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New Species of the Planthopper Genus *Parkana* (Hemiptera: Fulgoroidea: Delphacidae) from Mesoamerica

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ABSTRACT

Six new species from Mesoamerica are described and illustrated into the formerly monotypic genus *Parkana*. These species are segregated into 3 subgenera, *Parkana* s.s. (bearing a large dorsal process on the aedeagus) consisting of 5 species, and a single species each in *Furcoparca* **new subgenus** (with the median processes of the pygofer formed into a large forked process), and *Litoparca* **new subgenus** (lacking both features, genitalia relatively simple, aedeagus bearing lateral teeth). The new species are *P.* (*P.*) *mirasol*, *P.* (*P.*) *nigra*, *P.* (*P.*) *pallida*, *P.* (*P.*) *tres*, *P.* (*F.*) *chico* (all from Mexico, except P. *nigra* also from Guatemala), and *P.* (*L.*) *costa* (Costa Rica). Keys are provided to subgenus and species. *Parkana* was previously known only from the type species (*P. alata*) from western United States. The diversity of Mesoamerican delphacid species is briefly discussed.

Key Words: Delphacidae, Fulgoroidea, Auchenorrhyncha, planthopper, new species, Guatemala, Costa Rica, Mexico, Poaceae, Cyperaceae

Parkana Beamer, 1950 (Delphacinae: Delphacini) was described with the single species, *P. alata* Beamer, 1950. *Parkana* is unusual among New World Delphacini in bearing a pair of elongate strongly asymmetrical median processes on the ventral margin of the male pygofer opening, and unique in having the pygofer ventrally compressed or 'excavated' (Beamer 1950: 129). Other genera with elongate pygofer processes include *Scolopygos* Bartlett 2002, *Pissonotus* Van Duzee 1897, *Megamelus* Fieber 1866, and the adventive *Perkinsiella* Kirkaldy 1903. None of these other genera have strongly asymmetrical processes or the 'excavated' pygofer. *Scolopygos* may be the most similar because the processes are slightly asymmetric and the genus otherwise resembles *Parkana* in general habitus.

A number of other Delphacini bear male pygofer structures of varying appearance (e.g., *Acanthodelphax* LeQuesne 1964, *Phrictopyga* Caldwell 1951, *Pygospina* Caldwell 1951, *Akemetopon* Weglarz & Bartlett 2011, and some *Achorotile* Fieber 1866 and *Bakerella* Crawford 1914). Although such structures are useful from a descriptive standpoint, the may be of limited value phylogenetically, because potentially homologous structures can be found among Asiracinae (e.g., *Ugyops palliatus* Fennah, see Fennah 1964, figs. 7-8), Plesiodelphacinae (e.g., *Burnilia spinifera* Fennah, see Fennah 1945, fig. 86, Asche 1985, fig. 594) and Tropidocephalini (e.g., *Columbiana lloydi* Muir, see Muir 1919, fig. 7).

Here six additional species of *Parkana* from Mesoamerica are described and illustrated, with keys provided to separate species. *Parkana* is compared with similar genera. Two new subgenera are described – ***Furcoparca*** and ***Litoparca*** – to accommodate less typical forms in the genus.

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METHODS

Specimens were examined from the following collections (abbreviations following Arnett et al. 1993, plus UCM):

BYUC – Brigham Young University, Monte L. Bean Life Science Museum, Provo, UT.
INHS – Illinois Natural History Survey, Champagne, IL.
LBOB – Lois O'Brien collection (LBOB, Green Valley, Arizona; affiliated with the California Academy of Sciences, San Francisco, CA).
NCSM – North Carolina State Museum of Natural Sciences, Raleigh, NC.
TAMU – Texas A&M collection (TAMU, Department of Entomology, College Station, Texas).
UCM – Collection of Steve Wilson, University of Central Missouri, Department of Biology and Agriculture, Warrensburg, MO.
UDCC – University of Delaware, Department of Entomology, Insect Reference Collection, Newark, DE.
UKYC – University of Kentucky, Department of Entomology, Lexington, KY.
USNM – Smithsonian Institution National Museum of Natural History, Washington DC.

Preparation and clearing of genitalia follows methods described in Wilson & McPhearson (1980), Bartlett & Deitz (2000) and Wilson (2005). Morphological terminology follows that of Asche (1985, 1990) and subsequent authors (e.g., Bartlett & Deitz 2000, Gonzon & Bartlett 2008, Bartlett & Hamilton 2011, Bartlett et al. in press). Roman numerals are used for all counts of segments. Plant names are from USDA PLANTS database (USDA, NRCS 2013).

Photographs and measurements were taken using a digital imagery system consisting of a Nikon SMZ1500 microscope, Nikon Digital Sight DS-U1 camera and NIS Elements Imaging software (version 3.0). Line art was digitally traced from photographs. All measurements are in millimeters (mm).

Label data were recorded for all included specimens. For primary types, labels were quoted verbatim using "/" to indicate a line break and "//" to indicate a new label and with supplemental information given in brackets. For other material examined, label data were rewritten to maintain consistency in pattern, beginning with the country, state or province, and more specific locality, followed by the collection date, collector, and lastly the number and gender of specimens (m=male, f=female) and the depository where the specimens are located, given in parentheses. Additional information was included in the same order as seen on the label data. Abbreviations in label data were expanded for clarity, except where the meaning was unclear. Specimens were provided 2D barcode labels (when not already present) and data were captured for online presentation following publication (visualized at www.discoverlife.org) using "Arthropod Easy Data Capture" (Schuh et al. 2010, Schuh 2012, Arthropod Easy Capture 2013).

RESULTS

Descriptive Taxonomy

Parkana Beamer, 1950

Type species.—*Parkana alata* Beamer, 1950.

Type locality.—USA: Arizona, Coconino Co., Flagstaff.

Diagnosis.— Body color with dark brown and stramineous theme; brachypters common with tegmina often embrowned with pale distal margin; macropterous wings clear. Head slightly narrower than pronotum. Carinae of head and thorax evident (when concolorous) to conspicuous (when contrasting in color); base of Y-shaped carina of vertex weaker. Lateral margins of frons weakly arched, length about 2x width; median carinae forked on frons just below fastigium (arms of fork approximated); vertex subquadrate, longer than wide. Antennae terete, relatively short; segment II longer than segment I; segment II bearing sensory plaques (rhinaria) organized approximately into 5 rows. Ocelli faint, near ventral anterior margin of compound eye. Brachypterous wings truncate, usually not exceeding posterior margin of tergite V. Spinulation of hind leg: tibiae 5 (3+2), basitarsus 7 (5+2), tarsomere II 4. Calcar tectiform with ~15-30 mean = 20, n=9) fine, black-tipped teeth. Lateral carinae of pronotum not reaching hind margin

(except *P. costa*). Male pygofer large, roughly rhomboid in lateral view, dorsolateral portion of opening expanded and posteriorly projecting. In caudal view, ventral margin of pygofer irregularly compressed and asymmetrical (less strongly in subgenera *Furcoparca* and *Litoparca*); opening bearing pair of elongate, closely approximated, asymmetrical median processes (e.g., Fig. 1G). Diaphragm incomplete medially, lateral portions strong, often forming a cuplike structure subtending parameres apices. Parameres broad, cupped, and bearing laterally inflected flange on portions of the medial margin (small in *Litoparca*). Aedeagus broad and decurved, bilaterally asymmetric, usually bearing large dorsal process in basal half (absent in *Furcoparca* and *Litoparca*), and lateral flanges for most of length. Suspensorium evident, "O"-shaped. Anal segment (segment X) small, unarmed; anal tube (segment XI) short, subequal in height to segment X.

Key to subgenera of *Parkana* Beamer
(apparent synapomorphies in italics)

1 Midventral processes of pygofer opening *very large, exceeding parameres*, and *broadly fused in basal half, forming forked structure* (Fig. 6G); aedeagus lacking dorsal process (Fig. 9H); *parameres with large process at base*, appearing triangular in caudal view (Figs. 9F, G) . . . . . ***Furcoparca*** new subgenus

1' Midventral processes of pygofer opening elongate (e.g., Figs. 1G, 2H) or short (Fig. 4G, H) but not fused basally or exceeding parameres; aedeagus usually with large dorsal (or dorsolateral) process (e.g., Figs. 8C, F, J); parameres (e.g., Fig. 8A) lacking large basal process 2

2 Genitalia relatively simple (Figs. 7E, F); aedeagus subsymmetrical, lacking dorsal projection, *bearing strong lateral teeth* (Figs. 7H, I); parameres parallel-sided; head slightly projected anteriorly (Fig. 7A); *lateral carinae of pronotum reaching posterior margin* . . . . . ***Litoparca*** new subgenus.

2' Genitalia more complex (e.g., Figs 1E, F); *aedeagus asymmetrical with dorsal projection*, lacking strong lateral teeth (Figs. 8C, F, J; 9C, E); parameres broad, not parallel-sided (e.g., Figs. 8A, D, G); head not projecting anteriorly (e.g., Fig. 1A); lateral carinae of pronotum not reaching posterior margin . . ***Parkana*** Beamer

Subgenus *Parkana* Beamer, 1950

Type species.— *Parkana alata* Beamer, 1950.

Type locality.— Arizona, Coconino County, Flagstaff.

Diagnosis.—Vertex just longer than wide (l:w 1.29:1). Lateral carinae of pronotum not reaching posterior margin. Male pygofer strongly compressed and asymmetrical; diaphragm forming lateral ridge, dorsally forming cuplike cavity for the reception of the parameres. Processes on ventral margin of pygofer usually with left process distinctly shorter than right (e.g., Fig. 1G, except *P. pallida*, Fig. 4H). Parameres broad and cupped, dorsomedial margin inflected laterally; lacking broad, ventral projection. Aedeagus large, decurved, bearing large dorsal (or dorsolateral) projection in basal half.

Etymology.— Beamer (1950) did not specify the etymology of *Parkana*. It may have been derived from *Parca* (Latin, goddess of destiny), *parcus* (Latin, frugal, scanty), *park* (*parc*) (Latin, a preserve), or possibly a less evident derivation. *Parkana* is understood to be feminine in gender.

Subgenus *Furcoparca*, new subgenus
urn:lsid:zoobank.org:act:EDD366A4-C4A6-4D54-9D52-56BB56A02002

Type species.—*Parkana chico,* new species.

Type locality.— MEXICO: Mexico state, Hwy 190, Río Frío [de Juárez].

Diagnosis.—Vertex just longer than wide (l:w 1.27:1). Lateral carinae of pronotum not reaching posterior margin. Male pygofer (Figs. 6E-G) weakly compressed, subsymmetrical, diaphragm forming weak lateral ridge; ventral margin of pygofer opening bearing very large forked process, exceeding parameres in height, proximally fused along midline to midlength, then diverging and

narrowed to acuminate hooked apices. Parameres broad, flat and cupped; bearing large proximal plate, in shape of a scalene triangle in caudal view. Aedeagus (Fig. 9H) large, decurved, lacking large dorsal projection in basal half.

Etymology.— The subgenus name is derived from the Latin word *furca* (fork) combined with *parca*, an arbitrary combination of letters evocative of *Parkana*. *Furcoparca* is to be understood as feminine in gender.

Subgenus *Litoparca*, new subgenus

urn:lsid:zoobank.org:act:9ECE8630-9B15-4447-8DB8-337E1CF6886B

Type species.—*Parkana costa,* new species.

Type locality.— Costa Rica: San José prov., 29 miles north San Isidro de El General.

Diagnosis.—Vertex longer than wide (l:w 1.32, n=2), head slightly projecting (Fig. 7A). Lateral carinae of pronotum reaching posterior margin. Male pygofer (Figs. 7E, F) weakly compressed, asymmetrical; diaphragm forming lateral ridge (having a 'scalloped' appearance in *P. costa*). Processes on ventral margin of pygofer elongate and sinuate, right just shorter than left. Parameres relatively narrow (Figs. 7F, G), cupped, with dorsolateral margin inflected laterad; lacking broad, ventral projection. Aedeagus relatively slender (Figs. 7H, I), decurved, lacking large dorsal projection in basal half.

