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The Central American genus *Rhicnoderma* (Orthoptera, Romaleidae, Bactrophorinae, Bactrophorini) and some closely related new taxa

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Abstract

Newly discovered species of Central American bactrophorine grasshoppers in the genera *Rhicnoderma* Gerstaecker, *Lempira* Rehn (n. stat.) (from El Salvador) and *Pararhicnoderma* n. genus (from Costa Rica) are reported and/or described. The genus *Rhicnoderma* is reviewed, and keys provided to the described species of all three genera.

Key words

Central America, grasshoppers, new species, new genera

Introduction

Rhicnoderma species are medium sized thamnophilous bactrophorine grasshoppers, confined to Central American moist tropical forests. They are typically found resting on medium-sized twigs of trees and shrubs; their thoracic sterna are concave to accomodate such a support, and their rather short and wide hair-fringed hind femora are arranged at rest to merge the outline of the insect into that of the branch. The females of all species and the males of many are mottled green and brown, and intensely cryptic when at rest. For this reason, they are rarely seen or collected, and few specimens are available for taxonomic work. I have been able to make only a very few natural history observations; from these, it seems likely they are generalist herbivores and lay their eggs either in soil or arboreal humus clumps.

A considerable number of undescribed species superficially similar to *Rhicnoderma* spp. have become available through recent collecting activities. Their range of form suggests they should be arrranged in more than one genus. This article consequently erects the new genus *Pararhicnoderma*, and raises *Rhicnoderma* (*Lempira)* Rehn, 1938 to the status of a full genus. These two genera, together with *Rhicnoderma* Gerstaecker and *Panamacris* Rehn, are shown in the companion paper (Amedegnato *et al.* this issue) to constitute a clade, and are here referrred to as the Rhicnoderma genus group.

Abbreviation of depositaries

ANSP: Academy of Natural Sciences, Philadelphia.
MNHN: Museum Nationale d'Histoire Naturelle, Paris.
RC: the author's collection.
UMMZ: University of Michigan Museum of Zoology.
ZIMG: Zoologisches Institut und Museum Greifswald.

Taxonomy

Rhicnoderma Gerstaecker 1889

Type species.— *Rhicnoderma olivaceum* Gerstaecker, 1889, by original designation.

Gerstaecker. 1889. Mitt. Naturw. Ver. Greifswald 20: 28.
Rehn, J.A.G. 1938. Proc. Acad. Nat. Sci. Philad. 90: 48.
Dirsh, V. 1965. Eos 40: 442.
Amedegnato, C. 1974. Acrida 3: 199.
Otte, D. 1995. Orthoptera Species File 4: 21.
Eades, D. 2000. J. Orth. Res. 9: 204.

The genus *Rhicnoderma* was erected by Gerstaecker (1889) to accommodate his *Rh. olivaceum* from Chiriquí, W. Panama, the type of the genus. Seven other Central American species were added later: *humilis* Rehn, 1905 (W. Costa Rica), *glabra* Bruner, 1907 (W. Costa Rica), *basalis* Bruner, 1907 and *pugnax* Bruner, 1907 (both S. Mexico) and *magnificum* Hebard, 1924 (Panama). Both Rehn (1938) and Descamps (1975) considered *pugnax* to be a synonym of *basalis*. Rehn (1938) synonymized *glabra* with *olivaceum* and transferred *magnificum* to the new genus *Panamacris*. Two species from Honduras (*archimimus* Rehn, 1938 and *arcanum* Rehn, 1938) were referred to a subgenus *Rhicnoderma* (*Lempira*) by Rehn (1938). These changes are summarized in Table 1.

Redescription.— (See Figs 1-4, Plates 1-8) Medium-sized insects. Orthognath or slightly prognath. Females are medium-large (up to 51 mm in overall length), cylindrical in form, often with a densely punctate integument, principally green, brown or olive brown in color. Males are smaller (about 35 mm in length) and have a slightly smoother integument.

Antennae filiform, as long (females) or about half as long again (males) as the head and pronotum together, 20 flagellar segments. Vertex and occiput in some spp. with a suspicion of a fine medial carina. Interocular space more than twice as wide as the frontal ridge, the latter measured between the antennae. Fastigium essentially obsolete, vertex curves smoothly down into the frons; the fastigium itself is almost vertical, its margins demarcated by irregular nodules. Frontal ridge above medial ocellus with thickened carinae, widely but shallowly sulcate, interrupted just above the medial ocellus by a transverse ridge; below the ocellus, frontal ridge increasingly obsolete.

Pronotum cylindrical, with 4 sulci. Medial and lateral carinae absent (differentiates from *Lempira*). The first (most anterior) sulcus does not attain the disc. Disc is crossed by the remaining 3 sulci, the

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Table 1. Taxonomic fate of older *Rhicnoderma* species. Junior synonyms in parentheses.

Original name and locality	Synonymies	Present generic status
olivaceum Gerstaecker (W. Panama)		*Rhicnoderma* (type of genus)
(*glabra* Bruner) (W. Costa Rica)	Syn. of *olivaceum*, Rehn 1938*	*Rhicnoderma*
humilis Rehn (W. Costa Rica)		*Rhicnoderma*
basalis Bruner (S. Mexico)		*Rhicnoderma*
(*pugnax* Bruner) (S. Mexico)	Syn. of basalis (Rehn 1938, Descamps 1975)*	
magnificum Hebard (Central Panama)		*Panamacris*
archimimus Rehn (Honduras)		*Lempira*
arcanum Rehn (Honduras)		*Lempira*

* The present author has examined the type specimens of these taxa and supports these synonomies.

most anterior of which (the second from the front) is sometimes more or less obsolete. Lateral and (usually) medial pronotal carinae absent. Anterior margin of pronotum very slightly emarginate medially, the embayment flanked by two very small pointed processes projecting over the occiput. Posterior margin of pronotum straight. Metazona very short, leaving mesonotum largely exposed. Posterior margin of metathoracic tergum with a prominent midline embayment. Prosternal process a wide transverse ridge, either straight or slightly curved, convex side to the front, the outer corners each bearing a minute erect tubercle, the whole tending towards a weakly bifid condition (Fig. 2). Mesosternal interspace transverse; metasternal lobes touching. All thoracic sterna slightly concave. In both sexes the pronotal lobes are monochrome, without a ventral stripe of pale color (differentiates from *Lempira* and *Pararhicnoderma*).

Apterous and atympanate. Fore and middle femora laterally compressed, wide. Hind femur not exceeding abdomen in length, about 4.3× longer than wide; dorsal femoral carina coarsely and very shallowly serrate. Hind knee with a very small subterminal spine, the ventral lobes angular or rounded, inclined slightly downwards. Hind tibia with 7-8 external spines and 9 internal ones, including the apical spines. The foot is long, the three tarsal segments being subequal, but the basal segment is the longest, the second segment the shortest. Foot formulae of the different species in the range 38: 25-28: 34-37.

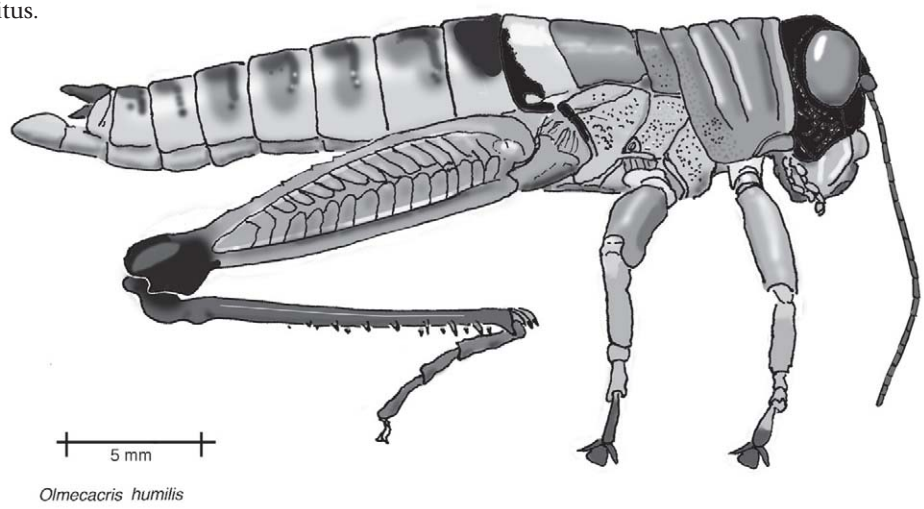
Abdominal segments less rugose, almost smooth, with a continuous fine medial carina. The first abdominal tergite is large and conspicuous, often of a pale color (pink, white or yellow) which contrasts with the green or brown ground color. Medial carina of

Table 2. *Rhicnoderma* species, dimensions in mm. Character abbreviations: L, length of body from frons to tip of abdomen. F, length of hind femur. FW, maximal width of hind femur. IOS, interocular space. FRW, width of frontal ridge (taken at level of antennae). ANT, length of antennal flagellum. H+PN, Length of head plus pronotum. P, length of pronotum in midline. H depth, length of head from tip of mouthparts to top of occiput. Ta1, Ta2, Ta3, Lengths of first, second and third tarsal joints of the hind foot. "Foot formula", the relative lengths (as percentage of their total) of first, second and third tarsal joints of the hind foot. Shaded columns are ratios, not dimensions.

	Charact.	L	F	FW	F/ FW	IOS	FRW	IOS/ FRW	ANT	H +PN	ANT/ H+PN	P	H depth	HD/P	Ta1	Ta2	Ta3	Ta1-3
Locality	sp. no.																	
Rhicnoderma olivaceum		female holotype																
"Chiriquí"	no number	40.94	20.05	4.15	4.83	3.40	1.30	2.62	broken	11.94	unknown	5.02	9.33	1.86	broken	broken	broken	broken
Rhicnoderma olivaceum female ex Bahia honda																		
Bahia honda	2003445	47.86	21.21	4.35	4.88	3.60	1.43	2.52	12.82	10.03	1.28	5.55	10.54	1.90	3.36	2.26	2.88	8.50
Rh. olivaceum female (lectotype of *Rhicnoderma glabra* Bruner)																		
Pozo Azul	no number	50.95	21.5	4.64	4.63	3.52	1.37	2.57	broken	11.18	unknown	5.73	10.71	1.87	3.31	2.52	3.05	8.88
Means		46.58	20.92	4.38	4.78	3.51	1.37	2.57	12.82	11.05	1.28	5.43	10.19	1.88	3.34	2.39	2.97	8.69
													foot formula:		0.38	0.28	0.34	1.00
Rhicnoderma olivaceum		male (lectotype of *Rh. glabra* Bruner)																
Pozo Azul	no number	34.00	18.13	3.47	5.22				12.80	7.13	1.80				2.00	1.07	2.07	5.14
													foot formula:		0.39	0.21	0.40	
Rhicnoderma humilis		females																
S.Luis, MV	002 443095	30.62	15.96	3.70	4.31	2.50	1.00	2.50	broken	8.29	unknown	4.93	7.78	1.58	2.48	1.72	2.40	6.60
Carara	91230	37.38	18.33	4.17	4.40	3.10	1.19	2.61	11.22	8.80	1.28	5.49	9.07	1.17	2.87	1.90	2.53	7.30
Carara	91231	35.07	18.09	4.26	4.25	2.85	1.33	2.14	broken	9.76	unknown	5.37	8.53	1.59	2.62	1.85	2.72	7.19
Carara	91232	38.13	17.97	4.18	4.30	3.04	1.23	2.47	broken	9.10	unknown	5.80	8.80	1.52	2.67	1.80	2.80	7.27
Cabo Blanco	2001060	40.30	18.06	4.15	4.35	2.76	1.16	2.38	10.66	9.20	1.16	5.30	8.50	1.60	2.89	1.90	2.82	7.61
Means		36.30	17.68	4.09	4.32	2.85	1.18	2.42	10.94	9.03	1.22	5.38	8.54	1.49	2.71	1.83	2.65	7.19
													foot formula:		0.38	0.25	0.37	1.00
Rhicnoderma humilis		males																
R. Naranjo	94034	32.12	16.2	3.58	4.53	2.14	1	2.14	broken	7.84		4.6	6.9	1.50	2.36	1.64	2.29	6.29
Carara	91227	33.6	17.92	3.98	4.50	2.43	1.14	2.13	12.3	8.8	1.40	5.19	7.77	1.50	2.52	1.73	2.29	6.54
Carara	91234	36.25	18.19	4.15	4.38	2.5	1.17	2.14	11.88	9.24	1.29	5.36	8.2	1.53	2.84	1.87	2.74	7.45
Carara	91225	37.8	18.8	4.5	4.18	2.81	1.06	2.65	11.76	9.83	1.20	5.86	8.53	1.46	3.08	2.1	2.81	7.99
Cabo Blanco	2001061	35.86	18.4	4.15	4.43	2.39	1	2.39	13.28	8.4	1.58	5.1	8.19	1.61	2.89	2.11	2.81	7.81
Means		35.13	17.90	4.07	4.40	2.45	1.07	2.29	12.31	8.82	1.37	5.22	7.92	1.52	2.83	1.95	2.66	7.45
													foot formula:		0.38	0.26	0.36	1.00
																		0.00
Rhicnoderma basalis holotype female																		
	no number	42.03	20.06	5.12	3.92	3.31	1.55	2.14	broken	11.4	unknown	6.91	10.38	1.50	3.25	2.28	2.7	8.23
													foot formula:		0.39	0.28	0.33	
Rh. basalis male (holotype of *Rh. pugnax*)																		
	no number	32.5	14.28	3.31	4.31	2.28	1.15	1.98	10.54	8.2	1.29	4.1	7.6	1.85	2.27	1.63	2.35	6.25
													foot formula:		0.36	0.26	n	

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Fig.1. *Rhicnoderma humilis* Rehn, male. Habitus. For color version, see Plate 2.



the second abdominal segment of the female devoid of any anterior tubercle (differentiates from *Pararhicnoderma.)* Tenth abdominal tergite completely divided; male furcula absent. Supra-anal plate (Fig. 3) roughly triangular, transversely divided, with a smoothly rounded tip. Cerci styliform, simple. Male subgenital plate pointed, only slightly exceeding the supra-anal plate in length, the tip entire, not bifid. Ovipositor valves robust, with lamellate smooth edges. Tips of dorsal valves emarginate on their inner edges and converge inwards. Phallic structure (Fig. 4) typical of the Rhicnoderma group, as follows: epiphallic layer: consists of a minute bridge-shaped epiphallus and no ventrolateral sclerites. Ectophallic layer: the cingulum is capsular, with paired dorsal posterior processes on the zygoma, which has an internal medial ridge and short, flat, weakly developed apodemes. The cingular rami meet ventrally but do not fuse and on their posterior margin their sheath forms short, cross-striated aedeagal valves. Endophallic layer: the endophallus bears small anterior apodemes, laterally flattened and divergent; the gonopore process is slender and digitiform with a T-shaped tip. The middle and posterior parts of the endophallus consist of two long fine laterodorsal rods, completely lacking a differentiated posterior part and without a flexure. They end within the zygoma without participating in the aedeagal sclerites. Ejaculatory and spermatophore sacs both voluminous.

Dimensions.—See Table 2.

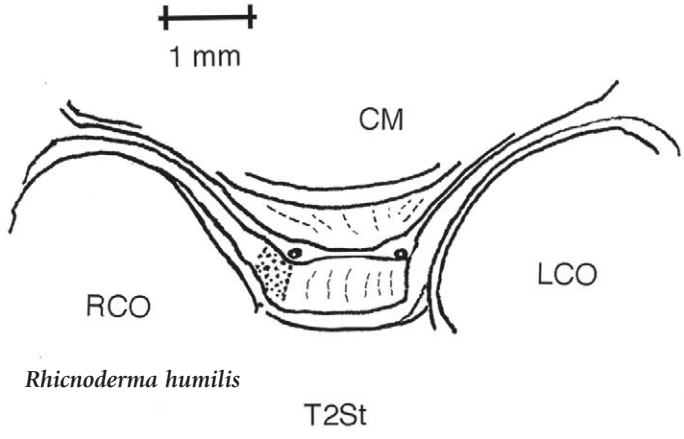


Fig. 2. *Rhicnoderma humilis*. Prosternal process in oblique ventral view. CM, cervical membrane; RCO, LCO, Right and left coxal opening; T2St, mesosternum.

