

## The Central American species of *Diplonevra* Lioy (Diptera: Phoridae)

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### Abstract

The species of *Diplonevra* Lioy of Central America are reviewed, with particular attention to the structure at the base of the posterior face of the hind femur. Six species are recognized, five of which are new to science: *D. ereba*, *D. goliatha*, *D. hypermekka*, *D. truncatiseta*, and *D. gnoma*. The sole described species, *D. setigera* (Malloch), is found to be a senior synonym of the North American *D. gaudialis* (Cockerell) and the Brazilian *D. impressa* (Borgmeier), both **new synonyms**.

**Key words:** Diptera, Phoridae, new species, Neotropical, taxonomy, key

### Introduction

The genus *Diplonevra* Lioy is a worldwide group of 78 currently recognized species. Although the greatest species richness so far recognized is in the Palearctic Region, much of the Neotropical fauna is still to be assessed. These flies are prominent in the phorid catches from middle elevation sites throughout Central and South America, but so far only 15 Neotropical species have been recognized, and none have been described since the latest review of the fauna (Borgmeier, 1969).

The way of life of most species of *Diplonevra* is unknown. This is especially true of Neotropical species, for which records are exceedingly scarce. For the warm tropical parts of this region (i.e. excluding extreme southern South America), the only existing information is that of Disney (1995), who recorded *D. setigera* (Malloch) (as *D. impressa* (Borgmeier)) from light traps operated in caves in Trinidad. This species is found widely outside of caves, however, and is clearly not obligatorily associated with this environment. Elsewhere in the world (summarized by Disney, 1994), *Diplonevra* larvae are scavengers,

sometimes associated with fungi and social insects, as well as parasitoids of earthworms and termites. Adults of some species are known to visit flowers.

There has been a significant advance in the recognition of *Diplonevra* species, namely the recognition of the importance of the setation and processes of the base of the posterior face of the hind femur and the setation of the trochanter (e.g. Disney, 1983: figs. 46–53). All species need to be re-examined to determine the character states in this part of the body, to allow development of a more rational basis for the species in the group. Using these characters in particular, we examined our holdings of Central American specimens of *Diplonevra* to produce the following review.

### Methods & materials

Most specimens examined were collected by Malaise traps, preserved in alcohol, then chemically dried using hexamethyldisilazane (Brown, 1993).

All specimens have a barcoded insect label, and their data are stored at the LACM. Barcode data for holotypes is presented in square brackets for their easy identification.

Material is deposited in the following collections (for more details on collections, see Arnett et al., 1993):

- EAPC—Escuela Agrícola Panamericana, Honduras
- EMUS—Utah State University, Logan
- INBC—Instituto Nacional de Biodiversidad, Costa Rica
- LACM—Natural History Museum of Los Angeles County
- MCZC—Museum of Comparative Zoology, Harvard University
- MIUP—Museo de Invertebrados, Universidad de Panama
- MUCR—Universidad de Costa Rica, San José
- MZLU—Lund University, Sweden
- NHRM—Naturhistoriska Riksmuseet, Stockholm, Sweden
- SEMC—Entomology Museum, University of Kansas
- USNM—United States National Museum, Washington

### Genus *Diplonevra* Lioy

*Diplonevra* Lioy, 1864: 77.

Diagnosis. Frons with one pair reclinate supra-antennal setae. Anepisternum bare, undivided. Midtibia with near basal pair of isolated large setae, one anterior and one posterodorsal. Hind tibia with 2 dorsal longitudinal setal palisades (3 palisades in some extralimital species). Wing vein  $R_{2+3}$  present. Male with cercus a separate, smaller sclerite mounted on long stalk (Figs. 20–25), of contentious origin (Disney, 1986; Brown, 1992).

***Diplonevra ereba* new species**

Figs. 1, 14, 20.

**Recognition.** This species and *D. goliatha* are the only New World *Diplonevra* with a row of enlarged anterodorsal setae. In Borgmeier's (1969) latest key to Neotropical species, couplet 1 gives the alternatives "hind tibia with anteroventral bristles" versus "hind tibia without anteroventral bristles", which theoretically could allow species with anterodorsal setae; however, none of the other Neotropical species have them. Unlike *D. goliatha*, *D. ereba* has a dark brown palpus, forelegs, and halter, as well as many thick setae at the base of the inner face of the hind femur (Fig. 1). Females of both species are among the largest New World phorids.

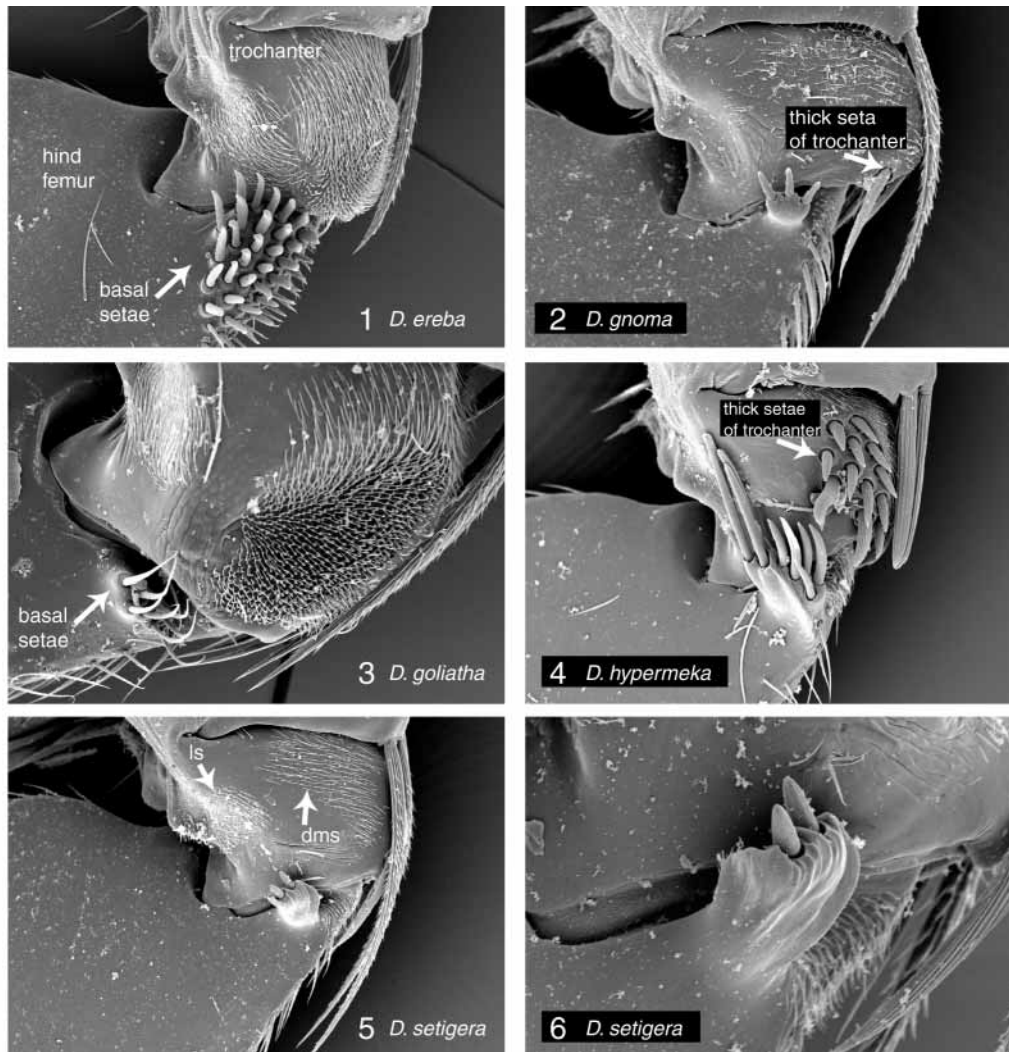
**Description.** Male. Body length 3.95–4.25 mm. Frons black, shallowly punctate. Mean frontal width 0.57 head width. Flagellomere 1 black, slightly oval. Arista black. Palpus brown, setose with many small, fine setulae; apex with several long (0.16 mm), thick pointed setae. Proboscis yellow-brown, elongate, narrow. Scutum and scutellum black; scutellum with 2 pairs of large setae. Pleuron black-brown, tomentose, shiny. Legs dark brown. Apical one-half of mid- and hind femur with darkening on both anterior and posterior faces; basal half light brown. Hind tibia with 3–4 anterodorsal setae. Posterior face of hind trochanter with medial and lateral dense, extremely fine setae (Fig. 1). Ventrobasal region of posterior face of hind femur with many short setae present, lacking process. Wing brown, especially dark at tip and anterior to vein  $M_1$ , vein  $R_{2+3}$  present, fork large (Fig. 14). Costal length 0.45–0.50 wing length. Costal setae 0.11 mm. Mean costal sector ratio 7.0: 1.8:1.0; range 6.6–7.7:1.6–1.9:1.0. Base of radial sector with 2 small setae. Halter dark brown. Abdominal tergites dark brown and present on all segments. Venter of abdomen dark gray. Epandrium dark brown, glossy. Left side of epandrium with posterior margin setose, with one long and several short setae. Right side of epandrium (Fig. 20) with posterior margin setose, with 1 extremely thick seta ventrally; posterior margin with protruding transparent lobe. Cercus light brown, setose. Stalk of cercus dark brown to grey, setose except ventrobasally bare.

