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Drepanoneura gen. nov. for *Epipleoneura letitia* and *Protoneura peruviensis*, with descriptions of eight new Protoneuridae from South America (Odonata: Protoneuridae)

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Abstract

A new genus, *Drepanoneura* (type species *Drepanoneura loutoni* **sp. nov.**), is described to include *Epipleoneura letitia* Donnelly, *Protoneura peruviensis* Fraser, and six new congeneric species from South America: *D. donnellyi*, *D. flinti*, *D. janirae*, *D. loutoni*, *D. muzoni*, and *D. tennesseni*. *Drepanoneura* is similar to *Epipleoneura* and *Epipotoneura* in venational characters, but differs from them in morphology of male cercus, genital ligula, female pronotum, and epiproct. A new species of *Epipleoneura* from Venezuela, *E. demarmelsi*, and a new species of *Epipotoneura* from Brazil, *E. machadoi*, are described, and diagnostic illustrations for the poorly known *Epipotoneura nehalennia* Williamson are also presented. A generic characterization, diagnoses, and keys for species of *Drepanoneura* are provided, as well as diagnostic illustrations and distribution maps for all involved species.

Key words: Odonata, Zygoptera, Protoneuridae, *Epipleoneura*, *Epipotoneura*, *Protoneura*, new genus, new species, South America

Resumen

Un nuevo género, *Drepanoneura* (especie tipo *D. loutoni* **sp. nov.**), se describe para incluir a *Epipleoneura letitia* Donnelly, *Protoneura peruviensis* Fraser, y seis nuevas especies congenéricas de Sudamérica: *D. donnellyi*, *D. flinti*, *D. janirae*, *D. loutoni*, *D. muzoni* y *D. tennesseni*. *Drepanoneura* se asemeja a *Epipleoneura* y *Epipotoneura* en sus caracteres de venación, pero difiere de ellos en la morfología del cerco del macho, de la lígula genital, del pronoto de la hembra y del epiprocto. Una nueva especie de *Epipleoneura* de Venezuela, *E. demarmelsi*, y una nueva especie de *Epipotoneura* de Brasil, *Epipotoneura machadoi*, son descriptas, y también se presentan ilustraciones diagnósticas de la poco conocida *E. nehalennia* Williamson. Se proporcionan una caracterización genérica, diagnosis y claves para las especies de *Drepanoneura*, así como ilustraciones diagnósticas y mapas de distribución para todas las especies involucradas.

Introduction

Family Protoneuridae includes slender and inconspicuous Zygoptera with a rectangular discoidal cell and a strong tendency towards venational reduction. It is represented by approximately 90 species within 14 genera in the Neotropical region (Pessacq 2008). Knowledge of neotropical Protoneuridae is still poor, with new genera and numerous new species still being collected and described (Garrison 1999; Lencioni 1999; De Marmels 2003; Machado 2005a–c, 2007; Meurgey 2006; Juillerat 2007; Pessacq & Costa 2007).

Based exclusively on venational characters, Williamson (1915) briefly described genera *Epipleoneura*, *Epipotoneura*, and *Psaironeura* in a key separating them from *Protoneura* Selys *in* Sagra 1857. He restricted species with relatively narrow wings (one seventh or less as wide as long) to *Protoneura* and species with relatively wide wings (one sixth or more as wide as long) to his three new genera. He further separated *Protoneura* by having the first antenodal space longer than the third and as long as twice the second or more, compared to the first antenodal space as long as the third and shorter than twice the second for the other three genera. He diagnosed *Epipleoneura* by its point of origin of IR_2 at vein descending from subnodus, which in *Psaironeura* and *Epipotoneura* is distal to vein descending from subnodus. He characterized *Psaironeura* by MP ending at the vein descending from subnodus and three antenodal spaces subequal, as opposed to MP ending distally to the vein descending from subnodus and second antenodal space the shortest in *Epipotoneura*.

Fraser (1946) described *Protoneura peruviensis* referring it to Selys' (1886) second group. He was apparently unaware of Williamson's (1915) generic reassignments, since this species would fit in *Epipleoneura* based on Williamson's (1915) key. Fraser (1946) mentioned that it differed from all its congeners by the shape of male cerci. This species was later transferred to *Epipleoneura* by Bridges (1994) based on written communication by RWG who had examined and illustrated the holotype.

Based on Williamson's (1915) generic definitions, Donnelly (1992) assigned a new species from Panama, *E. letitia*, to *Epipleoneura*, noting that it differed from all other known species in the genus by the reduced and simple supra-anal plate (enlarged in *Epipleoneura*), by the shape of the male cerci, and by the simple morphology of the female mesostigmal plates. He suggested that due to these characters and its disjunct distribution, this species might be an ancestral form annectant with the genus *Psaironeura*, but that it would be premature to erect a new genus for it.

We found that *Protoneura peruviensis* and *Epipleoneura letitia* share a characteristic and unique male cercus shape and an unmodified epiproct (not forming a 'supra-anal' plate) with several undescribed species from South America distributed from Colombia to N Bolivia. Wing venation alone would place this complex of species in *Epipleoneura* and *Epipotoneura* or in-between based on Williamson's (1915) key since we found that both the origin of IR_2 respect to the subnodus and the termination of MP with respect to the vein descending from subnodus are inter- and intraspecifically variable.

In the key for males of Protoneuridae genera recently published by Pessacq (2008), these species key to *Epipleoneura* based on their paraproct being as long as half or more of the cercus and the cercus being shorter than S10, although they disagree with *Epipleoneura* by characters of the epiproct and the genital ligula. Consequently we describe here a new genus, *Drepanoneura*, to include these species and provide keys, illustrations, and distributional maps for them.

We also describe a new species of *Epipleoneura*, *E. demarmelsi*, from Venezuela and a new species of *Epipotoneura*, *E. machadoi*, from Brazil. An updated distributional map for *Epipotoneura nehalennia*, so far known only from its original description, is also provided.

Methodology

Nomenclature for wing venation follows Riek & Kukalová-Peck (1984) and for genital ligula Kennedy (1916). Measurements are given in millimeters for as many specimens available to a maximum of ten males and ten females; total length and abdomen length exclude cerci. All drawings were made with the aid of camera lucidae coupled to Wild M8 and Nikon SMZ1500 stereomicroscopes and are not to scale. Wings were scanned from specimens. Abbreviations for structures used throughout the text are as follows: Fw: forewing; Hw: hindwing; pt: pterostigma; Ax: antenodal crossvein; Px: postnodal crossveins; S1-10: abdominal segments 1 to 10. Maps represent distribution records from collections and reliable literature records, and were created electronically from the Digital Chart of the World (1:1,000,000) using ArcView 9.1. Elevation data and longitude/latitude coordinates were culled from the Global Gazetteer website (<http://www.fallingrain.com/world/>). Acronyms used for collections are as follows:

BMNH	British Natural History Museum, London, UK
DRP	Dennis R. Paulson collection, Seattle, Washington, USA
FSCA	Florida State Collection of Arthropods, Gainesville, Florida, USA
GSV	Graham S. Vick collection, Tadley, Hampshire, UK
KJT	Ken J. Tennessen collection, Florence, Alabama, USA
MLP	Museo de Ciencias Naturales de La Plata, La Plata, Argentina
MM	Michael May collection, Rutgers, New Jersey, USA
MNRJ	Museu Nacional Rio de Janeiro, Rio de Janeiro, Brazil
RWG	Rosser W. Garrison collection, Sacramento, California, USA
SWD	Sidney W. Dunkle collection, Tucson, Arizona, USA
TWD	Thomas W. Donnelly collection, Binghamton, New York, USA.
UMMZ	University of Michigan, Museum of Zoology, Ann Arbor, Michigan, USA
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA

Taxonomic treatment

***Drepanoneura* gen. nov.**
Figures 1, 2, 3–9, 11a–b, 13–20, 27–30, 36a–j, 37

Type species: *Drepanoneura loutoni* **sp. nov.** by present designation.

Etymology. Latinized from Greek *drepanon* meaning 'sickle' — referring to the shape of male cerci — and Greek *neura*, a common suffix for protoneurid genera.

Generic characterization. Head. Frons angulate in profile, with carina continued on dorsal surface of antennifer (ca, Fig. 1a); labium, ventral third of labrum, anteclypeus, and triangular spot on anterior surface of antennifer pale yellow; base of mandibles, genae, and ventral half of antefrons pale blue (Fig. 1a), remainder of head black (Fig. 1b).

Thorax. Pterothorax black with metallic copper, greenish or bluish reflections; part of metepisternum, metepimeron, and venter pale yellow (Fig. 2). Mesepisternum with a narrow, yellow humeral stripe (Figs. 2b, e, g–k), which can become obscured in mature specimens of some species. Legs relatively long and thin, with hind femur reaching or surpassing anterior margin of S1 (Fig. 2); spurs on femora and tibiae shorter than twice intervening spaces (Fig. 2); pretarsal claws each with well developed supplementary tooth. Postero-lateral margin of prothorax with moderate lobes, not longer than wide, and posterior margin of pronotum smoothly rounded in males. In females interspecifically variable, from smoothly curved (Fig. 5) or linear (Fig. 4), to medially cleft (Fig. 7) or trilobed (Figs. 6, 8–9), lacking projections along posterior margin (Figs. 4–5), or with one to five (Figs. 3, 6-9). Mesostigmal plates in both sexes triangular and flat, with transverse length shorter than width of medial disc (Figs. 3c–9c). Wings (Fig. 11a–b) one sixth or less as wide as long; anteno-dal space 1 shorter than twice the length of 2, and slightly shorter than or as long as 3; CuA and CuP&AA completely fused to wing margin; MP reaching wing margin at vein descending from subnodus or within the basal half of first cell posterior to it; IR_2 arising at vein descending from subnodus or slightly distal to it (intra- and interspecifically variable); IR_2 and RP_3 separated by a short crossvein or joined one cell posterior to their origin (intra- and interspecifically variable); divergence of RP-RA (arculus) distal to Ax 2; RP_2 in Fw begin-ning closer to Px 4–7 (most frequently at 5) and in Hw closer to Px 3–4 (most frequently at 3); pt shorter than or as long as underlying cell, with its costal side shorter than or as long as its posterior side.

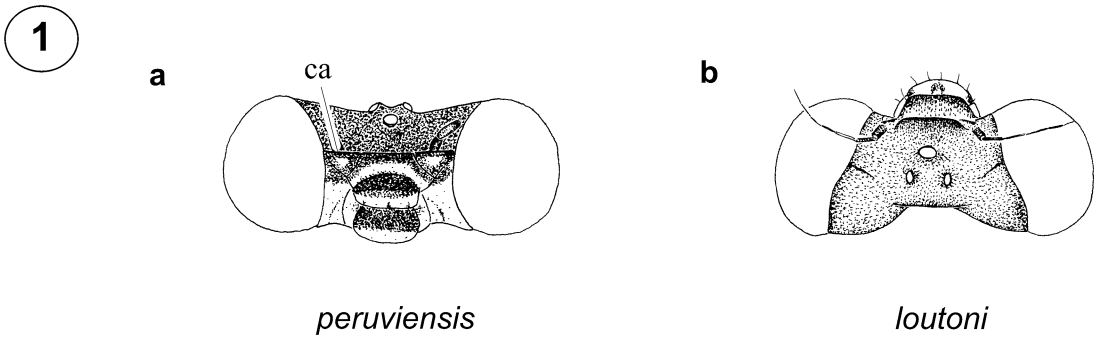


FIGURE 1. Head. (a) *Drepanoneura peruviensis*, ♀ Peru, Iquitos (frontal view); (b) *D. loutoni* n. sp., ♂ paratype Peru, Pakitza (dorsal view). ca: carinated antennifer.

Abdomen. Abdomen dorso-laterally entirely or almost entirely black with metallic reflections, except for narrow distal yellow rings on S3–6 in some species; latero-ventral portion of terga and sterna pale brown to yellow. Genital ligula lacking an inner fold basal to flexure, with a short medial membranous triangular inner

process distal to flexure (ip, Figs. 13b–16b, 20b); apex entire (Fig. 13a) or with a v- (Figs. 14a–16a, 18a) or u-shaped cleft (Figs. 17a, 19a–20a), and with latero-distal corners projected into short (ld, Figs. 14a, c–16a, c,

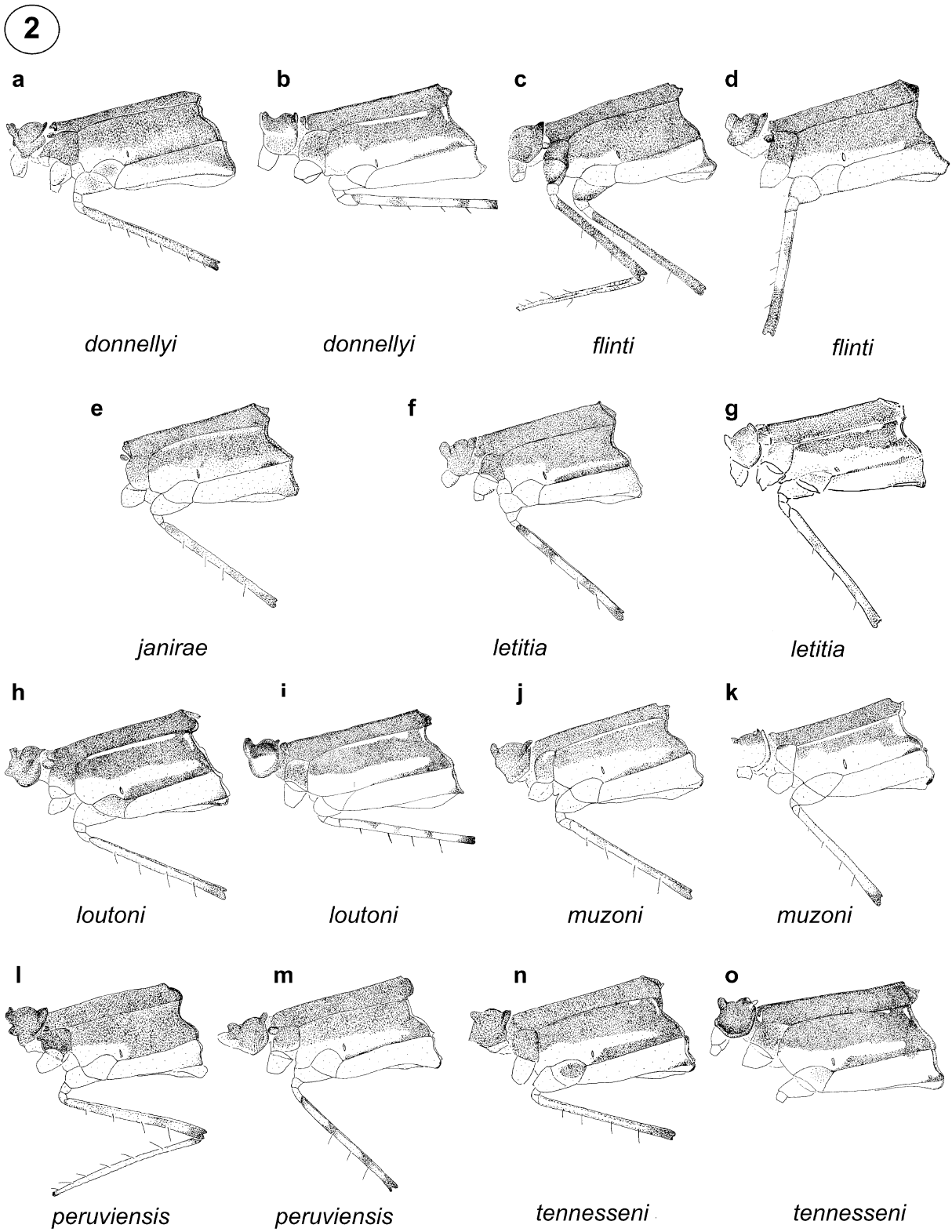
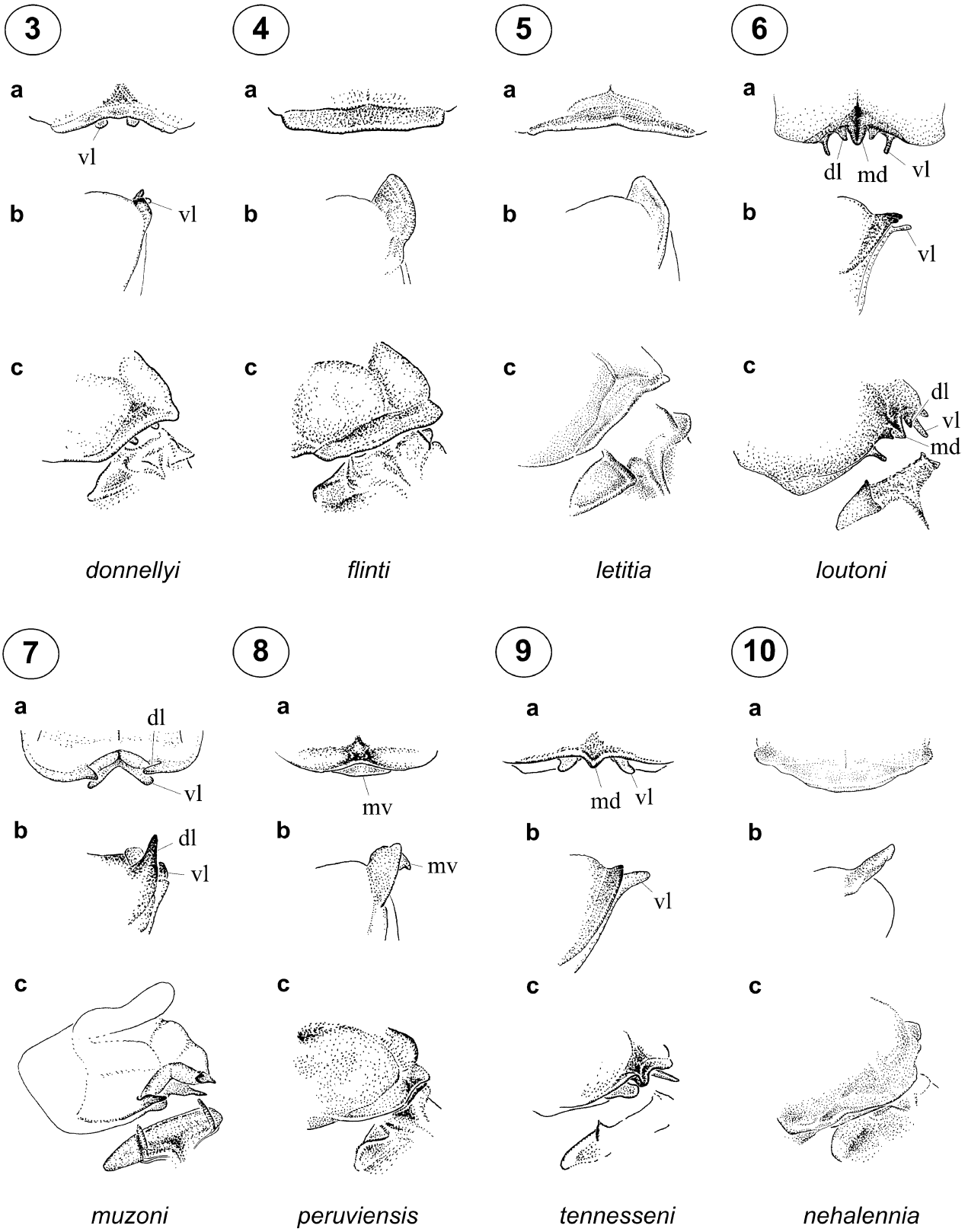


FIGURE 2. Thoracic color pattern, lateral view. (a–b) *Drepanoneura donnellyi* **sp. nov.**, (a) ♂ holotype, (b) ♀ paratype Colombia, Cristalina; (c–d) *D. flinti* **sp. nov.**, (c) ♂ holotype, (d) ♀ paratype Colombia, Puerto Abeja; (e) *D. janirae* **sp. nov.**, ♂ paratype Brazil, Villa Murtinho; (f–g) *D. letitia*, (f) ♂ Panama, Pipeline road, (g) ♀ allotype; (h–i) *D. loutoni* **sp. nov.**, (h) ♂ holotype, (i) ♀ paratype Peru, Pakitza; (j–k) *D. muzoni* **sp. nov.**, (j) ♂ holotype, (k) ♀ paratype Ecuador, Yasuni; (l–m) *D. peruviensis*, (l) ♂ Peru, Iquitos, (m) ♀ Peru, Iquitos; (n–o) *D. tennesseni* **sp. nov.**, (h) ♂ paratype Ecuador, Río Sinde, (o) ♀ paratype Ecuador, Río Sandalias.



