Taxonomic notes on some Central American Ommatolampinae

Author: Rowell, C. H. F.

Source: Journal of Orthoptera Research, 17(1) : 57-81

Published By: Orthopterists' Society

URL: https://doi.org/10.1665/1082-6467(2008)17[57:TNOSCA]2.0.CO;2

Taxonomic notes on some Central American Ommatolampinae

Accepted February 20, 2008

C.H.F. ROWELL

Zoologisches Institut der Universitaet Basel, Klingelbergstr. 50, CH-4056 Basel, Switzerland. E-mail: hrowell@netplus.ch

Abstract

Nicarchus enyalius Rehn (Ommatolampini: Vilernae) is synonomized with *N. erinaceus* Stål, leaving the genus monospecific. A redescription is given.

The previously unknown male of *Cryptacris costaricensis* Descamps & Rowell is described, and the genus redescribed; its probable position within the Vilernae is reaffirmed, and it is newly recorded from Panama as well as from Costa Rica.

A new species of *Pauracris* Descamps & Amedegnato, a genus previously known only from Colombia, is described from Caribbean Costa Rica (*P. brachyptera*). *Christenacris* Descamps and Rowell is provisionally transferred from the Ommatolampini to the Pauracrini.

A new subspecies of *Ateliacris annulicornis* (Bruner) *(A. a. pulchra)* (Syntomacrini: Caloscirtae) is described from Western Costa Rica. It differs from the nominate form principally in the coloration of the male.

The systematic position of *Leptalacris* Descamps & Rowell is reconsidered, and it is transferred from the Ommatolampinae: Clematodinini to the Eucopiocerae group.

One new species (*jagoi*) and one new subspecies (*chrysonota salazari*) of *Rhachicreagra* are described from Costa Rica (Abracrini). Additional notes on *Rh. gracilis* Bruner, *drymocnemensis* Jago & Rowell and *dierythra* Rowell are given.

Key words

Orthoptera, Acrididae, Ommatolampinae, Central America, new species, taxonomy

Introduction

The Ommatolampinae are a large subfamily of the Acrididae, confined to South and Central America with Mexico and the Greater Antilles, and were first erected and classified by Amedegnato (1974, 1977). Currently about 100 genera are placed in this taxon. They are divided into seven tribes, at least four of which have Central American representatives, showing various amounts of differentiation from the South American forms. These four tribes are the Ommatolampini (represented in Central America only by the subtribe Vilernae), Pauracrini, Syntomacrini (represented only by the subtribe Caloscirtae), and Abracrini.

The purpose of the present paper is to present the results of some recent taxonomic work on the ommatolampines of southern Central America. The genera *Microtylopteryx* and *Rhachicreagra* were previously revised (Rowell 2003, Jago & Rowell 1981), and several new species of *Rhachicreagra* were described by Rowell & Amedegnato (2000). The current aim is bring up to date our knowledge of these and other ommatolampine genera of Costa Rica and Panama.

Methods

Standard taxonomic methods were employed throughout.

Abbreviations of depositories.—

ANSP: Academy of Natural Sciences, Philadelphia, USA. INBio: Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica. RC: the author's collection. GBFM: Universidad de Panama, Museo de Invertebratos G.B. Fairchild. NMW: Naturhistorisches Museum, Wien, Austria.

Coordinates of collection localities are given using the Lambert North or Lambert South (LN or LS) grids of the Costa Rican 1: 50000 topographical maps published by the Instituto Geográfico Nacional.

Results

1. Subtribe Vilernae
Nicarchus Stål, 1878
(Figs 1-7)

Stål. 1878. Bihang till Kungliga Svenska Vetenskaps-Akademiens Handlingar. 5(4): 34, 78.
Type species: *Nicarchus erinaceus* Stål.

Subsequent literature: Brunner von Wattenwyl. 1893: 139. Kirby 1910: 433. Rehn 1929: 37 [Romaleinae: Dracotettigini]. Amedegnato 1974: 201 [Ommatolampinae: Ommatolampini]. Descamps 1976: 512.

The genus has, until now, comprised two species, *erinaceus* Stål (the type of the genus) and *enyalius* Rehn 1929. The former was described from a single specimen from an unspecified locality in Panama, and the latter from two examples from Guápiles, Costa Rica.

Examination of new specimens from both countries and of the original holotypes indicates that they all represent the same species. Rehn's *enyalius* is thus a junior synonym.

Stål's original diagnosis of *erinaceus* indicated that the apex of the fastigium was emarginate, and that the 1st and 2nd lateral processes of the pronotal disc were small, the 3rd and 4th large. Rehn differentiated his specimens from *erinaceus* on the grounds that the apex of the fastigium was not emarginate, and that the 1st and 4th lateral processes of the pronotal disc were small, the 2nd and 3rd large. Following his usual practice, he did not examine the European type.

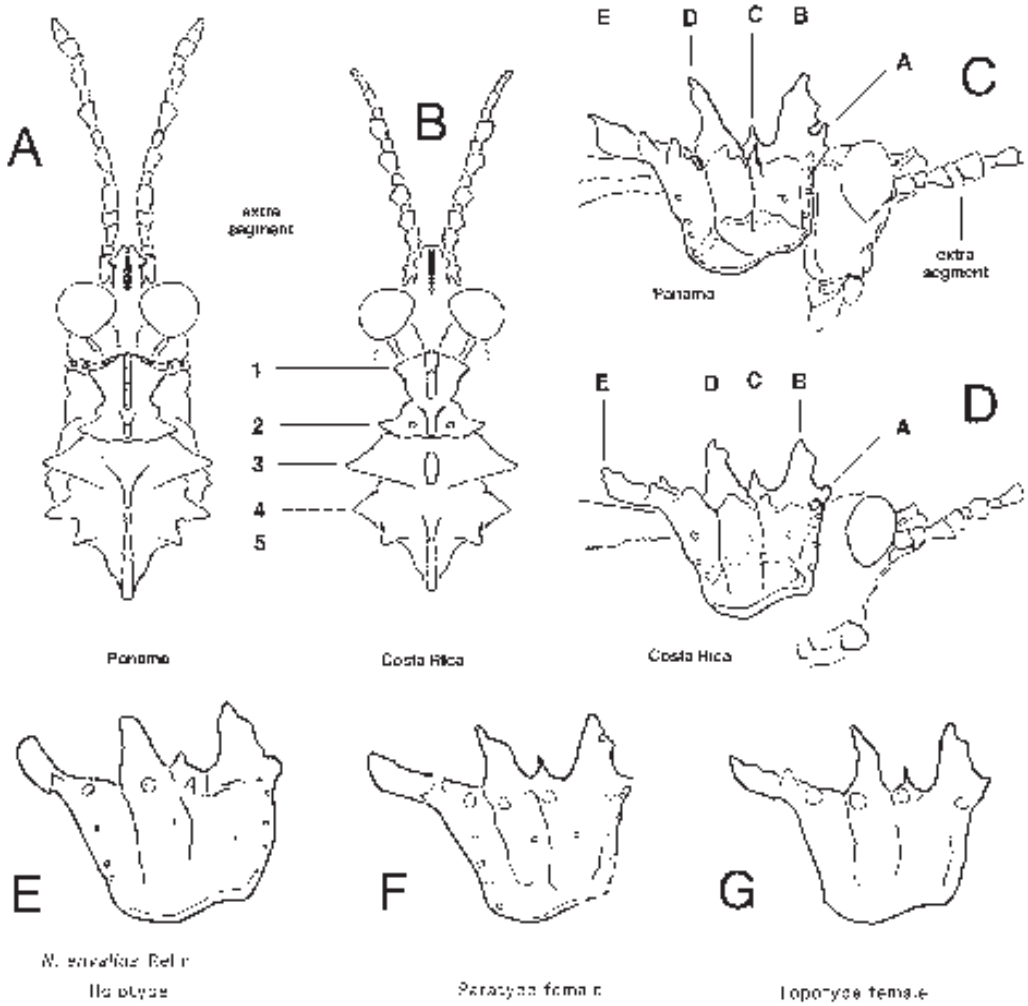
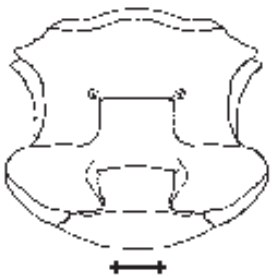


Fig. 1. *Nicarchus* spp. A. Dorsal view of head and pronotum of a Panamanian specimen. B. Dorsal view of head and pronotum of a Costa Rican specimen. The lateral processes of the pronotum are numbered from 1 to 5. C & D. As A & B, but lateral views. The medial processes of the pronotum are lettered A to E (small capitals). E-G. Lateral views of the pronota of a series of Costa Rican specimens from the Guapiles area, including the holotype and paratype of *N. enyalius* Rehn. H. Pterothoracic sterna (female); scale 1 mm.



H

Examination of a somewhat larger series indicates that there is some variation in the apex of the fastigium, but that most specimens are more or less emarginate, including those from or near to Rehn's Costa Rican locality. Further, there are actually 5 (not 4!) lateral spines on the pronotum (Fig. 1A & B); the differences reported relate simply to which pair was omitted from the original count. Stål appears to have overlooked the most anterior pair, and Rehn the most posterior, but the two types are identical in this respect. While there is substantial variation between specimens in the detailed shape of the medial spines of the pronotum, especially of the most anterior one (Fig.1 C-G), the lateral spines are invariant.

Rehn (1929) gives an exhaustive description of the external anatomy. The internal genitalia have not been described previously.

Redescription

Habitus, Fig. 2. Of medium size. Sexual dimorphism (P_{male}/P_{female}, pronotum male/pronotum female) = 0.68 (for dimensions and further ratios see Table 1).

Antennae (Fig. 1A, B) nodular, with alternating expanded and nonexpanded segments, not longer than head and pronotum together, 13-14 flagellar segments, proportionately 60% longer in male. Pronounced rostrum (Fig. 3B). Fastigium (Fig. 3D) subtriangular, elongate, truncate and notched at tip, with paired dorsal marginal processes, carinae of frontal ridge visible in dorsal view. Frons concave. Lateral carinae of face with three paired processes (Fig. 3A), increasing in size from top to bottom. Frontal ridge narrower than antennal scape, longitudinally grooved; lateral carinae prominent and raised above medial ocellus, obsolete below (Fig. 3A).

Eyes prominent, globular, fairly small for the group, vertical diameter about 50% of head above clypeal suture. Interocular space (Fig. 3D), broad, twice as wide as antennal scape, not relatively

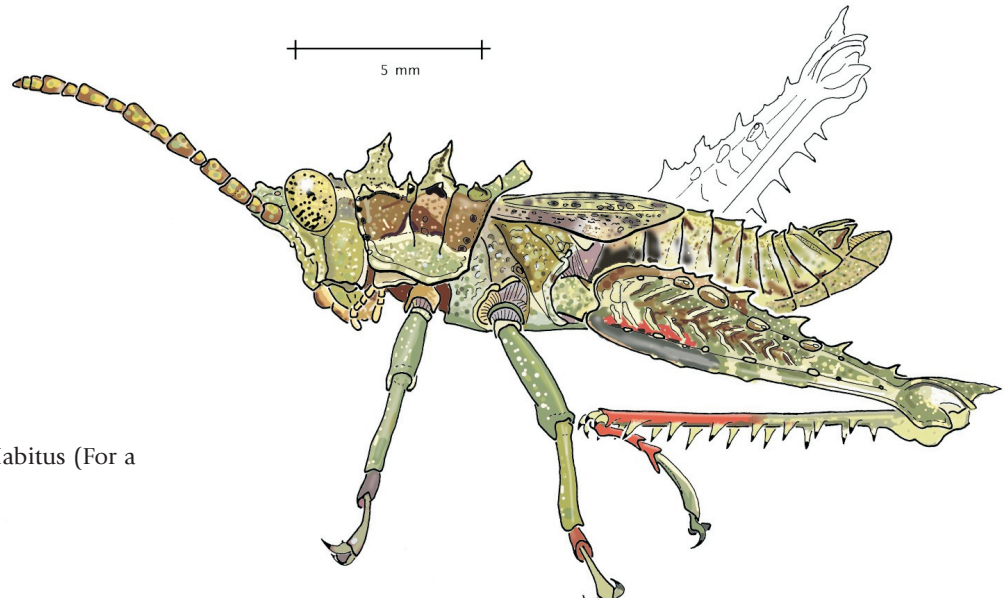


Fig. 2. *Nicarchus erinaceus*, male. Habitus (For a color version, see Plate III).

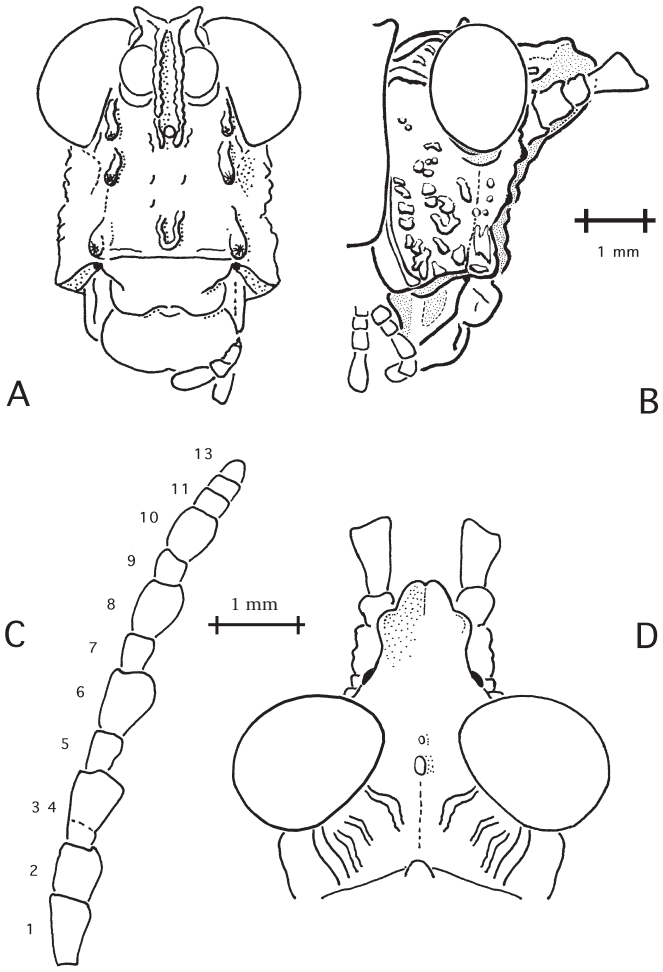


Fig. 3. *Nicharchus erinaceus*. Structure of head. A. Frontal view. B. Lateral view. C. Right antenna. D. Vertex and fastigium, dorsal view.

smaller in male. Carina of vertex consists of two isolated processes, the posterior one the larger (Fig. 3B, D).

Medial carina of pronotum extended into 5 vertical processes, lateral carinae into 5 paired spines; posterior margin of pronotal disc sharply angulate, terminating in a medial process or tooth of variable size (Fig. 1). Prosternal process spiniform, vertical. Thorax wide, mesosternal interspace transverse (Fig. 1H). Brachypterous, elytra of variable length but not extending much further than the 3rd/4th abdominal segment boundary (Fig. 2). Tympanum present. Posterior medial margin of each abdominal segment produced into a long, laterally flattened process.

Hind femur slender, length/depth = 4.64 (not counting teeth; F/FD, Table 1). All 3 dorsal carinae of hind femur with prominent teeth. Dorsal terminal spine of hind knee very long. Seven external and 8-10 internal spines on hind tibia. Hind foot long, 33% of length of hind femur; foot formula 33:13:54.

Male terminalia (Fig. 4)Tenth abdominal tergite decorated with 5 melanized points, but no furcula *per se*. Supra-anal plate triangular, the point somewhat produced, with a thickened margin and decorated with irregular melanized tubercles. Cercus short, simple, conical, with a strong black internal apophysis. Subgenital plate short, rounded in dorsal view, bluntly pointed in lateral view.

Phallic complex (Fig. 5).—**Epiphallic layer**. Epiphallus (Fig. 5A, B) a narrow bridge, joining small lateral plates with well-developed posterior processes. Oval sclerites present. Lophi of epiphallus melanized and divergent in axial view, bifid, the outer branch much the larger. Ancorae distinct. Ventrolateral sclerites present but weakly developed, neither hooked nor melanized, bearing campaniform sensilla on their outer surface (Fig. 5C).

Ectophallic layer. Apodemes of cingulum (Fig. 5D) dorsoventrally flattened, wide, outer margins convex, tapering to rounded points. Zygoma large. Rami (Fig. 5E), narrow, vertical, encircling, simple, about twice as long as endophallus is deep; retractor apodeme present. Arch of moderate size. Ectophallic membrane participates in aedeagal valves.

Endophallic layer. Endophallus relatively small. Apodemes laterally flattened, but ventrally diverging outwards at their tips to form

Table 1. *Nicarchus*. Upper table dimensions. Lower table ratios. Abbreviations: P, Pronotum, dorsal midline; L, Length of body; Ant, Antenna; IOS, Interocular space; E-E, max. width Eyes; Fast B, Breadth Fastigium, dorsal view; Fast L. Length of Fastigium; F, hind Femur length; FD, Depth hind Femurs; Ta 1-3, hind Tarsal segments.

		Dimensions, mm.					*				§	#					Number	
Spec. No.	Locality	P	L	Ant	IOS	E-E	Fast B	Fast L	F	FD	Tegmen	Ta1	Ta2	Ta3	Ta1+2+3	Ext. spines	Int. Spines
Males	C.R.:																
CRI002																	
114187	R.B. S. Ramón	5.13	17.36	7.59	0.54	3.66	1.13	1.04	11.33	2.44	5.68	1.19	0.50	2.02	3.71	7.00	8.00
Females	C.R.:																
80789	N.P. Braulio-Carrillo	7.46	22.91	6.32	0.87	4.45	1.39	1.32	14.15	3.13	7.06	1.62	0.58	2.52	4.72	7.00	8.00
	Panama:																
99151	Queb. Felix	7.64	24.36	7.30	0.75	4.63	1.24	1.23	14.29	3.10	9.33	1.56	0.70	2.75	5.01	7.00	8.00
	Minimum	7.46	22.91	6.32	0.75	4.45	1.24	1.23	14.15	3.10	7.06	1.56	0.58	2.52	4.72	7.00	8.00
	Maximum	7.64	24.36	7.30	0.87	4.63	1.39	1.32	14.29	3.13	9.33	1.62	0.70	2.75	5.01	7.00	8.00
	Average	7.55	23.64	6.81	0.81	4.54	1.32	1.28	14.22	3.12	8.20	1.59	0.64	2.64	4.87	7.00	8.00
	N	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
										**Foot formula(%):		0.33	0.13	0.54			
Sex. Dimorphism (M/F)		0.68	0.73	1.11	0.67	0.81	0.86	0.82	0.80	0.78	0.69	0.75	0.78	0.77	0.76	1.00	1.00

Ratios

Spec. No.	Locality	L/P	Ant/P	IOS/P	E-E/P	Fast B/P	Fast L/P	F/P	FD/P	Tegmen/P	Ta1/P	Ta2/P	Ta3/P	Ta1-3/P	F/FD	Ta1-3/F	Fast L/B
Males																	
CRI002																	
114187	C.R.: R.B. S. Ramón	3.38	1.48	0.11	0.71	0.22	0.20	2.21	0.48	1.11	0.23	0.10	0.39	0.72	4.64	0.33	0.92
Females																	
80789	C.R.: Braulio-Carrillo	3.07	0.85	0.12	0.60	0.19	0.18	1.90	0.42	0.95	0.22	0.08	0.34	0.63	4.52	0.33	0.95
99151	Pan: Queb. Felix.	3.19	0.96	0.10	0.61	0.16	0.16	1.87	0.41	1.22	0.20	0.09	0.36	0.66	4.61	0.35	0.99
	Minimum	3.07	0.85	0.10	0.60	0.16	0.16	1.87	0.41	0.95	0.20	0.08	0.34	0.63	4.52	0.33	0.95
	Maximum	3.19	0.96	0.12	0.61	0.19	0.18	1.90	0.42	1.22	0.22	0.09	0.36	0.66	4.61	0.35	0.99
	Average	3.13	0.90	0.11	0.60	0.17	0.17	1.88	0.41	1.08	0.21	0.08	0.35	0.64	4.57	0.34	0.97
	N	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sex. Dimorphism (M/F)		1.08	1.64	0.98	1.19	1.26	1.20	1.17	1.15	1.02	1.10	1.15	1.13	1.12	1.02	0.96	0.95

Notes: *Fastigium breadth measured to outer margins of lateral ocelli.** Foot formula is the relative lengths of the 3 hind tarsal joints expressed as percentages of the total length of the foot. §Excluding spines. #From tip to suture between mesothoracic epimeron/episternum. Males have proportionally longer antennae, longer fastigium and hind femora and a longer hind foot.

oblique surfaces. Ejaculatory sac small. Gonopore processes small, simple, digitform, no ventral processes. Flexure narrow. Ventral aedeagal sclerites with an internal flange, angled upwards to enclose the dorsal sclerites. Dorsal aedeagal sclerites short, pointed, curved upwards and inwards at tips.

