

**NEW SPECIES AND RECORDS OF *INDIOPSOCUS* MOCKFORD
(PSOCODEA: 'PSOCOPTERA': PSOCIDAE) FROM TEXAS**EDWARD L. MOCKFORD^{1,2} & DIANE W. YOUNG²¹*School of Biological Sciences, Illinois State University, Normal, Illinois 61790 – 4120*
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*youngdw@centurytel.net***ABSTRACT**

The number of species of *Indiopsocus* known (i.e. published in print) from Texas is raised from three to seven. Three of the newly recorded species are new and are here named and described. Distribution records are given for them within and outside of Texas. Texas distribution records are given for the previously known species. The series of syntypes of *Indiopsocus texanus* (Aaron) in the Philadelphia Academy of Natural Sciences and in the Cornell University Insect Collection was examined, and the single male in the series (Cornell Collection) was selected as lectotype for this species, the generotype of *Indiopsocus*. A brief phenetic classification of *Indiopsocus* is included with the known species listed in each category. A key to the species of *Indiopsocus* recorded from Texas and eastward to the Atlantic coast is included.

Key Words. Psocoptera, *Indiopsocus*, new species, phenetic grouping, species key.

INTRODUCTION

Psocidae, the largest family of free-living Psocodea (see Lienhard & Smithers, 2002) is well represented in Texas (personal observations of both authors), but published (i.e. in print) information on the Texas fauna is minuscule. S. Frank Aaron, after collecting on the Gulf Coast of southern Texas (Aaron, 1884), published descriptions of two species and a “variety” (which was really a distinct species) from the region (Aaron, 1886). Mockford (1984) recorded *Blaste garciorum* Mockford from several localities in the lower Rio Grande Valley. Mockford (1993) noted the existence of 17 species of Psocidae in Texas but did not present distribution records. The Psocoptera of Texas website (D. Young, <http://sam-diane.com/psocopteraoftexas.html>) added nine species, raising the total to 26. Considering the size, geographic position, and diversity of habitats in Texas, it is likely that the number will increase considerably.

The genus *Indiopsocus* Mockford (1974) is proving to be an important component of the Texas Psocidae. This is a genus of tree- and shrub-inhabiting psocids with 36 described species and numerous species awaiting description. *Indiopsocus* appears to be restricted to the Western Hemisphere and a few mid-Atlantic islands. The greatest diversity of the genus appears to lie in the American tropics, including the islands of the Caribbean Sea.

Here, we describe three new species from Texas, present records of the seven species now known from the state, designate a lectotype for the type species, *Indiopsocus texanus* (Aaron), and propose an artificial (phenetic) classification of the known species which may facilitate subsequent phylogenetic investigation. We also include a key to the species known from Texas and eastward to the Atlantic coast.

MATERIALS AND METHODS

The material examined consists, for the new species, of the following: for *I. lanceolatus* n. sp., 19 males and 22 females; for *I. lacteus* n. sp., 25 males and 35 females; for *I. palmatus* n. sp., 12 males and 26 females. Numbers of the other included species are as listed in the records.

Holotypes and allotypes of the new species will be deposited in the collection of the Illinois State Natural History Survey, Champaign, IL (INHS). Paratypes will be placed in INHS, the collections of the authors, ELM (above address), and DWY (above address), and in the collections of Auburn University, Auburn, Alabama (AU), Texas A & M University, College Station, Texas (TAMU), and the University of Texas at Austin (UT).

Illustrations were made with the aid of a drawing tube. Measurements, expressed in μm , were made with a filar micrometer. Body lengths and head measurements were taken with a dissecting microscope on whole specimens held in place on fine sand. All other measurements were made on slide-mounted material. Color descriptions are based on observations with direct light through a dissecting microscope on specimens preserved in 80–95% ethyl alcohol. Habitus images were taken with a Canon Rebel Tli camera and Canon MP-E 65mm lens.

Abbreviations used in the descriptions and measurements (μm) are as follows: BL = body length; F = length of hind femur; fl...f3 = first to third antennal flagellomeres and their lengths; FW = forewing length; HW = hindwing length; P4 = distal segment of maxillary palpus; T = length of hind tibia; t1 and t2 = first and second tarsomeres and lengths of hind tarsomeres; t1ct = number of ctenidiobothria (comb-based setae) on hind t1; v1...v3 = first, second, and third ovipositor valvulae (ventral, dorsal, and lateral gonapophyses respectively). For head measurements and ratios, IO and d are as defined and illustrated by Mockford (1989a). The nomenclature of wing venation follows Yoshizawa (2005).

SYSTEMATICS

Indiopsocus Mockford

Indiopsocus Mockford, 1974: 165.

Generic diagnosis

With the characters of family Psocidae, subfamily Psocinae, and tribe Ptyctini (sensu Mockford, 1993). Adults of both sexes usually macropterous, females rarely brachypterous. Distal inner labral sensilla in two series: 5 outer sensilla of 3 placoids alternating with 2 trichoids; 4 inner sensilla of trichoids, or the two series intermingles, with 3 trichoids between each pair of placoids. Forewing markings usually a dark mark in pterostigma and stigmasaum and a partial or complete nodal band. Hypandrium asymmetrical, roughly triangular, broad based, tapering towards apex, the base preceded by a pair of rounded sclerites. Phallosome broad based, either tapering towards apex or with sides parallel; apex usually asymmetrical. Male epiproct flat, not extending anteriorly over clunium. Subgenital plate with distal process (egg guide) generally possessing a pair of well sclerotized lateral bands; pigmented arms of base of plate variable. Ovipositor valvulae: apical process of v2 relatively long and slender; v3 transversely elongate, usually with a well-developed median lobe.

The following skeletal classification of the described species of *Indiopsocus* includes only forms known from males. It is not possible to assign species known only from females at this time.

Group I

Phallosome a broad-based triangular structure tapering to a slender distal process. Male clunium extending as a broad plate over the base of the epiproct.

Subgroup A — Forewing marking including spots and banding in distal R and M cells as well as spots in the pterostigma, stigmasaum, nodal band region, etc. (see Mockford, 1974, Figs. 157, 158, 177). Hypandrium with a slender central process bearing large teeth. Female ninth sternum

asymmetrical, with a broad, heavily sclerotized central plate and the spermapore opening to one side of this plate. Included species: *I. denticulatus* García Aldrete, *I. microvariegatus* Mockford, *I. variegatus* Mockford. The known species are Cuban.

Subgroup B — Forewings lacking spots and banding in R and M cells. Hypandrium unknown. Females unknown. Included species *I. expansus* (New & Thornton). The single included species is from a mountain area in Colombia.

Group II

Forewing marking mostly restricted to spots in the pterostigma, stigmata, basal one-third of cell r5, nodal band, and regions basal to nodal band; distal R and M cells unmarked or with very light clouding (exception: females of *I. coquilletti* (Banks)). Hypandrium variable. Phallosome broad, quadrate. Male clunium not or only slightly (e.g. *I. mendeli*, Lienhard & Ashmole, 2011: fig. 9d) extending over epiproct. Female ninth sternum symmetrical with spermapore opening (where known) located medially.

Subgroup A — Hypandrium terminating in a slender process bearing a row of large teeth and abundant short bristles (see Mockford, 1974, Fig. 145). Phallosome quadrate, closed distally or not, bearing distally a pair of broad paddle-shaped structures. Male paraproctal process a long, slender hook. Included taxa: two species complexes, here designated A-1 and A-2.

Complex A-1. Phallosome closed distally (see Mockford, 2012, Fig. 32). Included species: *I. affinis* Mockford, *I. campestris* (Aaron), *I. campestroides* Mockford, *I. caraibensis* Badonnel. The known species are from the Atlantic coast of the United States, Bahama Islands, Bermuda, Cuba, and the French West Indies (FWI).

Complex A-2. Phallosome open distally (see Badonnel, 1989, Fig. 24). Included species: *I. etiennei* Badonnel (from Guadaloupe, FWI).

Subgroup B — Hypandrium terminating in a broad process curved upward at its tip. Phallosome with broad base, tapering somewhat distally, and asymmetrical at apex, usually with a slender process to one side of the midline plus blunt processes or

rounded lobes (Figs. 4, 12). Included species: *I. acraeus* (Thornton & Woo), *I. bisignatus* (Banks), *I. camagueyensis* Mockford, *I. caribe* Mockford, *I. ceterus* Mockford, *I. coquilletti* (Banks), *I. cristatus* (New & Thornton), *I. cubanus* (Banks), *I. fallax* Mockford, *I. hilburni* Mockford, *I. infumatus* (Banks), *I. jamaicensis* Turner, *I. lacteus* n. sp., *I. lanceolatus* n. sp., *I. nebulosus* Mockford, *I. obrieni* Badonnel, *I. texanus* (Aaron), *I. ubiquitous* Mockford. The subgroup is widely distributed over North, Central, and South America.

