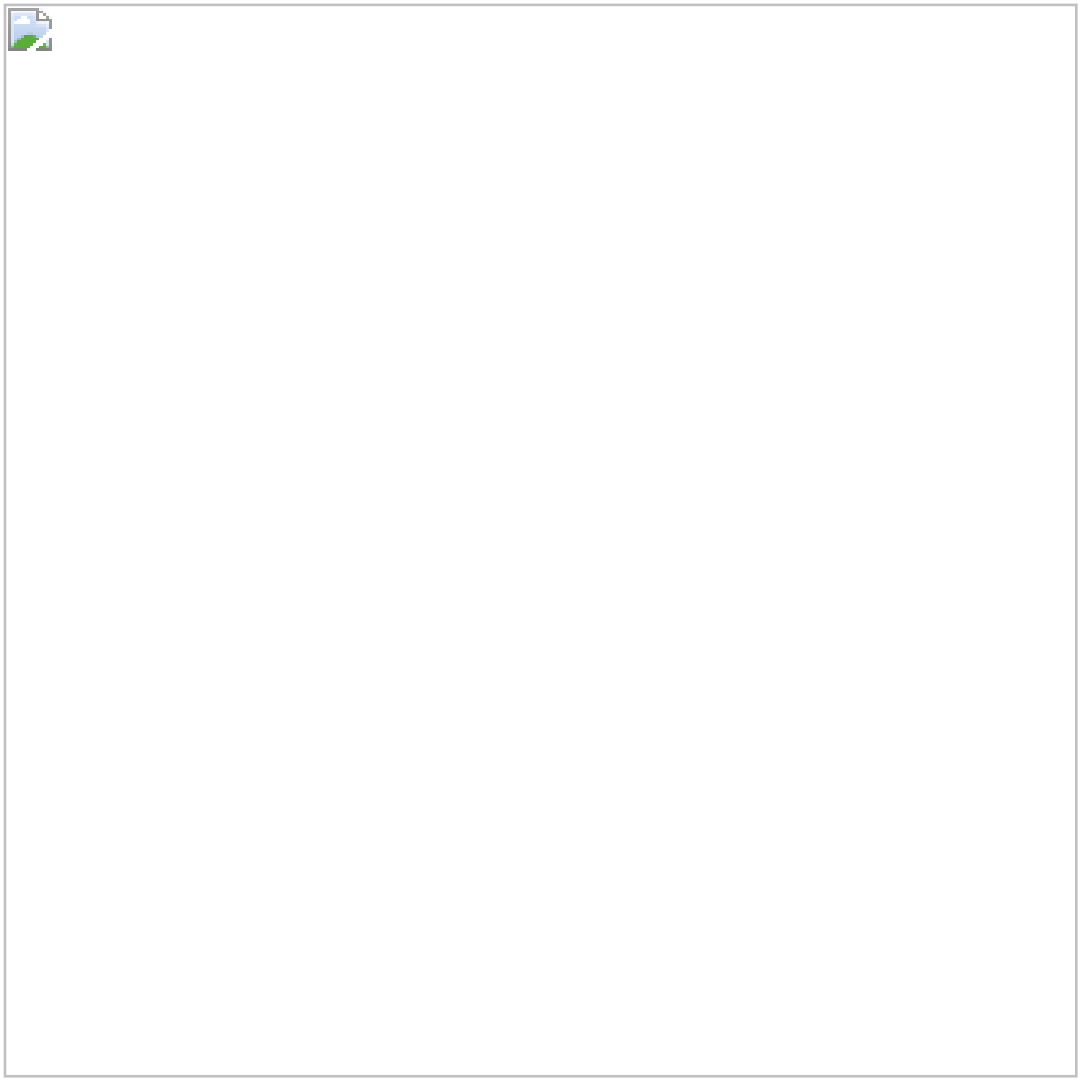

The Rhytidochrotinae of Panama, with new species of HylopedetesRehn 1929, OedalacrisDescamps and Amédégnato 1972 and Chiriquacris n. gen.

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The Rhytidochrotinae of Panama, with new species of *Hylopedetes* Rehn 1929, *Oedalacris* Descamps and Amédégnato 1972 and *Chiriquacris* n. gen.

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Abstract

We report the occurrence in Western Panama of several previously unsuspected species of the genus *Hylopedetes*, including *H. fuliginosus* n. sp. and *H. nigrithorax panamensis* n. ssp. *H. gemmeus* Rehn 1929, previously known only from Costa Rica, is also recorded. A further spp. of *Hylopedetes*, *H. punctatus* n. sp. is described from W. Central Costa Rica. We also describe *Chiriquacris quadrimaculata*, n. gen, n. sp., from W. Panama, and *Oedalacris cambrai* n. sp. and *O. lesbiae* n. sp. from Eastern Panama. *Oedalacris* was previously known only from Colombia. We describe the previously unknown female of *Piezops ensicornis* (Stål 1878) and provide information on the distribution and biology of that species in Panama.

Key words

Orthoptera, Acrididae, Rhytidochrotinae, Central-America, Panama, taxonomy, biogeography

Introduction

The Rhytidochrotinae (Amedegnato 1974) are a small subfamily of Neotropical acridid grasshoppers; most of the known genera come from either Colombia (the majority) or Costa Rica (for reviews, see Descamps and Amedegnato 1972, and Rowell 1995). Only a single species, *Piezops ensicornis* (Stål 1878), has been previously recorded from Panama (Hebard 1923, 1924).

In this article we show that the Costa Rican genus *Hylopedetes* Rehn 1929 is widely distributed in the highlands of Western Panama; we describe one new species and one new subspecies from that area and a further new species from West Central Costa Rica. From the same area of Western Panama we describe the new genus and species *Chiriquacris quadrimaculata*. We further describe, from Eastern Panama, 2 new species of *Oedalacris* Descamps & Amedegnato 1972, a genus previously known only from northern Colombia. We present new information on the distribution and biology of *Piezops* and describe the previously unknown female. This contribution brings to 7 the number of known Rhytidochrotine taxa within Panama.

Methods

Dimensions were measured with a graticule eyepiece at a total magnification of ×25 (Wild M5 stereomicroscope) in conjunction with a moving stage fitted with a digital micrometer (Mitutoyo) reading to 0.01 mm. Measurements were repeatable to within 0.02 mm. The various dimensions measured are detailed in Fig. 1 and its caption.

Abbreviations of depositories: ANSP, Academy of Natural Sciences, Philadelphia; INBC, Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica (INBio); RC, the senior author's (CHFR) collection; STRI, Smithsonian Institute for Tropical Research, Panama City; URFCN, Entomología, Facultad de Ciencias, Universidad Nacional, Montevideo; GBFM, G.B. Fairchild Museum of Invertebrates, Universidad de Panama, Panama City.

Descriptions

HYLOPEDETES Rehn 1929

Type species.— *H. mirandus* Rehn 1929

Descamps & Rowell (1978) provided a key to the 5 Costa Rican species then known and the genus was reviewed by Rowell (1995). Though erected by Rehn in 1929, the genus was first properly characterized by Descamps and Amedegnato (1972). The following diagnosis is largely taken from their account.

Small in size, cuticle smooth and shiny but pitted on thorax. Fastigium short, subhorizontal or slanting downwards, rounded at tip. Interocular space narrow, subequal to antennal pedicel. Vertex only slightly inflated. Profile of face not clearly concave at level of median ocellus. Frontal ridge narrow and flat above medial ocellus, absent or subobsolete below it. Lateral carinae of face thick and little projecting. Eyes strongly protruding. Antennae filiform, < 2× as long as head and pronotum together, flagellum of 15 to 16 segments. Sulci of pronotum deep, but the first obsolete, so not cutting pronotum midline. Upper edge of pronotum is more or less rectangular (in lateral view). Posterior margin of pronotal disc sinuous or truncated; anterior margin excurved in the middle. Prosternal process a conical tubercle, sharply pointed and sometimes inclined forwards. Mesothoracic interspace wider than long, metathoracic interspace longer than wide. Mesonotum and metanotum without posterior-medial projections. Abdominal tympanum absent. Hind femora with smooth carinae; the dorsomedial carina terminates in an indistinct process or a short spine. Posterior tibiae with 7 external spines and 9 internal ones. Third tarsal segment longer than the other two combined.

Male: Posterior margin of last tergite with small furcula, the tips being obtuse and melanized. The space between the tips varies characteristically between species (Fig.15), from 33% to 52% of basal width of supra-anal plate. Supra-anal plate triangular, a little longer than wide at its base, lacking the black granules seen in many genera of this subfamily, weakly divided transversely by a furrow at mid length. The dorsal rim of the apex of the subgenital capsule is

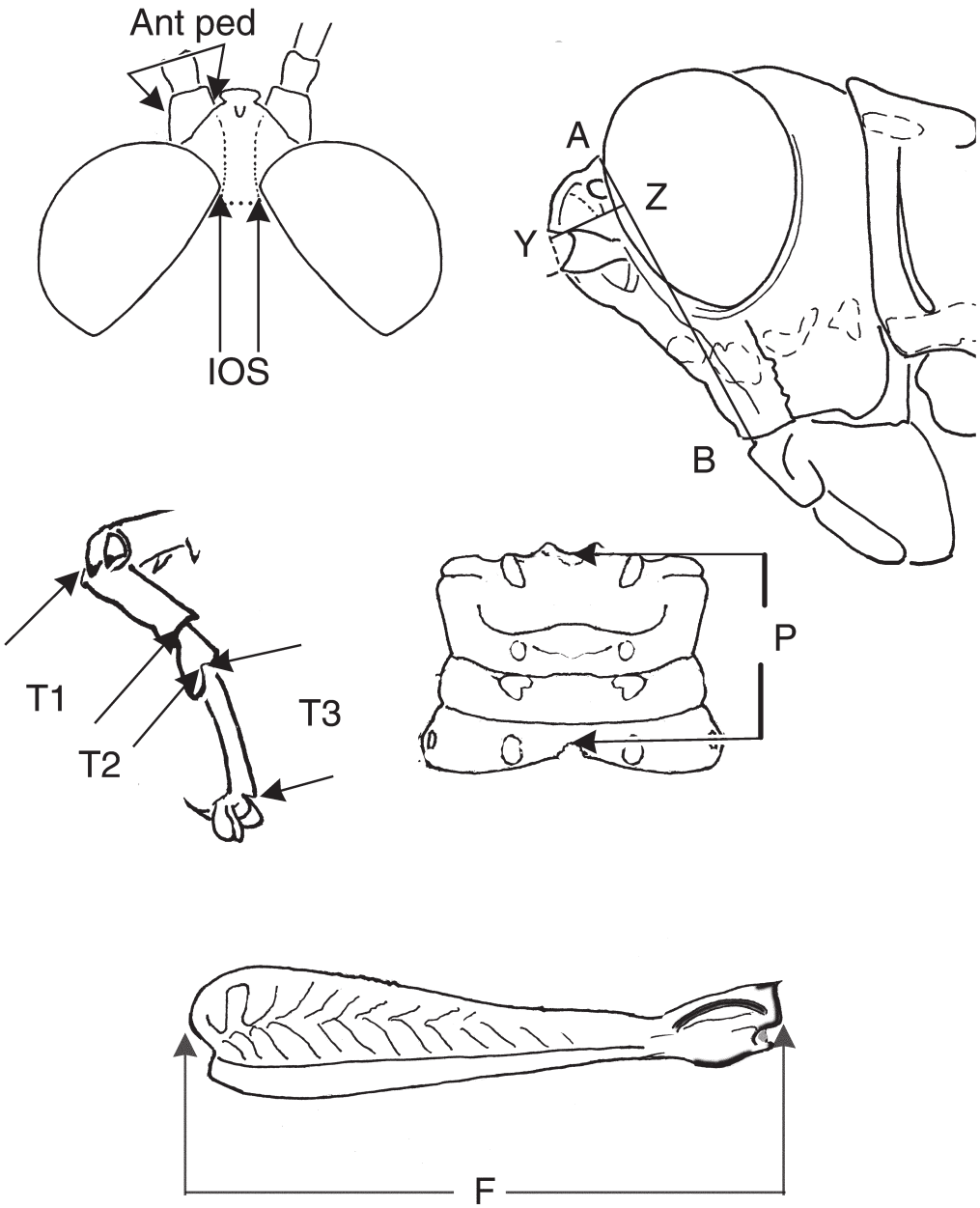

Fig. 1. The dimensions measured in this work: Ant ped = width of antennal pedicel; IOS= width of interocular space; T1-T3 = length of the three tarsal segments of the hind foot; P = length of pronotum in dorsal midline; the rostrum index is the ratio YZ: AB; F, is the maximum length of the hind femur; L, the Overall Length (not figured) is the distance from the most anterior part of the frontal ridge to the posterior end of the subgenital plate (males) or the extremities of the ovipositor valves (females); the width of the furcula is measured as shown in Fig.15.

notched or grooved medially in all species, and in some the groove is provided with raised lips which continue for a little way onto the posterior face of the capsule.

Phallic complex typical of the subfamily. Epiphallus with large conical black lophi, posterior processes large and diverging, ancorae weak, ventrolateral sclerites subcircular, well developed, set rather far back on the phallus. Ventral aedeagal valves completely sheathed, cingular arch large and robust, but usually devoid of valves.

Female: subfusiform in shape. Ovipositor valves with toothed external margins and somewhat hooked at tip. Spermatheca typical of subfamily, tubular, with small apical diverticulum and large cylindrical subapical diverticulum. The duct arises directly from the genital chamber with no bursa, and the opening is supported in most species by a v-shaped sclerite. Most species lack columellae on the internal surface of the subgenital plate. If present (e.g., *H. surdus*), there is only a single pair. The subgenital plate terminates in a short triangular egg guide with a rounded tip.

In several but not all species there is a small ventrally directed process at the anterior angle of the pronotum. *Hylopedetes* has the smallest relative interocular distance of any of the Central American Rhytidochrotine genera and (together with *Talamancacris* Rowell

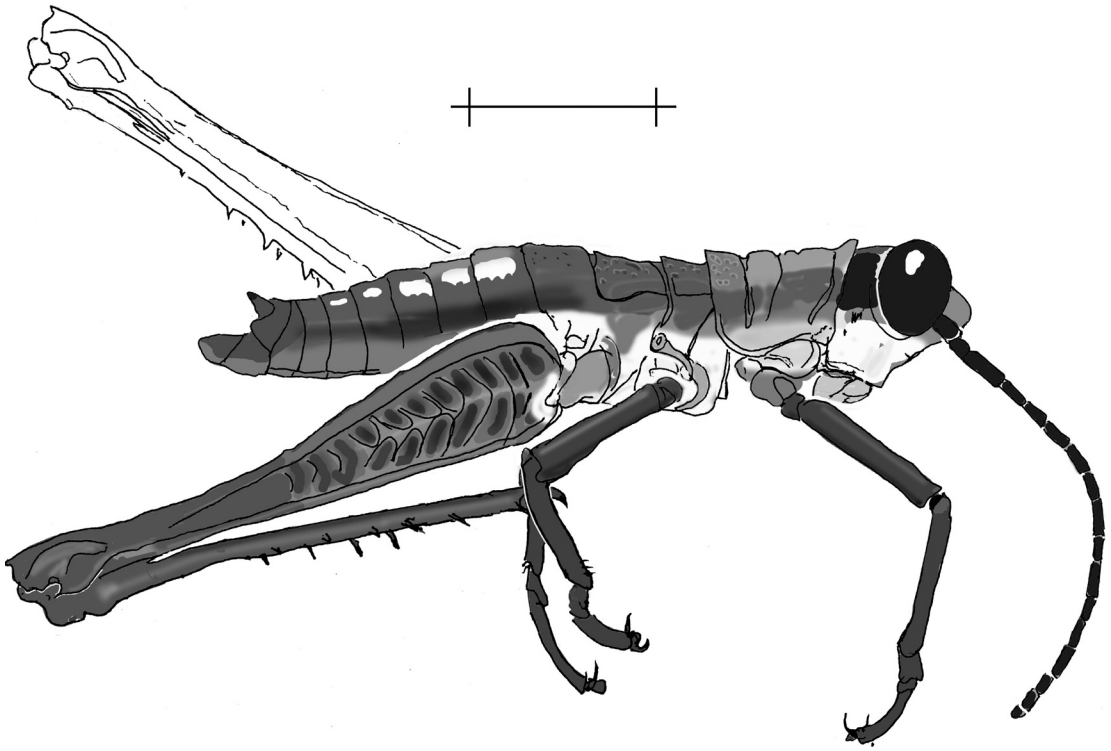

Fig. 2. *Hylopedetes gemmeus*, (Panamanian specimen), habitus of male. Scale 5 mm.

1995) the relatively shortest antennae. The pattern of the antennal sutures is similar to that of the closely related *Exerythracris* Rowell 1995, with which it also shares a proportionately very long last segment of the hind tarsus (50 to 60% of foot). *Hylopedetes* is a difficult genus to diagnose with discrete positive characters, but very characteristic and readily recognizable once seen. The different species form a very homogenous group morphologically and ecologically, differing principally in coloration, which is often vivid. Typically the males have a slightly different color pattern from the females.

Hylopedetes gemmeus Rehn 1929

This is the *Hylopedetes* species most likely to be found in thick forest at low light intensities. It is usually found on ferns, in Costa Rica especially on members of the genera *Dryopteris* and *Pteris*. In that country it occurs on the Cordillera de Tilarán in the north and from there south and east along the north slope of the Cordillera Central, at least as far as the Río Frío. The type locality lies to the south of this, in the northern Talamanca foothills at Navarro in the central part of the country, but the species has not been seen there since its original collection, presumably a consequence of the general forest degradation in that area (Rowell 1995). The species has not been recorded in Costa Rica south of this point.

