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701

**Twenty-five new species of Costa Rican Limacodidae
(Lepidoptera: Zygaenoidea)**

MARC E. EPSTEIN & JORGE F. CORRALES



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Twenty-five new species of Costa Rican Limacodidae (Lepidoptera: Zygaenoidea)

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ABSTRACT

Twenty-five new species of neotropical Limacodidae, primarily from Central America, are described. The majority of these species (n=15) are from *Parasa* and *Natada* generic complexes, both presently known to contain only spiny caterpillars. In the *Parasa* complex, they include: *Parasa figueresi*, new species, *Parasa joanae*, new species, *Parasa sandrae*, new species, *Parasa shirleyae*, new species, *Euclea mesoamericana*, new species, *Euclea zurquicola*, new species, *Euclea microcippus*, new species, *Euclea costaricana*, new species, *Euclea gajentaani*, new species, *Euclea josepsi*, new species, *Talima beckeri*, new species, *Talima weissi*, new species, and *Talima erojasi*, new species. In the *Natada* complex, two new taxa are *Natada delgadoi*, new species, and *Natada varablancana*, new species. In a generic complex with hairy caterpillars, the *Phobetron* complex, six new taxa are: *Phobetron guzmanae*, new species, *Isochaetes dwagsi*, new species, *Isochaetes kenjii*, new species, *Isochaetes heevansi*, new species, *Isochaetes tapantiensis*, new species, and *Vipsophobetron davis*, new species. In the *Prolimacodes* and *Perola* complexes, caterpillars are known to be smooth. New species in the *Prolimacodes* complex are *Prolimacodes montanus*, new species, and *Dichromapteryx saborioi*, new species, while the *Perola* complex includes *Perola aenea*, new species, and *Epiperola browni*, new species. *Euclea microcippus*, *Parasa sandrae* and *Vipsophobetron davis* are the smallest species known to occur in their genera. *Euclea mesoamericana* and *Parasa figueresi* are relatively common in collections but have been mistakenly grouped with *Euclea cippus* (Cramer) and *Parasa schausi* Dyar, respectively. Each was reported from both Central and South America, but is now considered to be limited to South America. *Talima weissi* is closely related to the Mexican species *T. assimilis* (Dyar), sharing both a detachable clump of hairs on 8th abdominal segment in males and large ductus seminalis, which hold the hairs, in females. Larval descriptions or hostplants are presented for *P. sandrae*, *P. joanae*, *E. mesoamericana*, *E. gajentaani*, *T. beckeri*, *T. weissi*, *I. dwagsi*, *I. kenjii*, *I. heevansi*, and *V. davis*. *Euclea zurquicola*, *E. josepsi*, *T. erojasi*, *N. delgadoi*, *N. varablancana*, *P. guzmanae*, *I. tapantiensis*, and *E. browni* are known from only one locality, each in Costa Rica, while the last four are known only from unique specimens.

Key words: Insecta, Lepidoptera, Limacodidae, new species, larval descriptions, larval hostplants, parasitoids, *Parasa* complex, *Natada* complex, *Phobetron* complex, *Prolimacodes* complex, *Perola* complex, *Parasa*, *Euclea*, *Talima*, *Natada*, *Prolimacodes*, *Dichromapteryx*, *Perola*, *Epiperola*, Costa Rica, Mexico, Central America, South America

INTRODUCTION

This is the last in a series of four papers on new neotropical species of Limacodidae, primarily known from Costa Rica (Corrales and Epstein 1997, 2000, 2004). All of the species treated here have been found in Costa Rica and in some cases from elsewhere in Latin America. The new species are organized by generic complexes (*sensu* Epstein 1996), defined by a combination of immature and adult stages. In some cases the larva is not known (e.g., *Dichromapteryx* Dyar), so the placement in a generic complex is provisional. Complexes with spiny (= nettle) caterpillars will be presented first, followed by those with hairy caterpillars, and finally those with smooth (=gelatine) caterpillars.

MATERIALS AND METHODS

Specimens examined in this study are from the following collections: American Museum of Natural History, New York (AMNH); The Natural History Museum, London (BMNH); California Academy of Sciences, San Francisco (CAS); Florida State Collection of Arthropods, Gainesville (FSCA); Instituto Nacional de Biodiversidad (INBio); Natural History Museum of Los Angeles Co. (LACM); Museum of Comparative Zoology, Harvard University (MCZ); San Diego Museum of Natural History (SDM); Vitor O. Becker private collection, Brasilia, Brazil (VOB); Essig Museum of Entomology, University of California, Berkeley (UCB); Bohart Collection, University of California, Davis (UCD); Universidad Nacional de Autonomía de México (UNAM); National Museum of Natural History, Smithsonian Institution (USNM). Paratypes or additional voucher material not found in the USNM and INBio collections will be deposited at each institution following the completion of a book on the Limacodidae of Costa Rica. Bar codes indicated under "Material Examined" are for data base purposes only and do not indicate the collection of deposition. For brevity, we report multiple bar codes with similar label data as either INBIOCRI: ##### or USNM ENT: #####. The bar codes on actual specimens have the prefix INBIOCRI 00(0) or INB00 for INBio bar codes, or USNM ENT 00. Alpha-numeric codes for specimens from the Essig Museum of Entomology are abbreviated EMEC #####. Specimens that were reared in Guanacaste National Park by Janzen, Hallwachs, and the gusaneros (= wormers) are indicated by year-SRNP-number (e.g., 01-SRNP-377).

Terminology for wing veins, genitalia, and caterpillars follows Epstein (1988, 1996). The male uncus is illustrated without the dense setae along the membranous lateral portions. Descriptions of the caterpillars were done by Epstein and are based primarily on photographs by Janzen and Corrales. Some aspects of the caterpillar form were inferred from studying congeneric specimens in alcohol or cast skins, and the literature.

The color figures of adults presented here are from electronic images. Those in the text have no modifications of the wings or body, in order to accurately render actual specimens, either holo- or paratypes. In contrast, the color plates of the adults (Figs. 1–55) are

considered to be photo-illustrations. The wing and body damage was “repaired” using Adobe Photoshop, with the goal of facilitating identification. The genitalia were illustrated by Alejandro Herrera unless otherwise noted in the figure legends.

SYSTEMATICS

PARASA complex

The *Parasa* complex is a pantropical group of limacodid genera characterized by larvae with deciduous spine patches at the base of dorsal scoli A8 and A9 (Dyar 1899; Epstein 1988). The type species of *Parasa* Moore, *Parasa chloris* (Herrich-Schäffer) is a New World species with close relatives in the Neotropical Region. There has been disagreement whether similar Old World species with green patches on the forewing, green scales on the thoracic dorsum, and basally bipectinate male antennae should be placed in *Parasa* (Holloway 1986) or *Latoia* Guérin (Cai 1983). The New World *Parasa* complex also includes *Euclea* Hübner, *Acharia* Hübner (= *Sibine*), *Adoneta* Clemens, *Monoleuca* Grote & Robinson, *Talima* Walker, *Paraclea* Dyar, and *Zaparasa* Dyar (Epstein 1996; Epstein 1988). The pantropical genus *Miresa* Walker appears to be closely related to the *Parasa* complex.

Adults in the New World *Parasa* complex usually have a male antenna that is bipectinate along the basal half, while in the female it is always filiform. The forewing has a wide variety of colors and patterns, with green found only in *Parasa*, *Paraclea*, *Zaparasa*, and *Euclea*. Forewing R₃ and R₄ are always stalked off of R₅. Proboscis ranges from longer than basal segment of the labial palpus to absent, often longer in females than males. The third segment of the labial palpus is short, attached either at the apex of the second segment or medially. Tibial spurs are always 0-2-2. Male genitalia have an uncus with a downcurved claw at the apex rather than to the anterior, as often occurs in *Prolimacodes* Schaus, *Phobetron* Hübner, *Natada* Walker, and *Apoda* complexes (Epstein 1988). Female genitalia are of the bisignate type (Holloway 1986; Epstein 1988).

All species in the *Parasa* complex have spiny caterpillars, and many have scoli and brightly colored central bands or ovals along the back (e.g., saddleback caterpillars). The dorsal scoli tend to be longer near the front and rear of the body, though the scoli tend to become more equal in length during the last stages before spinning a cocoon.

In this paper we add 13 new species to the 130 neotropical species in the *Parasa* complex (Becker and Epstein 1995).

Genus *Parasa* Moore

There are presently 29 species of *Parasa* in the New World, a net increase of four species described herein. The green scales on the forewing make *Parasa* one of the most colorful

genera of Limacodidae. In Costa Rica, *Parasa* is distinguished from other limacodid genera with green on the forewings by presence of green piliform scales on thorax and head. Two other Neotropical genera, *Paraclea* and *Zaparasa*, share this feature, however, both are likely to be synonyms of *Parasa*. Often there is a narrow line of brown scales down the middle of the thorax, with vertex of head green and frons and labial palpus brown. The green on the forewing in *Parasa* can cover most of the wing or be in the form of bands or spots. Several species have green bands, but only in the females (e.g., *P. cebrenis* (Schaus), *P. figueresi*, and *P. viridogrisea* (Dyar)). The hindwing may be yellow, dark brown or divided between the two extremes. The male antenna, while typically bipectinate along the basal half, can be pectinate to near the apex (e.g., *P. viridiplena* (Walker)). All species of *Parasa* known to occur in Costa Rica have bipectinate antennae along the basal half except *P. macrodonta* Hering & Hopp and *P. sandrae*, which are bipectinate beyond. Male genitalia of *Parasa* have an indistinct claw at the uncus apex, which is not strongly downcurved and is without lateral lobes. The absence of these lobes distinguishes *Parasa* species from a number of *Talima* and *Euclea* species. Transtilla can be either simple or have elongate, hairy, bifurcate processes that can evert (e.g., *P. figueresi*). Female genitalia are variable, with the ductus bursae long, short or coiled. The signum is present in only a few known species in the Neotropics. Papillae anales are strongly narrowed along margins below the midpoint, as is typical in the *Parasa* complex, though perhaps moreso than in the other genera. Anterior apophyses are normal in length or very short. The lateral lobes of the 8th segment are present in most species.

Caterpillars for New World *Parasa* are not known to have wide, bright-colored bands or ovals lengthwise along the midline of the dorsum as in *Euclea*, *Talima*, or *Acharia*. There are two basic forms. The first type is rather typical of the *Parasa* complex: elongate scoli on the anterior and posterior end, with four deciduous spine patches. They have a pair of longitudinal dorsal stripes between the A1 and A6 scoli of the body or across each of these same segments (e.g., *P. wellesca* Dyar, *P. joanae*, *P. sandrae*, and *P. macrodonta*). The second type is distinctive in the dorsal hump on the anterior end, drab coloration, scoli and their spines held close to the body, and absent or inconspicuous deciduous spine patches on the posterior scoli. In late instars there is a fusion of the normal scoli on the A9 segment (*P. chloris*, see Dyar 1897; *P. minima* Schaus [=*P. cuernavaca* Dyar], *P. viridogrisea*, *P. cebrenis*, see images in Janzen and Hallwachs 2004).

***Parasa figueresi* Corrales and Epstein, new species**

Figs. 9, 10, 56, 68

Diagnosis. Sexually dimorphic; male has dark brown, narrow forewing and small, partially clear hindwing; female has forewing green band and scaled hindwing. In Costa Rica, male *Parasa cebrenis* has same wing pattern, thus cannot be distinguished without genitalic dis-

section. *P. figueresi* has simple, yellowish line present at base of fringe on both wings rather than yellowish orange spots at junction of wing veins along outer margin, as in *P. cebrenis*. Aedeagus of *P. figueresi* differs from *P. cebrenis* by presence of single coiled process on distal arm rather than u-shaped process. Female genitalia differ from *P. cebrenis* by presence of a lobe posterior to ostium bursae and more expanded 8th segment, wrinkled laterad and dorsad.

Holotype ♂ *Parasa figueresi*Paratype ♀ *Parasa figueresi* (INBIOCRI001665743)

Description. Forewing length 9.1–10.7 mm (male); 12.4–14.6 mm (female). Male forewing (Fig. 9) narrow and dark, with faint marginal and medial bands of charcoal and warmer brown. Male hindwing with translucent medial patch from base to outer margin; inner and costal margins with dark, pilose scale borders. Faint yellow line along outer margin of forewing and hindwing (barely visible in old or damaged specimens). Female forewing (Fig. 10) brown with medial green band delineated on inner and outer border by reddish brown line; green extends to base of wing along inner margin. Thorax green with scarcely visible brown longitudinal line in middle. Male antenna bipectinate along basal half. Labial palpus short, approximately equal to vertical eye width; with brown scales. Proboscis present in both sexes. Frons and vertex with brown scales. Forecoxa with dark scales, in contrast to lighter yellow brown scales on remainder of leg. Dense, pilose scales of dorsal tibia and tarsi light yellow brown on midleg contrasting with dark pilose scales on dorsal hindleg. Dorsal abdomen dark brown, with red brown at posterior end.

Male genitalia (Fig. 56): truncate uncus apex with short claw and hint of lateral lobes. Posterior arm of gnathos flattened above. Valva triangulate with apex rounded, upcurved, extended beyond uncus; inner surface has clump of long, wide setae, midway between dorsum and ventrum. Transtilla with pair of elongate lobes, either projecting anterior-ventral in repose or to posterior (see Fig. 56). Juxta a setose horizontal plate divided and upcurved in apical third, reaching margin of valva below. Aedeagus with basal and distal arms at right angles, approximately equal in length, with rounded hump on dorsum at junction of arms; distal arm a long, narrow upcurved process with blunt apex and coiled dorsal process. Vesica without cornuti; extrudes between base of dorsal process and apex of distal arm. Saccus simple.

Female genitalia (Fig. 68): straight ductus bursae. Ductus seminalis connected at distal end of antrum, third distance between ostium bursae and corpus bursae. Antrum has longitudinal ridges and recurved at distal end. Corpus bursae wrinkled and ovoid; signum absent. Ventral part of 8th segment divided into anterior part with ostium bursae near margin, followed by contiguous conical lobe to posterior; posterior part of ventrum raised and extends to ventral margin of papillae anales. Lateral and dorsal margins of 8th segment sclerotized and granulate in texture. Lateral lobe of 8th segment in recessed depression above anterior apophysis. Papillae anales with dorsal lobes triangulate, with apex directed dorsad. Anterior apophysis roughly third width of 8th segment.

Remarks. *Parasa figueresi* belongs in the same species complex as *P. chloris*, the type species of the genus *Parasa*. Many of the species in this group are sexually dimorphic, though *P. chloris* is one of the exceptions. Although the immature stages are not known for *P. figueresi*, it is almost certain to have a caterpillar with recessed scoli that splay out when attacked, and hump-backed at the anterior end, sloping downward to the posterior.

There are other species that are difficult to separate from *P. figueresi* besides *P. cebre-nis*. These include *P. schausi*, whose type locality is French Guiana and does not occur in Central America. Males of *P. figueresi* can be separated from *P. schausi* by having a more elongate uncus and gnathos; in *P. schausi* they are short and triangulate. The distal arm of the aedeagus of *P. figueresi* has a single coiled process, whereas *P. schausi* has an uncurved, blunt process. Males of *P. figueresi* are similar to *P. viridogrisea*, but differ in the forewing by having no line in the median region and are more uniformly colored. Females of *P. figueresi* are similar to those of *P. viridogrisea* and *P. minima*, but can be separated by presence of a faint yellow line along forewing and hindwing borders in marginal area.

Etymology. This species honors José María Figueres, President of Costa Rica 1974–1978, for his foresight in promoting the quest of a sustainable development model for the country in alliance with nature, and his interest and support of INBio and the country's biodiversity conservation efforts.

Distribution. *Parasa figueresi* is known from Costa Rica to Panama. In Costa Rica this species is known from lowlands along the Pacific Coast, from the Osa Peninsula to Manuel Antonio, to 800 m and 1200 m in Guanacaste and San José Provinces. There are only three lowland records from the Caribbean slope, two from La Selva and another from Limón Province.

Material examined. 36 specimens (21 ♂, 15 ♀).

Holotype ♂, Costa Rica: Puntarenas Province: Rancho Quemado, Peninsula de Osa, 200m, F. Quesada, Sep 1991, (INBio), (INBIOCRI 001190171).

