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SYSTEMATICS AND EVOLUTION OF THE TRIBES PYROPHORINI AND HELIGMINI, WITH DESCRIPTION OF CAMPYLOXENINAE, NEW SUBFAMILY (COLEOPTERA, ELATERIDAE)

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ABSTRACT

Examination of types and comparative studies of the male and female genitalia and other morphological characters of all genera of the "Pyrophorini" permitted a reclassification of this tribe. It is divided into two others: Pyrophorini sensu stricto *and Heligmini, trib. n. The former, exclusively bioluminescent, includes seventeen genera* (Pyrophorus sensu stricto, *two genera here revalidated:* Phanophorus *Solier, 1851 and* Hypsiophthalmus *Latreille, 1834, and the following new ones:* Nyctophyxis, Noxlumenes, Cryptolampros, Sooporanga, Pyroptesis, Hapsodrilus, Ptesimopsia, Pyrearinus, Fulgeochlizus, Opselater, Ignelater, Lygelater, Deilelater *and* Vesperelater). *The latter includes all non luminous genera previously placed within the "Pyrophorini" (except for* Hifo *Candèze, 1881,* Hifoides *Schwarz, 1906,* Hemirhipus *Latreille, 1829, and* Chalcolepsis *Candèze, 1857) and four new genera originally described in the genus "Pyrophorus"* (Agnostelater, Coctilelater, Euplinthus *and* Arcanelater).

Campyloxenus *Fairmaire, 1860, is removed from the Pyrophorinae and placed in a new subfamily.*

The hypothetical phylogeny of both tribes based on morphological evidence combined with geographical patterns, is given.

Considerations on the biology and ecology of the Pyrophorini are given.

INTRODUCTION

The old Pyrophorinae are world-wide in distribution and contain about 100 genera and 2.000 species. They include many tribes whose systematic position is not yet clearly defined.

Crowson (1960) commented that the classification of the Elateridae is very difficult. To solve the systematic difficulties of this family he found new adult characters, combined with the larva characters and offered a new classification. He characterized the Pyrophorinae as following. "Adult: tarsal claws with a seta or group of setae near the

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base ventrally; wings never with a closed cell (wedge cell); ovipositor without articulated styli. Larva with mandibles simple, without distinct retinaculum; mentum narrowed to a point posteriorly; terga of prothorax and abdominal segment 9 usually more sclerotized than remaining ones". I am adding other characters to the larva: predaceous, dorsoventrally compressed; mandibles stout, arcuate.

The new tribe Heligmini is very closely related to the Pyrophorini; the latter is exclusively bioluminescent, while the former has not acquired this capacity.

The Heligmini include many genera previously placed within the "Pyrophorini": *Alampes* Champion, 1895, *Alampoides* Schwarz, 1906, *Heligmus* Candèze, 1865, *Meroplinthus* Candèze, 1891, *Paraphileus* Candèze, 1881 and *Pyrischius* Hyslop, 1921.

Meroplinthus Candèze, 1891, is divided into: *Meroplinthus sensu stricto, Compsoplinthus,* gen. n. and *Euplinthus,* gen. n.. I have created three new genera based on non-luminescent species originally described in *Pyrophorus.*

Hifo Candèze, 1881, and *Hifoides* Schwarz, 1906, do not have the characters considered here as diagnostic for the Pyrophorinae, for that reason they will not be included in this work. *Hemirhipus* Latreille, 1829, and *Chalcolepsis* Candèze, 1857, recently listed by Arnett et al. (1969) as "Pyrophorini" do not belong to this tribe.

Two genera from the New World (*Pyrophorus,* distributed all over the Americas, including the Antilles; and *Campyloxenus,* restricted to Chile) and one genus peculiar to some Oceanic Islands (*Photophorus*) were recognized as luminescent, and placed within the "Pyrophorini".

The comparative study of both male and female genitalia and other morphological characters of all species of *"Pyrophorus"* showed that this genus was a mixed assemblage. Therefore, I am placing the species in three subtribes: Pyrophorina, with *Pyrophorus sensu stricto,* two genera here revalidated (*Hypsiophthalmus* and *Phanophorus*) plus seven new genera; Hapsodrilina and Nyctophyxina, with four and three new genera respectively.

Photophorus (from Oceania) is apparently similar to *Ignelater,* gen. n. (from the Antilles), see male and female genitalia, figs. 50-51 and 69-71; but it differs in the shape of the mesosternal cavity and in the absence of a suture between the meta- and mesosternal plates. These characters exclude this genus from the New World Pyrophorini. It is possible that this is a convergence. Only future studies can confirm this hypothesis.

Campyloxenus shows many deviate characters and must be removed from the Pyrophorinae to constitute a new subfamily.

I have studied all types, except the following, which are probably lost: *"Pyrophorus";* Castelnau (*P. phosphorescens, P. acutipennis, P. havaniensis*), Blanchard (*P. elongatus, P. laticollis*), Drapiez (*P. nigropunctatus*), Fairmaire & Germain (*P. conicicollis*), Guérin (*P. perspicax*), Candèze (*P. ardens, P. limbatus, P. lucidus, P. leporinus*), Germar

(*P. marginicollis*), Illiger (*P. cucujos, P. lucifer*), Voet (*P. lucifer, P. fuscus, P. minor*); *Alampes occiduus* Erichson; *Meroplinthus ophthalmicus* Perty; *Paraphileus thoreyi* Germar, and *Pyrischius biplagiatus* Janson.

All designations of lectotypes and paralectotypes of this paper are new.

Eschscholtz's types were not examined; they are in the Collection of the Zoological Museum, Lomonosov University, Moscow.

The study of the tribe Heligmini includes keys to genera and species, redescriptions, and descriptions of new species. For the Pyrophorini I do not include descriptions of new species, but only a list of the known ones; the new species will be described in forthcoming papers. I am adding a series of bionomic data, obtained during many years of observations, rearing and maintenance of larvae and adults in the laboratory.

During the course of this study over 10.000 specimens of all genera were examined. Such collection could only be made available through the cooperation and loan from many institutions and individuals, namely:

AMNH — American Museum of Natural History, New York; BM — British Museum (Natural History), London; CM — Carnegie Museum of Natural History, Pittsburg; CAS — California Academy of Sciences, San Francisco; CIS — California Insect Survey, Berkeley; CCS — Coleção Campos Seabra, Rio de Janeiro; CNCI — Canadian National Collection of Insects, Ottawa; DEIE — Deutsches Entomologisches Institut, Eberswalde; DZUP — Departamento de Zoologia da Universidade do Paraná, Curitiba; EAU — Entomologiska Avdelningen, Uppsala; ENA — Escola Nacional de Agronomia do Rio de Janeiro; FHC — Facultad de Humanidades y Ciencias, Montevideo; FMNH — Field Museum of Natural History, Chicago; IBSP — Instituto Biológico, São Paulo; IML — Instituto "Miguel Lillo", Tucumán; IPEA — Instituto de Pesquisas e Experimentação Agropecuárias do Centro-Sul, km 47, Rodovia Rio-São Paulo; IOC — Instituto Oswaldo Cruz, Rio de Janeiro; IRSN — Institut Royal des Sciences Naturelles, Bruxelles; MCZ — Museum of Comparative Zoology, Cambridge; MNHNP — Muséum National d'Histoire Naturelle, Paris; MNRJ — Museu Nacional, Rio de Janeiro; MPEG — Museu Paraense "Emilio Goeldi", Belém; MB — Museum für Naturkunde der Humboldt-Universität, Berlin; MZH — Museum of the University of Helsinki, Helsinki; MZUSP — Museu de Zoologia da Universidade de São Paulo; MSUC — Michigan State University Collection, Michigan; RMS — Naturhistoriska Riksmuseum, Stockholm; SNCN — Sociedad de Ciencias Naturalles La Salle, Caracas; SMF — Natur-Museum und Forschungs Institut Senckenberg, Frankfurt; SMTD — Staatliches Museum für Tierkunde, Dresden; USNM — United States National Museum, Washington; UZM — Universitetets Zoologiske Museum, Copenhagen.

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Maps showing the known general distribution of each genus and species (including the new species of Pyrophorini, not described here) are given; these are based on records of specimens I have examined and localities available in the literature. For Brazilian localities I have followed Vanzolini & Papavero (1968); for Latin-American localities, Hanson (1945). Many times other publications were useful: Brown (1941), Selander & Vaurie (1962), etc..

The phylogeny is hypothetical and based on morphological evidence combined with geographical patterns. For phytogeographical correlations I have used the publications of Kuchler (1964), Starker (1950), Stuart (1966) and Hueck (1966).

SYSTEMATICS

Subfamily **Pyrophorinae** Candèze

Pyrophorites Candèze, 1863: 1-3; 1891: 5.

Pyrophoridae; Fleutiaux, 1891: 390.

Pyrophorini; Champion, 1895: 463; Schwarz, 1906: 209; Heyne & Taschenberg, 1908: 161; Arnett, 1969: 14.

Pyrophorina; Hyslop, 1917: 252; Leng, 1920: 167; Blackwelder, 1944: 285.

Pyrophorinae; Schenkling, 1927: 345.

Adults with one or more setae on the claw near the base; hind wings without wedge cell; ovipositor without stylus. Larvae predaceous, dorsoventrally compressed; mandibles stout, arcuate, and without distinct retinaculum; mentum narrowed to a point posteriorly; terga of prothorax and abdominal segment 9 usually more sclerotized than remaining ones.

Key to tribes

1. Adults very colorful, without luminous organs, neither on the prothorax nor on abdomen ..... Heligmini, trib. n.

   Adults generally darker, with luminous organs on the prothorax and or on abdomen ..... Pyrophorini Candèze

Heligmini, trib. n.

The Heligmini are closely related to the Pyrophorini, both presenting many characters in common, but the former are more colorful and do not have luminous organs, neither on the prothorax nor on the abdomen.

The absence of luminous organs in the Heligmini has been discussed from time to time. Many of the genera were originally described in *Pyrophorus* and considered as weakly luminous. Others in spite of their evidente non-luminosity were described in *Pyrophorus* because the authors did not consider the significance of the lack of luminosity.

In characterizing *Heligmus* Candèze (1865), said: "Son prothorax est, à la vérité, dépourvu de vésicules phosphoriques; mais si l'on regarde avec soin la base de ses angles postérieurs, on aperçoit un espace lisse et dénué de points, ce qui frappe d'autant plus que ceux-ci sont très denses par tour ailleurs; on y voit en autre par transparence deux petites masses opaques. Il est donc probable que ce insect jouit pendent la vie, de la propriété d'emettre de la lumière, comme les *Pyrophorus*". This same author (1878) in the description of *Pyrophorus ruber* commented: "Au premier abord, la couleur rouge et l'absence de vésicules phosphoriques sur le prothorax éloignent l'idée que cette espéce est un *Pyrophorus*. Étant admis cepandant, qu'il y a des *Pyrophorus* sans vésicules apparentes, on est bien obligé de comprendre celui ci dans ce genre, dont il présente tous les autres caractères". In spite of this, Candèze (1891) put *Pyrophorus ruber* in the genus *Meroplinthus*.

Up to now no information is available on the biology of the Heligmini. Whether or not they are luminescent is unknown. But as they do not have the slightest evidence of luminescent organs, probably a monophyletic character, this constitutes sufficient justification to segregate them in a different tribe.

Key to subtribes of Heligmini

1. Antenna strongly serrate or pectinate from the 3rd segment onwards; mesosternal cavity horizontal (fig. 255) ..... Heligmina, subtr. n.

   Antenna serrate from the 4th segment onwards; mesosternal cavity not horizontal 2

2. Mesosternal cavity more or less raised behind (fig. 254), female genitalia short (figs. 201-203) ..... Alampina, subtr. n.

   Mesosternal cavity sinusoidal (fig. 253) or strongly angulate, forming a right angle (fig. 256); mandibles not denticulate; female genitalia elongate (figs. 207-212) 3

3. Mesosternal cavity strongly angulate, forming a right angle (fig. 256); epipleura not marginated .... Compsoplinthina, subtr. n.

Mesosternal cavity sinusoidal (fig. 253), epipleura marginated .... Euplinthina, subtr. n.

Alampina, subtr. n.

Small (14,0/18,0 mm/length), slender Pyrophorinae. Ground color very dark-brown or bicolorous. Pubescence slightly apparent, short and sparse. Front large, frontal carina absent. Antenna extending to apex of hind angle of prothorax or surpassing the angle by one or more segments; in the female always shorter than in the male. Prothorax slightly convex; sides subparallel; punctures variable. Mesosternal cavity more or less raised behind. Elytra 2.5 times as long as the prothorax, sides slightly convergent on basal three-fifths, then rounded to apices. Male genitalia (figs. 226-233, 235, 236, 240-242, 245), short or slender; basal piece variable in shape. Female genitalia (figs. 201-206, 213-215): ovipositor short; bursa copulatrix with a variable number of longer spines; median oviduct simple.

Distribution (map 10). This is a predominantly South-American group with some penetration into Central America. *Alampes* and *Alampoides* are typically from forested areas; *Coctilelater* shows an apparently disjunct distribution and *Agnostelater* seems to occur in open formations.

Key to genera

1. Mandibles without teeth (fig. 250) 2

Mandibles with teeth (figs. 249, 252) 3

2. Last abdominal segment in the male with flying setae on the apex. (female unknown) ..... *Agnostelater*, gen. n.

Last abdominal segment in both sexes with simple pubescence .... *Coctilelater*, gen. n.

3. Antennal segments 2 and 3 usually subequal; antenna extending to apex of hind angle of prothorax or shorter; mesosternal cavity closed and raised behind ..... *Alampes* Champion, 1895

Antennal segment 3 usually twice as long as 2; antenna extending to apex of hind angle of prothorax or longer; mesosternal cavity open and slightly raised behind (fig. 254) .... *Alampoides* Schwarz, 1906

Agnostelater, gen. n.

Mandibles (fig. 250) without teeth and of a characteristic shape. Antenna extending to apex of hind angle of prothorax. Eyes little developed. Mesosternal cavity slightly raised behind. Last abdominal segment of males with flying setae on the apex.

Type-species: *Pyrophorus mesochrous* Germar, 1843.

Distribution: Open formations of Central and Southeastern Brazil.

Discussion: The general habitus and the absence of a frontal carina, places *Agnostelater* in the Alampina, where it is closely related to *Coctilelater* in the shape of the mandibles. This genus is well characterized and distinct from the others genera by the considerably coarser punctures and the presence of flying setae on the last abdominal segment of the male.

Agnostelater mesochrous (Germar, 1843), comb. n.

(Figs. 228, 250)

Pyrophorus mesochrous Germar, 1843: 91 (type-locality: Brazil); Candèze, 1863: 24; Schenkling, 1927: 362; Blackwelder, 1944: 285.

Very dark-brown. A humeral spot on each elytron and epipleura yellowish. Pubescence moderate, short, recumbent, grey. Eyes little developed. Front not convex with punctures deep and close together. Mandible (fig. 250) with an acute apex. Antenna extending to apex of hind angle of prothorax; second segment subequal to third; second and third together as long as fourth. Pronotum longer than wide, sides subparallel, regularly convex, slightly marginated on the sides, anterior angle rounded in the apex, hind angle slightly divergent in the apex and with a weak carina, punctures coarse and close. Prosternum and proepisternum with numerous coarse, close and homogeneous punctures. Metasternal punctures similar to those on prosternum. Abdominal punctures fine and heterogeneous. Last abdominal segment on males with flying setae on the apex. Elytron slightly raised and rounded to apex, striae coarsely impressed, intervals slightly convex. Male genitalia (fig. 228), simple; median and lateral lobes slender.

Dimensions (mm, ♂). Total length, 14,0; length of pronotum, 4,5; length of elytron, 9,0; width of pronotum, 3,5; humeral width, 4,0.

Lectotype ♂ BRAZIL. Coll. Janson ex-Schaum (BM).

BRAZIL. *Goiás.* Campinas, 2♂ (MZUSP). Dianópolis, 4♂ (MZUSP). Leopoldo Bulhões, 10♂ (MZUSP). Vianópolis, 3♂ (MZUSP). *São Paulo.* Mogi Guaçu (Fazenda Campininha), 25♂ (MZUSP).

Alampes Champion, 1895

Alampes Champion, 1895: 474; Schwarz, 1906: 210, 216; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Mandibles toothed (fig. 252). Antennae short, second segment subequal to third. Prosternal suture slightly open anteriorly. Mesosternal cavity well raised behind. Tarsi simple. Male genitalia (figs. 240-242, 245) simple. Female genitalia (figs. 201-203) short; bursa copulatrix with a few long spines; two pairs of short accessory glands.

Type-species: *Alampes vestitus* Champion, 1895 (Hyslop's designation, 1921: 624).

Distribution: Colombia, Brazil (Western Amazonas) and Central American rain forest.

Discussion: Very closely related to *Alampoides* but differing in the length of the antenna, in the shape of the mesosternal cavity and in the female genitalia.

Key to the species

1. Integument bicolorous; pubescence concolorous 2
   Integument unicolorous; pubescence variegated 3

2. Elytron with a black submarginal stripe extending from the shoulder to the apex ..... *melanoxanthus* Candèze, 1865
   Elytron with an oblique black submarginal stripe extending from the middle to the apex ..... *restinctus* Champion, 1895

3. Pubescence yellowish except on scutellum and a long oblique stripe on each elytron extending for some distance below the shoulder to the suture, forming a V-shaped mark, blackish-brown ... . *vestitus* Champion, 1895
   Pubescence entirely yellowish or grey on scutellum and elytra .... *abnormis* Candèze, 1863

Alampes abnormis (Candèze, 1863)

(Fig. 242)

Pyrophorus abnormis Candèze, 1863: 36 (type-locality: Colombia); Schenkling 1927: 349; Blackwelder, 1944: 285.

Alampes abnormis; Champion, 1895: 474.

Brownish. Epipleura and the three first segments of antenna yellowish. Pubescence short, dense, yellowish or grey. Eyes well developed. Front nearly flat with punctures fine and dense. Antenna extending to apex of hind angle of prothorax, second and third segments subequal, the two together of the same size of the fourth. Prothorax regularly convex, sides subparallel; hind angles slightly divergent and with distinct carina. Punctures on pronotum fine and dense, on prosternum similar to those on pronotum. Proepisternum densely punctured. Metasternum and abdomen fine and densely punctuated. Elytron rounded to apex, striae slightly impressed, intervals convex and micropunctulate. Male genitalia (fig. 242), simple.

Dimension (mm, ♂). Total length, 14,0-18,0; length of pronotum, 3,0-4,5; length of elytron, 10,0-12,5; width of pronotum, 4,0-4,5; humeral width, 4,0-5,0.

Lectotype ♂, Colombia. Coll. Janson ex-Laferté n.º 1565 (BM). Paralectotype ♂, Colombia. Coll. Janson ex-Candèze (BM).

Discussion: Closely related to *vestitus*, differing in the vestiture. It differs from *melanoxanthus* by the fine punctures on front and pronotum; from *restinctus* by the size of the second and third antennal segments.

Alampes melanoxanthus (Candèze, 1865)

(Figs. 201-203, 241, 252)

Pyrophorus melanoxanthus Candèze, 1865: 51 (type-locality: Venezuela).

Alampes melanoxanthus; Champion, 1895: 474, t. 21, fig. 1; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Rufo-testaceous or testaceous. Antennae, a large oblong-oval patch on the disc of the prothorax, scutellum and a submarginal stripe on the elytra extending from the shoulders to the apex, black. Pubescence short, dense and yellowish. Front flat, coarsely and densely punctulate. Antenna short, third segment slightly longer than the sencond, the two together slightly longer than the fourth. Mandibles toothed (fig. 252), with a characteristic shape. Prothorax subquadrate, regularly convex, anterior angles short and rounded, hind angles short, not divergent and with a strong carina; pronotum without tubercle on the base; punctures strong and dense, but finer on the disc. Punctures on prosternum fine and sparse, on proepisternum fine, denser than on prosternum; on metasternum and abdomen fine and heterogeneous. Elytra rounded to apices, striae slightly impressed, intervals flat. Male genitalia (fig. 241) simple. Female genitalia (figs. 201-203) short; bursa copulatrix bipartite, a little spiraled and with long spines; two pairs of accessory glands and median oviduct simple.

Dimensions (mm)	♂	♀
Total length	15,0	16,5
Length of pronotum	4,0	4,5
Length of elytron	10,5	11,0
Width of pronotum	4,0	4,0
Humeral width	4,5	4,0

Lectotype ♀ VENEZUELA. Coll. Candèze (IRSN). Paralectotype ♂ COLOMBIA. Bogotá, Charles col., Coll. Chevrolat (MNHNP).

PANAMA. 1 sp. (MNHNP). *Canal Zone.* La Chorrera, 3 sp. (CAS). COLOMBIA. 1 sp. (BM); 1 sp. (MNHNP). *Antioquia.* Nare, 2 sp. (MNHNP). VENEZUELA. 1 sp. (BM). PERU. *Loreto,* Pebas, 1 sp. (MNHNP).

Discussion: Closely related to *restinctus,* differing in the color pattern and in the more distinct carina on the hind angles of the prothorax.

Alampes restinctus (Champion, 1895), comb. n.

(Fig. 245)

Pyrophorus restinctus Champion, 1895: 473 (type-locality: Nicaragua, Chontales), t. 20, figs. 33, 33a; Schenkling, 1927: 349; Blackwelder, 1944: 286.

Rufo-testaceous or testaceous, the apical eight segments of the antennae, a broad spot on the pronotal disc, scutellum and apical 3/4 of sides of elytra, broadly black; the black on the elytra gradually extending inwards and reaching the suture some distance before the apex. Pubescence fine, short and grey. Eyes moderately large. Front almost plain, punctures distinct and sparse. Antennae almost reaching the hind angles of the prothorax, third segment little longer than second, the two together slightly longer than fourth. Prothorax slightly convex, sides subparallel, finely marginated; hind angles short, not divergent, slightly carinate. Pronotum finely and densely punctulate. Punctures on prosternum sparse; on proepisternum similar to those on pronotum. Metasternum and abdomen fine and heterogeneously punctured. Elytra tapering from basal third to apices, which are submucronate; finely punctate-striate; punctures coarser on humerus. Male genitalia (fig. 245), simple.

Dimensions (mm, ♂). Total length, 15,0; length of pronotum, 4,0; length of elytron, 10,0; width of pronotum, 4,0; humeral width, 4,0.

Lectotype ♂ NICARAGUA. *Chontales,* T. Belt col., (BCA) (BM). Paralectotype NICARAGUA. Chontales, 1♂ T. Belt col., Champion (BCA) (BM); 2♂ Coll. Janson ex-Champion (BCA) (BM).

NICARAGUA. 1♂ (BM). Chontales, 1♂ (BM).

Discussion: Closely related to *melanoxanthus,* differing in the characteristic color pattern and by the fine punctures on front and pronotum.

Alampes vestitus Champion, 1895

(Fig. 240)

Alampes vestitus Champion, 1895: 474 (type-locality: Panama, Bugaba), t. 21, figs. 3, 3a; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Castaneous. Epipleura yellowish. Pubescence short, dense, yellowish, except on the scutellum and on a long oblique stripe on each elytron extending for some distance below the shoulder to the suture, forming a blackish-brown pubescent V shaped mark. Front broadly depressed, punctures strong and dense. Antennae reaching the hind angles of the prothorax, the third joint little longer than second, the two together nearly longer than fourth. Prothorax slightly convex, sides parallel; hind angle little divergent and carinate; anterior angles rounded. Pronotum fine and densely punctulate. Proepisternum more densely punctulate than prosternum. Punctures on metasternum and abdomen fine and heterogeneous. Elytra with apices submucronate, finely punctate-striate, interstices feebly convex and densely punctulate. Male genitalia (fig. 240), simple.

Dimensions (mm)	♂	♀
Total length	16,0	18,5
Length of pronotum	4,0	5,0
Length of elytron	11,0	12,5
Width of pronotum	4,0	4,5
Humeral width	4,5	5,0

Lectotype ♀ PANAMA. Bugaba (BCA) (BM). Paralectotype ♂ PANAMA. Bugaba (BCA) (BM).

PANAMA. *Chiriqui.* Volcán de Chiriqui, 2 sp. (MNHNP).

Discussion. Closely related to *abnormis* but it differs by the type of the vestiture and by third antennal segment which is little longer than second.

Alampoides Schwarz, 1906

Alampoides Schwarz, 1906: 216; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Elongate, rather narrow, moderately convex. Front without carina. Mandibles slightly denticulated (fig. 249). Antenna surpassing the apex of hind angle of prothorax; third segment usually twice as long as second. Prosternal suture closed anteriorly. Mesosternal cavity open and slightly raised behind (fig. 254). Male genitalia (figs. 232, 233) very simple. Female genitalia (figs. 204-206), short; bursa copulatrix a little spiraled and with a few to many long spines; a pair of accessory glands present.

Type-species: *Pyrophorus submaculatus* Schwarz, 1902: 284 (Hyslop's designation, 1921: 625).

Distribution: Forested regions of Peru, Ecuador and Bolivia.

Discussion: This genus is well characterized by its color pattern, the shape of the mandibles, the shape of the mesosternal cavity and the length of the antenna.

Key to the species

1. Integument unicolorous 2
   Integument bicolorous 4

2. Antenna with the third segment a little longer than the second 3
   Antenna with the third segment two times longer than the second ... . *fulvus*, sp. n.

3. Elytra with interstices flat; antenna surpassing the hind angle of prothorax by three segments ..... *boliviensis* Candèze, 1900
   Elytra with the interstices feebly convex; antenna surpassing the hind angle of prothorax by one and a half segments .... *alychnus* Kirsch, 1873

4. Elytra closely spotted in yellow and black .... *tessellatus* Candèze, 1863
   Elytra with submarginal dark stripe ..... *badius*, sp. n.

Alampoides alychnus (Kirsch, 1873)

(Figs. 204-206, 232, 233)

Pyrophorus alychnus Kirsch, 1873: 368 (type-locality: Peru).
Alampoides alychnus; Schwarz, 1906: 216; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Brownish. Epipleura yellowish. Pubescence fine and grey. Punctures on front fine and dense. Antenna surpassing hind angle of prothorax by one and a half segments; third joint little longer than second. Prothorax slightly convex, sides subparallel; anterior angles smaller and rounded; hind angles moderately divergent and distinctly carinate. Punctures on pronotum fine and dense; on prosternum similar to pronotum; on proepisternum close; on metasternum and abdomen fine. Elytra distinctly punctate-striate, interstices feebly convex, dense and minutely punctate. Male genitalia (figs. 230, 231), the shortest type; basal piece

well developed. Female genitalia (figs. 204-206), short; bursa copulatrix with a few long spines.

Dimensions (mm)	♂	♀
Total length	13,5	17,0
Length of pronotum	3,5	4,0
Length of elytron	9,5	12,5
Width of pronotum	3,0	4,0
Humeral width	4,0	5,0

Lectotype ♂ Peru. Kirsch (IRSN).

PERU. 1 sp. (MNHNP). *Junin.* Chanchamayo, 5 sp. (MNHNP). Cumbase, 1 sp. (MNHNP). *Huanaco.* Huallaga (rio Mixiollo), 6 sp. (MNHNP). *Cuzco.* Marcapata, 1 sp. (DEIE). Vilcanota, 5 sp. (MNHNP). *Loreto.* Pebas, 3 sp. (MNHNP). BRAZIL. *Amazonas.* Fonte Boa, 2 sp. (MNHNP). Itaituba, 4 sp. (MNHNP). São Paulo de Olivença, 13 sp. (MNHNP); 1 sp. (BM). Tefé, 6 sp. (MNHNP); 2 sp. (BM). *Pará.* Tapajós, 1 sp. (BM). *Mato Grosso.* 8 sp. (MNHNP).

Discussion. Closely related to *boliviensis* and *fulvus.* From the former it differs by the length of the antenna and from the latter by the shape of the male genitalia. It also differs from the other species by the color pattern.

Alampoides boliviensis (Candèze, 1900)

(Fig. 226)

Alampes boliviensis Candèze, 1900: 19 (type-locality: Bolivia).
Alampoides boliviensis; Schwarz, 1906: 216; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Light-brownish. Pubescence fine, dense and yellowish. Front wide and flat, with fine and dense punctures. Antenna surpassing the hind angle of prothorax by three segments; second and third segments short and subequal, together smaller than fourth. Prothorax subquadrate, moderately convex, sides parallel; anterior angle short, not rounded; hind angle short, not divergent and weakly carinate. Pronotum without tubercle on the base, punctures fine on disc and close on antero-lateral margin. Punctures on prosternum fine and sparser; on proepisternum close; on metasternum and abdomen fine and hererogenous. Elytra gradually tapering to apices; finely punctate-striate; interstices flat. Male genitalia (fig. 226), short, with a well developed basal piece.

Dimensions (mm)	♂	♀
Total length	14,5	20,0
Length of pronotum	4,0	4,5
Length of elytron	10,0	14,5
Width of pronotum	3,5	5,0
Humeral width	4,0	5,5

Lectotype ♂ BOLIVIA, Coll. Candèze, ex-Coll. Steinheil, 1897 (IRSN).

BOLIVIA. S. Antonio, 3 sp. (MNHNP). *La Paz,* Coroico, 6 sp. (MNHNP).

Discussion. Closely related to *alychnus* by the shape of the male genitalia but differs in possessing a longer antenna.

Alampoides tessellatus (Candèze, 1863)

(Figs. 213-215, 229)

Pyrophorus tessellatus Candèze, 1863: 50 (type-locality: Peru).
Alampoides tessellatus; Schwarz, 1906: 216; Schenkling, 1927: 355; Blackwelder, 1944: 286.
Alampoides submaculatus Schwarz, 1902: 287 (type-locality: Ecuador, Balzapamba); Schwarz, 1906: 216; Schenkling, 1927: 355; Blackwelder, 1944: 286, *syn. n.*

Reddish-brown, a narrow median stripe on disc of the pronotum, black. Elytra spotted yellow and black. Front slightly flat, fine and densely punctulate. Antenna surpassing by more than three segments the hind angle of prothorax; third segment twice longer than second; 2-3 together subequal to fourth. Prothorax subquadrate, regularly convex, sinuate on sides; anterior angle short and rounded; hind angle divergent and with a strong carina. Punctures on pronotum fine and little close on antero-lateral margin; on prosternum and proepisternum similar to those on pronotum; on metasternum and abdomen fine and heterogeneous. Elytra tapering to the apices, distinctly punctate-striate, interstices flat. Male genitalia (fig. 229), elongated; basal piece well developed, lateral lobes with stout spines on the apices. Female genitalia (figs. 213-215), short; one pair of accessory glands; bursa copulatrix well spiraled and with numerous long spines.

Dimensions (mm)	♂	♀
Total length	16,5	20,0
Length of pronotum	3,0	4,5
Length of elytron	12,5	14,0
Width of pronotum	3,0	5,0
Humeral width	4,0	5,0

Lectotype ♀ PERU. Coll. Janson ex-Sanders (BM).

COLOMBIA. 1 sp. (IRSN); 1 sp. (CNHM). *Caldas.* Manizales, 7 sp. (MNHNP). *Valle.* Cauca (Pereira), 1 sp. (MNHNP). ECUADOR. Chimbo, 4 sp. (MNHNP). *Chimborazo.* Balzapamba, 24 sp. (MNHNP); 1 sp. (DEIE).

Discussion. Closely related to *badius,* but it differs in the length of the antenna and by the different color pattern. I saw the type of *submaculatus* Schwarz, 1902 and I noticed that this species is the female of *tessellatus* Candèze, 1863.

Alampoides badius, sp. n.

(Figs. 232-233)

Brownish; a submarginal stripe on elytron from the shoulder to the apex, a median longitudinal spot on disc of the prothorax and scutellum, darker. Front flat with punctures fine and dense. Antenna surpassing by one and a half segments the hind angle of prothorax; third segment two times longer than second. Prothorax a little convex, sides parallel; hind angle slightly divergent and with a strong carina. Pronotum finely and densely punctured. Punctures on proepisternum fine and denser than on prosternum where they are sparser. Metasternum and abdomen finely and heterogeneously punctulate. Elytra pointed to apices, finely punctate-striate; interstices flat and micropunctulate. Male genitalia (figs. 232-233) simple.

Dimensions (mm)	♂	♀
Total length	17,0	21,0
Length of pronotum	4,0	5,0
Length of elytron	12,0	15,0
Width of pronotum	4,0	5,0
Humeral width	5,0	5,0

Holotype ♂ PERU. *San Martin.* Moyobamba, M. de Mathan col., 1888 (MNHNP). Paratypes: Same data as holotype (4 sp. MNHNP).

Discussion. Closely related to *tessellatus* differing by the colour pattern and shorter antennae.

Alampoides fulvus, sp. n.

Brownish, elytra yellowish, scutellum darker. Front flat, fine and dense punctulate. Antenna surpassing the hind angles of prothorax, with third segment two times longer than second. Prothorax a little convex, parallel-sided, hind angles not divergent and with a strong carina. Pronotum fine, dense and heterogeneously punctured. Proepisternum fine and denser punctulate than prosternum. Metasternum and abdomen finely and heterogeneously punctulate. Elytra rounded to apices, finely punctate-striate; interstices flat. Male genitalia (fig. 227) very elongated; basal piece small.

Dimensions (mm)	♂	♀
Total length	14,0	18,0
Length of pronotum	3,5	4,0
Length of elytron	10,0	13,0
Width of pronotum	3,5	4,5
Humeral width	4,0	5,0

Holotype ♂ PERU. *San Martin.* Tarapote, M. de Mathan col., 1886 (MNHNP). Paratypes: Same data as holotype (4 sp. MNHNP; 2 sp. MZUSP).

Discussion: Closely related to *alychnus,* but differs by the general facies, the length of the antenna and by the shape of the male genitalia.

Coctilelater, gen. n.

General body shape short. Eyes slightly developed. Antennae short. Mandibles not denticulated. Mesosternal cavity slightly raised behind. Male genitalia (figs. 235, 236), simple. Bursa copulatrix with a few long spines and median oviduct with a pair of sclerotized plates.

Type-species: *Alampes corymbitoides* Candèze, 1900.

Distribution: Apparently disjunct, with one species from the Amazonian region and another from the Atlantic forest.

Key to the species

1. A submarginal stripe on pronotum and epipleura reddish yellow; elytra with interstices flat ..... *corymbitoides* Candèze, 1900

   Pronotum black or red-black; elytra with interstices slightly convex ..... *sanguinicollis* Candèze, 1878

Coctilelater corymbitoides (Candèze, 1900), comb. n.

(Fig. 235)

Alampes corymbitoides Candèze, 1900: 95 (type locality: Brazil, Goiás).

Pyrophorus corymbitoides; Schwarz, 1906: 214; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Light black. A submarginal stripe on pronotum and epypleura reddish-yellow. Pubescence fine, brownish and sparser. Eyes little developed. Front flat, with punctures coarse and close. Antena almost reaching apex hind angle of prothorax, third and second segments subequal, together as long as the fourth. Prothorax subquadrate, regularly convex, finely marginated; posterior angle slightly divergent and strongly carinate. Pronotum with punctures coarse and homogeneous. Punctures on prosternum fine and sparser on middle, close on anterior margin, on proepisternum practically absent; on metasternum and abdomen fine and heterogeneous. Elytra rounded to apices, distinctly punctate-striate; interstices flat. Male genitalia (fig. 235) simple; median lobe gradually tapering to apex; lateral lobes short.

Dimensions (mm)	♂	♀
Total length	13,5	12,5
Length of pronotum	3,5	3,0
Length of elytron	9,0	8,5
Width of pronotum	3,5	3,0
Humeral width	4,0	3,5

Lectotype ♂ BRAZIL. Goiás, n.º 1896 Coll. E. Candèze (IRSN).

Paralectotype ♂ BRAZIL. Goiás, 2 sp., n.º 1896 Coll. E. Candèze (IRSN).

BRAZIL. *São Paulo.* Franca, 1 sp. (MZUSP). Itu, 1 sp. (MZUSP). São Paulo, 3 sp. (MZUSP).

Discussion. Closely related to *sanguinicollis,* but differs by the general color pattern and by general coarse punctures.

Coctilelater sanguinicollis (Candèze, 1878), comb. n.

(Fig. 236)

Pyrophorus sanguinicollis Candèze, 1878: 91 (type-locality: French Guiana, Cayenne); Schenkling, 1927: 354; Blackwelder, 1944: 286.

Black; pronotum black or reddish-black. Pubescence fine and sparse. Front flat with punctures rugose and coarse. Antenna short, third segment slightly longer than second. Prothorax subquadrate, regularly convex, sides subparallel; hind angle slightly divergent and feebly carinate. Pronotum with punctures strong and homogeneous. Punctures on prosternum similar to pronotum, but close on anterior margin; on proepisternum finer than the general punctures of the body. Metasternum and abdomen heterogeneous and finely punctulate. Elytra rounded to apices, strongly punctate-striate; interstices slightly convex, micropunctulate. Male genitalia (fig. 236) simple.

Dimensions (mm)	♂	♀
Total length	12,5	13,5
Length of pronotum	3,0	3,5
Length of elytron	8,0	9,0
Width of pronotum	3,0	3,5
Humeral width	3,5	4,0

Lectotype ♂ FRENCH GUIANA. Cayenne, Coll. E. Candèze (IRSN). Paralectotype ♂ BRAZIL. *Pará.* Rio Amazonas, Coll. E. Candèze (IRSN).

FRENCH GUIANA. Gourdonville, 1 sp. (MNHNP). Cayenne, 1 sp. (BM). BRAZIL. *Amazonas*. 1 sp. (IRSN). Rio Autaz, 2 sp. (MNHNP).

Discussion. It differs from *corymbitoides* in the length of the antenna and by the more impressed punctures.

Euplinthina, subtr. n.

Body slightly robust (21,0/23,0 mm) uni-/or bicolorous. Punctation variable. Pubescence pratically absent to the naked eye. Mandibles toothed or not. Antenna generally short, serrate from the fourth segment onwards. Prothorax regularly convex, with or without tubercle near the base. Mesosternal cavity sinusoidal. Elytron gradually tapering to the apex. Epipleura marginated. Male genitalia (figs. 225, 238, 239, 246) very simple; median lobe well developed with or without cuticular scales. Female genitalia (figs. 207-212) elongate, with one pair of accessory glands; median oviduct with sclerotized plates; bursa copulatrix slightly spiraled and with a variable number of long spines.

Distribution (map 11): This is a South American group which does not penetrate into Central America and Mexico. It is typically from the forest (Amazonian or/and Atlantic forest). *Paraphileus* seems to be the only genus occuring in open formations, this in Uruguay, Argentina and Central Brazil.

Key to the genera

1. Mandibles toothed (fig. 248) 2
   Mandibles not toothed (fig. 247) ..... *Euplinthus,* gen. n.

2. Front slightly carinate, bursa copulatrix with long spines, eyes little developed ..... *Paraphileus* Candèze, 1881
   Front without carina, bursa copulatrix without spines, eyes well developed ..... *Arcanelater,* gen. n.

Arcanelater, gen. n.

Front without carina. Mandibles toothed (fig. 248). Antenna short. Eyes well developed. Mesosternal cavity sinusoidal. Epipleura marginated. Bursa copulatrix without spines.

Type-species: *Pyrophorus spurius* Germar, 1841.

Distribution. Southwestern Brazil.

Discussion. Closely related to *Paraphileus* but differing in the color pattern, the eyes more developed, the front without carina, the third segment of antennae longer than the second and the bursa copulatrix without spines.

Arcanelater spurius (Germar, 1841), comb. n.

(Fig. 248)

Pyrophorus spurius Germar, 1841: 56 (type-locality: Brazil, Porto Alegre); Candèze, 1863: 50; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Reddish-brown, antenna darker. Pubescence fine and not visible to the naked eye. Front slightly flat, finely punctured. Antenna with the third segment longer than second. Prothorax regularly convex, rounded at the sides; hind angle not divergent, slightly carinate. Punctures on pronotum fine and close; on the prosternum sparse; on proepisternum similar to pronotum. Metasternum and abdomen with fine and heterogeneous punctures. Elytra rounded to apices, finely punctate-striate; interstices micropunctulate. Female genitalia elongated; bursa copulatrix simple and without spines.

Dimensions (mm, ♀). Total length, 18,0-22,0; length of pronotum, 5,0-6,0; length of elytron, 12,5-15,0; width of pronotum, 5,5-6,0; humeral width, 5,0-6,0.

Lectotype ♀ BRAZIL. *Rio Grande do Sul.* Porto Alegre, Sello col., n.º 17169 (BM). Paralectotype ♀ BRAZIL. *Rio Grande do Sul.* Porto Alegre, n.º 17169 (BM).

BRAZIL. *Rio Grande do Sul.* Santa Rosa, 1♀ (BM).

Euplinthus, gen. n.

Bicolorous. Front slightly carinate. Eyes little developed. Mandibles (fig. 247) not denticulate. Antenna short. Pronotum with a more or less prominent basal tubercle. Prosternal suture slightly open on anterior region. Mesosternal cavity sinusoidal. Scutellum convex. Tarsi simple. Male genitalia (figs. 238, 239) simple. Female genitalia (figs. 207-209) elongated; bursa copulatrix well spiraled and with long spines; one pair of sclerotized plates on median oviduct.

Type-species: *Monocrepidius ophthalmicus* Perty, 1830.

Distribution: Apparently disjunct in the Amazonian and Atlantic forests.

Discussion: The general color pattern, the non-denticulated mandibles and the typical basal tubercle on prothorax, make this genus very characteristic and different from the others.

Key to the species

1. Black spots on pronotum small; a black, submarginal and slender stripe on proepisternum; elytra with apical third and a slender median stripe extending up to the humerus, black; third antennal segment slightly longer than second; scutellum slender and very convex ..... *notatissimus* Candèze, 1881

   Black spots on pronotum larger; on proepisternum located inwards; elytra with apical third and two slender longitudinal stripes, the first submarginal, and the second covering the suture, black; antenna with third segment a little longer than second; scutellum not very convex ..... *ophthalmicus* Perty, 1830

Euplinthus notatissimus (Candèze, 1881) comb. n.

(Fig. 238)

Pyrophorus notatissimus Candèze, 1881: 92 (type-locality: Surinam).

Meroplinthus notatissumus; Candèze, 1891: 163; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Bicolorous; black spots on pronotum small, black stripe on proepisternum submarginal and slender; elytra with apical third and a median slender stripe extending up to the humerus, black; scutellum black. Pubescence yellowish, fine and sparse. Front with coarse and rugose punctures. Third antennal segment slightly longer than second. Prothorax convex, rounded on sides; hind angle slightly divergent and well carinate. Pronotum with a large basal tubercle, and coarse punctures. Punctures on prosternum and proepisternum coarse, but sparser than on pronotum; on metasternum and abdomen distinct and heterogeneous. Elytra distinctly punctate-striate; interstices convex. Male genitalia (fig. 238) simple; median lobe well developed.

Dimensions (mm)	♂	♀
Total length	22,0	26,5
Length of pronotum	6,0	8,0
Length of elytron	14,5	17,5
Width of pronotum	6,0	8,0
Humeral width	6,0	7,5

Lectotype ♀ SURINAM. Coll. E. Candèze, ex-Coll. Mniszech (IRSN).

FRENCH GUIANA. Cayenne, 1 sp. (BM).

BRAZIL. 4 sp. (IRSN); 1 sp. (BM). *Bahia.* 2 sp. (MNHNP); 1 sp. (IRSN); 1 sp. (BM).

Discussion. Closely related to *ophthalmicus* but it differs in the color pattern, the convex and slender scutellum and by the absence of minute scales on median lobe of the male genitalia.

Euplinthus ophthalmicus (Perty, 1830) comb. n.

(Figs. 207-209, 239, 247)

Monocrepidius ophthalmicus Perty, 1830: 21, pl. 5, fig. 4 (type-locality, Brazil, Minas Gerais); Germar, 1839: 229.

Calais ophthalmica; Candèze, 1857: 243, pl. iv, fig. 7; 1878: 42.

Meroplinthus ophthalmicus; Candèze, 1891: 163; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Calais quadrilineatus Candèze, 1857: 244; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Bicolorous; black spots on pronotum large, on proepisternum located inwards, elytra with apical third and two slender longitudinal stripes, the first submarginal and the second covering the suture, black. Pubescence brownish, fine and sparse. Front coarse and rugosely punctulate. Mandibles (fig. 247) not denticulated. Antenna with third segment a little longer than second. Prothorax convex, sides subparallel, hind angle slightly divergent and distinctly carinate. Pronotum with coarse and close punctures, and large basal tubercle. Punctures on prosternum and proepisternum strong, sparser than on pronotum; on metasternum and abdomen distinct and heterogeneous. Elytra distinctly punctate striate; interstices convex and micropunctulate. Male genitalia (fig. 239) with median lobe with minute cuticular scales on dorsal view. Female genitalia (figs. 207-209), elongate; bursa copulatrix very spiraled and with long spines; median oviduct with a pair of sclerotized plates.

Dimensions (mm)	♂	♀
Total length	17,5	21,0
Length of pronotum	5,0	6,0
Length of elytron	11,5	14,0
Width of pronotum	4,5	6,0
Humeral width	5,0	6,0

BRAZIL. 2 sp. (MNHNP); 1 sp. (IRSN). *Bahia.* 2 sp. (BM). Cachimbo, 2 sp. (MNHNP). Vitoria da Conquista, 9 sp. (MNHNP). *Minas Gerais.* Diamantina (Fazenda das Melancias), 1 sp. (MNHNP); (Fazenda Riacho Fundo), 1 sp. (MNHNP).

Discussion. Closely related to *notatissimus* but differs by the color pattern, the less convex scutellum and also the male genitalia.

Paraphileus Candèze, 1881

Aphanobius Germar, 1844: 188.

Paraphileus Candèze, 1881: 92; 1891: 163; Schwarz, 1906: 210, 217; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Front slightly carinate. Eyes little developed. Mandibles toothed. Antenna extending up to hind angles of prothorax. Mesosternal cavity sinusoidal. Male genitalia (fig. 225) simple; median lobe stout; apex of lateral lobes with many long setae.

Type-species: *Aphanobius thoreyi* Germar, 1844 (Hyslop's designation, 1921: 662).

Discussion. Closely related to *Arcanelater* but differs by the slightly carinate front, the long spines on bursa copulatrix and less developed eyes.

Paraphileus thoreyi (Germar, 1844)

(Fig. 225)

Aphanobius thoreyi Germar, 1844: 188 (type-locality: Brazil).