In Panama we have found large populations of *H. gemmeus* in the mountains of the watershed between the provinces of Chiriquí and Bocas del Toro in Western Panama, and less commonly further east in the Cordillera Central, only 100 km W of Panama City. In all these localities it is associated with ferns in wet montane forest, especially with *Hypolepis* sp. The Panamanian specimens (Fig. 2) are slightly larger than those from Costa Rica (by about 7 to 10%, as assessed by the length of the male hind femur) but appear otherwise identical. There is no difference in either the male or female internal genitalia (Figs 3,4), which are of the form characteristic of the genus (given how generally uniform the genitalia are in this genus, or even this subfamily, however, this finding says little as to the possible genetic separation of the 2 populations). The epiphallic lophi are shouldered on their external faces and slightly divergent. In the female, the aperture of the duct of the spermatheca is supported by a sclerite in the form of an inverted V. A simple paired columella is sometimes present, mostly absent.

New records.— PANAMA: Chiriquí Province: Fortuna: Centro de Investigaciones Jorge L. Arauz (IRHE), 1300 m, coords N964000 E363700, in dense montane forest on ferns, 22.9.1997 (Rowell CHF, Bentos-Pereira A), specimen nos 97432 & 97433 (RC). As above, but 23.9.1997, specimen nos 97436, 97442 - 97447; as above, but specimen nos 97438, 97440 and 97441 (STRI); as above, but specimen no. 97437 (GBFM): as above, but Valle de las Minas, 3 km N on rd to Chiriqui Grande, coords N958200 E365800, 25.9.1997, specimen no. 97517 (RC). Bocas del Toro Province: 1-3 km past watershed on road from Fortuna to Chiriquí Grande, 1035 m - 850 m., coords N973000 E366000 approx., 23.9.1997 (Rowell CHF, Bentos-Pereira A), specimen no. 97450 (RC); as above, but 18.9.1997 (URFCN); Altos del Valle, Río Guabo, 8.5 km after watershed on rd. to Chiriquí Grande, 400-500 m, coords N977000, E372200, 28.9.1997 (Rowell CHF, Bentos-Pereira A), specimen nos 97585 - 97587 (GBFM); Quebrada Felix, 2 km NW of summit of rd to Chiriqui Grande, 900 m, coords N972500 E365800, 26.9.1997 (Rowell CHF, Bentos-Pereira A); as preceding, but 19.09.99, speci-

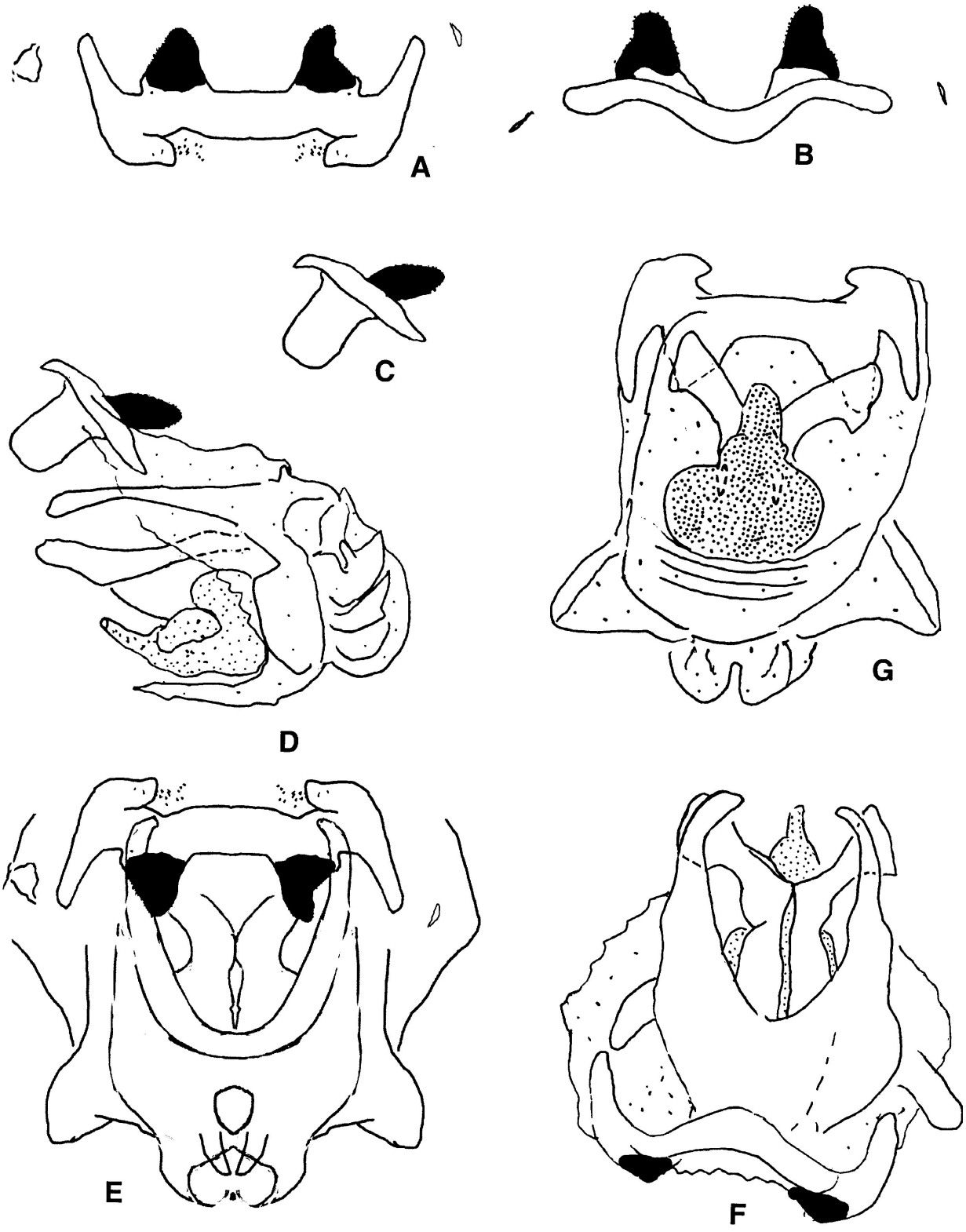

Fig. 3. *Hylopedetes gemmeus* (Panamanian specimen), phallic structures. A. Epiphallus, dorsal view B. Epiphallus, axial view. C. Epiphallus, lateral view. D. Phallic complex, lateral view. E. As D, but dorsal view. F. As E, but epiphallus reflected to the rear, to show cingular and endophallic apodemes. G, as F, but ventral view.

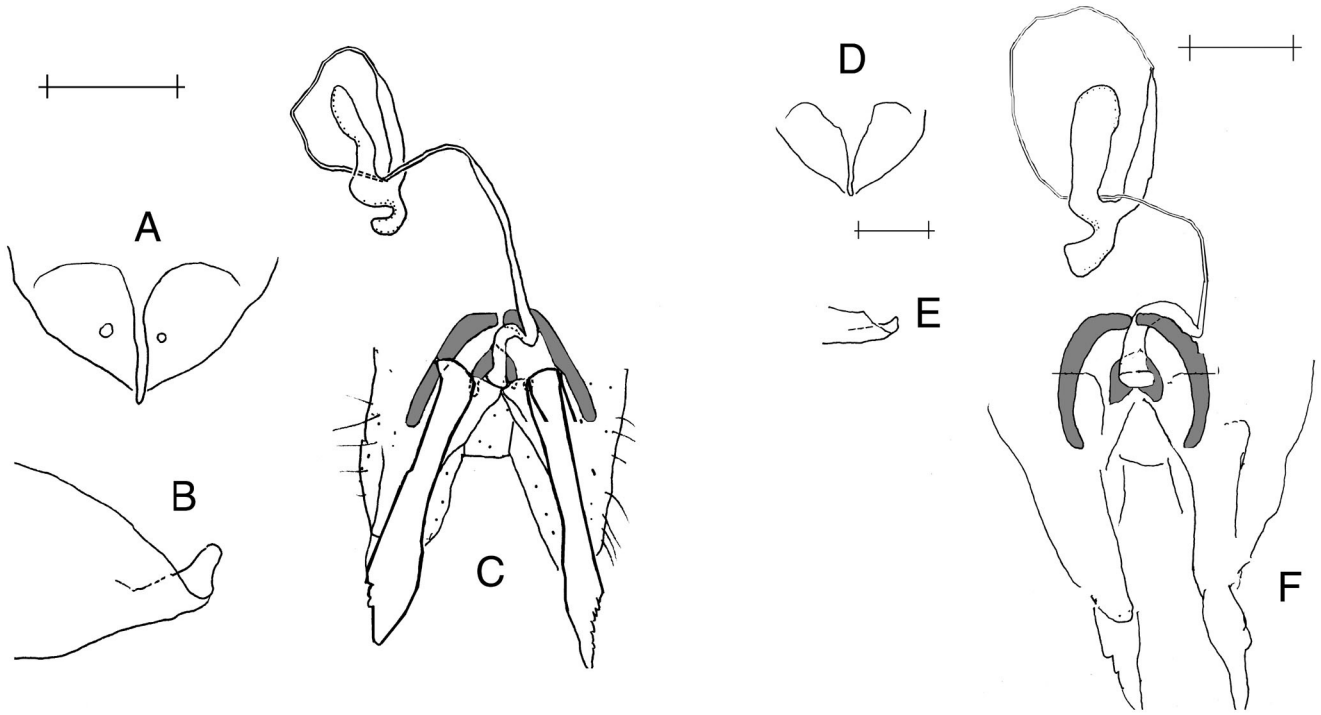

Fig. 4. *Hylopedetes gemmeus* female internal genitalia. A-C are from a Panamanian specimen, D-F from a Costa Rican one. A, D, dorsal view of tip of subgenital plate. B,E, lateral view of subgenital plate, showing egg guide. C,F, Spermatheca. The basivalvular sclerites and the sclerite supporting the aperture of the duct are shaded. Scales 1 mm.

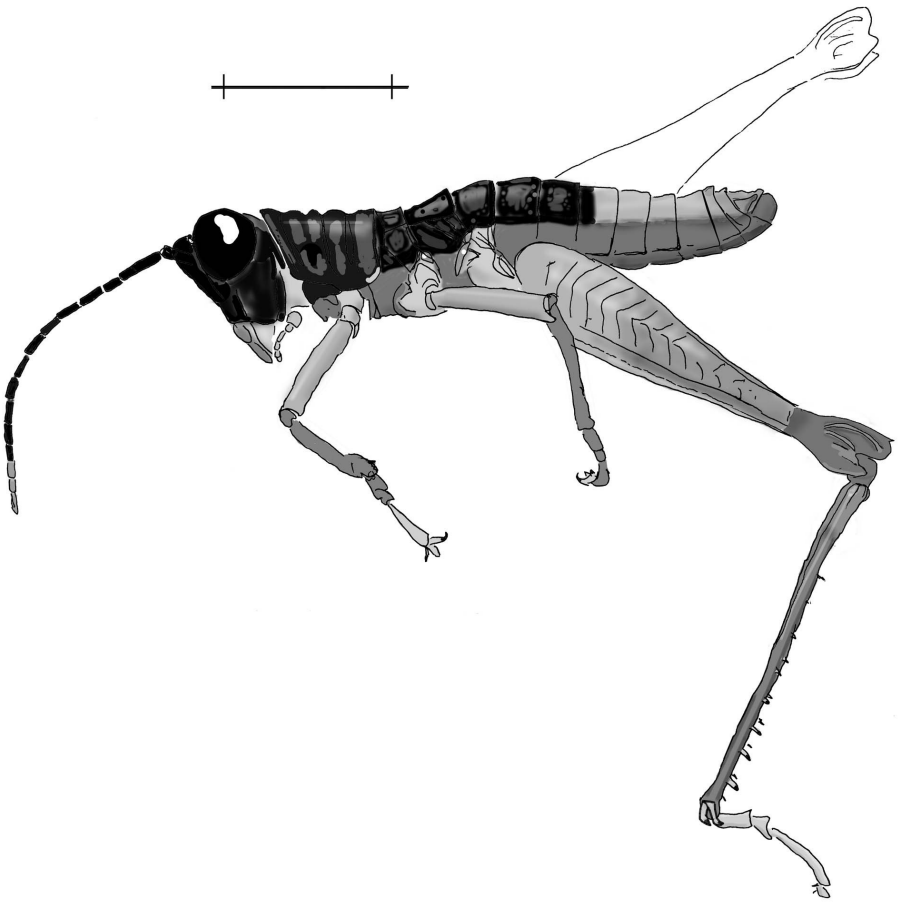

Fig. 5. *Hylopedetes nigrithorax panamensis* n. ssp. male, habitus. Scale 5 mm.

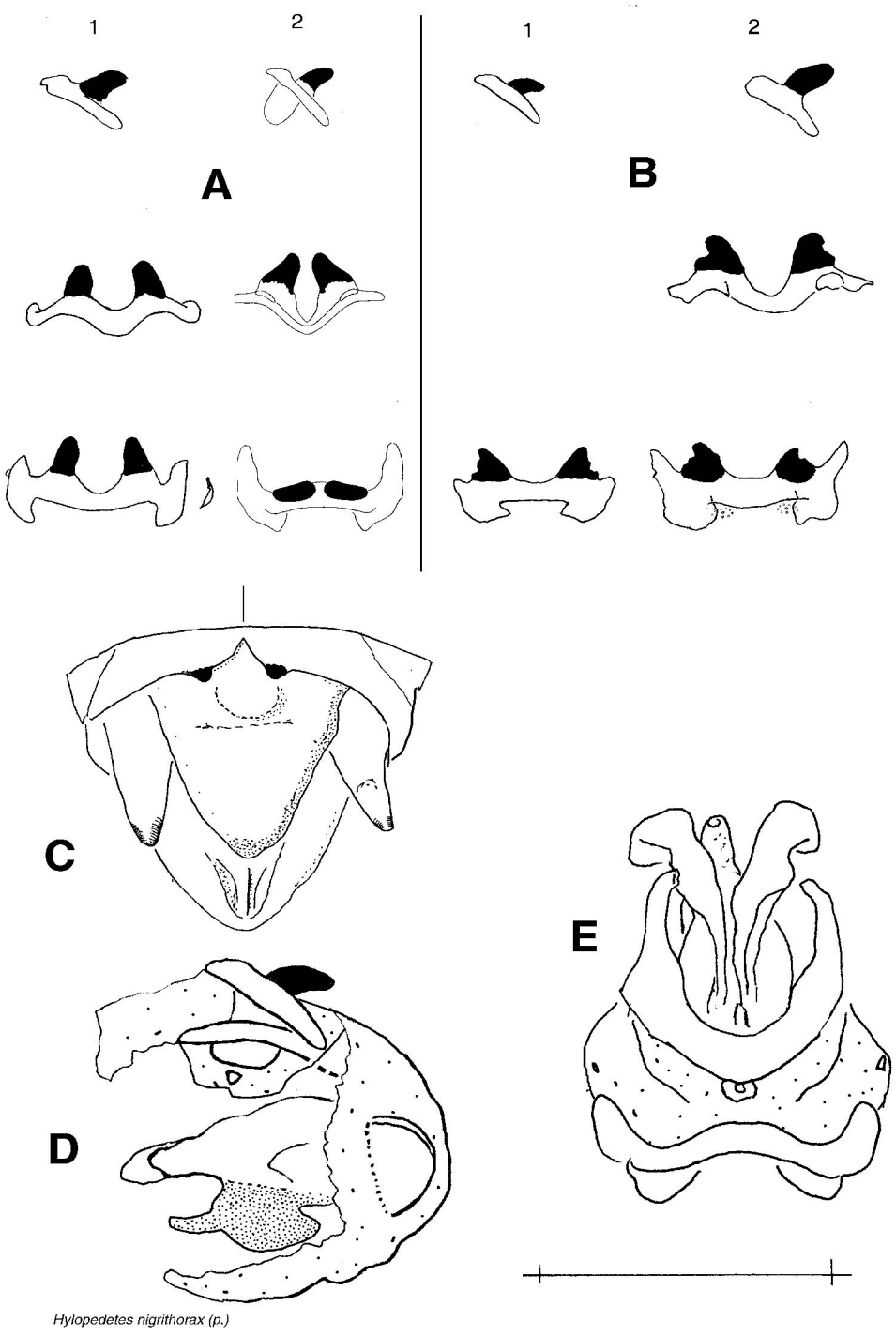

Fig. 6. *Hylopedetes nigrithorax panamensis* n. ssp. Male genital structures. A,B, epiphalli of A) 2 Costa Rican specimens and B) 2 Panamanian specimens. The top row shows lateral views, the second row axial views, the third row dorsal views. C, Supra-anal plate and furcula, dorsal view. D, Phallus, lateral view. E, As D, but dorsal view and epiphallus reflected to the rear. Scale bar, 1 mm.

men nos 99144, 99164, 99166 & 99168 (GBFM); as preceding, but 19.09.99, specimen no. 99167 (RC); Coclé Province: Cerro Copé, 900 m, on ferns on Pacific side of watershed, 13.09.99 ((Rowell CHF, Bentos-Pereira A), specimens nos 99088 & 99089 (RC).

Hylopedetes nigrithorax panamensis n. ssp.

Holotype male: PANAMA: Bocas del Toro Province: 1-3 km past watershed on road from Fortuna to Chiriquí Grande, 1035 m - 850 m., coords. N973000_E366000 approx., 24.9.1997 (Rowell CHF, Bentos-Pereira A), specimen nos. 97500 (ANP).

Paratype female: as holotype, but specimen no. 97505 (ANSP).

Other Paratypes: on road from Fortuna to Chiriquí Grande, 1035 m - 850 m., coords. N973000_ E366000 approx., 23.9.1997 (Rowell CHF, Bentos-Pereira A), specimen no. 97457, (1♀)(ANSP); as above, but 24.9.97, specimen no. 97508 (1♂)(ANSP);on road from Fortuna to Chiriquí Grande, 1035 m - 850 m., coords. N973000_E366000 approx., 23.9.1997 (Rowell CHF, Bentos-Pereira A), specimen no. 97456(♂), 97468 (♀) and 97469 (♂) (RC); as above, but 24.9.97, specimen nos) 97501(♂), 97507 (♀) & 97508 (♀) (RC); as above, but specimen nos. 97481, 97490, 97504, 97511 (GBFM); as above, but specimen nos. 97482, 97484, 97485, 97491 (STRI); as above, but 18.09.99, specimen nos. 99129 & 99130 (GBFM); Quebrada Felix, 2 km NW of summit of rd. to Chiriquí Grande, 900 m, coords. N972500 E365800, 22.09.99, (Rowell CHF, Bentos-Pereira A. specimen nos. 99145, 99162, 99187, & 99188 (GBFM); other material from this locality in URFCN.