FIGURES 3–10. ♀ pronotum and mesostigmal plates: (a) pronotum, dorsal view, (b) pronotum, lateral view, (c) pronotum and mesostigmal plates, medio-dorsal view. (3) *Drepanoneura donnellyi* **sp. nov.**, paratype Colombia, Cristalina; (4) *D. flinti* **sp. nov.**, paratype Colombia, Puerto Abeja; (5) *D. letitia*, allotype; (6) *D. loutoni* **sp. nov.**, paratype Peru, Pakitza; (7) *D. muzoni* **sp. nov.**, paratype Ecuador, Yasuni; (8) *D. peruviensis*, Peru, Iquitos; (9) *D. tennesseni* **sp. nov.**, paratype Ecuador, Río Sandalias; (10) *Epipotoneura nehalennia*, allotype. dl: dorso-lateral process; md: medio-dorsal process; mv: medio-ventral process; vl: ventro-lateral process.

18a, c–19a, c) to long (ld, Figs. 13a, c, 17a, c, 20a, c) lateral lobes curved medially (Figs. 14c–20c) or externally (Fig. 13c). Postero-dorsal margin of male S10 projected posteriorly (Figs. 28b–d, f–g) or not projected (Figs. 28a, e, h). Male cercus in lateral view shorter than S10, with a pointed ventro-apical process perpendicular to main axis, slightly shorter to slightly longer than base of cercus, and with a short dorso-apical hook (ah, Figs. 27–30). Male paraproct bilobed in posterior view, subequal to cercus in length (Fig. 28). Epiproct much smaller than cercus, rounded and undifferentiated in both sexes (ep, Figs. 27–30, 36b, e, h). Female cerci conical, shorter than S10; outer valves of ovipositor with a single row of teeth along distal fourth (Figs. 36a, c–d, f–g, i–j); sub-basal plate of ovipositor meeting its counterpart ventrally, with dorsal side linear (Fig. 36i) to concave (Figs. 36a, c–d, g, j); tip of ovipositor (excluding stylus) extending beyond posterodorsal margin of S10 but not surpassing tip of cerci (Figs. 36a, c–d, f–g, j). Larva unknown.

Diagnosis. Among neotropical Protoneuridae, *Drepanoneura* differs from *Lamproneura* De Marmels 2003, *Idioneura* Selys 1860, *Junix* Rácenis 1968, *Neoneura* Selys 1860, *Peristicta* Hagen *in* Selys 1860, and *Proneura* Selys 1889 by the complete fusion of CuA and CuP&AA to wing margin (absence of anal vein). Among genera which share this state (*Forcepsioneura* Lencioni 1999, *Microneura* Hagen *in* Selys 1886, *Phasmoneura* Williamson 1916, Psaironeura Williamson 1915, and Roppaneura Santos 1966), both sexes of *Drepanoneura* differ by the carinated antennifer (ca, Fig. 1a), which is cylindrical in the five genera mentioned. *Drepanoneura* differs from *Protoneura* by antenodal space 1 being shorter than twice the length of 2 (Figs. 11a–b); from *Epipleoneura* and *Epipotoneura* by the small unmodified button-shaped epiproct (Figs. 27–30, 36b, e, h), which in *Epipleoneura* is always enlarged and longer than wide (Figs. 31b–c–33b–c) and in *Epipotoneura* is small but bifid (Figs. 34b, d–e–35b, d–e, 36l). Additionally, male cercus morphology (approaching an inverted 'L', with a ventro-apical process perpendicular to main axis and subequal in length to base of cercus, Figs. 27–30) is unique for *Drepanoneura*. In *Epipleoneura* there is usually a ventro-basal swelling or branch (Figs. 31b–c–33b–c) and in *Epipotoneura* there are no apical or basal ventral branches, and there is instead a small sub-basal tooth (st in Figs. 34a–c–35a, c). The absence of an inner fold basal to flexure in male genital ligula of *Drepanoneura* (Figs. 13b–c–20b–c) is shared only with *Epipleoneura* (Figs. 21b–23b), *Epipotoneura* (Figs. 25b–26b) and *Phasmoneura* (Fig. 24b), and the presence of an inner membranous process distal to flexure (ip in Figs. 13–20) is shared only with *Epipotoneura* (Figs. 25b–c–26b–c) and *Phasmoneura* (Fig. 24b). However, the morphology of the inner processes in these three genera is different, consisting of a single small medial narrow process in *Drepanoneura* (Figs. 13b–16b, 20b), a medial process bifid at tip to completely split into two narrow small processes in *Epipotoneura* (Figs. 25b–26b), and a large, u-shaped wide fold medially attached to the distal segment of genital ligula in *Phasmoneura* (Fig. 24b). *Epipleoneura* further differs from *Drepanoneura* (Figs. 13–20) and *Epipotoneura* (Figs. 25–26) by the presence of a pair of latero-posterior membranous processes (lp, Figs. 21–23).

The key to males of neotropical genera of Protoneuridae provided by Pessacq (2008) can be modified to include *Drepanoneura* as follows:

8. Cerci usually shorter than S10 (i.e. Figs. 28a–h).....9
8'. Cerci and/or paraprocts usually longer than S10.....10 [to *Microneura* and *Protoneura*]
9. Epiproct enlarged, sclerotized, longer than wide, and adjacent to mesal margin of cerci; cercus with a ventro-basal branch (i.e. Figs. 31b–33b); genital ligula lacking inner processes on distal segment and with a pair of latero-posterior outer processes at level of flexure (i.e. lp, Figs. 21–23)..... *Epipleoneura*
9'. Epiproct small, rounded, not forming a sclerotized plate, and not adjacent to mesal margin of cerci (Fig. 30); cercus with a ventro-apical process perpendicular to main axis and subequal in length to base of cercus (Figs. 28–30); genital ligula with a small medial narrow inner process distal to flexure (ip, Figs. 13–20) and lacking outer latero-posterior processes at level of flexure..... *Drepanoneura*

Distribution. Members of this genus occur along rivers and streams within forests and occupy largely allopatric distributions from Panama south through foothills of the Andean cordillera in Colombia, Ecuador, and Peru. Three species, *D. flinti*, *D. peruviensis*, and *D. janirae*, occur in the Amazonian regions of Colombia, Peru, SW Brazil, and NW Bolivia; *D. muzoni* is sympatric with *D. tennesseni* in Ecuador and with *D. loutoni* in Peru (Fig. 37). Due to their somber coloration and cryptic appearance in nature, we suspect that more species will be discovered within intervening areas.

Species included. *Drepanoneura donnellyi* **sp. nov.**; *D. flinti* **sp. nov.**; *D. janirae* **sp. nov.**; *D. letitia* (Donnelly 1992) **comb. nov.**; *D. loutoni* **sp. nov.**; *D. muzoni* **sp. nov.**; *D. peruviensis* (Fraser 1946) **comb. nov.**; *D. tennesseni* **sp. nov.**

Key to males of *Drepanoneura*

Caution should be used in using this key. Identification relies on subtle differences of the cerci, paraprocts, and apex of the genital ligula. Extrusion and cleaning of anal appendages with a paint brush following relaxation of specimens will more easily allow examination of the ventral branch of the cercus in lateral view. Some species pairs, *D. flinti* and *D. peruviensis*, and *D. donnellyi* and *D. letitia*, can be separated with assurance only by characters of the genital ligula. We recommend comparison with illustrations and diagnoses before determinations are considered final.

1. Ventral branch of cercus in posterior view arising at mid-width of cercus, slightly convergent to branch of opposite cercus at tip (Figs. 30b, f–g).....2
1'. Ventral branch of cercus in posterior view aligned with inner margin of cercus at base, slightly divergent to branch of opposite cercus at tip (Figs. 30a, c–e, h) 4
2. Ventral branch of cercus in lateral view as long as base of cercus (Fig. 28f); in posterior view narrowing gradually to tip, with inner side approximately linear (Fig. 30f); Orellana Prov. in Ecuador to Madre de Dios Dept. in Peru (Fig. 37)..... *D. muzoni*
2'. Ventral branch of cercus in lateral view longer than base of cercus (Figs. 28b, g); in posterior view narrowing abruptly at base, with inner side concave (Figs. 30b, g) 3
3. Apex of genital ligula with a shallow v-shaped cleft (14a); Amazonas Dept. in Colombia (Fig. 37) ....*D. flinti*
3'. Apex of genital ligula with a deep u-shaped cleft (19a); Loreto Dept. in Peru (Fig. 37)..... *D. peruviensis*
4. In lateral view postero-dorsal margin of S10 projected posteriorly and ventral branch of cercus shorter than base of cercus (Fig. 28c); N Bolivia and W Brazil (Fig. 37) ..... *D. janirae*
4'. In lateral view postero-dorsal margin of S10 not or only slightly projected posteriorly and ventral branch of cercus as long as or longer than base of cercus (Figs. 28a, d–e, h).....5
5. Apex of paraproct truncate in lateral view (Figs. 28e, h) 6
5'. Apex of paraproct truncate pointed in lateral view (Figs. 28a, d) 7
6. Ventral branch of cercus in lateral view cylindrical, gradually narrowing distally (Fig. 28e); usually a long yellow stripe along ventral margin of humeral suture (Fig. 2h); Morona-Santiago Prov. in Ecuador to Madre de Dios Dept. in Peru (Fig. 37) ..... *D. loutoni*
6'. Ventral branch of cercus in lateral view wide at base, laminar, and becoming abruptly truncate apically (Fig. 28h); usually a short yellow stripe or spot at posterior end of humeral suture (Fig. 2n); Sucumbíos to Napo Provs. in Ecuador (Fig. 37) ..... *D. tennesseni*
7. Apex of genital ligula approximately linear (Fig. 13a) and latero-apical lobes long, narrow, and directed externally (Fig. 13c); Antioquia to Tolima Depts. in Colombia (Fig. 37)..... *D. donnellyi*
7'. Apex of genital ligula with a shallow v-shaped cleft (Fig. 16a) and latero-distal lobes short, broad, and curved medially (Fig. 16c); Panamá Prov. in Panama (Fig. 37)..... *D. letitia*

Key to females of *Drepanoneura*
[female of *D. janirae* unknown]

Unlike males, known females can be easily identified by their unique modifications of prothoracic hind lobe.

1. Posterior lobe of prothorax lacking processes (Figs. 4–5).....2
1'. Posterior lobe of prothorax with processes (Figs. 3, 6–9).....3
2. Posterior lobe of prothorax with a medial shallow concavity (Fig. 5); ventral side of sub-basal plate of ovipositor convex (Fig. 36d); Panamá Prov. in Panama (Fig. 37)..... *D. letitia*
2'. Posterior lobe of prothorax linear to slightly bilobate (Fig. 4); ventral side of sub-basal plate of ovipositor concave (Fig. 36c); Amazonas Dept. in Colombia (Fig. 37)..... *D. flinti*
3. Posterior lobe of prothorax with a dorsal or ventral medial projection (Figs. 6, 8–9) 4
3'. Posterior lobe of prothorax lacking a medial projection (Figs. 3, 7).....6
4. Posterior lobe of prothorax with a ventro-medial semicircular projection and lacking lateral projections (Fig. 8); dorsal and ventral sides of sub-basal plate of ovipositor linear (Fig. 36i); Loreto Dept. in Peru (Fig. 37) ..... *D. peruviensis*
4'. Posterior lobe of prothorax with a medio-dorsal triangular projection (Figs. 6, 9); dorsal side of sub-basal plate of ovipositor slightly concave and ventral side slightly convex (Figs. 36f, j).....5
5. Posterior lobe of prothorax on each side with two lateral processes, a cylindrical ventro-lateral process and a flat short dorso-lateral process (Fig. 6); Morona-Santiago Prov. in Ecuador to Madre de Dios Dept. in Peru (Fig. 37)..... *D. loutoni*
5'. Posterior lobe of prothorax on each side with one laminar ventro-lateral process (Fig. 9); Sucumbíos to Napo Provs. in Ecuador (Fig. 37)..... *D. tennesseni*
6. Posterior lobe of prothorax smoothly concave, with only one small, as long as wide ventro-lateral laminar process on each side (vl, Fig. 3); Antioquia to Tolima Depts. in Colombia (Fig. 37)..... *D. donnellyi*
6'. Posterior lobe of prothorax medially cleft, with two lateral processes on each side: a larger, outer, erect, dorso-lateral laminar process (dl, Fig. 7), and a smaller, inner, ventro-lateral process (vl, Fig. 7); Orellana Prov. in Ecuador to Madre de Dios Dept. in Peru (Fig. 37) ..... *D. muzoni*

***Drepanoneura donnellyi* sp. nov.**
Figures 2a–b, 3, 11a, 13, 27a–30a, 36a–b, 37

Etymology. We name this species *donnellyi* (noun in the genitive case) in honor of our friend and colleague Thomas W. Donnelly, who first noted differences between his new species *D. letitia* and both *Epipleoneura* and *Psaironeura*, in recognition of his life-long contributions to the knowledge of New World Odonata and his continuing assistance throughout our studies.

Specimens examined. Total 65 ♂, 2 ♀.— **Holotype** ♂: Colombia, Antioquia Department, Cristalina (06°29'N, 74°50'W, 320 m), 13 ii 1917, leg. J.H. & E.B. Williamson (UMMZ). **Paratypes**: 14 ♂, same data as holotype (UMMZ); 2 ♂, same data (USNM); 2 ♂, same data (TWD); 9 ♂, 1 ♀, same data (RWG); 2 ♂, same data but 12 ii 1917 (RWG); 9 ♂, same data but 14 ii 1917 (UMMZ); 1 ♂, same data but 15 ii 1917 (UMMZ); 1 ♂, same data but 17 ii 1917 (UMMZ); 1 ♂, 1 ♀, same data but 18 ii 1917 (UMMZ); 5 ♂ same data but 19 ii 1917 (UMMZ); 2 ♂ same data but 19 ii 1917 (RWG). Tolima Department: 10 ♂, Mariquita (05°12'04"N, 74°54'46"W, 450 m), 04 ii 1917, leg. J.H. & E.B. Williamson (UMMZ); 6 ♂, same data (RWG).

Male holotype. Head. Labium, ventral third of labrum, anteclypeus, and second antennal segment pale yellow; base of mandibles, genae, and ventral half of antefrons pale blue; remainder of head black.