Included species.— Four: *Rh. olivaceum* Gerstaecker *(= glabra* Bruner*); humilis* Rehn*; basalis* Bruner *(=pugnax* Bruner). Also including an undescribed species from Sumidero, Chiapas, Mexico, which is retained by the MNHN Paris. The males of this Chiapas species are green, have the inner hind femur orange red, 9 external tibial spines, and a greatly inflated tip to the subgenital plate.

Key to species of *Rhicnoderma*

A. Females:

1. Medium-large insects, body length (L) = 41-51 mm. Pronotal episternum in lateral view projects beyond the adjacent anterior margin of the pronotal lobes, and is asymetrically rounded at its tip (Fig. 6A). All known specimens (only 3!) are unicolorous light green, with knee arch and hind tibia weakly tinged with light brown. (See Plate 1). By analogy with other species, a brown morph may also exist. Western Panama and South Western Costa Rica . . . . . ***olivaceum*** Gerstaecker.
1A. Not as above. 2

2. Medium-size insects, L = 30-40 mm (mean 36 mm). Pronotal episternum in lateral view does not project beyond the adjacent anterior margin of the pronotal lobes, and is irregularly straight or bifid or trifid at its tip (Fig. 6C). Supra-anal plate narrower than long,

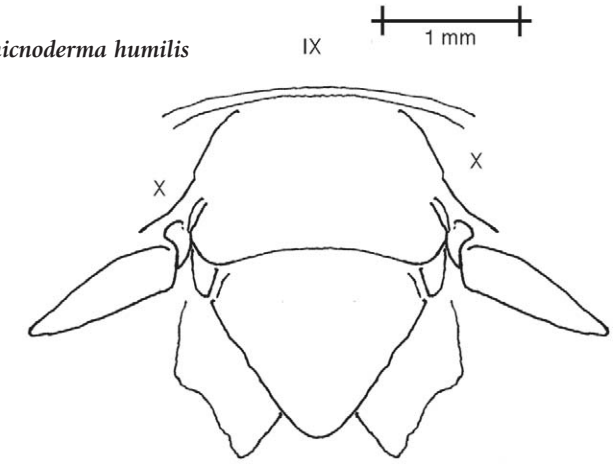


Fig. 3. *Rhicnoderma humilis*. Female supra-anal plate, paraprocts and cerci. IX, X, ninth and tenth abdominal tergites.

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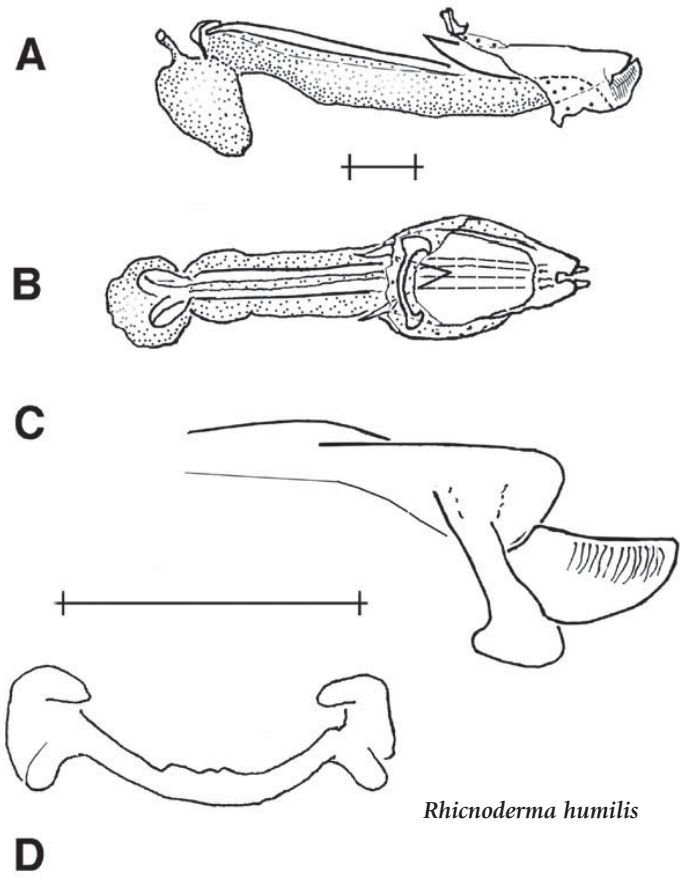


Fig. 4. *Rhicnoderma humilis*. Phallus. A. Entire phallus in lateral view. B. Entire phallus in dorsal view. C. Posterior tip of cingulum and ectophallic valves, lateral view. D. Epiphallus, dorsal view. Scale-bars, 1 mm. The upper bar refers to A & B, the lower bar to C & D.

subtriangular, with a rounded tip (Fig. 5). Two color morphs, green and brown. The green form (see Plate 5) is unicolorous, apart from yellow-brown eyes and outer sides of hind knees; the anterior margin of the pronotum is outlined with yellow in fresh specimens. First and second tarsal segments of hind foot red, third segment greenish brown, inner face of hind femur and hind tibia dark blue, drying black. Hind tarsal spines whitish with black tips. Brown females vary considerably in their depth of color and complexity of pattern (see Plate 4, Plate 6). Some are almost all black. Typically the head, apart from the mouthparts, is black, as are the hind knees. The distal part of the hind tibia, and all of the foot, are red. Inner surface of hind femur and hind tibia dark brown or black. Outer surface of hind femur light brown. Some green coloration may persist on the pronotum and the outer face of the hind femur. Especially in darker forms, the first abdominal tergite is noticeably paler, giving the impression of a yellow band around the body. Western Costa Rica from the Osa Peninsula to northern Guanacaste, including Tilarán and Nicoya . . . . . ***humilis*** Rehn

2A. Not as above 3

3. Medium sized insects, L = 42 mm (sole measured individual). Prothoracic episternum in lateral view does not project beyond the adjacent anterior margin of the pronotal lobes, and is symmetrically rounded (Fig. 6) with a slight tendency to being bifid at the extreme tip.Vertex and fastigium with a faint medial carina, continued weakly onto the pronotum as an absence of integumentary pitting rather than a raised carina. Supra-anal plate as wide as long, smoothly rounded (Fig. 5). Available female specimens are all of the brown color form (Plate 7); by analogy with the closely similar *humilis*, a green form is also possible. General color a rather uniform olive brown, the 1st abdominal tergite is noticeably paler, yellow or almost white. Occiput and anterior part of 2nd abdominal segment darker brown. Hind knees blackish brown. Outer and inner faces of hind femur a lighter brown, tinged pink. Hind tibia: outer face reddish brown, inner and anterior faces black. Outer spines light brown with black tips, inner spines black. First and second hind tarsal segments bright red, third segment reddish brown. Abdominal segments with posterior margins picked out in blackish color. Southern Mexico (Veracruz, Guerrero, Tehuantepec), Yucatan . . . . . ***basalis*** Bruner

B. Males:

1. Medium sized insects, L = 34 mm (sole measured individual.) Pronotal episternum in lateral view projects beyond the adjacent anterior margin of the pronotal lobe, is asymmetrically rounded at the tip and slightly angled downwards (Fig 6B). Hind femora green, hind tibia red. Rest of body was probably green in life (only museum specimen available). . . . . (*olivaceum* Gerstaecker)

2. Medium sized insects. L_{mean} = 35 mm. Pronotal episternum and supra-anal plate as described in 2 above for female *humilis*. Coloration: a brown form exists, but it is rare (less than 1 in 30 individuals). Most males examined are predominantly green (Plate 2, Plate 3) on pronotum, thoracic pleura, fore and middle legs, and hind femur. Head black, except for yellow mouthparts and eyes. Antennae dark red-brown, paler distally. Anterior margin of pronotum lined with yellow, posterior margin with black. First abdominal tergite bright yellow, second abdominal tergite predominantly black. Remaining abdominal segments green laterally and ventrally, light brown dorsally with a narrow black ring at the posterior margin of the tergite. Hind femora green, knee black, genicular membrane shining white. Hind tibia and tarsi bright red. Western Costa Rica from the Osa Peninsula to northern Guanacaste, including Tilarán . . . . . *humilis* Rehn

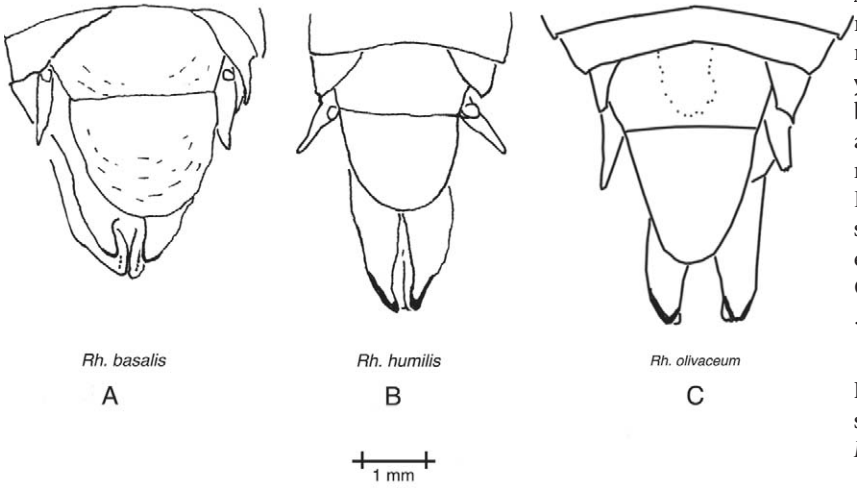


Fig. 5. Female terminalia, to show especially the supra-anal plate. A. *Rh. basalis*, B. Rh. *humilis*, C. *Rh. olivaceum*.

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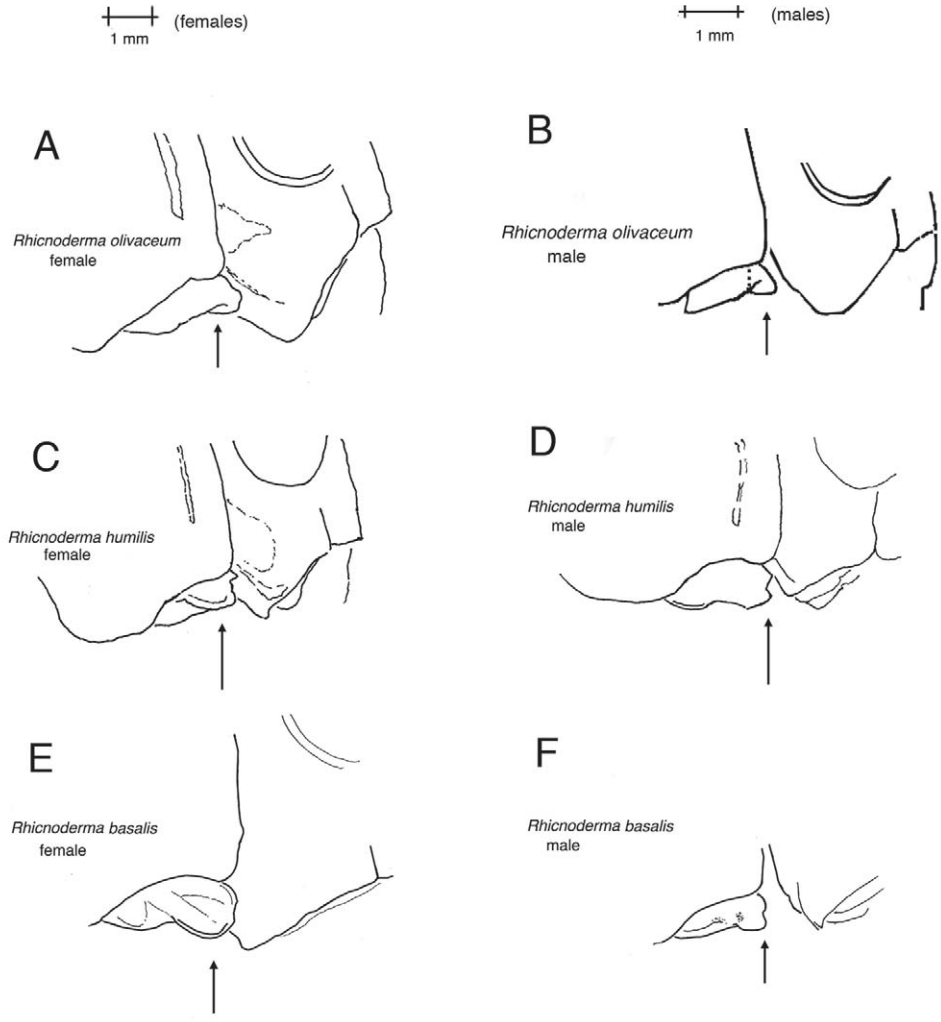


Fig. 6. Prothoracic episterna in *Rhicnoderma* spp. A, *Rh. olivaceum*, female; B, *Rh. olivaceum*, male; C, *Rh. humilis*, female; D. *Rh. humilis*, male: E, *Rh. basalis*, female; F. *Rh. basalis*, male. Arrows indicate the anterior faces of the episterna.

pronotum yellow. First abdominal segment pale yellow or whitish, bordered with black on the adjacent segments. Ventral surface of hind femora reddish. Hind knee blackish brown on both internal and external faces. External face of hind tibia reddish brown, internal face black. Hind tarsi bright red. Southern Mexico (Veracruz, Guerrero, Tehuantepec), Yucatan. . . . . *basalis* Bruner

Note 1: *Rh. basalis* and *Rh. humilis* are extremely similar, and may well be subspecies of a single taxon that perhaps extends up the entire Pacific coast of Central America, a possibility already entertained by Rehn 1938: 60.

Note 2. *Rh. basalis* and *Rh. humilis* occur intermittently throughout the literature as "*basale*" and "*humile*". This confusion dates back to inconsistent usage by both Rehn and Bruner. The OSF on-line (Eades *et al.* 2011) lists the –e forms as junior synonyms of the –is forms.

***Lempira* Rehn, 1938 (new status)**

2A. Not as above 3

3. Medium sized insects. L = 32.5 mm (sole measured individual). Antennae dark red brown. Prothoracic episternum in lateral view does not project beyond the adjacent anterior margin of the pronotal lobes, and is slightly bifurcate at its anterior margin. Prosternal process transverse, chisel shaped, but not as wide as in other species. Supra-anal plate triangular, transversely divided. General color olive brown (See Plate 8). Head dark brown. Anterior margin of

Type species.—Rhicnoderma (*Lempira) archimimus* Rehn, 1938: 63, by original designation.

Differs from *Rhicnoderma* s. str. and *Pararhicnoderma* nov. as follows: metazona of pronotum covers somewhat more of the mesonotum. Medial pronotal carina weakly cristate behind the first and third sulci, lower in the prozona but higher in the metazona. Rehn's (1938) description at first seems to suggest that in both sexes the medial carina of the pronotum "is represented by separated, linearly disposed cristulate nodes". Only on a closer reading of the

Table 3. *Lempira metapanensis*, n.sp., dimensions in mm. Abbreviations as in Table 2 caption. M/F, ratio of male to female means.