The nominate race of the species was originally described by Descamps & Rowell (1978) from a locality on the Fila Cruces, which forms the most southwesterly ridge of high ground before the Pacific plain of Southwestern Costa Rica. *H.n. nigrithorax* occurs in montane forest to the north and south along this same ridge, at altitudes between 1100 and 1700 m, and extends downhill to Campo Dos y Medio near the Panamanian border at 600 m. The preference of *H. nigrithorax* at the type locality for certain species of ferns (including *Hypolepis hostilis*) was documented previously (Rowell *et al*. 1984); however, it can sometimes be found on Asteraceae.

We have found *H. nigrithorax* abundantly on ferns in montane forest on the Caribbean slope of Western Panama, where it is sympatric with *H. gemmeus*, *H. fuliginosus* n. sp. and *Chiriquacris quadrimaculata* n. sp.

The Panamanian form (Fig. 5) is 30% larger than the Costa Rican one; the fastigium is sometimes (*e.g.* specimens no. 97501, 97469) but not invariably, deeply grooved. It also differs slightly in coloration. The antennae are black, with a brownish tip, and NOT red; all abdominal terga, except the first 2, are more green than black; and (especially in females) the hind tibia are blackish green with brown, black-tipped spines, whereas in the Costa Rican form they are green. The tip of the male abdomen in dorsal view is green in the Panamanian population, but red in the Costa Rican one. The furcula is narrower in the Panamanian population (35% of basal width of the supra-anal plate relative to 41%: see Figs 6C, 15)

Further, the epiphallus of the males is significantly different (Figs 6A, B). The Costa Rican form has smoothly tapering lophi that converge inwards towards the midline, whereas the Panamanian one has shorter, shouldered lophi that diverge rather than converge. This is not merely an individual variation, but a population one.

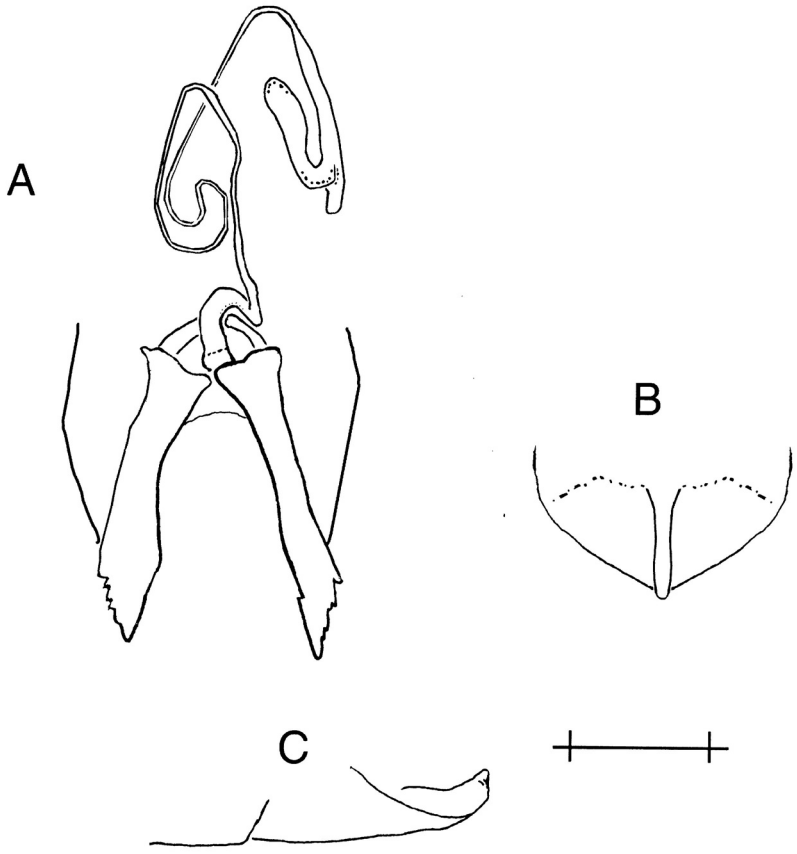

Fig. 7. *Hylopedetes nigrithorax panamensis* n. ssp. Female genital structures. A Spermatheca. Note absence of supporting sclerite at aperture of canal. B,C, Dorsal and lateral views of subgenital plate. Scale 1 mm.

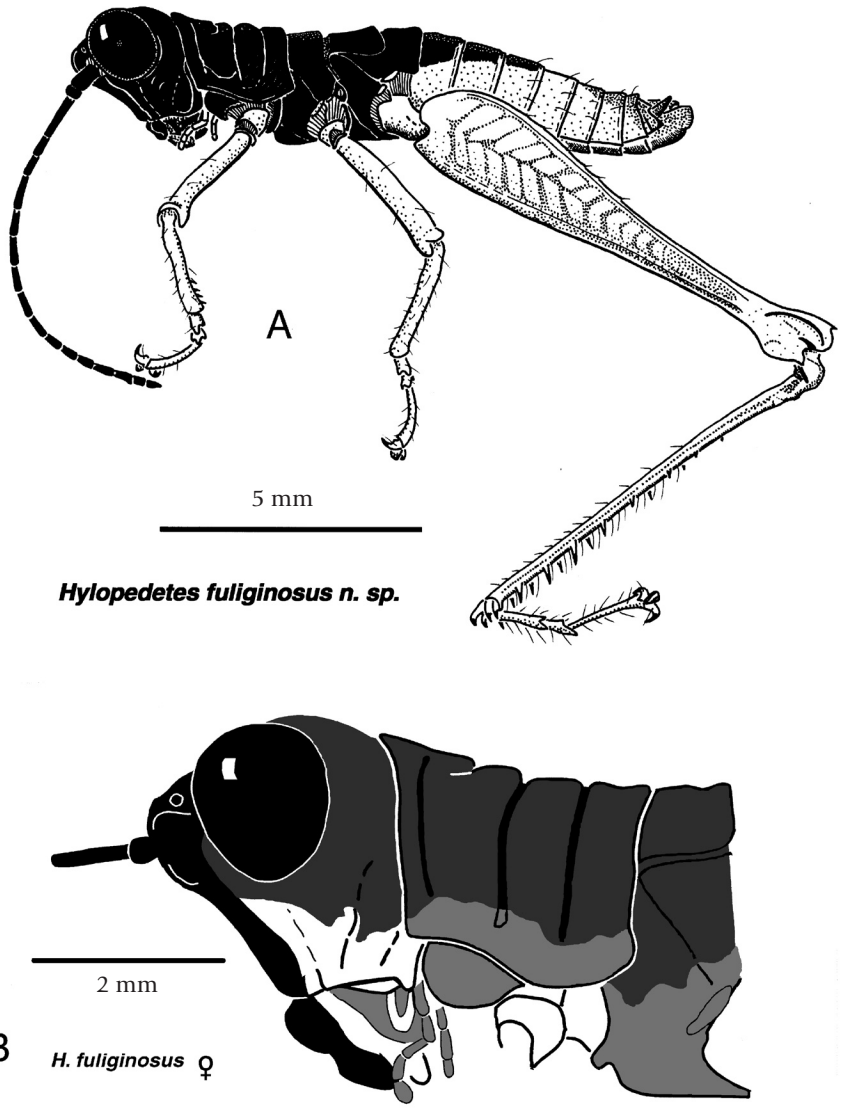

Fig. 8. *Hylopedetes fuliginosus* n. sp. A. male habitus B. Female head and thorax to show pale markings on genae and pronotal lobes, absent in the male.

In view of the great uniformity of the genitalia within this genus, and indeed within the subfamily, a consistent difference of this sort must be regarded as significant, and is here used as the basis for subspecific differentiation. The female internal genitalia are typical for the genus (Fig. 7) and show no difference between the two populations. A basal sclerite of the spermathecal duct is usually lacking.

***Hylopedetes fuliginosus* n. sp.**

Holotype male: PANAMA: Province Bocas del Toro; Quebrada Felix, 1.5 km E of summit of rd to Chiriquí Grande, 940 m, 27.9.1997 (Rowell CHF, Bentos-Pereira A), specimen no. 97570 (ANSP).

Paratype female: as holotype, but 24.9.1997, specimen no. 97493(ANSP).

Other paratypes: 2 ♀, data as holotype, but 24.9.1997, Sp. nos 97478 & 97503. 4 ♂♂, Prov. Bocas del Toro: Quebrada Felix, 2 km NW of summit of road to Chiriquí Grande 900m.19 - 22. 09 .1999 (Rowell CHF, Bentos-Pereira A), specimen nos. 99161, 99158, 99160, 99198; 7 ♀♀, data as previous entry, specimen nos. 99174, 99175, 99176 , 99177, 99190, 99191, 99195, 99197. All ANSP. Locality and collectors as holotype: 1 ♂, 24Sept 1997, Specimen no. 97492; 1 ♂, 26. Sept 1997, specimen no. 97466; 1 ♂, 26. Sept 1997, specimen no. 97466; 1 ♂, 24. Sept 1997, specimen no. 97502; 1 ♀, 27. 9.1997,specimen no. 97571; 2 ♀♀, Prov. Bocas del Toro: Quebrada Felix, 2 km NW of summit of road to Chiriquí Grande, 900m. 22. 09. 1997 (Rowell CHF, Bentos-Pereira A), specimen numbers 99192 & 99197. All RC.

Etymology.— Latin *fuliginosus*, sooty.

Description.— Male. (Fig. 8A) About same size as *H. mirandus*, type of the genus (Table 1), and with typical form and habit of genus. Cuticle of thorax and head minutely punctate, producing a dull matte surface. Rostral index 0.27 (*H. mirandus* 0.28), antennal flagellum with 16 segments. Seven external hind tibial spines, 8 internal spines. The characteristic foot form of genus preserved: hind foot is large (36% of length of femur) with very short second segment and very long last segment (foot formula 30: 14: 56). Differs from other species of genus in coloration (below) and as follows: lateral margins of fastigium (Fig. 9A) elevated into ridges which run posteriorly, bordering margin of eyes, through interocular space.

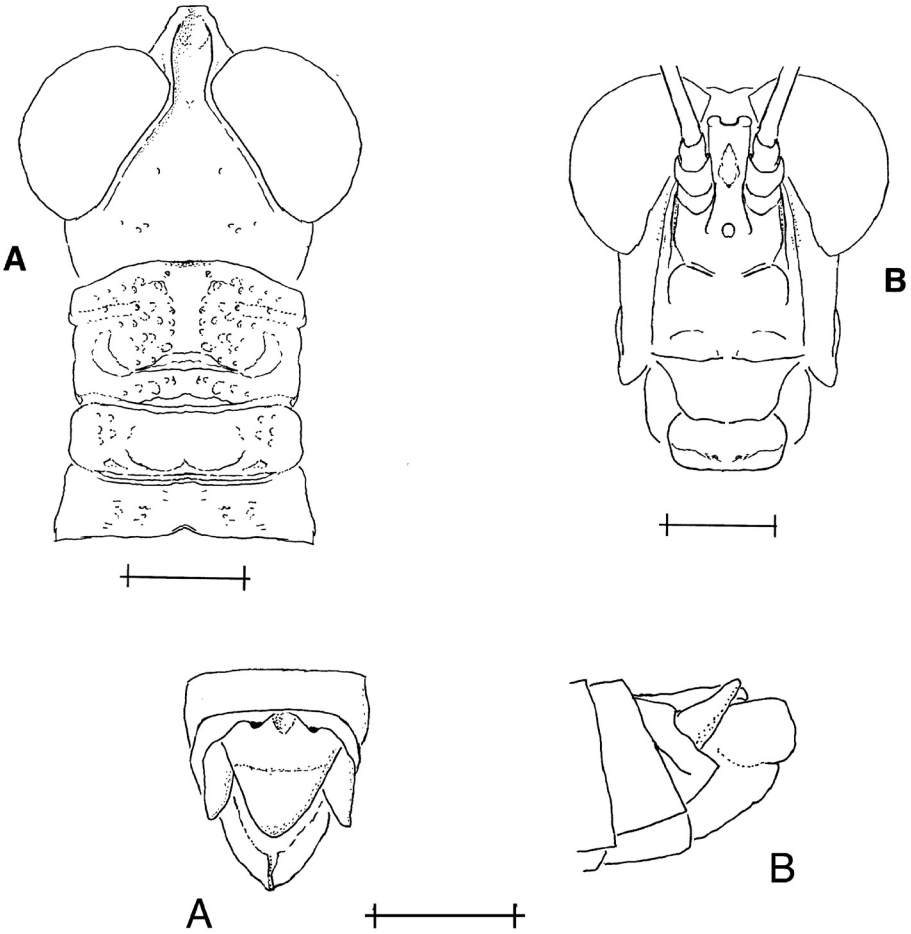

Fig. 9. *Hylopedetes fuliginosus* n. sp. A. Male head and pronotum, dorsal view. B. Male face, frontal view. Scale 1 mm.

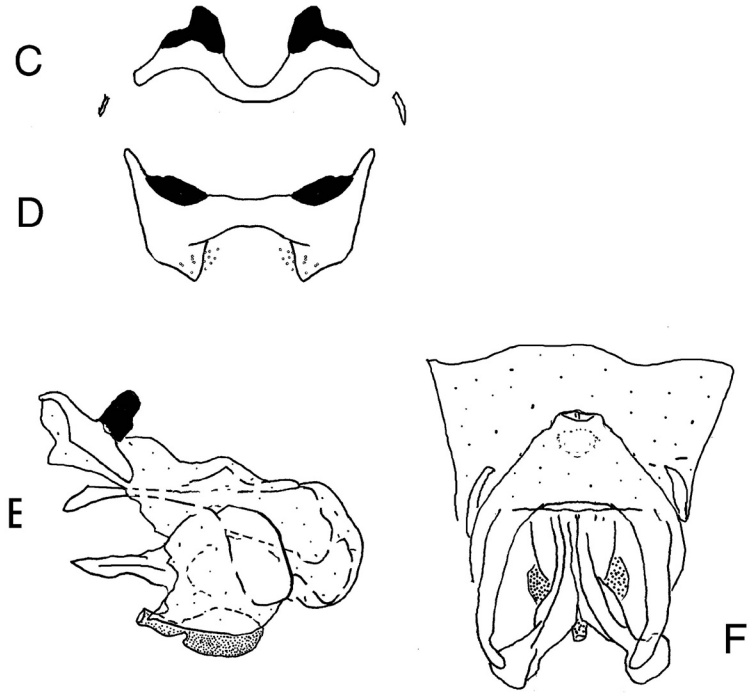

Fig. 10. *Hylopedetes fuliginosus* n. sp. Male reproductive structures. A,B, tip of abdomen in dorsal and lateral views. C,D. Epiphallus, axial and dorsal views. E. Phallic complex, lateral view. F. As E, but epiphallus reflected to the rear.

Frontal ridge widest at junction with fastigium, tapering to a narrowest point a little above medial ocellus, obsolete below ocellus (Fig. 9B). Anterior angle of pronotum scarcely produced. Anterior margin of pronotal disc excurved medially, posterior margin straight or notched medially (Fig. 9A). Prosternal process short and pointed, vertical, or angled slightly forwards. Phallic complex (Fig. 10) typical of genus, lophi straight or slightly divergent. Furcula with widely spaced tips, index 52; medial dorsal rim of subgenital plate deeply notched, and edged with lips (see Figs 6C, 15)

Female genitalia (Fig. 11) typical of the genus.

Sexual dimorphism.— Males are on average 0.84× (0.75 to 0.95) the size of females (based on F,P).

Coloration.— **Male**. Antennae, eyes (reddish brown when dried), head, thorax, including thoracic sterna and terga of first 4 abdominal segments, sooty black. Ventral rims of all 3 thoracic episterna and of metathoracic epimeron, outlined with greenish yellow. Remaining areas, including palps and legs, dark green. Genital area suffused blackish. Semilunar processes of hind knee black, tibial spines, spurs and tarsal claws basally green, then brownish, tipped black.
Female (Fig. 8B) Generally similar to male, but differs as follows. Most areas sooty black in male are in female dark blue-green (discoloring to blackish green in dried specimens). Frons, frontal ridge, black. Ventral margins of genae, shining white (fading in dried specimens). Sides of mandibles, ventral border of pronotal lobe, prothoracic episternum, pale greenish yellow. Genital area not suffused with dark color. Ventral surface olive brown, not black.

Hylopedetes punctatus n. sp.

Holotype male: COSTA RICA: Prov. S. Jose: Sa. Elena: Fila above Los Nubes, valley of R. Peñas Blancas, 1350-1550 m. L-S 372800_507800, 06 June 2000 (C.H.F. Rowell) specimen No. 2000047 (ANSP).
Paratype female as holotype, specimen 2000051 (ANSP).

Other paratypes: data as holotype: 1♂, specimen no. 2000042, 1 ♀, specimen no. 20000050; 1 ♀, data as holotype, but 9 October 1999, sp.no. 99429 (ANSP,); 1 ♂, specimen no. 20000103, COSTA RICA: Prov. S. Jose: 3 km N of Zapotal, valley of R. Union, LS367600_517800, 7 June 2000 (Rowell CHF), 2♀♀, data as 20000103, but specimen nos 2000102 & 2000050 (all ANSP).
Data as holotype: 2 ♀♀, specimen nos 2000063 and 2000049; 1 female larva, as holotype, but 07 June 2000, sp. no 2000104; 1 ♂, data as holotype, specimen no. 2000046; 2 ♂♂, data as holotype, but 9 October 1999, specimen nos 99432 & 99449. (All INBC).
1 ♂, data as holotype, specimen no.2000045: 2 ♂♂, data as holotype, but 9 October 1999, specimen nos 99428 & 99431; 1 ♂, specimen no. 20000102, COSTA RICA: Prov. S. Jose: 3 km N of Zapotal, valley of R. Union, LS367600_517800, 7 June 2000 (Rowell CHF). (All URFCN).

