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# New bactrophorine taxa (Orthoptera, Romaleidae, Bactrophorinae) from Panama and Costa Rica

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## Abstract

New species of the genera *Mezentia* Stål, *Taeniophora* Stål, *Nautia* Stål, *Caenolampis* Descamps and *Inbiolampis* n. gen. (all members of the Bactrophorinae Amedegnato 1974) are described from Costa Rica and Panama. The previously unknown male of *Taeniophora rubrosignata* Descamps & Rowell 1984 is described; its cercal structure links it to South American species of the genus, rather than to the other Central American species. A key to the Central American species of *Mezentia* is provided. New species: *Mezentia prymnocerca*, *M. provacerca*, *Taeniophora pirrensis*, *T. santosi*, *Caenolampis copensis*, *Inbiolampis herediensis*.

## Key words

neotropical fauna, grasshoppers, new species, *Mezentia*, *Taeniophora*, *Nautia*, *Caenolampis*, *Inbiolampis*

## Introduction

The Bactrophorinae Amedegnato 1974 are a characteristic group of Neotropical grasshoppers. The great majority are forest dwelling, and many are arboreal, which makes them difficult to study or collect; they are consequently rather poorly known.

The subfamily is currently subdivided into three tribes: the Bactrophorini Amedegnato 1974, the Taeniophorini Brunner von Wattenwyl 1893, and the Ophthalmolampini Descamps 1978. In all, the subfamily currently comprises 36 valid genera, 195 valid species (Eades *et al.*, accessed September 2010). Most taxa are solely or mainly South American, the subfamily is rather thinly represented in Central America. This is especially true of the Ophthalmolampini. The majority of one of the two clades of Bactrophorini (the Hyleacrae, Amedegnato *et al.* 2012) are however Central American, and various new taxa of the Rhicoderma genus group, especially Costa Rican species of *Pararhicoderma*, were recently described by Rowell (2012). The present paper extends that work by describing new Costa Rican species of *Mezentia* (Bactrophorini Boraе), and new species of *Taeniophora* (Taeniophorini) and of *Nautia*, *Caenolampis* and *Inbiolampis* n.gen. (Ophthalmolampini) from Costa Rica and Panama.

### A. Tribe Bactrophorini.

#### *Mezentia* Stål 1878

*Type species.*—*M. gibbera* Stål.

*No. of described species.*— 2. Two new species are described below, bringing the total to four. A fifth undescribed species from Colombia is retained by the MNHN.

*Range of genus.*—Colombia to at least N. Honduras.

*Mezentia* Stål in the sense of earlier authors (*e.g.*, Rehn 1938) has been recently split into *Mezentia* s.str, *Andeomezentia* Amedegnato and Poulain 1994, and *Hylaezentia* Amedegnato *et al.* 2012. Accordingly, the range of the genus no longer includes the Amazonian area.

*Mezentia* are relatively large, brachypterous and tympanate arboreal grasshoppers. Females are large (up to 52 mm length), cylindrical, heavily built insects, predominantly dull brown in color (Plate 2). Males are smaller (up to 38 mm in length), predominantly mottled green in color; the entire genital area, including the 10<sup>th</sup> abdominal tergite, is highly modified; the hind femur is strikingly patterned in dark green and white or very pale green. Ventral surfaces of feet, legs and tip of abdomen are densely haired.

*Generic description.*—(See also Fig 1, Plates 1-3). Head short and broad, interocular space more than twice as wide as frontal ridge. Fastigium downward sloping, ending at a rostrately produced fastigiofacial angle. Antenna thick filiform, with 20-23 flagellar segments. Eyes prominent, globose.

Pronotum devoid of medial or lateral carinae, with four deeply incised sulci; all but the first cross the disc. Anterior margin of pronotum concave medially, with flanking points that project slightly over the occiput (Fig. 2). Posterior margin of pronotum convex, obtuse angulate or truncated in the midline. The posterior part of the pronotum (behind the third sulcus) has a rugose and tuberculate integument, is inflated and projects dorsally beyond the head, prozona and abdomen – this "hunchbacked" form is the origin of the specific name of the type species, but is typical of the genus as a whole. Prosternal process short and rounded, subcylindrical, not transverse as in the Rhicoderma genus group. Brachypterous; wings and elytra extend as far as the third (females) or fourth or fifth (males) abdominal tergite. Hind femora with a weakly serrulate dorsal carina, and in most species also a faintly serrulate outer ventral carina. Hind knees do not extend beyond tip of abdomen. Hind tibia with 5-6 internal and external spines; the inner series are inwardly curved and strongly developed. Interior tibial spurs longer than external spurs. Hind foot long, slightly exceeding half the length of the hind tibia (53-58%), the three tarsal joints subequal in length, with the second joint the smallest (foot formulae 35-38, 27-31, 34-37).

In males, the penultimate (10<sup>th</sup>) abdominal tergite is markedly inflated and expanded laterally, resulting in an abdomen that either does not taper towards the rear or even widens slightly. The posterior margin of the 10<sup>th</sup> tergite, and dorsal surface of the supra-anal plate, are ornamented with a variety of black sclerotised points and bosses (Fig. 3). Male subgenital plate tapers to a point, overlain by the linguulate tip of the supra-anal plate. The posterior lateral margins of

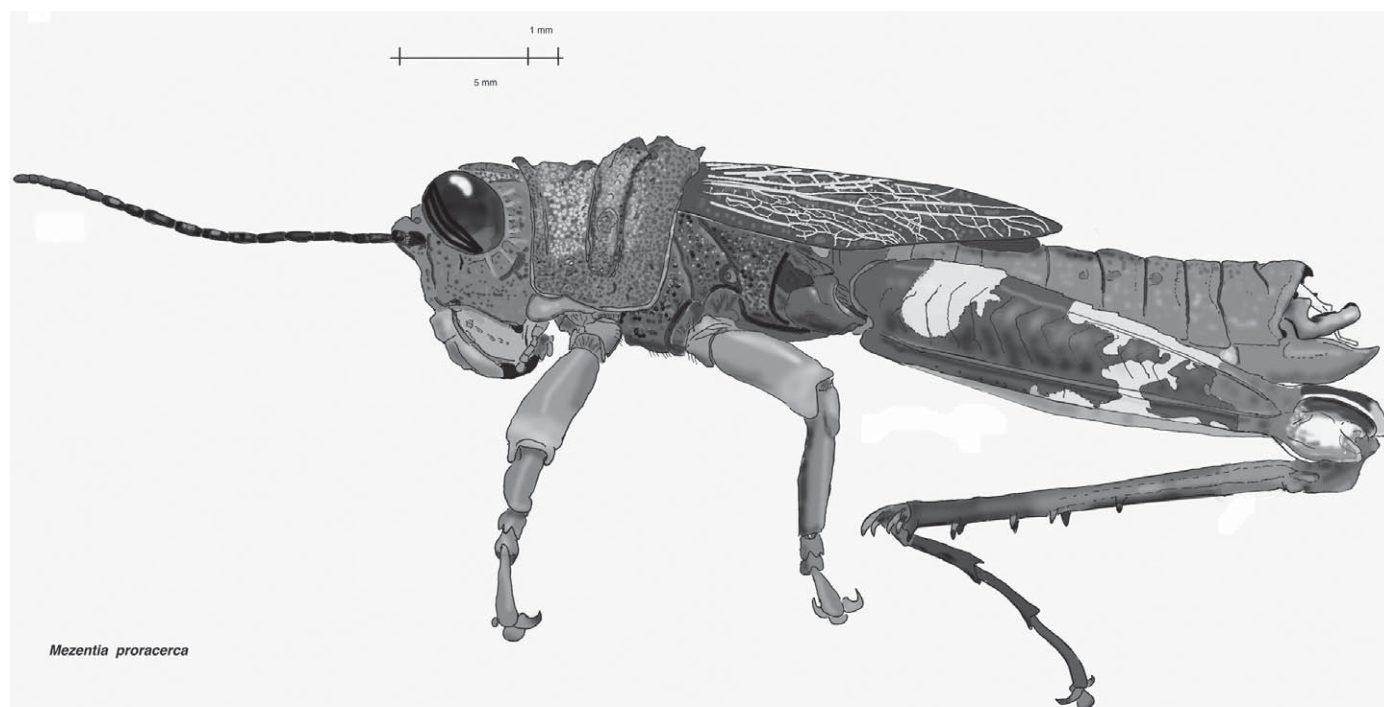


Fig. 1. *Mezentia proracerca*, habitus. The genus is homogenous, and all members show the features seen here: the inflated posterior pronotum, and in the male, the right angled cerci, the piebald markings of the hind femur and the inflated and armed 10<sup>th</sup> abdominal tergite. For a color version, see Plate 1.

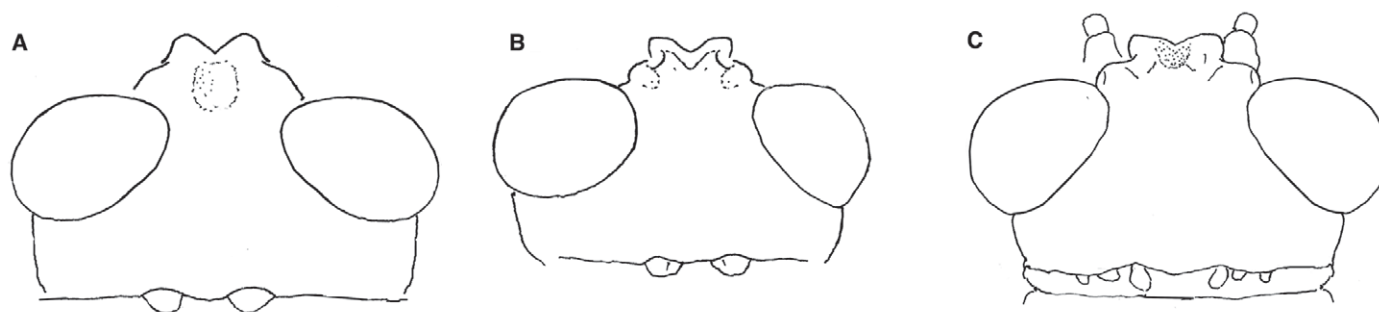


Fig. 2. *Mezentia* spp.: outlines of fastigium and anterior margin of pronotum in males. A. *M. prymnocerca* n. sp. B. *M. proracerca* n. sp. C. *M. gibbera* Stål.

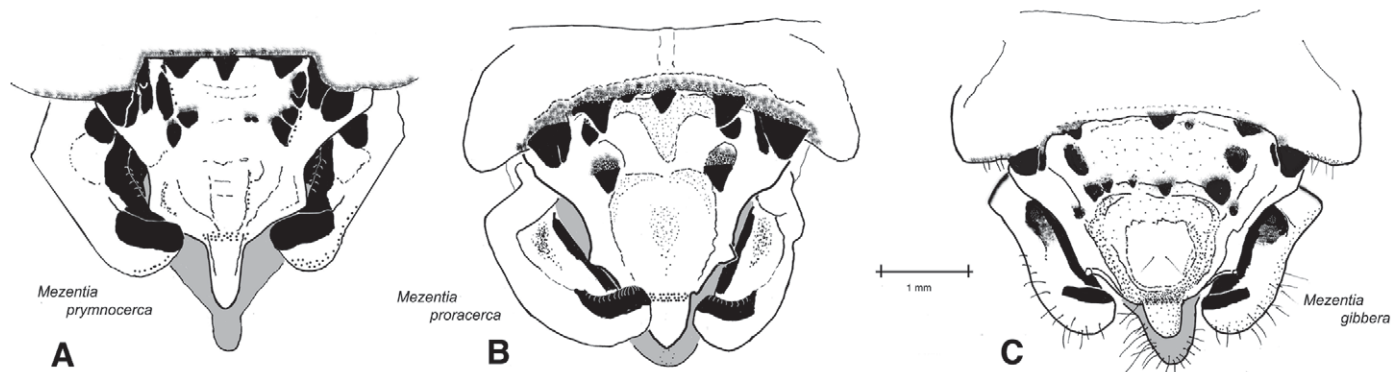


Fig. 3. *Mezentia* spp.: Male terminalia in dorsal view. The subgenital plate is shaded grey. Scale bar 1 mm. A. *M. prymnocerca* n. sp. B. *M. proracerca* n. sp. C. *M. gibbera* Stål.