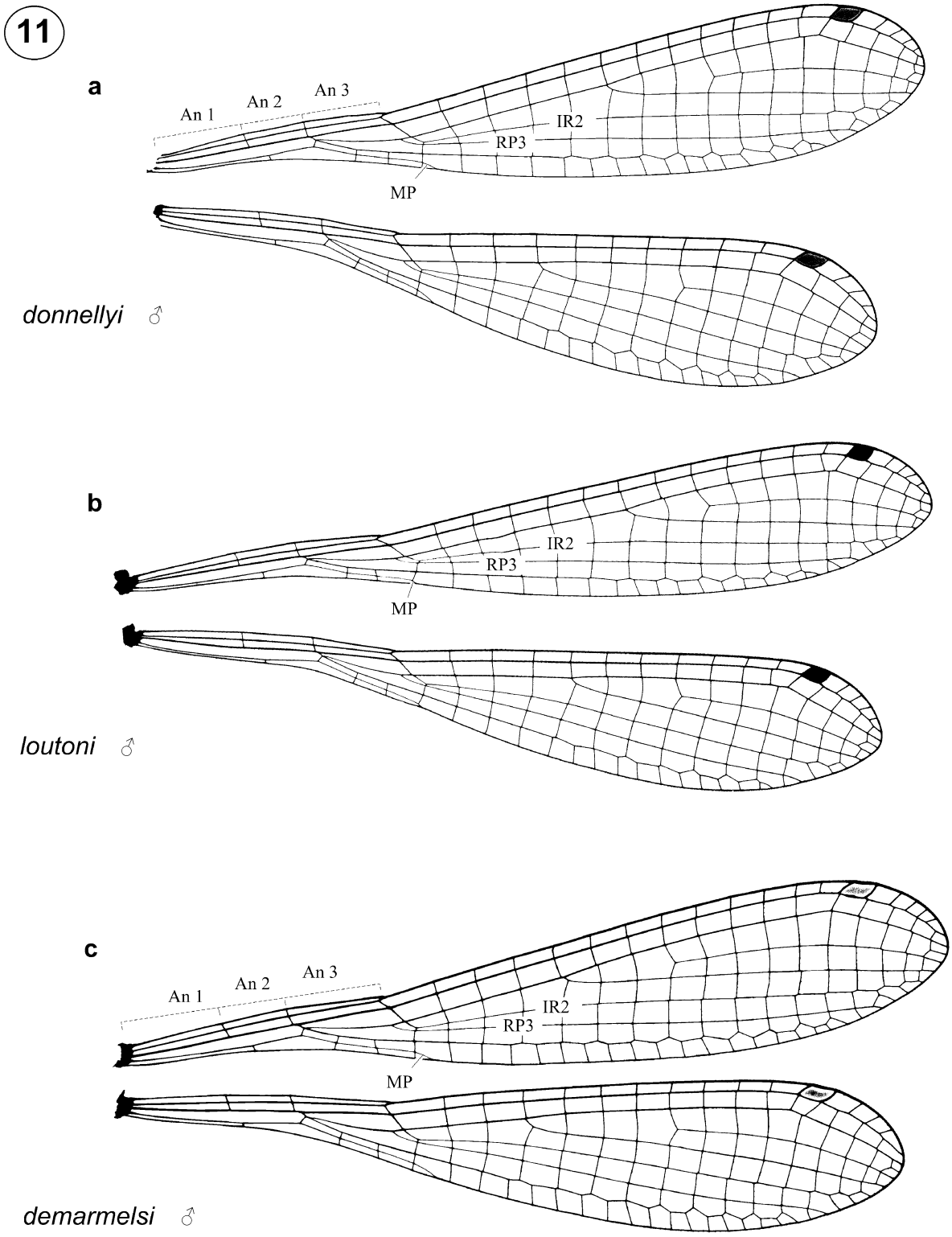


FIGURE 11. Wings. (a) *Drepanoneura donnellyi* **sp. nov.**, ♂ paratype Colombia, Cristalina; (b) *D. loutoni* **sp. nov.**, ♂ paratype Peru, Pakitza; (c) *Eplipleoneura demarmelsi* **sp. nov.**, ♂ paratype Venezuela, Salto Ángel. An: Antenodal space.

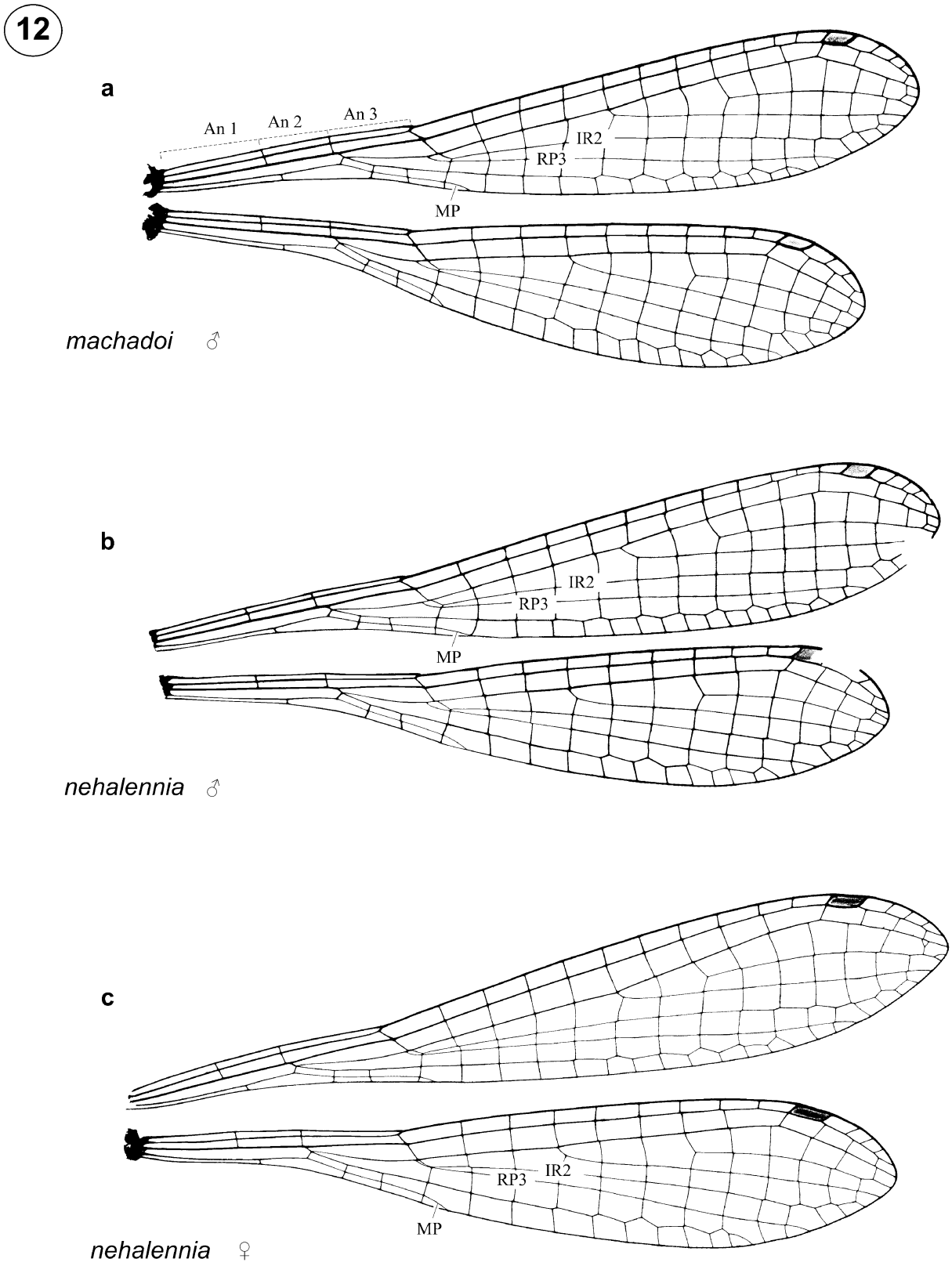
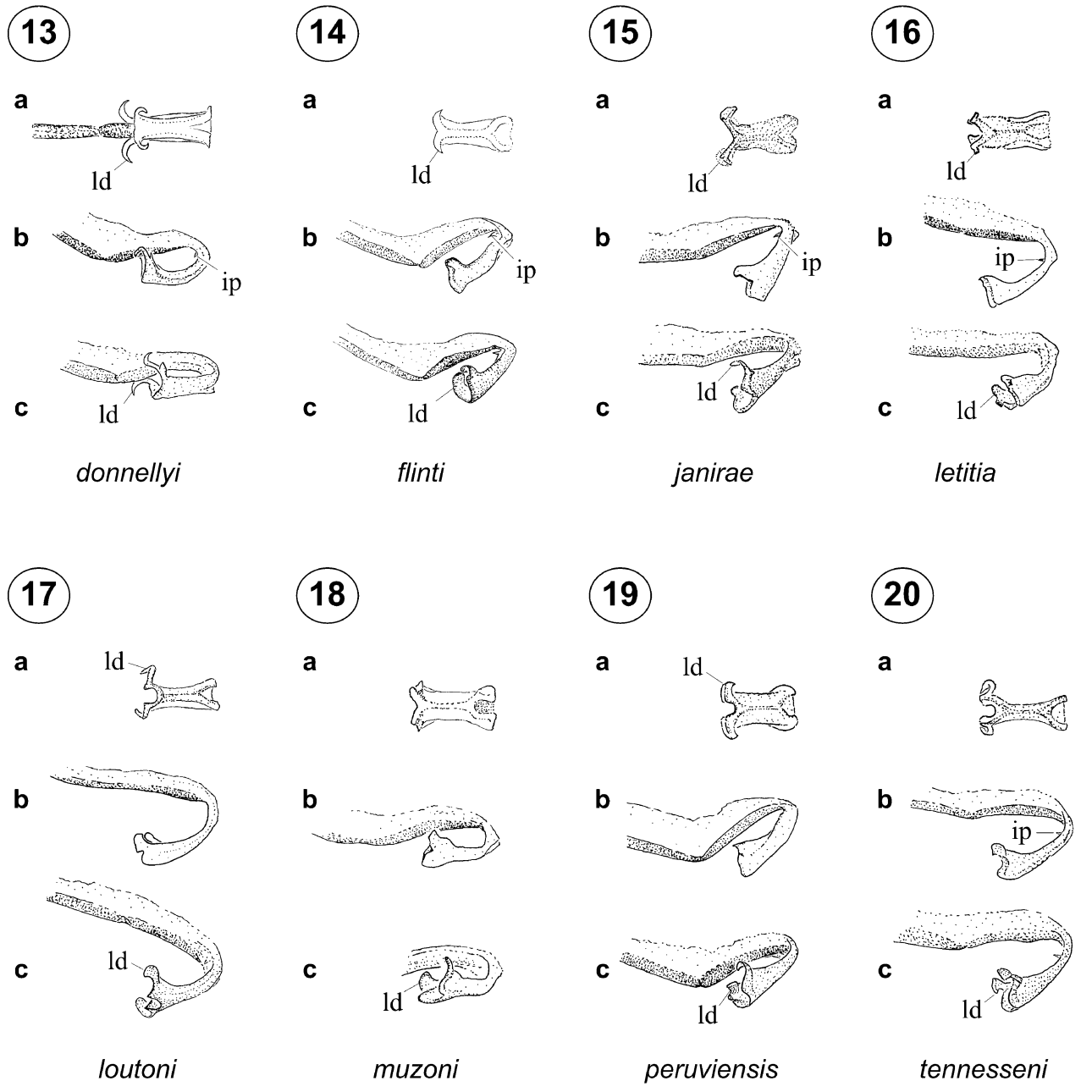


FIGURE 12. Wings. (a) *Epipotoneura machadoi* **sp. nov.**, ♂ holotype Brazil, Rio Xingu; (b) *E. nehalennia*, ♂ Brazil, Manaus; (c) *E. nehalennia*, ♀ paratype Guyana, Tumatumari.

Thorax. Prothorax, mesepisternum, mesepimeron, portion of metepisternum posterior to metastigma, and dorsal portion of metepimeron black with metallic green and copper reflections; portion of metepisternum

anterior to metastigma, ventral portion of metepimeron, and pterothoracic venter pale yellow (Fig. 2a); coxae blackish; trochanters yellow; femora yellow with three black bands; tibiae, tarsi, and pretarsi yellow with black apices; 5 spurs on metafemora, 6 on metatibiae. Hw 5.1 times as long as wide; 11 Px in Fw, 9 Px in Hw; MP reaching wing margin at 1/4–1/3 of cell distal to vein descending from subnodus; IR_2 arising just distal to vein descending from subnodus in left Fw and at vein descending from subnodus in right Fw and in both Hw; IR_2 and RP_3 separated by a short crossvein one cell posterior to their origin; RP_2 beginning closer to Px 5 in Fw and to Px 3 in Hw; pt brown with pale brown marginal hairline, shorter than underlying cell, with costal side as long as posterior side (Fig. 11a).



FIGURES 13–20. ♂ genital ligula: (a) ectal view, (b) lateral view, (c) latero-ectal view. (13) *Drepanoneura donnellyi* **sp. nov.**, holotype; (14) *D. flinti* **sp. nov.**, holotype; (15) *D. janirae* **sp. nov.**, paratype Bolivia, Beni; (16) *D. letitia*, Panama, Pipeline road; (17) *D. loutoni* **sp. nov.**, paratype Peru, Satipo; (18) *D. muzoni* **sp. nov.**, paratype Ecuador, Yasuni; (19) *D. peruviensis*, Peru, Iquitos; (20) *D. tennesseni* **sp. nov.**, holotype. ip: inner process; ld: latero-distal lobe.

Abdomen. Dorso-laterally black with metallic reflections except for narrow pale brown bands interrupted medio-dorsally on base of S4–7, latero-ventral portion of terga and sterna pale brown to yellow. Apex of genital ligula entire with long and narrow latero-distal lobes curved distally (as in Figs. 13a, c). Dorso-posterior margin of S10 not or only slightly projected posteriorly (Figs. 27a–29a). Ventral branch of cercus as long as base of cercus, approximately cylindrical (as in Fig. 28a), in posterior view aligned with inner margin of cercus and diverging from ventral branch of opposite cercus at tip (Fig. 30a). Paraproct pointed (as in Fig. 28a).

Dimensions. Total length 34.0 mm; abdomen length 29.1 mm; Hw 17.6 mm.

Paratypes. Paratypes are similar to holotype but vary as follows: narrow yellow humeral stripe present in juvenile specimens and females; femora banded to entirely dark brown; 4–6 spurs on metafemora, 5–6 on metatibiae; Hw 4.8–5.3 times as long as wide; 11–12 Px in Fw, 9–10 Px in Hw; MP reaching wing margin between vein descending from subnodus to half-length the cell distal to it; RP_2 beginning closer to Px 3–4 in Hw. Females have the dark color of thoracic dorsum extending to ventral margin of mesepimeron, reaching second lateral suture only at its posterior end (Fig. 2b); the posterior margin of female prothorax is smoothly concave, with a small laminar ventro-lateral process on each side (Fig. 3); the dorsal side of sub-basal plate of ovipositor is concave and the ventral side is slightly convex (Fig. 36a).

Dimensions. Males (n = 10): total length 33.2–36.1 mm [mean 34.1 mm; SD 0.8]; abdomen 28.2–29.4 mm [mean 28.9 mm; SD 0.4]; Hw 17.2–18.0 mm [mean 17.6 mm; SD 0.3]. Females (n = 2): total length 31.9–33.2 mm; abdomen 26.9–28.4 mm; Hw 18.4–18.6 mm.

Diagnosis. Male is most similar to *D. letitia* and can be separated confidently from it only by its genital ligula with an approximately linear apex and long and narrow latero-externally directed apical lobes (Fig. 13a) as described in couplet 7 in the key. Male further differs from *D. flinti*, *D. muzoni*, and *D. peruviensis* by having its cercus ventral branch aligned with cercus inner margin and diverging from branch of opposite cercus towards tip (Fig. 30a), from *D. janirae* by having its ventral branch of cercus longer than base of cercus, and from *D. loutoni* and *D. tennesseni* by its pointed paraproct (Fig. 28a). Female is easily distinguished by its unique posterior margin of prothorax: smoothly concave with a short, as long as wide ventro-lateral process on each side (Fig. 3).

Biology. Adults were collected along a small stream within densely wooded forest, where the stream was one to three feet wide and frequently disappeared within the gravel bed (Williamson 1918).

Distribution. Antioquia to Tolima Departments in Colombia (Fig. 37).

***Drepanoneura flinti* sp. nov.**
Figures 2c–d, 4, 14, 27b–30b, 36c, 37

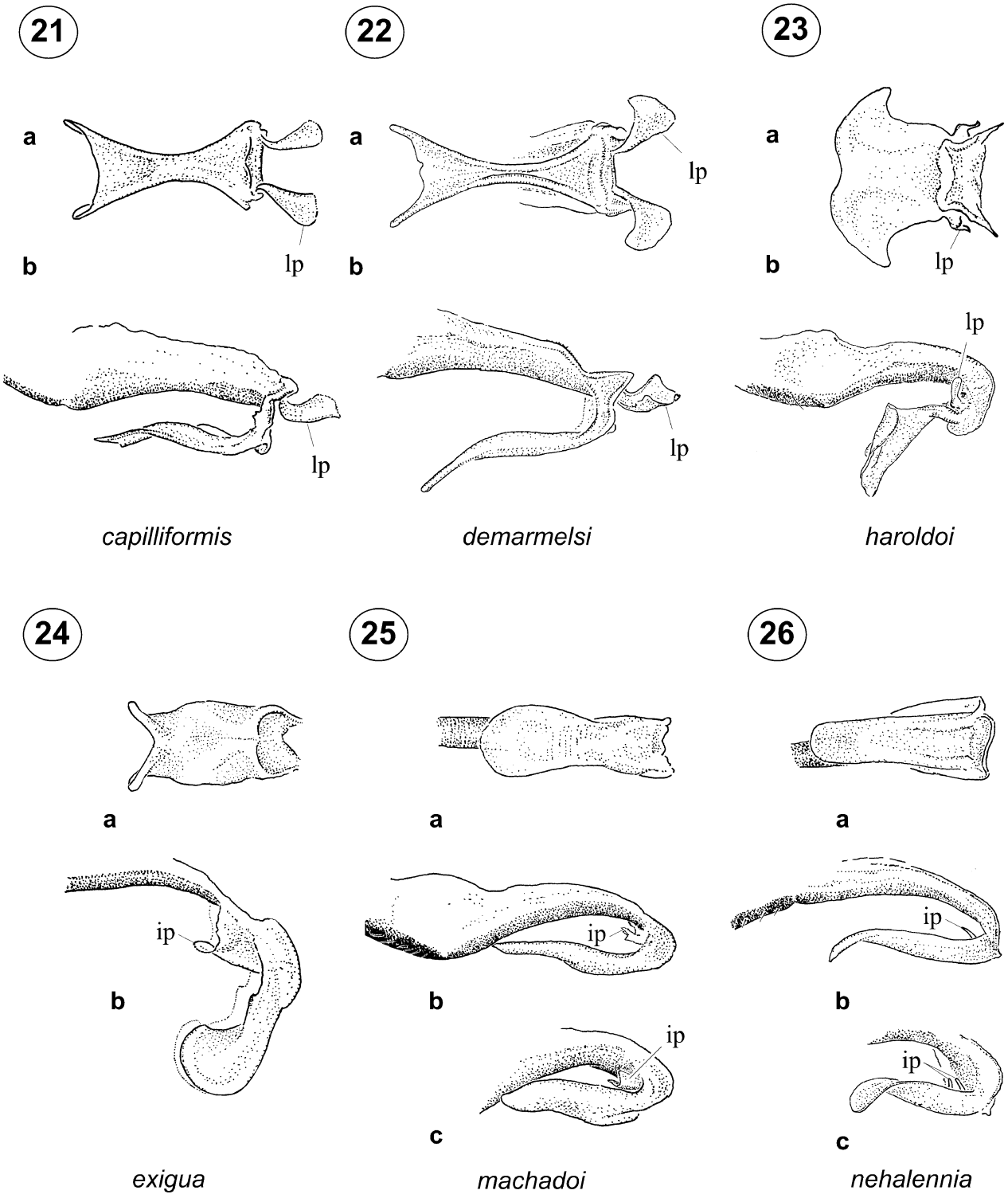
Etymology. We name this species *flinti* (noun in the genitive case) in honor of our friend and colleague Oliver Flint Jr. in recognition of his contributions to the knowledge of New World Odonata and his ongoing kind assistance to odonate students as curator of the rich USNM collection.