Etymology.— The subgenus name is derived from the Greek word *litos* (plain, simple) combined with *parca*, an arbitrary combination of letters evocative of *Parkana*. *Litoparca* is to be understood as feminine in gender.

Remarks.— *Parkana* is readily recognized by the male genitalia having a compressed ventral region of the pygofer, i.e., "[m]ale genital capsule in lateral view greatly excavated on caudo-ventral margin…" (Beamer 1950: 128); and by having the ventral margin of the pygofer opening bearing a pair of elongate, asymmetrical processes. The most similar genus is *Scolopygos,* which also bears a pair of closely approximated processes on the ventral opening of the pygofer; but these are weakly asymmetrical; also the ventral margin of the pygofer is not compressed as it is in *Parkana*. Beyond male genitalia, *Scolopygos* and *Parkana* are similar in general morphological features. Other North American taxa bearing similar elongate projections on the ventral margin of the pygofer opening include *Pissonotus* Van Duzee, *Megamelus* Fieber, and the adventive *Perkinsiella* Kirkaldy. *Pissonotus* is unlike both genera in coloration (generally orangish to chestnut-colored), and has symmetrical genitalia, a strongly flattened aedeagus (usually bearing retrose processes), and the anal segment bearing a pair of spinelike processes (Bartlett & Deitz 2000). *Megamelus* also bears projections on the opening of the pygofer, but the 'inflated or lobed' (Beamer 1955: 29) appearance of the genitalia is unique. The adventive *Perkinsiella* has midventral projections of the pygofer, but bear little obvious similarity to *Parkana*, including their large size (> 4 mm) and flattened antennae.

The subgenera *Furcoparca* and *Litoparca* are described to accommodate forms that vary substantively from typical *Parkana*. These subgenera might have been considered separate genera based on differences in genitalia, but I have retained them in *Parkana* to emphasize their kinship to *Parkana sensu stricto*. As indicated in the key to subgenus (see *italics*), each subgenus is supported by at least one synapomorphy. Nearly all examined *Parkana* specimens of all species were brachypterous, except for *P. mirasol* n. sp., which were all macropterous.

In addition to the species described below, specimens of 2 other potential new species were examined (subgenus *Parkana*), but the material in hand was not deemed adequate for description. One of these was a single disheveled, mostly stramineous, male and 3 tentatively associated females with incomplete collecting information (near Mexico City) in the UDCC. The other was a single specimen, a dark species, from Amecameca (Mexico state) whose genitalia had been damaged during dissection (from LBOB). This specimen was recorded from '*Panicum maximum*' (*Urochloa maxima* (Jacq.) R. Webster; guineagrass), and the aedeagus bears ventral serrations.

Artificial key to species of *Parkana* (males)

1 Pronotum and mesonotum dark (except carinae and posterior margin; Figs. 2A, 3A), body dark with few pale markings **2**

1' Pronotum and mesonotum mostly pale, except sometimes on lateral portions (e.g., Figs. 1A, 4A, 5A), body usually predominately pale although some taxa with extensive dark markings **3**

2 Usually brachypterous (Fig. 3A); pale markings narrowly restricted to carinae, posterior margins of nota and antennae; proximally inflected portion or parameres large, in caudal extending more than half way to lateral margin (Fig. 8G); aedeagus with narrowed portion of aedeagal apex elongate and smoothly decurved (Fig. 8J) . . . ***P. nigra***

2' Usually macropterous (Fig. 2A); pale markings sometimes more extensive; proximally inflected portion of paramere smaller (Fig. 8D), extending less than halfway to lateral margin in caudal view; aedeagus (Fig. 8F) with narrowed portion of apex short and angularly decurved . . . . . ***P. mirasol***

3. Frons extensively pale (e.g., Figs. 1B, 4C; intercarinal region may be slightly darkened) **5**

3' Frons dark between carinae (Figs. 5C, 6C) . . **4**

4 Pro- and mesonota entirely pale (Fig. 6A). . . . . ***P. chico***

4' Lateral portions of pro- and mesonota dark (Fig. 5A) . . . . . ***P. tres***

5 Head narrow and slightly projecting anteriorly (Fig. 7A); abdomen broadly pale medially; lateral portions or pro- and mesonota distinctly darkened. . . . . ***P. costa***

5' Head nearly as wide as pronotum, not projecting (Figs. 1A, 4A) ; abdomen with dorsal pale markings but not broadly pale; lateral portions of nota weakly darkened. . . . **6**

6 Intercarinal regions of frons usually weakly embrowned (Fig. 1B); ventral margin of pygofer opening with elongate, distinctly asymmetrical median processes (Fig. 1G); distribution Western USA . . . . . ***P. alata***

6' Frons uniformly pale (Fig. 4C); ventral opening of pygofer with 2 short, weakly asymmetrical processes (Fig. 4H); distribution Mexico . . . . . ***P. pallida***

Key to *Parkana* species based on genitalic features

1 Ventromedial process very large, exceeding parameres, broadly fused basally into forked structure (Fig. 6G); parameres with large, flattened basal projection (Figs. 9F, G); pygofer weakly compressed, subsymmetrical (subgenus *Furcoparca*) . . . . . ***P. chico***

1' Ventromedial processes elongate (e.g., Fig. 1G) or short (Fig. 4H), not exceeding parameres and not fused into large forked structure; parameres lacking large, flattened basal structure (e.g., Fig. 8A); pygofer usually distinctly compressed and asymmetrical at ventral margin of opening (e.g., Fig. 1E). . . . **2**

2 Aedeagus simple (Figs. 7H, I), weakly asymmetric, without dorsal projection in basal half; in lateral view decurved and tapered distally, with lateral rows of few large teeth; parameres (Figs. 7F, G) relatively narrow and parallel-sided, cupped and somewhat forcepslike with small distal inflection (subgenus *Litoparca*) . . . . . ***P. costa***

2' Aedeagus (e.g., Figs. 8C, F) asymmetrical with dorsal projection in proximal half; parameres broad (e.g., Fig. 8A), irregular in outline, usually with large laterodistal inflection . . . . . (subgenus *Parkana*) **3**

3 Ventromedial processes of pygofer opening short (Fig. 4H) and weakly asymmetric . . . . . ***P. pallida***

3'. Ventromedial processes of pygofer opening elongate (e.g., Fig. 1G), asymmetric, with left process longer than right **4**

4. Dorsal process of aedeagus bearing ca. 4 large distally directed teeth (Fig. 8C); distribution north of Mexico . . . . . ***P. alata***

4' Dorsal process of aedeagus with a simple, distally directed process (e.g., Fig. 8F); distribution Mexico and Central America . . . **5**

5 Aedeagus broad (Fig. 9E), with dorsal serrations (in lateral view); median portions of pro- and mesonota pale . . . . . ***P. tres***

5' Aedeagus more elongate (Figs. 8F, J), lacking dorsal serrations (in lateral view); dorsal portions of pro- and mesonota dark (except carinae) **6**

6 Distal paramere flange in caudal view less than half width of paramere (Fig. 9D); apex of aedeagus gradually narrowed to angularly decurved apex (Fig. 9I) . . . . . ***P. mirasol***

6' Distal paramere flange in caudal view more than half width of paramere (Fig. 8G); apex of aedeagus abruptly narrowed smoothly decurved distal projection (Fig. 8J) . . . . . ***P. nigra***

Subgenus *Parkana* Beamer

***Parkana (Parkana) alata* Beamer**
(Figures 1, 8A-C)

Parkana alata Beamer 1950: 128.

Type locality.—Arizona, Coconino County, Flagstaff

Diagnosis.—Body generally stramineous except brown over much of abdomen (including male pygofer), lateral portions of pronotum, mesonotum and sometimes between carinae of frons. Ventral margin of male pygofer opening with asymmetrical pair of elongate, closely appressed, sinuate median processes, with left process longer than right. Parameres broad with mediodorsal portion inflected into lobed projection. Aedeagus large, decurved, with dorsal process near midlength bearing ca. 4 large, distally directed teeth.

Description.—**Color.** Varied and sexually dimorphic, body color stramineous to brownish, with females usually much paler than males. Males stramineous except darker between carinae on frons, genae, lateral compartments of pronotum and mesonotum, parts of pleura and proximal portions of legs, most of abdomen (except midventral, especially distally) and pygofer. Brachypterous forewings clear or faintly smoky. Antennae stramineous with obscure darker markings proximally and distally.

Structure. Brachypter. Body length, male: mean = 2.53 (range 2.46-2.61 mm, n=2), female: 2.47 (n=1). Macropter. Male not seen, female mean = 2.84 (body only, range 2.68-2.99 mm, n=2), mean = 4.25 (including wings, range 4.24-4.26 mm, n=2); body width at tegulae, brachypter mean = 0.81 (range 0.80-0.82, n=4; macropter, mean = 1.02 mm (range 1.00-1.04, n=2). *Head*. Head just narrower than pronotum. Vertex slightly longer than wide (l:w 1.24:1, n=6). Carinae of vertex evident although Y-shaped carina more obscure. Frons with lateral margins slightly bowed laterally, widest near level of antennae; carinae distinct but not sharp, median carina forked just below fastigium. Antennal segment I about twice as long as wide, antennal segment II slightly longer than I. *Thorax*. Prothorax about 0.75x width mesothorax; carinae evident, lateral carinae diverging, nearly straight, not quite reaching posterior margin. Mesonotum with carinae evident, median carinae obsolete on scutellum, lateral carinae diverging, reaching posterior margin. Brachypterous forewings longer than broad, distally rounded on leading and trailing margin, truncate apically; not exceeding abdominal tergite V. Calcar approximately 0.66x length of hind basitarsus (0.69:1), flattened, tectiform, cultrate, bearing continuous row of approximately 14-19 black-tipped teeth on posterior lateral margin. *Abdomen*. Tergites slightly narrowed

distally to caudally prominent pygofer; obscurely middorsally keeled. Pygofer large and prominent; dorsolateral margins strongly projecting caudally; ventral portion strongly compressed (i.e., "sinuately excavated"; Beamer 1950: 129). In caudal view, ventral portion of pygofer opening asymmetrical, bearing pair of elongate, weakly sinuate processes, left process longer and originating caudad of right. Lateral portions of diaphragm forming flange, dorsally formed into cavity to receive parameres. Parameres broad, cupped, and irregular in shape, with dorsomedial margins curled to form lobed projection. Aedeagus large, bilaterally asymmetrical, widest near base, curving and tapering distally; with flattened dorsolateral process near midlength bearing 4 distally-directed processes. Abdominal segment X small; segment XI about 0.66x height of segment X.

Remarks.—This is the only species of *Parkana* known north of Mexico. Distinguished from all other members of the subgenus by the 4 processes on the dorsolateral projection of the aedeagus. Most individuals examined were brachypters.

Reported hosts.—*Carex utriculata* Boott (Cyperaceae).

Distribution.—USA: AZ, CO, MT, SD, UT.

Etymology.—Although Beamer (1950) did not specify the origin of the specific name, '*alatus*' is the Latin term meaning 'winged'; evidently a reference to the process on the aedeagus, with the '*-a*' termination indicating the feminine inflection.

Type material examined.—**USA:** Colorado**:** No specific locality or date provided, C. F. Baker (labeled as paratype, not reported in Beamer 1950; 2m, USNM). Utah**:** *Summit Co.:* Park City, 01 Aug 1947, R. H. Beamer (paratype, 2m USNM).

Other material examined.—**USA:** Colorado**:** *La Plata Co.:* Rt. 160, 0.5 km W of jct. rt. 140, NW of Hesperus, 37.29238°N 108.04203°W, 19 Aug 2009, A. G. Wheeler, Jr., *Carex utriculata* (Cyperaceae) (2m, 2f, UDCC). Montana**:** *Lake Co.:* S. end Swan Lake, 05 Jul 1995, S. Wilson, (1m, 1f, UCM). South Dakota**:** *Lawrence Co.:* Little Spearfish Creek, Roughlock Falls, 44.35°N 103.93555°W, 13 Jul 1997, Baumann & Kondratieff (1m, BYUC).