Female. Body length 5.20–5.80 mm. Frons black, shallowly punctate; swelling with medial indentation above supra-antennal setae present. Mean frontal width 0.58 head width. Flagellomere 1 black, spherical. Arista black. Palpus dorsoventrally flattened, black-brown and enlarged, extending beyond flagellomere 1. Entire margin of palpus with small, fine setulae; apex of palpus with several long (0.15–0.30 mm), thick pointed setae. Clypeus elongate, black-brown. Proboscis elongate and geniculate. Labrum brown. Labellae yellow-brown. Scutum and scutellum black; scutellum with 2 pairs of large setae. Pleuron dark brown, tomentose except venter of anepisternum, all of katepisternum and round medioventral spot of meron black-brown, shiny. Legs black-brown. Hind tibia with 3–5 anterodorsal setae. Wing vein  $R_{2+3}$  present, fork large. Costal length 0.48–0.50 wing length. Costal setae 0.15 mm. Mean costal sector ratio 7.7:2.4:1.0; range 7.2–8.2:2.2–2.4:1.0. Wing membrane noticeably darkened, especially anteriorly. Halter

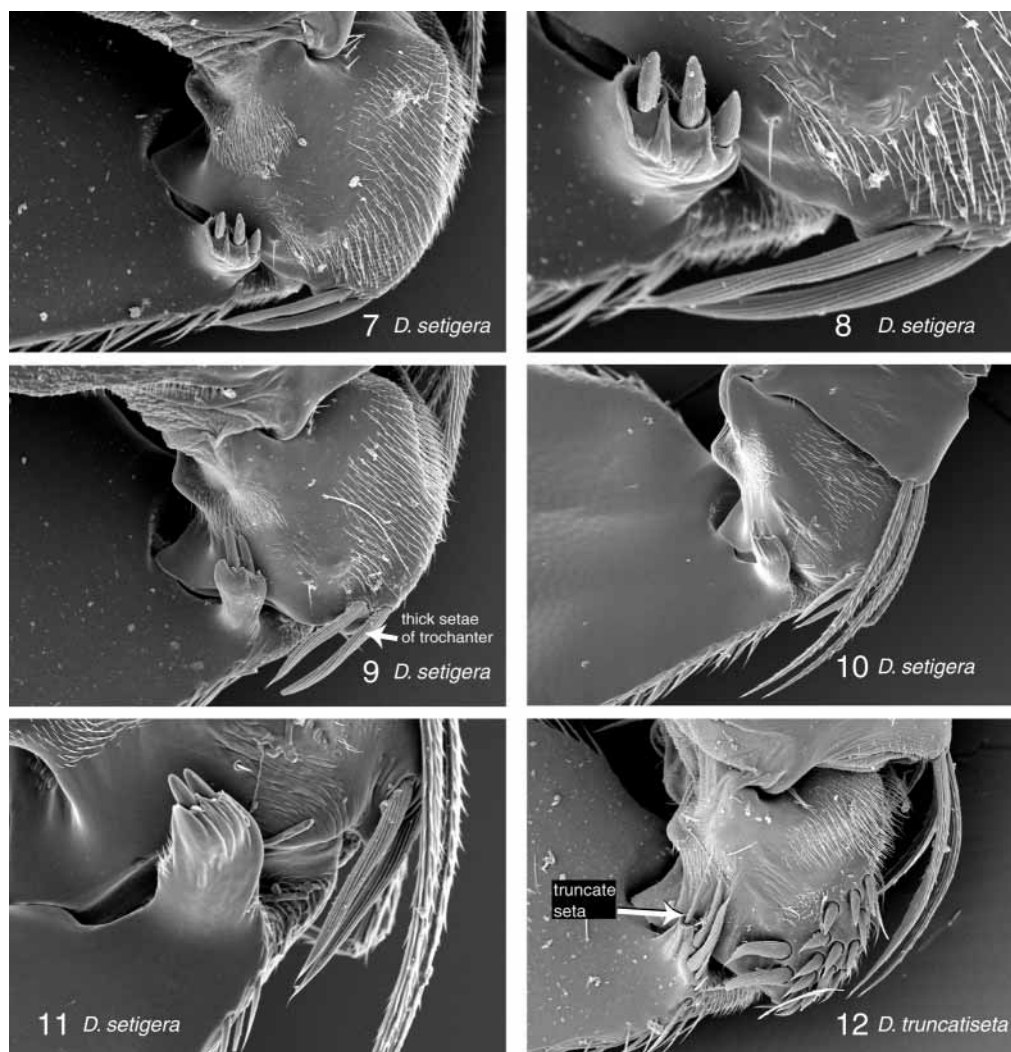
brown. Abdominal tergites black-brown and present only on segments 1–3. Tergite 1 broad and extremely short. Tergite 2 covers entire segment. Tergite 3 extends full length of segment, but only two-thirds of width. Venter of abdomen dark gray.

**Derivation of specific epithet.** Derived from the Latin word *erebus*, meaning a place of darkness in the nether world, or god of darkness. This refers to the dark body and head of this species.