Female reproductive structures (Figs 6, 7).—Supra-anal plate (Fig. 6B) triangular, tip rounded; divided transversely into two halves by a furrow with a somewhat sclerified anterior wall; both halves with symmetrical raised ornamentation. Cerci short, conical, simple. Subgenital plate (Fig. 6C,D) simple, smoothly pointed posterior margin, with a membranous fringe that may be either smooth (Panama) or irregular (Costa Rica). Egg guide (Fig. 7C) pointed, arising anterior to tip of plate, pointed obliquely upwards. Ovipositor valves (Fig. 6A) robust, outer edges melanized, crenulated. Bursa copulatrix bipartite, wide and thin-walled proximally, with a semicircular sclerite near the opening, thinner, asymmetrical, curved to the right-hand side distally, leading to a thin duct (Fig. 7A,B). Spermatheca: apical diverticulum long, slender, subcylindrical, twice folded back on itself; preapical diverticulum absent.

Nicarchus erinaceus Stål, 1878

Stål 1878: 34, 78.
Type locality: "Panama"; no further data.
Location of type specimen: NMW, holotype male.

Etymology.— from Latin *erinaceus*, the hedgehog, a spiny insectivorous mammal.

Subsequent literature: Bruner 1908: 289. Kirby 1910, Synon. Cat. Orth. 3: 433. Rehn 1929: 37. Descamps 1975: 512.
Synonymy: = *N. enyalius* Rehn, **new synonym.** Rehn 1929, 37, Plate 1, Figs 7,8.

Diagnosis.—Monospecific genus, the generic diagnosis applies.

Dimensions.— see Table 1.

Specimens examined.—
COSTA RICA
Prov. Alajuela: - La Fortuna. Sector Catarata. 500 m. In Malaise trap. LN 268500 462500, 15.12.97 (Carballo G.), female, specimen no. CRI002 595021 (INBio). - R.B. San Ramón, 800m, LN 244100 470100, 15.11.1994 (Carballo G), male, specimen no. CRI002 114187 (INBio).
Prov. Guanacaste: - Volcan Tenorio, Bajo Los Cartagos, Río San Lorenzo. 1050 m, LN 287800 427600, 15.1.1992 (Alvarado C),) female, specimen no. CRI000 557159 (INBio).
Prov. Limón: - Guápiles, La Emilia, 1000', (LN 243800 559900), (Rehn, JAG, holotype male of *enyalius* Rehn) (ANSP)
- Date as above, paratype female of *enyalius* Rehn (ANSP).
- Data as above, paratype male of *enyalius* Rehn (ANSP, examined in laboratory of CS Carbonell, Montevideo).

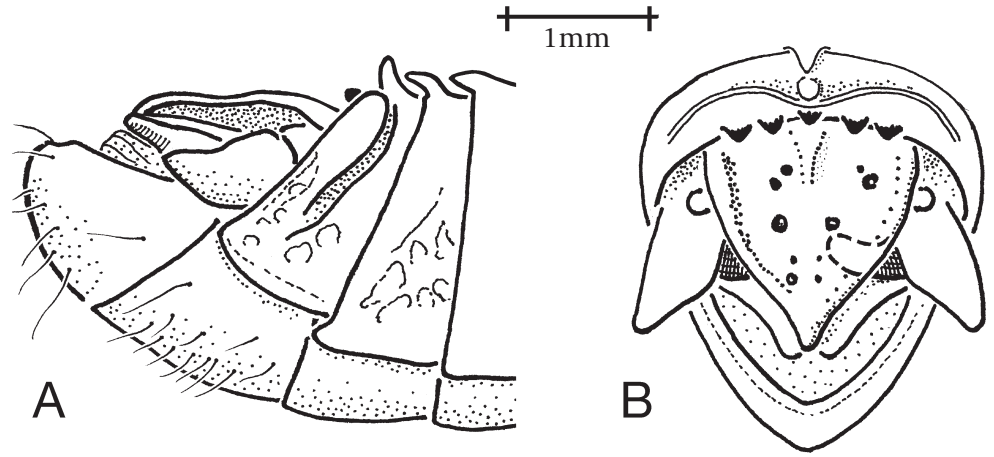


Fig. 4. *Nicarchus erinaceus*. Male terminalia. A, Lateral view. B, Dorsal view,

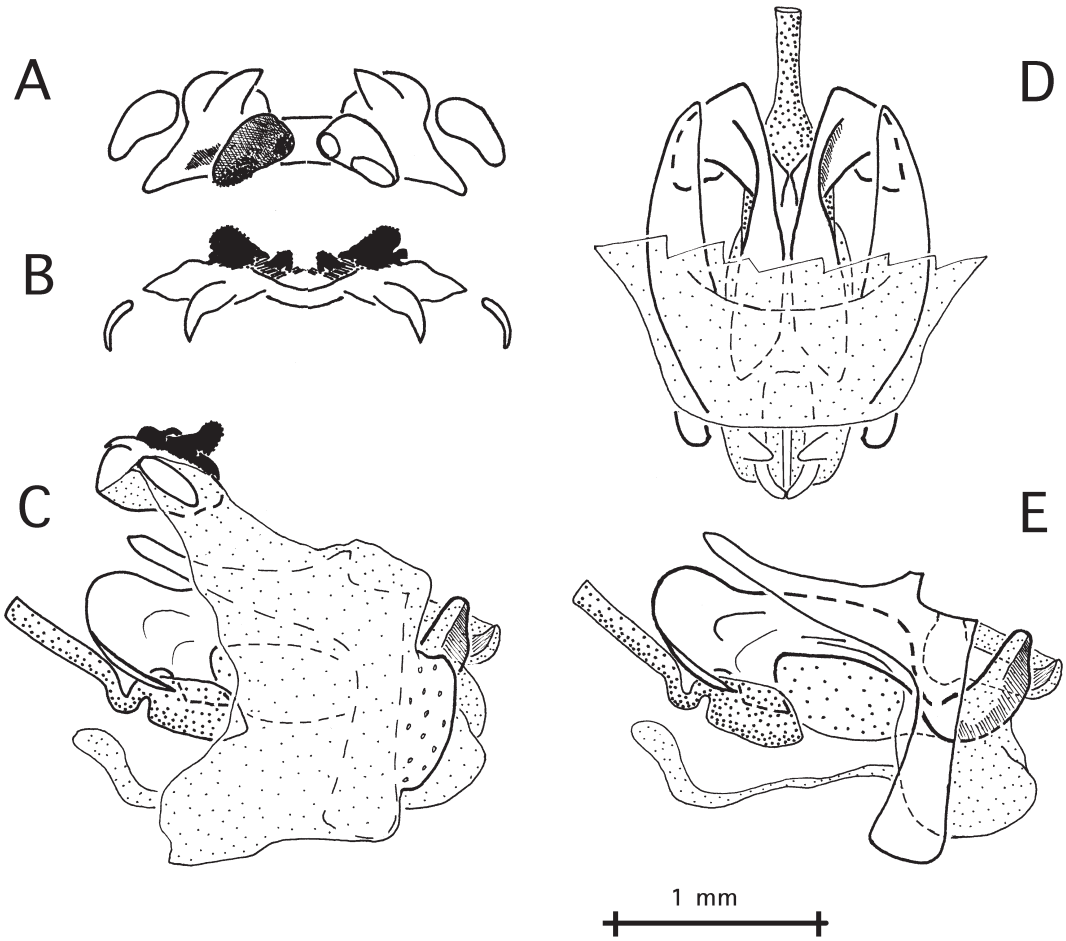


Fig. 5. *Nicarchus erinaceus*, male. Phallic structures. A. Epiphallus, dorsal view. B. Epiphallus, axial view. C Phallic complex, lateral view. D. Phallic complex minus epiphallus, dorsal view. E. Phallic complex, with epiphallic layer removed.

- 5 km W. of Guápiles, LN 243450 554900, 9.8.1963 (Hubbell SP). female (UMMZ).
- Guápiles. 300 m LN 244200 559100, 1.2.1965 (Janzen D, Roberts HR) female (ANSP).

Prov. S. José: - P.N. Braulio-Carrillo: Quebrada Sanguijuela. 800 m. LN 237800 539800, 1.5.1980 (DeVriess P), female, specimen no. 43288 (RC).
- P.N. Braulio-Carrillo: Transecto entre R.B. La Selva y V. Barva, Refugio 1070 m, LN 527281 249761, 18.2.2001 (Solis A), female, specimen no. CRI 3314032 (INBio).

PANAMA

No data. Holotype male of *erinaceus* (NMW, kindly examined by Dr. A.-P. Kaltenbach at my request).

Prov. Bocas del Toro: - Quebrada Felix, 2 km NW of summit of road to Chiriqui Grande, 900 m, L 972500 365800, 19.09.99 (Rowell CHF, Bentos A), female, specimen no. 99151 (RC) .
- As above; female 5th instar larva. (Univ. Nacional Uruguay).

Prov. Chiriquí: - Fortuna, ca 900m:, in Malaise trap, 19.0.199 (Cambra R), male, specimen no. 2003417 (GBFM).

Distribution.—Lower montane forest of Caribbean slope of Costa Rica and Western Panama.

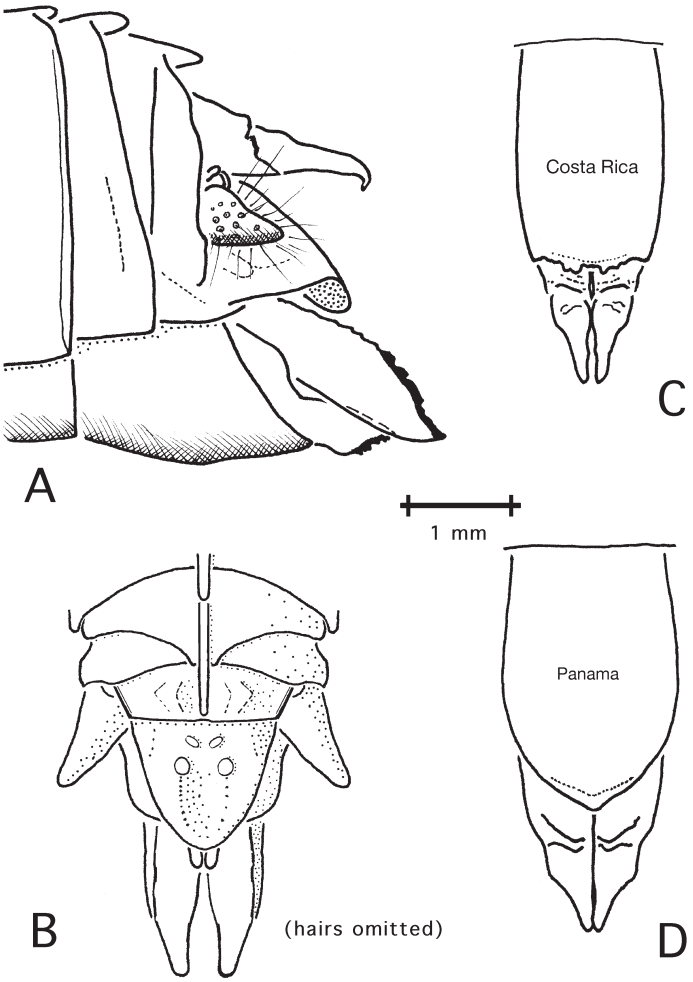


Fig. 6. *Nicarchus erinaceus*. Female terminalia. A. Lateral view. B, dorsal view. C. ventral view of a Costa Rican specimen D., as C, a Panamanian specimen.

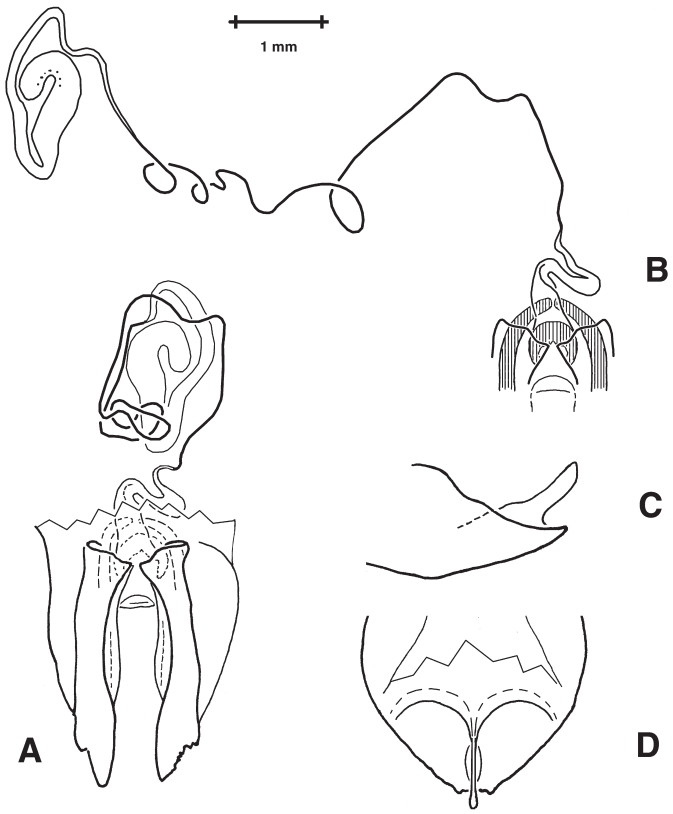


Fig. 7. *Nicarchus erinaceus*. Female internal genitalia. A. Ventral ovipositor valves, bursa copulatrix and spermatheca. B. As A, but spermatheca extended. Basivalvar and bursal sclerites hatched. C. Egg guide in lateral view. D. Subgenital plate, dorsal view.

Natural history.—The species is remarkable for the spiny processes which decorate the fastigium, pronotum and the hind femora; these, together with the coloration, make the insects resemble pieces of bark encrusted with lichen and alga. Both sexes are green marbled with pinkish brown in life; museum specimens are either green or brown, but the brown color appears to be due to subsequent relaxation or to immersion in alcohol. The basal internal surface of the hind femur, and to a much smaller extent, the external surface and the distal portion of hind tibia, are vivid coral red. This species not only looks like moss, it also eats it, as shown by microscopic examination of faecal pellets.

Systematic position.—*Nicarchus* falls clearly into the subtribe Vilernae (for criteria see discussion under *Cryptacris* below). It departs from the typical characters of that group only in having no columellae on the postvaginal sclerites.

Cryptacris Descamps & Rowell, 1984
(Figs 8-13)

Cryptacris was originally described from a single holotypic female. The recent capture of a further female and of two males now allows a redescription of the genus, a description of the male, and reconsideration of the tribal position.

Type species.—*Cryptacris costaricensis* Descamps & Rowell 1984: 146.

Etymology.— Greek *kryptos*, hidden, secret; *acris*, conventionally used for grasshopper. Refers to the cryptic coloration.

Redescription

Small insects, males *ca* 12 mm in length (for dimensions, see Table 2). Male slender and hump-backed (Fig. 8), female (see Decamps & Rowell 1984, Fig. 6) fusiform. Tegument mostly smooth, some rugose areas on lobes of metazona of pronotum, mesothoracic epimeron, metathoracic episternum, and in the female on the expanded terga of the metathorax and 1st abdominal segment. Head (Fig. 9) rather short, rostrum present but not strongly developed, eyes large, globular and protuberant; interocular space narrower than antennal scape. Frons concave in profile, tapering downwards in frontal view; lateral carinae of the face practically absent. Frontal ridge wider than the interocular space, almost flat, obsolete a little way below median ocellus, briefly grooved above and below ocellus (Fig. 9C). Fastigium subtriangular, truncated and slightly grooved at the tip (Fig. 9B). Antennae filiform, thin and fairly short in female, in male very long, more than twice the length of head and prothorax combined (Fig. 8), thickening distally, 18-20 segments. Tips of palps flattened, dark colored.

Pronotum (Fig. 9A, B) slightly saddle-shaped in profile; posterior margin moderately incised in midline; without lateral carinae, but

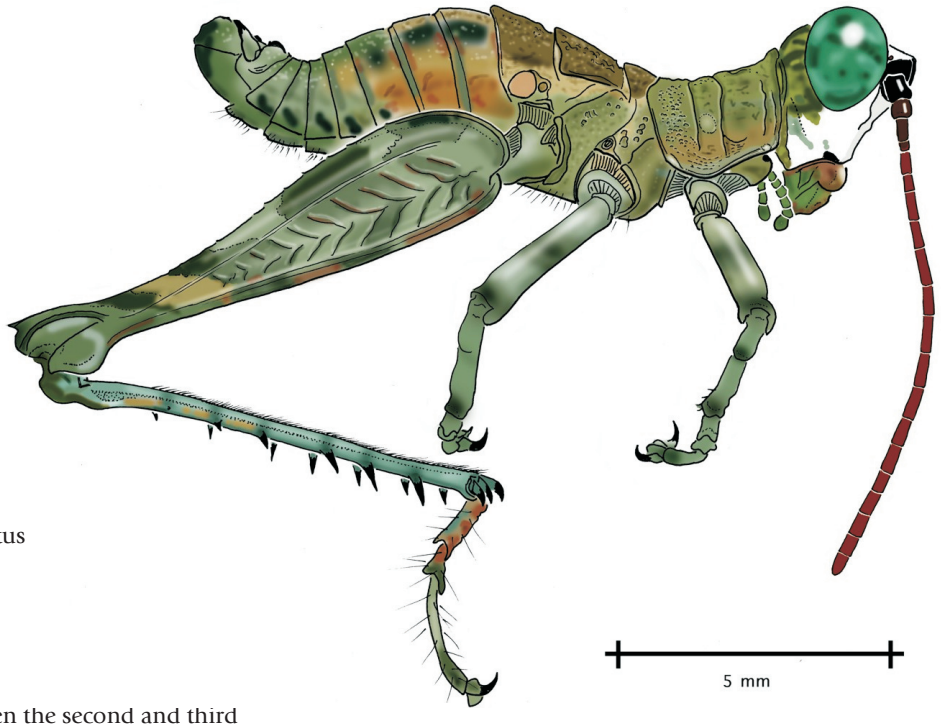


Fig. 8. *Cryptacris costaricensis*, male, habitus (see Plate III for a color version).

with a pair of lateral protuberances between the second and third sulcus, very weak in the male; anterior ventral angle of lobe of pronotum almost rectangular, sharply outwardly reflexed, posterior angle bluntly rounded; prosternal process very low, with an obtuse blunt point, vertical. Thoracic sterna (Fig. 10) wide, inner edges of mesosternal lobes diverging sharply; metasternal interspace of female transverse. Tympanum present, large and circular. Carinae of hind femora smooth, except dorsal medial carina minutely serrate, corresponding to insertion of hairs, and ending in a short sharp point at the knee (Fig. 9E). Five external and 8 internal spines on posterior tibia, tibial spines long and thin. Hind foot long (43% of femur) with a very long third tarsal segment; foot formula 28: 13:59.