Specimens examined. Total 8 ♂, 1 ♀.— **Holotype** ♂: Colombia, Amazonas Department, Puerto Abeja, Stream #3, N of Araracuara (00°04'44"S, 72°26'50"W), 03 vii 1996, leg. G. Pritchard & J. Zloty (USNM). **Paratypes**: 1 ♂, same data as holotype (USNM); 6 ♂, 1 ♀, same data (RWG).

Male holotype. Head. Labium, ventral third of labrum, anteclypeus, and triangular spot on anterior surface of antennifer pale yellow; base of mandibles, genae, and ventral half of antefrons pale blue, remainder of head black.

Thorax. Prothorax, mesepisternum, mesepimeron, and portion of metepisternum posterior to metastigma black with metallic green and copper reflections; portion of metepisternum anterior to metastigma, metepimeron, and pterothoracic venter pale yellow (Fig. 2c); coxae blackish; trochanters yellow; femora brown to black at apex; tibiae, tarsi, and pretarsi yellow with black apices; 3 spurs on metafemora, 6 on metat-

ibiae. Hw 5.5 times as long as wide; 12 Px in Fw, 10 Px in Hw; MP reaching wing margin at vein descending from subnodus; IR_2 arising just distal to vein descending from subnodus; IR_2 and RP_3 in contact one cell posterior to their origin; RP_2 beginning closer to Px 5 in Fw and to Px 3 in Hw; pt pale brown with yellow marginal hairline, shorter than underlying cell in Fw and as long as underlying cell in Hw, with costal side as long as posterior side.



FIGURES 21–26. ♂ genital ligula: (a) ectal view, (b) lateral view, (c) latero-ental view. (21) *Eplipleoneura capilliformis* Brazil, Obidos, in RWG; (22) *E. demarmelsi* **sp. nov.**, ♂ paratype Venezuela, Salto Ángel; (23) *E. haroldoi* Brazil, Manaus, in RWG; (24) *Phasmoneura exigua* Brazil, Reserva Ducke, in RWG; (25) *Epipotoneura machadoi* **sp. nov.**, ♂ holotype Brazil, Rio Xingu; (26) *E. nehalennia* Brazil, Manaus. ip: inner process; lp: latero-posterior lobe.

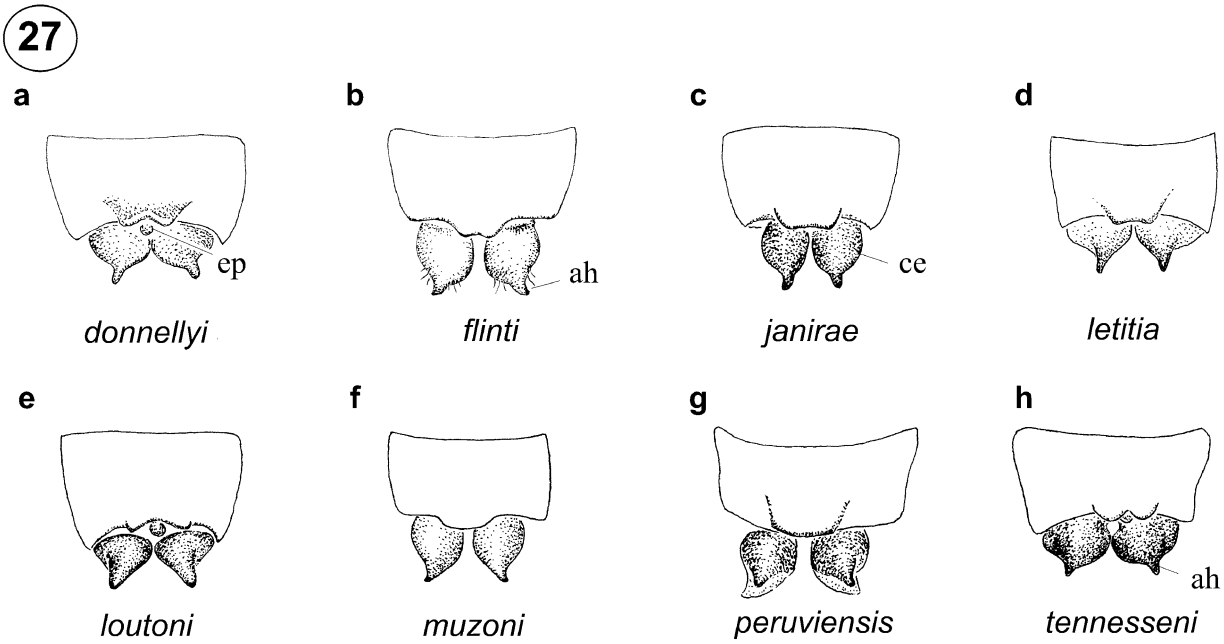


FIGURE 27. ♂ S10, dorsal view. (a) *Drepanoneura donnellyi* **sp. nov.**, paratype Colombia, Cristalina; (b) *D. flinti* **sp. nov.**, holotype; (c) *D. janirae* **sp. nov.**, holotype; (d) *D. letitia*, Panama, Pipeline road; (e) *D. loutoni* **sp. nov.**, paratype Peru, Satipo; (f) *D. muzoni* **sp. nov.**, holotype; (g) *D. peruviensis*, Peru, Iquitos; (h) *D. tennesseni* **sp. nov.**, holotype. ah: apical hook; ce: cercus; ep: epiproct.

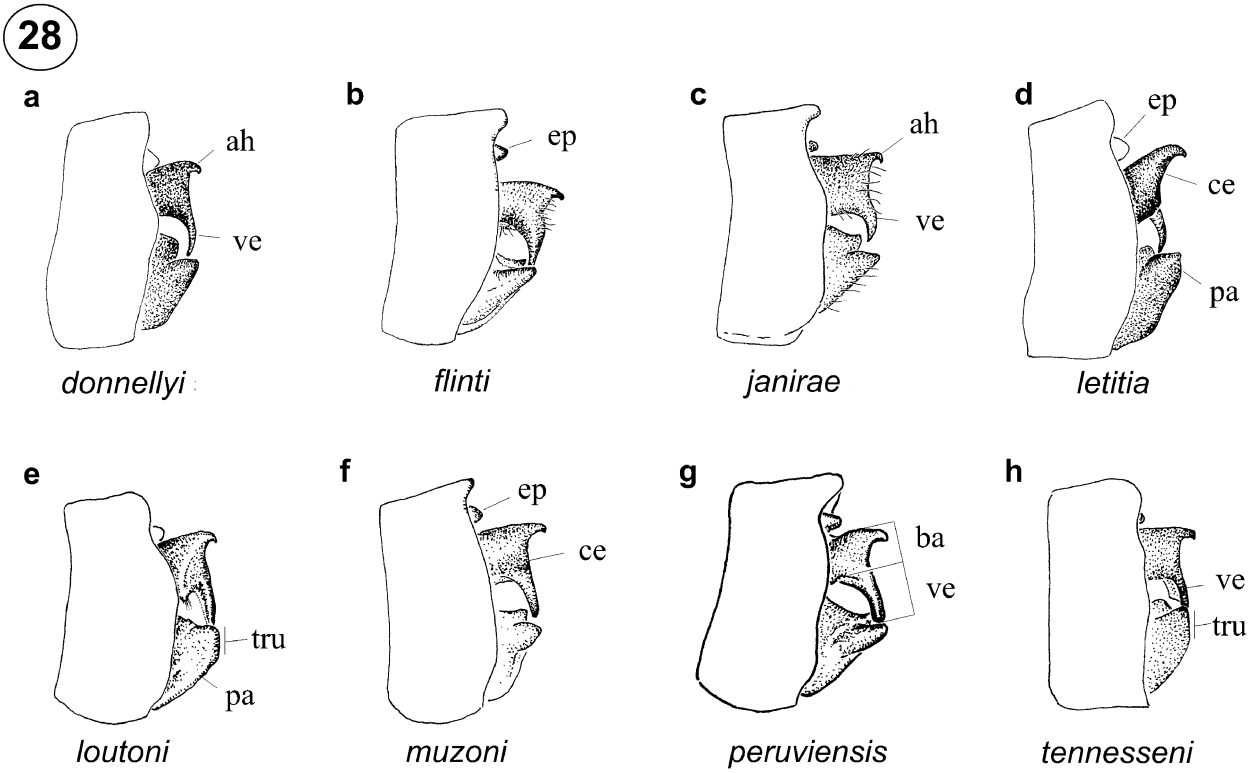


FIGURE 28. ♂ S10, lateral view. (a) *Drepanoneura donnellyi* **sp. nov.**, paratype Colombia, Mariquita; (b) *D. flinti* **sp. nov.**, holotype; (c) *D. janirae* **sp. nov.**, holotype; (d) *D. letitia*, paratype Panama, Quebrada Juan Grande; (e) *D. loutoni* **sp. nov.**, paratype Peru, Satipo; (f) *D. muzoni* **sp. nov.**, holotype; (g) *D. peruviensis*, holotype; (h) *D. tennesseni* **sp. nov.**, holotype. ah: apical hook; ba: base of cercus; ce: cercus; ep: epiproct; pa: paraproct; tru: truncate; ve: ventro-apical branch.

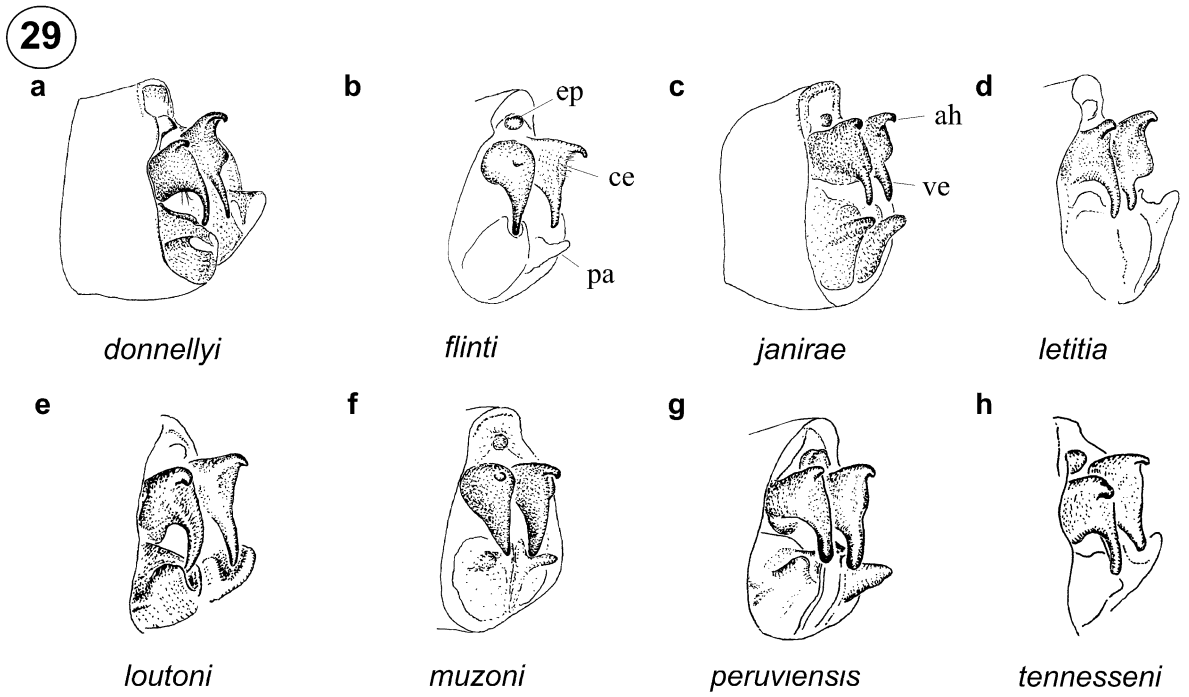


FIGURE 29. ♂ S10, medio-posterior view. (a) *Drepanoneura donnellyi* **sp. nov.**, paratype Colombia, Cristalina; (b) *D. flinti* **sp. nov.**, holotype; (c) *D. janirae* **sp. nov.**, holotype; (d) *D. letitia*, Panama, Pipeline road; (e) *D. loutoni* **sp. nov.**, paratype Peru, Satipo; (f) *D. muzoni* **sp. nov.**, holotype; (g) *D. peruviensis*, holotype; (h) *D. tennesseni* **sp. nov.**, paratype Ecuador, Río Sinde. ah: apical hook; ce: cercus; ep: epiproct; pa: paraproct; ve: ventro-apical branch.