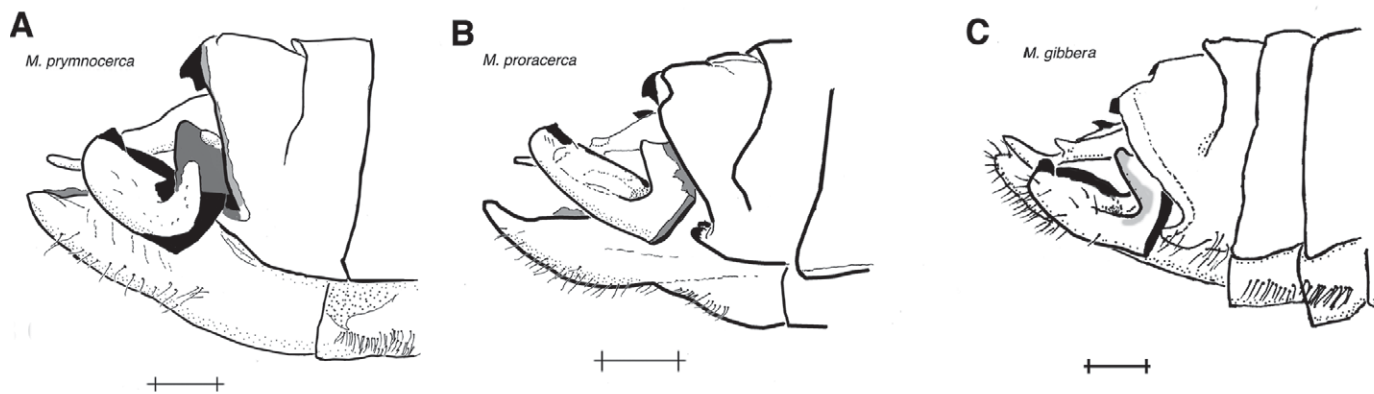


Fig. 4. *Mezentia* spp.: Male terminalia in lateral view. Scale bars 1 mm. A. *M. prymnocerca* n. sp. B. *M. proracerca* n. sp. C. *M. gibbera* Stål.

the transversely divided supra-anal plate are expanded into points, especially prominent in the male. Male cerci (Fig. 4) large, laterally flattened; the basal portion descends more or less vertically, the distal part is longer and extends horizontally, after a 90° flexure; tips of male cerci equal or almost equal to the supra-anal plate in length. Tips and upper margins of the distal arm of the cerci melanised. In females, the ventral surface of the subgenital plate (Fig. 5) bears divergently curving ridges, ending at the posterior margin of the plate in areas of variously ornamented or transparent integument. Female cerci simple, conical. Ovipositor valves robust, with smooth lamellate edges.

**Key to Central American species of *Mezentia***

The known species of *Mezentia* are all very similar in coloration, size and morphology. The most useful distinguishing characters are the details of male terminalia and of the female subgenital plate.

**Females:**

1. Hind wings, yellow, semitransparent; tegminal membrane (between the veins) light green, internal and ventral faces of hind femora, internal face of hind tibia, blue black. External ventral carina of hind femur smooth (N. Honduras) . . . . . *M. cutteri* Rehn, 1938
- 1A Hindwings opaque dark brown; tegminal membrane dark brown or dark green, proximal internal face of hind femur and distal internal face of hind tibia, shiny black; ventral face of hind femur, inner face of hind knee, reddish. External ventral carina of hind femur slightly denticulate or serrate. (Costa Rica or Panama) . . . . . 2
- 2 Posterior region of pronotum ornamented with numerous reddish tubercles. Tips of tegmina barely attain third abdominal tergite. Posterior margin of subgenital plate ends in two melanised lateral points, each flanked medially by a patch of transparent integument (Fig. 5C). (Caribbean slope of Panama) (see also Plate 2) . . . . . *M. gibbera* Stål, 1878

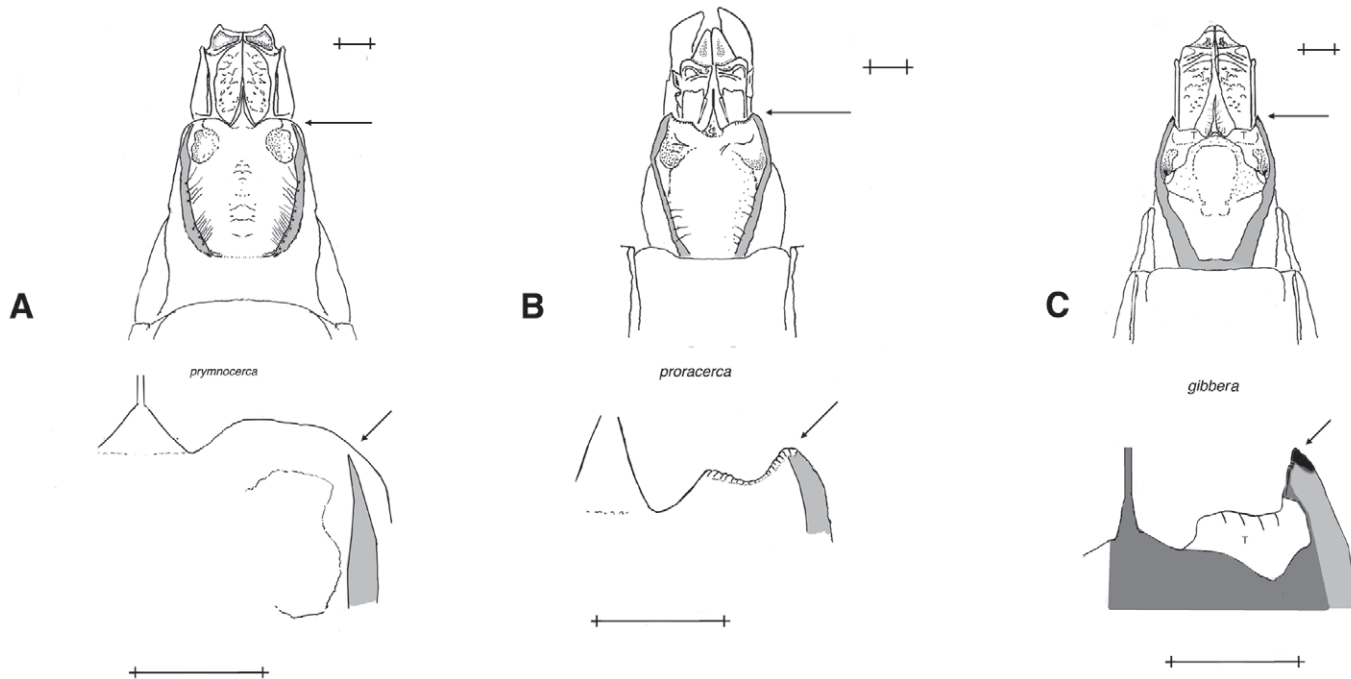


Fig. 5. *Mezentia* spp.: Female subgenital plates in ventral view. Scale bars 1 mm. A. *M. prymnocerca* n. sp. B. *M. proracerca* n. sp. C. *M. gibbera* Stål. The divergent ridge on the ventral surface of the plate is shaded in grey. Where this ridge terminates against the posterior margin of the plate (arrowed in the upper row of Figs) there is a species-specific form to the integument, e.g., a melanised spine with a medial transparent area in C. These structures are shown at higher magnification in the lower row of figures. In C the nontransparent integument has been shaded in dark grey to emphasize the transparent area, and the transparent area is labeled with the letter T.

**Table 1.** *Mezentia* spp. dimensions (mm). Note, values on shaded areas are derived figures, usually ratios, not measurements. Abbreviations: L, length from fastigium to tip of abdomen; F, length of hind femur; FW, maximum width of hind femur; IOS, interocular space; FRW width of frontal ridge.

Sp.	Locality	Charact.: Specimen no.	L	F	F/L	FW	F/FW	IOS	FRW	IOS/FRW
<i>prymnocerca</i>										
A. Females	V. Cacao	CRI000 384256	61.9	26.3	0.42	4.86	5.41	4.3	1.9	2.26
B. Males	V. Cacao	CRI000 258393	38.10	missing		?		2.50	1.19	2.10
		Sexual dimorphism: M/F	0.62	?	?	?	?	0.58	0.63	0.93
<i>proracerca</i>										
A. Females	Upala	94033	48.53	22.65	0.47	5.06	4.48	3.62	1.69	2.14
	Magsasay	CRI000 607456	54.63	23.56	0.43	5.02	4.69	3.2	1.51	2.12
	MEAN		51.58	23.11	0.45	5.04	4.58	3.41	1.60	2.13
B. Males	Magsasay	CRI000 680829	33.24	18.91	0.57	4.24	4.46	2.05	0.95	2.16
	Pital	94032	32.80	18.55	0.57	4.12	4.50	2.06	0.91	2.26
	La Selva	27443	32.69	18.35	0.56	4.24	4.33	2.15	0.94	2.29
	MEAN		32.91	18.60	0.57	4.20	4.43	2.09	0.93	2.24
		Sexual dimorphism: M/F	0.64	0.81	1.26	0.83	0.97	0.61	0.58	1.05
<i>gibbera</i>										
Female	Ft. Sherman	99352	51.75	23.10	0.45	4.35	5.31	3.61	1.60	2.26
Male	Ft. Sherman	99351	31.81	20.12	0.63	4.73	4.25	2.50	1.15	2.17
	"Panama"	Rehn's (1938) values	32.00	20.70	0.65	?	?	?	?	?
	MEAN		31.91	20.41	0.64					
		Sexual dimorphism: M/F	0.61	0.87	1.42	1.09	0.80	0.69	0.72	0.96

2A Tegmina extend almost to 4<sup>th</sup> abdominal tergite. Posterior margin of subgenital plate not provided with lateral points . . . . . 3.

3. Tegminal membrane dull brown, little or no red coloration on the venation. Posterior margin of subgenital plate entire and slightly convex (Fig. 5A) (Cordillera Norte of Costa Rica). . . . .

. . . . . *M. prymnocerca* n. sp.

3A Tegminal membrane dark green with prominent dark red blotching on the venation. Posterior margin of subgenital plate slightly concave with fine striations (Fig. 5B). (Lowland forest of Costa Rica, Pacific and Caribbean slopes) . . . . . *M. proracerca* n. sp.

#### Males:

1. Posterior margin of 10<sup>th</sup> abdominal tergite adjacent to supra-anal plate orthogonally recessed, forming an almost rectangular aperture (Fig. 3A). Horizontal limb of male cercus in side view little or not at all longer than vertical limb. In dorsal view, tips of cerci do not extend as far as tip of supra-anal plate (Fig. 3). Lingulate tip of supra-anal plate narrow and strap like. (Cordillera Norte of Costa Rica . . . . . *M. prymnocerca* n. sp.

1A Posterior margin of 10<sup>th</sup> abdominal tergite adjacent to supra-anal plate concave, curved inwards . . . . . 2

2A. Posterior margin of 10<sup>th</sup> abdominal tergite recessed in an arch-like concavity above supra-anal plate. Horizontal limb of male cercus clearly longer than vertical limb. Tips of cerci extend at least to tip of supra-anal plate, sometimes to tip of subgenital plate. Lingulate tip of supra-anal plate wide (Fig. 3B). (Lowland forest of Costa

Rica, Pacific and Caribbean slopes) . . . . . *M. proracerca* n. sp.

2B. Shapes of recess in 10<sup>th</sup> abdominal tergite, and of tip of supra-anal plate, both lie between the two extremes described above. Tips of cerci blunt, almost squared-off in dorsal view, shorter than the tip of the supra-anal plate (Fig. 3C). Lateral points on the margin of supra-anal plate very well developed. (Caribbean slope of Panama). See also Plate 3 . . . . . *M. gibbera* Stål.

The male of *M. cutteri* Rehn is unknown.

#### Species descriptions

##### 1. *Mezentia prymnocerca* n. sp.

*Holotype male*. — COSTA RICA, Prov. Guanacaste, Volcan Cacao, lado suroeste, 1000-1400 m. July 1989- March 1990, in Malaise trap. Col. INBio. Specimen no. CRI000 258393. INBio.

*Paratype female*. — Data as for holotype, but February-March 1989. Parque Nacional Guanacaste, Inventario de Biodiversidad. Specimen no. CRI000 384256. INBio.

*Etymology*. — Greek *prymnos*, stern of a small boat, plus Greek *kerkos*, tail. Refers to the blunt shape of the tip of the male cerci.

*Diagnosis*. — The main distinguishing features are given in the key above. Most readily recognized by the shape and patterning of the male supra-anal plate (Fig. 3A), and the relatively short and stubby



**Table 1.** Continued. Ant, length of antenna; H + PN, length of head and pronotum together; P, length of pronotum (midline); H depth, Length of head from top of vertex tip of mandibles. Ta1, Ta2, Ta3, Length of 1st, 2nd, and 3rd tarsal segments of hind foot; Tib, length of hind tibia.