**Geographical distribution.** Costa Rica and Nicaragua.



**FIGURES 1–6.** *Diplonevra* spp. Basal region of posterior face of hind tibia and trochanter (scanning electron micrographs). Fig. 1. *D. ereba* new species. Fig. 2. *D. gnoma* new species. Fig. 3. *D. goliatha* new species. Fig. 4. *D. hypermeke* new species. Figs. 5–6. *D. setigera* (Malloch), Zurquí de Moravia, Costa Rica. Abbreviations: dms – dorsomedial setulae of trochanter; ls – lateral setulae of trochanter.

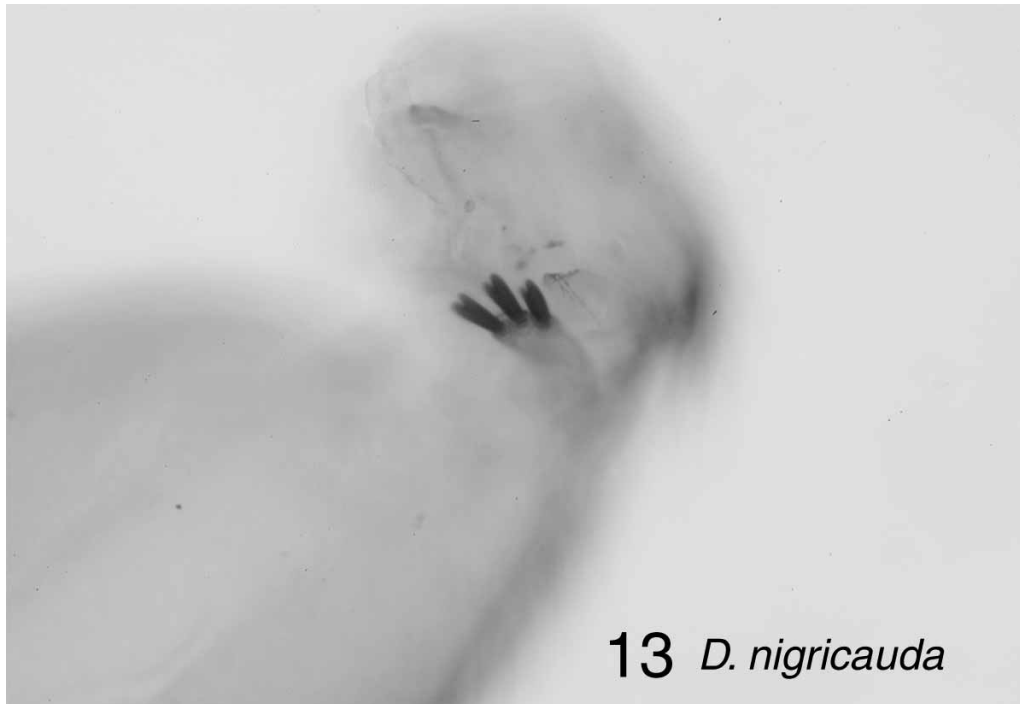


**FIGURES 7–12.** *Diplonevra* spp. Basal region of posterior face of hind tibia and trochanter (scanning electron micrographs). Figs. 7–8. *D. setigera* (Malloch), second specimen from Zurquí de Moravia, Costa Rica. Fig. 9. *D. setigera* (Malloch), Placerita Canyon, California, USA. Figs. 10–11. *D. setigera* (Malloch), Petropolis, Brazil. Fig. 12. *D. truncatiseta* new species.

**Holotype.** ♂, COSTA RICA: San Jose: 20 km S. Empalme, 9.63° N, 83.85° W, iii–iv.1990, P. Hanson, Malaise trap, 2800 m [LACM ENT 065708] (LACM).

**Paratypes.** COSTA RICA: Cartago: Villa Mills, 9.57°N, 83.73°, 2♂, iii–iv.1990, P. Hanson, Malaise Trap, 3000 m (LACM, MUCR); Heredia: Vara Blanca, 10.15°N, 84.15°W, 1♀, iii–iv.1990, P. Hanson, Malaise trap, 2100 m (LACM); San José: 4 km NE Canon Genesis II, 9.71°N, 83.91°W, 2♂, iii.1996, P. Hanson, Malaise trap, 2350 m (LACM), 16 km S. Empalme, 2♀, iii–iv.1989, P. Hanson, I. Gauld, Malaise Trap, 2600 m (INBC, LACM, MUCR), 20 km S. Empalme, 9.63°N, 83.85°W, 4♂, 1♀, iii–iv.1989, 1♀,

vii–viii.1989, 2♂, 2♀, iii–iv.1990, P. Hanson, I. Gauld, Malaise trap, 2800 m (INBC, LACM), 19 km W. Empalme, 9.65°N, 83.87°W, 14♀, xi–xii.1989, P. Hanson, Malaise trap, 2600 m (LACM), 80.5 km Pan American Hwy, 9.56°N, 83.80°W, 1♀, 21–23.vii.2000, J. Ashe, R. Brooks, Z. Falin, FIT, 2150 m (LACM). NICARAGUA: Matagalpa: Fuente Pura, 13.02°N, 85.92°W, 1♂, 6.vii.1994, J. M. Maes, Malaise trap, 1500 m (LACM).



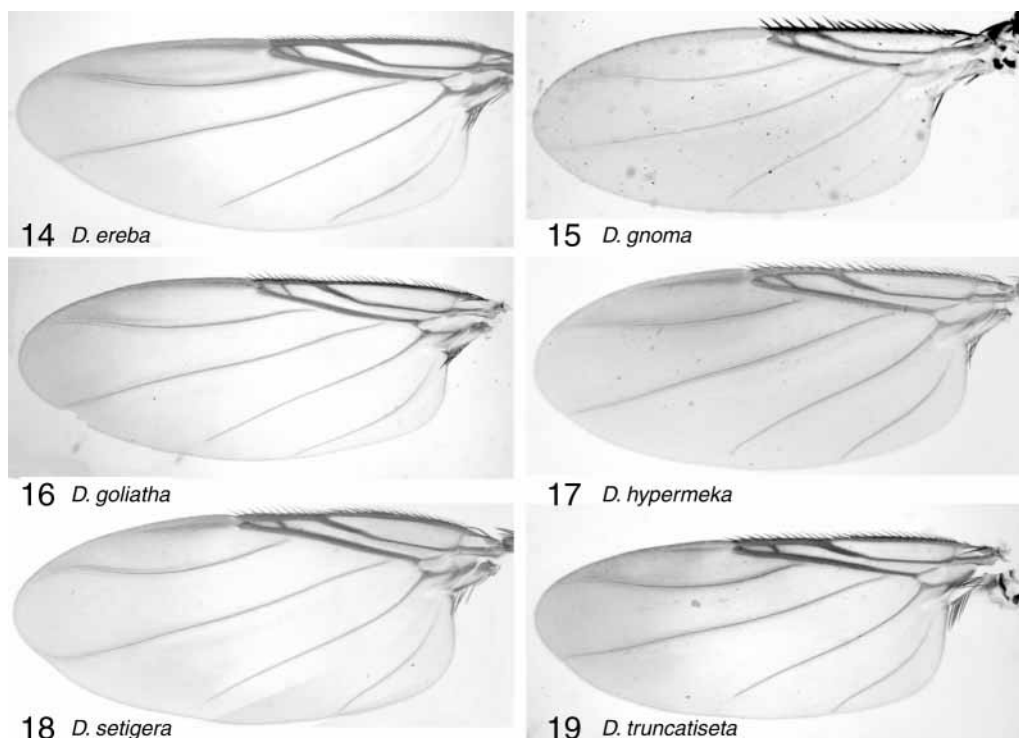
**FIGURE 13.** *Diplonevra nigricauda* Borgmeier. Basal region of posterior face of hind tibia (light microscopy).