Paraphileus thoreyi; Candèze, 1881: 93; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Black; lateral margin of pronotum, a submarginal stripe on proepisternum, and elytra, reddish. Pubescence fine, brownish, not visible to the naked eye. Front concave, with coarse and rugose punctures. Antena extending up to hind angles of the prothorax, second and third segments short and spherical. Prothorax convex, rounded to sides; hind angle slightly divergent and strongly carinate. Pronotum without basal tubercule, with coarse and close punctures. Prosternum and proepisternum with fine punctures. Metasternum and abdomen fine and heterogeneously punctulate. Elytra distinctly punctate-striate; interstices convex and micropunctulate. Male genitalia (fig. 225), with apex of lateral lobe densely hairy.

Dimensions (mm, ♂). Total length, 25,5; length of pronotum, 7,0; length of elytron, 17,5; width of pronotum, 8,0; humeral width, 8,5.

BRAZIL. 4 sp. (IRSN). *Mato Grosso*. S. Antonio, 1 sp. (IRSN). URUGUAY. Paysandu, 2 sp. (MNHNP). *Treinta y Tres*. Quebrada de los Cuervos, 1 sp. (IBSP). Montevideo, 1 sp. (BM). ARGENTINA. 1 sp. (MNHNP). La Plata, 1 sp. (BM).

Compsoplinthina, subtr. n.

Antennae serrate from the fourth segment onwards. Mesosternal cavity strongly angulate forming a right angle (fig. 256). Metasternum convex, weakly limited with the mesosternum. Epipleura not marginated. Male genitalia (fig. 246) simple. Female genitalia (figs. 210-212) with ovipositor elongated.

Distribution. Open formations of Central Brazil.

Compsoplinthus, gen. n.

Front slightly carinate. Antenna short. Eyes little developed. Mandibles not toothed (fig. 251). Prosternal suture slightly open anteriorly. Scutellum concave. Male genitalia (fig. 246) simple; median lobe with minute cuticular scales. Female genitalia (figs. 210-212) elongate; median oviduct with sclerotized plates; bursa copulatrix with a few long spines and a pair of accessory glands.

Type-species: *Pyrophorus ruber* Candèze, 1878.

Distribution. Open formations of Central Brazil.

Compsoplinthus ruber (Candèze, 1878), comb. n.

(Figs. 210-212, 246, 251, 256)

Pyrophorus ruber Candèze, 1878: 41 (type-locality: Brazil, Bahia).

Meroplinthus ruber; Candèze, 1891: 163; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Black; pronotum, a submarginal stripe on proepisternum, and elytra, reddish. Pubescence extremely fine and yellowish, not visible to the naked eye. Front concave, with punctures deep and rugose. Antenna with second and third segments short and semi-spherical. Mandibles (fig. 251) not toothed. Prothorax convex, sides subparallel; anterior angle rounded and large; hind angles slightly divergent and not carinate. Pronotum with a small tubercle at the base, punctures deep, close and umbilicate on sides but sparse on disc. Punctures on prosternum, proepisternum, metasternum and abdomen coarse and heterogeneous. Elytra strongly punctate-striate; interstices little convex. Male genitalia (fig.

246) simple; median lobe with minute cuticular scales. Female genitalia (figs. 210-212) elongate; with a pair of accessory glands; median oviduct with a pair of sclerotized plates; bursa copulatrix slightly spiraled and with few long spines.

Dimensions (mm)	♂	♀
Total length	23,0	22,5
Length of pronotum	7,0	6,5
Length of elytron	15,0	15,0
Width of pronotum	6,0	7,0
Humeral width	7,0	6,0

Lectotype ♂ BRAZIL. Bahia. Dohrn, Coll. E. Candèze (IRSN).

BRAZIL. *Amazonas*. Tefé, 1 sp. (BM). *Pará*. Santarém, 1 sp. (BM). *Minas Gerais*. Diamantina (Fazenda das Melancias), 1 sp. (MNHNP). Pirapora, 1 sp. (MZUSP). *Goiás*, 1 sp. (MNHNP); 1 sp. (MZUSP). Jataí, 1 sp. (MNHNP). Vianópolis, 2 sp. (MZUSP); 2 sp. (MNHNP); 1 sp. (IBSP).

Heligmina, subtr. n.

General shape large (19,0/24,0 mm); uni- or bicolorous; practically glabrous to the naked eye. Mandibles generally toothed. Antenna strongly serrate from the third segment onwards (males of *Heligmus* have the antenna almost pectinate). Prothorax not much convex, with or without basal tubercles. Mesosternal cavity directed horizontally backwards (fig. 255). Elytron rounded to apex. Male genitalia (figs. 234, 237, 243, 244), simple (*Meroplinthus* has the median lobe fused basally to the lateral lobes in both sides). Female genitalia (figs. 216-224) elongate; bursa copulatrix with or without long spines and median oviduct simple or with sclerotized plates.

Distribution. This is a typical South American group, with one genus (*Pyrischius*) penetrating into Central America and Mexico. *Heligmus* and *Meroplinthus*, with species in open formations and forests.

Key to genera

1. Front without carina; antenna short; male genitalia with lateral lobes free, at least in the ventral side (figs. 234, 237) 2

   Front slightly carinate; antenna sometimes extending up to hind angles of the prothorax; median lobe fused basally to the lateral lobes in both sides (figs. 243, 244) .... *Meroplinthus* Candèze, 1891

2. Antenna strongly serrate or pectinate; eyes normal; prothorax largely marginated; bursa copulatrix without long spine (figs. 216-218) ..... *Heligmus* Candèze, 1865

Antenna serrate; eyes small; bursa copulatrix with numerous long spines (figs. 219-221); prothorax slightly marginated .... *Pyrischius* Hyslop, 1921

Heligmus Candèze, 1865

Heligmus Candèze, 1865: 52; 1891: 163; Schwarz, 1906: 210, 218; Schenkling, 1927: 357; Blackwelder, 1944: 286.

Front without carina. Antenna appearing or actually 12 segmented, strongly serrate or pectinate (males of *H. glyphoderus* have antenna pectinate). Mandibles toothed. Pronotum and elytra marginated. Male genitalia (figs. 234, 237) with very characteristic lateral lobes. Female genitalia (figs. 216-218) short and with long hairs.

Type-species: *Heligmus glyphoderus* Candèze, 1865 (Hyslop's designation, 1921: 648).

Distribution. With species in the Atlantic forest and in the open formations of Central Brazil and Bolivian Chaco.

Discussion: Apparently allied to *Pyrischius* but as I did not see the male of that genus, it is very difficult to make any conclusions. *Heligmus* is well characterizated by its general habitus, the strongly serrate or pectinate antennae and the bursa copulatrix without spines.

Key to species

1. Bicolored, antenna distinctly 12 segmented .... *glyphoderus* Candèze, 1865

Unicolored, antenna appearing 12 segmented ..... *obscurus*, sp. n.

Heligmus glyphoderus Candèze, 1865

(Figs. 216-218, 237)

Heligmus glyphoderus Candèze, 1865: 52 (type-locality: Brazil); 1891: 163; Schwarz, 1906: 210, 218; Schenkling, 1927: 357; Blackwelder, 1944: 286.

Black; pronotum, proepisternum, legs (except tarsi) yellowish. Pubescence fine, scarse and not visible to the naked eye. Front concave, slightly prominent on the region above antennal insertion; coarse and

rugosely punctulate. Antenna short, 12-segmented, pectinate in males, second segment short and spherical. Prothorax subquadrate; marginated; slightly convex; anterior angle large, rounded and prominent; hind angle short, very divergent and without carina. Pronotum without basal tubercle but with foveae; finely and densely punctured. Punctures on prosternum fine and scarse; on proepisternum pratically absent; on metasternum and abdomen fine and heterogeneous. Elytron rounded to apex, finely punctate-striate; interstices convex, rugose and micropunctulate. Male genitalia (fig. 237), median lobe slender; lateral lobe rounded to apex and densely hairy. Female genitalia (figs. 216-218) ovipositor short, with very long hairs; bursa copulatrix not spiraled, simple.

Dimensions (mm)	♂	♀
Total length	19,0	19,0
Length of pronotum	4,0	4,0
Length of elytron	14,0	14,0
Width of pronotum	4,5	6,0
Humeral width	6,0	7,0

Lectotype ♂ BRAZIL. Coll. E. Candèze, ex-Coll. Mniszech (IRSN).

BRAZIL. *Espírito Santo*. 1 sp. (BM).

Discussion. Closely related to *obscurus* but differs in color pattern, the pectinate male antenna and other characters.

Heligmus obscurus, sp. n.

Dark-brown; shining; pubescence short, scarce and grey. Front concave; coarse and densely punctulate; antenna apparently 12-segmented, serrate or slightly pectinate. Prothorax convex; with foveae; rounded to sides; anterior angles rounded and large; hind angles short, divergent and slightly carinate. Pronotum with coarse and homogeneous punctures. Punctures on prosternum coarser than on proepisternum. Metasternum and abdomen coarsely and homogeneously punctulate. Elytron rounded to apex; finely punctate-striate; interstices convex and micropunctured. Male genitalia (fig. 234), median lobe gradually tapering to the apex.

Dimensions (mm)	♂	♀
Total length	18,5	25,0
Length of pronotum	4,5	6,0
Length of elytron	13,0	17,5
Width of pronotum	6,0	7,5
Humeral width	6,0	8,0

Holotype ♂ BRAZIL. *Pernambuco*. Tapera. I.1932 (MZUSP).

Paratypes. BRAZIL. *Mato Grosso.* Cûiabá, 1 sp. (MNHNP). Pimentel Barbosa (Rio das Mortes), 1 sp., Dente & Werner col., X.1949 (MZUSP). Xingu, 1 sp., O. Vilas Boas col., IX.1955 (MNRJ). *Paraná.* Guaíra (Sete Quedas), 1 sp., G. R. Kloss col., 9.XII.1969 (MZUSP). BOLIVIA. Buena Vista. Ichilo, 1 sp., A. Martinez col., II.1950 (MZUSP).

Discussion. Closely allied to *glyphoderus* but differing in the unicolored integument; antenna less pectinate and only apparently 12-segmented.

Meroplinthus Candèze, 1891

Meroplinthus Candèze, 1891: 163; Schwarz, 1906: 210, 217; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Bicolorous; glabrous to the naked eye. Front large. Eyes little developed. Antenna short. Mandibles not denticulated. Mesosternal cavity (fig. 253) horizontal. Tarsi simple. Male genitalia (figs. 243, 244) with median lobe basally fused in both sides. Female genitalia (figs. 222-224) elongate; bursa copulatrix and median oviduct very simple.

Type-species: *Pyrophorus trinotatus* Candèze, 1881 (Hyslop's designation, 1921: 657), now considered synonym of *trilineatus* Lucas.

Distribution: Atlantic forest and open formations of South Brazil and Uruguay.

Discussion. This genus is well characterizated by the front slightly carinate, the mandibles not denticulate, the mesosternal cavity horizontal and the type of the male genitalia.

Key to the species

1. Elytra black ..... *ambrosius,* sp. n.
   Elytra bicolorous 2
2. Prothorax with longitudinal dark stripes ... *trilineatus* Lucas, 1859
   Prothorax with rounded dark spots 3
3. Pronotum with two rounded spots ..... *decorus,* sp. n.
   Pronotum with one discal spot ..... *schneideri* Schwarz, 1906

Meroplinthus ambrosius, sp. n.

(Fig. 243)

Light black; prothorax yellowish; discal spot and prosternal process blackish. Pubescence fine and yellowish. Front slightly concave; coar-

sely punctulate. Antenna short. Prothorax convex, rounded to sides; hind angle short, divergent and slightly carinate. Pronotum without basal tubercle, finely punctured; punctures denser on the latero-anterior region. Prosternum with punctures very fine, denser on anterior part and practically absent in the middle; proepisternum with punctures coarse and umbilicate. Metasternum and abdomen coarsely and heterogeneously punctulate. Metacoxal plate abruptly expanded inwards. Elytron rounded to apex, punctures more distinct on anterior half. Male genitalia (fig. 243), simple; median lobe subparallel; lateral lobes with a small apical spine.

Dimensions (mm)	♂	♀
Total length	18,0	22,0
Length of the pronotum	4,5	5,0
Length of the elytron	12,0	15,0
Width of the pronotum	4,5	6,0
Humeral width	5,0	6,0

Holotype ♀ BRAZIL. *São Paulo.* Piracicaba (Escola de Agronomia) (MZUSP).

Paratypes. BRAZIL. *Mato Grosso.* 1 sp., P. Germain col., 1886 (MNHNP). *Goiás.* Jataí, 4 sp., C. Pujol col., 1895-96 (MNHNP).

Discussion. This is the only known species with black elytra; its lighter color and general habitus distinguishes it from the others.

Meroplinthus decorus, sp. n.

Yellowish; two small patches on pronotal disc, a central spot on proepisternum, prosternal process, humerus and apical 1/3 of elytra, black. Front strong and rugosely punctulate. Antenna short. Prothorax subquadrate; convex; finely marginated; hind angle short, little divergent and carinate. Pronotum finely punctured. Prosternum and proepisternum less punctured than pronotum. Metasternum and abdomen finely and heterogeneously punctulate. Elytra strongly punctate-striate; intervals convex, second and eighth intervals more convex than the others.

Dimensions (mm, ♀). Total length, 23,0; length of pronotum, 6,0; length of elytron, 16,0; width of pronotum, 7,0; humeral width, 7,0.

Discussion. I have seen one male from Corrientes, D'Orbigny, 1834 (MNHNP), which seems to belong to this species. It differs by a very small spot on pronotal disc and by the absence of the patches on proe-

pisternum and humerus. As I have examined only females, I believe that this difference is due to sexual dimorphism, but as only one specimen is available it was not included here.

This species is closely related to *schneideri* but has different color pattern.

Holotype ♀. URUGUAY. *Montevideo.* Sayago, A. Silveira col., 25.I.1955 (IBSP).

Paratypes. BRASIL. 1♀ (89-9 BM). *Rio Grande do Sul.* Pelotas, 1 ♀ I. Figueiredo col., II.1934 (IBSP). URUGUAY. *Montevideo,* Sayago, 1♀, 1948 (MZUSP).

Meroplinthus schneideri (Schwarz, 1906)

(Figs. 222, 224, 253)

Pyrophorus schneideri Schwarz, 1906: 155, pl. 6, fig. 13 (type-locality: Brazil, São Leopoldo); Schenkling, 1927: 354, Blackwelder, 1944: 286.

Meroplinthus schneideri; Schwarz, 1906: 217.

Reddish-yellow; apical eight segments of antennae, a spot on the pronotal disc, scutellum, a submarginal and a sutural stripe on the elytra, extending from the apical 3/4 of each elytron and fused at apex, black. Pubescence extremely fine and invisible to the naked eye. Front finely punctured. Antenna short, second segment short and spherical. Prothorax regularly convex; sides rounded; anterior angle rounded; hind angle slightly divergent and weakly carinate. Pronotum finely punctured and without basal tubercle. Prosternum and proepisternum more densely punctured than pronotum. Metasternum and abdomen finely and heterogeneously punctured. Metacoxal plates abruptly expanded inwardly. Elytron two and a half times longer than prothorax; rounded to apex; distinctly punctate-striate. Female genitalia (figs. 222-224): elongate; bursa copulatrix and median oviduct simple.

Dimensions (mm, ♀). Total length, 27,0; length of pronotum, 7,0; length of elytron, 18,0; width of pronotum, 7,0; humeral width, 7,0.

Holotype ♀. BRAZIL. *Rio Grande do Sul.* São Leopoldo, F. Schneider col. (DEIE).

BRAZIL. *São Paulo.* São Paulo, 3 sp. (MZUSP); 1 sp. (IBSP). *Santa Catarina.* Corupá, 2 sp. (IBSP). Pinhal, 2 sp. (CCS).

Discussion. Closely related to *trilineatus* but easily differentiated by the color pattern.

Meroplinthus trilineatus (Lucas, 1859), comb. n.

(Fig. 244)

Adelocera trilineata Lucas, 1859: 73 (type-locality: Brazil); Schenkling, 1927: 16, 513.

Pyrophorus trinotatus Candèze, 1881: 91.

Meroplinthus trinotatus; Candèze, 1891: 163; Schwarz, 1906: 217; Schenkling, 1927: 356; Blackwelder, 1944: 286, *syn. n.*

Reddish-yellow; three slender and longitudinal stripes on pronotum, apical 1/3 of elytra, apical eight antennal segments, a submarginal diffused spot on metasternum and abdomen, black. Pubescence fine and sparse. Front almost flat; punctures deep but not dense. Antennae almost reaching the hind angles of prothorax. Prothorax subquadrate; convex; sides rounded; anterior angle small and rounded; hind angle slender, divergent and not carinate. Pronotum without basal tubercle; punctures deep and dense on the anterior half and fine on the posterior region. Punctures on prosternum strong and sparse; on proepisternum strong medially. Metasternum and abdomen finely and heterogeneously punctured. Elytron rounded to apex; finely punctate-striate; intervals micropunctulate. Male genitalia (fig. 244) simple.

Dimensions (mm)	♂	♀
Total length	20,0	32,0
Length of pronotum	6,0	8,0
Length of elytra	13,0	22,0
Width of pronotum	6,0	9,0
Humeral width	6,0	9,0

Lectotype ♂ BRAZIL. Rio, Castelnau col., 1844 (MNHNP).

BRAZIL. 3 sp. (BM); 1 sp. (IRSN). *Guanabara.* Rio de Janeiro. 1 sp. (MNHNP); (Corcovado), 2 sp. (MNRJ).

Discussion. I have seen the types of *Adelocera trilineata* Lucas and *Meroplinthus trinotatus* Candèze at the Paris Museum and I have noticed that they are the same species. The type of *trilineata* has a label written by Fleutiaux which indicates this synonymy. As Fleutiaux has apparently never published this, it is being so done here.

The color pattern of this species distinguishes it from the others.

Pyrischius Hyslop, 1921

Ischius Candèze (preocc. Wesmael, 1837-Hym.), 1857: 195; 1878: 41; Champion, 1895: 475; Schwarz, 1906: 210, 217.

Pyrischius Hyslop, 1921: 668; Schenkling, 1927: 357; Blackwelder, 1944: 286.

Front without carina. Eyes little developed. Mandibles denticulate. Antenna short, slightly serrate from the third segment onwards. Prosternal suture slightly open on anterior region. Mesosternal cavity enlarged and horizontal (fig. 255). Female genitalia (figs. 219-221), elongate with accessory glands well developed, bursa copulatrix little spiraled and with long spines, median oviduct with a pair of sclerotized plates.

Type-species: *Ischius gerstaeckeri* Candèze, 1857: 195 (Hyslop's designation, 1921: 668).

Discussion: The general facies and the type of the bursa copulatrix characterize this genus and make it very different from the others.

Distribution: Amazonian region and Central American rain forests.

Key to the species

1. Elytra unicolorous ..... *haagi* Champion, 1895
   Elytra bicolorous 2

2. Pronotum black with a yellow spot on disc .....
   ..... *gerstaeckeri* Candèze, 1857
   Pronotum black with two yellow spots on disc .....
   ..... *biplagiatus* Janson, 1882

Pyrischius biplagiatus (Janson, 1882)

(Figs. 219-221)

Ischius biplagiatus Janson, 1882: 36, fig. 6 (type-locality: Equador, Chiguinda).

Pyrischius biplagiatus; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Yellowish. Antenna, two spots on pronotal disc, apical half of elytron, the entire ventral surface (except of the inner part of the proepisternum), black. Front concave with punctures deep and not dense. Mandibles slightly denticulate. Antenna short, second segment short and spherical. Prothorax convex, sides subparallel; anterior angle large and rounded; hind angle stout, slightly divergent and weakly carinate. Pronotum with a small basal tubercle, punctures fine and dense on sides but deeper and sparser on disc. Prosternum and proepisternum less densely punctulate than pronotum. Metasternum and abdomen finely and

heterogeneously punctulate. Elytra punctate-striate, the punctures decreasing in size from the humerus to the apices; intervals flat and micropunctulate. Female genitalia (figs. 219-221), ovipositor short; one pair of accessory glands; median oviduct with a pair of sclerotized plates; bursa copulatrix little spiraled and with few long spines.

Dimensions (mm, ♀). Total length, 22,0; length of pronotum, 6,5; length of elytron, 15,0; width of pronotum, 7,0; humeral width, 7,0.

ECUADOR. Gualaquizo, 1 sp. (MNHNP).

BRAZIL. *Pará*. Tocantins, 1 sp. (BM); 1 sp. (MNHNP).

Discussion. Closely related to *gerstaeckeri* differing in the color pattern and other characters.

Pyrischius gerstaeckeri (Candèze, 1857)

Ischius gerstaeckeri Candèze, 1857: 196 (type-locality: Guianas); 1878: 41; 1891: 163; Schwarz, 1906: 218.

Pyrischius gerstaeckeri; Hyslop, 1921: 668; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Yellowish. Antennae, a basal spot on the middle of the prothorax, apical half of elytra and ventral surface (except a submarginal stripe on the proepisternum), black. Pubescence short, fine and yellowish. Front very enlarged, almost flat; finely punctured. Antenna short. Prothorax subquadrate, convex, sides rounded; anterior angle small and rounded; hind angle stout, slightly divergent and weakly carinate. Pronotum with a large basal tubercle; punctures fine and dense; proepisternum fine and densely punctured. Metasternum and abdomen strong and heterogeneously punctulate. Elytra gradually tapering to the apices; finely punctate-striate, the punctures more distinct on humerus; humeral interstices very convex.

Dimensions (mm, ♀). Total length, 17,5-25,0; length of pronotum, 5,0-8,0; length of elytron, 11,0-16,0; width of pronotum, 5,5-8,0; humeral width, 5,0-7,5.

Lectotype ♀ "GUIANAS". Coll. E. Candèze (IRSN).

Paralectotypes. FRENCH GUIANA. Cayenne, 1♀ Coll. Janson ex-Coll. Candèze (BM); 1♀ Coll. Fairmaire-Candèze (MNHNP).

BRAZIL. *Amapá*. Serra do Navio, 1♀ (MZUSP).

Discussion. It differs from the others in the color pattern.

Pyrischius haagi (Champion, 1895)

Ischius haagi Champion, 1895: 475, pl. 21, fig. 5 (type-locality: Mexico).

Pyrischius haagi; Schenkling, 1927: 356; Blackwelder, 1944: 286.

Black, the prothorax flavo-testaceous, with a very large subcruciform black patch; the proepisternum entirely flavo-testaceous. Pubescence short, fine and grey. Front concave, finely and densely punctulate. Antennae short, the third segment small, slightly longer than the second. Prothorax convex, sides rounded; hind angle slightly divergent and strongly carinate. Pronotum with a small basal tubercle; finely and densely punctured; punctures fine and less dense ventrally. Metasternum and abdomen finely and heterogeneously punctulate. Elytron finely punctate-striate; intervals micropunctured. Female genitalia: bursa copulatrix little spiraled and with few long spines; median oviduct with a pair of very characteristic sclerotized plates.

Dimensions (mm, ♀). Total length, 24,0; length of pronotum, 7,5; length of elytron, 15,0; width of pronotum, 7,5; humeral width, 7,5.

Lectotype ♀ MEXICO. Coll. Janson ex-Coll. Candèze (BM).

Paralectotype ♀ GUATEMALA. Cobán. Vera Paz, Champion (BCA) (BM).

Discussion. Apart from the very different color pattern, it differs from the other species by the small third joint of the antenna.

Pyrophorini Candèze, 1863

Adults generally dark, with luminous organs on the prothorax and/or on abdomen; mesosternal cavity generally sinusoidal.

BIOLOGICAL DATA

Generally the first reaction of the adults when disturbed is to simulate death, as occurs with several insects. When they are disturbed for a long time, they begin to emit light and are very active. The adults are phytophagous consuming vegetal juices; in the laboratory adults of many species can be kept alive for more than three months by feeding them a sugar syrup.

OVIPOSITION

I have been able to observe a single oviposition of *Opselater pyrophanus*. Before ovipositon the female walked quickly from side to side

of the cage, emitting an intermitent light. When she found a suitable place, she stopped, protruded the ovipositor and touched the place many times with it; after this she began to lay eggs. Laying lasted one minute and during this time she emitted light twice.

The number of eggs laid during one day is very high; in the genus *Fulgeochlizus* I have counted over 100 eggs.

Eggs are generally semispherical, very small (in the genus *Pyrophorus* the largest ones are 0,5 mm in diameter); opaque-white when laid, turning yellowish shortly and becoming transparent near eclosion. At this later stage one can see the small larva moving inside.

In the laboratory I have observed that a batch of eggs from one female of *Pyrearinus* does not hatch at the same time, in fact some do not hatch until a year late. For this reason larvae from the first instar were obtained at different periods of the year.

I have reared three generations of one species of *Pyrearinus* but I never observed mating.

LARVAE

I have reared larvae of several Pyrophorina (*Pyrophorus, Fulgeochlizus, Opselater* and *Pyrearinus*) and Hapsodrilina (*Hapsodrilus*), but did not notice any significant morphological difference between them. The main characters of the mature larva are: body surface yellowish; head, pronotum and prosternum darker. Head and body dorsoventrally compressed. Cranial sutures widely separated in front, converging behind. Mandibles without teeth. Surface of ninth abdominal segment with small hairy tubercles; apex bifurcate.

The larvae are generally found on the ground, in rotten wood, or under stones. They are predaceous, eating other larvae, as well as Collembola, Isoptera, etc. When disturbed, they eliminate a brown liquid through the mouth; when much disturbed, luminescence appears on the thoracic and abdominal segments. In some cases it was observed that luminescence appears only shortly before and after ecdyses; during the intermediate phases no light emission was observed. Pupae, when disturbed, always produce intense light.

Larvae of Nyctophyxina are unknown at present.

Larvae of *Photophorus,* preserved in alcohol, received from the British Museum have no noticeable morphological difference from other larvae of Pyrophorinae studied.

LUMINESCENCE

None of the species reared showed luminescence on eggs. Bianchi (1937) and Costa (1970) have observed that neither the eggs nor the young larvae showed luminescence. However, Dubois (1886) refered to the luminescence of eggs of *Pyrophorus noctilucus.*

I have observed that larvae of *Pyrophorus punctatissimus,* when disturbed, showed luminescence on the thoracic and abdominal segments, round spots laterally and transverse zones dorsoventrally.

Larvae of *Fulgeochlizus* showed luminescence on two prothoracic spots and one dorso-median spot on each abdominal segment. Larvae of *Opselater pyrophanus* showed luminescence only on two small spots on the prothorax. Larvae of *Pyrearinus,* when disturbed, showed luminescence on the first prothoracic segment and on the abdominal segments, round spots laterally; well developed larvae of this genus, when disturbed, showed intense luminescence on two spots on the prothorax and then following as a syncronized chain on the abdomen, with round spots laterally and a smaller series on the dorso-median surface. As soon as the abdomen starts to shine, the thorax gradually diminishes its light; finally only the nine abdominal segments remain slightly luminous, and then luminosity stops completely.

Bianchi (1937) said that larvae of *Deilelater bellamyi* do not show luminescence during long phases:

"Whether the ability to produce it (luminescence) ever completely and permanently disappears is not known but it was distinctly observed that field-collected larvae were less apt to glow in the laboratory after a few moults than they had been in the field. When luminescence is present either in larvae, pupae or adults it is constant at a certain minimum of intensity. At this minimus it may be hardly perceptible or easily distinguishable but the intensity of the light and the extent of the luminescent areas increase suddenly when the insect is prodded or shaken. A maximum of intensity is then quickly reached, followed by more gradual return to the constant minimum... It is seemingly a voluntary reaction with a protective purpose and in the case of luminescent larvae it is invariably associated with the act of biting, when the individual is sufficiently aroused to have recourse to this more vigorous defense".

I have observed larvae of two species of *Hapsodrilus.* One of them showed luminescence only on the first prothorax segment, and the other showed beyond this a thin light also on the abdominal segments, transversal zones dorsoventrally.

Prepupae and pupae generally showed luminescence over the entire body, with variations of intensity depending on the species. After 10 to 14 days of the pupal period one is generally able to perceive the outlines of the adult luminescent spots. Pupae of some species of *Pyrearinus,* when undisturbed, showed a thin, white light to the naked eye; when disturbed, they glow intensely, changing to a very light green.

Newly emerged adults show luminescence at the prothoracic spots, the anterior margin of the prothorax, the organ between the metathorax and the first abdominal segments, and all over the urotergites and urosternites as transverse zones which correspond to the limits between segments. As the adult becomes more sclerotized, the anterior margin of the prothorax and the abdominal segments lose their luminescence. In the senile phase, the adult gradually loses the capacity of light emis-

sion; one day or two before death luminescence is completely lost. There seems to be a period of most luminescence coinciding with the newly emerged adult phase.

LUMINESCENCE AND EVOLUTION

Harvey (1932) said about the evolution of the luminescence the following: "Generally, luminescence has appeared sporadically in the living world, with a few luminous species scattered here and there among structurally very close non-luminous relatives. This again means that luminescence can be readily developed in the course of evolution by some slight change in a mechanism already existing within all cells".

Seliger & McElroy (1965) said: "We think that these light-emitting reactions in organisms were, in fact, detoxifying processes for the removal of oxygen which was necessary for the survival of early anaerobic forms of life. We propose that the use of organic reduction substance to remove oxygen by direct reduction led to the formation of an excited state which could emit light. These reactions were the basis for the origin and evolution of luminescence in organisms... With such systems established and with the appearance of the true aerobes, it is evident that the direct reduction of oxygen and the accompaying luminescence were no longer of selective advantage. Therefore, with the appearance of the aerobes, luminescence would begin to disappear. However, since light emission was originally intimately connected with the essential energy-liberating electron transport processes it is likely that a number of the light-emitting systems would persist. It is therefore our argument that bioluminescence is a vestigial system in the evolutionary process and that there is, at present, no selective advantage insofar as the primary excitation process is concerned. It is true, however, that during the evolution of various species the luminescence system has been adapted for secondary purposes which have selective advantage. The identification of the female firefly by the male is an excellent example".

There are certain relations between the degree of luminescence and sexual dimorphism. Genera with more evident secondary sexual characters (*Hypsiophthalmus*) do not have a great development of luminous organs. In *Pyrophorus,* on the other hand, there are no dimorphic characters but it is noticed that luminous organs are more developed. I think that in *Hypsiophthalmus* there may have been ecological restrictions and a reduction of dispersive capacity (females with vestigial hind wings do not fly); in fact, this genus is isolated in Southeastern Brazil. In *Pyrophorus,* dispersal capacity is greater, as one can see by the distribution of this genus, which was able to reach the Antilles.

If luminous genera succeed better, it becomes clear that luminescence, as an adaptative character, reaches its greatest selective value in the genus *Pyrophorus.*

DURATION OF THE BIOLOGICAL CYCLE

The larval phase generally required about two years. Sometimes, for reasons unknown to me, the larval period took three years. The pre-pupa period took on the average 21 days; the pupal phase the average of 24 days. Females live on the average two to three months and males for a shorter time.

SYSTEMATICS

Key to subtribes

1. Eyes little developed; male genitalia simple (figs. 75-76, 130); luminescent organs of the prothorax flat, localized posteriorly; without abdominal luminescent organ ..... Nyctophyxina, subtr. n.

   Eyes normal, or very prominent, male genitalia complex; luminous organs of the prothorax variable in shape and position; abdominal luminescent organs present 2

2. Elytron parallel; front without carina; male genitalia with median lobe basally fused to the lateral lobes on both sides (figs. 131-140) ..... Hapsodrilina, subtr. n.

   Elytron tapering to apex; front carinate; male genitalia with median lobe free on ventral face (figs. 1-26, 34-51, 77-80, 94-115, 128, 129) ..... Pyrophorina Candèze, 1863

Nyctophyxina, subtr. n.

Generally dark-brown or black. Pubescence short or longer, more or less bristly. Punctures in general well impressed. Head small. Eyes little developed or small. Front carinate. Antennae reaching hind angles of prothorax or extending a little beyond, and serrate from the fourth segment onwards. Prothorax regularly convex, sides subparallel. Luminous spots flat, localized posteriorly. Metacoxal plate tapering outwards. Abdominal luminous organs absent (figs. 191, 195). Elytra more or less three times longer than prothorax, sides parallel up to the middle; apices rounded. Tarsi decreasing in length from the first to the fourth; the fifth segment of the same length as the third and fourth together. Male genitalia (figs. 75, 76, 130) very simple. Female genitalia (figs. 81-83): bursa copulatrix bipartite, not spiraled with few long spines; median oviduct with a pair of characteristic sclerotized plates. Sexual dimorphism very evident (figs. 177, 178): the females are recognized by being more convex, more rounded, by the smaller eyes, and by antennae and hind wings shorter than usual.

Distribution (map 2): From the map we can deduce that this group is predominantly South-American, without penetration into Central America and Mexico. *Nyctophyxis* is endemic to Chile; *Noxlumenes* occurs in Argentina; and *Cryptolampros* shows an apparently disjunct distribution.

This subtribe is very primitive; it probably was more widely distributed before; and nowadays it is probably receding through competition with more advanced subtribes.

Key for the genera

1. Eyes very small; pubescence very bristly and long (figs. 177, 178) ..... *Nyctophixis*, gen. n.

   Eyes a little more developed, pubescence not very bristly and short 2

2. Third antennal segment short, subequal in length and shape to the second ..... *Noxlumenes*, gen. n.

   Third antennal segment longer than second, slightly triangular and smaller than the fourth ..... *Cryptolampros*, gen. n.

Nyctophyxis, gen. n.

Black. Pubescence long, sparse, fine, very bristly and grey. Eyes very small. Antenna 11-segmented, serrate from the fourth segment onwards, the three first segments shining, the apical ones dull; second segment short, third relatively long and triangular, smaller than fourth. In males the antennae extend up to the hind angles of the prothorax; in females are shorter. Prothorax quadrate in males (figs. 177, 178), rounded in females. Luminous spots large, oval, flat and posterior. Punctures extremely large and umbilicate. Metacoxal plates tapering outwards. Abdominal luminous organs absent (fig. 191). Elytron tapering to the apex; punctate-striate; intervals rugose. Male genitalia (fig. 76) simple; median lobe little developed. Female genitalia (figs. 81-83); bursa copulatrix bipartite, not spiraled with a few long spines; median oviduct with a pair of sclerotized plates. Sexual dimorphism very evident; males with larger eyes, longer antennae; females more rounded, hind wings shorter than usual.

Type-species: *Pyrophorus ocellatus* Germar, 1841.

Distribution: CHILE. *Coquimbo. Santiago. Colchagua. Curicó. Ñuble. Bío-Bío.*

Nyctophyxis ocellatus (Germar, 1841), comb. n. (Figs. 76, 81-83, 177, 178, 191).

Pyrophorus ocellatus Germar, 1841: 49 (type-locality. Chile); Candèze, 1863: 47; Fleutiaux, 1907: 211; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Pyrophorus conicicollis Fairmaire & Germain, 1860: 5 (type-locality: Chile); Schnkling, 1927: 352; Blackwelder, 1944: 286.

Pyrophorus variolosus Solier, 1851: 29 (type-locality: Santa Rosa); Candèze, 1863: 47; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Nyctophyxis leporinus (Candèze, 1863), comb. n.

Pyrophorus leporinus Candèze, 1863: 47 (type-locality: Mendoza, Chile); Burmeister, 1875: 269; Fleutiaux, 1907: 211; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Noxlumenes, gen. n.

Brownish. Pubescence sparse, short and little bristly. Eyes normal. Antennae very long, serrate from the fourth segment onwards; second and third segments subequal. Prothorax subquadrate. Luminous spots rounded, flat, posterior, and visible beneath the proepisternum. Metacoxal plates tapering outwards. Abdominal luminous organs absent. Male genitalia (fig. 75): lateral and median lobes very elongate in relation to the basal piece.

Type-species: *Noxlumenes bardus,* sp. n.

Noxlumenes bardus, sp. n.

(Fig. 75)

Front slender, almost flat, slightly prominent anteriorly; punctures strong, dense and umbilicate. Prothorax with foveae, sides subparallel; anterior angle divergent, slender and strongly carinate; punctures coarse, dense, umbilicate and homogeneous. Punctures on prosternum coarse, dense and umbilicate, except on the anterior region, where they are fine. Proepisternum practically without punctures on the region corresponding to the luminous spots. Metasternum and abdomen fine and heterogeneously punctulate. Elytron three times the length of the prothorax; rounded to apex; laterally marginated; distinctly punctate-striate; intervals convex. Male genitalia (fig. 75): lateral lobes with short and hairy apices, median lobe slightly straight.

Dimensions (mm, ♂). Total length, 21,0; length of pronotum, 5,0; length of elytron, 15,0; width of pronotum, 5,5; humeral width, 6,0.

Holotype ♂: ARGENTINA. *Neuquén*: Las Lajas, S. Martin & Monné col., 16.I.1967 (FHC). Paratypes: same data as holotype, 1 sp. (FHC); Zapala, 2 sp., Mesa & Sandulski col., 23.III.1964 (FHC).

Cryptolampros, gen. n.

Black, elytra brownish. Pubescence short, dense, yellowish, recumbent. Eyes little developed. Antennae extending up to the hind angles of the prothorax, serrate from the fourth segment onwards, the first three segments shining, the others dull; second segment short; third little longer, but smaller than the fourth. Prothorax regularly convex; luminous spots small, rounded, flat, posterior, and visible under the prothorax. Abdominal luminous organ absent (fig. 195). Elytron rounded to apex, finely punctate-striate. Male genitalia (fig. 130): lateral lobe and median lobe simple.

Type-species: *Pyrophorus coecus* Germar, 1841.

Distribution (map 2). FRENCH GUIANA. COLOMBIA. *Cundinamarca.* BRAZIL. *São Paulo. Paraná. Rio Grande do Sul.*

Cryptolampros coecus (Germar, 1841), comb. n.

Pyrophorus coecus Germar, 1841: 40 (type-locality: BRAZIL. *Rio Grande do Sul.* Porto Alegre); Candèze, 1863: 35; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Hapsodrilina, subtrib. n.

Generally dark-brown, sometimes bicolorous. *Pyroptesis* has the lateral margin of the prothorax yellowish. *Sooporanga* is reddish-yellow, with dark spots on prothorax and dark stripes on elytra. Pubescence variable, very dense, or fine, sometimes absent to the naked eye. Eyes normally developed. Front without carina or slightly carinate, in the latter case it is absent in the middle. Antenna generally elongate; in *Ptesimopsia* it is serrate from the third segment onwards, this segment is subequal to the fourth or slightly shorter; in the other genera the antennae are serrate from the fourth segment onwards, but the third is more or less triangular. Prothorax generally convex, sides rounded or subparallel, in some species of *Ptesimopsia* dorsoventrally compressed. Luminous spots on prothorax flat or slightly convex, localized at the corner of the hind angles, or near the basal margin. Mesosternal cavity sinusoidal, in *Ptesimopsia* slightly horizontal. Metacoxal plates tapering or abruptly enlarged inwardly. Abdominal luminous organs (figs. 196-200) variable in shape. Elytra two to three times longer than the prothorax, sides subparallel up to the apical third; apices rounded. Tarsi decreasing in length from the first to the fourth; fifth segment as long as the third and fourth together. Male genitalia (figs. 131-140): median lobe fused basally to the lateral lobes in both faces. Median lobe with or without minute cuticular scales or spines. Female genitalia (figs. 141-146): median oviduct simple or with sclerotized plates; bursa copulatrix with few or without long spines; accessory

glands little developed. Sexual dimorphism not very evident; sometimes the female can be recognized by its larger size, more rounded prothorax and shorter antennae.

Distribution (maps 3 and 4). This group is predominantly South American, the only exception being one species of *Hapsodrilus* and this may represent a recent invasion.

Sooporanga and *Pyroptesis* are restricted to the forest of Southeastern Brazil. *Ptesimopsia* is aparently disjunct in the open formations of the Chaco and in forested areas of Brazil.

This group, at present chiefly restricted to the Southeastern areas of Brazil, has probably occupied all South American forests in earlier times.

Key to the genera

1. Bicolored; pubescence sparse; luminous spots blending with the color of the integument 2

   Unicolored; pubescence dense; bristly; luminous spots variable .. 3

2. Integument yellowish, a spot on pronotal disc and a submarginal stripe on elytra, darker; luminous spots slightly convex .... *Sooporanga,* gen. n.

   Integument black, lateral margins of the prothorax reddish-yellow (fig. 181) ..... *Pyroptesis,* gen. n.

3. Antennae serrate from the fourth segment onwards; luminous spots flat and localized at the corner of the hind angle (fig. 182) ... . *Hapsodrilus,* gen. n.

   Antennae serrate from the third segment onwards, luminous spots slightly convex and localized posteriorly ... *Ptesimopsia,* gen. n.

Sooporanga, gen. n.

Reddish-yellow, a spot on pronotal disc and a submarginal stripe on the elytra, the eighth apical segment of the antennae, darker. Pubescence short, sparse, yellowish and bristly. Eyes normally developed. Antennae reaching the hind angles of prothorax, second segment short, third slightly triangular and smaller than the fourth. Prothorax laterally marginated, little convex. Luminous spots angular, slightly convex. Mesosternal cavity sinusoidal. Metacoxal plates tapering outwards. Elytra parallel, rounded to apices, finely marginated. Abdominal luminescent organ of median size. Male genitalia (figs. 131, 131a): median lobe tapering to apex; lateral lobes short and hairy. Female genitalia:

bursa copulatrix simple, spiraled, with a few long spines; median oviduct simple; accessory glands little developed. No apparent sexual dimorphism.

Type-species: *Pyrophorus formosus* Germar, 1841.

Distribution (map 3). BRAZIL. *Minas Gerais. Rio de Janeiro. São Paulo. Paraná.*

Sooporanga formosus (Germar, 1841), comb. n. (figs. 131, 131a).

Pyrophorus formosus Germar, 1841: 41 (type-locality: Brazil); Candèze, 1863: 41; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyroptesis, gen. n.

Black, lateral margin of the prothorax yellowish. Pubescence short, brownish, not very dense and bristly. Eyes normal. Front prominent. Antennae reaching the hind angles of the prothorax; serrate from the fourth segment onwards; second very small, third slightly triangular and shorter than the fourth. Prothorax regularly convex, sides subparallel. Luminous spots angular and without distinct margin (fig. 181). Abdominal luminous organs (fig. 199) of median size. Elytra parallel, rounded to apices; finely marginated to sides; punctate-striate. Male genitalia (figs. 136-137): median lobe simple, almost straight; lateral lobes pointed and divergent. Female genitalia (figs. 144-146): ovipositor with lateral setae well developed; median oviduct with a pair of sclerotized plates.

Types-species: *Pyrophorus cincticollis* Germar, 1841.

Distribution (map 3). BRAZIL. *Bahia. Rio de Janeiro. São Paulo. Paraná. Rio Grande do Sul.*

Pyroptesis cincticollis (Germar, 1841), comb. n. (Figs. 137, 144-146, 181).

Pyrophorus cincticollis Germar, 1841: 44 (type-locality: Salto Grande); Candèze, 1863: 39; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyroptesis maculicollis (Candèze, 1863), comb. n. (Figs. 137, 199)

Pyrophorus maculicollis Candèze, 1863: 38 (type-locality: Nova Friburgo, Brazil); Schenkling, 1927: 352; Blackwelder, 1944: 285.

Hapsodrilus, gen. n.

Dark brown or reddish-brown. Pubescence relatively dense, yellowish and bristly. Eyes normal. Front without carina. Antennae elon-

gate, serrate from the fourth segment onwards; second segment short; third triangular and smaller than the fourth. Prothorax (fig. 182) quadrate, almost convex. Luminous spots flat, angular, without distinct limits. Mesosternal cavity sinusoidal. Metacoxal plates narrow, with sinusoidal margin. Abdominal luminous organ (fig. 198, 200), size variable from small to median. Male genitalia (figs. 138, 140): median lobe with cuticular scales and spines. Female genitalia (figs. 141-143): bursa copulatrix without long spines and oviduct simple. Sexual dimorphism little developed.

Type-species: *Pyrophorus ignifer* Germar, 1841.

Distribution (map 4). MEXICO. *Chiapas.* BRAZIL. *Minas Gerais. Espírito Santo. Rio de Janeiro. Goiás. São Paulo. Santa Catarina. Rio Grande do Sul.* URUGUAY. *Rivera.* ARGENTINA. *Cordoba.*

Hapsodrilus funale (Candèze, 1863), comb. n.

Pyrophorus funale Candèze, 1863: 37 (type-locality: Brazil); Schenkling, 1927: 350; Blackwelder, 1944: 285.

Hapsodrilus ignifer (Germar, 1841), comb. n. (fig. 139).

Pyrophorus ignifer Germar, 1841: 16 (type-locality: BRAZIL); Candèze, 1863: 43; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Hapsodrilus luculentus (Germar, 1841), comb. n. (figs. 138, 141-143, 198).

Pyrophorus luculentus Germar, 1841: 46 (type-locality: Brazil); Candèze, 1863: 43; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Pyrophorus facifer Germar, 1841: 48 (type-locality: Brazil); Blanchard, 1843: 142; Candèze, 1863: 43; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Hapsodrilus pyrotis (Germar, 1841), comb. n. (figs. 140, 140a).

Pyrophorus pyrotis Germar, 1841: 42 (type-locality: Montevideo); Candèze, 1863: 37; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Ptesimopsia, gen. n.

Dark-brown. Pubescence dense, yellowish or seemingly glabrous to the naked eye. Eyes normally developed. Front slightly carinate. Antennae reaching the hind angles of prothorax, serrate from the third segment onwards; third segment of the same length of the fourth. Prothorax (figs. 183, 184) more or less convex; in some species dorsoventrally compressed. Luminous spots posterior, slightly convex. Mesosternal cavity slightly horizontal. Metacoxal plate abruptly enlarged in-

wardly. Abdominal luminous organ very small or indistinct (figs. 196, 197). Elytron parallel, rounded to apex; punctate-striate. Male genitalia (figs. 132-135): lateral lobe short; median lobe tapering to apex.

Type-species: *Pyrophorus candezei* Fauvel, 1861.