ANT	H +PN	ANT/H+PN	P	H depth	HD/P	Ta1	Ta2	Ta3	Ta1-3	Tib	Ta1-3/Tib
13.7	16.54	0.83	10.36	11.99	1.16	4.01	3.36	4.29	11.66	21.79	0.54
missing	12.44		7.46	8.52	1.14	m	m	m		?	?
?	?	?	0.72	0.71	?	?	?	?			
					foot formula						
missing	14.67	?	9.56	10.37	1.08	3.82	3.35	3.60	10.77	20.23	0.53
missing	15.5	?	8.9	10.4	1.17	3.85	3.4	3.69	10.94	20.79	0.53
missing	15.09	?	9.23	10.39	1.13	3.84	3.38	3.65	10.86		
					foot formula	0.35	0.31	0.34	1.00		
missing	11.16		6.56	6.73	1.03	3.24	2.70	3.03	8.97	15.52	0.58
12.90	10.40	1.24	6.20	7.00	1.13	3.15	2.60	3.00	8.75	15.60	0.56
broken	10.65	?	5.99	7.17	1.20	2.90	2.82	3.17	8.89	14.83	0.60
12.90	10.74	1.24	6.25	6.97	1.12	3.10	2.71	3.07	8.87		0.58
					foot formula	0.35	0.31	0.35	1.00		
	0.71	?	0.68	0.67	0.99	0.81	0.80	0.84	0.82		
									0		
12.62	15.00	0.84	9.25	10.50	1.14	4.08	3.18	3.46	10.72	19.29	0.56
					foot formula	0.38	0.30	0.32	1.00		
15.33	11.30	1.36	6.52	7.17	1.10	3.40	2.38	3.12	8.90	16.10	0.55
?	?	?	6.80	?	?	?	?	?	?		
			6.66								
					foot formula	0.38	0.27	0.35	1.00		
1.21	0.75	1.61	0.70	0.68	0.97	0.83	0.75	0.90	0.83		

horizontal limb of the male cercus (Fig. 4A). The shape of the margin of the female subgenital plate (Fig. 5A) is also diagnostic. The fastigium, in dorsal view, is longer and its apices more pointed than in the other species (Fig. 2A). The male holotype lacks both hind legs, any possibly characteristic coloration of the femur and tibia is therefore unknown. In view of the paucity of specimens, the internal genitalia have not been dissected. Dimensions, see Table 1.

*Distribution.*—To date known only from the type specimens, taken in montane forest on Volcan Cacao and from a single specimen from Monteverde, Tilarán.

*Natural history.*—Unknown. Their capture in malaise traps indicates that neither sex can be exclusively arboreal in its habits.

## 2. *Mezentia proracerca* n. sp.

*Holotype male.*—COSTA RICA, Prov. Heredia: P.N. Braulio-Carrillo, Estación Magsasay, (Sarapiquí). July 15, 1990 (Garballo, G.). Specimen no. CRI000 680829. INBio.

*Paratype female.*—Same data as holotype, but September 15<sup>th</sup>, 1990 (Fernandez, A). Specimen No. CRI000 607456. INBio.

*Other paratypes.*—

Males:

1. COSTA RICA, Prov. Heredia, Perto Viejo: Finca La Selva, 40m. (Sarapiquí).

June 13, 1983 (H.E. Braker). Specimen No. 83093. RC.

2. COSTA RICA, Prov. Alajuela, 2 km S. of Pital. September 16, 1988 (F.D. Parker). Specimen no. 94032. ANSP.

3. COSTA RICA, Prov. Puntarenas. P.N. Carara, Sendero Carara. July 26, 1980. (Rowell C.H.F., Rowell-Rahier M.). Specimen number 80283. RC. This specimen consists only of a detached hind leg, found on a leaf in forest understorey, but the identification seems certain.

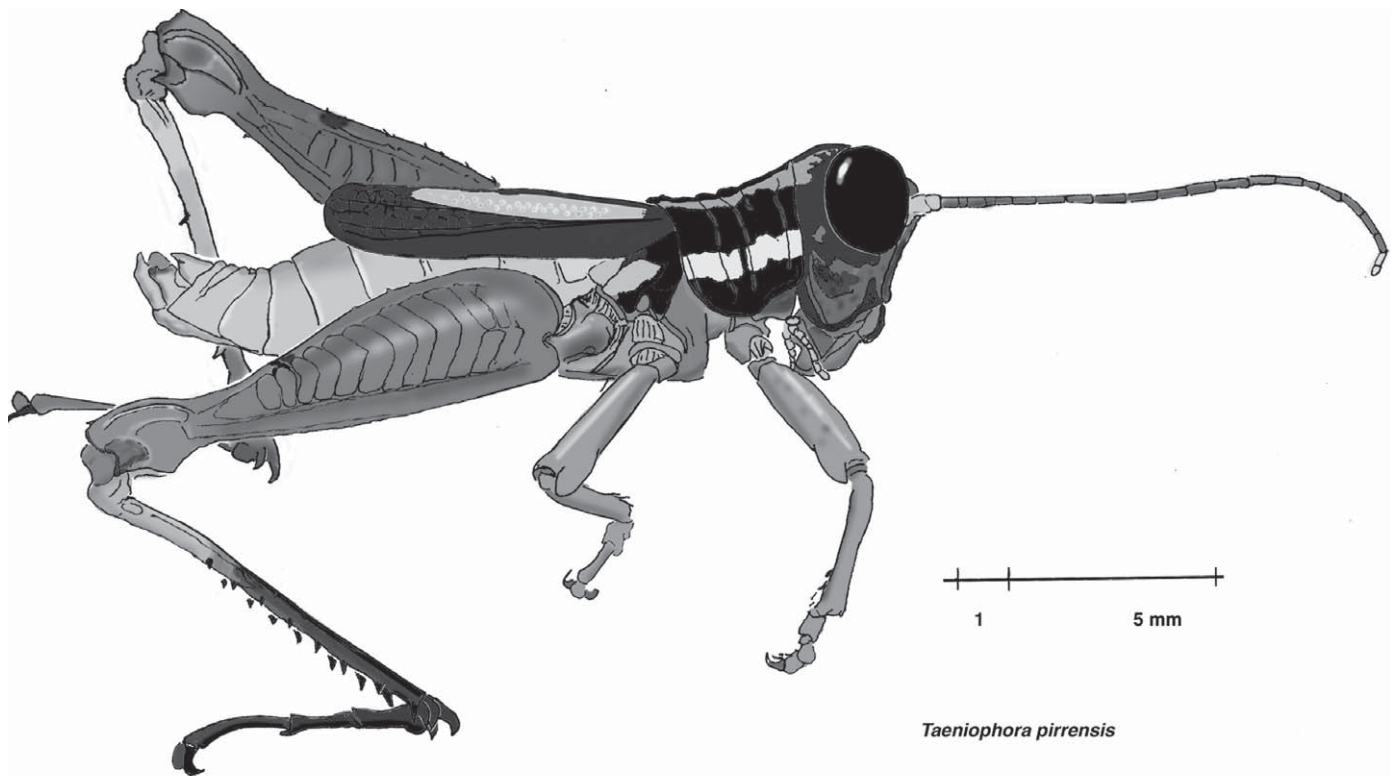
Female:

COSTA RICA, Prov. Alajuela, 20km S. of Upala, 4 km N. of Bijagua. 350 m. May 27, 1990. (F.D. Parker). Specimen number 94033. ANSP.

*Etymology.*—Greek 'prora', prow of a small boat, plus Greek 'kerkos', tail. Refers to the narrow tapering shape of the tip of the male cerci.

*Diagnosis.*—Habitus, see Fig. 1 and Plate 1. The main distinguishing features are given in the key above. Most readily recognized by the shape and patterning of the male supra-anal plate with a wide lingulate terminal process (Fig. 3), and the relatively long and narrow horizontal limb of the male cercus (Fig. 4). The shape of the margin of the female subgenital plate (Fig. 5) is also diagnostic.

Internal face of hind tibia, proximally light green, distally shiny black. Internal face of hind femur, pale green or whitish, with two prominent transverse bands in dark green (in a 4<sup>th</sup> instar male larva the proximal inner face of the femur is dark blue and there is single black transverse band distally).



*Taeniophora pirrensis*

Fig. 6. *Taeniophora pirrensis* n. sp. habitus. For a color version, see Plate 4.

In view of the paucity of specimens, the internal genitalia have not been dissected.

*Distribution.*—To date known only from the specimens listed above, which include both Caribbean and Pacific slope forests.

*Natural history.*—Unknown. Parker's specimens were taken from light traps. A 4<sup>th</sup> instar male larva was taken by the present author on the trunk of an Inga tree near Puerto Viejo, and in captivity ate Inga leaves. However, the male paratype 1, from the same locality, refused this food. This larva was a mottled light gray in color, closely matching its bark substrate, with none of the characteristic blotched green patterning of the adult male. This suggests that the larvae may be capable of background homochromy, as is commonly the case in some Acridid subfamilies, e.g., the Oedipodinae.

### B. *Taeniophorini*

*Tribal diagnosis.*—The male subgenital plate is split or bilobed at the end; the supra-anal plate is never compound (apparently divided into two transversely) (thus contrasting with the Ophthalmolampinae and Bactrophorini); the male cerci are subrectangular in profile and bilobed; the face is smooth and not pitted. There are currently four genera in the tribe, only two of which (*Taeniophora* Stål and *Megacheilacris* Descamps) occur in Central America.

#### *Taeniophora* Stål 1873

The genus *Taeniophora* was erected by Stål (1873) with the description of *T. dentipes* from Antioquia Province, Colombia, later designated by Kirby (1910) as the type of the genus. Bruner (1907) added *T. femorata* from Costa Rica, and suggested that *Acridium* (*Oxya*) *unistrigatum* de Haan 1842 might belong to the genus as

well. As the type of the latter is lost, the question is insoluble, but given that it came from New Guinea, it seems highly improbable. Hebard (1923) described *T. chocoensis* and *T. dagua* from NW Colombia and (1924) *T. panamae* from Central Panama. Descamps and Amedegnato (1971) gathered together these older species and a number of newly collected forms from Colombia, together with Gerstaecker's (1873) *Ommatolampis pugnax* and *O. acanthopus* and Bruner's (1907) *Megacephalacris* and distributed the assemblage between two more precisely defined genera, *Taeniophora* and *Megacephalacris*. (Descamps (1978) later split the species of *Megacephalacris* again, erecting the genus *Megacheilacris* to accommodate three of its former species). Since then only one further species, the Costa Rican *T. rubrosignata* Descamps & Rowell 1984, has been added, giving a present day total of 13 species of *Taeniophora*. The majority of these are Colombian or Ecuadorian, but of these *T. chocoensis* extends into Panama (Hebard 1924); and *T. panamae*, *femorata* and *rubrosignata* are known only from Panama and Costa Rica. Here I describe 2 new species of *Taeniophora* from Eastern and Central Panama, and the previously undescribed male of *T. rubrosignata*.

*Generic diagnosis.*— Descamps & Amedegnato (1971:117) give an exhaustive generic definition. The genus is homogenous, the species differing mainly in size and coloration; genital differences are almost imperceptible. All species are small, brachypterous, usually brightly colored with longitudinally striped tegmina, with large protuberant eyes, a very narrow interocular space, and long filiform antennae. The male terminalia are characteristic; the supra-anal plate is triangular, wide and lobate, bearing 2 or more small black processes on its anterior surface; the cerci are laterally flattened, bilobate at the tip, the upper fork forming a thin vertical fin, the lower incurved and thickened, often with a subcylindrical form, sometimes in contrast forming a sharp hook; the apex of the subgenital plate is divided, forming two small triangular lobes. The most basal tarsal joint of the

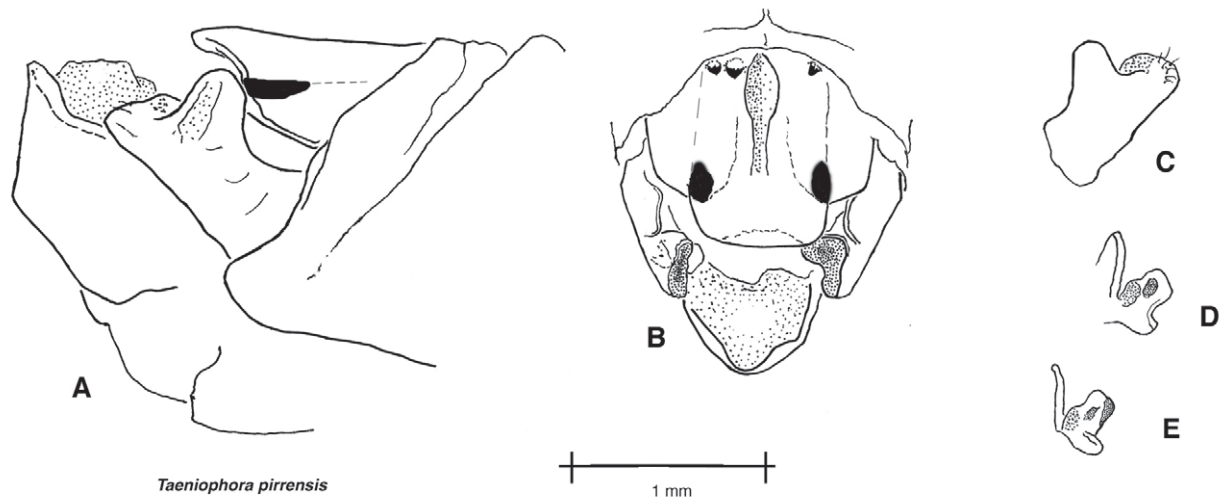


Fig. 7. *Taeniophora pirrensis* n. sp. Male terminalia. A. Lateral view. B. Dorsal view, showing melanised ornamentation on the SAP, and forked cerci. C-E. Male cercus, lateral to axial views.

hind foot is usually shorter than the other two. The typical habitat is forest edge or light gaps within forest, where they feed on forbs, shrubs or vines; at least *T. panamae* and *T. femorata* are oligophagous specialists, on Solanaceae and Asteraceae respectively.

#### 1. *Taeniophora pirrensis* n. sp.

**Holotype.**—PANAMA: Prov. Darién: Parque Nacional Darién: Pirre: Estación Rancho Frio, 80 m., 8° 02' 53" N, 77° 43' 21" W, 20 March-5 April 2000. Coll. Cambra, R., Santos, A., Bermudez, S. Male, Specimen No. 2000271. (ANSP).

