-0.32 0.29 (2)	0.52-0.55 0.53 (2)	0.50-0.58 0.54 (2)	0.20-0.27 0.23 (2)	0.25-0.30 0.28 (2)	0.22-0.23 0.23 (2)	0.78-0.87 0.83 (2)
<i>flabellatus</i>	Range 2.85-3.49 Ave. (n) 3.10 (5)	0.91-1.07 0.99 (5)	0.30-0.34 0.33 (5)	0.55-0.64 0.60 (5)	0.53-0.58 0.55 (5)	0.27-0.35 0.30 (5)	0.27-0.36 0.32 (5)	0.22-0.25 0.24 (5)	0.64-0.81 0.75 (5)
<i>frontalis</i>	Range 2.55-3.12 Ave. (n) 2.93 (9)	0.85-1.11 0.99 (9)	0.32-0.38 0.35 (9)	0.53-0.65 0.57 (9)	0.54-0.65 0.60 (9)	0.25-0.30 0.27 (9)	0.25-0.33 0.27 (9)	0.19-0.30 0.25 (9)	0.73-1.00 0.83 (9)
<i>guttatus</i>	Range 2.67-2.88 Ave. (n) 2.78 (5)	0.71-0.76 0.74 (5)	0.27-0.28 0.28 (5)	0.49-0.52 0.51 (5)	0.52-0.56 0.55 (5)	0.18-0.25 0.21 (5)	0.24-0.31 0.28 (5)	0.17-0.19 0.18 (5)	0.55-0.79 0.63 (5)
<i>jamaicensis</i>	Range 2.23 Ave. (n) (1)	0.62 (1)	0.23 (1)	0.48 (1)	0.48 (1)	0.23 (1)	0.23 (1)	0.13 (1)	0.57 (1)
<i>lactifasciatus</i>	Range 2.04-2.48 Ave. (n) 2.30 (5)	0.67-0.78 0.74 (4)	0.25-0.30 0.29 (5)	0.47-0.55 0.50 (5)	0.50-0.63 0.57 (5)	0.18-0.20 0.19 (5)	0.24-0.27 0.26 (5)	0.18-0.22 0.20 (5)	0.69-0.92 0.78 (5)

Maximum width of head	Length of antennal segment I	Length of antennal segment II	Ratio of antennal segment I/II	Maximum width of pronotum	Length of pronotum at midline	Length of mesonotum at midline	Length of tegmina	Length of calcar	Number of calcar teeth	Width of front tibia
0.58-0.62 0.61 (4)	0.13-0.18 0.16 (4)	0.25-0.28 0.28 (4)	0.47-0.73 0.57 (4)	0.78-0.85 0.81 (4)	0.22-0.25 0.29 (4)	0.35-0.45 0.38 (4)	0.80-0.88 0.85 (4)	0.38-0.41 0.40 (4)	13-14 13 (4)	0.07-0.08 0.08 (3)
0.58-0.63 0.60 (5)	0.11-0.17 0.15 (5)	0.28-0.30 0.29 (5)	0.36-0.58 0.49 (5)	0.66-0.77 0.72 (5)	0.19-0.22 0.21 (5)	0.26-0.29 0.27 (5)	0.65-0.73 0.68 (5)	0.20-0.28 0.24 (4)	6-11 9 (4)	0.07-0.08 0.07 (3)
0.59-0.64 0.62 (5)	0.09-0.13 0.12 (5)	0.23-0.27 0.26 (5)	0.39-0.50 0.45 (5)	0.71-0.85 0.76 (5)	0.18-0.22 0.20 (5)	0.23-0.35 0.29 (5)	0.68-0.83 0.75 (5)	0.27-0.33 0.29 (4)	9-12 10 (4)	0.08 0.08 (3)
0.64-0.93 0.68 (5)	0.13-0.17 0.15 (5)	0.28-0.36 0.32 (5)	0.42-0.53 0.46 (5)	0.82-0.93 0.93 (5)	0.24-0.28 0.26 (5)	0.31-0.35 0.34 (5)	0.80-0.95 0.87 (5)	0.27-0.36 0.31 (4)	9-13 11 (4)	0.09-0.10 0.10 (5)
0.57-0.70 0.64 (2)	0.16-0.17 0.17 (2)	0.37 0.37 (2)	0.43-0.46 0.45 (2)	0.85 0.85 (2)	0.23-0.26 0.25 (2)	0.35-0.37 0.36 (2)	0.75-0.80 0.77 (2)	0.29-0.30 0.30 (2)	7-9 8 (2)	0.08-0.09 0.09 (2)
0.80-0.88 0.84 (5)	0.23-0.33 0.31 (5)	0.47-0.57 0.53 (5)	0.50-0.68 0.59 (5)	1.06-1.17 1.10 (5)	0.27-0.33 0.29 (5)	0.40-0.46 0.43 (5)	1.05-1.21 1.12 (5)	0.33-0.45 0.37 (4)	7-8 7 (5)	0.15-0.18 0.16 (5)
0.69-0.77 0.73 (5)	0.15-0.19 0.16 (5)	0.37-0.43 0.40 (5)	0.38-0.45 0.41 (5)	0.86-0.95 0.92 (5)	0.23-0.27 0.25 (5)	0.31-0.38 0.34 (5)	0.78-0.90 0.86 (5)	0.30-0.32 0.31 (5)	8-11 9 (5)	0.14-0.15 0.15 (4)
0.61-0.67 0.64 (5)	0.10-0.17 0.13 (5)	0.28-0.33 0.31 (5)	0.35-0.50 0.42 (5)	0.68-0.79 0.74 (5)	0.18-0.21 0.19 (5)	0.28-0.32 0.30 (5)	0.62-0.79 0.69 (5)	0.25-0.28 0.27 (5)	7-10 8 (4)	0.07-0.08 0.08 (5)
0.57-0.62 0.58 (5)	0.16-0.20 0.17 (5)	0.28-0.38 0.31 (5)	0.41-0.63 0.57 (5)	0.78-0.86 0.82 (5)	0.23-0.27 0.25 (5)	0.36-0.45 0.42 (5)	0.85-0.98 0.90 (5)	0.42-0.48 0.45 (5)	13-18 15 (5)	0.08-0.09 0.08 (5)
0.65-0.70 0.68 (5)	0.10-0.17 0.13 (5)	0.24-0.32 0.28 (5)	0.34-0.62 0.47 (5)	0.82-0.85 0.84 (5)	0.21-0.23 0.22 (5)	0.30-0.39 0.35 (5)	0.72-0.83 0.80 (5)	0.28-0.31 0.29 (4)	7-13 9 (4)	0.07-0.09 0.08 (4)
