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Antlions of Hispaniola (Neuroptera: Myrmeleontidae)

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## Antlions of Hispaniola (Neuroptera: Myrmeleontidae)

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**Abstract.** Twelve extant species of antlions are known from Hispaniola including four **new species** (*Eremoleon petrophila*, *Eremoleon phasma*, *Purenleon nunezi*, *Purenleon woodruffi*) and one **new genus** (*Peruveleon*). Five New World species are transferred into *Peruveleon* resulting in **new combinations**: *Peruveleon bruneri* (Alayo), *Peruveleon camposi* (Banks), *Peruveleon dolichogaster* (Navás), *Peruveleon dorsalis* (Banks), *Peruveleon indiges* (Walker). *Vella fallax haitiensis* Smith is considered a **new synonym** of *Vella eggerti* Esben-Petersen. Descriptions and records for the species are provided as well as keys to the adults and larvae. The larvae of eleven species were found and reared.

**Resumen.** Se documentan doce especies de Myrmeleontidae de Hispaniola incluyendo cuatro **especies nuevas** (*Eremoleon petrophila*, *Eremoleon phasma*, *Purenleon nunezi*, *Purenleon woodruffi*) y un género nuevo (*Peruveleon*). Cinco especies son transferidos al género *Peruveleon* resultando **nuevas combinaciones**: *Peruveleon bruneri* (Alayo), *Peruveleon camposi* (Banks), *Peruveleon dolichogaster* (Navás), *Peruveleon dorsalis* (Banks), *Peruveleon indiges* (Walker). *Vella fallax haitiensis* Smith es considerado como un **sinónimo nuevo** de *Vella eggerti* Esben-Petersen. Se proporcionan descripciones y registros para las especies y claves para los adultos y larvas. Las larvas de once especies fueron descubiertas y asociadas con adultos.

### Introduction

The only published account of the antlions of Hispaniola is that of Roger Smith (1931) which treated the species of Haiti. Banks (1941) added a sixth species. Poinar and Stange (1996) described *Porrerus dominicanus* from Dominican amber. Pérez-Gelabert and Flint (2001) provided a list of described species. We made an extensive field study of the Myrmeleontidae of the Dominican Republic in 1986. We concentrated on finding larvae and reared several new species bringing the total number of extant species to twelve. Four new species were collected and are described in the present work. These new species in addition to *Purenleon imbellis* Banks are endemic to Hispaniola. Many of the species live in sand or fine soil around tree bases, in sand tracts or dunes, but species of *Eremoleon* and two species of *Purenleon* are found in the mouths of dry caves or under large rock overhangs. Many species that live in coastal habitats are transcaribbean species. These are *Myrmeleon insertus* (Hagen), *Vella eggerti* Esben-Petersen, *Purenleon minor* (Banks), *Purenleon bistictus* (Hagen), and *Peruveleon indiges* (Walker).

### Materials and methods

Descriptions of the larvae are based on third instar larvae. Depositories for specimens are indicated by the following codens (mostly as set by Arnett et al. 1993).

**BMNH** The Natural History Museum, London, England

**FSCA** Florida State Collection of Arthropods, Gainesville, Florida, U.S.A.

**IZAC** Academia de Ciencias de Cuba, Havana, Cuba.

**MCZC** Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.

**MNHN** Museum National d'Histoire Naturelle, Paris, France.

**TAMU** Department of Entomology, Texas A & M University, College Station, Texas, U.S.A.  
**WORK** Jim Work collection, Ashland, Oregon, U.S.A.  
**ZMUH** Universität von Hamburg, Hamburg, Germany.

### Checklist of Myrmeleontidae from Hispaniola

#### Subfamily Myrmeleontinae

##### Tribe Acanthaclisini

1. *Vella eggerti* Esben-Petersen

##### Tribe Brachynemurini

2. *Peruveleon indiges* (Walker)

##### Tribe Myrmeleontini

3. *Myrmeleon insertus* Hagen

4. *Porrerus dominicanus* Poinar and Stange (fossil)

##### Tribe Nemoleontini

5. *Eremoleon cerverai* (Navás)

6. *Eremoleon cerverinus* (Navás)

7. *Eremoleon petrophila* n. sp.

8. *Eremoleon phasma* n. sp.

9. *Purenleon bistictus* (Hagen)

10. *Purenleon imbellis* (Banks)

11. *Purenleon minor* (Banks)

12. *Purenleon nunezi* n. sp.

13. *Purenleon woodruffi* n. sp.

### Key to extant species of Myrmeleontidae from Hispaniola

#### Adults

1. Origin of hindwing radial sector well distad of base, about same distance as that of forewing, two or more presectoral crossveins (Figure 3); male with pilula axillaris; forefemur with row of clubbed setae or setae on ventral surface of distal tarsomere less than 1/3 length of tarsomere diameter ..... **2**
- Origin of hindwing radial sector near base, about half as distant from base as that of forewing, one (rarely two) presectoral crossveins (Figure 5); male without pilula axillaris; forefemur without knobbed setae; setae on ventral surface of distal tarsomere more than 1/2 as long as tarsomere diameter (Tribe Nemoleontini) ..... **4**
- 2(1). Hindfemur with elongate sense hair; distal palpomere of labium with sensory area slit-like; hindwing vein CuA unites with posterior fork of MP2 shortly after fork (Figure 1); large, robust, hairy species (Tribe Acanthaclisini) ..... ***Vella eggerti* Esben-Petersen**
- Hindfemur without elongate sense hair; distal palpomere of labium with sensory area oval-shaped; hindwing vein CuA runs to hind margin, connected to posterior fork of MP2 by several crossveins (Figure 3); medium size, slender, not especially hairy species ..... **3**
- 3(2). Ventral setae of distal tarsomere less than 1/3 length of tarsomere diameter; forefemur without clubbed setae; male ectoproct without postventral lobe; forewing vein 2A runs close to 1A for a short distance and then bends at a sharp angle toward 3A (Tribe Myrmeleontini) ..... ***Myrmeleon insertus* Hagen**
- Ventral setae of distal tarsomere more than 1/2 length of tarsomere diameter; forefemur with clubbed setae; male ectoproct with elongate postventral lobe (Figure 2); forewing vein 2A runs in a fairly even curve and is connected to 3A by a short crossvein or connected to it for a short distance (Tribe Brachynemurini) ..... ***Peruveleon indiges* (Walker)**

- 4(1). Forefemur slender and elongate, at widest point about equal at most to interantennal distance, with sparse pubescence (Figure 10); femoral sense hair of foreleg less than one-third length of femur; female ectoproct not produced ventrally (*Eremoleon*) ..... 5  
 — Forefemur swollen, at widest point much wider than interantennal distance, with abundant pubescence, especially on closing face; femoral sense hair of fore leg over one-half length of femur; female ectoproct with ventral projection (*Purenleon*) ..... 8
- 5(4). Mesoscutum and mesoscutellum with many elongate, erect white bristles ..... 6  
 — Mesoscutum and mesoscutellum with inconspicuous setae only ..... 7
- 6(5). Antennal flagellomere 3 wider than long; female ectoproct with short digging setae, posterior gonapophysis with some setae longer than gonapophyseal length .....  
 ..... *Eremoleon cerverinus* (Navás)  
 — Antennal flagellomere 3 longer than wide; female ectoproct without digging setae, posterior gonapophysis with all setae shorter than one-half length of gonapophysis, somewhat thickened .....  
 ..... *Eremoleon petrophila* new species
- 7(5). Body predominately dark brown; forewing with numerous dark brown suffused areas (Figure 4); antennal flagellomere 3 longer than wide ..... *Eremoleon cerverai* (Navás)  
 — Body predominately pale brown; wings without markings (Figure 12); antennal flagellomere 3 as wide as long ..... *Eremoleon phasma* new species
- 8(4). Pronotum with elongate white bristles at lateral margin, at least subequal in length to those on forecoxa; midfemoral sense hair about one-half length of forefemoral sense hair .....  
 ..... *Purenleon bistictus* (Hagen)  
 — Pronotum without elongate white bristles at lateral margin (sometimes with black setae laterally which are shorter than those on forecoxa); midfemoral sense hair about one-half to as long as that of midfemur ..... 9
- 9(8). Forewing costal area with many crossveins interconnected; midfemoral sense hair about one-half as long as that of forefemur ..... *Purenleon imbellis* (Banks)  
 — Forewing costal area without interconnected crossveins except rarely toward stigma; midfemoral sense hair as long as that of forefemur ..... 10
- 10(9). Basitarsus of hindleg 2.5 times longer than greatest diameter, much shorter than pretarsal claws .....  
 ..... *Purenleon woodruffi* new species  
 — Basitarsus of hindleg at least 3.0 times longer than its greatest diameter, nearly as long as pretarsal claws ..... 11
- 11(10). Forecoxa with a few elongate white bristles posteriorly nearly equal in length to greatest coxal diameter; forewing costal area with cells above radial sector at least as high as long; subcostal area often narrowly dark suffused opposite some of the dark segments of radial vein; female ectoproct upturned .....  
 ..... *Purenleon nunezi* new species  
 — Forecoxa with white bristles (if present) shorter than coxal diameter; forewing costal area with cells above radial sector wider than long; subcostal area not suffused; female ectoproct not upturned ..... *Purenleon minor* Banks

#### Larvae (unknown for *P. imbellis*)

1. Labial palpus shorter than basal width of mandible; mesothoracic spiracle not borne on tubercle; head without dolichasters; backward movement only ..... 2  
 — Labial palpus longer than basal width of mandible; mesothoracic spiracle usually borne on tubercle; head often with dolichasters; backward and forward movement ..... 3

- 2(1). Mandible with some setae on exterior margin as long or longer than greatest mandibular width; sternite VIII with pair of inconspicuous submedian teeth near posterior margin; make pitfall traps ..... *Myrmeleon insertus* Hagen
- Mandible with longest setae on exterior margin less than one-half greatest mandibular width; sternite VIII without teeth on subapical margin; no pitfall traps ..... *Vella eggerti* Esben-Petersen
- 3(1). Mandible with distal tooth shorter than middle tooth, set at different angle; sternite VIII with pair of inconspicuous submedian teeth near posterior margin; live in open sand ..... *Peruveleon indiges* (Walker)
- Mandible with distal tooth as long as or longer than middle tooth, all teeth parallel and usually equidistant; sternite VIII without submedian teeth; usually live under rock overhangs, cave mouths or on cave walls (Tribe Nemoleontini) ..... 4
- 4(3). Ventral head capsule with many dolichasters (Figure 33) and usually with dark brown spots ... 5
- Ventral head capsule with only simple setae, color pale brown, sometimes dark brown ..... 8
- 5(4). Ventral head capsule with large median dark brown spot (Figure 33); head capsule about as wide as long ..... *Purenleon minor* Banks
- Ventral head capsule with sublateral dark brown spots; head capsule much longer than wide... 6
- 6(5). Abdomen with spiracles not borne on elongate tubercles; mandible without dolichasters; ventral head capsule usually with 2 pairs of dark brown sublateral spots (Figure 31); live in sand dunes ..... *Purenleon bistictus* (Hagen)
- Abdomen with spiracles borne on tubercles which are longer than wide; mandible with several pale dolichasters on mesal margin near base; ventral head capsule with one pair of dark brown sublateral spots (Figure 37); live under rock overhangs ..... 7
- 7(6). Head capsule light reddish ..... *Purenleon nunezi* new species
- Head capsule tan colored ..... *Purenleon woodruffi* new species
- 8(4). Abdomen with lateral scoli (Figure 25, 26); head with many long white, hairlike setae laterally; mandible with middle tooth much closer to distal tooth than to basal tooth; live on exposed rock under overhangs ..... *Eremoleon petrophila* new species
- Abdomen without lateral scoli; head without long, hairlike setae laterally; mandible with teeth nearly equidistant; live in dust or soil under rock overhangs ..... 9
- 9(8). Mesothoracic spiracle not borne on tubercle (Figure 27) ..... *Eremoleon phasma* new species
- Mesothoracic spiracle borne on tubercle ..... 10
- 10(9). Ventral head capsule with dark brown submedian coloration (Figure 22) ..... *Eremoleon cerverai* (Navás)
- Ventral head capsule completely pale (Figure 24) ..... *Eremoleon cerverinus* (Navás)

## TAXONOMIC ACCOUNT

### TRIBE ACANTHACLISINI

#### *Vella* Navás

*Vella* Navás 1913: 46. **Type species:** *Acanthaclisis fallax* Rambur, by original designation (as “*Vella fallax* Rambur”).