**Paratype.**— Data as holotype, but female, specimen no. 2000163. (ANSP).

**Other paratypes.**— 5 males, 5 females, 1 female larva. Data as holotype. Of these, 2 males and 3 females were taken in a Malaise trap, and subsequently pinned from alcohol; they are discolored. U. Panama.

**Habitus.**— see Fig. 6 and Plate 4.

**Male:** Antennae filiform, much longer than head and PN together. Vertex prominently convex. Fastigium downward sloping, truncate in dorsal view, merging smoothly with the frontal ridge. Frontal ridge smooth, nonsulcate, obsolete below median ocellus. Lateral carinae of face obsolete. Eyes large, protuberant, interocular space very narrow, less than width of antennal flagellum.

Pronotum devoid of lateral and medial carina. Disc crossed by 4 deep sulci, the most anterior being interrupted in the midline. Metazona much shorter than prozona. Anterior margin of pronotal disc bisinuate, slightly overhanging occiput. Posterior margin extremely obtuse angulate, almost truncated, with a slightly thickened margin. Integument of pronotum mostly smooth, but punctate in metazonal disc and along ventral margin of lateral lobes. Prosternal process large, bluntly pyramidal, with a very small acute point on its posterior face, inclined backwards. Tegmina short, reaching to posterior margin of 4<sup>th</sup> abdominal segment, overlapping dorsally. Wings reduced, cycloid, greyish, infumate along their anterior edge and around their margins, with very coarse cross venation. Tympanum present, large. Pro- and mesothoracic femora robust, but unarmed, completely lacking the dorsal spines characteristic of many species of the genus. Prothoracic tibia with 5 external and 6

internal spines, mesothoracic tibia with 5 external and 4 internal spines. Hind femora robust, equalling or exceeding the tip of the abdomen in length. Dorsal medial carina of hind femur slightly rugose, ends on knee in a small spine. Outer face of hind femur with prominent raised chevron ridges, corresponding to the extensor muscle attachments. Hind tibia with 8 external and 8 internal spines, including the apical ones. Hind tarsal segments subequal, the distal being the longest, foot formula 31:28:41.

Male supra-anal plate with a medial longitudinal depression proximally and a blunt rectangular tip. It is ornamented with two large melanised bosses near the tip, and with smaller melanised points basally (Fig 7B). Cerci (Fig. 7 A-E) typical of the genus, bilobed, with an upper fin and a subcylindrical lower fork, which is concave on its posterior face and slightly angled inwards towards the midline.

**Female:** Larger than the male (see Table 2) but closely similar in structure. The upper valves of the ovipositor are noticeably indented near their tip, forming a prominent shoulder in dorsal view.

**Coloration.**—Head predominantly olive green, with a large black triangle on the occiput, black postocular stripe, small black markings on the gena and a black border along its ventral edge. Labrum tinged red, palps and sides of mandibles green. Fastigium and dorsal parts of frontal ridge probably red in life, at least in females. Antennae light brown, darkening distally, but with a whitish extreme tip. Pronotum black, longitudinally striped with four light blue-green stripes. The midline of the pronotal disc is black, but in the metazona only is bisected longitudinally by a thin green line situated where one might expect a medial carina. Thoracic pleura mostly black, with lighter color in the centre of each sclerite, and reddish ventral edges. Mesothoracic episternum red. Tegmina black, each with a broad longitudinal pale green central stripe which does not quite extend to the tip of the wing. Pro- and mesothoracic legs green, the femora with reddish bases. Hind femur bright red on all faces, but shading to orange-brown at the knee. Usually there is a single small black spot placed centrally on the dorsal medial carina near the knee. This is often larger in females and can then extend over the internal and external dorsal faces of the femur, giving the impression of a black band when viewed from above. Hind tibia green, shading to black distally, tibial spines black. Tarsi green with black lining on their distal margins. Abdomen (and underside of



Table 2. *Taeniophora* spp. dimensions (mm). Note, values on shaded areas are derived figures, usually ratios, not measurements. Abbreviations as in Table 1.

Character:	F	FW	F/FW	P	E	F/L	L	Ta1	Ta2	T3	Ta1-3	Tibia	Ta1-3/Tib
<b>Species Specimen number</b>													
<i>T. pirrensis</i>													
Male	9.69	2.62	3.70	2.80	6.62	0.64	15.19	1.55	1.40	2.07	5.02	8.12	0.62
Holotype						Foot formula		0.31	0.28	0.41	1.00		
Female	10.80	2.67	4.04	3.10	7.18	0.53	20.35	1.54	1.47	2.30	5.31	8.69	0.61
Allotype						Foot formula		0.29	0.28	0.43	1.00		
Sexual dimorphism (M/F)	0.90	0.98	0.91	0.90	0.92	1.20	0.75	1.01	0.95	0.90	0.95	0.93	1.01
<i>T. santosi</i>													
Male	9.96	2.54	3.92	3.15	6.19		14.54	1.41	1.43	2.14	4.98	8.11	0.61
Holotype						Foot formula		0.28	0.29	0.43	1.00		
<i>T. rubrosignata</i>													
Males													
94077	10.37	2.44	4.25	3.18	8.69	0.64	16.24	1.76	1.84	2.34	5.94	8.98	0.66
CRI000334981	10.65	2.61	4.08	3.09	10.36	0.65	16.42	1.67	1.81	2.38	5.86	9.02	0.65
MEAN	10.51	2.53	4.17	3.14	9.53	0.64	16.33	1.72	1.83	2.36	5.90	9.00	0.66
						Foot formula		0.29	0.31	0.40			
Females													
Holotype	13.00			4.10	11.50								
CRI000423227	12.73	3.03	4.20	3.80	10.97	0.62	20.46	1.78	2.38	2.95	7.11	10.77	0.66
94041	11.63	3.23	3.60	3.87	10.91	0.58	20.09	1.79	2.08	2.39	6.26	9.31	0.67
95449	13.27	3.30	4.02	4.08	12.05	0.67	19.66	1.89	2.23	2.76	6.88	11.09	0.62
94039	12.38	3.12	3.97	4.08	11.20	0.65	19.01	2.03	2.24	2.53	6.80	10.12	0.67
MEAN	12.60	3.17	3.95	3.99	11.33	0.63	19.81	1.87	2.23	2.66	6.76	10.32	0.66
						Foot formula		0.28	0.33	0.39			
Sexual dimorphism (M/F)	0.83	0.80	1.06	0.79	0.84	1.02	0.82	0.92	0.82	0.89	0.87	0.87	1.01

thorax) light olive brown, upper forks of male cerci blackish. Two tiny black erect processes on the anterior surface of the supra-anal plate (Fig. 7), and two larger black marks on its distal edge. Male and female are colored similarly, apart from differences in the size of the femoral black spot. The species has a color scheme and appearance similar to *T. valleana* (Colombia) and *T. femorata* (Costa Rica), differing principally in its nonbanded hind femora and smaller size. *T. nitida* (Colombia) is also chromatically similar to *T. pirrensis*, but much smaller. The male genitalia of *T. pirrensis*, both internal and external, closely resemble those of *T. valleana*, which may well be its closest relative.

## 2. *Taeniophora santosi* n. sp.

*Type locality*.—PANAMA: Prov Panamá: Cerro Azul: Las Nubes.

*Location of type specimen*.—ANSP.

*Etymology*.—named for the collector, Alonso Santos of the University of Panama.

*Diagnosis*.—Habitus, see Plate 5. Very similar in general coloration and morphology to *T. panamae* Hebard 1923, but differs from that species as follows:

- Smaller size ( $F_{\text{male}} = 9.62$  mm (*panamae* = 11.45 mm))
- Male femora all unarmed (just a slight thickening of the dorsal carina of the mesothoracic femur, but no spine is developed).
- Abdomen, legs and basal segments of antennae all brown, not green.
- Almost the entire lateral lobe of pronotum pale yellow, with

only thin blackish brown horizontal stripes above and below

- No pale markings on the elytra.
- No pale markings on posterior edge of eye.

The male cercus is indistinguishable from that of *T. panamae*. To avoid damage to the unique holotype, the phallic complex has not been examined.

*Natural history*.—Unknown. The species is known only from the male holotype and has not been seen in the wild since. As the type locality is frequently collected by personnel of the University of Panama, it is presumably very uncommon.

## 3. *Taeniophora rubrosignata* Descamps & Rowell 1984.

*Description of holotype female*.—Descamps & Rowell 1984:158.

*Habitus*.—Plate 6.

Apart from its smaller size (see Table 2) the male is closely similar to the female, with identical coloration and markings. Similarly, the predominantly blue-grey ground color seen in the living animal changes to shades of green in the dried specimen. Fig. 9 shows the male terminalia. Unlike other Central American species of the genus, the internal fork of the cercus is not subcylindrical, but hook-shaped, and directed towards the midline, perhaps linking this species with the Colombian *T. tenuipes*, which shows a similar modification. The supra-anal plate is smoothly rounded at its tip, not produced, and has two longitudinal melanic stripes down its edges. At the proximal end of each of these stripes there is a small black

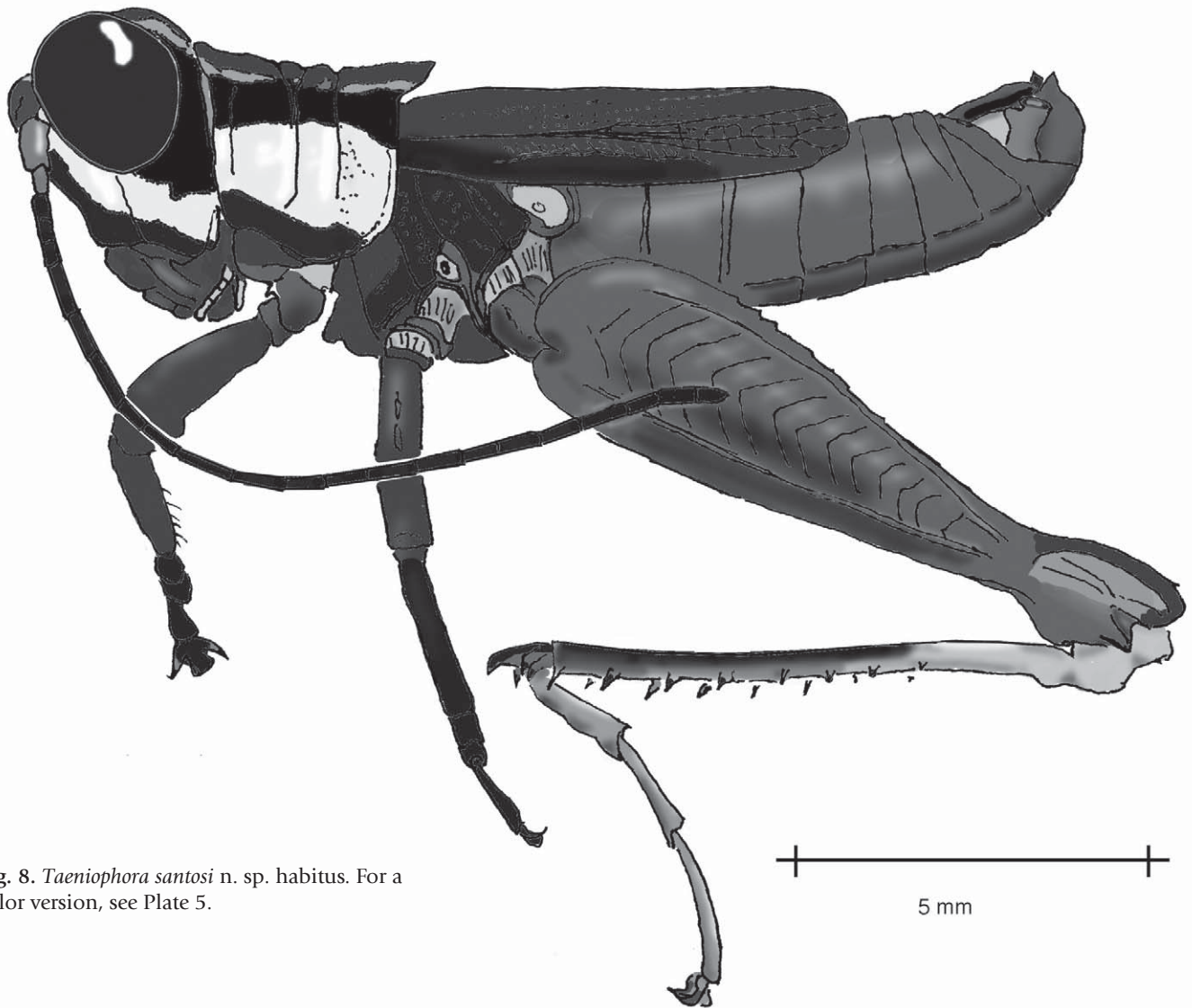


Fig. 8. *Taeniophora santosi* n. sp. habitus. For a color version, see Plate 5.

erect tubercle. The area between the stripes is recessed proximally. The thoracic femora are unarmed.