Subgroup C — Hypandrium with a rounded median lobe bearing apically an asymmetrical process with irregular spinose and denticulate surface. Phallosome with broad base, tapering somewhat distally and bearing at apex five dactyloid processes arranged symmetrically or nearly so (Fig. 20). Median lobe of v3 short, rounded (Fig. 24). Included species: *I. dentatus* (Thornton & Woo), *I. mendeli* Lienhard, *I. palmatus* n. sp. See Discussion for distributions.

Note. *I. fittkaui* Badonnel appears to be close to this subgroup in nature of the hypandrium and subgenital plate, but not in the phallosome.

Group II, Subgroup A, Complex A-1.

Indiopsocus campestris (Aaron)

Psocus campestris Aaron, 1886.

Psocus insulanus Chapman, 1930.

Psocidus insulanus (Chapman). Smithers, 1967.

Indiopsocus insulanus (Chapman). Mockford, 1974.

Indiopsocus campestris (Aaron). Mockford, 1993.

Texas records — Austin Co.: Sealy: Frazer Road, N 29°49.430', W 96°11.684', 30 April – 02 May 2013, beating *Quercus virginiana*, 3 males, 8 females, coll. DWY; Stephen F. Austin State Park, N 29°48.848', W 96°06.578', 01 May 2013, on dead branch with lichen, 1 female, coll. DWY. All specimens are in the collection of DWY.

Group II, Subgroup B

Indiopsocus bisignatus (Banks)

Psocus bisignatus Banks, 1904.
Psocidus bisignatus (Banks). Smithers, 1967.
Indiopsocus bisignatus (Banks). Mockford, 1974.

Texas records (all coll. DWY and in collection of DWY except Jeff Davis Co. record) – Bastrop Co.: Bastrop State Park, N 30° 06.33', W 97° 16.90', 11 October 2009, 1 male, 1 female; 10 November 2009, on *Quercus stellata*, 1 male, 1 female; 12 June 2013, on *Quercus stellata*, 1 female; Comal Co.: Potter's Creek, N 29° 55.53', W 98° 16.05', 30 April 2010, on *Quercus virginiana*, 1 female; Highway 32 x Highway 3424, N 29° 56.38', W 98° 12.33', 14 April 2012, on *Juniperus ashei*, 3 females; Hays Co.: San Marcos, Thousand Oaks Loop, N 29° 56.40' – 56.43', W 97° 55.30' – 55.37', 9 – 16 May 2010, on *Quercus virginiana*, 1 male, 6 females; 11 November 2010, on *Juniperus ashei*, 1 female; 16 April 2012 on *Juniperus ashei*, 1 female; 14 December 2010, on *Prosopis glandulosa*, 1 male; 3 – 7 April 2012, on *Juniperus ashei*, 1 male, 2 females; San Marcos: Hilliard Rd., N 29° 57.90', W 97° 59.70', 1 May 2010, on *Celtis reticulata*, 1 female; Spring Lake Preserve, N 29° 53.83', W 97° 55.83', 16 June 2012, on *Juniperus ashei*, 1 female; Jeff Davis Co.: Davis Mountains Resort, 20 July 1997, Malaise trap (TAMU); Tom Green Co.: San Angelo, Concho River, N 31° 27.50' W 100° 26.30', on *Quercus virginiana*, 1 female, coll. DWY.

Indiopsocus infumatus (Banks)

Psocus infumatus Banks, 1907.
Psocidus infumatus (Banks). Smithers, 1967.
Indiopsocus infumatus (Banks). Mockford, 1974.

Texas records — Bastrop Co.: Bastrop State Park, N 30° 06.18', W 97° 16.54', 19 November 2010, on *Quercus stellata*, 1 female, coll. DWY (DWY).

Indiopsocus lanceolatus n. sp.

urn:lsid:zoobank.org:act:D0B15484-A697-4021-95D2-40D22CEBC3AD

Diagnosis — A species of group II, subgroup B, differing from all of the described species of the subgroup in having a much longer medio-distal pointed process of the phallosome and much larger distal flanking lobes of the phallosome (Fig. 4).

Male color (in alcohol 11 months) —

Compound eyes black. Rest of head dull creamy white marked with medium to dark brown: a broad band of medium brown spotting along median ecdysial line and a narrow band of same bordering each eye medially; a slender medium-brown band along each frontal ecdysial line; ocellar field dark brown; a medium brown pentagonal mark with white center in middle of frons with a pale brown band extending posterolaterally from it on each side; a dark brown ring around each antennal base; postclypeal striae medium brown. Antenna: scape and pedicel colorless except each with dark brown base; flagellum with f1 white with gray tip, other flagellomeres gray. Thorax dull creamy white with brown notal lobes and a brown border behind each dorso-ventral suture. Coxae dark brown; rest of each leg white with a brown distal ring on each femur and each t1 gray, gradually becoming black distally; each t2 black. Forewing membrane (Fig. 2) mostly clear in basal two-thirds, pale grayish-brown in distal one-third; nodal band consisting of a brown spot at base of pterostigma, another at distal end of basal radial cell (Rs-M junction), one distally in cell cua2, and one at nodulus; pterostigma dark brown in distal one-third except clear along antero-distal border area; stigmasum dark brown in distal one-third, the pigment extending into cell r1; a brown spot on vein M+CuA before its branching; base of cell a1 brown; a cloudy brown mark in base of cell r5. Hindwings clear, unmarked. Preclunial abdominal segments dull creamy white with a ragged red-brown mark around each spiracle and extending dorsally as a weak, irregular line from the spiracle, joining dorsally a ragged red-brown median band running length of the preclunial region. Well-sclerotized portions of terminalia dark brown.

Male structural characters — Compound eyes large. Median and frontal ecdysial lines distinct. Ocellar field round; lateral ocelli somewhat larger than median, the latter on frons. Antenna: flagellum moderately densely setose, the setae slanting distad and slightly longer than width of their segment. Legs: coxal organ with well-defined quadrate rasp and oval mirror about same length as rasp; pulvillus slender, decidedly curved, slightly knobbed at tip. Forewing (Fig. 2): Rs-M junction short, about one-fourth length of preceding Rs segment. Hindwing normal for the genus. Hypandrium (Figs. 3 A, B) with a slender median strap curved inward at apex, its right edge slightly bulging and crenulate its entire length; the strap flanked on each side by a thicker lobe, each flanking lobe reaching to near apex of strap. Phallosome (Fig. 4): base wide; apical pointed process decidedly left of center, long and recurved towards tip; a large mushroom-like, bulging lobe on each side, that of the left side fused to the base of the pointed process. Epiproct as in Fig. 5. Paraproct (Fig. 5) broad, bearing a rounded lobe partly attached to a sclerotized band, with denticulate surface basal to sensorium; prong acuminate-tipped, subtended by a blunt-pointed lobe.

Male measurements — BL = 2141; FW = 3172; HW = 2375; F = 584; T = 1290; t1 = 451; t2 = 132; t1ct = 26; f1 = 618; f2 = 534; f3 = 440; IO = 291; d = 367; IO/d = 0.793.

Female color (in alcohol 9 months) — Head, including antenna, also thorax and legs as described for male. Wings as described for male. Preclunial abdominal segments as described for male except red-brown mark around each spiracle much heavier and the line extending dorsally from it expanding into a broad band on segments 2 – 7. Heavily-sclerotized regions of terminal segments medium to dark brown. Tips of paraprocts and epiproct pale white.

Female structural characters — Head as described for male except compound eyes much smaller and ocellar field triangular. Flagellum with short, sparse setae slanting distad, not exceeding width of their segment in length. Legs and wings as described for male. Subgenital plate (Fig. 6): arms slender, curved, joining relatively long lateral areas; egg guide with slightly curved lateral

sclerotized strips, scattered setulae between strips, and a group of long setae at base; a back-curved extension on each side of base of egg guide. Ovipositor valvulae (Fig. 7): v2 with distal process long, slender, straight; a heavily-pigmented field of reticulate sculpture occupying a large distal area of v2; v3 with a relatively short, rounded distal lobe. Ninth sternum (Fig. 8) a rounded lobe preceded by three transverse folds in membrane. Paraproctal sensorium with a field of 18 – 21 trichobothria on basal florets. Epiproct (Fig. 9) with broad basal region of heavy sclerotization extending ventrally as two dactyloid projections.