=*Grypoptectron* Esben-Petersen 1928: 75 (after Stange and Miller 1985: 39). **Type species:** *Myrmeleon americanum* Drury, by original designation.

**Further description.** Esben-Petersen 1928: 76; Banks 1927: 83; Stange and Miller 1985: 39 (larva).

**Distribution.** West Indies; North America; South America

**Diagnosis. Adult:** Medium to large size species; ocular rim with or without white setae that project over eye; distal palpomere of labius with palpimacula an elongate slit; pronotum wider than long, without dense pile of long hair posteriorly; forewing costal area with cross veins interconnected at least beyond apical one-half, upper series somewhat narrower than lower series except near stigma; radial sector about in same position to cubital fork (forewing) or medial fork (hindwing) in both wings; femora with 1 or 2 elongate sense hairs; postventral lobe of male ectoproct longer than median diameter.

**Larva.** Mandible with 3 close, fairly blunt teeth, no setae between teeth; head with anterior margin of clypeal labrum weakly sinuate; ventral surface of head capsule densely setose; antenna longer than basal width of mandible; mid tarsus much shorter than midtibia, and less than one-half as wide even basally; hind pretarsal claws much longer than mid tarsal claws.

### ***Vella eggerti* Esben-Petersen**

(Figure 1)

*Vella fallax eggerti* Esben-Petersen 1928: 74, figure 2 (wings). **Holotype female**, St. Thomas, 10.VIII.1897, Eggert (ZMUH, destroyed).

=*Acanthaclisis cubana* Hagen 1860: 363 (**Nomen nudum**).

=*Vella fallax haitiensis* Smith 1931: 815, figure 16 (wings). **New synonym. Holotype female**, Jacmel, Haiti, G.N. Wolcott, V.1927 (MCZC).

**Taxonomy.** Navás 1932a: 33 (*haitiensis* good species).

**Further description.** Hagen 1861: 223; Gundlach 1888: 199; Navás 1932a: 33, figure 34 (forewing); Alayo 1968: 71, figures 21 (wings), Plate 3, figure 11; Plate 7, figure 7.

**Biology.** Hagen 1873: 269-271 (as *A. congener?*).

**Distribution.** Bahamas (Eleuthera Island); Caicos Island; Cayman Islands; Cuba (Gundlach 1888: 200; Alayo 1968: 72); Florida Keys (Bahia Honda Key; Big Pine Key); Grand Turk Island; Hispaniola; St. Croix; St. Thomas.

**Diagnosis. Adult:** Large (body length 48 to 68 mm; forewing length 50-70 mm), robust, hairy species. **Coloration:** forewing costal area mostly pale brown at basal one-half. **Chaetotaxy:** forefemur and midfemur with two equal and elongate sense hairs; hindfemur with elongate sense hair. **Structure:** pretarsal claws well developed, strongly arched near base; tibial spurs well developed, gently curved; origin of hindwing radial sector well distad from wing base, about same distance as that of forewing, two or more presectoral crossveins; male with pilula axillaris; hindwing without indication of Banksian line (Figure 1); hindwing subcostal area not marked; forewing costal area narrower at radial sector than presectoral area before radial area; abdomen with hair pencils; male ectoproct with elongate postventral lobe.

**Larva.** Head capsule with dolichasters ventrally except along mid line; labial palpus shorter than basal width of mandible; head without dolichasters; mandible with longest setae on exterior margin less than one-half greatest mandibular width mesothoracic spiracle not borne on tubercle; sternite VIII without teeth on subapical margin; sternite VIII without short, blunt, peg-like setae, although with stout but pointed digging setae present; no pitfall traps; backward movement only.



**Figures 1-4.** Adult antlions. **1)** *Vella eggerti* (Hagen), male. **2)** *Peruveleon indiges* (Walker), male. **3)** *Myrmeleon insertus* Hagen, female. **4)** *Eremoleon cerverai* (Navás), male.

**Records. DOMINICAN REPUBLIC. San Juan Province:** El Capa, 17 km. northeast Vallejuelo, 27.V.1986, Miller and Stange (3 m, 1f, FSCA). **Monte Cristi Province:** 9 km. north Villa Elisa, 4.VI.1986, Miller and Stange (1f, FSCA); 3 km. north Villa Elisa, 1.X.1988, L. Stange (1 f, FSCA); Papillo Salcedo (1f, FSCA). **Pedernales:** Cabo Rojo Aloca, 20.VI.1999, R. Woodruff, on spider web (1f, FSCA). **HAITI.** Jacmal, V.1927, G. N. Wolcott (1f, MCZC).

**Discussion.** This is the largest antlion found on Hispaniola. It is easily recognized in the adult and larval stages from the characters given in the key. The larva makes no pitfall trap and only moves backwards under the sand searching for its prey and leaving distinctive trails in the sand that are usually most visible in the morning and evening. The adult probably rests on tree trunks and wooden poles as this behavior has been observed in other species of *Vella* Navás.

#### TRIBE BRACHYNEMURINI

#### *Peruveleon* Miller and Stange, new genus

**Type species:** *Brachynemurus camposi* Banks, by present designation.

**Further description.** Stange 1970a: 64 (as *Abatoleon*, A. indiges Group, part); 1994: 79.

**Distribution.** Neotropical Region (south Texas to Argentina; Caribbean (including Florida Keys).

**Description. Adult:** Body size 20 to 30 mm, forewing length 16 to 22 mm. Frons without setae; antennal fossae separated by about width of pedicel; forefemur with clavate setae (sometimes weakly thickened



subapically); ocular rim with or without setae that project over eye; femoral sense hair of fore leg about as long as femur and much longer than that of mid leg; mesonotum without blade-like setae; tibial spurs present; pretarsal claws longer than hind basitarsus but less than one-half length of distal tarsomere; pilula axillaris present; hindwing shorter than forewing, in repose apices of wings nearly coincide; Banksian lines absent; costal area of forewing with one series of cells for most of its distance; posterior area of hindwing narrower than presectoral area; CuA bends to hind margin at or before origin of medial fork; antenna short, usually with less than 30 flagellomeres; postventral lobe of male ectoproct well developed but less than one-half length of eighth abdominal segment, without median or secondary lobes; gonarcus reduced in size, mediuncus of male genitalia smooth, conspicuously expanded covering modified parameres; genital sac without secondary sclerites or clavate setae; female terminalia with pregenital plate membranous; gonapophyseal plate long and slender; lateral gonapophysis separate, with weak digging setae; ectoproct with digging setae, sometimes weakly developed; posterior gonapophysis elongate, sometimes somewhat swollen.

**Larva.** Dorsal surface of head capsule and prothorax with or without dolichasters; basal tooth is closer to distal tooth than to mandibular base; mesothoracic spiracle borne on tubercle that is at least as long as wide; abdominal spiracles sometimes borne on tubercles, often associated with tube-like structures; submedian teeth on sternite VIII present, variable in development usually shorter than basal width.

**Included species.** The following species are now assigned to *Peruveleon*, creating **new combinations**.

*Peruveleon indiges* (Walker) 1860: 189 (*Myrmeleon*). **Holotype male**, Haiti (BMNH).

*Peruveleon bruneri* (Alayo) 1968: 65 (*Austroleon*). **Holotype male**, Vinales, Pinar del Rio, Cuba, III.1939 (IZAC).

*Peruveleon camposi* (Banks) 1908: 32 (*Brachynemurus*). **Holotype**, Santa Elena, Ecuador (MCZC).

*Peruveleon dolichogaster* (Navás) 1915: 7 (*Austroleon*). **Holotype male**, Las Garzas, Santa Fe, Argentina (MNHN).

*Peruveleon dorsalis* (Banks) 1903: 240 (*Brachynemurus*). **Holotype female**, Laredo, Texas (MCZC).

*Peruveleon cubitalis* (Navás) 1921: 117. **Holotype female**, Playa Chivo, Habana, Cuba (MCZC).

**Discussion.** This is the only pan-Neotropical genus of the tribe, occurring from south Texas to Argentina and also in the Caribbean including the Florida Keys. The clavate setae present on the forefemur are distinctive in the tribe except for *Abatoleon* Banks and *Chaetoleon* Banks. *Chaetoleon* differs from *Peruveleon* in lacking the postventral lobe of the male ectoproct, shape of the male genitalia and membranous pregenital plate of the female. These species were formerly included in *Abatoleon* but that genus is now restricted to two Argentina species, *A. deprivatus* Banks and *A. frontalis* Banks. These two species differ from *Peruveleon* by having the male ectoproct much longer than abdominal segment VIII and because the abdomen is shorter than the wings. The female has the posterior gonapophysis with several apical scraping setae and the ectoproct and lateral gonapophysis has silken hairs and the abdomen is shorter than the wings. Although the larva of *Abatoleon* has not been discovered, the structure of the female terminalia (presence of scraping setae on posterior gonapophysis) suggests that the eggs are laid on rocks or perhaps plants. The larvae of *Peruveleon* live in open sand.

**Etymology.** The masculine generic name refers to the abundance of species of this genus found in the Peruvian Coastal Desert of Perú.

### ***Peruveleon indiges* (Walker)**

(Figure 2)

*Myrmeleon indiges* Walker 1860: 189. **Holotype male**, Haiti (BMNH, type examined).

=*Nelees cubitalis* Navás 1921: 117 (after Smith 1931: 816). **Holotype female**, Playa Chivo, Habana, Cuba, 7.VII.1919, Cervera (MCZC, type examined).

**Taxonomy.** Smith 1931: 816 (in *Austroleon*); Navás 1922: 168 (in *Clathroneuria*); Stange 1970: 68 (in *Brachynemurus*); 1994: 80 (in *Abatoleon*).

**Further description.** Smith 1931: 816, figure 18 (photo of wings); Alayo 1968: 63, figs. 10, 21 (wings) (Plate IV, figures 1-3 (vertex, nota), plate VII, figure 9 (male terminalia); Stange 1970a: 68, figs. 65, 66 (male genitalia, terminalia).