***Parkana (Parkana) mirasol,* new species**
(Figures 2, 8D-F)
urn:lsid:zoobank.org:act:6AC63075-3FFE-4901-B54E-AA3FCAD2FA07

Type locality.—Mexico, Mexico state, La Mirasol, 7 km SW Santiago Tianguistengo.

Diagnosis.—Body very dark brown; frons dark brown with pale carinae. Ventral margin of pygofer opening with asymmetrical pair of elongate, closely appressed, sinuate median processes, with left process longer than right. Parameres broad with median portion curled lateral, forming lobed projection; in caudal view, projection covering less than half of parameres. Aedeagus large, decurved, with large subdorsal process in basal third; aedeagus distally narrowed to short, decurved apex. All examined specimens macropterous.

Description.—**Color**. Body very dark brown except carinae of head and prothorax, tegulae, and portions of the antennae and legs; some specimens with lateral portions of pro- and mesonota paler. Antennae stramineous except on leading margin and at joint between segments. Macropterous wings clear with some veins infuscated. Legs distally pale.

Structure. Brachypter. Not observed. Macropter. Body length, male: mean = 2.9 (body only, range 2.7-3.1, n=3), mean = 4.3 (including wings, range 4.0-4.4 mm, n=3); female: 3.3 mm (body only, n=1), 4.6 mm (including wings, n=1); body width, male mean = 1.04 mm (range 1.02-1.06, n=3), female 1.13 (n=1). *Head*. Head narrower than pronotum. Vertex slightly longer than wide (l:w 1.29:1, n=4). Carinae of vertex evident. Frons with lateral margins slightly bowed laterally, widest at bottom of compound eye; carinae distinct, median carina forked just below fastigium (near top of compound eye). Antennal segment I more than twice as long as wide, antennal segment II slightly longer than I. *Thorax*. Prothorax about 0.5x width mesothorax; carinae evident, lateral carinae diverging, nearly straight, not reaching posterior margin. Mesonotum with carinae weaker than pronotum, median carinae obsolete distally, lateral carinae slightly diverging, nearly reaching posterior margin. Macropterous wings exceeding

abdomen by 0.75x length of abdomen. Calcar approximately 0.66x length of hind basitarsus (0.66:1), flattened, tectiform, cultrate, bearing continuous row of approximately 21-29 black-tipped teeth on posterior lateral margin. *Abdomen*. Tergites narrowed distally to prominent pygofer; obscurely middorsally keeled. Pygofer large and prominent; dorsolateral margins (in lateral view) strongly projecting caudally; ventral portion strongly compressed. Diaphragm forming strong lateral flange, dorsally formed into cuplike cavity to receive the parameres. In caudal view, ventral portion of pygofer opening asymmetrical, bearing pair of elongate, sinuate processes, left process longer and originating caudad of right. Parameres broad, cupped, foliate and asymmetrically ovate, with mesal margins curled to form lobed projections. Aedeagus large, bilaterally asymmetrical, widest and rather bulbous at base, curving and weakly tapering distally; with large subdorsal spinelike process in basal third and with lateral flanges for most of length; aedeagus abruptly narrowed distally, forming short down-angled apex. Abdominal segment X small, short; segment XI about height of segment X.

Remarks.— This species is at present only known from macropters. It is very similar to *P. nigra* and *P. tres*. *Parkana mirasol* and *P. nigra* are darker than *P. tres* (the latter with the dorsum of the pro- and mesonota stramineus vs. dark brown in *P. nigra* and *P. mirasol*). *Parkana nigra* and *P. mirasol* can be separated by the shape of the parameres (with *P. mirasol* having a smaller curled inflection) and the aedeagus (*P. mirasol* having a short, angled apex), and ostensively also by range (*P. nigra* is more southern) and wing form.

Reported hosts.— None.

Distribution.— Mexico (Mexico, Morales).

Etymology.— The specific name '*mirasol*' is taken from the locality name (Spanish for sunflower), and is to be treated as indeclinable.

Type material examined.—Holotype "MEX., Mex. LaMirasol / 7km. SW. Santiago de / Tianguistengo 2800m // XI-2-1973 / C.W. O'Brien // HOLOTYPE / *Parkana* / *mirasol* Bartlett [red paper]" (male macropter, LBOB). Paratypes. **MEXICO:** Mexico, same as holotype (5m, 1f, all macropters); Morelos, Laguna de Zemprala, Oct. 21, 1945, 9500ft, Pine + lake meadow, D. M. Delong (1m, UDCC).

***Parkana (Parkana) nigra*, new species**
(Figures 3, 8G-J)
urn:lsid:zoobank.org:act:54286C80-542E-4391-B1EC-035A2707B03C

Type locality.— Guatemala, Totonicapán Department, 6 mi SE Totonicapán.

Diagnosis.—Color dark brown; frons dark brown with paler carinae. Ventral margin of pygofer opening with asymmetrical pair of elongate, closely appressed, sinuate median processes, with left process longer than right. Parameres broad with median margin curled to form large, lobed, lateral projection, occluding more than half subtending paramere in caudal view. Aedeagus with large dorsal projection in basal third, aedeagus abruptly narrowed distally to form elongate, decurved apex.

Description.— **Color**. Males dark brown; paler on carinae of head and prothorax, also antennae, posterior margins of prothorax and scutellum, legs and posterior margin of brachypterous forewings. Brachypterous forewings infuscate, macropterous wings clear. Females paler, variable from mostly dark (approaching male coloration) to dirty stramineous (frons intercarinal region always dark). Abdomen including terminalia dark brown.

Structure. Brachypter. Body length, male: mean = 2.63 mm (range 2.55-2.69, n=3); body width mean = 0.86 mm (0.84-0.87, n=3); female, body length mean = 2.53 mm (range 2.44-2.61, n=2); body width mean = 0.72 mm (0.68-0.75, n=2). Macropter, male not seen; female, body length (without wings) mean = 2.35 mm (range 2.24-2.45, n=2); body length (with wings) mean = 3.58 mm (range 3.47-3.69, n=2); body width mean = 0.82 mm (0.77-0.87, n=2). *Head*. Head slightly narrower than pronotum. Frons 2x as long as wide (l:w 2.14:1) with lateral margins subparallel (widest just beneath eyes), carinae conspicuous, median carina forked on frons just below fastigium. Median carina of postclypeus conspicuous. Vertex slightly longer than wide (l:w 1.40:1), carinae conspicuous. Antennae relatively short with antennal segment II about 1.5x as long as

segment I. *Thorax*. Pronotum about 0.66x length of mesonotum (along midline); lateral carinae diverging, slightly sinuate, abruptly ending before reaching posterior margin. Median carinae of mesonotum obsolete on scutellum, lateral carinae lateral carinae diverging, distally arced, reaching posterior margin. Forewings weakly rounded at posterior margin, just exceeding abdominal tergite V. Calcar approximately 0.75x length of hind basitarsus (0.74:1), flattened, tectiform, cultrate, bearing a continuous row of 20-24 black-tipped teeth on posterior lateral margin. Hind basitarsus 0.66x length of all tarsomeres combined. *Abdomen*. Male pygofer large, roughly rhomboid in lateral view, dorsocaudal margin posteriorly projecting. In caudal view, pygofer weakly asymmetrical, ventral region irregularly compressed, opening wider than tall; bearing pair of elongate, sinuate processes, left taller and caudad of right. Diaphragm forming lateral flange, dorsally forming shallow, cuplike cavity to receive paramere apices. Parameres flattened, broad, cupped, with medial margins curled, forming large lobe in distal half and much smaller, more distal lobe; large lobe occluding more than half face of paramere in caudal view. Aedeagus large, bilaterally asymmetrical, roughly parallel-sided in lateral view (dorsal and ventral margins sinuate in lateral view), abruptly narrowed to elongate, decurved apex; aedeagus with large dorsal projection in basal fourth, and weak dorsolateral ridges along most of length. Segment X small, rather triangular in lateral view, segment XI about length of segment X in lateral view.

Remarks.— This species is similar to *P. mirasol* and *P. tres*. *Parkana nigra* is a dark species, unlike *P. tres* that is marked with stramineous. *Parkana nigra* has a larger inflected lobe on the paramere and an elongate aedeagal apex compared with *P. mirasol*.

A series of this species was examined from Llano de las Flores, Oaxaca, Mexico. Males from this series were dark and very similar to the specimens from Guatemala; however, females varied from mostly dark to having extensive pale markings. These specimens were evidently mounted out of a fluid media and exhibited some distortion from shrinkage, causing measurements from these females to vary more than expected. The females are excluded from the paratype series because of these reasons and the inherent uncertainties of assigning species to female delphacids.

Reported hosts.— None.

Distribution.— Guatemala (Chimaltenango and Totonicapán Departments); Mexico (Oaxaca).

Etymology.— The specific name '*nigra'* is the feminine declination of the Latin term '*niger*' (black, dark), a reference to the dark color of this species.

Material examined.—Holotype (here designated; LBOB, brachypterous male) "GUATEMALA, 6mi. SE. / Tolonicapan Department, 10,000' / VII-28-1974 C.W. & L. / O'Brien & Marshall // HOLOTYPE / *Parkana* / *nigra* Bartlett [red paper]". Paratypes: **GUATEMALA:** Totonicapán Department, same as holotype (1m, LBOB); Chimaltenango Department, 38 mi. NW. Chimaltenango, 8700', VI-7-1974, [C.W. & L.] O'Brien & Marshall (1m, LBOB). **MEXICO:** Oaxaca, Llano de las Flores, 15 mi NE Ixtlan de Juarez, 21-VII-1985, J. Woolley, G. Zolnerowich 85/082 (TAMU-ENTO X0867457, X0882488, X0885526, X0622272, X0885822, X0885143, X0885258, X0885969, 8m, TAMU, UDCC); same data, excluded from paratype series (8f brachypters, 2f macropters, 1 broken).

***Parkana (Parkana) pallida*, new species**
(Figures 4, 9A-C)
urn:lsid:zoobank.org:act:6BDEC80D-EE47-4C14-8C88-8F779A2A2EFB

Type locality.— Mexico, Durango, near Neveros.

Diagnosis.—Color stramineous with dark abdomen; frons pale. Ventral margin of pygofer opening with pair of short, subequal, approximated median processes. Parameres broad, irregular in shape, with median margin broadly curled. Aedeagus relatively simple, decurved, weakly flattened and parallel sided in basal half, distally tapering to acute apex, with large dorsal projection in basal fourth.

Description.— **Color**. Color stramineous (carinae concolorous) with contrasting dark brown

abdomen; irregular dark markings on lateroanterior portion of pronotum, pleuron, and metacoxae brown; abdomen dark except tergum segments IV and VIII and irregular pale markings on dorsum of segments V-VII and pygofer. Brachypterous forewings clear with some veins slightly infuscate, macropterous wings clear.

Structure. Brachypter. Body length, male: mean = 2.45 mm (range 2.28-2.60, n=4); body width mean = 0.92 mm (0.81-1.00, n=5); female mean = 2.45 mm (range 2.07-2.53, n=6); body width mean = 0.92 mm (0.84-0.97, n=4). Macropter. Male, dissected, disheveled; female, not seen. *Head*. Head slightly narrower than pronotum. Frons 2x as long as wide (l:w 2.01:1) with lateral margins slightly bowed, widest near ventral margin of eyes, carinae conspicuous (concolorous), median carina forked on frons in dorsal third of compound eyes. Median carina of postclypeus evident. Vertex nearly as wide as long (l:w 1.14:1), carinae evident. Antennae relatively short with antennal segment II nearly 2x as long as segment I. *Thorax*. Pronotum about 0.66x length of mesonotum (along midline); lateral carinae diverging, slightly arced laterally, ending before posterior margin. Median carinae of mesonotum obsolete on scutellum, lateral carinae lateral carinae diverging, reaching posterior margin. Forewings truncate at posterior margin, just exceeding abdominal tergite V. Calcar approximately 0.75x length of hind basitarsus (0.72:1), flattened, tectiform, cultrate, bearing continuous row of 15-20 black-tipped teeth on posterior lateral margin. Hind basitarsus 0.66x length of all tarsomeres combined. *Abdomen*. Male pygofer large, roughly rhomboid in lateral view, dorsocaudal margin posteriorly projecting. In caudal view, pygofer slightly asymmetrical, opening wider than tall; ventral margin compressed, bearing pair of short, subequal, approximated processes; lateral portions of diaphragm strong, subtending parameres. Parameres broad, irregularly shaped, cupped, median portion broadly curled. Aedeagus relatively narrow, simple and decurved; weakly flattened, parallel-sided in basal half, tapering distally to acute apex; bearing large subdorsal process in basal fourth. Segment X small, segment XI about length of segment X in lateral view.