#### C. Tribe Ophthalmolampini

*Diagnosis.*—Male subgenital plate simple (except in *Zoumolampis*, which can be distinguished by the specialised 8<sup>th</sup> abdominal tergite of the male); supra-anal plate compound, apparently divided into two transversely; cerci never bilobed. Integument of face densely pitted.

#### Subtribe Ophthalmolampae.

*Diagnosis.*—Prozona as long as or longer than the distance from the anterior margin of pronotum to the tip of the fastigium. Seven external tibial spines (including apical spine), lateral lobes of pronotum monochrome.

*No. of included genera.*—9 (*Adrolampis*, *Aphanolampis*, *Apophylacris*, *Caenolampis*, *Chromolampis*, *Nothonautia*, *Ophthalmolampis*, *Peruiviacris*, *Poecilolampis*).

*Range.*—from Amazonian Brazil, Bolivia and Peru through Guyana, French Guiana, Venezuela, Colombia, Ecuador, Panama and Costa

Rica. All genera apart from *Caenolampis* are exclusively South American.

#### *Caenolampis* Descamps 1978

Descamps 1978: 468.

*Type species.*—*Ophthalmolampis osae* Roberts 1973, by original designation.

*No. of known species.*—4.

*Range.*—Ecuador, Panama, Costa Rica.

*Natural history.*—Canopy species of lowland rain forest to at least 1100 m altitude. Females come to the ground at night, possibly for oviposition.

*Diagnosis.*—The only genus of the subtribe known in Central America. It superficially resembles *Nautia*, but can be distinguished by the double row of black plaques on the outer face of the green hind femur. The number of plaques varies, but some are always present. (*Nautia conspersipes* and some individuals of *N. flavosignata* have

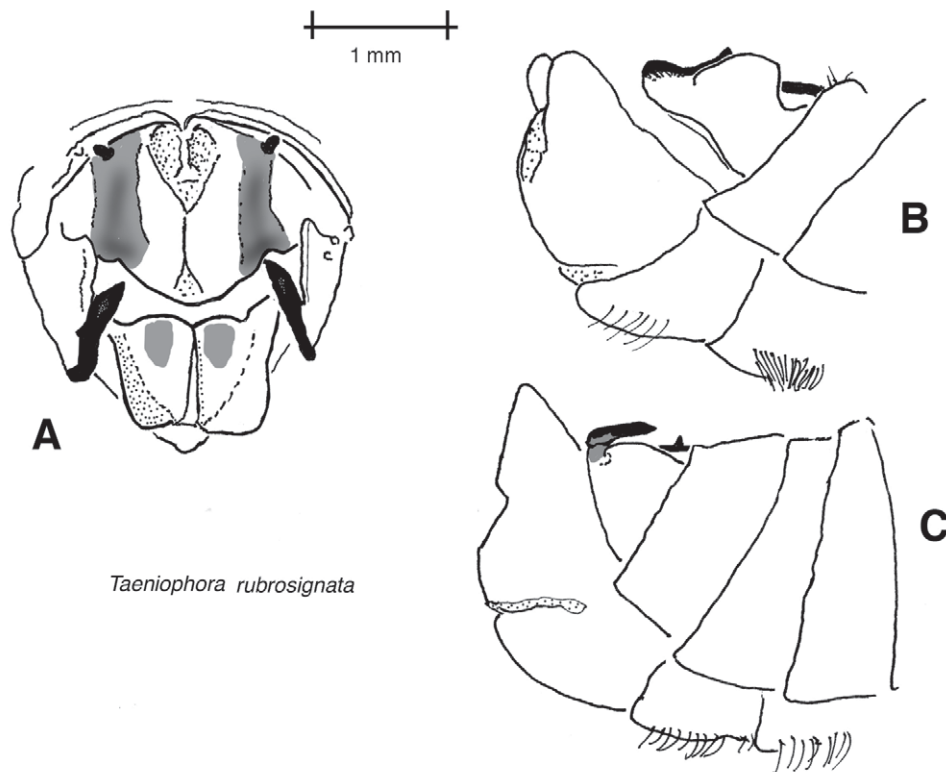


Fig. 9. *Taeniophora rubrosignata* Descamps and Rowell. Male terminalia. A, dorsal view; B & C, two lateral views. For habitus, see Plate 6.

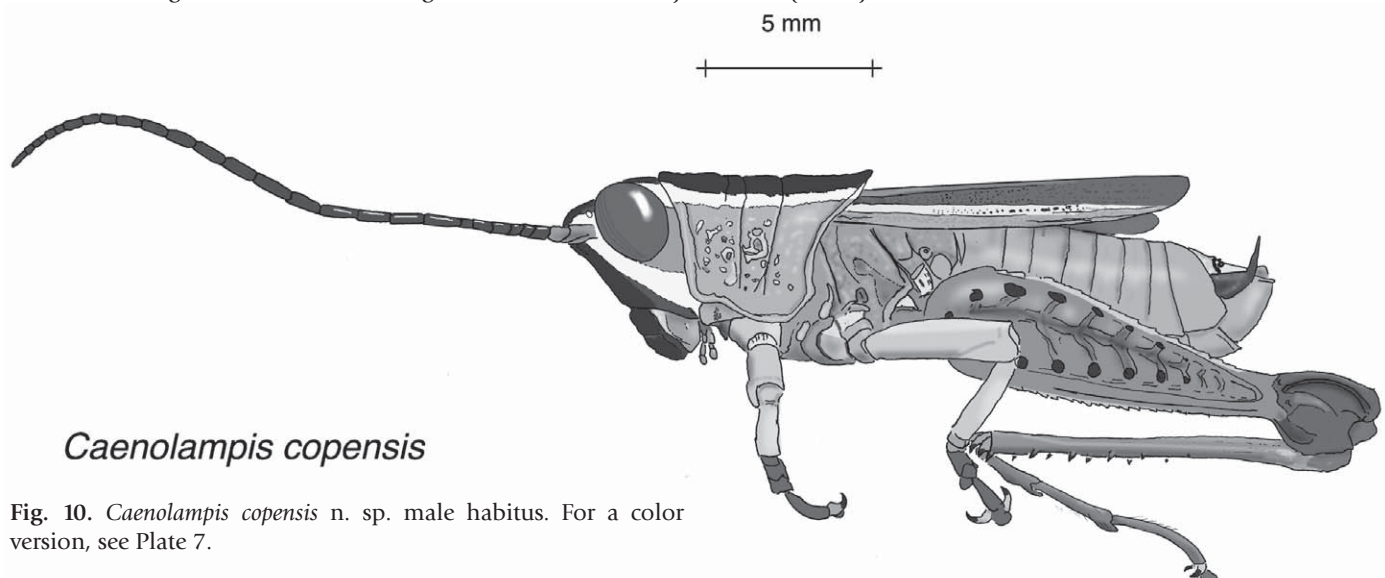
*Taeniophora rubrosignata*

a fine black speckle on the femur, but never plaques). Fastigium moderately produced, horizontal or downward sloping. Antennae ensiform, dark brown (usually purple or black in *Nautia*), as long as or much longer than the head and pronotum. Pronotum subcylindrical, medial and lateral carinae absent. Anterior margin slightly produced, with a small midline embayment. Metazona 0.6× to 1.0× as long as the prozona; posterior margin broadly convex. Four transverse sulci, all but the most anterior cross the disc. The prosternal process is very small and bluntly pointed, mounted on a massive pediment. Alate and tympanate. Tegmina and wing extend into the 9<sup>th</sup> abdominal segment. Wings opaque dark brown. Tegmen dark brown, with a longitudinal band in which the reticulum veins are white or yellow; this gives the superficial impression of a pale stripe marked with brown spots of various sizes (corresponding to the brown tegminal membrane showing between the reticulum).

Legs green. Six external hind tibial spines, six internal spines. Inner tibial spurs twice as long as outer spurs. Hind feet pink, more than half the length of the femur. Foot formula 25:32:43. Male SAP triangular, with melanic ornament on at least the proximal part. Furcula absent (posterior margin of 10<sup>th</sup> abdominal segment is the transverse divide of the supra-anal plate). Male cerci laterally flattened proximally, thin and rod-like distally, curving upwards and inwards. Pallium heavy and pigmented (green). Ovipositor valves thin and elongate, but not completely rod-shaped.

1. *Caenolampis copensis* n. sp.

*Holotype male*.—PANAMA: Prov. Coclé: Cerro Copé, 850 m, 14.09.1999 (Rowell CHF & Bentos-Pereira, A). Specimen no. 99078. (ANSP).



*Caenolampis copensis*

Fig. 10. *Caenolampis copensis* n. sp. male habitus. For a color version, see Plate 7.

Table 3. *Caenolampis copensis* n. sp. spp. dimensions (mm). Note, values on shaded areas are derived figures, usually ratios, not measurements. Abbreviations as in Table 1.

Species		L	F	FW	F/FW	PN	Metazona	Prozona	IOS	Ant. Scape W	Antennae	T1	T2	T3	T1-3
Number	Character:														
Holotype male		22.3	14.3	3.44	4.16	6.41	2.6	3.81	0.2	0.6	21.5	1.97	2.5	3.34	7.81
										Foot formula		0.25	0.32	0.43	1

*Known distribution.*—Panama (type locality only).

Female unknown.

*Diagnosis.*—Habitus: Fig. 10, Plate 7. Dimensions, Table 3. At first sight very similar to *C. robertsi* Descamps 1978, the commonest species of the genus in both Panama and Costa Rica. Coloration: antennae, dark brown; head, sides of thorax, abdomen and legs emerald green. Face green with brown speckle. Frontal yellow stripe starts at antennal sockets, runs in front of the eyes and is produced downwards and backwards as a slanting stripe across the genae. Vertex and fastigium brown, bordered with bright yellow longitudinal stripes. Brown and yellow stripes continue backwards from vertex over pronotum and tegmina, extending almost to genitalia. Hind femora with ventral and dorsal rows of black plaques, 8 in each row. Hind femora exceed abdomen in length, >4.2× as long as wide. Hind feet pink.

Distinguished from *C. robertsi* and *C. osae* by the relatively much longer antennae (almost as long as the body, ca 3× head and pronotum together), the color of the hind knees (uniform reddish or purplish brown, with no pale patch on the external ventral lobe of the knee) and by the presence of melanic ornamentation on the distal portion of the male SAP (absent in *C. robertsi* and *osae*) (Fig. 11). The brown speckle within the yellow elytral stripe is much finer and less obvious than in *robertsi*.

To avoid damage to the unique type specimen, the genitalia were not dissected. Descamps and Rowell (Figs 48-50, 1984) figure the phallus of *C. robertsi*, which is typical of the subtribe.

*Natural history.*—Unknown. The other species of the genus are all canopy dwellers in wet forest, but are not infrequently found at ground level, as was the type of this species.

### Subtribe Lagarolampae

*Diagnosis.*—Interocular space very narrow, less than width of antennal flagellum. Antennae usually filiform. Male cerci styliform. Always atympanate.

### *Inbiolampis* n. gen.

*Justification for a new genus.*—The genera of the Ophthalmolampini were comprehensively revised by Descamps (1978,1983). Using his 1978 key to genera the present specimen resolves as follows:

Couplet 7. Interocular space very narrow, less than antennal flagella; Antenna filiform (though broken in type); Tympanum absent >> subtribe Lagarolampae.

This subtribe currently contains only 8 genera: *Hekistolampis*, *Lagarolampis*, *Tikaodacris*, *Eleutrolampis*, *Habrolampis*, *Pterochromacris*, *Helolampis* and *Orthnacris* (all due to Descamps 1977 or 1978).

All these genera can be eliminated as follows:

Couplet (C) 2, C3. Face with dense cupules, 8 tibial spines – excludes *Hekistolampis*.

C10. Inferior and supero-internal carinae of hind femur smooth – excludes *Helolampis* and *Othnacris*.

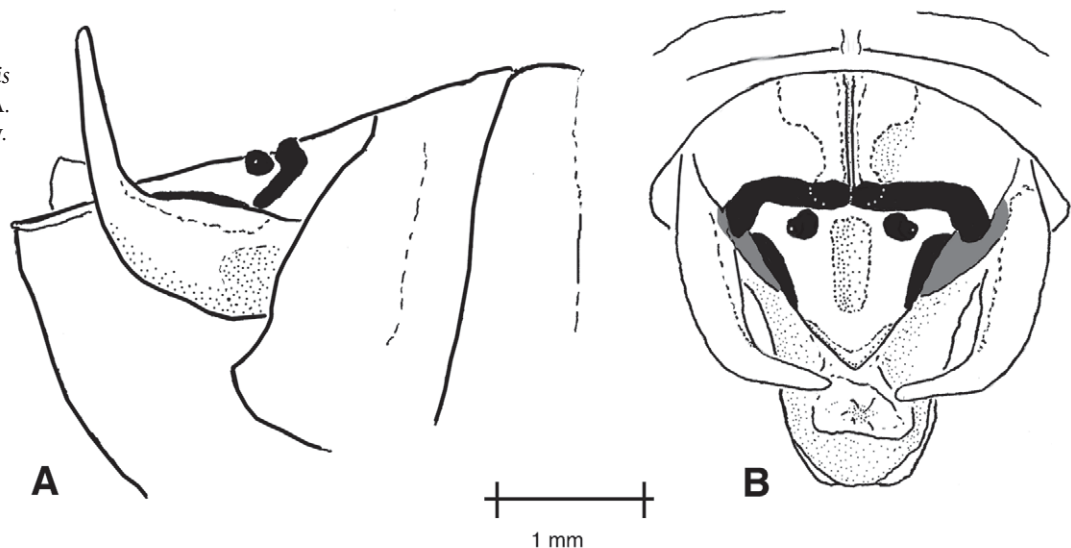
C11. Superior carina of hind femur not smooth, but serrate – excludes *Lagarolampis* and *Tikaodacris*.