Male terminalia.— (Fig. 11) Posterior margin of 10th abdominal terga of male melanized, with irregular projections, but not forming a symmetrical furcula. Supraanal plate of male triangular, slightly ligulate at tip, with a pair of large transverse black bosses near the tip, and two weak longitudinal rows of small black spots proximally. Male cercus short, conical, tips slim and melanized, slightly incurved at half length, internal basal apophysis absent or subobsolete, probably represented by a small black disc on inner surface of cercus. Subgenital plate short, smoothly rounded at apex.

Phallic structures.— (Fig. 12)
Epiphallic layer: Epiphallus a narrow bridge, with clearly defined, sclerotized ancorae, lateral plates with prominent posterior pro-

Table 2. *Cryptacris costaricensis* dimensions. Abbreviations, see Table 1.

Dimensions (mm)											
Males (N = 1)											
Specimen Number	Locality	P	F	FD	L	IOS	Ant	T1	T2	T3	T1-3
2003307	Tierras Morenas	2.26	9.18	2.14	12.54	0.19	8.45	1.14	0.57	2.21	3.92
							Foot formula	29%	15%	56%	
Females (N = 1,2)											
Specimen Number	Locality	P	F	FD	L	IOS	Ant	T1	T2	T3	T1-3/F
2003306	Tierras Morenas	2.54	10.28	2.28	15.45	0.40	6.46	1.22	0.58	2.55	4.35
43229 (Holotype) (*ex* Descamps)	Virgin del Socorro	2.50	9.70								
	Mean	2.52	9.99								
							Foot formula	28%	13%	59%	
Sex. Dimorph. (dimensions)		0.90	0.92	0.94	0.81	0.48	1.31	0.93	0.98	0.87	0.90
		Ratios	Males								
		F/P	L/P	IOS/P	Ant/P	F/FD	T1-3/F				
		4.06	5.55	0.08	3.74	4.29	0.43				
		Ratios	Females								
		F/P	L/P	IOS/P	Ant/P	F/FD	T1-3/F				
		4.05	6.08	0.16	2.54	4.51	0.42				
Sex. Dimorph. (Ratios)		1.00	0.91	0.53	1.47	0.95	1.01				

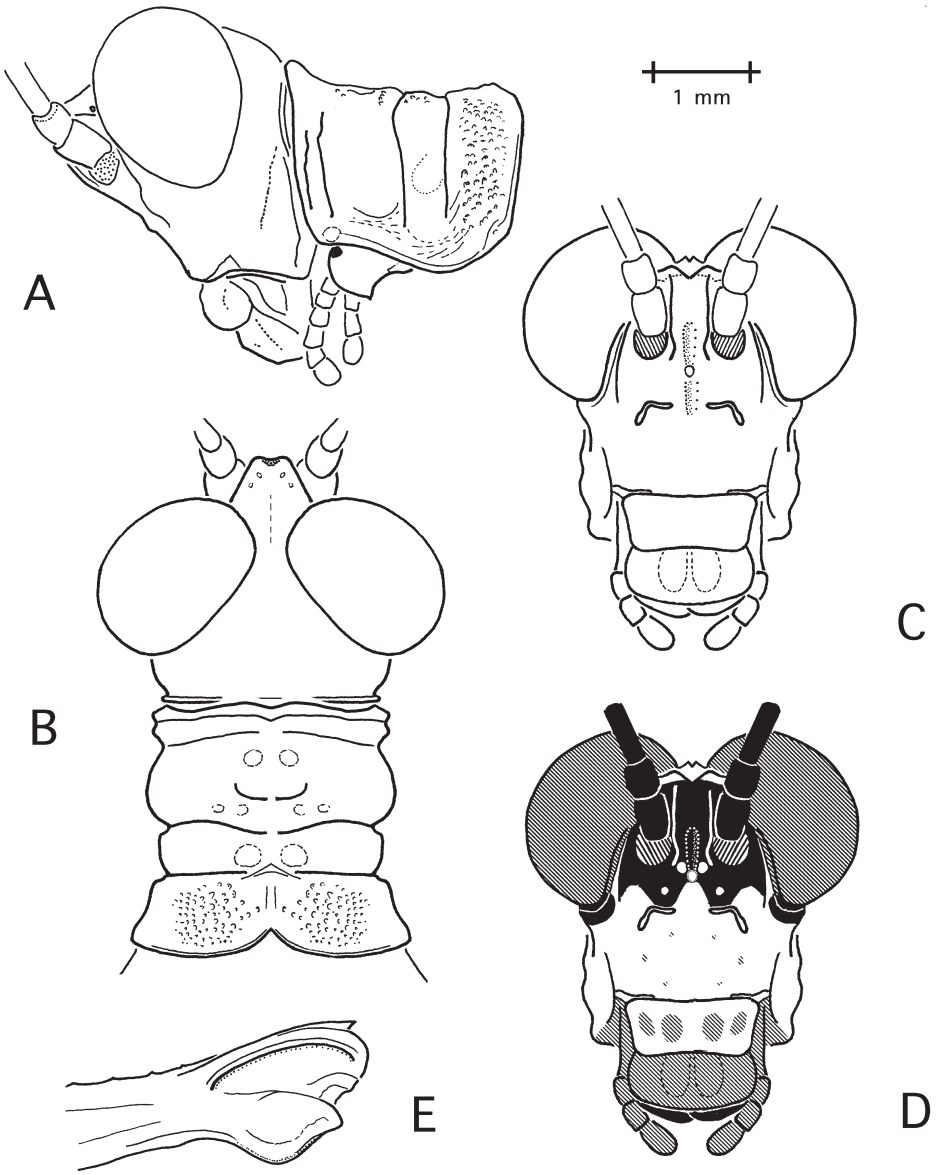


Fig. 9. Head and thorax of male *Cryptacris costaricensis*. A. Lateral view. B. Dorsal view. C. Frontal view of head. D. As C, but showing pigmentation. E. Distal extremity of hind femur.

cesses, oval sclerites present, long and thin. Lophi (Fig. 12D) black, digitiform, simple. Lateroventral lobes (Figs 12A, E) well developed, melanized, strongly at posterior margin, not hooked.

Ectophallic layer: cingular apodemes straight, slim, flattened dorsoventrally, slightly incurved and upcurved at their tips (Fig. 12 E). Zygoma large, with a central membranous window. Rami large, sloping backwards, encircling the aedeagus, with paired, melanized, laterally directed, pointed processes protruding from the ectophallic membrane inside the ventrolateral lobes (apparently an apomorphy of genus) (Fig. 12B, F). Ventral retractor apodeme large. Aedeagal sclerites swathed in ectophallic membrane, which contributes largely to the structure of the valves. Arch large, overlapping ventrally the basal parts of the ventral aedeagal valves (Fig. 12C).

Endophallic layer: anterior apodemes laterally compressed, elongate, rounded (Fig. 12C).Gonopore processes digitform, tapering, no ventral process. Ejaculatory sac medium sized, spermatophore sac small. Middle part of endophallus barely extends over walls of spermatophore sac. Flexure narrow. Ventral aedeagal sclerites with a ventral, inwardly directed flange, short, continued dorsally and distally by curved plates of ectophallic membrane. Dorsal aedeagal valves short and straight, the bridge fused with the arch.

Female terminalia.— (Fig. 13A-C). Supraanal plate triangular, with a deeply concave transverse furrow dividing it into posterior and anterior halves; lateral margins of anterior portion lightly sclerotized, a proximal depression medially. Cerci simple, conical. Ovipositor valves robust, the ventral ones inflected upwards distally; outer edges melanized but smooth, devoid of crenulations or teeth. Female subgenital plate simple, ending in a long slim medial point

Female interal genitalia.— (Fig. 13 D-F). Egg guide long, thin, straight, pointed, angled upwards at about 30°, arising anterior to apex of subgenital plate; columellae of postvaginal sclerite absent. Bursa copulatrix in two parts, with the duct arising from the asymmetrical anterior portion. No semicircular sclerite. Spermatophore duct fairly short; apical diverticulum long and cylindrical, doubly bent back on itself; preapical diverticulum present, fairly large for the subtribe.

No. of known species.—1.

Range.—Costa Rica, Western Panama.

Cryptacris costaricensis Descamps & Rowell, 1984

Descamps & Rowell 1984: 146.

Type locality.— La Virgen del Socorro, Sarapiquí, Costa Rica.

Location of type specimen.— MNHN Paris (female holotype).

Diagnosis.—Monospecific genus to date, the generic diagnosis applies.

Dimensions.— see Table 2. Foot formula(%) 29:14:57, foot 0.43× as long as femur. Sexual dimorphism (Pmale/Pfemale) = 0.90. Proportionately, the males have much longer antennae and a much narrower interocular space.

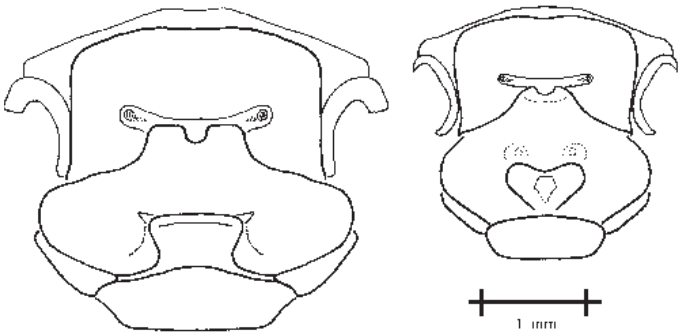


Fig. 10. Sterna of pterothorax of *Cryptacris costaricensis*. A. Female. B. Male.

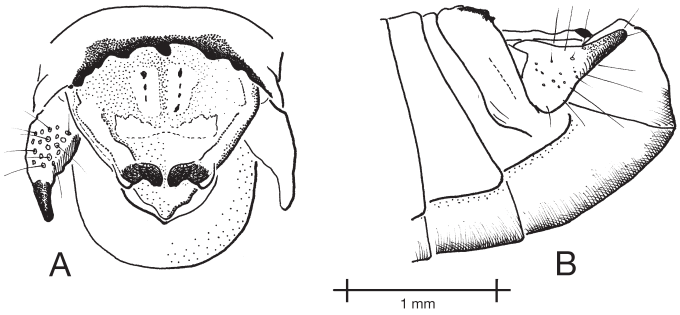


Fig. 11. *Cryptacris costaricensis*. Male terminalia. A. Dorsal view B. Lateral view.

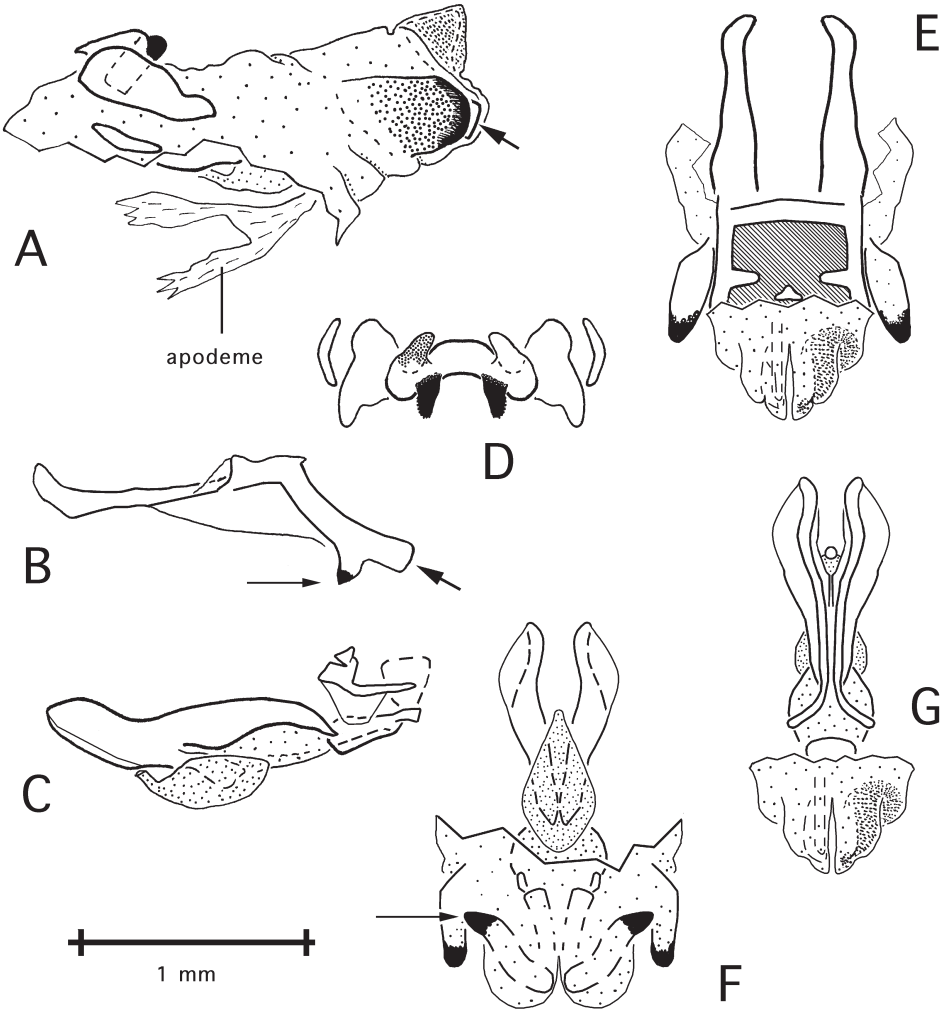


Fig. 12. *Cryptacris costaricensis*, phallic structures. A. Entire phallic complex, lateral view. Arrow indicates tip of cingular ramus, as also in B. B. Cingulum, side view. The heavy arrow indicates the tip of the ramus and the lighter arrow the melanized process that arises from it. C. Endophallus, with ectophallic dorsal aedeagal valves shown above. D. Epiphallus, dorsal view. E. Dorsal view of phallic complex with epiphallus removed. F. Ventral view of endophallus and cingulum, with epiphallic layer removed. The process of the cingular ramus (also shown in C.) is arrowed. G. Dorsal view of endophallus and sheathed aedeagus.

Field characters.—Small insects (L = 12-16 mm). The very short pronotum suggests a rhytidochrotine. Apterous, but the contrasting red-brown meso- and metathoracic terga of the living female at first give the impression of short wings. Intensely cryptic, resembling alga-coated bark. General color in life grey-green, with brown and black speckling, eyes yellowish in female, blue-green in male. Palps greenish, darkening towards their tips. Antennae black at the base, otherwise reddish brown, with 4-5 yellow rings in the female; unringed in the male, but there with white tips. Legs greenish or blue-grey, with multiple dark bands on all femora. The white lower face of both sexes and the white fastigium of the male are the only conspicuous markings (Fig. 9D).

Natural history.—Found in the canopies of low trees, such as *Blakea gracilis* (Melastomaceae), in montane woodland. Nothing is known of its diet or reproductive biology. The unusual hindfoot may be an adaptation to arboreal life, and the coloration suggests that it rests on bark.

Distribution.—Costa Rica and extreme NW Panama. Very rare in montane forests (*ca* 1000 m altitude) of the Cordillera Central and

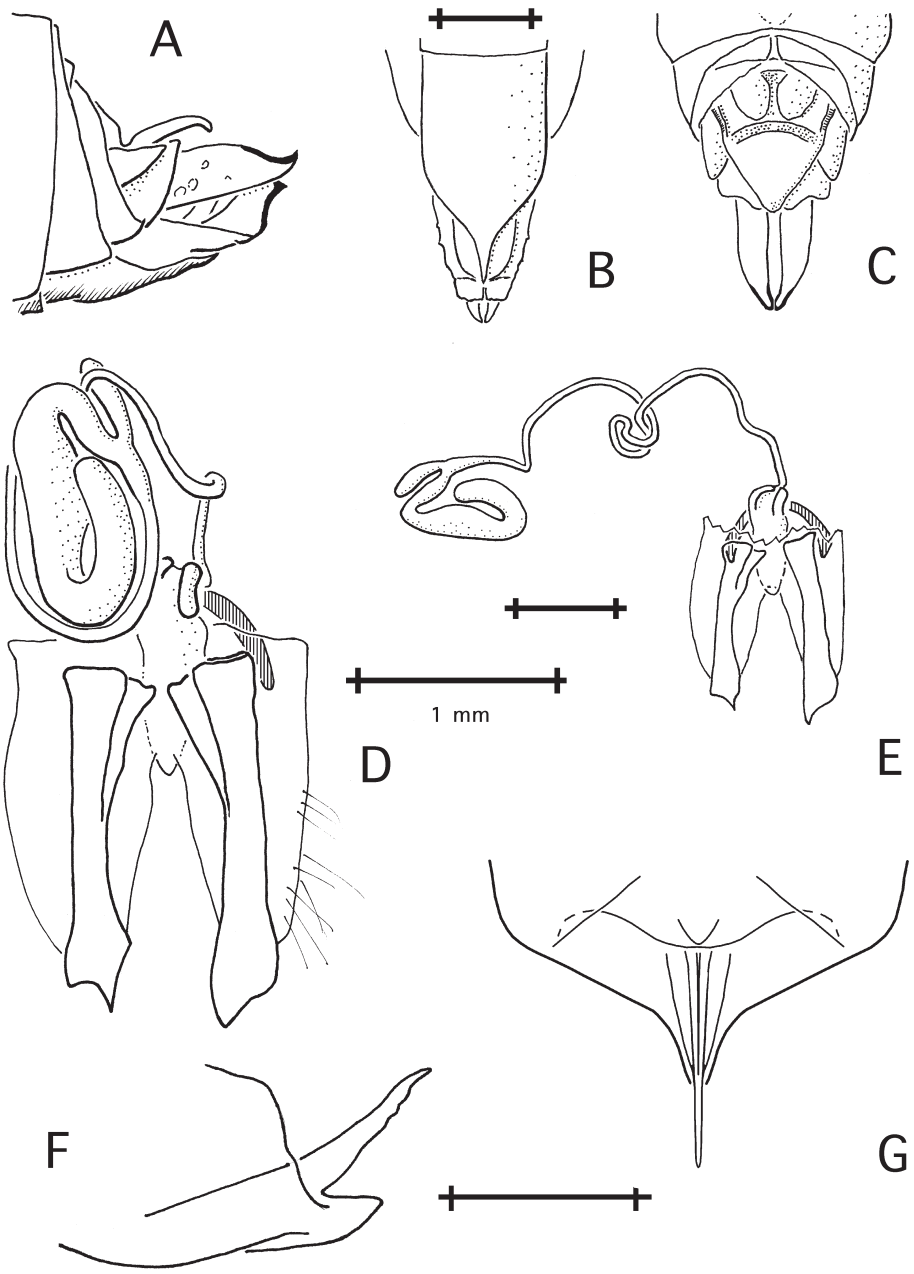


Fig. 13. *Cryptacris costaricensis*, female reproductive structures. A. Tip of abdomen, lateral view. B, as A, ventral view. C. As A, dorsal view. D. Ventral ovipositor valves, bursa copulatrix, spermatheca. Basivalvular sclerites hatched. E. As D, but spermathecal duct partially unwound. F. Subgenital plate, lateral view, showing egg guide. G. Subgenital plate, dorsal view.

on Volcan Tenorio; possibly occurs on other peaks of the Cordillera del Norte. Also from the highlands of Prov. Bocas del Toro, Panama. To date known from only four individuals.