Female measurements — BL = 2582; FW = 3164; HW = 2514; F = 579; T = 1246; t1 = 369; t2 = 126; t1ct = 21; f1 = 580; f2 = 425; f3 = 337; IO = 481; d = 238; IO/d = 2.02.

Material examined — Texas: Austin Co.: Sealy, N 29°49.493', W 96°11.707', 30 April – 2 May 2013, on *Quercus virginiana*, holotype male, allotype female (INHS), 3 male and 6 female paratypes (1 male, 1 female to TAMU, 1 male, 4 females to DWY). Other paratypes: Alabama: Lee Co.: Auburn, N 32°58.25', W 85°45.72', 16 April 2012, at light, 1 male, coll. C. Ray (AU); Mobile Co.: Mobile, N 30°62.45', W 88°10.95', 22 January – 19 February 2012, at light, 3 males, coll. R. L. Zimlich (DWY). Florida: Alachua Co.: Gainesville: Doyle Conner Building, 29 April 1986, black light trap, 1 male, coll. F. W. Mead (ELM); Levy Co.: Highway 40 from Inglis to west end of Highway, 14 – 15 April 1965, beating *Juniperus lucayana* and broad-leaf trees, 8 males and 8 females, coll. ELM (3 males and 3 females to INHS; 5 males and 5 females to ELM); Wakulla Co.: 2 miles N Ochlockonee River on Highway 98, beating live oaks in sand scrub, 1 male, 2 females, coll. ELM (ELM). Georgia: Camden Co.: Crooked River State Park, 16 October 1973, beating scrub live oak (*Quercus geminata*) and long-leaf pine, 1 male, coll. ELM (ELM). Texas: Austin Co.: Sealy, N 29°49.50', W 96°10.80', 29 March 2009, on *Quercus virginiana*, 4 females, coll. DWY (DWY); 25 – 26 March 2011, on *Quercus virginiana*, 2 males, 1 female, coll. DWY (DWY); Colorado Co.: Atwater Prairie Chicken NWR, N 29°42.210', W 96°16.597', on *Quercus virginiana*, 1 female (DWY). Virginia: Princess Anne Co.: Seashore State Park, December

1956, on limb with Spanish moss, 1 male, coll. M. A. Byrd (ELM).

Etymology — The name refers to the long, lanceolate process of the phallosome (Latin, lanceolatus = armed with a little lance or point).

***Indiopsocus lacteus* n. sp.**

urn:lsid:zoobank.org:act:A97288C9-F049-45A0-BB6A-348EEB15D488

Diagnosis — A species of Group II, subgroup B. Sharing with the following species a distinct, brown nodal band on the forewing and a broad median strap of the hypandrium terminating distally in 2 tiers, the right tier extending beyond the left: *I. acraeus*, *I. camagueyensis* (nodal band slender and broken), *I. ceterus*, *I. cubanus*, *I. hilburni*, *I. jamaicensis* (hypandrium not known), *I. texanus*, and *I. ubiquitous*. Sharing with *I. hilburni* and *I. texanus* a broad nearly unbroken nodal band of the forewing (Fig. 10) and the distal projection of the phallosome flanked on each side by a distally-directed point or lobe (Fig. 12); in this species the flanking structures more acute than in either of the other two species.

Male color (in alcohol 9 months) — Habitus, Fig. 1A. Compound eyes pale gray. Rest of head ivory marked with dark brown: a band of spots along median ecdysial line, spots bordering eyes medially, a narrow band along each frontal ecdysial line, a U-shaped mark (open anteriorly) on frons before ocelli, postclypeal striae. Antennae gray basally, becoming black in f2 and beyond. Mesonotal lobes gray anteriorly, dark brown posteriorly; metanotal lobes dark brown; regions between lobes white. Thoracic pleura variegated dark brown and white. Legs: coxae dark brown; trochanters through tibiae white; each femur with a pale brown subdistal ring; tarsi pale gray on each t1, dark gray on each t2. Forewing (Fig. 10): mostly hyaline, marked with brown: a narrow border of vein R from wing base nearly to R1 – Rs branching; a nearly complete nodal band slightly interrupted below nodus and before vein CuP; a distal spot in pterostigma becoming pale brown on distal margin of pterostigma; stigmasaum brown in distal two-fifths of region from base to hind angle of pterostigma; an irregular spot posterior to region of

stigmasaum, basal one-third of cell a1. Hindwings unmarked except for a pale brown smudge in distal end of cell cup. Preclunial abdominal segments pale gray with a brown spot below each spiracle and a brown mid-dorsal band from base to clunium, slightly expanded laterally in segments 2 – 4. Heavily sclerotized regions of terminal segments dark brown.

Male structural characters — Compound eyes large. Median and frontal ecdysial lines distinct. Ocellar field triangular with median ocellus on frons, all ocelli approximately equal in size. Antenna: flagellum moderately densely setose, the setae slanting distad and slightly longer than width of their segment. Legs: coxal organ with well-defined rasp and mirror, rasp slightly longer than the round mirror; pulvillus slender, slightly curved, knobbed at tip. Forewing (Fig. 10): Rs-M junction short, ca. one-third length of preceding Rs segment. Hindwing normal for the genus. Hypandrium (Figs. 11A, B): bearing strap of moderate width with left edge serrate along most of its length; terminal lobe slightly twisted and involuted. Phallosome (Fig. 12): base of moderate width; apical pointed process far left of center and subtended by a shorter pointed process; on right a short, broad, pointed process; basal to the pointed processes an ear-like lobe present on each side. Epiproct as in Fig. 13. Paraproct (Fig. 13) with heavy outer sclerotic band; prong acuminate-tipped.

Male measurements — BL = 2395; FW = 3363; HW = 2602; F = 638; T = 1284; t1 = 418; t2 = 165; t1ct = 22; f1 = 717; f2 = 607; f3 = 455; IO = 301; d = 348; IO/d = 0.825.

Female color — Habitus, Fig. 1B. As described for male except brown spots of vertex paler and more diffuse, subdistal brown femoral ring very pale on front femur, absent on middle and hind femora; dorsal brown spots of preclunial abdominal segments somewhat more discrete, not or only partially forming a continuous band, and decidedly expanded laterally in segments 2 – 5.

Female structural characters — Head ecdysial lines and ocelli as described for male except median ocellus minute. Antennal flagellum with short, fairly dense setae slanting distally its entire length. Legs and wings as described for male. Subgenital plate (Fig. 14) with heavily sclerotized

transverse basal band of egg guide continuous with pair of sclerotized bands running distally towards tip, curving outward and reaching lateral margin well before tip; a field of ca. 15 setulae occupying space between the two bands near their base; a transverse row of 4 long setae immediately basal to sclerotized transverse band. Ovipositor valvulae (Fig. 15): v2 with distal process straight and slender; a conspicuous field of spicules around base of distal process; v3 with long tapering distal lobe. Ninth sternum as in Fig. 16. Paraproctal sensorium with field of 23 – 27 trichobothria on basal florets. Epiproct (Fig. 17) with heavy sclerotization restricted to sides and subdistal partial ring.

Female measurements — BL = 2353; FW = 3362; HW = 2508; F = 602; T = 1284; t1 = 410; t2 = 156; t1ct = 23; f1 = 655; f2 = 573; f3 = 460; IO = 445; d = 236; IO/d = 1.886.

Material examined (all coll. DWY on bare limbs of *Juniperus ashei* unless indicated otherwise) — Texas: Hays Co.: San Marcos: Thousand Oaks Loop, N 29°56.20' - 56.24', W 97°55.30' – 55.40', 8 – 19 November 2011, holotype male (intact), allotype female (intact), 5 male and 10 female paratypes (holotype, allotype, 2 male and 3 female paratypes to INHS, 3 male and 7 female paratypes to DWY). Other paratypes: Texas: Blanco Co.: Highway 32 x Highway 473, N 30°01.40', W 98°19.90', 14 April 2012, 1 male (DWY); Comal Co.: Highway 32 x Highway 3424, N 29°56.38', W 98°12.33', 14 April 2012, 1 female (DWY); Hays Co., San Marcos: Spring Lake Preserve, N 29°53.93', W 97°55.93', 6 – 7 November 2011, 1 male, 8 females (1 male, 6 females to DWY, 2 females to ELM); N 29°56.4', W 97°55.3', 8 November 2011, 1 male, 2 females (DWY); N 29°56.20', W 97°57.00', 13 – 16 November 2011, 2 males (ELM); N 29°53.93', W 97°55.56', 20 November 2011, 1 male, 2 females (ELM); N 29°56.4', W 97°55.3', 1 January 2012, 1 male (DWY); N 29°53.60', W 97°55.65', 16 April 2012, 2 males (DWY); N 29°56.47', W 97°55.38', 12 April 2012, 4 males (DWY); N 29°53.77', W 97°55.78', 11 November 2012, 1 male, 2 females (UT); N 29°53.83', W 97°55.83', 11 October 2012, 1 male, 1 female (TAMU); N 29°56.48', W 97°55.38', 16 November 2012, 1 male, 4 females (DWY); Travis Co.: Balcones Canyonlands Preserve, 5 July 1994,

1 male, coll. M. Quinn (TAMU); N 30°25.60', W 98°51.60', 29 November 2011, 2 males, 5 females (DWY).