**Distribution.** Florida Keys, Bahamas, Cuba, Hispaniola.

**Diagnosis. Adult:** length to apex of tergite IX about 30 to 34 mm (male) or 24 to 28 mm (female); forewing length 16 to 22 mm. **Coloration:** general coloration light brown; pronotum mostly pale, usually with median stripe posteriorly, divergent dark brown stripes beyond furrow; mesoscutellum pale with broad median stripe; femur and tibia mostly pale with scattered dark brown spots; wings with some dark brown spots, especially along the forewing vein CuA and cross veins between medius and hind margin; abdomen with longitudinal light brown streaks, not banded. **Chaetotaxy:** ocular rim without setae; head male pilula axillaris forming a mat, longest setae shorter than stem of the pilula; forefemur without minor row of clavate setae; setae posterior to major row of clavate setae appressed, seldom thickened apically with longest setae shorter than one-eighth length of basal clavate seta of major row. **Structure:** ninth sternite of male abdomen weakly emarginate posteriorly postventral lobe of male ectoproct about four times longer than middle diameter; male genitalia with mediuncus very large, narrow, bifurcate posteriorly; paramere small, shorter than width of mediuncus; Rs with several forks, first near middle of wing; abdomen dark brown or with longitudinal light brown streaks, not banded.

**Larva.** Labial palpus longer than basal width of mandible; mandible much darker at distal one-third than rest, with distance between base and basal tooth longer than between basal and distal tooth, distal tooth is shorter than middle tooth and set at different angle than other teeth; dorsal surface of head capsule with dolichasters; mesothorax without dolichasters; setae on anterior margin of head between mandibular bases at least twice as long as median diameter; mesothoracic spiracle borne on tubercle that is about as long as median width; abdominal spiracle enlarged, often with associated secondary tube-like structures; sternite VIII with pair of sclerotized submedian teeth.

**New records. DOMINICAN REPUBLIC. Azua Province:** Tabara Abajo, 16.VI.1986, Woodruff and Stange (2f, FSCA); Playa Tortuguero, 23.V.1986, Miller and Stange (1f, FSCA). **Barahona Province:** 7 miles east Barahona, 28.IX.1985, L. Stange (1m, 2f, FSCA); 24 km. east Barahona, 27.IX.1985, Stange (2f, FSCA); 1.6 km. east Fondo Negro, 24.V.1985, Woodruff and Stange (1f, FSCA); 10 miles north Cabral, 28.IX.1986, Woodruff and Stange (1f, FSCA); 1.6 miles west Fondo Negro, 24.V.1985, Woodruff and Stange (1f, FSCA). **Dajabón Province:** 5 km. North Dajabón, 25.IV.2000, R. Woodruff & T. Henry (1f, FSCA). **Independencia Province:** Los Rios, Lago Enriquillo, 23.V.1986, Miller and Stange (1f, FSCA). **Monte Cristi Province:** 9 km. north Monte Cristi, 17.VI.1986, Stange and Woodruff (2m, 1f, FSCA); 10 miles south Monte Cristi, 2.X.1985 (1f, FSCA); 3 km. north Villa Elisa, 1.X.1986, Stange and Woodruff (4f, FSCA); 9 km. north Villa Elisa, 4.VI.1986, Miller and Stange (5m, 3f, FSCA). **Peravia Province:** Matanzas, 19.V.1985, Woodruff and Stange (1f, FSCA). **Pedernales Province:** Cabo Rojo Alcoa, 9-13.IV.2000, R. Woodruff and T. Henry (2m, FSCA). **San Juan Province:** El Capa, 17 km. northeast Vallejuelo, 27.V.1986, Miller and Stange (3m, 3f, FSCA); 13 km. west Los Tres Charcos, 22.V.1985, Woodruff and Stange (1m, FSCA). **HAITI.** Cul de Sac plain, 5.I.1919, R. Smith (2m, MCZC).

**Discussion.** This is the only species of the tribe known from Hispaniola and therefore easy to identify from the key. It is one of few species of *Peruveleon* to lack ocular rim setae that project over the eye. There is considerable confusion as to the number of species of *Peruveleon* occurring in the West Indies and further studies are needed to resolve this taxonomic question.

#### TRIBE MYRMELEONTINI

#### *Myrmeleon* Linnaeus

*Myrmeleon* Linnaeus 1767: 913. **Type species:** *Myrmeleon formicarium* Linnaeus, by subsequent designation by Latreille 1810:435 [as *Myrmeleon formacarium*, Fab. (sic)].

**Diagnosis. Adult:** body length size 22 to 32 mm, forewing length 20 to 25 mm. Antennal fossae separated by more than diameter of scape; forewing vein CuP originates at or very near (about cubital vein diameter) basal cross vein; forewing vein 2A variable in form; forewing vein 2A runs close to 1A for short distance, then bends at sharp angle toward 3A; hindwing vein CuA connected to posterior fork of MP2 by cross veins; hindfemur without sense hair; tibial spurs and tarsal claws well developed, not arched or bent; ventral surface of distal tarsomere with all setae reduced to less than one-third width of tarsomere; hindwing with four or more presectoral cross veins; male pilula axillaris present; male abdomen without hair pencils; male ectoproct without postventral lobe.

**Discussion.** This cosmopolitan genus contains more described species than any other genus. One key character of *Myrmeleon* is the chaetotaxy of the distal tarsomere. The ventral setae of distal tarsomere are less than 1/3 the length of tarsomere diameter. Also, the wing venation is distinctive with more than four presectoral crossveins in the hindwing and the forewing vein 2A runs close to 1A for a short distance and then bends at a sharp angle toward 3A. The larvae construct pitfall traps and can only move backwards.

### *Myrmeleon insertus* Hagen

(Figure 3)

*Myrmeleon insertus* Hagen 1861: 233. **Syntypes**, Cuba, Poey (MCZC) and Port au Prince, Haiti (MCZC).

**Further description.** Gundlach 1888: 200; Smith 1931: 817, figure 15 (photo of wings); Wolcott 1950: 91, figure (drawing of adult); Alayo 1968: 71, figure 23, Plate VI, figure 2, Plate VII, figure 12 (head; nota; wings; female terminalia).

**Biology.** Gosse 1853: 506; Lucas and Stange 1981: 213, figure 4 (larval head).

**Distribution.** Florida Keys; Bahamas (Eleuthera Key); Cuba; Dominica; Hispaniola; Jamaica; Puerto Rico.

**Diagnosis. Adult:** body length about 22 to 32 mm, forewing about 20 to 25 mm long. **Coloration:** body mostly dark brown; antenna mostly dark brown with pale brown at apex of flagellomeres; vertex pale brown with dark band anteriorly, double dark brown spots medially extended posteriorly as solid brown band; dark brown laterally at posterior margin; pronotum light brown with broad median dark brown stripe expanded near middle, nearly complete sublateral dark brown stripes sublaterally; legs dark brown and pale brown; wings with longitudinal veins alternating dark and light brown, nearly unmarked; pterostigma not milky white; abdominal tergites nearly all black with pale brown posteriorly, tergite VIII and ectoproct mostly pale brown. **Chaetotaxy:** distal tarsomere with setae less than one-half length of tarsomere diameter. **Structure:** head with antennae separated by about twice width of scape; forewing with costal area not greatly expanded at stigma, at most one and one-half times wider than costal area above radial sector, without interconnected cross veins; male ectoproct without postventral lobe; tergite IX ventrally produced into lobe; male ectoproct not produced ventrally; ventral process not bifurcate; sternite IX broadly truncate posteriorly, with median lobe; paramere without hooks; secondarily sclerotized structure under sternite IX.

**Larva. Coloration:** head and mandibles light brown to tan; ventral and dorsal body with rows of black spots on pink to light brown background; ventral head capsule with complex dark brown marks forming in part an "H" shape mark; dorsal head with posterior part dark brown with 4 dark brown parallel bars, anteriorly light brown with 4 dark brown spots forming a "Y" shape mark between antenna, base of "Y" pointing anteriorly. **Chaetotaxy:** head with long setae; mandible with some setae on exterior margin as long or longer than greatest mandibular width, average of 3 jaw setae near mandibular base but not found distal to basal tooth; head without dolichasters. **Structure:** head nearly rectangular with

lateral indentations, about 1.31 mm long; labial palpus shorter than basal width of mandible; mesothoracic spiracle not borne on tubercle; sternite VIII with pair of inconspicuous sclerotized submedian teeth near posterior margin.

**New records. DOMINICAN REPUBLIC. Barahona Province:** 6 km. northeast Paraíso, 24.V.1986, L. Stange (1m, 3f, FSCA); Fondo Negro, **emerged** 17.X.1985 (2m, FSCA). **La Vega Province:** 5 km. west Mauabao, 14-16.V.2001, R. Woodruff, blacklight (1f, FSCA). **Peravia Province:** Matanzas, 19.V.1986 (1m, 1f, FSCA). **Monte Cristi Province:** 3 km. north Villa Elisa, 1.X.1985, Woodruff and Stange (1m, FSCA); Paroli (beach), 2.VI.1986, Miller and Stange (1m, 1f, FSCA). **Pedernales Province:** 13 km. north Los Charcos, 23.V.1985, Woodruff and Stange (1m, FSCA). **San Juan Province:** El Capa, 17 km. northeast Vallejuelo, 27.V.1986, Miller and Stange (5m, 1f, FSCA). **HAITI.** Port-au-Prince, V.1938, (1f, FSCA); Hatte Lathan, 15.XII.1930 (MCZC).

**Discussion.** This is the only extant species of the tribe in Hispaniola and easily identified by the characters in the key. The pitfall traps are conspicuous making it easy to find the larvae. The adults are more difficult to find although they are sometimes taken at lights.

### *Porrerus* Navás

*Porrerus* Navás 1913:14. **Type species:** *Porrerus famelicus* Navás, by original designation and monotypy. = *Grapa* Navás 1932b: 55 (after Stange 1967: 61). **Type species:** *Grapa dealbata* Navás, by original designation and monotypy.

**Further description.** Markl 1954:234 (as tribe).

**Distribution.** Brazil; Panama; Paraguay; Uruguay; Venezuela.

**Diagnosis. Adult:** body length about 20 to 34 mm, forewing length about 20 to 30mm. Interantennal distance less than 1.5 times longer than greatest scape diameter; distal tarsomere with ventral setae at least one-half length of tarsomere diameter; forewing with costal area not greatly expanded at stigma, at most one and one-half times wider than costal area above radial sector, without interconnected cross veins; hindwing with at least four presectoral crossveins; male ectoproct with postventral lobe.

**Larva.** Mandible with some setae on exterior margin as long or longer than greatest mandibular width; labial palpus shorter than basal width of mandible; head without dolichasters; mesothoracic spiracle not borne on tubercle; sternite VIII with pair of inconspicuous sclerotized submedian teeth near posterior margin.

**Discussion.** This genus has living representatives only in South America and Panama. The larvae are very close morphologically to those of *Myrmeleon* and are usually found under rock overhangs. The larvae can only move backwards. The adults differ from those of *Myrmeleon* by having longer ventral setae on the distal tarsomere and having a postventral lobe developed on the male ectoproct.