Paratypes. Costa Rica: Guanacaste Province: Monte Alto, Sector Mirador, 700–800m, 1 ♂, H. Mendez, 13–18 Nov 2001, (INBio), (INBIOCRI 003400995), Santa Cruz, Bosque Nacional Diríá, Retallano, Alrededor torre de control de incendio, 600–700m, 1 ♂, H. Mendez, 15–18 Sep 2001, (INBio), (INBIOCRI 003375791); Heredia Province: Estación

Biología La Selva, 50–150m, 1 ♂, D.L. Wagner, Jan 2000, (INBio), (INBIOCRI 002723632), 1 ♀, M. Volovski, 21–30 Jun 2003, (INBio), (INB0003243318); Limón Province: A.C. Llanuras del Tortuguero, Pococí, Río Sardinas, Barra del Colorado, 0–100m, 1 ♀, F. Araya, 11–19 Oct 1993, (INBio), (INBIOCRI 001632151); Puntarenas Province: Aguirre, Quepos, P. N. Manuel Antonio, 0–100m, 1 ♂, G. Varela, Aug 1991, 2 ♂, Nov 1992, (INBio), (INBIOCRI: 1317368, 821696, 821699), Estación Esquinas, Península de Osa, 0–100m, 2 ♀, J. Quesada, Dec 1993, M. Segura, Oct 1993, (INBio), (INBIOCRI: 1827142, 1665743), Garabito, Reserva Biol Carara, Estación Quebrada Bonita, 0–100m, 2 ♀, R. Guzmán, Oct 1994, J.C. Saborio, Sep. 1992, (INBio), (INBIOCRI: 2118178, 961465), Golfito, Jiménez, Albergue Cerro de Oro, 100–200m, 1 ♂, L. Angulo, 16–20 May 1996, (INBio), (INBIOCRI 002454456), Golfito, P.N. Piedras Blancas, Estación El Bonito, 100–200m, 1 ♂, M. Moraga, Jan–Feb 2002, (INBio), (INBIOCRI 003434816), Rancho Quemado, Península de Osa, 200m, 4 ♂, F. Quesada, Dec 1991, Dec 1992, Sep 1991 [same label data as holotype], Jul 1992, (INBio), (INBIOCRI: 345910, 906103, 1190170, 928530), 2 ♀, J. Quesada, M. Segura, Jul 1992, (INBio), (INBIOCRI: 731208, 928532), P. N. Manuel Antonio 120 m, Quepos, 0–100m, 1 ♂, G. Varela, Nov 1990, (INBio), (INBIOCRI 000533044), Rincon, 1.8 mi W, Osa Peninsula, 1 ♂, 2 ♀, J.P. Donahue & C.L. Hogue, 3 Feb 1971, (LACM), (INBIOCRI: 1120823, 1120827, 1121291), Rio Bonito, 100–200m, 1 ♂, M. Segura, Nov 1993, (INBio), (INBIOCRI 001938807); San José Province: Estación Bijagual, 600 m. N de Bijagualito, 400–500m, 1 ♂, J.C. Saborio, Jul 1995, (INBio), (INBIOCRI 002206388), Estación Santa Elena, Las Nubes, 1200–1300m, 1 ♂, E. Alfaro, 13–14 Nov 1996, (INBio), (INBIOCRI 002484101); Panama: Barro Colorado Island: 1 ♂, D.Q. Cavagnaro & M.E. Irwin, 24 Jul 1963, (CAS), (USNM ENT: 171304), 3 ♀, S.S. & W.D. Duckworth, 1–9 May 1964, (USNM), N. McFarland, 15 Jul 1958, (LACM), R.B. & L.S. Kimsey, 5 Jul 1972, (UCD), (INBIOCRI: 1121292-94); Canal Zone, Coco Solo, R.E. Ludwig, 1946–47, 2 ♂, 2 ♀, (CAS), (USNM ENT: 171305-08).

***Parasa sandrae* Corrales and Epstein, new species**

Figs. 1, 11–14, 57, 69



Diagnosis. Among smallest New World species of *Parasa*, most easily confused with *Euclea microcippus* (see below). Separated from *E. microcippus* by having green scales on thoracic dorsum and more green scales beyond discal cell (as a patch or spots) than basally.

← Holotype ♂ *Parasa sandrae*

Description. Forewing length 6.5–8.0 mm (male); 9.7–14.0 mm (female). Forewing light to dark brown with green patch extended from median of costal margin towards tornus along end of discal cell; male green patch either partially divided (lowland) from distal side by small dark spot (Fig. 11) or completely divided into two spots (upland) (Fig. 12). Second green patch occurs at base below discal cell. Female with (Fig. 13) or without (Fig. 14) small dark spot in subapical green patch. Hindwing brown. Male antenna bipectinate from base to beyond midpoint. Head with green vertex; frons dark brown. Labial palpus yellowish orange on ventrum, brown on dorsum; >1.5x length of vertical eye width. Proboscis absent. Thoracic dorsum dark brown along lateral margin, including tegula, with green collar; posterior green patches on each side of dark brown median. Ventral part of body cream. Foreleg and midleg with coxa and femur with cream scales; dorsum of tibia and tarsi with long, dark brown scales; hindleg with dark brown scales only on tarsi.

Male genitalia (Fig. 57): uncus narrow, drawn into a slightly downcurved spine at apex. Gnathos parallel, equal length to uncus; flat, increasing in width from base of transverse portion to near distal end of rounded apex (spoonshaped) (see Fig. 57). Valva triangulate at base, more digitate proximal to apex; groups of several long downward directed setae on ventral margin, third distance from base; inner portion with scattered setae; parallel longitudinal ridge from base near dorsal margin extending two-thirds distance to apex. Transtilla a small membranous cap above anellus. Juxta a simple vertical plate. Aedeagus curved approximately 45° in basal third, distal end with two short dorsolateral spines near apex; apex upcurved from below. Saccus a rounded lobe directed to anterior.

Female genitalia (Fig. 69): ductus bursae long, narrow and straight, except curved antrum; corpus bursae small, around sixth length of ductus bursae; signum absent. Ductus seminalis connected to ductus bursae beyond distal end of antrum at distance equal in length to antrum. Antrum weakly sclerotized and short. Papillae anales with lateral margin of ventral lobe extended as wide as dorsal lobe; ventral lobe about two-thirds length of dorsal. Anterior apophysis well developed and directed towards anterior, about a third length of distance between ostium and apophysis. Lateral lobes on 8th segment normal. Small lobes with tufts of setae on laterodorsal surface near lateral lobes.

Larva. Late instar caterpillars (Fig. 1) yellowish green with yellow-orange hyperbolic bands on dorsum edged with turquoise band on outer margin; line along inner border nearly black. D scoli on dorsum of segments A1 and A7 most prominent; purple above with black spines (late instars). Thorax and base of D scoli on A1 in late instars blue green compared to yellowish green in early instars. In lateral view, particularly in late instars, caterpillars of *P. sandrae* “tallest” on A1, sloping downward toward posterior end as in *P. chloris* and related species. Four posterior deciduous spine patches present; caltrops on dorsal apices of lateral SD scoli.

Larval host plants. *Parasa sandrae* has been found on 27 plant families (175 records).

These include: Anacardiaceae, Aquifoliaceae, Araliaceae, Bignoniaceae, Celastraceae, Clethraceae, Euphorbiaceae, Flacourtiaceae, Hippocastanaceae, Icacinaceae, Lauraceae, Melastomataceae, Meliaceae, Myrsinaceae, Myrtaceae, Ochnaceae, Olacaceae, Piperaceae, Rosaceae, Rubiaceae, Rutaceae, Sabiaceae, Sapindaceae, Simaroubaceae, Solanaceae, Theophrastaceae, and Tiliaceae. Among the five most common records are: *Pentagonia donnell-smithii* (Rubiaceae)(n = 51), *Quassia amara* (Simaroubaceae)(n = 17), *Prunus annularis* (Rosaceae)(n = 15), *Meliosma glabrata* (Sabiaceae)(n=10), *Randia grandifolia* (Rubiaceae)(n = 6) (all records from: D. H. Janzen and W. Hallwachs 2004).

Parasitoids. Bombyliid sp., Tachinid spp. (n=5), *Uramya* spp. (Tachinidae; n=7; det. D.M. Wood), (all records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. *Parasa sandrae* exhibits an unusual amount of size difference for *Parasa* species with green on the forewing in both sexes. The smaller males are the smallest in the genus. Genitalia of both sexes are similar to the type species of monotypic genus *Paraclea*, *P. pretiosa* (Strecker) (Epstein 1988). However, we place the new species in *Parasa* because of the similarity of the larva of *P. sandrae* to several *Parasa* species (e.g., *P. joanae*, *P. wellesca*) and the possibility that *Paraclea* and *Parasa* are synonyms. The presence of dark brown scales on the thorax, with only green patches, is similar to the condition found in *P. macrodonta*.

This is one of several limacodid species in which more adult specimens have been reared from caterpillars from the ACG (Área Conservación de Guanacaste) than have been captured at lights in Costa Rica. Females were only known from few specimens that came to lights prior to the discovery of the caterpillars.

Etymology. The second author names this species in honor of his wife and longtime friend, supporter and nature lover.

Distribution. *Parasa sandrae* has been found in Costa Rica and Panama. It occurs from around sea level to 1500 m. In Costa Rica lowland records have been only on the Pacific slope.

Material examined. 91 specimens (40 ♂, 51 ♀).

Holotype ♂. Costa Rica: Puntarenas: Estación Quebrada Bonita, R.B. Carara, 50m, R.M. Guzmán, Apr 1993, (INBio), (INBIOCRI 001115830).

Paratypes. Panama: Barro Colorado Isl, 2 ♂, S.S. & W.D. Duckworth, 1–9 May 1964, (USNM), (INBIOCRI: 1120790-91); 1 ♂, R.B. Kimsey, 24 Jul 1963, (UCD), (USNM ENT: 171309); Costa Rica: Alajuela Province: Finca San Gabriel, (16 km ENE Quebrada Grande), 1 ♂, D.H. Janzen & W. Hallwachs, 9 Mar 1984, (USNM), (INBIOCRI 001120792), Upala, Sector San Ramón de Dos Ríos, 1.5 km NW Hacienda Nueva Zelândia, 600–700m, 1 ♀, C. Cano, 28 Apr–11 May 1995, (INBio), (INBIOCRI 002386346); Cartago Province: A.C.L.A.P, Paraíso, P.N. Tapantí, Estación Quebrada Segundo, Send Arboles Caídos, 1200–1300m, 1 ♂, R. Delgado, Oct 1999, (INBio), (INBIOCRI 003041792), Turrialba, 600m, 1 ♂, V.O. Becker, 8 Apr 1973, (VOB), (USNM ENT: 169683), Rio Aquiares, nr Santa Cruz, 9 air km NW Turrialba, 1500m, J. Powell, 1 ♂, 8

Jun 1988, (UCB), (EMEC 51006); Puntarenas Province: A.C.L.A.P, Coto Brus, Estación Biol Las Alturas, 1300–1400m, 1 ♂, 1 ♀, A. Sourakov, 12 Jul 1992, (INBio), (INBIOCRI: 1121397, 1148945), Estación Quebrada Bonita, R.B. Carara, 50m, 2 ♂, J.C. Saborio, May 1993, Apr 1993, (INBio), (INBIOCRI: 1115611, 1115813), 1 ♂, R.M. Guzmán, Sep 1994, (INBio), (INBIOCRI 001121280)[note: specimens from type locality], Golfito, 1 ♂, P. & D. Allen, 1948, (MCZ), (USNM ENT: 169682), Estación Quebrada Bonita, Res Biol Carara, 50m, 1 ♂, J.C. Saborio, Oct 1994, (INBio), (INBIOCRI 002045244); Guanacaste Province: Estación Cacao, 1000–1100m, 1 ♀, M. Ortiz, 21–29 May 1992, (INBio), (INBIOCRI 001109442), Liberia, Mayorga, Estación Cacao, 2 km SW de Cerro Cacao, 900–1000m, 1 ♂, C. Chavez, Sep 1991, (INBio), (INBIOCRI 000356941); Parque Nacional Guanacaste: Corrales Viejos, 495m, 1 ♂, F. Quesada, Aug 2001, (01-SRNP-2421), 1 ♀, G. Sihezar, Nov 2001, (01-SRNP-3962), Gmelina Bufalo, 560m, 1 ♀, G. Sihezar, Jan 1998, (97-SRNP-7135), Potrero Argentina, 520m, 2 ♀, F. Quesada, Nov 2001, (01-SRNP-3902), G. Sihezar, Dec 2001, (01-SRNP-3939), Quebrada Cementerio, 700m, 1 ♀, G. Sihezar, Nov 2001, (01-SRNP-3886), Rio Blanco Abajo, 500m, 1 ♀, A. Vincent, Oct 2002, (02-SRNP-19369), 1 ♂, T. Prescott, May 2002, (02-SRNP-1079), Rio Cucaracho, 640m, 2 ♀, C. Cano, Aug 2001, (01-SRNP-401), Oct 2002, (02-SRNP-19199), 1 ♀, O. Espinoza, Jun 1998, (98-SRNP-6264), Rio Sabalo, 1 ♀, 1 ♂, L. Ríos, Aug 2002, (02-SRNP-27361), (02-SRNP-27360), Sendero Arenales, 1080m, 1 ♂, F. Quesada, Apr 2003, (02-SRNP-24417), 1 ♀, 2 ♂, H. Ramirez, Aug 1999 (99-SRNP-1020), Sep 2002, (02-SRNP-23303), Apr 2003, (02-SRNP-24241), 1 ♀, M. Pereira, Aug 1998, (98-SRNP-3229), 1 ♂, R. Moraga, Jul 1997, (97-SRNP-1202), Sendero Bejuquilla, 280m, 1 ♀, 3 ♂, L. Ríos, Dec 2001, (01-SRNP-11794), Oct 2001, (01-SRNP-11257), Oct 1998, (98-SRNP-13665), Nov 1998, (98-SRNP-13666), 2 ♀, R. Moraga, May 1999, (98-SRNP-14252), (98-SRNP-14255), Sendero Circular, 1185m, ♀, H. Ramirez, Sep 1998, (98-SRNP-3277), 1 ♀, R. Franco, Apr 1999, (97-SRNP-11015), Sendero Corredor, 620m, 2 ♀, C. Cano, Apr 2000, (00-SRNP-565), Nov 2002, (02-SRNP-19593), 1 ♀, D.H. Janzen, Aug 2001, (01-SRNP-2403), 3 ♀, F. Quesada, May 2002, (02-SRNP-905), Aug 1999, (99-SRNP-12420), Nov 1999, (99-SRNP-13271), 1 ♂, F. Quesada, Nov 1999, (99-SRNP-13270), 2 ♀, G. Sihezar, Mar 2002, (02-SRNP-888), Nov 1999, (99-SRNP-13348), 4 ♂, G. Sihezar, Dec 2002, (02-SRNP-19930), Aug 1999, (99-SRNP-12495), Aug 1999, (99-SRNP-12497), Nov 1999, (99-SRNP-13349), 1 ♀, gusaneros, Mar 2001, (01-SRNP-192), 2 ♀, O. Espinoza, Nov 2000, (00-SRNP-21632), Nov 1999, (99-SRNP-13231), Sendero Derrumbe, 1220m, 2 ♀, F. Quesada, Sep 2002, (02-SRNP-23317), Oct 2002, (02-SRNP-23399), 1 ♀, H. Ramirez, May 2001, (00-SRNP-23634) 1 ♀, M. Pereira, Apr 1999, (98-SRNP-15984), Sendero Nayo, 1090m, 1 ♀, 1 ♂, A. Guadamuz, Aug 1997, (97-SRNP-1565), Aug 1997, (97-SRNP-1564), 2 ♀, R. Franco, May 1998, (97-SRNP-11111), Aug 1997, (97-SRNP-1454), Sendero Palmas, 1 ♀, J. Perez, Nov 2001, (01-SRNP-5895), Sendero Perdido, 620m, 1 ♂, C. Cano, Nov 2001, (01-SRNP-3572), 1 ♀, F. Quesada, Nov 1999, (99-SRNP-13171), 2 ♀, G. Sihezar, Jan 2001, (00-SRNP-22088), Apr 2000, (00-SRNP-867), 1 ♀, O. Espinoza,

Nov 1999, (99-SRNP-13236), Sendero Pinyal, 620m, 1 ♀, F. Quesada, Aug 1999, (99-SRNP-12165), 1 ♀, 3 ♂, G. Sihezar, Dec 1998, (98-SRNP-14998), Mar 2001, (01-SRNP-311), Mar 2001, (01-SRNP-312), Nov 1998, (98-SRNP-14917), Sendero Tigre, 260m, 3 ♀, 3 ♂, L. Ríos, Oct 2001, (01-SRNP-11206), Aug 2001, (01-SRNP-9785), May 1999, (98-SRNP-14318), Nov 2001, (01-SRNP-11403), May 1999, (98-SRNP-14319), Apr 1999, (99-SRNP-2052), Sendero Vivero, 730m, 1 ♀, 1 ♂, G. Sihezar, Aug 1998, (98-SRNP-6960), Aug 1998, (98-SRNP-6961), Sitio San Geronimo, 680m, 1 ♀, O. Espinoza, Nov 1999, (99-SRNP-13380), Trocha, 1 ♀, F. Vargas, May 2002, (02-SRNP-6342), Vado Cucaracho, 1 ♂, G. Sihezar, Dec 2001, (01-SRNP-22743).

***Parasa joanae* Epstein, new species**

Figs. 2, 15-16, 58, 70



Holotype ♂ *Parasa joanae*

Diagnosis. Green forewing similar to *Parasa constricta* Druce, but has marginal band with smoother inner border and subapical indentation (toward base). *Parasa joanae* is separated from similar dark hindwing forms of *P. wellesca* by presence of faint green discal spot on forewing rather than brown spot. Gnathos not extended beyond uncus, as in *P. constricta*.

Description. Forewing length 14.7–16.2 mm (male); 20.5–23.0 mm (female).