0.67 0.67 (2)	0.27-0.32 0.29 (2)	0.38-0.42 0.40 (2)	0.64-0.83 0.74 (2)	0.90-1.05 0.98 (2)	0.25-0.26 0.25 (2)	0.37-0.43 0.40 (2)	0.90-1.03 0.96 (2)	0.30-0.35 0.33 (2)	6 6 (2)	0.08-0.09 0.09 (2)
0.60 0.60 (3)	0.11-0.16 0.14 (3)	0.23-0.28 0.26 (3)	0.46-0.58 0.52 (3)	0.71-0.73 0.72 (3)	0.18-0.22 0.20 (3)	0.26-0.38 0.32 (3)	0.71-0.73 0.72 (3)	0.33-0.34 0.33 (3)	10-11 10 (3)	0.07-0.08 0.07 (3)
0.58-0.68 0.64 (5)	0.18-0.23 0.20 (5)	0.33-0.40 0.37 (5)	0.44-0.66 0.55 (5)	0.72-0.88 0.81 (5)	0.19-0.23 0.21 (5)	0.28-0.32 0.29 (5)	0.63-0.80 0.75 (5)	0.27-0.32 0.29 (5)	9-10 10 (4)	0.08-0.10 0.09 (5)
0.55-0.62 0.58 (5)	0.10-0.15 0.13 (5)	0.30-0.35 0.33 (5)	0.32-0.47 0.41 (5)	0.64-0.77 0.70 (5)	0.21-0.24 0.23 (5)	0.30-0.37 0.33 (5)	0.65-0.82 0.73 (5)	0.29-0.32 0.30 (4)	10-13 11 (4)	0.07-0.08 0.07 (5)
0.69-0.76 0.72 (3)	0.18-0.20 0.19 (2)	0.30-0.34 0.32 (2)	0.59-0.60 0.60 (2)	0.83-0.93 0.89 (3)	0.20-0.22 0.21 (3)	0.37-0.39 0.38 (3)	0.78-0.89 0.86 (3)	0.25-0.28 0.27 (3)	7-9 8 (3)	0.06-0.08 0.07 (3)
0.72-0.76 0.74 (5)	0.17-0.18 0.17 (5)	0.33-0.40 0.37 (5)	0.42-0.50 0.46 (5)	0.93-1.09 1.01 (5)	0.26-0.30 0.28 (5)	0.38-0.47 0.42 (5)	0.97-1.05 1.01 (5)	0.33-0.38 0.37 (4)	8-11 10 (4)	0.08-0.10 0.09 (4)
0.63-0.74 0.69 (2)	0.21-0.23 0.22 (2)	0.35-0.40 0.38 (2)	0.56-0.60 0.58 (2)	0.85-0.98 0.91 (2)	0.23-0.26 0.24 (2)	0.30-0.33 0.32 (2)	0.83-0.85 0.84 (2)	0.32-0.33 0.33 (2)	11-13 12 (2)	0.08-0.10 0.09 (2)
0.68-0.72 0.70 (5)	0.17-0.20 0.19 (5)	0.36-0.43 0.39 (5)	0.46-0.52 0.48 (5)	0.90-1.04 0.95 (5)	0.23-0.31 0.27 (5)	0.36-0.44 0.39 (5)	0.88-1.08 0.98 (5)	0.27-0.42 0.33 (5)	7-10 9 (5)	0.22-0.26 0.23 (5)
0.67-0.85 0.72 (9)	0.18-0.25 0.23 (9)	0.35-0.42 0.37 (9)	0.52-0.68 0.60 (9)	0.79-1.03 0.92 (9)	0.21-0.27 0.24 (9)	0.33-0.45 0.40 (9)	0.91-1.09 1.05 (9)	0.27-0.38 0.32 (8)	7-10 9 (7)	0.08-0.10 0.09 (5)
0.54-0.57 0.56 (5)	0.18-0.22 0.19 (5)	0.34-0.40 0.37 (5)	0.47-0.54 0.52 (5)	0.67-0.76 0.72 (5)	0.21-0.28 0.24 (5)	0.28-0.37 0.32 (5)	0.73-0.82 0.77 (5)	0.28-0.33 0.30 (4)	7 7 (4)	0.08 0.08 (5)
0.50 (1)	0.18 (1)	0.28 (1)	0.62 (1)	0.60 (1)	0.20 (1)	0.32 (1)	0.68 (1)	0.28 (1)	— (1)	0.07 (1)
0.54-0.62 0.58 (5)	0.10-0.13 0.11 (5)	0.30-0.33 0.31 (5)	0.31-0.42 0.35 (5)	0.63-0.74 0.70 (4)	0.17-0.20 0.19 (5)	0.28-0.36 0.32 (5)	0.66-0.82 0.73 (5)	0.23-0.27 0.25 (5)	8-12 10 (5)	0.08 0.08 (4)

## Appendix 9. Continued

<i>Pissonotus</i> spp.	Body length	Body width of at tegulae	Width of frons at antennae	Height of frons at midline	Ratio frons width/height	Length of postclypeus at midline	Length of vertex at midline	Width of vertex	Ratio vertex length/width
<i>marginalis</i>	Range 2.54-3.40 Ave. (n) 3.12 (5)	0.78-0.94 0.89 (5)	0.28-0.33 0.32 (5)	0.50-0.59 0.55 (5)	0.56-0.62 0.59 (5)	0.23-0.27 0.26 (5)	0.25-0.31 0.29 (5)	0.20-0.24 0.22 (5)	0.67-0.92 0.77 (5)
<i>melanurus</i>	Range 2.36-2.57 Ave. (n) 2.46 (2)	0.83-0.94 0.89 (2)	0.28-0.29 0.28 (5)	0.54-0.59 0.57 (2)	0.49-0.52 0.51 (2)	0.25-0.27 0.26 (2)	0.27 0.27 (2)	0.20-0.22 0.21 (2)	0.74-0.81 0.78 (2)
<i>merides</i>	Range 2.09-2.60 Ave. (n) 2.32 (5)	0.70-0.81 0.75 (5)	0.26-0.29 0.28 (5)	0.47-0.56 0.52 (5)	0.49-0.58 0.53 (5)	0.19-0.24 0.22 (5)	0.22-0.31 0.26 (5)	0.15-0.18 0.17 (5)	0.58-0.73 0.64 (5)
<i>minutus</i>	Range 1.81-1.99 Ave. (n) 1.89 (5)	0.57-0.64 0.62 (5)	0.25-0.26 0.26 (5)	0.43-0.45 0.44 (5)	0.56-0.61 0.58 (5)	0.15-0.18 0.16 (5)	0.21-0.26 0.17 (5)	0.17-0.18 0.17 (5)	0.65-0.81 0.73 (5)