C14. Superior carina of hind femur serrate, mesosternal space more or less square. Metasternal lobes nearly touching.>> C15.

C15. No male available to examine 8<sup>th</sup> abdominal tergite: but this couplet when positive leads to *Zoumolampis*. *Zoumolampis* is excluded in females by the absence of 2 strong projections on either side of pronotum. Also the pronotal sulci are narrow, not wide.

C16. Elytra are not lateral and widely separated, but instead touching and overlapping dorsally. Excludes *Eleutrolampis*.

Fig. 11. *Caenolampis copensis* n. sp. male terminalia. A. Lateral view. B. Dorsal view.





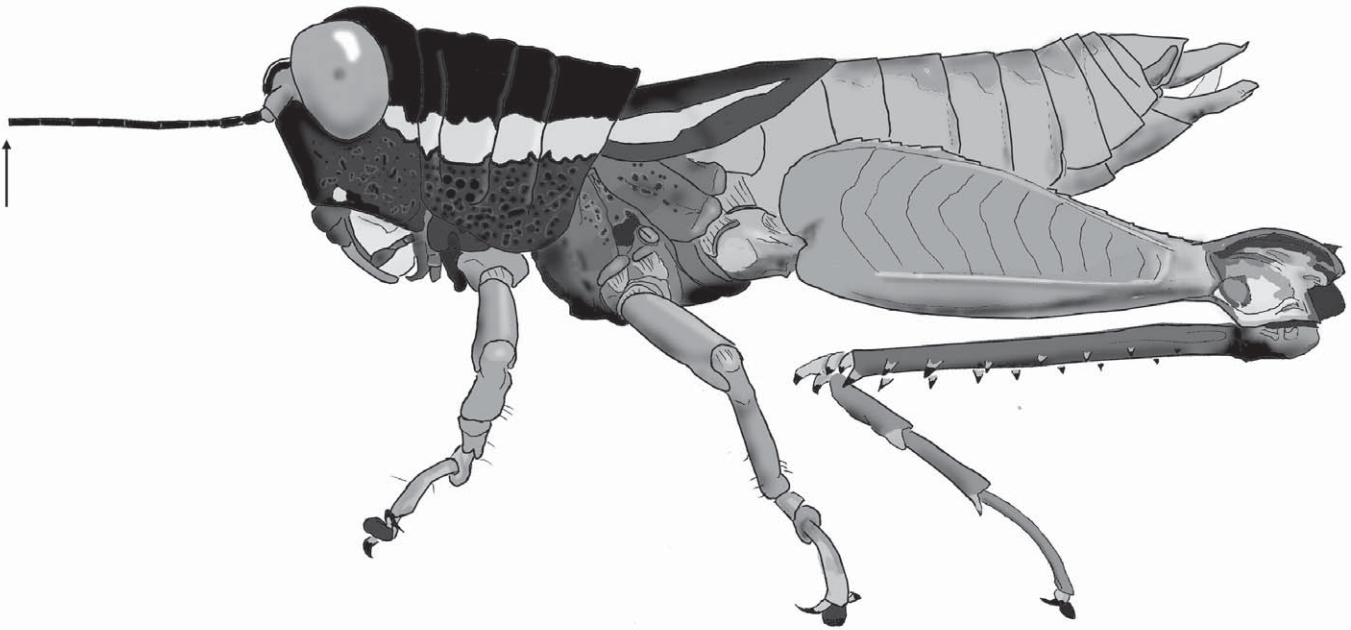


Fig. 12. *Inbiolampis herediensis* n. sp. female habitus. Note broken antenna (arrowed). For a color version, see Plate 8.

C18. Posterior margin of PN not bisinuate at base of elytra. Excludes *Habrolampis*, despite this taxon having a narrow yellow stripe on elytron, like the present specimen.

C19. Yellow elytral stripe not divided by a black one. Excludes *Pterochromacris*.

(Further, elytra are too short for either *Habrolampis* or *Pterochromacris*, and metazona not strongly projecting, as specified for both by C17).

From the above I conclude that this is a new genus, though obviously a Lagarolampan, most closely allied to the *Zoumolampis*, *Habrolampis*, *Pterochromacris*, *Eleutrolampis* group. The absence of a male makes generic determination difficult and uncertain.

Note that the Lagarolampae, represented by *Lagarolampis* and *Zoumolampis*, are already known to be present in Costa Rica and Panama (Rowell 1999, Rehn 1928).

*Type species.*—*Inbiolampis herediensis* n. sp.

*Etymology.*—Generic name derived from INBio, the abbreviation for the Instituto Nacional de Biodiversidad of Santa Domingo de Heredia, Costa Rica, in recognition of their valuable work in surveying the insects and other organisms of that country. The unique type specimen derives from their collecting.

*Diagnosis.*—Typical Lagarolampan genus. Habitus, Fig. 12, Plate 8B. Alate but brachypterous, atympanate.

Fastigium short, transverse, and downwards slanting. Frontal ridge, well developed and parallel sided above medial ocellus, increasingly obsolete below the ocellus. Integument of frons, vertex and genae densely pitted. Antennae filiform, black, length unknown (broken in specimen).

Pronotum cylindrical, lateral and medial carinae absent. Metazona shorter than (61% of) prozona. Four narrow pronotal

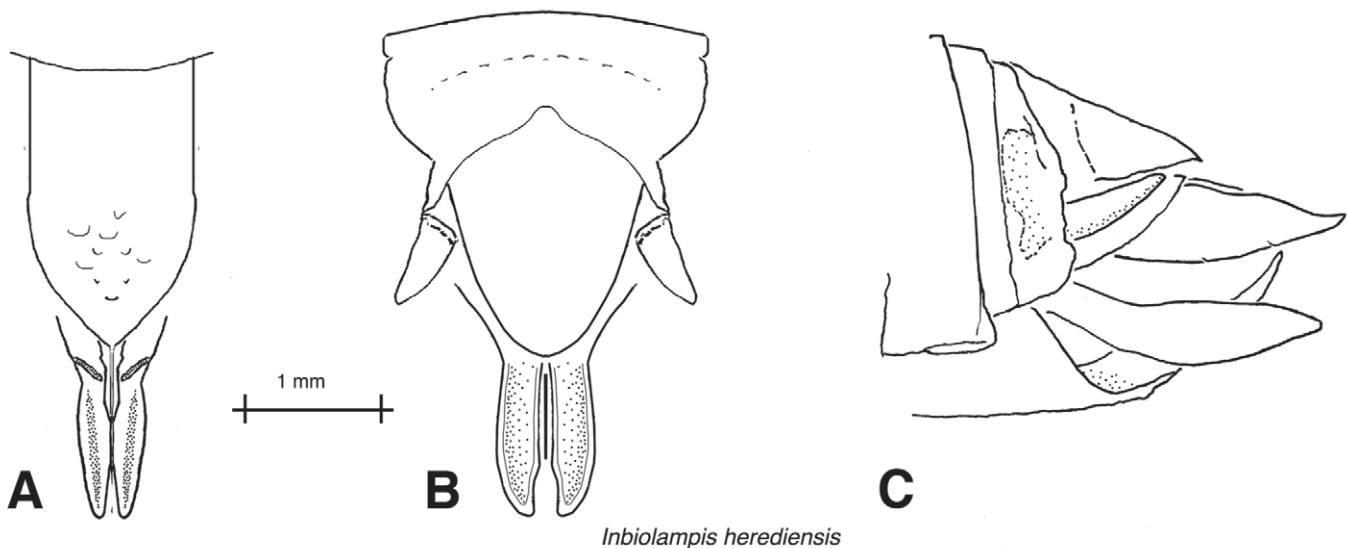


Fig. 13. *Inbiolampis herediensis* n. sp., female terminalia. A. Ventral view. B. Dorsal view. C. lateral view.

Table 4. *Inbiolampis herediensis* n.sp. spp. dimensions (mm). Note, values on shaded areas are derived figures, usually ratios, not measurements. Abbreviations as in Table 1.

Character:	L	F	FW	F/FW	PN	Metazona	Prozona	Mz/Pz	IOS	Ant. Scape W	Antennae	T1	T2	T3	T1-3
Female holotype	20.20	11.76	3.34	3.52	4.76	1.81	2.95	0.61	0.13	0.80	broken	1.74	2.01	2.81	6.56
											Foot Formula:	0.27	0.31	0.43	1

sulci, all but the most anterior cross the disc. All surfaces of pronotum, except in the cream coloured lateral stripe, heavily pitted. Anterior and posterior margins of pronotal disc weakly produced, bluntly rounded; anterior margin slightly notched in the midline. Prosternal process massive, subconical, with a bluntly round tip. Mesosternal interspace about as wide as long, definitely not longitudinal. Metasternal lobes almost but not quite touching. Integument of meso and metathoracic pleura pitted. Ventral margins of metathoracic episterna and epimera slightly produced and outwardly flared. Elytra overlap in the dorsal midline, and extend into the third abdominal tergite. Hind femora slightly exceed the tip of abdomen, 3.5× longer than their maximal width. Dorsal and ventral carinae weakly serrate, the dorsal carina more so. Dorsal medial carina ends in a small spine on the knee. Ventral external lobe of knee pointed, and directed slightly downwards. Tibia with 8 external and internal spines (including terminal spines). Interior tibial spurs much longer than external ones. Foot slightly more than half as long as tibia. Second tarsal segment longer than first segment, but shorter than the third and most distal one; foot formula 27:31:43.

Abdominal tergites devoid of a medial carina, tergites 9 and 10 fused. Supra-anal plate (Fig. 13B) triangular, with a smooth dorsal surface and rounded tip; the extreme posterior margins slightly thickened. Ovipositor valves long and slender, but stylet-like, not rod-like (*i.e.*, not circular in cross section). Dorsal face of superior valves and ventral face of inferior valves concave, tips pointed and in profile very slightly hooked. Subgenital plate (Fig. 13A) with a simple triangular posterior margin converging on the base of a slender pointed egg guide, inclined upwards at about 30–40°. Cerci simple, conical, and curved slightly outwards.

Male unknown.

#### 1. *Inbiolampis herediensis* n. sp.

*Holotype female*.—COSTARICA, Prov. Heredia: P.N. Braulio Carrillo, Estación El Ceibo, LN 236000\_5426000, 15.03.1990 (Chavez, C.), specimen no. CRI 1000 167507 (INBio).

*Diagnosis*.—Female. Habitus, Fig. 12, Plate 8, Dimensions, Table 4. The generic description applies. Small to medium in size (L = 20.2 mm).

*Coloration*.—Head apart from mouthparts mostly black, fastigium and basal antennal segments green. Antennal flagellum black. Frons greenish black, with small white patches just above the extremities of the frontoclypeal suture. Labrum and palps green, lateral areas of mandibles whitish. Eyes protuberant, drying brown (color in living animal unknown). Postocular stripe white or cream, slanting downwards to the rear.

Pronotum dorsally black, lateral lobes black tinged with green. Postocular stripe continued as a narrow white or cream stripe across lateral lobe, and almost to the tip of the otherwise purple-red tegmen. The wing is about half the length of the tegmen, and similarly coloured. Legs green; hind knee reddish, except for a large green patch on the ventral outer lobe. Tibia green, hind feet red. Abdomen green, with brown shading on dorsal tergites.

*Natural history*.—Unknown; members of the subtribe typically inhabit understorey trees or bushes in wet forest, which describes the site of capture of the type specimen.

*Distribution*.—Known only from the type locality, in Caribbean slope forest on the northern foothills of the Cordillera Central, Costa Rica.



Fig. 14. *Nautia atrata* n. sp. female habitus. For a color version, see Plate 9.