2 ♀♀, data as holotype, specimen nos 2000041 &2000052; 2 ♂♂, data as holotype, sp. nos 20000444 & 2000048; 2 ♂♂, data as holotype, but 9 October 1999, sp. nos 99430 & 99433; 1 ♀, as preceding entry, but specimen no. 99427; 1♀, COSTA RICA: Prov. S. Jose: 3 km N of Zapotal, valley of R. Union, LS367600_517800, 7 June 2000 (Rowell CHF),specimen. no. 2000100 (all RC).

Etymology.— Latin *Punctum*, small hole, dot, spot, point: referring to the small pale spots on the generally dark integument.

Form and size typical for the genus (Fig. 12). Dimensions (Table 1). Fastigium inclined downwards, medially grooved. Rostrum rather bluntly terminated in side view (compare *e.g.* with Fig. 2 *H. gemmeus*). Prosternal process conical, acutely pointed, vertical or angled slightly forwards. Seven external and 8 internal hind tibial spines. Terminal spine on dorsal carina of hind knee very small or completely absent. Antennal flagellum with 16 to 17 segments, slightly longer than head and pronotum together. Medial carina of pronotum incised by 3 wide sulci. Anterior margin of disc convex medially, posterior margin slightly emarginate.

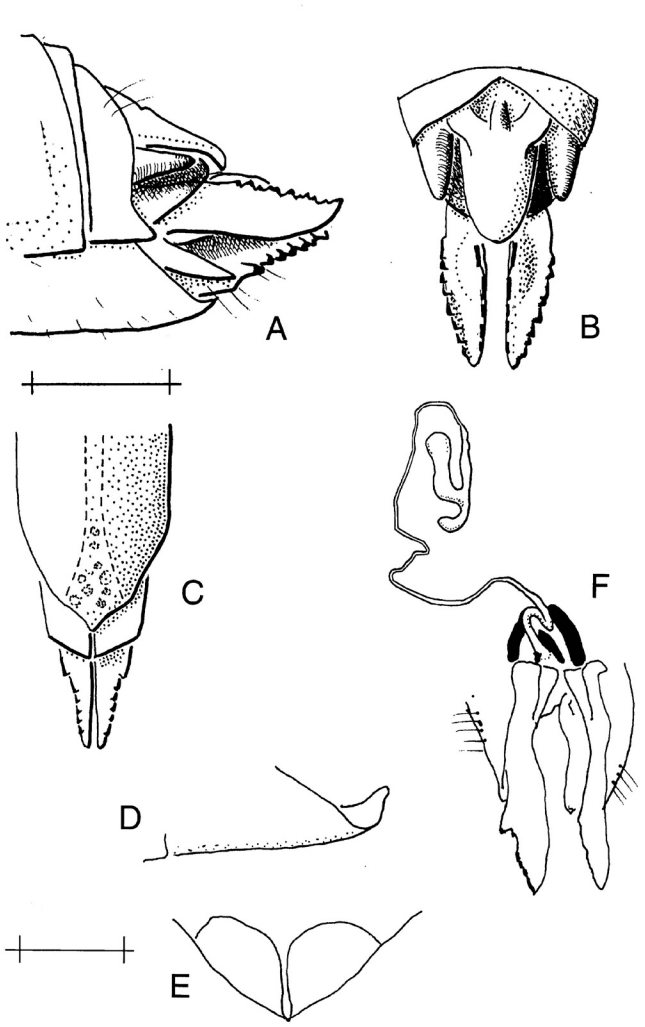

Fig. 11. *Hylopedetes fuliginosus* n. sp. Female reproductive structures. A,B,C, tip of abdomen in lateral, dorsal and ventral views. D,E, subgenital plate in lateral and dorsal views. F. Spermatheca. The basivalvular sclerites and the sclerite supporting the aperture of the duct are shaded. Scale 1 mm.

Male supra-anal plate (Fig. 13D) triangular with a rounded tip, indistinctly divided at half-length by a weak transverse fold. Furcula (Fig. 14D) small, with 2 obtusely angled triangular points, melanized at the tip, and more widely spaced than in any other known species of the genus (55% of basal width of supra-anal plate, Fig.15). Cerci short, conical, straight. Posterior rim of genital capsule grooved medially and produced into two lip-like structures down the posterior tip of the subgenital plate. Phallus (Fig. 13 A-C) typical of the genus. Lophi of epiphallus conical, slightly convergent towards the midline. The extreme tips of the ventral aedeagal sclerites

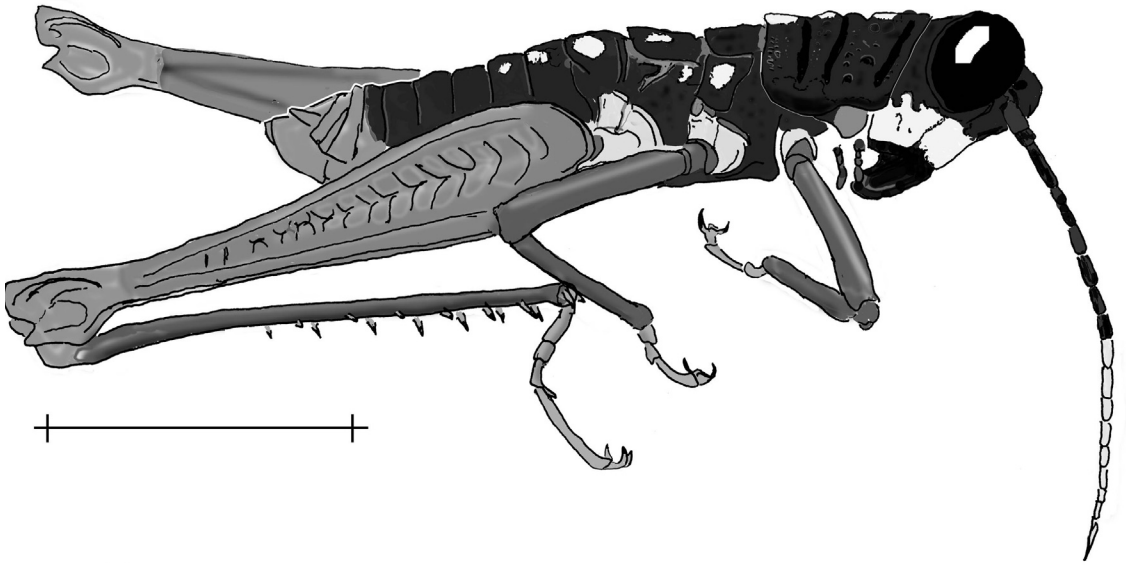

Fig. 12. *Hylopedetes punctatus* n.sp, male habitus. Scale 5 mm.

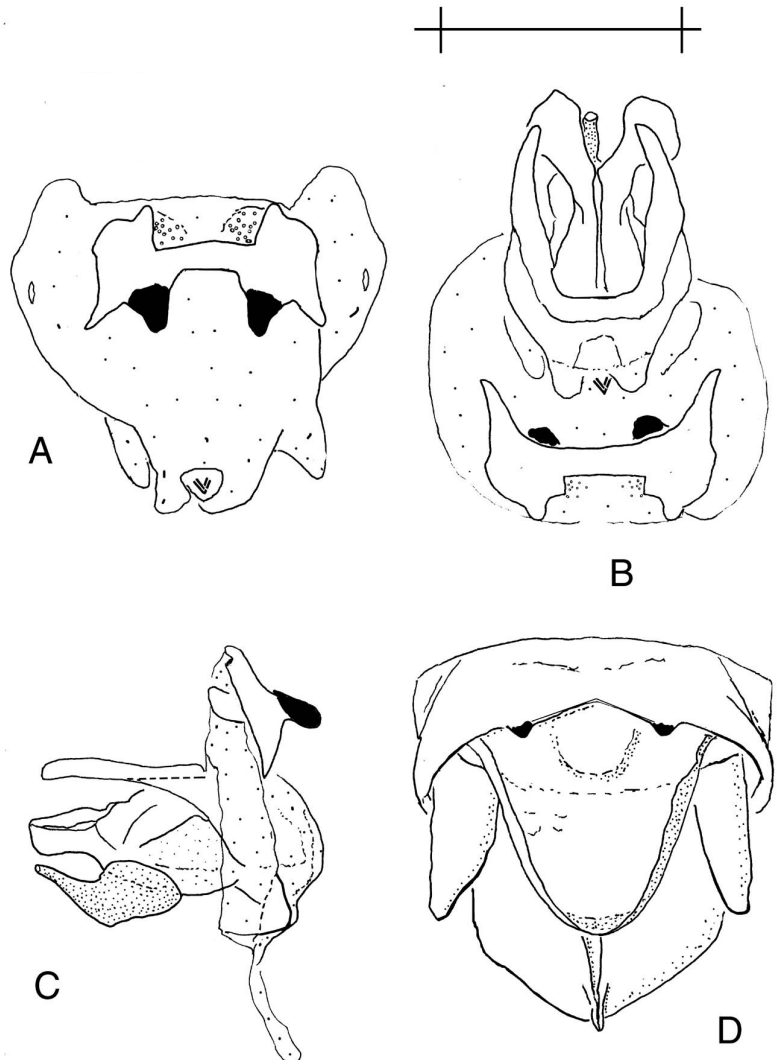

Fig. 13. *Hylopedetes punctatus* n. sp. Male reproductive structures. A, Phallic complex, dorsal view. B. As A, but epiphallus reflected to the rear. C. As B, but lateral view. D. Tip of abdomen in dorsal view. Scale 1 mm.

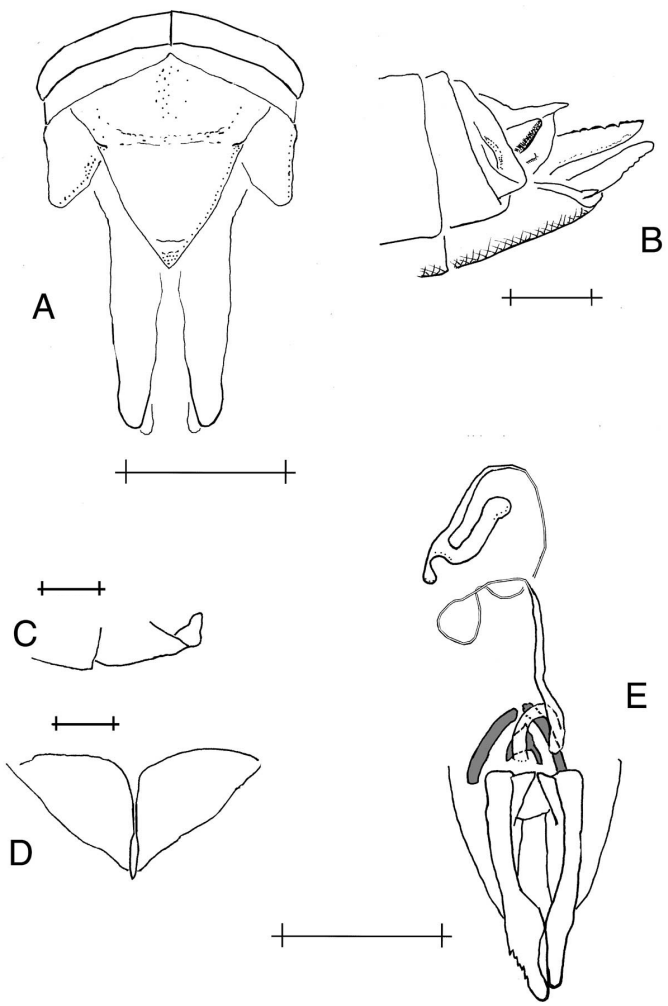

Fig. 14. *Hylopedetes punctatus* n. sp. female reproductive structures. A & B, tip of abdomen in dorsal and lateral views. C & D, subgenital plate, lateral and dorsal views. E. Spermatheca. Basivalvular sclerites and the sclerite supporting the aperture of the duct are shaded.

are visible, and not completely hidden by the folds of ectophallic membrane as in most species of this genus.

Female ovipositor (Fig.14 A,B) robust, bluntly toothed along outer edges. Spermatheca (Fig. 14E) typical for the genus, the duct opening is supported by a v-shaped sclerite. No columellae on subgenital plate, which ends in a triangular egg guide which is rather large for the genus (Fig. 14C).

Coloration.— (Both sexes). General color dark greenish black. In male the entire thorax and pronotum is black. Eyes and proximal segments of antennae shining black. Terminal 9 antennal flagellar segments ochraceous, yellowish or white. Lower part of frons and genae white or yellow in females, but not in males, extending backwards along the ventral edges of the pronotal lobes. Three pairs of white or yellow or golden spots on the dorsal surface of the pronotum, and one pair on each of the meso- and metathoracic and first and second abdominal terga. Other pale spots on the meso and metathoracic epimera. These spots, especially those on the terga, vary in distinctness and are nearly absent in some individuals, very conspicuous in others. Legs green, the hind femur being the lightest in color, the hind tibia the darkest, almost black. Hind tibial spines ochre, with black tips. Feet ochre or green (especially in females). Genital region and hind knees vermillion.

Distribution, biology.— Known only from the headwaters of two adjacent tributaries (Rio Union, R. Peñas Blancas) of the Rio El General in West Central Costa Rica. These rivers drain the Pacific slope of the Talamanca range. Found in deep forest on *Pteris* ferns and tree ferns (Cyatheaceae), but also in forest edge situations on *Hypolepis* (reminiscent of *H. gemmeus*).

Comment. This paper brings the number of named taxa within the genus *Hylopedetes* to 8, of which 2 (*H. fuliginosus*, *H nigrithorax panamensis*) are to date confined to Panama. *H. gemmeus* is found in both countries. The remainder are endemic to Costa Rica. *H. gemmeus*, *punctatus* and *fuliginosus* seem to form a related group sharing some morphological characters such as the form of the male subgenital plate (Fig.13D) with its lipped terminal dorsal groove. *H. cruentus* (direction of curvature of spermathecal duct), *surdus* (possession of female columella, epiphallic lophi straight, neither converging nor diverging) and *mirandus* (shape of basal sclerite of spermathecal duct), all have unique features shared by no other species, and may thus be less closely related to the rest.

Key to species of *Hylopedetes*

1 Some red coloration present 2
1A No red coloration anywhere. 7

2 At least some red coloration present on dorsa or pleura of thorax 3
2A No red color on dorsa or pleura of thorax, but may be red elsewhere. 5

3 Antennae entirely black, rest of body mostly green. Thoracic pleura and sometimes rear of pronotum with bright red marks. Conspicuous yellow patches on nota of abdominal segments (Fig. 2). (Costa Rica & Panama). . . . . .*H. gemmeus*
3A Not as above, antennae not entirely black 4

4 Antennae black basally but the terminal 6-7 segments yellow-brown. Red colour mostly confined to thoracic pleura and sterna. Frons and genae yellow. Hind knees yellow-brown….(Costa Rica). . . . . *H. mirandus*
4A Antennae brown or red. Head, thorax, and much of abdomen dark purplish red; legs green, hind knees light brown, male cerci red. .(Costa Rica) . . . . . .*H. cruentus*

5 Hind knees red
- Tip of abdomen (both sexes) and hind knees red, general colour dark blackish-green. Dorsa of thorax and anterior abdominal segments with paired white or yellow dots of variable intensity. (Costa Rica). . . . . *H. punctatus*
5A Hind knees, underside and in male sides of abdomen red. Male thorax black with bluish iridescence . . . . . *H. nigrithorax* - (Costa Rica & Panama) 6

6 Antennae red. Tip of adult male abdomen red on dorsal surface (Costa Rica) . . . . . .*H. nigrithorax nigrithorax*
6A Antennae black, brown at the tip. Tip of adult male abdomen green on dorsal surface (Panama) . . . . . *H. nigrithorax panamensis*

7 No red coloration at all 8

8 Frons entirely black. Antenna black basally, terminal 3-5 segment yellowish white. Female with lower genae and ventral edge of pronotal lateral lobes cream or greenish white. Male with head and pronotum entirely black (Panama) . . . . . *H. fuliginosus*
8A Antennae black with brown tips. General color orange- brown and green. Frons and ventral margin of lateral lobes yellow. Hind knees green or (V. Tenorio and further north) yellow (Costa Rica) . . . . . *H. surdus*

CHIRIQUACRIS n.g.

At first sight this genus evokes the Costa Rican *Brakeracris*, (Rowell 1995) to which it is probably related. It resembles that genus in having 6 to 7 external and 8 to 9 internal tibial spines, a markedly concave frons and a pitted cuticle, but it lacks the medial carinae on the pronotum and the lateral projections between pronotal sulci 2,3 (compare with Rowell 1995, Fig. 4C). The adult female is much larger than that of *Brakeracris* and the female supra-anal plate is of a different form, with a long thin lingulate tip. The antennae are not at all flattened. For further characters, see the species description below.

Type species: *C. quadrimaculatus* n. sp.

Chiriquacris quadrimaculata n. sp.

Holotype male: PANAMA: Province Bocas del Toro: Quebrada Felix, 2 km NW of summit of rd to Chiriquí Grande, 900 m, coords. N972500 E365800, 19.09.99 (Rowell CHF, Bentos-Pereira A), specimen no. 99157; Paratype female: same data, but 22.09.99 and specimen no. 99195; both ANSP.

Dimensions.— see Table 2.