<i>mutri</i>	Range 3.02-3.14 Ave. (n) 3.06 (5)	0.77-0.85 0.81 (5)	0.24-0.28 0.26 (5)	0.58-0.63 0.60 (5)	0.41-0.45 0.43 (5)	0.27-0.31 0.29 (5)	0.24-0.32 0.28 (5)	0.16-0.18 0.17 (5)	0.56-0.75 0.63 (5)
<i>neotropicus</i>	Range 2.44-3.43 Ave. (n) 2.93 (5)	0.75-0.95 0.85 (5)	0.33-0.38 0.36 (5)	0.43-0.49 0.47 (5)	0.75-0.80 0.78 (5)	0.21-0.23 0.22 (5)	0.25-0.29 0.26 (5)	0.27-0.31 0.29 (5)	0.97-1.24 1.10 (5)
<i>niger</i>	Range 2.48-2.79 Ave. (n) 2.63 (5)	0.79-0.85 0.81 (5)	0.25-0.28 0.28 (5)	0.45-0.50 0.48 (5)	0.55-0.62 0.58 (5)	0.20-0.25 0.23 (4)	0.23-0.27 0.25 (5)	0.17-0.19 0.18 (5)	0.65-0.83 0.72 (5)
<i>nigriculus</i>	Range 1.98-2.32 Ave. (n) 2.15 (5)	0.65-0.72 0.68 (5)	0.25-0.27 0.26 (5)	0.40-0.47 0.44 (5)	0.57-0.63 0.59 (5)	0.17-0.19 0.18 (5)	0.19-0.24 0.22 (5)	0.14-0.16 0.15 (5)	0.63-0.79 0.69 (5)
<i>nitens</i>	Range 2.21-2.89 Ave. (n) 2.56 (5)	0.67-0.87 0.78 (5)	0.25-0.28 0.27 (5)	0.51-0.57 0.54 (5)	0.47-0.54 0.50 (5)	0.19-0.25 0.24 (5)	0.21-0.28 0.25 (5)	0.16-0.20 0.18 (5)	0.67-0.86 0.72 (5)
<i>paludosus</i>	Range 2.11-2.67 Ave. (n) 2.41 (5)	0.68-0.74 0.72 (4)	0.25-0.28 0.27 (5)	0.46-0.53 0.50 (5)	0.50-0.57 0.54 (5)	0.19-0.22 0.21 (5)	0.24-0.28 0.26 (5)	0.16-0.20 0.18 (5)	0.61-0.74 0.69 (5)
<i>paraguayensis</i>	Range 2.50-2.52 Ave. (n) 2.51 (2)	0.78-0.80 0.79 (2)	0.27-0.30 0.29 (2)	0.48 0.48 (2)	0.55-0.62 0.59 (2)	0.20-0.21 0.21 (2)	0.20-0.27 0.23 (2)	0.22 0.22 (2)	0.81-0.92 0.87 (2)
<i>piceus</i>	Range 2.81-3.19 Ave. (n) 2.98 (5)	0.74-0.83 0.79 (5)	0.27-0.28 0.27 (5)	0.59-0.63 0.61 (5)	0.43-0.47 0.44 (5)	0.25-0.28 0.26 (5)	0.29-0.36 0.32 (5)	0.17-0.19 0.18 (5)	0.53-0.66 0.58 (5)
<i>quadripustulatus</i>	Range 3.00-3.23 Ave. (n) 3.10 (5)	0.91-0.98 0.94 (5)	0.33-0.35 0.34 (5)	0.57-0.65 0.61 (5)	0.53-0.61 0.56 (5)	0.22-0.28 0.26 (5)	0.34-0.38 0.30 (5)	0.23-0.27 0.25 (5)	0.68-0.74 0.72 (5)
<i>rubrilatus</i>	Range 2.68-2.88 Ave. (n) 2.76 (5)	0.78-0.82 0.80 (5)	0.27-0.30 0.28 (5)	0.51-0.58 0.56 (5)	0.48-0.56 0.51 (5)	0.21-0.23 0.23 (5)	0.21-0.28 0.25 (5)	0.19-0.22 0.20 (5)	0.70-1.05 0.82 (5)
<i>spatulatus</i>	Range 2.37 Ave. (n) (1)	0.76 (1)	0.27 (1)	0.52 (1)	0.52 (1)	0.20 (1)	0.25 (1)	0.20 (1)	0.80 (1)
<i>spooneri</i>	Range 2.24-2.37 Ave. (n) 2.30 (5)	0.72-0.79 0.74 (5)	0.28-0.30 0.29 (5)	0.45-0.50 0.47 (5)	0.57-0.67 0.61 (5)	0.20-0.25 0.22 (5)	0.23-0.27 0.25 (5)	0.18-0.23 0.20 (5)	0.78-0.88 0.83 (5)
<i>tessellatus</i>	Range 2.24-2.68 Ave. (n) 2.44 (5)	0.68-0.78 0.74 (5)	0.25-0.28 0.26 (5)	0.42-0.43 0.43 (5)	0.58-0.67 0.62 (5)	0.16-0.23 0.20 (5)	0.21-0.27 0.24 (5)	0.17-0.19 0.18 (5)	0.70-0.86 0.74 (5)
<i>humidus</i>	Range 2.87-3.51 Ave. (n) 3.26 (5)	0.92-1.09 1.01 (5)	0.30-0.32 0.31 (5)	0.58-0.70 0.63 (5)	0.44-0.53 0.49 (5)	0.28-0.34 0.31 (5)	0.23-0.31 0.28 (5)	0.21-0.29 0.23 (5)	0.71-1.26 0.85 (5)

Maximum width of head	Length of antennal segment I	Length of antennal segment II	Ratio of antennal segment I/II	Maximum width of pronotum	Length of pronotum at midline	Length of mesonotum at midline	Length of tegmina	Length of calcar	Number of calcar teeth	Width of front tibia
0.62-0.67 0.65 (5)	0.19-0.27 0.23 (5)	0.38-0.43 0.40 (5)	0.45-0.67 0.57 (5)	0.76-0.92 0.87 (5)	0.20-0.25 0.23 (5)	0.37-0.43 0.39 (5)	0.82-1.00 0.89 (5)	0.29-0.37 0.33 (5)	7 7 (5)	0.08-0.0 0.09 (4)