Lempira metapanensis																	
	Males																
Charact.	L	F	FW	F/FW	IOS	FRW	I O S / FRW	ANT	H +PN	ANT/ H+PN	P	H depth	HD/P	Ta1	Ta2	Ta3	Ta1-3
2011117	26.50	14.47	2.97	4.87	2.10	0.75	2.80	10.50	6.60	1.59	3.90	6.65	1.71	2.54	1.80	2.20	6.54
2011112	25.90	14.06	2.95	4.77	2.05	0.70	2.93	9.75	6.40	1.52	3.70	6.23	1.68	2.49	1.52	2.16	6.17
MEANS	26.20	14.27	2.96	4.82	2.08	0.73	2.86	10.13	6.50	1.56	3.80	6.44	1.69	2.52	1.66	2.18	6.36
												foot formula:		0.40	0.26	0.34	1.00
	Females																
2011121	27.68	14.90	3.49	4.27	2.75	0.84	3.27	8.45	7.07	1.20	4.73	7.45	1.58	2.53	1.67	2.17	6.37
2011104	23.81	12.14	2.66	4.56	2.20	0.66	3.33	6.00	6.85	0.88	4.30	5.96	1.39	2.00	1.58	1.60	3.18
2011130	30.38	13.65	3.25	4.20	2.50	0.94	2.66	7.35	6.87	1.07	4.33	7.02	1.62	2.23	1.42	2.00	5.65
MEANS	27.29	13.56	3.13	4.34	2.48	0.81	3.09	7.27	6.93	1.05	4.45	6.81	1.53	2.25	1.56	1.92	5.73
												foot formula:		0.39	0.27	0.34	
M/F	0.96	1.05	0.94	1.11	0.84	0.89	0.93	1.39	0.94	1.49	0.85	0.95	1.11	1.12	1.07	1.13	1.11

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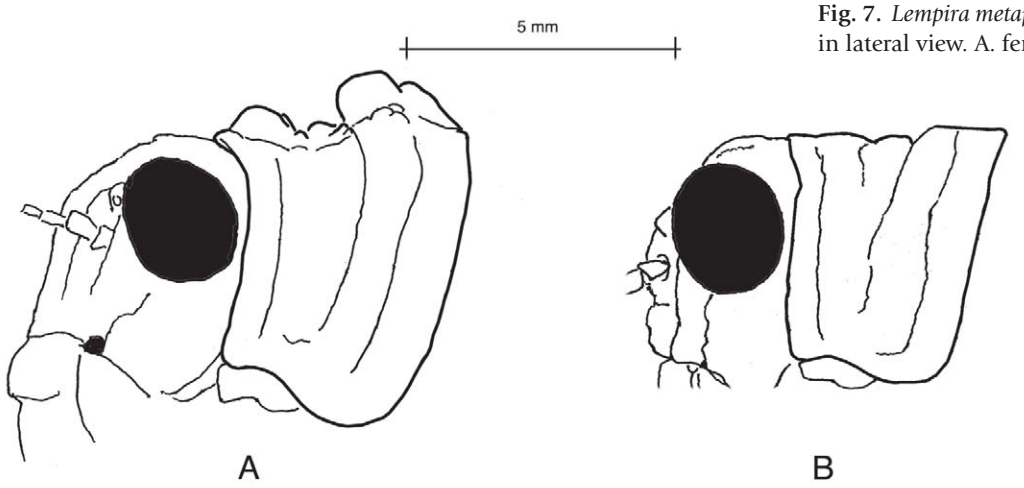


Fig. 7. *Lempira metapanensis* n. sp., head and pronotum in lateral view. A. female. B. male.

species' descriptions does it become clear that this is true only of the adult female; the male pronotum is almost flat in the midline. In the new species reported below (*L. metapanensis*) only the female pronotum is noticeably cristate; in the adult male it is almost flat (Fig. 7). Further, there are no raised cuticular structures in the mid line of the pronotum in larval specimens of either sex: instead, there are lines of nodules in the position of the lateral pronotal carinae, which disappear in the adult. These observations throw doubt on the relevance of Rehn's description of *L. arcanum*, which is known only from larval specimens. In other respect Rehn's generic description holds for the new species.

Male subgenital plate long, tapering and pointed, considerably exceeding the supra-anal plate in length (Fig. 8), its dorsal surface deeply grooved, but the tip entire.

Second abdominal tergite of female has no raised process on the medial carina (differentiates from *Pararhicnoderma*). Seven to eight external hind tibial spines.

Insects smaller, more rugose, browner; sexual dimorphism less than in most other rhicnodermoid genera, ratio M/F around 0.95 for linear measurements (See Table 3). Male PN lateral lobes with a pale yellow stripe which does not extend forward onto the genae and slopes upwards towards the rear of the pronotum, barely attaining the mesonotum. Females monochrome brown or with weak yellow markings on the mesonotum only, not on the pronotum.

There are two described species, *L. archimimus* Rehn, 1938 and *L. arcanum* Rehn, 1938, both from Honduras. Two undescribed species are known from Guatemala (MNHN Paris) and a third is described below from El Salvador (see also Plate 9, Plate 10, Plate 11).

Lempira metapanensis n. sp.

Holotype male.—EL SALVADOR, Dept. Sta Ana: Metapán, Finca El Limo, 14° 24′ 39.91″ N, 89° 24′ 28.07″ W, 1450 m., 27. August 2011 (Rowell, C.H.F.). Specimen no. 2011112. ANSP.
Paratype female, same data as holotype. Specimen no. 2011121. ANSP.

Etymology.— Derived from the name of the type locality.

Dimensions.—Table 3.

Male.— (Fig. 9, Plate 9, Plate 10, Plate 12) L, 26.0 mm; F, 14.3 mm. FW, 2.96 mm. Integument of head, dull and rugose; elsewhere, shiny but finely pitted. Antennae 40% longer than head and PN together, 20 flagellar segments, filiform. Fastigium and occiput with a weak medial carina, fastigium steeply downward sloping, almost vertical, delimited above the lateral ocelli by a weak carina. Frontal ridge above medial ocellus parallel sided, with prominent lateral carinae, about half the width of the interocular space, below medial ocellus subobsolete. Lateral facial carinae well developed, vertical and parallel, not diverging downwards (Fig. 10). Eyes large and protuberant, interocular space wide, more than twice the width of the frontal ridge between the antennae.

Pronotum very short, exposing mesonotum. Posterior margin straight, anterior margin slightly concave in midline, forming two small projections laterally which overhang the occiput. Up to 4 transverse sulci on the pronotum, of which only the posterior two

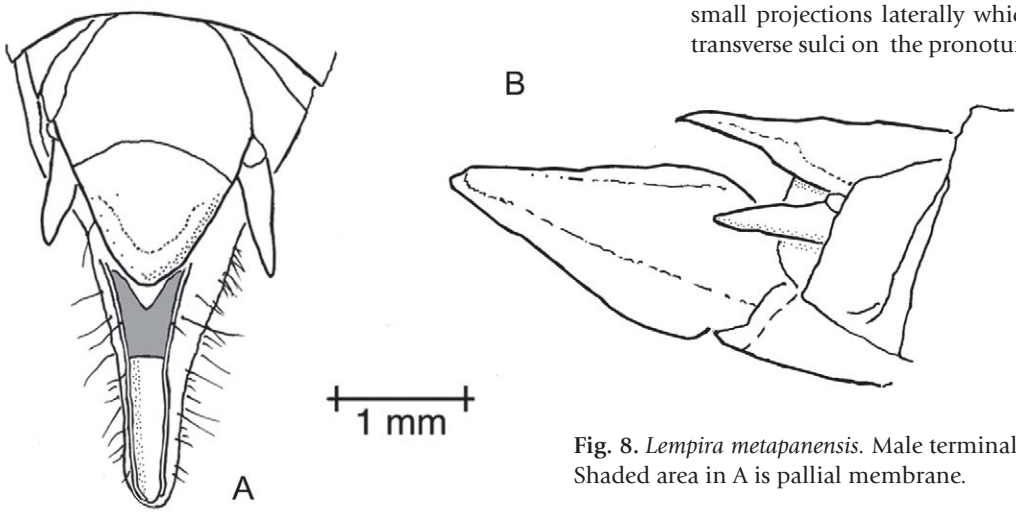


Fig. 8. *Lempira metapanensis.* Male terminalia. A. Dorsal view. B. Lateral view. Shaded area in A is pallial membrane.

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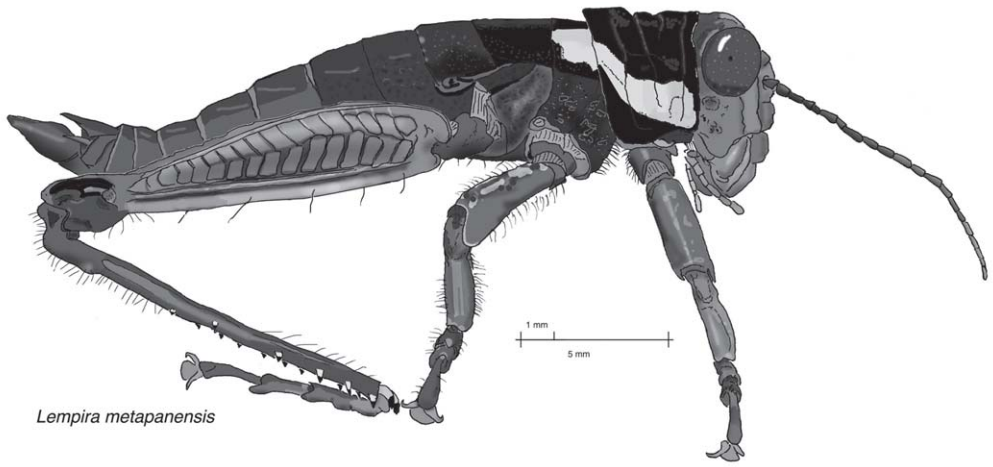


Fig. 9. *Lempira metapanensis, male,* habitus. For color version see Plate 12.

cross the disc. Integument slightly raised in side view between the third and fourth sulci, but not approaching the cristate condition of the female (Fig. 7). Prosternal process transverse, but almost devoid of a transverse apical ridge with elevated corners, much less sharply defined than in other Rhicnoderma-group genera. Mesosternal interspace much wider than long, metasternal lobes touching. Pterothoracic sterna slightly concave overall. Apterous and atympanate. Hind femora fairly short and broad, 4.7× as long as wide, with prominent sculpting on outer face; knees not exceeding the tip of abdomen. Lower knee lobes bluntly pointed. Hind tibia with 8-9 external spines, including the apical spine, and 11 internal ones. Inner tibial spurs longer than outer pair. Foot formula 40:26:34.

First seven abdominal tergites with a weak medial carina. Tenth abdominal tergite completely divided, supra-anal plate triangular with a rounded tip, divided transversely. Subgenital plate much longer than supra-anal plate, laterally compressed, tapering to a point, the dorsal surface behind the pallial membrane deeply grooved (Fig. 8). Cerci simple, conical, pointed.

Phallus of the typical type for the genus group (Fig. 11), with a very elongate rod-like endophallus..

Coloration.—Most areas brown. Antennae and cerci distally reddish brown. Fore and middle femora ornamented with orange blotching. Lower margin of lateral lobes of PN yellow, at the rear extending upwards onto sides of mesothoracic tergite. A black blotch in the midline of the tergite separates the two yellow patches. Inner face of hind femur black. Ventral face of hind femur, inner face of hind tibia, light blue (in fresh material).

Female.— (Plate 11), L = 27.82 mm. F = 14.79mm. FW = 3.3 mm. Slightly larger and less gracile than the male, with relatively shorter antennae. Differs from male in coloration and most conspicuously in the lateral profile of the pronotal crest (Fig. 7A), with prominent protuberances in both pro and metazona. No yellow markings on lateral lobes of pronotum, but diffuse yellow color on the sides of the mesothoracic tergum in some individuals. Ovipositor valves project clearly beyond the end of the supra-anal plate; posterior margins of subgenital plate concave, terminating in a slender and pointed egg guide. Cerci simple, conical, robust (Fig. 12).

Natural history.—Fairly common at the type locality in montane oak/pine forest at around 1500 m. Most individuals were found on the stems or leaf peduncles of robust herbs, rather than on woody shrubs or trees. *Urera* (Urticaceae) and *Costus* (Gingiberaceae) were especially favored plant genera. In August of 2011 the majority of individuals were half grown (second to third instar) larvae.

Key to species of *Lempira*

1. Internal face of hind femur black 2
1A. Internal face of hind femur brown 3

2A. Ventral face of hind femur black with violet carina. Internal and flexor face of hind tibia violet (Northern Honduras) . . . . . *archimimus* Rehn
2B. Ventral face of hind femur, internal face of hind tibia, light blue (in fresh material) (Northern El Salvador) . . . . . *metapanensis* nov.

3. Internal face of hind tibia apricot orange (Southern Honduras). . . . . *arcanum* Rehn

Note: the distinguishing characters of the aforementioned Honduran species, *L. arcanum*, are taken from Rehn 1938, and his specimens of *arcanum* were larval, not adult.

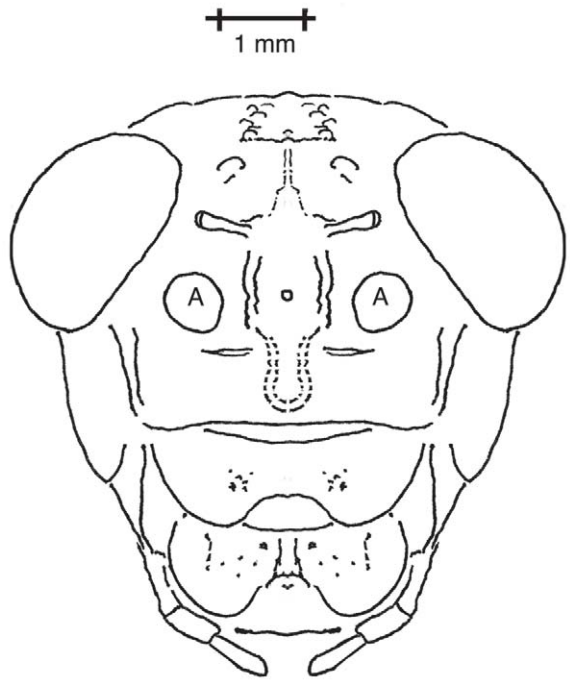


Fig. 10. *Lempira metapanensis*, face of male, frontal view. A, antennal openings.

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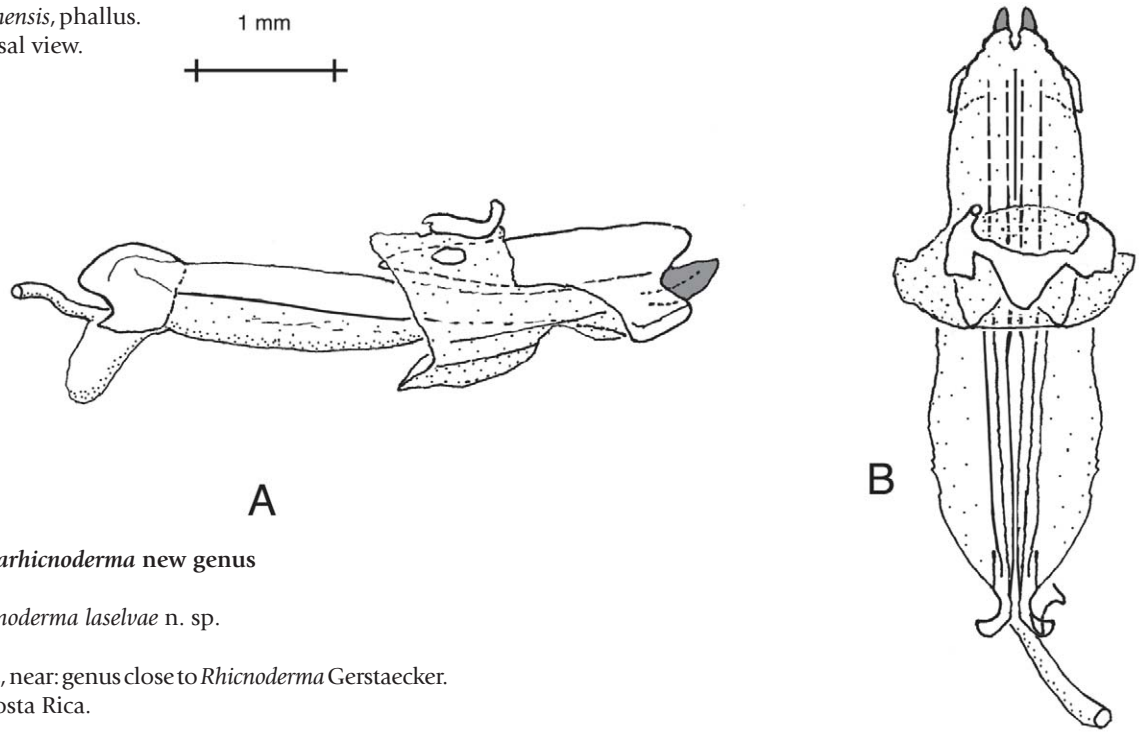


Fig. 11. *Lempira metapanensis*, phallus. A. Lateral view. B. Dorsal view.