### *Porrerus dominicanus* Poinar and Stange (fossil)

*Porrerus dominicanus* Poinar and Stange 1996: 384, figures 1-5 (photos of whole insect, head, female terminalia). **Holotype female**, Mina La Toca, Dominican Republic, in amber (WORK).

**Diagnosis. Adult:** body long, slender, about 24 mm; forewing length about 30 mm; head with antennae separated by less than 1.5 times diameter of scape; labial palpus with small palpimacula; distal tarsomere with setae at least one half length of tarsomere diameter; male ectoproct with short postventral lobe.

**Discussion.** This is an extinct species. The holotype probably became embedded in tree resin 20 to 30 million years ago.

## TRIBE NEMOLEONTINI

***Eremoleon* Banks**

- Eremoleon* Banks 1901: 366. **Type species:** *Myrmeleon macer* Hagen, by original designation.  
=*Glenopsis* Banks 1913: 229 (after Stange 1967: 57). **Type species:** *Myrmeleon anomalus* Rambur, by original designation  
=*Segura* Navás 1914: 18 (after Banks 1927: 71). **Type species:** *Segura vitreus* Navás, by original designation and monotypy  
=*Sosa* Navás 1914a: 218 (after Stange 1970b: 10). **Type species:** *Sosa conspicuus* Navás, by original designation and monotypy  
=*Belen* Navás 1921a: 119 (after Adams 1957b: 6). Type species: *Belen cerverinus* Navás, by original designation and monotypy.  
=*Cortesius* Navás 1924b: 107 (after Stange 1970b: 20). Type species: *Cortesius genini* Navás, by original designation and monotypy.  
=*Novulga* Navás 1925a: 189 (after Adams 1957a: 87). Type species: *Novulga mexicana* Navás, by original designation and monotypy  
=*Dobla* Navás 1927: 428 (after Stange 1970b: 20). Type species: *Dobla arcuata* Navás, by original designation and monotypy  
=*Joergenia* Esben-Petersen 1933: 118 (after Stange 1970b: 20). Type species: *Joergenia pulchra* Esben-Petersen, by monotypy.  
=*Antilloleon* 1943: 168 (after Stange 1970b: 20). Type species: *Glenurus cerverai* Navás, by original designation.

**Taxonomy.** Navás 1916a: 232 (*Incamoleon* Banks=*Formicaleo* Leach; *Glenopsis* Banks = *Glenurus* Hagen); Adams 1957a: 85 (*Belen* = *Eremoleon*); Stange 1967: 57 (*Incamoleon* good genus).

**Key to species.** Banks 1927: 70, 1942: 144; Adams 1957a: 85-86; Stange 1970b:17-18; 2002: 284 (Costa Rica).

**Further description.** Banks 1927: 69; Stange 1970b: 8; 2002: 283.

**Distribution.** Caribbean; North America; South America.

**Diagnosis. Adult:** length of body 15-33 mm, forewing 12-28 mm. Antenna long and slender, fossa separated from ocular rim by less than greatest diameter of pedicel; pronotum variable, usually longer than wide; legs about equal in length except usually hind legs longer; tibia spurs variable in length, usually shorter than forecoxal length; pretarsal claws not capable of closing again distal tarsomere; forewing with anterior margin evenly curved toward apex, costal area at point of coalescing of subcostal and radial veins usually lower than at middle of wing; forewing radial sector originates somewhat before forking of CuA or well beyond; posterior fork of forewing vein CuA at an oblique angle to hind margin; forewing vein 2A widely separated from 3A before strong angle toward posterior margin; hindwing vein CuA extends nearly to forking of MP2 or somewhat beyond male ectoproct simple without postventral lobe; male paramere in form of rigid plate; female ectoproct usually with weak digging setae; posterior gonapophysis longer than wide, digitiform.

**Larva.** Mandible with three teeth, length between basal tooth and distal tooth shorter than that between base of mandible and basal tooth; dorsal surface of head without dolichasters; labial palpus with three segments; abdomen without scoli (except *Eremoleon petrophila*).

**Discussion.** This genus contains about 34 species. Twenty-three species have been reared from larvae. Nearly all of the known larvae live under rock overhangs or in caves. However, *E. nigribasis* lives in animal holes. *E. pallens* Banks is one of the few truly cave species of the family with the entire life cycle lived out in the inner, dark recesses of caves. One species from the Dominican Republic lives on bare rock similar to larvae of *Navasoleon* Banks and, like *Navasoleon*, has abdominal scoli. Recognition characters



Figures 5-8. *Eremoleon cerverinus* (Navás). 5) Adult male. 6) Adult body. 7) Adult male legs. 8) Female terminalia.

of this genus in the New World are the elongate legs and simple tarsal claws. The only other New World genus of this tribe with these characters is *Glenurus* Hagen, which has very distinctive larvae with two mandibular teeth (three teeth in *Eremoleon*). Adults of *Glenurus* have much more wing suffusion and the female posterior gonapophysis is very short. Nearly all the species of *Eremoleon* have banded abdomens, which is probably an adaptation for resting on the rock surface where the larvae live.

### *Eremoleon cerverai* (Navás)

(Figures 4, 20, 21, 22)

*Eremoleon cerverai* (Navás) 1921: 118, figure 3 (forewing) (as *Glenurus*). **Holotype female**, Santiago (de las) Vegas, Habana, Cuba, 23.VIII.1915, Cervera (MCZC, type examined).

**Taxonomy.** Navás 1929: 39 (in *Dendroleon*); 1943: 168 (in *Antilloleon*); Stange 1970b: 21 (in *Eremoleon*).

**Further description.** Smith 1931: 814, figure 13 (wings); Alayo 1968: 68, figure 22, Plate VI, figure 1, Plate VII, figure 5 (head; nota; wings; female terminalia).

**Distribution.** Cuba; Hispaniola.

**Diagnosis. Adult:** length of body 19-21 mm, forewing 24-26 mm. **Coloration:** forewing with oblique dark brown stripe from origin of radial sector to area beyond cubital fork (Figure 4); wing veins (at least radial vein and forewing vein CuA) with alternating dark and pale brown areas; forewing with oblique dark brown stripe from origin of radial sector to area beyond cubital fork (Figure 4). **Chaetotaxy:** forefemur with sparse pubescence; femoral sense hair of foreleg less than one-third length of femur; mesoscutellum with short, hair-like setae. **Structure:** antennal flagellomere III as long as wide or longer than wide; distal palpomere of labium moderately swollen (about twice as swollen as that of maxillus) with palpicum in distal one-half; forefemur slender and elongate, at widest point about equal at most to interantennal

distance; hind basitarsus about four times longer than middle diameter; forewing costal cells near middle of wing less than twice as high as wide; female ectoproct not produced ventrally.

**Larva.** Mandible with distal tooth as long as or longer than middle tooth, all teeth parallel and usually equidistant; sternite VIII without submedian teeth; labial palpus longer than basal width of mandible; mesothoracic spiracle usually borne on tubercle; head often with dolichasters; ventral head capsule (Figure 22) with dark brown submedian coloration, with only simple setae.

**New records. DOMINICAN REPUBLIC. La Altagracia Province:** Cueva de Berna, Boca de Yuca, 6.VI.1986, Miller and Stange (1m, 8f, FSCA). **La Vega Province:** 6 km. southeast Jarabacoa, 31.V.1986, **reared**, Miller and Stange (13m, 14 f, FSCA, TAMU). **Pedernales Province:** south end of Lago Oviedo, 24.V.1986, Miller and Stange (1m, FSCA). **HAITI.** Damien (MCZC); Port-au-Prince VIII.1924, G. Wolcott (MCZC).

**Discussion.** This species was reared from larvae found in rock overhangs and cave mouths. The length of time in the pupal stage averaged about 30 days. About 5% of the larvae were parasitized by a bombyliid fly. The abundant wing markings (Figure 5) distinguish this species from other *Eremoleon* found in Hispaniola.

### *Eremoleon cerverinus* (Navás)

(Figures 5, 6, 7, 8, 23, 24)

*Belen cerverinus* Navás 1921: 120, figure 4 (apex forewing). **Holotype female**, Rio Almendares, Habana, Cuba, 1.VIII.1915, Cervera (MCZC, type examined).

**Taxonomy.** Adams 1957b: 6 (in *Eremoleon*).

**Further description.** Adams 1957b: 6, figure 1 (vertex; pronotum; male genitalia; labial palps); Alayo 1968: 70, figure 10; Plate III, figure 3; Plate VII, figure 10 (head; nota; wings; female terminalia).

**Distribution.** Cuba; Hispaniola.

**Diagnosis. Adult:** length of body 19-21 mm, forewing 24-26 mm. **Coloration:** forewing with oblique dark brown stripe from origin of radial sector to area beyond cubital fork (Figure 6); wing veins (at least radial vein and forewing vein CuA) with alternating dark and pale brown areas; forewing with oblique dark brown stripe from origin of radial sector to area beyond cubital fork (Figure 6). **Chaetotaxy:** forefemur with sparse pubescence; femoral sense hair of foreleg less than one-third length of femur; mesoscutellum with short, hair-like setae. female ectoproct with short digging setae, posterior gonapophysis with some setae longer than gonapophyseal length. **Structure:** antennal flagellomere III as long as wide or longer than wide; distal palpomere of labium moderately swollen (about twice as swollen as that of maxillus) with palpimacula in distal one-half; forefemur slender and elongate, at widest point about equal at most to interantennal distance; hind basitarsus four times or less longer than middle diameter; forewing costal cells near middle of wing less than twice as high as wide; female ectoproct not produced ventrally; female ectoproct with short digging setae, posterior gonapophysis with some setae longer than gonapophyseal length.

**Larva.** Mandible with distal tooth as long as or longer than middle tooth, all teeth parallel and usually equidistant; mesoscutum and mesoscutellum with many elongate, erect white bristles; abdomen without lateral scoli; head without long, hair-like setae laterally; labial palpus longer than basal width of mandible; mesothoracic spiracle borne on tubercle; ventral head capsule completely pale (Figure 24). without dolichasters.

**New records. DOMINICAN REPUBLIC. Azua Province:** Playa Tortuguero, 23.V. 1986, Miller and Stange, **reared** (14m, 5 f, FSCA); Puerto Tortuguero, 19.IX.1985, Woodruff and Stange (1f, FSCA).

**Discussion.** Larvae were found and reared from rock overhangs where they live in fine, white silt. Superficially this species resembles *Eremoleon petrophila* but differs in having the antennal flagellomere 3 times wider than long and the scutellum has a complete dark sublateral dark stripe. Also, the chaetotaxy of the female terminalia is different. This is related to a basic difference in biology. The larvae of *E. cerverinus* live in fine sand at the bottom of the cave overhang whereas those of *E. petrophila* live on the bare rock of the ceiling. The female of *E. petrophila* oviposits on the bare rock surface whereas the female of *E. cerverinus* oviposits on the sand.

***Eremoleon petrophila* Miller and Stange, new species**

(Figures 9, 10, 11, 25, 26)

**Holotype male**, El Capa, 17 km. northeast Vallejuelo, San Juan Province, Dominican Republic, 27.V.1986, Miller and Stange (FSCA).