0.66-0.69 0.68 (2)	0.20-0.22 0.21 (2)	0.37-0.38 0.38 (2)	0.52-0.59 0.56 (2)	0.78-0.90 0.84 (2)	0.22-0.24 0.23 (2)	0.30-0.31 0.31 (2)	0.70-0.83 0.77 (2)	0.31-0.33 0.32 (2)	10-11 11 (2)	0.09-0.1 0.10 (2)
0.54-0.59 0.56 (5)	0.12-0.18 0.15 (5)	0.28-0.33 0.32 (5)	0.35-0.55 0.45 (5)	0.68-0.77 0.71 (5)	0.19-0.23 0.20 (5)	0.29-0.32 0.30 (5)	0.64-0.76 0.71 (5)	0.26-0.34 0.29 (5)	9-11 10 (5)	0.07-0.0 0.07 (5)
0.51-0.55 0.53 (5)	0.09-0.10 0.10 (5)	0.23-0.25 0.25 (5)	0.36-0.43 0.40 (5)	0.55-0.61 0.59 (5)	0.17-0.19 0.18 (5)	0.25-0.28 0.26 (5)	0.54-0.64 0.57 (5)	0.18-0.21 0.20 (4)	7-8 8 (4)	0.07-0.0 0.07 (4)
0.54-0.58 0.56 (5)	0.25-0.33 0.28 (5)	0.36-0.39 0.37 (5)	0.68-0.91 0.76 (5)	0.70-0.79 0.74 (5)	0.22-0.25 0.24 (5)	0.33-0.43 0.38 (5)	0.74-0.84 0.79 (5)	0.33-0.43 0.38 (5)	6-8 7 (5)	0.08 0.08 (5)
0.67-0.77 0.73 (5)	0.14-0.17 0.15 (5)	0.28-0.30 0.29 (5)	0.46-0.59 0.53 (5)	0.75-0.87 0.83 (5)	0.21-0.26 0.24 (5)	0.35-0.47 0.39 (5)	0.79-0.92 0.87 (5)	0.33-0.42 0.39 (5)	11-17 13 (5)	0.15-0.1 0.16 (5)
0.55-0.63 0.59 (5)	0.14-0.18 0.16 (5)	0.31-0.35 0.34 (5)	0.40-0.54 0.48 (5)	0.70-0.81 0.77 (5)	0.19-0.24 0.22 (5)	0.32-0.34 0.33 (5)	0.82-0.88 0.84 (5)	0.25-0.31 0.27 (4)	5-9 7 (4)	0.07 0.07 (4)
0.51-0.58 0.54 (5)	0.08-0.12 0.10 (5)	0.25-0.26 0.25 (5)	0.33-0.47 0.41 (5)	0.62-0.69 0.66 (5)	0.17-0.19 0.18 (5)	0.23-0.32 0.27 (5)	0.70-0.85 0.75 (5)	0.20-0.25 0.24 (5)	6-9 7 (4)	0.06-0.0 0.07 (4)
0.53-0.63 0.58 (5)	0.15-0.23 0.21 (5)	0.33-0.38 0.35 (5)	0.45-0.68 0.58 (5)	0.67-0.82 0.74 (5)	0.20-0.23 0.21 (5)	0.24-0.35 0.30 (5)	0.60-0.84 0.71 (5)	0.25-0.35 0.30 (5)	7-10 8 (5)	0.22-0.3 0.30 (5)
0.54-0.60 0.57 (5)	0.11-0.17 0.15 (5)	0.30-0.36 0.34 (5)	0.36-0.50 0.44 (5)	0.63-0.71 0.69 (4)	0.19-0.25 0.22 (5)	0.25-0.33 0.28 (5)	0.62-0.74 0.69 (5)	0.22-0.25 0.24 (5)	8-12 10 (5)	0.08 0.08 (5)
0.65-0.67 0.66 (2)	0.18-0.19 0.19 (2)	0.32-0.34 0.33 (2)	0.56-0.58 0.57 (2)	0.78-0.80 0.79 (2)	0.18-0.19 0.19 (2)	0.25-0.27 0.26 (2)	0.69-0.73 0.71 (2)	0.35-0.37 0.36 (2)	12-13 13 (2)	0.07 0.07 (2)
0.55-0.60 0.58 (5)	0.13-0.15 0.14 (5)	0.31-0.33 0.32 (5)	0.40-0.47 0.44 (5)	0.72-0.81 0.76 (5)	0.20-0.28 0.25 (5)	0.35-0.53 0.40 (5)	0.78-0.95 0.85 (5)	0.35-0.44 0.41 (5)	14-17 16 (5)	0.08 0.08 (4)
0.80-0.85 0.82 (5)	0.20-0.29 0.25 (5)	0.35-0.38 0.38 (5)	0.52-0.76 0.56 (5)	0.87-0.93 0.91 (5)	0.25-0.27 0.26 (5)	0.39-0.49 0.42 (5)	0.87-0.96 0.90 (5)	0.31-0.34 0.32 (5)	9-10 10 (4)	0.10-0.1 0.11 (5)
0.60-0.62 0.61 (5)	0.12-0.17 0.14 (5)	0.32-0.34 0.33 (5)	0.36-0.50 0.43 (5)	0.73-0.79 0.77 (5)	0.21-0.23 0.22 (5)	0.33-0.39 0.36 (5)	0.77-0.89 0.83 (5)	0.26-0.30 0.27 (4)	7-9 8 (5)	0.08-0.0 0.09 (5)
0.65 (1)	0.17 (1)	0.28 (1)	0.61 (1)	0.75 (1)	0.19 (1)	0.35 (1)	0.73 (1)	0.30 (1)	14 (1)	0.08 (1)
0.59-0.60 0.59 (5)	0.10-0.16 0.12 (5)	0.30-0.33 0.32 (5)	0.31-0.49 0.39 (5)	0.70-0.73 0.72 (5)	0.20-0.23 0.21 (5)	0.27-0.31 0.29 (5)	0.63-0.69 0.67 (5)	0.18-0.25 0.24 (5)	7-9 8 (5)	0.18-0.2 0.19 (5)
0.56-0.60 0.59 (5)	0.09-0.15 0.12 (5)	0.30-0.38 0.34 (5)	0.31-0.45 0.37 (5)	0.65-0.77 0.72 (5)	0.20-0.24 0.22 (5)	0.25-0.31 0.29 (5)	0.75-0.89 0.82 (5)	0.23-0.27 0.25 (5)	9-11 10 (5)	0.21-0.2 0.23 (5)
0.67-0.74 0.70 (5)	0.20-0.30 0.25 (5)	0.42-0.47 0.45 (5)	0.43-0.64 0.55 (5)	0.92-1.03 0.97 (5)	0.24-0.28 0.25 (5)	0.35-0.49 0.42 (5)	0.95-1.24 1.05 (5)	0.28-0.37 0.33 (4)	6-8 7 (4)	0.12-0.1 0.13 (3)

Species with no female brachypters available were omitted.