***Pararhicnoderma* new genus**

Type species.—*Pararhicnoderma laselvae* n. sp.

Etymology.— Greek *para*, near: genus close to *Rhicnoderma* Gerstaecker. Range: S. Mexico to Costa Rica.

No. of species included.—Four are newly described below from Costa Rica; there are 3 other undescribed species, from Mexico (Chiapas, El Vergel), Honduras and Guatemala respectively (NMNH Paris).

Diagnosis.—Medium-sized, apterous and atympanate insects. Females are 30 to 35 mm in overall length, cylindrical in form, often with a highly rugose and frequently warty integument, green, brown or olive-brown in color. Males are smaller [Male values of L & F (Table 4) are 60- 90% of female values], more slender, somewhat flattened dorsoventrally, with smoother cuticle, and are ornamented with a horizontal pale band running across the lateral pronotal lobes to the thoracic pleura (but never affecting the mesoepisternum), and are generally more brightly colored.

Antennae filiform, sometimes slightly flattened, about as long (females, 0.85-1.6×) or about half as long again (males, 1.37-1.85×) as the head and pronotum together, 20 - 23 flagellar segments. Interocular space often bears a transverse row of three prominent nodules, and is twice as wide as the frontal ridge, the latter measured between the antennae. Fastigium essentially obsolete, vertex curves smoothly down into the frons, the fastigium itself is almost vertical. Margins of fastigium and of frontal ridge demarcated by irregular nodules. Frontal ridge above medial ocellus bounded by nodular carinae, more or less deeply sulcate; below the ocellus, obsolete. Galea very large, completely covering the mandibles in ventral view.

Pronotum cylindrical, disc crossed by up to 4 sulci, the second from the front usually more or less obsolete, the third being the most marked. Lateral pronotal carinae absent. Medial carina represented in some but not all spp., by a more or less linear row of irregular swellings. Anterior margin of pronotum emarginate medially, more so than in *Rhicnoderma* and *Lempira*, the embayment flanked by two small processes projecting over the occiput, each of which may bear a large tubercle. Posterior margin of pronotum straight.

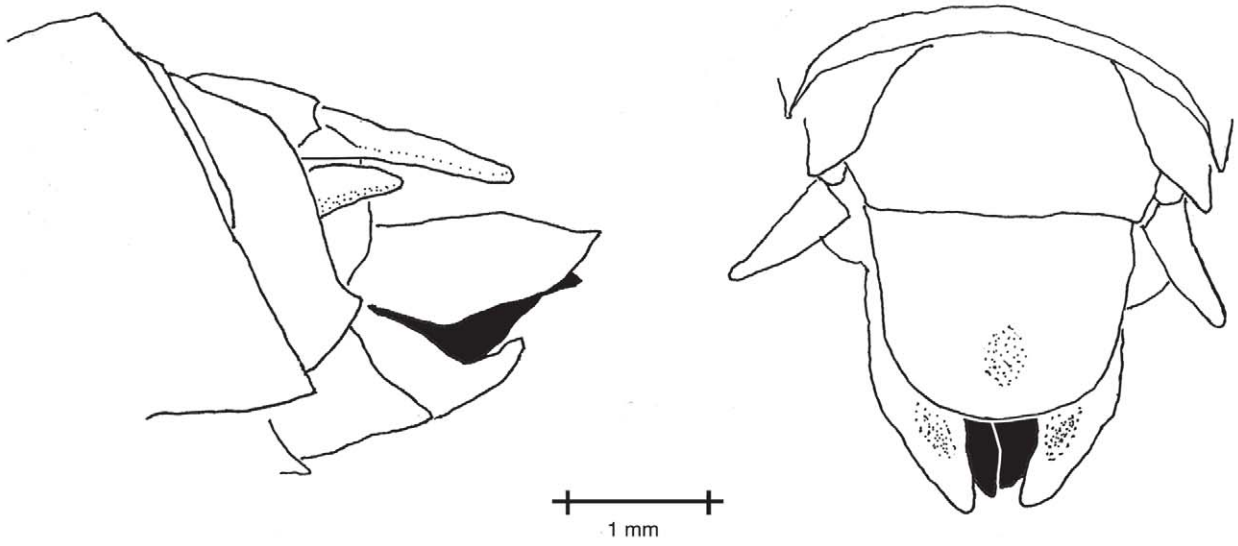


Fig. 12. *Lempira metapanensis*, female terminalia. The ventral ovipositor valves are colored black for clarity.

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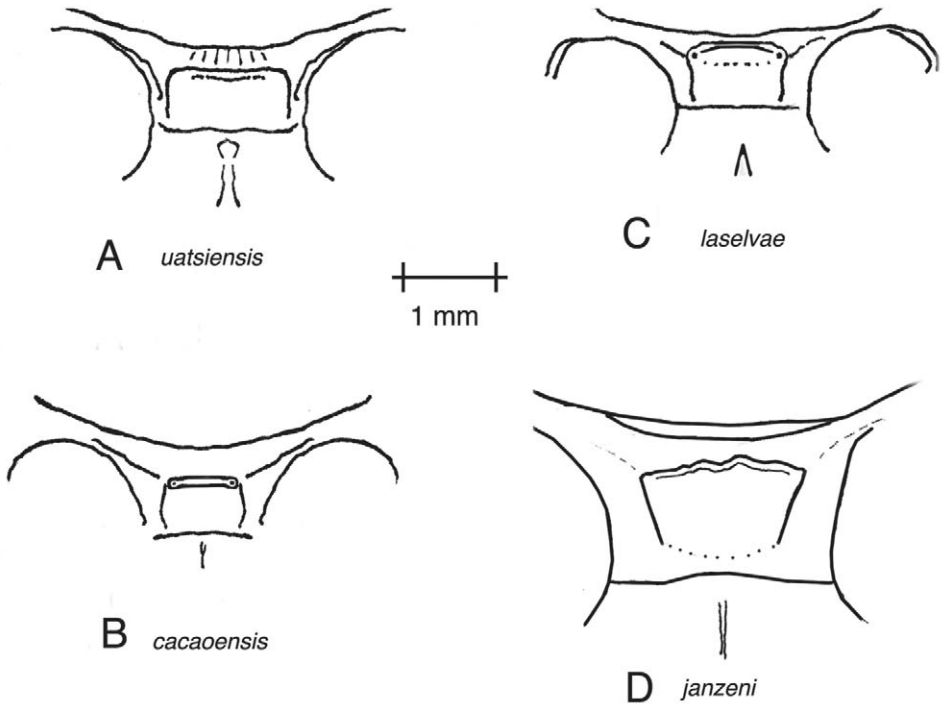


Fig.13. *Pararhicnoderma* spp. Prosternal processes, in ventral view.

Metazona very short, leaving mesonotum largely exposed. Lateral lobes of pronotum marked by a pale horizontal stripe in the male, extending over the pronotal lobes and often continuing onto the thoracic pleura (Plate 13). Prosternal process (Fig. 13) similar to that of *Rhicnoderma*, a long transverse ridge, the outer corners each bearing a small erect tubercle, the whole tending weakly towards a bifid condition. Mesosternal interspace transverse; metasternal lobes touching. All thoracic sterna slightly concave.

Apterous and atympanate. Fore and middle femora laterally compressed, wide. Hind femur not exceeding abdomen in length, 4.5 – 5.8× longer than wide; dorsal and ventral carinae coarsely and shallowly serrate (Fig.14). Inner and outer faces of the hind tibiae often of different, species-specific colors. Lobes of hind knee rounded, with a very small subterminal spine. Hind tibia with 5-6 external spines, plus external apical spine. Foot is long, the three tarsal segments being subequal, but the second segment is the shortest. Foot formula 35-37: 28-30: 34-35

Abdominal segments less rugose, with a continuous fine medial carina. At the anterior edge of the second abdominal segment of the female this carina bears a small, slightly raised tubercle; Dr. Amedegnato (*in litt.*) suggested it might serve as a stabilising foothold for the much smaller male during copulation. This structure is rather variable in size and shape between conspecific individuals, but is diagnostic for the genus (Plate 22). Tenth abdominal tergite completely divided. Supra-anal plate (Fig.15) triangular with a smoothly rounded tip, transversely divided. Cerci styliform, simple. Male subgenital plate pointed, only slightly exceeding the supra-anal plate in length, the tip minutely bifid or (rarely) entire. Ovipositor valves robust, with lamellate smooth edges. The tips of the dorsal valves converge inwards.

All ventral surfaces of the thorax and abdomen and the hind foot are more or less densely fringed with sensory hairs.

Phallus.—(Fig. 16) Epiphallic layer: consists of a minute bridge-shaped epiphallus and no ventrolateral sclerites.

Ectophallic layer: the cingulum is capsular, with paired dorsal posterior processes on the zygoma, which has an internal medial ridge and short, flat, weakly developed apodemes. The cingular rami meet ventrally but do not fuse and on their posterior margin their sheath forms cross-striated aedeagal valves.

Endophallic layer: The endophallus bears small anterior apodemes, laterally flattened and divergent, the gonopore process is slender and digitiform with a T-shaped tip.The middle and posterior parts of the endophallus consists of two long fine laterodorsal rods, completely lacking a differentiated posterior part and without a flexure. They end within the zygoma without forming aedeagal sclerites. Ejaculatory and spermatophore sacs both voluminous.

The species of *Pararhicnoderma* are all very similar, differing most obviously in color pattern, with few other differences. The most useful morphological characters are 1) the details of the rugosities and tuberculation of the head and prothorax of the females 2) the details of the prosternal process. The phalli of the different species described below do not differ appreciably from one another, and unfortunately provide no good species-specific characters.

Dimensions.—Table 4.

1. *Pararhicnoderma uatsiensis* n. sp.

Holotype male.—COSTA RICA: Prov. Limón: Cerro Uatsi (lies between the Valle de la Estrella and Valle del Sixaola, above Bri-brí), 600 m. 25. August 1997 (Rowell, C.H.F. & Singh, I.) Specimen no. 97207 (ANSP).
Paratype male (97206, RC) and paratype female (97208, ANSP), same date as holotype; holotype and paratype female in copulation.

Dimensions.—see Table 4. Habitus Fig. 18. See also Plates 13 - 17.

Male: integument finely punctate, but relatively smooth for the genus, not nodular. Antennae brown basally, shading to black distally, 20 flagellar segments. Fastigium with only a single pair of transversely elongated tubercles. Interocular space more or less

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Table 4. *Pararhicnoderma*, n. gen., dimensions in mm. Conventions as in Table 2 and 3.

Pararhicnoderma																			
	Charact.		L	F	FW	F/FW	IOS	FRW	IOS/ FRW	ANT	H +PN	ANT/ H+PN	P	H depth	HD/P	Ta1	Ta2	Ta3	Ta1-3
Sp.	Locality	Sp. no.																	
A. Females																			
P. laselvae	Toro amarillo		34.92	16.24	3.37	4.82	2.79	1.20	2.33	9.50	7.89	1.20	4.00	7.50	1.88				
	La Selva		34.03	16.4	3.1	5.29	2.4	1.21	1.98	12.83	8.05	1.59	4.1	7.6	1.85				0
	MEAN		34.48	16.32	3.24	5.05	2.60	1.21	2.15	11.17	7.97	1.40	4.05	7.55	1.86				
P. janzeni	S. Vito		30.83	15.38	2.95	5.21	2.42	1.09	2.22	n.a.	7.47	?	4.01	7.04	1.76				0
																			0
P. uatsiensis	Uatsi		33.65	15.84	3.5	4.53	2.1	1.1	1.91	6.27	7.4	0.85	3.85	6.98	1.81				0
																			0
P. cacaoensis	V. Cacao		30.00	15.33	3.00	5.11	2.35	0.97	2.42	9.10	7.10	1.28	3.93	6.88	1.75				0
																			0
B. Males																			
P. laselvae	Toro amarillo		22.88	11.44	2.10	5.45	1.62	0.79	2.05	7.90	5.16	1.53	2.67	4.85	1.82	n.a.	n.a.	n.a.	n.a.
	(Upala)	USUL	25.38	12.16	2.61	4.66	1.70	0.87	1.95	8.79	5.89	1.49	2.76	5.48	1.99	2.35	2.01	2.18	6.54
	La Selva		26.01	12.72	2.52	5.05	1.76	0.87	2.02	>8	5.99	>1.34	2.83	5.39	1.90	2.19	1.78	2.17	6.14
	MEAN		24.76	12.11	2.41	5.05	1.69	0.84	2.01	8.35	5.68	1.51	2.75	5.24	1.90	2.27	1.90	2.18	6.34
													Foot formula			0.36	0.30	0.34	1.00
																			0
P. janzeni	S. Vito		22.35	11.71	2.20	5.32	1.45	0.60	2.42	?	5.45	?	2.77	4.43	1.60				0
P. uatsiensis	Uatsi	97207	27.66	14.52	2.85	5.09	1.50	0.86	1.74	11.24	6.77	1.66	3.38	6.17	1.83	2.41	1.84	2.36	6.61
		97206	25.50	12.68	2.48	5.11	1.41	0.71	1.99	9.00	6.29	1.43	3.12	5.27	1.69	2.21	1.64	1.90	5.75
	MEAN		26.58	13.60	2.67	5.10	1.46	0.79	1.87	10.12	6.53	1.55	3.25	5.72	1.76	2.31	1.74	2.13	6.18
													Foot formula			0.37	0.28	0.34	1.00
																			0
P. cacaoensis	Cacao	CRI 000 097931	26.06	13.50	2.58	5.23	1.85	0.67	2.76	9.84	6.36	1.55	3.20	5.76	1.80	2.31	1.97	2.31	6.59
	Cacao	91170	27.45	14.16	2.56	5.53	1.75	0.81	2.16	11.04	6.19	1.78	3.23	6.14	1.90	2.60	2.11	2.72	7.43
	Cacao	CRI 000 48096	28.81	14.78	2.68	5.51	1.86	0.81	2.30	9.70	7.06	1.37	3.51	6.17	1.76	2.72	2.78	2.65	8.15
	S. Ramón	2001120	25.70	13.29	2.32	5.73	1.70	0.75	2.27	10.70	5.78	1.85	3.27	5.56	1.70	2.46	2.07	2.39	6.92
	Tenorio	2003284	26.37	14.62	2.61	5.60	1.90	0.94	2.02	10.48	6.59	1.59	3.55	5.99	1.69	2.81	2.20	2.74	7.75
		MEAN	26.88	14.07	2.55	5.52	1.81	0.80	2.30	10.35	6.40	1.63	3.35	5.92	1.77	2.58	2.23	2.56	7.37
													Foot formula			0.35	0.30	0.35	1.00

C. Sex dimorphism		L	F
		M/F	M/F
laselvae	(Toro amarillo)	0.66	0.70
	(La selva)	0.73	0.74
	MEAN	0.69	0.72
P. janzeni	S. Vito	0.72	0.76
	Cerro Uatsi	0.72	0.76
uatsiensis	Cerro Uatsi	0.79	0.86
cacaoensis	V. Cacao	0.90	0.92

smooth, lacking three prominent tubercles arranged in a transverse line. Prosternal process (Fig. 13A) transverse, chisel-shaped, without obvious tubercles at its extremities. Dorsal carinae of hind femur only very slighty serrate (Fig.14D). Male SGP bluntly conical, the tip entire and not bifid in dorsal aspect.

Coloration.— Head and eyes brown, palps green, postocular stripe cream, continued across the pronotal lobes and thoracic pleura and ending on the first abdominal pleura, but not extending to the tergum of this segment. Pronotal disc dark brown, pronotal lobes olive brown below pale stripe. Abdomen chestnut brown dorsally, shading to olive green laterally. Abdominal sterna yellowish. Legs green; hind knee olive brown dorsally, outer ventral lobe of hind knee olive green, with an angular tip. Internal ventral lobe of hind knee bright red. Hind tibiae and first two tarsal segments bright red on both internal and external faces. Distal tarsal segment olive green.