**Diagnosis.** Antennal flagellomere 3 longer than wide; female ectoproct without digging setae; mesoscutum and mesoscutellum with many elongate, erect white bristles; posterior gonapophysis with all setae shorter than one-half length of gonapophysis, somewhat thickened.

**Description.** **Holotype male**, length of body 20 mm, forewing 25 mm, abdominal tergite III 3.1 mm in length. **Coloration:** pale brown with contrasting dark brown markings; clypeus and labrum pale brown, with small sublateral dark spot on clypeus; mouthparts pale brown except for dark brown cardo and dark suffusion at palpimacula; broad interantennal dark brown spot, more extensive below antennae, dark brown encircling antennal bases; vertex pale brown with 4 dark brown suffused scars on anterior row, lateral ones much wider than long, double median scars longer than wide; small, irregular dark spot behind lateral spot of anterior row, with another dark brown area behind that; dark brown at posterolateral margin; antenna mostly pale brown, scape dark brown mesally and laterally; pedicel mostly dark brown except apex; flagellomeres before subapical swelling with dark brown basally on median face and lateral face, uninterrupted pale bands extend from near base to flagellar expansion on two sides; clava mostly darker brown preceded by several mostly pale brown flagellomeres; pronotum pale brown with dark brown areas submedially at middle and anteriorly, sublateral dark brown spots posteriorly and anteriorly, and small dark brown spot laterally at posterior end; nota pale brown with dark brown spots; pterothorax mostly pale brown with numerous dark brown areas on scutum, mesoscutellum and pleura; metascutellum nearly all pale brown; postnota extensively dark brown; coxae pale brown with small dark brown spot on lateral face; femora, tibiae and tarsi of all legs similarly colored, pale brown with dark brown apical spot on femora and tibiae, tibiae also with subbasal dark



**Figures 9-11.** *Eremoleon petrophila* Miller and Stange. 9) Female adult body. 10) Adult lateral view. 11) Female terminalia.



brown area (reduced in size on hindtibia), tarsus mostly pale brown with some dark brown on tarsomeres 3 and 4 and apex of distal tarsomere; abdomen mostly pale brown with dark brown banding dorsally; large dark spot on middle of tergite II, most of posterior third of tergites III-IV except apically, tergite VIII and most of sternites nearly all pale brown; wing membrane without suffusion except small rhegmal and stigmal areas, veins pale brown with dark brown interruptions at vein and crossvein junctures. **Chaetotaxy:** pronotum with many elongate, erect white bristles including sublateral ones; nota and scutella with elongate, erect white bristles; forecoxa with several elongate white bristles posteriorly. **Structure:** antenna with flagellomere III longer than wide; distal palpomere of labium moderately swollen; forefemur slender and elongate, at widest point about equal at most to interantennal distance, with sparse pubescence; femoral sense hair of fore leg less than one-third length of femur; forewing with costal area higher before stigma than above radial sector, not narrowing toward stigma, with single series of cells for entire distance, radial sector arising about 1/3 distance from base to apex of wing; hindwing not abruptly narrowed toward apex; medial area at highest point narrower than wing area above it; pretarsal claws of hindleg shorter than basitarsus which is about 4 times longer than greatest diameter; hindtibial spurs reaching beyond tarsomere II.

**Female.** About as described for male except for terminalia. Ectoproct not produced ventrally; lateral gonapophyses fused, posterior gonapophysis with short, stout setae, ectoproct without digging setae.

**Larva.** Mandible with distal tooth as long as or longer than middle tooth, all teeth parallel and usually equidistant head with many long, white, hairlike setae laterally; mandible with middle tooth much closer to distal tooth than to basal tooth; labial palpus longer than basal width of mandible; mesothoracic spiracle borne on tubercle; abdomen with lateral scoli (Figure 25); mesoscutum and mesoscutellum with many elongate, erect, white bristles; ventral head capsule with only simple setae.

**Paratypes.** **Dominican Republic: San Juan Province:** El Capa, 17 km. northeast Vallejuelo, 27.V.1986, Miller and Stange, **reared** (14m, 10f, FSCA, USNM). **Barahona Province:** 6 km. northeast El Paraiso, 24.V.1986, **reared**, Miller and Stange (1m, 1f, FSCA).

**Discussion.** This new species is strikingly similar to *P. cerverinus* in coloration and structure. The major differences are found on the female terminalia. Also, the antenna is longer with the third flagellomere about as long as wide rather than wider than long in *cerverinus*. There also appears to be more bristle-like setae on *E. petrophila* especially on the metanotum and forecoxa. This species could be segregated into its own genus since the characters of the female terminalia and larvae are significantly different in other *Eremoleon*. These modifications are probably attributable to the different larval microhabitat. As in most rock dwelling larvae, the larvae of *E. petrophila* are flattened with well-developed scoli that provide camouflage. The female lays the egg on the rock ceiling and uses its modified terminalia to clean the egg deposition spot. We saw eggs glued on the ceiling in clusters of 4 to 6 eggs near the presence of adult antlions. The short, stout setae on the posterior gonapophysis presumably evolved for this purpose although they are not as well developed in other species with this habit such as those of *Navasoleon* Banks and *Jaffuelia* Navás. Some adults were found during the day resting on the ceiling where larvae also were present. The larva photographed in Figures 24 and 25 was a preserved specimen so that the colors are not correct. The larva is mostly pale brown in color.

**Etymology.** The specific name is Greek for rock loving.

### ***Eremoleon phasma* Miller and Stange, new species**

(Figures 12, 13, 14, 27, 28, 29)

**Holotype male,** Los Ríos, Lago Enriquillo, Independencia Province, Dominican Republic, 23.V.1986, Miller and Stange (FSCA).

**Diagnosis.** Antennal flagellomere 3 as wide as long; mesoscutum and mesoscutellum with inconspicuous setae only; body predominately pale brown; wings without markings.

**Description.** **Holotype male**, body length 23 mm, forewing length 26 mm, third abdominal segment length 3.5 mm. **Coloration:** yellowish brown with restricted dark brown markings as follows: submedial dark spot on clypeus, palpimacula, scape and pedicel anteriorly and laterally as band, small comma shaped mark sublaterally on anterior row of vertex markings, larger submedial spot on middle row of vertex markings, 3 small spots laterally on pronotum, anterior area of prescutum, several lateral spots on mesonotum, postnota, mero of mid and hindlegs; faded spot on apex of femora, subbasally and apically on femora, and apex of distal tarsomeres; pleura toward venter, spots below wing base, abdomen with sublateral, longitudinal band toward posterior margin; wing membrane without dark brown suffusion (Figure 12), stigma whitish, venation mostly pale brown with some dark brown at vein and veinlet junctures, especially basally. **Chaetotaxy:** nota with moderate number of fairly short white bristles; forecoxa without outstanding white bristles posteriorly. **Structure:** antenna with weakly expanded club, flagellomere III longer than wide; distal palpomere of labium moderately swollen; forewing costal area about as high before stigma as above radial sector, radial sector arising well before midpoint of wing; hindwing not abruptly narrowed toward apex, medial area at highest point higher than wing area above it; forefemur slender and elongate, at widest point about equal at most to interantennal distance, with sparse pubescence; femoral sense hair of foreleg less than one-third length of femur; pretarsal claws longer than basitarsus of midleg; basitarsomere of hindleg about 3 times longer than wide; tibial spurs of hindleg reaching beyond tarsomere II.

**Female.** About as described for male except for terminalia. Female ectoproct not produced ventrally.

**Larva.** Mandible with distal tooth as long as or longer than middle tooth, all teeth parallel and usually equidistant (Figure 29); labial palpus longer than basal width of mandible; mesothoracic spiracle not borne on tubercle; head with dolichasters; abdomen without lateral scoli; head without long, hairlike setae laterally;

**Paratypes. Dominican Republic. Azua Province:** Playa Tortuguero, 23.XI.1986, Miller and Stange, **reared** (1m, 4f, FSCA); Puerto Tortuguero, 29.XI.1986, Miller and Stange, **reared** (1m, 2f, FSCA). **Independencia Province:** Los Rios, Lago Enriquillo, 23.V.1986, **reared**, Miller and Stange (4m, 3f, FSCA).

**Discussion.** The larvae were found under rock overhangs and stayed in the pupal stage about 7 weeks.



**Figures 12-14.** *Eremoleon phasma* Miller and Stange. 12) Adult female. 13) Adult legs. 14) Female terminalia.

**Etymology.** This is the largest *Eremoleon* in Hispaniola and is mostly of a pale yellow color, hence the name, *phasma*, which is Greek for ghost.

### *Purenleon* Stange

*Purenleon* Stange 2002: 285. **Type species:** *Purenleon abruptus* Stange, by original designation = *Diazus* Navás 1914a:220 (preoccupied by *Diazus* LeConte, 1859, Coleoptera: Scarabaeidae) by Stange 2002: 285. **Type species:** *Diazus clavatus* Navás, by original designation (after Stange 1970b: 16).

**List of species.** Stange 1970b: 23; 2004: 215-217.

**Distribution.** Caribbean; North America; South America.

**Description. Adult:** Body length 21-29 mm; forewing length 23-31 mm. Antennal fossa separated from ocular rim by much less than greatest diameter of scape; antenna relatively short with evident clava; pronotum wider than long; mesoscutellum smaller than metanotum; legs about equal in length, except hindleg longer than foreleg; tibial spurs well developed; pretarsal claws well developed, at least as long as basitarsus of foreleg, not capable of closing against ventral surface of tarsomere; hind basitarsus at least 2.5 times longer than greatest diameter **or** midtibia swollen about twice as wide as that of foreleg; midfemoral sense hair various, longer or shorter than forefemoral sense hair; forewing with costal margin evenly curved toward apex, height of costal area at point of coalescing of subcostal and radial veins lower than at middle of wing; forewing radial sector originates well beyond forking of CuA; forewing vein 2A widely separated from 3A before strong angle toward posterior wing margin; hindwing vein CuA extends nearly to forking of MP2, sometimes well beyond this point; male ectoproct simple, without postventral lobe; male paramere in form of rigid plate; male gonarcus not greatly expanded laterally; tergite VIII of female without subapical row of stout bristles; female ectoproct not produced ventrally, without digging setae; posterior gonapophysis well developed, often somewhat inflated.

**Larva** with three equally spaced teeth, increasing in length apically; labial palpus longer than basal width of mandible; distal palpomere over twice as long as wide; scoli absent; dolichasters usually present on head; mesothoracic spiracle borne on tubercle; abdominal segment IX wider than long; sternite VII with submedial teeth.

**Discussion.** *Purenleon* now includes 17 species, most of which were formerly included in *Psammoleon* Banks (now *Euptilon* Westwood, in part). The five known species of *Euptilon* are unique in having modified female terminalia adapted for throwing eggs. Tergite VIII has a subapical row of stout bristles directed posteriorly which partially lock the previously sand coated egg into a lateral alignment and prevents the egg from slipping anteriorly on the abdomen during the throwing. The angle of the setae on the tergite VIII determines the projectory angle of the egg. Also, the leg structure is different in having a short hindleg basitarsus (shorter than pretarsal claws). Species of *Purenleon* lack the subapical row of stout bristles found in *Euptilon*. There are three distinct species groups in *Purenleon*. Only the bistictus group is found in the West Indies and has the hind basitarsus is elongate, at least 2.5 times longer than greatest diameter. The inscriptus group is found in North America and has the pretarsal claws small, those of foreleg not more than one-half length of basitarsus whereas the pretarsal claws are moderately long, those of foreleg at least subequal to length of basitarsus in *Purenleon*. A third, undescribed group is found in Colombia and Venezuela and have the midtibia greatly swollen, much broader than the foretibia and the basitarsus of hindleg is about twice as long as greatest diameter. Larvae of *Purenleon* have been found in diverse habitats such as in cave mouths, in sand under palm fronds (*P. minor*), and living in loose soil around tree bases.