Parasa joanae has green forewing with dark marginal band; dark patch at base (Figs. 15–16). Marginal band has one blunt subapical indentation; silvery scales in band mostly confined to smooth inner border. Green discal spot darker than surrounding scales. Basal patch dark brown, with small posterior portion along inner margin lighter. Lateral margin of tegula with dark brown scales matching dark part of basal patch it borders. Hindwing brown, paler in female. Thoracic dorsum green with narrow medial brown line. Dorsal abdomen matching hindwing in color; ventrum yellowish brown, matching thorax (apart from legs). Vertex green, with frons brown. Male antenna bipectinate to just beyond midpoint. Labial palpus brown, appearing broad throughout, with apical segment slightly angled horizontally; > 1.5X vertical eye width. Proboscis absent. Fore- and midleg dark brown; hindleg pale yellowish brown with dark scales at base of each tarsus. Foretibia with small yellow patch at distal end.

Male genitalia (Fig. 58): uncus directed horizontally from base; apical claw angled downward at about 45°. Gnathos concave above and extends to end of uncus; lateral mar-

gin at distal end angled downward to lower apex. Valva digitate and gradually angled upward, similar to *P. constricta*. Transtilla a membranous cap above aedeagus. Aedeagus weakly angled between base and distal portion; processes include hook at apex, down-curved to right, and right dorsolateral process directed to posterior, reaching about half distance from its base to aedeagus apex. Saccus small, directed equally to anterior and posterior.

Female genitalia (Fig. 70): bursa copulatrix that about twice length of papillae anales. Ductus bursae narrow, slightly coiled, and broadest in middle of antrum, nearly equal in length with ovoid corpus bursae. Signum absent. Ductus seminalis connects just beyond distal end of antrum. Ostium bursae a wide and weakly sclerotized bowl. Papillae anales with dorsal third widest and triangulate; lateroventral margin concave with narrow ventral lobe. Anterior apophysis elongate, around half length of papillae anales. Lateral lobes on 8th segment well developed.

Larva. Late instar caterpillar (Fig. 2) yellowish green with elongate D scoli on A1 and A7; distinct pinkish orange color of dorsal hyperbolic bands, edged with bluish purple (this banding separates *P. joanae* from similar patterned Costa Rican *P. wellesca* and *P. sandrae*). Pinkish D scoli on A1 and A7 outwardly extend hyperbola formed by pinkish band (visual effect is enhanced by the placement of scoli at each end of band and subtle continuation of blue and pink colors). Dorsum between bands yellowish green, whereas scoli and lateral, anterior and posterior regions bluish green. Four reddish brown posterior spine patches and pinkish caltrop patches on dorsal tips of SD scoli easily visible. D scoli easily detected on segments A3–A5, but reduced on A2 and absent on A6, at least in late instars. Transverse pink bands with dark green outlines found in lateral region; extend from bases of SD scoli on A3–A5 to corresponding D scoli on same segments.

Larval host plants. *Dendropanax arboreus* (Araliaceae)(n=1), *Ardisia revoluta* (Myrsinaceae)(n=1), *Prunus annularis* (Rosaceae)(n=9), *Meliosma glabrata* (Sabiaceae)(n=1), *Mortoniendron costaricense* (Tiliaceae)(n=1) (all records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. *Parasa joanae* appears to be most closely related to *P. constricta* and *P. imitata* Druce based on features of the genitalia, including a large gnathos (relative to the uncus) with a broad apex, as well as the presence of the dark green spot in the forewing discal cell. Other neotropical species that appear to be relatives, but more distant, include *P. laranda* Druce and *P. wellesca*. Although the relations between these species will be sorted out elsewhere, there has been a lot of confusion over the identities of species in this group, in particular *P. imitata*, *P. wellesca*, and another species that appears not to be closely allied with the others, *P. laonome* Druce.

Etymology. This species is named in honor of Joan F. Epstein, the wife of the senior author, whose artistic talent and eye have led her to an appreciation of moths.

Distribution. *Parasa joanae* is presently known only from Costa Rica. It occurring principally on the Caribbean slope at medium to high elevations (700–1650 m).

Material examined. 9 specimens (4 ♂, 5 ♀).

Holotype ♂, Costa Rica: Guanacaste: Estación Cacao, 2 km SW del Cerro Cacao, 1000–1400m, C. Moraga, 30 Aug 1995, (INBio), (INBIOCRI 002357036).

Paratypes. Costa Rica: Guanacaste: Estación Cacao, 1150m, 2 ♀, M. Pereira, 15 Jul 2001, (01-SRNP-6542, 01-SRNP-6544), 1 ♀, R. Franco, 17 Aug 1997, (97-SRNP-1093), Estación Pitilla, 9 km S Santa Cecilia, 600–700m, 1 ♀, C. Moraga, Jan 1994, (INBio), (INBIOCRI 001828396), Finca La Luz, W side V. Cacao, 1000m, 1 ♂, D.H. Janzen & W. Hallwachs, 3–8 Aug 1986, (INBio), (INBIOCRI 001121034), Estación Mengo, SW side Volcán Cacao, 1100m, 1 ♀, 1 ♂, D.H. Janzen & W. Hallwachs, 24 Jan 1987, (INBio), (INBIOCRI: 1120412, 1121035), Puntarenas: Monteverde, San Luis, Fca. Buen Amigo, 4 km S Res Bosque Nuboso, 1000–1350m, 1 ♂, Z. Fuentes, Aug 1998, (INBio), (INBIOCRI 003052743).

***Parasa shirleyae* Epstein and Corrales, new species**

Figs. 17–18, 59, 71



Holotype ♂ *Parasa shirleyae*

Diagnosis. Forewing marginal band unique to New World *Parasa* in two aspects: presence of marked silver-scaled line along inside edge and presence of green scales in widest portion at tornus. Separated from other New World *Parasa* with green forewing by absence of subapical indentation along margin.

Description. Forewing length 11.0–12.5 mm (male); 13.5 mm (female). Forewing (Figs. 17–18) primarily green, though green portion less than half width of wing below discal cell. Marginal band with distinct silver edging along inner margin; mixture of green and brown scales near tornus, and mixture of silver and brown scales above. Subapical region of band without second indentation, although margin of band becomes wider at costa. Basal dark patch broad with two teeth directed toward outer margin, one on M vein and other on anal veins; pilose green scales interspersed. Discal spot dark brown. Forewing apex unusually round. Green medial area with faint brown v-shaped pattern pointing toward base along CuA₁ and CuA₂ veins. Male hindwing cream colored with dark fringe along posterior end of outer margin; dark throughout in female (1 specimen). Vertex green; frons brown with blend of green along median to posterior border with vertex. Labial palpus with brown scales, mixed with scattered yellow scales laterad; > 2X vertical

eye width. Proboscis present but reduced. Legs brown with cream-colored scales on tarsi. Male antenna bipectinate along basal half.

Male genitalia (Fig. 59): uncus longer than tegumen; claw small, obliquely down-curved, weakly sclerotized near apex. Gnathos distal arm directed horizontally, equal in width, concave above; extended to beyond middle of uncus. Valva obliquely angled upward with rounded apex; extended to end of uncus. Aedeagus with basal and distal arms obliquely reflexed but twisted with each arm in same horizontal plane (base located to left); distal end with three triangulate spines, one across from other and third medial to anterior spine; vesica with single line of cornuti evenly spaced with distance between each spine, approximately width of two cornuti. Juxtal plate broad below aedeagus; connected to membranous anellus. Transtilla a membranous cap. Saccus broader to posterior.

Female genitalia (Fig. 71): antrum broad laterally; most sclerotized just below ostium bursae. Ductus seminalis connected at end of antrum. Ductus bursae with one loose coil at end of antrum, followed by five tight coils before corpus bursae. Two-parted signum with each member in contact above and angled downward forming triangle (not shown in Fig. 71). Papillae anales with lateral margins indented in ventral third. Anterior apophysis well developed, curved upward near apex. Lateral lobes on 8th segment present.

Remarks. At present, *P. shirleyae* does not show any clear affinities to other species of *Parasa*. The small spines on the end of the aedeagus (Fig. 59) are similar to those found in *Paraclea pretiosa* (Strecker) and *Parasa sandrae* (Fig. 57), but the base of the aedeagus is more reflexed and the presence of cornuti are more similar to *P. wellisca*.

The presence of a dark hindwing on the female but not males is unusual in *Parasa*. Perhaps additional material will yield yellow hindwing females and dark hindwing males, as occurs in *Parasa wellisca*. It is unusual, however, for both forms of the hindwing to occur at the same locality, as occurs in *P. shirleyae* at Tapantí.

Etymology. The first author has selected the name *shirleyae* to honor his mother, Shirley Wein Epstein, who more than anyone nurtured his early interest in Lepidoptera.

Distribution. *Parasa shirleyae* is a montane species, reported from 1150 m to as high as 1800 m. It has been found from Veracruz, Mexico to Chiriquí, Panama. In Costa Rica the species has only been found in Cartago Province on the Tapantí Reserve.

Material examined. 8 Specimens (7 ♂, 1 ♀).

Holotype ♂, Costa Rica: Cartago Province: Paraíso, P.N. Tapantí-Macizo de la Muerte, Mirador, 1300m, J. Corrales, 1 ♂, 12 Nov 1999, (INBio), (INBIOCRI 003169848).

Paratypes. Costa Rica: Cartago Province: Estación Quebrada Segundo, 1150m, R. Delgado, 1 ♂, Nov 1994, (INBio), (INBIOCRI 002117249), Río Grande de Orosi, desde Puente Río Dos Amigos hasta la Represa, 1400–1800m, R. Delgado, 1 ♀, Oct 1995, (INBio), (INBIOCRI 002363924); Mexico: Veracruz: Huatusco, 1300m, V.O. Becker, 3 ♂, 19–23 Aug 1981, Becker no. 44050, (VOB), (USNM ENT: 171216-18), 1 ♂, VOB genitalia slide: 2375, (VOB), (USNM ENT: 171219); Panama: Chiriquí, no. 382, 1 ♂, MEE genitalia slide: 77, (BMNH), (USNM ENT: 171220).

Genus *Euclea* Hübner

The genus *Euclea* is among the most species-rich limacodid genera in Central America; 17 species are second only to *Natada* in Costa Rica. There are currently 38 species of *Euclea* in the neotropics, including the six described below in addition to the previous tally in Becker and Epstein (1995). The species richness in the neotropics is expected to rise to at least 50 based on undescribed species known by Epstein (in prep.). Further study of the genus is needed to determine whether it is monophyletic. *Monoleuca* and *Adoneta*, two small mostly North American genera, are thought to be closely related to *Euclea*. *Euclea* is distributed from the Great Lakes Region in Canada to Argentina.

Euclea species have forewing lengths that range from 7–18 mm. *Euclea* and *Acharia* are usually distinguished from other neotropical genera in the *Parasa* complex by having postmedial and subapical spots (=macula) on the forewing. These spots can be either green or white in *Euclea*, whereas in *Acharia* they are only shades of white or absent. The postmedial spot can be a narrow line, straight or wavy, in which the directions of indentations can be useful in separating species, or a rounded or triangulate patch. In many *Euclea* the postmedial spot is bordered on the outside with a quadrate patch that is lighter in color than the surrounding scales. The hindwing of *Euclea* often has a similar hue to that of the forewing, and only rarely (e.g., *E. zygia* Druce) is yellowish in contrast to a darker forewing, as found in some *Parasa* and *Talima*. Unlike *Parasa*, green scales are never present on the dorsum of the thorax. The male antennae are often bipectinate only in the basal half, but in some species the bipectinations go beyond the midpoint (e.g., *E. urba* Druce). *Semyra* Walker, an unrelated genus that occurs in the neotropics, has a similar appearing postmedial spot and quadrate patch, but is separated from *Euclea* by the presence of two pairs of spurs on the hind tibia and a male antenna that is bipectinate to the apex. The labial palpus in *Euclea* is upcurved to near the vertex and ranges from 1.3 to 2X of the eye (vertical diameter). The proboscis may be present, highly reduced (vestigial), or absent, tending toward more reduction in males. For the purposes of this paper “absent” can also mean highly reduced because it would be difficult to detect the galea without special preparation and microscopy (see Epstein 1996, p. 16: Fig. 59).

Male genitalia of a number of *Euclea* species have lateral lobes near the apex of the uncus. *Talima* is the only other neotropical limacodid genus with this trait. These lobes can often be observed by brushing the scales off the end of the abdomen in dried specimens. Most species have a membranous cap above the aedeagus, which can range from densely to moderately setose. The aedeagus is often angled between the basal and distal portions, usually with large or small process(es) near the apex. Six Costa Rican species have sclerotized, non-reversible processes arising from the juxta below or laterad of the aedeagus. Female genitalia often have a lobe posterior to the ostium bursae that is possibly homologous to the lobe in *Acharia*. In *Euclea* the lobe is sometimes medially divided. The signum is differentiated into two parts or absent. In *Euclea* and *Acharia*, the anterior apophysis is more frequently elongate compared to those found in *Parasa* and *Talima*.

The larval stages are known for six of the 17 Costa Rican species. Some late instars have double ovals on the dorsum that touch (figure-8, dumbbell) or are independent, while others have simple dorsal bands (red, blue and yellow markings) or have cryptic patterns (see *E. mesoamericana*, below). All develop the dense spine patches on posterior scoli.

Published keys for *Euclea* include Dyar (1926, 1935) for the New World fauna and Forbes (1942) for those occurring on Barro Colorado Island, Panama. Revised keys will be needed to accommodate the taxonomic changes and new species.

***Euclea mesoamericana* Epstein and Corrales, new species**

Figs. 4, 19–22, 60–62, 72–73



Holotype ♂ *Euclea mesoamericana*

Diagnosis. Most variable wing pattern found among neotropical *Euclea*. High altitude forms of *E. mesoamericana* among largest species of *Euclea* with green fascia on forewing, along with *E. norba* (Druce). *Euclea mesoamericana* differs from *E. norba* in having a triangulate versus oval green submedial fascia, bordered on outside by reddish-brown patch in lowland form.

Description. Forewing length 9.5–11.5 mm (male: lowland form and montane form), 12.5–14.0 mm (male: high altitude form), 13.0–15.4 mm (female: lowland form and montane form), and 15.0–17.1 mm (female: high altitude form). *Euclea mesoamericana* has three forms, one from lowlands (sea level to 600 m), two from higher elevations (700–1500 m, 1600–2850 m). **Lowland form** (Fig. 19): forewing reddish brown with triangulate, green submedial fascia, below discal cell with two patches of white scales along outer margin; fascia and extension outlined by narrow row of dark brown scales. Large quadrate patch of reddish brown scales contiguous to green fascia on median (very evident in specimens in good condition). A thin line of green scales stretches from superior angle of green fascia along posterior margin of discal cell and downcurving along CuA₂ (above quadrate patch); at end of quadrate patch a thin, irregularly spaced row of green scales angle toward costa along outer margin of discal cell; small subapical patch between R₃ + R₄ and R₅ near basal connection of these veins; tiny patch of few green scales on R₂ above subapical patch. Discal cell with a small black spot. **Montane form** (Fig. 21): male dark gray brown, slightly smaller than lowland form; forewing more oblong; median patch of reddish-brown scales darker, less evident; white scales between green fascia and reddish brown patch absent; discal spot absent or difficult to detect. Female forewing lighter than

male with submedial green fascia and reddish brown patch more similar to lowland form; band slightly lighter than ground color of wings located between reddish medial patch and subapical green patch. **High altitude form** (Figs. 20, 22): lighter gray brown than montane form; green greatly expanded into a dentate band, edged with white scales, extending to costal margin; discal spot evident; female lighter in color. Hindwings dark brown. Male antenna bipectinate along basal half. Labial palpus brown; 1.3X vertical eye width. Proboscis absent in male; present in female. Ventral part of body dark brown. Legs dark brown with frontal distal part of each tarsus and tibia yellow.

Description. Forewing length 9.5–11.5 mm (male: lowland form and montane form), 12.5–14.0 mm (male: high altitude form), 13.0–15.4 mm (female: lowland form and montane form), and 15.0–17.1 mm (female: high altitude form). *Euclea mesoamericana* has three forms, one from lowlands (sea level to 600 m), two from higher elevations (700–1500 m, 1600–2850 m). **Lowland form** (Fig. 19): forewing reddish brown with triangulate, green submedial fascia, below discal cell with two patches of white scales along outer margin; fascia and extension outlined by narrow row of dark brown scales. Large quadrate patch of reddish brown scales contiguous to green fascia on median (very evident in specimens in good condition). A thin line of green scales stretches from superior angle of green fascia along posterior margin of discal cell and downcurving along CuA_2 (above quadrate patch); at end of quadrate patch a thin, irregularly spaced row of green scales angle toward costa along outer margin of discal cell; small subapical patch between $R_3 + R_4$ and R_5 near basal connection of these veins; tiny patch of few green scales on R_2 above subapical patch. Discal cell with a small black spot. **Montane form** (Fig. 21): male dark gray brown, slightly smaller than lowland form; forewing more oblong; median patch of reddish-brown scales darker, less evident; white scales between green fascia and reddish brown patch absent; discal spot absent or difficult to detect. Female forewing lighter than male with submedial green fascia and reddish brown patch more similar to lowland form; band slightly lighter than ground color of wings located between reddish medial patch and subapical green patch. **High altitude form** (Figs. 20, 22): lighter gray brown than montane form; green greatly expanded into a dentate band, edged with white scales, extending to costal margin; discal spot evident; female lighter in color. Hindwings dark brown. Male antenna bipectinate along basal half. Labial palpus brown; 1.3X vertical eye width. Proboscis absent in male; present in female. Ventral part of body dark brown. Legs dark brown with frontal distal part of each tarsus and tibia yellow.