Remarks.— *Parkana pallida* is easily recognized by the pale coloration and the short, subequal processes on the opening of the pygofer. The type specimens were collected by vacuum sampling.

Reported hosts.— *Muhlenbergia* sp. (Poaceae, Chloridoideae).

Distribution.— Mexico (Durango, Federal District)

Etymology.— From the Latin term *pallidus*, meaning pale, with the feminine '*–a'* termination.

Material examined.—Holotype (here designated; INHS, brachypterous male) "MEXICO, DURANGO / Niveros Rd. [sic, Neveros], 2660m, 2 mi N. Nr. 40 // 24-X-1995 / C. Dietrich / Muhlenbergia sp. // HOLOTYPE / *Parkana* / *pallida* Bartlett [red paper]" Paratypes. **MEXICO**. Durango: Same data as holotype (1 male, 6 females double pointed on 3 pins, INHS); Federal District: rt. 95, km 41 S. Mexico City, 2970m, N19.12496, W99.19440, 18.x.2005, C. H. Dietrich, MX 05-03-3 vacuum, NYSM Genome Bank 09-11-15-24 (4 males, UDCC; 8 males NCSM #09-11-15-24 in ETOH).

***Parkana (Parkana) tres*, new species**
(Figures 5, 9D, E)
urn:lsid:zoobank.org:act:999E2F22-47C7-4D9C-B196-C973ACEC706A

Type locality.— Mexico, Hidalgo, Hwy 105, 2.4 mi North of Tlanchinol.

Diagnosis.—Color deep brown with prominent stramineous markings, especially on dorsum of pro- and mesothorax. Frons dark with pale carinae. Ventral margin of pygofer opening with asymmetrical pair of elongate, closely appressed, sinuate median processes, with left process longer than right. Parameres broad and cupped with dorsomedial margin curled forming lobed projection. Aedeagus robust, broad in lateral view, bearing few dorsal teeth near midlength and with large subdorsal projection in basal fourth.

Description.— **Color**. Dark brown with dorsal portions of vertex, pronotum, mesonotum, and distal abdominal segments, plus legs, antennae and carinae pale (some specimens darker with notal carinae and scutellum broadly pale). Brachypterous

forewings infuscate with distal and proximal portions pale, white on distal margin. Female coloration similar with more extensive pale markings.

Structure. Brachypter. Body length, male: mean = 2.64 mm (range 2.44-2.73, n=5); body width mean = 0.82 mm (0.76-0.85, n=5); female: mean = 2.58 mm (range 2.34-2.80, n=5); body width mean = 0.90 mm (0.86-0.96, n=5). Macropter, not seen. *Head*. Head slightly narrower than pronotum. Frons >2x as long as wide (l: w 2.12:1) with lateral margins slightly bowed, widest just below ventral margin of eyes, carinae conspicuous, contrasting, median carina forked on frons in dorsal 1/4 of compound eyes. Median carina of postclypeus conspicuous. Vertex longer than wide (l:w 1.43:1), carinae evident. Antennae relatively short with antennal segment II twice length of segment I. *Thorax*. Pronotum about half length of mesonotum (along midline); lateral carinae diverging, not reaching posterior margin. Median carinae of mesonotum obsolete before scutellum, lateral carinae lateral carinae diverging, reaching posterior margin. Forewings truncate at posterior margin, not exceeding abdominal tergite V. Calcar approximately 0.75x length of hind basitarsus (0.72:1), flattened, tectiform, cultrate, bearing a continuous row of 19-27 black-tipped teeth on posterior lateral margin. Hind basitarsus 0.66x length of all tarsomeres combined. *Abdomen*. Male pygofer large, roughly rhomboidal in lateral view, lateral margins of opening posteriorly projecting. In caudal view, pygofer slightly asymmetrical, opening wider than tall; ventral portion irregularly compressed; ventral margin of opening bearing pair of elongate, asymmetrical closely appressed, sinuate processes on opening, left longer than right. Diaphragm forming lateral flange, dorsally formed into a cavity to receive parameres. Parameres broad, flattened, and cupped, with median portion curled to form prominent 2-lobed, laterally-projected process. Aedeagus very broad and robust, decurved, weakly narrowed distally; bearing large subdorsal process in basal third; dorsal margin with few (ca. 4) large teeth (each progressively smaller distally) past midlength; aedeagus with midlateral flanges along most of length; aedeagus distally narrowed to blunt, bayonetlike apex. Segment X small, segment XI about 0.66x height of segment X.

Remarks.— Superficially this species is similar to *P. mirasol* and *P. nigra*, but separable from these based on the pale coloration of the median portions of the pro- and mesonota. Also *P. tres* has a very broad aedeagus bearing serrations on the dorsum that are absent in *P. nigra* and *P. mirasol*.

Reported hosts.— None.

Distribution.— Mexico (Hidalgo)

Etymology.— From the Latin term '*tres,*' meaning three (this was the third new species I recognized), treated as indeclinable.

Material examined.—Holotype (here designated, brachypterous male, LBOB): "MEXICO, Hgo, Hwy105 / 2.4 mi. N Tlanchinol / 5000' 1 Aug. 1982 C.W. & / L. O'Brien & G. Wibmer // HOLOTYPE / *Parkana* / *tres* Bartlett [red paper]." Paratypes. **MEXICO**: Hidalgo. Same as holotype (25m, 13f, LBOB, UDCC).

Subgenus *Furcoparca* nov.

***Parkana (Furcoparca) chico*, new species**
(Figures 6, 9F-I)
urn:lsid:zoobank.org:act:919F5A6C-A947-4D66-8FE1-245A2DF71C1B

Type locality.— Mexico, Mexico state, Hwy 190, Río Frío [de Juárez].

Diagnosis.—Color stramineous with boldly contrasting brown tegmina (except pale apex), abdomen (except middorsum), and intercarinal portion of frons. Pygofer opening with very large forked process, exceeding parameres, apices acuminate and strongly hooked. Parameres broadly flattened, bearing large projection at base (appearing triangular in caudal view). Aedeagus decurved, simple (lacking dorsal projection of subgenus *Parkana*), with dorsal serrulate flange in distal half.

Description.— **Color.** Body stramineous with dark intercarinal regions of frons (clypeus paler than frons), tegmina (except pale at apex), portions of pleuron and most of abdomen, except middorsal and lateral regions.

Structure. Brachypter. Body length, male: mean = 3.01 mm (range 2.86-3.15, n=2); body

width mean = 0.83 mm (0.82-0.84, n=2); female and macropters not seen. *Head*. Head slightly narrower than pronotum. Frons <2x as long as wide (l:w 1.75:1) with lateral margins weakly arced (widest near lower margin of eyes), carinae very conspicuous, median carina forked just below fastigium. Vertex slightly longer than wide (l:w 1.27:1), carinae conspicuous. Antennae relatively short with antennal segment II about 2x as long as segment I. *Thorax*. Pronotum about 0.66x length of mesonotum (along midline); lateral carinae obscure, diverging, not reaching posterior margin. Median carinae of mesonotum obsolete on scutellum, lateral carinae lateral carinae diverging to posterior margin. Forewings truncate at posterior margin, reaching posterior margin of abdominal tergite IV. Calcar approximately 0.66x length of hind basitarsus (0.62:1), flattened, tectiform, cultrate, bearing a continuous row of approximately 19 black-tipped teeth on posterior lateral margin. Hind basitarsus 0.66x length of all tarsomeres combined. *Abdomen*. Male pygofer large, roughly rhomboid in lateral view, dorsolateral region of opening expanded and posteriorly projecting. In caudal view, pygofer subsymmetrical, opening taller than wide, ventral region weakly compressed. Ventral margin of pygofer opening bearing very large forked process, exceeding parameres in height, proximally fused along midline to midlength, then diverging and narrowed to acuminate strongly hooked apices (a diagonally weakened portion allows flexion of distal projections). Lateral portion of diaphragm forming narrow ridge. Parameres flattened and cupped, with median portion curled; base with large flattened projection, in shape of scalene triangle in caudal view. Aedeagus robust, decurved, weakly bilaterally asymmetrical; tapering distally to rounded membranous apex; aedeagus bearing lateral flanges for most of length and prominent dorsal flange in apical half, aligned slightly diagonal to plane of aedeagus, crowned with long series of sharp serrulations. Segment X small and short; segment XI about as tall as segment X.

Remarks.— The rather dramatic embellishment of the ventral margin of the pygofer allows recognition of this species and is the main diagnostic feature of the subgenus *Furcoparca*.

Reported hosts.— *Muhlenbergia macroura* (Kunth) Hitchc. (Poaceae, Chloridoideae)

Distribution.— Mexico (Federal District, Mexico)

Etymology.— The specific name '*chico*' is a truncation of the paratype locality of "El Chico" (in Mexico City), and is treated as indeclinable.

Material examined.—Holotype (here designated; LBOB, brachypterous male): "MEXICO, Mex.Hwy. / 190, Rio Frio, June 5, / 1983, 10,000' C.W.& L. / O'Brien&GBMarshall // on *Muhlenbergia* / *macroura* // HOLOTYPE / *Parkana* / (*Furcoparca*) / *chico* Bartlett [red paper]". Paratype. **MEXICO**: Federal District, Hgo [Hidago, understood as Álvaro Obregón borough, 01120 Ciudad de México], El Chico, VII-II [19]37 [understood as July 11], 9000ft, M. A. Embury (1m, LBOB).

Subgenus *Litoparca* nov.

***Parkana (Litoparca) costa*,** new species
(Figure 7)
urn:lsid:zoobank.org:act:FDF3D009-2C7D-4CC1-9B35-232B70F1FA51

Type locality.— Costa Rica, San Jose, 29mi N. San Isidro de El General.

Diagnosis.—Body stramineous except lateral portions of pro- and mesothorax, lateroproximal portion of tegmina, and lateral portions of abdomen deep brown. Head narrow and weakly projecting anteriorly. Pygofer weakly compressed, asymmetrical, dorsolateral portions of opening expanded and caudally projecting; diaphragm forming lateral scalloped baffle; ventral portion of pygofer opening bearing 2 elongate, sinuate, asymmetrical processes, with right just shorter than (and originated cephalad of) left. Aedeagus relatively slender, decurved, distally narrowed, bearing asymmetrical lateral flanges with few large teeth.

Description.— **Color**. Color stramineous with dark brown markings including lateral portions of pronotum, mesonotum, and abdomen; brachypterous wings yellowish, irregularly darkened on proximal portion of remigium (clavus pale).