Appendix 10. Measurements and ratios of *Pissonotus*: male macropters

<i>Pissonotus</i> spp.	Range	Body length (excluding wings)	Body length (including wings)	Body width of at tegulae	Width of frons at antennae	Height of frons at midline	Ratio frons width:height	Length of postclypeus at midline	Length of vertex at midline	Width of vertex
<i>albivittatus</i>	2.00-2.06	2.92-3.02	0.79-0.87	0.23	0.48-0.49	0.46-0.47	0.18	0.21-0.22	0.15	
Ave. (n)	2.03 (2)	2.97 (2)	0.83 (2)	0.23 (2)	0.49 (2)	0.47 (2)	0.18 (2)	0.22 (2)	0.15 (2)	
<i>albivenosus</i>	1.87-2.38	2.60-3.35	0.75-0.93	0.21-0.27	0.44-0.52	0.47-0.52	0.18-0.20	0.18-0.30	0.15-0.20	
Ave. (n)	2.19 (5)	3.05 (5)	0.87 (5)	0.23 (5)	0.48 (5)	0.48 (5)	0.19 (4)	0.25 (5)	0.18 (5)	
<i>aphidoides</i>	—	3.93	1.13	0.30	0.62	0.48	0.28	0.25	0.22	
Ave. (n)	—	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	
<i>basalis</i>	2.67	3.56	0.95	0.28	—	—	—	0.24	0.22	
Ave. (n)	(1)	(1)	(1)	(1)	—	—	—	(1)	(1)	
<i>binotatus</i>	2.00	2.66-2.97	0.73-0.92	0.25-0.26	0.41-0.48	0.53-0.61	0.13-0.18	0.18-0.25	0.18-0.20	
Ave. (n)	2.00 (2)	2.84 (5)	0.85 (5)	0.25 (5)	0.45 (4)	0.57 (4)	0.16 (4)	0.20 (5)	0.19 (5)	
<i>boliviensis</i>	2.40-2.42	3.13	0.85-0.92	0.23	0.50-0.52	0.46-0.47	0.18	0.21-0.27	0.16-0.17	
Ave. (n)	2.41 (2)	3.13 (3)	0.89 (3)	0.23 (3)	0.51 (3)	0.47 (3)	0.18 (3)	0.24 (3)	0.16 (3)	
<i>brunneus</i>	2.06-2.27	3.22-3.23	0.82-0.95	0.24-0.26	0.43-0.48	0.52-0.56	0.18-0.23	0.18-0.23	0.18-0.21	
Ave. (n)	2.18 (5)	3.23 (2)	0.90 (5)	0.25 (5)	0.46 (5)	0.54 (5)	0.20 (5)	0.21 (5)	0.19 (5)	
<i>delicatus</i>	2.17-2.40	3.31-3.43	0.87-1.00	0.25-0.28	0.48-0.55	0.48-0.57	0.20-0.22	0.23-0.26	0.17-0.22	
Ave. (n)	2.27 (5)	3.39 (5)	0.92 (4)	0.26 (5)	0.52 (5)	0.51 (5)	0.21 (5)	0.24 (5)	0.19 (5)	
<i>dentatus</i>	2.00-2.07	2.73-2.86	0.75-0.83	0.22-0.23	0.50-0.52	0.43-0.45	0.18	0.22-0.26	0.15-0.21	
Ave. (n)	2.03 (2)	2.81 (3)	0.78 (3)	0.22 (4)	0.51 (3)	0.44 (3)	0.18 (3)	0.24 (4)	0.18 (4)	
<i>divergens</i>	2.20	3.25-3.63	0.87-0.95	0.28-0.30	0.39-0.46	0.62-0.77	0.18	0.20-0.25	0.22-0.25	
Ave. (n)	2.20 (1)	3.46 (3)	0.89 (3)	0.29 (3)	0.42 (3)	0.70 (3)	0.18 (3)	0.22 (3)	0.23 (3)	
<i>dorsalis</i>	2.83-3.30	3.75-4.19	1.07-1.17	0.32-0.33	0.60-0.66	0.50-0.53	0.18-0.28	0.28-0.36	0.22-0.26	
Ave. (n)	3.12 (3)	4.05 (4)	1.11 (4)	0.32 (4)	0.63 (4)	0.51 (4)	0.24 (4)	0.31 (4)	0.24 (4)	
<i>flabellatus</i>	2.47-2.80	3.44-3.63	0.90-1.00	0.30	0.52-0.57	0.53-0.58	0.23-0.27	0.22-0.26	0.20-0.21	
Ave. (n)	2.63 (2)	3.54 (2)	0.95 (2)	0.30 (2)	0.55 (2)	0.56 (2)	0.25 (2)	0.24 (2)	0.21 (2)	
<i>frontalis</i>	2.18-2.63	3.50-3.94	0.92-1.11	0.28-0.33	0.48-0.53	0.56-0.63	0.20-0.25	0.21-0.28	0.22-0.26	
Ave. (n)	2.49 (5)	3.75 (4)	1.04 (6)	0.31 (6)	0.52 (6)	0.59 (6)	0.23 (5)	0.23 (6)	0.25 (6)	
<i>lactofasciatus</i>	2.01	3.30	0.70	0.27	0.47	0.57	0.18	0.25	0.20	
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	
<i>neotropicus</i>	1.86-2.03	2.77-3.15	0.84-0.86	0.28-0.30	0.34-0.39	0.74-0.80	0.17-0.18	0.17-0.21	0.23-0.26	
Ave. (n)	1.95 (4)	2.94 (4)	0.85 (2)	0.29 (4)	0.38 (4)	0.76 (4)	0.18 (4)	0.20 (4)	0.24 (4)	
<i>nigriculus</i>	—	3.16	0.88	0.25	0.42	0.60	0.18	0.18	0.18	
Ave. (n)	—	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	
<i>piceus</i>	2.13-2.38	3.10-3.37	0.67-0.81	0.22-0.23	0.48-0.57	0.41-0.45	0.18-0.20	0.24-0.28	0.14-0.17	
Ave. (n)	2.26 (5)	3.23 (4)	0.75 (5)	0.23 (5)	0.53 (5)	0.43 (5)	0.19 (5)	0.26 (5)	0.15 (5)	
<i>rubrilatus</i>	—	3.30	0.87	0.27	0.58	0.47	0.20	0.18	0.20	
Ave. (n)	—	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	
<i>spatulatus</i>	—	3.20	0.87	0.25	0.43	0.58	0.20	0.21	0.18	
Ave. (n)	—	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	
<i>spooneri</i>	2.37	2.57	0.83	0.28	0.47	0.61	0.22	0.24	0.20	
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	