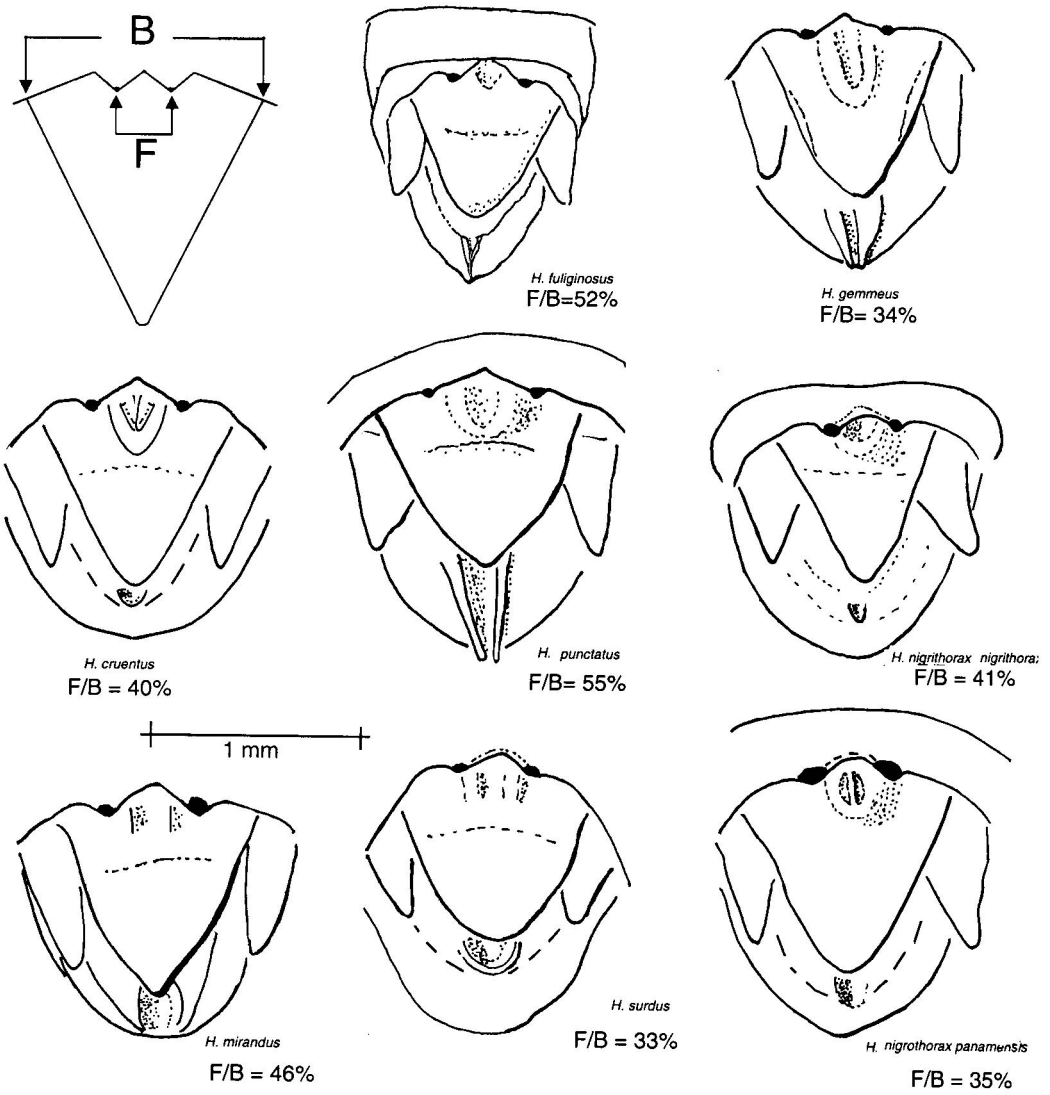

Fig. 15. Male supra-anal plates and furculae of the genus *Hylopedetes*. The ratio F/B (see top left figure) gives a comparative measure of the width of the furcula.

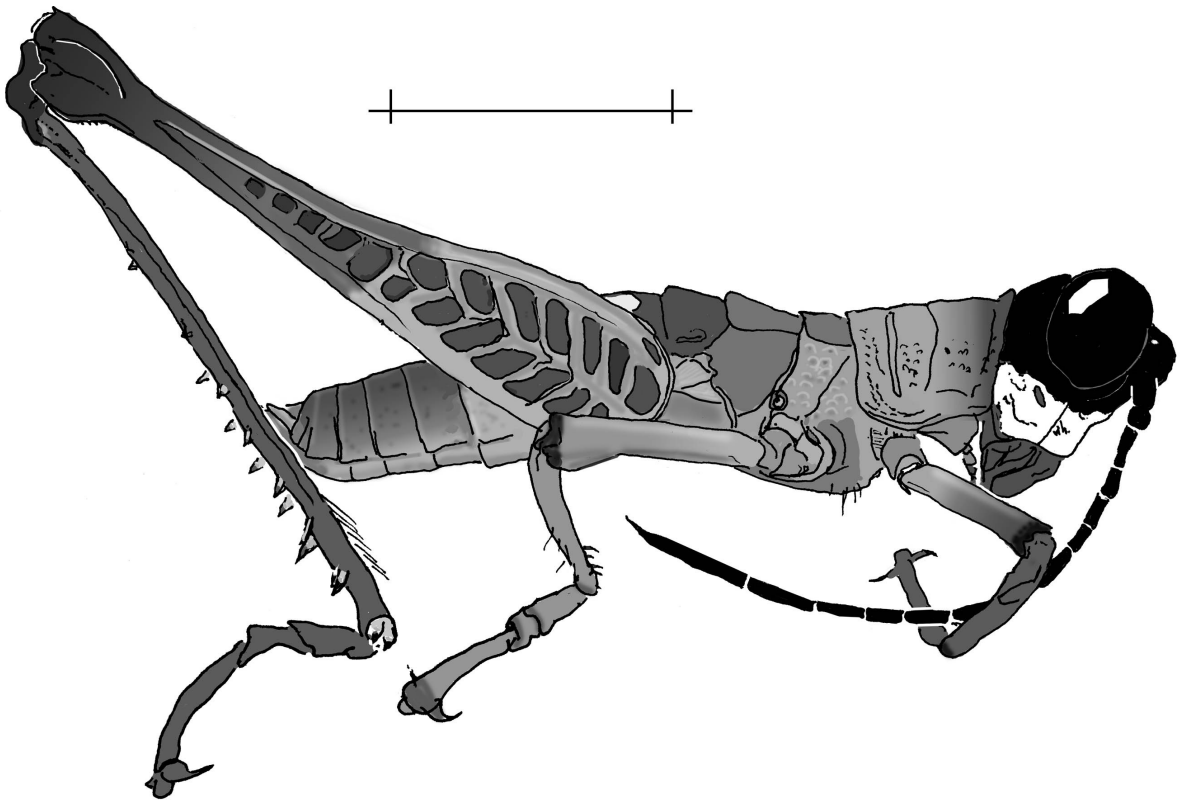

Fig. 16. *Chiriquacris quadrimaculata* n. sp. Male habitus.

Etymology.— From Chiriquí, the town nearest the type locality, and Latin *quadrimaculata*, 4-spotted, referring to the pale yellow markings on the abdominal terga 2,3.

Male: (Fig. 16) small, body length 15 mm. Apterous and atympanate. Cuticle weakly pitted on dorsal surfaces. Eyes globular and protruding, forming widest point of body. Fastigium (Fig. 17A) triangular, with a shallow medial groove, truncate at tip in dorsal view, slanting downward and forward. Frons markedly concave, rostrum blunt-ended in lateral view. (Fig. 17B) Frontal ridge parallel-sided, flat, obsolete below medial ocellus.

Antenna filiform, with 15 flagellar segments. Pronotum devoid of medial or lateral carinae. Three sulci cross its dorsal midline. No lateral processes between sulci 2 and 3. Posterior margin of pronotal disc slightly incised medially, anterior margin somewhat excurved medially (Fig. 17A). Prosternal process conical, pointed, vertical or inclined slightly forwards. Cerci, short, conical and straight. Supra-anal plate (Fig. 17D) triangular, weakly divided transversely at half-length, the proximal half with medial depression, tip acutely pointed. Furcula small, consisting of 2 closely spaced (index = 0.34) obtuse triangular points. Hind femora nearly twice as long as abdomen. Dorsal carina of hind femur with a few hair-bearing irregularities basally, smooth distally, terminating in a small spine at the knee. six external tibial spines, 8 or 9 internal ones. The hind foot is 35% as long as the hind femur; the foot formula is 28:15: 57.

Phallus (Figs 17E-G).Typical of subfamily. Lophi conical, slightly diverging, weakly shouldered on their internal face. Ventrolateral sclerites present, rather small.

Coloration.— Antennae black. Head and eyes, black. Lower frons and genae, shining white; Mouthparts, pale greenish blue. Dorsal surface of fastigium with 2 indistinct yellow streaks, which darken and disappear in some dried specimens. Thorax, abdomen and legs green, tinged with olive brown on the pronotum. One pair of large pale yellow spots on dorsum of 2nd abdominal segment and a smaller, less distinct pair on that of the 3rd abdominal. Distal third of hind femur, hind knee, proximal half of hind tibia, blackish blue. Proximal part of hind femur with prominent herring-bone pattern in blackish blue-green on both outer and inner faces. Distal extremity of fore and middle femora, fore and middle tibia, blackish blue. Feet and tibiae, blue.

Female: (Fig. 18) fusiform in shape, much larger than male (body length 25 mm, 1.65× that of male). Similar to male, but eyes less prominent (Fig. 18B); body widest in first segment of abdomen, and abdomen > 2/3 as long as hind femora. Coloration as in male, but sides of abdominal pleura 2,3 and 4, below the dorsal pale spots, glossy black.

Cuticle of thorax and abdominal dorsa heavily pitted, floor of pits being darker green color than rest of cuticle. Ovipositor valves (Fig.18E) robust, with serrated outer margins. Posterior margins of subgenital plate (Fig.18D) triangular, the edges concavely incurved, egg guide short and upcurved, not extending dorsally beyond the upper surface of the lower valves. Supra-anal plate (Fig. 18C) triangular, weakly divided transversely at half-length, the proximal half with a strong medial depression, the distal half narrow, lingulate, tip acutely pointed. Cerci short, conical, bluntly pointed. The spermatheca was not dissected from the female to avoid damaging the unique specimen. Hind femur with 6 or 7 external spines and 9 internal ones.

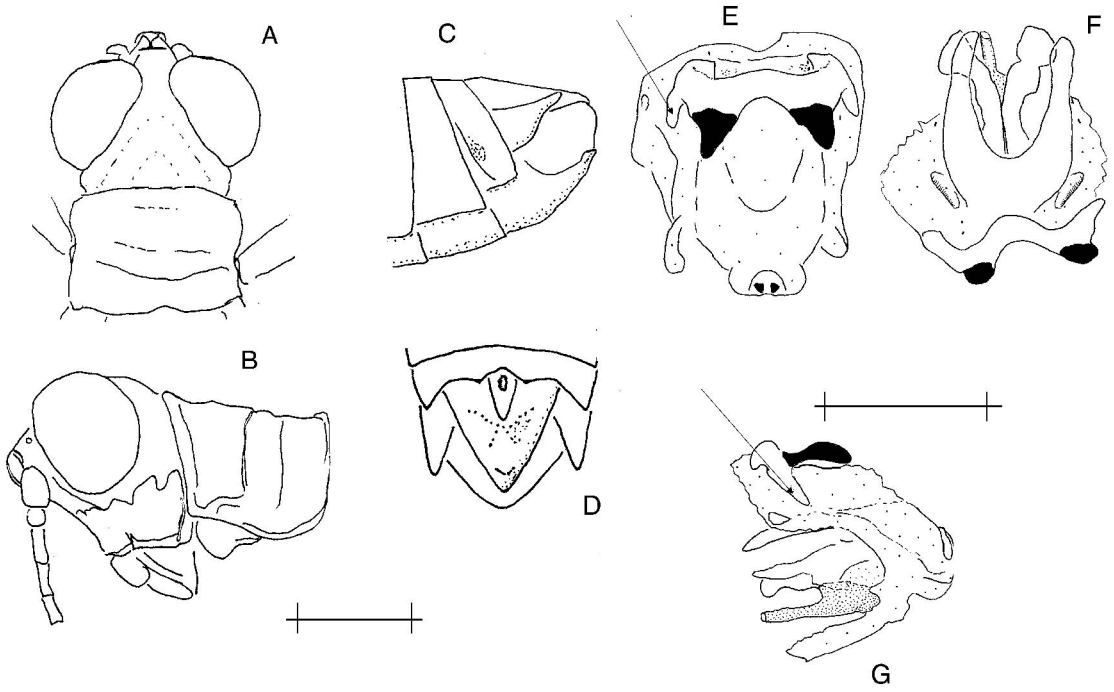

Fig. 17. *Chiriquacris quadrimaculata* n. sp. Male. A. Head and pronotum, dorsal view. B. The same, lateral view. C. Tip of abdomen, lateral view. D. The same, dorsal view. E. Phallic complex, dorsal view. F, as E, but epiphallus reflected to the rear. G. Phallic complex, lateral view. The arrow in E,G indicates the long thin posterior process of the epiphallus. Scale 1mm.

Larval coloration.—Second (or 3rd?) instar: General color, olive green. Antennae, vertex and eyes, black. Fastigium, areas of vertex and genae forming posterior and ventral borders of eyes, white. Frons, labrum, mandibles, olive green. Anterior border of pronotum, white. Hind knee black, pregenicular ring white.
V instar: coloration as adult in both sexes.

Field characters.— Among several similarly sized green and black sympatric taxa at this locality (*e.g.*, *H. nigrithorax*, *H. fuliginosus* n. sp., *Drymophilacris nigrescens* Rowell 2000) *Chiriquacris* can readily be distinguished by the combination of its shining white lower face and the 4 yellow spots on the abdominal terga.

This species was found only rarely in forest-edge situations on a variety of plants, including ferns.

Other material examined.—PANAMA: Bocas del Toro Province: 1-3 km past watershed on road from Fortuna to Chiriquí Grande, 1035 m - 850 m., coords. N973000 E366000 approx., 24.9.1997 (Rowell CHF, Bentos-Pereira A), specimen no. 97455 (female Vth instar larva); as above but 23.9.1999, specimen nos. 99204 & 99205 (one II and one IV instar larva); as holotype, but 26.9.1997, specimen nos. 97534 97543 (one Vth and one IIIth larva).

Piezops Hebard 1923

Hebard 1923: 296; Hebard 1924: 136; Amedegnato 1974:201; Descamps & Amedegnato 1972: 1087

Hebard's genus was erected to accommodate *Rhytidochrota ensicornis* Stål 1878. It lacked a formal description other than the information given in a key to *Rhytidochrotine* genera presented at the same time. The genus has since remained monospecific. It seems closest to the Colombian *Opaon*, sharing with it large size and a more or less spiny cuticle, and is one of the few tympanate genera of the subfamily so far found outside of South America. The type locality was given only as "Panama" — and almost no other biological or distributional data are available. At the time of Descamps and Amedegnato's (1972) review, the female was unknown. Their description, presumably made from the holotype male, describes the antennae as being red. This is not true in any of the specimens we have seen. In these, the antennae are black or blackish brown in both sexes.

Generic diagnosis.— (see also Fig 19.) Of large size (see Table 3). Overall length from 25 mm (♂) to 40 mm (♀.) Cuticle rough and granular. Fastigium of vertex slanting downward and triangular, tip often deeply incised by groove running up the frontal ridge. Profile of face strongly concave. Frontal ridge obsolete below medial ocellus, and deeply grooved above it. Lateral carinulae of face interrupted below eyes. The infra-ocular distance is a little less than length of eye. Antennae strongly ensiform, segments at base of flagellum wider than interocular space, and longer than head and pronotum together, about as long as hind femur.

Pronotum rough with narrow sulci. Metazona with a strong medial process. Anterior margin excurved and bisinuate in midline, projecting over occiput. Posterior margin almost straight. Prosternal process with a posterior spine. Disc has a strong, bluntly spinous lateral process between sulci 2,3(Fig. 20). Meso- and metanotum very rough and granulate and with posterior medial processes (Fig. 20). Upper part of the mesothoracic epimeron strongly inflated into rough, bluntly spinous projection. Similar, somewhat weaker, projections found on mesothoracic episternum and metathoracic

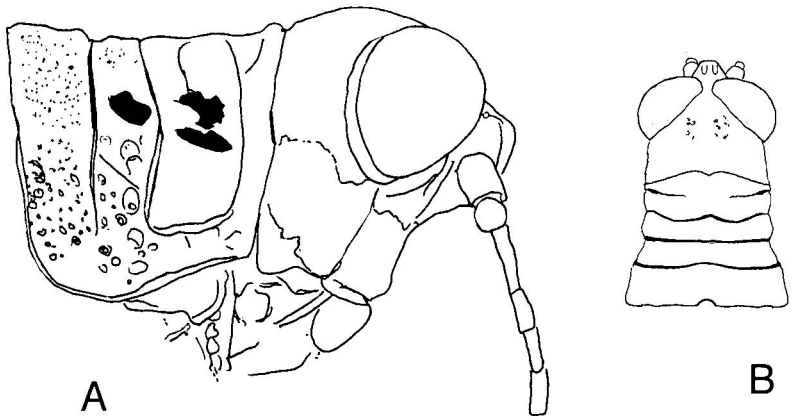

Fig. 18. *Chiriquacris quadrimaculata* n. sp. Female. A,B. Head and pronotum, lateral and dorsal views. C,D,E. Tip of abdomen in dorsal, ventral and lateral views. Scale 1 mm.

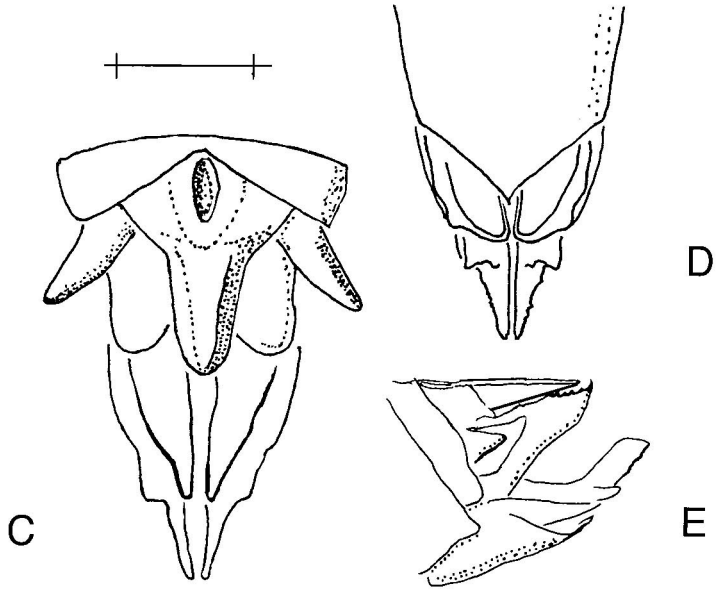

Fig. 19. *Piezops ensicornis* Stål. Female, habitus. Scale 5 mm.