Structure. Brachypter. Body length, male: 2.43 mm (n=1, holotype dissected); body width 0.76 mm; female and macropter not seen. *Head*. Head narrower than pronotum. Frons 2x as long as wide (l:w 2.07:1) with lateral margins subparallel (widest near level of antennae), carinae conspicuous, median carina forked on frons below fastigium (arms of fork closely appressed). Median carina of postclypeus conspicuous. Vertex slightly longer than wide (l:w 1.32:1), carinae conspicuous. Antennae short with antennal segment II about 2x as long as segment I. *Thorax*. Pronotum about 0.66x length of mesonotum (along midline); lateral carinae diverging, just reaching posterior margin. Mesonotum with lateral carinae diverging, reaching posterior margin, median carinae obsolete on scutellum. Forewings truncate at posterior margin, just reaching abdominal tergite V. Calcar approximately 0.75x length of hind basitarsus (0.79:1), flattened, tectiform, cultrate, bearing continuous row of 14-15 black-tipped teeth on posterior lateral margin. Hind basitarsus just over half length of all tarsomeres combined. *Abdomen*. Male pygofer large, roughly rhomboid in lateral view. In caudal view, pygofer opening taller than wide, dorsolateral region of strongly expanded and projected posteriorly; diaphragm with scalloped appearance, lying in diagonal plane of lateral portion of pygofer opening; ventral margin bearing pair of elongate, sinuate processes, left longer than (and originating caudad of) right. Parameres relatively narrow and parallel-sided, distally cupped, widest just above midlength; dorsomedially apex curled. Aedeagus slender, bilaterally asymmetrical, decurved, broadest proximally gradually tapered distally to rounded apex, laterally bearing asymmetrical flanges with few large teeth, teeth smaller distally. Segment X small, triangular in lateral view; segment XI about 0.75x height of segment X.

Remarks.— *Parkana costa* is easily distinguished from other species of *Parkana* by the relatively simple and weakly asymmetrical genitalia, and the lack of the dorsal projection of the aedeagus found in all members of the subgenus *Parkana*.

Reported hosts.— *Swallenochloa subtessellata* (Hitchc.) McClure (Poaceae, Bambusoideae).

Distribution.— Costa Rica (San Jose).

Etymology.— The specific name '*costa*' is a truncation of Costa Rica, treated as indeclinable.

Material examined.—Holotype (here designated; LBOB, brachypterous male): "COSTA RICA, S.J., / 29mi. N. Sanisidro / delGeneral, 11000' / VI-23-1974 // C. W. & L. B. O'Brien / & G.B. Marshall // on *Chusquea* / *subtesselata* // HOLOTYPE / *Parkana* / (*Litoparca*) / *costa* Bartlett [red paper]". Paratype. **COSTA RICA.** San José: same data as holotype.

DISCUSSION

The delphacid fauna of Mesoamerica remains markedly under investigated. The described delphacid fauna of Mesoamerica stands at 43 genera and 108 species (including subspecies and doubtful records), compared with 61 genera 312 species north of Mexico (Bartlett et al. in press). The recognition of *Parkana* species increases these numbers to 44 genera and 114 species so far known for Mesoamerica. In comparison, collectively for the Caribbean (plus Bermuda), Mesoamerica and South America (including the Juan Fernandez Islands) there are 79 delphacid genera and 318 species (including *Parkana*). The collective New World fauna is approximately 104 genera and 582 species (pers. obs., including the *Parkana* described here). The correspondence between these figures and the true faunal diversity is unclear, but (based on numbers of undescribed species found among undetermined specimens) for America north of Mexico, these figures probably approach the true delphacid diversity. For Mesoamerica, the true diversity is likely double the currently observed diversity (particularly if described, but unreported species are considered). Nevertheless, these figures are confounded somewhat by unreported synonyms and genera of dubious species composition (e.g., *Delphacodes* Fieber 1866, *Dicranotropis* Fieber 1866, *Kormus* Fieber 1866, *Euides* Fieber 1866, and the invalid genus *Liburnia* Stål 1866).

Here 6 new species of *Parkana* are described (and 2 putative new forms noted). It is remarkable that a genus as distinctive as *Parkana* has gone thus far unrecognized in the Mesoamerican fauna.

There can be little doubt that additional species of *Parkana* remain to be found.

Host information is here reported for *Parkana* for the first time. *Parkana alata* is reported from a sedge (*Carex utriculata*, Cyperaceae), and grasses (*Swallenochloa subtessellata*, *Muhlenbergia macroura*, and *Muhlenbergia* sp., and an undescribed species from *Urochloa maxima*, all Poaceae) are reported hosts for new species of *Parkana*. *Muhlenbergia* Schreb. appears to be a particularly good genus for delphacids as species of *Akemetopon* Weglarz & Bartlett and *Frameus* Bartlett are also reported from this grass genus (Bartlett 2009, Weglarz and Bartlett 2011). *Muhlenbergia* and *Urochloa* are C_4 grasses, whereas *Swallenochloa* is a C_3 grass and the photosynthetic pathway of *Carex utriculata* is evidently undetermined, although *Carex* might have either C_3 or C_4 photosynthetic pathways (Waller & Lewis 1979, Bruhl & Wilson 2007). While information regarding host associations of *Parkana* is limited, collectively, it suggests that the ecological habit may vary among *Parkana* species.

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REFERENCES

Arnett, R. H., Jr., G. A. Samuelson and G. M. Nishida. 1993. The Insect and Spider Collections of the World, 2nd ed. Sandhill Crane Press, Gainesville, Florida. 310 pp.

Arthropod Easy Capture. 2013. https://sourceforge.net/projects/arthropodeasy. Version: 1.34. Date Accessed: 2013-09-04.

Asche, M. 1985. Zur Phylogenie der Delphacidae Leach, 1815 (Homoptera: Cicadina: Fulgoromorpha). Marburger Entomologische Publikationen 2(1), volume 1 pp. 1-398, volume 2 pp. 399-910.

Asche, M. 1990. Vizcayinae, a new subfamily of Delphacidae with revision of *Vizcaya* Muir (Homoptera: Fulgoroidea) - a significant phylogenetic link. Bishop Museum Occasional Papers 30: 154-187.

Bartlett, C. R. 2002. A new genus and species of delphacid planthopper (Hemiptera: Fulgoroidea) from Canada. Entomological News 113: 97-102.

Bartlett, C. R. 2009. Diversity in New World stenocranine planthoppers (Hemiptera: Delphacidae). Transactions of the American Entomological Society 135: 443-486.

Bartlett, C. R. and K.G.A. Hamilton. 2011. *Aethodelphax prairianus* gen. et sp. nov. (Hemiptera: Delphacidae) and seven congeneric species from North American *Delphacodes*. Zootaxa 2837: 48–66.

Bartlett, C. R. and L. L. Deitz. 2000. Revision of the New World delphacid planthopper genus *Pissonotus* (Hemiptera: Fulgoroidea). Thomas Say Publications in Entomology: Monographs. 234 pp.

Bartlett, C. R., L. B. O'Brien and S. W. Wilson. In press. A review of the planthoppers (Hemiptera: Fulgoroidea) of the United States. Memoirs of the American Entomological Society. Volume 50.

Beamer, R. H. 1950. Five new genera of delphacine fulgorids (Homoptera - Fulgoridae - Delphacinae). Journal of the Kansas Entomological Society 23: 128-133.

Beamer, R. H. 1955. A revision of the genus *Megamelus* in America north of Mexico (Homoptera, Fulgoridae, Delphacinae). Journal of the Kansas Entomological Society 28(1): 29-46.

Bruhl, J. J. and L. L. Wilson. 2007. Towards a comprehensive survey of C3 and C4 photosynthetic pathways in Cyperaceae. Aliso: A Journal of Systematic and Evolutionary Botany 23: 99-148.

Caldwell, J. S. 1951. *in* J. S. Caldwell and L. F. Martorell. 1951 [dated 1950]. Review of the Auchenorynchous [sic] Homoptera of Puerto Rico. Part II. The Fulgoroidea except Kinnaridae. Journal of Agriculture of the University of Puerto Rico 34: 133-269.

Crawford, D. L. 1914. A contribution toward a monograph of the homopterous insects of the family Delphacidae of North and South America. Proceedings of the United States National Museum 46: 557-640.

Fennah, R. G. 1945. The Fulgoroidea, or lanternflies, of Trinidad and adjacent parts of South America. Proceedings of the United States National Museum 95(3184): 411-520.

Fennah, R. G. 1964. New species of *Ugyops* (Fulgoroidea: Delphacidae) from South America and South-east Asia. Bulletin of the British Museum (Natural History) Entomology 15(5): 117-143.

Fieber, F. X. 1866. Grundzüge zur generischen Theilung der Delphacini. Verhandlungen der Kaiserlich-Königlichen Zoologish-botanischen Gesellschaft in Wien 16: 517-534.

Gonzon, A. T. and C. R. Bartlett. 2008 (dated 2007). Systematics of *Hadropygos* n. g., *Metadelphax* Wagner and New World *Toya* Distant (Hemiptera: Delphacidae). Transactions of the American Entomological Society 133: 205-277.

Kirkaldy, G. W. 1903. Miscellanea Rhynchotalia No. 7. Entomologist 36: 179-181.

Le Quesne, W. J. 1964. Some taxonomic observations on the British Delphacidae (Hemiptera). Proceedings of the Royal Entomological Society of London (B) 33(3-4): 56-58.

Muir, F.A.G. 1919. Some New American Delphacidae. Canadian Entomologist 51: 35-39.

Schuh, R. T., S. Hewson-Smith and J. S. Ascher. 2010. Specimen databases: A case study in entomology using Web-based software. American Entomologist 56: 206-216.

Schuh, R. T. 2012. Integrating specimen databases and revisionary systematics. ZooKeys 209: 255–267, doi: 10.3897/zookeys.209.3288.

Stål, C. 1866. Hemiptera Homoptera Latr. Hemiptera Africana 4. (Stockholm: Officina Norstedtiana). 276 pp.

Urban, J. M., C. R. Bartlett and J. R. Cryan. 2010. Evolution of Delphacidae (Hemiptera: Fulgoroidea): combined-evidence phylogenetics reveals importance of grass host shifts. Systematic Entomology 35: 678-691.

USDA, NRCS. 2013. The PLANTS Database (http://plants.usda.gov. National Plant Data Center, Baton Rouge, LA 70874-4490 USA (accessed 25 Mar. 2013).

Van Duzee, E. P. 1897. A preliminary review of the North American Delphacidae. Bulletin of the Buffalo Society of Natural Sciences 5(5): 225-261.

Waller, S. S. and J. K. Lewis. 1979. Occurrence of C_3 and C_4 photosynthetic pathways in North American Grasses. Journal of Range Management 32: 12-28.

Weglarz, K. M. and C. R. Bartlett. 2011.