***Diplonevra gnoma* new species**

Figs. 2, 15, 21

**Recognition.** This species does not key easily in Borgmeier's 1969 key. It keys to couplet 4, which has the alternatives "halter yellow" versus "halter black." The halter in *D. gnoma* is light brown, so following the first lead (halter yellow), specimens key to *D. nigricauda* Borgmeier. The hind femur of *D. nigricauda*, however, has 3 pairs of setae on the projecting lobe (Fig. 13), whereas in *D. gnoma* there are only 3 single setae (Fig. 2). If we accept "halter black" at couplet 4, specimens key out to *D. gaudialis* (= *D. setigera* in this paper) from which they can be separated by characters in the key.

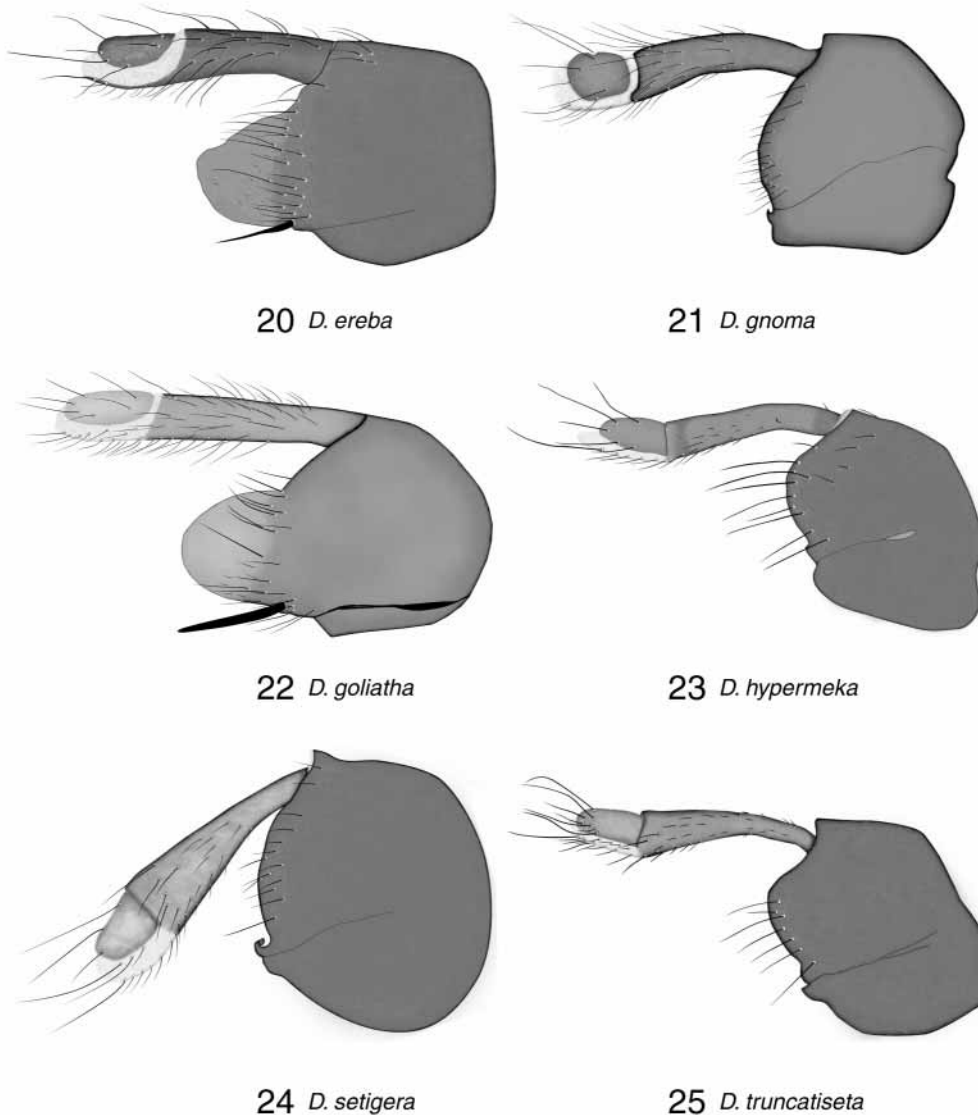
This species is extremely similar to small specimens of *D. setigera*, with which it is sympatric in Patagonia, Arizona, USA. It is not clear whether some specimens listed by Borgmeier (1963) as *D. gaudialis* (= *D. setigera*) were this species, as we were not able to examine all of his specimens, but we suspect that this is so based on his description of the cercus as “Anal tube brown or yellowish.”



FIGURES 14–19. *Diplonevra* spp. Left wings.

**Description.** Male (female unknown). Body length 1.70–1.95 mm. Frons dark brown to black-brown, punctate. Mean frontal width 0.57 head width. Flagellomere 1 brown to dark brown, spherical. Arista brown. Palpus yellow-brown; apex with large, pointed setae that range in length from 0.038–0.075 mm and many small, extremely fine setulae along basal three-quarters. Proboscis yellow and elongate, narrow. Scutum dark brown to black-brown; scutellum black, anterior scutellar seta two-thirds size of posterior seta. Pleuron shiny, dark brown, tomentose. Forelegs light brown. Mid- and hind legs dark brown. Posterior face of hind trochanter with dorsomedial dense, extremely fine, shorter setae (Fig. 2); ventrally with 1 long thick seta. Ventrobasal region of posterior face of hind femur with process containing three thick setae. Wing brown, vein  $R_{2+3}$  present, fork small (Fig. 15). Costal length 0.45–0.47 wing length. Costal setae 0.54 mm. Mean costal sector

ratio 5.5:1.2:1.0; range 5.1–5.8:1.0–1.3:1.0. Base of radial sector with 1 small seta. Halter light brown. Abdominal tergites black-brown. Venter of abdomen dark gray. Epandrium dark brown. Left side of epandrium tomentose except glossy along entire margin with darkening along basal margin of glossy section; posterior margin with 2 fine setae and 1 long seta. Right side of epandrium (Fig. 21) glossy except tomentose ventrobasally; posterior margin of glossy section darkened; posterior margin setose with several fine subequal setae. Hypandrium dark brown. Left side of hypandrium tomentose except glossy along posterior margin. Right side of hypandrium tomentose except glossy darkening along entire margin. Stalk of cercus dark brown and setose except dorsal one-fourth bare; cercus lighter brown.



**FIGURES 20–25.** *Diplonevra* spp. Male terminalia, right lateral.



**Geographical distribution.** Costa Rica and southwestern USA. This is the only species of Central American *Diplonevra* that we know has been collected from a lowland site.

**Natural history.** One specimen in the USNM collection has the label “Host: *Spodoptera frugiperda* (Smith), reared in lab.” Presumably this fly was reared from a laboratory colony of its host, the fall armyworm (Lepidoptera: Noctuidae). It is not clear whether the fly was actually parasitizing the moth larva, or whether it was a scavenger on an already dead or diseased host.