Distribution (map 4). SURINAM. FRENCH GUIANA. COLOMBIA. *Cauca.* PERU. *Junin.* BRAZIL. *Amazonas. Bahia. São Paulo. Santa Catarina. Mato Grosso. Rio Grande do Sul.* PARAGUAY. *Concepcion. Central. Paraguay. Caazapa.* URUGUAY. *Rivera, Tacuarembó. Treinta y Tres. Canelones. Maldonado. Montevideo. Rocha.* ARGENTINA. *Santiago del Estero. Santa Fé. Chaco. Tucumán. Misiones.*

Ptesimopsia candezei (Fauvel, 1861), comb. n. (figs. 132, 183).

Pyrophorus candezei Fauvel, 1861: 307 (type-locality: Cayenne); Candèze, 1863: 45; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Ptesimopsia lucifuga (Curtis, 1839), comb. n. (figs. 134, 184, 197).

Pyrophorus lucifugus Curtis, 1839: 107 (type-locality unknown); Germar, 1841: 73; Candèze, 1863: 70; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Pyrophorus crassus Blanchard, 1843: 141 (type-locality: Montevideo). Candèze, 1863: 42; Burmeister, 1875: 270; Schenkling, 1927: 350; Blackwelder, 1944: 285, *syn. n.*

Ptesimopsia parallela (Germar, 1841), comb. n. (figs. 133, 196).

Pyrophorus parallelus Germar, 1841: 45 (type-locality: Brazil, Porto Alegre); Candèze, 1863: 41; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Pyrophorus rubripes Blanchard, 1843: 140 (type-locality: Corrientes); Candèze, 1863: 42; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Ptesimopsia pyraustes (Germar, 1841), comb. n. (fig. 135).

Pyrophorus pyraustes Germar, 1841: 47 (type-locality: Brazil); Candèze, 1863: 44; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrophorina Candèze, 1863

Size very variable, the smaller forms occur in the genus *Pyrearinus* (7 mm) and the largest in the genus *Pyrophorus* (38 mm). Generally unicolorous, very dark brown or brownish. Some species of the genera *Pyrearinus* and *Lygelater* have a bicolor prothorax. Pubescence short, recumbent, yellowish or grey; in *Pyrearinus* and *Hypsiophthal-*

mus there are some species seemingly glabrous to the naked eye. Generally the pubescence is not very dense, but in *Pyrophorus* it is dense enough to cover the integument completely, giving it a velvety appearance. Punctures variable, some species of *Hypsiophthalmus, Pyrearinus* and *Phanophorus* practically impunctate. Generally the pronotum and prosternum show more strongly impressed punctures, even if they are very fine elsewhere. Eyes variable, medium-sized in *Pyrophorus,* very convex and large in *Hypsiophthalmus.* The greater or lesser development of the eyes is a secondary sexual character: males always have larger eyes than the females. In males of *Hypsiophthalmus* the eyes reach the largest size and the front is very narrow and very concave; this explains the fact that the mouth pieces are very compressed. The mouth pieces seem to be adaptated to the habit of these insects; the pieces have very long hairs to facilitate selection of liquid food. Labrum (fig. 32) with semilunar aspect and inner part densely covered with fine hairs. Mandibles (fig. 33), toothed or not, generally stout, hairy. Penicillium well developed. Maxilla (figs. 31, 91) with membraneous galea and lacinia. Palpus with four segments. Labium (figs. 30, 92) with membraneous pre-mentum, densely hairy inwardly. Mentum quadrate with long setae and three segmented palpi. Antennae generally short, in the genera with sexual dimorphism they are always longer in the male than in the female, 11 or 12 segmented, always serrate from the fourth segment onwards. Pronotum more or less convex, with/or without tubercles at the base; hind angles variable. Luminous spots on prothorax variable in position and shape. *Pyrophorus* shows true, convex and lateral vesicles (nearer to the lateral than to the posterior margin). *Ignelater* shows almost true slightly convex, lateral or angulate vesicles (localized at the same distance from both margins). Some other genera have luminous spots localized posteriorly (nearer to the basal than to the lateral margin). Prosternal suture simple, slightly open anteriorly. Elytra gradually tapering to the apices; apices rounded or pointed; punctate-striate; punctures variable. Hind wings (figs. 156-160) without subcosta; radius fused with costa; media and cubitus fused; fourth anal and anal cell absent. Two folds present (fig. 157), one in the anal region and other in the antero-apical region. Fêmales of *Hypsiophthalmus* have vestigial hind wings (fig. 160), they are therefore flightless; the radial sector is practically absent; the anal less distinct; this wing does not present folds when in resting position. Some species of *Pyrearinus* and *Phanophorus* present the female hind wings a little shorter than usual, but show the same folds of normal wings. Mesosternal cavity sinusoidal or slightly horizontal. Hind coxal plate slightly enlarged inwardly. In *Hypsiophthalmus* the coxal plates are rounded and are more or less of the same width over the expansion. Abdominal luminous organ (figs. 187-190, 192-193) variable in size; in some genera it is very small, in others it occupies the entire internal surface of the first urosternite. In some genera, there are two lamellae, one on each side (fig. 194). These lamellae are very conspicuous and can be opened or closed in the living insect, like window-shades, hiding or exposing the luminous organ. Male genitalia (figs. 1-26, 34-51, 54-59, 77-80, 94-115,

128-129) simple or more complex; median lobe with/or without tubercles, and minute cuticular scales or long spines, lateral lobes with/or without well developed spines. Female genitalia (figs. 27-29, 60-74, 84-89, 116-124, 161). Ovipositor (fig. 161 a) without stylus and baculum short. Ovary (fig. 161 i) follicular (when well developed it occupies the entire abdominal cavity). Bursa copulatrix (fig. 161 g) bipartite, more or less spiraled, with/or without numerous long spines. Spermatheca membranous (fig. 161 h) with numerous ramifications, localized above the bursa copulatrix; in some genera it was not observed due to poor preservation. Median oviduct (fig. 161 d) with/or without sclerotized plates; accessory glands (fig. 161) more or less developed in the various genera.

With the exception of *Pyrophorus* the other genera show a more or less developed sexual dimorphism. In this case, females are generally larger than males, very convex and less punctulate, in some genera the hind wings are vestigial or shorter than usual. Males are smaller, more punctulate, the antenna more elongated and the eyes larger. *Pyrophorus* does not present evident sexual dimorphism but its luminous organs are better developed. I suspect that, in *Pyrophorus,* dimorphism is restricted to bioluminescent patterns.

Distribution (maps 5-9). From observation of the maps we can see that this group is mainly South-American, but penetrating into Central America, Mexico, Southern USA and the Antilles.

Phanophorus (map 5) is restricted to Chile.

Hypsiophthalmus (map 5) occurs mainly in Southeastern Brazil.

Pyrearinus (maps 6 and 7) has several species groups. The *basalis, pumilus,* and *amplicollis* groups are mainly Amazonian; the *lampadion* and *lineatus* groups are predominantly from the Atlantic forest; the *lampyris* group is apparently disjunct in the Amazonian and Atlantic forests; the *nyctolampis* group is also disjunct.

Fulgeochlizus (map 6) occurs only in the Central-South of South America.

Opselater (map 8) is mainly distributed in the Atlantic forest and some species are apparently disjunct.

Lygelater (map 8) is mainly Amazonian, with a small penetration into Central America.

Deilelater (map 8) occurs in Southeastern USA, Mexico, Central America and South America (western side).

Vesperelater (map 8) is known from western Mexico and the Southwestern USA.

Ignelater (map 8) is restricted to the Antilles.

Pyrophorus (map 9) shows two main species-groups; the first (*divergens* group) occurs predominantly in the Atlantic forest and has penetrated into the Antilles; the other (*noctilucus* group) is Amazonian, with penetration into Central America. Both groups present species with disjunct distribution.

Key to the genera

1. Luminous vesicles posterior (figs. 169-172) 2
   Luminous vesicles lateral (figs. 162-163) 5

2. Elytra marginated, mainly at the apices 3
   Elytra not marginated 4

3. Eyes slightly convex, pubescence fine, short and bristly .....
   ..... *Phanophorus* Solier, 1851
   Eyes well developed and convex, glabrous or with a fine pubescence (fig. 175) ..... *Hypsiophthalmus* Latreille, 1834

4. Antennae with third segment elongate and of same length as fourth; bursa copulatrix little spiraled; median oviduct with sclerotized plates (figs. 116-124, 169-171) ..... *Pyrearinus,* gen. n.
   Antennae with third segment more or less triangular and smaller than fourth; bursa copulatrix not spiraled; median oviduct without sclerotized plates (figs. 172, 125-127) .....
   ..... *Fulgeochlizus,* gen. n.

5. Slender and small; antennae extending up to or surpassing the hind angles of the prothorax; sexual dimorphism little developed
   6
   Robust and large; antennae shorter; sexual dimorphism not apparent ..... *Pyrophorus* Billberg, 1820

6. Antennae with third segment larger than second; the two together more or less of the same length as the fourth; front prominent; luminous spots small and flat ..... *Opselater,* gen. n.
   Antennae with third segment subequal to second; or the third segment slightly larger than second, front not prominent 7

7. Third antennal segment slightly larger than second, more or less triangular, the two together smaller than fourth .....
   ..... *Ignelater,* nom. n.
   Second and third segments subequal; the two together more or less of the same length as the fourth 8

8. Second and third antennal segments subequal, the two together smaller than the fourth; luminous spots on prothorax very little developed or absent ..... *Lygelater,* gen. n.

Second and third antennal segments subequal, the two together the same length as the fourth; luminous spots on prothorax well distinct, flat or slightly convex 9

9. Male genitalia with well developed median lobe with numerous cuticular, minute scales and long spines ..... *Deilelater,* gen. n.

Male genitalia with median lobe abruptly pointed near the apex; lateral lobes with well developed subapical spines (figs. 56-59) ..... *Vesperelater,* gen. n.

Phanophorus Solier, 1851

Phanophorus Solier, 1851: 26; Lacordaire, 1857: 205; Candèze, 1863: 3, 66-67; Schenkling, 1927: 345; Blackwelder, 1944: 285.

Reddish-brown. Pubescence not very short, more or less dense, yellowish and bristly. Eyes slightly prominent in males, normal in females. Male antennae reaching hind angles of prothorax, in females shorter; second segment small, third longer than second, more or less triangular and smaller than fourth. Prothorax small and subquadrate in males, larger and rounded in females; luminous spots angular (figs. 179, 180). Mesosternal cavity sinusoidal. Metacoxal plates gradually enlarged inwardly. Elytra weakly punctate-striate; marginated at sides and apices. Male genitalia (fig. 80); simple, median lobe little developed. Female genitalia (figs. 84-86): bursa copulatrix simple, without long spines; median oviduct without sclerotized plates; accessory glands little developed. Sexual dimorphism accentuate; male with more developed eyes, longer antennae. Females more rounded on sides, more convex, hind wings and antennae shorter.

Type-species: *Phanophorus parallelus* Solier, 1851 (Hyslop's designation, 1921: 663).

Distribution (map 5). CHILE: *Valparaiso. Santiago. Colchagua. Concepción. Arauco. Malleco. Cautín. Osorno.*

Phanophorus perspicax (Guérin, 1830), comb. n. (figs. 80, 84-86, 179, 180, 190).

Elater perspicax Guérin, 1830: 69 (type-locality: Chile).

Pyrophorus perspicax; Germar, 1841: 74; Candèze, 1863: 71; Fleutiaux, 1907: 212; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Phanophorus dilatatus Solier, 1851: 27 (type-locality: Concepción, Chile).

Pyrophorus dilatatus; Candèze, 1863: 66; Fleutiaux, 1907: 212; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Phanophorus niger Solier, 1851: 27 (type-locality: Chile).

Pyrophorus niger; Candèze, 1863: 66; Fleutiaux, 1907: 212; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Phanophorus parallelus Solier, 1851: 27 (type-locality: Chile).

Hypsiophthalmus Latreille, 1834

Hypsiophthalmus Latreille, 1834: 145; Germar, 1841: 11; Candèze, 1863: 3, 68; Schenkling, 1927: 345; Blackwelder, 1944: 285.

Belania Castelnau, 1840: 236; Candèze, 1863: 3, 67; Schenkling, 1927: 345; Blackwelder, 1944: 285, *syn. n.*

Dark brown or black. Glabrous or with pubescence extremely fine, short and sparse. Eyes very prominent in males and smaller in females. Antennae very short, 11-segmented, slightly serrate from the fourth segment onwards; second segment short and spherical, third elongate and of the same length as the fourth. Mouth pieces (figs. 90-93), a little depressed in males because of the great development of the eyes. Prothorax (figs. 175, 176) small and trapezoidal in males; convex, rounded to sides in females. Luminous spots localized posteriorly, round, visible also on the proepisternum (in males they are smaller than in females). Mesosternal cavity sinusoidal. Metacoxal plates of the same width throughout. Abdominal luminous organ (figs. 192, 193) usually median sized; frequently less developed or vestigial in the female. Elytra weakly punctate-striate, sides and apices marginated; in female less punctulate. Male genitalia (figs. 77-79): simple, median lobe little developed. Female genitalia (figs. 87-89): bursa copulatrix with a single spiral and a few long spines; median oviduct without sclerotized plates; accessory glands little developed. Sexual dimorphism extremely accentuate; in addition to the characters already referred to, the female has vestigial hind wings (fig. 160).

Type-species: *Pyrophorus buphthalmus* Eschscholtz, 1829.

As the designation of the type-species of the genus *Hypsiophthalmus* by Hyslop (1921: 651) is erroneous, the following explanation is necessary.

Latreille (1834: 145) created the genus *Hypsiophthalmus* for two species of *Pyrophorus* enlisted in "Division D" of Eschscholtz: *Pyrophorus buphthalmus* and *"P. luciferus"*.

Hyslop (1921: 651) designated as type-species of *Hypsiophthalmus "Pyrophorus luciferus"* Eschscholtz by elimination, since in his opinion *Pyrophorus buphthalmus* should be the type of the genus *Belania* Castelnau, 1840. Hyslop added in his comments that Gemminger & Harold (1869) considered d'Urville as the author of *"Pyrophorus luciferus"* (in Dejean's Catalog).

"P. luciferus" Eschscholtz and *luciferus* d'Urville in Dejean's Catalog are *nomina nuda;* moreover, *luciferus* Eschscholtz is not cited in Eschscholtz's work. Therefore, the type-species of the genus *Hypsiophthalmus* must be *Pyrophorus buphthalmus* Eschscholtz, the only valid, originally included species.

Belania Castelnau thus becomes automatically a synonym of *Hypsiophthalmus.*

Distribution (map 5). BRAZIL. *Minas Gerais. Rio de Janeiro. São Paulo. Paraná. Santa Catarina. Rio Grande do Sul. Mato Grosso.* PARAGUAY. *Alto Paraná.* URUGUAY. *Artigas. Canelones. Tacuarembó. Montevideo. Rivera.*

Hypsiophthalmus boops (Germar, 1841), comb. n. (fig. 78).

Pyrophorus boops Germar, 1841: 69 (type-locality: Brazil); Candèze, 1863: 68; Schenkling, 1927: 349; Blackwelder, 1944: 285.

Hypsiophthalmus buphthalmus (Eschscholtz, 1829), comb. n.

Pyrophorus buphthalmus Eschscholtz, 1829: 32 (type-locality: La Plata); Germar, 1841: 68; Candèze, 1863: 67; Schenkling, 1927: 349; Blackwelder, 1944: 285.

Hypsiophthalmus buphthalmus; Latreille, 1834: 145.

Pyrophorus (*Belania*) *buphthalmus;* Castelnau, 1840: 236.

Hypsiophthalmus grossicollis (Blanchard, 1843), comb. n. (figs. 77, 87-93, 159, 160, 175, 176, 192, 193).

Pyrophorus grossicolis Blanchard, 1843: 141 (type-locality: Corrientes); Candèze, 1863: 68; Schenkling, 1927: 349; Blackwelder, 1844: 285.

Pyrophorus cephalotes Blanchard, 1843: 144 (type-locality: Corrientes); Candèze, 1863: 69; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Hypsiophthalmus microspilus (Germar, 1841), comb. n. (fig. 70).

Pyrophorus microspilus Germar, 1841: 71 (type-locality: Santa Catarina); Candèze, 1863: 68; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Hypsiophthalmus raninus (Eschscholtz, 1829), comb. n.

Pyrophorus raninus Eschscholtz, 1829: 32 (type-locality: Santa Catarina); Germar, 1841: 71; Candèze, 1863: 69, 1 fig.; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Pyrophorus brevicollis Eschscholtz, 1829: 32 (type-locality: Rio de Janeiro); Germar, 1841: 75; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Elater exophthalmus Guérin, 1830: 69; Candèze, 1863: 69.

Pyrophorus longipennis Germar, 1841: 55 (type-locality: Brazil); Candèze, 1863: 64-69; Schenkling, 1927: 354.

Pyrearinus, gen. n.

Size variable (from 7 to 26 mm). Brownish or black; some species have a bicolorous prothorax (lateral margins yellowish or reddish and discal region darker). Pubescence dense, short and yellowish or not so dense and apparently absent. Eyes little prominent in males. Antennae short, serrate from the fourth segment onwards; second small, third a little longer, elongate and almost of the same length as the fourth. Prothorax more or less convex. Luminous spots flat or slightly convex, localized posteriorly; in species with bicolorous prothorax the spots are confused with the color of the integument. Punctures variable. Mesosternal cavity sinusoidal. Metacoxal plates tapering outwardly. Abdominal luminous organ small, sometimes indistinct. Male genitalia (figs. 94-115) extremely homogeneous; median lobe tapering to apex; lateral lobe short. Female genitalia (figs. 116-124), bursa copulatrix more or less spiraled with a variable number of long spines; median oviduct with sclerotized plates. Sexual dimorphism more or less accentuate, males with eyes larger than the females, and with longer antennae; in one species group (*nyctolampis*) the females have hind wings little shorter than usual.

Type-species: *Pyrophorus nyctolampis* Germar, 1841.

Distribution (maps 6 and 7). *nyctolampis* group. COLOMBIA. *Magdalena.* TRINIDAD & TOBAGO. FRENCH GUIANA. BRAZIL. *Pará. Bahia. Espírito Santo. Minas Gerais. Mato Grosso. Goiás. São Paulo. Paraná. Rio Grande do Sul.* URUGUAY. *Artigas. Tacuarembó. Rivera. Durazno. Paysandu. Treinta y Tres. Rocha.* BOLIVIA. *Santa Cruz. Beni.* PARAGUAY. *Central. Caazapa.* ARGENTINA. *Salta. Cordoba. Catamarca. San Luiz. Tucumán. Buenos Aires.*

amplicollis group: VENEZUELA. TRINIDAD & TOBAGO. GUYANA. SURINAM. FRENCH GUIANA. ECUADOR. BRAZIL. *Amapá. Amazonas. Pará. Rondonia. Mato Grosso. Goiás.* PERU. *Loreto. Huánuco. San Martin.* BOLIVIA. *Beni.*

lineatus group: BRAZIL. *Bahia. Minas Gerais. Espírito Santo. Rio de Janeiro. São Paulo. Paraná. Santa Catarina. Mato Grosso. Goiás.* BOLIVIA. *Santa Cruz.* PARAGUAY. *Itapuá. San Pedro.* ARGENTINA. *Salta. Santa Fé. Tucumán. Misiones.*

pumilus group: GUIANA. PERU. *Loreto.* BOLIVIA. *Santa Cruz.* BRAZIL. *Amazonas. Pará. Mato Grosso. Goiás. Minas Gerais.*

lampyris group: FRENCH GUIANA. ECUADOR. BRAZIL. *Amazonas. Goiás. Rio de Janeiro.*

basalis group: ECUADOR. *Esmeraldas. Napo.* BRAZIL. *Amazonas.*

lampadion group: FRENCH GUIANA. BRAZIL. *Rio Grande do Norte. Ceará. Pernambuco. Fernando Noronha Island. Bahia. Minas Gerais. Paraná. Mato Grosso. Goiás.* BOLIVIA. *Santa Cruz.* PARAGUAY. *Alto Paraná. Central. Chaco.* URUGUAY. *Artigas. Rivera. Durazno. Montevideo.* ARGENTINA. *Santiago del Estero. Chaco. Misiones.*

Pyrearinus acutus (Candèze, 1863), comb. n.

Pyrophorus acutus Candèze, 1863: 62 (type-locality: Colombia); Schenckling, 1927: 349; Blackwelder, 1944: 285.

Pyrearinus alvarengai (Cobos, 1959), comb. n. (figs. 105, 169).

Pyrophorus alvarengai Cobos, 1959: 469-470, 2 figs. (type-locality: Fernando Noronha Island).

Pyrearinus amplicollis (Candèze, 1863), comb. n. (figs. 102, 122-124).

Pyrophorus amplicollis Candèze, 1863: 58, pl. I, fig. 16 (type-locality: Guianas); Schenkling, 1927: 349; Blackwelder, 1944: 285.

Pyrearinus basalis (Schwarz, 1902), comb. n. (fig. 113).

Pyrophorus basalis Schwarz, 1902: 284 (type-locality: Napo, Archidona); Schenkling, 1927: 349; Blackwelder, 1944: 285.

Pyrearinus candelarius (Germar, 1841), comb. n. (figs. 96, 116-118).

Pyrophorus candelarius Germar, 1841: 59 (type-locality: Brazil); Candèze, 1863: 52, pl. 1, fig. 18; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrophorus diffusus Germar, 1841: 61 (type-locality: Brazil); Candèze, 1863: 52; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrearinus candens (Germar, 1841), comb. n. (fig. 100).

Pyrophorus candens Germar, 1841: 65 (type-locality: Brazil); Candèze, 1863: 55; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrophorus flammiger Germar, 1841: 52 (type-locality: Brazil); Candèze, 1863: 58; Schenkling, 1927: 350; Blackwelder, 1944: 285, *syn. n.*

Pyrophorus observator Germar, 1841: 64 (type-locality: Brazil); Candèze, 1863: 66; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrophorus perspicillatus Germar, 1841: 54 (type-locality: Brazil); Blanchard, 1843: 143; Candèze, 1863: 46; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrearinus cinerarius (Germar, 1841), comb. n. (figs. 107, 109-121).

Pyrophorus cinerarius Germar, 1841: 65 (type-locality: Brazil); Candèze, 1863: 57; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrearinus commissator (Germar, 1841), comb. n.

Pyrophorus commissator Germar, 1841: 51 (type-locality: São Paulo); Candèze, 1863: 60; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrearinus depressicollis (Blanchard, 1843), comb. n. (fig. 95).

Pyrophorus depressicollis Blanchard,1843: 143 (type-locality: Samai-pata, Valle Grande); Candèze, 1863: 55; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrearinus fulgurans (Candèze, 1865), comb. n. (figs. 109, 171).

Pyrophorus fulgurans Candèze, 1865: 52 (type-locality: Cayenne); Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrearinus gibbicollis (Blanchard, 1843), comb. n. (fig. 98).

Pyrophorus gibbicollis Blanchard, 1843: 142 (type-locality: Corrientes); Candèze, 1863: 60; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Elater janus Herbst, 1806: 16, 1 fig. (type-locality: Brazil); Illiger, 1807: 148.

Pyrophorus janus; Germar, 1841: 50; Candèze, 1863: 53; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Phosporus minor Voet, 1806: 43, fig. 17 (type-locality: Surinam); Germar, 1841: 50; Candèze, 1863: 53; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Elater speculator Illiger, 1807: 147 (type-locality: Ceará).

Pyrophorus speculator; Germar, 1841: 62; Candèze, 1863: 53; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrearinus lampadion (Illiger, 1807), comb. n. (fig. 104).

Elater lampadion Illiger, 1807: 144 (type-locality: Bahia).

Pyrophorus lampadion; Germar, 1841: 57; Candèze, 1863: 61; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrophorus scintillans Germar, 1841: 66 (type-locality: Bahia); Candèze, 1863: 61; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrearinus lineatus (Candèze, 1863), comb. n. (fig. 101).

Pyrophorus lineatus Candèze, 1863: 62 (type-locality: Paraguay); Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrearinus lucernula (Illiger, 1807), comb. n. (fig. 103).

Elater lucernula Illiger, 1807: 147 (type-locality: Ceará).

Pyrophorus lucernula; Germar, 1841: 68; Candèze, 1868: 58; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrearinus lucidulus (Illiger, 1807), comb. n. (fig. 110).

Elater lucidulus Illiger, 1807: 146 (type-locality: Peru).

Pyrophorus lucidulus; Germar, 1841: 57; Candèze, 1863: 72; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Pyrearinus lucificus (Germar, 1841), comb. n. (fig. 114).

Pyrophorus lucificus Germar, 1841: 43 (type-locality: Bahia); Candèze, 1863: 38; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Pyrearinus nictitans (Illiger, 1807), comb. n. (fig. 108).

Elater nictitans Illiger, 1807: 146 (type-locality: Pará).

Pyrophorus nictitans; Germar, 1841: 60; Candèze, 1863: 51; Schenkling, 1927: 352; Blackwelder, 1944: 285.

Pyrearinus nyctolampis (Germar, 1841), comb. n. (fig. 97).

Pyrophorus nyctolampis Germar, 1841: 54 (type-locality: Porto Alegre); Candèze, 1863: 60; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Pyrophorus planicollis Blanchard, 1843: 143 (type-locality: Santa Cruz de la Sierra); Candèze, 1863: 55; Schenkling, 1927: 350; Blackwelder, 1944: 285, *syn. n.*

Pyrearinus nyctophilus (Germar, 1841), comb. n. (figs. 94, 173, 174).

Pyrophorus nyctophilus Germar, 1841: 51 (type-locality: Porto Alegre); Candèze, 1863: 59; Schenkling, 1927: 352; Blackwelder, 1944: 286.

Pyrearinus pumilus (Candèze, 1863), comb. n. (figs. 115, 170).

Pyrophorus pumilus Candèze, 1863: 63 (type-locality: Brazil); Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrearinus retrospiciens (Illiger, 1807), comb. n. (fig. 106).

Elater retrospiciens Illiger, 1807: 145 (type-locality: Pará).

Pyrophorus retrospiciens; Germar, 1841: 58; Candèze, 1863: 71; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Pyrearinus scintillula (Candèze, 1881), comb. n. (fig. 111).

Pyrophorus scintillula Candèze, 1881: 90 (type-locality: Pará); Schenkling, 1927: 354; Blackwelder, 1944: 286.

Fulgeochlizus, gen. n.

Brownish. Pubescence short, dense, yellowish or reddish, forming a spotted pattern. Eyes normally developed. Antennae short, 11 or 12-segmented, serrate from the fourth segment onwards; second segment very small, spherical; third elongated and smaller than the fourth. Prothorax convex; luminous spots large, rounded, flat and localized posteriorly (fig. 172). Mesosternal cavity sinusoidal. Metacoxal plates tapering outwards. Abdominal luminous organ more or less developed. Male genitalia (figs. 128-129) simple; median lobe well daveloped, tapering to apex. Female genitalia (figs. 125-127): bursa copulatrix little spiraled, with some long spines; median oviduct without sclerotized plates; accessory glands little developed. Sexual dimorphism little accentuate.

Type-species: *Pyrophorus bruchi* Candèze, 1896.

Distribution (map 6). BRAZIL. *Pará. Mato Grosso.* BOLIVIA. *Santa Cruz.* PARAGUAY. *Chaco.* ARGENTINA. *Salta. Catamarca. Tucumán. La Rioja. San Juan. Formosa. Chaco. Santiago del Estero. Córdoba. Misiones. Buenos Aires.*

Fulgeochlizus bruchi (Candèze, 1896), comb. n. (figs. 125-128, 172).

Pyrophorus bruchi Candèze, 1896: 66 (type-locality: Cordoba, Argentina); Schenkling, 1927: 349; Blackwelder, 1944: 285.

Pyrophorus lineatocollis Schwarz, 1906: 153 (type-locality: Brazil); Schenkling, 1927: 349; Blackwelder, 1944: 285, *syn. n.*

Fulgeochlizus germani (Candèze, 1863), comb. n. (fig. 129).

Pyrophorus germari Candèze, 1863: 48, fig. 13 (type-locality: Corrientes, Tucumán); Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrophorus ortizi Candèze, 1891: 500 (type-locality: Gran Chaco); Schenkling, 1927: 352; Blackwelder, 1944: 286, *syn. n.*

Opselater, gen. n.

Small; dark-brown. Pubescence short, dense yellowish or grey. Eyes in males slightly more developed than in females. Front prominent. Antennae reaching the hind angles of the prothorax, serrate from fourth segment onwards; third segment little longer than second, the two together of the same length of the fourth. Prothorax slightly convex, punctures variable. Luminous spots small, lateral, flat and visible also in the proepisternum. Mesosternal cavity sinusoidal and a little raised behind. Metacoxal plates little enlarged inwardly. Abdominal luminous organ small and lamellate. Elytral sides subparallel and rounded to apices. Male genitalia (figs. 35-38; 48): median lobe very enlarged at the middle,

with or without minute cuticular scales. Female genitalia (figs. 60-62, 161): bursa copulatrix more or less spiraled, with long spines; accessory glands well developed; spermatheca well developed and median oviduct with sclerotized plates.

Type-species: *Elater pyrophanus* Illiger, 1807.

Distribution (map 8). PANAMÁ. *Chiriqui.* FRENCH GUIANA. PERU. *Loreto. San Martin.* BRAZIL. *Amazonas. Pará. Pernambuco. Alagoas. Minas Gerais. Espírito Santo. Rio de Janeiro. São Paulo. Santa Catarina. Rio Grande do Sul. Mato Grosso. Goiás.* PARAGUAY. *Central. Alto Paraná.* ARGENTINA. *Misiones.*

Opselater hebes (Germar, 1841), comb. n. (figs. 37, 37a).

Pyrophorus hebes Germar, 1841: 27 (type-locality: São João del Rey, Brazil); Candèze, 1863: 35; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Pyrophorus lusciosus Germar, 1841: 39 (type-locality: Bahia); Candèze, 1863: 30; Schenkling, 1927: 354; Blackwelder, 1944: 286, *syn. n.*

Opselater helvolus (Germar, 1841), comb. n.

Pyrophorus helvolus Germar, 1841: 28 (type-locality: Brazil); Candèze, 1863: 32; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrophorus pyralis Germar, 1841: 35 (pars) (type-locality: "America Meridionalis"), *syn. n.*

Opselater lucens (Illiger, 1807), comb. n. (figs. 48, 48a, 168).

Elater lucens Illiger, 1807: 150 (type-locality: Bahia); Candèze, 1863: 30; Schenkling, 1927: 352.

Pyrophorus lucens; Germar, 1841: 34; Blackwelder, 1944: 286.

Elater pyrophanus Illiger, 1807: 149 (pars), *syn. n.*
Pyrophorus illuminans Germar, 1841: 30 (pars) (type-locality: Brazil), *syn. n.*

Pyrophorus fulvotomentosus Blanchard, 1843: 139 (type-locality: Corrientes); Candèze, 1863: 32; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Pyrophorus obscuratus Germar, 1841: 23 (type-locality: Brazil), *syn. n.*

Pyrophorus rufofuscus Sturm, 1843: 67 (type-locality: Brazil); Schenkling, 1927: 351; Blackwelder, 1944: 285.

Opselater melanurus (Candèze, 1863), comb. n. (fig. 36).

Pyrophorus melanurus Candèze, 1863: 23 (type-locality: Cayenne); Schenkling, 1927: 352; Blackwelder, 1944: 285.

Opselater pyrophanus (Illiger, 1807), comb. n. (figs. 35, 60-62, 161).

Elater pyrophanus Illiger, 1807: 149 (type-locality: Bahia).

Pyrophorus pyrophanus; Germar, 1841: 38; Candèze, 1863: 29, 1 fig.; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrophorus acuminatus Eschscholtz, 1829: 32 (type-locality: Rio de Janeiro and Bahia); Candèze, 1863: 29; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrophorus acutipennis Castelnau, 1840: 236 (type-locality: French Guiana); Candèze, 1863: 30; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrophorus angusticollis Eschscholtz, 1829: 32 (type-locality: Rio de Janeiro); Germar, 1841: 74; Candèze, 1863: 29; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrophorus pyrrhoderus Germar, 1841: 37 (type-locality: Bahia); Candèze, 1863: 29; Schenkling, 1927: 354.

Pyrophorus quadricollis Eschscholtz, 1829: 32 (type-locality: Rio de Janeiro); Germar, 1841: 75; Candèze, 1863: 30; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Opselater quadraticollis (Blanchard, 1843), comb. n. (fig. 30).

Pyrophorus quadraticollis Blanchard, 1843: 140 (type-locality: Santa Cruz de La Sierra); Candèze, 1863: 30; Schenkling, 1927: 354; Blackwelder, 1944: 286.

Ignelater, nom. n.

Stilpnus Castelnau (preocc. Gravenhorst, 1829-Hymenoptera), 1840: 236; Candèze, 1863: 30; Schenkling, 1927: 354; Blackwelder, 1944: 285.

Siender; reddish-brown. Pubescence short, fine, more or less dense, yellowish or grey. Eyes slightly prominent in male. Front not prominent, more or less concave in the middle. Antennae elongate, surpassing the hind angles of the prothorax; third segment slightly longer than second, more or less triangular, the two together smaller than fourth. Prothorax slightly convex. Luminous spots lateral, rounded, slightly convex and visible beneath on the proepisternum. Abdominal luminous organ small and lamellate. Male genitalia (figs. 34, 47, 49): median lobe with or without median tubercles; with minute cuticular scales and long spines. Female genitalia (figs. 66-68): bursa copulatrix well spiraled, median oviduct with a pair of sclerotized plates.

Type-species: *Pyrophorus* (*Stilpnus*) *havaniensis* Castelnau, 1840.

Distribution (map 8). UNITED STATES. *Florida.* MEXICO. *Vera Cruz.* ANTILLES. *Bahamas. Cuba. Pinós. Haiti. Republica Dominicana. Porto Rico.* Lesser Antilles.

Ignelater phosphoreus (Linnaeus, 1758), comb. n. (fig. 47).

Elater phosphoreus Linnaeus, 1758: 404 (type-locality: "America"); Olivier, 1790: 16-17; Illiger, 1807: 146.

Pyrophorus phosphoreus; Castelnau, 1840: 236; Germar, 1841: 53; Candèze, 1863: 56; Schenkling, 1927: 353; Blackwelder, 1944: 286.

Pyrophorus acuminatus; Germar (nec Eschs.), 1841: 31.

Pyrophorus lychniferus Germar, 1841: 32 (pars) (type-locality: Sto. Domingo); Candèze, 1863: 27; Chevrolat, 1867: 612; Schenkling, 1927: 347.

Pyrophorus lychnus Candèze, 1863: 26 (type-locality: Sto. Domingo); Chevrolat, 1867: 612; Schenkling, 1927: 347, *syn. n.*

Pyrophorus longipennis Schwarz, 1906: 154 (type-locality: Cuba).

Ignelater havaniensis (Castelnau, 1840), comb. n. (figs. 49, 49a, 66-68, 164).

Pyrophorus (*Stilpnus*) *havaniensis* Castelnau, 1840: 236 (type-locality: Havana-Cuba); Candèze, 1863: 29; Champion, 1905: 469, 1 fig.; Schenkling, 1927: 346; Blackwelder, 1944: 285.

Pyrophorus causticus Germar, 1841: 36 (type-locality: Cuba); Candèze, 1863: 28; Champion, 1895: 469; Schenkling, 1927: 346; Blackwelder, 1944: 285.

Pyrophorus impressifrons Sturm, 1843: 67 (type-locality: Cuba); Schenkling, 1927: 347; Blackwelder, 1944: 285.

Ignelater luminosus (Illiger, 1807), comb. n. (figs. 34, 34a).

Elater luminosus Illiger, 1807: 149 (type-locality: "America").

Pyrophorus luminosus; Germar, 1841: 29; Candèze, 1863: 25, 1 fig.; Schenkling, 1927: 347; Blackwelder, 1944: 285.

Pyrophorus pyralis Germar, 1841: 35 (*pars*) (type-locality: "America Meridionalis"); Candèze, 1863: 25; Schenkling, 1927: 347; Blackwelder, 1944: 285.

Lygelater, gen. n.

Small; reddish-brown. Pubescence fine, short, sparse and yellowish; in some species the prothorax is bicolorous: lateral margins yellowish or reddish-yellow, disc darker. Eyes slightly convex. Front narrow, not prominent. Antennae reaching the hind angles of prothorax; second and third segments very small and subequal; the two together smaller than the fourth. Prothorax slightly convex. Luminous spots very small, flat, lateral or indistinct (fig. 167). Abdominal luminous organs small and lamellate, sometimes the lamella covers the entire organ. Elytra

tapering to apices. Male genitalia (figs. 39-42a; 54), median lobe generally with trilobate apex or more or less abruptly pointed to the apex, with variable number of spines in the middle; lateral lobes with or without spines near the apices, and more or less hairy. Female genitalia (figs. 63-65): bursa copulatrix well spiraled; median oviduct with sclerotized plates.

Type-species: *Pyrophorus fulgidus* Germar, 1841.

Distribution (map 8). MEXICO. *Vera Cruz.* GUATEMALA. *Vera Paz.* HONDURAS. *Cortés.* COSTA RICA. *Guanacaste.* PANAMÁ. *Chiriqui. Canal Zone.* COLOMBIA. *Antioquia. Cundinamarca. Valle. Cauca.* VENEZUELA. *Sucre. Yaracuy. Distrito Federal. Miranda. Zulia. Carabobo. Apuré.* TRINIDAD & TOBAGO. GUIANA. SURINAM. FRENCH GUIANA. LESSER ANTILLES. *Santa Lucia.* BRAZIL. *Amazonas. Pará. Mato Grosso. Goiás.* ECUADOR. *Napo. Loja.* PERU. *Loreto. San Martin.* BOLIVIA. *Beni. La Paz. Cochabamba. Santa Cruz.*

Lygelater bifossulatus (Candèze, 1865), comb. n.

Pyrophorus bifossulatus Candèze, 1865: 51 (type-locality: Peru); Schenkling, 1927: 349.

Lygelater fulgidus (Germar, 1841), comb. n. (figs. 39, 39a, 63-65).

Pyrophorus fulgidus Germar, 1841: 24 (type-locality: Santa Fé de Bogotá); Candèze, 1863: 22; Champion, 1895: 468, 1 fig.; Schenkling, 1927: 346; Blackwelder, 1944: 285.

Pyrophorus adumbratus Germar, 1841: 27 (type-locality: Brazil); Candèze, 1863: 22-23; Champion, 1895: 468; Schenkling, 1927: 346; Blackwelder, 1944: 285.

Lygelater ignitus (Fabricius, 1787), comb. n. (figs. 54, 167).

Elater ignitus Fabricius, 1787: 172 (type-locality: Cayenne); Olivier, 1790: 17; Fabricius, 1792: 218; Fabricius, 1801: 151; Illiger, 1807: 151.

Pyrophorus ignitus; Germar, 1841: 21; Candèze, 1863: 21; Fleutiaux, 1911: 262; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Phosphorus fuscus Voet, 1769-(1806): 116, 1 fig. (type-locality unknown); Candèze, 1863: 21; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Elater fuscipes Herbst, 1806: 159, 1 fig. (type-locality unknown); Schenkling, 1927: 351; Blackwelder, 1944: 285.

Elater lambens Fabricius, 1801: 244 (type-locality: "America Meridionalis"), *syn. n.*

Pyrophorus lambens; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Elater salingeri Herbst, 1806: 11; Germar, 1841: 21; Candèze, 1863: 21; Schenkling, 1927: 350; Blackwelder, 1944: 285.

Lygelater indicus (Herbst, 1783), comb. n. (figs. 41, 41a).

Elater indicus Herbst, 1783: 110, 1 fig. (type-locality: "America"); Candèze, 1863: 22.

Pyrophorus indicus; Fleutiaux, 1911: 262; Schenkling, 1927: 351; Blackwelder, 1944: 285.

Elater exstinctus Illiger, 1807: 151 (type-locality: Pará, Brazil); Fleutiaux, 1911: 262; Schenkling, 1927: 351.

Pyrophorus exstinctus; Germar, 1841: 22; Candèze, 1863: 22; Blackwelder, 1944: 285.

Lygelater piceus (Schwarz, 1902), comb. n. (figs. 40, 40a).

Pyrophorus piceus Schwarz, 1902: 285 (type-locality: Santa Inez, Ecuador); Schenkling, 1927: 353; Blackwelder, 1944: 286.

Deilelater, gen. n.

Generally very small. Reddish-brown. Pubescence short, not very dense, yellowish. Eyes slightly convex. Front narrow, not prominent. Antennae reaching hind angles of prothorax; second and third segments subequal; the two together of the same length as the fourth. Prothorax more or less convex; luminous spots lateral, flat or slightly convex, visible also in the proepisternum. Abdominal luminous organ small and lamellate. Elytra sides subparallel, rounded to apices. Male genitalia (figs. 43-46, 52, 53, 55), median lobe abruptly pointed near apex, with small cuticular scales. Female genitalia: bursa copulatrix spiraled and with long spines; elongate sclerotized plates in the median oviduct.

Type-species: *Pyrophorus physoderus* Germar, 1841.

Distribution (map 8). UNITED STATES. *Florida. Alabama. Texas. Arizona.* MEXICO. *Chihuahua. Taumalipas. San Luis Potosi. Vera Cruz. Coahuila. Oaxaca. Chiapas. Yucatan. Quintana Roo.* GUATEMALA. *Baja Vera Paz. Alta Vera Paz.* BRITISH HONDURAS. *Belize. Toledo.* HONDURAS. *Cortés. Olancho.* EL SALVADOR. *San Salvador.* NICARAGUA. *Zelaya.* COSTA RICA. *Guanacaste. Cartago. Puntarenas.* PANAMA. *Chiriqui.* PERU. *Junin.*

Deilelater atlanticus (Hyslop, 1917), comb. n. (fig. 52).

Pyrophorus atlanticus Hyslop, 1917: 8, 1 pl. (type-locality: Enterprise, Florida); Schenkling, 1927: 346.

Deilelater bellamyi (Van Zwaluwenberg, 1936), comb. n.

Pyrophorus bellamyi Van Zwaluwenberg, 1936: 231-234, 1 fig. (type-locality: El Salto, Escuintla).

Deilelater caudatus (Champion, 1895), comb. n. (fig. 53).

Pyrophorus caudatus Champion, 1895: 468, 1 fig. (type-locality: Costa Rica); Schenkling, 1927: 346; Blackwelder, 1944: 285.

Deilelater mexicanus (Champion, 1895), comb. n. (fig. 45)

Pyrophorus mexicanus Champion, 1895: 470 (type-locality: Temax, Yucatan); Schenkling, 1927: 347; Blackwelder, 1944: 285.

Deilelater physoderus (Germar, 1841), comb. n. (figs. 46, 46a, 165).

Pyrophorus physoderus Germar, 1841: 36 (type-locality: Alabama); Le Conte, 1853: 492; Candèze, 1863: 33; Champion, 1895: 471, 1 fig.; Hyslop, 1917: 6, 1 pl.; Schenkling, 1927: 346; Blackwelder, 1944: 286.

Pyrophorus texanus Hyslop, 1917: 9, 1 pl. (type-locality: Brownsville, Texas); Schenkling, 1927: 346, *syn. n.*

Deilelater radians (Champion, 1895), comb. n. (figs. 43, 43a).

Pyrophorus radians Champion, 1895: 472, 3 figs. (type-locality: Panciña Vera Paz); Schenkling, 1927: 349; Blackwelder, 1944: 286.

Deilelater sirius (Candèze, 1878), comb. n. (figs. 55, 55a).

Pyrophorus sirius Candèze, 1878: 41 (type-locality: Costa Rica); Candèze, 1891: 158; Champion, 1895: 468; Schenkling, 1927: 349; Blackwelder, 1944: 286.

Deilelater stella (Candèze, 1863), comb. n. (fig. 44).

Pyrophorus stella Candèze, 1863: 32 (type-locality: Mexico); Champion, 1895: 471, 2 figs.; Schenkling, 1927: 349; Blackwelder, 1944: 286.

Pyrophorus caliginosus Sturm, 1843: 67 (type-locality: Mexico); Schenkling, 1927: 349; Blackwelder, 1944: 286.

Vesperelater, gen. n.

Small, slender. Reddish-brown. Pubescence short, dense and yellowish. Eyes slightly prominent. Front narrow, not prominent. Antennae reaching the hind angles of the prothorax; second and third segments subequal, the two together of the same length as the fourth. Prothorax little convex. Luminous spots lateral, slightly convex and also visible beneath in the proepisternum. Luminous abdominal organ small and lamellate. Elytra tapering and rounded to apices. Male genitalia (figs. 56-59): median lobe abruptly narrowed near the apex; lateral

lobes with one or more pairs of long spines. Female genitalia (figs. 72-74): bursa copulatrix spiraled and with long spines; median oviduct with two pair of sclerotized plates.

Type-species: *Pyrophorus ornamentum* Germar, 1841.

Distribution (map 8). UNITED STATES. *Arizona.* MEXICO. *Sonora. Chihuahua. Sinaloa. Nayarit. Jalisco. Colima. Michoácan. Guerreiro. Mexico. Morelos.*

Vesperelater arizonicus (Hyslop, 1917), comb. n. (fig. 59).

Pyrophorus arizonicus Hyslop, 1917: 8, 1 pl. (type-locality: Patagonia Mts., Arizona); Schenkling, 1927: 346.

Vesperelater gemmiferus (Germar, 1841,) comb. n. (fig. 58).

Pyrophorus gemmiferus, 1841: 26 (type-locality: Mexico); Candèze, 1863: 35; Champion, 1895: 470.

Vesperelater occidentalis (Champion, 1895), comb. n. (figs. 57, 166).

Pyrophorus occidentalis Champion, 1895: 470 (type-locality: Tres Marias Is., Mexico); Schenkling, 1927: 348; Blackwelder, 1944: 286.

Vesperelater ornamentum (Germar, 1841), comb. n. (figs. 56, 72-74, 194).

Pyrophorus ornamentum Germar, 1841: 39 (type-locality: Mexico): Candèze, 1863: 34; Champion, 1895: 469, 1 fig.; Schenkling, 1927: 348; Blackwelder, 1944: 286.

Pyrophorus Billberg, 1820

Elater (*pars*) Linnaeus, 1758: 404; De Geer, 1774: 160; Olivier, 1790: 15; Fabricius, 1792: 218; 1801: 223; Herbst, 1801: 331; Latreille, 1804: 14; Illiger, 1807: 141.

Pyrophorus Billberg, 1820: 20; Eschscholtz, 1829: 32; Castelnau, 1840: 235; Germar, 1841: 1; Candèze, 1863: 3; Champion, 1895: 463; Schenkling, 1927: 345; Blackwelder, 1944: 285; Navajas, 1952: 52-56.