Etymology — The name refers to the pallid white ground color of this species (Latin, lacteus = milky white).

Indiopsocus texanus (Aaron)

Psocus texanus Aaron, 1886.

Psocidus texanus (Aaron). Smithers, 1967.

Indiopsocus texanus (Aaron). Mockford, 1974.

The single male syntype of this species (Cornell University type No. 4848) was examined and we were able to confirm thereby that the name is correctly placed. This individual is here designated lectotype of the species. We include here figures of diagnostic features of the hypandrium and phallosome of the lectotype (Figs. 27, 28). Two female syntypes accompanying this male (also C. U. type No. 4848) were not in suitable condition to allow identification. Eight female syntypes from the same series, deposited by Aaron in the Philadelphia Academy of Natural Sciences, were also examined. The body and wing color of these pinned specimens are well preserved and suffice to ascertain that all are the same species and that they are, beyond reasonable doubt, females of this species. These female syntypes automatically become paralectotypes.

The type locality cannot be established precisely, but Aaron's (1884) account of collecting in southern Texas suggests that it is probably in the vicinity of Corpus Christi.

Material examined (in addition to the type material noted above) — Texas: Aransas Co.: Palm Harbor, N 27°57.60', W 97°06.68', 12 April 2013, on *Quercus virginiana*, 1 male, 1 female, coll. DWY (DWY); Kenedy Co.: Kenedy Ranch, N 26°58.13', W 97°40.98', 21 April 2001, Malaise trap, 1 female, coll. Goodwin & E. Riley (TAMU); San Patricio Co.: Welder Wildlife Refuge, N 28°06.703', W 97°25.029', 10 April 2013, on *Prosopis glandulosa*, 1 female, coll. DWY (DWY); same locality, N 28°06.694', W 97°25.023', 11 April 2013, on *Quercus virginiana*, 1 female, coll. DWY (DWY).

Group II, subgroup C

Indiopsocus palmatus n. sp.

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Diagnosis — A species of Group II, subgroup C, differing from the described species in having a nearly complete nodal band of the forewing (Fig. 18) and in genitalic details of both sexes.

Male color (in 95% ethyl alcohol ca. 16 months) — Compound eyes black with grayish surface. Rest of head dull white with pale brown markings: entire hind margin of vertex continuous with a broad band bordering median ecdysial line and a narrow band bordering each eye; a U-shaped mark open forward in middle of frons with a forward-directed curved line appended on each side; slender postclypeal striae. Ocelli with dark brown median crescents. Antennae (missing beyond f3) dull white in scape, pedicel, and f1, gray in f2 and f3. Maxillary palpus colorless except P4 with gray tip. Thorax variegated dull white and medium brown: brown on notal lobes and along sutures of pleura; remainder dull white. Legs: coxae medium brown; rest of leg white except each femur with a dull brown distal ring, each t2 dark brown. Forewing (Fig. 18) mostly clear; a pale brown spot covering most of distal half of pterostigma; a medium brown spot covering most of distal half of stigmasaum and extending back into cell r1, a nearly complete, medium brown nodal band narrowly interrupted behind nodus and before nodulus; cell a1 pale brown in basal one-third. Preclunial abdominal segments grayish white with an obscure brown band along dorsal midline and a diffuse reddish-brown spot above and below each spiracle on segments 2 – 7. Well-sclerotized regions of terminal segments medium to dark brown.

Male structural characters — Compound eyes large. Median and frontal ecdysial lines distinct. Ocelli large and bulging, the median ocellus on frons. Flagellum moderately densely setose, the setae slanting distad and decidedly shorter than the width of their segment. Legs: coxal organ with well-defined rasp and mirror, the mirror slightly ovoidal in shape; pulvillus slender, slightly curved, with slender, somewhat flattened knob at tip. Forewing (Fig. 18): Rs-M junction short, ca. one-third length

of preceding Rs segment. Hindwing normal for the genus. Hypandrium (Figs. 19A, B): median distal lobe rounded, asymmetrical with a small denticulate projection on left side and a larger distal projection bearing numerous minute denticles and setulae. Phallosome (Fig. 20) essentially symmetrical distally, the set of five dactyloid projections flanked on each side by a short, broad lobe. Paraproct (Fig. 21): prong slightly recurved, with acuminate tip. Epiproct as in Fig. 21.

Male measurements — BL = 2653; FW = 3392; HW = 2634; F = 676; T = 1498; t1 = 487; t2 = 150; t1ct = 24; f1 = 697; f2 = 580; f3 = 463; IO = 374; d = 409; IO/d = 0.914.

Female color (in 95% ethyl alcohol ca. 17 months) — Compound eyes and rest of head as described for male, but also a medium brown spot in each parietal area. Antennae (missing beyond f3) dull white on scape, pedicel, and f1, but gray on tip of f1 and base of f2, darkening to black from base to tip of f2, black throughout f3. Thorax and legs as described for male. Forewing as described for male except distal brown spots of pterostigma and stigmasaum smaller (Fig. 22), and brown area of cell a1 restricted to extreme base. Preclunial abdominal segments 2 – 7 each with a transverse partial ring, primarily following the intersegmental line and not extending below the spiracle. Well-sclerotized regions of terminal abdominal segments dark brown.

Female structural characters — Compound eyes smaller than in male. Rest of head as described for male. Antennal flagellomeres with short, sparse setae slanting distad, less than width of their flagellomere in length. Leg characters as described for male. Wings as described for male except Rs-M junction of forewing slightly longer than indicated for male. Subgenital plate (Fig. 23): arms long and slender, each curving to a quadrate lateral area somewhat longer than broad; egg guide with heavily sclerotized lateral strips curving around to partially enclose its distal end; a field of setulae between strips; base of egg guide with a pointed extension on each side. Ovipositor valvulae (Fig. 24): v2 with distal process long, slender, slightly recurved; a heavily pigmented field of reticulate sculpture distally in v2; v3 with a short, rounded distal lobe. Ninth sternum as in Fig. 25. Paraproctal sensorium

with a field of 20 – 21 trichobothria on basal florets. Epiproct (Fig. 26) with broad basal region of heavy sclerotization.

Female measurements — BL = 2531; FW = 3256; HW = 2530; F = 623; T = 1404; t1 = 446; t2 = 140; t1ct = 21; f1 = 690; f2 = 623; f3 = 490; IO = 481; d = 268; IO/d = 1.79.

Material examined — Texas: Aransas Co.: Rockport: Connie Hager Cottage Park, N 28°01.07', W 97°05.91', 30 December 2011, on *Quercus virginiana*, holotype male, allotype female, 1 female paratype, coll. DWY (INHS). Other paratypes: Texas: Aransas Co.: Rockport: N 28°00.6', W 97°05.5', 27 April 2011, on *Quercus virginiana*, 1 male, 1 female, coll. DWY (DWY); type locality, 13 April 2013, on live oaks, 1 male, coll. ELM (ELM); Austin Co.: Sealy, N 29°49.30', W 96°10.48', 26 March 2011, on *Quercus virginiana*, 2 males, 2 females, coll. DWY (DWY); Sealy, N 29°49.43', W 96°11.684, on *Quercus virginiana*, 3 males, 8 females, coll. DWY (DWY); Hays Co.: San Marcos, N 29°52.42', W 97°55.54', 11 May 2012, on dead grass stems, 1 female, coll. DWY (DWY); Nueces Co.: Port Aransas, N 27°49.38', W 97°04.41', 5 May 2012, on *Quercus virginiana*, 2 females, coll. DWY (DWY); San Patricio Co.: Welder Wildlife Reserve, N 28°06.10', W 97°21.36', 23 – 24 April 2010, on *Acacia farenosa*, *Celtis reticulata*, *Quercus virginiana*, and a dead branch, 4 females, coll. DWY (DWY); same locality, N 28°06.49', W 97°25.06', 25 – 26 April 2011, on *Ulmus crassifolia*, *Celtis laevigata*, *Celtis reticulata*, *Quercus virginiana*, 1 male, 3 females, coll. DWY (ELM); same locality, N 28°06.703', W 97°25.029', 10 – 11 April 2013, 3 males, 4 females, on *Quercus virginiana*, coll. DWY (1 male, 1 female to TAMU, 2 males, 3 females to DWY).