Male genitalia (Figs. 60–62): uncus apex with two lateral lobes and central claw (lowland)(Fig. 60), or lateral lobes absent (montane) (Fig. 61) or vestigial (high altitude) (Fig. 62); apex of some lowland specimens slightly curved upwards on dorsum. Gnathos extends beyond midpoint of uncus; small dentate portion on posterior end of dorsum (lowland and montane, only). Valva digitate, transverse for short distance from base; beyond angled obliquely upward to uncus apex. Transtilla a hairy cap above aedeagus. Juxta with anellus somewhat sclerotized. Aedeagus with basal and distal arms bent at right angle;

former half as long as latter. Aedeagus apex and vesica variable depending on elevation. Lowland: similar to montane form, but with cornuti weakly sclerotized and not easily visible (Fig. 60). Montane: left apical spine straight and pointed 45° and right spine hooked, directed anterodorsad; cornuti sclerotized and spinulate and form band for most of vesica (Fig. 61). High elevation: two spines lateroventral with one on each side, no cornuti (Fig. 62). Saccus produced to anterior and posterior.

Female genitalia (Figs. 72–73): antrum cup-shaped and somewhat irregular. Ostium bursae broad and ovoid, moderately sclerotized. Ductus bursae elongate, variable in length, ranging from about equal to corpus bursae (montane form)(Fig. 73), or twice length of corpus bursae or greater (lowland and high altitude forms)(Fig. 72). Two-part signum broadly connected in middle, rounded along margins; located near distal end of corpus bursae in montane and high altitude forms (not illustrated in Fig. 73). Ductus seminalis connected to ductus bursae at distance from ostium bursae approximately equal to length of papillae anales. Papillae anales lateral margin angled towards median in dorsal half; ventral part of lobes more narrow with rounded apex. Posterior lobe to ostium bursae slightly emarginate at apex. Lateral lobes present on 8th segment. Anterior apophysis ranges from half (Fig. 72)(lowland and high altitude forms) to approximately equal in length to remaining 8th segment (Fig. 73)(montane form).

Larva. Late instars of *E. mesoamericana* have an irregular light and dark pattern (Fig. 4). D scoli longest on A1 and A7; scoli on T2, T3, A8, A9 only slightly larger than lateral SD scoli. D scoli on A4 larger than adjacent D scoli, while those on A2 and A6 smaller than A3–A5. Light patches on body can either be yellow-green or yellow; dark patches brown or violet. All scoli with light background color and around bases. Dark pattern on lateral ridges between D scoli and SD scoli nearly encircle lighter ovals. In some individuals dark pattern replaced by light patches on A3 and A6. Widest dark patches occur in three places on dorsum: anterior to D scoli on A3, between A5 and A6, and between A7 and A8. Along dorsal midline, between D scoli for most of body, series of ovals connected by central yellow or yellow-green line. Caltraps yellowish brown; present on ends of SD scoli. Four posterior deciduous spine patches dark.

Larval hostplants. Caterpillars of *E. mesoamericana* have been found feeding on 18 different plant families (Annonaceae, Anacardiaceae, Bombacaceae, Celastraceae, Clethraceae, Euphorbiaceae, Fabaceae, Flacourtiaceae, Juglandaceae, Lauraceae, Malpighiaceae, Malvaceae, Melastomataceae, Myrsinaceae, Myrtaceae, Rosaceae, Sapindaceae, Ulmaceae; 44 rearing records) with no suggestion of preference for any of them (all records from: D. H. Janzen and W. Hallwachs 2004).

Parasitoids. *Uramaya* spp. (Tachinidae) (n=2) (det. D.M. Wood & D.H. Janzen) (all records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. Many adult specimens of *E. mesoamericana*, old and new, are in collections made from Mexico to South America. The reason that *E. mesoamericana* remained undescribed until now is that this species is easily confused with *Euclea cippus* unless the male

genitalia are examined. *Euclea cippus* was previously considered to be distributed from Mexico to Paraguay (Dyar 1935). It is now apparent that all of this distribution in Mesoamerica belongs to *Euclea mesoamericana* and *E. cippus* is restricted to the Guianas and Trinidad (Epstein in prep).

Euclea cippior Dyar from Peru has a similar forewing pattern to the highland form of *E. mesoamericana* with the large green patch, but distinct male genitalia.

The larva of *E. mesoamericana* appears similar to that of *E. cippus* figured by Genty et al. (1978) from Colombia and another from Trinidad (Ken Preston-Mafham, pers. comm.), except in *E. cippus* there is a solid dark brown band along the middle of the dorsum.

Etymology. The name of this species is derived from the Mexican and Central American portion of the distribution of this species.

Distribution. *Euclea mesoamericana* is known from Mexico to Ecuador and along the Caribbean side of Colombia. Although there is specimen in the Dyar collection (USNM) labeled "Peru," it is believed to be mislabeled. Recently collected specimens in the *Euclea cippus* complex from upper and lower elevations in Peru have male genitalia that are distinctly different from those of *E. mesoamericana* or *E. cippus* (Epstein and Hessler, in prep). The precise northern extent of the distribution of *E. mesoamericana* remains unclear at this time. This is due to the presence in northern Mexico of what may be either an undescribed species or intergrades between populations of the North American species *E. delphinii* and *E. mesoamericana*. In Costa Rica, *E. mesoamericana* is widespread in rainforests from sea level up to 2850 m; it does not occur in the dry forests of Guanacaste Province.

Material examined. 257 specimens (200 ♂, 57 ♀)

Holotype ♂, Costa Rica: Heredia Province: Estación Biología La Selva, D. Wagner, 8 Mar 1999, (INBio, ALAS), (INBIOCRI 001147504).

Paratypes. Costa Rica: Cartago Province: Turrialba, 600m, V.O. Becker, 3 ♂, 25 Aug 1971, 4 ♂, 25 Jul 1972, 10 Jan 1973, 10 Feb 1973, 8 Apr 1973, (USNM), (INBIOCRI: 1121144-45, USNM ENT: 167595-98, 167603), Turrialba, P.N. Barbilla, Estación Barbilla, 500–600m, L. Chavarría, 2 ♂, Aug 2001, (INBIOCRI: 3351573, 3351592); Heredia Province: A.C.C.V.C, Sarapiquí, La Virgen, P.N. Braulio Carrillo, Estación Magsasay, 100–200m, 1 ♂, R. Aguilar, Oct 1990, (INBio), (INBIOCRI 000281831), Estación Biología La Selva, 0–100m, 4 ♂, M.M. Chavarría, Jun 1986, 11 Jan 1986, 28 Oct–9 Nov 1986, 24 Feb–4 Mar 1987, (INBio), (INBIOCRI: 1118852-53, 1118893-94), 1 ♂, D.H. Janzen & W. Hallwachs, 6–9 Mar 1985, (INBIOCRI 001118892), 1 ♀, W. Steiner, J. Hill, J. Swearingen, J. Mitchell, 21 Mar 1988, (USNM), (INBIOCRI 001121147), 1 ♂, ALAS, 16 Mar 1999, (INBIOCRI 001147393), 6 ♂, D. Wagner, 8 Mar 1999, 24 Jun 2000, 17 Feb 2002, 1 Mar 2003, (INBIOCRI: 1147502-03, 1147505, 3208081, 3215853, 3228985), Sarapiquí, La Virgen, P.N. Braulio Carrillo. Estación Magsasay, 100–200m, 1 ♂, A. Fernandez, Jul 1991, (INBIOCRI 001377928); Limón: 9.4 km W de Bribri, 0–100m, 2 ♂, D.H. Janzen & W. Hallwachs, 9–11 Jun 1983, (INBIOCRI: 1118854, 1118856), A. C. Lla-

nuras del Tortuguero, Pococí, Estación Aguas Frías, 0–100m, 3 ♂, E. Rojas, Jun 1997, Jul 1997, Oct 1997, (INBIOCRI: 2554307, 2559059, 2591245), A.C.L.A.C, Central, Res Biol Hitoy Cerere, Estación Hitoy Cerere, Send Bobocara, 1 ♀, R. Barton Salazar, 700–800m, 15–17 May 1999, 1 ♂, 500–600m, 11 Oct 1999, (INBio), (INBIOCRI: 3027858, 3041400), 1 ♀, L. Chavarría, 100–200m, Mar 2001, (INBio), (INBIOCRI 003154506), 9.4 km W Bribri, Suretka, 3 ♂, 1 ♀, D.H. Janzen & W. Hallwachs, 9 Jun 1983, (INBio, USNM), (INBIOCRI: 1121141-43, 1121148), Cerro Tortuguero, 0–100m, Jo. Solano, 2 ♂, Nov 1989, (INBio), (INBIOCRI: 140840, 140902), R. Delgado, 1 ♂, Jul 1993, (INBio), (INBIOCRI 001153039), Manzanillo, 0–100m, 1 ♂, K. Taylor, 6–27 Jan 1993, (INBio), 1 ♂, F. Quesada, (INBIOCRI: 997520, 1295587), Pococí, Colorado, Sector Cerro Cocorí, 30 km N de Cariari, 100–200m, E. Rojas, 2 ♂, Jan 1991, (INBIOCRI: 678236, 678295), 2 ♂, 1 May 1994, Nov 1993, (INBIOCRI: 1879599, 1652681), Pococí, Finca INBio, 200–300m, 1 ♂, R. Delgado, 26–29 Sep 2000, (INBIOCRI 003311693), Pococí, Rita, Sector Cedrales de la Rita, 3 km N del Puente Río Suerte, Ruta Puerto Lindo, 0–100m, E. Rojas, 2 ♂, Sep 1995, 3 ♂, Apr 1996, 1 ♂, Oct 1995, 1 ♂, Oct 1996, 1 ♀, 3 ♂, Nov 1996, (INBio), (INBIOCRI: 2308677, 2308685, 2463220-21, 2463232, 2485321, 2492515, 2493444, 2493446, 2493449, 2493451), R.B. Hitoy Cerere, Sendero Toma de Agua, 0–100m, 1 ♂, E. Rojas, 24 Apr–5 May 1998, (INBIOCRI 002526382), Six[a]ola River, 1 ♂, Wm. Schaus & J. Barnes, Apr 1907, (USNM), (INBIOCRI 001120518), Tapezco (La Suerte), Hac., 29 air km W Tortuguero, 40m, 1 ♂, Donahue, Hair, Moore, Hopkins, 13 Aug 1979, (LACM), (USNM ENT: 169800), Valle de la Estrella, Reserva Biológica Hitoy Cerere, Estación Hitoy Cerere, 100–200m, 2 ♂, E. Rojas, 18–29 Jun 1998, (INBio), (INBIOCRI: 3012932, 3012935); Puntarenas Province: A.C.O, Golfito, P.N. Corcovado, Estación Sirena, Playa Sirena, 0–100m, G. Fonseca, 5 ♂, Nov 1989, (INBio), (INBIOCRI: 113694, 113801, 113803-04, 114143), 1 ♂, Apr 1991, 3 ♂, Dec 1989, (INBio), (INBIOCRI: 579784, 189877, 205817-18), 4 ♂, Jan 1990, Jun 1991, Mar 1990, May 1991, (INBIOCRI: 185192, 669705, 1377035, 589890), 4 ♂, Oct 1989, (INBio), (INBIOCRI: 278562, 279216, 279222-23), J. Corrales, 1 ♂, 18–21 Jan 1994, (INBio), (INBIOCRI 001985974), J.C. Saborio, 1 ♂, Nov 1990, (INBio), (INBIOCRI 000542789), A. Picado, 1 ♂, 6–12 Apr 1995, (INBio), (INBIOCRI 002196529), N. Obando, 1 ♂, Jun 1990, (INBio), (INBIOCRI 000289218), A.C.P.C, Garabito, Tarcoles, Estación Quebrada Bonita, 100–200m, J.C. Saborio, 3 ♂, Oct 1994, 2 ♂, Nov 1994, Dec 1994, (INBIOCRI: 2045219-20, 2113422, 2045224, 2054893), Estación Esquinas, Peninsula de Osa, 0–100m, 1 ♂, M. Segura, Oct 1993, (INBio), (INBIOCRI 001665669), Garabito, Reserva Biol Carara, Estación Quebrada Bonita, 0–100m, 1 ♂, E. Bello, Jul 1990, (INBIOCRI 000241605), J.C. Saborio, 1 ♂, 1 Sep 1992, 2 ♂, 1 Sep 1993, 2 ♂, Aug 1992, 1 ♂, Aug 1993, 2 ♂, Jul 1993, 1 ♂, May 1993, 1 ♂, 1 ♀, Nov 1992, 1 ♂, Oct 1993, (INBio), (INBIOCRI: 964733, 1655354-55, 856444-45, 1669204, 1684731-32, 1198763, 841459, 841473, 1665030-32), R. Guzmán, 1 ♂, Nov 1993, 2 ♂, Oct 1993, (INBIOCRI: 1187140, 1631496, 1631499), Osa, Sierpe, Rancho Quemado, 200–300m, 2 ♂, F. Quesada, Feb 1991, (INBIOCRI:

217523-24), 1 ♂, B. Apu, Oct 1990, (INBio), (INBIOCRI 001112222), 1 ♂, F. Quesada, Jul 1991, (INBio), (INBIOCRI 001407214), 1.8 mi W Rincon, Osa Peninsula, 3 ♂, J.P. Donahue & C.L. Hogue, 15 Feb 1971, 5 Mar 1971, 27 Feb 1971, (LACM), (USNM ENT: 167607-09), Sirena, Corcovado Nat. Pk., Osa Peninsula, 0–100m, 1 ♂, D.H. Janzen & W. Hallwachs, 16–26 Nov 1978, (USNM), (INBIOCRI 001118855).

Other material examined. Costa Rica: Alajuela Province: A.C.A, Guatuso, P.N. Tenorio, Puesto Quebradón, 300–400m, 2 ♂, G. Rodriguez, Sep 1998, Feb 1998, A.C.A, San Carlos, Reserva Ftal Arenal, Send Pilón, 600–700m, 1 ♂, G. Rodriguez, Dec 1999, A.C.C.V.C, Central, Sarapiquí, Virgen del Socorro, 700–800m, 1 ♀, B. Espinoza, 6 Feb 1987, Guatuso, P.N. Volcán Tenorio, Sector El Pilón, 700–800m, 1 ♂, G. Rodriguez, Jun 2002, R. B. San Ramón, 800–900m, 1 ♀, G. Carballo, Nov 1994, San Ramón, Angeles, R.B. Alberto Brenes, Sector Catarata, 1000–1100m, 1 ♀, G. Carballo, Nov 1994, Sector Colonia Palmareña, San Ramón, 700–800m, 1 ♂, J.C. Saborio, Oct 1995, Upala, Bijagua, Albergue Heliconias, 800–900m, 1 ♂, L. Chavarría, Apr 2000, 1 ♂, G. Rodriguez, Jul 1999, 1 ♀, G. Rodriguez, 7–30 Oct 2000, (INBio), 8 km N Vara Blanca, J. McCarty & J. Powell, 1 ♂, 25 Mar 1992, Rio Savegre nr San Gerardo, J. McCarty & J. Powell, 1 ♂, 23–24 Mar 1992, (UCB); Cartago Province: A.C.L.A.P, Paraíso, P.N. Tapantí, Queb Segunda, Send Catarata, 1400–1500m, 1 ♂, R. Delgado, May 1999, A.C.L.A.P, Paraíso, P.N. Tapantí, Sect La Represa, del Puente del Río Porras 300m S, 1500–1600m, 1 ♂, R. Delgado, Aug 2001, El Guarco, Macizo de la Muerte, Sector de la esperanza, 2600–2700m, 3 ♂, R. Delgado, Oct 2001, El Guarco, San Isidro, Estación La Esperanza, 2400–2500m, 3 ♂, R. Delgado, Mar 2001, Paraíso, P.N. Tapantí, Estación Quebrada Segundo, 1300–1400m, 1 ♂, R. Delgado, Jul 1999, Quebrada Segunda, 1200–1300m, 1 ♀, G. Mora, Jun 1992, Río Grande de Orosi, desde Puente Río Dos Amigos hasta la Represa, 1500–1600m, 3 ♂, R. Delgado, Mar 1995, Aug 1996, Jul 1995, Turrialba, Tayutic, Grano de Oro, Chirripo, 1100–1200m, 1 ♂, P. Campos, Aug 1993, (INBio); Guanacaste Province: Camino Rio Francia, 1 ♂, J. Perez, 2 Oct 2001, 1 ♂, O. Espinoza, 24 Jun 2001, Cerro Pedregal, 1080m, 1 ♂, F. Quesada, 17 May 2002, Corrales Viejos, 495m, 1 ♀, F. Vargas, 2 Aug 2002, Derrumbe, Estación Cacao, 1 K. W de cerro Cacao, 1300–1400m, 1 ♀, W. Hallwachs, 26–27 May 1992, Estación Cacao (all reared larvae, dates = eclosion), 1150m, 1 ♂, 1 ♀, H. Ramirez, 13 May 2001, 26 Oct 2002, 5 ♀, F. Quesada, 22 May 2002, 10 Jun 2002, 22 May 2002, 6 Jun 2002, 2 Jun 2002, 1 ♀, H. Ramirez, 2 Jul 1997, 1 ♂, R. Moraga, 29 Aug 1997, 1 ♀, gusaneros, 12 May 1997, 1 ♀, gusaneros, 21 May 1997, Estación Mengo, SW Side Volcán Cacao, 1000–1100m, 1 ♀, D.H. Janzen & W. Hallwachs, 13 Jun 1987, Estación Pitilla, 9 km S Santa Cecilia, 600–700m, 1 ♀, C. Moraga, Jun 1991, 1 ♀, C. Moraga, Apr 1991, GNP Biodiv. Inv., 7 ♂, May 1989, Feb 1989, 3 ♂, C. Moraga, 9 Nov 1993, 19 May 1993, Jan 1994, 1 ♂, Espinosa & Chaves, Jul 1988, 1 ♀, D.H. Janzen & W. Hallwachs, 18 May 1988, 1 ♀, A. Chacon & M. Espinoza, Feb 1988, Guayabas, 1 ♂, J. Perez, 13 Oct 2000, Liberia, Mayorga, Estación Cacao, 2 km SW de Cerro Cacao, 900–1000m, 2 ♀, W. Hallwachs, May 1992, 1 ♀, C. Chavez, 8 Jun 1991, 1 ♀, C. Chavez, 8 Jun