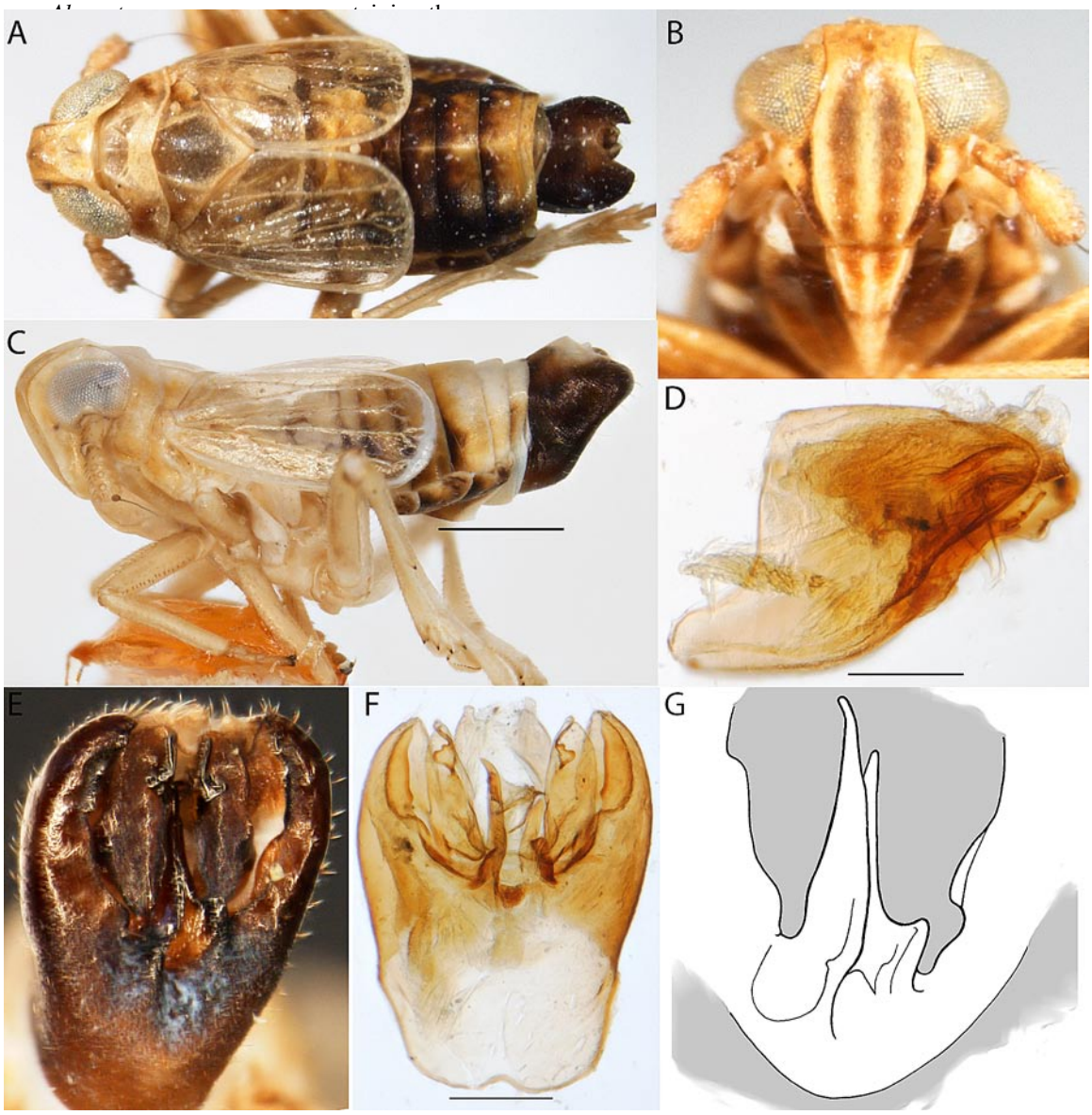

Figure 1. *Parkana (Parkana) alata* (male, brachypter). A. dorsal habitus, B. frontal view, C. lateral habitus, D. male pygofer, lateral view, E. semicaudal view, male pygofer (in situ), F. caudal view, male pygofer (cleared), G. ventral margin of pygofer opening showing asymmetrical median processes.

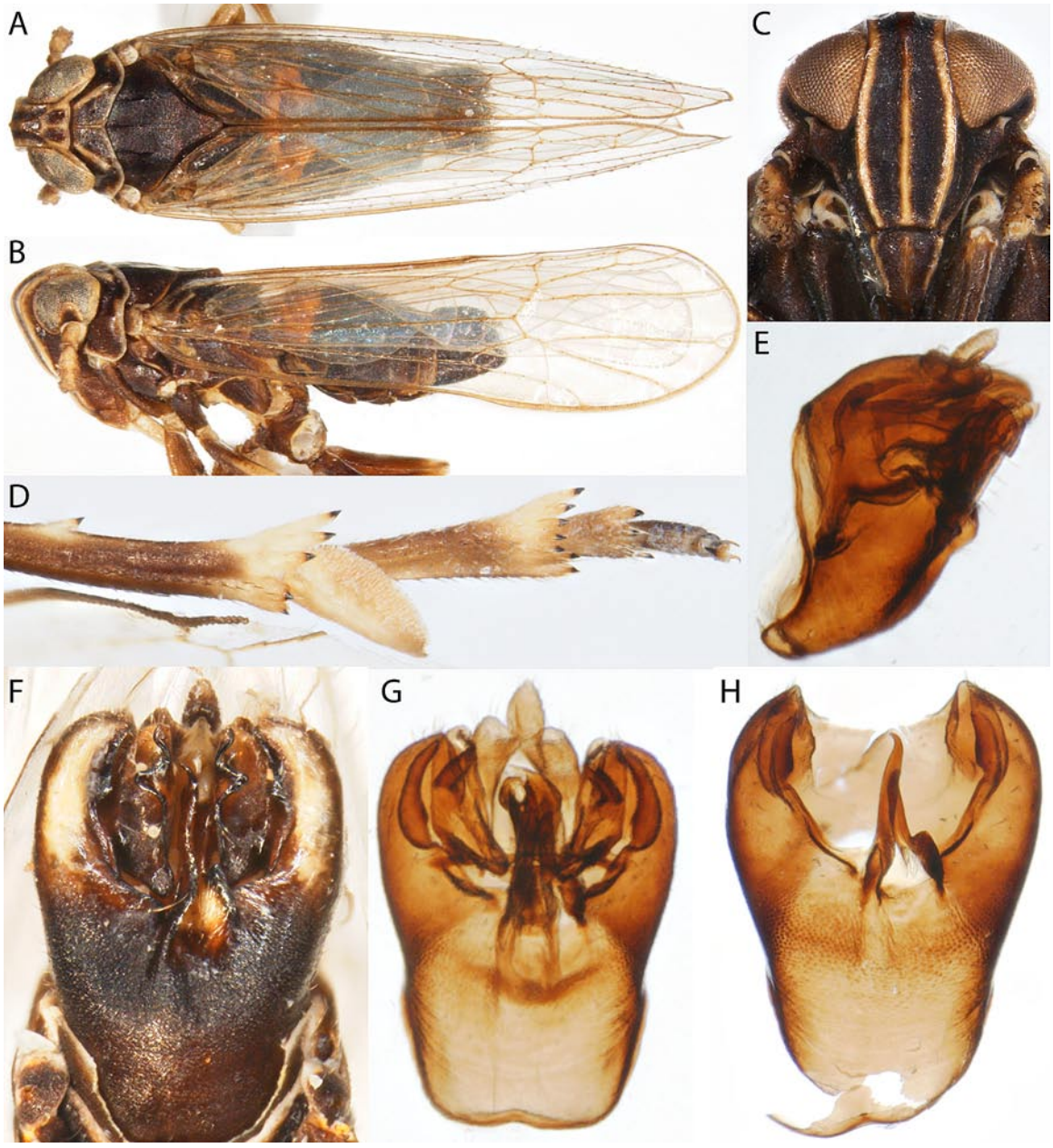

Figure 2. *Parkana (Parkana) mirasol* (male, macropter). A. dorsal habitus, B. lateral habitus, C. frontal view, D. apex of hind leg, ventral view; E. male pygofer, lateral view, F. male pygofer, caudal view (in situ), G. male pygofer, caudal view (cleared), H. male pygofer, caudal view, with aedeagal complex, abdominal segments 10 and 11 removed.

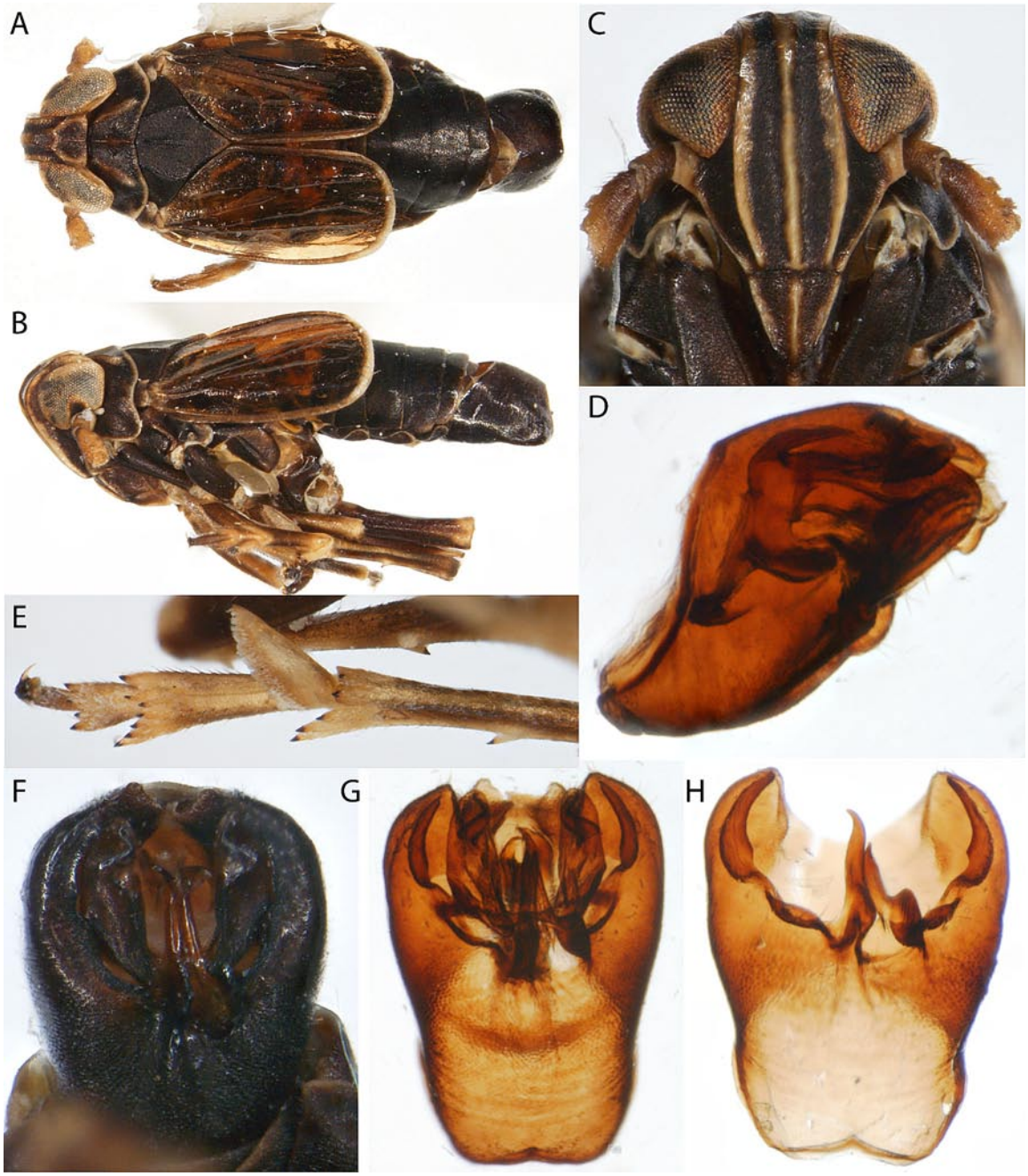

Figure 3. *Parkana (Parkana) nigra* (male, brachypter). A. dorsal habitus, B. lateral habitus, C. frontal view, D. apex of hind leg, ventral view; E. male pygofer, lateral view, F. male pygofer, caudal view (in situ), G. male pygofer, caudal view (cleared), H. male pygofer, caudal view, with aedeagal complex, abdominal segments 10 and 11 removed.