### *Purenleon bistictus* (Hagen)

(Figures 15, 30, 31)

*Myrmeleon bistictus* Hagen 1861: 235. **Holotype**, Cuba, Poey (not located).



**Figures 15-18.** *Purenleon* spp. **15)** *P. bistictus* (Hagen), adult male. **16)** *P. minor* (Banks), adult male. **17)** *P. nunezi* Miller and Stange, adult male. **18)** *P. nunezi* Miller and Stange, wing pattern variation.

**Taxonomy.** Navás 1921: 117 (in *Nelees*); Banks 1927: 61 (in *Psammoleon*); Stange 2002: 286 (in *Purenleon*).

**Further description.** Gundlach 1888: 201; Banks 1927: 61, figure x 33 (female terminalia); Smith 1931: 815, figure 14 (wings); Alayo 1968: 67, figure 24 (wings), Plate V, figure 2 (head; nota), Plate VII, figure 1 (female terminalia).

**Distribution.** Bahamas; British Virgin Islands; Cayman Islands; Cuba; U.S.A. (Florida Keys); Mexico (Campeche; Quintana Roo); Puerto Rico.

**Diagnosis.** Adult: body length 25-29 mm; forewing length 28-32 mm, hindwing 26 to 30 mm. **Coloration:** interantennal dark brown mark large, extending well below antennae and becomes sericeous above antennae; vertex markings black; antenna weakly annulated with brown; pronotum dull black, sericeous, with pale brown median line and broader pale brown streaks on each side; rest of notum dull black with pale brown areas especially at middle; legs predominantly black, forefemur pale brown in front, midfemur and hindfemur with pale band or spot beyond middle; tibiae pale brown at base and with pale brown spot or streak on outer side; tarsi mostly wholly black; abdomen dull black, sericeous, each dorsal tergite with long pale brown streak on either side, sometimes divided into two spots; wings (Figure 15) with oblique streak from anal area and from rhexma; pterostigma with dark brown spot at base; venation dark brown and pale brown in streaks, mostly dark brown at junctures with crossveins. **Chaetotaxy:** pronotum with elongate white bristles at lateral margin, at least subequal in length to those on forecoxa; mid femoral sense hair about one half length of fore femoral sense hair; femora and tibia with white setae and many black setae; abdomen with mostly white setae. **Structure:** pronotum broader than long; basitarsus of hindleg over five times longer than greatest diameter, nearly twice as long as pretarsal claw; hindtibial spurs about equal to 1.5 times as long as basitarsus; forewing costal area with only one series of cells; CuP + 1A of forewing runs obliquely to hind margin along posterior fork of CuA at a point below origin of radial sector.

**Larva.** Mandible with distal tooth as long as or longer than middle tooth, all teeth parallel and usually equidistant, without dolichasters; ventral head capsule with many dolichasters.

**Records. HAITI.** No further data (MCZC).

**Discussion.** This species is often collected at lights near coastal areas of most of the Caribbean Islands. So far, no specimens are available from the Dominican Republic and Smith (1931) mentioned only four specimens collected in Haiti. This is probably a collecting anomaly and further collecting efforts on Hispaniola will probably reveal it to be a common species. The larvae live in loose sand especially in coastal sand dunes. Two chaetotaxy characters will distinguish this species from nearly all other species in Hispaniola. The pronotum has elongate white bristles at the lateral margin and the midfemoral sense hair is only about one half the length of that of the forefemur. The latter character is shared only with *Purenleon imbellis* on Hispaniola.

### ***Purenleon imbellis* (Banks)**

*Puren imbellis* Banks 1941: 102. **Holotype**, Port au Prince, Haiti, 20.XI., R. Smith (MCZC).

**Taxonomy:** Stange 1970b: 24 (in *Psammoleon*); 2002: 286 (in *Purenleon*).

**Diagnosis. Adult:** (based on original description) Length of body about 21mm, forewing 20 mm. **Coloration:** head and thorax yellowish brown; dark brown interantennal mark truncate below antennae and dorsally extending nearly to vertex but with a median pale yellowish spot; vertex with anterior row of markings consisting of four almost connected black stripes, middle row consists of brown spots, posterior row consisting of pair of dark brown spots extending posteriorly; antenna pale brown on basal one-half with weak brown bases becoming dark apically, club dark brown; pronotum pale brown with median white line and lateral dark brown stripes laterally; abdomen brown with pale median line or spots that on tergite II is a line, elongately enlarged at middle and slight enlarged posteriorly; tergite III with broad pale area at base partly divided and followed by a line which is widened at tip; tergite IV with large pale brown spot at base which tapers toward tip; legs mostly pale brown, apices of femora dark brown, foretibia and midtibia mostly dark brown, hindtibia dark brown at apex only; tarsi mostly dark brown at base and apex; forewing with subcosta much interrupted with brown areas, radius with longer brown streaks, cubitus with more separated streaks; crossveins usually dark brown at ends; brown line from near end of anal vein and oblique brown line at rhexma. **Chaetotaxy:** pronotum with only short black setae; foretibia and midtibia with both white and black setae, hindtibia mostly with black setae. **Structure:** pronotum about as long as broad; fore tibial spurs about equal to basal three tarsomeres, hindtibial spurs about equal to basal two tarsomeres; forewing costal area swollen with two series of cells from near base to origin of radial sector.

**Larvae.** Unknown.

**Distribution.** Only the holotype is known.

**Discussion.** The partial double series of costal cells is distinctive.

### ***Purenleon minor* (Banks)**

(Figures 16, 32, 33, 34, 35)

*Psammoleon minor* Banks 1927: 62, figs. 32, 42 (tibial spurs; female terminalia). **Lectotype female**, Dry Tortugas, Loggerhead Key, Florida, VI.1917 (MCZC), designated by Stange 1961: 674. =*Psammoleon minora* Wolcott 1950: 91 (misspelling).

**Taxonomy.** Stange 2002: 286 (in *Purenleon*).

**Further description.** Alayo 1968: 66, figure 24, Plate V, figure 4, Plate VII, figure 4 (wings; head; nota; female terminalia).

**Biology.** Stange and Miller 1990: 158, figure 11(photo of larva).

**Distribution.** Bahamas; Cayman Islands; Cuba, U.S.A. (Florida Keys); Puerto Rico.

**Diagnosis. Adult:** length of body 18 to 20 mm, forewing 18-22 mm. **Coloration:** scape nearly all pale posteriorly; interantennal area dark brown; forefemur mostly pale brown with only scattered white appressed setae on outer face; forewing subcostal area not suffused; abdomen dark brown with some pale brown areas dorsally. **Chaetotaxy:**

pronotum without elongate white bristles at lateral margin (sometimes with black setae laterally which are shorter than those on forecoxa); forecoxa with white bristles (if present) shorter than coxal diameter; midfemoral sense hair as long as forefemoral sense hair. **Structure:** forewing costal area without interconnected cross veins except rarely toward stigma; forewing vein CuP + 1A reaches hind margin at a point below origin of radial sector; basitarsus of hindleg at least 3.0 times longer than greatest diameter, nearly as long as pretarsal claws; female ectoproct not upturned.

**Larva.** Ventral head capsule with many dolichasters, with large median dark brown spot (Figure 33); head capsule about as wide as long.

**New records. DOMINICAN REPUBLIC. Monte Cristi Province:** Monte Cristi (Chic Hotel), 1.X.1985, Woodruff and Stange, flying (1f, FSCA); 10 km. south Monte Cristi, 2.X.1985, Woodruff and Stange, blacklight trap (1f, FSCA).

**Discussion.** This is the smallest species of *Purenleon* in Hispaniola easily recognized by the narrow wings and elongate hind basitarsus. The larvae live under palm fronds on the sand in coastal areas. The large median dark brown spot on the ventral head capsule distinguishes it from other known larvae in Hispaniola.

***Purenleon nunezi* Miller and Stange, new species**  
(Figures 17, 18)

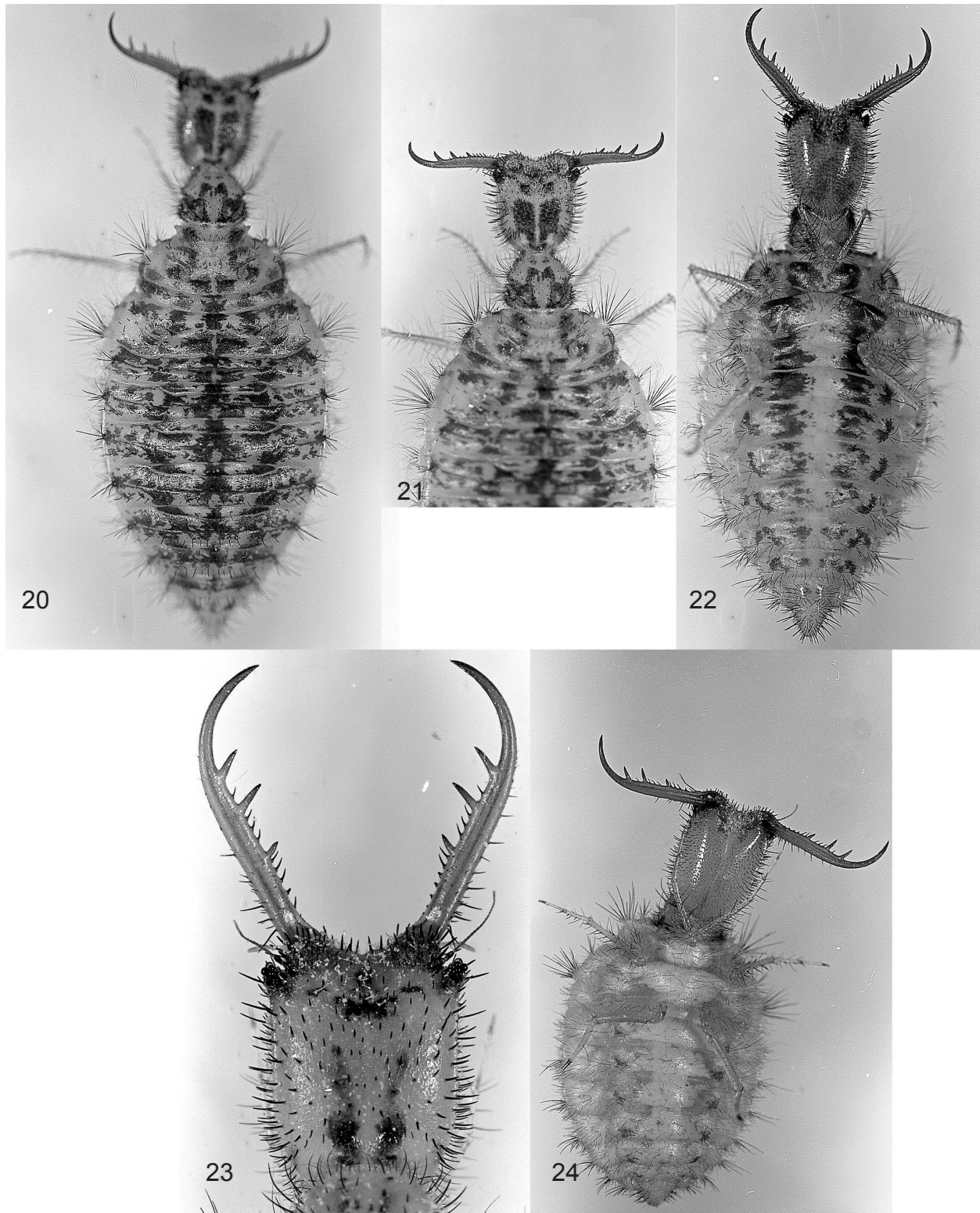
**Holotype male,** El Capa, 17 km. northeast of Vallejuelo, San Juan Province, Dominican Republic, 27.V.1986, Miller and Stange (FSCA).