1991, 2 ♀, J. Corrales, 11 Feb 1995, 11 Feb 1995, Estación Mengo, SW side Volcán Cacao, 1100m, 1 ♂, 1 ♀, D.H. Janzen & W. Hallwachs, 24 Jan 1987, Quebrada Cementerio, 700m, 1 ♀, O. Espinoza, 26 Nov 1998, Río Blanco Abajo, 500m, 1 ♀, G. Sihezlar, 22 Aug 2001, Río Negro, 1 ♂, A. Rios, 13 Aug 2002, Río San Lorenzo, Tierras Morenas, 900–1000m, 1 ♂, C. Alvarado, May 1991, Sendero Arenales, 1080m, 2 ♀, M. Pereira, R. Franco, Sendero Circular, 1185m, 1 ♀, H. Ramirez, Sendero Derrumbe, 1220m, 1 ♂, H. Ramirez, 1 ♀, F. Quesada, Sendero Maritza, 760m, 1 ♂, 1 ♀, M. Pereira, 1 ♂, 2 ♀, F. Quesada, 1 ♀, W. Hallwachs, Sendero Nayo, 1090m, 1 ♀, M. Pereira, Sendero Vivero, 730m, 1 ♀, G. Sihezlar, (INBio); Heredia Province: 6 km ENE Vara Blanca, 1950–2050 m, 1 ♂, 1 ♀, D. Wagner, K. Nishida, C. Chompipe, Res. Biol. Chompipe, R. F. Cord. Vol. Cent., 2000–2100m, 3 ♂, J. Corrales, 23 Mar 1993, 15 Mar 1994, (INBio), 16 km SSE La Virgen, 1050–1150m, 2 ♀, J. Brown, 17–19 Apr 2001, ALAS, (INBio), 11 km ESE La Virgen, 300m, 1 ♂, 1 ♀, Brown, Rota, & Oboyski, 20–21 Mar 2004, (INBio); Puntarenas Province: Guacimal, Finca Buen Amigo Monteverde, 4km S. de la Reserva, 1000–1100m, 1 ♀, Z. Fuentes, Sep 1994, Monteverde, 1 ♂, 1 ♀, D.H. Janzen, 23 Aug 1978, 8–10 Dec 1978, (INBio), 1 ♂, C. Nagano & M. Hayes, Sep 1992, Monteverde, (LACM), Estación La Casona, 1500–1600m, 1 ♂, N. Obando, Sep 1992, (INBio), San José: Estación Bijagual, 600 m N de Bijagualito, 400–500m, 1 ♂, J.C. Saborio, Jul 1995, Estación Santa Elena, Las Nubes, 1200–1300m, 2 ♂, M. Segura, 6 Apr 1997, 7 ♂, E. Alfaro, 5 May 1997, 14 Dec 1996, 6–10 Apr 1997, 13 Nov 1996, 8 Mar 1997, Estación Zurqui (el Tunel), P.N. Braulio Carrillo, 1600–1700m, 1 ♀, I. Chacon, Mar 1986, (INBio); Colombia: CC Hq. Bajo Calima, 3 ♂, J. B. Sullivan, 11–12 Jan 1985, (USNM, FSCA), Las Marinas Río Sating Narino, 1 ♂, R.W. Hutchings, 20 Aug 1977, (USNM), Cauca, Micay, 2 ♂, Aug 1896, (USNM), Valle del Cauca, Old B'vtura & Río Valle, 2 ♂, J. B. Sullivan, 7–8 Feb 1989, (USNM); Ecuador: Esmeraldas, 2 ♂, J. Hillman, 4 Dec 1995, (CMNH), Río Cayapas, 2 ♂, (CMNH), Tinalandia, 4 ♂, S. J. Weller, P. Bara, M. J. Ryan, 18 Mar 1990, (USNM), J. B. Heppner, 5–10 Jul 1993, (FSCA), J. S. Miller, 17 Oct 1988, (AMNH), C. V. Covell Jr., 19 May 1985, (USNM); Guayas Prov.: Hacienda San Juquin, 4 rd km SW Bucay, 250m, 2 ♂, S. McKamey, 1–4 May 1986, (LACM), Pichincha Prov.: Colectiva Fuerzas Unidos, 20 rd km E of Patricia, Río Palenque, 50 km S Santo domingo de los Colorados, 250m, 1 ♂, K. Osborne & S. McKamey, 1 Feb 1986, (LACM), Estación Científico Río Palenque, 56 rd km S Santo Domingo de los Colorados, 250m, 1 ♂, K. Osborne & S. McKamey, 30 Jan 1986, (LACM); El Salvador: Cerro Miramindo, 1 ♀, S. & L. Steinhäuser, 3 Dec 1972, (USNM); Mexico: Veracruz: Jalapa, 1 ♂, W. Schaus, (USNM), Nayarit: Hunjicari Picacho, 2 ♂, N. Bloomfield, 23–24 Sep 1986, (SDM), Sinaloa: Santa Lucia, 1 ♂, D. Faulkner, 6 Aug 1986, (SDM); Panama: Bugaba, 1 ♀, W. Schaus, (USNM), Chir. Vulk. Tr., 1 ♂, W. Schaus, (USNM), Chiriqui, 1 ♂, W. Schaus, (USNM), Colon, Barro Colorado Isl., 1 ♀, W.D. & S.S. Duckworth, 10–17 May 1964, (USNM), 1 ♀, 1 ♂, M. Bates, Oct 1927, (MCZ), Dec 1923, (MCZ), 1 ♂, R. Silbglie & A. Aiello, 23 Apr 1979, (USNM); Peru: no data, 1 ♂, Collection H.G. Dyar, (USNM).

Euclea zurquicola Epstein and Corrales, new species

Figs. 63, 74

Holotype ♂ *Euclea zurquicola*Paratype ♀ *Euclea zurquicola*

Diagnosis. Similar to *E. urba* Druce, another species with restricted distribution in Costa Rica. *Euclea zurquicola* can be distinguished by having a more triangulate forewing apex and round, cream-colored to yellow submedial fascia, rather than linear and green. Female similar in appearance to an *Acharia* (= *Sibine*) with yellow spots. Aedeagus of *E. zurquicola* differs from *E. urba* in distal arm being straighter and more angled with basal arm.

Description. Forewing length 10.0 mm (male); 12.5 mm (female). Male wings and body (Fig. 23) dark reddish brown, unmarked other than cream-colored submedial fascia and subapical spots. Male forewing triangulate at apex, but convex along outer margin. Submedial fascia round with small anterior finger and smaller subapical spot that runs perpendicular to costa, which it nearly contacts. Female (Fig. 24) ash color with elongate forewing; submedial fascia more yellow than in male, though similar in shape. Subapical spot white; reaching costa. Hindwing color matches forewing; fringe white in male, brown in female. Male antenna bipectinate along basal half. Labial palpus brown with yellow scales on frontal part of middle segment (male only); >2X vertical length of eye (male); 1.3X (female). Yellow on ventrum of thorax and abdomen. Legs brown with yellow scales at distal end of each tarsus (male) or mixed with brown (female). Proboscis absent.

Male genitalia (Fig. 63): uncus apex with central downcurved claw and paired lateral processes. Gnathos concave above, subequal width from base to near rounded apex. Valva digitate with slight indentation below near apex. Transtilla cap moderately hairy. Juxta a simple plate with anellus extended along aedeagus to near dorsal opening for vesica. Aedeagus with base approximately half length of distal arm at nearly right angle; apex slightly wider than distal arm and slightly downcurved on ventrum at point below opening for vesica with short spine on each side on dorsum directed to posterior (right spine slightly projecting dorsomedial). Saccus short triangular lobe between ventral base of valvae and directed to posterior.

Female genitalia (Fig. 74): ostium bursae in shallow depression, weakly sclerotized and smooth. Antrum narrow, small with slightly expanded margins below ostium bursae; weakly sclerotized. Ductus bursae straight, subequal in length to corpus bursae; signum absent. Ductus seminalis connected to ductus bursae at approximately third distance between ostium bursae and corpus bursae. Lobe posterior to ostium bursae forms short transverse ridge, slightly elevated in median between ventral papillae anales. Papillae anales narrow throughout with dorsal width 1.5X ventral. Anterior apophysis elongate, about half length of distance from ostium bursae to base of anterior apophysis, along anteventral margin of 8th segment; posterior apophysis slightly longer than anterior apophysis.

Remarks. It is interesting that three of the smallest species in the *Euclea cippus* complex are currently known only from Costa Rica, *E. zurquicola*, *E. urba* and *E. microcippus* and all lack a signum on the corpus bursae. *Euclea zurquicola* and *E. josepsi* (see below) are the only Costa Rican species of *Euclea* that are known from one locality.

Etymology. The species is named for Zurquí, its only known locality.

Distribution. *Euclea zurquicola* is known only from Estación Zurquí at 1600 m, 500 m southwest of the road (Hwy 32) tunnel in Braulio Carrillo National Park, Costa Rica.

Material examined. 2 specimens (1 ♂, 1 ♀)

Holotype ♂, Costa Rica: San José: Estación Zurquí, 500 m antes del Tunel Zurquí, P.N. Braulio Carrillo, G. Maass, 1600m, Mar 1991, (INBio), (INBIOCRI 000617476).

Paratype. Costa Rica: San José: Estación Zurquí, 500 m antes del Tunel Zurquí, P.N. Braulio Carrillo, G. Maass, 1600m, 1 ♀, Mar 1991, (INBio), (INBIOCRI 000617465).

Euclea microcippus Epstein and Corrales, new species

Figs. 25–26, 64, 75



Holotype ♂ *Euclea microcippus*

Diagnosis. Smallest species of *Euclea*, only confused with upland male *Parasa sandrae*, which has small forewing green spots (see above). Separated by absence of green scales on head and thoracic dorsum.

Description. Forewing length 6.0 mm (male); 6.8 mm (female). Male forewing (Fig. 25) brown with three green patches; submedial triangulate fascia largest with narrow extension toward base of wing and few white scales along distal margin.

Other green patches include one near subapex with white scales along outer margin and a tiny patch just below middle of discal cell (absent in one individual). Hindwing dark brown. Female (Fig. 26) similar in size and

pattern. Male antenna bipectinate along basal half. Head, thorax and abdomen warm brown with some cream scales intermixed. Labial palpus 1.5X vertical eye width; mostly cream-colored scales on ventral surface and brown on dorsal surface. Proboscis absent. Ventrums of body cream colored. Legs with mixture of brown, yellow and cream scales.

Male genitalia (Fig. 64): uncus triangulate apical claw and with lateral lobes directed to posterior. Gnathos broad dorsoventrally and of equal depth throughout, extended nearly as far as uncus; apex rounded and upcurved with dense spinules. Transtilla with membranous cap, densely setose above. Anellus with microsetae at posterior end. Aedeagus with basal arm at right angle to distal arm; distal arm with large process at end on right side, curved dorsally with sharp apex curved obliquely ventrad. Vesica with strong cornuti, extruding on left side of large process. Saccus rounded, directed to anterior.

Female genitalia (Fig. 75): broad transverse ostium bursae, emarginate along dorsal rim, forming lateral oval on each side. Antrum also transversely broad, like washing basin with conical drain below, sclerotized with longitudinal ridges along bottom, covered with spinules on outside, and curved toward dorsum. Ductus bursae beyond antrum short and narrow, gradually widening into ovoid corpus bursae; signum absent. Posterior lobe between ostium bursae and papillae anales undivided and covered with spinules. Medial sclerotized oval on dorsum of 7th segment. Papillae anales widest in dorsal portion with convex lateral margins; narrow digitate lobes in ventral third curved laterad. Anterior apophysis well developed, nearly half width of 8th segment; posterior apophysis short, not reaching anterior margin of segment. Lateral lobes not detected.

Remarks. This is the smallest known species in the genus *Euclea*. The forewing pattern allies it to the *E. cippus* complex, which includes *E. mesoamericana*, although the aedeagus and cornuti are similar to some species of *Acharia* (= *Sibine*). Two cornuti were found in the corpus bursae of the female along with a spermatophore.

Etymology. The name refers to a miniature *Euclea cippus*, the much larger South American species with similar color pattern.

Distribution. *Euclea microcippus* is known only from Costa Rica. Most of the specimens are from lowlands of the Caribbean side, but single specimens from Estación Pitilla (600–700 m) and Las Cruces (1200 m) are the exceptions.

Material examined. 13 specimens (12 ♂, 1 ♀).

Holotype ♂. Costa Rica: Heredia Province: Estación Biológica La Selva, D. Wagner, 22–29 Jan 2000, (INBio), (INBIOCRI 002724012).

Paratypes. Costa Rica: Guanacaste Province: Estación Pitilla, 9 km S Santa Cecilia, 600–700m, C. Moraga, 2 ♂, Nov 1990, Jan 1995, (INBio), (INBIOCRI: 686246, 2131726); Heredia Province: Estación Biológica La Selva, Puerto Viejo de Sarapiquí, 50–150 m, K. Nishida, 1 ♂, 11 Nov 2002, (INBio), (INBIOCRI 003224304), D. Wagner, 2 ♂, 14 Feb 2003, 12–25 Jan 1999, (INBio), (INBIOCRI: 3226395, 1284822), D.R. Perry, 2 ♂, 19–26 Jun 1975, 12–13 Jun 1975, (LACM), (INBIOCRI: 169147-48), D. Wagner & J. Rota, 1 ♂, 22–31 Mar 2001, (INBio), (INBIOCRI 003205556), ALAS, 1 ♀, 15 Jun 1999,

(INBio), (INBIOCRI 001286648); Limón: Tapezco, Hac., 29 air km W Tortuguero, 40m, Donahue, Panny, Moeller, Lewis, 2 ♂, 9 Mar 1978, (LACM), (INBIOCRI: 1120796-97); Puntarenas Province: Las Cruces, Malaise trap, methyl salicylate, 1200m, E.A. Sugden, 1 ♂, 18 Jul 1977, (UCD), (INBIOCRI 001120798).

***Euclea gajentaani* Epstein and Corrales, new species**

Figs. 3, 27–28, 65, 76



Holotype ♂ *Euclea gajentaani*

Diagnosis. *Euclea gajentaani* cannot be separated from *E. diversa* (Druce) without dissection, although they appear to be allopatric. In Costa Rica *E. gajentaani* is most similar to *E. distrahens* Dyar, but has a larger discal spot, subapical spots connected rather than separated, and tends to be darker, although *E. distrahens* has dark individuals as well.

Description. Forewing length 10.5–12.0 mm (male); 16.0 mm (female). Male forewing

(Fig. 27) with dark discal spot and subapical spots that form wavy line (no individual spots); dark brown patch between end of discal cell and subapical line with triangulate, light brown patch directly below between M_2 and CuA_2 . Submedial fascia thin with lower part directed toward tornus; dark patch surrounding fascia. Medium dark brown areas bordering inner and outer margins, and inside of discal cell, except for discal spot. Cream-colored line along outer margin, at base of fringe, and along $1A+2A$ from base to tornus. Hindwing color matching medium brown submarginal area. Female (Fig. 28) similar to male in both coloration and patterns, but noticeably larger. Male antenna bipectinate along basal half. Labial palpus 1.3X vertical eye width. Proboscis absent. Dense pilose scales on dorsum of body with scattered rows of darker scales. Dense scales on dorsum of legs darker along tips than bases.