Robust, dark-brown. Pubescence dense, short, yellowish, covering the color of the integument. Eyes normal. Antennae very short, serrate from the fourth segment onwards, second segment very short, third more or less triangular and smaller than the fourth. Prothorax convex; punctures variable; hind angle stout, prominent, more or less divergent and carinate. Luminous vesicles convex, lateral, visible or not beneath in the proepisternum. Mesosternal cavity sinusoidal. Metacoxal plates gradually enlarged inwardly. Abdominal luminous organ (figs. 1-26):

median lobe tapering to the apex, and with numerous minute cuticular scales; lateral lobes short and hairy. Female genitalia (figs. 27-29): bursa copulatrix well spiraled and with numerous long spines; median oviduct without sclerotized plates; spermatheca well developed and accessory glands characteristic.

Type-species: *Elater noctilucus* Linnaeus, 1758 (Hyslop's designation, 1921: 668).

Distribution (map 9). MEXICO. *Vera Cruz. Oaxaca. Chiapas. Tabasco. Yucatan.* GUATEMALA. *Izabal. Vera Paz. Chiquimula.* BRITISH HONDURAS. *Belize. Cayo. Stann Creek. Toledo.* HONDURAS. *Cortés. Camayaguá.* NICARAGUA. *Matagalpa. Chontales. Zelaya.* COSTA RICA. *Guanacaste. Alajuela. San Jose. Cartago. Puntarenas.* PANAMÁ. *Bocas del Toro. Chiriqui. Veraguas. Colón. Canal Zone. Darién.* COLOMBIA. *Magdalena. Santander. Antioquia. Chocó. Valle. Cauca. Tolima. Cundinamarca. Boyacá. Meta. Caquetá.* VENEZUELA. *Zulia. Merida. Carabobo. Aragua. Distrito Federal. Miranda. Sucre. Monaguas. Apuré. Bolivar. Território Amazonas.* TRINIDAD & TOBAGO. GUYANA. SURINAM. FRENCH GUIANA. BRAZIL. *Amapá. Amazonas. Acre. Rondônia. Pará. Alagoas. Bahia. Minas Gerais. Espírito Santo. Rio de Janeiro. São Paulo. Paraná. Santa Catarina. Rio Grande do Sul. Goiás.* URUGUAY. *Salto. Paysandu. Montevideo.* ECUADOR. *Esmeraldas. Pichial. Napo. Cotopaxi. Tungurahua. Chimborazo. Guayas. Morona-Santiago. Loja-Zamora.* PERU. *Loreto. Amazon. San Martin. Huánuco. Junin. Cuzco. Madre de Dios. Arequipa. Puno.* BOLIVIA. *Beni. La Paz. Cochabamba. Santa Cruz. Chuquisaca.* PARAGUAY. *Concepción. Presidente Hayes. Caaguazú. Alto Paraná. La Cordillera. Central. Guaira. Paraguari. Itapuá.* ARGENTINA. *Salta. Catamarca. La Rioja. Santiago del Estero. Tucumán. Cordoba. Chaco. Santa Fé. Misiones. Entre Rios. Buenos Aires.* ANTILLES. *Cuba. Jamaica. Haiti. Republica Dominicana. Guadeloupe. Dominica. Martinica. Santa Lucia. S. Vicent.*

Pyrophorus angustus angustus Blanchard, 1843 (fig. 17).

Pyrophorus angustus Blanchard, 1843: 139 (type-locality: Santa Cruz de la Sierra).

Pyrophorus angustus angustus; Costa, 1968: 77, figs. 5, 6, 11, 19; 1972: 201.

Pyrophorus angustus hayekae Costa, 1968 (figs. 21, 187).

Pyrophorus angustus hayekae Costa, 1968: 82, figs. 3, 8, 11, 18 (type-locality: Rio Essequibo — Guiana); Costa, 1972: 202.

Pyrophorus angustus luscus Candèze, 1889 (fig. 20).

Pyrophorus luscus Candèze, 1889: 4 (type-locality: Guatemala).

Pyrophorus angustus luscus; Costa, 1968: 78, figs. 2, 9, 11, 16, 20; Costa, 1972: 201.

Pyrophorus avunculus Costa, 1972 (figs. 10, 10a).

Pyrophorus avunculus Costa, 1972: 214, figs. 10, 10a (type-locality: Bocas del Toro, Potrerillos).

Pyrophorus clarus Germar, 1841 (fig. 18).

Pyrophorus clarus Germar, 1841: 18 (type-locality: Santa Fé de Bogotá); Costa, 1969: 250, figs. 5, 6, 11, 16.

Pyrophorus divergens Eschscholtz, 1829 (fig. 23).

Pyrophorus divergens Eschscholtz, 1829: 32 (type-locality: Santa Catarina, Brazil); Costa, 1971: 66, figs. 1-6, 1 est.; Costa, 1972: 200.

Pyrophorus nyctophanus (pars) Germar, 1841: 12 (type-locality: "Brazil-Buenos Aires"); Navajas, 1952: 52-56, figs. 1, 3-4, 7-9.

Pyrophorus dulcifer Costa, 1972 (fig. 11).

Pyrophorus dulcifer Costa, 1972: 215, fig. 11 (type-locality: Tungurahua, Ambato).

Pyrophorus evexus Costa, 1972 (fig. 5).

Pyrophorus evexus Costa, 1972: 213, figs. 5, 20 (type-locality: Itapuá-Cantero).

Pyrophorus expeditus Costa, 1972 (figs. 15, 15a).

Pyrophorus expeditus Costa, 1972: 225, figs. 15, 15a (type-locality: Merida, Venezuela).

Pyrophorus indistinctus Germar, 1841 (figs. 22, 188).

Pyrophorus indistinctus Germar, 1841: 20-21 (type-locality: Cayenne); Costa, 1969: 252, figs. 4, 8, 11, 12; Costa, 1972: 202.

Pyrophorus indulcatus Costa, 1972 (figs. 9, 92).

Pyrophorus indulcatus Costa, 1972: 208, figs. 9, 9a, 18 (type-locality: S. Vincent. Lesser Antilles).

Pyrophorus ingens Costa, 1972 (figs. 7, 7a).

Pyrophorus ingens Costa, 1972: 224, figs. 7, 7a (type-locality: Cartago, Irazu-Guyabillos).

Pyrophorus jocundus Costa, 1972 (figs. 2, 2a).

Pyrophorus jocundus Costa, 1972: 211, figs. 2, 2a, 19 (type-locality: Bocas del Toro, Potrerillos).

Pyrophorus magnus Costa, 1972 (fig. 14).

Pyrophorus magnus Costa, 1972: 222, fig. 14 (type-locality: Cascho Crespejo, Tambo à Starosa).

Pyrophorus mellifluus Costa, 1972 (fig. 1, 1a, 189).

Pyrophorus mellifluus Costa, 1972: 211, figs. 1, 1a, 17, 24 (type-locality: Diquini, Haiti).

Pyrophorus noctilucus (pars); Germar, 1843: 13; Candèze, 1863: 14; Champion, 1895: 466.

Pyrophorus mellitus Costa, 1972 (fig. 3).

Pyrophorus mellitus Costa, 1972: 210, figs. 3, 21 (type-locality: Santa Lucia, Lesser Antilles).

Pyrophorus noctilucus (Linnaeus, 1758) (figs. 19, 27-33, 157, 158, 162).

Elater noctilucus Linnaeus, 1758: 404 (type-locality: "America").

Pyrophorus noctilucus; Costa, 1968: 71, figs. 1, 4, 7, 10, 17; Costa, 1971: 66; Costa, 1972: 202.

Pyrophorus pellucens Eschscholtz, 1829: 32; Candèze, 1863: 18; Costa, 1971: 66.

Pyrophorus pisticus Costa, 1972 (figs. 12, 12a).

Pyrophorus pisticus Costa, 1972: 221, figs. 12, 12a (type-locality: Morona-Santiago).

Pyrophorus plagiophthalmus Germar, 1841 (fig. 26).

Pyrophorus plagiophthalmus Germar, 1841: 14-15 (type-locality: Jamaica); Costa, 1969: 225, figs. 3, 10, 11, 13; Costa, 1972: 201.

Pyrophorus phosphorescens Castelnau, 1840 (fig. 6).

Pyrophorus phosphorescens Castelnau, 1840: 236 (type-locality: Guadeloupe); Germar, 1841: 19; Fleutiaux & Sallé, 1889: 414; Fleutiaux, 1911: 261; Costa, 1972: 206, figs. 6, 23.

Pyrophorus nyctophanus var. Germar, 1841: 12.

Pyrophorus pellucens (pars); Candèze, 1863: 18.

Pyrophorus punctatissimus Blanchard, 1843.

Pyrophorus punctatissimus Blanchard, 1843: 138 (type-locality: Corrientes); Costa, 1969: 257, figs. 2, 4, 11, 14; Costa, 1972: 201.

Pyrophorus strabus Germar, 1841 (figs. 25, 25a).

Pyrophorus strabus Germar, 1841: 15 (type-locality: Mexico); Costa, 1969: 260, figs. 1, 9, 9a, 11, 15; Costa, 1972: 200.

Pyrophorus stupendus Costa, 1972 (fig. 13).

Pyrophorus stupendus Costa, 1972: 216, fig. 13 (type-locality: Carabobo, Borhurata).

Pyrophorus tuberculifer Eschscholtz, 1829 (figs. 4, 163).

Pyrophorus tuberculifer Eschscholtz, 1829: 32 (type-locality: Rio de Janeiro); Germar, 1841: 16; Candèze, 1863: 17; Costa, 1972: 203, figs. 4, 22.

Pyrophorus hesperus Candèze, 1863: 18.

Pyrophorus tuberculifer bahiensis Camargo, 1938: 99-102.

Pyrophorus validus Costa, 1972 (figs. 16, 16a).

Pyrophorus validus Costa, 1972: 217, figs. 16, 16a (type-locality: Ecuador, Baños).

Pyrophorus veriloquus Costa, 1972 (figs. 8, 8a).

Pyrophorus veriloquus Costa, 1972: 219, figs. 8, 8a (type-locality: Guatemala).

Campyloxeninae, subfam. n.

Claws without setae near the base; hind wings with wedge cell (fig. 155); female genitalia with stylus and a very elongate baculum.

To this subfamily belongs a single genus, *Campyloxenus,* from Southwestern Chile and Argentina (map 1).

Campyloxenus Fairmaire, 1860

Campyloxenus Fairmaire, 1860: 6; Candèze, 1863: 508; Champion, 1895: 457; Fleutiaux, 1907: 214; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Black with a reddish pronotum. Pubescence long, dense, bristly and brownish. Eyes very small (figs. 185-186). Front carinate. Antennae elongate, surpassing the hind angles of the prothorax, serrate from the fourth segment onwards; second segment short, third elongate, two times longer than second and of the same length as the fourth. Prothorax subquadrate, slightly convex. Luminous spots occupying the entire middle region on each side of the prothorax and visible beneath on the proepisternum. Mesosternal cavity almost horizontal. Metacoxal plate very narrow and of the same width throughout. Adbominal luminous organ absent. Male genitalia (fig. 150): median lobe narrow and straight; lateral lobes elongate, with few hairs. Female genitalia (fig. 147): stylus and baculum elongate, eighth urosternite elongate inwardly;

bursa copulatrix not spiraled, with a few sclerotized scales. Sexual dimorphism accentuate; females with small eyes, more convex and more rounded prothorax; antennae shorter.

Type-species: *Campyloxenus pyrothorax* Fairmare, 1860 (Hyslop's designation, 1921: 633).

Distribution (map 1). CHILE: *Arauco. Cautin. Lhanquihue. Chiloe.* ARGENTINA. *Rio Negro.*

Campyloxenus pyrothorax Fairmaire, 1860 (figs. 147-155, 185, 186).

Campyloxenus pyrothorax Fairmaire, 1860: 6 (type-locality: Chile); Candèze, 1863: 508; Champion, 1895: 457; Fleutiaux, 1907: 214; Schenkling, 1927: 355; Blackwelder, 1944: 286.

Pyrophorus megalophysus Philippi, 1861: 744 (type-locality: Valdivia, Chile); Schwarz, 1906: 215; Fleutiaux, 1907: 213; Schenkling, 1927: 355; Blackwelder, 1944: 286.

PHYLOGENY OF THE PYROPHORINI AND HELIGMINI

As result of a comparative study of all species of Pyrophorini and Heligmini, certain characters may be postulated for the hypothetical common ancestor of these genera:

1. pubescence long, sparse and bristly;
2. eyes very small;
3. antennae serrate from fourth segment onwards;
4. frontal carina absent;
5. hind angle of the prothorax not divergent and not carinate;
6. mesosternal cavity horizontal;
7. metacoxal plate of the same width throughout;
8. luminous organs absent;
9. mandibles not denticulate;
10. male genitalia simple, median and lateral lobes without secondary formations;
11. female genitalia short; bursa copulatrix not spiraled, without long spines; median oviduct without sclerotized plates.

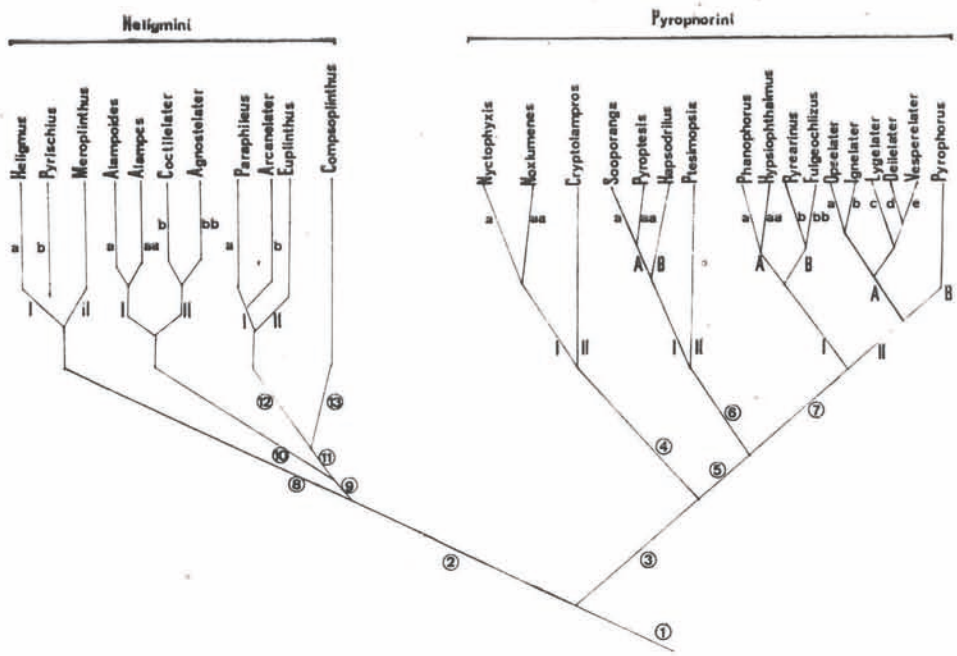
This hypothetical ancestor (1) gave rise to two lines: (2) Heligmini, which have kept many of the primitive characters and did not develop luminous organs; this group has probably occupied a large area, but is now restricted to small areas (maps 10-12); (3) Pyrophorini, which became specialized by the development of luminous organs on the prothorax and abdomen.

PHYLOGENY OF THE HELIGMINI

The hypothetical ancestor (2) gave rise to two lines: (8) where the antennae are serrate from the third segment onwards and the mesosternal cavity directed horizontally backwards (fig. 255); (9) where the antennae are serrate from the fourth segment onwards and the mesosternal cavity changed its shape.

The line (9) gave rise to two stocks: (10) with small, slender and little convex species, without carina in the front and with short female genitalia (Alampina); (11) where the species are bigger and robust and the female genitalia is elongated.

The stock (11) gave rise to two groups: (12) where the mesosternal cavity became sinusoidal and the epipleura remained marginated (Euplinthina); (13) where the mesosternal cavity became strongly angulate, forming a right angle (fig. 256) and the epipleura not marginated (Compsoplinthina).



Phyletic Chart. Phyletic arrangement of the tribes Heligmini & Pyrophorini.

PHYLOGENY OF THE HELIGMINA (map 12)

The hypothetical ancestor (8) gave rise to three lines, forming two basic patterns.

Pattern (I) retained the free median lobe of the male genitalia on the ventral side and gave rise to two groups:

a) which evolved a characteristic pubescence on the ovipositor (figs. 216-218); the antennae became almost pectinate, mainly in the males; the male genitalia remained very simple (genus *Heligmus*, nowadays in the open and forested areas of Brazil);

b) where the bursa copulatrix became spiraled, with internal spines; the median oviduct developed sclerotized plates (figs. 219-221), (genus *Pyrischius*, from the Amazonian and Atlantic forests).

In pattern (II) the median lobe of the male genitalia (figs. 243-244) has fused basally to the lateral lobes, in both sides (genus *Meroplinthus*, with species in the Atlantic forest and open formations).

PHYLOGENY OF THE ALAMPINA (map 10)

The ancestor (10) of Alampina gave rise to two phyletic lines, one leading to *Alampes* and *Alampoides* and the other to *Coctilelater* and *Agnostelater*.

The first line developed denticulate mandibles and gave rise to two stocks:

a) in which the antennae remained elongate; the eyes became larger; the bursa copulatrix became slightly spiraled, and with a few long spines (figs. 204-206; 213-215); and one pair of accessory glands; and the mesosternal cavity became open and slightly raised behind (fig. 254a) (genus *Alampoides*, Amazonian area of Peru and Ecuador);

aa) in which the antennae became shorter; the bursa copulatrix well spiraled, with many long spines; two pairs of accessory glands (figs. 201-203); mesosternal cavity closed and is even more raised behind (genus *Alampes*, forested areas of South and Central America).

The second line retained the toothless mandibles and gave rise to two stocks:

b) in which the bursa copulatrix remained practically unchanged, but the median oviduct developed a different type of sclerotized plate; and the last abdominal segment of males remained unchanged (genus *Coctilelater*, apparently disjunct in the South American forested areas);

bb) in which the last abdominal segment of males developed flying setae (females unknown) (genus *Agnostelater*, in the Brazilian open formations).

PHYLOGENY OF THE EUPLINTHINA (map 11)

The ancestor (12) gave rise to two phyletic lines: one leading to *Euplinthus*, with primitive mandibles (today apparently disjunct in the forested areas of Brazil); the other line became specialized with denticulate mandibles, and gave rise to two stocks:

a) the third and second antennal segments became short and spherical; the bursa copulatrix evolved long internal spines; the eyes re-

mained very small (genus *Paraphileus*, from the Pampas of Argentina and Uruguay);

b) the third antennal segment became slightly longer than the second; the eyes became more developed; the bursa copulatrix remained without spines (genus *Arcanelater*, from the Atlantic forest of Brazil).

PHYLOGENY OF THE COMPSOPLINTHINA (map 11)

The single genus in this subtribe became specialized by the development of a strongly angulate mesosternal cavity and by the disappearance of the epipleura margin (genus *Compsoplinthus*, open formations of Brazil).

PHYLOGENY OF THE PYROPHORINI

The ancestor (3) gave rise to two lines, one leading to the Nyctophyxina and the other to the ancestor of Hapsodrilina and Pyrophorina. In the former the male genitalia and the shape of the eyes remained unchanged; the bursa copulatrix became bipartite; the median oviduct developed sclerotized plates; and luminous organs appeared on the prothorax. In the latter (5) the male genitalia became more complex; the eyes have developed in size; the bursa copulatrix became a little spiraled and with long spines; the median oviduct developed different type of sclerotized plate and luminous organs appeared on the abdomen.

This ancestor (5) gave rise to two stocks, one of which led to the Hapsodrilina and the other to the Pyrophorina. The former (6) have the median lobe of the male genitalia basally fused to the lateral lobes on both sides; the sides of the elytra became parallel and rounded to apices; the front remained without a carina; the antennae became serrate from the third segment onwards. The latter (7) developed a carinate front; the median lobe remained free at the ventral side, but became more complex; the elytra became submucronate and tapering to the apices; the antennae remained serrate from the fourth segment onwards.

PHYLOGENY OF THE NYCTOPHYXINA

The ancestor (4) gave rise to three different lines forming two basic patterns.

Pattern (I) retained the bristly pubescence and the well impressed punctures; it gave rise to two stocks:

a) with the median lobe of the male genitalia more developed, the lateral lobes became shorter and hairy (fig. 76); the eyes remained little developed; the sexual dimorphism became more accentuate (females more convex and more rounded, hind wings and eyes smaller than in the males) (genus *Nyctophyxis*, restricted today to Chile);

aa) the median lobe and the lateral lobes became more elongate in relation to the basal piece, and the apices of the lateral lobes became more hairy (fig. 75); the eyes became little more developed; the third and second antennal segments became subequal and the pubescence sparse (genus *Noxlumenes,* Argentina).

In pattern (II) the pubescence became recumbent and dense, the punctures fine; the median lobe pointed to the apex; the lateral lobes rounded and typically hairy (fig. 130); the eyes larger and the antennae shorter (genus *Cryptolampros,* apparently disjunct in the Amazonian and Atlantic forests).

PHYLOGENY OF THE HAPSODRILINA

The ancestor (6) gave rise to two lines. In line (I) the antennae remained serrate from the fourth segment onwards; the third segment became more or less triangular; the metacoxal plate became gradually enlarged inwardly. This line gave rise to two stocks:

One (A) bicolorous, with dense pubescence and less distinct luminous organs on the prothorax. This stock evolved into two other groups:

a) the median loge became larger and gradually pointed to the apex, with minute scales and spines (figs. 131, 131a); the bursa copulatrix became more spiraled (genus *Sooporanga,* today restricted to the Brazilian Atlantic forest);

aa) the lateral lobes became shorter, pointed, and divergent (figs. 136, 137); the median oviduct developed sclerotized plates (figs. 144-146) (genus *Pyroptesis,* today restricted to the Brazilian Atlantic forest).

The other stock (B) unicolorous; pubescence dense and with distinct luminous organs on the prothorax; median lobe carinate on the dorsal side, with minute cuticular scales and spines; lateral lobe short (figs. 138-140a); median oviduct with sclerotized plates and bursa copulatrix weakly spiraled (genus *Hapsodrilus,* Brazilian Atlantic forest).

In line (II) the antennae became distinctly serrate from the third segment onwards; the metacoxal plates became abruptly enlarged inwards; the lateral lobe became short (figs. 132-135) and the median lobe stout and excavate (genus *Ptesimopsia,* in the Amazonian region, Chaco and Pampas formations).

PHYLOGENY OF THE PYROPHORINA (maps 5-9)

The ancestor (7) gave rise to two main lines from which evolved many other stocks.

Line (I) developed luminous spots localized posteriorly on the prothorax; the male genitalia remained practically unchanged. This line gave rise to two stocks:

A) the median lobe (figs. 77, 80) remained unchanged, but the lateral lobe became short and pointed to the apex; the elytra became more marginated at the sides. This stock formed two different patterns, according to type of the female genitalia, and the greater or lesser evidence of sexual dimorphism.

a) sexual dimorphism not much accentuated; males much more slender, their eyes larger, their antennae more elongate; the females more convex, less punctulate, eyes smaller, antennae and hind wings shorter, the ovipositor remained very short with a short baculum, the bursa copulatrix not spiraled and without long spines (figs. 84-86) (genus *Phanophorus,* today restricted to Chile);

aa) the ovipositor and baculum became more elongate; the bursa copulatrix remained little spiraled and with elongate minute spines (figs. 87-89). There was a great development of the secondary sexual characters. The males developed very prominent eyes (figs. 90-93). The females became more convex and rounded; less punctulate; eyes little developed; antennae shorter. The hind wings of the female became vestigial, in accordance with a change in ecology (genus *Hypsiophthalmus,* Brazilian Atlantic forest).

B) the median lobe became more developed; the lateral lobes more or less short (figs. 94-129). As shown by the female genitalia and other characters, this stock gave rise to two other groups:

b) bursa copulatrix more or less spiraled with or without long spines; median oviduct with sclerotized plates (figs. 116-124); sexual dimorphism accentuate: eyes prominent in males (but not so prominent as in *Hypsiophthalmus*); hind wings of females normal, except in one species group, short, but not vestigial (genus *Pyrearinus,* with several species groups, some restricted to the Amazonian forest, others to the Atlantic forest, and still others with a disjunct pattern);

bb) bursa copulatrix weakly spiraled, with minute elongate spines; median oviduct simple (figs. 125-127); no sexual dimorphism; antennae more or less appendiculate, sometimes distinctly 12-segmented; eyes normal (genus *Fulgeochlizus,* today restricted to the Chaco region).

Line (II) evolved luminous spots laterally on the prothorax and gave rise to two stocks:

A) characterized by a small and slender size, the longer antennae, the less accentuate sexual dimorphism, and by the formation of several different male genitalia patterns associated with many other characters:

a) the median lobe became stout and laterally expanded in the middle, with minute cuticular scales (figs. 35-38, 48); the bursa copulatrix became more spiraled; the median oviduct developed different type of sclerotized plate; there occurred a great development of the spermatheca and accessory glands (figs. 60-62, 161). The third antennal

segment became longer than the second; the luminous spots became laterally located but not much developed (genus *Opselater,* from Brazilian Atlantic forest);

b) the median lobe became more complex, with median-lateral tubercles and long spines (figs. 34, 37, 49); bursa copulatrix spiraled and with long spines; the median oviduct developed more sclerotized plates (figs. 66-68). Third antennal segment more or less triangular and smaller than the fourth (genus *Ignelater,* restricted to the Antilles);

c) the median lobe became very complex, with an acute apex, sometimes strongly-reentrant, with a variable number of long spines in the middle (figs. 39-42, 54); the female genitalia shows the same modifications described above (figs. 62-65); the third and second antennal segments became subequal; the abdominal luminous organs developed two lamellae (fig. 194); the lateral margins of the prothorax remained yellowish or reddish-yellow and for this reason the prothoracic luminous organs became less distinct (genus *Lygelater,* from the Amazonian region);

d) the median lobe became abruptly narrowed near the apex; with numerous long spines in the middle (figs. 43-46, 52, 53, 55); the third and second antennal segments became subequal but not so small as in *Lygelater;* the luminous spots of the prothorax became slightly convex (genus *Deilelater,* eastern Central America to southeastern USA);

e) the median lobe became abruptly pointed near the apex, but did not develop cuticular scales or long spines; the lateral lobes developed large spines near and at the apices (figs. 56-59); the external habitus remained very similar to *Deilelater* (genus *Vesperelater*, western region of Mexico to Southeastern USA).

B) characterized by a stout and robust size, shorter antennae, absence of sexual dimorphism, median lobe very robust, gradually tapering to the apex, with minute cuticular scales; lateral lobe short and hairy on the apex (figs. 1-26); bursa copulatrix well developed, extremely spiraled, with numerous long spines; the spermatheca developed a different shape; the median oviduct remained simple (genus *Pyrophorus,* with two species groups: one predominantly Amazonian, the other in the Atlantic forest and open formations which have penetrated the Antilles, giving rise to several endemic species).

CONCLUSIONS

The Heligmini and Pyrophorini are a monophyletic group. They radiated in the forests of the Guiano-Brazilian subregion, and by centrifugal and intermittent pulsations (according to Brown, 1957) colonized other distant areas. At first they probably occupied all the forested regions of South America. As a consequence of ecological competition

with the presumably more successful Pyrophorini, the Heligmini became restricted to certain peripheral areas (maps 10-12).

Evidence that the Heligmini had a previously larger distribution can be deduced from the disjunct patterns that they now show. The genera *Coctilelater* and *Euplinthus*, for instance have disjunct, different species in the Amazonian and Atlantic forests. *Meroplinthus* has some species in the open formations of Central Brazil, in the Pampas of South Brazil and Uruguay, and also in the Atlantic forest. *Paraphileus*, now restricted to the Pampas of Uruguay and Argentina, should have had a more Southeastern distribution. Finally, *Pyrischius* is the single genus of this tribe which seems to have recently invaded the Central American forest, probably after the establishment of the connection between South and Central America, during the Plio-Pleistocene transition.

The Pyrophorini were apparently more successful in their radiation; this can be deduced from their present distribution patterns. Their bioluminescence may have been an important factor in competition and survival, especially if we take into consideration larval longevity and luminescence.

As is known, luminescence in the adults is an important factor for specific recognition, but in the larvae it is mainly a defensive mechanism. The larvae are predaceous, and luminescence, for them, probably an efficient factor in survival as a way of obtaining food or to frighten enemies.

Evidence of the great expansion of the Pyrophorini can be obtained from the endemic genera: *Nyctophyxis* and *Phanophorus*, restricted to Chile; *Sooporanga* and *Pyroptesis*, restricted to the Atlantic forest; *Ignelater*, endemic in the Antilles, etc..

In the colonization of the Antilles two phases are noticiable, an older one that allowed the formation of one endemic genus (*Ignelater*) and another, more recent phase that allowed the establishment of several endemic species (of *Pyrophorus*). It is very probable that the invasion of the Antilles occurred through larvae and eggs transported by way of natural rafts (the long duration of the larvae and the great resistance of the eggs may have constituted favorable factors). In both cases colonization took place from South American stocks.

In short, the story must have been the following:

I. the hypothetical ancestor (1) at first occupied all the forested areas of South America and gave rise to two lines:

i. a stock that gave rise to the Heligmini, today restricted to the peripheral areas of South America; ii. a stock that gave rise to the Pyrophorini, which radiated greatly and supplanted the former.

II. The ancestor (2) gave rise to three different groups:

i. a line that gave rise to the Heligmina, today represented by: a) *Heligmus,* in the Atlantic forest and open formations of Central Brazil and Bolivian Chaco; b) *Pyrischius,* from the Amazonian region and Central American rain forest; c) *Meroplinthus,* mainly from the Atlantic forest.

ii. a line that gave rise to the Alampina, today represented by: a) *Alampoides,* from the Amazonian region of Peru, Ecuador and Bolivia: b) *Alampes,* from Colombia, Brazil (Western Amazonas) and the Central American rain forest; c) *Agnostelater,* from the open formations of Brazil; d) *Coctilelater,* disjunct in the Amazonian and Atlantic forests.

iii. a line that gave rise to the Euplinthina, today represented by: a) *Paraphileus,* restricted to the Pampas of Argentina and Uruguay; b) *Arcanelater,* from the Atlantic forest; c) *Euplinthus,* disjunct in the Amazonian and Atlantic forests.

iv. a line that gave rise to the Compsoplinthina, today represented by a single genus, *Compsoplinthus,* from the open formations of Central Brazil.

III. The ancestor (3) gave rise to three different groups:

i. the line that formed the Nyctophyxina, today represented by: a) *Nyctophyxis,* restricted to the dry subtropical Chilean forest; b) *Noxlumenes,* from Argentina; c) *Cryptolampros,* disjunct in the Amazonian and Atlantic forests.

ii. the line that gave rise to the Hapsodrilina, today mainly restricted to the Atlantic forest and represented by: a) *Sooporanga* and *Pyroptesis,* restricted to the Atlantic forest; b) *Hapsodrilus,* in the Atlantic forest and open formations of the Chaco (a single species found in Mexico seems to indicate a recent penetration towards the North); c) *Ptesimopsia,* disjunct in the Amazonian region, and Pampas and Chaco.

iii. the line forming the Pyrophorina, which had a powerful radiation, and today represented by: a) *Phanophorus,* restricted to the Valdivian rain forest; b) *Hypsiophthalmus,* in the Atlantic region and Pampas: c) *Pyrearinus,* with several species groups; exclusively Amazonian: *basalis* and *amplicollis* groups; restricted to the Atlantic forest: *lineatus* group; disjunct in the Amazonian region and Atlantic forests, but also with some species in the Chaco and Pampas regions: *nyctolampis* and *lampadion* groups; in the Amazonian region and open formations of Brazil: *pumilus* group: d) *Fulgeochlizus,* restricted to the Chaco region; e) *Opselater,* with a disjunct distribution in the Amazonian and Atlantic forests: f) *Lygelater,* endemic in the Antilles; g) *Deilelater,* from the Amazonian region, Central American rain forest and open formation of Texas, Arizona and in the Florida mixed forest; i) *Vesperalater,* from the open formations of Arizona and thorn forest of Mexico; j) *Pyrophorus,* that gave rise to two subgroups: a) *noctilucus* group, typically Amazonian, and disjunct in the Atlantic forest; it in-

vaded Central America up to Mexico through the rain forest; b) *divergens* group, with a disjunct distribution in the Amazonian region and Atlantic forest; one species of this group invaded open formations of the Pampas, Chaco and Central Brazil; others colonized the Antilles.

I would also like to point out some preliminary aspects about speciation in the Pyrophorini and Heligmini.

According to several authors: Haffer (1969, 1970), Vanzolini and Williams (1970), Vanzolini (1973), the Quaternary in South America was a time of drastic climatic changes. Vanzolini (1973) said: "An alternation between drier and wetter episodes was reflected in cycles of spreading and retreat of the large forests and of the complementary open formations" ... "The basic pattern is a two-phase cycle, with one wetter and one drier episode. During the drier phase, open formations made impressive inroads in the Amazonian forest which was reduced to isolated patches in areas where conditions remained relatively more favorable. From the view-point of the forest fauna, these areas functioned as refuges in which populations were isolated and consequently became differentiated".

According to Patterson & Pascual (1972) ... "The mammals of Southern Patagonia, through the Miocene, suggest a climate sufficient genial to permit such now mainly tropical animals... to flourish there... At the beginning of the Pliocene a change began in the Southern part of the continent... this coincided with a phase of Andean uplift that was to result in elevation of the main Cordillera. It has a marked ecological effect, largely by acting as a barrier to moisture-laden Pacific winds. The Pampas probably came into prominence at about this time, many of the subtropical savanna-woodland forms retreated northward and new opportunites arose for those mammals able to adapt to a plains environment".

One can infer then, that South America once had a more or less homogeneous climate; and at that time the Heligmini and Pyrophorini were able to occupy a large area. The fact that they today have many restricted and disjunct species may be explained by the numerous climatic changes that occurred. Speciation patterns in the Pyrophorini and Heligimini will be discussed in forthcoming papers.

I consider, at this moment, that there are only two tribes in the Pyrophorinae. However, the classification of the Elateridae is still very confused. Forthcoming papers will try to establish the classification and phylogeny of this family, and very probably many modifications will have to be introduced, including some in regard to the present concept of the Pyrophorinae.

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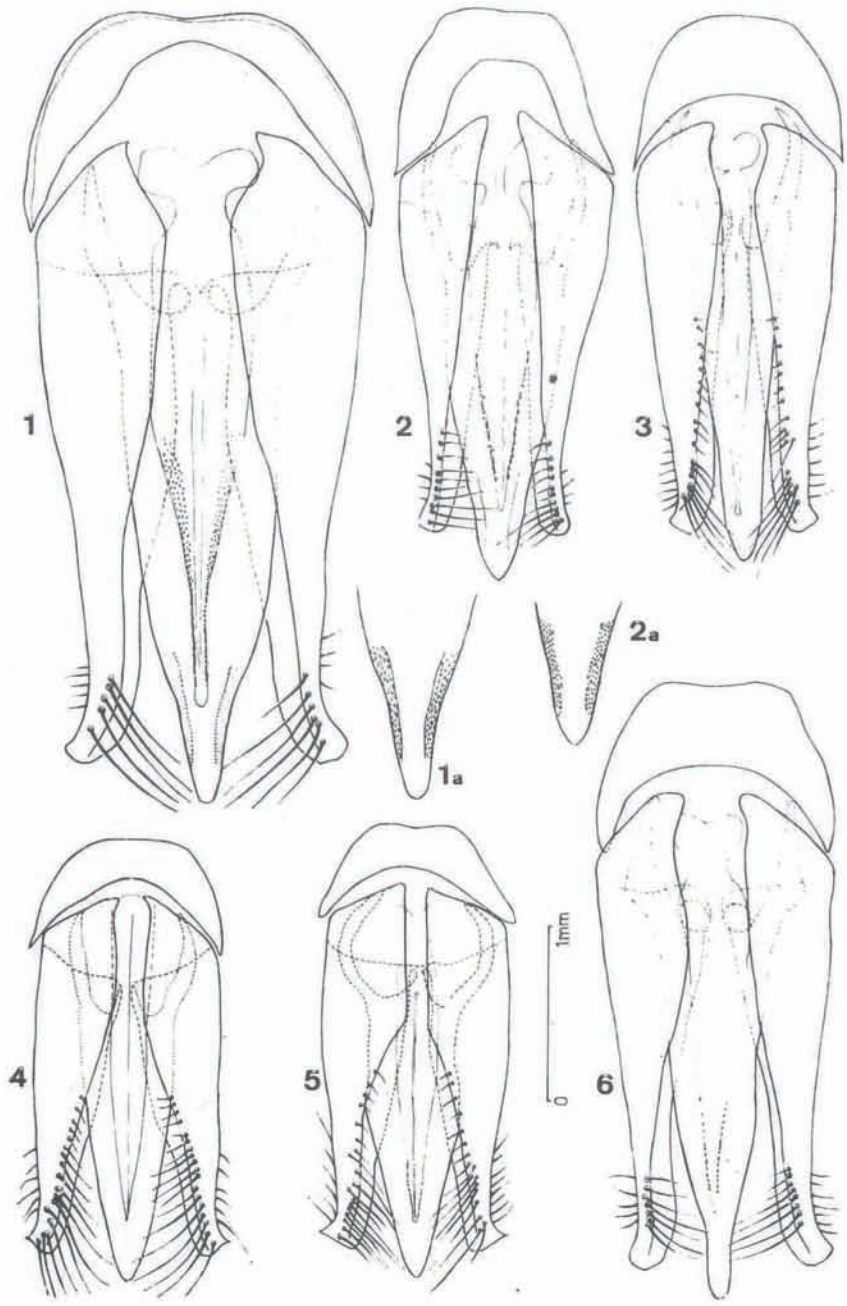
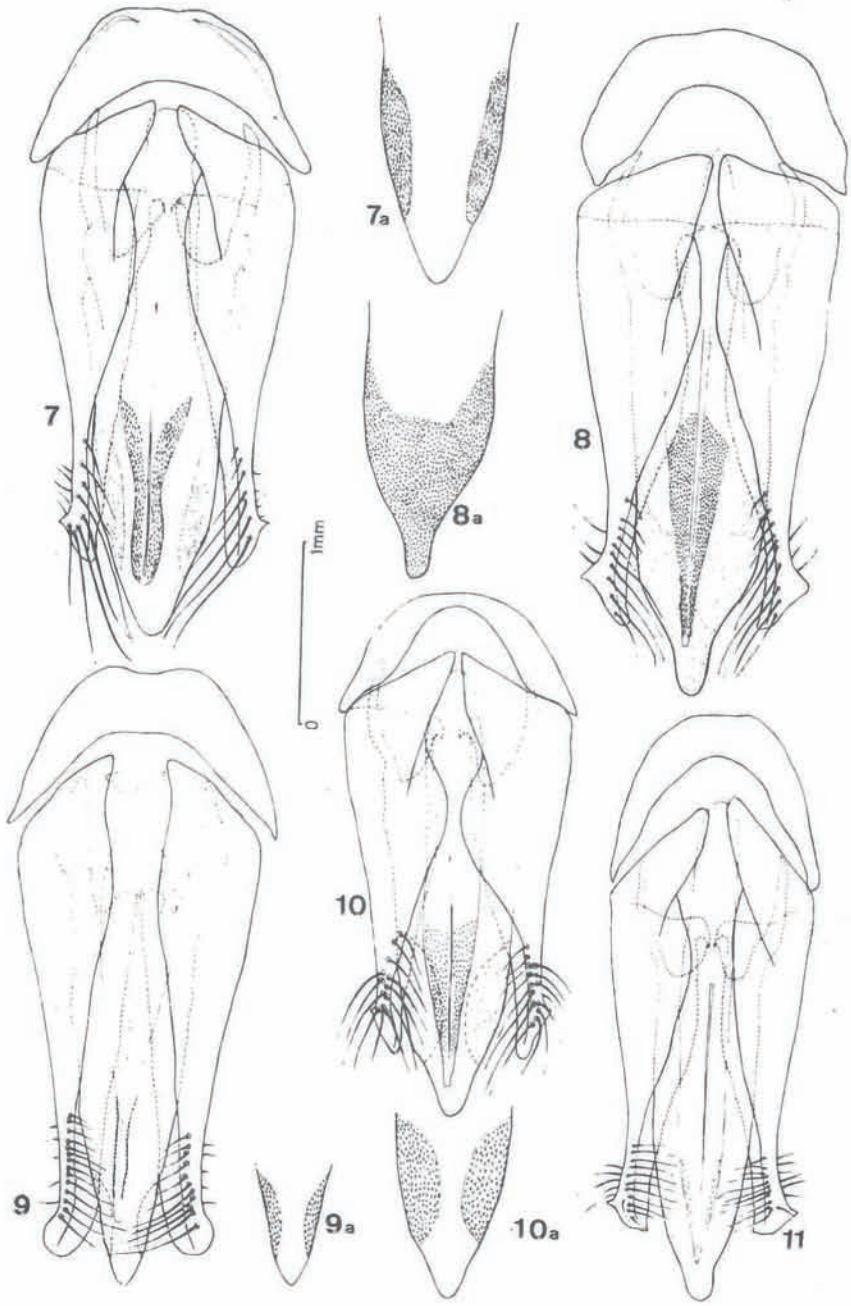
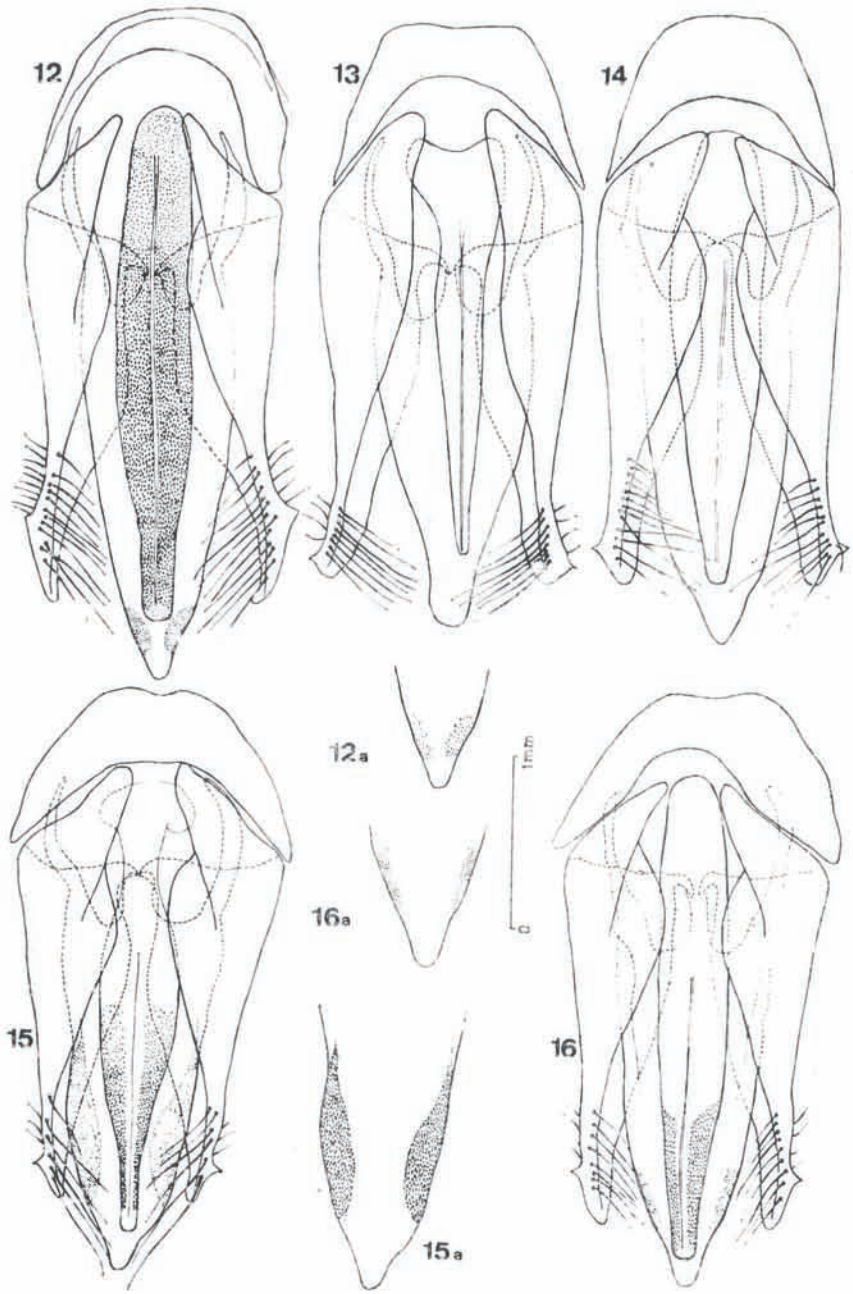


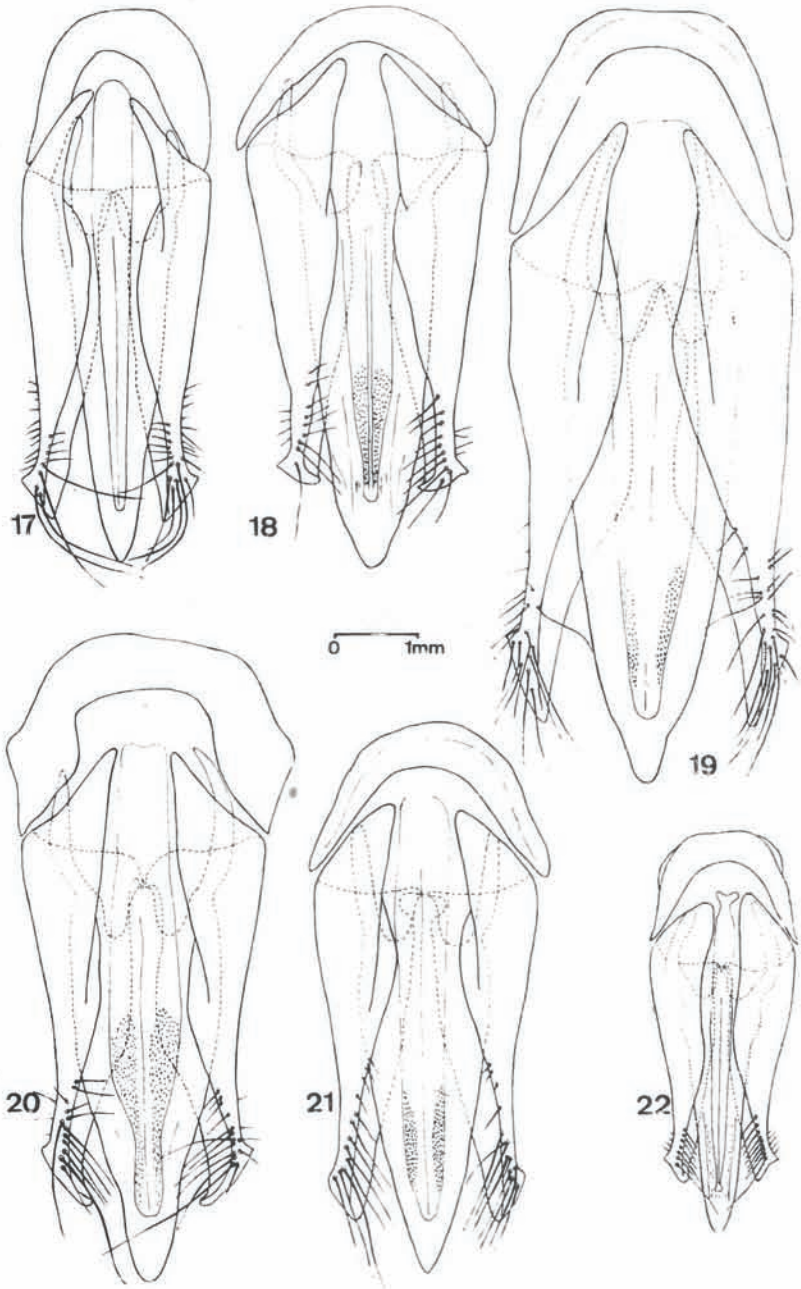
Male genitalia (ventral and dorsal aspects): fig. 1, 1a, *Pyrophorus melliffluus;* fig. 2, 2a, *P. jocundus;* fig. 3, *P. mellitus;* fig. 4, *P. tuberculifer;* fig. 5, *P. evexus;* fig. 6, *P. phosphorescens*.