New material.— COSTA RICA: Prov. Guanacaste: Volcan Tenorio: near summit of track from Tierras Morenas to Bajo Los Cartagos, 1040 m, 09.10.2003 (CHF Rowell), one male allotype, specimen number 2003307 (ANSP). Same data, one female, specimen number 2003306 (RC).

PANAMA: Prov. Bocas del Toro: 1-3 km East of watershed on road from Fortuna to Chiriqui Grande, 1035 m - 850 m., 23.9.1999, (Rowell CHF & Bentos, A.) One male, specimen no 99205. (RC)

Systematic position

Cryptacris presents a mosaic of characters that makes it difficult to place with certainty, other than within the Acrididae.

At first sight, *Cryptacris* seems most likely to be a rhytidochrotine. Like most members of that subfamily, it is small, montane, apterous, with a short pronotum which leaves exposed all the metathoracic and much of the mesothoracic nota; the mesosternal interspace is transverse, the male supra-anal plate is decorated with black dots, the hind foot is very long and with a very long last tarsal segment, and there are no columellae on the postvaginal sclerite. However, it lacks the following typical rhytidochrotine characters:

— a symmetrical male furcula,
— endophallic apodemes dorsoventrally compressed at their ends, and widely divergent,
— midpart of endophallus strongly upwardly convex,
— gonopore processes directed ventroposteriorly, with a large ventral process,
— aedeagal sclerites extremely short, invisible before dissection of the ectophallic membrane,
— aedeagal valves incorporating little or no ectophallic membrane,
— ejaculatory sac large, pendulous,
— absence of discrete bursa copulatrix,

If the Rhytidochrotinae are rejected on these grounds, the triangular male supra-anal plate with black nodular ornamentation and the black, ornamented border of the male 10th abdominal tergite, place *Cryptacris* in either the Syntomacrini or the Ommatolampini of the subfamily Ommatolampinae (all these taxa due to Amedegnato 1974). The Syntomacrini were divided into two subtribes by Amedegnato (1977), the Syntomacrae, exclusively S. American, and the Caloscirtae, with several Central American genera; the Ommatolampini were divided into three subtribes, of which only the Vilernae are known to have Central American representatives. The Vilernae are the least well-defined subtribe of the Ommatolampini, as the other two (Ommatolampae and Oulenotacrae) have been subsequently reviewed (Carbonell & Descamps 1978, Descamps 1979), whereas the Vilernae are essentially described only by Amedegnato (1977).

The black basal internal apophysis of the male cercus expected from members of both the Syntomacrini and the Ommatolampini is absent in *Cryptacris*, or at least very reduced, but there are other instances of this in the Caloscirtae (*e.g.*, *Caloscirtus* itself - see Amedegnato 1977: 149 and her Fig. 206). The general habitus of the male, other than its aptery, is in general very reminiscent of the arboreal Syntomacrae — slender, small, with narrow interocular space, huge eyes and very long antennae. The forked extremity of the cingular ramus is also a syntomacrous character, though the extraordinary situation seen in *Cryptacris* would be unusual there too. The lateroventral sclerites, large, oval, sclerotized, but lacking hooks, are typical of the Caloscirtae but not the Vilernae. The epiphallus is similar to others found in both the Vilernae (*e.g.*, *Sciaphilacris*) or the Caloscirtae (*e.g.*, *Caloscirtus*), but the sclerified ancorae speak for the Vilernae. The endophallus seems typical of the Vilernae: the anterior region is elongate and linear, with rounded, laterally (not dorsoventrally) flattened apodemes; the gonopore processes lack a ventral expansion; the middle region of the sclerite does not extend laterally over the wall of the spermatophore sac; the aedeagal sclerites are short and are supplemented by sclerotized ectophallic membrane. The absence of a well-defined symmetrical furcula speaks also against a placement in the Syntomacrini.

In the female, the spermatheca is typically ommatolampine, but compatible with either tribe, as some but not all Vilernae lack the preapical diverticulum, well developed in *Cryptacris*. The bipartite bursa seems closer to the Vilernae than the Caloscirtae or Syntomacrae. There are no columellae on the postvaginal sclerites; this is unusual for either tribe, but is also found in *Nicarchus* (see preceding section), which undoubtedly belongs to the Vilernae.

Descamps and Rowell (1984) placed the female holotype in the Vilernae, and on balance this still seems to be the best place for it, though it must be considered a very aberrant member of that assemblage.

2. Tribe Pauracrini

Pauracris Descamps & Amédégnato, 1972
(Figs 14-17)

The genus to date contains only a single species, *P. tenera* Descamps & Amedegnato 1972, from the Pacific coast of Colombia, just North of Ecuador, a zone that can be considered biogeographically (and to some extent geologically) as an extension of Central America. The genus is the type of the tribe Pauracrini, which to date contains no other genera, though Descamps and Rowell (1984: 145) noted that the Costa Rican *Christenacris* (see below) could be a possible second member. We here describe a second species of *Pauracris* from the Caribbean slope of Costa Rica, confirming that the tribe is represented in Central America proper. It is very similar to *P. tenera*, but is larger, has much shorter wings, a different set of ornaments on the male supra-anal plate and minor color differences.

In the light of the new material, the generic description must be slightly modified: there is a weak medial carina on the metazona of the pronotum, and the midline of the pronotum is not necessarily cut by all four sulci — in the new species the anterior two are restricted to the lateral lobes. The posterior tibiae have up to 6 (not 4) external spines and 8 internal ones.

Pauracris brachyptera n. sp.

Etymology.— Greek *brachys* short, *pteron*, wing.

Male (Fig. 14). Antenna with 18 flagellar segments, the terminal ones being somewhat wider than the preceding ones. Head and thorax similar to those of *P. tenera*. The metazona has a weak medial carina. The midline of the prozona is crossed by only the most posterior two of the four sulci. Elytra extend only to the junction of 4th and 5th abdominal segments, entirely covering the tympanum. Pro- and mesothoracic tibia each with 4 pairs of small black spines. Metathoracic tibia with 6 external spines and 8 internal ones. Supra-anal plate with no medial black spots (*cf. P. tenera*) but with a single pair of marginal melanized bosses, halfway down the lateral margins (Fig. 15C). Cerci conical, the tips curved slightly outwards (Fig. 15C) Apex of subgenital plate bluntly rounded in side view (Fig. 15D). Phallic structures (Fig. 16) similar to those of *P. tenera*. Ancorae of epiphallus (Fig. 16G) sharp and hooked; lophi of epiphallus tilted forward, rather than posteriorly as in *P. tenera*.

Coloration.— Similar to that of *P. tenera*. General color yellow-green.

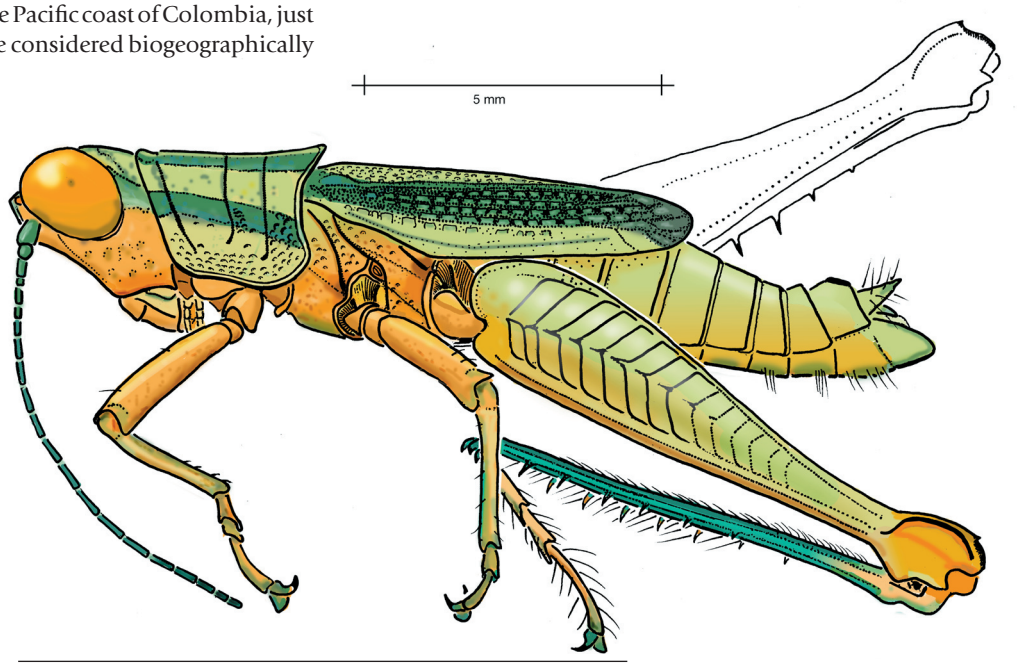
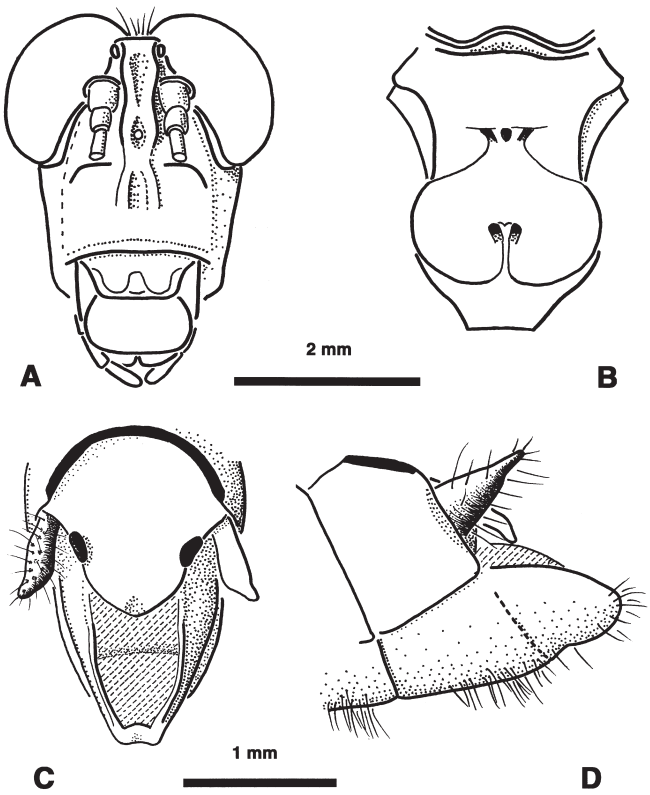


Fig. 14. *Pauracris brachyptera* n. sp. Male. Habitus. See Plate III for color version.

Fig. 15. *Pauracris brachyptera* n. sp. Male. A. Frontal view of head. B. Pterothoracic sterna. C. Tip of abdomen, dorsal view. D. Tip of abdomen, lateral view.



Antennae blackish brown, intersegmental areas in proximal two-thirds of flagellum whitish. Tips of palps dark green. Diffuse dark green postocular stripe. Two pairs of longitudinal dark green stripes on pronotum and elytra, plus a weak medial stripe on the metazona. Hind knees edged with dark blue; hind tibia and the distal parts of all terminal tarsal segments dark blue.

Female. Similar to *P. tenera*. The tympanum is partly exposed under the edge of the elytron. External genitalia, see Fig.17. Coloration similar to that of male, but antennae lack the white rings, and the hind tibiae and tarsi are red, not dark blue. The spermatheca of *P. tenera* was figured by Amedegnato (1977, her Fig. 196).

Dimensions are given in Table 3. Comparison with the published figures for hind femur and pronotum of *P. tenera* indicates that *P. brachyptera* is about 10% larger. Sexual dimorphism in linear dimensions (M/F) is about 0.75. Dimensional ratios, *i.e.*, bodily proportions, are about equal in the two sexes, except for the male interocular space, which is relatively much narrower.

Material examined.—COSTA RICA: Prov. Heredia: Puerto Viejo:

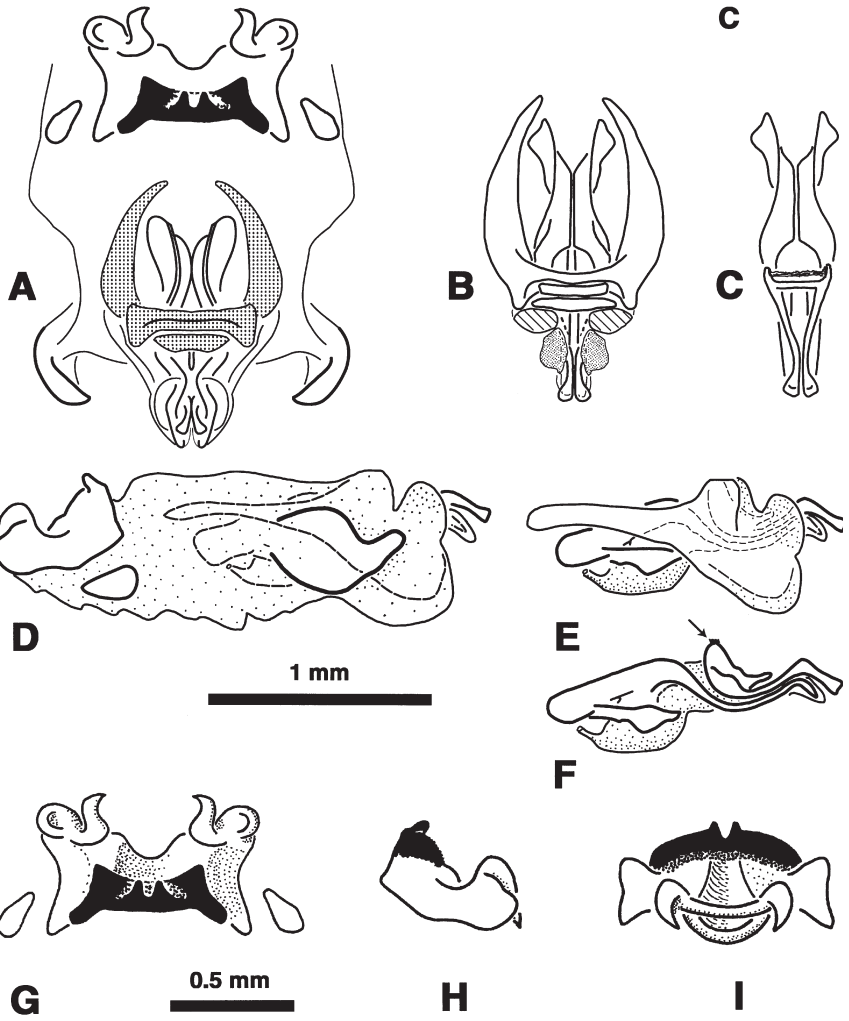


Fig. 16. *Pauracris brachyptera* n. sp. Male. Phallic structures. A. Entire phallus, dorsal view. B. Epiphallic layer removed, dorsal view. C. Endophallus, dorsal view. D. As A, lateral view. E. As B, lateral view. F. As C, lateral view. Arrow, cut edge of arch. G. Epiphallus, dorsal view. H. Epiphallus, lateral view. I. Epiphallus, axial view.

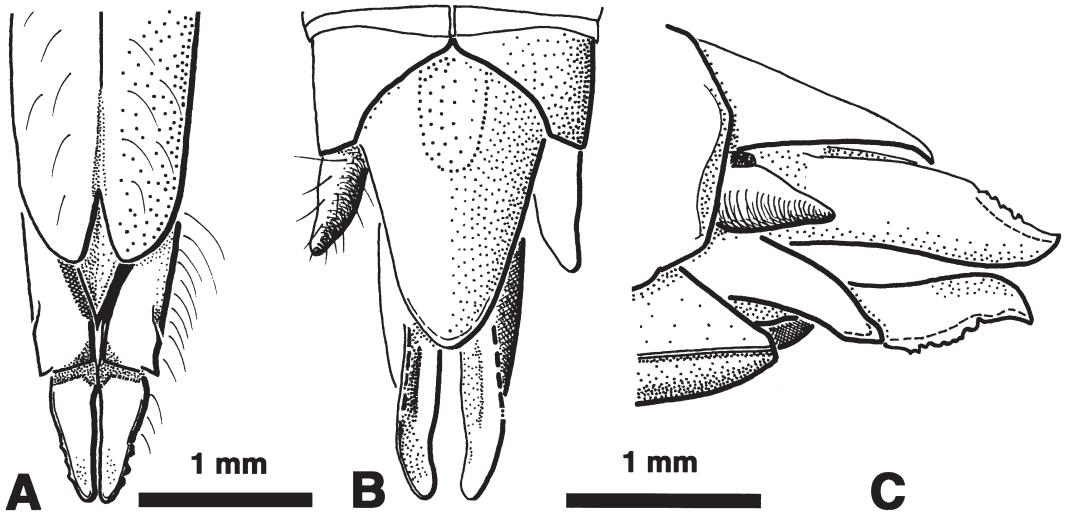


Fig. 17. *Pauracris brachyptera* n. sp. Female terminalia. A, ventral view. B. Dorsal view. C. Lateral view. The scale bar between B & C relates to both illustrations.

Finca La Selva. 40 m. LN N268800 E535300, 29 Jul 1982 (Braker HE), specimen number 82146, holotype male (ANSP). Same data as holotype, but 15 May 1982, specimen number 82120, allotype female. (ANSP).

Paratypes.—Same data as holotype, but 15 Jun 1982, specimen number 82136 (female) (RC).
COSTA RICA Prov. Guanacaste: Est. Pitilla, 9 km. S. of Sa. Cecilia. 700 m. LN 330200 380400 15 Jul 1994 (Moraga C), specimen no. CRI002 002039 (female) (INBio).

Natural history.—*P. brachyptera* is a rare member of the understorey fauna of the Caribbean rain forest of Costa Rica. Two of the four known examples were found on the leaves of Melastomataceae; one found on *Clidemia* was eating this plant, but it is not known whether this is the normal food. A third specimen was found on *Psychotria* (Rubiaceae). These plant families, both of which are common in the understorey, are rarely eaten by grasshoppers. The known capture localities do not suggest that *P. brachyptera* is actually an arboreal form which occasionally falls into understorey vegetation, but this possibility cannot be excluded. All specimens were caught between May and July, which is earlier than the adults of most seasonally breeding Costa Rican species appear. *Pauracris* may therefore either breed year round or have an unusual breeding season.

Key to species of *Pauracris*

1. Fully alate; medial carina of prothorax crossed by all four sulci; supra-anal plate of male with two medial black spots (Colombia) . . . . . *P. tenera* Descamps & Amédégnato 1972
- Brachypterous; medial carina of prothorax crossed by only two sulci; supra-anal plate of male with a single pair of melanized bosses, halfway down the lateral margins (Costa Rica) . . . . . *P. brachyptera* n. sp.