Etymology — The name refers to the similarity of the distal end of the phallosome to the palm of a hand, with five finger-like digits arising from it (Latin, palmatus = lobed or divided like an outspread hand).

**Key to the Species of *Indiopsocus* of Southeastern United States
(Texas east to the Atlantic Coast)**

1. Forewing dusky gray, darker on pterostigma and stigmasaum, but not otherwise marked (see Mockford 1993, Fig 846) *I. infumatus*
- Forewing not as above, generally membrane clear with several dark pigment spots, some spots forming a nodal band 2
2. Phallosome symmetrical distally, terminating in 5 dactyloid processes (Fig. 20). Subgenital plate with pigmented arms long and slender, approximately two-thirds the length of the lateral pigmented areas to which they connect *I. palmatus* n. sp.
- Phallosome not as above, usually asymmetrical distally or with only a single distal process. Subgenital plate with pigmented arms much shorter, not more than half length of the lateral pigmented areas to which they connect 3
3. Frame of phallosome parallel-sided, bearing distally two long processes, each as long as the frame (see Mockford 1993, Fig. 309). Hypandrium with denticulate ridge to right of midline dividing it into more sclerotized left-hand region and more membranous right-hand region. Pigmented arms of subgenital plate directed antero-laterally at base, then bent abruptly forward, then expanded to sides as large quadrate areas (see Mockford 1993, Fig. 311) *I. campestris*
- Frame of phallosome with sides converging slightly towards distal end, with a single distal process generally shorter than the frame (Figs. 4, 12). Hypandrium with an asymmetrical central strap. Pigmented arms of subgenital plate curving antero-laterally or extremely short 4

4. Phallosome with distal process short, pointed, approximately on midline of expanded distal plate (see Mockford 1993, Fig. 316). Pigmented arms of subgenital plate relatively short and broad, the lateral areas tapering anteriorly (Fig. 29) *I. bisignatus*
- Phallosome with distal process longer and at least slightly to side of midline of the distal plate (Figs. 4, 12). Pigmented arms of subgenital plate, and lateral areas variable. 5
5. Phallosome (Fig. 4) with a long, blade-like distal process on left, subtended by a large, mushroom-shaped lobe, the latter on each side. Ovipositor valvulae (Fig. 7): v3 with a short distal lobe *I. lanceolatus* n. sp.
- Phallosome not as above, the distal process dactyloid, of moderate length, subtended by only modest swellings (Fig. 12). Ovipositor valvulae (Fig. 15): v3 with a long distal lobe extending nearly to tip of body of v2 6
6. Distal process of phallosome straight, bluntly pointed at tip and subtended on same side by a shorter blunt-pointed process (Fig. 12). Lateral pigmented areas of subgenital plate oriented in same direction as pigmented arms leading to them (Fig. 14). *I. lacteus* n. sp.
- Distal process of phallosome curved, with rounded or truncated tip and subtended by a rounded lobe (see Mockford, 1993, figs. 317, 319). Lateral pigmented areas of subgenital plate oriented at a decided angle to the pigmented arms leading to them (see Mockford 1993, Figs. 318, 320) 7
7. Distal process of phallosome with truncated tip (Fig. 28); the process separated by an indentation from a shorter, blunt process on same side (see Mockford 1993, Fig. 319). Pigmented arms of subgenital plate distinct, leading to longer than broad lateral pigmented areas (see Mockford 1993, Fig. 320) *I. texanus*

- Distal process of phallosome with rounded tip, a low hump at its base on same side (see Mockford 1993, Fig. 317). Pigmented arms of subgenital plate diffuse, leading to lateral pigmented areas about the same length as width (see Mockford 1993, Fig. 318). *I. ceterus*

DISCUSSION

The phenetic classification of the described species of *Indiopsocus*, presented above prior to the descriptions, is a preliminary attempt at classification and will, no doubt, have to be greatly modified or replaced when the genus is better known. It is based in part on the following literature: Aaron, 1886; Badonnel, 1989; Banks, 1904, 1907, 1908, 1920; García Aldrete, 1999; Lienhard & Ashmole, 2011; Mockford, 1974, 1985, 1989b, 1993, 1996, 2012; New & Thornton, 1975, 1981; Thornton & Woo, 1973; Turner, 1975.

Aside from its invasions of the Atlantic islands of Bermuda (Mockford, 1989b) and Ascension (Lienhard & Ashmole, 2011), and the Pacific islands of the Galápagos (Thornton & Woo, 1973; Mockford, 1985), *Indiopsocus* is strictly a Western Hemisphere genus, with species occurring from eastern Canada south to central Chile (see Lienhard & Smithers, 2002). It is, perhaps, not extraordinary, then, to find that the Texas fauna, located only slightly north of the middle of the continental range of the genus, consists of representatives of each of the three subgroups of Group II. It is of particular interest to find *I. palmatus* n. sp., a representative of subgroup C, in Texas. This is the subgroup represented on Ascension in the Atlantic and the Galápagos in the Pacific. The subgroup is also represented by several undescribed species, which are found on the Florida Keys, coastal Veracruz in Mexico, Belize, Puerto Rico, and the Panama Canal Zone. *I. palmatus*, which ranges well inland in Texas, is the only species of the subgroup known to date that is neither insular nor strictly coastal in distribution.

Of the three new species described here, two, *I. lacteus* and *I. palmatus*, appear to be endemic to southeastern Texas.