Ratio vertex length:width	Maximum width of head	Length of antennal segment I	Length of antennal segment II	Ratio of antennal segment I/II	Maximum width of pronotum	Length of pronotum at midline	Length of mesonotum at midline	Length of tegmina	Length of calcar	Number of calcar teeth	Width of front tibia
0.68-0.71	0.55-0.57	0.10-0.13	0.25	0.40-0.53	0.70-0.76	0.16	0.47	2.42-2.57	0.27-0.28	12	0.08
0.70 (2)	0.56 (2)	0.12 (2)	0.25 (2)	0.47 (2)	0.73 (2)	0.16 (2)	0.47 (2)	2.51 (2)	0.28 (2)	12 (2)	0.08 (2)
0.65-0.82	0.56-0.65	0.12-0.20	0.28-0.29	0.41-0.69	0.62-0.75	0.16-0.20	0.43-0.53	2.10-2.67	0.21-0.30	10-13	0.08
0.73 (5)	0.61 (5)	0.15 (5)	0.29 (5)	0.51 (5)	0.70 (5)	0.19 (5)	0.50 (5)	2.47 (5)	0.27 (5)	11 (3)	0.08 (3)
0.88	0.75	0.27	0.51	0.60	0.93	0.18	0.68	2.67	0.33	6	0.13
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.92	0.59	0.15	—	—	0.90	0.24	0.52	3.00	—	—	0.13
(1)	(1)	(1)	—	—	(1)	(1)	(1)	(1)	—	—	(1)
0.80-1.00	0.53-0.63	0.11-0.17	0.28-0.31	0.38-0.56	0.56-0.75	0.11-0.17	0.47-0.51	2.16-2.43	0.22-0.28	5-9	0.07-0.08
0.94 (5)	0.60 (5)	0.13 (5)	0.29 (5)	0.45 (5)	0.66 (5)	0.15 (5)	0.49 (5)	2.31 (5)	0.25 (5)	7 (5)	0.08 (5)
0.63-0.76	0.52-0.55	0.12-0.15	0.28-0.30	0.40-0.59	0.71-0.73	0.13-0.18	0.57-0.60	2.67-2.68	0.42-0.47	16-18	0.07-0.08
0.67 (3)	0.53 (3)	0.13 (3)	0.29 (3)	0.46 (3)	0.73 (3)	0.16 (3)	0.58 (3)	2.67 (3)	0.44 (3)	17 (3)	0.07 (3)
0.88-1.00	0.63-0.65	0.09-0.13	0.28-0.32	0.32-0.45	0.75-0.79	0.15-0.18	0.52-0.57	2.60-2.67	0.27-0.30	9-11	0.08
0.91 (5)	0.64 (5)	0.11 (5)	0.29 (5)	0.38 (5)	0.77 (5)	0.17 (5)	0.54 (5)	2.63 (4)	0.29 (4)	10 (4)	0.08 (5)
0.69-0.88	0.61-0.65	0.17-0.20	0.33-0.37	0.48-0.55	0.74-0.85	0.18-0.20	0.53-0.55	2.67-2.97	0.25-0.28	10-13	0.08-0.09
0.80 (5)	0.63 (5)	0.18 (5)	0.35 (5)	0.51 (5)	0.78 (4)	0.19 (5)	0.54 (5)	2.86 (5)	0.26 (5)	11 (5)	0.09 (4)
0.60-0.88	0.50-0.55	0.10-0.13	0.28-0.31	0.32-0.47	0.64-0.65	0.16-0.22	0.34-0.45	2.20-2.33	0.26-0.28	10	0.07
0.76 (4)	0.53 (4)	0.12 (4)	0.30 (4)	0.39 (4)	0.64 (3)	0.19 (4)	0.41 (4)	2.24 (4)	0.27 (2)	10 (2)	0.07 (3)
0.87-1.14	0.62-0.63	0.17-0.18	0.33	0.50-0.55	0.75-0.80	0.18	0.52-0.58	—	0.28-0.28	7-10	0.07-0.08
1.04 (3)	0.62 (3)	0.18 (3)	0.33 (3)	0.53 (3)	0.78 (3)	0.18 (3)	0.55 (3)	—	0.28 (3)	8 (3)	0.07 (3)
0.72-0.82	0.70-0.75	0.15-0.20	0.33-0.38	0.41-0.52	0.93-0.99	0.22-0.27	0.60-0.68	3.25-4.00	0.34-0.35	7-9	0.08-0.09
0.76 (4)	0.72 (4)	0.17 (5)	0.36 (4)	0.47 (4)	0.96 (4)	0.25 (4)	0.64 (4)	3.53 (4)	0.35 (2)	8 (2)	0.09 (3)
0.81-0.91	0.64-0.69	0.67	0.35-0.36	0.47-0.48	0.79-0.86	0.19-0.25	0.57-0.70	3.00	0.32-0.35	9-10	0.23
0.86 (2)	0.67 (2)	0.67 (2)	0.36 (2)	0.48 (2)	0.83 (2)	0.22 (2)	0.64 (2)	3.00 (2)	0.34 (2)	10 (2)	0.23 (2)
0.89-1.19	0.64-0.81	0.15-0.26	0.32-0.37	0.45-0.76	0.75-0.92	0.17-0.23	0.56-0.67	2.77-3.88	0.28-0.32	8-11	0.08-0.10
1.07 (6)	0.74 (6)	0.22 (6)	0.34 (6)	0.63 (6)	0.83 (6)	0.20 (6)	0.62 (6)	3.32 (3)	0.29 (5)	9 (5)	0.09 (3)
0.80	0.60	0.12	0.31	0.39	0.70	0.17	0.53	2.73	0.25	11	0.07
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1.14-1.35	0.57-0.59	0.11-0.13	0.25-0.28	0.43-0.55	0.69-0.72	0.15-0.20	0.49-0.56	2.27-2.43	0.29-0.33	13-15	0.13-0.15
1.26 (4)	0.59 (4)	0.12 (4)	0.26 (4)	0.46 (4)	0.70 (3)	0.18 (4)	0.51 (4)	2.35 (4)	0.31 (4)	15 (4)	0.14 (4)
1.00	0.61	0.19	0.33	0.58	0.75	0.17	0.54	2.67	0.27	7	0.08
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.49-0.71	0.46-0.55	0.10-0.13	0.27-0.32	0.35-0.41	0.59-0.66	0.16-0.19	0.48-0.55	2.56-3.22	0.33-0.40	14-16	0.07-0.09
0.56 (5)	0.52 (5)	0.11 (5)	0.29 (5)	0.39 (5)	0.62 (5)	0.18 (5)	0.53 (5)	2.77 (5)	0.37 (5)	15 (4)	0.08 (5)
1.11	0.62	0.13	0.33	0.39	0.78	0.15	0.55	2.67	0.28	11	0.08
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.86	0.62	0.13	0.32	0.41	0.76	0.17	0.53	2.60	0.28	13	0.07
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.83	0.63	0.10	0.30	0.33	0.73	0.17	0.56	2.57	0.20	7	0.07
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

Species with no male macropters available were omitted.