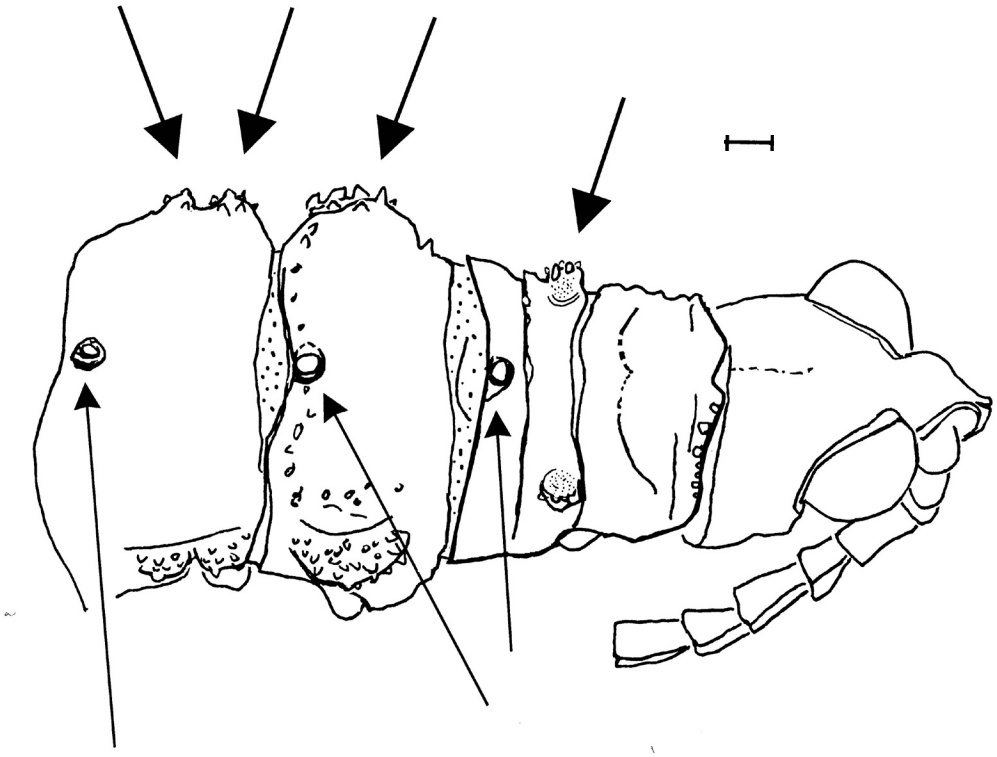

Fig. 20. *Piezops ensicornis* Stål. Female, Oblique dorsal view of head and thorax, to show dorsolateral protuberances on pronotum and meso- and metathorax (heavy arrows, above) and the medial posterior processes (light arrows, below) on the pro-, meso- and metanota. Scale 1 mm.

epimeron (Fig. 20).

Hind femora with rough carinae, and rather stronger spines on internal dorsal and ventral carinae. The chevron markings of the outer femoral face are rugose. The dorso-medial carina of the hind femur terminates in a relatively strong spine. Hind tibiae with 7 external and 9 internal spines, these long and sharp, those of the internal margin somewhat curved upwards dorsally. Foot formula 35:14:51: the foot is 30% as long as the hind femur.

Large abdominal tympanum present. Posterior margin of last tergite notched or incurved, but lacking a well-developed furcula in male. Phallic complex (Fig. 21), also figured by Descamps and Amedegnato (1972, their Figs 77, 78). Phallus typical for the group; epiphallus with long thin posterior processes and weak ancorae, lophi thin and rounded at their tips, melanized and either straight or converging towards midline. Cingular valves absent.

Female: (Fig.19) Similar to but much larger than male—see table of Dimensions — ratios F/M of various dimensions vary between 1.5× (overall length) and 1.2× (length of 3rd tarsal joint) : Morphological ratios show little or no sexual dimorphism, other than in the much wider interocular space of the female. Ovipositor valves short and robust, smoothly pointed, the lower valves completely devoid of teeth or serrations, the upper valves with dorsal outer edges slightly notched. Posterior margin of subgenital plate (Fig. 22B) triangular, the apex surmounted by a short robust egg guide. Columellae absent. Female supra-anal plate (Fig. 22A) triangular, with rounded tip, weakly divided transversely. Spermatheca (Fig. 22C) typical of subfamily, with a short apical diverticulum and a longer curved preapical diverticulum. The aperture of the duct into the genital chamber is supported by a V-shaped sclerite, and there is no well-developed bursa copulatrix.

Biology.— *Piezops* is typically found in groups, often including adults and larvae, or composed only of adults, either a single female and several males, or a group of males only. The range of ages and sexes seen in the groups suggests they form from mutual attraction between individuals, and not necessarily from the progeny of a single egg pod. It prefers open sunny localities close to dense montane forest. It has been seen eating 3 quite unrelated plants: *Bocconia* (Papaveraceae), *Clibadium* (Asteraceae) and *Hyptis* (Labiatae). Although *Clibadium* is eaten by several Neotropical acridoids [including *Rhachicreagra* (Ommatolampinae) and *Munatia* (Romaleinae)] the other 2 genera are rarely if ever eaten by other grasshoppers. We have never found an association with ferns, in contrast to some other Central American rhytidochrotine genera (e.g. *Hylopedetes*, *Exerythracris*). *Piezops* is a striking animal, large, blackish or very dark brown or rarely dark green in color, with orange fore and middle legs and hind tibiae, and very long black ensiform antennae.

Larvae.— Young larvae of *Piezops* are entirely black. In the second instar they gain yellow legs; in the adults this yellow turns to orange, and the males also develop orange lateral patches at the base of the abdomen, absent in the larvae. Occasionally specimens are seen in which the orange color is replaced by red.

Distribution.— We have recently collected this species in several localities and revised other specimens in the collections of UP and STRI. Together these localities (see below) indicate a distribution extending at least from the western end of the Serranía de San Blás

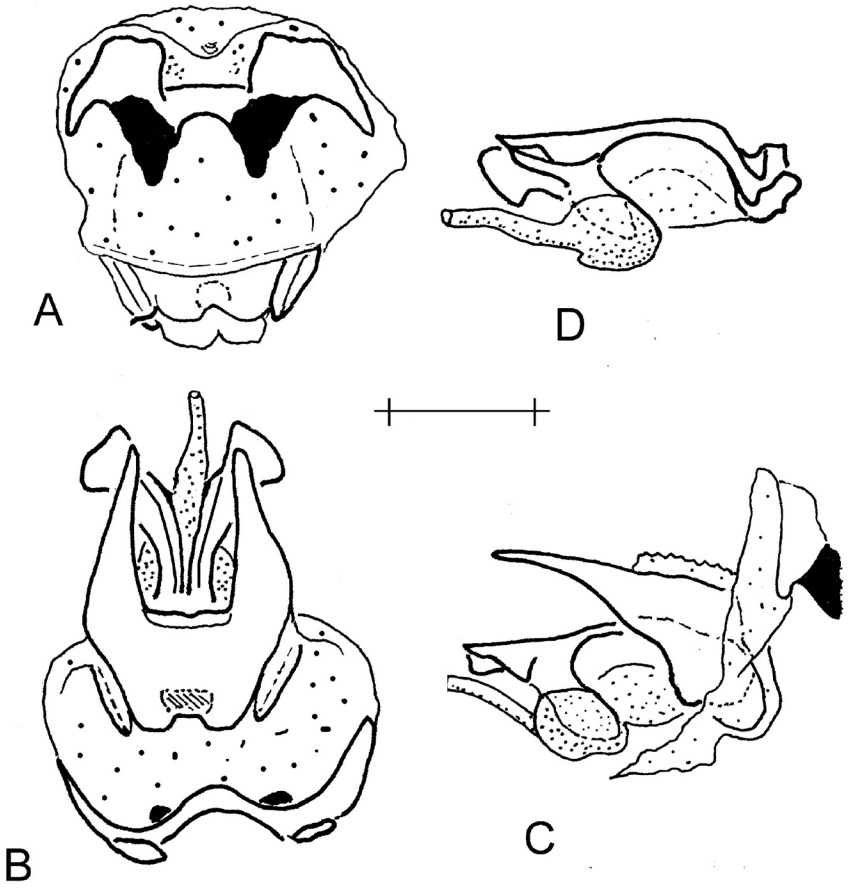

Fig. 21. *Piezops ensicornis* Stål. Phallus. A Phallic complex, dorsal view. B, as A, but epiphallus reflected to the rear. C, as B but lateral view. D. Endophallus. Scale 1 mm.

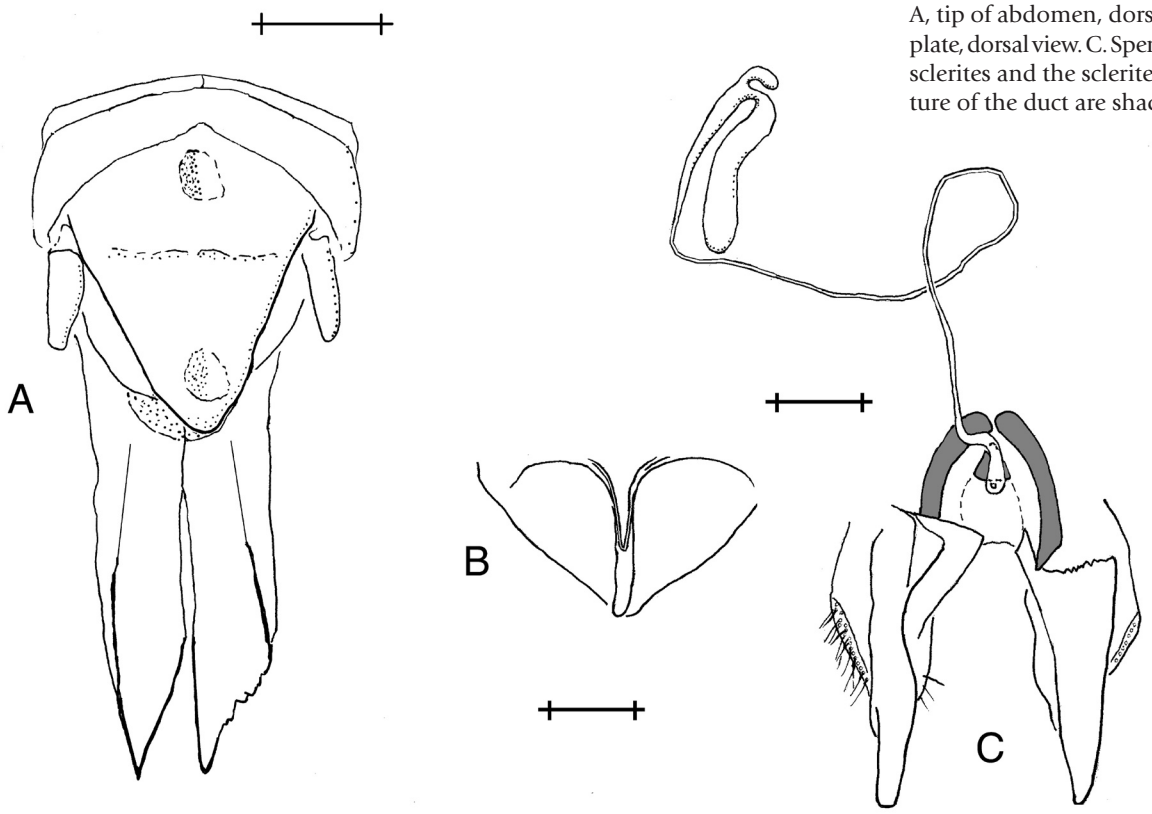

Fig. 22. *Piezops ensicornis* Stål. Female genitalia. A, tip of abdomen, dorsal view. B. Subgenital plate, dorsal view. C. Spermatheca. Basivalvular sclerites and the sclerite supporting the aperture of the duct are shaded. Scale 1 mm.

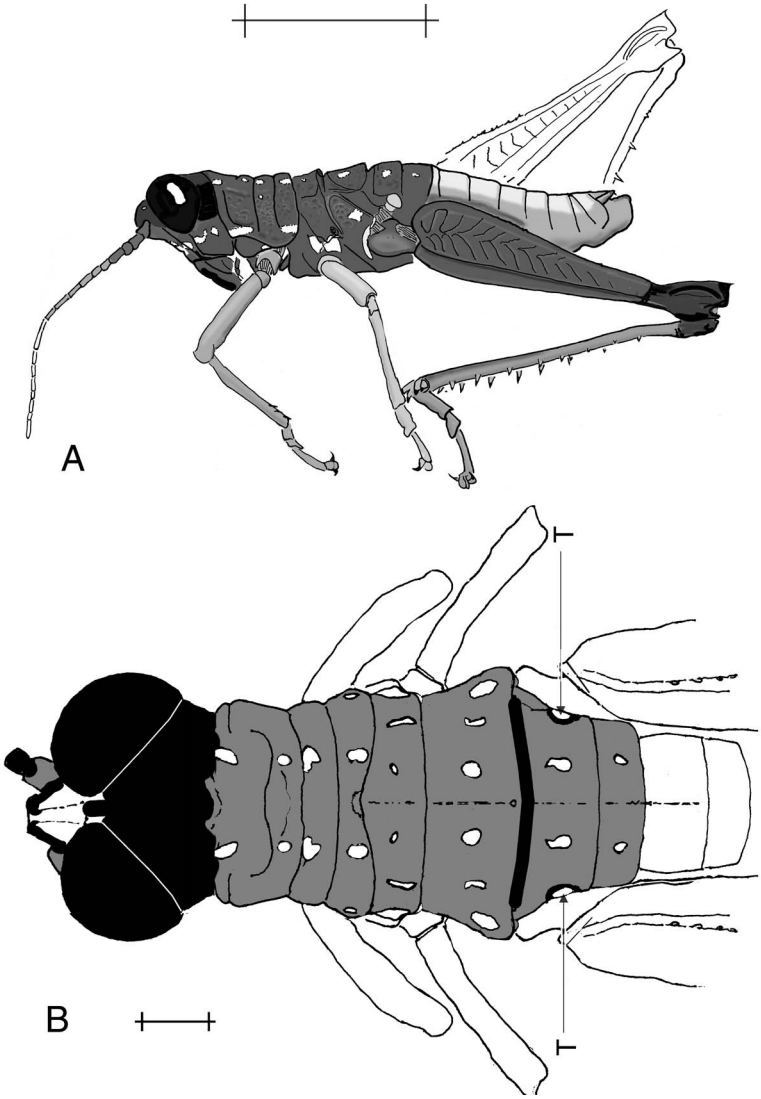

Fig. 23. *Oedalacris cambrai* n. sp. A . Male Habitus. Scale 5 mm. B. Male head and thorax from above, to show distribution of light markings. Scale 5 mm

in the East, to the western end of the Cordillera Central at its junction with the Cordillera de Talamanca in the West. The paucity of collections from Eastern Panama leaves open the possibility of a still wider range. All localities are highland, between 750 and 1200 m in altitude. Hebard 1924: 137 records ANSP specimens collected by A. Busck in 1911 and 1912 in Portobello, which is at sea level; but there is higher country close behind this settlement and the specimens may have come from such areas. We have not found it in the Portobello area proper, despite search.

Records.— (Here presented from East to West): PANAMA; Province Panamá: Altos de Pacora, 750 - 950 m., 26.10.94 (Hernández L), specimen no. 99261 (GBFM); Cerro Azul; Altos de Utivé. 800 m, 11.2.98 (Cambra R), specimen no. 99262 (GBFM); P.N. Altos de Campana, 950 m. 12.8. 99 (Santos A, González P), specimen no. 99264 (GBFM); Province Coclé: El Valle de Antón: Cerro Gaitál, 800-1000 m, 10.09.99 (Rowell CHF, Bentos-Pereira A), specimen nos. 99043 - 99045, 99051; El Copé, 10 km. N, 16.7.1983 (Garcia M, Jaramillo C), specimen no. 99263 (GBFM); 5 km N of El Copé, 850 m, 17.06.1991 (Windsor D, Stockwell HP) (STRI); Cerro Copé: 830 m, 20.9.1997 (Rowell CHF, Bentos-Pereira A), specimen nos. 97384 - 97388 (RC); as above, but 13.09.99, on Atlantic side of watershed, 850 m, specimen nos. 99077 99082 (GBFM); Province Bocas del Toro: 1 km past watershed on road from Fortuna to Chiriquí Grande, 950 m, 18.09.99 (Rowell CHF, Bentos-Pereira A), specimen nos. 99139 (RC) & 99137 (GBFM).

OEDALACRIS Descamps and Amedegnato 1972

The genus was erected to accommodate 2 Colombian species, *O. cordobae* Descamps and Amedegnato 1972 and *Rhytidochrota antennata* Stål 1873. The genus is recognized by the presence of a tympanum and a male furcula, by having 8 (not 7) external spines on the hind tibia, no protuberances on T2 and T3, and the dorsal carina of the femur toothed, not smooth. The dorsal cuticle is heavily pitted. The dorsal medial carina of the hind femur ends in a sharp spine at the knee.