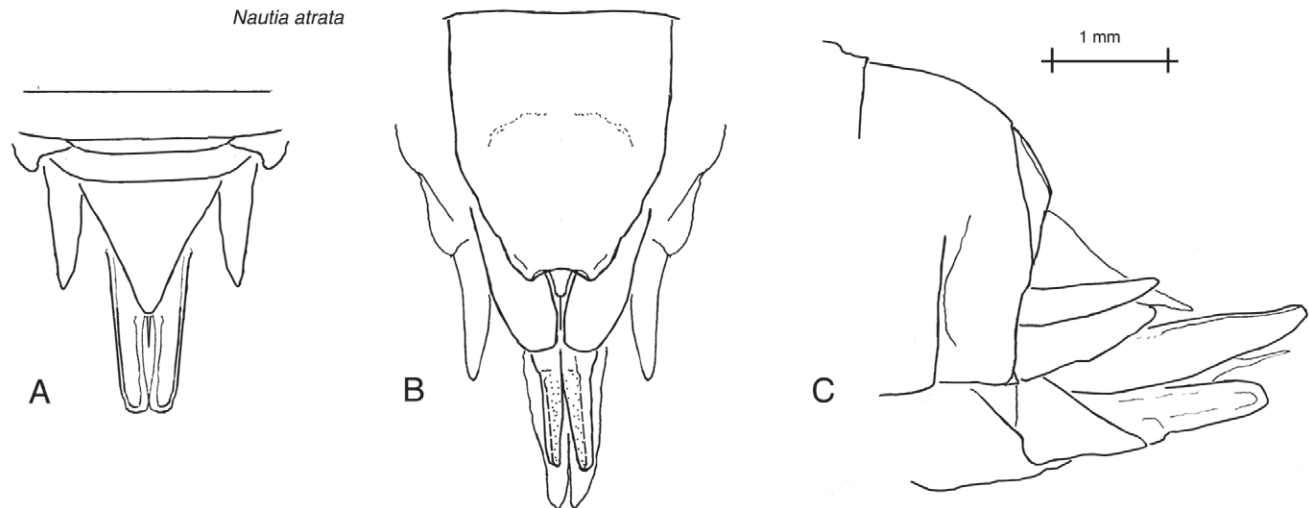


Fig. 16. *Nautia atrata* n.sp., female terminalia. A, dorsal view. B, ventral view. C, lateral view.

of the antenna in front of the eyes and slants across the genae. On vertex, 3 small yellow spots, one medial and one at the posterior margin of each eye (Fig 14). Similar pale vertex spots are seen in other species of the genus too.

Pronotum and thorax, black. A broken line of yellow spots continues the transjugal stripe across the lower lateral lobes to the posterior angle, ending with a spot on the mesoepimeron. A still more interrupted and incomplete line of yellow spots extends along the margin of the pronotal disc (Fig 14). Elytra black with three narrowly separated longitudinal bands of yellow reticular veins, the two most anterior fusing distally. These elytral bands roughly continue the line of the lateral yellow markings of the pronotum (Fig. 15).

Fore and middle legs, black. Hind femora, emerald green, with black knees. Hind tibia, emerald green in central area, black distally and proximally. Tibial spines black. Hind feet, dusky pink, more than half as long as the hind tibiae; foot formula 28:29:43. Abdominal segments blackish brown dorsally, blue-green ventrally and laterally. Terminalia black.

### Acknowledgements

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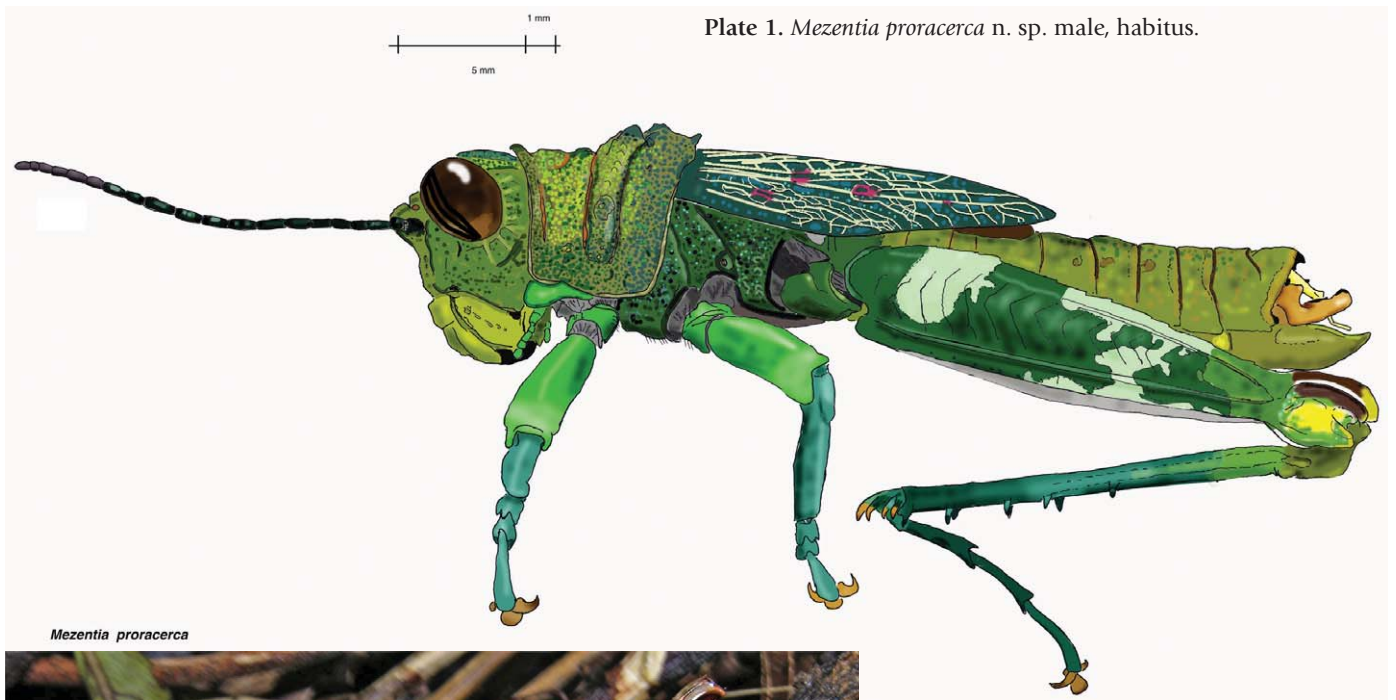


Plate 2. *Mezentia gibbera* Stål, female. Bocas del Toro, Panama. Photo courtesy Dr. Arthur Anker, Universidade Federal do Ceará, Brazil.

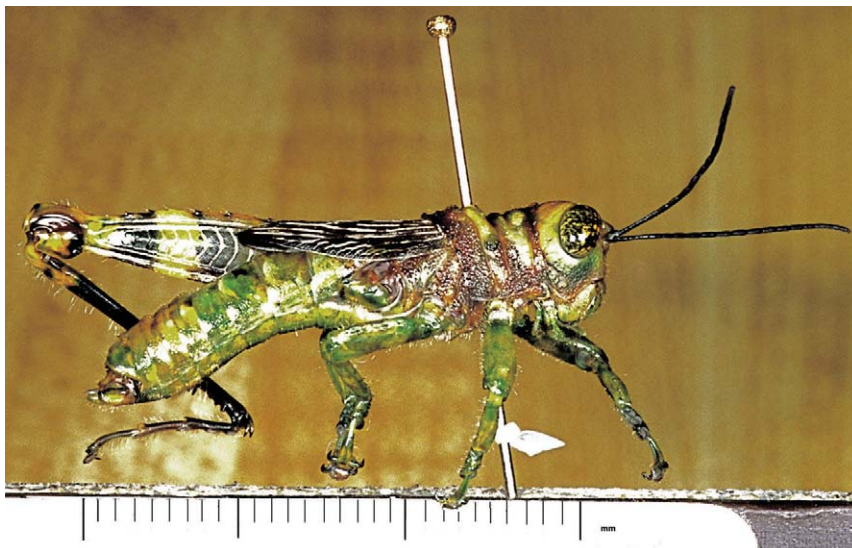


Plate 3. *Mezentia gibbera*, male. Bosque de Protección San Lorenzo, Fort Sherman, Colón, Panama.

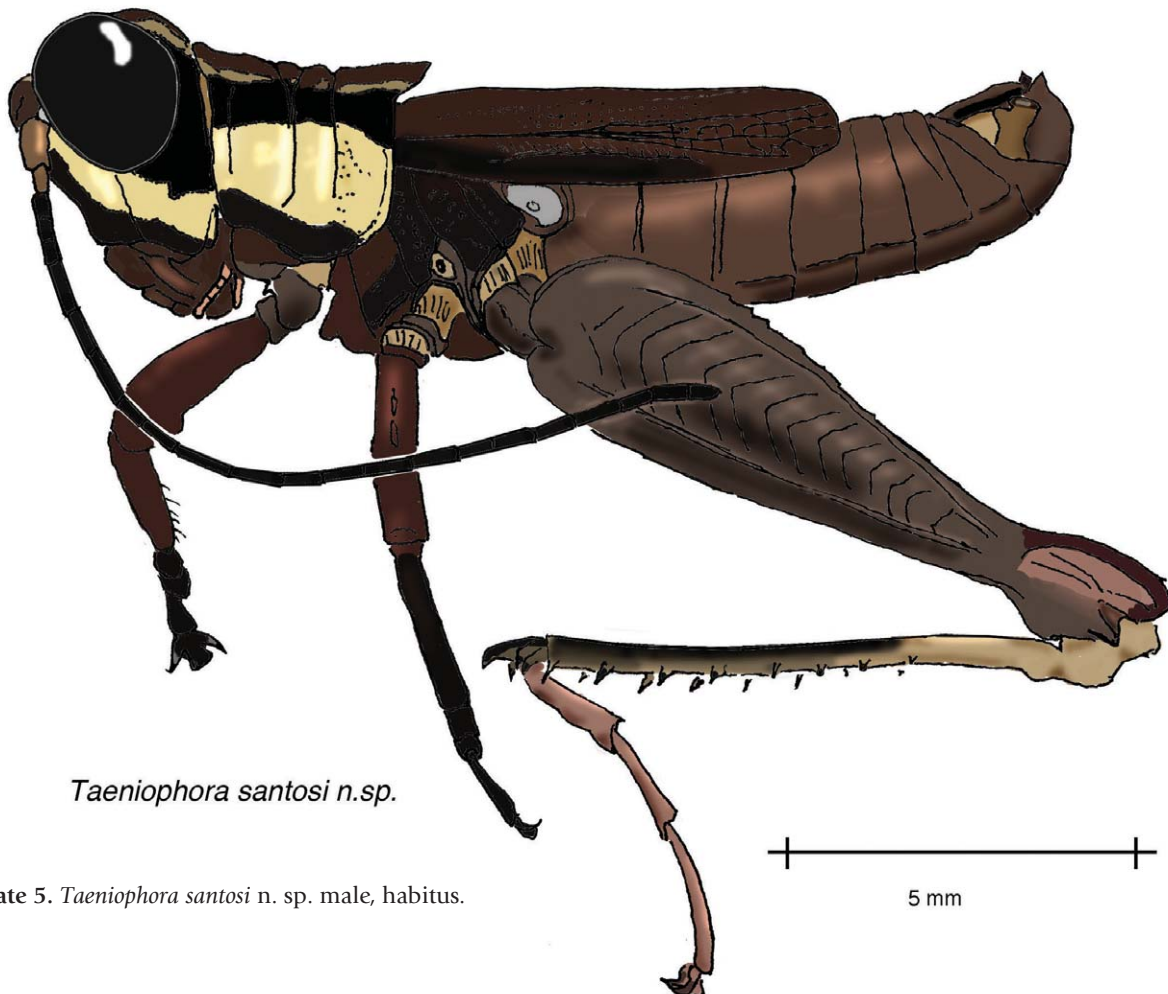
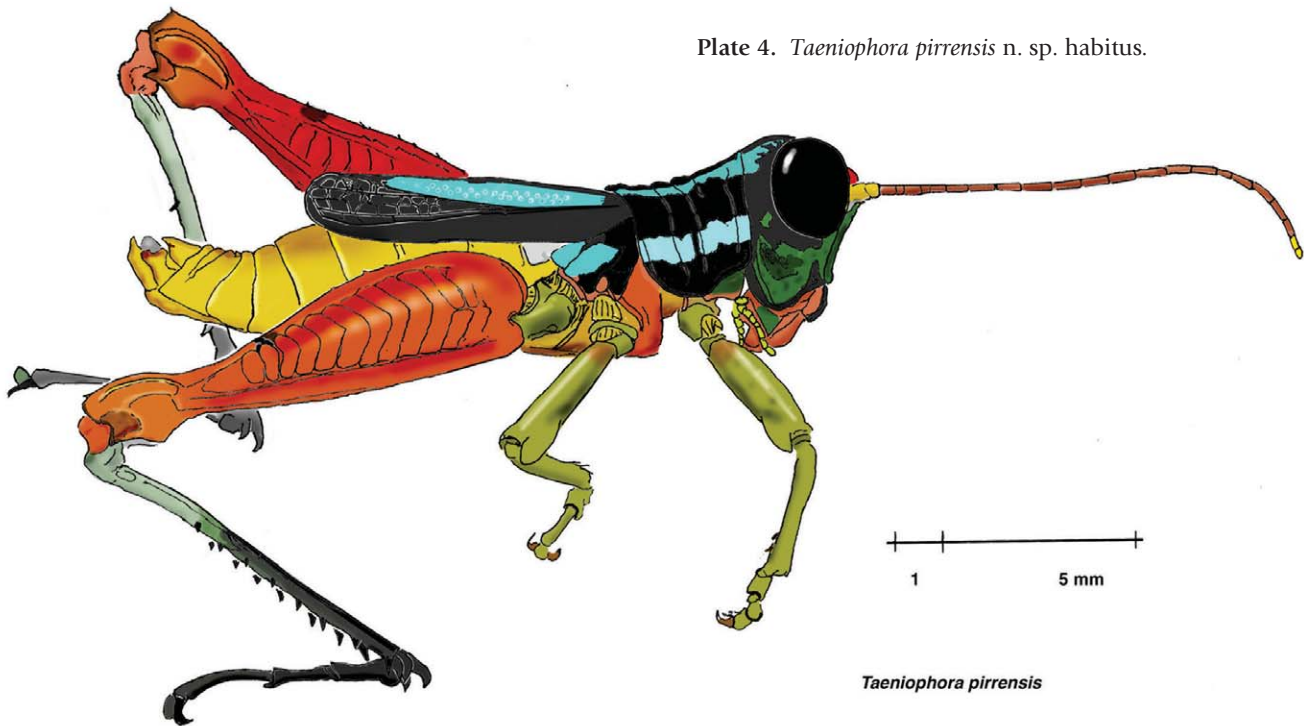
Plate 4. *Taeniophora pirrensis* n. sp. habitus.Plate 5. *Taeniophora santosi* n. sp. male, habitus.