**Derivation of specific epithet.** Derived from the Latin term *gnomus*, for dwarf, referring to the small body size of this species.

**Holotype.** ♂, USA: Arizona: Santa Cruz Co., Patagonia, 31.53°N, 110.77°W, 13.viii.1995, B. Brown, E. Wilk, Malaise trap [LACM ENT 050834] (LACM).

**Paratypes.** COSTA RICA: Puntarenas: Palo Verde NP, 10.35°N, 85.35°W, 4♂, iii.1991, P. Hanson, Malaise trap, 10 m (LACM, MUCR). USA: Arizona: Maricopa Co., Mesa, U of A Experimental Station, 1♂, 2.xii.1964, Ayoade, host: *Spodoptera frugiperda* (Smith), reared in lab. (puparium mounted on same point as adult specimen) (USNM); Santa Cruz Co., Patagonia, 31.53°N, 110.77°W, 4♂, 24.x.1993, 2♂, 4.xi.1993, 1♂, 25.v.1994, 9♂, 24.vi.1994, 2♂, 8.vii.1994, 6♂, 13.viii.1995, 1♂, 10.ix.1995, B. Brown, E. Wilk, Malaise trap (EMUS, MCZC, LACM, SEMC, USNM); Texas: Travis Co., Austin, 30.3°N, 97.78°W, 1♂, 6–11.xii.1989, C. R. Nelson, Malaise trap (LACM).

### *Diplonevra goliatha* new species

Figs. 3, 16, 22

**Recognition.** See the closely related *D. ereba*, from which this species differs by the light-colored palpus, forelegs, and halter, as well as the thinner, fewer setae at the base of the inner face of the hind femur (Fig. 3).

**Description.** Male. Body length 4.40–4.90 mm. Frons black to brown, densely punctate. Mean frontal width 0.51 head width. Flagellomere 1 brown, slightly spherical. Arista brown. Palpus orange, setose with many small, fine setulae along margin laterally; apex with several long, thick pointed setae that range from 0.10–0.20 mm. Proboscis yellow, ventrally setose, elongate, narrow. Scutum black-brown, yellow mediolaterally, brown anterolaterally, with 2 brown anteromedial stripes; scutellum black with 2 pairs of large setae. Pleuron dark brown, tomentose, shiny. Forelegs yellow. Apices of mid- and hind femora with darkening on both anterior and posterior faces; basal two-thirds yellow. Hind tibia black with 3–4 anterodorsal setae. Large medial and small lateral region of posterior face of hind trochanter with dense, extremely fine setae (Fig. 3). Ventrobasal region of posterior face of hind femur with several thin setae present, lacking process. Wing, brown, especially near wing tip, vein  $R_{2+3}$  present, fork large (Fig. 16). Costal length

0.48–0.49 wing length. Costal setae 0.10–0.15 mm. Mean costal sector ratio 5.1:1.3:1.0; range 5.0–5.2:1.2–1.5:1.0. Base of radial sector with 2 small setae. Halter yellow. Abdominal tergites black-brown. Venter of abdomen dark gray. Left side of epandrium dark brown, tomentose; posterior margin setose, with 1 long and several shorter setae. Epandrium with protruding, transparent lobe. Left side of hypandrium dark brown, tomentose except shiny posterodorsally. Right side of epandrium (Fig. 22) brown, tomentose posteriorly, dark brown dorsally; posterior margin setose, with 1 extremely thick seta ventrally. Cercus yellow, setose. Stalk of cercus yellow, setose except anteroventral one-quarter bare.

Female. Body length 6.40–6.70 mm. Frons black, densely punctate. Swelling with medial indentation above supra-antennal setae present on frons. Mean frontal width 0.51 head width. Flagellomere 1 brown, slightly spherical. Arista brown. Palpus dorsoventrally flattened, orange, elongated extending beyond flagellomere 1. Lateral margin of palpus with small, fine setulae; apex of palpus with several long, thick pointed setae (0.18–0.28 mm). Clypeus elongated, black-brown. Proboscis elongate, geniculate. Labrum glossy, light brown. Labellae glossy, orange. Scutum black-brown except light brown mediolaterally, anterolaterally, 2 anteromedial strips; scutellum black with 2 pairs of large setae. Pleuron black-brown, tomentose, shiny except dorsum of anepisternum black, dorsal two-thirds of meron dark brown, anterior margin of katepisternum light brown. Forelegs yellow except femur dark brown dorsal two-thirds. Mid- and hind femora with darkening on both anterior and posterior faces; basal half yellow. Hind tibiae black with 3–4 anterodorsal setae. Wing vein  $R_{2+3}$  present, fork large. Costal length 0.49–0.52 wing length. Costal setae 0.15–0.20 mm. Mean costal sector ratio 5.8:1.5:1.0; range 5.6–6.0:1.4–1.6:1.0. Wing membrane noticeably darkened, especially anteriorly. Halter yellow. Abdominal tergites black and present only on segments 1–4. Tergite 1 broad, short. Tergite 2 covers entire segment. Tergite 3 extends full length of segment, but only four-fifths of width. Tergite 4 extends full length of segment, but only three-sevenths of width. Venter of abdomen dark gray.

**Geographical distribution.** Honduras

**Derivation of specific epithet.** Derived from the name of the Philistine giant, referring to the large size of this species.

**Holotype.** ♂, HONDURAS: Cortes: Parque Nacional Cusuco, 5 km N. Buenos Aires, 15.48°N, 88.22°W, 30. vi. 1995, R. Cave. [LACM ENT 053932] (LACM).

**Paratypes.** HONDURAS: Cortes: Parque Nacional Cusuco, 5 km N. Buenos Aires, 15.48°N, 88.22°W, 1♂, 15.ii.1995, 1♀, 30.iii.1995, 1♂, 30.vi.1995, 1♀, 15.vii.1995, R. Cordero, R. Cave, Malaise trap, 1600 m (LACM, MZLU).

***Diplonevra hypermeka* new species**

Figs. 4, 17, 23

**Recognition.** This species keys to *D. impressa* (= *D. setigera* herein) in Borgmeier's (1969) key, but differs in the setation at the base of the hind femur. In *D. hypermeka* there is a group of setae, including 3 long ones and several shorter (Fig. 4), whereas *D. setigera* has 2–3 short setae only (Figs. 5–11). In Central America, this species is most like to be confused with *D. truncatiseta*, whose setae (Fig. 12) differ markedly, and whose single reduced seta is easily visible with light microscopy.