Two new species have now been collected in Southern Panama, thus extending the range of the genus north into that country. The original diagnosis of the genus specified that the antennae are 2× as long as head and pronotum together. This is not the case in the

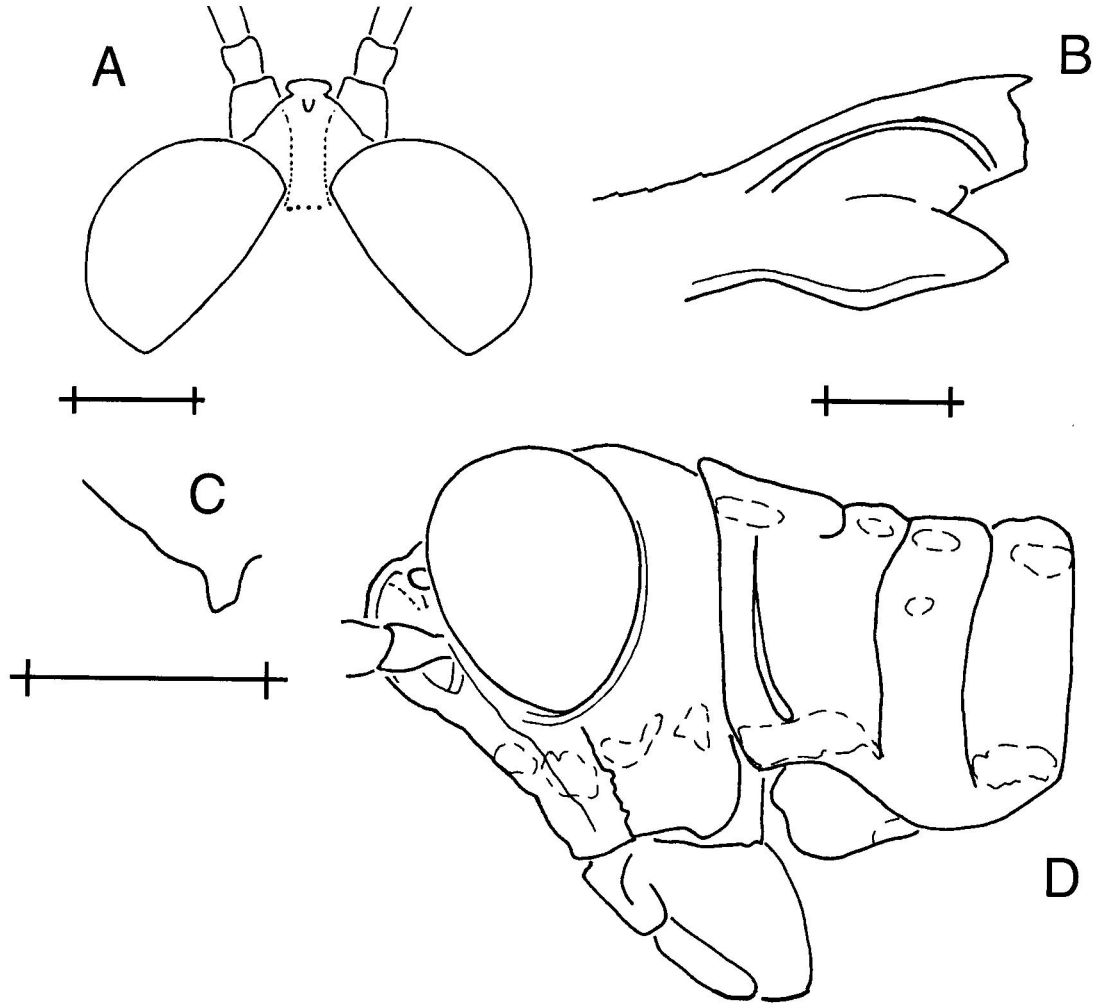

Fig. 24. *Oedalacris cambrai* n. sp Male. A. Fastigium, dorsal view. B. Hind knee. C. Prosternal process. lateral view. D. Head and pronotum, lateral view. Scales 1 mm.

species described here, where the antennae are somewhat shorter: in *O. cambrai* n. sp. the antenna is 1.54 (♂) or 1.45 (♀) times as long as the head and prothorax.

O. cambrai n. sp.

Holotype male. Panama: Prov. Darién: P.N. Darién: Pirre: Est. Rancho Frio. 7-10. November 2000, Cambra R & Santos A. Specimen no. 2000219 (ANSP).

Paratype female. Data as holotype, specimen no. 2000230 (ANSP).

Other Paratypes. 7 males, data as holotype, 2000215 to 20000218, 2000220 to 2000222 (All ANSP); 7 females, data as holotype, sp. nos, sp. Nos 2000223 to 2000229. (All ANSP).

Same data as holotype, specimen nos 2000212, 2000213(both males), 2000214(female); as holotype, but 20 March-5 April 2000, Cambra R Santos A Bermudez S. specimen no. 2000.211.(♀). (All RC.)

Forty further specimens from the original type series are deposited in GBFM.

Etymology.— Named for the first collector, Prof. Roberto Cambra, University of Panama, in recognition of his help during our work in Panama.

Very similar to the Colombian *O. cordobae* Descamps and Amedegnato 1972, but more brightly colored and bearing more pale spots. (Figs 23A,B). Pronotal process short and obliquely truncated in lateral view (Fig. 24C). Posterior margin of female subgenital plate (Fig. 25A) smoothly triangular, terminating in an irregularly pointed egg guide (Fig. 25B). Bursa copulatrix short and cylindrical, not well developed; spermatophore duct long and narrow, apical diverticulum of spermatheca short and truncated at tip, preapical diverticulum longer and undulated, with a rounded tip. The aperture of the duct is supported by an arrowhead-shaped sclerite (Fig. 25C.) Dimensions: see Table 4A. Sexual dimorphism — male/female dimensions approximately 0.9.

Coloration in life.— Head, pterothorax, first abdominal segment, hind femora, rich chocolate brown. Head and thorax profusely ornamented with yellow markings. The pronotum bears 3 or 4 pairs of yellow spots dorsally, the meso- and metanota and the notum

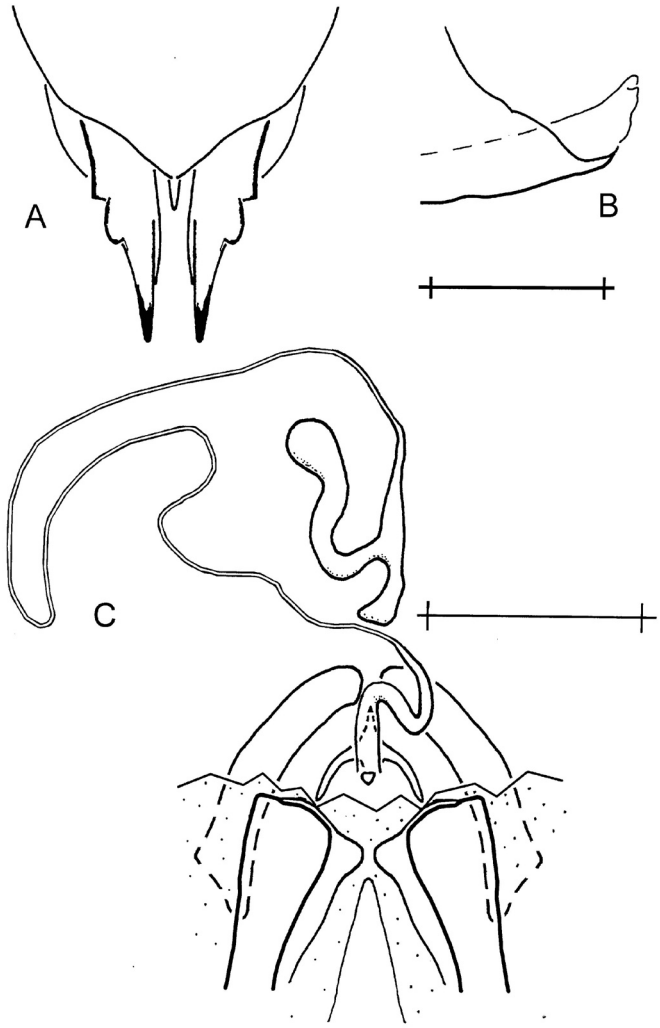

Fig. 25. *Oedalacris cambrai* n. sp. Female. A. Ventral view of subgenital plate and ovipositor. B. Lateral view of subgenital plate. C. Spermatheca. Scale 1 mm.

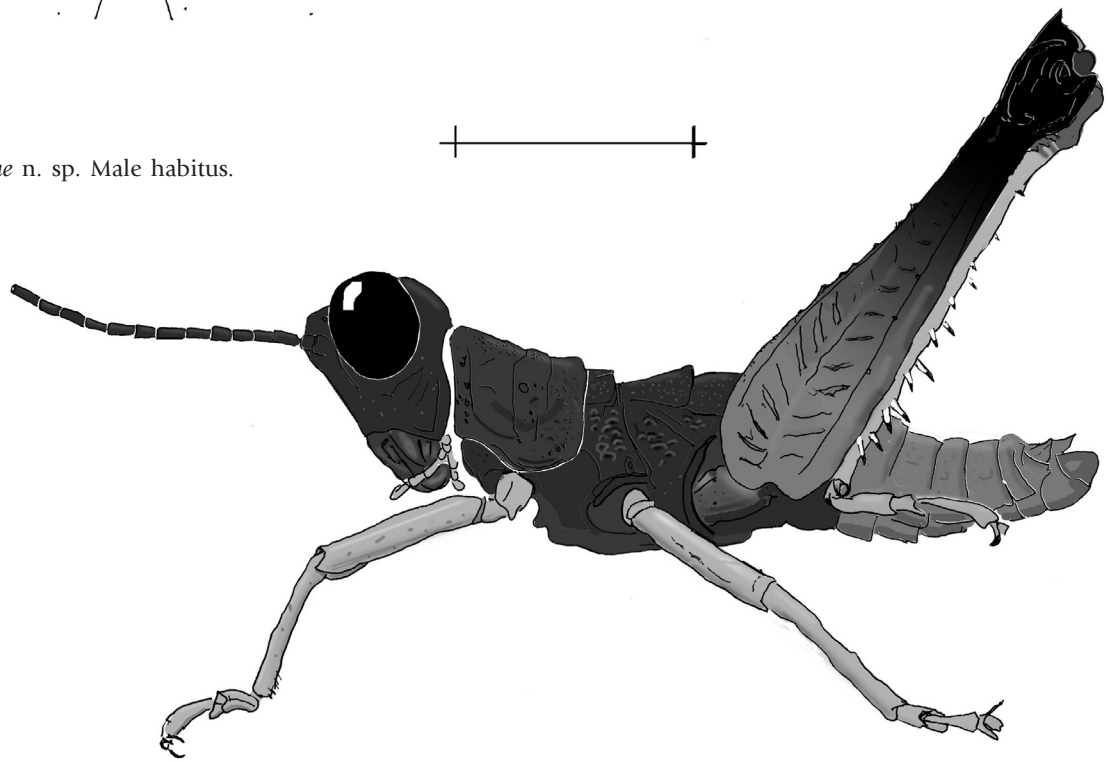

Fig. 26. *Oedalacris lesbiae* n. sp. Male habitus. Scale 5 mm.

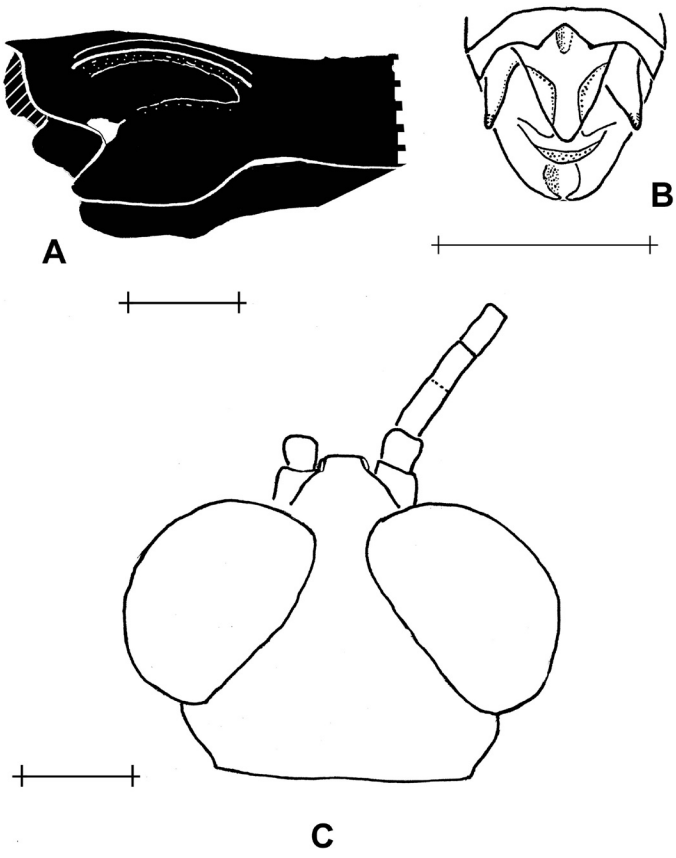

Fig. 27. *Oedalacris lesbiae* n. sp. Male A. Hind knee. B. Tip of abdomen, dorsal view. C. Head, dorsal view. Scale 1 mm.

of the first abdominal segment one pair each. There are also yellow marks at the anterior and posterior edge of the pronotal lateral lobe, and on the prothoracic epimeron, and the meso- and metathoracic epimera and episterna. The fastigium is yellow dorsally; there is a row of yellow spots below the eye and the antennal socket running across the genae and onto the frons. Antenna red brown basally, shading through red to pale yellow distally. Fore and middle legs, green. Hind tibiae blackish brown, with black-tipped spines. Foot ochraceous. Abdomen brown basally, leaf green distally.

Phallic complex rather small. Epiphallus bridge-shaped, posterior processes elongate. Lophi melanized, rather elongate, bluntly pointed at tip, pointing backwards and slightly inwards. Other than this convergent orientation of the lophi, the phallus is identical with that of *Oe. lesbiae* (below, Fig. 28). Latero-ventral sclerites present, as 2 roughly circular plates either side of the aedeagus. Cingular apodemes slender, almost filamentous at their tips, U-shaped in dorsal view. Zygoma of cingulum rather broad. Rami well developed, completely enveloping the aedeagus. Endophallic apodemes dorsoventrally flattened and twisted outwards at their anterior extremities; gonopore processes long, thin and pointed at their tips, with a rectangular ventral flange. Endophallic flexure narrow, complete. Aedeagus very small, both upper and lower valves reduced and not projecting beyond the cingular rami.

O. lesbiae n. sp.

Holotype male: Panama: Comarca Kuna Yala: Ustupo, Tierra firme, on *Piper (Pothomorphe) peltatum* (Spanish "Hinojo"),Piperaceae, which it also ate in captivity. De Gracia L , González P., 08.12.1999. Specimen no. 99527.

Paratype female: same data as holotype, with which in copula, specimen no. 99528. Both ANSP.

Other paratypes: -adult female specimen no. 2003435, last instar female larva, specimen no. 2003434. Both same date and locality data as holotype (GBFM).

Etymology.— named for Lesbia De Gracia, the collector, in recognition of her assistance in the field and laboratory during our collecting activities in Panama.

Description.— (Fig. 26). Apterous, tympanum present. Small to medium sized; slightly larger than other described species of the genus (see table 4B). Differs from other species in having no pale spots. Prosternal process short, obtusely conical, ending in a small bead-like point. The furcula of the male is minute, but clearly defined (Fig. 27B). I can detect no difference in the phallic complex between this species (Fig. 28) and the previous one, except that (in my sole specimen of *O. lesbiae*!) the lophi are directed straight backward and not inclined inward toward the midline as they are in *O. cambrai*. Female genitalia: (Fig. 29). Posterior margin of subgenital plate smoothly triangular, terminating in a small pointed egg guide, inflected upwards at about 30°. Cerci black-tipped. Ventral ovipositor valves smooth, edges devoid of teeth. Supraanal plate triangular, transversely divided, the proximal portion with a medial hollow.

Coloration.— Head, eyes, palps, antennae, thorax and first 2 abdominal segments— blackish brown. Abdomen ochraceous grey with darker rings around the distal part of each segment. Fore and middle legs, green. Hind femora bright maroon, knee black; hind tibia olive green, tibial spines white, tipped with black; hind feet, yellow-grey.

Discussion

The specimens presented here indicate that Rhytidochrotinae are to be found in most and probably all highland areas between central Colombia and (at least) northern Costa Rica. The anomalous discontinuous distribution of the subfamily, artificially created by ignorance of the Panamanian fauna, is now removed. It is also clear that *Hylopedetes*, formerly considered an exclusively Costa Rican genus with 5 endemic species, is almost as well represented in Panama (with 3 native species). Further, the range of 2 of the Costa Rican species, *H. nigrithorax* and *H. gemmeus*, transpires to be much larger than previously thought; the latter extends over a distance of approximately 500 km and neither species is endemic to Costa Rica. Similarly, *Oedalacris*, known previously only from northern Colombia, is shown to extend into Eastern Panama. *Piezops*, however, is so far confirmed as a Panamanian endemic genus, though there appears to be no obvious reason for its apparent absence from southern Costa Rica, which it approaches to within 45 km and which offers apparently identical habitat and food plants.