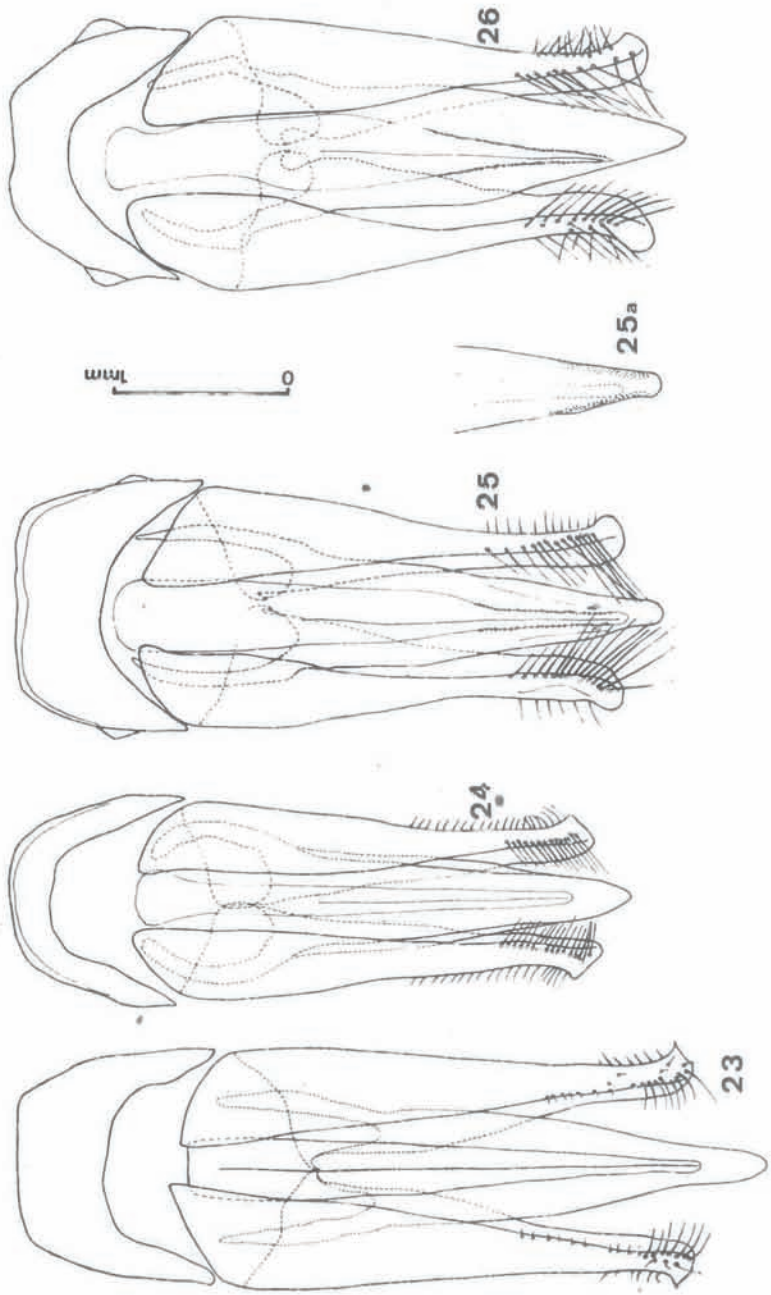
Male genitalia (ventral and dorsal aspects): fig. 7, 7a, *Pyrophorus ingens;* fig. 8, 8a, *P. veriloquus;* fig. 9, 9a, *P. indulcatus;* fig. 10, 10a, *P. avunculus;* fig. 11, *P. dulcifer.*



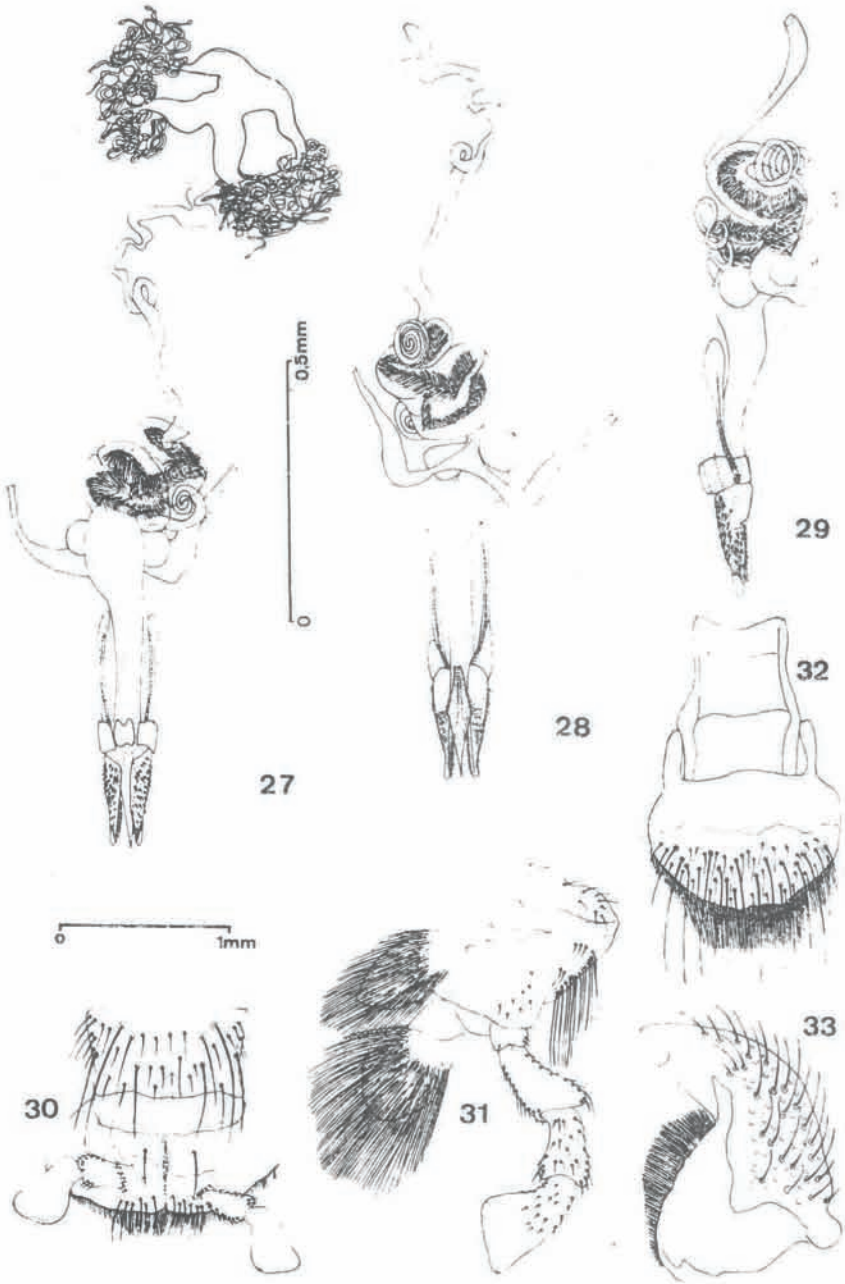
Male genitalia (ventral and dorsal aspects): fig. 12, 12a, *P. pisticus;* fig. 13, *P. stupendus;* fig. 14, *P. magnus;* fig. 15, 15a, *P. expeditus;* fig. 16, 16a, *P. validus*.



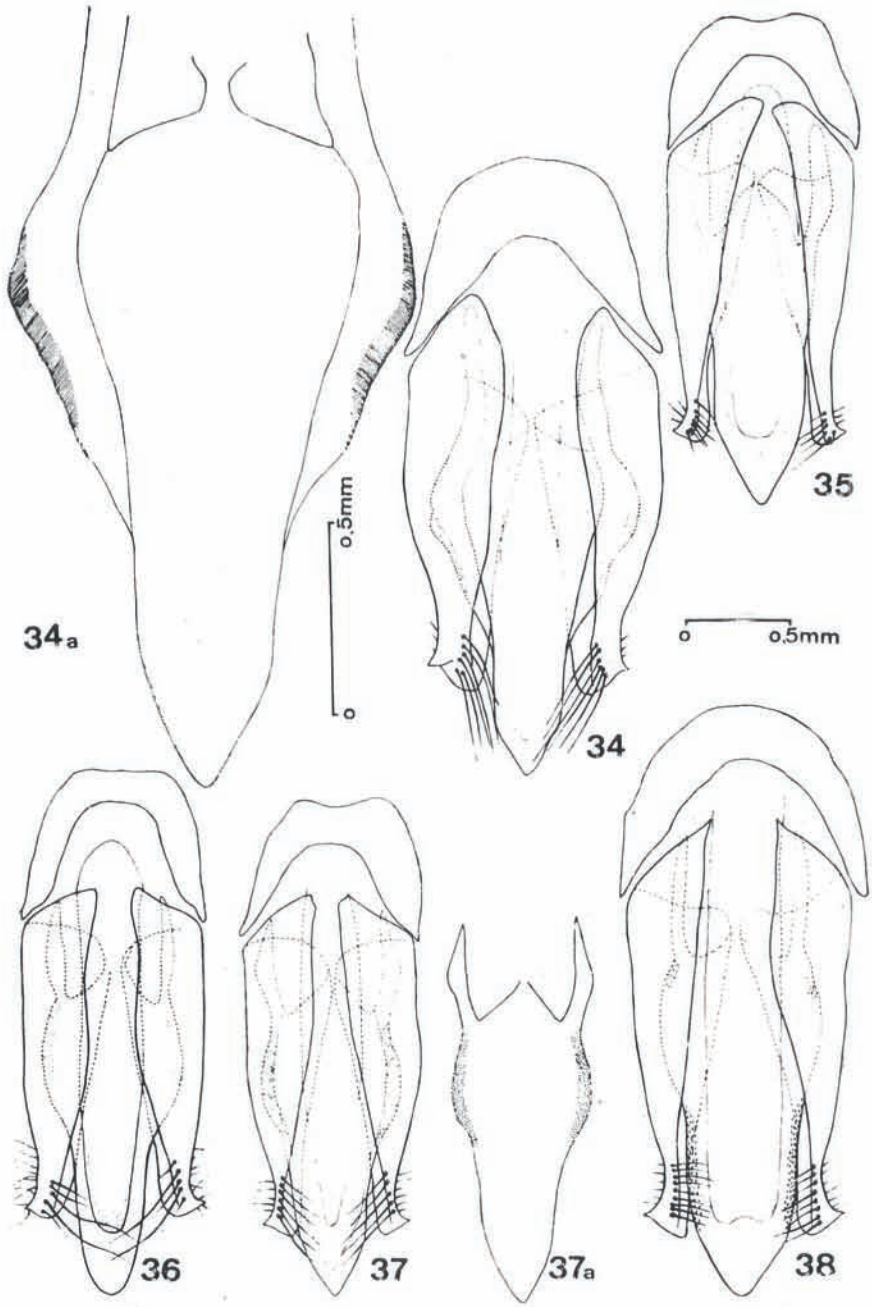
Male genitalia: fig. 17, *P. angustus angustus*; fig. 18, *P. clarus;* fig. 19, *P. noctilucus;* fig. 20, *P. angustus luscus;* fig. 21, *P. angustus haykae;* fig. 22, *P. indistinctus.*



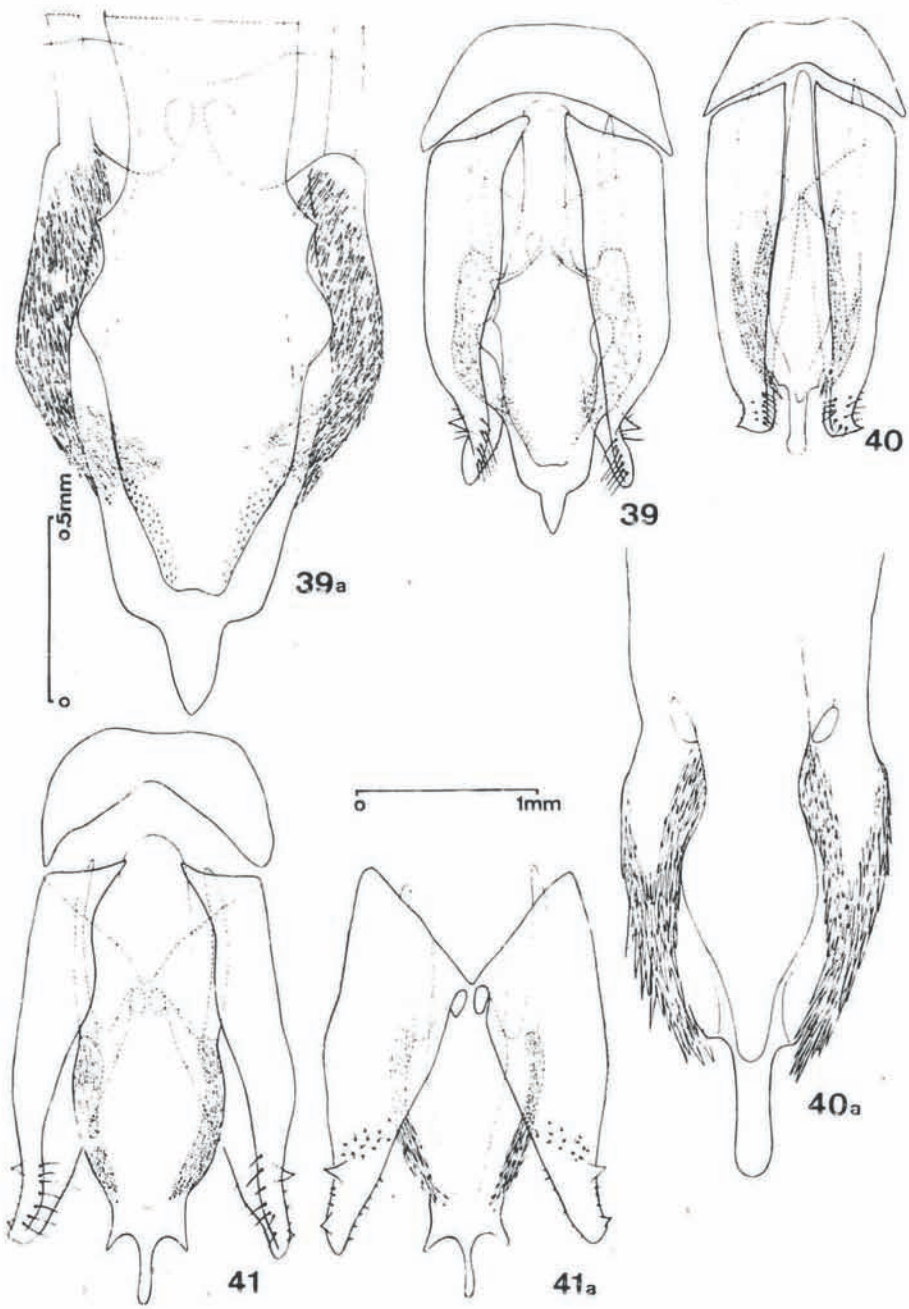
Male genitalia (ventral and dorsal aspects): fig. 23, *Pyrophorus divergens*; fig. 24, *P. punctatissimus*; fig. 25, 25a, *P. strabus*; fig. 26, *P. plagiophthalmus*.



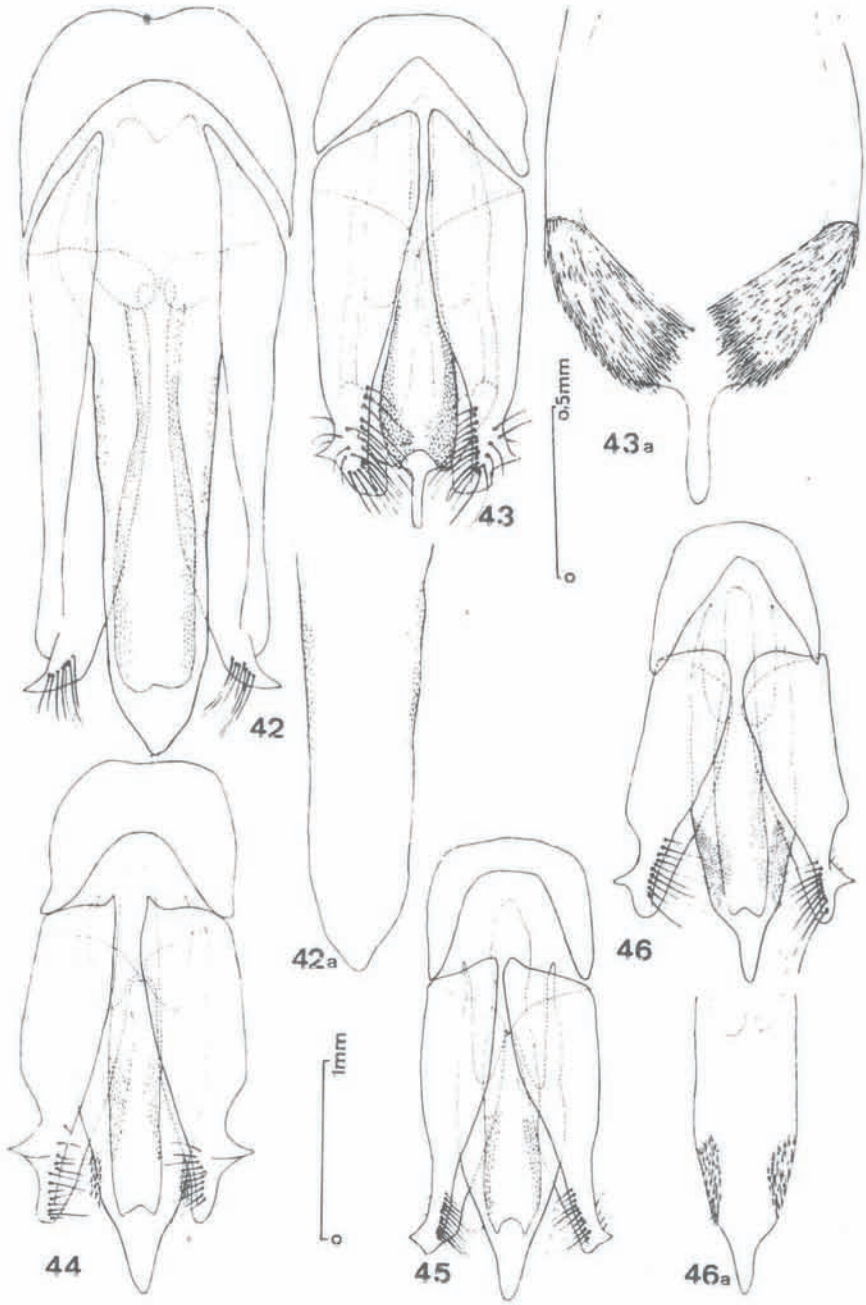
Pyrophorus noctilucus Linnaeus: figs. 27-29, female genitalia; fig. 30, labium; fig. 31, maxilla; fig. 32, labrum; fig. 33, mandible.



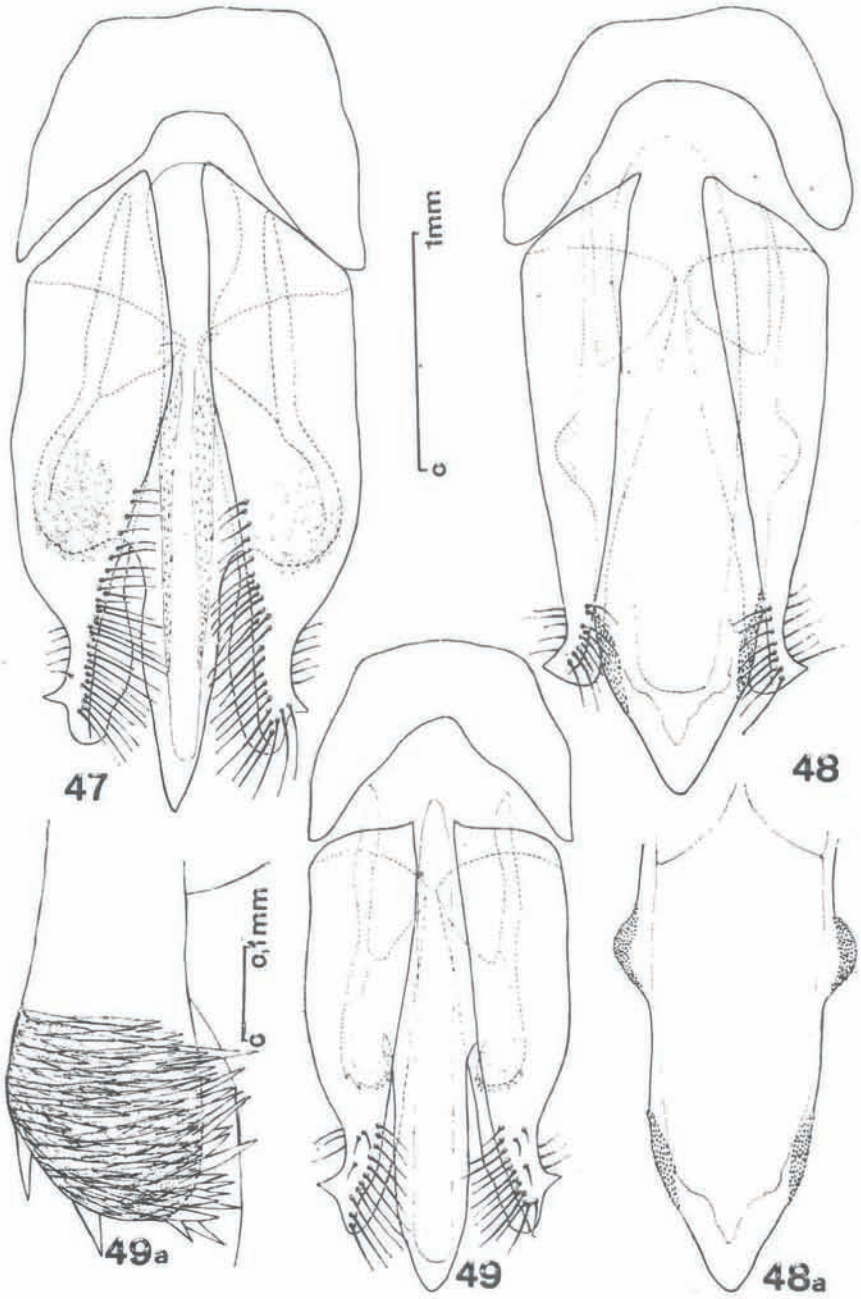
Male genitalia (ventral and dorsal aspects): fig. 34, 34a, *Ignelater luminosus;* fig. 35, *Opselater pyrophanus;* fig. 36, *O. melanurus;* fig. 37, 37a, *O. hebes;* fig. 38, *O. quadraticollis.*



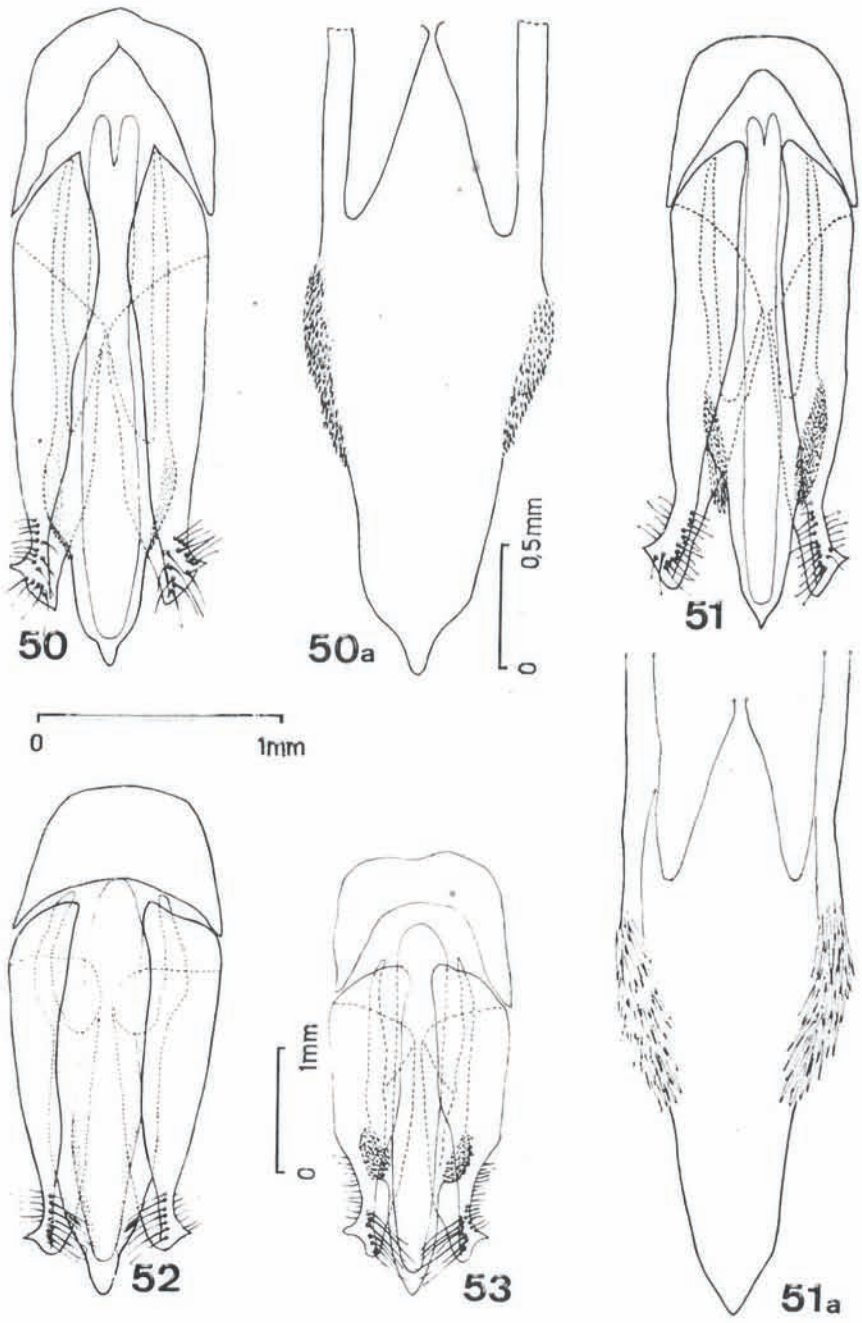
Male genitalia (ventral and dorsal aspects): fig. 39, 39a, *Lygelater fulgidus;* fig. 40, 40a, *L. piceus;* fig. 41, 41a, *L. indicus*.



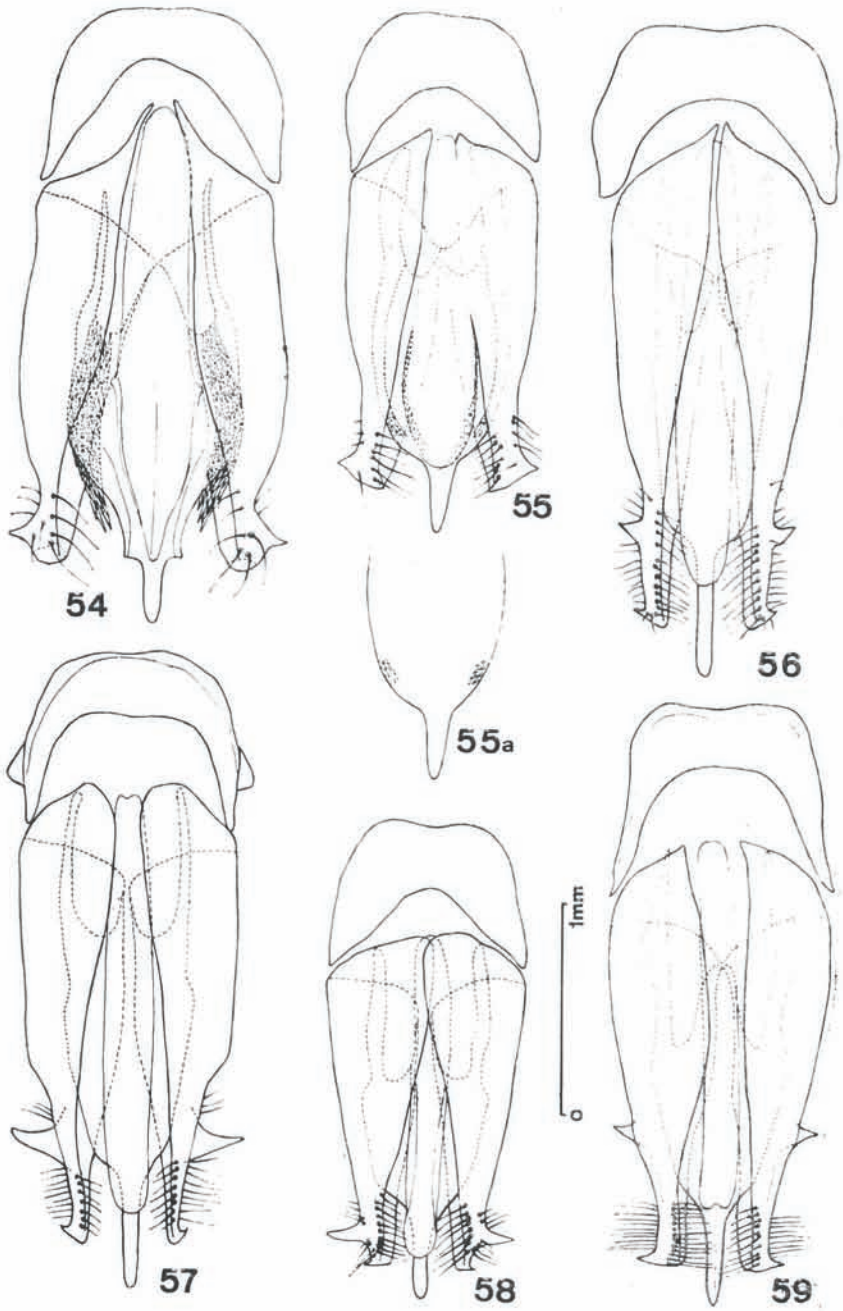
Male genitalia (ventral and dorsal aspects): fig. 42, 42a, *Lygelater bifossulatus;* fig. 43, 43a, *Deilelater radians;* fig. 44, *D. stella;* fig. 45, *D. mexicanus;* fig. 46, 46a, *D. physoderus*.



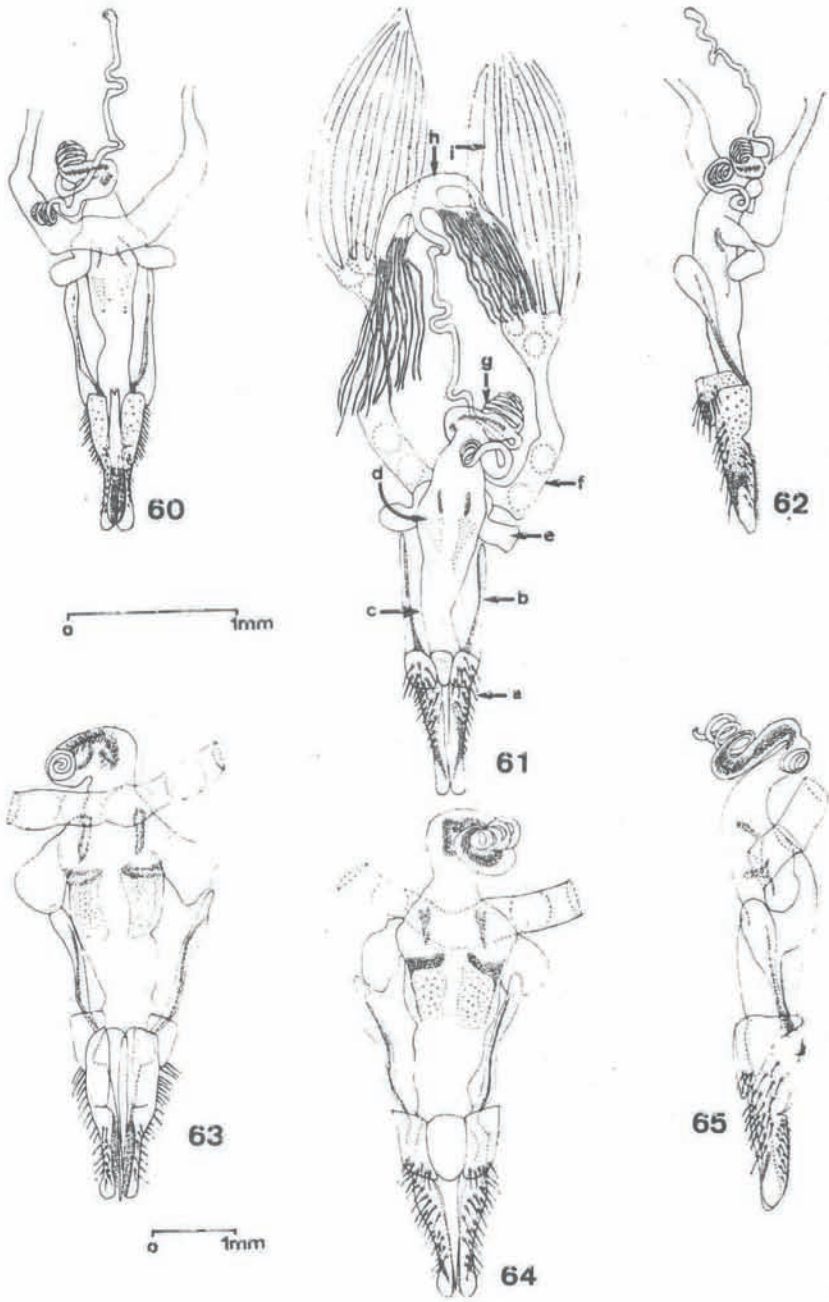
Male genitalia (ventral and dorsal aspects): fig. 47, *Ignelater phosphoreus;* fig. 48, 48a, *Opselater lucens;* fig. 49, 49a, *Ignelater havaniensis.*



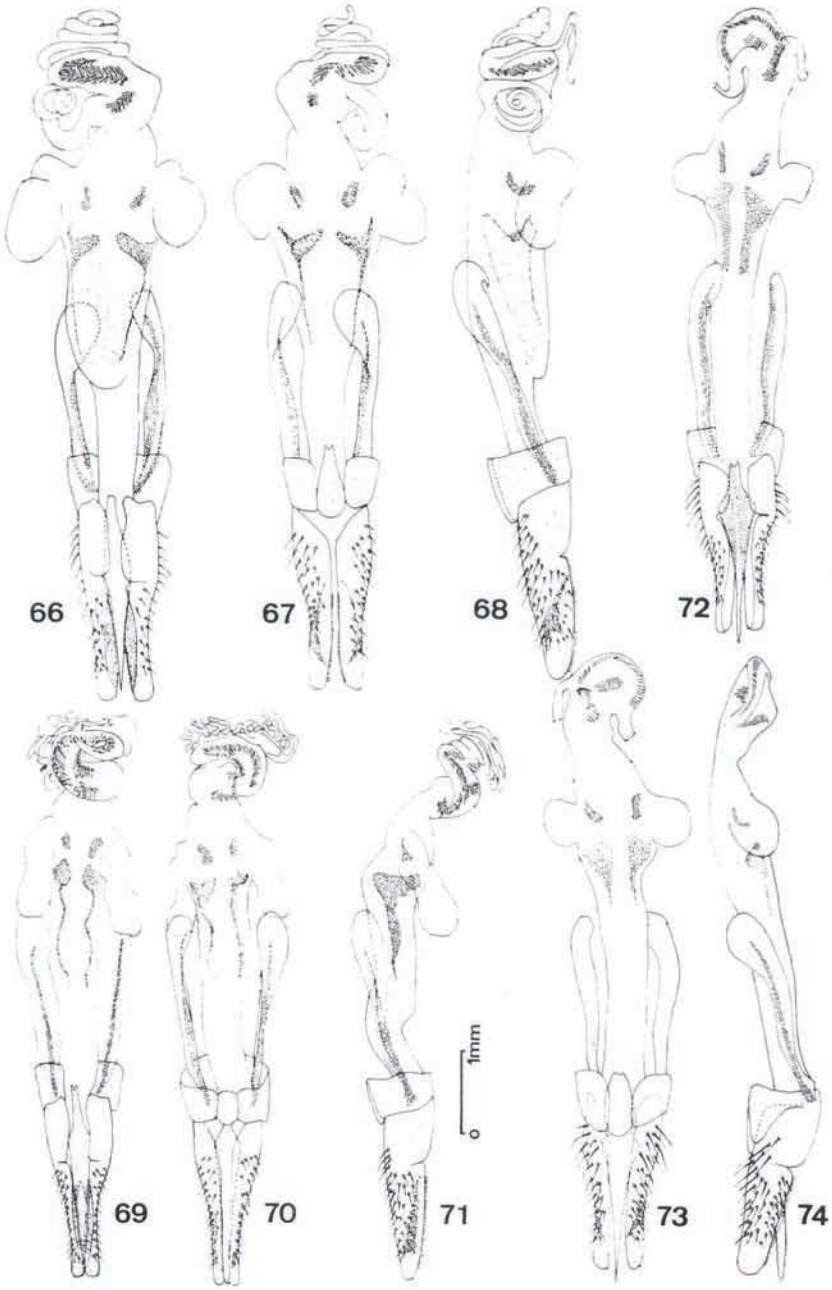
Male genitalia (ventral and dorsal aspects): fig. 50, 50a, *Photophorus bakewelli;* fig. 51, 51a, *P. jansoni;* fig. 52, *Deilelater atlanticus;* fig. 53, *Ignelater caudatus*.



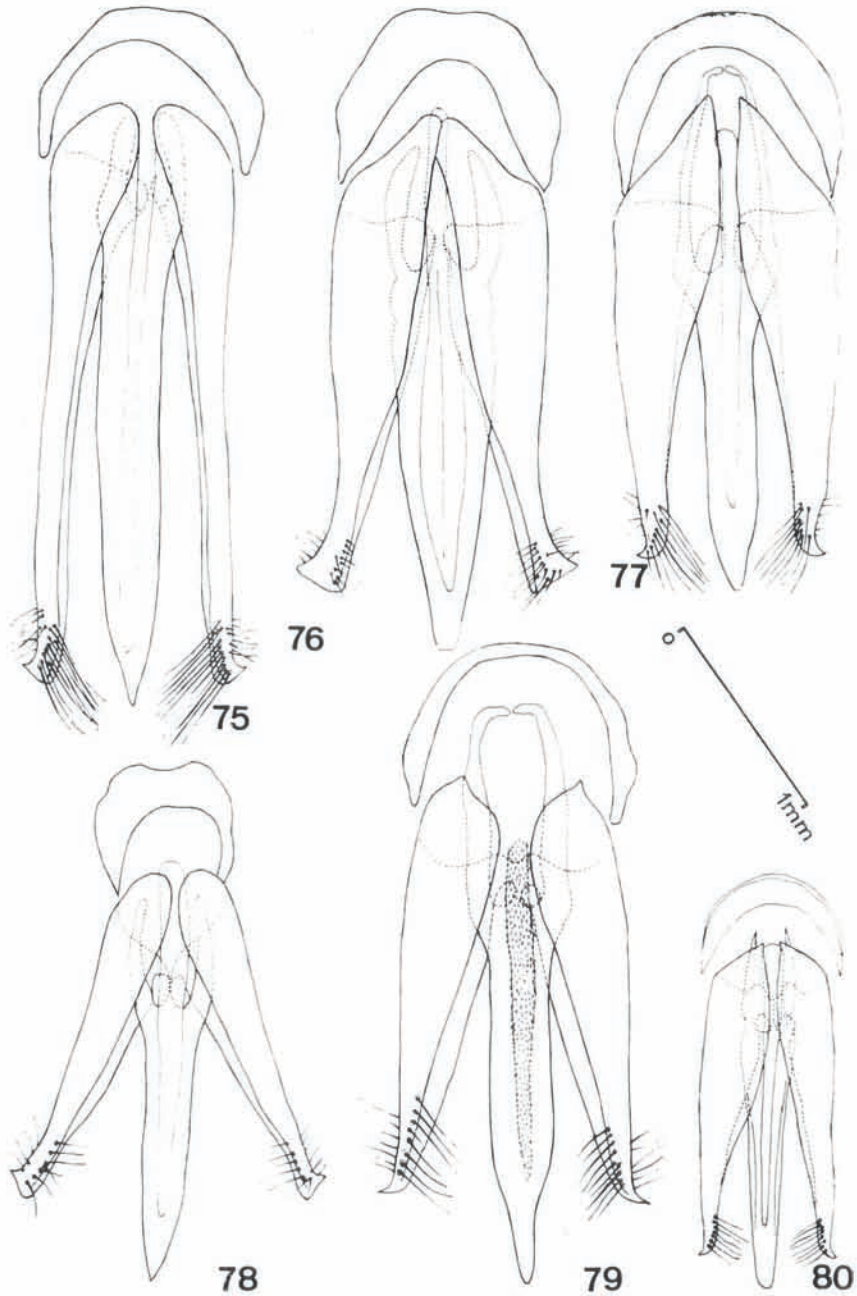
Male genitalia: fig. 54, *Lygelater ignitus;* fig. 55, 55a, *Deilelater sirius;* fig. 56, *Vesperelater ornamentum;* fig. 57, *Vesperelater occidentalis;* fig. 58, *V. gemmiferus;* fig. 59, *V. arizonicus.*



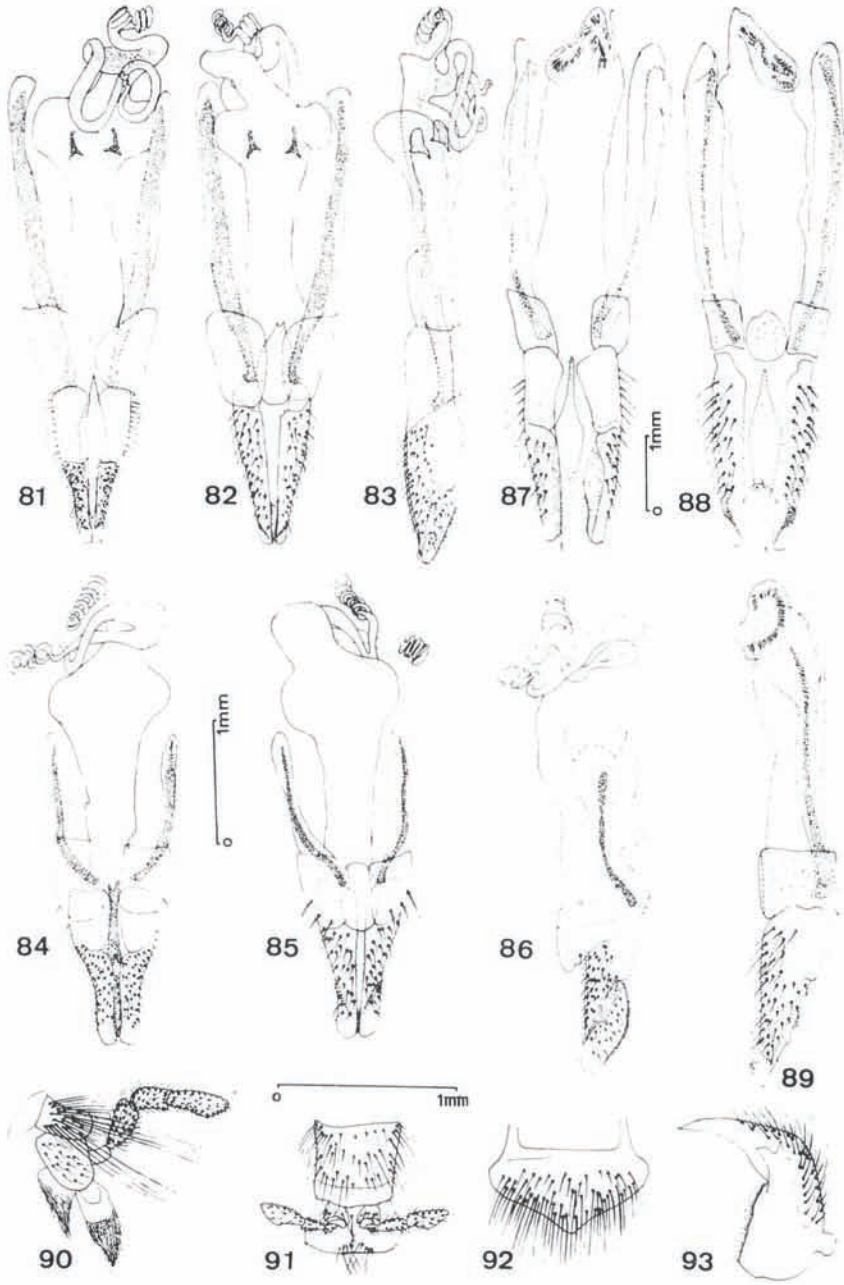
Female genitalia (dorsal, ventral and lateral view): figs. 60-62, *Opselater pyrophanus*; figs. 63-65, *Lygelater fulgidus*.