Christenacris Descamps and Rowell, 1984

The taxon is known from a single Costa Rican specimen, the holotype male of *C. sanguilenta*.

The original description placed the genus in the Ommatolampini, though noting that some characters linked it with Pauracrini, then known only from *P. tenera* from Colombia. Amedegnato's (1977) definition of the Pauracrini was necessarily based only on that species. As this description is not generally available, I give it here in translation:

"The tribe Pauracrini, containing only the genus *Pauracris*, presents some characters intermediate between those of the Ommatolampini, the Syntomacrini and the Abracrini.

"**1. External morphology**: close to that of the Syntomacrini. Body small and gracile. Alate or slightly brachypterous. Integument smooth. Head weakly opisthognath. Fastigium short and somewhat rounded. Interocular space very narrow, less than half the diameter of the antennal scape.

In the male, the posterior margin of the 10th abdominal tergite melanized. Supra-anal plate almost entirely smooth, bearing only two small granulations. Cerci short, conical, without internal apophysis.

"**2. Male genitalia**:

a) Epiphallic layer. Lateroventral sclerites large, hook shaped as in the Ommatolampini, but less sclerified, clear at their tips. Epiphallus large, bridge shaped, very slightly folded into a gutter. Ancorae well developed. Lophi melanized, bifid, flattened, touching in the midline.

b) Ectophallic layer. Arch of the cingulum small. Sheath much less well developed than in the Ommatolampini, not taking part in the formation of the aedeagal complex. The ectophallus remains quite membranous at the tips of the superior sclerites and participates only slightly at the tips of the inferior aedeagal sclerites.

c) Endophallic layer. Apodemes of the endophallic sclerites flattened laterally. Gonopore process digitiform, directed towards the rear, with a small ventral expansion. The middle part of the sclerites somewhat extended over the walls of the spermatophore sac. Flexure large and not strongly accentuated. Both the upper and lower aedeagal sclerites are simple, the upper pair longer than the lower pair.

"**3. Female genitalia**. Postvaginal sclerites with a single columella. Bursa copulatrix very large (much larger than the aedeagus). Preapical diverticulum of the spermatheca well developed, the apical diverticulum inflated."

Christenacris fits this description almost perfectly. The only divergent characters are that in *Christenacris* the lateroventral sclerites of the phallus, though large, are not hooked, and that the epiphallus

Table 3. *Pauracris brachyptera* dimensions. Abbreviations see Table 1.

Dimensions (mm)	Holotype Male			Sex. Dimorphism M/F
Hind femur	9.53			0.76
Rostrum-subgen. plate	15.14			0.79
Pronotum (midline)	3.14			0.73
Pronotum longest	3.15			0.74
Interocular space	0.12			0.41
Antennal pedicel (width)	0.38			1.11
Antenna length	7.87			?
Antenna max. width	0.16			?
T3 tarsus 1 + 2	1.98			0.81
T3 tarsus 3	1.53			0.75
Elytron length	6.23			0.78
Ratios				
Femur/Pronotum	3.04			1.05
L/P	4.82			1.06
Interoc./P	0.04			0.51
Interocular/pedicel	0.32			0.36
Tarsus 3/ 1+2	0.77			1.01
Tarsus 1+2+3/F	0.37			1.04
Tarsus 1+2+3/P	1.12			1.09
Ant/P	2.51			?
Ant L/W	49.19			?
Dimensions (mm)	Females, (n=3)			
	Mean	Max.	Min.	
Hind femur	12.47	12.68	12.25	
Rostrum-subgen. plate	19.24	20.77	18.25	
Pronotum (midline)	4.28	4.40	4.14	
Pronotum longest	4.28	4.40	4.14	
Interocular space	0.29	0.31	0.28	
Antennal pedicel (width)	0.34	0.35	0.33	
Antenna length	broken			
Antenna max. width	broken			
T3 tarsus 1 + 2	2.43	2.60	2.34	
T3 tarsus 3	2.05	2.36	1.85	
Elytron length	7.97	8.24	7.56	
Ratios				
Femur/Pronotum	2.90	2.96	2.84	
Length/Pronotum	4.56	4.72	4.41	
Interoc./Pronotum	0.08	0.08	0.07	
Interocular/pedicel	0.88	0.89	0.88	
Tarsus 3/ 1+2	0.77	0.83	0.71	
Tarsus 1+2+3/F	0.35	0.36	0.35	
Tarsus 1+2+3/P	1.03	1.04	1.01	
Ant/P	broken			
Elytron/Pronotum	1.85	1.99	1.72	

is narrow and crescent shaped, rather than being broad and subrectangular. Further, the border of the male's 10th abdominal tergite is not thickened or melanized. These however seem to be minor differences that could well vary between the genera of a single tribe.

In contrast, there seem to be more significant divergences from the definition of the Ommatolampini, despite the diversity of the latter tribe, which includes 3 subtribes: in *Christenacris* the flexure of the endophallus is relatively wide, the gonopore processes have a ventral extension, and the male cerci lack an internal apophysis.

Female characters of *Christenacris* are unfortunately not available.

In 1984 it was not known that the Pauracrini were represented at all in Central America, whereas the discovery of *P. brachyptera* n. sp. (above) makes it clear that they are. This fact, together with the morphological similarities mentioned above, in my view justifies the transfer of *Christenacris* to the Pauracrini.

3. Syntomacrini: Caloscirtae

Ateliacris Descamps & Rowell, 1978
(Figs 18-22)

The genus was erected to accomodate a single species, *Ommatolampis annulicornis* Bruner (1908). This species inhabits montane and submontane forests of the Pacific slope of Southern Costa Rica and the extreme West (Chiriquí Province) of Panama. It is subapterous and sombrely colored, highly shade tolerant, and is found, not only in light gaps, but in the understorey of closed- canopy mature forest as well. It eats *Sanicula* (Apiaceae) in the wild, and may take other plants too. White rings on the antennae and white flattened tips of the maxillary palps are apparently used as intraspecific visual signals in the dark habitat. The distinctive internal male genitalia are very similar to those of the genus *Ortalacris* of Western Colombia, which is probably its nearest known relative.

The new subspecies described below is morphologically very similar to *annulicornis*, and no change in the generic diagnosis is made necessary by it. The original diagnosis should however be enlarged to record that in the female only 2-3 indistinct sulci are visible on the very rugose pronotum; the female subgenital plate is semicylindrical, polished, with a simple triangular tip; the female cerci are simple and conical, with long thin tapering points, the dorsal ovipositor valves are concave dorsally, sharply hooked, with 4-5 coarse teeth on the proximal outer margin, the tips slender and squared off at the end; ventral ovipositor valves are simple and smooth edged.

Both subspecies of this genus secrete unusually copious epicuticular wax and cement, which often coat the entire animal with a greyish layer, especially in the depressions in the rugose cuticle. Particles of sand and vegetable detritus are often embedded in this layer, making the animals extremely cryptic. Often it has to be chipped or dissolved away from pinned specimens in order to reveal the true coloration.

Key to subspecies of *Ateliacris* (males only)

1. Dorsal surface uniformly sooty black, rest of body light yellowish brown (Fig.18) . . . . . *annulicornis annulicornis* (Bruner).
- Dorsal surface black with a row of orange or yellow medial markings from fastigium to middle of abdomen (Fig.19). Clypeus, labrum and underside black. Lower frons, genae, and lower lateral lobes of pronotum, yellow . . . . . *annulicornis pulchra* n. ssp.

Ateliacris annulicornis pulchra n. ssp.

Holotype.— COSTA RICA: Prov. S. José: Sa. Elena: Fila above Las Nubes, N. side of valley of Río Peñas Blancas, 1350-1550 m, LS 372800_507800, 9. Oct. 1999 (Rowell CHF), specimen no. 99441 (ANSP).
Paratype male.— as holotype, but specimen number 99435. Paratype female: 1 last instar larval female, specimen no. 2000039 (both ANSP)

Other Paratypes.— Same data as holotype, 6 males, specimen nos.

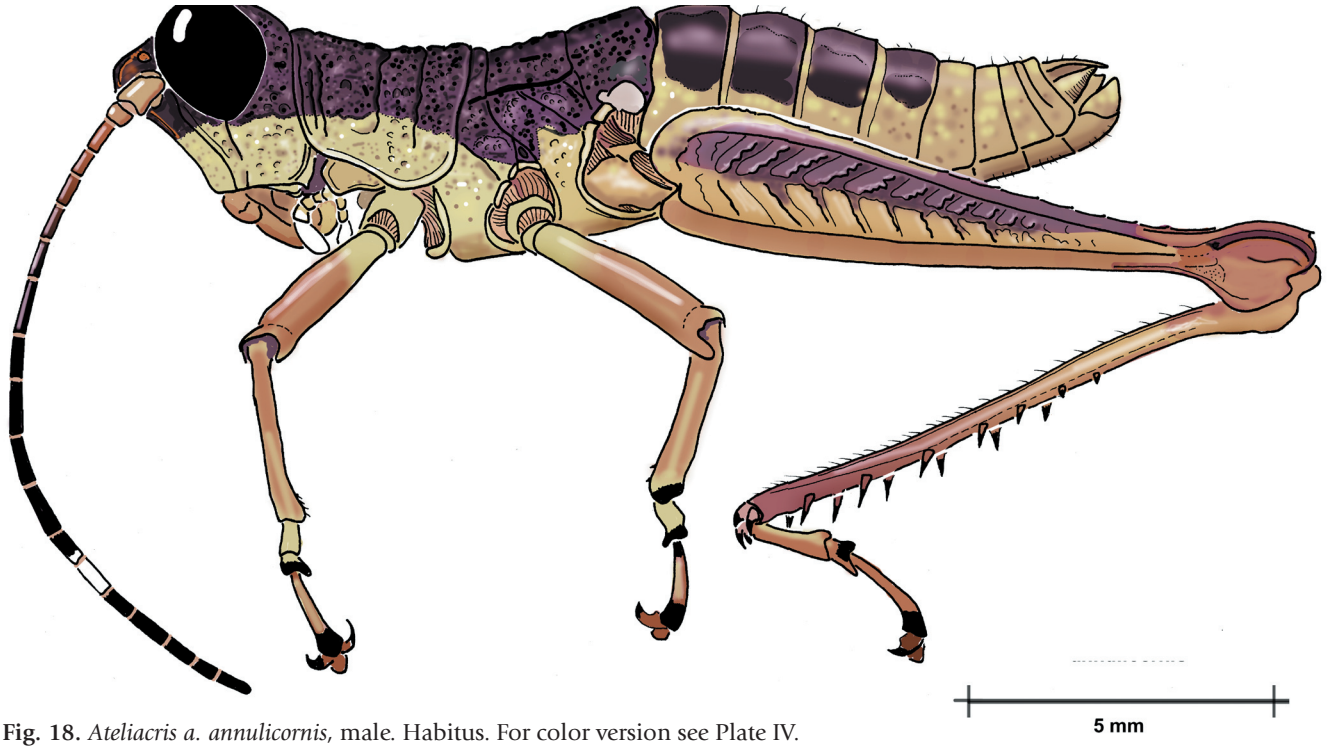


Fig. 18. *Ateliacris a. annulicornis*, male. Habitus. For color version see Plate IV.

99434, 99435, 99436, 99438, 99439, and 99440; 1 last instar female larva, specimen no. 2000099 (all RC); same data but 6 June 2000, male, specimen number 2000037; same data, but LS 372500_507200, 11 Jun. 1977 (Alfaro E), 1 male, specimen no. CRI 002-541737 (both INBio). Prov. S. José: Río Unión: 3 km N of Zapotal, 1350 m. LS 367600_517800, 7 June 2000 (Rowell CHF), 1 male, specimen no. 2000073, 1 last instar larval female, specimen no. 200009. (RC)

Diagnosis.—Morphologically similar to *A. annulicornis annulicornis*. Differs from that subspecies as follows: Slightly smaller [the difference is about 5%, but not significant (two samples of N = 10 each)], and with a relatively somewhat longer femur (for dimensions see Table 4). The head is about 10% smaller, and shorter dorsoventrally, than in *annulicornis*. The frons is more concave in profile, resulting in a more prominent rostrum, and the eye is narrower in its lower half (Fig. 20). The frontal ridge is completely obsolete ventral to the medial ocellus and the lateral carinulae of the face are obsolete for an interval below the eyes (both are continuous in *A. a. annulicornis*) (Fig. 21). Fastigium and frontal ridge are much less deeply grooved. The furcula of the male normally has an additional medial pair of projections, usually fused into a single medial process, and the supraanal plate is almost always decorated with a black medial spot (only occasional *in A. a. annulicornis*) (Fig. 22).

Male internal and external genitalia are not significantly different from those of *A. a. annulicornis*.

Coloration.—Male. Highly distinctive, very different from the uniform black and fawn of *a. annulicornis*. Antennae black, with a white ring on the 10th and 11th segment. Eyes black. Head and mouthparts black, except for vertex and fastigium, upper part of frontal ridge, the lower frons and genae below the eyes, bright yellow (Fig. 21). Ultimate and penultimate segments of both pairs of palps, greenish white.

Upper surface of body black, with a medial row of irregular orange-yellow lozenges from pronotum to the terminal abdominal segments, becoming more diffuse and darker posteriorly (Fig 19). Underside black (pale fawn in *annulicornis*). Ventral half of lateral lobes of pronotum, yellow, continuing the coloration of the genae rearwards. Abdominal pleura black above, brownish ventrally. Fore and middle coxae and proximal femora, light brown, distal femora and tibia, dark brown, tarsi light green with blackish brown distal margins. Hind leg blackish brown, with a light green-brown dorsal surface to the femur and a strip of the same color on the ventral and proximal part of the outer face of the femur. Last tarsal segment with the same light green and black markings as in the anterior pairs of legs.

Female (based on last instar larvae and comparison with *A. annulicornis*). Dull brown or reddish brown. Antennae with several indistinct paler bands proximal to that of the 10th and 11th segment. Palps as in male. Proximal abdominal pleura, black. Legs blackish brown. The last instar larval females of *A. pulchra* are indistinguishable from those of *A. annulicornis*; it is presumed that the same will be true of the adults.

Distribution.— Costa Rica. Known to date only from the upper reaches of two Talamancan valleys (R. Peñas Blancas, R. Unión) draining into the upper part of the Rio del General. Presumably the subspecies originated as a local isolate of the more widely distributed *a. annulicornis*.

Natural history.—To date appears identical to that of *A. a. annulicornis*. Females seem to be unusually difficult to find; no adult female has been captured.

Taxonomic comment.—The type locality of *A. a. annulicornis* (Pozo Azul de Pirrís) is the most northerly locality known for this species, yet more northerly than that of *A. a. pulchra*; further, the holotype is a female, and the females of the two subspecies are probably not separable. These two facts raise the possibility that the holotype

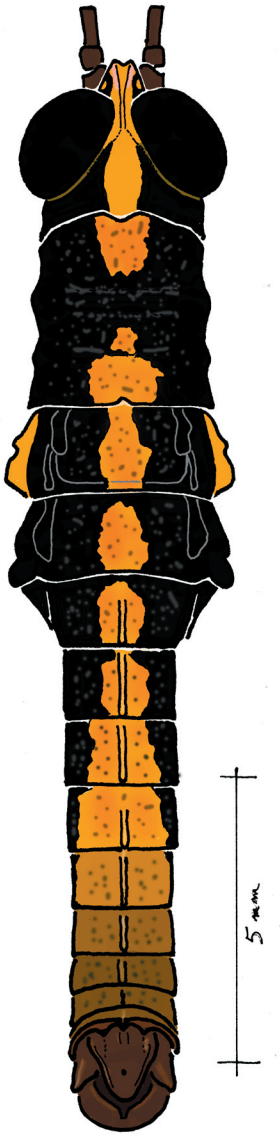


Fig. 19. *Ateliacris annulicornis pulchra* n. ssp.,male, dorsal view of body to show characteristic markings. For color version see Plate IV.

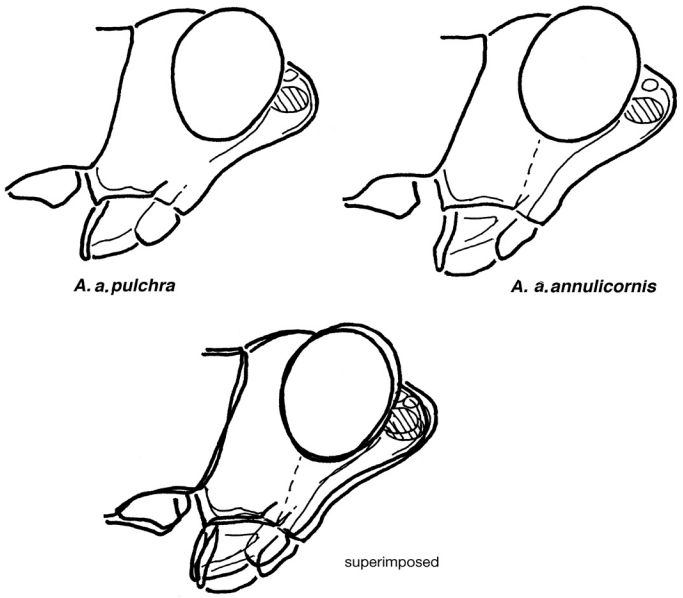


Fig. 20. Side view of head of *A. a. pulchra and A. a. annulicornis*, and the two superimposed, to show slightly smaller size of the former ssp.

could in fact be a member of the taxon here called *A. a. pulchra*, and that the more southerly populations, including the allotype male, have been wrongly attributed by us (Descamps & Rowell 1978) to *a. annulicornis*. A male from the area around the Río Pirrís will be necessary to resolve this, but in view of modern deforestation this is likely to be difficult to obtain.

4. Abracrini

Rhachicreagra Rehn 1905
(Figs 23-28)

Rehn 1905: 444.
Type species*: Rh. nothra* Rehn 1905.

Subsequent literature: Kirby 1910: 544. Hebard 1932: 296. Amedegnato 1974: 202. Tribal assignment. Descamps 1975: (*Rh. mexicanus* only). Jago & Rowell 1981: 181. Revision of genus. Rowell 1985,: 87 *et seq*. Ecology. Rowell & Amedegnato 2000: 390. New species, genitalic characters.

Rhachicreagra is a forest-edge and light-gap genus, endemic to Central America, extending from S. Mexico to Central Panama; it has been extensively studied. It is very prone to speciation and to local races. The phallic complex is very elaborate, the left and right aedeagal valves being each separately enclosed in a sheath formed from membrane, derived from the cingular rami, and the left hand valves being typically secondarily reduced in size. Here I describe one new subspecies and one new species and redescribe two more.

Rh. gracilis Bruner 1908

Jago and Rowell (1981: 204, Figs 65-71) treated two distinct

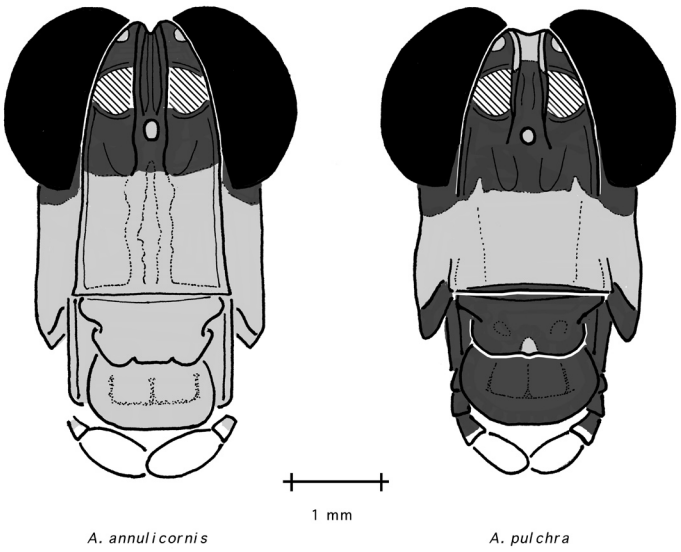


Fig. 21. Frontal view of heads of *A. a. pulchra and A. a. annulicornis*, showing differences in coloration and sculpturing.