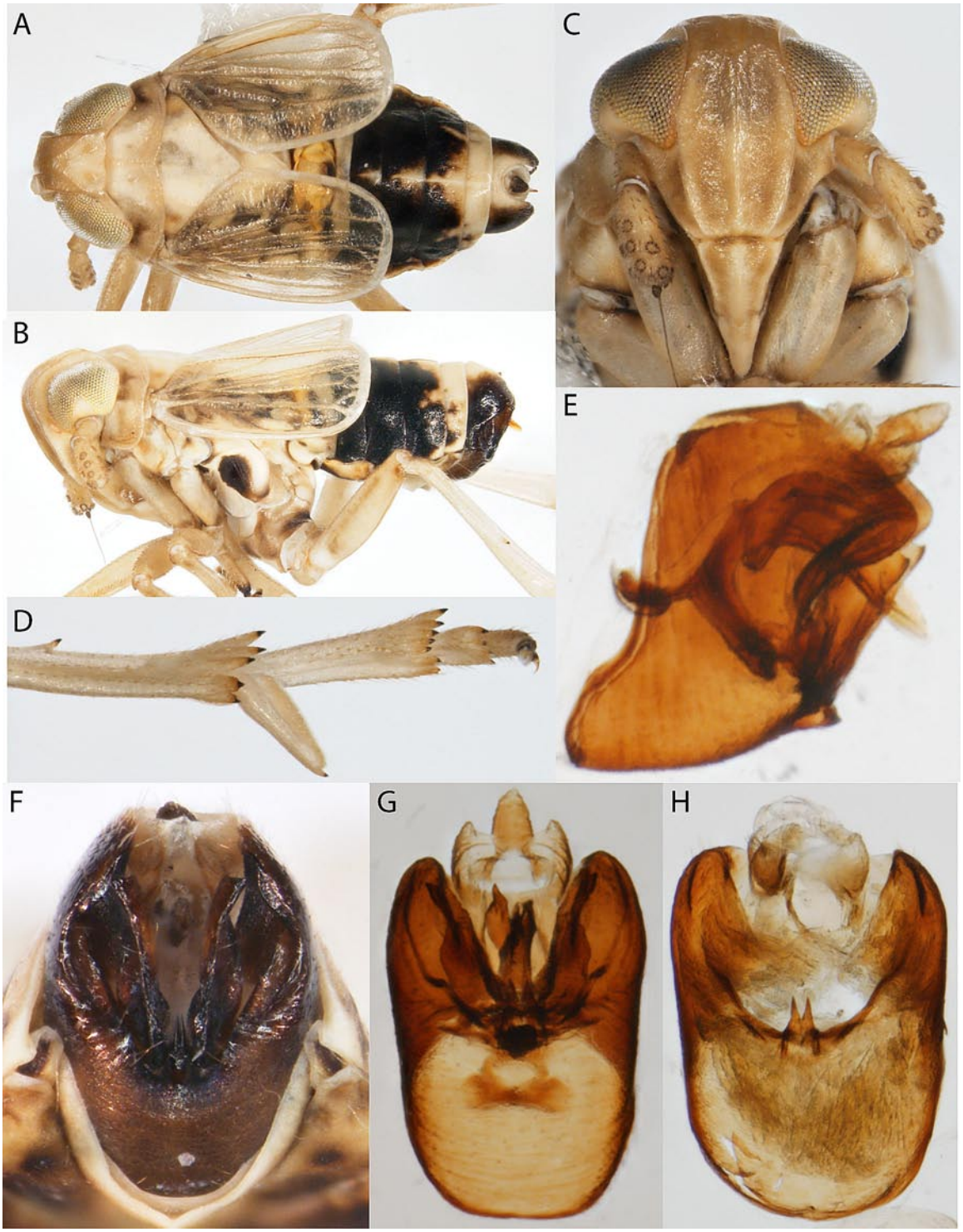

Figure 4. *Parkana (Parkana) pallida* (male, brachypter). A. dorsal habitus, B. lateral habitus, C. frontal view, D. apex of hind leg, ventral view; E. male pygofer, lateral view, F. male pygofer, caudal view (in situ), G. male pygofer, caudal view (cleared), H. male pygofer, caudal view, with aedeagal complex, abdominal segments 10 and 11 removed.

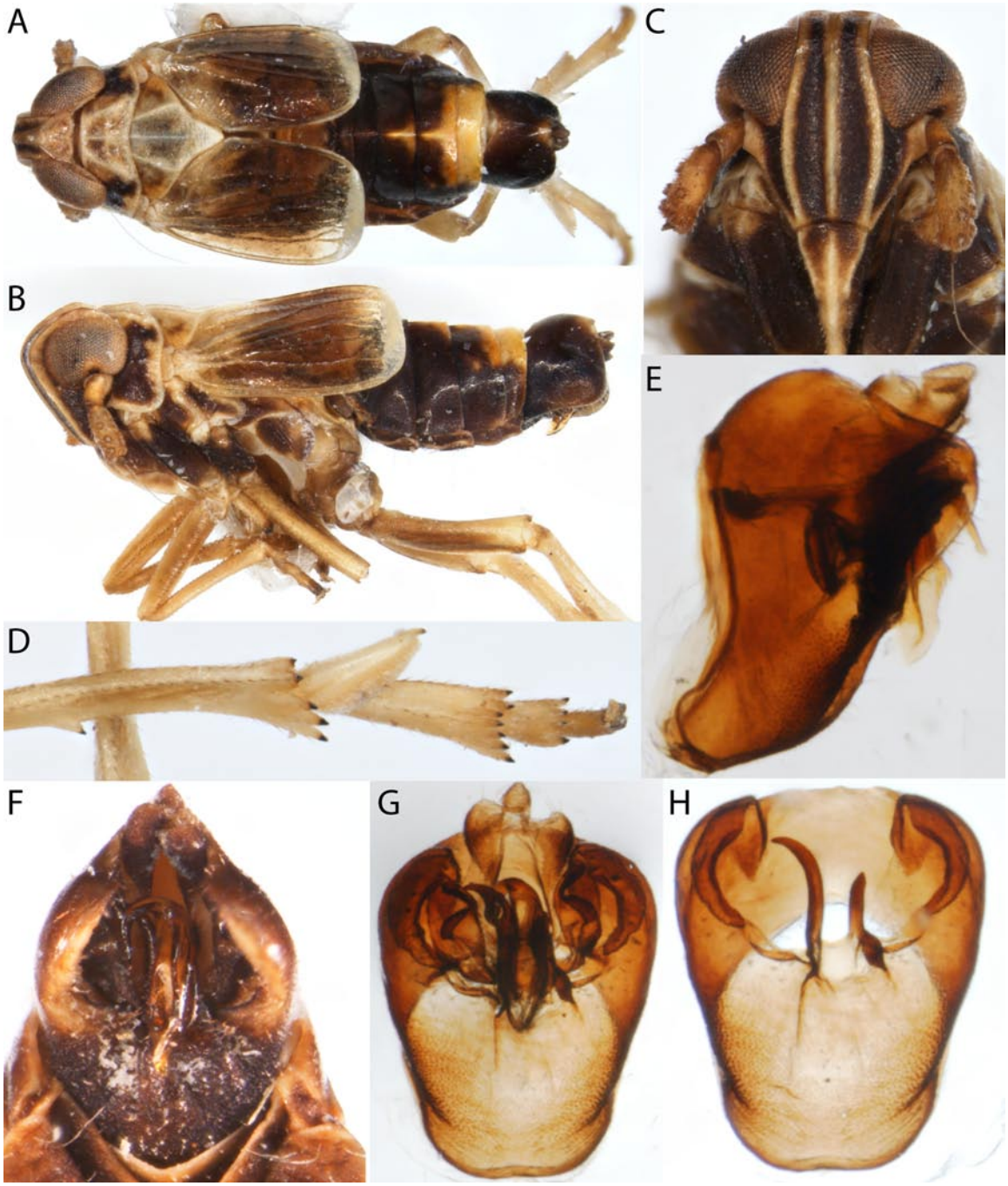

Figure 5. *Parkana (Parkana)tres* (male, brachypter). A. dorsal habitus, B. lateral habitus, C. frontal view, D. apex of hind leg, ventral view; E. male pygofer, lateral view, F. male pygofer, caudal view (in situ), G. male pygofer, caudal view (cleared), H. male pygofer, caudal view, with aedeagal complex, abdominal segments 10 and 11 removed.

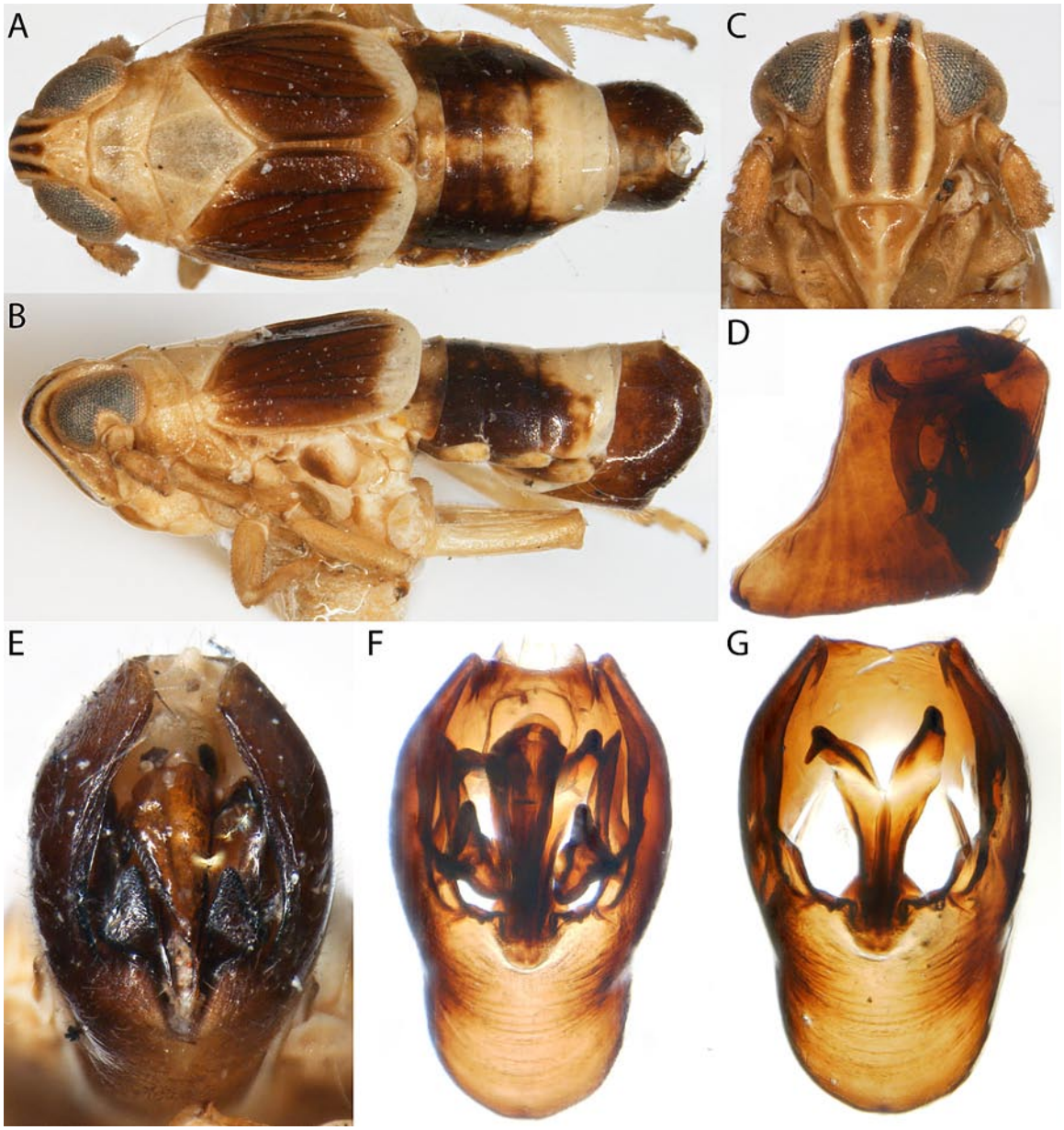

Figure 6. *Parkana (Furcoparca) chico* (male, brachypter). A. dorsal habitus, B. lateral habitus, C. frontal view, D. male pygofer, lateral view, E. male pygofer, caudal view (in situ), F. male pygofer, caudal view (cleared), G. male pygofer, caudal view, with aedeagal complex, abdominal segments 10 and 11 removed.