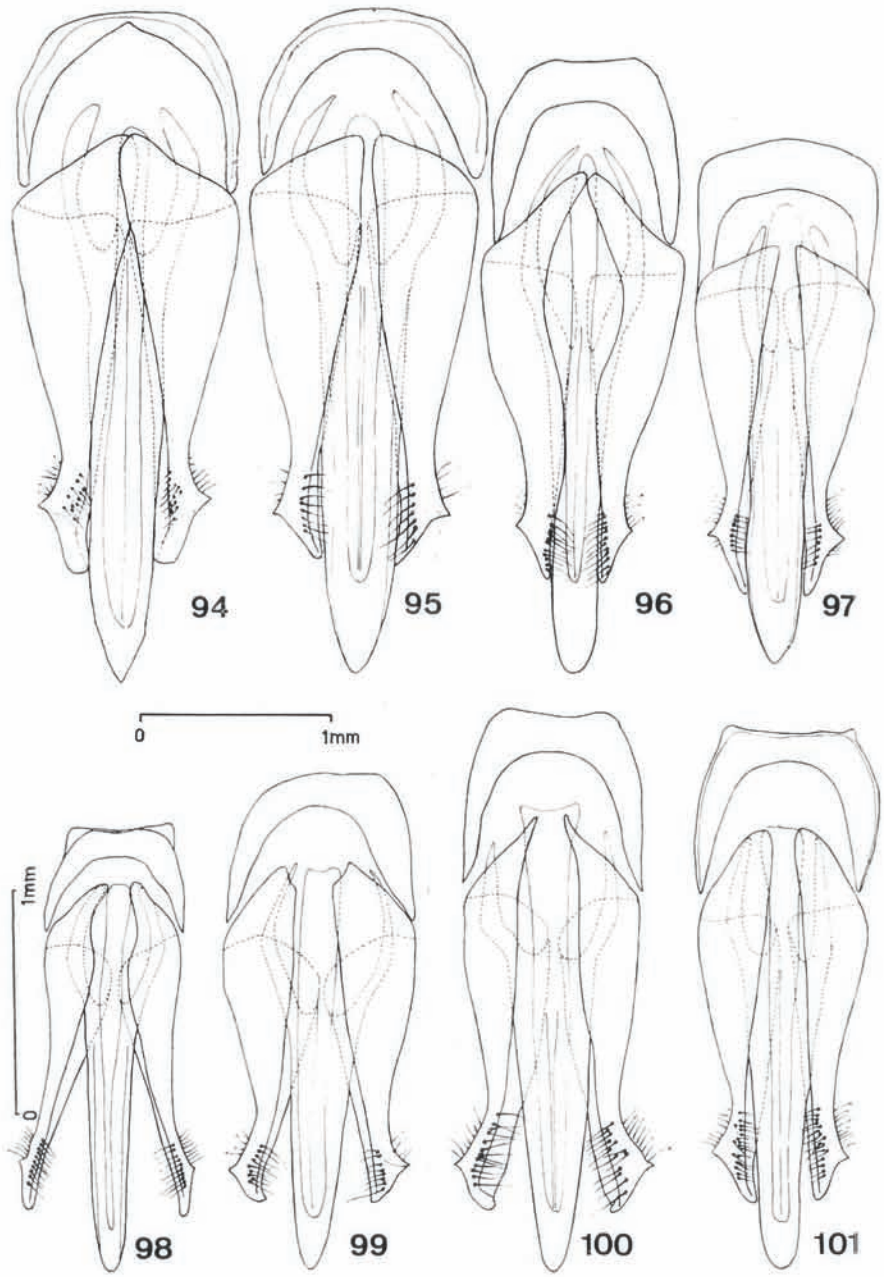
Female genitalia (dorsal, ventral and lateral view): figs. 66-68, *Ignelater havaniensis;* figs. 69-71, *Photophorus jansoni;* figs. 72-74, *Vesperelater ornamentum.*



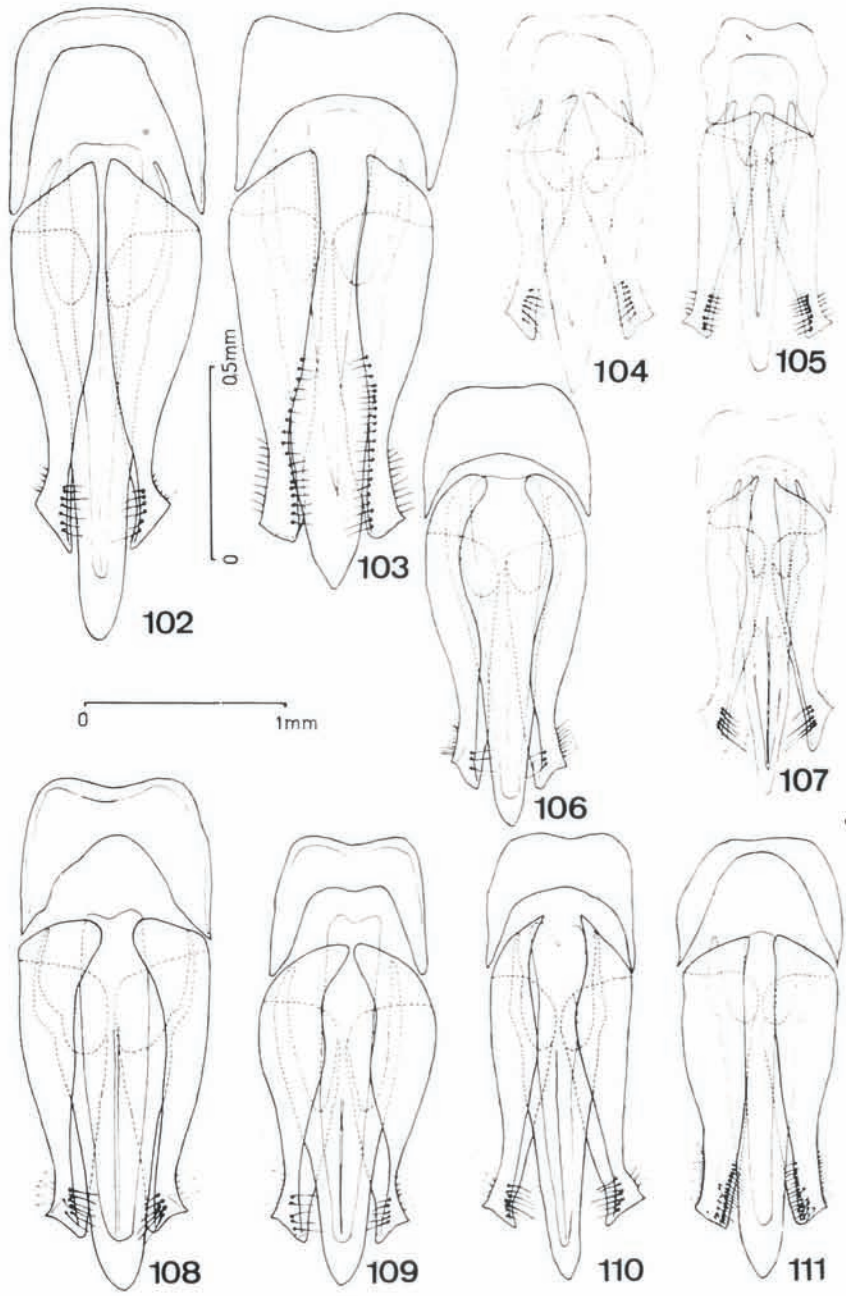
Male genitalia: fig. 75, *Noxlumenes bardus*, n. sp.; fig. 76, *Nyctophyxis ocellatus;* fig. 77, *Hypsiophthalmus grossicollis;* fig. 78. *H. boops;* fig. 79. *H. microspilus;* fig. 80. *Phanophorus perspicax*.



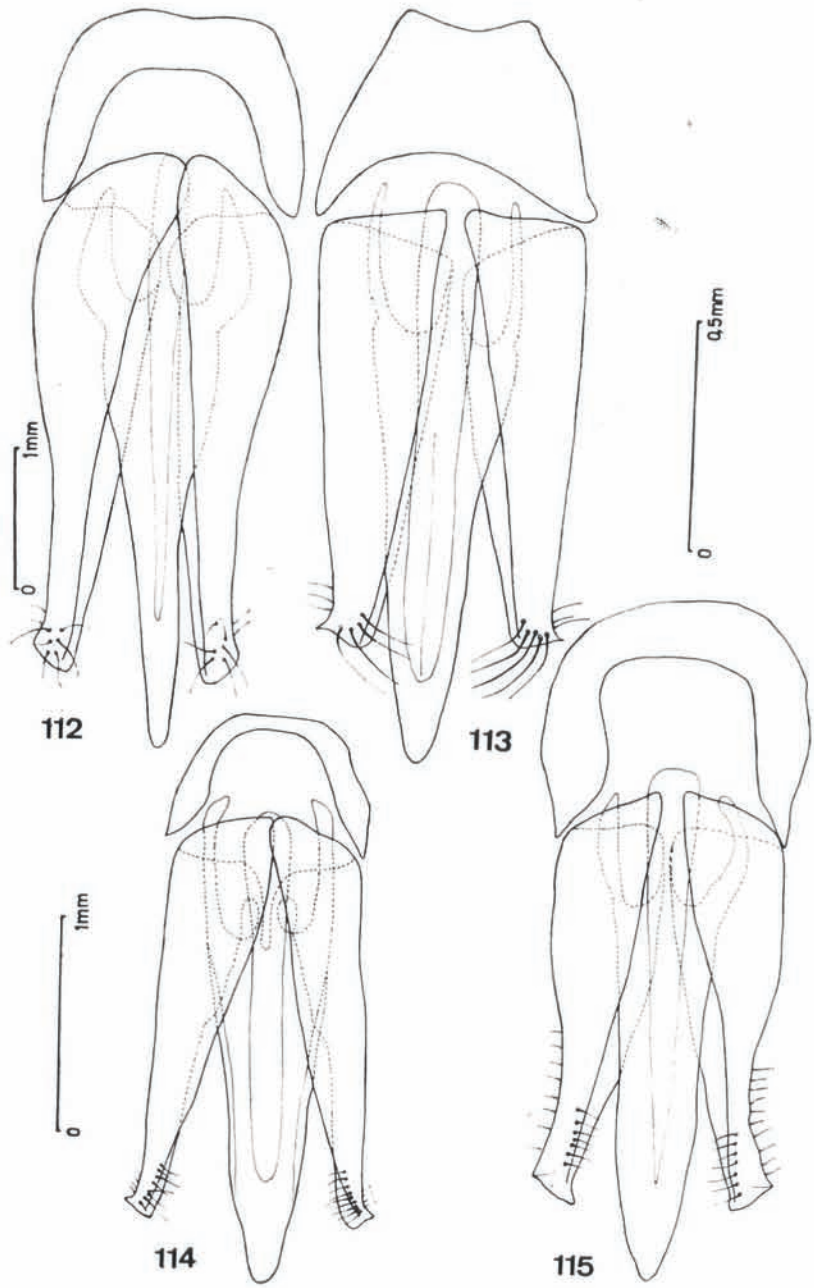
Female genitalia (dorsal, ventral and lateral view): figs. 81-83, *Nyctophyxis ocellatus;* figs. 84-86, *Phanophorus perspicax;* figs. 87-89, *Hypsiophthalmus grossicollis.* Mouth pieces: *Hypsiophthalmus grossicollis*: fig. 90, maxilla; fig. 91, labium; fig. 92, labrum; fig. 93, mandible.



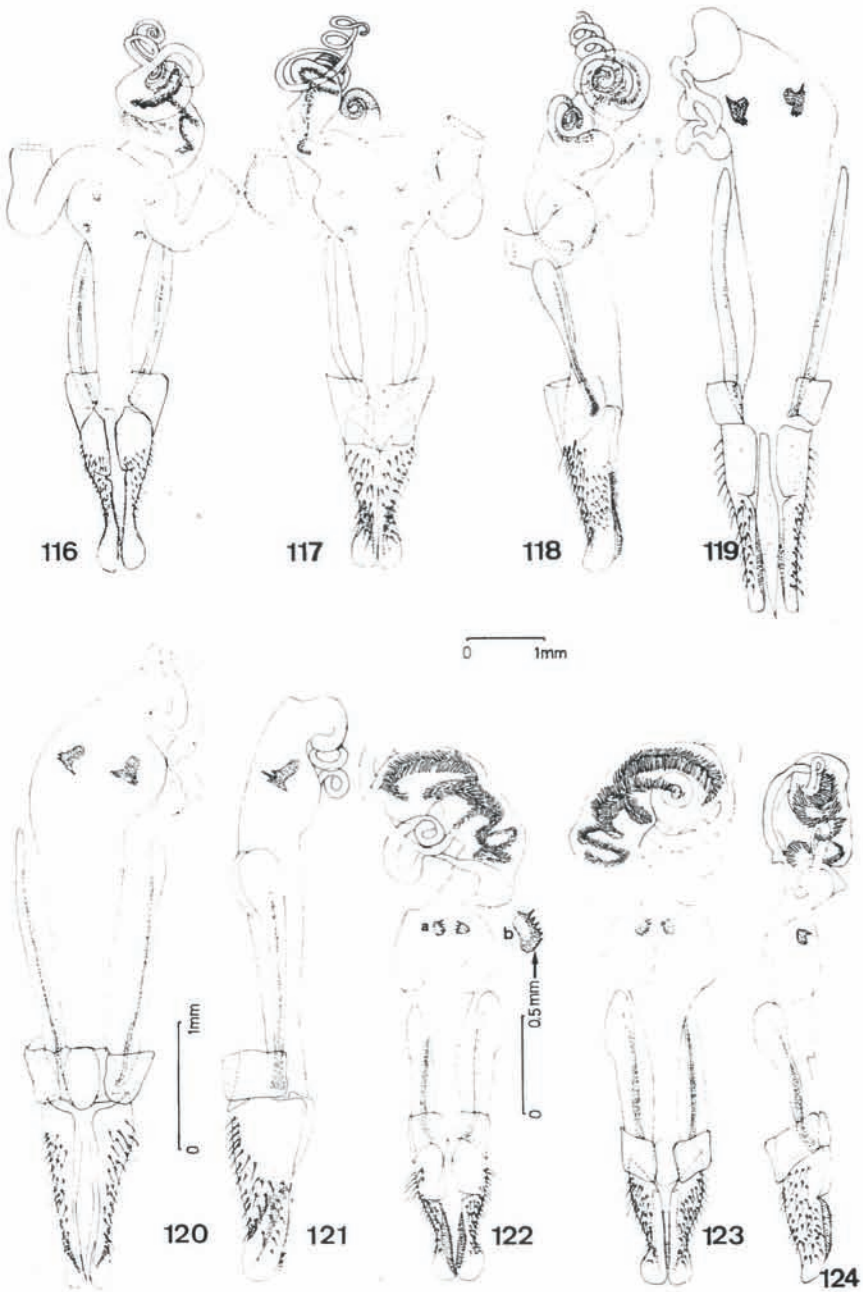
Male genitalia: fig. 94, *Pyrearinus nyctophilus;* fig. 95, *P. depressicollis;* fig. 96, *P. candelarius;* fig. 97, *P. nyctolampis;* fig. 98, *P. gibbicollis;* fig. 99, *P. janus;* fig. 100, *P candens;* fig. 101, *P. linearis.*



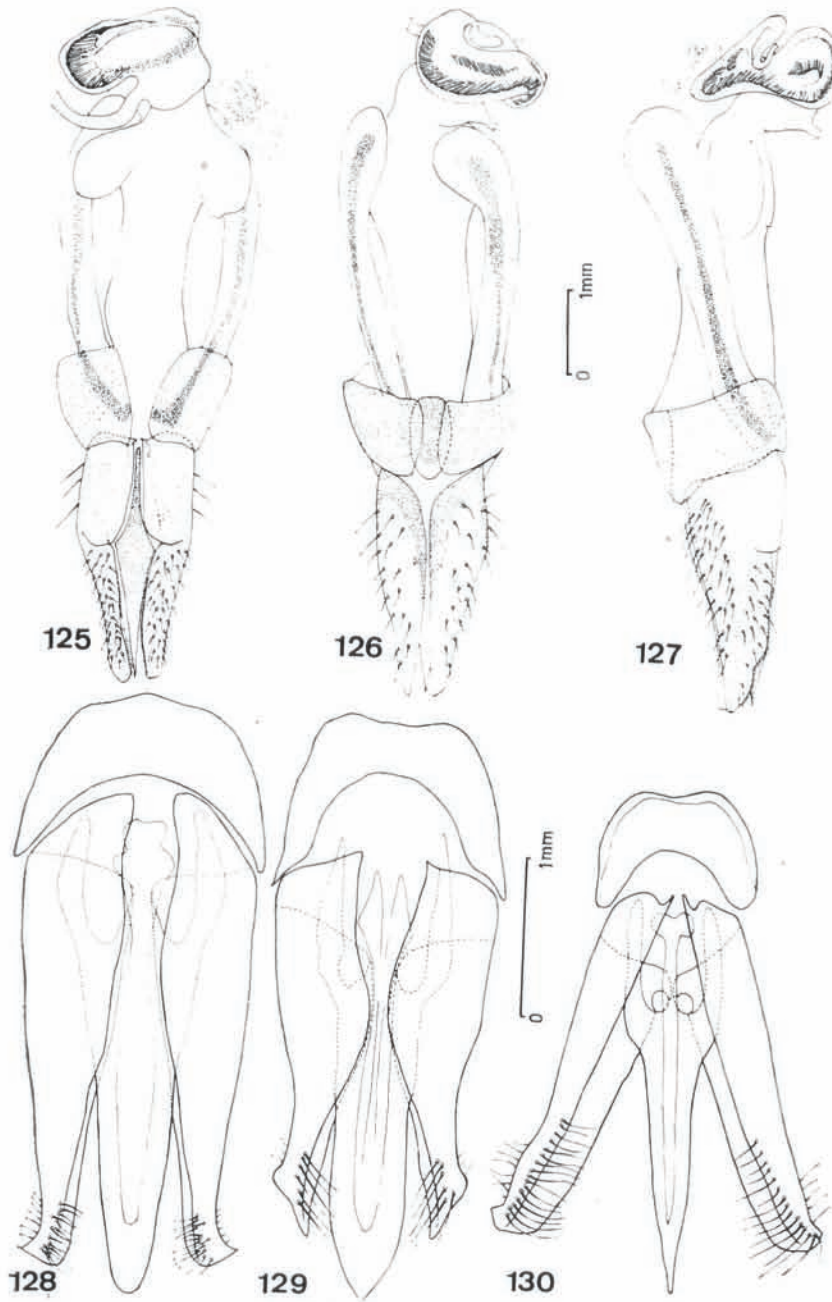
Male genitalia: fig. 102, *Pyrearinus amplicollis;* fig. 103, *P. lucernula;* fig. 104, *P. lampadion;* fig. 105, *P. alvarengai;* fig. 106, *P. retrospicicns;* fig. 107, *P. cinerarius;* fig. 108, *P. nictitans;* fig. 109, *P. fulgurans;* fig. 110, *P. lucidulus;* fig. 111, *P. scintillula.*



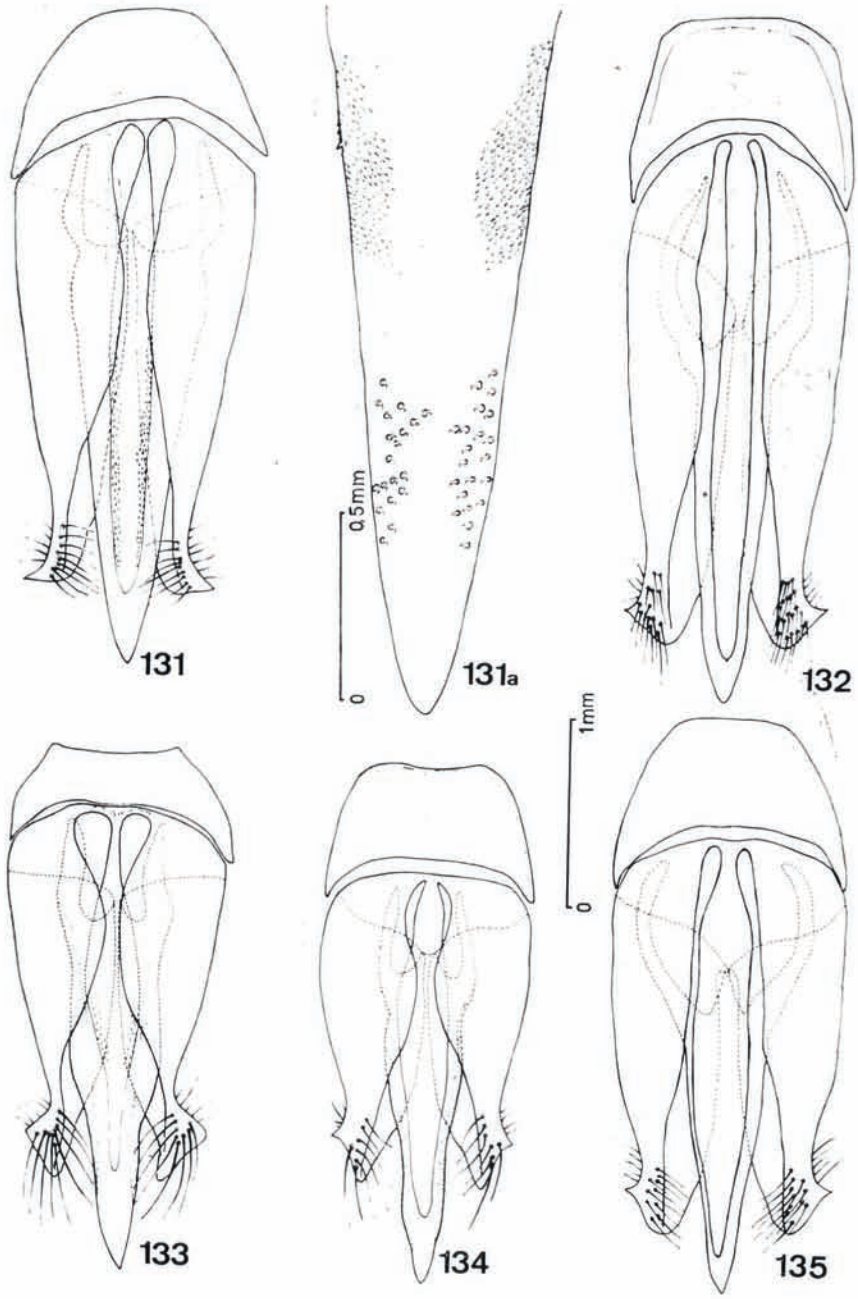
Male genitalia: fig. 112, *Pyrearinus lampyris;* fig. 113, *P. basalis;* fig. 114, *P. lucificus;* fig. 115, *P. pumilus*.



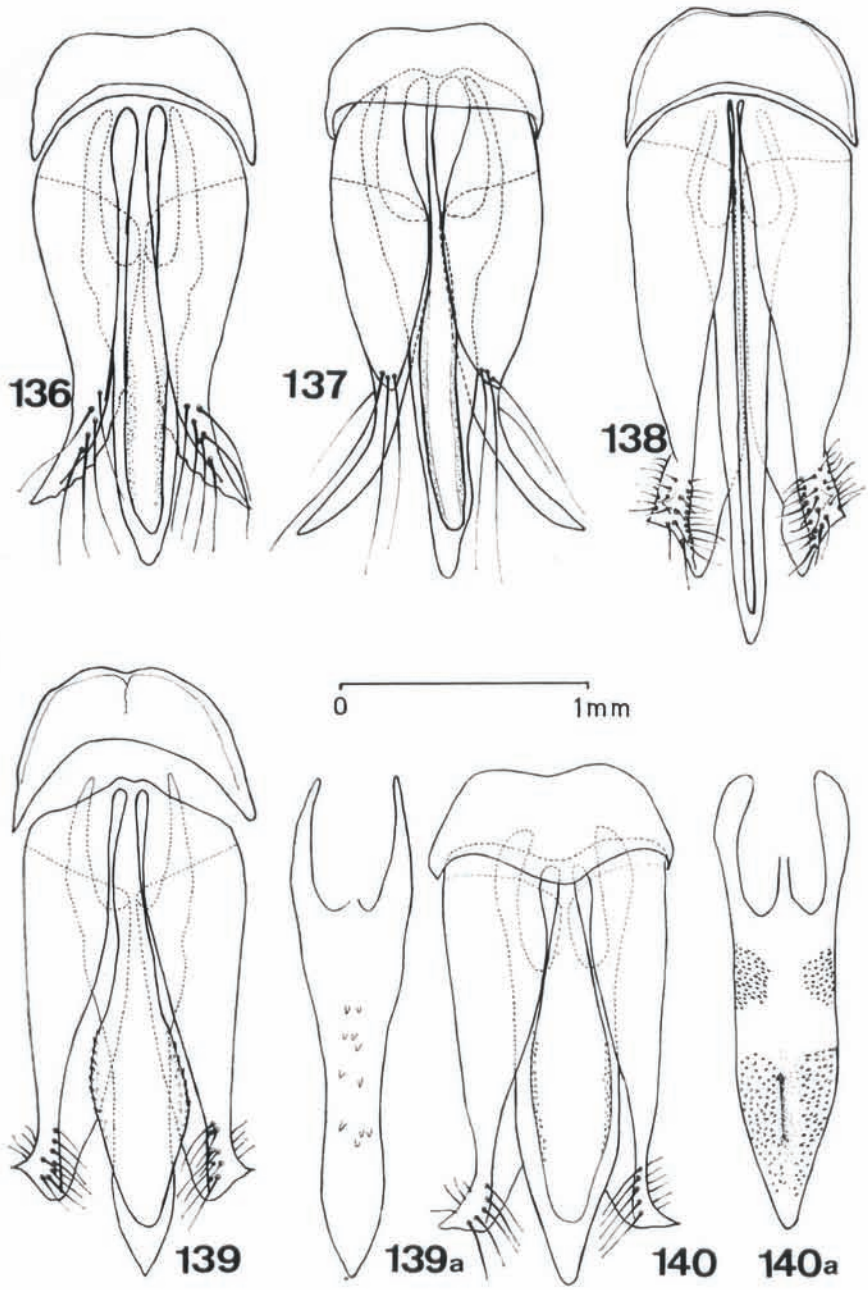
Female genitalia (dorsal, ventral and lateral view): figs. 116-118, *Pyrearinus candelarius;* figs. 119-121, *P. cinerarius;* figs. 122-124, *P. amplicollis*.



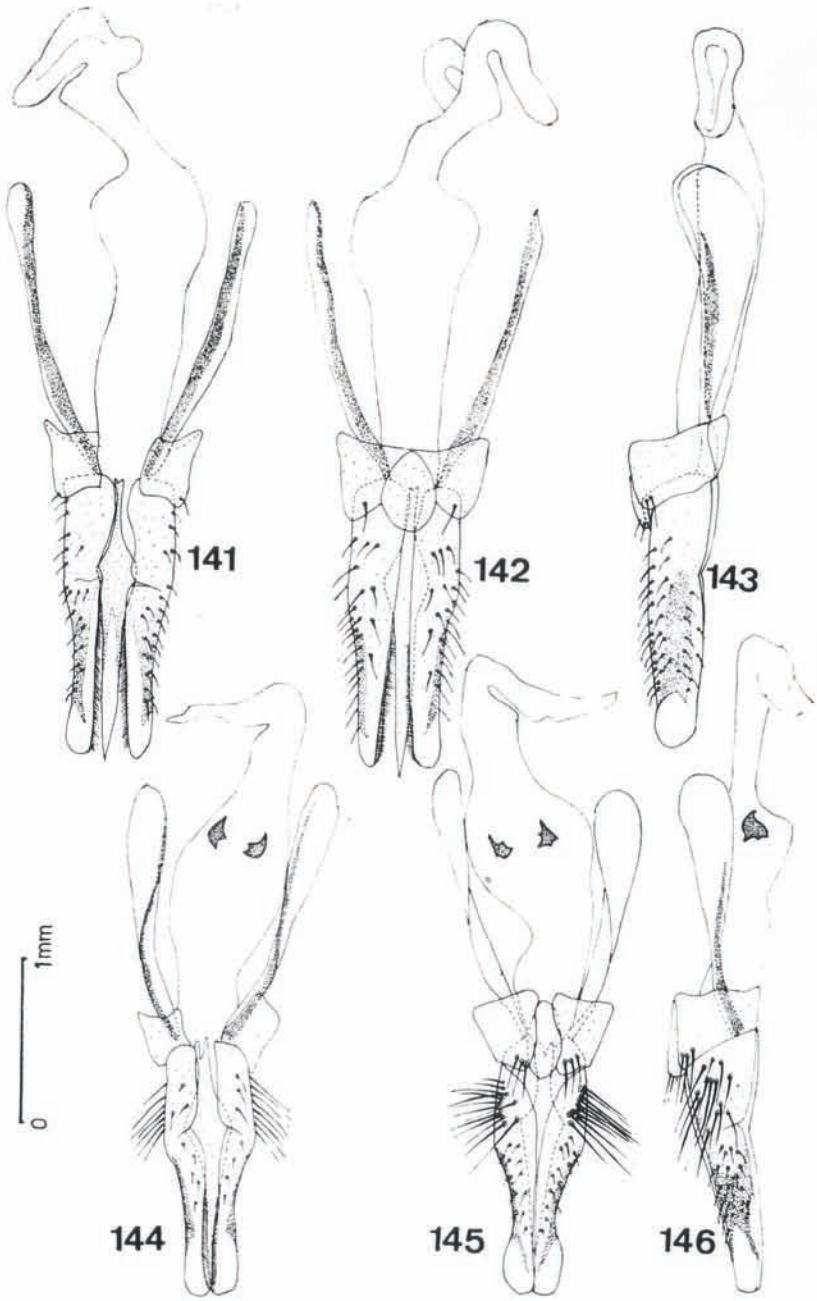
Female genitalia (dorsal, ventral and lateral view): figs. 125-127, *Fulgeochlizus bruchi*. Male genitalia: fig. 128, *Fulgeochlizus bruchi;* fig. 129, *F. germari;* fig. 130, *Cryptolampros coecus*.



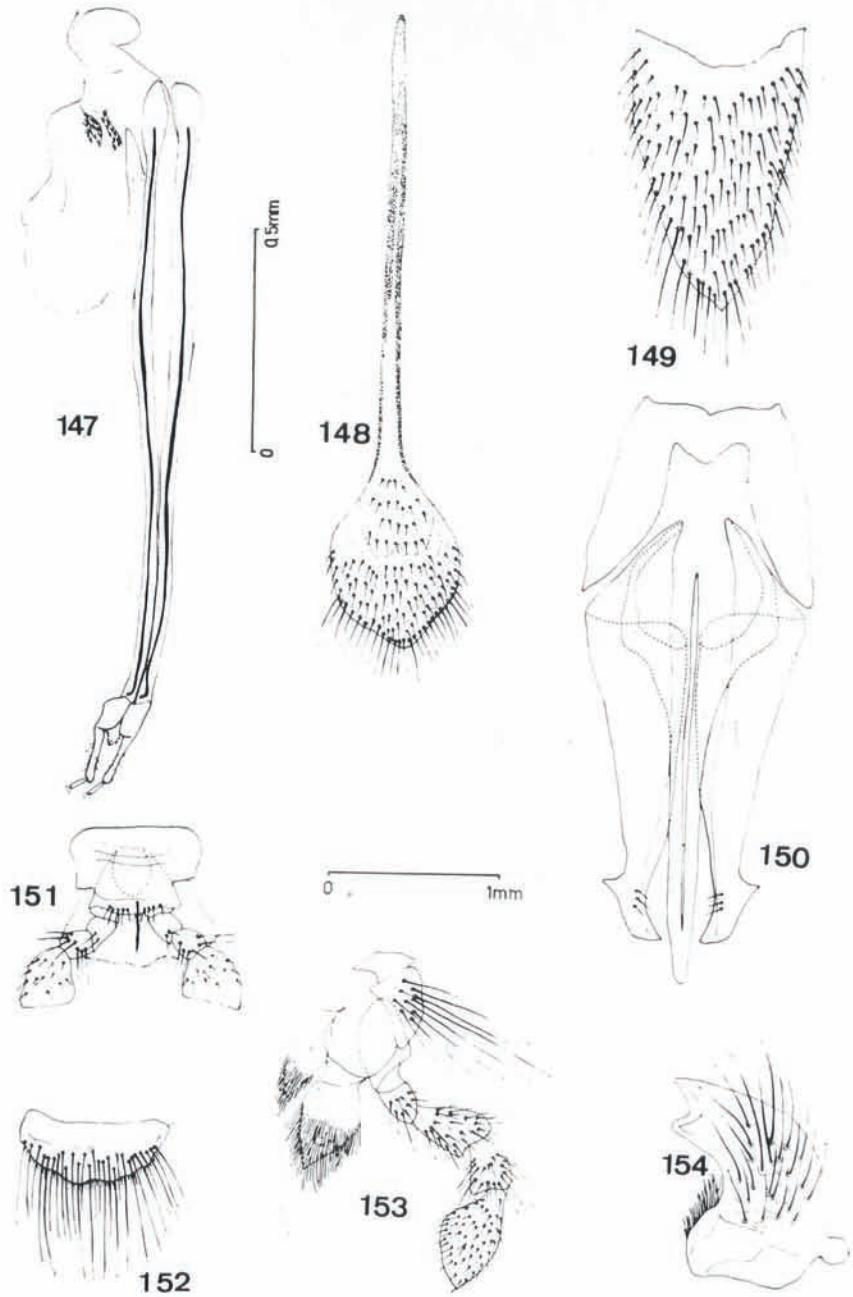
Male genitalia: figs. 131, 131a, *Sooporanga formosus;* fig. 132, *Ptesimopsia candezei;* fig. 133, *P. parallela;* fig. 134, *P. lucifuga;* fig. 135, *P. pyrausta.*



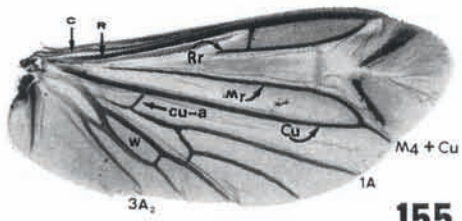
Male genitalia: fig. 136, *Pyroptesis maculicollis;* fig. 137, *P. cincticollis;* fig. 138, *Hapsodrilus luculentus;* fig. 139, 139a, *H. ignifer;* fig. 140, 140a, *H. pyrotis*.



Female genitalia (dorsal, ventral and lateral view): figs. 141-143, *Hapsodrilus luculentus;* figs. 144-146, *Pyroptesis cincticollis.*



Campyloxenus pyrothorax Fairmaire: female genitalia fig. 147; 8th urosternum, fig. 148; 8th urotergum, fig. 149; male genitalia, fig. 150; labium, fig. 151; labrum, fig. 152; maxilla, fig. 153; mandible, fig. 154.



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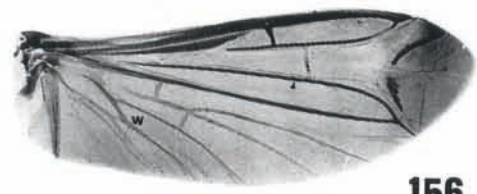
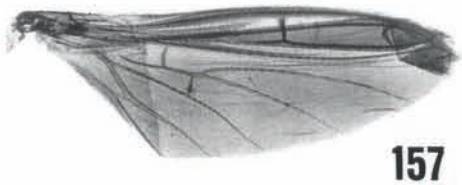


156



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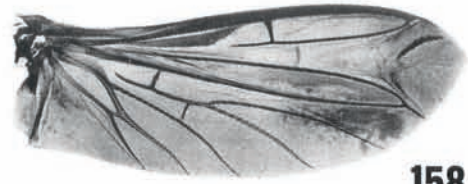

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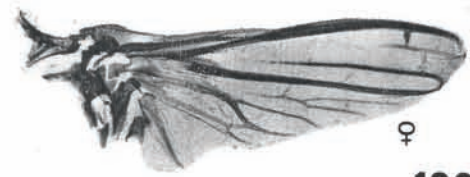
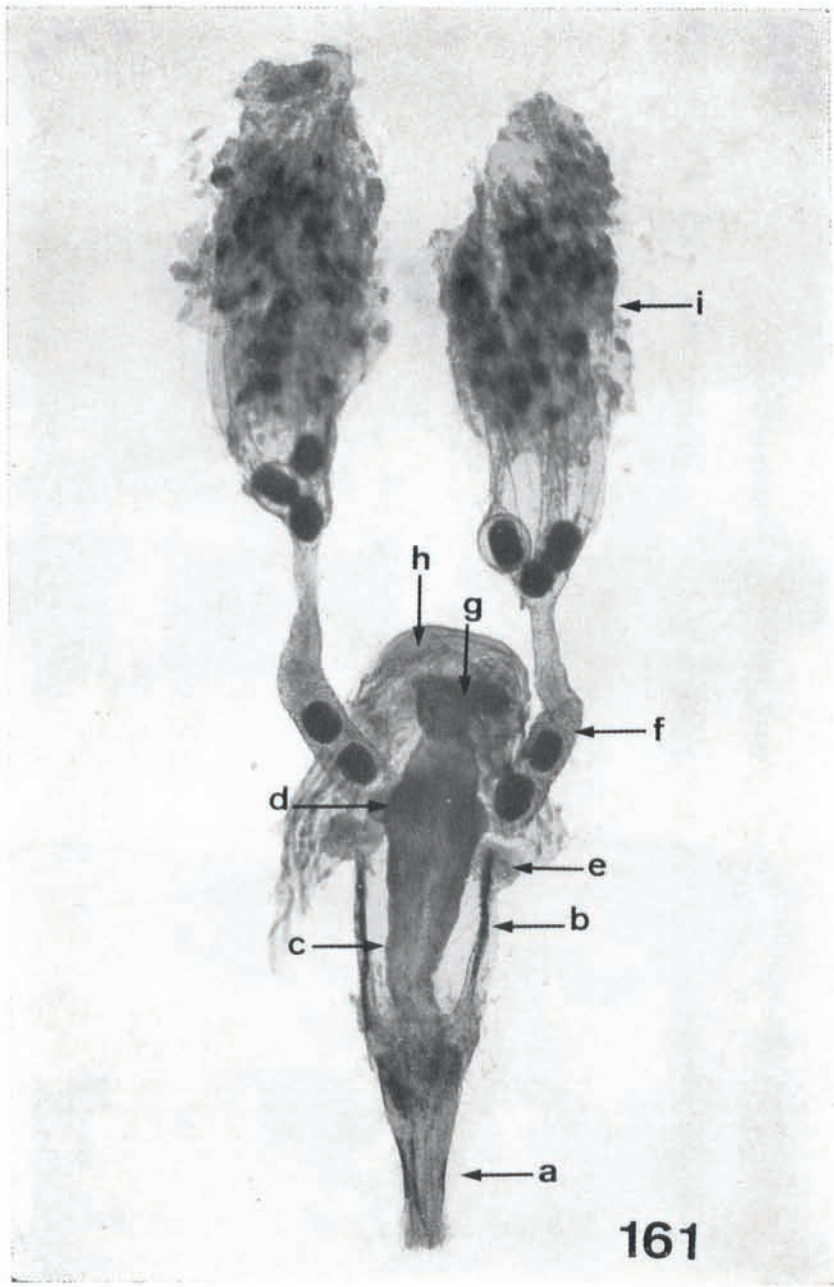


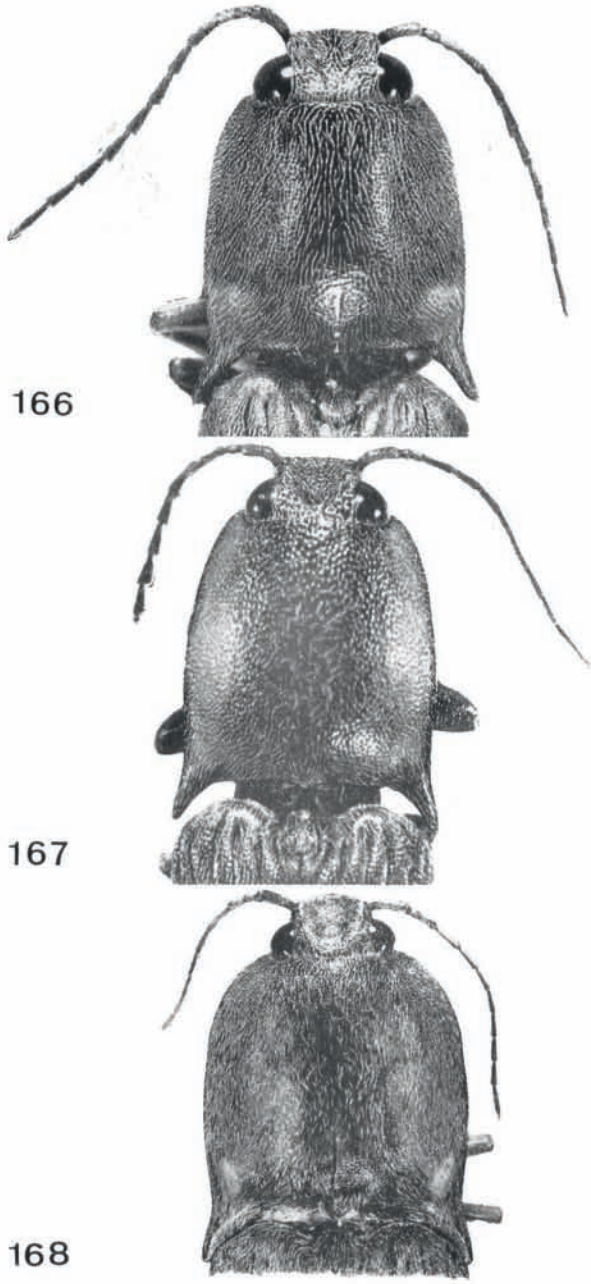
160

Hind wings: fig. 155, *Campyloxenus pyrothorax;* fig. 156, *Hapsedrilus ignifer;* figs. 157, 158, *Pyrophorus noctilucus;* figs. 159, 160, *Hypsiophthalmus grossicollis*. (Abreviations: C, Costal vein; R, Radius; Mr, Median; 1A, First Anal vein; $3A_2$, Second branch of third anal vein; Cu, Cubitus; Cu-a, Cubital-anal cross-vein; W, Wedge Cell).

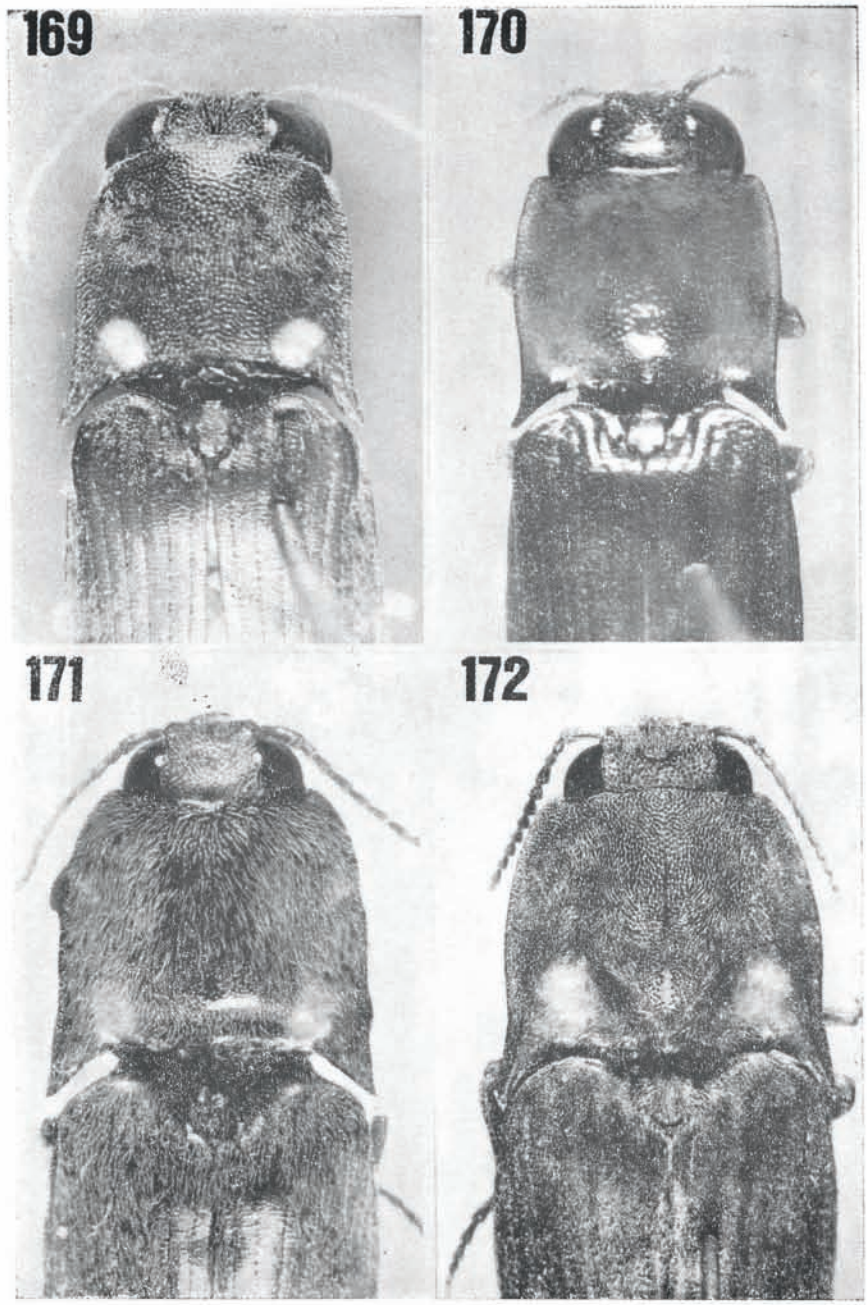


Female genitalia: *Opselater pyrophanus*, fig. 161 (a, ovipositor; b, baculum; c, vagina; d, median oviduct; e, accessory gland; f, oviduct; g, bursa copulatrix; h, spermatheca; i, ovary).