Plate 6. *Taeniophora rubrosignata* Descamps & Rowell, male, habitus.

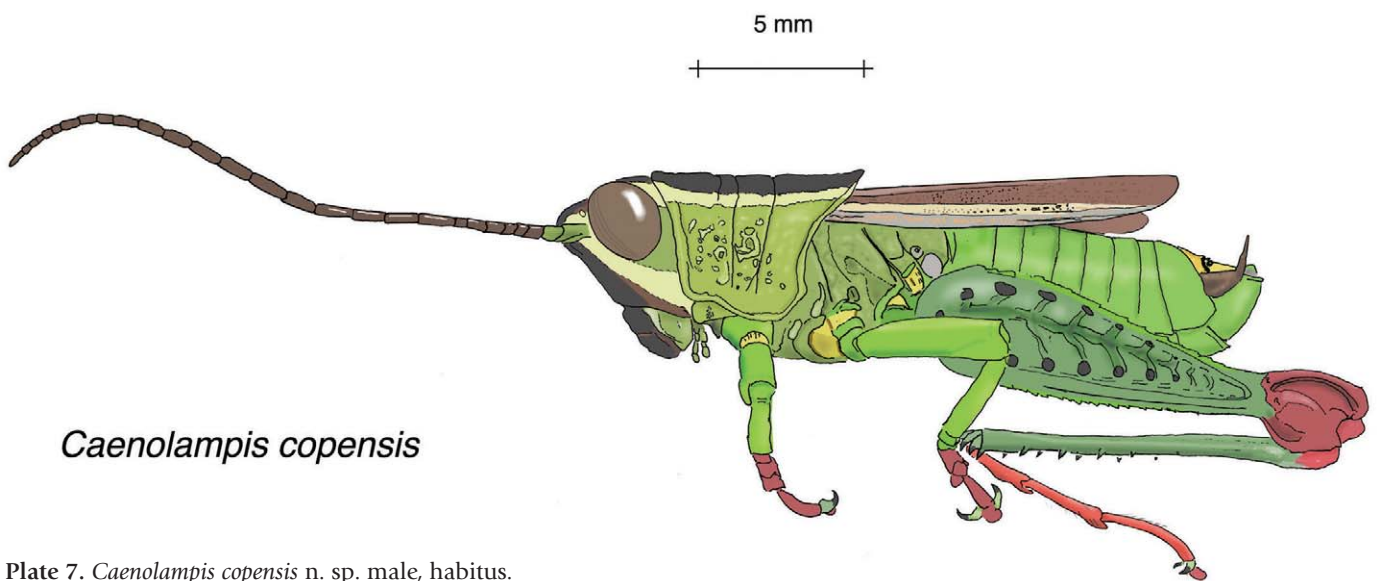
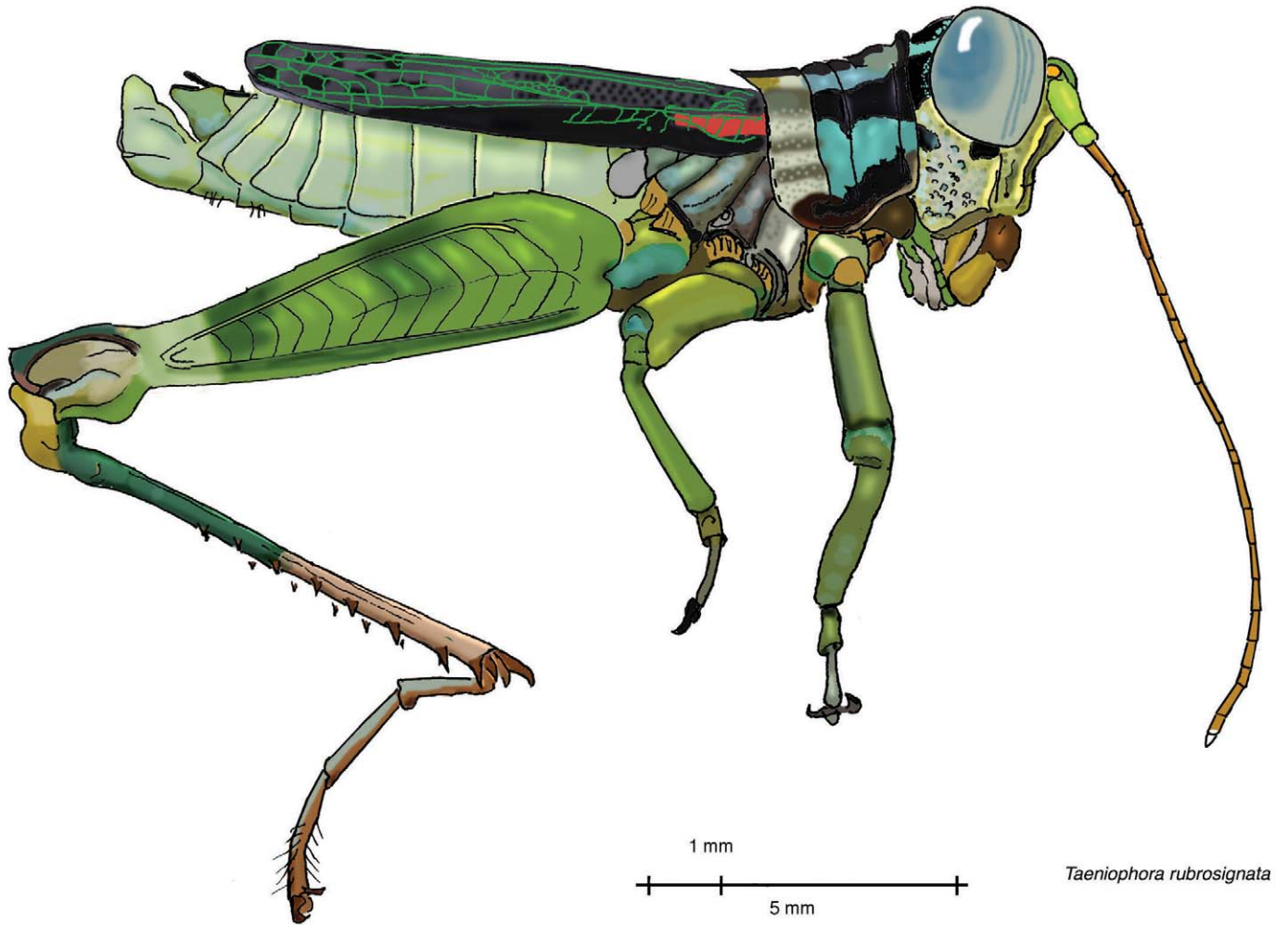


Plate 7. *Caenolampis copensis* n. sp. male, habitus.



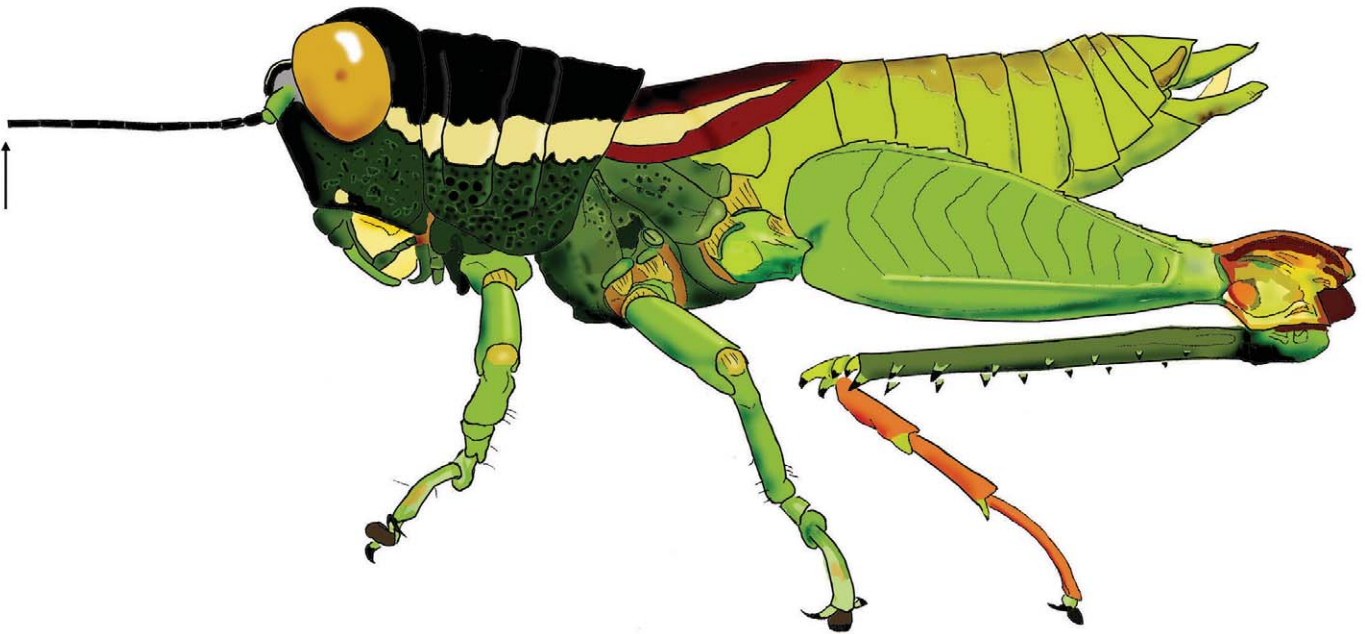


Plate 8. *Inbiolampis herediensis* n. sp. female, habitus. The arrow indicates the point of breakage of the antenna.

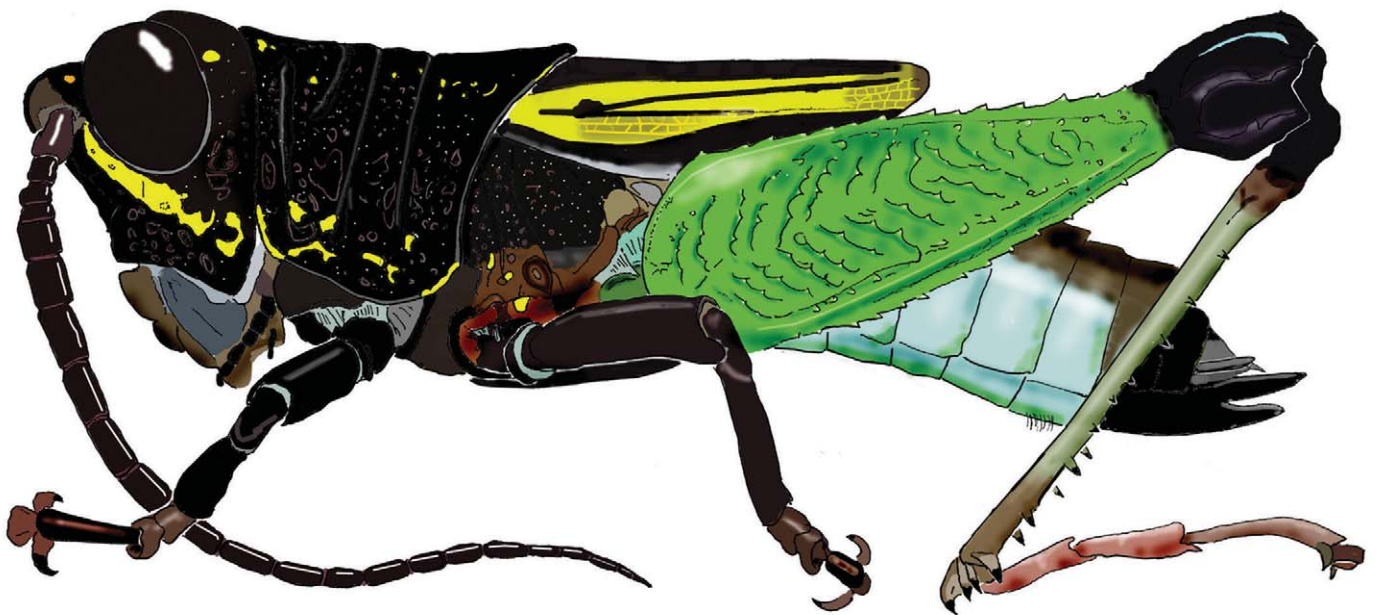


Plate 9. *Nautia atrata* n. sp. female habitus.