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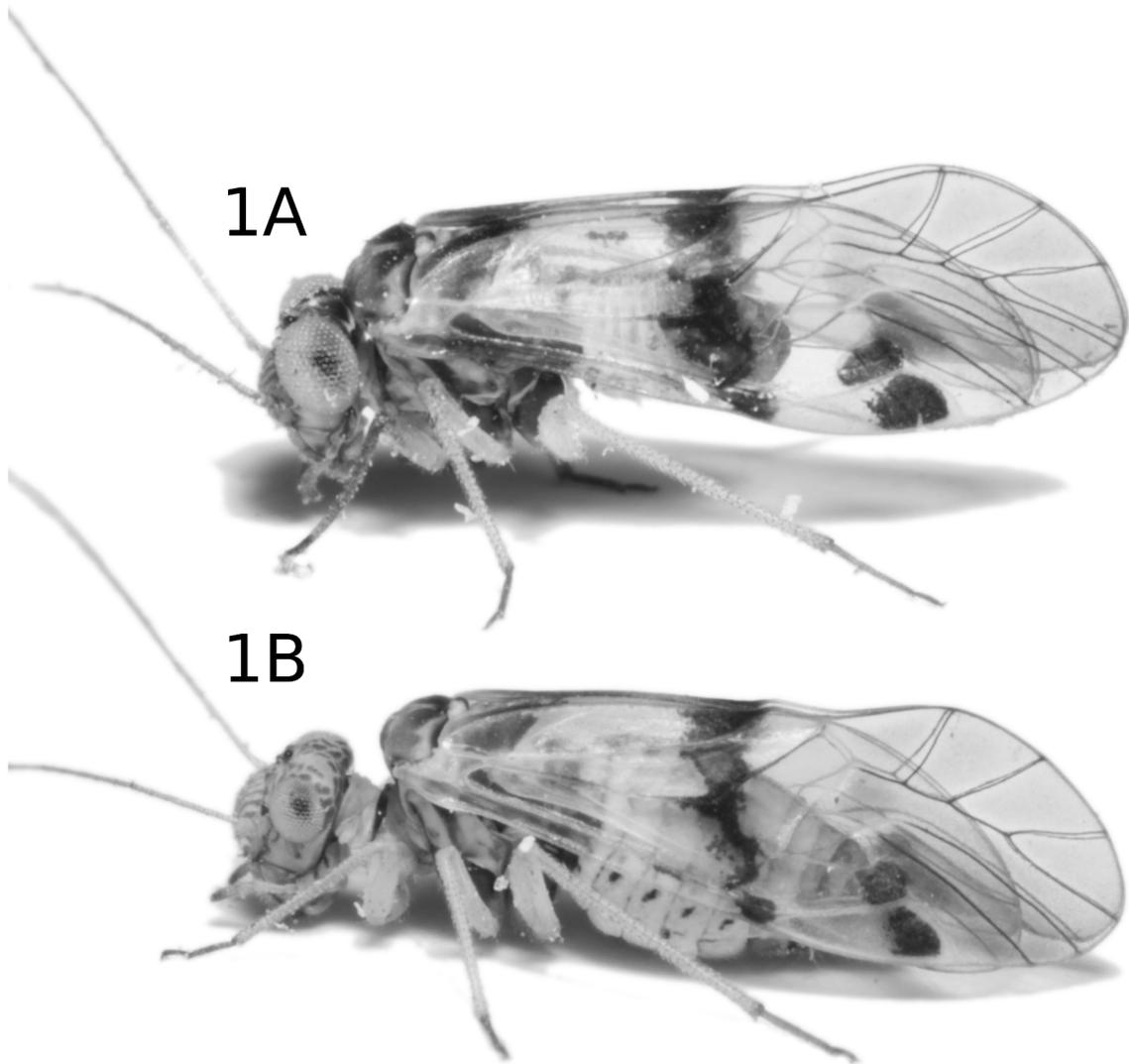
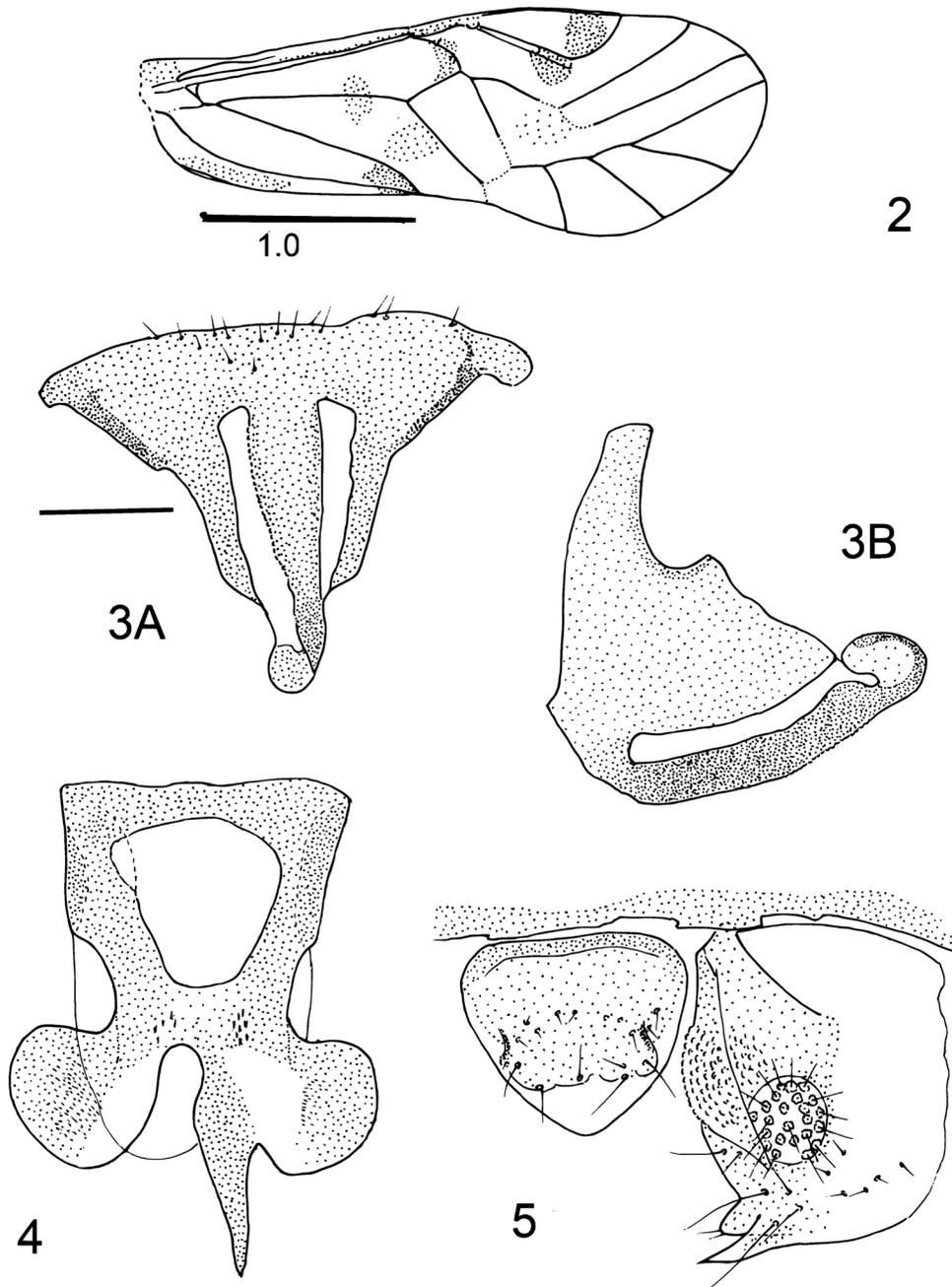
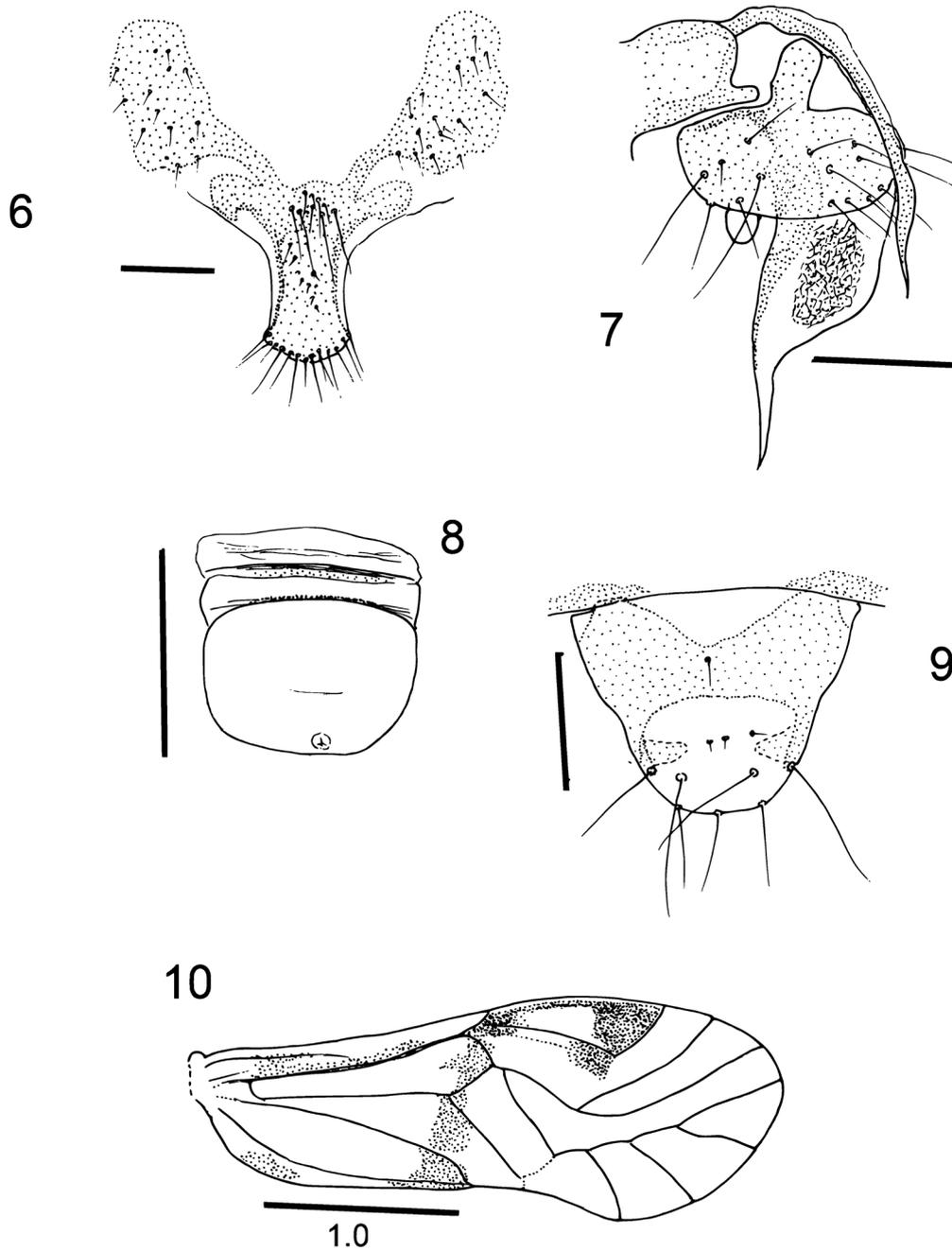