Female: fastigium with only a single pair of transversely elongated tubercles. Interocular space more or less smooth, lacking prominent tubercles arranged in a transverse line. (If present at all, these are broad and indistinct, as in Fig.17 G-I.) Pronotal sulci: the first is well marked but does not cross disc dorsally. Second is more or less completely obsolete, but a very small segment is visible in midline of disc only. Third and fourth well marked and cross the disc. Disc of pronotum devoid of large swellings, tubercles confined to the two processes of the anterior margin (Fig. 17I).

Coloration.—Light olive green, finely mottled with light brown and speckled with small black spots. Inner, ventral and dorsal faces of hind tibia and first two tarsal segments red, but outer tibial face is mottled olive brown (see Plate 17).

Distribution.—Currently known only from the type locality in S.E. Costa Rica.

2. *Pararhicnoderma cacaoensis* n. sp.

Holotype male.—COSTA RICA: Prov. Guanacaste: S.W. slope of Volcan Cacao, 1000-1400 m., LN 323300_375700 Oct 1989 (Blanco R, Chavez C), Specimen no. CRI000 097931 (INBio).

Male Paratypes.—1/. Locality data as holotype; July 1989 (GNP Biodiv. Survey), specimen no. CRI000 048096 (INBio). 2/. COSTA RICA: Prov. Guanacaste: S.W. slope of Volcan Cacao, 1040 m., LN 323300 375300, 25.July 1991 (Rowell CHF, Elsner N), specimen no. 91170. ANSP. 3/. COSTA RICA: Prov. Guanacaste: P.N. Tenorio,

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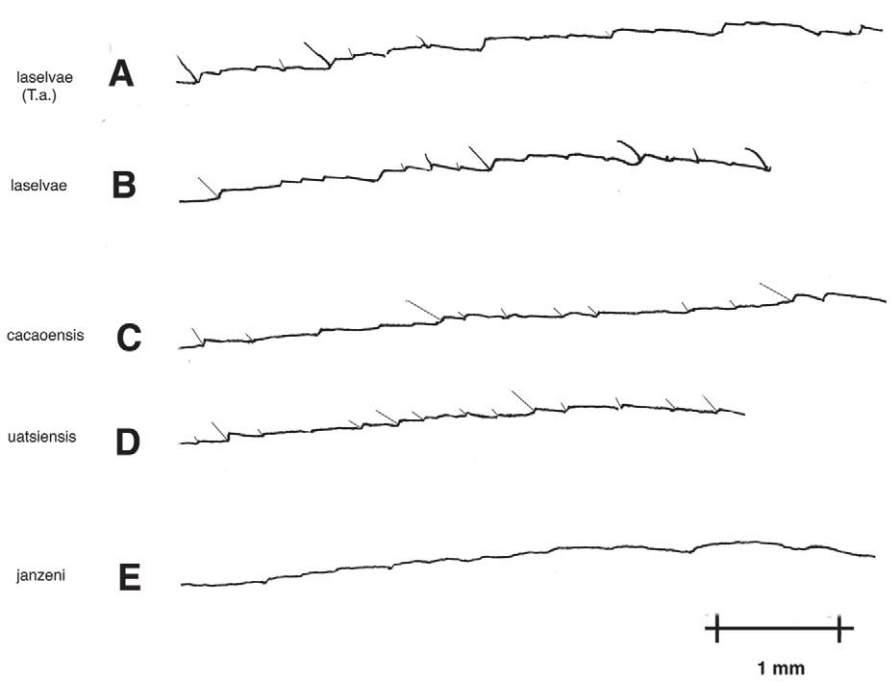


Fig.14. *Pararhicnoderma* spp. Males. Dorsal carina of hind femur in ventral view, to show extent of serrations. A & B. *P. laselvae* (A. is the specimen from Río Toro Amarillo, B from Puerto Viejo). C. *P. cacaoensis*. D. *P. uastsiensis*. *E. P. janzeni*.

1 km NE of Estación Los Jilgueros, 1000m. LN 288800_428600, 7. October 2003 (Rowell CHF, Azofeifa JA). Specimen no. 2003284. RC. 4/. COSTA RICA: Prov. Alajuela: Res. Biol. San Ramón, Rio S. Lorencito. 1030 m. LN 243900_471000 (Rowell CHF) Specimen no. 2001120 (RC).

Female paratypes.—1/. Data as holotype, but September 1989. specimen no. CRI000 042872. INBio. 2/. Locality data as holotype, but 15 April 1988 (Espinoza M). Specimen no. CRI000 036472. INBio. 3/. Data as male paratype 2/, but 26 July 1991. Specimen no. 91171. ANSP. 4/. Data as male paratype 2/, but 24 July 1991. Specimen no. 91169. RC. 5/. COSTA RICA: Prov. Puntarenas: Res. Biol. Monteverde, Sendero nuboso, LN 253500_ 449400. 15. February 1978. Specimen no. 78102 (Malaret L). RC.

Dimensions.—See Table 1. Habitus Fig.19. See also Plate13B and Plate 18.

In form and coloration very similar to preceding species, *P. uatsiensis*. Differs from that species as follows:

Male: prosternal process transverse, chisel shaped, somewhat less wide than that of *P. uatsiensis*, and the outer corners of the apical ridge are decorated with two minute tubercles (Fig. 13B). Interocular space rugose, but devoid of a transverse row of three tubercles. Fastigium with a single transverse row of two tubercles, each somewhat elongated laterally. Pronotum devoid of swellings or tubercles, except on the two processes of the anterior margin. Integument more or less deeply punctate. The second pronotal sulcus is better defined in this species than in the others. Dorsal carina of hind femur only slightly serrate, similar to that of *uatsiensis (*Fig. 14C*)*. Tip of subgenital plate clearly bifid.

Coloration.— Brown coloration of thoracic tergites separated from the white lateral stripe by a broad black band, which extends forward over the pronotum to cover the vertex and occiput of the head. Joints between abdominal segments ringed with black. Antennal scape green, flagellum black, 20 flagellar segments. The white stripes running from the anterior edges of the pronotum to the 1st abdominal pleura continue dorsally over the 1st abdominal tergite, giving a white ring around the animal in dorsal view. Hind knee, shiny black, especially on its inner face; lower lobe of outer face green. Hind tibia: outer face light brown, remaining faces shiny black. Tarsus: first and second segments pink, third segment olive green.

Female: integument much more rugose than in male. Fastigium with two transverse rows of paired, laterally elongated tubercles. Interocular space variably rugose, but usually with 2, sometimes 3 small tubercles, arranged transversely. Pronotum decorated with a single prominent medial swelling situated on the disc between the first and second pronotal sulci, composed of several tubercles; this structure is diagnostic of the females of this species (Fig. 17D-F).

Coloration.—Olive brown or olive green, speckled with isolated black spots. Most individuals show one or two diffuse transverse darker bands on the hind femur. Inner face of hind knee and hind tibia shiny black, sometimes this color extends onto outer face of knee and inner face of hind femur. Outer face of hind tibia grey-brown or olive green. Tarsus: first and second segments pink, third segment olive green.

Distribution, natural history.—Found in montane and cloud forest along the chain of the Cordillera del Norte, from Tilarán north through the mountains of Guanacaste, and may well extend into Nicaragua. Usually found on Fabaceous trees, such as *Lonchocarpus* and *Pterocarpus*, and eats their foliage in captivity.

3. Pararhicnoderma laselvae n. sp.

Holotype male.— COSTA RICA: Prov. Heredia: Puerto Viejo: Finca La Selva, 40m. , LN 268800_ 5300, 5 September 1983 (H.E. Braker). Specimen no. 83092 (ANSP).

Paratype males.—1/ COSTA RICA: Prov. Alajuela: 20 km. S. of Upala. 28-30 August 1990 (Parker FD). (This locality is 4 km N. of Bijagua, 350 m., LN 30600_423000). Specimen no. 94037 (RC). 2/ COSTA

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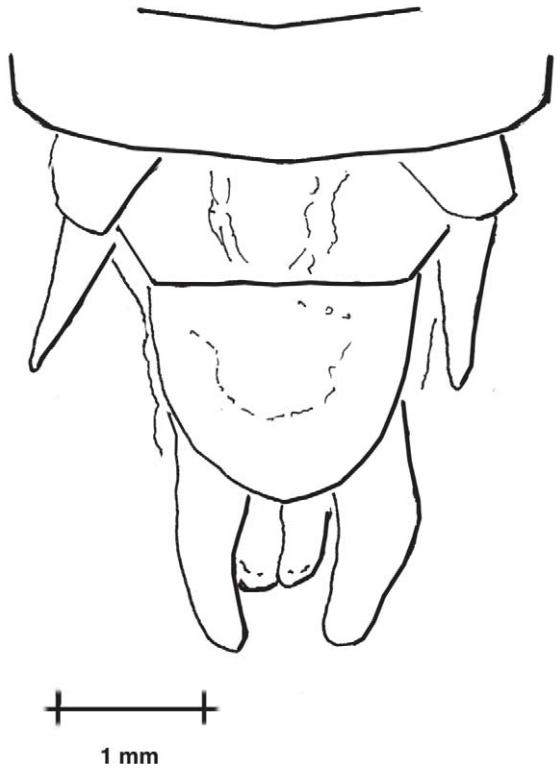


Fig. 15. *Pararhicnoderma uatsiensis*. Female terminalia, dorsal view.

RICA: Prov. Limón: 7 km W. of Guapiles, at crossing of Rio Toro Amarillo, on road to S. José. 14 August 1964 (S.P. Hubbell). In cop. with female paratype 2. (This locality was a patch of woodland around and under the road bridge, which was destroyed in the modernisation of the highway in the 1970s. Its Lambert North co-ordinates were LN 243300_556400).UMMZ.

Paratype females.—1/ Locality data as holotype, 13.September 1976 (Rowell, CHF). Specimen no. 76141 (ANSP). 2/ All data as male paratype 2.

Dimensions.—See Table 1. Habitus Fig. 13. See also Plate 19, Plate 20.

Male: integument rugose and granular. Fastigium with two horizontal rows each of two tubercles, those of the lower row being laterally elongated. Interocular space with a transverse row of three distinct round tubercles. The paired projections of the anterior margin of the pronotum are also decorated with smaller tubercles (Fig. 17 A-C). The midline of the disc of the pronotum bears two or three small swellings, considerably smaller than that seen in the female of *Rh. cacao*, situated between the sulci and visible in profile (Fig. 17B), lying between the first and second, second and third, and third and fourth sulci respectively. Hind femur with a prominent "herrringbone" pattern on the outer face, with nodular decoration. Tip of lower lobe of hind knee truncate, slightly rounded. Dorsal carina of femur coarsely but shallowly serrate (Fig. 14A, B). Ventral surfaces of legs and abdomen richly provided with whitish hairs. Tip of subgenital plate minutely bifid.

Coloration: (See Plates 19, 20). General coloration in life dark moss green, heavily marbled with olive brown and black. Antennae basal segments green, flagellar segments brown, lightening to pale red brown at the tips, with 3- 4 narrow yellow bands. Palps green. Eyes brown, mottled with white. Postocular band pale, cream colored, indistinct or absent on the head, continued more distinctly across the pronotal lobes, and very weakly onto the lateral regions of the mesothoracic tergum. In some but not all males the pale pronotal band is interrupted at the level of the third pronotal sulcus, forming two discrete patches of pale color (see Plate 21). Underside yellow grey. Legs green. Hind femur: outer face dark leaf green, hind knee brown dorsally, outer ventral knee lobe green. Ventral face of femur dark blue in life, in dried specimens turning blackish brown. Outer face of hind tibia pale greyish brown or green, inner face dark blue in life, drying to dark brown. First two tarsal joints pink, third joint olive green. Intersegmental membranes of the leg joints are bluish -purple in life.

Female: relatively robust, integument rugose and granular. Head and pronotum bear the same array of tubercles and swellings as detailed for the male (Fig. 17A-C), and the antennae are similarly colored, with pale-banded tips.

Coloration.—General coloration green, marbled with brown and black. The hind femur is less uniformly green than in the male, and has the traces of two darker transverse bands. Coloration of

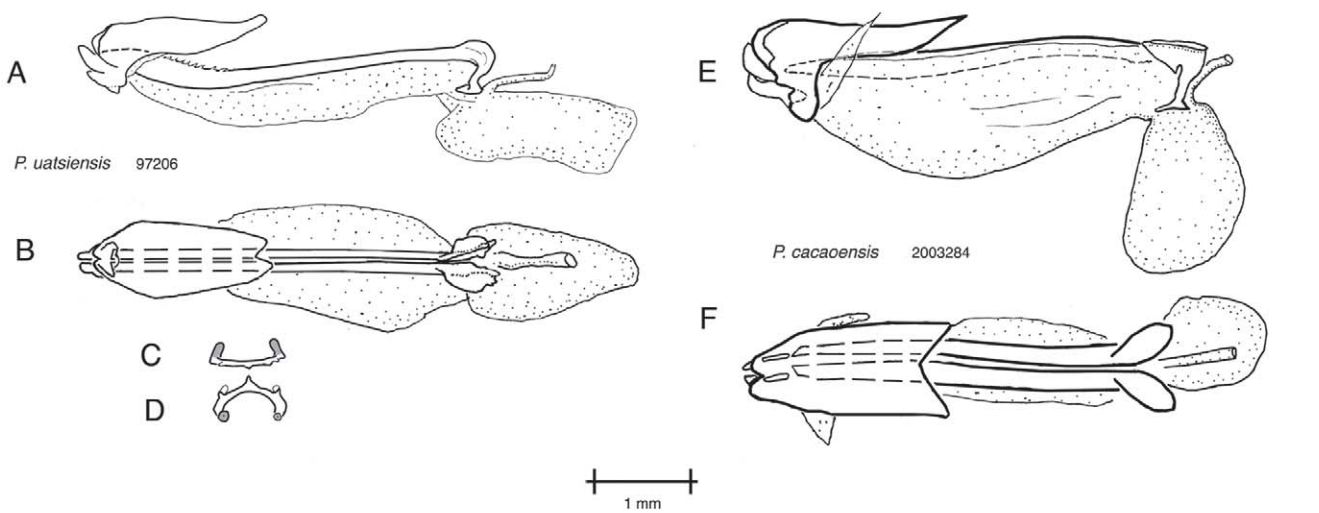


Fig.16. *Pararhicnoderma* spp. Phalli. A-D, *P. uatsiensis;* E, F, *P. cacaoensis*. A, E, lateral view; B, F, dorsal view. C, D, epiphallus in axial and dorsal views.