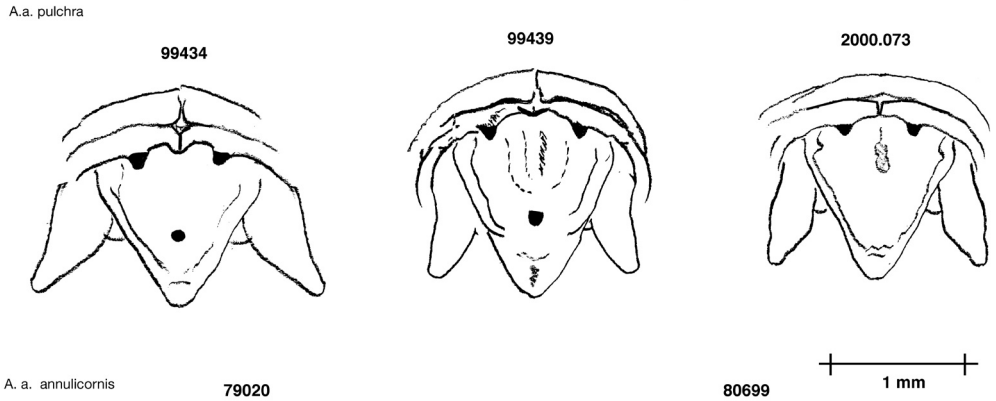


Fig. 22. Sketches of supra-anal plates of of *A.a.pulchra and A.a. annulicornis*, showing differences in furcula and patterning. Specimens chosen to show range of form in both subspecies. The multidigit numbers are specimen numbers.

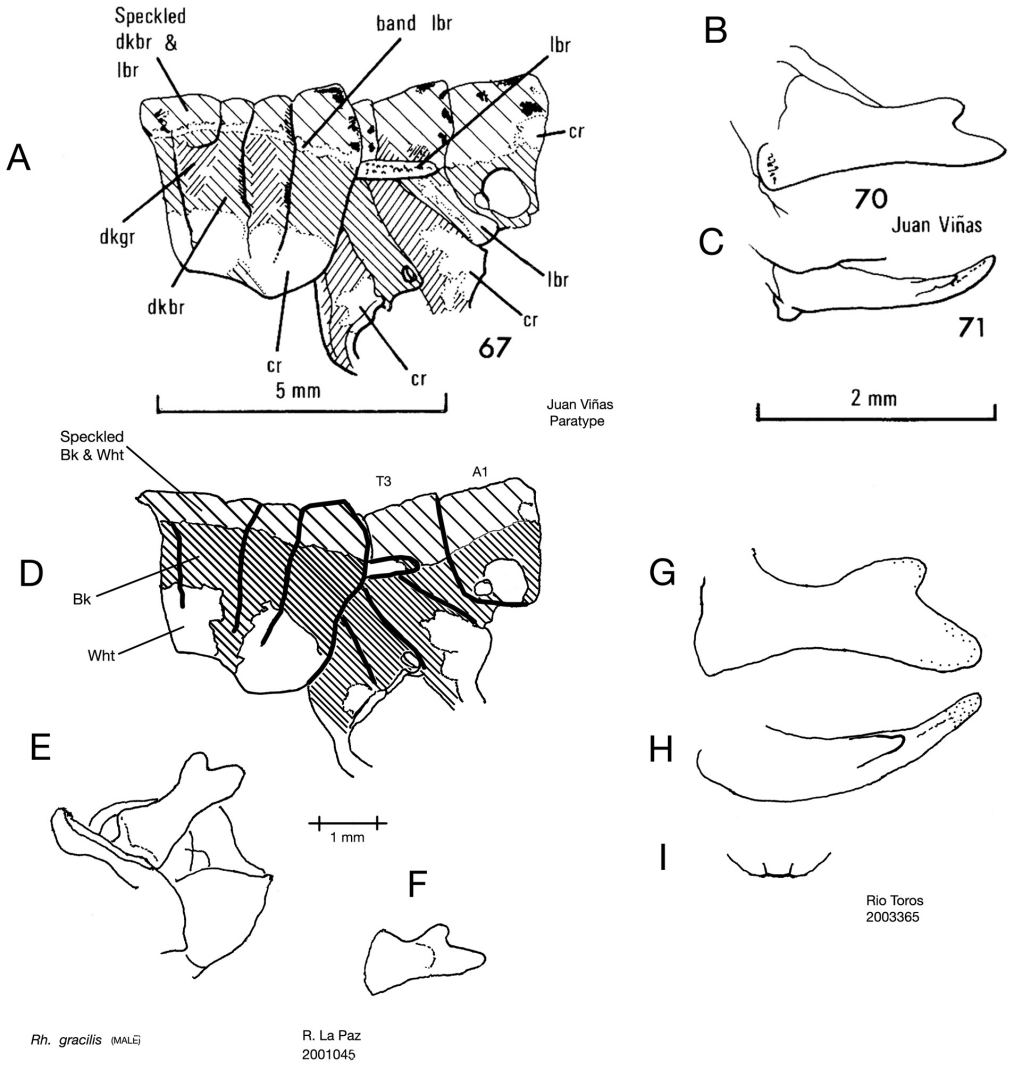


Fig. 23. *Rhachicreagra gracilis*, male. Comparison of type and modern populations.

A, B, C: Type series, (Juan Viñas) reproduced from Jago and Rowell, 1981, Figs 67, 70, 71. D, E, F: Sarapiqui, Rio La Paz. G,H & I: Rio Toro.

A, D. Thorax and 1st abdominal segment, lateral view, to show color and patterning. The differences in color can be attributed to fading in the specimen shown in A. B. F, G, male cercus in lateral view C, H. Male cercus, dorsal view. I. Tip of rim of male subgenital plate.

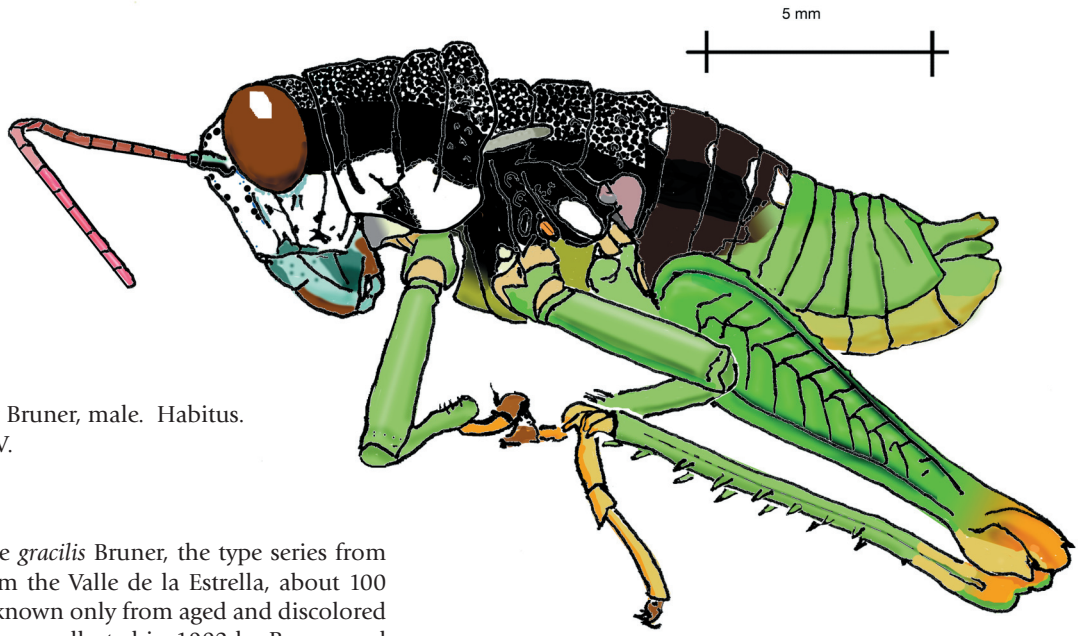


Fig. 24. *Rhachicreagra gracilis* Bruner, male. Habitus. For color version, see Plate IV.

populations under the name *gracilis* Bruner, the type series from Juan Viñas and another from the Valle de la Estrella, about 100 km distant. Both were then known only from aged and discolored museum specimens, the former collected in 1902 by Bruner and Calvert, the latter by Rehn in 1921.We noted, however, some morphological differences between the two. Fresh material from the Valle de la Estrella and the discovery and collection of new populations of the Juan Viñas taxon in the Cordillera Central now make it clear that these are in fact two different species, differing greatly in coloration and significantly in phallic structure.

Redescription

The following description is based on Bruner's type material (from Juan Viñas, in the valley of the Rio Reventazón on the South side of the Cordillera Central) and on recently collected material from the upper valleys of the Rios Sarapiquí and Toro, both draining the north side of the Cordillera Central. There is quite good agreement between the old and the modern samples, allowing for the negative effects of 100 years of museum preservation on coloration. The major differences are the following (Fig. 23):

a) The tegmen of the modern specimens is shorter than in the type series, where it usually reaches to the posterior margin of T3 tergite. In the modern specimens the tegmen usually ends within the third thoracic tergite, without reaching its posterior edge.

b) The paired pale spots on the pronotal lobes of the type series are partially confluent: in the new material they are narrowly divided by a patch of dark pigment.

As the genus is especially prone to local geographical variation, and the old and new populations are separated by a minimum of 55 km, these differences are not surprising.

Phallic structures, and both the male and female terminalia, are identical in the old and new specimens. Allowing for color change, all other aspects of coloration are identical too. The unusually distinctive coloration of the hind femur in the female is especially well replicated in the two samples.

Coloration.—Male (Fig. 24, Plate 6). Antennae dull red. Eyes dark brown. Palps white, labrum and clypeus tinged red brown. Frons and genae white, speckled with cobalt blue (turning brown in ancient specimens). Spots on ventral margin of pronotal lobe white, nar-

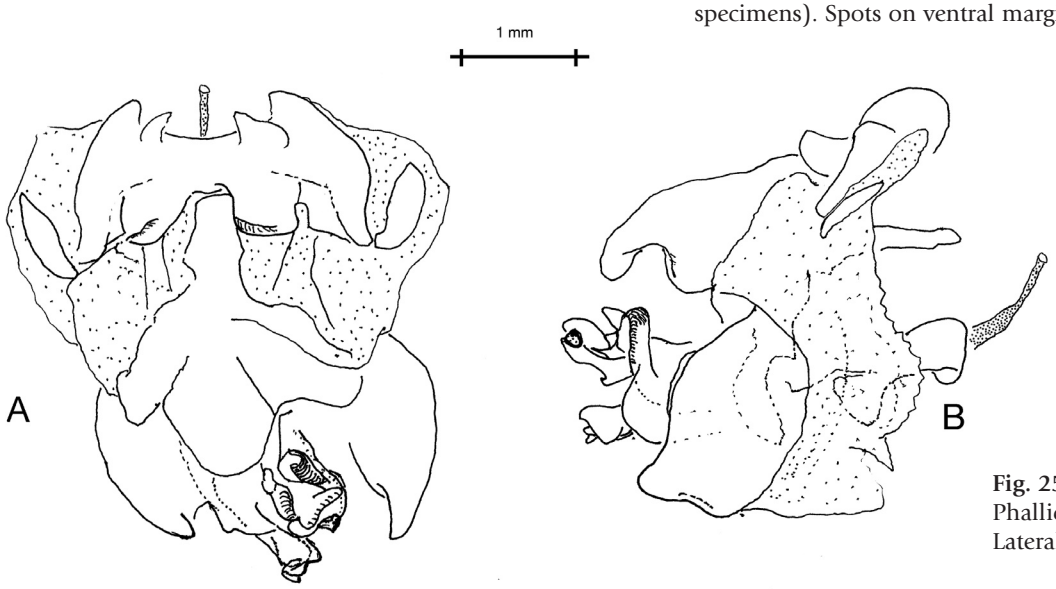


Fig. 25. *Rhachicreagra gracilis* Bruner. Phallic complex. A. Dorsal view. B. Lateral view.

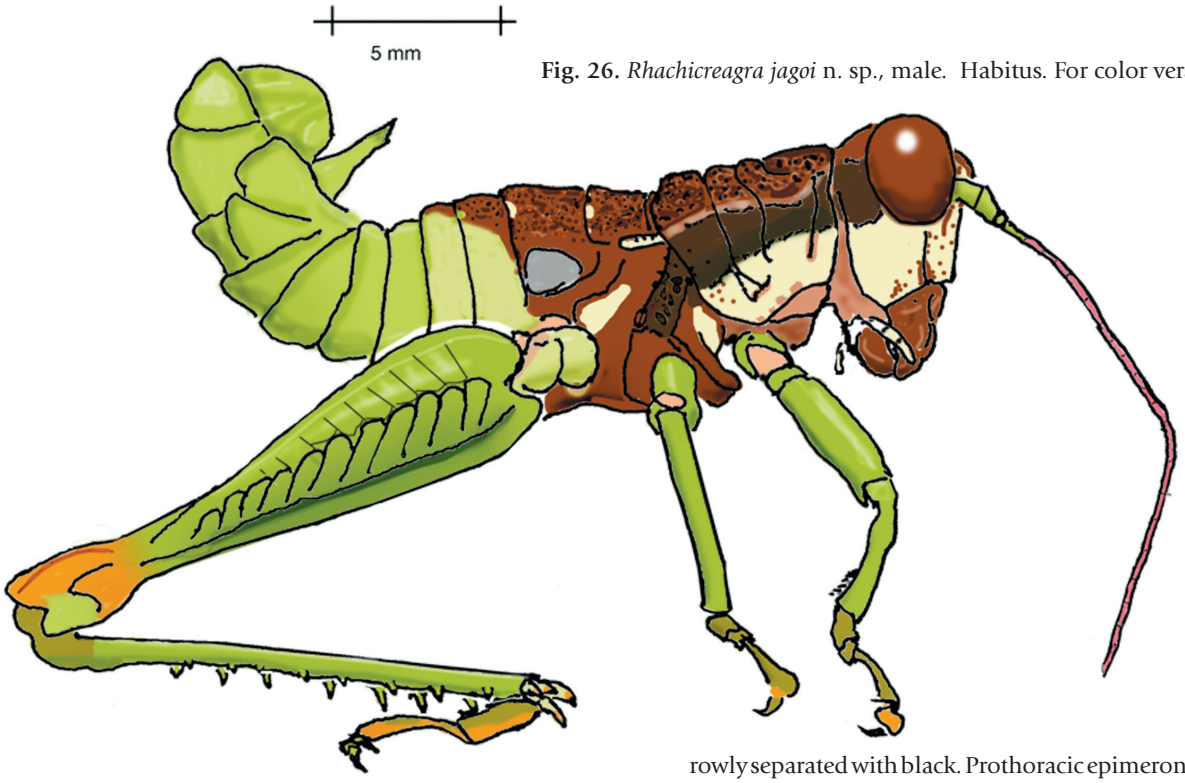


Fig. 26. *Rhachicreagra jagoi* n. sp., male. Habitus. For color version, see Plate IV.

rowly separated with black. Prothoracic epimeron white posteriorly, black or grey anteriorly. Postocular stripe, lateral lobe of pronotum, and meso- and metathoracic epimera and episterna, shiny black, with a green sheen; white spots on mesothoracic and metathoracic episterna. Dorsal surface of fastigium, vertex, disc of pronotum, thoracic and first abdominal tergites, white ground color thickly pitted and blotched with black, giving a greyish appearance. Elytron white, often with black tip, usually extending to about 70% of T3. Tympanal membrane pinkish white. Abdominal terga 2-4 black dorsally,with white spots on their posterior margins. Remainder of abdomen bright green, cerci and supra-anal plate edged with light red-brown. Cerci mainly bright green, only tips of their forks reddish. All legs emerald green. All feet reddish. Hind knees and first part of hind tibia yellowish, genicular lunules and the inner "elbow" surface of tibia pale red brown. Undersurface olivaceous green.

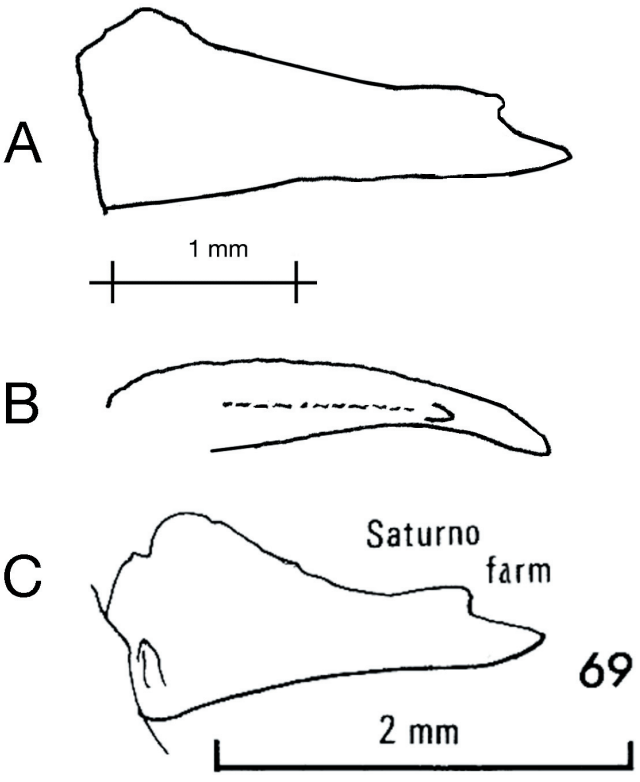


Fig. 27. *Rhachicreagra jagoi* n. sp., male cercus. A. Lateral view. B. Dorsal view. C. Lateral view of cercus of Rehn's 1921 specimen (from Jago & Rowell 1981, Fig 69). Upper scale bar refers to both A and B.

Female (brown form): antennae dull red. Most of animal dull mid brown, abdominal segments somewhat tinged green, especially distally (green color lost in dried specimens). Frons, genae and lower part of pronotal lobes dull ochre. Eyes dark brown, some vertical darker barring. Faint dark postocular stripe, continued obliquely over pronotal lobes between brown and ochre areas, ending on mesothoracic epimeron. Patches of slightly lighter brown occur on the lower pronotal lobes between the 1st and 2nd sulci, and on the meso- and metathoracic episterna. Black spots on posterior margin of first abdominal tergum, and posterior border of tympanum. External dorsal face of hind femur chestnut, including the knee. Outer face of femur blackish green above, pale ochre below. Inner face dark olive green. Rest of knee olive, tibia olive brown; all feet dark brown. Underside bright green.

Two of 8 females are green forms, with coloration essentially the same as the male, though slightly less brilliant, especially the face.

Terminal medial process of notum of first abdominal segment smoothly rounded, not inflected.