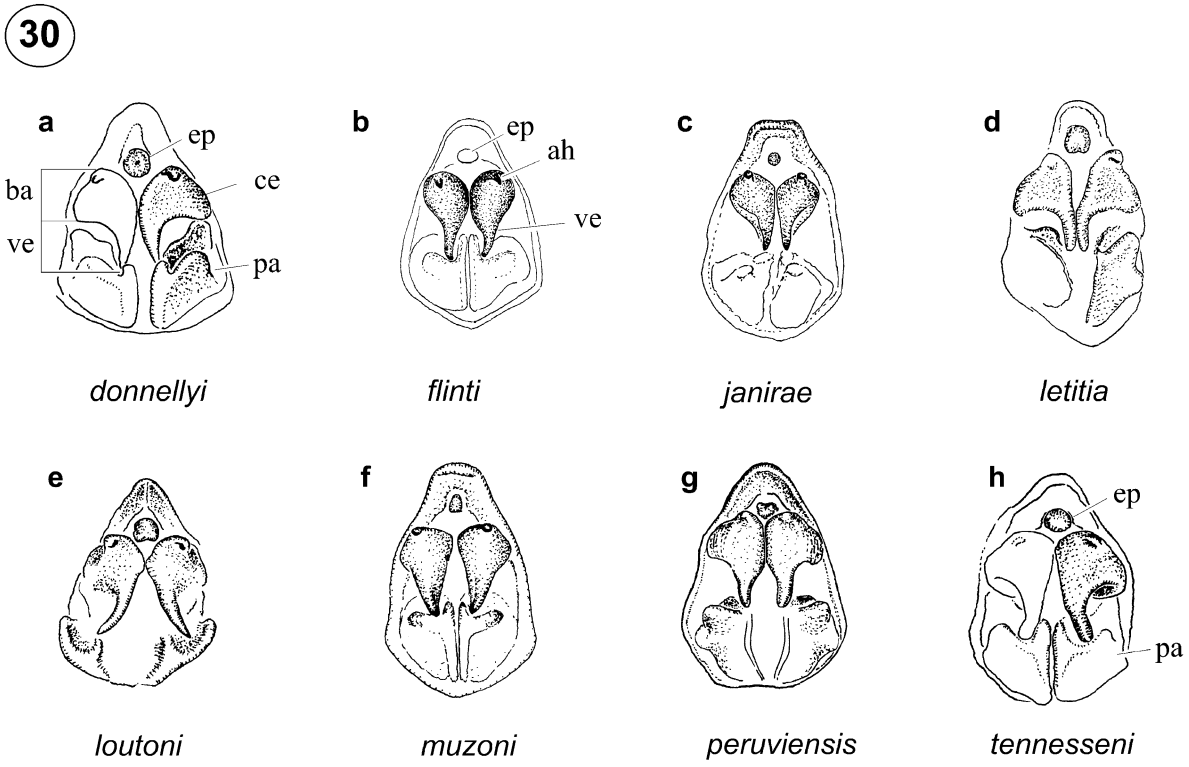
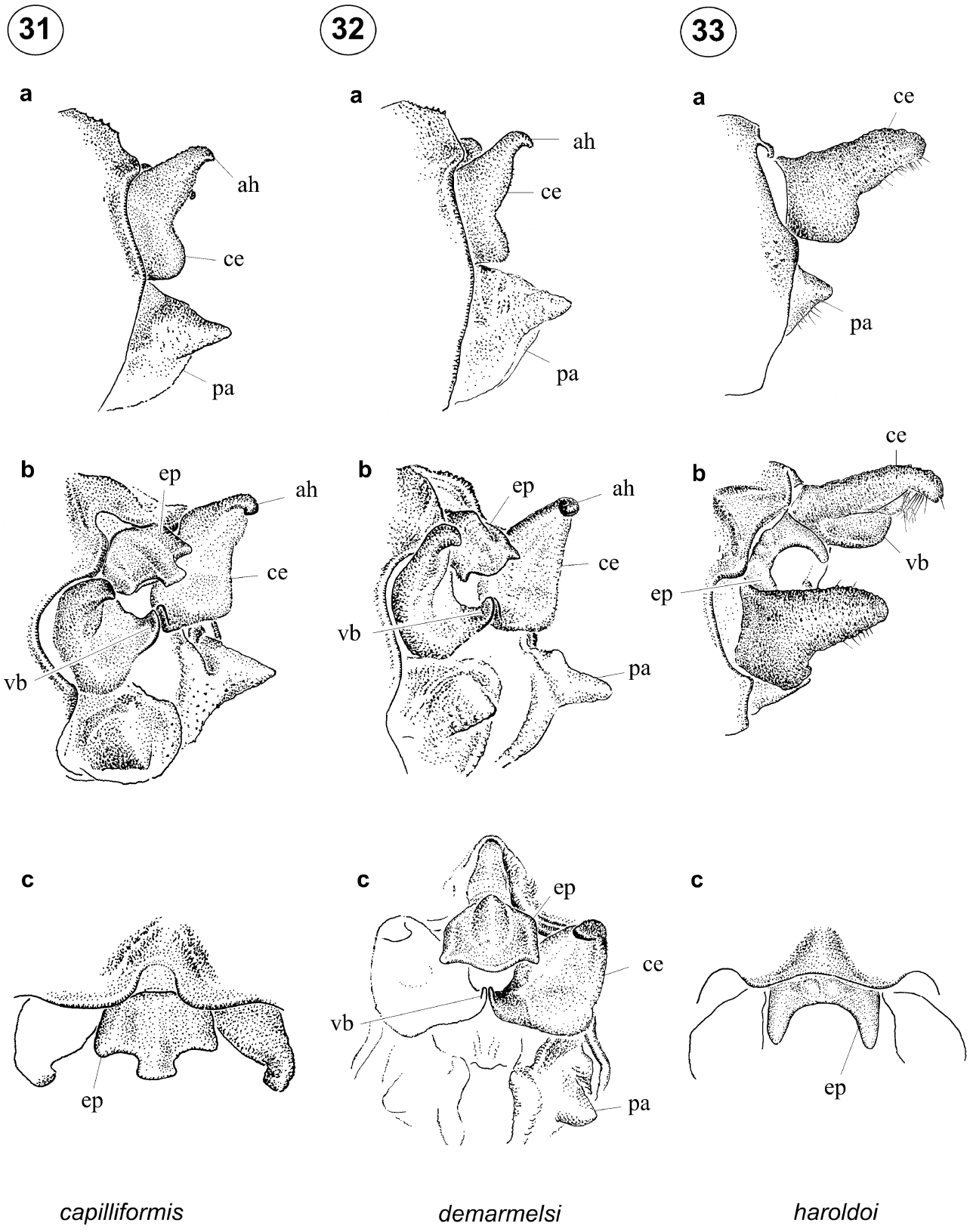
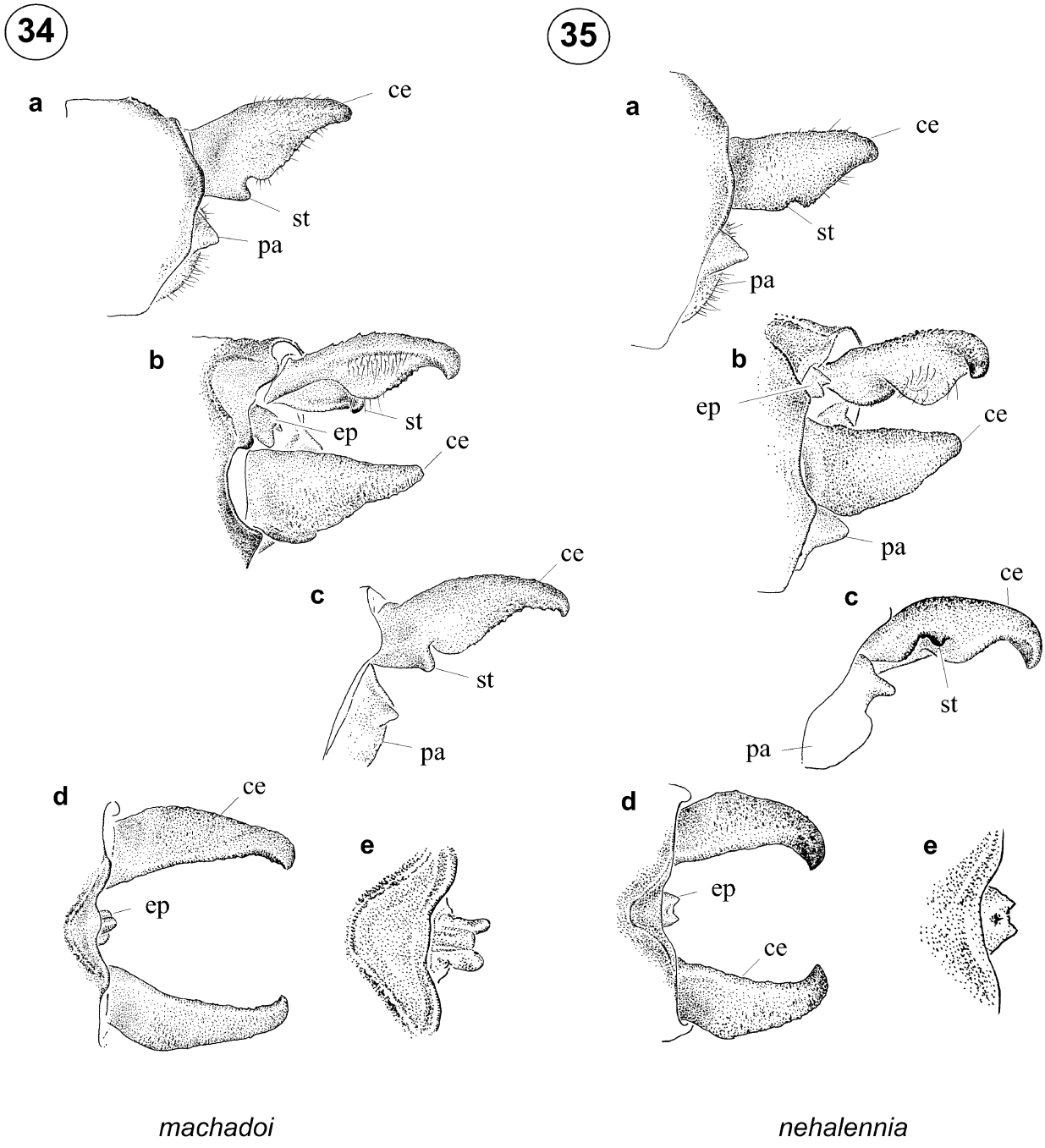


FIGURE 30. ♂ S10, posterior view. (a) *Drepanoneura donnellyi* **sp. nov.**, paratype Colombia, Cristalina; (b) *D. flinti* **sp. nov.**, paratype Colombia, Puerto Abeja; (c) *D. janirae* **sp. nov.**, holotype; (d) *D. letitia*, Panama, Pipeline road; (e) *D. loutoni* **sp. nov.**, paratype Peru, Satipo; (f) *D. muzoni* **sp. nov.**, holotype; (g) *D. peruviensis*, holotype; (h) *D. tennesseni* **sp. nov.**, paratype Ecuador, Río Sinde. ah: apical hook; ba: base of cercus; ce: cercus; ep: epiproct; pa: paraproct; ve: ventro-apical branch.



FIGURES 31–33. ♂ S10: (a) lateral view, (b) medio-dorsal view, (c) posterior view. (31) *Epipleoneura capilliformis* Brazil, Manaus, in RWG; (32) *E. demarmelsi* **sp. nov.**, ♂ paratype Venezuela, Salto Ángel; (36) *E. haroldoi* Brazil, Manaus, in RWG. ah: apical hook; ce: cercus; ep: epiproct; pa: paraproct; vb: ventro-basal branch.



FIGURES 34–35. ♂ S10: (a) lateral view, (b) medio-dorsal inner view, (c) medio-ventral outer view, (d) dorsal view, (e) detail dorsal view epiproct. (34) *Epipotoneura machadoi* **sp. nov.**, holotype Brazil, Rio Xingu; (35) *E. nehalennia*, holotype. ce: cercus; ep: epiproct; pa: paraproct; st: sub-basal tooth.

Abdomen. Dorso-laterally black with metallic reflections, latero-ventral portion of terga and sterna pale brown to yellow. Apex of genital ligula with a shallow v-shaped cleft (Fig. 14a) and latero-distal lobes short, broad, and curved medially (Fig. 14c). Dorso-posterior margin of S10 projected posteriorly (Figs. 27b–28b). Ventral branch of cercus longer than its base, approximately cylindrical (Fig. 28b), in posterior view arising at mid-width of cercus and convergent to branch of opposite cercus at tip (Fig. 30b). Paraproct pointed (Fig. 28b).

Dimensions. Total length 29.9 mm; abdomen length 25.5 mm; Hw 16.4 mm.

Paratypes. Paratypes are similar to holotype but vary as follows: femora banded to entirely dark brown; 4–5 spurs on metafemora, 5–6 on metatibiae; Hw 5.6–5.8 times as long as wide; 11–13 Px in Fw, 9–11 Px in Hw; MP reaching wing margin from slightly distal to vein descending from subnodus to distally for 1/4–1/3 of length of adjacent cell, and IR_2 sometimes arising at vein descending from subnodus. Females have the ventral fourth of labrum yellow, dark color of thoracic dorsum extending to metapleural suture only at posterior fifth (Fig. 2d), femora yellow with two black bands, posterior margin of female pronotum approximately linear (Fig. 4), and dorsal and ventral sides of sub-basal plate of ovipositor concave (Fig. 36c).

Dimensions. Males (n = 7): total length 29.9–31.1 mm [mean 30.5 mm; SD 0.5]; abdomen 25.4–27.4 mm [mean 26.1 mm; SD 0.6]; Hw 16.4–17.6 mm [mean 16.8 mm; SD 0.5]. Female (n = 1): total length 29.6 mm; abdomen 24.9 mm; Hw 17.1 mm.

Diagnosis. Male differs from *D. peruviensis* only by morphology of its genital ligula. Male shares cercus with ventral branch arising at mid-width and parallel to branch of opposite cercus only with *D. muzoni* and *D. peruviensis* (Fig. 30b), but it differs from the former by its ventral branch of cercus longer than base of cercus (Fig. 28b), and from both species by its apex of genital ligula with a shallow v-shaped cleft (Fig. 14a). Female is unique in having the posterior lobe of pronotum approximately linear and devoid of ventro-lateral processes (Fig. 4) and by the sub-basal plate of ovipositor with both ventral and dorsal sides concave (Fig. 36c).

Biology. Adults were collected at a stream (collection label).

Distribution. Amazonas Department, Colombia (Fig. 37).

***Drepanoneura janirae* sp. nov.**

Figures 2e, 15, 27c–30c, 37

Etymology. We name this species *janirae* (noun in the genitive case) in honor of our friend and colleague Janira M. Costa, in recognition of her friendship and her contributions to the knowledge of New World Odonata.

Specimens examined. Total 12 ♂.— **Holotype** ♂: Brazil, Rondônia State, Villa Murtinho (10°21'S, 65°19'W, 133 m), 04 iv 1922, leg. J.H. Williamson & J.W. Strohm (UMMZ). **Paratypes**: 1 ♂, same data as holotype (RWG); 1 ♂, same data as holotype but 28 iii 1922 (RWG); 3 ♂, same data but 04 iv 1922 (RWG); 1 ♂, same data but 06 iv 1922 (MNRJ). Bolivia, Beni Department: 1 ♂, Río Beni, Cachuela Esperanza (10°32'S, 65°38'W, 122 m), 10/13 iv 1922, leg. J.H. Williamson & J.W. Strohm (UMMZ); 4 ♂, same data (RWG).

Male holotype. Head. Labium, labrum except medio-basal black spot, and second antennal segment pale yellow; base of mandibles, anteclypeus, genae, ventral half of antefrons, and triangular spot on anterior surface of antennifer pale blue; remainder of head black.

Thorax. Prothorax, mesepisternum, mesepimeron, and metepisternum posteriorly to metastigma black with metallic green and copper reflections; narrow faint yellow stripe along ventral margin of humeral suture, metepimeron, and pterothoracic venter pale yellow (as in Fig. 2e); coxae and trochanters yellow; femora yellow with four faint black bands; tibiae, tarsi, and pretarsi yellow with black apices; 4 spurs on metafemora, 6 on metatibiae. Hw 5.4 times as long as wide; 11 Px in Fw, 10 Px in right Hw, 9 in left Hw; MP reaching wing margin at vein descending from subnodus; IR_2 arising slightly distal to vein descending from subnodus; IR_2 and RP_3 separated by a short crossvein one cell posterior to their origin; RP_2 beginning closer to Px 5 in Fw and to Px 3 in Hw; pt pale brown with marginal yellow hairline, shorter than underlying cell, with costal side as long as posterior side.

Abdomen. Dorso-laterally black with metallic reflections except for narrow pale brown bands interrupted medio-dorsally by black on base of S3–7; latero-ventral portion of terga and sterna pale brown to yellow. Apex of genital ligula with a moderate v-shaped cleft (as in Fig. 15a) with short and broad latero-distal lobes curved medially (as in Fig. 15c). Dorso-posterior margin of S10 projected posteriorly (Figs. 27c–28c). Ventral branch of cercus shorter than base of cercus, approximately cylindrical (Figs. 29c–30c); in posterior view

aligned with inner margin of cercus and diverging from ventral branch of opposite cercus at tip (Fig. 30c). Paraproct pointed (Fig. 28c).

Dimensions. Total length 33 mm; abdomen length 28.4 mm; Hw 17.3 mm.

Paratypes. Paratypes are similar to holotype but vary as follows: 4–6 spurs on metafemora, 5–7 on metatibiae; Hw 5.2–5.6 times as long as wide; 11–12 Px in Fw, 7–10 Px in Hw; IR_2 arising at vein descending from subnodus or slightly distal to it; IR_2 and RP_3 in contact one cell posterior to their origin or separated by a short crossvein; RP_2 beginning closer to Px 4–5 in Fw and to Px 3–4 in Hw; and pt shorter than or as long as underlying cell with costal side shorter to longer than posterior side. Dark color on thoracic dorsum extends to metapleural suture or to mid-height of metepisternum, and narrow pale brown bands are interrupted mediodorsally by black on base of abdominal S3–6 or S3–7. Female unknown.

Dimensions. Males (n= 10): total length 31.1–33.0 mm [mean 32.0 mm; SD 0.7]; abdomen 26.6–28.5 mm [mean 27.5 mm; SD 0.6]; Hw 17.1–18.3 mm [mean 17.6 mm; SD 0.4].

Diagnosis. This species is unique by the ventral branch of cercus shorter than the base of cercus. It further differs from *D. flinti*, *D.muzoni*, and *D. peruviensis* by the ventral branch of male cercus being aligned with cercus inner margin and diverging from branch of opposite cercus at tip (Fig. 30c); from *D. donnellyi*, *D. letitia*, *D. loutoni*, and *D. tennesseni* by the postero-dorsal margin of male S10 markedly projected posteriorly (Fig. 28c); and further from *D. loutoni* and *D. tennesseni* by its pointed paraproct (Fig. 28c).

Biology. Unknown; males reported as 'hang[ing] from tip of leaves' (data from collection label).

Distribution. Amazon forest in Rondônia, Brazil and Beni, Bolivia (Fig. 37).

***Drepanoneura letitia* (Donnelly 1992) comb. nov.**
Figures 2f–g, 5, 16, 27d–30d, 36d–e, 37

Epipleoneura letitia Donnelly 1992: 73–76, figs. 5.21–5.24 (description of male and female; illustration of male S10, base of Hw, female pronotum and mesostigmal plate); — Bridges (1994: VII.133; synonymic list); — Tsuda (2000: 12; synonymic list).

Specimens examined. Total 5 ♂ (**paratypes**), 1 ♀ (**allotype**). — Panama, Panamá Province: 1 ♀, Pipeline road, 1.7–4.8 miles NW of Gamboa, 22 v 1970, leg. E. Morton (USNM); 1 ♂, same data but 01 vii 1970, leg. E.S. Morton (TWD); 1 ♂, same data but Río Frijoles, 23 I 1975, leg. M.L. May (MM); 1 ♂, same data but Quebrada Juan Grande, 09 v 1975, leg. M.L. May (TWD); 2 ♂, Limbo river at Limbo Hunt Club, near Pipeline Rd., 8 km NW of Gamboa (09°07'N, 79°42'W), 09 i 1977, leg. M.L. May (MM, RWG).

Characterization. Posterior prothoracic lobe smoothly convex in male, in female smoothly concave and lacking projections (Fig. 5). Pterothoracic dorsum dark to mid-height of metepisternum (Figs. 2f–g), with a dark stripe on metapleural suture in male, and in juvenile specimens a narrow faint yellow humeral stripe. Apex of male genital ligula with a shallow v-shaped cleft (Fig. 16a) and latero-distal lobes short, broad, and curved medially (Fig. 16c). Dorso-posterior margin of male S10 projected posteriorly only slightly (Figs. 27d–28d). Ventral branch of male cercus as long as base of cercus, approximately cylindrical (Fig. 28d), in posterior view aligned with inner margin of cercus and diverging from opposite at tip (Fig. 30d). Paraproct pointed (Fig. 28d). Dorsal side of sub-basal plate of ovipositor slightly concave and ventral side slightly convex (Fig. 36d).

Diagnosis. Male of *D. letitia* most closely approximates *D. donnellyi*; both are diagnosed under the latter species. Male differs from *D. flinti*, *D. muzoni*, and *D. peruviensis* by the ventral branch of male cercus being aligned with cercus inner margin and diverging from the branch of opposite cercus at tip; from *D. janirae* by the ventral branch of cercus as long as base of cercus (Fig. 28d) and postero-dorsal margin of S10 not or only slightly projected posteriorly (Figs. 27d–28d), and from *D. loutoni* and *D. tennesseni* by its pointed paraproct. Female posterior lobe of pronotum of *D. letitia* lacks ventro-lateral processes as in *D. flinti*, but it is unique by

its smoothly concave margin (Fig. 5). *Drepanoneura letitia* further differs from *D. flinti* by its quadrangular sub-basal plate of ovipositor (sb, Fig. 36d), which is acutely pointed (sb, Fig. 36c) in the latter.

Biology. Adults are inconspicuous, fly close to quiet water on margins of wooded streams (Donnelly 1992).

Distribution. Panamá Province in Panama (Fig. 37).

***Drepanoneura loutoni* sp. nov.**
Figures 1b, 2h–i, 6, 11b, 17, 27e–30e, 36f, 37

Etymology. We name this species *loutoni* (noun in the genitive case) in honor of our good friend and colleague Jerry A. Louton, who collected this species in Peru, in recognition of his contributions to the knowledge of New World Odonata and his friendship and continuous assistance.