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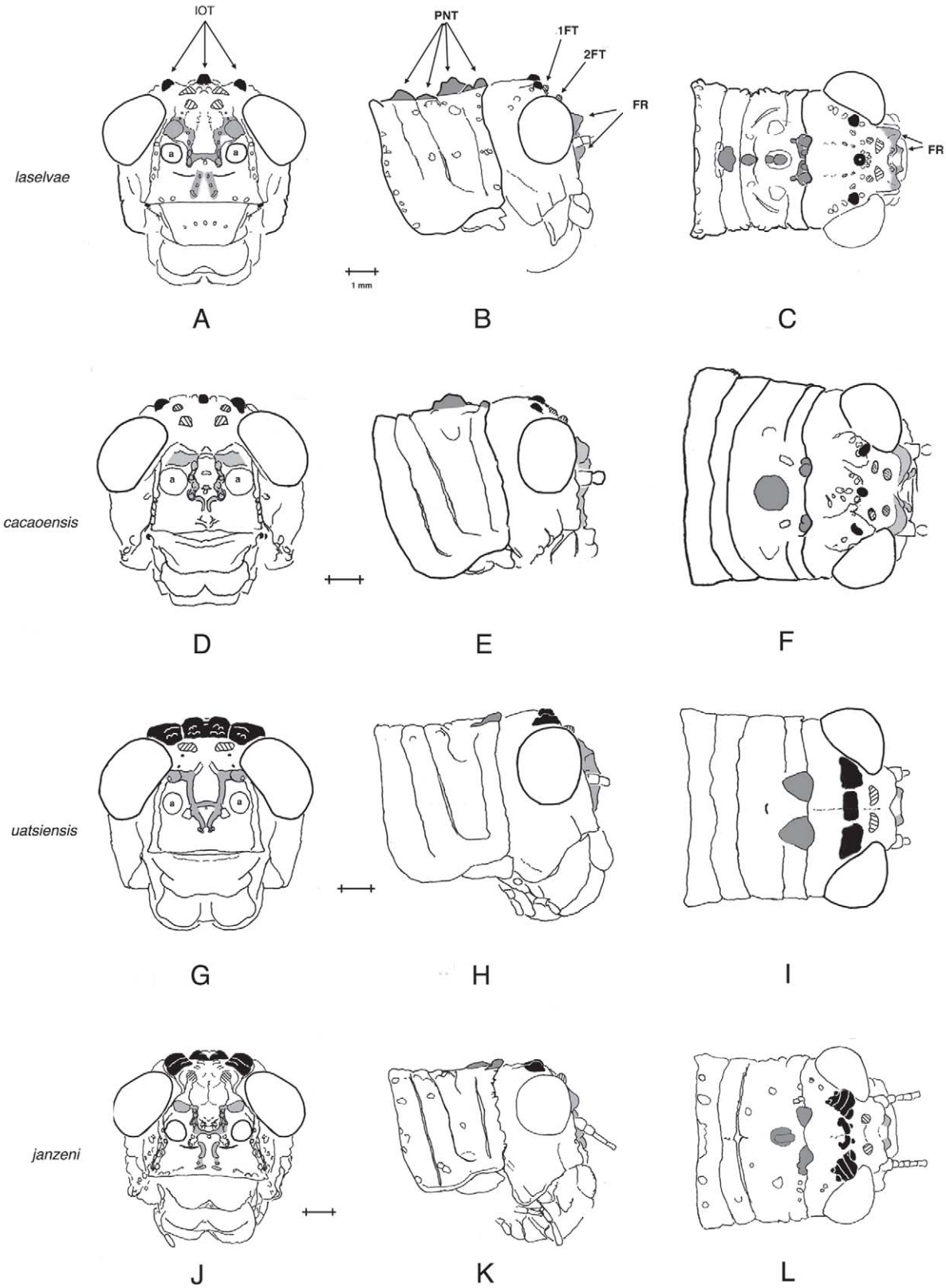


Fig. 17. *Pararhicnoderma* spp. Female head and pronotum, to show the most prominent tubercles and projections, in axial (ADGJ),lateral (BEHK) and dorsal (CFIL) views. A-C, *P. laselvae;* D-F, *P. cacaoensis;* G-I, *P. uatsiensis;* J-K, *P. janzeni*. a,a, antennal sockets. IOT, interocular tubercles; PNT, pronotal tubercles; 1FT, first row of fastigial tubercles; 2FT, second row of fastigial tubercles; FR, carinae of frontal ridge. L Oc, M Oc, lateral and medial ocelli. The different sets of tubercles are shaded similarly on the three drawings; the shading does NOT indicate a pigmentation difference, it is merely for navigational purposes. Note that while the male head is smaller and its integument often less rugose, the disposition and number of tubercles in the three areas is the same as in the corresponding females.

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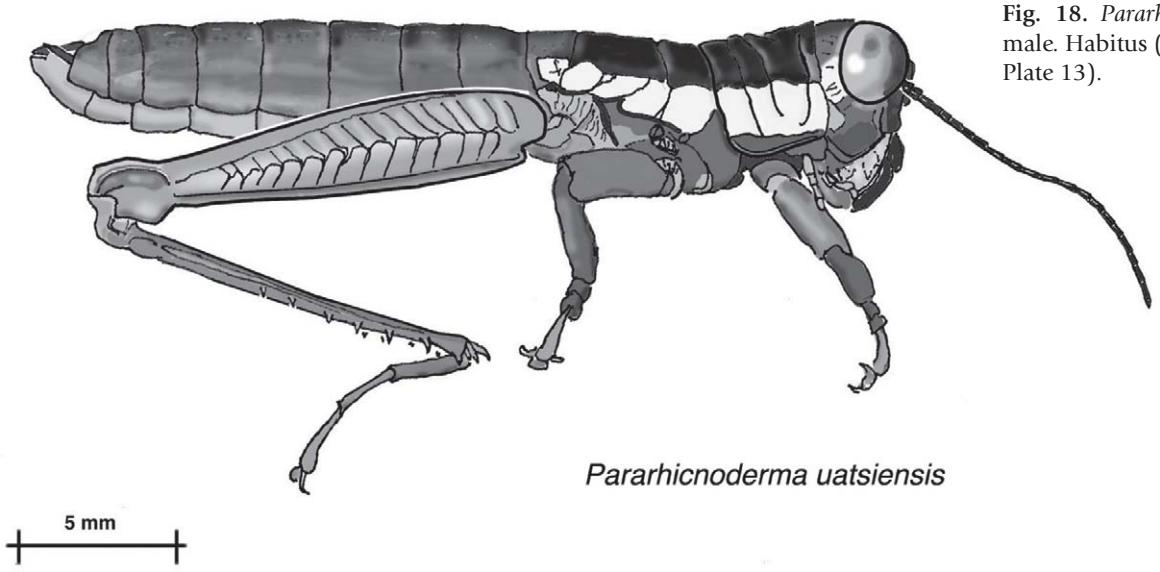


Fig. 18. *Pararhicnoderma uatsiensis*, male. Habitus (for color version, see Plate 13).

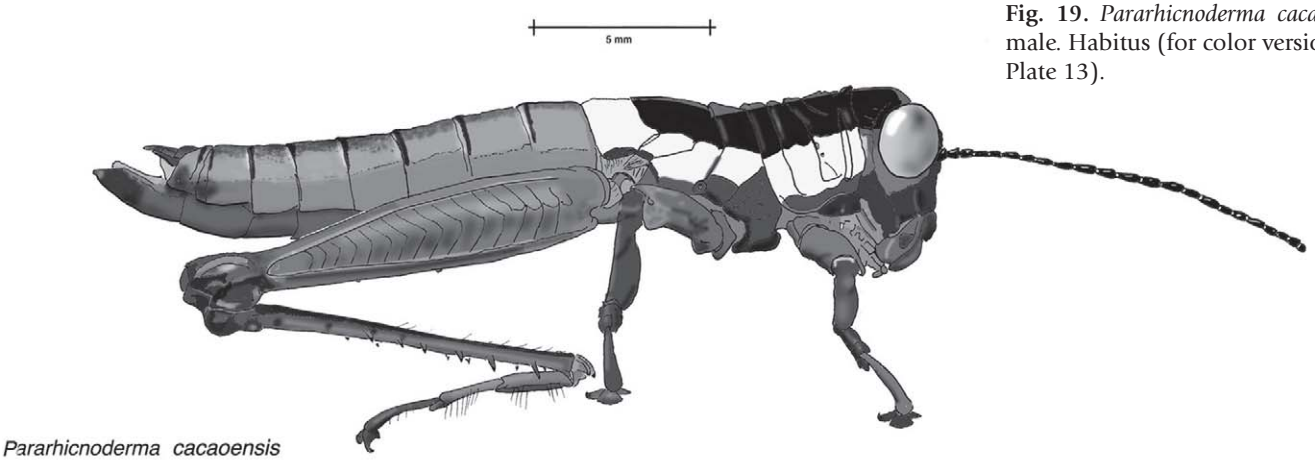


Fig. 19. *Pararhicnoderma cacaoensis*, male. Habitus (for color version, see Plate 13).

hind knees, tibiae and tarsi as in male. Once again, the striking dark blue of the living insect fades to a dark brown in dried specimens. Sexual dimorphism is more pronounced in this species than the others described here; the male is relatively smaller.

Distribution and natural history.—Known principally from the Puerto Viejo area, Sarapiquí, in the lowland Caribbean plain of N.E. Costa Rica. The type specimens described here were both found on "atypical" plants which are probably not their food plants: the holotype was found on the underside of a *Chamaedora* palm frond, and the female on a fern frond at the forest edge. Other specimens were seen on understorey trees and shrubs. (See *e.g.*, Plate 23). The Rio Toro Amarillo near Guápiles, locality of the second paratype pair, is less than 30 km distant from the type locality and also on the Caribbean plain.

What is apparently the same species is also recorded from Bijagua, which is at the extreme Western edge of the Caribbean forest, and has many elements of the fauna of that zone.

4. *Pararhicnoderma janzeni* n. sp.

Holotype male.—COSTA RICA: Prov. Puntarenas: San Vito de Jaba, 29 August 1974 (Janzen DH). In cop. with female paratype. Both specimens, UMMZ.

Paratype female: all data as holotype.

Etymology.—Named for the collector, the eminent entomologist Daniel H. Janzen, in recognition of his outstanding contributions to Costa Rican biology.

Dimensions.—See Table 1. Habitus Fig. 21, Plate 22.

Male: slender and elongate, integument of thorax punctate but mostly smooth, not nodular. Antennae with 19 segments. Moderately sexually dimorphic, the ratio m/f varies between 0.69 (pronotum) and 0.76 (hind femur). Fastigium ornamented with a single transverse row of tubercles. Inter-ocular space has numerous rugosities, but lacks the transverse row of 3 well-defined tubercles seen in some other species. Prosternal process transverse and chisel shaped, diverging slightly towards its tip; edge of terminal ridge slightly undulant, no tubercles at the outer corners (Fig. 13D).

Coloration.— General coloration olive green, fore and mid legs green. Postocular stripe absent. Pale band on pronotal lobes partially or completely interruped at the level of the third pronotal sulcus, but then continued again to the posterior margin of the pronotum. Mesoepisternum and mesoepimeron devoid of pale color, but a cream-colored patch on the lower lateral part of the mesothoracic tergum, a large one on the metathoracic episternum and epimeron, with a small patch anteriorly and laterally on the metathoracic tergum (see Fig. 21, Plate 22). Hind femur pale leaf green, knee olive, with

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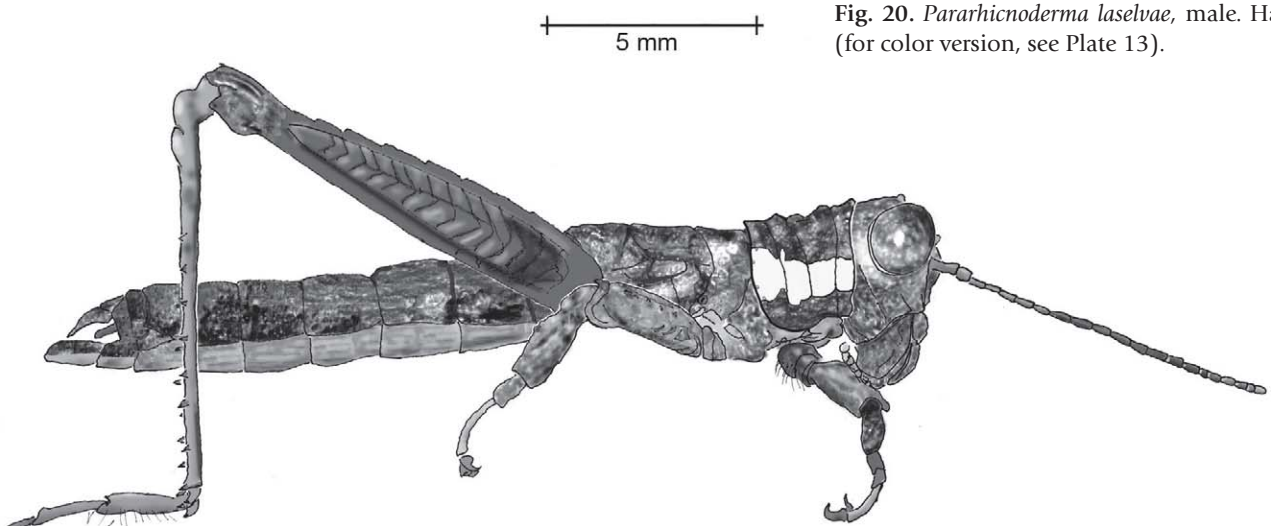
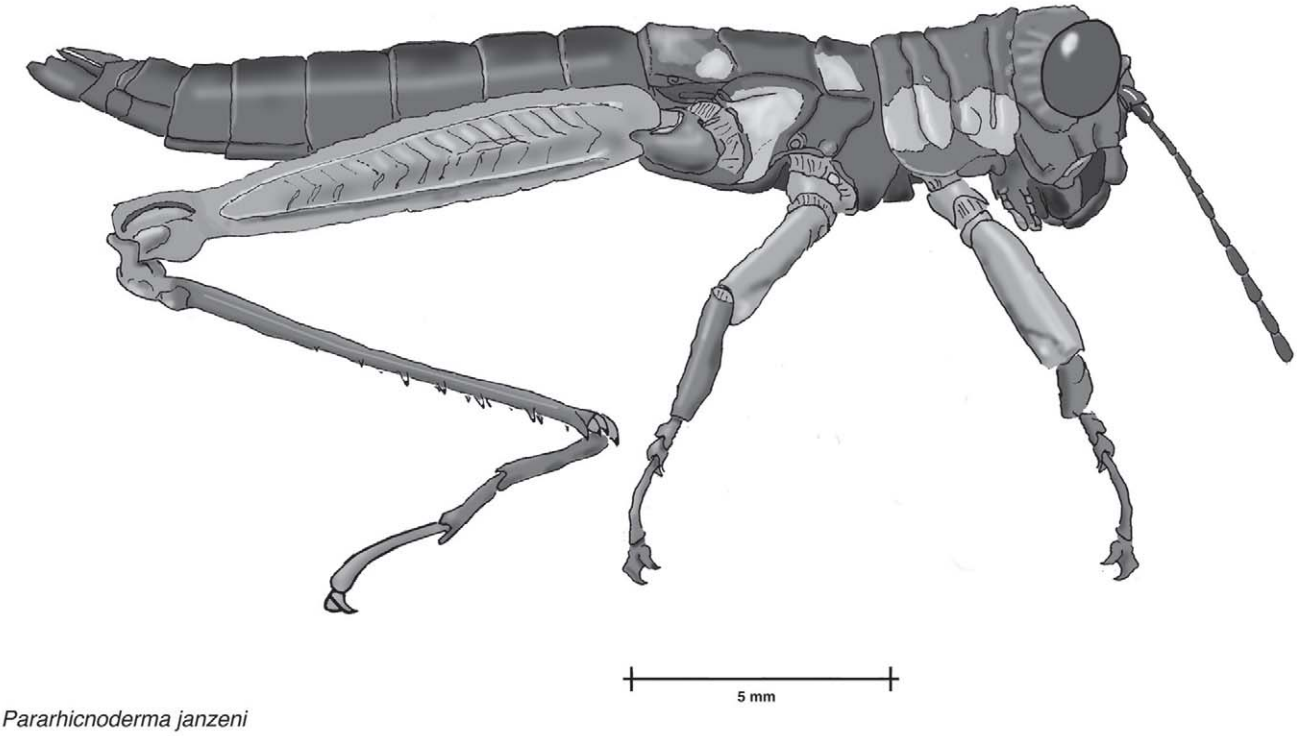


Fig. 20. *Pararhicnoderma laselvae*, male. Habitus (for color version, see Plate 13).

Fig. 21. *Pararhicnoderma janzeni*, male. Habitus (for color version, see Plate 13).



brown semilunar processes. Hind tibia proximally olive, then red on all faces. First and second tarsal joints red, third joint olive green.

Female.—More robust and integument more rugose. A single swelling in the midline of the pronotum at the level of the first pronotal sulcus (Fig.17J-L), posterior margin of pronotum decorated with evenly spaced dark patches. Tubercles of fastigium and interocular space as described for the male. Coloration mottled olive brown and green, legs olive green, hind tibia and tarsi as in male.

This species is only moderately sexually dimorphic, the ratio m/f varies between 0.69 (pronotum) and 0.76 (hind femur).

Distribution.—To date known only from the type locality. Other specimens of presumably the same species were taken there by D.C.F. Rentz in 1969, but could not be located for examination for the present work.

Key to species of *Pararhicnoderma*.