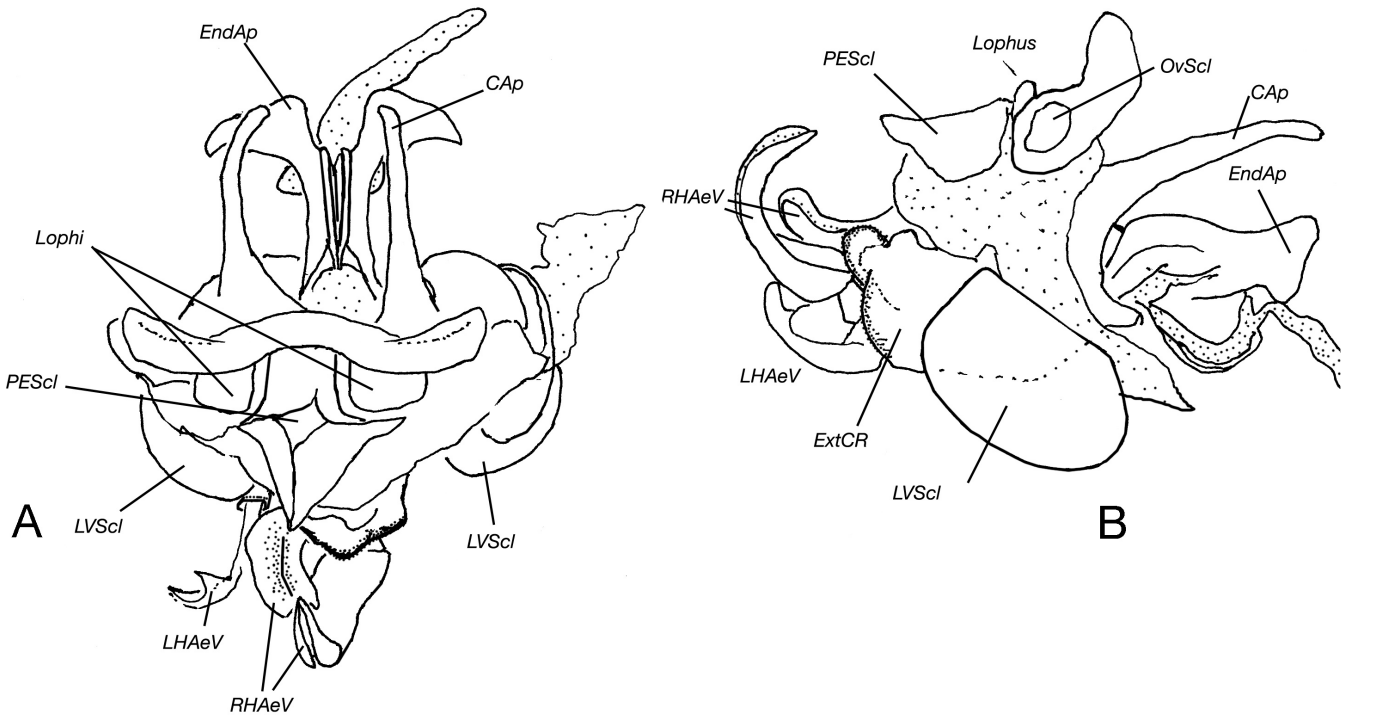


Fig. 28. *Rhachicreagra jagoi* n. sp., phallic complex. A. Dorsal view. B. Lateral view. Abbreviations: CAp Cingular apodeme, EndAp endophallic apodeme, ExtCr Extension of cingular ramus, LH AeV Left hand aedeagal valve, Lophi Lophi of epiphallus, LVScl Lateroventral sclerite, OvScl Oval sclerite, PEScl Post epiphallic sclerite, RHAeV Right hand aedeagal valve.

Male cerci spatulate at tip, upper fork much shorter than lower, SGP rim slightly squared off at tip, suggestion of papillae. (Fig. 23).

Dimensions.— see Table 5.

Phallic complex.—(Fig. 25) [Figs 65 and 66 of Jago and Rowell 1981 also show the phallus of a paratype of *gracilis* Bruner (Juan Viñas)].

Of the usual type for the genus, with highly asymmetrical aedeagal valves. Epiphallus bridge shaped, flattened and more or less oblong in plan view, posterior processes large and outwardly curved. Lophi oblong with thickened upper edges. Oval sclerites present, large. Postepiphallic sclerites large and medially fused. Lateroventral sclerites large, approximately hemispherical, their ventral distal margin somewhat produced. Cingular apodemes fairly short, straight, parallel, downwardly inflected at their tips. Zygoma and rami of cingulum robust, heavily sclerotized. Distal edge of sheath of aedeagal valves formed from extension of cingular ramus melanized and thickened. The extremities of the upper and lower valves themselves are not especially hypertrophied.The slit between upper and lower valves is rotated outwards to approach the horizontal. Left hand aedeagal valves reduced in size, flaccid and depressed. Endophallic apodemes laterally flattened, somewhat obliquely twisted. Gonopore processes large, triangular and downwardly directed. Dimensions are given in Table 5. The values obtained from the original Juan Viñas population are within the range of those of the modern Sarapiqui population. Sexual dimorphism (M/F) is about 0.8 in linear dimensions. The male has a relatively narrower interocular space and longer antennae.

***Rhachicreagra jagoi* n. sp.**

This taxon is erected to accommodate the Valle de la Estrella population erroneously subsumed under *gracilis* by Jago and Rowell (1981).

Holotype male.— COSTA RICA: Prov. Limón: Valle de la Estrella: Concepción, 5 km S along Rio Cerere, LN186000 642600, 20.8.1979 (Rowell CHF & Rowell-Rahier M), specimen no. 79171d (ANSP). Paratype male: as holotype, but specimen no. 79171a. (ANSP). Paratype female: as holotype, but Concepción, 3 km SW beyond Rio Cerere LN 188000 642000, 18.8.1979, specimen no. 79169. (ANSP).

Other paratypes.— COSTA RICA: Prov. Limón: Estrella Valley: Saturno Farm, 100 feet. 12.10.1923 (J.A.G. Rehn)., male. Bears Jago's ID *Rh. gracilis* Bruner. (LN approx. 189500 642500). (ANSP).

COSTA RICA: Prov. Limón: Res. Biol. Hitoy Cerere, Est. Hitoy Cerere, 100 m. LN 184200 643300,4-20.12.1991 (Garballo G), 2 males, specimen nos. CRI000 490065 & CRI000 490068 (INBio).

As holotype, but 20.8.1979, 2 females, specimen nos. 79172a & 79172b (RC). As holotype, but 20.8.1979, 2 males, specimen nos. 79171b & 79171c (RC).

Etymology.— Named for N.D. Jago, British orthopterist, friend, colleague and mentor, who first brought order to the chaos of this genus and described its remarkable phallic structures.

Coloration.— (In life.)
Male: (Fig. 26, Plate 7): antennae reddish brown. Frons and genae yellow, vertex and fastigium brown. Thorax and prothorax brown,

Table 4. *Ateliacris* dimensions. Abbreviations, see Table 1.

1. *Ateliacris annulicornis pulchra*

Males		mm									Ratios:				
Specimen No.	Locality	L	Ant	P	F	FD	Ta1	Ta2	Ta3	Ta1+2+3	F/P	F/L	F/FD	Ta1-3/F	A/L
2-541737	Sa. Elena	15.77	11.49	3.02	11.39	2.31	1.22	0.42	1.81	3.45	3.77	0.72	4.93	0.30	0.73
99434	Sa. Elena	17.39	12.99	2.84	11.47	2.35	1.18	0.48	1.87	3.53	4.04	0.66	4.88	0.31	0.75
99435	Sa. Elena	16.07	11.52	2.88	11.27	2.29	1.22	0.45	1.84	3.51	3.91	0.70	4.92	0.31	0.72
99436	Sa. Elena	16.65	12.42	2.81	10.82	2.26	1.16	0.43	1.81	3.40	3.85	0.65	4.79	0.31	0.75
99438	Sa. Elena	16.30	11.13	3.01	10.89	2.29	1.13	0.41	1.95	3.49	3.62	0.67	4.76	0.32	0.68
99439	Sa. Elena	16.76	11.74	2.97	11.07	2.31	1.17	0.46	1.82	3.45	3.73	0.66	4.79	0.31	0.70
99440	Sa. Elena	15.93	11.80	2.82	11.03	2.40	1.23	0.43	1.75	3.41	3.91	0.69	4.60	0.31	0.74
99441	Sa. Elena	16.18	11.25	2.75	11.03	2.26	1.16	0.48	1.90	3.54	4.01	0.68	4.88	0.32	0.70
2000073	Zapotal	15.51	missing	2.74	11.41	2.37	1.32	0.44	1.91	3.67	4.16	0.74	4.81	0.32	
2000040	Sa. Elena	17.54	12.70	3.06	12.40	2.32	1.25	0.42	1.89	3.56	4.05	0.71	5.34	0.29	0.72
	Maximum	15.51	11.13	2.74	10.82	2.26	1.13	0.41	1.75	3.40	3.62	0.65	4.60	0.29	0.68
	Minimum	17.54	12.99	3.06	12.40	2.40	1.32	0.48	1.95	3.67	4.16	0.74	5.34	0.32	0.75
	Average	16.41	11.89	2.89	11.28	2.32	1.20	0.44	1.86	3.50	3.91	0.69	4.87	0.31	0.72
	$s_{\bar{x}}$	0.67	0.66	0.12	0.45	0.05	0.06	0.02	0.06	0.08	0.17	0.03	0.19	0.01	0.02
	$s_{\bar{x}}$/average	0.04	0.06	0.04	0.04	0.02	0.05	0.06	0.03	0.02	0.04	0.04	0.04	0.03	0.03
	N	10	9	10	10	10	10	10	10	10	10	10	10	10	9
	Foot formula						34%	13%	53%						

No females available

2. *Ateliacris annulicornis annulicornis*

Males		mm.									Ratios:				
No.	Locality	L	Ant	P	F	FD	Ta1	Ta2	Ta3	Ta1+2+3	F/P	F/L	F/FD	Ta1-3/F	A/L
95376	Dos y Media	17.91	12.86	3.09	11.77	2.51	1.28	0.49	2.07	3.84	3.81	0.66	4.69	0.33	0.72
99230	Volcán	16.34	11.70	2.89	11.15	2.37	1.13	0.45	2.00	3.58	3.86	0.68	4.70	0.32	0.72
99226	Volcán	17.05	12.68	2.88	11.56	2.39	1.19	0.52	1.65	3.36	4.01	0.68	4.84	0.29	0.74
93317	Las Cruces	17.69	13.36	3.11	11.93	2.53	1.24	0.43	2.11	3.78	3.84	0.67	4.72	0.32	0.76
80700	Las Cruces	16.70	12.80	3.02	10.85	2.35	1.21	0.43	1.85	3.49	3.59	0.65	4.62	0.32	0.77
79020	Las Cruces	16.83	13.59	3.12	11.45	2.38	1.26	0.39	2.12	3.77	3.67	0.68	4.81	0.33	0.81
79021	Golfito	18.20	14.85	3.32	12.37	2.67	1.45	0.47	2.01	3.93	3.73	0.68	4.63	0.32	0.82
95481	Las Alturas	16.26	12.72	2.82	10.94	2.22	1.22	0.40	2.00	3.62	3.88	0.67	4.93	0.33	0.78
95359	Fca Ilana	17.00	12.73	2.99	11.67	2.51	1.35	0.48	2.13	3.96	3.90	0.69	4.65	0.34	0.75
95358	Fca Ilana	17.62	12.90	3.15	11.72	2.48	1.50	0.45	2.04	3.99	3.72	0.67	4.73	0.34	0.73
	Maximum	16.26	11.70	2.82	10.85	2.22	1.13	0.39	1.65	3.36	3.59	0.65	4.62	0.29	0.72
	Minimum	18.20	14.85	3.32	12.37	2.67	1.50	0.52	2.13	3.99	4.01	0.69	4.93	0.34	0.82
	Average	17.16	13.02	3.04	11.54	2.44	1.28	0.45	2.00	3.73	3.80	0.67	4.73	0.32	0.76
	$s_{\bar{x}}$	0.66	0.81	0.15	0.46	0.12	0.12	0.04	0.15	0.21	0.12	0.01	0.01	0.01	0.03
	$s_{\bar{x}}$/average	0.04	0.06	0.05	0.04	0.05	0.09	0.09	0.07	0.06	0.03	0.02	0.02	0.04	0.05
	N	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Foot formula						34%	12%	54%						
Females											Ratios:				
No.	Locality	L	Ant	P	F	FD	Ta1	Ta2	Ta3	Ta1+2+3	F/P	F/L	F/FD	Ta1-3/F	A/L
93357	Fca Ilana	28.16		4.85	13.53	3.49	1.73	0.66	2.68	5.07	2.79	0.48	3.88	0.37	
80704	Loma Linda	24.07	12.12	4.70	16.10	3.46	1.69	0.66	2.51	4.86	3.43	0.67	4.65	0.30	0.50
80696	Las Cruces	25.59	11.95	4.47	16.06	3.25	1.57	0.66	2.59	4.82	3.59	0.63	4.94	0.30	0.47
79015	Las Cruces	23.74	11.30	4.38	15.44	3.40	1.57	0.61	2.61	4.79	3.53	0.65	4.54	0.31	0.48
78052	Las Cruces	25.11	11.30	4.51	15.31	3.33	1.73	0.65	2.54	4.92	3.39	0.61	4.60	0.32	0.45
80695	Las Cruces	26.06	12.55	4.78	16.53	3.44	1.74	0.65	2.52	4.91	3.46	0.63	4.81	0.30	0.48
80694	Las Cruces	25.79	12.44	4.61	16.02	3.45	1.70	0.66	2.63	4.99	3.48	0.62	4.64	0.31	0.48
80693	Las Cruces	25.84	11.50	4.66	15.57	3.17	1.55	0.60	2.51	4.66	3.34	0.60	4.91	0.30	0.45
80692	Las Cruces	24.80	12.43	4.31	15.42	3.36	1.68	0.60	2.55	4.83	3.58	0.62	4.59	0.31	0.50
76101	Las Cruces	25.43		4.32	15.46	3.49	1.61	0.65	2.42	4.68	3.58	0.61	4.43	0.30	
	Maximum	23.74	11.30	4.31	13.53	3.17	1.55	0.60	2.42	4.66	2.79	0.48	3.88	0.30	0.45
	Minimum	28.16	12.55	4.85	16.53	3.49	1.74	0.66	2.68	5.07	3.59	0.67	4.94	0.37	0.50
	Average	25.46	11.95	4.56	15.54	3.38	1.66	0.64	2.56	4.85	3.42	0.61	4.60	0.31	0.48
	$s_{\bar{x}}$	1.22	0.52	0.19	0.81	0.11	0.07	0.03	0.07	0.13	0.24	0.05	0.30	0.02	0.02
	$s_{\bar{x}}$/mean	0.05	0.04	0.04	0.05	0.03	0.04	0.04	0.03	0.03	0.07	0.08	0.07	0.07	0.04
	N	10	8	10	10	10	10	10	10	10	10	10	10	10	8
	Foot formula						34%	13%	53%						
Sexual dimorphism		0.67	1.09	0.67	0.74	0.72	0.77	0.70	0.78	0.77	1.11	1.01	1.03	1.03	1.59

Comments re *A. annulicornis annulicornis:* Ant: Somewhat longer male antennae
F/P: Relatively slightly larger male femur
A/L: Relatively much longer male antennae
Tal- 3/F: both sexes have same sized foot relative to their femora
F/FD: both sexes have same femoral proportions

Table 5. *Rhachicreagra gracilis* dimensions.

					(Sarapiquí population)									(Juan Viñas population)		
Males:																
Mean dimensions in millimetres:														Jago's values for males (N=11)		
Collection	RC	RC	RC	RC	RC	RC	RC	Aver-age	Min.	Max.	Count		Sex. Dim.	Average	Min	Max
specimen #	2001036	2001050	2001038	2001049	2001045	2001051	2001048						M/F			
Hind femur	11.76	10.8	10.84	11.15	10.92	11.37	11.07	11.13	10.80	11.76	7		0.83	10.86	10.24	11.68
Rostrum-subgen. plate	16.61	16.47	17.38	16.41	15.3	15.26	15.19	16.09	15.19	17.38	7		0.77			
Pronotum (midline)	3.57	3.4	3.52	3.52	3.39	3.46	3.47	3.48	3.39	3.57	7		0.76	3.47	3.3	3.8
Pronotum longest	3.81	3.53	3.7	3.7	3.65	4.01	3.92	3.76	3.53	4.01	7		0.76			
Interocular space	0.34	0.33	0.33	0.33	0.35	0.35	0.36	0.34	0.33	0.36	7		0.50	0.3	0.26	0.36
Antennal pedicel (width)	0.45	0.41	0.44	0.42	0.43	0.44	0.43	0.43	0.41	0.45	7		0.98			
Antenna length	10.35	10.47	10.63	11.13	11.61	10.33	10.81	10.76	10.33	11.61	7		1.29			
Antenna max. width	0.23	0.25	0.22	0.23	0.21	0.2	0.26	0.23	0.20	0.26	7		1.00			
T3 tarsus 1	1.60	1.39	1.39	1.42	1.39	1.46	1.41	1.44	1.39	1.60	7	0.34*	0.87			
T3 tarsus 2	0.59	0.55	0.62	0.57	0.56	0.5	0.66	0.58	0.50	0.66	7	0.16*	0.83			
T3 tarsus 3	2.11	2.22	2.21	2.27	2.18	2.35	2.2	2.22	2.11	2.35	7	0.52*	0.85			
Elytron length	1.73	1.72	1.6	1.64	1.46	1.53	1.58	1.61	1.46	1.73	7		0.84			
No. antennal segments	21.00	20	21	21	21	20	21	21	20.00	21.00	7		1.08			
Ratios																
Femur/Pronotum	3.29	3.18	3.08	3.17	3.22	3.29	3.19	3.20	3.08	3.29	7		1.09	3.13	3.10	3.07
L/P	4.65	4.84	4.94	4.66	4.51	4.41	4.38	4.63	4.38	4.94	7		1.01			
Interoc./P	0.10	0.10	0.09	0.09	0.10	0.10	0.10	0.10	0.09	0.10	7		0.66			
Interocular/pedicel	0.76	0.80	0.75	0.79	0.81	0.80	0.84	0.79	0.75	0.84	7		0.52			
Tarsus 2/1+2+3	0.14	0.13	0.15	0.13	0.14	0.12	0.15	0.14	0.12	0.15	7		0.97			
Tarsus 1+2+3/F	0.37	0.39	0.39	0.38	0.38	0.38	0.39	0.38	0.37	0.39	7		1.04			
Tarsus 1+2+3/P	1.20	1.22	1.20	1.21	1.22	1.25	1.23	1.22	1.20	1.25	7		1.13			
Ant/P	2.90	3.08	3.02	3.16	3.42	2.99	3.12	3.10	2.90	3.42	7		1.70			
Elytron/P	0.48	0.51	0.45	0.47	0.43	0.44	0.46	0.46	0.43	0.51	7		1.10			
	Females:													New measurements on females		
Mean dimensions in millimetres:																
Collection	RC	RC	RC	RC	RC	RC		Aver-age	Min.	Max.	Count			ANSP	ANSP	ANSP
specimen #	2001052	2001047	2001043	2001037	2001041	2001046								1	2	3
Hind femur	13.09	13.19	13.32	14.09	13.28	13.82		13.47	13.09	14.09	6			12.69	12.65	13.85
Rostrum-ovip. Tip	20.91	19.35	21.43	20.6	21.51	21.52		20.89	19.35	21.52	6					
Pronotum (midline)	4.61	4.5	4.55	4.74	4.24	4.78		4.57	4.24	4.78	6			4.26	4.16	4.76
Pronotum longest	5.04	4.93	4.99	4.96	4.67	5.18		4.96	4.67	5.18	6					
Interocular space	0.68	0.68	0.69	0.74	0.62	0.65		0.68	0.62	0.74	6			0.57	0.54	0.67
Antennal pedicel (width)	0.42	0.45	0.44	0.47	0.43	0.43		0.44	0.42	0.47	6					
Antenna length	8.73	7.83	8.82	8.58	8.1	7.95		8.34	7.83	8.82	6					
Antenna max. width	0.22	0.23	0.26	0.22	0.19	0.25		0.23	0.19	0.26	6					
T3 tarsus 1	1.59	1.6	1.62	1.72	1.59	1.78		1.65	1.59	1.78	6	0.33*				
T3 tarsus 2	0.64	0.71	0.7	0.69	0.71	0.73		0.70	0.64	0.73	6	0.14*				
T3 tarsus 3	2.45	2.65	2.45	2.75	2.65	2.64		2.60	2.45	2.75	6	0.53*				
Elytron length	1.91	1.85	2.14	1.6	1.78	2.21		1.92	1.60	2.21	6					
No. antennal segments	19.00	19.00	19.00	20	20	21		19.50	19.00	21.00	6					
Ratios																
Femur/Pronotum	2.84	2.93	2.93	2.97	3.13	2.89		2.95	2.84	3.13	6			2.98	3.04	2.91
Length/Pronotum	4.54	4.30	4.71	4.35	5.07	4.50		4.58	4.30	5.07	6.00					
Interoc./Pronotum	0.15	0.15	0.15	0.16	0.15	0.14		0.15	0.14	0.16	6					
Interocular/pedicel	1.62	1.51	1.57	1.57	1.44	1.51		1.54	1.44	1.62	6					
Tarsus 2/ 1+2+3	0.14	0.14	0.15	0.13	0.14	0.14		0.14	0.13	0.15	6					
Tarsus 1+2+3/F	0.36	0.38	0.36	0.37	0.37	0.37		0.37	0.36	0.38	6					
Tarsus 1+2+3/P	1.02	1.10	1.05	1.09	1.17	1.08		1.08	1.02	1.17	6					
Ant/P	1.89	1.74	1.94	1.81	1.91	1.66		1.83	1.66	1.94	6					
Elytron/P	0.41	0.41	0.47	0.34	0.42	0.46		0.42	0.34	0.47	6					

* Foot Formula

lateral lobes of prothorax brown, marginal spots yellow and confluent, with a dark green area above the yellow, shading to brown dorsally. Fine yellow supraocular stripe extends obliquely across pronotum, ends as yellow dot on the metathoracic episternum at base of hind leg. Abdomen and all legs green. Underside green. All brown areas finely stippled with yellow.
Female: General color dull brown. Antennae brown banded with black. Same distribution of yellow on thorax as in male, plus an additional yellow patch on outer face of hind femur.