**Diagnosis.** Pronotum without elongate white bristles at lateral margin (sometimes with black setae laterally which are shorter than those on forecoxa); midfemoral sense as long as that of forefemur, and about one-half as long as that of midfemur; basitarsus of hindleg about 3.0 times longer than greatest diameter, shorter than pretarsal claws which are shorter than tibial spurs which extend beyond apex of hind tarsomere II; forewing costal area without interconnected crossveins; female ectoproct upturned.

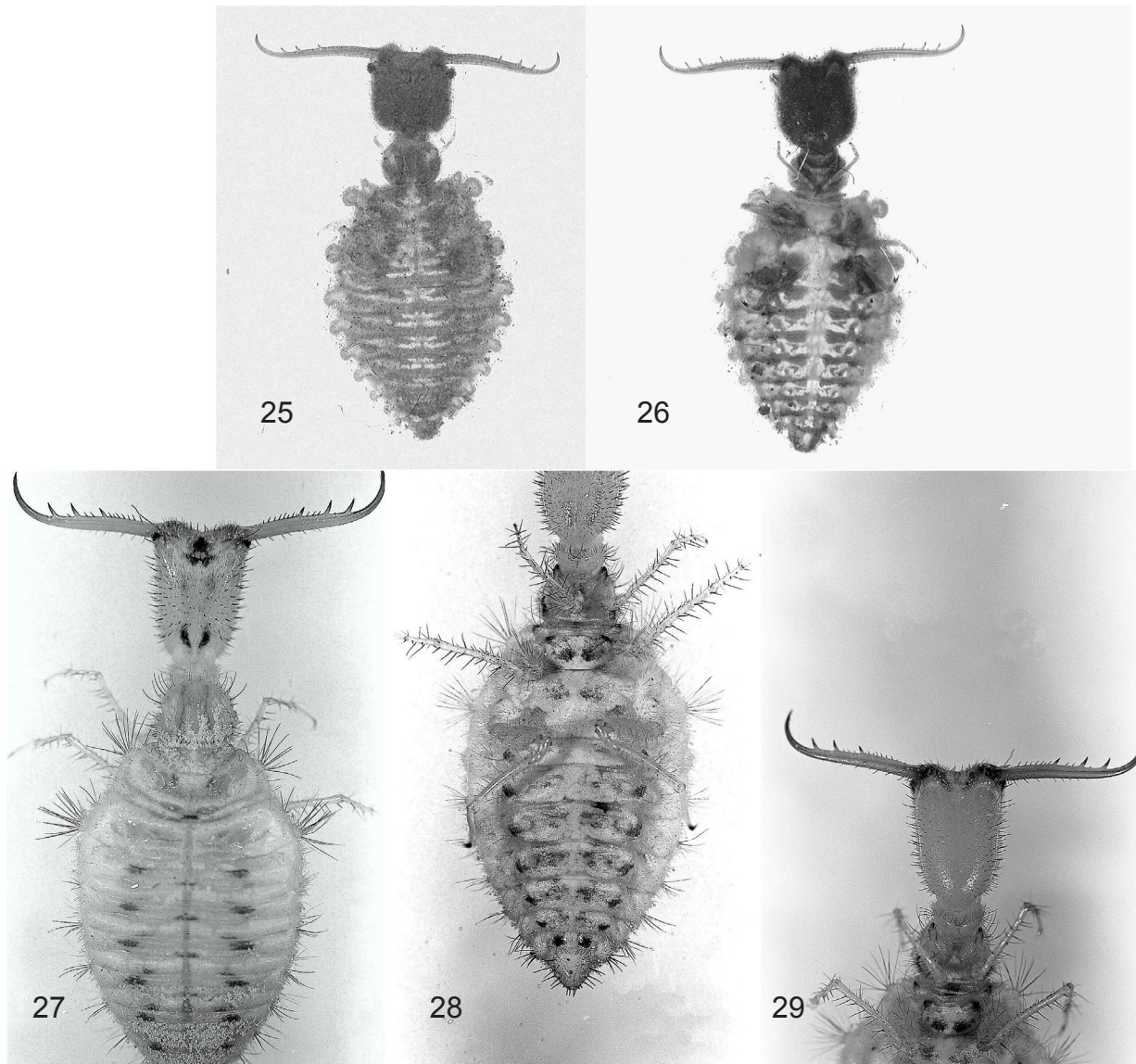
**Description. Holotype male:** body length 23 mm, forewing length 27 mm. **Coloration** dark brown; mouthparts pale brown with dark spot on stipes and lacinia; clypeus and labrum pale brown; large dark brown band under antennal bases, which fuses with smaller epicranial mark and encircles antennal bases laterally; anterior of row of dark brown scars consisting of dark brown sublateral band narrowly separating it from double dark brown spot at middle; middle row with broad submedial spot which is extended narrowly to posterior margin; antenna with scape pale brown with dark brown basal ring which is weak anteriorly, petiole with dark brown basal band interrupted anteriorly; flagellomeres with basal



**Figure 19.** *Purenleon woodruffi* Miller and Stange, adult male.



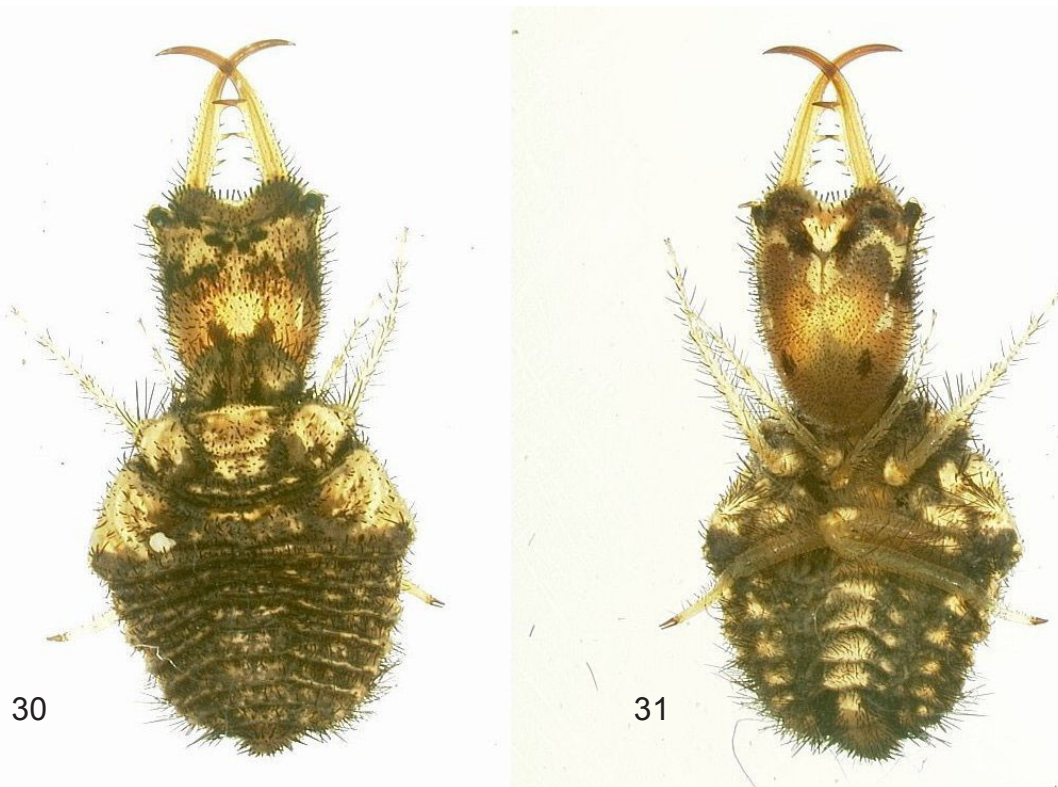
**Figures 20-24.** *Eremoleon* spp. larvae. **20-22)** *E. cerverai* (Navás). **20)** Dorsal view. **21)** Close-up of head. **22)** Ventral view. **23-24)** *E. cerverinus* (Navás). **23)** Dorsal view of head. **24)** Ventral view.



**Figures 25-29.** *Eremoleon* spp. larvae. **25-26)** *Eremoleon petrophila* Miller and Stange. **25)** Dorsal view. **26)** Ventral view. **27-29)** *Eremoleon phasma* Miller and Stange. **27)** Dorsal view. **28)** Ventral view. **29)** Ventral view of head.

half or more dark brown, becoming nearly all dark brown before clava; pronotum dark brown with weak median pale stripe, pale brown area submedially in furrow, pale brown sublaterally at middle extending to anterior margin, pale area posterolaterally; nota mostly dark brown with dark spot sublaterally on prescutum, scattered irregular pale areas, venter nearly all pale brown; forecoxa pale brown with two small dark brown areas on posterior face; mera dark brown; forefemur with broad subbasal dark area and apical dark brown area, closing face mostly pale brown; other femora with dark brown mostly restricted to apical area; foretibia and midtibia with three dark brown rings, subbasally, near middle and apically; femora and tibiae with some dark brown spots, especially at setal bases; tarsus with tarsomeres III and IV mostly dark brown, distal tarsomere dark brown apically; wing membrane with prominent rhagmal and cubital streaks, white stigma preceded by dark brown spots; subcostal area with some dark brown streaking; hindwing without suffusion; wing veins with alternate dark and pale brown areas; abdomen with tergites mostly dark brown with double pale brown spot posteriorly on tergite I, reduced pale brown areas on tergite II, tergites III to VIII with prominent pale streak submedially from near base to near middle, weakly connected at middle on tergites III and IV; sternites and terminalia mostly pale brown.