A. Males:

1. Brightly and contrastingly colored. Pale stripe on pronotal lobes continuous, not divided into 2 discrete patches 2
1A. General coloration more or less cryptic, in shades of olive green. Pale stripe on pronotal lobes generally divided into 2 discrete patches 3

2. Pale stripe on pronotal lobes extends backwards over thoracic pleura to 1st abd segment but does not extend over its tergum. It also extends forwards onto the genae as far as the hind margin of the eye. Inner face of hind knee and all of hind tibiae bright red.

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Occiput and disc of pronotum brown. Tip of SGP entire. . . . . ***uatsiensis*** (S.E. Costa Rica)

2A. Brightly colored, similar to *Rh. uatsiensis*, but more heavily marked with black. Inner face of knee and all but outer face of hind tibia shiny black, occiput, dorsolateral thoracic stripe and parts of pronotal disc black. Only 1st and 2nd hind tarsal segments red. The white color on segment A1 extends completely over the tergum. No white color on genae. Tip of male SGP bifid . . . . . ***cacaoensis*** (Cordillera del Norte, Costa Rica)

3. General coloration mottled dark green (in fresh material). Disc of pronotum with numerous small tubercles. Pale stripe on pronotal lobes *usually* divided into two patches. Hind knee brown dorsally, outer ventral knee lobe green. Ventral face of femur dark blue in life, in dried specimens turning blackish brown. Outer face of hind tibia pale greyish brown or green, inner face dark blue in life, drying to dark brown. Only1st & 2nd hind tarsal segments red. Tip of SGP minutely bifid . . . . . ***laselvae*** (Caribbean plain of Costa Rica).

3A. General coloration olive green or olive brown. Disc of pronotum smooth, not tuberculate. Pale stripe on pronotal lobes divided into two patches. No postocular stripe. Legs leaf green, hind knee olive brown. Hind tibia and first two tarsal segments red. Tip of SGP minutely bifid . . . . . ***janzeni*** (S.W. Costa Rica)

B. Females:

Females are best identified by their associated males. Where this is not possible, the pattern of nodular ornamentation on the head and pronotum (compare with Fig.17) should allow identification.

Discussion

The rather high density of *Rhicnoderma* group species in Costa Rica and S. Mexico, documented in this paper, suggests that there are probably numerous others awaiting recognition in less well-explored areas of Central America. It is probably significant that the genera *Lempira* Rehn, *Cristobalina* Rehn and *Mayalina* Amedegnato *et al.*, which show many morphological similarities and are probably fairly closely related, still seem to be confined to the more northerly parts of Central America (Mexico, Guatemala, El Salvador, Honduras), whereas *Rhicnoderma*, *Pararhicnoderma* and *Panamacris* are centered in the southern countries of Costa Rica and Panama, but have spread as far as Southern Mexico too.

Acknowledgements

I thank Dr. P. Michelik (Universität Greifswald) and Dr. A. Hänggi (Naturhistorisches Museum, Basel) for their help in facilitating the loan of the holotype of *Rh. olivaceum*, Mr. J. Weintraub (ANSP) for the loan of *Rhicnoderma* type material from the ANS Philadelphia, Dr. R. Cambra (Fairchild Museum of Invertebrates, University of Panama) for the loan of specimens; also M. Simon Poulain (MNHN Paris) for the loan of specimens and the use of his excellent photographs. Many thanks to Sra Silvia Figueroa of the Fundación Enrique Figueroa, Metapán, El Salvador, for hospitality and access to Finca El Limo and other Salvadoran collecting sites, and for the photographs of *L. metapanensis*. Some of the photographs of *Rh. humilis* in this paper were taken by the late Prof. N. Elsner, Universität Göttingen, and those of *Rh. basalis* by M. Simon Poulain, MNHN Paris..

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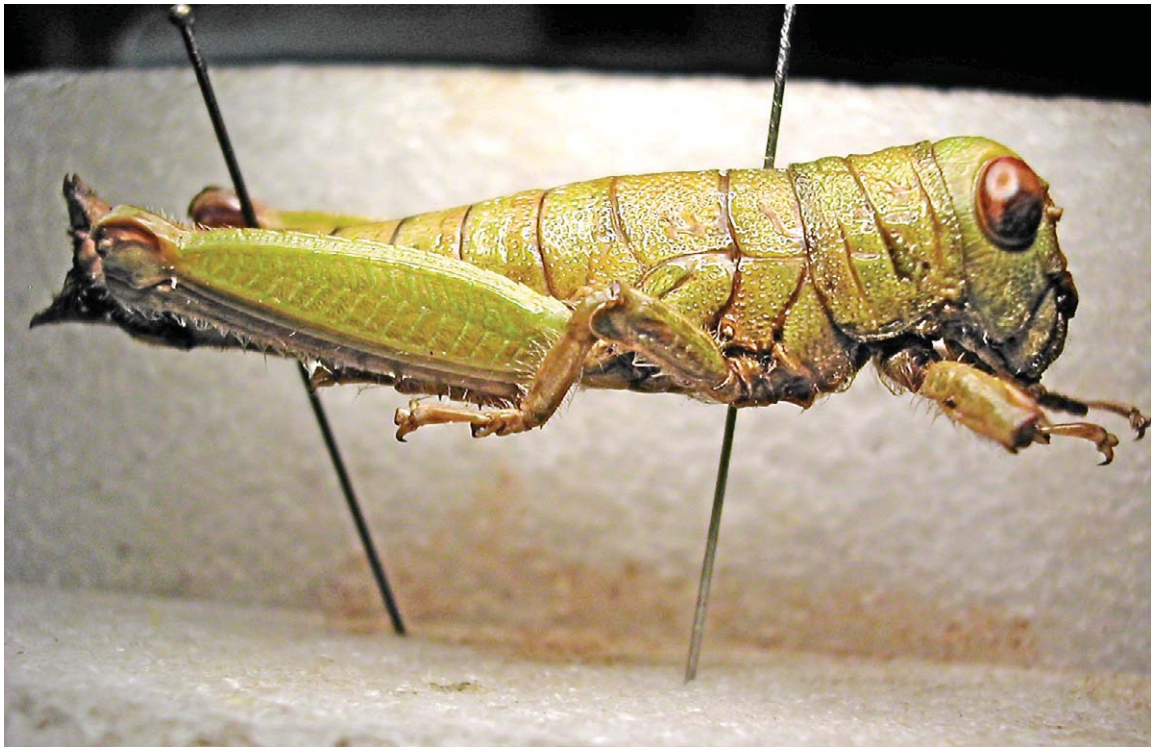


Plate 1. *Rhicnoderma olivaceum* Gerstaecker, female. This is the only specimen caught in modern times, and shows the natural colors. It was found at Playa del Sol, Bahia Honda, Prov. Veraguas, Panama, by Prof. R. Cambra & R. Miranda on 12.12.2001, and is deposited as specimen no. 2003445 in the Fairchild Museum of Invertebrates, University of Panama.

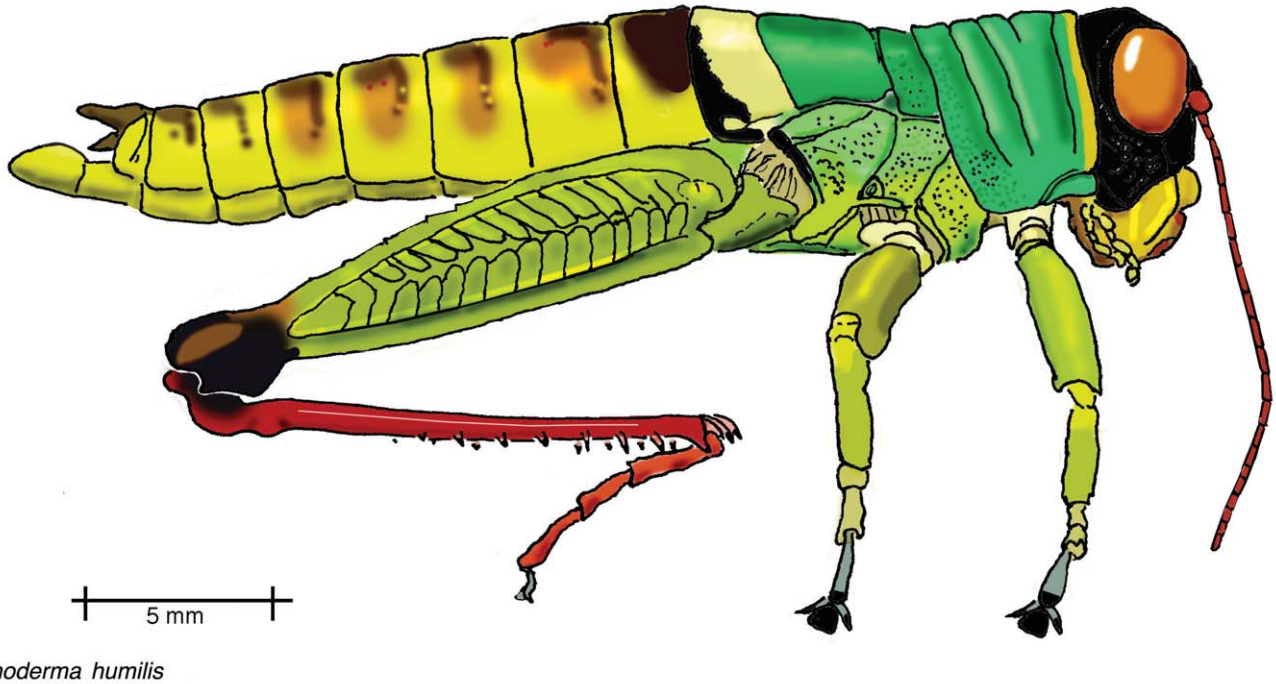


Plate 2. *Rhicnoderma humilis* Rehn, male. Drawn from specimens taken at R.B. Carara, Prov. Puntarenas, Costa Rica, in 1991.

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Plate 3. *Rhicnoderma humilis* Rehn, male. Photographed in the wild at R.B. Carara, Prov. Puntarenas, Costa Rica, in August, 1991. Photo N. Elsner.



Plate 4. *Rhicnoderma humilis* Rehn, female, brown form. Photographed in the wild at R.B. Carara, Prov. Puntarenas, Costa Rica, in August, 1991. Photo N. Elsner.

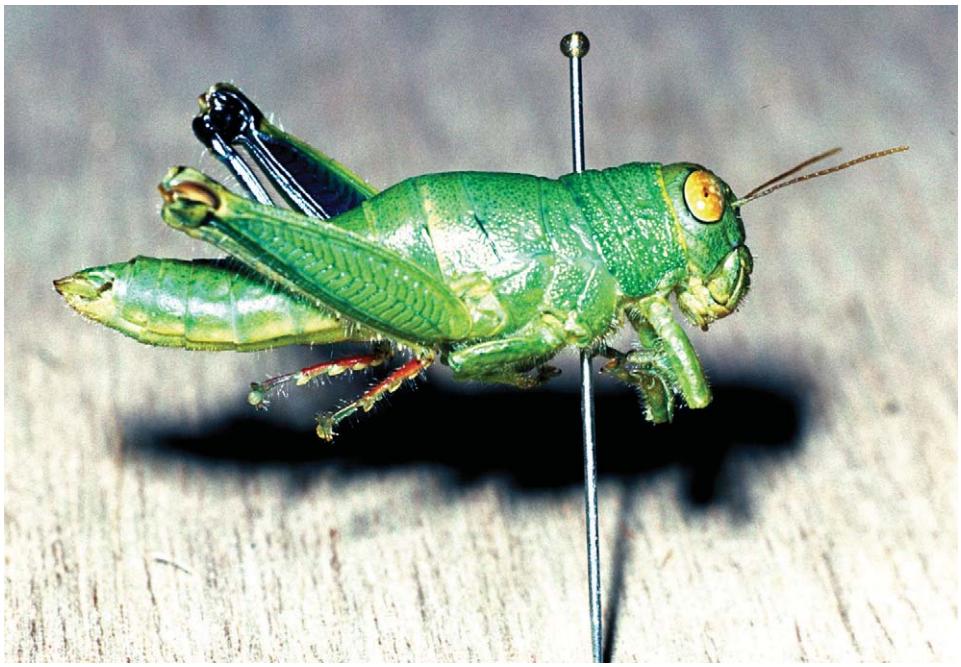


Plate 5. *Rhicnoderma humilis* Rehn, female, green form. Specimen taken at R.B. Carara, Prov. Puntarenas, Costa Rica in August, 1991. Freshly pinned specimen, the colors are natural. Note the dark blue inner face of the hind femur. (RC)

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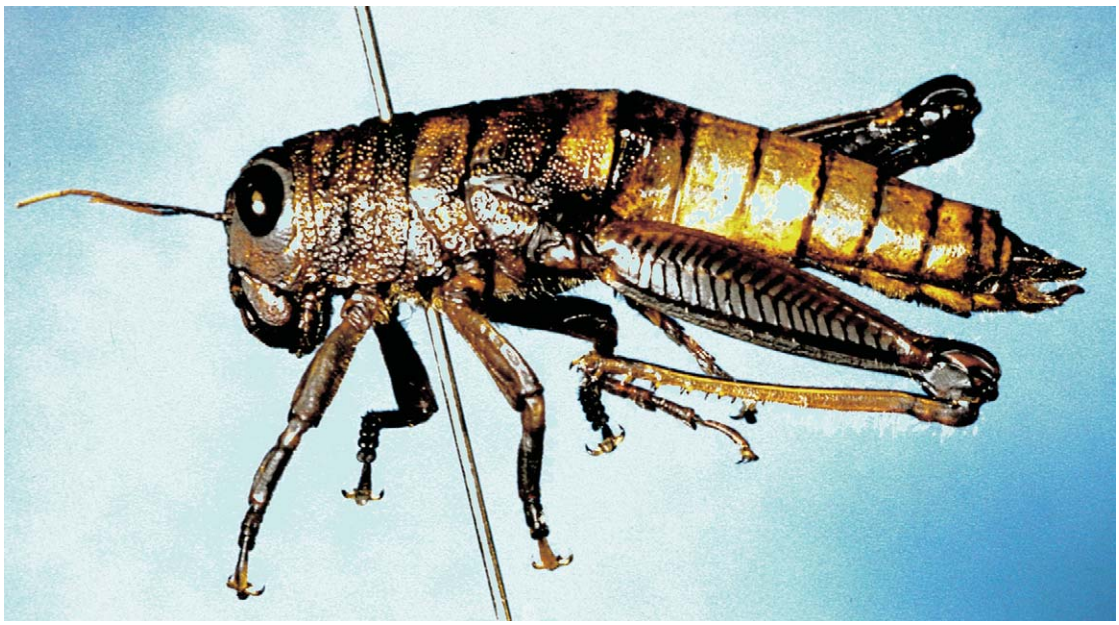


Plate 6. *Rhicnoderma humilis* Rehn, female, brown form. Specimen taken at R.B. Carara, Prov. Puntarenas, Costa Rica, in August, 1991. Freshly pinned specimen, the colors are natural. Note the black inner face of the hind femur (RC).



Plate 7. *Rhicnoderma basalis* Bruner, female. Specimen taken km 98, between Oaxaca and Tehuantepec, 10/1/1974, by M. Descamps (MNHN). Photo S. Poulain.



Plate 8. *Rhicnoderma basalis* Bruner, male. Specimen taken km 98, between Oaxaca and Tehuantepec, 10/1/1974, by M. Descamps (MNHN). Photo S. Poulain.

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Plate 9. *Lempira metapanensis* n. sp., male. Photographed in the wild at Finca El Limo, Metapán, El Salvador, 01/12/2010. Photo S. Figueroa.



Plate 10. *Lempira metapanensis* n. sp., male. Photographed in the wild at Finca El Limo, Metapán, El Salvador, 01/12/2010. Photo S. Figueroa.



Plate 11. *Lempira metapanensis* n. sp., female. Photographed in the wild at Finca El Limo, Metapán, El Salvador, 01/12/2010. Photo S. Figueroa. In life the stem on which the insect is sitting was vertical, not horizontal.