Dimensions.— See Table 6. Sexual dimorphism in linear dimensions approx. 0.85. Bodily proportions are the same in both sexes, apart from a narrower interocular space in males.

Male cerci, narrow, pointed, and rather straight, with a small upper fork. (Fig. 27). Figs 68, 69 of Jago and Rowell, 1981, labelled *Rhachicreagra gracilis*, actually refer to *Rh. jagoi*. No tubercles on rim of subgenital plate.

Phallic complex.—(Fig. 28) In general, similar to that of *Rh. gracilis* described above, but differing in that a) the distal margins of the sheaths of the aedeagal valves are less thickened and elaborated, b) the tips of aedeagal valves themselves are hypertrophied into long upwardly-curving gutters, and c) the postepiphallic sclerites are unusually large and robust, forming an angular prow overhanging the aedeagal valves.

Although the two species *jagoi* and *gracilis* are very similar in size and shape, if fresh material is available, they cannot be confused, as the former has the thoracic region colored brown and yellow, the latter black and white. In discolored dried specimens the male cercus serves to distinguish the two. The phallic complexes are also significantly different in the two species.

Rhachicreagra drymocnemensis Jago & Rowell, 1981

This species was originally described from a population occurring in and around Monteverde, on the western slopes of Cordillera de Tilarán. A further population is now reported from near Sangregado, on the northeastern shore of the Lago de Arenal, approximately 20 km from the original locality, on the eastern side of the Cordillera. There seem to be no significant differences in either coloration or genital structure between the two populations.

New material examined.— COSTA RICA: Prov. Guancaste: Lago de Arenal, 17 km from dam on road from Tabacón to Nuevo Arenal, roadside forest edge. LN 275000 445300, 10.10.2003 (Rowell, CHF). 1 adult male, specimen number 2003326, 1 adult female, specimen number 2003325 (RC). COSTA RICA: Prov. Guancaste: Lago de Arenal, 6 km from dam on road from Tabacón to Nuevo Arenal, roadside forest edge., nr. Sangregado. LN 272200 451200, 10.10.2003 (Rowell, CHF). 1 adult male, specimen number 2003324, 1 late nymphal female. (RC)

Rhachicreagra chrysonota Rowell 2000

This spectacularly colored species was described from an isolated population occurring on the crest of Cordillera de Guanacaste, on the slopes of Volcan Rincón de la Vieja. Neighboring localities instead harbor *Rh. melanota*. I now report a closely related but slightly different form from the Reserva Biológica de San Ramón, on the southern end of the Cordillera de Tilarán, about 100 km southeast of the original locality.

***Rhachicreagra chrysonota salazari* n. ssp.**

Holotype male.— COSTA RICA: Prov. Alajuela: Río S. Lorenzo, Riserva Biológica San Ramón, 800-900 m. LN 244500 471500, 20.10.2001 (C.H.F. Rowell), specimen no. 2001103 (ANSP).

Paratypes.—Male: as holotype, but specimen no. 2001205 (ANSP).
Females: as holotype, but specimen numbers 2001100 and 2001119 (green morph) (ANSP).

Etymology.— Named for Sr. Alberto Hamer Salazar Rodriguez, Director of the San Ramón Biological Field Station, in appreciation of his aid and hospitality there in 2001.

Differs slightly from the nominate ssp. in both coloration and size. There is no obvious difference in phallic structures. Fig. 29 shows the thoracic patterning of the two forms. The golden color which covers the pronotal disc and the thoracic and first abdominal tergites is much more heavily obscured by black mottling in the form *salazari*, giving the animal a darker and less brilliant appearance. In the nominate form the yellow spots on the lower margin of the pronotal lobes are widely separated by a broad band of black pigment, whereas in *salazari* the spots are often confluent or only weakly separated from each other. Further, in *salazari* the elytron is of rather variable length and lacks the dark distal coloration seen in *chr. chrysonota*. A green-morph female exists in *chrysonota salazari*, but has not been seen in *chrysonota chrysonota*.

The subspecies *salazari* has the same bodily proportions as *chrysonota*, but is slightly smaller in all dimensions: see Table 7 for a comparison between the two.

Rhachicreagra dierythra Rowell, 2000

The original description (Rowell & Amedegnato 2000: 401) was made from pinned, dried and slightly damaged specimens. Since then I have had the opportunity to get to know this species in the wild. Especially the description of the coloration in life needs modification:

Coloration.— Antenna, yellow green at base, then bright yellow, tips of flagellae pale chocolate brown. Eyes black (drying brown). Head, mouthparts, palps, light brown, with no spotting on the frons; postocular stripe pale blue-green. Pronotum: pale brown with green tinge when fresh, except for continuation of postocular stripe produced along lateral lobes as far as posterior sulcus, pale blue green, in fresh specimens not prominent; anterior and posterior margins decorated with 4 pairs of red spots, two dorsolateral, two ventral. Pterothorax and 1st abdominal segment, same pale brown color as pronotum and head; red marks on metathoracic episterna, and paired dorsolaterally on the metathoracic (very small) and 1st abdominal tergites (large). Dorsum of 2nd abdominal segment dark brown, paired yellow spots posteriorly. Tegmen pale brown. Other abdominal segments green (dries brown), including genital region (dries blue green). Tips of cerci and proximal outer edges of SAP tinged blackish green. Front and middle legs: coxae and femora dark green, tibiae and tarsae light yellow green (dries bright yellow). Hind femora dark green, external dorsal face olive brown (dries yellow). Knees green, (in dried specimens edged along dorsoposterior margin with yellow). Tibiae and tarsi yellow green with darker green longitudinal markings proximally, (drying bright yellow); all spines,

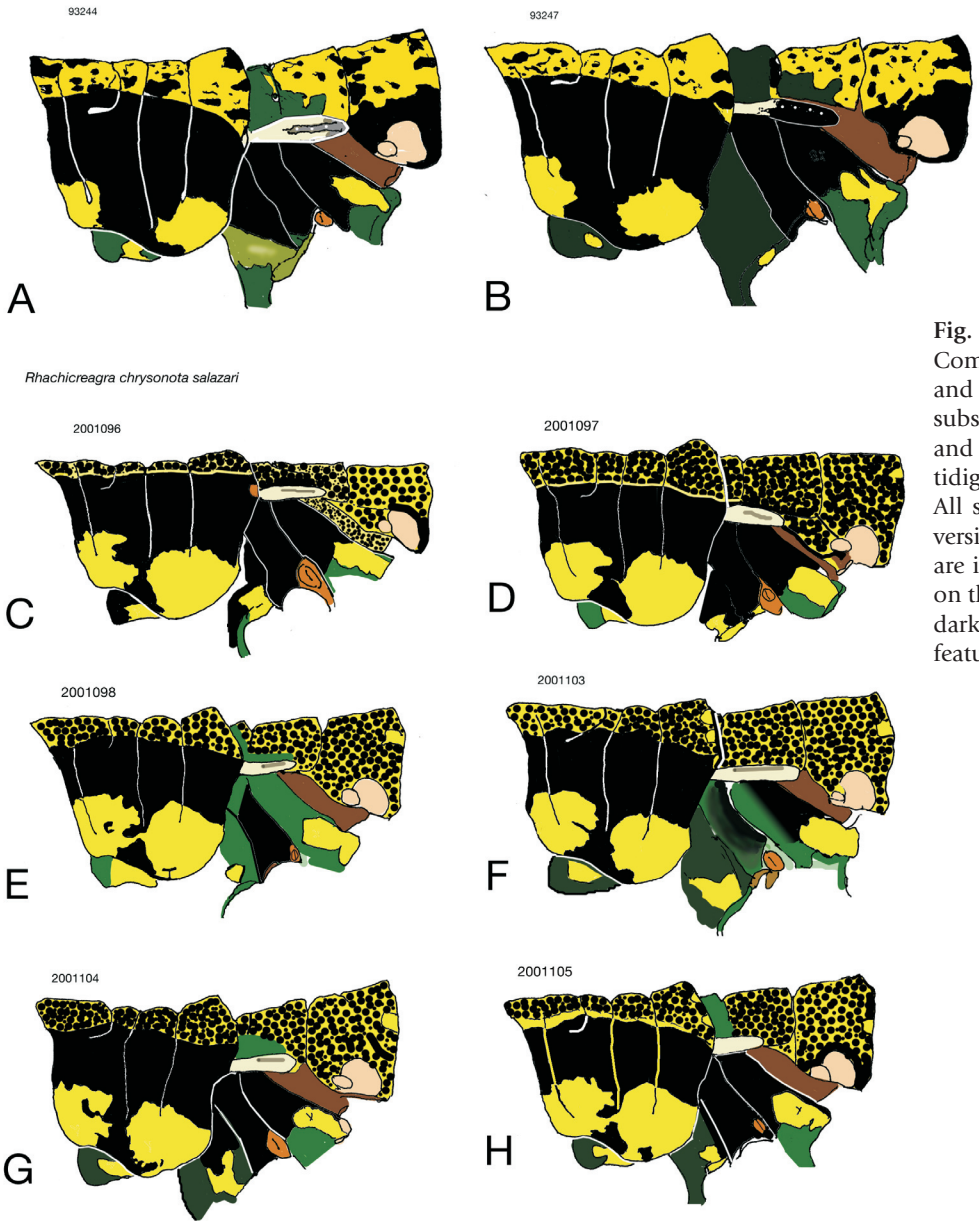


Fig. 29. *Rhachicreagra chrysonota*, males. Comparison of color patterning of thorax and 1st abdominal segment between the subspp. *chrysonota chrysonota* (Figs A,B) and *chrysonota salazari* (Figs C-H). Multidigit numbers are specimen numbers. All specimens are paratypes. For a color version see Plate V. The major differences are in a) the separation of the pale spots on the lateral lobe and b) the intensity of dark speckling of the gold notum. Both features are arrowed in Fig. B.

spurs and claws tipped with black. Pads of tarsi a darker color.

Female: Of normal shape for the genus, including external genitalia. Tegmen relatively shorter than in male, reaching only 3/4 of way to posterior margin of the metathoracic tergum.

Coloration.— Antennae entirely light pinkish brown (drying bright yellow, terminal segment suffused blackish); 21 flagellar segments. Eyes black (drying dark brown). Entire body a uniform shade of greenish brown (drying brown) with almost no markings. Hind femora slightly more reddish brown than body, knees dusky. (In dried specimens, distal abdominal segments a darker shade of brown; posterior margins of abdominal segments, outer face of hind femur and lateral lobes of hind knee suffused with black). Spines, spurs and claws tipped black.

Clematodinini

Leptalacris Descamps & Rowell, 1978

The original description (Decamps & Rowell 1978: 352) noted a similarity to some Copiocerinae, but placed the genus within the tribe Clematodinini of the Ommatolampinae, principally on the basis of the rather regressive aedeagal structure. This placement was biogeographically improbable from the start, as the other two known genera of this tribe (*Clematodina* and *Epedanacris*) are confined to the Guyanan Amazon, and no geographically intermediate forms have been discovered. Also, some characters of *Ateliacris*, especially the spermatheca with its long sinuous preapical diverticulum, do not fit with the other members of the Clematodinini. Dr. Christiane Amedegnato (pers.comm., 2002) proposed enlarging the group Eucopiocerae (Descamps 1975), to include the Mexican and Central

American genera *Eucopiocera*, *Chapulacris*, *Halffterina*, *Apoxitettix*, *Clematodes*, *Leptalacris* and at least one further undescribed genus. These genera all share common features of habitus and internal genitalia, and, with the exception of *Clematodes*, are all specialists on monocotyledenous plants. They also form a coherent geographical assemblage, being mostly found in the montane forests of Central America. I find this placement of *Leptalacris* much more attractive than the original one within the Clematodinini, and consider it to be the most plausible suggested to date.

Acknowledgements

I thank the Drs A. Solís (INBIO), A.-P. Kaltenbach (NMW) D. Otte and J.Weintraub (ANSP) and D. Quintero and R. Cambra (GBFM) for access to their collections and loan of specimens, Dr. A. Bentos-Pereira for help in field work in Panama, and the authorities of Costa Rica and Panama for permission to work in their national reserves.

References

Amedegnato C. 1974 Les genres d'Acridiens neotropicaux, leur classification par familles, sous-familes et tribus. Acrida 3: 193-204.

Amedegnato C. 1977 Etude des Acridoidea Centre et Sud Americains (Catantopinae senus lato): Anatomie des genitalia, classification, répartition, phylogénie. Thèse, Université Pierre et Marie Curie, Paris. 385 pp. (mimeo.) Annales de la Société entomologique de France (Nouvelle Serie) 20: 143-161.

Bruner L. 1908. Acrididae. In: Biologia Centrali Americana. Insecta, Orthoptera, 2: 1-342, plates 1-4 (1900-1909). Ed. Frederick Du Cane Godman. London: published for the Editor by R.H. Porter, 1893-1909.

Brunner von Wattenwyl K. 1893. Révision du système des Orthoptères et description des espèces rapportés par M. Leonardo Fea de Birmanie. Annali del Museo Civico di Storia Naturale di Genova, ser. 2, 13: 5-230, lam. 1-6.

Carbonell C.S., Descamps M. 1978. Revue des Ommatolampae (Acridoidea, Ommatolampinae). Annales de la Société d'Entomologie de France (N.S.) 14: 1-35.

Descamps M. 1975a. Les Nicarchi, Ommatolampini dendrosclérophiles de la foret néotropicale (Acridomorpha, Ommatolampinae). Annales de la Société d'Entomologie de France (N.S.) 12: 509-526.

Descamps M. 1975b. Etude du peuplement acridien de l'état de Vera Cruz (Mexique). Folia Entomológica Mexicana 31-32: 3-98.

Descamps M. 1975c. Le groupe des Eucopiocerae (Orth. Acrididae, Ommatolampinae). Bulletin de la Société Francaise d'Entomologie 80: 119-131.

Descamps M. 1979. La faune dendrophile néotropicale. IV. Le groupe des Oulenotacrae (Orthoptera: Ommatolampinae), (1. & 2. Parties). Revue française d'Entomologie (N.S.) 1: 117-131 & 150-159.

Descamps M., Amedegnato C. 1972 Contribution a la faune des Acridoidea de Colombie (missions M. Descamps). III. Diagnoses de Catantopinae (sensu lato). Annales de la Société d'Entomologie de France (N.S.) 8: 505-559.

Descamps M., Rowell C.H.F. 1978. Acridiens des clairières de Costa Rica. Diagnoses, signalisations, notes biologiques, polymorphisme (Acridomorpha, Acrididae). Annales de la Société Entomologique de France (N.S.) 14: 351-367.

Descamps M., Rowell C.H.F. 1984. Diagnoses d'Acridoidea des forêts de Costa Rica. Annales de la Société d'Entomologie de France (N.S.) 20: 143-161.

Hebard M. 1932. New species and records of Mexican Orthoptera. Transactions of the American Entomological Society 58(967): 201-371, pl. 17-21.

Jago N.D., Rowell C.H.F. 1981. *Rhachicreagra* (Acrididae, Ommatolampinae): forest grasshoppers from Central America with unique aedeagal asymmetry. Systematic Entomology 6: 179-212.

Kirby W.F. 1910. A synonymic catalogue of Orthoptera. Vol. 3. Orthoptera Saltatoria. Part. 2. (Locustidae vel Acrididae). British Museum, London, 674 pp.

Rehn J.A.G. 1905. A contribution to the knowledge of the Acrididae (Orthoptera) of Costa Rica. Proceedings of the Academy of Natural Sciences of Philadelphia 57: 400-454.

Rehn J.A.G. 1929. Studies in Costa Rican Dermaptera and Orthoptera. Paper two. New genera and species of Acrididae. Transactions of the American Entomological Society 55: 9-77, pl. 1 - 5.

Rowell C.H.F. 2003. Revision of the genus *Microtylopteryx* (Orthoptera, Acrididae, Ommatolampinae). Journal of Orthoptera Research 12: 1-30.

Rowell C.H.F. 1985a. The feeding biology of a species-rich genus of rain-forest grasshoppers (*Rhachicreagra*: Orthoptera, Acrididae). I. Food plant use and foodplant acceptance. Oecologia 68: 87-98.

Rowell C.H.F. 1985b. The feeding biology of a species-rich genus of rain-forest grasshoppers (*Rhachicreagra*: Orthoptera, Acrididae). II. Foodplant preference and its relation to speciation. Oecologia 68: 99-107.

Rowell C.H.F., Amedegnato C. 2000. New species of *Rhachicreagra* (Orthoptera: Acrididae). Annales de la Société d'Entomologie de France (N.S.). 2000, 36: 389-409.

Stål C. 1878. Systema acridiodeorum. Essai d'une systematisation des acridoidées. Bihang till Köngliga Svenska Vetenskaps-akademiens Handlingar 5: 1-100.