**Figure 30-31.** *Purenleon bistictus* (Hagen) larva. **30)** Dorsal view. **31)** Ventral view.

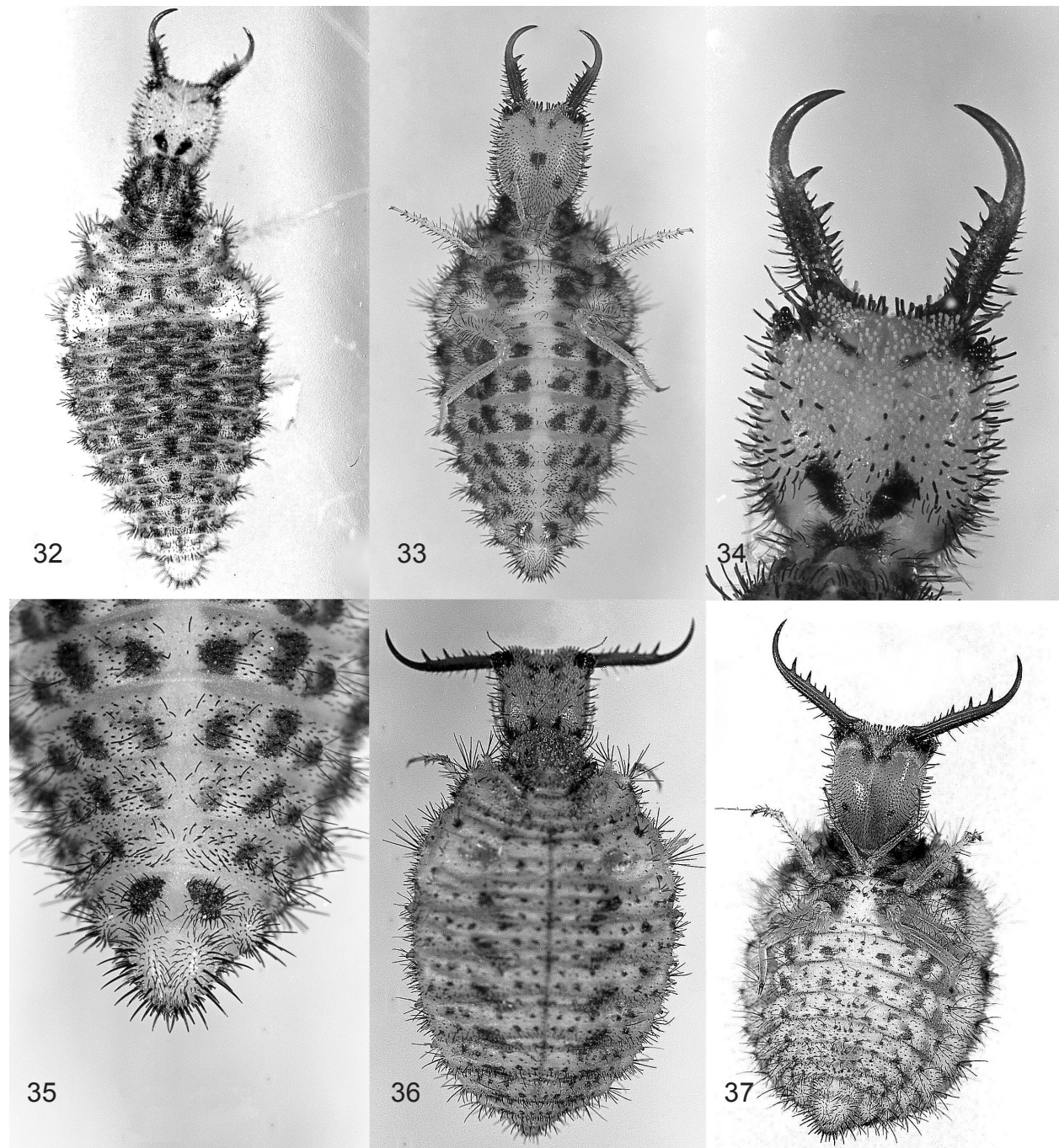
**Chaetotaxy:** pronotum and mesonotum without bristles, all setae shorter than those on forecoxa; forecoxa with a few elongate white bristles posteriorly nearly equal in length to greatest coxal diameter; midfemoral sense hair as long as forefemoral sense hair which is about  $3/4$  length of femur. **Structure:** forewing with costal cells simple, not interconnected, higher than wide above origin of radial sector; forewing vein CuP + 1A runs obliquely to hind margin along posterior fork of CuA at a point below origin of radial sector; midtibia slightly more swollen than foretibia; basitarsus of hindleg about 3.0 times longer than greatest diameter, shorter than pretarsal claws which are shorter than tibial spurs which extend beyond apex of hind tarsomere II; abdomen shorter than wings.

**Female.** About as in male except for terminalia. The ectoproct is upturned.

**Larva.** Head capsule light reddish; labial palpus longer than basal width of mandible; head much longer than wide (Figure 36), with dolichasters; ventral head capsule (Figure 37) with one pair of dark brown sublateral spots; mandible with several pale dolichasters on mesal margin near base; mesothoracic spiracle borne on tubercle.

**Paratypes. Dominican Republic: Monte Cristi Province:** 9 km. north Villa Elisa, 6.VI.1986, Miller and Stange (3m, 1f, FSCA, USNM); 17 km. south Monte Cristi, 2.X.1985, Woodruff and Stange, at blacklight (1m, 3f, FSCA); 3 km. north Villa Elisa, 17.VII.1986, Woodruff and Stange (1f, FSCA). **San Juan Province:** El Capa, 17 km. northeast of Vallejuelo, 27.V.1986, Miller and Stange (10m, 25f FSCA); El Capa, 1 km. on road to Vallejuelo, 21.V.1985, Núñez, Woodruff and Stange (13m, 20f, FSCA).

**Discussion.** This species can be distinguished from other *Purenleon* in Hispaniola except *P. woodruffi* by the complete lack of elongate bristle-like setae on the pronotum. The elongate midfemoral sense hair relates it to *P. minor* and *P. woodruffi*, which lack suffusion in the subcostal area. The hind basitarsus is about three times as long as middle diameter which is found also in *P. minor* but not in *P. woodruffi* which has the hind basitarsus about 2.5 times longer than middle diameter. The female terminalia are distinctive in *P. nunezi*. At El Capa after sunset, many dozens of adults began to fly and were concentrated in a small forest opening. This might have been a mating swarm. This has not be observed in other



**Figures 32-37.** *Purenleon* spp. larvae. **32-35)** *P. minor* Banks. **32)** Dorsal view. **33)** Ventral view. **34)** Close up of head. **35)** Close up of apex of abdomen (ventral view). **36-37)** *Purenleon woodruffi* Miller and Stange. **36)** Dorsal view. **37)** Ventral view.

species of *Purenleon*. Also, at the El Capa locality three females were collected which have different wing markings (Figure 18) than other specimens. In particular, the cubital stripe of most of the specimens is replaced by a large round dark brown spot. This might be a different species but male material is needed to resolve the problem. Larvae were found water deposited sand under rock overhangs in gullies.

**Etymology.** This species is named for the Dominican Republic entomologist, Carmelo Núñez, who assisted greatly in fieldwork.

***Purenleon woodruffi* Miller and Stange, new species**

(Figures 19, 36, 37)

**Holotype male**, 9 km. north of Villa Elisa, Monte Cristi Province, Dominican Republic, 24.VI.1986, R. Miller and L. Stange collectors (FSCA).

**Diagnosis.** Interantennal area pale brown; pronotum without elongate white bristles at lateral margin (sometimes with black setae laterally which are shorter than those on forecoxa); midfemoral sense hair as long as that of forefemur, about one-half as long as that of midfemur; basitarsus of hindleg 2.5 times longer than greatest diameter, much shorter than pretarsal claws; forewing costal area not suffused, without interconnected crossveins; female ectoproct not upturned.

**Description. Holotype male:** body length 26 mm; forewing length 30 mm. **Coloration:** pale brown; face pale brown with reduced dark brown band below antennal fossae, extending narrowly along mesal margin to merge with small dark brown area above antennal fossae; anterior row of vertex markings with sublateral dark band narrowly separated from double mesal mark; middle row of markings fainter, extending weakly to posterior margin, small dark spot at posterolateral margin; mouthparts pale brown except dark brown spot on stipes; antenna pale brown with small anterior mark on scape, dark brown marks on lateral and mesal margins of pedicel; basal dark brown band on flagellomeres (except basal one) before clava, more pronounced on lateral margins; pronotum pale brown with prominent double mark submesally enclosing completely pale area, small sublateral streak on basal one half; mesonotum about equally dark and pale brown with complex pattern; mesoscutellum with large submesal area enclosing pale brown spot, not reaching posterior margin; metanotum predominately dark brown; pleura mostly pale brown except mostly dark brown ventrally; forecoxa with two small dark brown areas near base and subapically; femora with dark brown subapical band, forefemur also with dark streak on lateral face; tibiae with apical dark brown band, foretibia and midtibia also with subbasal and medial bands; tarsus mostly pale brown with tarsomeres III and IV dark brown and distal tarsomere dark brown apically; wing membrane with prominent dark brown streak at rhexma, smaller one at cubitus; stigma whitish preceded by small dark brown area; wing veins and crossveins alternating pale and dark brown; abdomen with tergites mostly dark brown, pale brown on tergite II at anterior and posterior margins, tergites III-VI with double pale stripe at middle extending laterally toward posterior margin; apices narrowly pale brown. **Chaetotaxy:** pronotum with only inconspicuous setae that measure less than 1/2 length of forecoxal white setae which are restricted to ventral half of lateral margin and which are shorter than coxal width; midfemoral sense hair as long as that of forefemur which is over 3/4 length of femur. **Structure:** hindwing slightly longer than forewing; forewing with costal area with only one series of cells, those above radial sector higher than wide; forewing radial sector originates about at basal one-third; CuP + 1A runs to posterior margin a little beyond level of origin of radial sector; hind basitarsus about 2.5 times longer than greatest diameter, shorter than pretarsal claws; hindtibial spurs reach beyond apex of tarsomere II; abdomen much shorter than wings, ectoproct simple.

**Female.** About as described for male except for terminalia; ectoproct not upturned, posterior gonapophysis with many fine, light brown hair-like setae.

**Larva.** Head capsule tan colored; labial palpus longer than basal width of mandible; head much longer than wide (Figure 36), with dolichasters; ventral head capsule (Figure 37) with one pair of dark brown sublateral spots; mandible with several pale dolichasters on mesal margin near base; mesothoracic spiracle borne on tubercle.

**Paratypes. Dominican Republic. Monte Cristi Province:** 9 km. north of Villa Elisa, 4.VI.1986, reared, R. Miller and L. Stange collectors (7m, 6f, FSCA, USNM); 3 km. north of Villa Elisa, 1.X.1985, Woodruff and Stange (1m, 3f, FSCA).

**Discussion.** This species is structurally similar to *P. nunezi* but is lighter in coloration. It differs in having the hind basitarsus only 2.5 times longer than greatest width (about three times longer than greatest width in *P. nunezi* and *P. minor*). The simple female ectoproct is different than in *P. nunezi* and there are small differences in male genitalia. Larvae live under rock overhangs.

**Etymology.** This species is named for Robert E. Woodruff in recognition of his many contributions to our knowledge of the antlions of the Dominican Republic.

### Acknowledgments

Many thanks are due to Charles C. Porter and Catherine Tauber for their critical reviews of the manuscript. Mr. Joshua Jones provided many of the photographs of the adults. This is the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Entomology Contribution No. 1198.

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