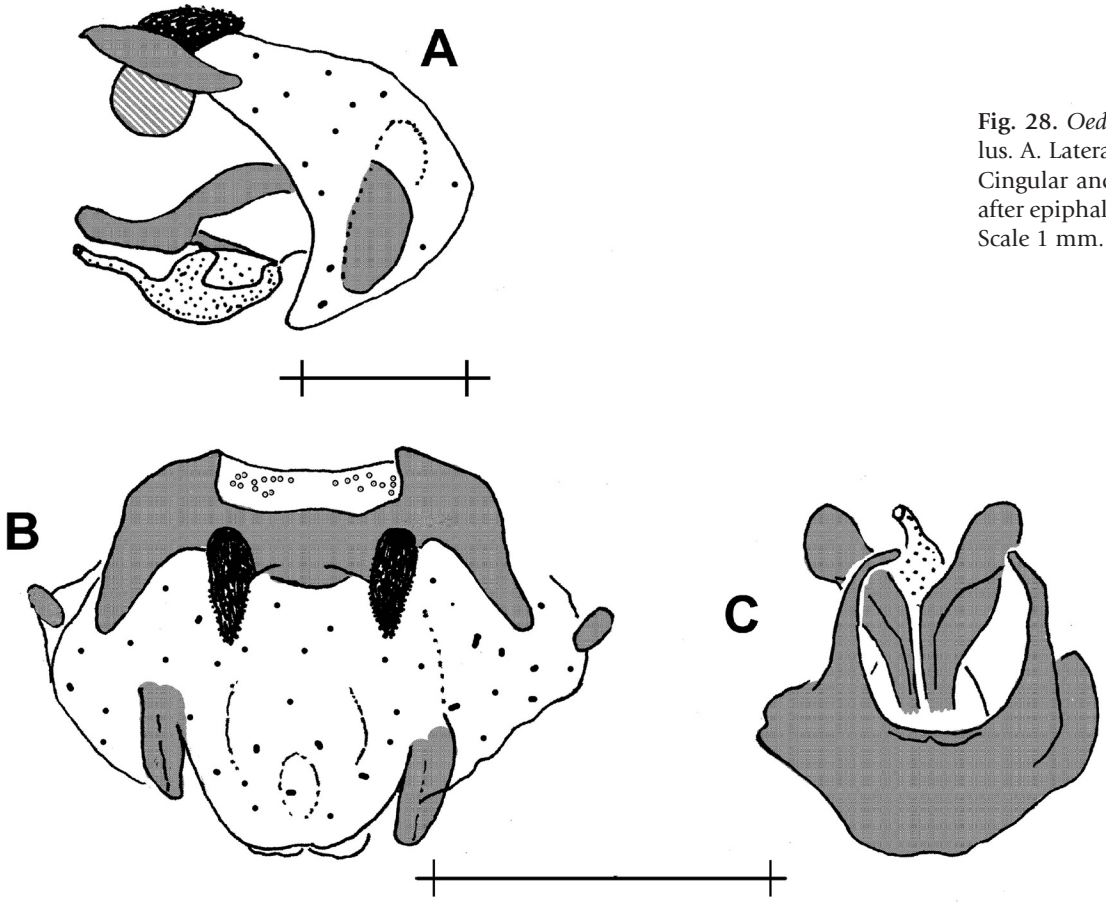

Fig. 28. *Oedalacris lesbiae* n. sp. Phallus. A. Lateral view. B. Dorsal view. C. Cingular and endophallic apodemes, after epiphallus is reflected to the rear. Scale 1 mm.

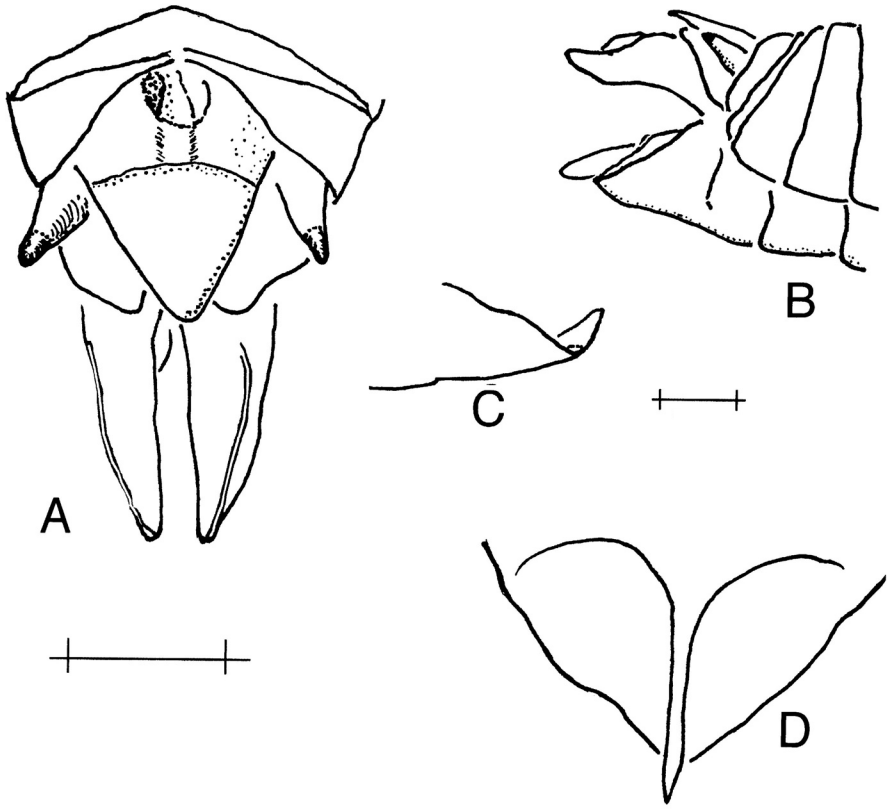

Fig. 29. *Oedalacris lesbiae* n. sp. Female. Tip of abdomen, dorsal view. B. The same, lateral view. C. Subgenital plate, lateral view. D. The same, dorsal view. Scale 1 mm.

Table 1. Dimensions of *Hylopedetes*, Measurements are given for 3 species: *H. mirandus*, the type of the genus, and the 2 new species, *H. punctatus* and *H. fuliginosus*. The boxed cells show the foot formula of each species and sex. The short second and long third tarsal segments, together with the marked sexual dimorphism in interocular space, are characteristics of the subfamily.

Hylodepedetes mirandus	Males				Females					
Dimensions in millimetres:	$\bar{x}$	MAX	MIN	N	$\bar{x}$	MAX	MIN	N	Sex. Dimorph (F/M)	
Hind femur	10.78	11.49	10.23	6	12.72	13.58	11.42	6	1.18	[1]
Rostrum-subgen. plate	13.91	14.61	13.47	6	18.20	19.48	16.30	6	1.31	[2]
Pronotum (midline)	2.64	2.82	2.46	6	3.31	3.59	2.95	6	1.25	[3]
Interocular space	0.26	0.29	0.22	6	0.34	0.38	0.30	6	1.30	[4]
Antennal pedicel (width)	0.41	0.46	0.37	6	0.43	0.47	0.39	6	1.04	
Antenna	8.52	10.08	7.46	6	7.55	8.17	6.52	6	0.89	[5]
T3 tarsus 1	1.14	1.26	1.04	6	1.30	1.43	1.20	6	1.14	
T3 tarsus 2	0.40	0.46	0.31	6	0.49	0.59	0.34	6	1.22	
T3 tarsus 3	1.89	2.16	1.73	6	2.275	2.54	2.05	6	1.20	
Ratios										
Femur/Pronotum	4.09	4.27	3.97	6	3.85	3.92	3.68	6	0.94	
L/P	5.28	5.51	5.17	6	5.51	5.99	5.26	6	1.04	
Interoc./P	0.10	0.11	0.09	6	0.10	0.11	0.10	6	1.04	
Interocular/pedicel	0.65	0.74	0.55	6	0.81	0.87	0.76	6	1.25	
Tarsus 1/ 1+2+3	0.33	0.35	0.31	6	0.32	0.35	0.28	6	0.97	[6]
Tarsus2/1+2+3	0.13	0.16	0.11	6	0.12	0.14	0.09	6	0.90	
Tarsus3/1+2+3	0.55	0.59	0.53	6	0.56	0.60	0.51	6	1.02	
Tarsus 1+2+3/F	0.28	0.31	0.25	6	0.32	0.35	0.30	6	1.14	
Tarsus 1+2+3/P	1.15	1.32	1.03	6	1.23	1.34	1.14	6	1.07	

[1]same in all spp.
[2]similar in all spp. Females relatively longer.
[3]only *punctatus* is different.
[4]similar in all spp, IOS bigger in females of all spp.
[5]here longer in males, in the other spp shorter.
[6]Foot formula similar in all spp.

Acknowledgements

We thank Prof. D. Quintero (University of Panama) and Dr. A. Aiello (Smithsonian Tropical Research Institute, Panama City) for permission to examine specimens from their collections; D. & R. Alvaredo, C. Martino, D. Quintero and N. Scott Pezet for logistic help and hospitality; and the Director and staff of the Administración Nacional del Ambiente (ANAM) of Panama for permission to collect and to use their accommodation.

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Table 1. cont.

Hylopedetes fuliginosus	Males				Females					
Dimensions in millimetres:	$\bar{x}$	MAX	MIN	N	$\bar{x}$	MAX	MIN	N	Sex. Dimorph (F/M)	
Hind femur	10.96	11.58	10.41	5	13.08	13.78	12.34	5	1.19	
Rostrum-subgen. plate	13.96	14.19	13.58	5	20.30	21.6	19.20	5	1.45	
Pronotum (midline)	2.57	3.09	2.25	5	3.08	3.24	2.89	5	1.20	
Interocular space	0.22	0.28	0.20	5	0.42	0.53	0.36	5	1.90	
Antennal pedicel (width)	0.32	0.34	0.30	5	0.36	0.41	0.33	5	1.12	
Antenna	7.84	8.12	7.65	3	9.69	10.7	8.75	3	1.24	
T3 tarsus 1	1.19	1.28	0.98	5	1.42	1.55	1.33	5	1.19	
T3 tarsus 2	0.54	0.61	0.49	5	0.65	0.73	0.57	5	1.22	
T3 tarsus 3	2.20	2.36	2.03	5	2.66	2.89	2.40	5	1.21	
Ratios										
Femur/Pronotum	4.31	4.63	3.44	5	4.24	4.49	3.96	5	0.99	
L/P	5.48	6.04	4.54	5	6.59	6.76	6.10	5	1.20	
Interoc./P	0.09	0.11	0.06	5	0.14	0.17	0.12	5	1.56	
Interocular/pedicel	0.68	0.85	0.62	5	1.17	1.61	1.02	5	1.71	
Tarsus 1/1+2+3	0.30	0.32	0.27	5	0.30	0.31	0.29	5	1.00	
Tarsus 2/ 1+2+3	0.14	0.15	0.13	5	0.14	0.16	0.12	5	0.99	[7]
TArsus3/ 1+2+3+	0.56	0.59	0.54	5	0.56	0.57	0.54	5	1.00	
Tarsus 1+2+3/F	0.36	0.38	0.33	5	0.36	0.39	0.33	5	1.01	
Tarsus 1+2+3/P	1.54	1.74	1.22	5	1.53	1.59	1.49	5	0.99	
Hylopedetes punctatus	Males				Females					
Dimensions in millimetres:	$\bar{x}$	MAX	MIN	N	$\bar{x}$	MAX	MIN	N	Sex. Dimorph (F/M)	
Hind femur	10.07	10.42	9.74	5	11.85	12.24	11.22	5	1.18	
Rostrum-ovipositor	12.77	12.90	12.65	5	17.93	18.73	17.56	5	1.40	
Pronotum (midline)	3.08	5.44	2.45	5	3.10	3.20	2.88	5	1.01	[8]
Interocular space	0.31	0.33	0.26	5	0.44	0.46	0.43	5	1.44	
Antennal pedicel (width)	0.36	0.38	0.35	5	0.40	0.43	0.37	5	1.09	
Antenna	7.49	7.85	7.08	5	7.96	10.98	6.75	5	1.06	
T3 tarsus 1	1.10	1.14	1.06	5	1.28	1.34	1.23	5	1.17	
T3 tarsus 2	0.46	1.44	0.44	5	0.48	0.51	0.45	4	1.04	
T3 tarsus 3	1.86	1.93	1.75	5	2.12	2.18	2.04	5	1.14	
Ratios										
Femur/Pronotum	3.62	4.25	1.81	5	4.24	5.95	3.68	5	1.17	
L/P	4.58	5.27	2.33	5	4.63	6.10	0.14	5	1.01	
Interoc./P	0.11	0.13	0.05	5	0.32	1.05	0.13	5	2.88	
Interocular/pedicel	0.85	0.94	0.70	5	1.06	1.24	0.72	5	1.25	
Tarsus1/1+2+3	0.32	0.34	0.25	5	0.33	0.33	0.32	5	1.02	
Tarsus 2/ 1+2+3	0.14	0.32	0.13	5	0.12	0.13	0.12	5	0.92	
TArsus3/ 1+2+3+	0.54	0.56	0.42	5	0.55	0.55	0.54	5	1.01	
Tarsus 1+2+3/F	0.36	0.46	0.33	5	0.33	0.34	0.32	5	0.91	
Tarsus 1+2+3/P	1.30	1.75	0.61	5	1.26	1.30	1.18	5	0.96	

[7]fulig. Has a longer 2nd joint than the others.
[8]unusual - no sex dim in P

Table 2. Dimensions of *Chiriquacris quadrimaculata*, n. g. n. sp. The boxed cells show the foot formula of each sex.

	male 99157	female 99195	Sex. Dimorph.
Dimensions in mm.			(F/M)
Hind femur	11.9	16.56	1.39
Rostrum-subgen. plate	15.33	25.26	1.65
Pronotum (midline)	2.62	4.16	1.59
Interocular space	0.21	0.43	2.05
Antennal Pedical (width)	0.37	0.53	1.43
Antenna	11.13	9.1	0.82
T3 tarsus 1	1.15	1.73	1.50
T3 tarsus 2	0.61	0.76	1.25
T3 tarsus 3	2.3	3.37	1.47
Ratios			
Femur/Pronotum	4.54	3.98	0.88
L/P	5.85	6.07	1.04
Interoc./P	0.08	0.10	1.29
Interocular/pedicel	0.57	0.81	1.43
Tarsus 1/(1+2+3)	0.28	0.30	1.06
Tarsus 2/ 1+2+3	0.15	0.13	0.86
Tarsus 3/ 1+2+3	0.57	0.58	1.02
Tarsus 1+2+3/F	0.34	0.35	1.04

Table 3. Dimensions of *Piezops ensicornis* Stål. The boxed cells show the foot formula of each sex.

Sex	1 Female	4 males				
Specimen No.	99051		99043,99044, 99045, 99083			Sex. Dimorph.
		$\bar{x}$	MAX	MIN	N	F/M
Hind femur	25.66	20.21	20.80	19.29	3.00	1.27
Rostrum-subgen. plate	39.03	25.51	26.86	23.83	4.00	1.53
Pronotum (midline)	5.09	3.85	4.06	3.70	4.00	1.32
Interocular space	1.36	0.91	1.02	0.86	4.00	1.49
Antennal pedicel (width)	1.07	0.89	0.94	0.83	4.00	1.21
Antenna	24.50	23.04	24.50	21.50	4.00	1.06
T3 tarsus 1	2.67	2.09	2.13	2.05	3.00	1.28
T3 tarsus 2	1.04	0.85	0.96	0.64	3.00	1.22
T3 tarsus 3	3.81	3.24	3.46	3.00	3.00	1.18
Femur/Pronotum	5.04	5.19	5.33	5.10	3.00	0.97
L/pronotum	7.67	6.63	6.96	6.30	4.00	1.16
interoc./pronotum	0.27	0.24	0.25	0.22	4.00	1.13
Interocular/pedicel	1.27	1.03	1.23	0.91	4.00	1.23
Tarsus 1+2+3	7.52	6.17	6.47	5.77	3.00	1.22
Tarsus 1+2+3/F	0.29	0.31	0.31	0.30	3.00	0.96
Tarsus 1+2+3/P	1.48	1.58	1.63	1.53	3.00	0.93
Tarsus1/1+2+3	0.36	0.34	0.37	0.32	3.00	1.05
Tarsus 2/1+2+3	0.14	0.14	0.15	0.11	3.00	1.01
Tarsus 3/ 1+2+3	0.51	0.52	0.53	0.52	3.00	0.97

Table 4A. Dimensions of *Oedalacris cambrai* n. sp. The boxed cells show the foot formula of each sex.

Oedalacris cambrai n. sp.	Males		Females		S.D.		
Males	$\bar{x}$	N	$\bar{x}$	N	F/M		
Dimensions in millimetres:							
Hind femur length	11.21	5	12.23	5	1.09		
Hinf femur: width	2.46	5	2.83	5	1.15	Male:	
Rostrum-subgen. plate	15.87	5	20.43	5	1.29	Antenna	10.17
Pronotum (midline)	2.67	5	3.03	5	1.14	Head and prothorax	6.59
Interocular space	0.38	5	0.57	5	1.50	Quotient	1.54
Antennal pedicel (width)	0.40	5	0.43	5	1.06		
Antenna	9.29	4	8.08	4	0.87	Female:	
T3 tarsus 1	1.25	5	1.41	5	1.13	Antenna	8.75
T3 tarsus 2	0.51	5	0.58	5	1.13	Head and prothorax	6.05
T3 tarsus 3	1.87	5	2.02	5	1.08	Quotient	1.45
Ratios							
Femur/Pronotum	4.21	5	4.04	5	0.96		
L/P	5.95	5	6.75	5	1.13		
Femur L/W	4.56	5	4.33	5	0.95		
Interoc./P	0.14	5	0.19	5	1.32		
Interocular/pedicel	0.95	5	1.34	5	1.41		
Tarsus1/1+2+3	0.34		0.35	5	1.03		
Tarsus 2/ 1+2+3	0.14	5	0.14	5	1.02		
Tarsus 3/1+2+3	0.52		0.50	5	0.98		
Tarsus 1+2+3/F	0.32	5	0.33	5	1.01		
Tarsus 1+2+3/P	1.21	5	1.32		1.09		

Note: Descamps and Amedegnato(1972) claim that antenna is twice length of head and prothorax.

Table 4B. Dimensions of *Oedalacris lesbiae* n. sp. The boxed cells show the foot formula of each sex.

Oedalacris lesbiae n. sp.	Male	female	
Specimen #	99528	2003435	
dimensions in mm.			Sex. Dim. (F/M)
Hind femur	12.54	12.70	1.01
Hind femur width	2.89	2.82	0.98
Rostrum-subgen. plate	18.74	19.28	1.03
Pronotum (midline)	2.87	3.05	1.06
Interocular space	0.64	0.72	1.13
Antennal pedicel (width)	0.40	0.39	0.98
Antenna		broken	
T3 tarsus 1	1.40	1.42	1.01
T3 tarsus 2	0.58	0.67	1.16
T3 tarsus 3	2.09	1.92	0.92
Ratios			
Femur/Pronotum	4.37	4.16	0.95
L/P	6.53	6.32	0.97
Femur L/W	4.34	4.50	1.04
Interoc./P	0.22	0.24	1.06
Interocular/pedicel	1.60	1.85	1.15
tarsus1/1+2+3	0.34	0.35	1.03
Tarsus 2/ 1+2+3	0.14	0.14	1.00
tarsus3/1+2+3	0.51	0.48	0.93
Tarsus 1+2+3/F	0.32	0.32	0.97
Tarsus 1+2+3/P	0.93	0.85	0.91