Appendix 11. Measurements and ratios of *Pissonotus*: female macropters

<i>Pissonotus</i> spp.	Body length (excluding wings)	Body length (including wings)	Body width at tegulae	Width of frons at antennae	Height of frons at midline	Ratio frons width/height	Length of postclypeus at midline	Length of vertex at midline	Width of vertex
<i>abdominalis</i>	Range 2.45-2.67	3.37-3.50	0.95-0.98	0.23-0.27	0.58-0.63	0.40-0.42	0.25	0.26-0.28	0.18
Ave. (n)	2.56 (2)	3.41 (2)	0.97 (2)	0.25 (2)	0.61 (2)	0.41 (2)	0.25 (2)	0.27 (2)	0.18 (2)
<i>albivittatus</i>	Range 2.23	2.85-3.56	0.92	0.23-0.25	0.52-0.57	0.44	0.20-0.23	0.20-0.28	0.18-0.19
Ave. (n)	2.23 (1)	3.20 (2)	0.92 (1)	0.24 (2)	0.54 (2)	0.44 (2)	0.22 (2)	0.24 (2)	0.19 (2)
<i>albovenosus</i>	Range 2.65-3.03	3.17-3.63	0.88-1.12	0.23-0.30	0.48-0.59	0.47-0.52	0.22-0.27	0.24-0.33	0.18-0.23
Ave. (n)	2.82 (5)	3.40 (5)	1.02 (5)	0.26 (5)	0.53 (5)	0.50 (5)	0.24 (5)	0.28 (5)	0.21 (5)
<i>aphidiotides</i>	Range 3.28	4.25-4.48	1.30-1.35	0.23-0.25	0.67-0.71	0.34-0.35	0.30-0.31	0.27-0.32	0.22-0.25
Ave. (n)	3.28 (2)	4.37 (2)	1.33 (2)	0.24 (2)	0.69 (2)	0.35 (2)	0.31 (2)	0.30 (2)	0.24 (2)
<i>basalis</i>	Range 2.67	3.56	0.95	—	0.28	—	—	0.24	0.22
Ave. (n)	(1)	(1)	(1)	—	(1)	—	—	(1)	(1)
<i>binotatus</i>	Range 2.20-2.60	2.93-3.15	0.95-0.97	0.28-0.29	0.48-0.54	0.52-0.60	0.20-0.23	0.20-0.23	0.20-0.23
Ave. (n)	2.38 (5)	3.07 (5)	0.95 (5)	0.28 (5)	0.52 (5)	0.55 (5)	0.21 (5)	0.21 (5)	0.21 (5)
<i>bolivienis</i>	Range 2.73-2.97	3.38-3.63	0.92-1.03	0.23-0.27	0.57-0.63	0.37-0.45	0.19-0.23	0.23-0.31	0.18-0.20
Ave. (n)	2.87 (5)	3.48 (5)	0.95 (5)	0.24 (5)	0.60 (5)	0.40 (5)	0.22 (5)	0.27 (5)	0.19 (5)
<i>brunneus</i>	Range 2.63-3.81	3.25-3.75	1.02-1.10	0.27-0.29	0.49-0.58	0.51-0.54	0.27-0.26	0.21-0.25	0.20-0.22
Ave. (n)	2.99 (5)	3.50 (5)	1.05 (5)	0.28 (5)	0.53 (5)	0.53 (5)	0.25 (5)	0.23 (5)	0.21 (5)
<i>delicatus</i>	Range 2.50-2.83	3.31-3.63	0.97-1.06	0.25-0.27	0.52-0.58	0.44-0.48	0.22-0.26	0.20-0.27	0.18-0.22
Ave. (n)	2.69 (5)	3.47 (5)	1.01 (5)	0.26 (5)	0.56 (5)	0.46 (5)	0.23 (5)	0.22 (5)	0.20 (5)
<i>dentatus</i>	Range 2.20-2.25	3.05-3.22	0.83-0.92	0.23-0.25	0.54-0.60	0.38-0.44	0.21-0.25	0.26-0.29	0.16-0.22
Ave. (n)	2.37 (5)	3.08 (4)	0.88 (5)	0.24 (5)	0.57 (5)	0.41 (5)	0.23 (5)	0.28 (5)	0.19 (5)
<i>divergens</i>	Range 2.67-2.83	3.63-3.88	1.07-1.18	0.33-0.35	0.45-0.52	0.65-0.75	0.23-0.25	0.28-0.32	0.26-0.28
Ave. (n)	2.73 (4)	3.77 (3)	1.14 (4)	0.34 (4)	0.49 (4)	0.71 (4)	0.25 (4)	0.29 (4)	0.27 (4)
<i>dorsalis</i>	Range 3.37	4.06	1.07	0.32	0.65	0.49	0.25	0.28	0.24
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>flabellatus</i>	Range 2.87-3.17	3.50-3.88	1.01-1.08	0.30-0.34	0.62-0.67	0.48-0.54	0.25-0.33	0.30-0.32	0.21-0.24
Ave. (n)	3.09 (5)	3.74 (5)	1.06 (5)	0.33 (5)	0.63 (5)	0.52 (5)	0.28 (5)	0.31 (5)	0.23 (5)
<i>frontalis</i>	Range 3.17-3.50	4.00	1.12-1.32	0.33-0.37	0.57-0.61	0.55-0.65	0.26-0.33	0.26-0.33	0.24-0.30
Ave. (n)	3.29 (5)	4.00 (2)	1.22 (5)	0.35 (5)	0.59 (5)	0.59 (5)	0.28 (5)	0.28 (5)	0.27 (5)
<i>guttatus</i>	Range 2.67-2.90	3.33	0.80-0.87	0.27-0.28	0.47-0.54	0.51-0.59	0.20-0.23	0.24-0.29	0.16-0.18
Ave. (n)	2.78 (3)	3.33 (2)	0.84 (3)	0.28 (3)	0.50 (3)	0.55 (3)	0.21 (3)	0.27 (3)	0.17 (3)
<i>jamalcoensis</i>	Range 2.50-2.57	3.00-3.33	0.88-0.92	0.20-0.22	0.48-0.54	0.37-0.45	0.22-0.25	0.18-0.22	0.14-0.18
Ave. (n)	2.54 (2)	3.17 (2)	0.90 (2)	0.21 (2)	0.51 (2)	0.41 (2)	0.24 (2)	0.20 (2)	0.16 (2)
<i>marginatus</i>	Range 3.13-3.30	3.81-3.88	1.13	0.32-0.35	—	—	—	0.21-0.24	0.22-0.23
Ave. (n)	3.22 (2)	3.85 (2)	1.13 (2)	0.34 (2)	—	—	—	0.23 (2)	0.23 (2)
<i>neotropicus</i>	Range 2.33	3.10-3.23	0.95-0.99	0.32-0.40	0.43-0.44	0.72-0.92	0.21-0.22	0.20-0.25	0.24-0.27
Ave. (n)	2.33 (2)	3.17 (2)	0.97 (2)	0.36 (2)	0.44 (2)	0.82 (2)	0.21 (2)	0.23 (2)	0.26 (2)
<i>nigriculus</i>	Range 2.63	3.25	0.84	0.28	0.54	0.52	0.20	0.21	0.22
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>pticens</i>	Range 2.73-3.18	3.38-3.81	0.87-1.02	0.26-0.28	0.59-0.64	0.42-0.47	0.22-0.27	0.31-0.34	0.16-0.19
Ave. (n)	2.96 (5)	3.71 (5)	0.94 (5)	0.27 (5)	0.62 (5)	0.43 (5)	0.25 (4)	0.32 (5)	0.18 (5)
<i>quadripustulatus</i>	Range 3.13	3.69	1.00	0.31	0.64	0.48	0.22	0.30	0.23
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>rubrilatus</i>	Range 2.88	3.69	1.13	0.28	0.55	0.51	0.25	0.27	0.22
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>spooneri</i>	Range 2.37	3.13	0.83	0.28	0.47	0.61	0.22	0.24	0.20