**Description.** Male (female unknown). Body length 2.65–3.35 mm. Frons black-brown, extremely slightly punctate. Mean frontal width 0.55 head width. Flagellomere 1 dark brown, spherical. Arista brown. Palpus light brown; apex with large, pointed setae that range in length from 0.08–0.15 mm and many small, fine setulae along margin laterally. Proboscis yellow-brown and elongate, narrow. Scutum and scutellum black-brown; anterior scutellar seta about two-thirds length but only one-half thickness of posterior seta. Pleuron dark brown, tomentose, shiny. Legs yellow. Medial region of posterior face of hind trochanter with 2 thick setae and several slightly shorter, thick setae (Fig. 4). Ventrobasal region of posterior face of hind femur with process containing three long, thick setae and several shorter setae (Fig. 4). Apex of hind femur with narrow darkening dorsoapically. Wing evenly dark brown, vein  $R_{2+3}$  present, fork large (Fig. 17). Costal length 0.52–0.57 wing length. Costal setae 0.07–0.15 mm. Mean costal sector ratio 5.7:2.3:1.0; range 5.4–6.0:2.0–2.7:1.0. Base of radial sector with 1 small seta. Halter brown. Abdominal tergites black-brown. Venter of abdomen dark gray. Epandrium brown and glossy. Left side of epandrium with posterior margin setose, with two long and several short setae. Right side of epandrium (Fig. 23) with posterior margin setose, with several long, posteroventral setae almost as long as length of epandrium (0.7–1.0). Left side of hypandrium tomentose except posterodorsal corner black and glossy. Right side of hypandrium glossy and brown. Cercus yellow-brown, setose. Stalk of cercus yellow-brown, setose ventroapically and laterally.

**Geographical distribution.** Costa Rica.

**Derivation of specific epithet.** Derived from Greek *hypermekes* meaning extremely long, referring to the long setae on the posterior margin of the right side of the epandrium.

**Holotype.** ♂, COSTA RICA: San Jose: Zurquí de Moravia, 10.05°N, 84.02°W, vi.1995, P. Hanson, Malaise trap, 1600m [LACM ENT 091504] (LACM).

**Paratypes.** COSTA RICA: Alajuela: Estación Biol. San Ramon, 10.06°N, 84.50°W, 1♂, 7–9.vii.2000, J. Ashe, R. Brooks, Z. Falin, FIT #84 (LACM); Cartago: 4 km NE Canon Genesis II, 9.71°N, 83.91°W, 2♂, ii.1995, 1♂, vi.1995, 2♂, viii.1995, 1♂, xi–xii.1995, 2♂, iii.1996, 3♂, iv.1996, 2♂, vii.1996, 1♂, ix.1996, 1♂, x.1996, 6♂, xi.1996, P. Hanson, Malaise trap, 2350 m (LACM), La Cangreja, 9.8°N, 83.97°W, 9♂, vi–vii.1992, P. Hanson, Malaise trap, 1950 m (LACM), Tapanti, 9.76°N, 83.78°W, 9♂, 17–20.vii.2000,

J. Ashe, R. Brooks, Z. Falin, FIT #192, 1200 m (LACM); Heredia: Varablanca, Refugio 2000 m, 10.18°N, 84.11°W, 1♂, 9–12.ii.2002, Brown, Walker, Gonzalez, Gressitt Malaise trap, 2000 m (LACM); Puntarenas: Monteverde, 8♂, 28.v–1.vi.1988, 17♂, 1–5.vi.1988, 1♂, 9–18.iii.1995, B. V. Brown, Malaise trap, 1700 m (LACM); San José: 16 km S. Empalme, 6♂, iii–iv.1989, P. Hanson, I. Gauld, Malaise trap, 2600 m (LACM), 19 km S, 3 km W Empalme, 9.65°N, 83.87°W, 1♂, iii–iv.1989, 2♂, xi–xii.1989, 1♂, ix.1992, P. Hanson, Malaise trap, 2600 m (LACM), 20 km S. Empalme, 9.63°N, 83.85°W, 20♂, ix.1988, 9♂, iii–iv.1989, 11♂, iii–vi.1990, P. Hanson, I. Gauld, Malaise trap, 2800m (LACM), Escazu, 9.9°N, 84.15°W, 2♂, ix–x.1996, C. Flores, Malaise trap, 2000 m (LACM), Estación Biol. Cuerici, 9.55°N, 83.67°W, 1♂, i.2000, P. Hanson, Malaise trap, 2600 m (LACM), 6 km N. San Gerardo, 9.95°N, 84.05°W, 1♂, viii.1992, P. Hanson, Malaise trap, 2000 m (LACM), Zurquí de Moravia, 10.05°N, 84.02°W, 1♂, i.1989, 1♂, iii.1989, 2♂, v.1989, 1♂, vii.1990, 4♂, ix–x.1990, 1♂, i.1991, 1♂, vii.1991, 2♂, vi.1992, 1♂, iv–v.1993, 1♂, 1–15.vi.1993, 1♂, 2–8.iii.1995, 2♂, iv.1995, 44♂, v.1995, 22♂, vi.1995, 1♂, ix.1995, 5♂, x.1995, 12♂, i.1996, 1♂, iii.1996, P. Hanson. Malaise trap. 1600 m (EMUS, INBC, LACM, MCZC, MUCR, NHRS, SEMC, USNM).

***Diplonevra setigera* (Malloch)**

Figs. 5–11, 18, 24.

*Dohrniphora setigera* Malloch, 1914: 24.

*Diplonevra setigera*: Borgmeier, 1961: 110.

*Dohrniphora gaudialis* Cockerell, 1915: 351–352. **NEW SYNONYMY.**

*Dohrniphora impressa* Borgmeier, 1923: 334–336, fig. 3. **NEW SYNONYMY.**

**Holotype.** ♂, COSTA RICA: Cartago, 3.i.1910, P. P. Calvert, sweeping over mud [ANSP holotype #6036] (ANSP; examined).

**Recognition.** This species differs from other Central American *Diplonevra* by the hind tibia bare of anterior setae, the small process at the base of the posterior face of the hind femur that bears 2–3 setae, and the setation of the trochanter.

The Brazilian species *D. impressa* Borgmeier was separated from *D. setigera* in Borgmeier's (1969) key because of supposed differences in the origin of wing vein  $M_1$ . In *D. impressa*,  $M_1$  is supposed to arise level with the fork of the radial veins, whereas in *D. setigera* it is stated to arise proximal to this fork; in reality, the vein arises at the same location in the holotype of *D. setigera* and in specimens of *D. impressa* from Brazil we examined. Because of the great similarity of the base of the hind femur (shown in Figs. 10–11), we therefore consider *D. impressa* a junior synonym of *D. setigera*.

The North American species *D. gaudialis* (Cockerell) is separated in Borgmeier's key by a short (less than 0.5 wing length – *D. gaudialis*) versus long (0.5 or more wing length – *D. setigera*) costa. This character is known to vary widely within species, however, and

comparison of the structure of the hind femur (Fig. 9) shows that these two species are also the same, and that *D. gaudialis* is a synonym of *D. setigera*.