Male genitalia (Fig. 65): uncus without lateral lobes; apex obliquely angled before downcurved. Gnathos extended to midpoint of uncus with dorsum slightly convex; upcurved only at apex. Valva with wide base, abruptly narrowing from middle to apex; ventral margin curved upwards with 4–6 spines on curved portion in narrow distal half only. Transtilla with membranous cap moderately setose. Juxta with broad, y-shaped process below aedeagus; arms of process connect to dorsoventral plate at base. Aedeagus with basal arm at right angle to distal arm with latter angled downward to nearly same level as base; apex with two processes, one rounded on right side and other, shorter, triangulate and pointed to left. Saccus well developed and rounded.

Female genitalia (Fig. 76): antrum oval, sclerotized but with outer membranous layer; wider beyond ostium bursae. Ductus bursae subequal in length to corpus bursae beyond antrum. Ductus seminalis connects to ductus bursae midway between ostium bursae and base of corpus bursae. Corpus bursae ovoid; signum faint and directed longitudinally. Ridge anterior to ostium bursae extends to lateral margin; lobe posterior to ostium and between ventral portions of papillae anales setose and triangulate. Papillae anales with lateral margin of dorsal lobe convex to apex, medial margin nearly vertical; middle third of lateral margin concave to round ventral lobe. Lateral lobes of 8th segment with raised sclerotized bases.

Larva. Yellow-green caterpillar with five oval spots on dorsum (Fig. 3). Two large ovals found on abdomen, one on each side of D scoli on A4; smaller ovals on T2, T3 and A8. Large ovals black on outer rim, lined with blue and orange suffused with green on inside. Small ovals black with trace of green on inside. Black outer rims of ovals do not interconnect as in other *Euclea* species with ovals (e.g., *E. buscki*). An additional ring of yellow suffused with orange found outside ovals. Largest D scoli on A1 and A7 orange-brown, each directed nearly laterad with like-colored band connecting opposing scoli. In late instars D scoli on A4 only D scoli visible between A1 and A7. Posterior deciduous spine patches orange-red. Yellow caltrops present on apex of SD scoli.

Larval host plants. *Ocotea insularis* (Lauraceae); *Andira inermis*, *Machaerium acuminatum*, and *Inga oerstediana* (Fabaceae); *Quassia amara* (Simaroubaceae) (all records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. This species is closely related to *Euclea diversa* (Druce) based on the forewing pattern and genitalia. *Euclea diversa* was described from female specimens. The type locality for the female lectotype is Cerro Zunil, Guatemala, 3000 to 4000 ft (Champion) (Druce, 1887; lectotype designated by Epstein and Becker 1994). The genitalia of this specimen has an elongate, sclerotized antrum (slide MEE#128), in contrast to the shorter, oval-shaped antrum in *E. gajentaani*. Males of *E. gajentaani* differ from Guatemalan *E. diversa* in the USNM collection by the presence of an additional process on the apex of the aedeagus. Other allied species are believed to be *E. distrahens* Dyar, *E. poasica* Dyar, and *E. byrne* Dyar. *Euclea retroversa* Dyar and *E. vericrux* Dyar, both considered a subspecies and synonym of *E. diversa* by Dyar (1935), are now considered to be distinct from *E. diversa* and closely related to each other (Epstein and Becker 1994).

There is a female specimen in the type series of *E. diversa* from Bugaba, Panama, 800 to 1500 ft (Champion). It was described as being "in very poor condition" (Druce, 1887:220). A specimen matching this description and label in the BMNH collection does not have a type label but was designated as a paralectotype by Epstein and Becker (1994). This specimen was dissected (slide MEE#214) and found to be *E. buscki* Dyar.

Etymology. This species is named after Henricus Gajentaan, Ambassador of the Netherlands to Costa Rica. Gajentaan's personal interest in biodiversity conservation helped bring about the support of the Dutch Government to the biodiversity management activities of INBio.

Distribution. *Euclea gajentaani* is known only from Costa Rica, where it occurs from 700–1200 m on the Caribbean slope.

Material examined. 16 specimens (14 ♂, 2 ♀).

Holotype ♂, Costa Rica: Heredia Province: 16 km SSE La Virgen, D. Wagner & J. Rota, 1070m, 19 Mar 2001, (INBio), (INBIOCRI 003206037).

Paratypes. Costa Rica: Alajuela Province: Sector Colonia Palmareña, San Ramón, G. Carballo, 700–800m, 1 ♂, Mar 1996, (INBio), (INBIOCRI 002450184), Finca San Gabriel, D.H. Janzen & W. Hallwachs, 1 ♂, 5 May 1984, (INBio), (INBIOCRI 001121059), Rio Sarapiquí, 2 km SE de Cariblanco, 700 m, J. McCarty & J. Powell, 1 ♂, 28 Mar 1992, (UCB), (EMEC 51114); Cartago Province: Turrialba, Tayutic, Grano de Oro, Chirripo, P. Campos, 1100–1200m, 1 ♂, Jul 1993, (INBio), (INBIOCRI 001153251); Guanacaste Province: 4 km E Casetilla, Rincon Nat. Pk., D.H. Janzen & W. Hallwachs, 1 ♂, 27 Dec 1981, (INBio), (INBIOCRI 001121060), Sendero Vivero, C. Cano, 730m, 1 ♂, 16 Dec 2001, (01-SRNP-22265), Limite Viales, O. Espinoza, 720m, 1 ♀, 10 Apr 2000, (99-SRNP-13717), Estación Pitilla, 9 km S Santa Cecilia, GNP Biodiv. Inv., 600–700m, 1 ♂, May 1988, (INBio), (INBIOCRI 000026693), C. Moraga, 2 ♂, 1 ♀, Mar 1993, 12–30 Jan 1993, Jan 1994, (INBio), (INBIOCRI: 1203078, 1975515, 1828453); Heredia Province: 16 km SSE La Virgen, ALAS, 1050–1150m, 1 ♂, 12 Apr 2001, (INBio), (INBIOCRI 002634224), D. Wagner & J. Rota, 1 ♂, 19 Mar 2001, (INBio), (INBIOCRI 003206027)[note: same label data as holotype]; San José: Braulio Carrillo, V.O. Becker, 1100m, 1 ♂, Jul 1981, (VOB), (USNM ENT: 167635), Estación Carrillo, P.N. Braulio Carrillo, J. Powell, 1 ♂, 28–30 Jul 1990, (UCB), (EMEC 51008).

Euclea costaricana Epstein and Corrales, new species

Figs. 29–31, 66, 77



Holotype ♂ *Euclea costaricana*

Diagnosis. A small species with diffuse and variable forewing pattern. *Euclea costaricana* can be confused with small specimens of *E. zygia* Druce, but *E. zygia* has a more distinct submedial fascia, with white portion more extended toward tornus.

Description. Forewing length 6.3–9.7 mm (male); 9.5–13.0 mm (female).

Forewing (Figs. 29–31) varies from a light to dark brown with apex slightly produced.

White or cream submedial fascia; subapical spots more distinct in some specimens than others. Submedial fascia, when distinct (only in males), surrounded by dark scales and reaching discal cell. Some male specimens have patches of dark scales both inside discal cell and below it; lower patch angled toward tornus. Up to three subapical spots. A sub-

marginal line extends to near tornus. Forewing fringe with mix of dark and light scales; some individuals with more pronounced checkered appearance especially along ends of veins. Some individuals have golden cast along costa near apex (Fig. 30). Hindwing brown, slightly lighter than forewing. Female less patterned than male; cream patches barely visible in submedian and subapex. Some specimens have hint of dark pattern angled toward tornus below discal cell. Male antenna bipectinate along basal half. Labial palpus brown with cream scales at apex; 1.3X vertical eye width. Proboscis absent (male) or weakly developed (female). Thoracic dorsum darker than abdomen. Ventral part of body light brown. Legs variable in color between individuals, often with dark scale tufts on hind tibia, tarsal segments brown with cream scales at end or more mixed.

Male genitalia (Fig. 66): uncus with two lateral lobes and median downcurved spine. Gnathos concave above, shorter than uncus, blunt at apex with small teeth above. Valva narrow, digitate, and extended about as far to posterior as apex of uncus. Transtilla membranous, divided into two lobes, densely setose; everted or directed cephalad (Fig. 66). Anellus membranous, covered with setae; juxta a vertical plate. Aedeagus base at right angle with distal portion; two long subequal spines proximate to apex. Saccus directed to anterior, triangulate; rounded at apex.

Female genitalia (Fig. 77): ostium bursae transverse and ovoid. Antrum cone shaped, moderately sclerotized. Ductus bursae straight, of variable length relative to corpus bursae. Corpus bursae bisignate with each member transversely elongate. Ductus seminalis connects short distance below antrum. Posterior lobe between ventrum of papillae anales sclerotized, setose, undivided and elongate: extended past papillae anales. Papillae anales with ventral third narrowed into smaller lobe. Anterior apophysis short, curved toward dorsum; pointed at apex. Lateral lobes present on 8th segment.

Remarks. Although one of the more common species of *Euclea* in the INBio collection, few have been found in other collections. It is likely that this species has remained undescribed because of its small size and diversity in forewing pattern. The lighter form is found primarily in the northern portion of the Pacific side of Costa Rica and has a white fascia (an M toward outer margin)(e.g., from Estación Pitillia). The darker form has dark scales in postmedial area "hiding" any fascia (a few white scales)(from Quebrada Bonita, Puntarenas).

The presence of a single, eversible tongue-like transtilla in *E. costaricana* is similar to those found in *Acharia* (=Sibine) (Dyar 1935).

Etymology. The name is derived from the country from which this species was first found.

Distribution. The known distribution of *E. costaricana* is from Costa Rica to Panama. This is a common species found in the Pacific rainforest lowlands, the Caribbean slope from sea level to 1500 m, and in middle elevations in Guanacaste. Insect surveys in Nicaragua will likely turn up this species, given its occurrence along the Costa Rican border.

Material examined. 309 specimens (302 ♂, 7 ♀).

Holotype ♂, Costa Rica: Puntarenas Province: Sirena, Corcovado Nat. Pk., Osa Peninsula, 100m, D.H. Janzen & W. Hallwachs, 23 Mar 1984, (INBio), (INBIOCRI 001120466).

Paratypes. Panama: Canal Zone, Barro Colorado Island, 2 ♂, Silberglied & Aiello, 16–18 Mar 1979, (USNM), (INBIOCRI: 1120516-17), Costa Rica: Puntarenas Province: Guacimal, Finca Buen Amigo Monteverde, 4 km S. de la Reserva, 1000–1100m, 4 ♂, Z. Fuentes, Sep 1998, Feb 1994, Dec 1997, 4–10 Apr 1997, (INBio), (INBIOCRI: 3018704, 2359223, 2408081, 2557761), Sirena, Corcovado Nat. Pk., Osa Peninsula, 100m, D.H. Janzen & W. Hallwachs, 4 ♂, 19–27 Mar 1981, (INBio), (INBIOCRI: 1121153, 1120440, 1120487, 1120493), 1 ♂, 23 Mar 1984, (INBio), (INBIOCRI 001120453), 4 ♂, 5–11 Jan 1981, (INBio), (INBIOCRI: 1120455, 1120457, 1120494, 1120073), F. Quesada, 2 ♂, Jun 1990, (INBio), (INBIOCRI: 677715-16), G. Fonseca, 6 ♂, Apr 1991, (INBio), (INBIOCRI: 288710, 288720, 449448, 475678, 579761, 579846), 1 ♂, Apr 1992, (INBio), (INBIOCRI 000790661), 1 ♂, Apr 1993, (INBio), (INBIOCRI 001202283), 2 ♂, Dec 1990, (INBio), (INBIOCRI: 624334, 700772), 1 ♂, Dec 1991, (INBio), (INBIOCRI 000381182), 6 ♂, Jul 1991, (INBio), (INBIOCRI: 334818, 334846, 334848, 334854, 334872, 334874), 9 ♂, Jun 1991, (INBio), (INBIOCRI: 676436, 676463, 676481, 676494, 676495, 676499, 676503, 676521, 676533), 3 ♂, Jun 1992, (INBio), (INBIOCRI: 708037, 708102, 708192), 2 ♂, Jun 1993, (INBio), (INBIOCRI: 1201352, 1201353), 1 ♂, Mar 1990, (INBio), (INBIOCRI 001925307), 6 ♂, Mar 1991, (INBio), (INBIOCRI: 299909, 300034, 300045, 365309, 365404, 447818), 4 ♂, Mar 1993, (INBio), (INBIOCRI: 1695392, 1695402, 1695439, 1695446), 1 ♀, 3 ♂, May 1991, (INBio), (INBIOCRI: 563226, 563143, 563328, 563405), 1 ♂, May 1993, (INBio), 1205143), 4 ♂, Nov 1990, (INBio), (INBIOCRI: 183298, 183450, 445726, 445778), 4 ♂, Nov 1991, (INBio), (INBIOCRI: 351614, 351647, 351659, 351968), 4 ♂, Oct 1990, (INBio), (INBIOCRI: 179021, 179041, 179228, 179242), 1 ♂, Oct 1991, (INBio), 348340), 2 ♂, Sep 1993, (INBio), (INBIOCRI: 1628775, 1628901), J.C. Saborio, 11 ♂, Nov 1991, (INBio), (INBIOCRI: 547415, 547421, 547455, 547539, 547540, 547559, 547561, 547565, 547567, 547578, 547583), 2 ♂, Sep 1991, (INBio), (INBIOCRI: 499191, 499219), R. Blanco, 3 ♂, Apr 1989, (INBio), (INBIOCRI: 1055368, 1055369, 1055376), Golfito, Jiménez, Albergue Cerro de Oro, 100–200m, E. Phillips, 1 ♂, 26–30 May 1995, (INBio), (INBIOCRI 002211047), Golfito Dept., P. & D. Allen, 1 ♂, 1948, (MCZ), (USNM ENT: 169569), Golfito, Osa, P.N. Piedras Blancas, Sector El Tajo, 100–200m, M. Moraga, 1 ♂, 14–15 May 2002, (INBio), (INBIOCRI 003493301), Osa, Sierpe, Rancho Quemado, 200–300m, F. Quesada, 3 ♂, Dec 1990, Jan 1991, May 1992, (INBio), (INBIOCRI: 342684, 392499, 852472), Esquinas Lodge, 100–200m, M. Moraga, 1 ♂, 16–18 Jun 2002, (INBio), (INBIOCRI 003514037), Rincon, 1.8 mi W, Osa Peninsula, J.P. Donahue & C.L. Hogue, 8 ♂, 21 Feb 1971, 5 Feb 1971, 9 Feb 1971, 30 Jan 1971, 19 Feb 1971, 17 Feb 1971, 13 Feb 1971, 5 Feb 1971), (LACM), (INBIOCRI: 1121259, 1120443, 1120479, 1120481, 1120489, 1120491, 1120508, 169572), J.P. Donahue & Williams, 1 ♂, 9 Mar 1971,

(LACM), (INBIOCRI 000169573), Rincon Nat. Pk Mirador, Ad., 900m, 1 ♂, D.H. Janzen & W. Hallwachs, 29 Mar 1984, (INBio), (INBIOCRI 001120449), Esquinas, Bosque, Pen. Osa, 200m, 1 ♂, M. Segura, 1 Mar 1994, (INBio), (INBIOCRI 001757210), Aguirre, Quepos, P. N. Manuel Antonio, 0–100m, G. Varela, 1 ♂, Sep 1992, (INBio), (INBIOCRI 000815675), 1 ♀, 4 ♂, Oct 1993, (INBio), (INBIOCRI: 1998516, 1998463, 1998556, 1998561, 1998659), A.C.P.C, Garabito, Tarcoles, Estación Quebrada Bonita, 100–200m, J.C. Saborio, 4 ♂, Oct 1994, (INBio), (INBIOCRI: 2045087, 2045243, 2045245-46), 3 ♂, Nov 1994, (INBio), (INBIOCRI: 2054918, 2054919, 2054955), Garabito, Reserva Biol Carara, Estación Quebrada Bonita, 0–100m, J.C. Saborio, 3 ♂, Jun 1993, (INBio), (INBIOCRI: 1184780, 1184782, 1184783), 6 ♂, May 1993, (INBio), (INBIOCRI: 1198725, 1198846-47, 1198850, 1198896, 1198904), 2 ♂, Oct 1993, (INBio), (INBIOCRI: 1664922, 1665043), 2 ♂, 1 ♀, Sep 1993, (INBio), (INBIOCRI: 1655161, 1655242, 1655405), R. Guzmán, 1 ♂, Jun 1996, (INBio), (INBIOCRI 002465427), 2 ♂, May 1993, (INBio), (INBIOCRI: 1744005, 1744010), 1 ♂, Oct 1993, (INBio), (INBIOCRI 001631366), 1 ♂, Sep 1993, (INBio), (INBIOCRI 001660553), R. Zuniga, 1 ♀, Jun 1991, (INBio), (INBIOCRI 000590526)

Other material examined. Costa Rica: Guanacaste Province: 2 km SW Sta Cecilia, 300–400m, 1 ♂, (INBio), 4km E Casetilla, Rincon Nat. Pk, 800–900m, 1 ♂, (INBio), Cañas, P.N. Volcán Tenorio, Sector Montezuma, 1300–1400m, 1 ♂, (INBio), Casetilla, Rincon Nat. Pk., 4 km E, 750m, 4 ♂, (INBio), Estación Pitilla, 9 km S Santa Cecilia, 600–700m, 23 ♂, (INBio), Hda. Santa Maria, 700–800m, 1 ♂, (INBio), Finca La Luz, W side V. Cacao, 1000m, 1 ♀, 1 ♂, (INBio), Liberia, Mayorga, Estación Cacao, 2 km SW de Cerro Cacao, 900–1000m, 1 ♂, (INBio), Pitilla, Estación, 9 km S Santa Cecilia, A.C.G, La Cruz, Parque Nacional Guanacaste, 700m, 1 ♂, (INBio), Sector Sendero Volcán, 3.5 km SSW del Volcán Rincon de la Vieja, 1100–1200m, 1 ♂, (INBio); Cartago Province: Paraíso, P.N. Tapantí, Sect. La Represa, del Puente del Río Porras, 1660m, 9 ♂, (INBio); Río Grande de Orosi, desde Puente Río Dos Amigos hasta la Represa, 1500–1600m, 9 ♂, (INBio); Heredia Province: Estación El Ceibo, 10 km SE La Virgen, 500m, 1 ♂, (INBio), 11 km ESE La Virgen, 300m, 4 ♂, (INBio); Sarapiquí, La Virgen, P.N. Braulio Carrillo. Estación Magsasay, 100–200m, 5 ♂, (INBio); Estación Biol. La Selva, 0–100m, 37 ♂, 1 ♀, (INBio), 2 ♂, (UCB); Limón: Guayacan, 650m, 1 ♂, (INBio); Tapantí, 0–100m, 1 ♂, (INBio); Cerro Tortuguero, 0–100m, 6 ♂, (INBio); Pococí, Colorado, Sector Cerro Cocorí, 30 km N Cariari, 100–200m, 2 ♂, 1 ♀, (INBio); 9.4 km W Bribri, Suretka, 1 ♂, (INBio); Valle de la Estrella, Reserva Biológica Hitoy Cerere, Estación Hitoy Cerere, 100–200m, 3 ♂, (INBio); R.B. Hitoy Cerere, Sendero Toma de Agua, 0–100m, 3 ♂, (INBio); Estación Hitoy Cerere, Send Bobocara, 700–800m, 1 ♂, (INBio); San José Province: Estación Bijagual, 600 m N de Bijagualito, 400–500m, 1 ♂, (INBio); Puntarenas Province: Estación Sirena, Playa Sirena, 0–100m, 20 ♂, (INBio); Estación Quebrada Bonita, 100–200m, 5 ♂, (INBio).