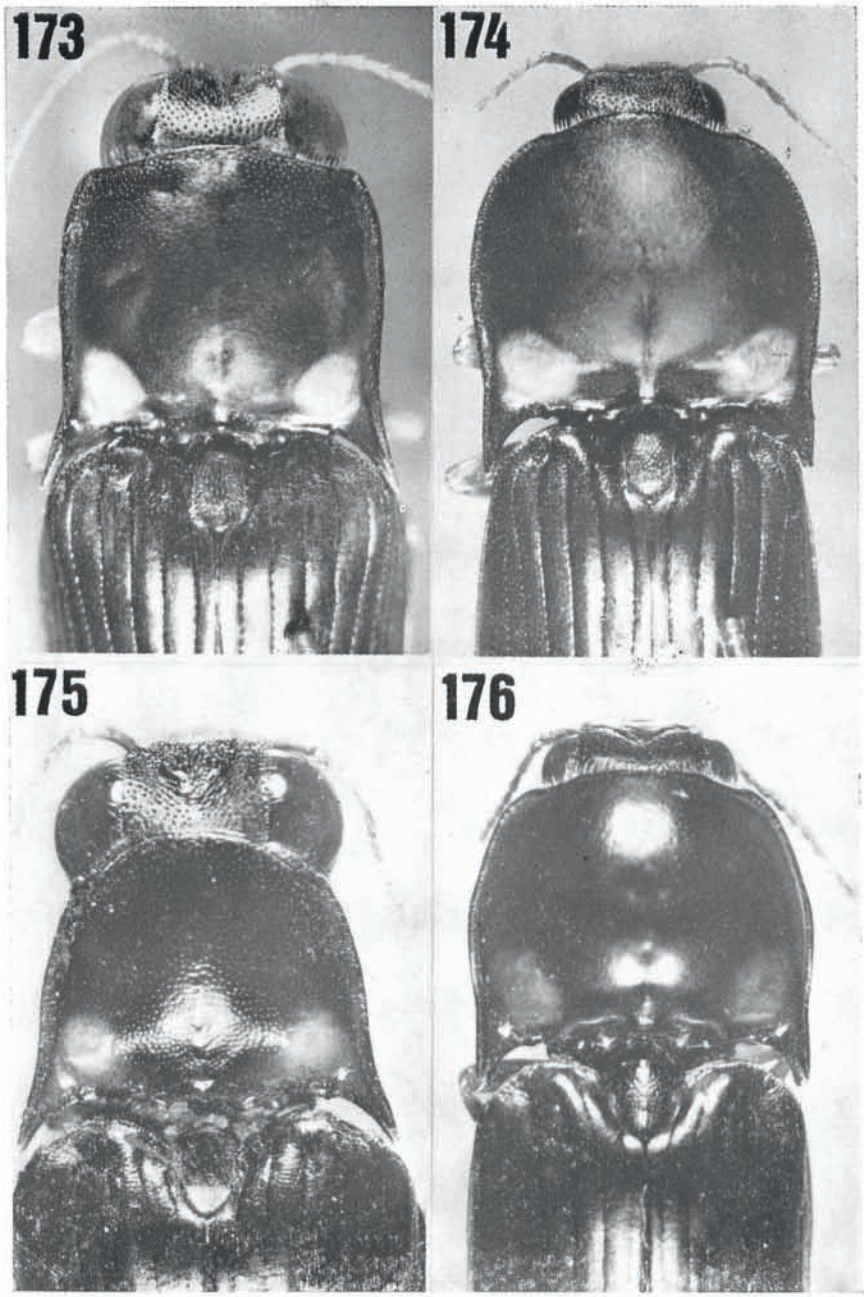
General view: fig. 162, *Pyrophorus noctilucus;* fig. 163, *Pyrophorus tuberculifer;* fig. 164, *Ignelater havaniensis;* fig. 165, *Deilelater physoderus*.



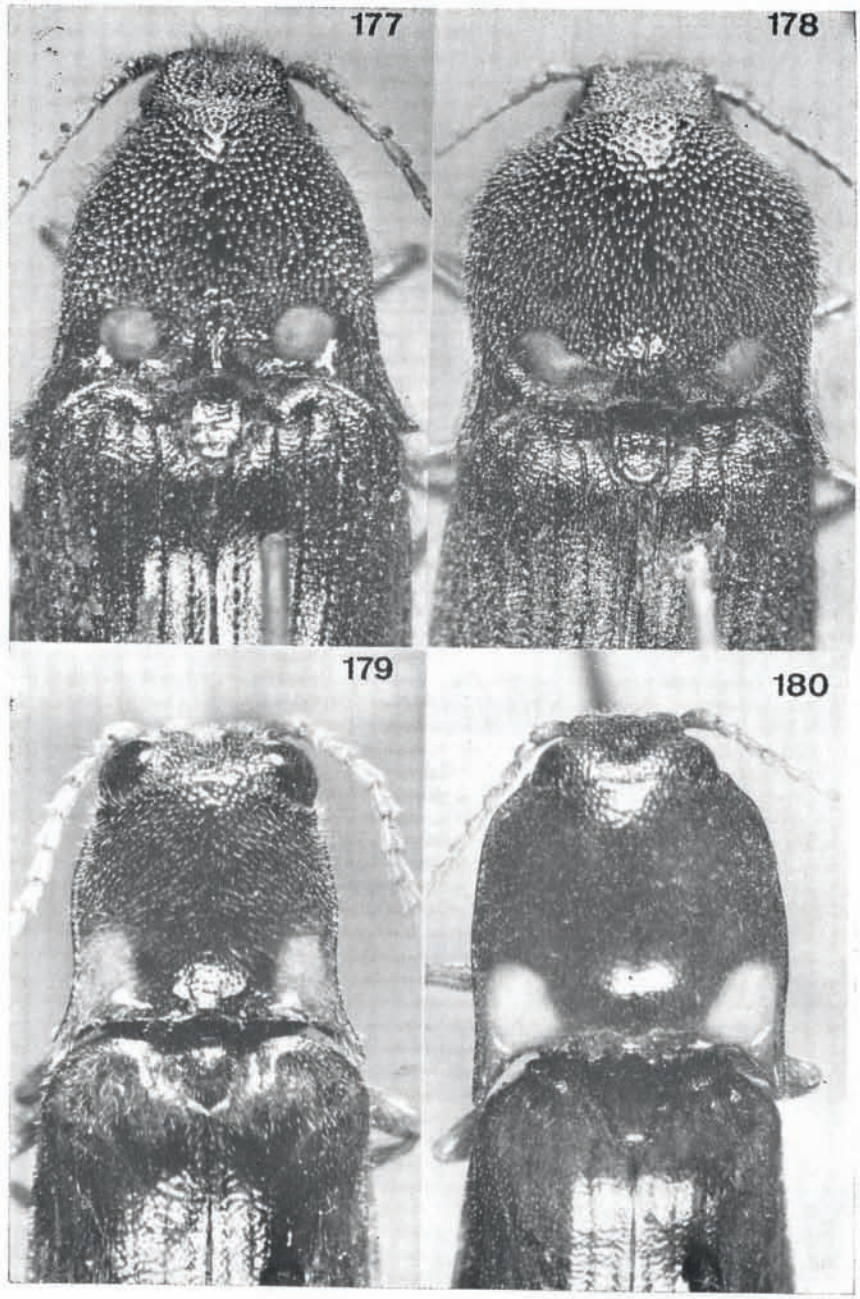
General view: fig. 166, *Vesperelater occidentalis;* fig. 167, *Lygelater ignitus;* fig. 168, *Opselater lucens*.



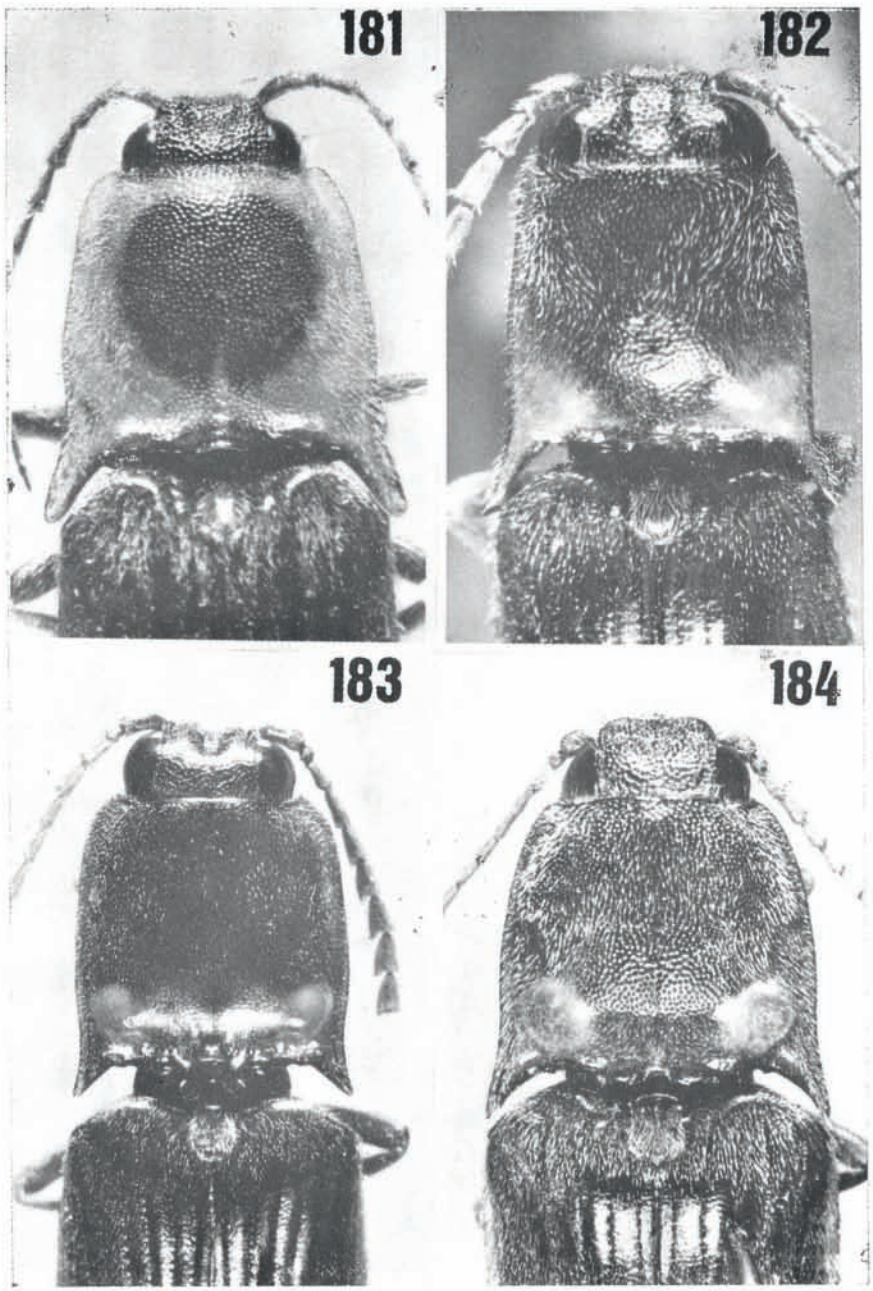
General view: fig. 169, *Pyrearinus alvarengai;* fig. 170, *Pyrearinus pumilus;* fig. 171, *Pyrearinus fulgurans;* fig. 172, *Fulgeochlizus bruchi.*



General view: fig. 173 ♂; fig. 174, ♀ of *Pyrearinus nyctophilus;* fig. 175. ♂; fig. 176. ♀ of *Hypsiophthalmus grossicollis*.



General view: fig. 177 ♂; fig. 178 ♀ of *Nyctophyxis ocellatus;* fig. 179 ♂; fig. 180 ♀ of *Phanophorus perspicax*.



General view: fig. 181, *Pyroptesis cincticollis;* fig. 182, *Hapsodrilus ignifer;* fig. 183, *Ptesimopsia candezei;* fig. 184, *Ptesimopsia lucifuga*.

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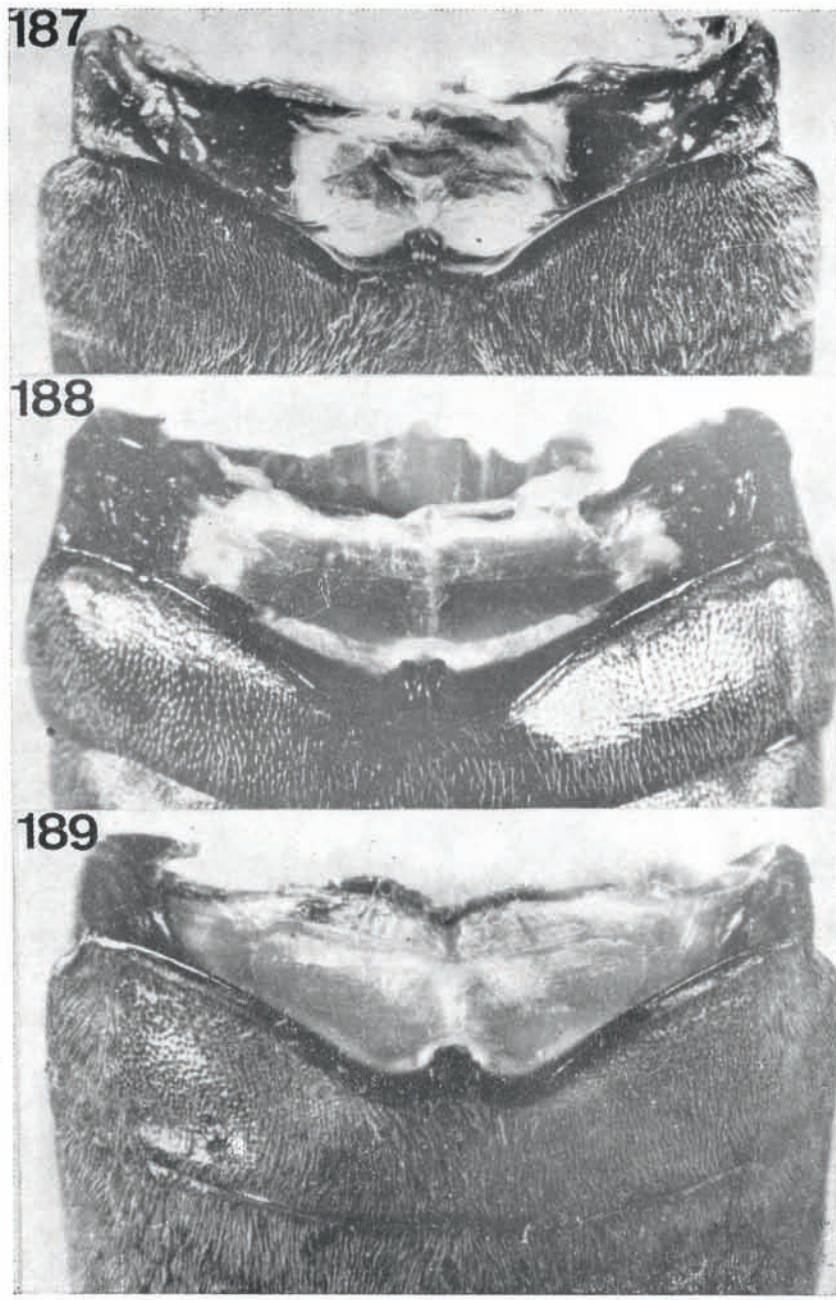
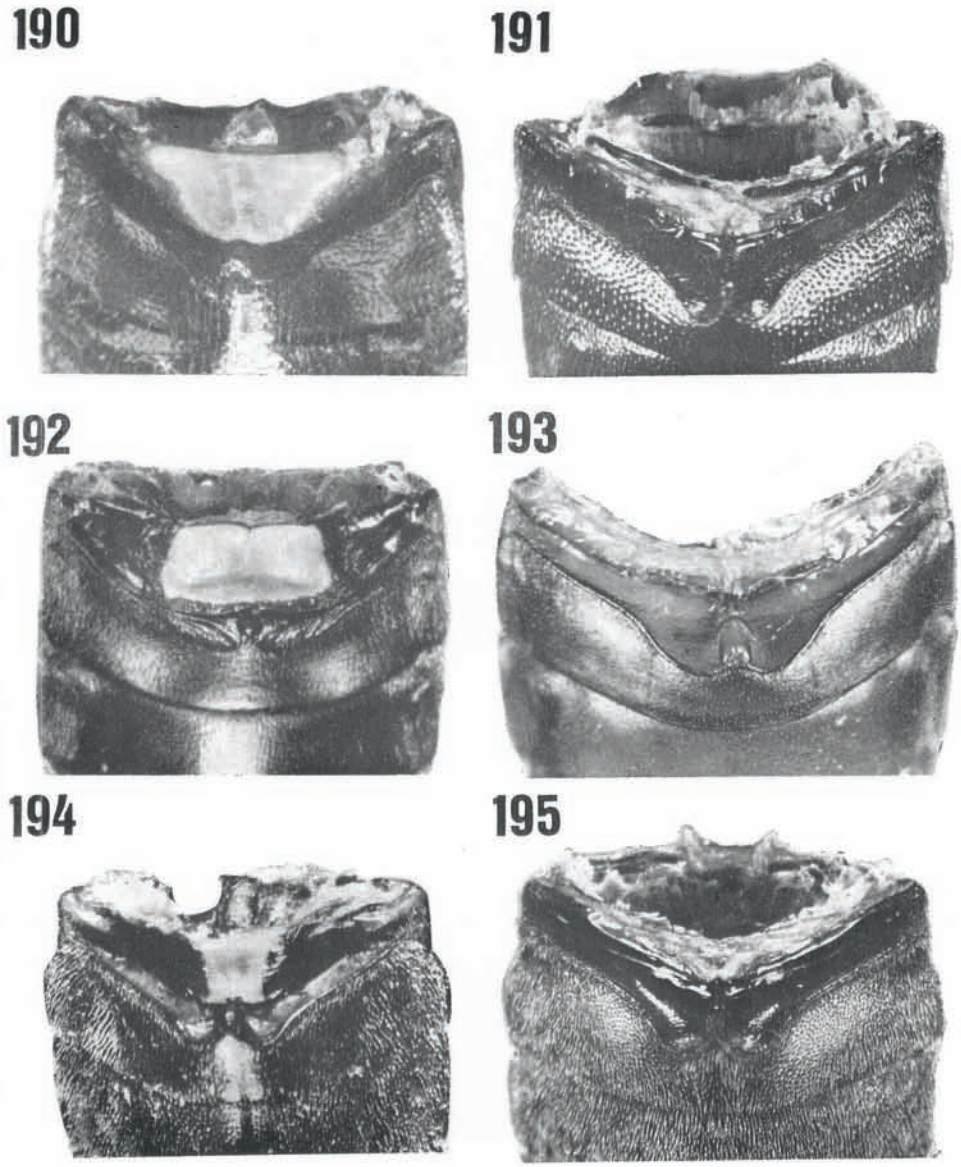
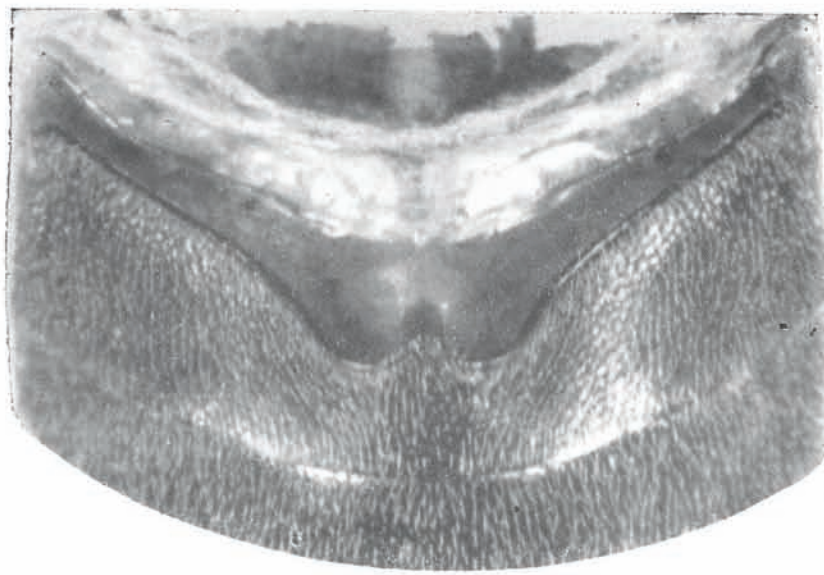
General view: figs. 185, 186 ♂ and ♀ of *Campyloxenus pyrothorax*.



Abdominal luminous organs: fig. 187, *Pyrophorus angustus hayekae;* fig. 188, *Pyrophorus indistinctus;* fig. 189, *Pyrophorus mellifluus*.



Abdominal luminous organ: fig. 190, *Phanophorus perspicax;* fig. 191, *Nyctophyxis ocellatus;* figs. 192, 193, ♂ and ♀ of *Hypsiophthalmus grossicollis;* fig. 194, *Vesperelater ornamentum;* fig. 195, *Cryptolampros coecus.*



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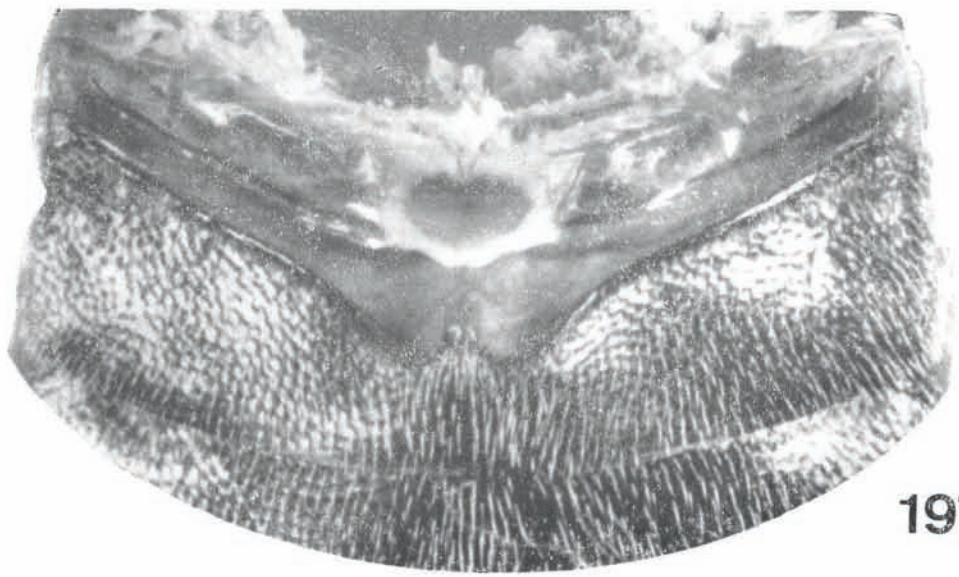
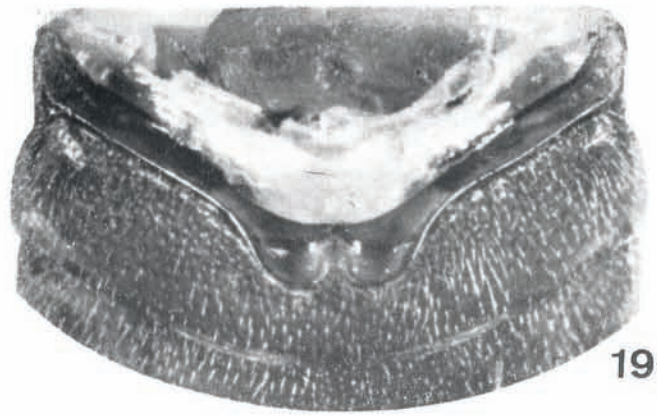
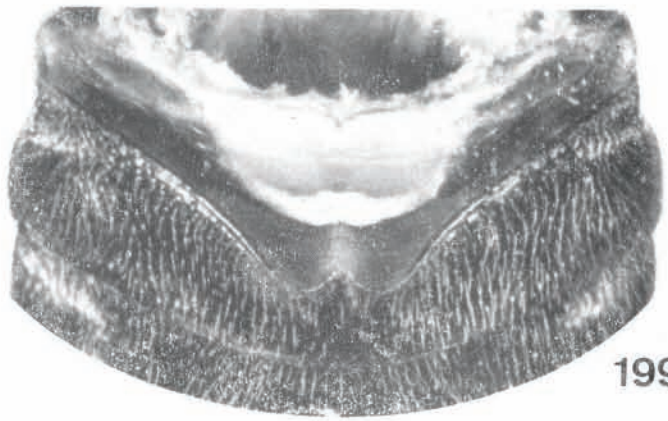


197

Abdominal luminous organ: fig. 196, *Ptesimopsia paralella;* fig. 197, *Ptesimopsia lucifuga*.



198



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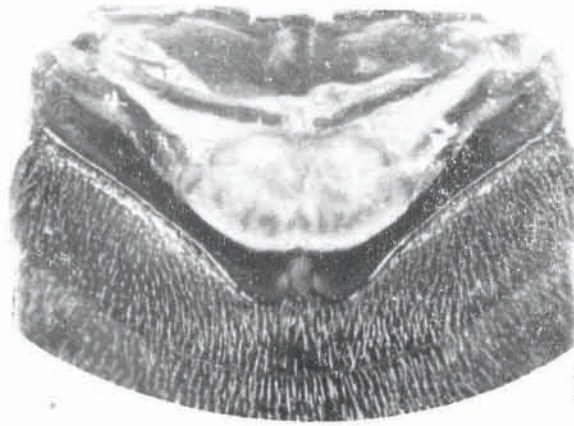
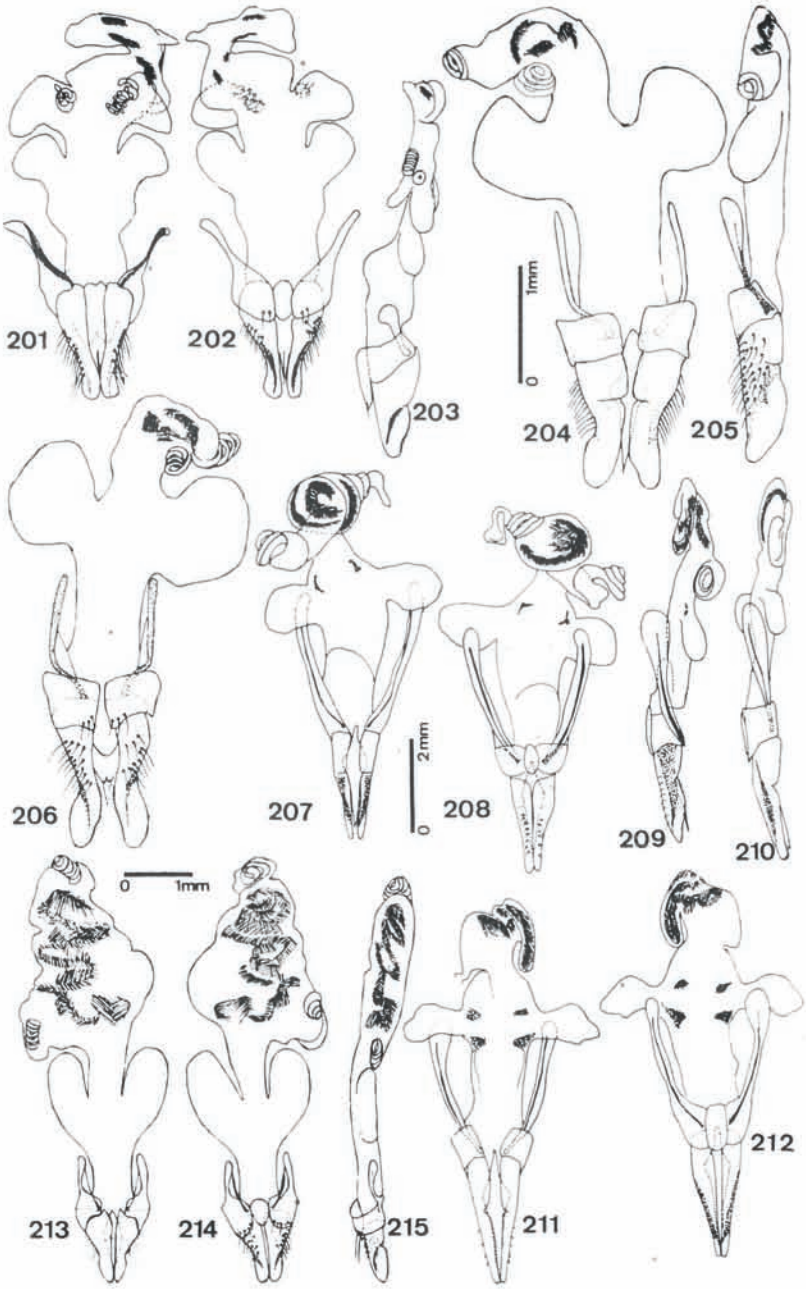
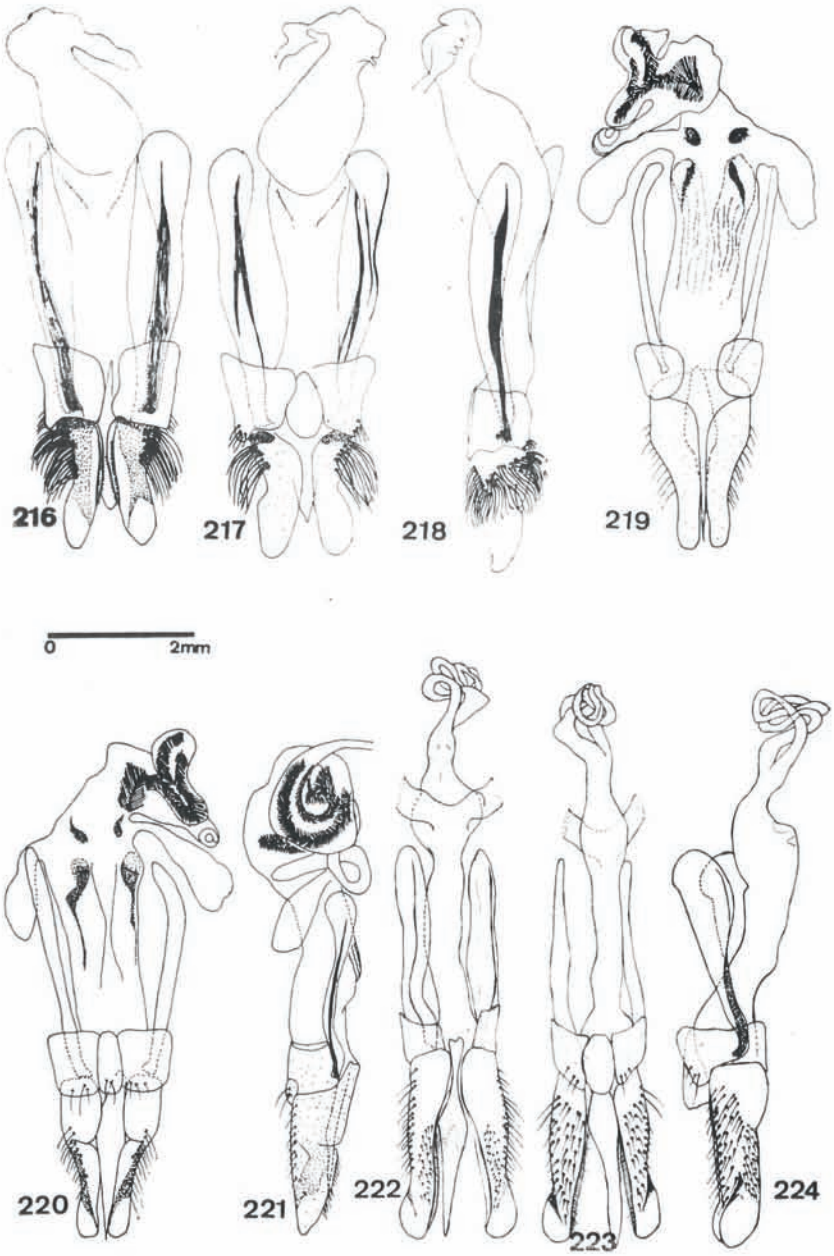


200

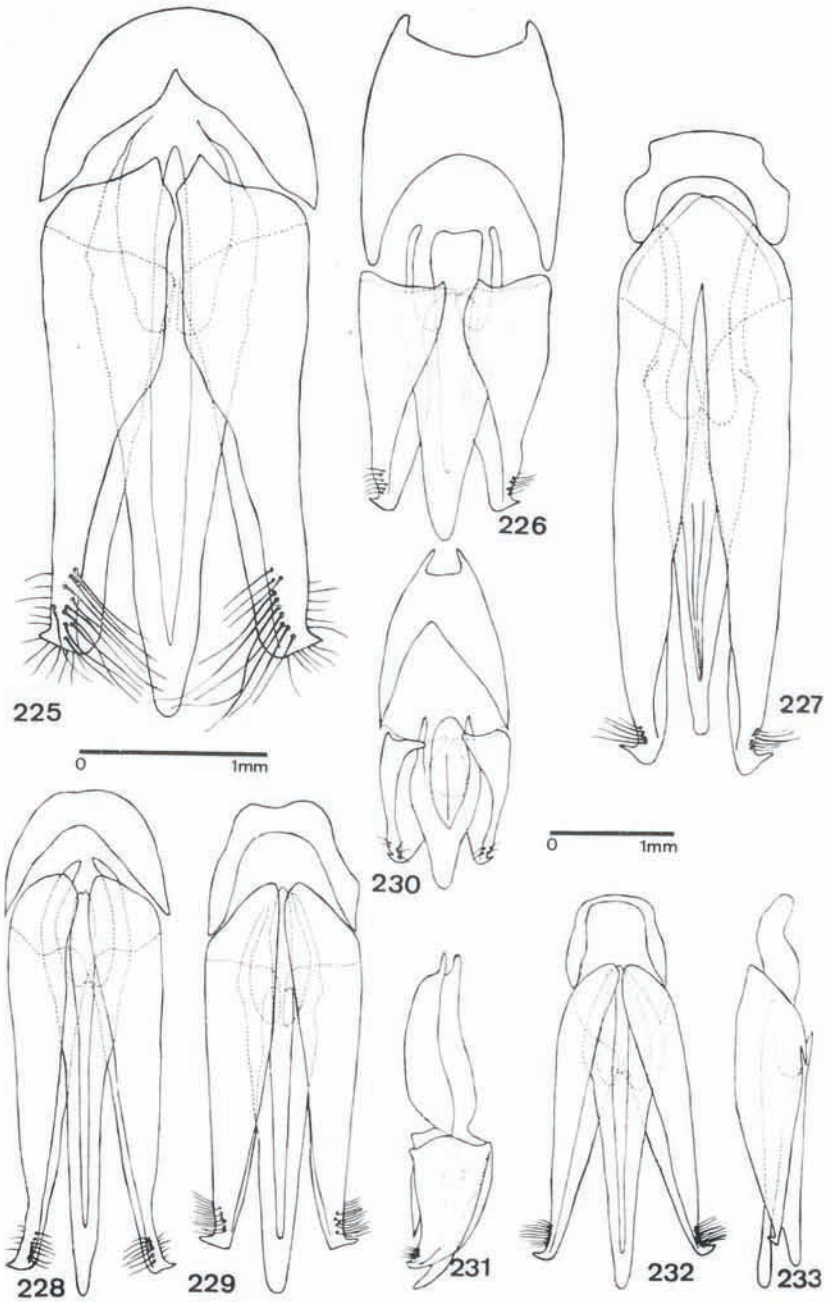
Abdominal luminous organ: fig. 198, *Hapsodrilus luculentus;* fig. 199, *Pyroptesis maculicollis;* fig. 200, *Hapsodrilus ignifer.*



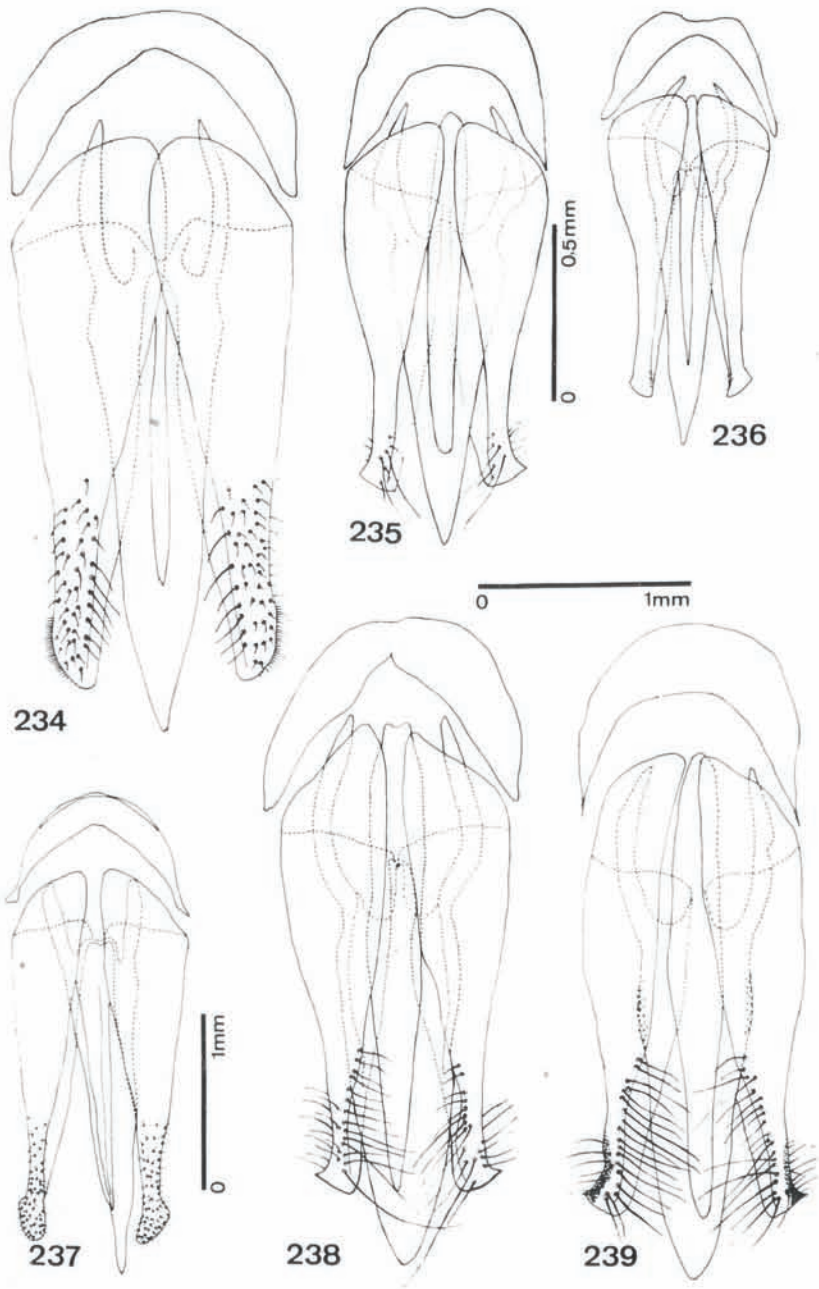
Female genitalia: figs. 201-203, *Alampes melanoxanthus;* figs. 213-215, *Alampes tessellatus;* figs. 204-206, *Alampoides alychnus;* figs. 207-209, *Euplinthus ophthalmicus;* figs. 210-212, *Compsoplinthus ruber*.



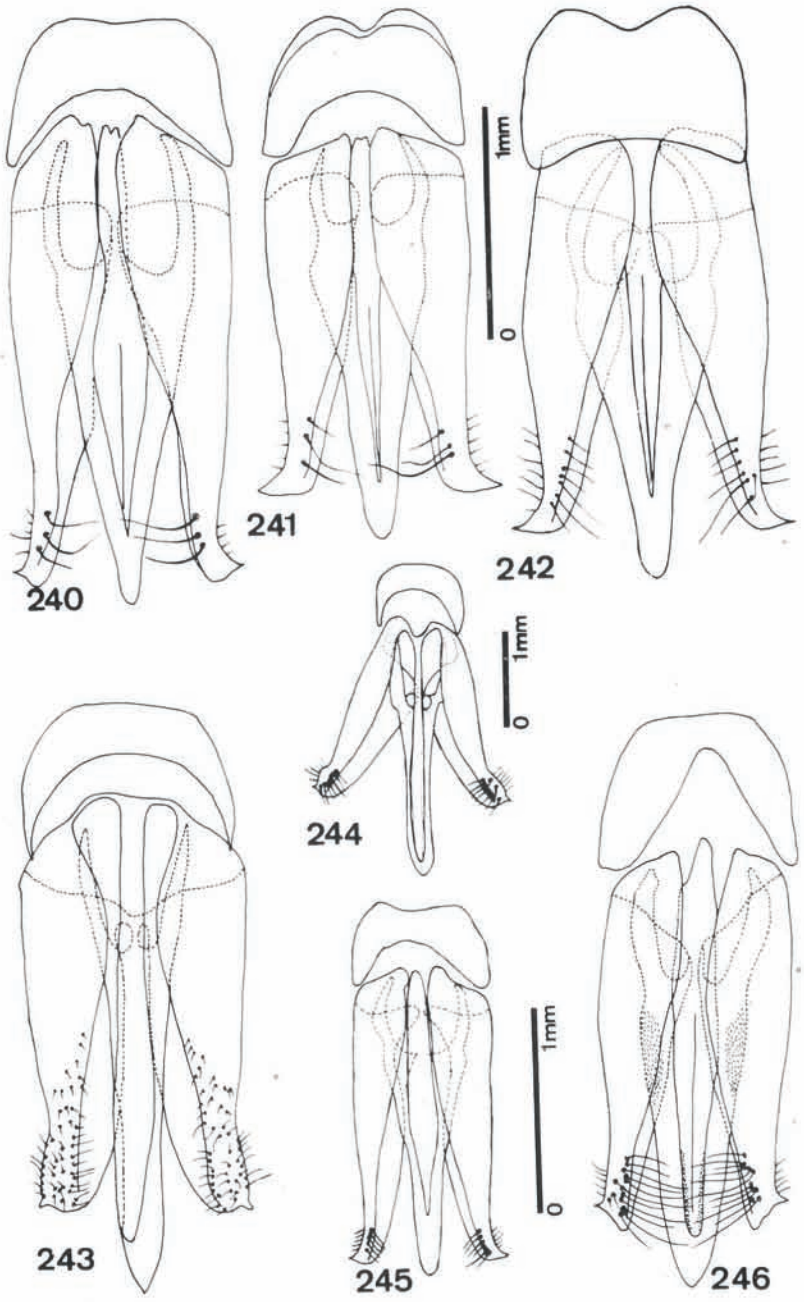
Female genitalia: figs. 216-218, *Heligmus glyphoderus;* figs. 219-221, *Pyrischius biplagiatus;* figs. 222-224, *Meroplinthus schneideri.*



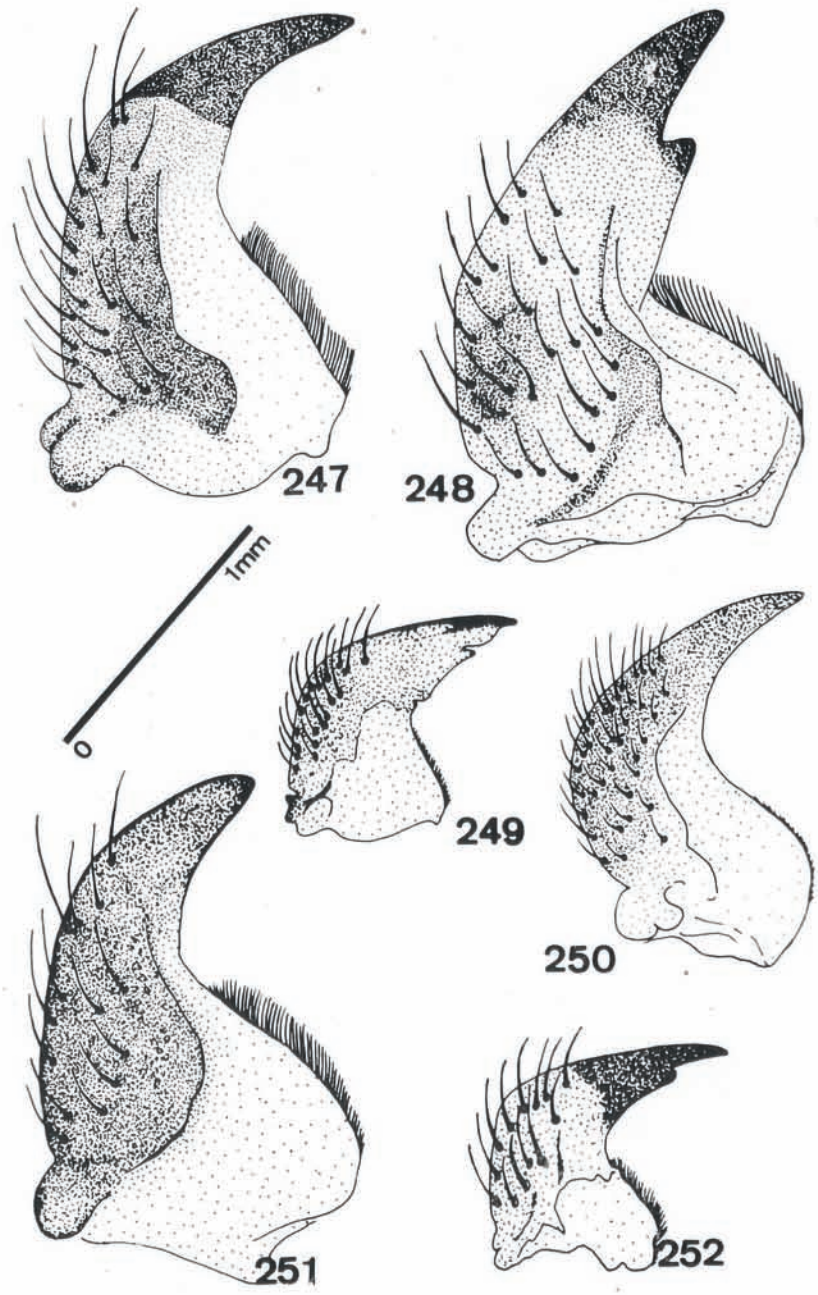
Male genitalia: fig. 225, *Paraphileus thoreyi;* fig. 226, *Alampoides boliviensis;* fig. 227, *Alampoides fulvus,* sp. n.; fig. 228, *Agnostelater mesochrous;* fig. 229, *Alampoides tessellatus;* figs. 230-231, *Alampoides alychnus;* figs. 232-233, *Alampoides badius,* sp. n.