**Description.** Male. Body length 1.85–3.3 mm. Frons dark reddish-brown to dark brown, punctate. Mean frontal width 0.50 head width. Flagellomere 1 brown, spherical. Arista brown. Palpus yellow-brown; apex with large, pointed setae that range in length from 0.055–0.15 mm, and many small, fine setulae along margin laterally. Proboscis yellow and elongate, narrow. Scutum dark reddish-brown to brown; scutellum brown, with anterior scutellar seta two-thirds length and one-half thickness of posterior seta. Pleuron shiny, tomentose, light brown to dark brown; some with dorsum of meron light brown to dark brown. Fore- and midlegs yellow. Posterior face of hind trochanter with dorsomedial and lateral dense, extremely fine setae; ventrally with 2 (rarely 3) long, thick setae (Fig. 9). Ventrobasal region of posterior face of hind femur with process containing 2–3 extremely short, thick setae (Figs. 5–11). Apical half of hind femur with darkening on both anterior and posterior faces; basal half yellow. Hind tibiae yellow to brown. Wing clear to evenly brown (sometimes just wing tip darkened), vein  $R_{2+3}$  present, fork large (Fig. 18). Costal length 0.48–0.53 wing length [need to redo]. Costal setae 0.07–0.12 mm. Mean costal sector ratio 4.0:1.0:1.0; range 3.5–4.3:1.0–1.1:1.0. Base of radial sector with 1 small seta. Halter light brown. Abdominal tergites black-brown to light brown. Venter of abdomen brown to dark gray. Epandrium yellow-brown to dark brown. Left side of epandrium glossy with posterior margin setose consisting of 1 long and several short setae. Right side of epandrium (Fig. 24) mostly tomentose except glossy dorsally with posteroventral margin setose consisting of several fine setae and 1 longer (0.5–0.8 length of epandrium), most posteroventral seta. Hypandrium yellow-brown to dark brown. Left side of hypandrium mostly tomentose except glossy posteriorly. Right side of hypandrium tomentose. Cercus yellow, setose. Stalk of cercus yellow to (rarely) yellowish-brown, setose except dorsally and basal one-fourth.

North American female specimens (as *D. gaudialis*) are described by Borgmeier (1963).

**Variation.** This species, as we recognize it, is varied in a number of characters. The most important character is the setation of the small process at the base of the posterior face of the hind femur in males. Some specimens have 2 setae (Figs. 5–6, 9–11), some (including the holotype) have 3 (Figs. 7–8), and some have 2 on one leg, and 3 on the other. Specimens formerly considered to be *D. impressa* have 2 (Figs. 10–11), as do those formerly considered *D. gaudialis* (Fig. 9).

The wing color is highly varied, from clear in USA specimens, to darkened at the tip in some Central American specimens, to completely darkened brown in color (other Central American specimens).

**Geographical distribution.** Southwestern USA to Brazil.

**Natural history.** One specimen has a label that says “dead gopher” according to Borgmeier (1963); presumably the specimen was collected on a dead rodent, but there is

no information on which collection the specimen came from, and we have not seen it.

**Central American material examined.** COSTA RICA: Alajuela: Penas Blancas Valley, 10.32°N, 84.76°W, 2♂, 12.i–2.ii.1987, 1♂, 5.iii.1988, E. Cruz, Malaise trap, 700 m (LACM), 5 km W. San Ramon, 10.06°N, 84.05°W, 6♂, i.1997, 1♂, iv.1997, 1♂, vii.1997, O. Castro, Malaise trap, 1200 m (LACM), Res. Biol. San Ramon, 10.22°N, 84.62°W, 3♂, iv–v.1995, P. Hanson, Malaise trap, 900 m (LACM); Cartago: 4 km NE Cañon, Genesis II, 9.71°N, 83.91°W, 1♂, iv.1995, 1♂, v.1995, 1♂, vi.1995, 2♂, vii.1995, 2♂, viii.1995, 3♂, iv.1996, 4♂, vii.1996, P. Hanson, Malaise trap, 2350 m (LACM), La Cangreja, 9.8°N, 83.97°W, 1♂, vii.1991, P. Hanson, Malaise trap, 1950 m (LACM), PN Tapanti, 9.76°N, 83.77°W, 2♂, ii.1995, G. Mora, Malaise trap, #4506, 1150 m (INBC), Tapanti, 9.76°N, 83.78°W, 1♂, 17–20.vii.2000, J. Ashe, R. Brooks, Z. Falin, FIT (LACM); Guanacaste: Volcan Cacao, Cerro Pedregal, 6♂, ii–iv.1989, I Gauld, D. Janzen, Malaise trap, 1000 m (LACM); Heredia: Vara Blanca, 10.15°N, 84.15°W, 1♂, i–ii.1990, P. Hanson, Malaise trap, 2100 m (LACM); Puntarenas: Monteverde Biological Station, 10.32°N, 84.80°W, 4♂, 28.v–1.vi.1988, 1♂, 1–5.vi.1988, B. V. Brown, Malaise trap, 1700 m (LACM), 1♂, 7–12.vi.1989, E. Fuller, Malaise trap (LACM), 2♂, 25–28.v.1998, B. Brown, V. Berezovskiy, Malaise trap #1, 1500 m (LACM), Monteverde Cloud Forest Preserve, 10.33°N, 84.79°W, 1♂, 7–10.iv.1999, J. Rifkind, Malaise trap, 1520 m (LACM), Las Alturas, 8.95°N, 82.83°W, 1♂, x.1991, 1♂, iii.1992, P. Hanson, Malaise trap, 1500 m (LACM), 2♂, 9.vi.1998, 1♂, 11.vi.1998, B. Brown, V. Berezovskiy, 2♂, Malaise trap #1, on windows (LACM), Las Cruces, 8.8°N, 82.97°W, 1♂, 5.vi.1988, P. Hanson, Malaise trap, 1200 m (LACM); San José: Braulio Carrillo NP, 9.5 km E. Tunel, 10.12°N, 83.97°W, 5♂, iv.1989, 1♂, x–xii.1989, 2♂, i–iii.1990, 4♂, iv–v.1990, P. Hanson, Malaise trap, 1000 m (LACM), Estación Biol. Cuerici, 9.55°N, 83.67°W, 19♂, i.2000, P. Hanson, Malaise trap, 2600 m (LACM), San Antonio de Escazu, 9.9°N, 84.15°W, 1♂, v–vi.1998, 1♂, i.1999, W. Eberhard, Malaise trap, 1500 m, 1300 m (LACM), 6 km N. San Gerardo, 9.95°N, 84.05°W, 2♂, vi.1992, 2♂, viii.1993, P. Hanson, Malaise trap, 2800 m (LACM), Zurquí de Moravia, 10.05°N, 84.02°W, 3♂, i.1989, 2♂, iii.1989, 1♂, v.1989, 1♂, ix–x.1990, 2♂, iii.1991, 4♂, vi.1992, 2♂, iv–v.1993, 9♂, 1–15.vi.1993, 1♂, ix–x.1993, 1♂, 2–8.iii.1995, 1♂, 7–9.iii.1995, 3♂, iv.1995, 4♂, v.1995, 4♂, vi.1995, 3♂, viii.1995, 1♂, x.1995, 7♂, i.1996, 4♂, vi.1996, 3♂, ix.1996, P. Hanson, Malaise trap, 1600 m (INBC, LACM, MUCR). EL SALVADOR: La Libertad: Finca La Giralda, 13.66°N, 89.68°W, 2♂, 14–17.x.2000, J. Donahue, Malaise trap, 1180 m (LACM). GUATEMALA: Chimaltenango: Yepocapa, 14.50°N, 90.96°W, 1♂, 4.vi.1947, H. T. Dalmat, 1403 m (USNM); Zacapa: San Lorenzo, 14.53°N, 89.68°W, 1♂, 4.iv.1987, M. Sharkey, Malaise trap, 2200 m (LACM). HONDURAS: Francisco Morazan: Cerro Uyuca, San Antonio de Oriente, 14.03°N, 87.07°W, 2♂, 13.i.1995, R. Cordero, FIT, 1800 m (LACM). MEXICO: Chiapas: San Cristobal, 16.75°N, 92.67°W, 2♂, 17.vi.1969, W. Mason, Malaise trap, 2000 m (CNCI, LACM); Veracruz: Jalapa, 2♂, 1–6.viii.1961, R. & K. Dreisbach (MCZC, USNM). PANAMA: Chiriqui: Volcan, 1♂, vii.1981, N. L. H. Krauss (LACM); Darien:

Cana Pirre Trail, 7.72°N, 77.7°W, 2♂, 7–9.vi.1996, J. Ashe, R. Brooks, FIT, 1200 m (LACM); Veraguas: 8 km W. Santa Fe, Cerro Tute, 8.50°N, 81.11°W, 1♂, 24 vii–8 viii.1999, J. Woolley, Malaise trap, 1000 m (LACM).