Euclea josepsi Epstein and Corrales, new species

Figs. 32, 67



Holotype ♂ *Euclea josepsi*

Diagnosis. Species with narrow and oblong forewing with reddish-brown submedial and subapical areas similar to *E. trichathdota* Dyar. Forewing of *E. josepsi* approximately twice as long as *E. trichathdota*; male genitalia distinct.

Description. Forewing length 10.9–11.2 mm (male); female unknown. Oblong forewing and dorsum of body dark red-brown (Fig. 32); submedial fascia thin and v-shaped,

angled toward outer margin; top arm around half length of bottom, each slightly curved toward costa and inner margin, respectively. Area surrounding fascia and subapex more noticeably reddish brown. Dark discal patch present, but obscure; sparse yellow scales in discal area. Male antenna bipectinate along basal half. Labial palpus and frons mostly dark scales with some lighter yellowish scales intermixed; 1.3X vertical eye width. Proboscis present. Coxa of foreleg with dark scales below labial palpus at base, followed by dense yellow scales. On all legs femur and tibia with mostly dark brown scales, followed by mostly yellow scales on tarsi.

Male genitalia (Fig. 67): uncus with modest lateral lobes, only visible from below, near apical claw; claw only slightly downcurved. Gnathos with distal arm concave above; apex rounded and upcurved. Valva triangulate with pointed apex curved to dorsum. Juxta with pair of subequal horizontal processes, reaching to near midpoint of valva. Aedeagus with short basal arm angled to distal arm, at approximately third length of aedeagus; distal arm slightly downcurved above beyond base; apex has pair of pointed triangulate processes with left process higher than right. Saccus short triangular lobe between ventral base of valvae; directed to posterior.

Remarks. Many species of *Euclea* have a pair of medial processes in the male genitalia. For some, the pair arises on the aedeagus, while others, such as *E. josepsi*, have the pair on the juxta surrounding the aedeagus. Placing species in groups based solely on this dichotomy should be resisted until a more complete character analysis of the genus is made. With this in mind, it is interesting to note that the species with most similar appearance to *E. josepsi* in Central America, *E. trichathdota*, also has a pair of processes on the juxta rather than the aedeagus.

Etymology. This species is named for Joseph S. Epstein, the late father of the senior author. Joe took his family on weekly visits to the Rocky Mountains, which led them to become hikers and lovers of natural history.

Distribution. Only two known specimens collected from one locality over the same dates, Estación Santa Elena, Las Nubes.

Material examined. 2 specimens examined (2 ♂s).

Holotype ♂, Costa Rica: San José: Estación Santa Elena, Las Nubes, 1210m, M. Segura, 6–10 Apr 1997, (INBio), (INBIOCRI 002510919).

Paratype. Costa Rica: San José: Estación Santa Elena, Las Nubes, 1210m, E. Alfaro, 1 ♂, 6–10 Apr 1997, (INBio), (INBIOCRI 002801160).

Genus *Talima* Walker

We add three new species of *Talima*, bringing the total of this neotropical genus to 19 (Becker & Epstein 1995). *Talima* is known from Mexico to Argentina. The male forewing has a dark band from postmedian to the outer margin of the forewing, which runs parallel to the margin. In females this is often just a dark line with the area along the outer margin matching the color in the median. This dimorphism can make it difficult to properly associate sexes within a species. *Talima* can often be separated from many other species in the *Parasa* complex by absence of light and contrasting submedial fascia and subterminal spots. The color of the hindwing either matches or contrasts with that of the forewing. The male antenna is bipectinate along the basal third. Smaller species can also be confused with *Tanadema* Dyar, though male *Tanadema* have unipectinate rather than bipectinate antennae near the base. Labial palpus is variable in size with the apical segment small. Proboscis is usually present.

Talima appears to be closely related to *Euclea*, although the genus may not be monophyletic (Epstein 1988). One male genitalic characteristic some *Talima* share with a number of *Euclea* species is the presence of lateral lobes near the posterior end of the uncus. This does not occur in any of the other species in the New World *Parasa* complex. The valva is narrow throughout or in apical half, or broad with divided apex. The aedeagus ranges from curved to nearly straight with the apex relatively simple and the vesica without cornuti. Lobes or processes around the aedeagus can be present or absent, and spiny or smooth when present. Males can have a hair patch on the ventrum of the 8th segment (Fig. 82). Female genitalia are variable with sclerotized setose structures sometimes surrounding the entrance of ostium bursae. Antrum are weakly developed with ductus seminalis of normal width or highly developed. Signum present or absent. Papillae anales in Costa Rican species usually with rather angled lateral margins in dorsal half and narrowed to digitate in ventrum.

Caterpillars are known for four species, two that occur in Costa Rica. Along with *Acharia* and *Euclea*, *Talima* are the only known members of New World *Parasa* complex to have oval saddleback patterns. Unlike *Acharia*, at least some species can have a variable pattern among siblings (e.g., *Talima postica* Walker from Venezuela)(Epstein pers. observ.). Deciduous spine patches are present on posterior scoli in the known larvae. Dyar (1926) wrote a key to 11 species of *Talima*. Some of these species were considered synonyms by Epstein and Becker (1994).

***Talima beckeri* Epstein and Corrales, new species**

Figs. 5, 33–34, 78, 81



Holotype ♂ *Talima beckeri*

Diagnosis. *Talima beckeri* has forewing with thin, white line that appears like submedial fascia at its base, as in many *Euclea* species, but it extends to near apex. Forewing shape similar to *Talima aurora* Dyar, but this and other similar species lack white line and are mostly orange throughout; *T. beckeri* has orange only along inner and outer margin, with dark discal area.

Description. Forewing length 8.8–12.4 mm (male); 12.1 mm (female)(from reared specimen). Forewing (Figs. 33–34) with thin horizontal line of white scales along 1A vein for approximately mid-distance across wing, then angled through medial region to subapex, becoming fainter in apical half of wing. Region between line and costa mostly dark brown, with some scattered yellow scales more concentrated near line, and lighter orange brown along costa. Area below line and between line and outer margin deep orange brown with white scales more abundant along veins and darker brown near apex. Forewing fringe along outer margin dark brown at base with an outer white layer except at subapex giving falcate appearance. Female similar in pattern except submarginal veins highlighted with dark scales. Hindwing dark brown, though little lighter than brown above forewing band; fringe with white scales. Thoracic dorsum and abdomen orange brown with mixed yellow with darker brown scales at anterior end of thorax. Frons and vertex with orange brown scales mixed with light yellow. Male antenna narrowly bipectinate along basal third. Proboscis absent. Labial palpus 2X vertical eye width with short third segment directed medially; dorsal surface with mixed scales as on vertex with mostly orange brown laterally and yellow ventrally. Legs mostly with light yellow scales mixed with dark brown, except orange-brown fore-tibia and tarsi.

Male genitalia (Fig. 81): uncus short, triangulate from above; lateral lobes nearly fused with downcurved, medial claw at apex. Gnathos upcurved to near posterior end of uncus. Valva triangulate with lower margin convex from base to near apex, where reflexed; upper margin nearly straight with small rounded process on inner side near apex. Transtilla a pair of dorsally convex lobes with dense setae or coremata long in medial region and about half length laterad. Juxtal plate vertical at base; distal end with pair of processes directed to posterior. Aedeagus with basal arm longer than distal arm; heart-shaped dorsal lobe at junction of basal and distal arms; distal arm with small triangulate dorsal process midway between base and apex of distal arm and pointed process at apex slightly downcurved. Saccus more produced to posterior.

Female genitalia (Fig. 78): narrow, straight ductus bursae beyond antrum; ductus seminalis connects midway between bottom of antrum and beginning of corpus bursae. Cor-

pus bursae elongate ovoid; two-part signum present (shaped like miniature papillae anales). Antrum conical and rugose; moderately sclerotized (= dense but not dark brown). Lobe posterior to ostium bursae, dark brown, covered with dense microsetae; extends to lateral margin of 8th segment. Dorsum of 8th segment smooth, sclerotized; lateral lobes of segment small and inconspicuous. Small sclerotized oval on dorsum at median of posterior margin of 7th segment. Papillae anales nearly equal width throughout without narrowed lobe along ventral margin. Anterior and posterior apophyses short.

Larva. Late instar caterpillar (Fig. 5) with striking pattern of yellow ovals, bordered with red and divided in two parts on dorsum by green; kidney-shaped ovals surround each D scolus on A4 with similar colored spots surrounding large D orange-red scoli on A1, and A7 and A8 combined. Overall shape and structure typical of many caterpillars in *Parasa* complex, especially *Euclea*; longest D scoli on A1, followed closely by D scoli on A7 with D scoli on T2, T3, and A8 longer than SD scoli. D scoli on A4 small with surrounding A2–3 and A5–6 absent (late instars) or highly reduced (earlier instars). This produces breaks in yellow and red oval pattern on dorsum of A2 and A6. Two dark dorsal, orange-brown ovals on T2 and T3, surrounded by yellow. Dark deciduous spine patches at dorsal bases of SD scoli on A8 and single pair of scoli on A9; caltrop spine patches on dorsal apices of SD abdominal scoli. Earlier instars with similar pattern, except red absent and green with dark markings on dorsum. Cocoon covered with detachable spines from larva.

Larval host plants. *Geonoma congesta* (Arecaceae), *Acalypha diversifolia* (Euphorbiaceae), *Croton megistocarpus* (Euphorbiaceae), *Dioclea malacocarpa* (Fabaceae), *Inga oerstediana* (Fabaceae), *Heliconia latispatha* (Heliconiaceae), *Heliconia vaginalis* (Heliconiaceae), *Musa cavendishii* (introduced) (Musaceae), *Myrcia splendens* (Myrtaceae), *Cupania macrophylla* (Sapindaceae), *Heliocarpus appendiculata* (Tiliaceae), *Myriocarpa longipes* (Urticaceae) (all records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. *Talima beckeri* is closely allied with *T. aurora* and other species (*T. ingenour* Dyar, *T. straminea* (Schaus)) based on features of both adult and immature stages. These similarities include an elongate forewing with a produced apex and a more suffused submarginal band or line than is found in a number of *Talima* species (e.g., *T. rubicolor* (Dyar), *T. latescens* Butler, *T. postica*, etc). Genitalic features that are shared with *T. aurora* include a dorsoventrally wide valva and papillae anales without a narrowed ventral portion. The lobe posterior to the ostium bursae in *T. beckeri* is entire, whereas it is bisected by the ostium bursae in *T. aurora* (Epstein 1988).

The shape and pattern of late instar caterpillars in *T. beckeri* is similar to *T. aurora*, though the colors are different. In *T. aurora* the ovals, scoli and a band including the SD scoli are white, in contrast to green on the remainder. The ovals lack a contrasting border color and the white surrounding the D scolus on A4 connects with white flanks along the SD scoli.

Etymology. This species is named in honor of lepidopterist Vitor O. Becker, who collected the first known specimens of this species. Through his seemingly tireless efforts

and encouragement of others, Becker has made significant advances in our knowledge of neotropical Lepidoptera.

Distribution. *Talima beckeri* is presently known from one locality in Venezuela, and the Caribbean slope to Guanacaste in Costa Rica. Guanacaste records are presently only from specimens reared from caterpillars. In Costa Rica *T. beckeri* occurs from 150 m at La Selva to 1200 m at Tapantí (a very large specimen), and in Venezuela at 1560 m.

Material examined. 27 specimens (17 ♂, 10 ♀).

Holotype ♂, Costa Rica: Heredia Province: La Selva Biological Station, Puerto Viejo, D. Wagner, 16 Mar 1999, (INBio), (INBIOCRI 001147398).

Paratypes. Costa Rica: Heredia Province: La Selva Biological Sta., D. Wagner, 1 ♂, 8–24 Mar 1999, (INBio), (INB11474020), D. Wagner & J. Rota, 1 ♂, 15 Mar 2001, (INBio), (INBCRI 003206007); Alajuela Province: Estación San Ramon Biol. Sta., A. Gonzalez H., 1 ♂, Jun 1997, (INBio), (INBCRI 001121327); Cartago Province: Paraíso, Parque Nacional Tapantí, Estación Quebrada Segundo, 1200m, R. Delgado, 1 ♂, Oct 1999, (INBio), (INBCRI 003041793), Turrialba, 600m, V.O. Becker, 2 ♂, 4 Aug 1973, 25 Aug 1971, (VOB), (INBIOCRI: 1121331-32), P.N. Braulio Carrillo, Transecto Irazu, Camp #2, 1500m, J. Montero, 1 ♂, 4–7 Jun 2004, (INBio), (INB 3854220); Guanacaste Province: Sendero Corredor, 620m, G. Sihezar, 1 ♀, 22 Jul 1998, (98-SRNP-6807), C. Cano, ♂, 11 Aug 1999, (99-SRNP-12355), Cementerio Viejo, 570m, F. Quesada, 1 ♂, 26 Nov 1999, (99-SRNP-13388), 1 ♀, 12 Nov 1999, (99-SRNP-13389), Potrero Argentina, 520m, G. Sihezar, 1 ♀, 26 May 2001, (01-SRNP-1483), Rio Blanco Abajo, 500m, C. Cano, 1 ♂, 29 May 2002, (02-SRNP-2878), F. Quesada, 1 ♂, 30 Mar 2002, (02-SRNP-1305), 1 ♀, 11 Apr 2002, (02-SRNP-1453), G. Sihezar, 1 ♂, 11 Apr 2002, (02-SRNP-1291), G. Sihezar, 1 ♀, 20 Aug 2001, (01-SRNP-2672), G. Sihezar, 1 ♀, 20 Aug 2001, (01-SRNP-2673), G. Sihezar, 1 ♀, 4 Oct 2002, (02-SRNP-19047), G. Sihezar, 1 ♀, 10 Nov 2002, (02-SRNP-19492), T. Prescott, 1 ♀, 30 Mar 2002, (02-SRNP-1086), V. Chien, 1 ♀, 21 Aug 2000, (00-SRNP-11783); Venezuela: Edo. Lara: Yacambu Natl Pk., 1560m, 13 km SE Sanare, 2 ♂, 6–11 Aug 1981, 2 ♂, 28–31 July 1981, J. Heppner, (FSCA), (USNM ENT: 169774-77).

***Talima weissi* Epstein and Corrales, new species**

Figs. 35–36, 79, 82–84

Diagnosis. Forewing with wavy dark brown submarginal and submedial lines on yellow to ochreous background, which can be confused with neotropical *Tanadema*. *Talima weissi* is separated from *Tanadema* by basally bipectinate versus unipectinate male antenna, one pair versus two pair of hind tibial spurs, and very small labial palpi. *Talima samuela* (Grote) in Western Mexico has similar pattern, but its green piliform scales on the thoracic dorsum and genitalic differences distinguish it.

Description. Forewing length 7.0–9.0 mm (male); 9.5–11.0 mm (female).