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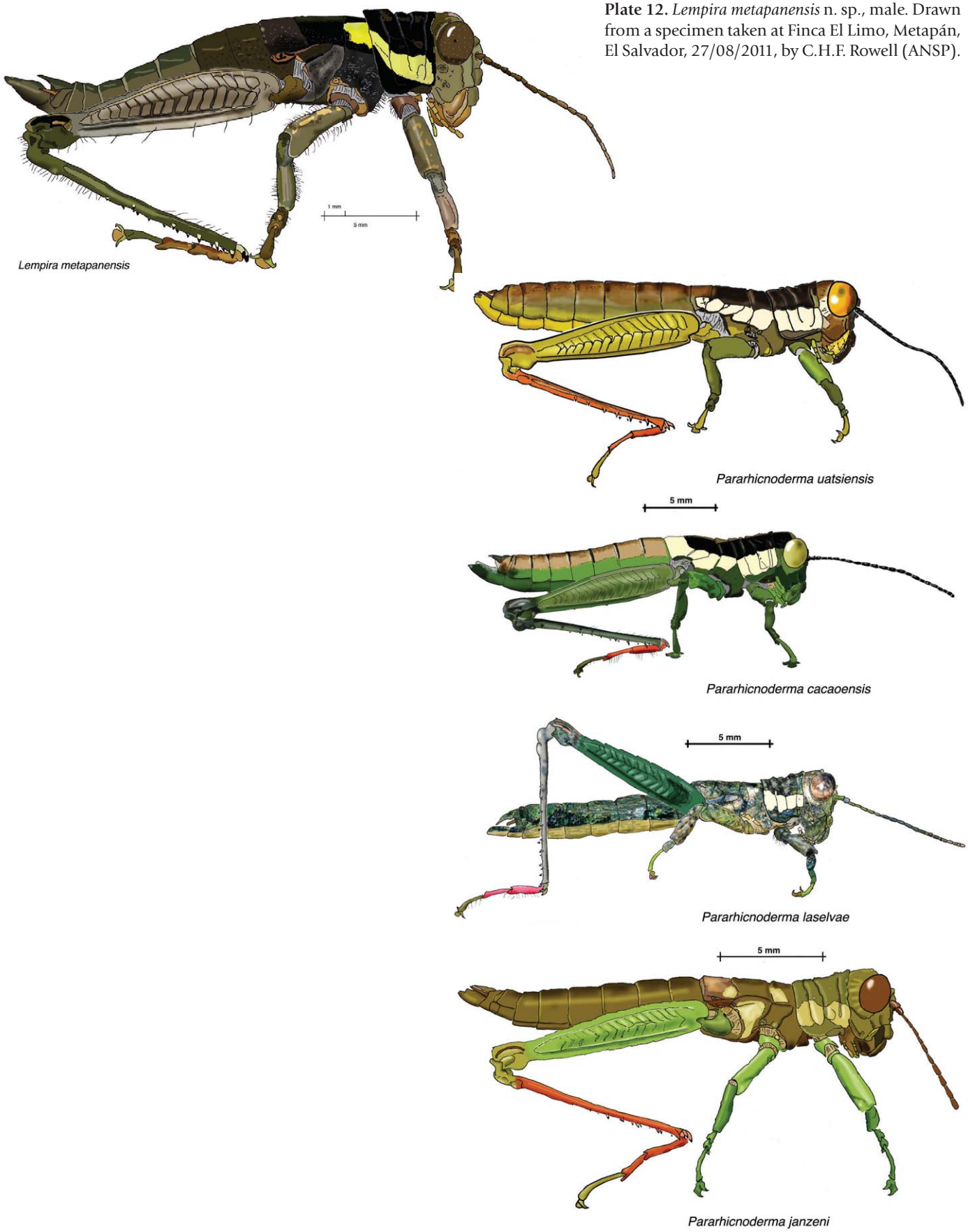


Plate 12. *Lempira metapanensis* n. sp., male. Drawn from a specimen taken at Finca El Limo, Metapán, El Salvador, 27/08/2011, by C.H.F. Rowell (ANSP).

Plate 13. *Pararhicnoderma uatsiensis* n. sp., *cacaoensis* n. sp., *laselvae* n. sp., and *janzeni* n. sp. Males, habiti. All drawn from holotypes. Scale bars 5 mm.

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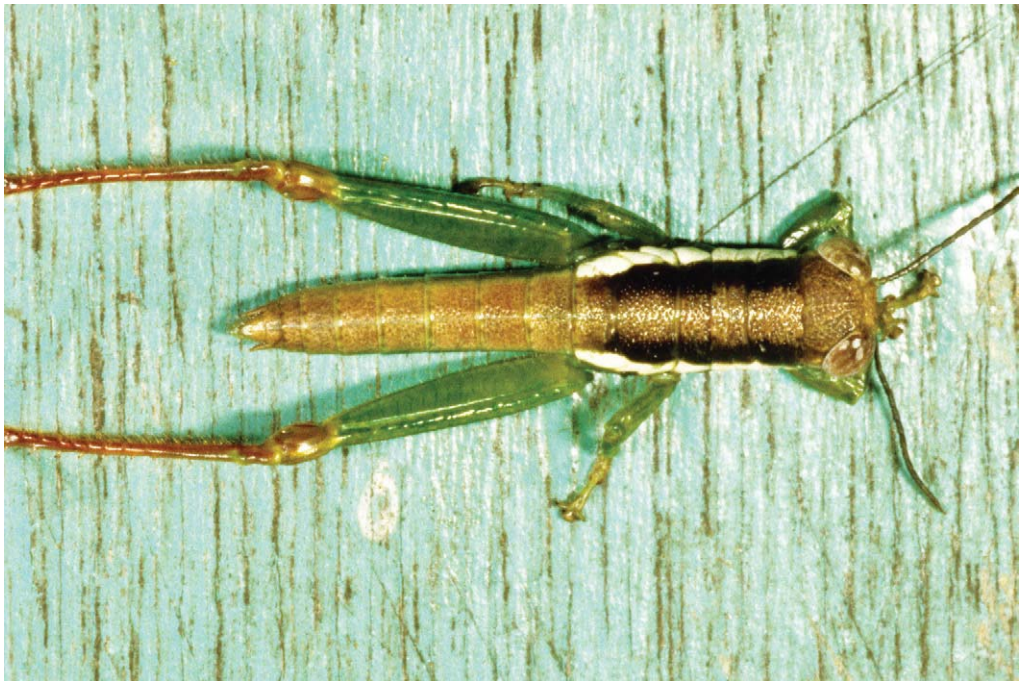


Plate 14. *Pararhicnoderma uatsiensis* n. sp. Male. Dorsal view of freshly killed holotype.

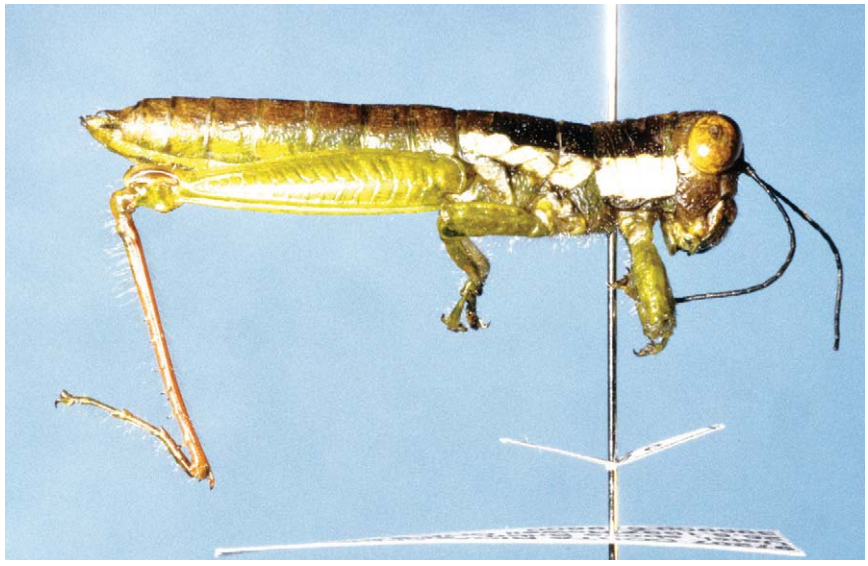


Plate 15. *Pararhicnoderma uatsiensis* n. sp. Male. Lateral view of freshly killed holotype.



Plate 16. *Pararhicnoderma uatsiensis* n. sp. Male. Dorsolateral view of freshly killed holotype.

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Plate 17. *Pararhicnoderma uatsiensis* n. sp. Female. Dorsal view of freshly killed paratype.

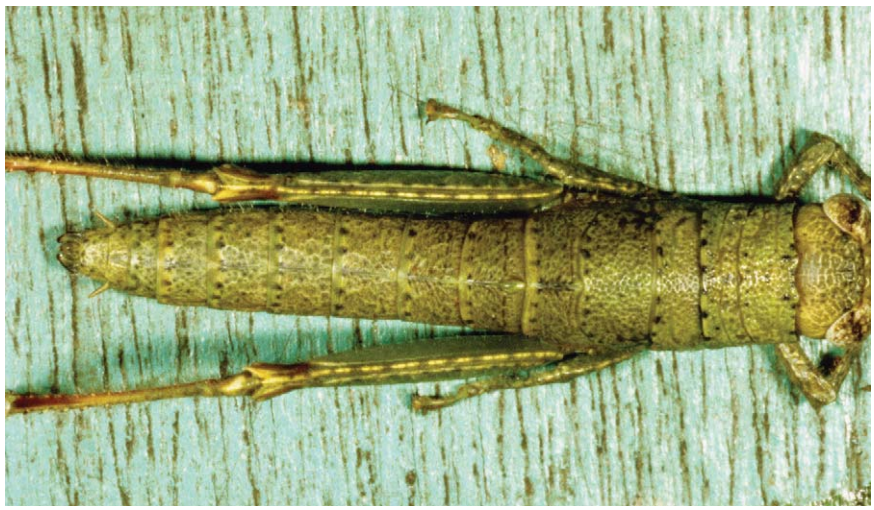


Plate 18. *Pararhicnoderma cacaoensis* n. sp. Male. Lateral view of freshly killed holotype.

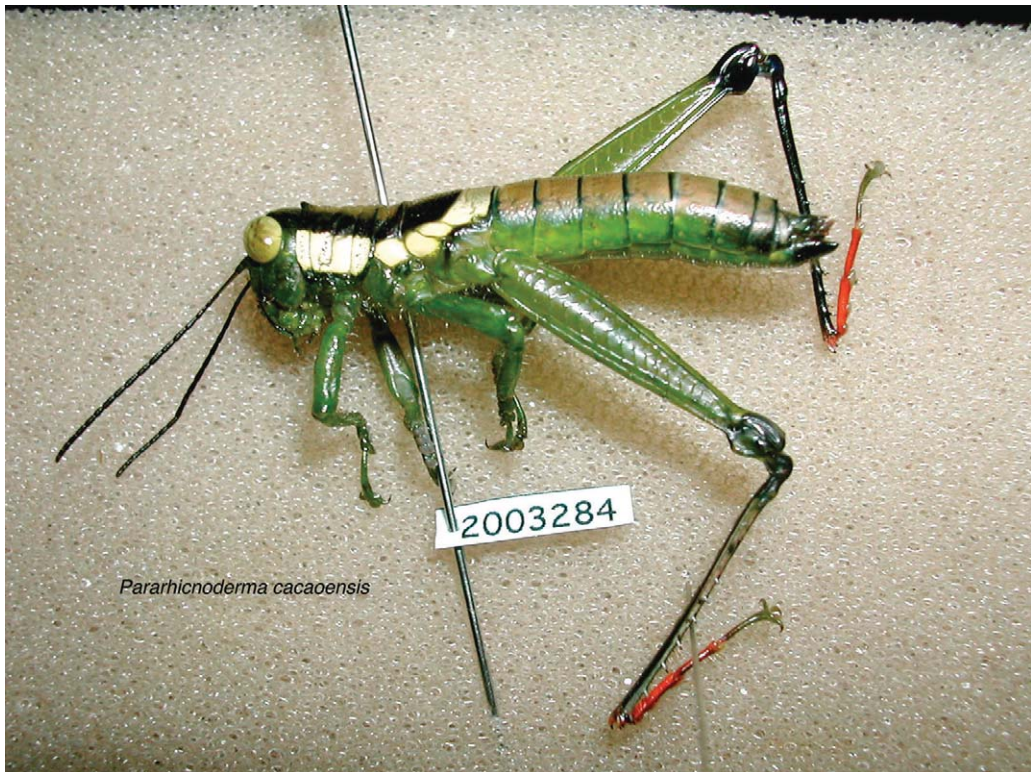


Plate 19. *Pararhicnoderma laselvae* n. sp. Male. Lateral view of freshly killed holotype.



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Plate 20. *Pararhicnoderma laselvae* n. sp. Male. Dorsal view of freshly killed holotype.



Plate 21. *Pararhicnoderma laselvae* n. sp. Pair in copula, photographed in the wild at Finca La Selva. Photo D.H. Janzen.

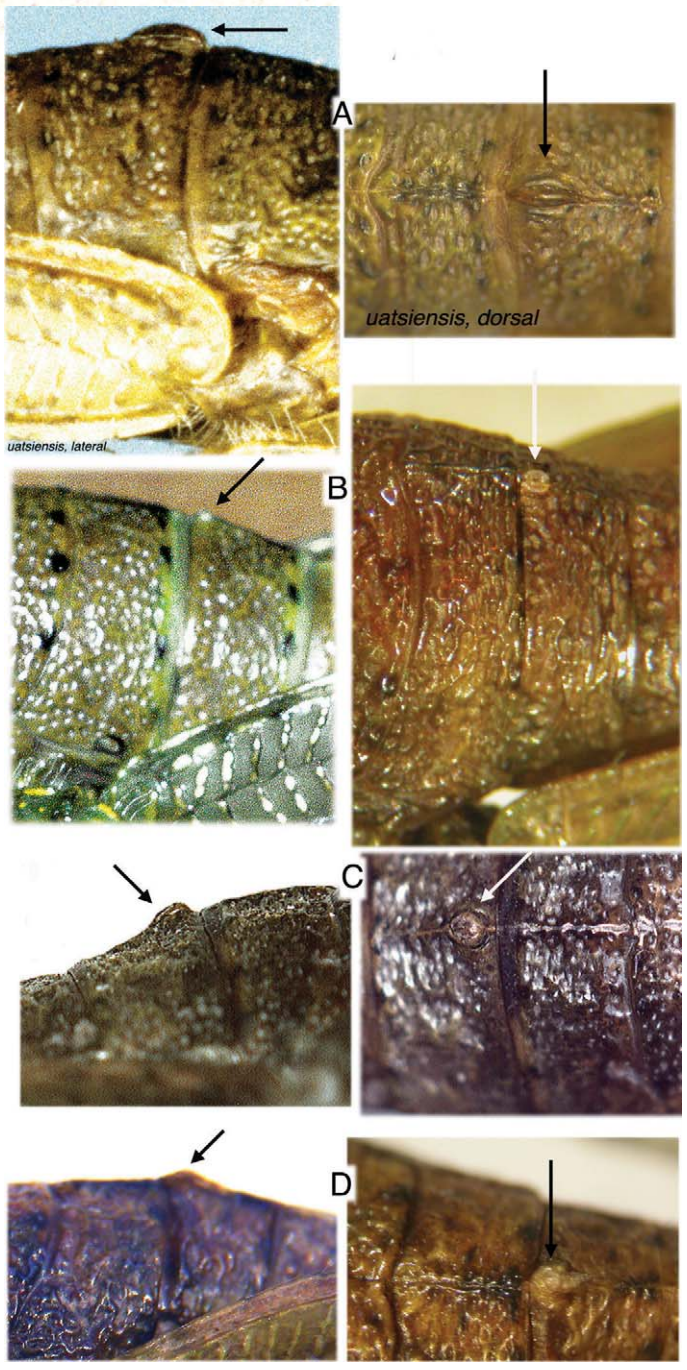


Plate 22. The tubercle on the midline of abdominal segment 2 in female *Pararhicnoderma*. **A.** *P. uatsiensis*. **B**. *P. cacaoensis*. **C**. *P. laselvae*. **D**. *P. janzeni*. Left hand column, lateral views; right hand column, dorsal views.

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