Specimens examined. Total 72 ♂, 6 ♀.— **Holotype** ♂: Peru, Madre de Dios Department, Manu, Pakitza, trail 1 (12°07'S, 70°58'W, 250 m), 12 ix 1988, leg. O.S. Flint, Jr. (USNM). **Paratypes**: Ecuador: Morona-Santiago Province: 1 ♂, Mayalico, on Río Nanganita (now Río Naganitza) (03°03'33"S, 77°59'44"W, 490 m), 02 xii 1941, leg. D.B. Laddey (UMMZ). Peru, San Martín Department: 5 ♂, 1 ♀, vicinity of Rioja (Soritor), in jungle (06°02'S, 77°10'W, 900 m), 13 x 1936, leg. F. Woytkowski (UMMZ); 4 ♂, same data (RWG); 2 ♂, same data but 14/17 x 1936 (UMMZ); 1 ♂, same data but 17 x 1936 (RWG). Huánuco Department: 1 ♂, Tingo María, muddy stream (08°58'S, 75°50'W, 440 m), 04 vii 1977, leg. D. Paulson (DRP). Junín Department: 5 ♂, Satipo (11°16'53"S, 74°41'"W, 714 m), 05/25 vi 1940, leg. P. Paprzycki (UMMZ); 3 ♂, same data but 05/18 vi 1940 (RWG); 7 ♂, same data but 05/31 vii 1940 (UMMZ); 4 ♂, same data (RWG); 3 ♂, same data but 09/10 viii 1940 (UMMZ); 1 ♂, same data (RWG); 3 ♂, same data but 19/23 x 1940 (UMMZ); 2 ♂, same data but 23/25 x 1940 (RWG); 10 ♂, same data but 10/31 xii 1940 (UMMZ); 4 ♂, same data but 16/30 xii 1940 (RWG); 2 ♂, same data but 01 i 1941 (UMMZ); 1 ♂, same data but 03 i 1941 (RWG); 1 ♂, same data but xii 1941 (UMMZ); 1 ♂, same data (RWG). Cusco Department: 2 ♂, Camisea R. drainage, San Martín "C", Shell Oil gas exploration site (11°46'53"S, 72°42'06"W, 431 m), 19/24 ii 1997, leg. J. Louton (RWG). Madre de Dios Department: 1 ♂, Manu, Pakitza, trail 1 (12°07'S, 70°58'W, 250 m), 12 ix 1988, leg. O.S. Flint, Jr. (RWG); 2 ♂, same data but (TWD); 1 ♀, same data but 17 ix 1988 (TWD); 1 ♀, same data but 23 ix 1988 (USNM); 2 ♂, same data but marker 14, first stream, 09/19 ix 1989, leg. N.E. Adams (USNM); 1 ♂, 1 ♀, same data but Trail 2, marker 18, seeps, 12/17 ix 1989 (USNM); 2 ♂, 1 ♀, same data but marker 15, first stream, 18 ix 1989 (USNM); 1 ♀, same data (RWG).

Male holotype. Head. Labium, labrum except medio-basal black spot, and second antennal segment pale yellow; base of mandibles, anteclypeus, genae, ventral half of antefrons, and triangular spot on anterior surface of antennifer pale blue, remainder of head black (as in Fig. 1b).

Thorax. Prothorax, mesepisternum, mesepimeron, and stripe along dorsal margin of metapleural suture black with metallic green and copper reflections; stripe along ventral margin of humeral suture, metepisternum, metepimeron, and pterothoracic venter pale yellow (Fig. 2h); coxae and trochanters yellow; femora yellow with black apical band; tibiae, tarsi, and pretarsi yellow with black apices; 4 spurs on metafemora, 6 on metatibiae. Hw 5.6 times as long as wide; 13 Px in right Fw, 12 in left Fw, 10 Px in Hw; MP reaching wing margin at vein descending from subnodus; IR_2 arising slightly distal to vein descending from subnodus; IR_2 and RP_3 separated by a short crossvein one cell posterior to their origin; RP_2 beginning closer to Px 5 in right Fw, to Px 6 in left Fw, and to Px 4 in both Hw; pt pale brown with marginal yellow hairline, shorter than underlying cell, with costal side slightly shorter than posterior side.

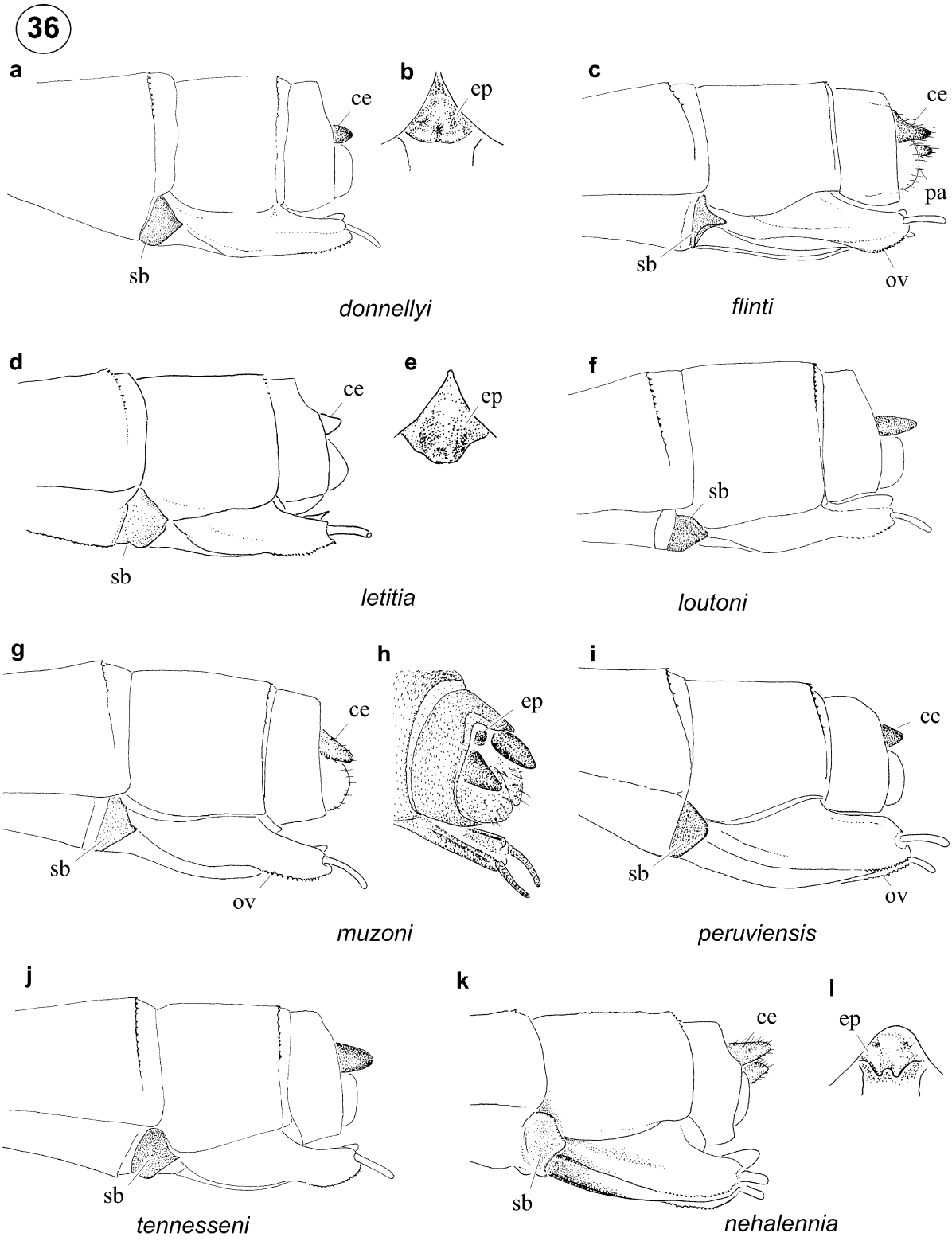


FIGURE 36. ♀ S8–10. (a–b) *Drepanoneura donnellyi* **sp. nov.**, paratype Colombia, Cristalina, (a) lateral view, (b) detail epiproct dorso-posterior view; (c) *D. flinti* **sp. nov.**, lateral view paratype Colombia, Puerto Abeja; (d–e) *D. letitia*, allotype, (d) lateral view, (e) detail epiproct dorso-posterior view; (f) *D. loutoni* **sp. nov.**, lateral view paratype Peru, Pakitza; (g–h) *D. muzoni* **sp. nov.**, paratype Ecuador, Yasuni, (f) lateral view, (g) dorso-posterior view; (i) *D. peruviensis*, lateral view Peru, Iquitos; (j) *D. tennesseni* **sp. nov.**, lateral view paratype Ecuador, Río Sandalias; (k–l) *Epipotoneura nehalennia*, allotype, (k) lateral view, (l) detail epiproct dorso-posterior view. ce: cercus; ep: epiproct; pa: paraproct; ov: ovipositor; sb: sub-basal plate of ovipositor.

Abdomen. Dorso-laterally black with metallic reflections except for narrow yellow bands interrupted medio-dorsally by black on base of S3–7; latero-ventral portion of terga and sterna pale brown to yellow. Apex of genital ligula with a deep ᴜ-shaped cleft (as in Fig. 17a) with long and broad latero-distal lobes curved medially (as in Fig. 17c). Dorso-posterior margin of S10 not projected posteriorly (as in Figs. 27e–28e). Ventral branch of cercus longer than base of cercus, approximately cylindrical (as in Fig 28e); in posterior view aligned with inner margin of cercus at base and diverging distally from ventral branch of opposite cercus (as in Fig. 30e). Paraproct truncate (as in Fig. 28e).

Dimensions. Total length 35.9 mm; abdomen length 30.8 mm; Hw 18.6 mm.

Paratypes. Paratypes are similar to holotype but vary as follows: femora banded to entirely dark brown; 4–6 spurs on metafemora, 5–6 on metatibiae; Hw 5.4–5.8 times as long as wide; 11–13 Px in Fw, 9–11 Px in Hw; MP reaching wing margin from vein descending from subnodus to half-length of the cell distal to it; and IR_2 arising at vein descending from subnodus or slightly distal to it (Fig. 11b). Posterior margin of female pronotum is trilobate with a medio-dorsal triangular projection, a dorso-lateral flat rounded process adjacent to medial projection and a ventro-lateral digitiform process on each side (Fig. 6); and the dorsal side of subbasal plate of ovipositor is concave and ventral side slightly convex (Fig. 36f).

Dimensions. Males (n = 10): total length 34.2–38.6 mm [mean 36.1 mm; SD 1.2]; abdomen 29.6–33.4 mm [mean 31.1 mm; SD 1.1]; Hw 18–19.8 mm [mean 18.6; SD 0.6]. Females (n = 6): total length 32.6–37.3 mm [mean 34.6 mm; SD 1.7]; abdomen 27.5–32 mm [mean 29.6 mm; SD 1.6]; Hw 19–21.3 mm [mean 19.8 mm; SD 0.8].

Diagnosis. Male of *D. loutoni* shares only with *D. tennesseni* the medially directed long and broad latero-apical lobes of genital ligula (Fig. 17c) and truncate paraproct (Fig. 28e), but differs by the approximately cylindrical ventral branch of cercus (Figs. 29e–30e), and usually by the presence of a narrow yellow stripe along most of humeral suture (Fig. 2h; obscured in some specimens). Female shares with *D. tennesseni* the pronotal posterior margin with a triangular medio-dorsal projection and posteriorly directed digitiform ventro-lateral processes, but it differs by the presence of a pair of dorso-lateral flat rounded processes adjacent to the medial projection (Fig. 6).

Biology. Specimens from Cusco Department were found at a large stream perched on vegetation just above water's surface and flying just above water in the sun and were hard to net (data from collection label). Felix Woytkowski included following notes with specimens he collected at Soritor: "keeps exclusively in shade beneath large trees growing along the river flowing across the jungle; lives in bushes fringing the waters, often hanging above the river and it is difficult to detect in account of the semidarkness; when disturbed rises up and lands on leaves of higher trees."

Distribution. Ecuador to Peru, from Morona-Santiago Province to Madre de Dios Department (Fig. 37).

***Drepanoneura muzoni* sp. nov.**
Figures 2j–k, 7, 18, 27f–30f, 36g–h, 37

Etymology. We name this species *muzoni* (noun in the genitive case) in honor of our good friend and colleague Javier Muzón, in gratitude for introducing the senior author to Odonatology and for his continuing aid during our studies, and in recognition of his contributions to the knowledge of neotropical Odonata.

Specimens examined. Total 45 ♂, 7 ♀.— **Holotype** ♂: Ecuador, Orellana Province, Parque Nacional Yasuni, stream on Waorani Reserve road (00°42'S, 76°28'W, 200 m), 18 vii 1996, leg. K.J. Tennessen (FSCA). **Paratypes**: Ecuador, Sucumbíos Province: 2 ♂, Limoncocha, forest stream (00°24'S, 76°36'W, 300 m), 23/24 vii 1977, leg. D.R. Paulson (DRP); 1 ♂, same data (RWG); 2 ♂, same data but 24 xi 1980, leg. M.J. Westfall, Jr. (FSCA); 3 ♂, 1 ♀, same data but Playaco River (243 m), 22/25 viii 1980, leg. K.W. Knopf (RWG); 3 ♂, same data (FSCA). Orellana Province: 1 ♂, Parque Nacional Yasuni, small stream 2.3 km E of Scientific

Research Station (00°38'S, 76°30'W, 180 m), 09 vi 1995, leg. K.J. Tennessen (RWG); 2 ♂, same data but slow stream 6.8 km from Scientific Station, 15 xi 1997 (KJT); 1 ♀, same data but stream at PC 29 & 30, 1.8 km from jct. with park road, 18 vii 1996 (RWG); 1 ♂, same data but 16 xi 1997 (RWG); 2 ♂, same data but leg. B. Mauffray (FSCA); 1 ♀, same data but Río Savaleto at km marker 31, 17 vii 1996 (KJT); 1 ♂, same data but stream at km 29 on Yasuni Road, 11 vi 1995 (KJT); 2 ♂, same data but km 46 on Waorani Reserve road, small forested stream (200 m), 16 xi 1997, leg. B. Mauffray (FSCA); 1 ♂, same data (RWG). Napo Province: 1 ♂, Río Jatún Yacu (01°01'S, 77°50'W, 700 m), 20 iii 1937, leg. W. Clarke-Macintyre (UMMZ); 2 ♂, 1 ♀, Río Chinchipino, E of Jatún Sacha, 27.7 km E of Puerto Napo (01°04'24"S, 77°35'12"W, 400 m), 13/22 vii 1996, leg. K.J. Tennessen (KJT); 1 ♂, same data (RWG); 3 ♂, same data but 13 xi 1997, leg. T.W. Donnelly (TWD); 2 ♂, same data (RWG); 6 ♂, Napo watershed, headwaters of Río Arajuna, stream 3 (01°05'S, 77°32'W, 1000 m), 23/30 iv 1941, leg. W. Clarke-Macintyre (UMMZ); 1 ♂, same data (MLP); 1 ♂, same data (RWG); 1 ♂, same data (TWD); 1 ♂, same data but stream 5 (RWG). Peru, Loreto Department: 1 ♀, Muniches, Río Paranapura on Río Huallaga (05°51'S, 76°10'W, 177 m), vii 1939, leg. G.G. Klug (RWG). Madre de Dios Department: 1 ♀, Pakitza, Res. Zone, PN Manu, Trail 1, Zone 2 to basecamp (11°56'S, 71°18'W, 250 m), 11 ix 1989, leg. J. Louton (USNM); 1 ♂, 1 ♀, same data but mrk. 18, seeps, 16/17 ix 1989, leg. N.E. Adams (USNM); 1 ♂, same data but 21 ix 1988, leg. O.S. Flint, Jr. (RWG); 2 ♂, Tambopata-Cándamo Reserved Zone, Camp 5, Río Tambopata east bank, at stream (12°50'18"S, 69°17'59"W), 12 i 1998, leg. M. Butt (RWG).

Male holotype. Head. Labium, labrum except medio-basal black spot, anteclypeus, and second antennal segment pale yellow; base of mandibles, genae, ventral half of antefrons, and triangular spot on anterior surface of antennifer pale blue, remainder of head black.

Thorax. Prothorax, mesepisternum, mesepimeron, and stripe along dorsal margin of metapleural suture black with metallic green and copper reflections; stripe along ventral margin of humeral suture, metepisternum, metepimeron, and pterothoracic venter pale yellow (Fig. 2j); coxae and trochanters yellow; femora yellow with three faint black bands; tibiae, tarsi, and pretarsi yellow with black apices; 4 spurs on metafemora, 6 on metatibiae. Hw 5.4 times as long as wide; 12 Px in Fw, 10 Px in Hw; MP reaching wing margin slightly distal to vein descending from subnodus; IR_2 arising just distal to vein descending from subnodus; IR_2 and RP_3 in contact one cell posterior to their origin; RP_2 beginning between Px 4 and 5 in right Fw, closer to Px 5 in left Fw and to Px 3 in both Hw; pt pale brown with yellow marginal hairline, shorter than underlying cell in Fw and as long as underlying cell in Hw, with costal side as long as or slightly shorter than posterior side.

Abdomen. Dorso-laterally black with metallic reflections except for narrow yellow bands interrupted medio-dorsally by black on base of S3–7; latero-ventral portion of terga and sterna pale brown to yellow. Apex of genital ligula with a shallow v-shaped cleft (Fig. 18a) and latero-distal lobes short, broad and curved medially (Fig. 18c). Dorso-posterior margin of S10 projected posteriorly (Figs. 27f–28f). Ventral branch of cercus as long as base of cercus, approximately cylindrical (Fig. 28f), in posterior view arising at mid-width of cercus and parallel to ventral branch of opposite cercus (Fig. 30f). Paraproct pointed (Fig. 28f).

Dimensions. Total length 33.8 mm; abdomen length 27.3 mm; Hw 18.5 mm.