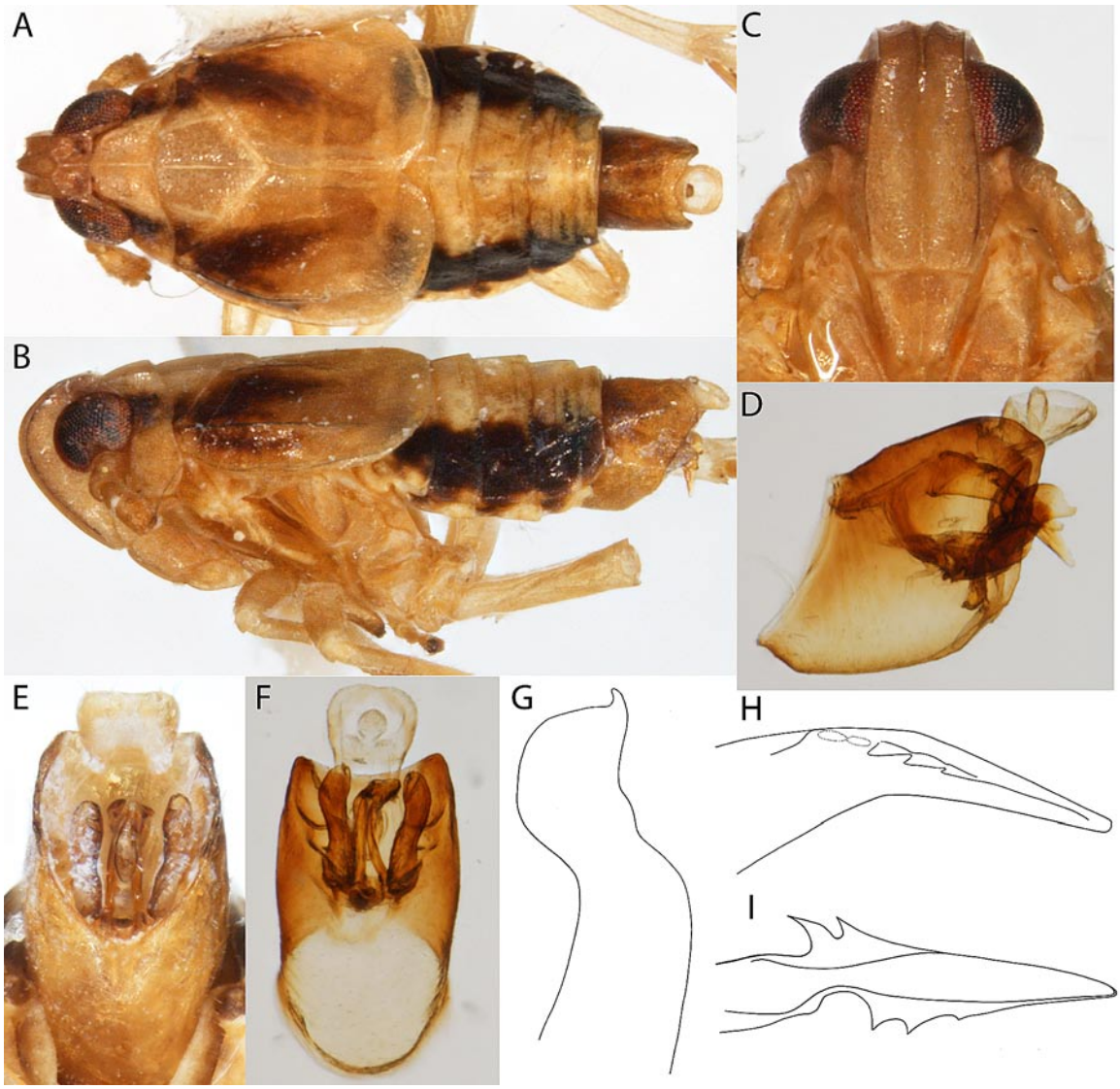

Figure 7. *Parkana (Litoparca) costa* (male, brachypter). A. dorsal habitus, B. lateral habitus, C. frontal view, D. male pygofer, lateral view, E. male pygofer, caudal view (in situ), F. male pygofer, caudal view (cleared), G. left paramere, caudal view, H. aedeagus, left lateral view. I. aedeagus, dorsal view.

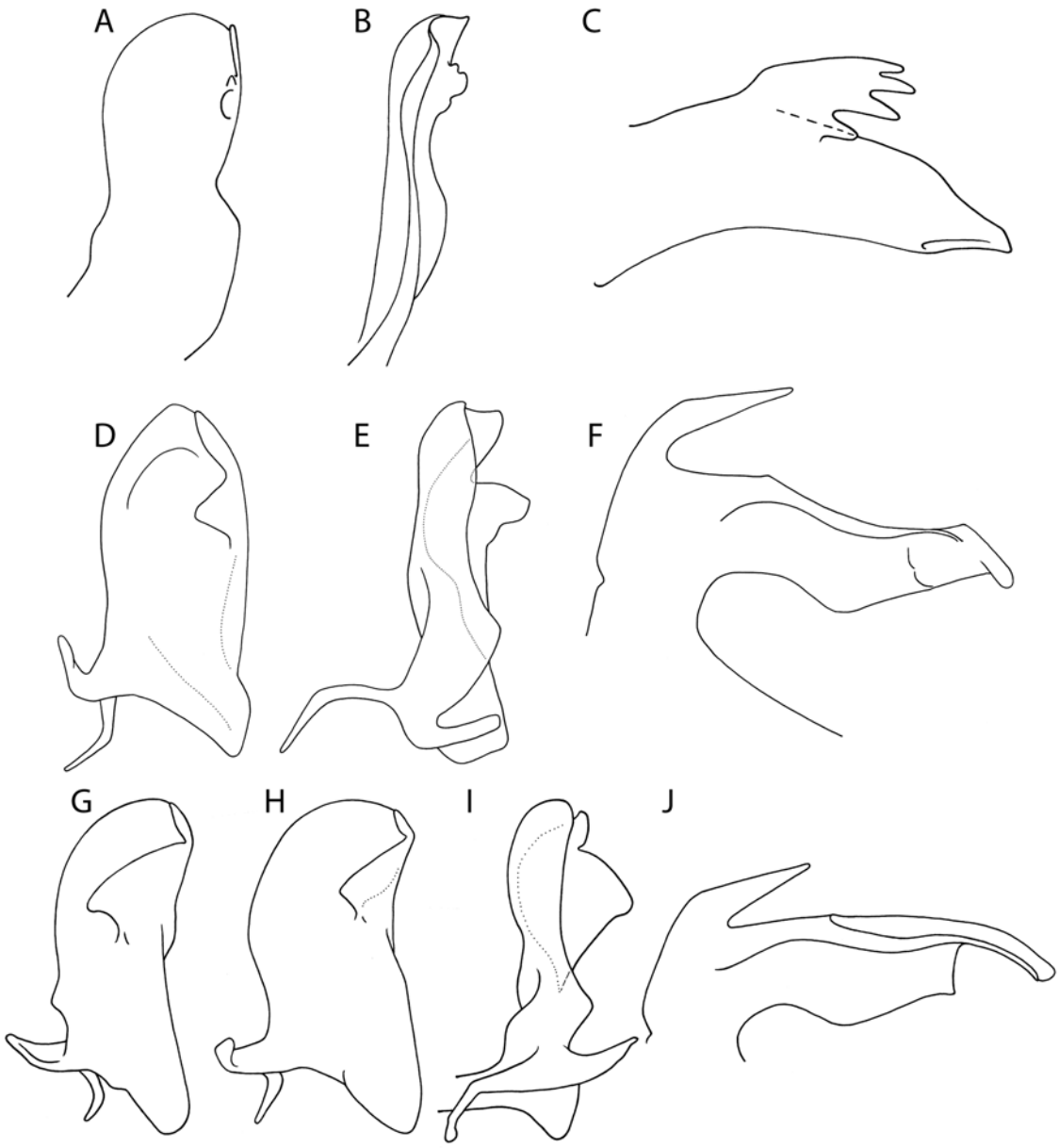

Figure 8. Male genitalia of *Parkana*, left parameres (A,B,D,E,G,I) and aedeagi, left lateral view (C,F,I). A-C *P. alata*, A. paramere, caudal view, B. paramere, narrowest view (rotated right), C. aedeagus; D-F *P. mirasol*, D. paramere, caudal view, E. paramere, narrowest view (rotated right), F. aedeagus; G-I *P. nigra*, G. paramere, caudal view, H. paramere, widest view (rotated right), I. paramere, narrowest view (rotated right), J. aedeagus.

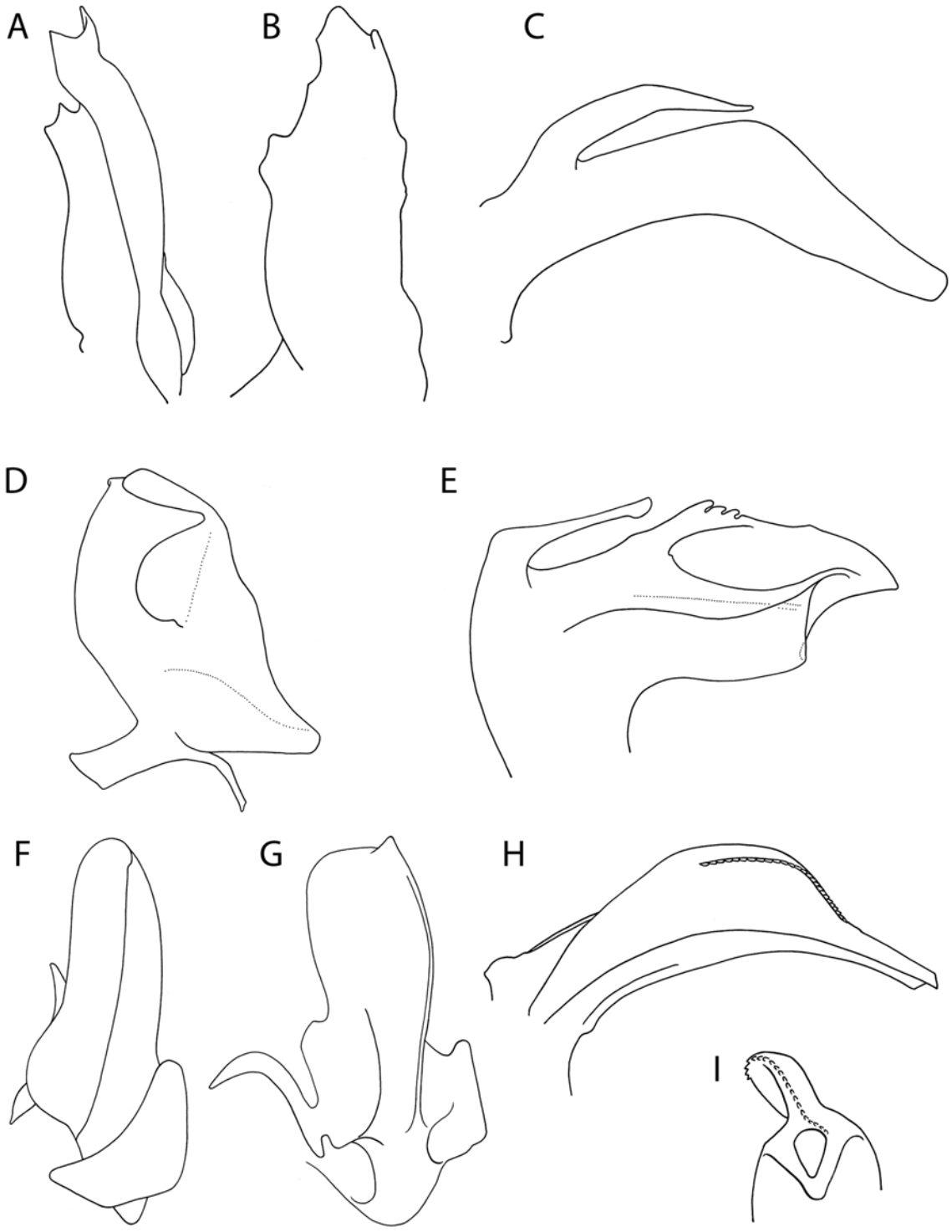

Figure 9. Male genitalia of *Parkana,* left parameres (A,B,D,F,G) and aedeagi (C,E,H,I). A-C *P. pallida*, A. paramere, caudal view, B. paramere, widest view (rotated right), C. aedeagus, left lateral view; D-E *P. tres,* D. paramere, caudal view, E. aedeagus, left lateral view, F-I *P. chico*, F. paramere, caudal view, G. paramere, rotated right, H. aedeagus, left lateral view, I. aedeagus, caudal view of apex.