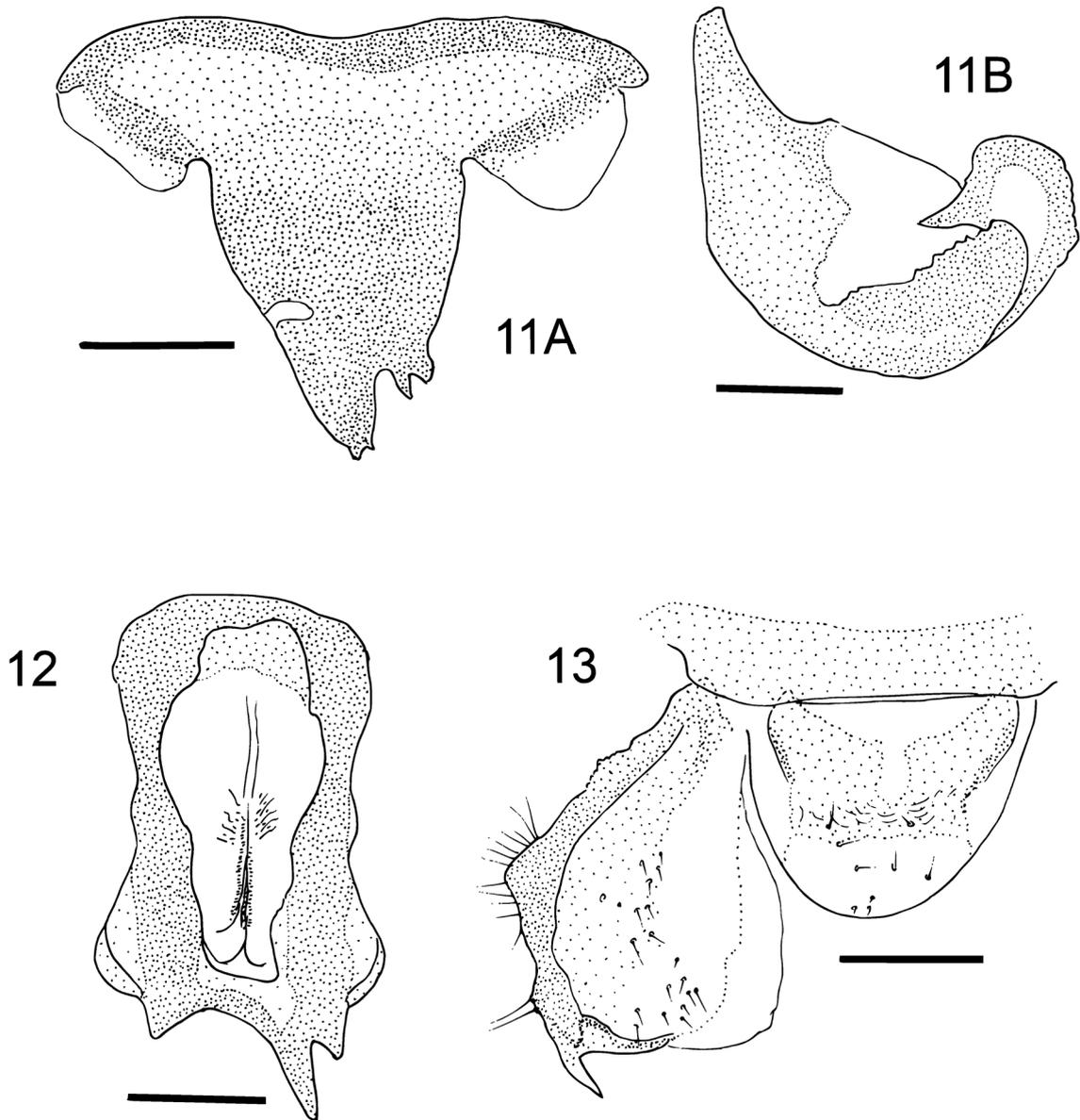
Figure 1. Habitus of *Indiopsocus lacteus* n. sp., A. male, B. female.



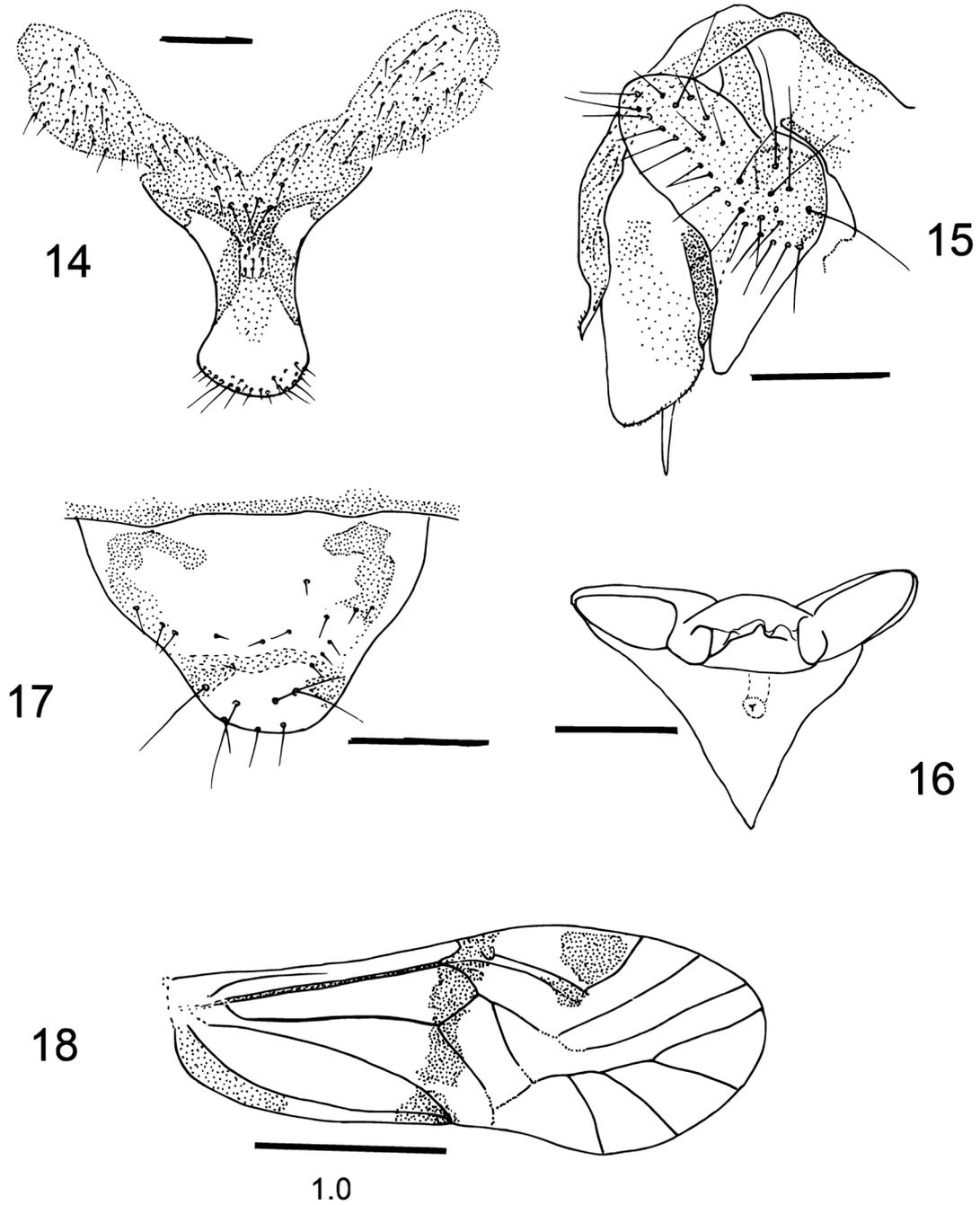
Figures 2 – 5. *Indiopsocus lanceolatus* n. sp., male, 2, forewing; 3A, hypandrium, ventral view; 3B, hypandrium, lateral view; 4, phallosome; 5, epiproct and right paraproct. Scale bars = 0.1 mm unless noted otherwise.