Ave. (n)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

Pseudo vertex length/width	Maximum width of head	Length of antennal segment I	Length of antennal segment II	Ratio of antennal segment I/II	Maximum width of pronotum	Length of pronotum at midline	Length of mesonotum at midline	Length of tegmina	Length of calcar	Number of calcar teeth	Width of front tibia
0.65-0.71	0.58-0.61	0.13	0.22-0.30	0.44-0.62	0.75-0.80	0.17-0.22	0.57-0.62	2.90-3.00	0.37-0.40	15-16	0.07-0.08
0.68 (2)	0.60 (2)	0.13 (2)	0.26 (2)	0.53 (2)	0.78 (2)	0.20 (2)	0.60 (2)	2.95 (2)	0.39 (2)	16 (2)	0.08 (2)
0.68-0.90	0.58-0.68	0.11-0.12	0.27-0.29	0.40-0.41	0.73-0.80	0.16-0.20	0.51-0.67	2.30-3.00	0.28-0.32	10-12	0.07-0.08
0.79 (2)	0.63 (2)	0.11 (2)	0.28 (2)	0.41 (2)	0.77 (2)	0.18 (2)	0.59 (2)	2.65 (2)	0.30 (2)	11 (2)	0.07 (2)
0.63-0.93	0.65-0.75	0.12-0.16	0.30-0.34	0.39-0.57	0.74-0.93	0.17-0.23	0.54-0.67	2.50-3.20	0.30-0.34	9-12	0.08-0.09
0.75 (5)	0.69 (5)	0.14 (5)	0.32 (5)	0.45 (5)	0.84 (5)	0.20 (5)	0.60 (5)	2.90 (5)	0.31 (4)	10 (4)	0.09 (4)
0.69-0.93	0.84-0.85	0.25-0.27	0.50-0.51	0.50-0.53	1.04-1.08	0.22-0.23	0.77-0.78	3.50-3.56	0.37-0.39	7-8	0.13-0.23
0.81 (2)	0.85 (2)	0.26 (2)	0.51 (2)	0.52 (2)	1.06 (2)	0.23 (2)	0.78 (2)	3.53 (2)	0.38 (2)	8 (2)	0.18 (2)
0.92	0.59	0.15	—	—	0.90	0.24	0.52	3.00	—	—	0.13
(1)	(1)	(1)	—	—	(1)	(1)	(1)	(1)	—	—	(1)
0.92-1.04	0.66-0.68	0.12-0.17	0.28-0.33	0.37-0.56	0.78-0.85	0.13-0.17	0.52-0.57	2.40-2.55	0.25-0.27	7-8	0.08
0.99 (5)	0.67 (5)	0.14 (5)	0.30 (5)	0.48 (5)	0.81 (5)	0.15 (5)	0.55 (5)	2.46 (5)	0.26 (3)	8 (3)	0.08 (4)
0.59-0.79	0.57-0.63	0.13-0.18	0.28-0.32	0.42-0.61	0.76-0.87	0.17-0.21	0.57-0.64	2.85-3.07	0.37-0.43	14-17	0.08-0.09
0.69 (5)	0.38 (5)	0.16 (5)	0.30 (5)	0.51 (5)	0.81 (5)	0.18 (5)	0.60 (5)	2.93 (5)	0.40 (5)	15 (5)	0.08 (3)
0.76-1.00	0.68-0.72	0.11-0.17	0.28-0.32	0.36-0.58	0.80-0.93	0.19-0.21	0.58-0.67	3.00-3.23	0.28-0.29	10-12	0.08-0.09
0.88 (5)	0.70 (5)	0.13 (5)	0.30 (5)	0.44 (5)	0.86 (5)	0.20 (5)	0.62 (5)	2.95 (5)	0.29 (2)	11 (2)	0.08 (2)
0.81-1.00	0.62-0.71	0.18-0.23	0.33-0.40	0.52-0.64	0.81-0.93	0.11-0.22	0.56-0.65	2.66-3.17	0.27-0.33	7-11	0.08-0.09
0.90 (5)	0.65 (2)	0.21 (5)	0.37 (5)	0.58 (5)	0.87 (5)	0.17 (5)	0.60 (5)	2.92 (5)	0.29 (5)	9 (5)	0.08 (5)
0.59-0.85	0.58-0.62	0.10-0.16	0.32-0.35	0.32-0.48	0.70-0.76	0.17-0.21	0.47-0.53	2.40-2.53	0.27-0.32	8-13	0.07-0.08
0.69 (5)	0.60 (5)	0.13 (5)	0.33 (5)	0.39 (5)	0.73 (5)	0.19 (5)	0.50 (5)	2.48 (5)	0.28 (5)	11 (5)	0.07 (5)
0.89-0.97	0.72-0.77	0.20-0.22	0.35-0.40	0.52-0.62	0.90-0.98	0.20-0.23	0.62-0.65	2.81-3.25	0.27-0.32	7-11	0.07-0.08
0.92 (4)	0.74 (4)	0.21 (4)	0.37 (4)	0.56 (4)	0.94 (4)	0.22 (3)	0.63 (4)	3.10 (3)	0.30 (4)	9 (4)	0.08 (4)
0.86	0.70	0.17	0.40	0.42	0.96	0.24	0.66	3.25	0.35	7	0.08
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.66-0.80	0.67-0.73	0.18	0.37-0.42	0.44-0.48	0.86-0.91	0.22-0.24	0.63-0.68	3.00-3.35	0.33-0.36	8-11	0.19-0.25
0.74 (5)	0.71 (5)	0.18 (5)	0.39 (5)	0.46 (5)	0.94 (5)	0.23 (5)	0.67 (5)	3.18 (5)	0.35 (4)	9 (5)	0.22 (5)
0.82-1.00	0.82-0.86	0.19-0.25	0.33-0.41	0.47-0.77	0.97-1.08	0.20-0.26	0.69-0.74	3.13-3.38	0.33-0.35	9-12	0.08-0.10
0.93 (5)	0.84 (5)	0.24 (5)	0.37 (5)	0.63 (5)	1.03 (5)	0.22 (5)	0.72 (5)	3.25 (4)	0.34 (4)	10 (4)	0.09 (4)
0.57-0.75	0.54-0.56	0.17-0.22	0.35-0.40	0.47-0.54	0.71-0.73	0.20-0.22	0.50-0.53	2.57-2.80	0.23-0.28	7-8	0.07-0.08
0.65 (3)	0.55 (3)	0.18 (3)	0.37 (3)	0.50 (3)	0.72 (3)	0.21 (3)	0.51 (3)	2.69 (3)	0.26 (3)	8 (3)	0.07 (3)
0.64-0.95	0.54-0.58	0.15-0.18	0.30-0.32	0.50-0.55	0.64-0.79	0.15	0.57-0.61	2.60-2.83	0.28	9-10	0.08
0.80 (2)	0.56 (2)	0.16 (2)	0.31 (2)	0.53 (2)	0.72 (2)	0.15 (2)	0.59 (2)	2.72 (2)	0.28 (2)	10 (2)	0.08 (2)
0.96-1.05	0.68-0.69	0.19-0.23	0.38-0.39	0.48-0.61	0.92	0.18-0.19	0.68-0.72	2.81-3.13	0.31-0.36	7-8	0.08
1.01 (2)	0.69 (2)	0.21 (2)	0.39 (2)	0.55 (2)	0.92 (2)	0.19 (2)	0.70 (2)	2.97 (2)	0.34 (2)	8 (2)	0.08 (2)
1.08-1.20	0.64-0.69	0.14-0.17	0.26-0.32	0.53-0.55	0.81-0.82	0.20	0.57-0.60	2.50-2.73	0.33-0.35	14-17	0.15
1.14 (2)	0.67 (2)	0.15 (2)	0.29 (2)	0.54 (2)	0.82 (2)	0.20 (2)	0.59 (2)	2.62 (2)	0.34 (2)	16 (2)	0.15 (2)
0.70	0.65	0.15	0.32	0.47	0.82	0.18	0.56	2.60	0.28	10	0.08
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
0.52-0.61	0.57-0.62	0.12-0.15	0.33	0							

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