**North American material examined.** Numerous specimens from USA: Arizona, California, Texas.

**South American material examined.** BRAZIL: Rio de Janeiro: Petropolis, 3♂, x.1922, Ronchi (LACM, MCZC).

***Diplonevra truncatiseta* new species**

Figs. 12, 19, 25.

**Recognition.** This species keys to *D. setigera* in couplet 20 of Borgmeier's (1969) key, but differs in the setation of the base of the hind femur and trochanter (Fig. 12). It is more likely to be confused with *D. hypermekia*; see discussion of that species for further comments.

**Description.** Male (female unknown). Body length 2.75–3.55 mm. Frons black. Mean frontal width 0.53 head width. Flagellomere 1 dark brown apically and light brown basally, spherical. Arista brown. Palpus yellow-brown; apex with large, pointed setae that range in length from 0.08–0.15 mm, and many small, fine setulae along margin laterally. Proboscis yellow and elongate, narrow. Scutum black-brown. Pleuron brown, tomentose, shiny. Fore- and midlegs yellow. Ventromedial region of posterior face of hind trochanter with two thick setae and several slightly shorter, thick setae (Fig. 12); laterally and dorsomedially with dense, extremely fine setae. Ventrobasal region of posterior face of hind femur with process containing two thick setae and one much thinner seta at apex (Fig. 12). Apical one-third of hind femur with darkening on both anterior and posterior faces; basal two-thirds yellow. Hind tibiae dark brown. Wing brown, especially at wing tip and anterior to vein  $M_1$ , vein  $R_{2+3}$  present, fork large (Fig. 19). Costal length 0.51–0.53 wing length. Costal setae 0.09–0.11 mm. Mean costal sector ratio 3.3:1.1:1.0; range 2.9–3.8:1.0–1.3:1.0–1.4. Base of radial sector with 1 small seta. Halter light brown. Abdominal tergites black-brown. Venter of abdomen dark gray. Epandrium brown. Left side of epandrium glossy, except tomentose ventrally; posterior margin bearing two long setae. Right side of epandrium (Fig. 25) tomentose, except glossy posterodorsally with several long posteroventral setae that range from 0.5–0.9 length of epandrium. Hypandrium brown. Left side of hypandrium tomentose, except glossy posterodorsally. Right side of hypandrium tomentose. Cercus light yellow, setose. Stalk of cercus yellow, setose except dorsoventrally.

**Geographical distribution.** Mexico to Costa Rica.

**Derivation of specific epithet.** Derived from Latin words for shortened seta, referring to the one incompletely developed seta of the hind femur.

**Holotype.** ♂. COSTA RICA: San José: Zurquí de Moravia, 10.05°N, 84.02°W, v.1995, P. Hanson, Malaise trap, 1600 m. [LACM ENT 089191] (LACM).

**Paratypes.** COSTA RICA: Cartago: 4 km NE Canon, Genesis II, 9.71°N, 83.91°W, 1♂, iii.1996, 1♂, vii.1996, P. Hanson, Malaise trap, 2350 m (LACM); Heredia: Vara Blanca, 10.15°N, 84.15°W, 2♂, i–ii.1990, P. Hanson, Malaise trap, 2100 m (LACM); Puntarenas: Las Alturas, 8.95°N, 82.83°W, 1♂, vi.1992, 1♂, i–iii.1995, P. Hanson, Malaise trap, 1500 m, 2100m (LACM); San José: 20 km S. Empalme, 1♂, iii–iv.1989, P. Hanson, I. Gauld, Malaise trap, 2800m (LACM), Estación Biol. Cuerici, 9.55°N, 83.67°W, 4♂, i.2000, P. Hanson, Malaise trap, 2600 m (LACM), Zurquí de Moravia, 10.05°N, 84.02°W, 1♂, i.1989, 1♂, iii.1991, 1♂, iv–v.1993, 1♂, ix–x.1993, 2♂, vi.1995, 1♂, x.1995, P. Hanson, Malaise trap, 1600 m (INBC, LACM, MUCR). MEXICO: Chiapas: Reserva El Triunfo, Sendero Cerro Triunfo, 15.66°N, 92.80°W, 1♂, 19–22.vii.1997, J. Woolley, Gonzalez, Malaise trap, 1982 m (LACM). NICARAGUA: Matagalpa: Fuente Pura, 13.02°N, 85.92°W, 2♂, 6.vii.1994, J. M. Maes, Malaise trap, 1500 m (LACM).

#### Key to Males of Central American *Diplonevra*

- 1 Hind tibia with 3–5 anterodorsal setae; with 1 long, extremely thick, most posteroventral seta on right side of epandrium (Figs. 20, 22) ..... **2**
- Hind tibia without anterodorsal setae; epandrium without such thickened seta (Figs. 21, 23–25) ..... **3**
- 2 Ventrobasal region of posterior face of hind femur with many short, thick setae (Fig. 1); forelegs and halter dark brown; palpus brown..... ***D. ereba* new species**
- Ventrobasal region of posterior face of hind femur with several thin setae (Fig. 3); forelegs yellow; halter yellow; palpus orange..... ***D. goliatha* new species**
- 3 Posterior face of hind trochanter with several short, thick setae (Figs. 4, 12); base of posterior face of hind femur with relatively long setae (Figs. ##); posterior margin of right side of epandrium with long, subequal posteroventral setae (Figs. 23, 25)..... **4**
- Posterior face of hind trochanter lacking short, thick setae (Figs. 2, 5, 7, 9, 10) except for 1–3 longer setae ventrally; base of posterior face of hind femur with relatively short setae (e.g. Figs. 5, 7); posterior margin of right side of epandrium with shorter setae ..... **5**
- 4 Ventrobasal region of posterior face of hind femur with process containing 3 long, thick setae and several shorter setae (Fig. 4); costal sector 2 much longer than 3 (mean costal sector ratio 5.7:2.3:1.0) (Fig. 17) ..... ***D. hypermeka* new species**
- Ventrobasal region of posterior face of hind femur with process containing two thick setae and one much thinner seta at apex (Fig. 12); costal sector 2 subequal in length to sector 3 (mean costal sector ratio 3.3:1.1:1.0) (Fig. 19).... ***D. truncatiseta* new species**
- 5 Cercus yellow, rarely yellowish-brown; ventral region of posterior face of hind trochanter with 2 (rarely 3) long, thick setae (Fig. 9) and dense, extremely fine setae



- present in lateral region (Fig. 5, ls) .. ..... *D. setigera* (Malloch)
- At least basal two-thirds of cercus dark brown; ventral region of posterior face of hind trochanter with 1 long, thick seta (Fig. 2) and lacking setae in lateral region .....
- ..... *D. gnoma* new species

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