Paratypes. Paratypes are similar to holotype but vary as follows: some specimens with pale humeral stripe and metepisternum obscured; femur yellow with one apical black band to entirely dark brown; 3-4 spurs on metafemora, 5–6 on metatibiae; Hw 5.3–5.6 times as long as wide; 11–15 Px in Fw, 9–12 Px in Hw; MP reaching wing margin at vein descending from subnodus to slightly distal to it, and IR_2 sometimes arising at vein descending from subnodus; IR_2 and RP_3 separated by a short crossvein one cell posterior to their origin; and RP_2 beginning between Px 4–7 in Fw and Px 3–4 in Hw. Female has ventral fourth of labrum yellow; more extensive pale color on mesepimeron and metepisternum (Fig. 2k); posterior margin of pronotum medially cleft with a pair of dorsally directed laminar dorso-lateral processes, and a pair of medio-posteriorly directed laminar ventro-lateral processes on each side (Fig. 7); and ventral side of sub-basal plate of ovipositor approximately linear and dorsal side concave (Fig. 36g).

Dimensions. Males (n=10): total length 32.2–35.7 mm [mean 33.9 mm; SD 1.2]; abdomen 27.3–30.7 mm [mean 28.9 mm; SD 1.1]; Hw 18–20.3 mm [mean 18.8 mm; SD 0.7]. Females (n=7): total length 30.7–33 mm [mean 32.1 mm; SD 0.7]; abdomen 26.2–28.2 mm [mean 27.4 mm; SD 0.7]; Hw 18.6–19.9 mm [mean 19 mm; SD 0.4].

Diagnosis. Male of *D. muzoni* shares with *D. flinti* and *D. peruviensis* the ventral branch of cercus arising at mid-width (not aligned with inner margin of cercus) and convergent to branch of opposite cercus at tip only (Fig. 30f). It differs from both by the ventral branch of cercus being as long as base of cercus (Fig. 28f) and usually by the presence of pale mesepisternal stripes (Fig. 2j; obscured in some specimens), and further from *D. peruviensis* by the apex of genital ligula with a shallow v-shaped cleft (Fig. 18a). Female is unique by its two pairs of laminar lateral processes on each side of posterior margin of pronotum, with the dorsal pair upright in lateral view (Fig. 7b).

Biology. Adults were collected at forest streams and rivers.

Distribution. Orellana Province in Ecuador to Madre de Dios Department in Peru (Fig. 37).

***Drepanoneura peruviensis* (Fraser 1946) comb. nov.**
Figures 1a, 2l–m, 8, 19, 27g–30g, 36i, 37

Protoneura peruviensis Fraser 1946: 459–460, figs. 5a–b (description of male, illustration of male S10); — Soukup (1954: 13; listed from Peru); — Rácenis (1959: 472; listed from Peru); — Kimmins (1966: 209; type catalog); — Davies & Tobin (1984: 117; synonymic list); — Steinmann (1997: 453; synonymic list).
Epipleoneura peruviensis Bridges (1994: VII.184; synonymic list); —Tsuda (2000: 12; synonymic list).

Specimens examined. Total 4 ♂, 2 ♀. — **Holotype** ♂, Peru, Loreto Department, Mishuyacu [near Iquitos] (03°51'S, 73°13'W), 02 vii 1930 (BMNH); 1 ♂, same data as holotype but Río Amazonas, Iquitos, ix 1938, leg. G.G. Klug (RWG); 2 ♂, same data but i/iv 1940 (RWG); 2 ♀, same data but vi 1939 (RWG).

Characterization. Posterior prothoracic lobe smoothly convex in male, with a wide and short semicircular medio-ventral projection in female (Fig. 8). Pterothoracic dorsum dark to upper 0.7 of metapleural suture in male (Fig. 2l), to mid-height of metepisternum and with a black stripe along anterior margin of metapleural suture in female (Fig. 2m). Apex of male genital ligula with a deep u-shaped cleft (Fig. 19a) and latero-distal lobes short, broad, and curved medially (Figs. 19b–c). Dorso-posterior margin of male S10 projected posteriorly (Figs. 27g–28g). Ventral branch of male cercus longer than base of cercus, approximately cylindrical (Fig. 28g), in posterior view arising at mid-width and convergent to branch of opposite cercus at tip (Fig. 30g). Paraproct pointed (Fig. 28g). Ventral and dorsal sides of sub-basal plate of female ovipositor linear (Fig. 36i).

Diagnosis. Male of *D. peruviensis* shares the ventral branch of cercus arising at mid-width and convergent to the branch of opposite cercus at tip only with *D. flinti* and *D. muzoni* (Fig. 30g); it differs from both by having the apex of genital ligula with a deep u-shaped cleft (Fig. 19a), and further from *D. muzoni* by the ventral branch of male cercus being longer than the base of cercus (Fig. 28g) and the absence of pale mesepisternal stripes (Fig. 2l). Female is unique by the presence of a medio-ventral semicircular projection on posterior margin of pronotum (Fig. 8) and by both ventral and dorsal sides of sub-basal plate of ovipositor linear (Fig. 36i).

Biology. Adults were collected at streams and rivers.

Distribution. Loreto Department, Peru (Fig. 37).

***Drepanoneura tennesseni* sp. nov.**
Figures 2n–o, 9, 20, 27h–30h, 36j, 37

Etymology. We name this species *tennesseni* (noun in the genitive case) in honor of our good friend and colleague Kenneth J. Tennessen, who first collected this species and recognized it as different from *D. peruviensis*, in recognition of his contributions to the knowledge of New World Odonata and his friendship and assistance.

Specimens examined. Total 45 ♂, 6 ♀.— **Holotype** ♂: Ecuador, Napo Province, Río Chinchipino, E of Jatún Sacha, 27.7 km E of Puerto Napo (01°04'24"S, 77°35'12"W, 400 m), 13 vii 1996, leg. K.J. Tennessen (FSCA). **Paratypes**: Ecuador, Sucumbíos Province: 2 ♂, Santa Cecilia, Río Aguarico (00°05'06"S, 76°59'33"W, 458 m), 25/31 iii 1969, leg. P.M. & P.J. Spangler (USNM); 1 ♂, Limoncocha, Río Playaco (00°24'S, 76°36'W, 243 m), 22 viii 1980, leg. K.W. Knopf (RWG). Orellana Province: 1 ♂, 1 ♀, stream 8.5 km E of Loreto (00°37'06"S, 77°17'42"W, 400 m), 14 xi 1997, leg. K.J. Tennessen (KJT). Napo Province: 1 ♂, Río Jatún Yacu (01°01'S, 77°50'W, 700 m), xii 1934, leg. W. Clarke-Macintyre (UMMZ); 1 ♂, same data (RWG); 1 ♂, side branch of Río Sinde, 5.3 km E of Puerto Napo on Jatún Sacha Road (01°03'S, 77°47'W, 522 m), 15 vi 1995, leg. K.J. Tennessen (KJT); 1 ♂, same data but 13 vii 1996, leg. K.J. Tennessen (KJT); 1 ♂, same data (RWG); 1 ♂, 1 ♀, same data but 12 xi 1997, leg. J.J. Daigle (RWG); 6 ♂, same data but leg. B. Mauffray (FSCA); 2 ♂, 1 ♀, same data (RWG); 1 ♂, same data but 6 km E of hwy 45 on Jatún Sacha road, 15 vi 1995 (FSCA); 1 ♂, same data but leg. K.J. Tennessen (KJT); 4 ♂, same data but 12 xi 1997 (KJT); 2 ♂, same data but leg. T.W. Donnelly (TWD); 1 ♂, same data (RWG); 1 ♂, same data but 11.2 km E of hwy 45 on Jatún Sacha Road, RíoTiyuyacu, 13 xi 1997, leg. B. Mauffray (FSCA); 1 ♂, 1 ♀, same data as holotype but 22 vii 1996 (KJT); 1 ♂, same data but 15 vi 1995 (KJT); 2 ♂, same data but 13 xi 1997 (KJT); 1 ♂, 1 ♀, same data but leg. T.W. Donnelly (TWD); 1 ♂, same data (RWG); 2 ♂, Río Anzu, Hacienda Ila (01°12'S, 77°50'W, 700 m), 18 xii 1937, leg. W. Clarke-Macintyre (UMMZ); 1 ♂, same data (RWG). Pastaza Province: 3 ♂, 1 ♀, Río Sandalias, 5 km S Puyo (01°30'01"S, 77°57'08"W, 700 m), 11 xi 1997, leg. K.J. Tennessen (KJT); 1 ♂, same data (RWG); 2 ♂, same data but leg. B. Mauffray (FSCA); 1 ♂, same data but leg. T.W. Donnelly (TWD).

Male holotype. Head. Labium, labrum except medio-basal black spot, anteclypeus, and second antennal segment pale yellow; base of mandibles, genae, ventral half of antefrons, and triangular spot on anterior surface of antennifer pale blue, remainder of head black.

Thorax. Prothorax, mesepisternum, mesepimeron, and stripe along dorsal margin of metapleural suture black with metallic green and copper reflections; metepisternum, metepimeron, and pterothoracic venter pale yellow; a short yellow humeral stripe and spot at posterior end of suture (as in Fig. 2n); coxae and trochanters yellow; femora black with yellow base and stripe at outer distal fifth; tibiae yellow with black base and apex; tarsi and pretarsi yellow with black apices; 4 spurs on metafemora, 6–7 on metatibiae. Hw 5.5 times as long as wide; 12 Px in right Fw, 13 in left Fw, 10 Px in both Hw; MP reaching wing margin slightly distal to vein descending from subnodus; IR_2 arising at vein descending from subnodus in Fw, slightly distal to it in Hw; IR_2 and RP_3 separated by a short crossvein one cell posterior to their origin; RP_2 beginning closer to Px 5 in Fw and to Px 3 in Hw; pt pale brown with marginal yellow hairline, shorter than underlying cell, with costal side slightly shorter than posterior side.

Abdomen. Dorso-laterally black with metallic reflections except for narrow yellow bands interrupted medio-dorsally by black on base of S3–7; latero-ventral portion of terga and sterna pale brown to yellow. Apex of genital ligula with a deep u-shaped cleft (Fig. 20a) with long and broad latero-distal lobes curved medially (Figs. 20b–c). Dorso-posterior margin of S10 not projected posteriorly (Figs. 27h–28h). Ventral branch of cercus as long as base of cercus, in lateral view flat, wide, and truncate apically (as in Fig. 28h), in posterior view aligned with inner margin of cercus at base and diverging distally from ventral branch of opposite cercus (as in Fig. 30h). Paraproct truncate (Fig. 28h).

Dimensions. Total length 33.1 mm; abdomen length 28.3 mm; Hw 17.4 mm.

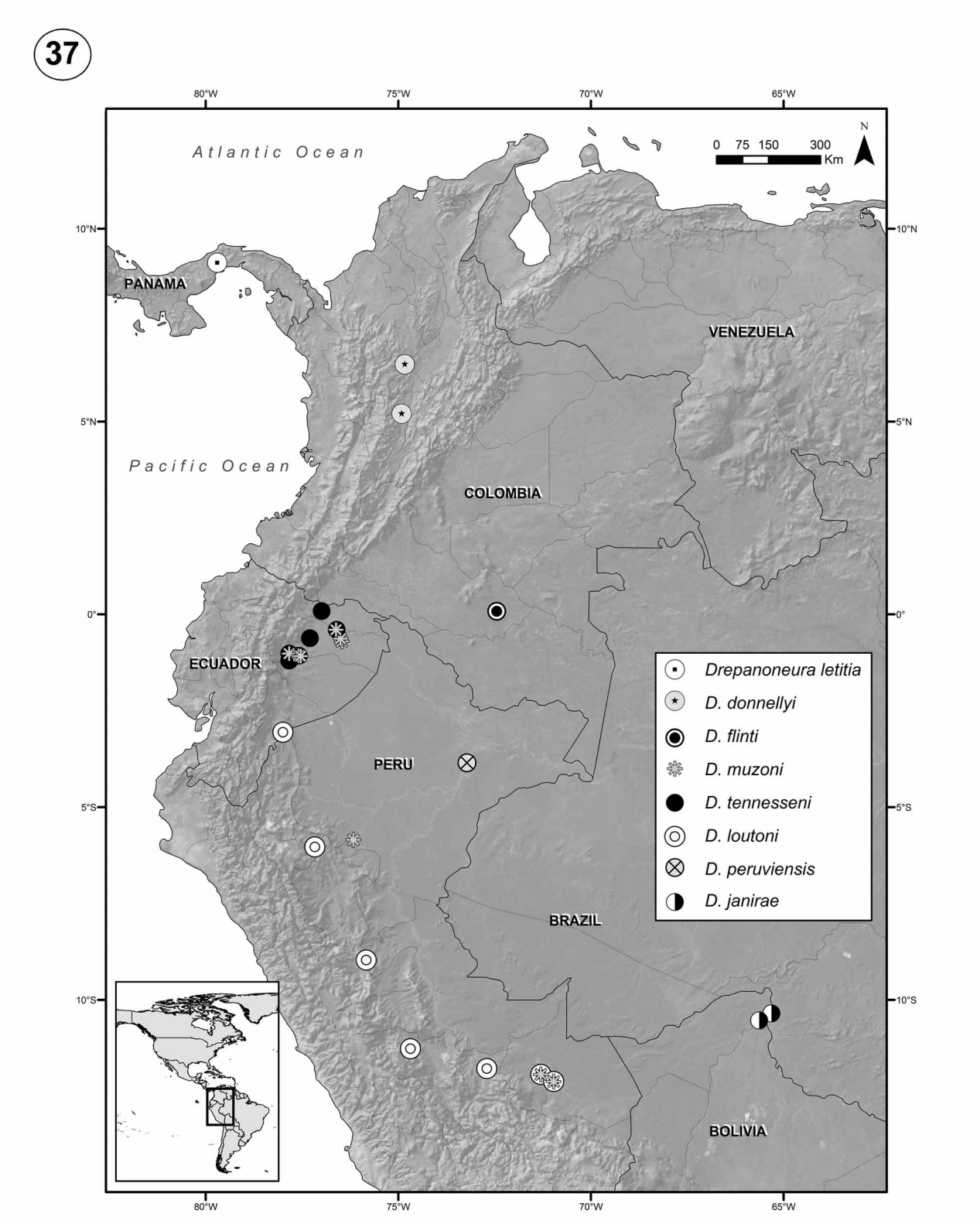


FIGURE 37. Distribution map of *Drepanoneura* in the Neotropical region.

Paratypes. Paratypes are similar to holotype but vary as follows: some specimens with femora entirely brown; 5–6 spurs on metatibiae; Hw 5.7 times as long as wide; 10–13 Px in Fw, and 8–11 Px in Hw. Posterior margin of female pronotum is trilobate, with a medio-dorsal triangular projection, and laterally with a posteri-

orly directed ventro-lateral digitiform projection (Fig. 9). The sub-basal plate of ovipositor has a concave dorsal margin and slightly convex ventral margin (Fig. 36j).

Dimensions. Males (n= 10): total length 33.1–36.0 mm [mean 34 mm; SD 1]; abdomen 27.4–31.0 mm [mean 29.1 mm; SD 0.9]; Hw 17.0–19.2 mm [mean 17.7 mm; SD 0.7]. Females (n=6): total length 31.8–32.8 mm [mean 32.3 mm; SD 0.4]; abdomen 26.9–27.7 mm [mean 27.3 mm; SD 0.3]; Hw 18.0–20.1 mm [mean 18.6 mm; SD 0.7].

Diagnosis. Male of *D. tennesseni* is unique by having the ventral branch of cercus in lateral view wide, laminar, and truncate apically (Fig. 28h). Female is unique by its posterior margin of pronotum with a mediodorsal triangular projection and having only one pair of ventro-lateral digitiform processes (Fig. 9); see under *D. loutoni* for further diagnosis.

Biology. Adults were collected at rivers.

Distribution. Ecuador, from Sucumbíos to Napo Provinces (Fig. 37).

Epipleoneura Williamson 1915

Figures 11c, 21–23, 31–33, 38

Type species: *Epipleoneura lamina* Williamson 1915 by original designation.

Diagnosis. See under *Drepanoneura*.

Distribution. South America, within forests from Venezuela and the Guyanas south through Ecuador, E Peru, and Brazil to Bolivia, Paraguay, and NE Argentina.

Remarks. The erection of *Drepanoneura* and corresponding transfer of two species formerly placed in *Epipleoneura* leaves 24 names currently associated with the latter genus. Fraser (1946) described *Protoneura protostictoides* from Mishuyacu, Peru, based on an incomplete male lacking S9–10, and he diagnosed it from other neotropical protoneurids by wing venation, size, and color. Examination of the holotype of *Protoneura protostictoides* by RWG convinced him that it is an *Epipleoneura* by its overall size, color pattern, and genital ligula morphology, and he (Garrison 1991: 29) suggested its synonymy with *E. lamina*. However, due to the speciose nature, poor knowledge of distributions, and high likelihood of new taxa within *Epipleoneura* we consider that it advisable to retain the name *Epipleoneura protostictoides* until further studies of material from the Mishuyacu region can be realized.

During August 1990, RWG and T.W. Donnelly collected a series of a small *Epipleoneura* in Bolívar State, Venezuela, which approaches *E. capilliformis* except for the shape of its sclerotized epiproct. This species, known only from a series of males, is described and compared with its sibling species *E. capilliformis*.

Epipleoneura demarmelsi sp. nov.

Figures 11c, 22, 32, 38

Etymology. We name this species *demarmelsi* (noun in the genitive case) in honor of our good friend and colleague Jürg De Marmels, in recognition of his invaluable contributions to the knowledge of New World Odonata and his continuing kind aid in our studies.

Specimens examined. Total 25 ♂.— **Holotype** ♂: Venezuela, Bolívar State, Río Churún at entrance to Salto Ángel (05°58'S, 62°31'W, 800 m), 10/11 viii 1990, leg. T.W. Donnelly (FSCA). **Paratypes**: 5 ♂, same data as holotype (TWD); 9 ♂, same data (RWG); 2 ♂, Río Chaverú, 4 km W of El Paují (04°28'N, 61°37'W, 900 m), 06 viii 1990, leg. T.W. Donnelly (TWD); 3 ♂, same data but leg. R.W. Garrison (RWG); 1 ♂, same data but Santa Elena de Uairén, El Paují, streams in forest N of village, 30 vii 1991, leg. G.S. Vick (RWG); 1

♂, same data (GSV); 1 ♂, Río Cinco Ranchos, 15 km E of El Paují (04°34'N, 61°31'W, 900 m), 07 viii 1990, leg. R.W. Garrison (RWG); 2 ♂, same data but leg. T.W. Donnelly (TWD).