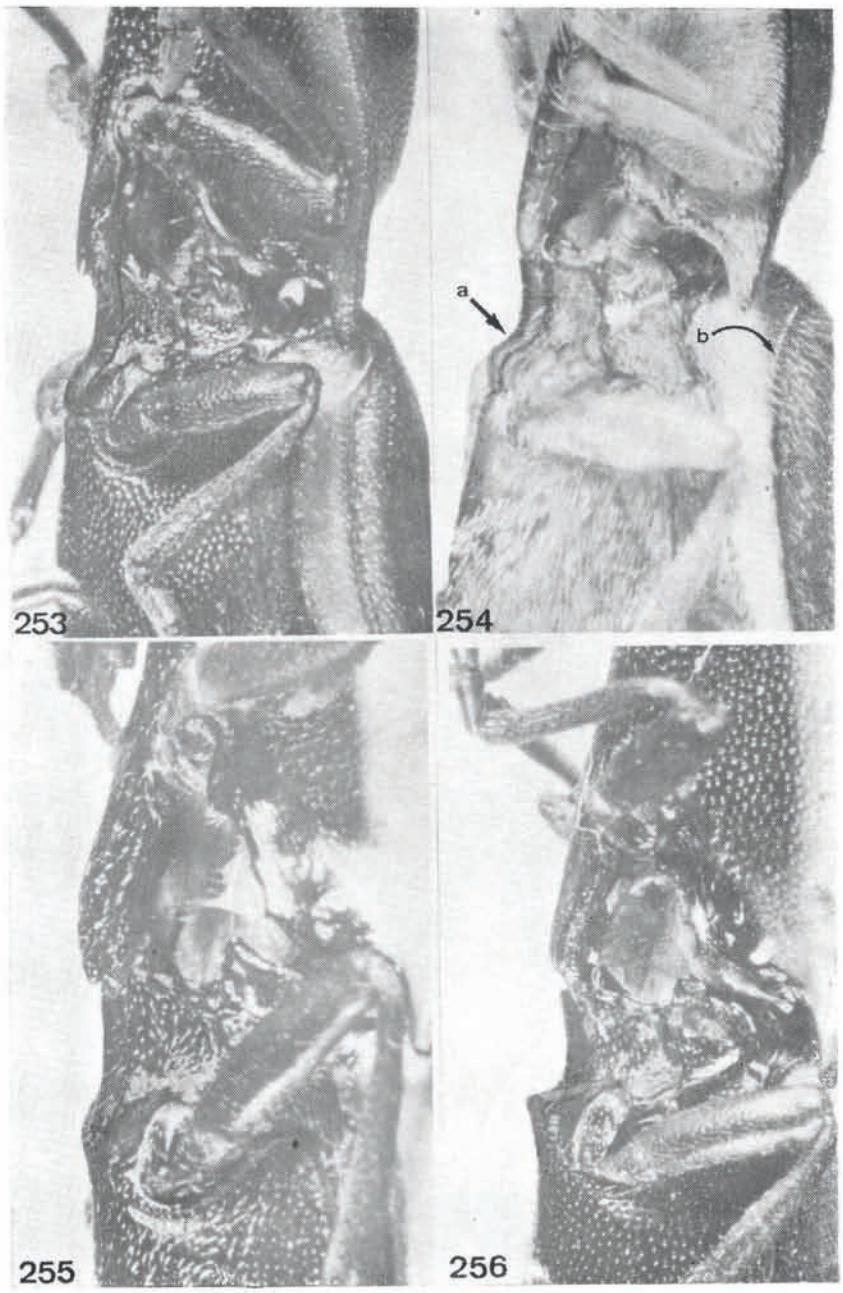
Male genitalia: fig. 234, *Heligmus obscurus*, sp. n.; fig. 235, *Coctilelater corymbitoides;* fig. 236, *Coctilelater sanguinicollis;* fig. 237, *Heligmus glyphoderus;* fig. 238, *Euplinthus notatissimus;* fig. 239, *Euplinthus ophthalmicus.*



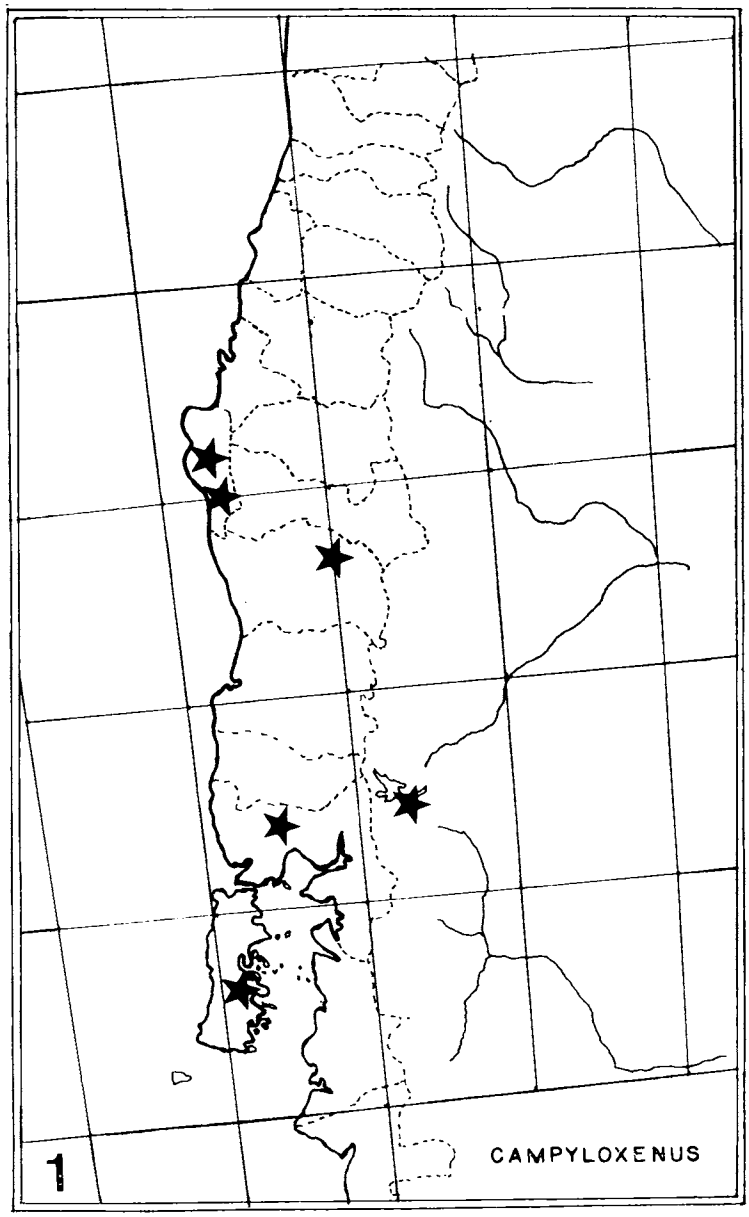
Male genitalia: fig. 240, *Alampes vestitus;* fig. 241, *Alampes melanoxanthus;* fig. 242, *Alampes abnormis;* fig. 243, *Meroplinthus ambrosius,* sp. n.; fig. 244, *Meroplinthus trilineatus;* fig. 245, *Alampes restinctus;* fig. 246, *Compsoplinthus ruber.*



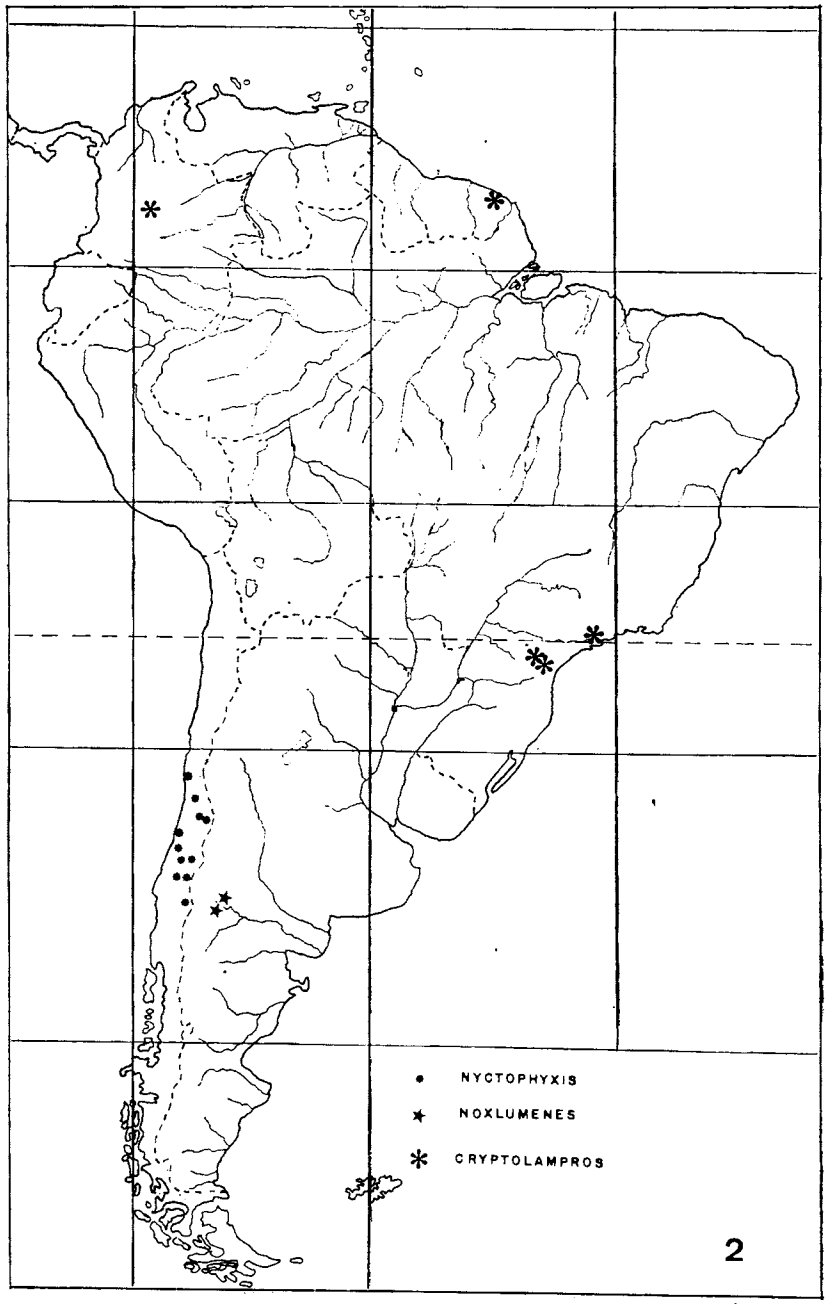
Mandibles: fig. 247, *Euplinthus ophthalmicus;* fig. 248, *Arcanelater spurius;* fig. 249, *Alampoides alychnus;* fig. 250, *Agnostelater mesochrous;* fig. 251, *Compsoplinthus ruber;* fig. 252, *Alampes melanoxanthus.*



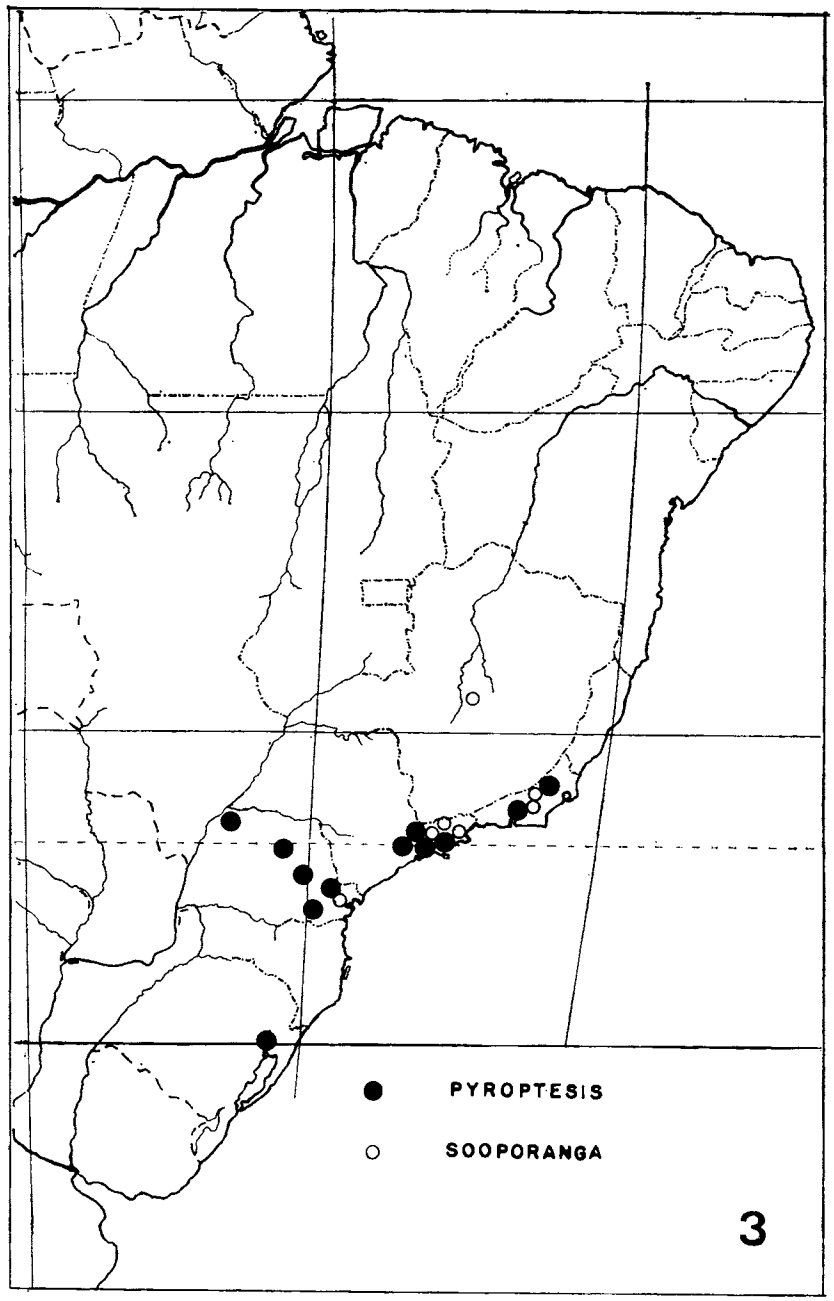
Mesosternal cavity: fig. 253, *Euplinthus ophthalmicus;* fig. 254, *Alampoides tessellatus;* fig. 255, *Pyrischius biplagiatus;* fig. 256, *Compsoplinthus ruber.*



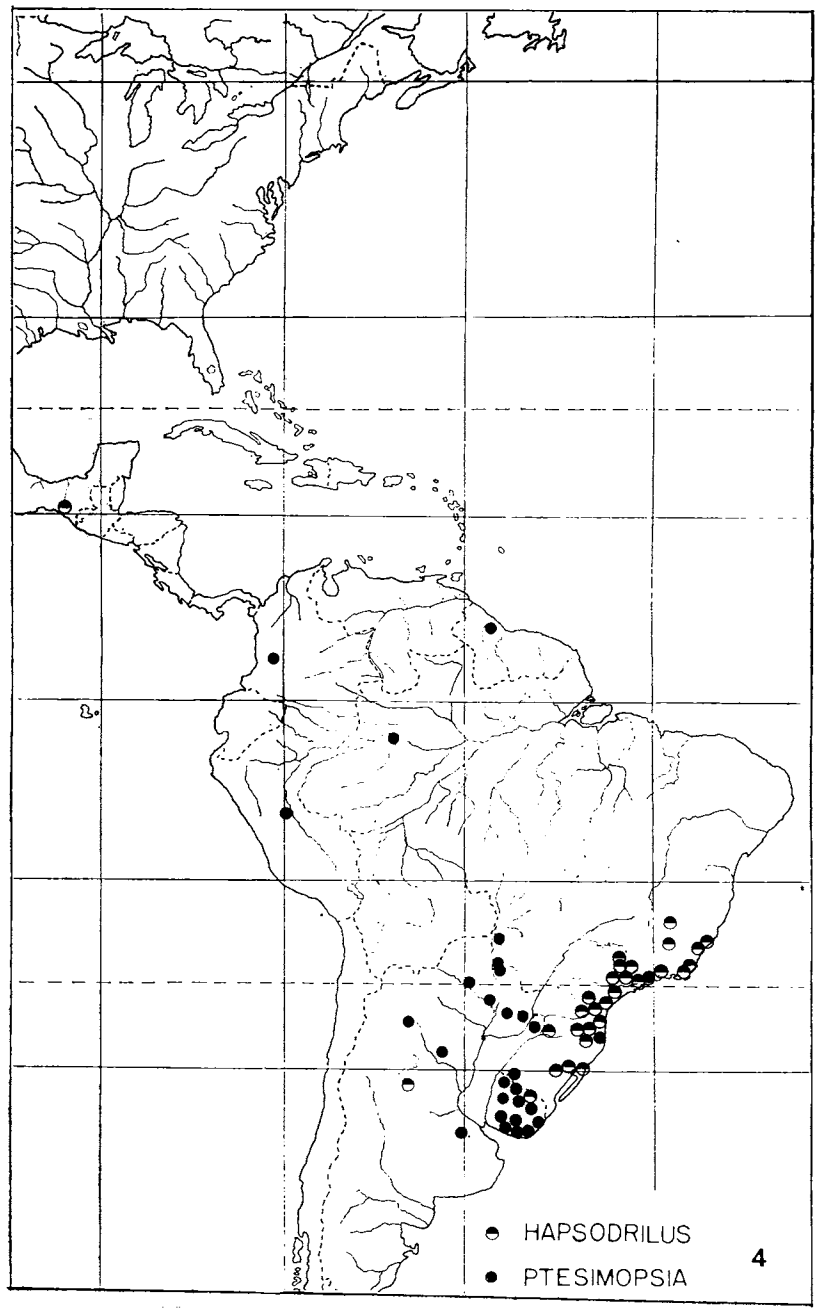
Map 1. Distribution of *Campyloxenus* in Chile.



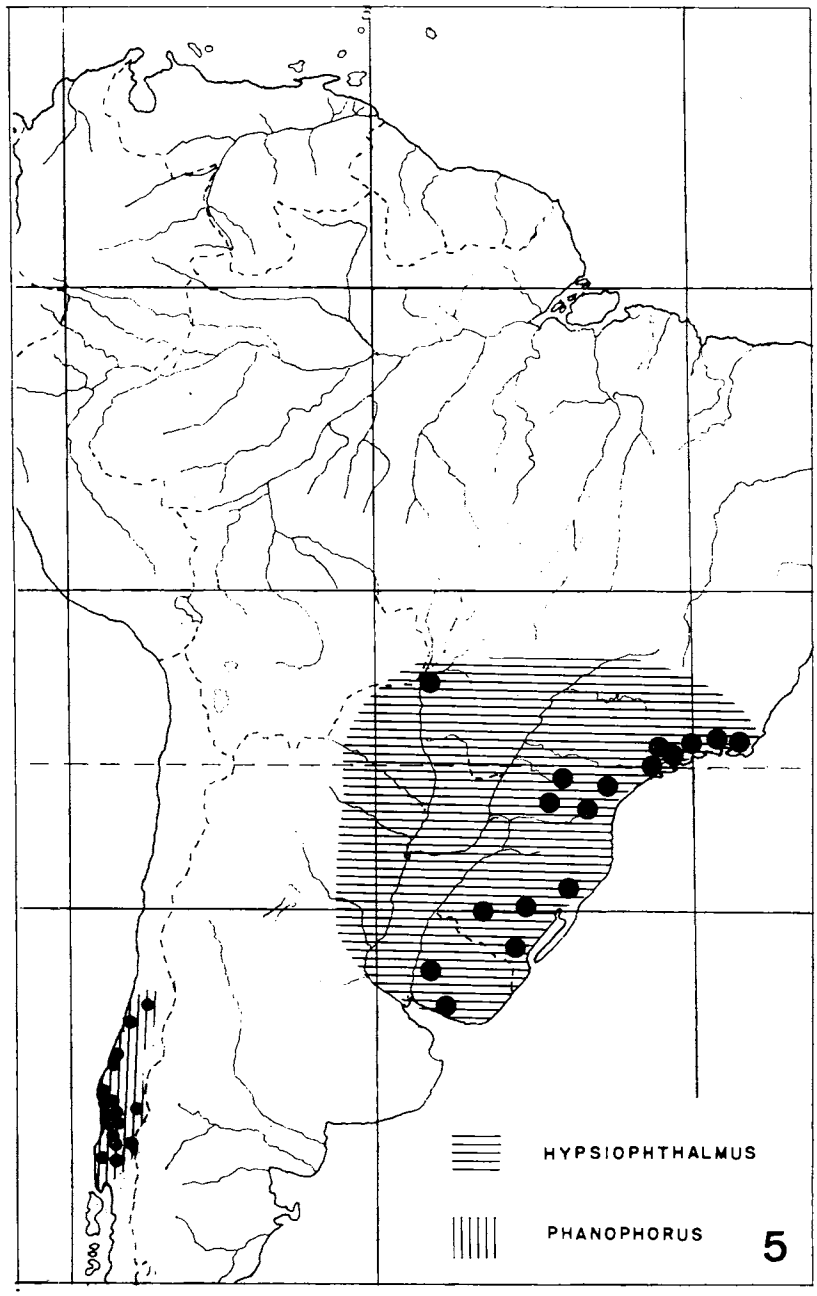
Map 2. General distribution of the subtribe Nyctophyxina.



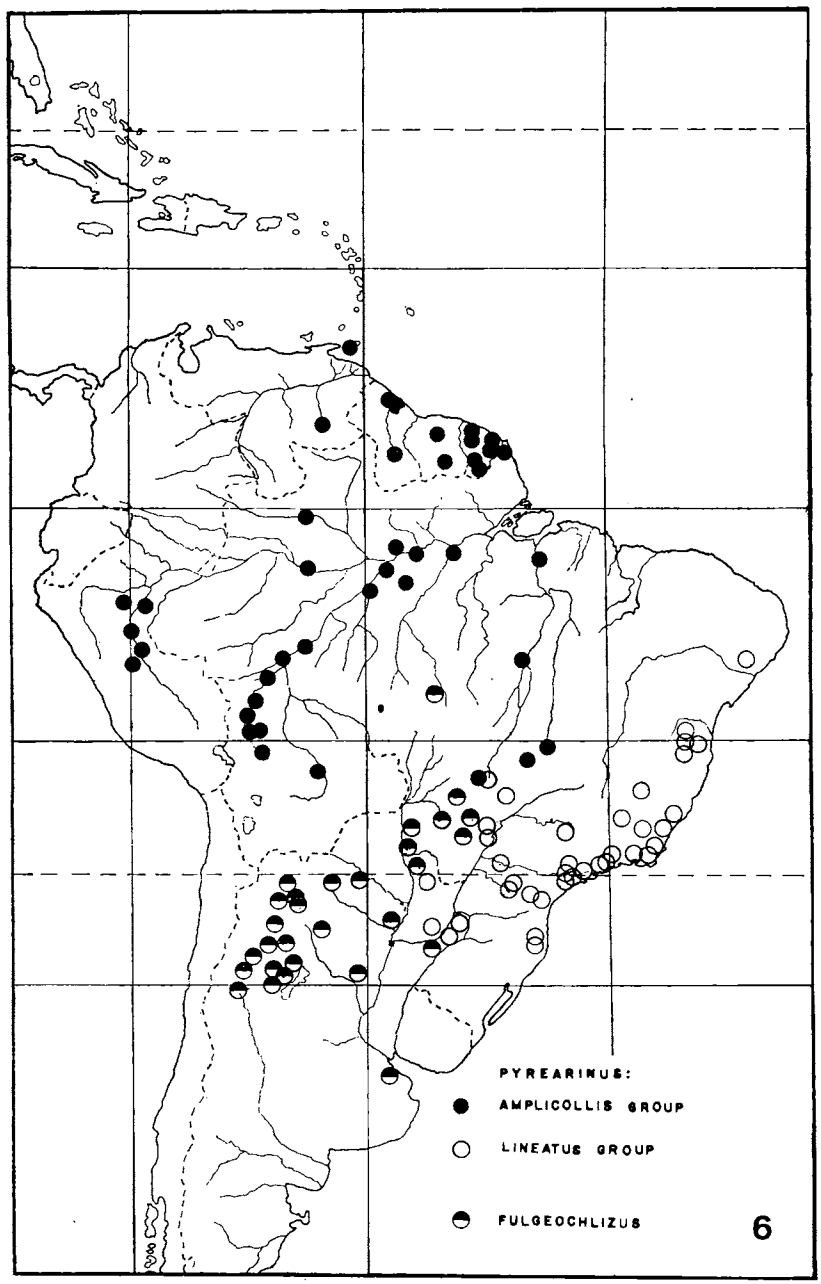
Map 3. Distribution of the subtribe Hapsodrilina.



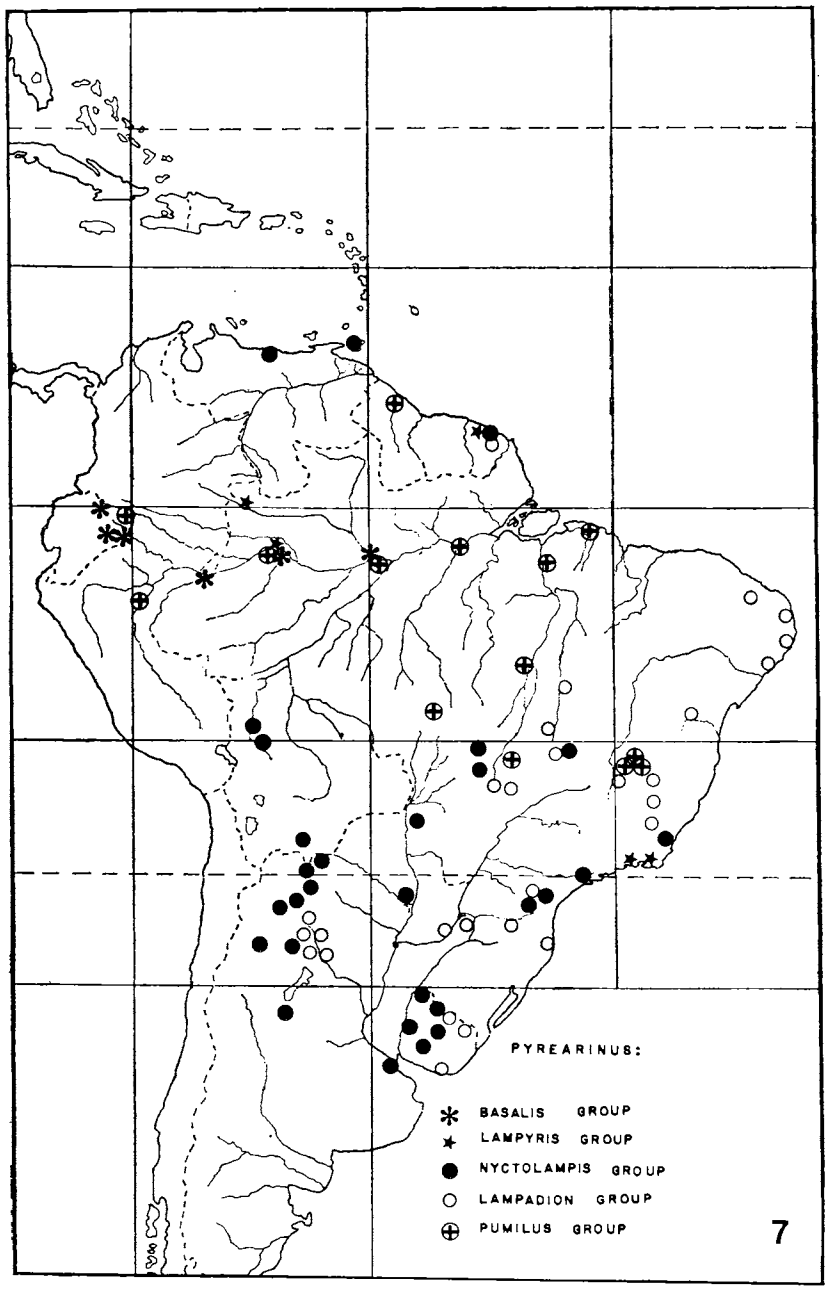
Map 4. Distribution of the subtribe Hapsodrilina.



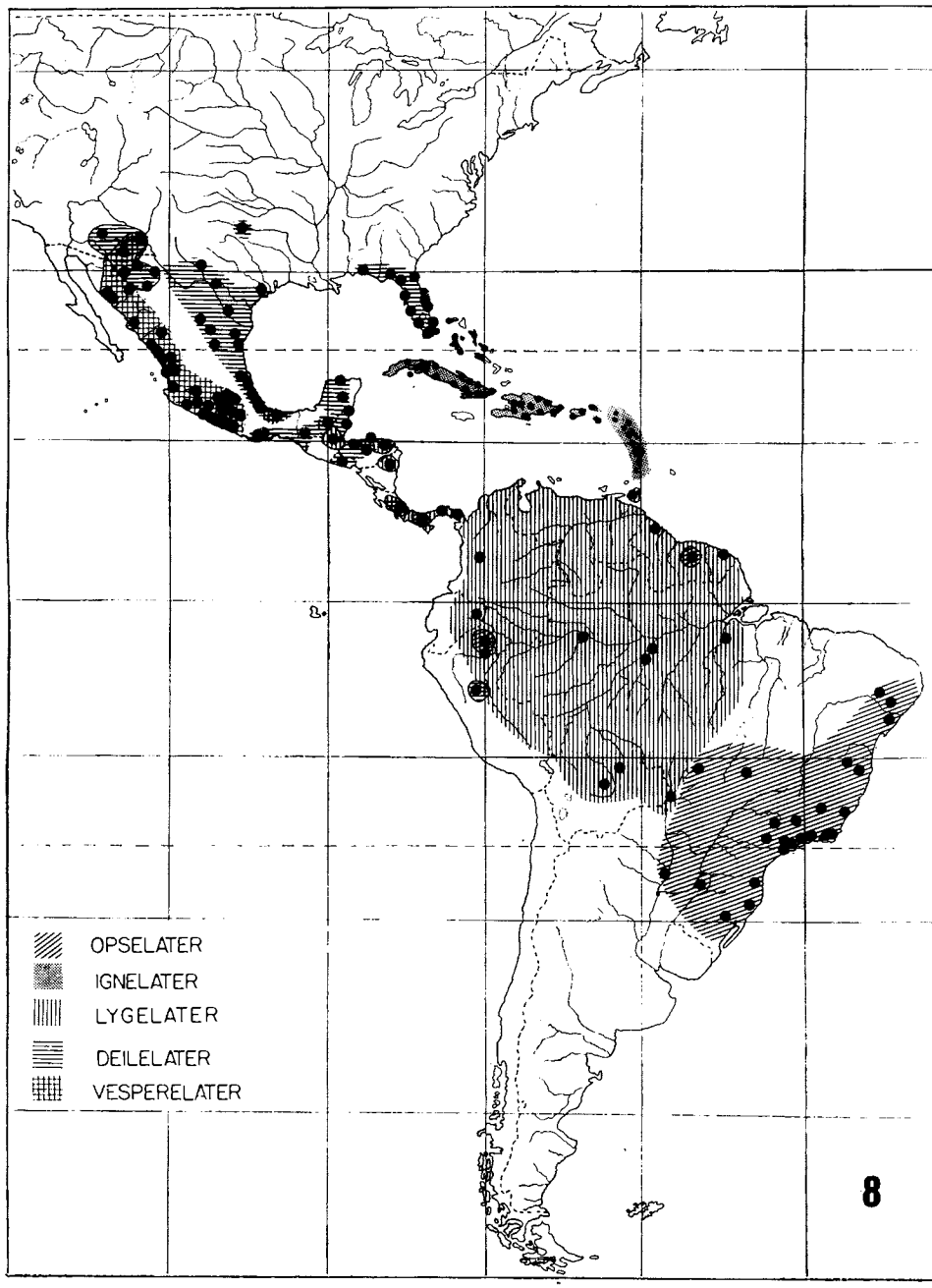
Map 5. Distribution of the subtribe Pyrophorina.



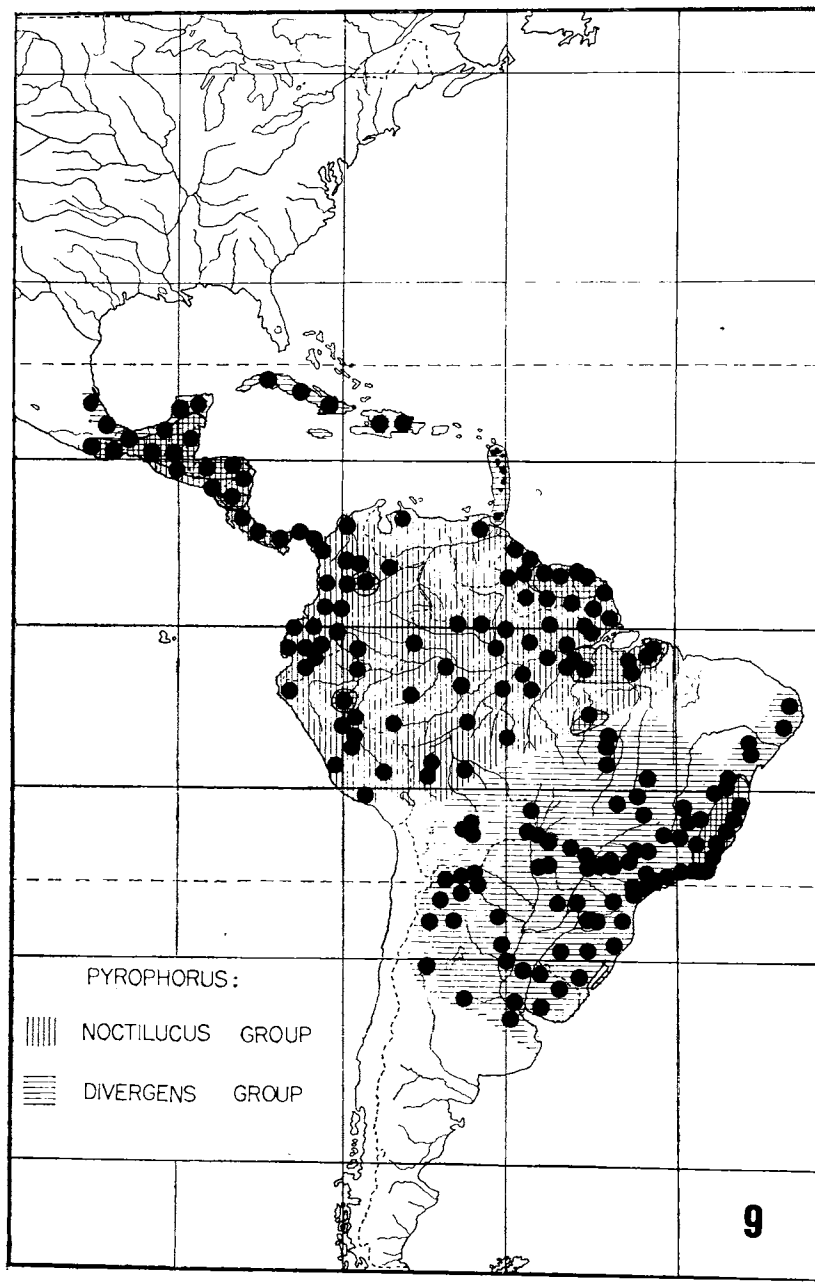
Map 6. Distribution of the subtribe Pyrophorina.



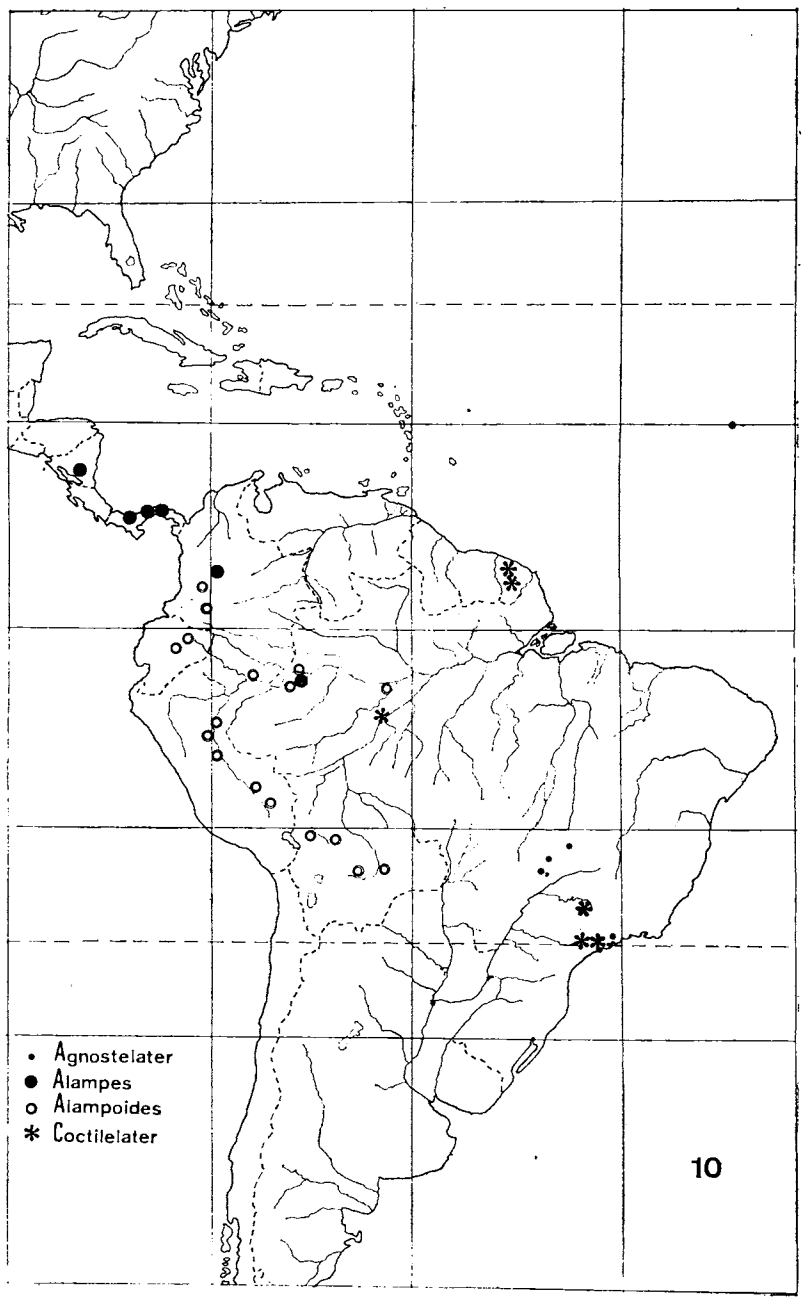
Map 7. Distribution of the subtribe Pyrophorina (*Pyrearinus* groups).



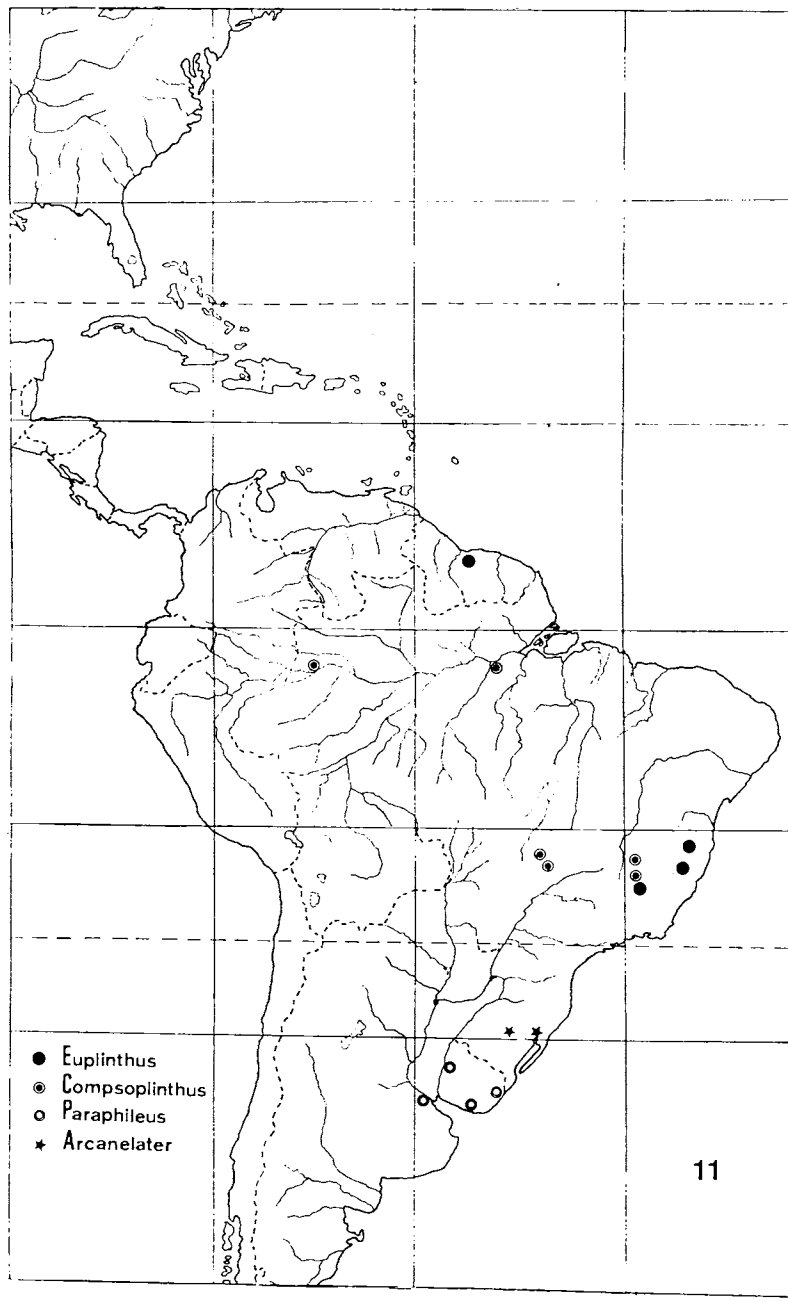
Map 8. Distribution of the subtribe Pyrophorina.



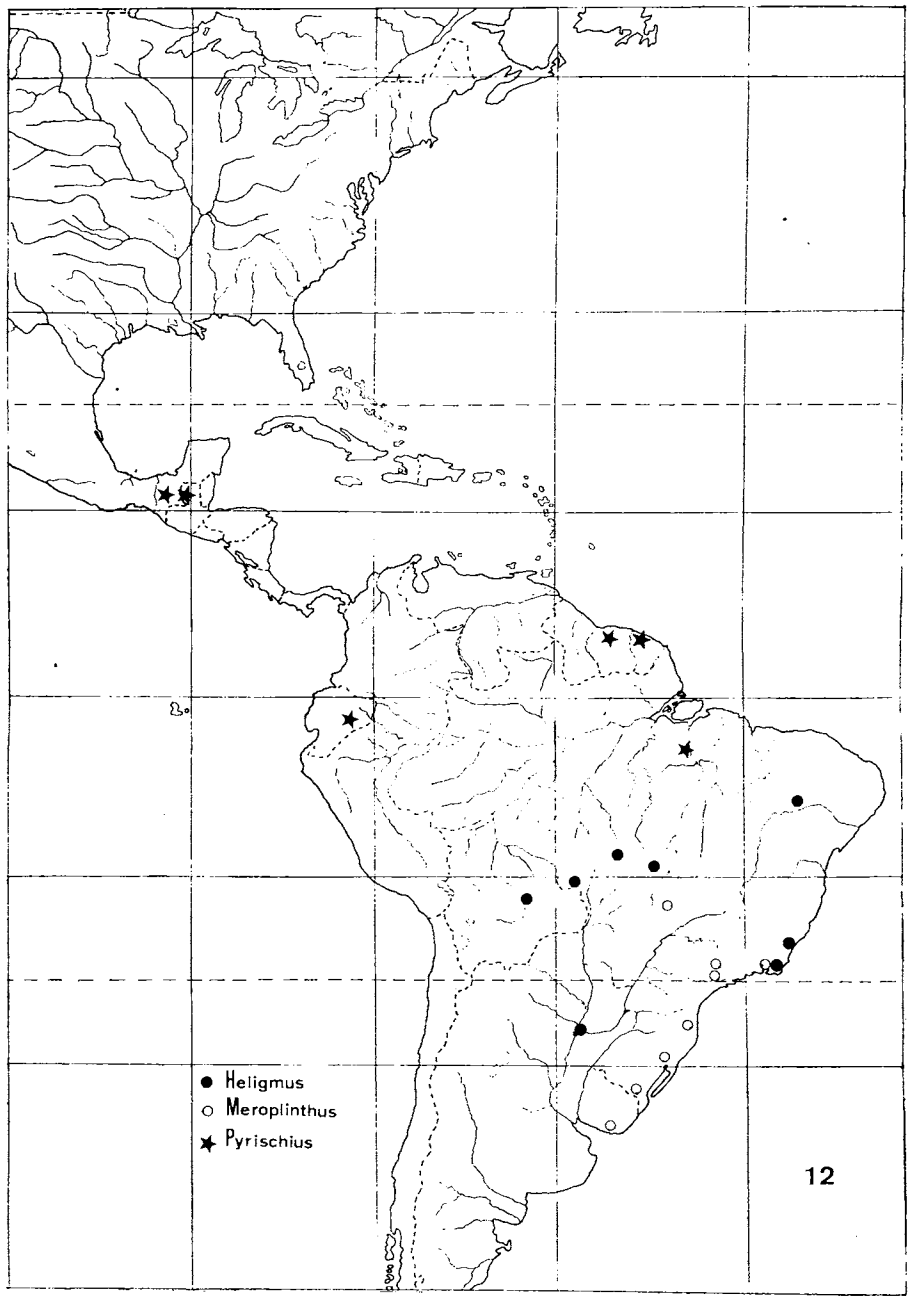
Map 9. Distribution of the subtribe Pyrophorina (*Pyrophorus* groups).



Map 10. Distribution of the subtribe Alampina.



Map 11. Distribution of the subtribes Euplinthina and Compsoplinthina.



Map 12. Distribution of the subtribe Heligmina.

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(Synonyms in italics)