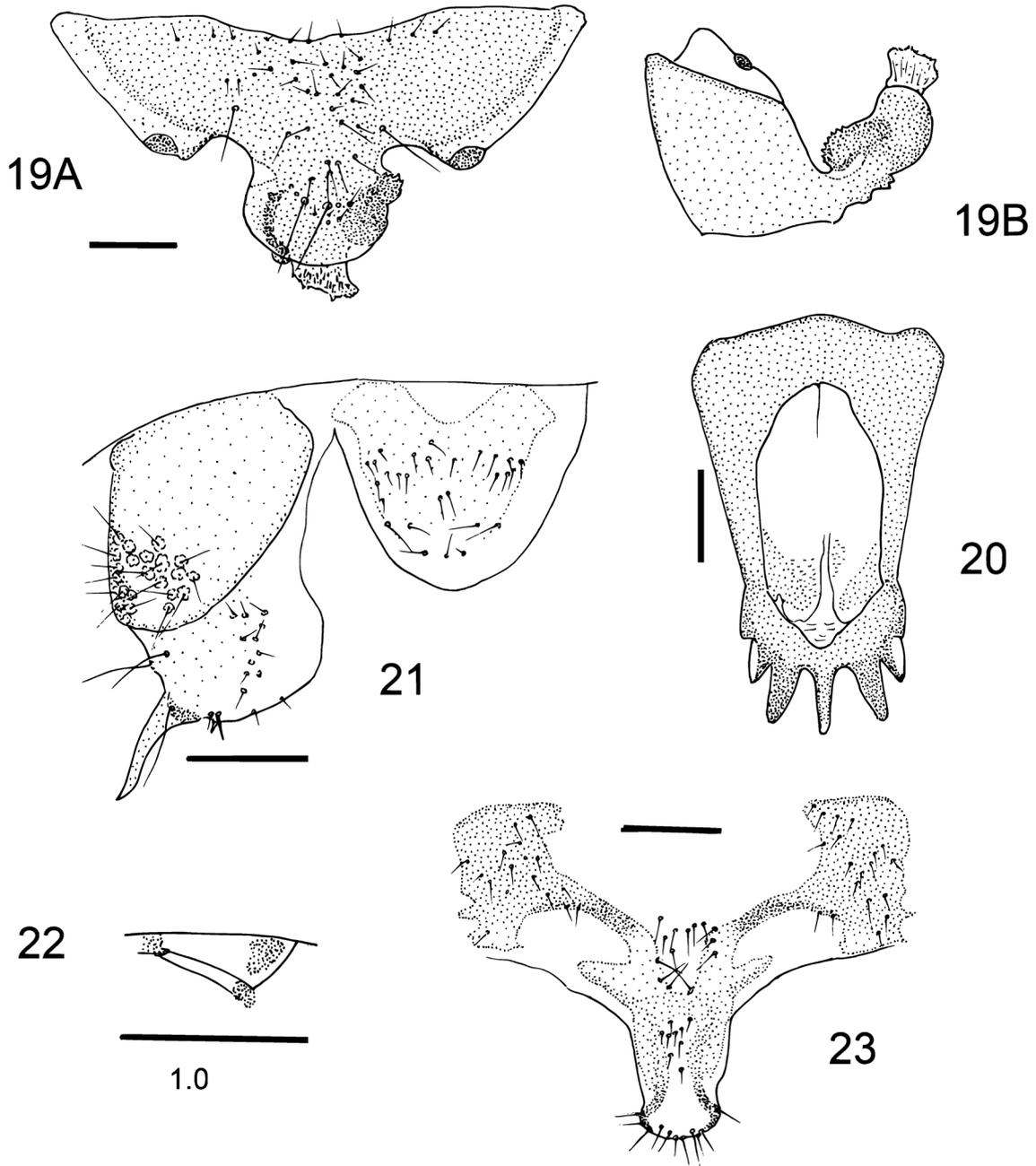
Figures 6 – 10. *Indiopsocus* spp., 6 – 9, *I. lanceolatus* n. sp., female, 6, subgenital plate; 7, ovipositor valvulae; 8, ninth sternum; 9, epiproct; 10, *I. lacteus* n. sp., male, forewing. Scale bars = 0.1 mm unless noted otherwise.



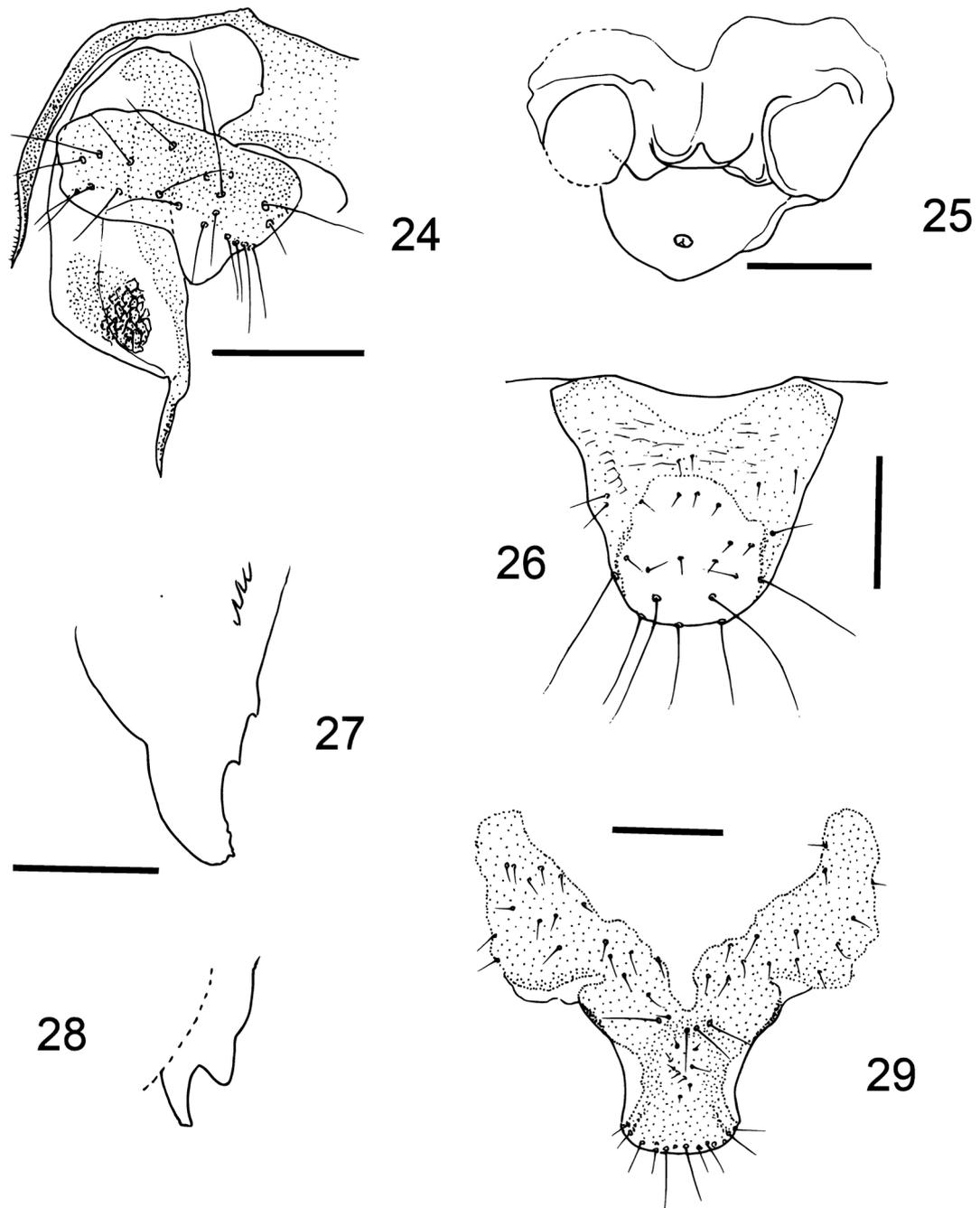
Figures 11 – 13. *Indiosocus lacteus* n. sp., male, 11, hypandrium, A, postero-ventral view, B, lateral view; 12, phallosome; 13, epiproct and left paraproct. Scale bars = 0.1 mm.



Figures 14 – 18. *Indiopsocus* spp., 14 – 17, *I. lacteus* n. sp., female, 14, subgenital plate; 15, ovipositor valvulae; 16, ninth sternum; 17, epiproct; 18, *I. palmatus* n. sp., male, forewing. Scale bars = 0.1 mm unless noted otherwise.



Figures 19–23. *Indiopsocus palmatus* n. sp., male, 19, hypandrium, A, postero-ventral view, B, lateral view; 20, male, phallosome; 21, male, epiproct and left paraproct; 22, female, pterostigma and surrounding region of forewing; 23, female, subgenital plate. Scale bars = 0.1 mm unless noted otherwise.



Figures 24 – 29. *Indiopsocus* spp., 24 – 26, *I. palmatus* n. sp., female, 24, ovipositor valvulae; 25, ninth sternum; 26, epiproct; 27 – 28, *I. texanus*, male lectotype, 27, distal end of hypandrium; 28, left side of distal edge of phallosome; 29, *I. bisignatus*, female, subgenital plate. Scale bars = 0.1 mm.