Male holotype. Head. Labium, anteclypeus, and genae pale yellow; labrum black except for narrow marginal yellow rim; base of mandibles, postclypeus, and antefrons glossy black; remainder including rear of head matte black; anterior surface of antennifer dark brown laterally, antennal pedicel and flagellum brown.

Thorax. Matte black; hind margin of prothorax evenly rounded with lateral rim becoming dark brown, prosternum light yellow with medio-ventral black spot; mesothorax with thin pale hairline along humeral suture interrupted at mesopleural fossa, mesostigmal plates flat and simple, with transverse length shorter than width of medial disc; metathorax becoming paler latero-ventrally and smudged with black along anterior half of metinfraepisternum; venter of thorax pale. Coxae pale smudged with black externally; trochanters yellow except for narrow margin of black between sutures; femora dark brown, becoming black distally; tibiae yellow with black base and apex, inner surface brown; tarsi and pretarsi yellow with black apices; 4 spurs on metafemora, 6 on metatibiae. Wings (as in Fig. 11c) 5.4 as long as wide; 12 Px in Fw,10 in Hw; antenodal space 1 shorter than twice the length of 2, and about as long as 3; CuA and CuP&AA completely fused to wing margin; MP reaching wing margin at basal third of first cell posterior to vein descending from subnodus; IR_2 arising at vein descending from subnodus; IR_2 and RP_3 separated by a short crossvein; divergence of RP-RA (arculus) distal to Ax 2; RP_2 in Fw beginning at Px 5 and in Hw at Px 3; pt pale brown with marginal yellow hairline, in Fw as long as underlying cell with costal side shorter than posterior side, in Hw longer than underlying cell with costal side as long as posterior side.

Abdomen. Dorso-laterally matte black except for narrow yellow bands interrupted medio-dorsally by black on base of S3–7; latero-ventral portion of terga and sterna pale brown to yellow. Genital ligula distal segment markedly constricted at mid-length, with a u-shaped cleft at apex (as in Fig. 22a); no inner fold or internal processes; a pair of latero-posterior flap-like pedunculate projections externally at level of flexure (as in Fig. 22a). Dorso-posterior margin of S10 not projected posteriorly (Figs. 32a–b). Cercus shorter than S10, with a dorso-apical hook and a short ventro-basal branch directed medially and adjacent to that of opposite cercus (Figs. 32b–c). Paraproct as long as cercus; epiproct forming a sclerotized, decumbent plate between cerci, with a medio-dorsal blunt tooth and distal margin trilobate (Figs. 32b–c).

Dimensions. Total length 36.1 mm; abdomen length 31.1 mm; Hw 18.5 mm.

Paratypes. Some paratypes are young specimens with slight metallic luster on black of thorax and head, and femora lighter brown. Variation is as follows: 3–5 spurs on metafemora and 5–7 on metatibiae, 10–11 Px in Hw, MP reaching wing margin at half to entire length of first cell posterior to vein descending from subnodus, RP_2 in Fw beginning at Px 4 or 5 (mostly at 5), and in Hw at Px 3 or 4 (mostly at 3). Female unknown.

Dimensions. (n = 10): total length 34.0–35.9 mm [mean 35.1 mm; SD 0.6]; abdomen length 29.0–30.6 mm [mean 30.0 mm; SD 0.6]; Hw 17.8–18.6 mm [mean 18.42 mm; SD 0.4].

Diagnosis. *Epipleoneura demarmelsi* is most similar in morphology to *E. capilliformis*. The shape of the cerci and paraprocts is essentially the same (Figs. 31–32), but in *E. demarmelsi* the ventral margin of the epiproct is convexly curved (Figs. 32b–c), while in *E. capilliformis* it forms a bluntly shaped quadrangular process (Figs. 31b–c).

Biology. Adults were inconspicuous. They were collected as they hovered near margins of forest rivers and streams.

Distribution. Bolívar State in Venezuela (Fig. 38).

***Epipotoneura* Williamson 1915**
Figures 10, 12, 25–26, 34–35, 36k–l, 38

Type species: *Epipotoneura nehalennia* Williamson 1915 by original designation.

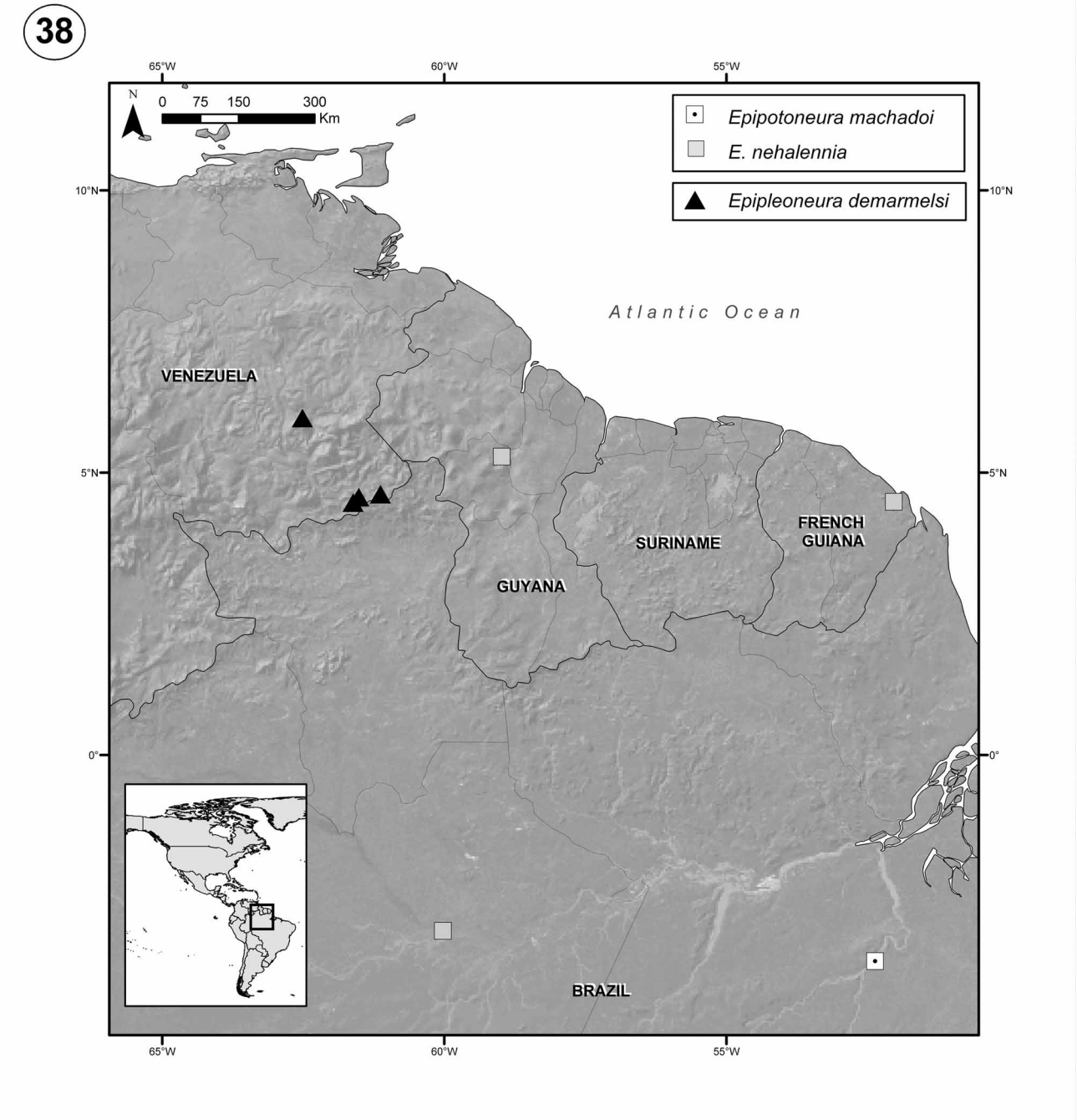


FIGURE 38. Distribution map of *Epipotoneura* and *Epipleoneura demarmelsi* in the Neotropical region.

Generic characterization. Head. Frons angulate in profile, with carina continued on dorsal surface of antennifer; labium, ventral third of labrum, base of mandibles, genae, anteclypeus, ventral half of antefrons, and triangular spot on anterior surface of antennifer pale yellow; remainder of head including rear of head black; dorsum of head with slight green metallic luster.

Thorax. Pterothorax black, ventral margin of propleuron becoming pale yellow, prosternum light yellow with midventral black spot, postero-lateral margin of prothorax with moderate lobes, not longer than wide, and posterior margin of pronotum smoothly rounded in males, and smoothly convex in known female (Fig. 10). Mesostigmal plates in both male and female flat and simple, with transverse length shorter than width of medial disc. Wings (Fig. 12) about 6 times as long as wide; antenodal space 1 shorter than twice the length of 2, and shorter than or as long as 3; CuA and CuP&AA completely fused to wing margin; MP reaching wing

margin within the first cell posterior to vein descending from subnodus; IR_2 arising at vein descending from subnodus or just distal to it (intraspecifically variable); IR_2 and RP_3 separated by a short crossvein or joined one cell posterior to their origin (intraspecifically variable); divergence of RP-RA (arculus) distal to Ax 2; RP_2 in Fw beginning closer to Px 4–5 (more frequently at 5) and in Hw closer to Px 3; pt shorter than or as long as underlying cell, with its costal side as long as its posterior side or slightly longer. Spurs on femora and tibiae shorter than twice intervening spaces; pretarsal claws with well developed supplementary teeth.

Abdomen. Dorso-laterally entirely or almost entirely black with metallic reflections, except for narrow distal yellow rings on S3–6; latero-ventral portion of terga and sterna pale brown to yellow. Male genital ligula lacking a true inner fold basal to flexure, with a single bifid process (Figs. 25b–c) or a pair of short membranous inner processes distal to flexure (Figs. 26b–c), and apex entire with latero-apical corners not projected into lobes (Figs. 25a–26a). Postero-dorsal margin of male S10 recessed (Figs. 34–35). Male cercus in lateral view as long as or slightly longer than S10 (Figs. 34a–35a), forcipate in dorsal view (Figs. 34d–35d), with a sub-basal tooth on its ventro-outer margin (Figs. 34a–c–35a, c). Male paraproct shorter than half of cercus length, and epiproct shorter than a sixth of cercus, small, and bifid in both male and female (Figs. 34b, d–e, 35b, d–e, 36l). Female cerci conical, shorter than S10; outer valves of ovipositor with a single row of teeth along distal three fifths; sub-basal plate of ovipositor meeting its counterpart ventrally, with dorsal and ventral sides concave, tip of ovipositor (excluding stylus) extending beyond posterodorsal margin of S10 but not surpassing tip of cerci (Fig. 36k). Larva unknown.

Diagnosis. See under *Drepanoneura*.

Distribution. Amazonian forest of Guyana and French Guiana to Brazil (Fig. 38).

Species included. *Epipotoneura machadoi* **sp. nov.** and *E. nehalennia* Williamson 1915

***Epipotoneura machadoi* sp. nov.**
Figures 12a, 25, 34, 38

Etymology. We name this species *machadoi* (noun in the genitive case) in honor of our friend and colleague Angelo B.M. Machado, in recognition of his manifold contributions to the knowledge of neotropical Odonata and his continuous assistance in our studies.

Specimens examined. Total 2 ♂.— **Holotype** ♂: Brazil, Pará State, Rio Xingu Camp, ca. 60 km S of Altamira, Igarapé Jabutí, Malaise trap (03°39'S, 52°22'W), 11 x 1986, leg. P. Spangler & O. Flint (USNM). **Paratype** ♂, same data as holotype but 15 x 1986 (RWG).

Male holotype. **Head**. Labium, ventral fourth of labrum, base of mandibles, genae, anteclypeus, and ventral half of antefrons ivory white; remainder of head including rear of head black; dorsum of head with slight green metallic luster.

Thorax. Largely black with metallic green luster; prothorax with rim of anterior lobe and ventral margin of propleuron light yellow; distal tip of mesostigmal plate and metathorax except for upper fourth of metepisternum pale yellow; venter of thorax, coxae, sides of femora pale yellow; posterior surfaces of femora and trochanter-femoral juncture brown, tip of femora edged with black; remainder of legs pale yellow, armature black; 4 spurs on metafemora, 6 on metatibiae. Hw (Fig. 12a) 5.1 times as long as wide; 9 Px in Fw, 8 Px in Hw; MP reaching wing margin slightly distal to basal third of first cell posterior to vein descending from subnodus; IR_2 arising at vein descending from subnodus; IR_2 and RP_3 separated by a short crossvein one cell posterior to their origin; RP_2 beginning closer to Px 4 in Fw and closer to Px 3 in Hw; pt pale brown with yellow marginal hairline, shorter than underlying cell, with costal side slightly longer than posterior side.

Abdomen. Dorso-laterally black except for narrow yellow bands interrupted medio-dorsally by black on base of S3–7; latero-ventral portion of terga and sterna pale brown to yellow, apical third of S9 pale yellow and connecting with yellow ventrally. Genital ligula with apex entire (Fig. 25a) and a single bifid inner pro-

cess distal to flexure (Figs. 25b–c). Cercus longer than male S10 in lateral view, widest at level of sub-basal tooth (Figs. 34a, c), which is prominent and visible in medio-dorsal view (Fig. 34b).

Dimensions. Total length 28.7 mm; abdomen length 24.3 mm; Hw 13.6 mm.

Paratype. Paratype is similar to holotype except for stronger metallic green luster, dorso-lateral yellow on S9 replaced by dull orange and interrupted by black above. Hw is 4.95 times as long as wide; there are 8 Px in Fw, 7 Px in Hw; and MP in Fw reaches wing margin slightly distal to half length of first cell posterior to vein descending from subnodus. Female unknown.

Dimensions. Male (n = 1): total length 27.9 mm; abdomen 23.5 mm; Hw 13.6 mm.

Diagnosis. Male of *Epipotoneura machadoi* differs from its sibling species *E. nehalennia* only by morphology of cercus and genital ligula. Cercus in *E. machadoi* is slightly longer than S10 (Fig. 34a) and widest at base, and there is a single well-developed medially curved sub-basal tooth which extends below ventral margin of cercus (best seen in medio-dorsal, lateral, and ventro-lateral views; st, Figs. 34a–c). Cercus in *E. nehalennia* is sub-equal to S10 (Fig. 35d), comparatively shorter than in *E. machadoi* (Fig. 34d) and parallel-sided at base, and the medially curved sub-basal tooth is hidden in lateral view (Fig. 35a) but it can be seen in latero-ventral view (st, Fig. 35c). Genital ligula of *E. machadoi* has one bifid inner process (Figs. 25b–c), while there are two relatively smaller digit-like inner processes in *E. nehalennia* (Figs. 26b–c).

Both species superficially resemble *Epipleoneura haroldoi* Santos 1964 by caudal appendage morphology (Figs. 33a–b), but in that species the epiproct is large, sclerotized, and apically bifid so that the lateral margins approximate the medial margins of the cerci (Fig. 33c); the epiproct in *Epipotoneura* is small, not sclerotized, and its sides do not come into contact with the mesal margins of the cerci (Figs. 34d–e–35d–e). The genital ligula of *Epipotoneura* (Figs. 25–26) lacks the modified latero-posterior (Figs. 21-23) pedunculate processes which uniquely characterize *Epipleoneura*.

Biology. Types were collected at a river.

Distribution. Pará State, Brazil (Fig. 38).

Epipotoneura nehalennia Williamson 1915

Figures 10, 12b–c, 26, 35, 36k–l, 38

Epipotoneura nehalennia Williamson 1915: 618, 620, 630–635, figs. 10, 22, 33–34 (description of male and female; photograph of wings and illustration of thoracic color pattern and male S10); — Davies & Tobin (1984: 115; synonymic list); — Bridges (1994: VII.163; synonymic list); — Steinmann (1997: 446; synonymic list); —Tsuda (2000: 13; synonymic list); — Pessacq (2008: 16; key for males of Protoneuridae).

Epipotoneura sp. — Machet (1989: 8; record for French Guiana).

Specimens examined. Total 3 ♂, 2 ♀.— Guyana, Upper Demerara-Berbice region: **Holotype** ♂, **Allotype** ♀, Potaro Landing (05°59'N, 58°33'W), 02 x 1912, leg. J.A. & E.B. Williamson & B.J. Rainey (UMMZ). Potaro-Siparuni region: 1 **paratype** ♀ [represented only by wings mounted on a slide], Tumatumari (05°17'N, 58°59'W, 20 m), 08 ii 1912, leg. J.A. & E.B. Williamson & B.J. Rainey (UMMZ). Brazil, Amazonas State: 2 ♂, Manaus (03°06'48"S, 60°01'31"W, 34 m), 06 viii 1964, leg. A.B.M. Machado (RWG).

Characterization. Posterior lobe of pronotum smoothly convex (Fig. 10). Hw (Figs. 12b–c) 5.1–5.2 times as long as wide; 10–11 Px in Fw, 8 Px in Hw; RP_2 beginning closer to Px 5 in Fw and closer to Px 3 in Hw. Genital ligula with apex entire (Fig. 26a) and paired inner processes distal to flexure (Figs. 26b–c). Male cercus about as long as male S10 in lateral view, widest posteriorly to sub-basal tooth (Figs. 35a, c), which is low and not visible in medio-dorsal view (Fig. 35b). Female cerci conical, shorter than S10; outer valves of ovipositor with a single row of teeth along distal three fifths; sub-basal plate of ovipositor meeting its counterpart ventrally, with dorsal and ventral sides concave; tip of ovipositor (excluding stylus) extending beyond postero-dorsal margin of S10 but not surpassing tip of cerci (Fig. 36k).

Dimensions. Males (n = 3): total length 27.0–30.0 mm [mean 28.5 mm; SD 2.1]; abdomen 23.0–25.5 mm [mean 24.2 mm; SD 1.8]; Hw 12.6–14.0 mm [mean 13.3 mm; SD 0.7]. Female (n = 1): total length 26 mm; abdomen 21.8 mm; Hw 15 mm.

Diagnosis. See under *E. machadoi*.

Biology. Adults were collected at rivers.

Distribution. Amazonas State in Brazil, Guyana, and French Guiana (Fig. 38).

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