Holotype ♂ *Talima weissi*Paratype ♀ *Talima weissi* (INBIOCRI001120776)

Forewing (Fig. 35–36) pale yellow to ochreous with dark brown postmedial line, arising from and perpendicular to inner margin, shifts distad near CuA_2 , forming wavy line that curves parallel to outer margin until near costal margin, where it angles away from apex. A broader, more diffuse dark line occurs submedially; dark spot found near end of discal cell. Pale yellow individuals with faint forewing lines occur in both sexes. Hindwing yellow with dark fringe scales at innermost part of outer margin (male) or absent (female). Head and thorax also ochraceous or light yellow with mixed dark scales. Male antenna bipectinate along basal half. Labial palpus small, not visible from above; .75X vertical eye width. Proboscis present. Legs with long pilose scales on dorsum, light yellow mixed with scattered dark scales. Abdomen and ventral part of body light yellow.

Male genitalia (Figs. 83–84) in Costa Rican populations with variable uncus and gnathos, uncorrelated with wing pattern. In some individuals distal half of gnathos angled downward with apex not extended as far to posterior as uncus apex (Fig. 84d), whereas others have distal half of gnathos directed to posterior and can be upcurved with apex extended short distance beyond uncus apex (Fig. 84b). An intermediate condition between these two is shown in Fig. 84c. Another variant has gnathos length nearly twice that of uncus, with uncus downcurved contacting medial part of gnathos (Fig. 84a). Valva narrow and digitate, nearly equal in width throughout, and slightly upcurved, either not reaching uncus or going beyond. Transtilla absent (gnathos and aedeagus in contact). Juxta a simple, obliquely angled plate, fused to short anellus. Aedeagus with distal part upcurved and base slightly upcurved and bulbous; base with an oval extension to anterior with narrow sclerotized strip along dorsoposterior margin. Saccus broader than vinculum to anterior. Eighth segment dorsum not extended to posterior over tegumen; subventrum of segment with dense clump of hairlike scales, reaching ventral base of valvae; easily detachable (Fig. 82).

Female genitalia (Fig. 79): ostium bursae small; antrum unsclerotized. Ductus bursae unsclerotized, straight, wider beyond antrum; corpus bursae crescent shaped; signum absent. Mated females with hairlike scales from male abdomen throughout bursa copulatrix and ductus seminalis. Ductus seminalis wide, equal in width to ductus bursae; coiled

around spermatheca; connects to ductus bursae about two-thirds distance from antrum to end of corpus bursae. Dorsal part of papillae anales angulate along lateral margin; ventral part narrow, laterally curved to narrow apex. Anterior apophysis relatively long; curved towards dorsum.

Larva. Awaits images for description.

Larval hostplant. *Thouinidium decandrum* (Sapindaceae) (from: D. H. Janzen and W. Hallwachs 2004).

Remarks. *Talima weissi* is closely related to *Talima assimilis* (Dyar) from Mexico. This is based on the presence of dense detachable scales at the posteroventral portion of the male abdomen (Fig. 82) and their presence inside the females in both species (Fig. 79); a condition not found in other known species in the genus. Perhaps the presence of these scales inside the female prevents multiple matings; though it may also be the collective buildup from successive matings (Epstein 1988). The uncus of *Talima assimilis* is similar to a variant found in *T. weissi* (Fig. 84d), while the female of *T. assimilis* does not have the ductus seminalis coiled around the spermatheca.

It is interesting to note that one specimen with a gnathos much shorter than the uncus is only known from a specimen on the island of Cocinero (Fig. 84a). Although the island is only 3 km from the coast of Guanacaste, limacodids are known to be poor at flight dispersal. The unusual shape of the uncus in this individual raises the possibility of genetic drift. Epstein and Miller (1990) noted unusual asymmetries in shapes of male genitalia in island species of Caribbean limacodids (e.g., *Alarodia* Möschler)

Etymology. This species is named for George Weiss of New York City in recognition of his magnificent support of the education and inventory activities in the Area de Conservacion Guanacaste, the activities that will ensure the survival of this species into perpetuity.

Distribution. *Talima weissi* is presently known from El Salvador to Costa Rica. In Costa Rica the species is known primarily from the Pacific dry forests in Guanacaste and the Gulf of Nicoya in Puntarenas from sea level to 400 m, however, it has also found at higher elevations to the south and east from 1000 to 1400 m. The most southern record for this species is at INBio near Santo Domingo de Heredia.

Material examined. 90 specimens (68 ♂, 22 ♀).

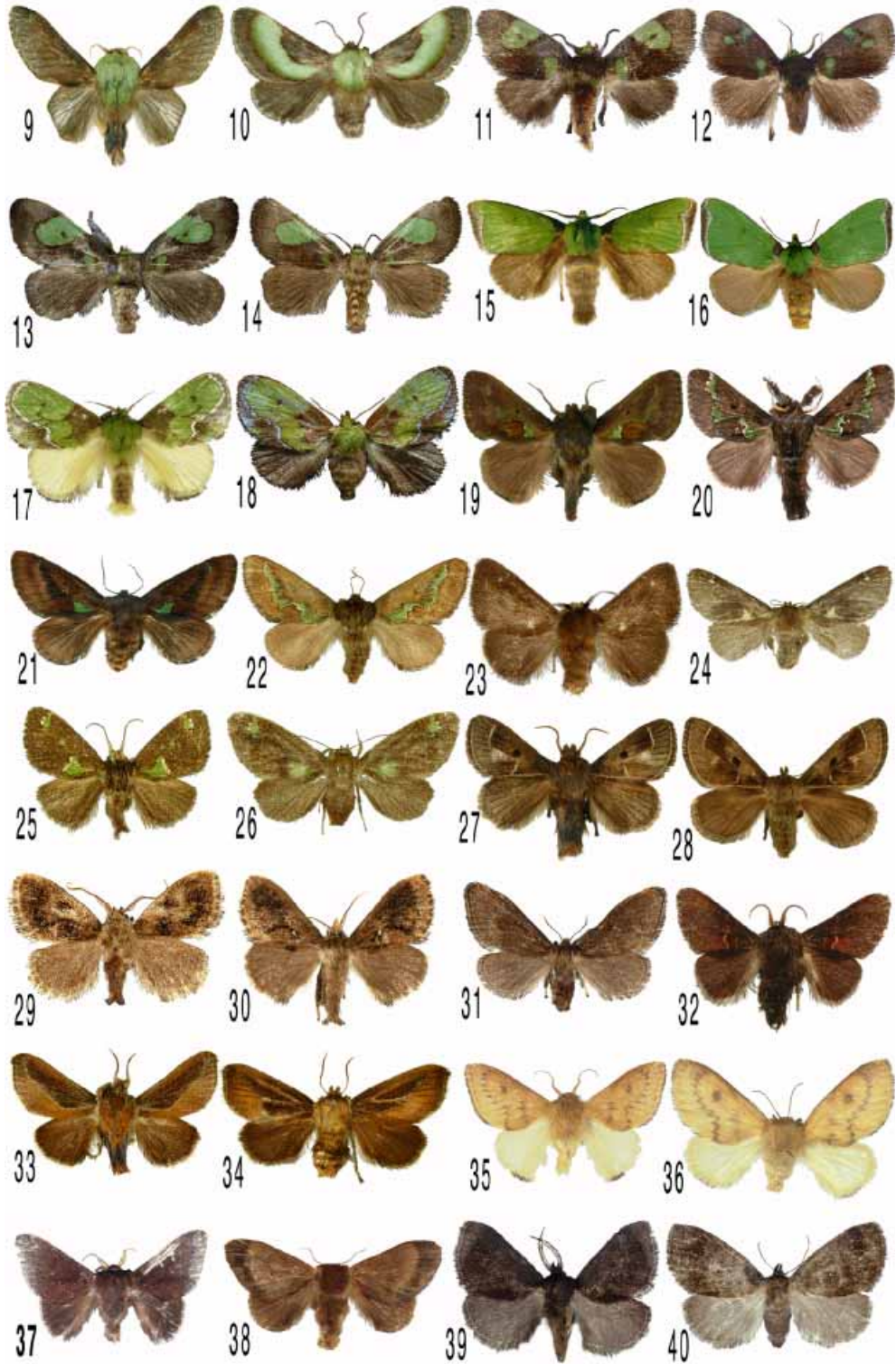
Holotype ♂, Costa Rica: Guanacaste Province: La Cruz, Santa Elena, P.N. Santa Rosa, Estación Murciélago, 8 km SW Cuajiniquil, 0–100m, F. Quesada, 11–29 Aug 1993, (INBio), (INBIOCRI 001140303).

Paratypes. Costa Rica: Alajuela Province: P.N. Volcán Tenorio, Albergue Heliconias, 700–800m, G. Rodriguez, 1 ♂, Aug 2001, (INBio), (INBCRI 003351920); Guanacaste Province: 2 km W Oficina de Biodiversidad, P.N. Barra Honda, 0–100m, M. Reyes, 1 ♂, Mar 1996, (INBio), (INBCRI 002373604), A.C.G. La Cruz, P.N. Santa Rosa, 300–400m, D.H. Janzen & W. Hallwachs, 3 ♀, 1 ♂, Dec 1983, (INBio, USNM), (INBIOCRI: 1119470, 1119475-76, 1119487), 1 ♀, 1 ♂, Feb 1983, (INBio, USNM), (INBIOCRI: 1119479, 1119481), 1 ♀, 2 ♂, Nov 1983, (INBio, USNM), (INBIOCRI: 1119478,

1119482-83), A.C.G. Liberia, P.N. Sta Rosa, Estación Santa Rosa, 200–300m, D.H. Janzen & W. Hallwachs, 2 ♀, 1 ♂, 12 Dec 1978–10 Jan 1979, 1 ♂, 10–12 Jul 1979, 1 ♀, 1 ♂, 10–12 Nov 1979, 3 ♂, 13–15 Nov 1979, 1 ♂, 1 ♀, 15–17 May 1979, 4 ♂, 19–21 Jul 1979, 1 ♂, 20–22 Nov 1979, 1 ♂, 2–11 Mar 1980, 1 ♂, 21–24 Dec 1979, 1 ♂, 22–24 Jul 1979, 1 ♂, 23–25 Nov 1979, 1 ♀, 26–28 Nov 1979, 1 ♂, 28–31 Jul 1979, 1 ♂, 29–30 Apr 1980, 1 ♂, 29–30 Nov 1979, 1 ♀, 4–6 Jul 1980, 2 ♂, 7–9 Nov 1979, (INBio, USNM), (INBIOCRI: 1119444-69), 1 ♂, 3 Jul 1978, 1 ♂, 10 Sep 1978, 1 ♀, 13–15 Jul 1980, 1 ♂, 9–12 Aug 1977, 1 ♂, 3 Jul 1978, 1 ♂, Jul 1982, 1 ♂, 3 Jul 1978, 1 ♂, 4 Jul 1978, 1 ♂, 2–11 Mar 1980, (INBio, USNM), (INBIOCRI: 1119471-74, 1119477, 1119480, 1119484-86), I Microlepidopt, 1 ♂, Jul 1990, (INBio), (INBCRI 000182355), D.H. Janzen & W. Hallwachs, 1 ♀, Jun 1994, (INBio), (INBCRI 001987550), Area Administrativa, 295m, D.H. Janzen, 1 ♀, (98-SRNP-7)(note: adult collected at light, not reared), Headquarters Area, 280m, J. Brown & J. Powell, 1 ♀, 1 ♂, 17, 18 Jun 1988, (UCB), (EMEC 51000-01), Arenal Queb. Tronadorcita, O.S. Flint, Jr, 5 ♂, 24 Jul 1967, (USNM), (INBIOCRI: 1120781-85), Cañas, P.N. Volcán Tenorio, Sector Montezuma, 1300–1400m, G. Rodriguez, 2 ♂, 20 Sep 2001, (INBio), (INBIOCRI: 3375620-21), Encenada frente a Isla Cocinero, 0–100m, Parataxonomos II, 1 ♂, Jul 1990, (INBio), (INBCRI 000308481), La Cruz, Santa Elena, P.N. Santa Rosa, Estación Murciélago, 8 km SW Cuajiniquil, 0–100m, F. Quesada, 3 ♂, 11–29 Aug 1993, 10–18 Sep 1993, 10–29 Oct 1993, (INBio), (INBIOCRI: 1627644, 1627646, 1852877), La Pacifica, 4 km NW Canas coll at light, P.A. Opler, 1 ♀, 20–23 Apr 1971, (UCB), (INBCRI 001120780), Playa Tamarindo, J. Chemsak, 1 ♂, 14 Jun 1986, (UCB), (EMEC 51003), Liberia, Nacascolo, P.N.S.R., Playa Naranjo, 0–100m, E. Alcazar, 2 ♂, Jan 1991, (INBCRI 001375125), Oct 1990, (INBCRI 000070148), Río San Lorenzo, Tierras Morenas, 900–1000m, G. Rodriguez, 1 ♂, Sep 1994, 2019594, Santa Cruz, Bosque Nacional Diríá, Retallano, alrededor torre de control de incendio, 600–700m, H. Mendez, 1 ♂, 15–18 Sep 2001, (INBCRI 003375790), Santa Rosa Nat Park, D.H. Janzen & W. Hallwachs, 300m, 1 ♂, 4–6 Jun 1981, 1 ♂, 1–3 Dec 1979, 1 ♀, 29–30 Apr 1980, 1 ♀, Jan 1984, 1 ♀, Oct 1982, 1 ♂, 29–30 Nov 1979, 1 ♀, 2–4 May 1984, (USNM), (INBIOCRI: 1120773-79), 800–900m, 1 ♂, 17–23 Jul 1993, (INBio), (INBCRI 001132867), Sector Las Pailas, 4.5 km SW del Volcán Rincón de la Vieja, 700–800, K. Taylor, 1 ♂, Nov 1993, (INBio), (INBCRI 001956235); Heredia Province: Tilarán, Tierras Morenas., 700–800, G. Rodriguez, 1 ♂, 1 ♀, Nov 1993, Oct 1994, (INBio), (INBIOCRI: 1956237, 2105428), Santo Domingo, Santa Rosa, INBio, 1100–1200m, J. Corrales, 1 ♂, 6 May 1994, (INBio), (INBCRI 001146226), B. Espinoza, 2 ♂, 12 Jun 1996, 20 May 1998, (INBio), (INBIOCRI: 1149804, 2519121); Puntarenas Province: Guacimal, Finca Buen Amigo Monteverde, 4km S de la Reserva, Z. Fuentes, 1 ♂, 3–8 Jun 1997, (INBCRI 002554570), Monteverde, J. Brown & J. Powell, 1 ♂, 12 Jun 1988, (UCB), (EMEC 51002), Rio Seco NW Esparza, O.S. Flint, Jr, 2 ♂, 23 Jul 1967, (USNM), (INBIOCRI: 1120786-87); El Salvador: L. Ilopango nr Abulo, O.S. Flint, Jr & Ortiz, 2 ♂, 4–5 Jul 1966, (USNM); Guatemala: Sta. Ana Vieja, Preten, V.O. Becker, 1 ♀, 18 Sep 1973, (VOB).



FIGURES 1–8. Caterpillars of new species of Costa Rican Limacodidae (photographs by D. Janzen unless indicated). 1, *Parasa sandrae*, Guanacaste Prov., Sendero Arenales, 1080 m, (98-SRNP-3229), 2, *Parasa joanae*, Guanacaste Prov., Estación Cacao, 1150 m, (97-SRNP-1093), 3, *Euclea gajentaani*, Guanacaste Prov., Limite Viales, 720 m, (99-SRNP-13717), 4, *Euclea mesoamericana*, Guanacaste Prov., Est. Cacao, (99-SRNP-519), 5, *Talima beckeri*, Guanacaste Prov., Cementerio Viejo, 570 m, (99-SRNP-13388), 6, *Isochaetes dwagsi*, Guanacaste Prov., Sector Cacao, Sendero Circular, (02-SRNP-9978), 7, *Isochaetes kenjii*, Puntarenas Prov., Monteverde, (96-JFCM-16)(photograph by J.F. Corrales), 8, *Prolimacodes montanus*, Guanacaste Prov., Casa Fran, 1140 m, (97-SRNP-1328).



FIGURES 9-40. Adults of new species of Costa Rican Limacodidae (note: specimens are not to scale; please see typical forewing lengths in text): 9, *Parasa figueresi* Corrales & Epstein, ♂, Paratype, (INBIOCRI 002723632), 10, *Parasa figueresi* Corrales & Epstein, ♀, Paratype, (INBIOCRI 001665743), 11, *Parasa sandrae* Corrales & Epstein, ♂, Holotype, (INBIOCRI 001115830), 12, *Parasa sandrae* Corrales & Epstein, ♂, Paratype, (98-SRNP-6961), 13, *Parasa sandrae* Corrales & Epstein, ♀, Paratype, (00-SRNP-867), 14, *Parasa sandrae* Corrales & Epstein, ♀, Paratype, (99-SRNP-13380), 15, *Parasa joanae* Epstein, ♂, Paratype, (INBIOCRI 003052743), 16, *Parasa joanae* Epstein, ♀, Paratype, (97-SRNP-1093), 17, *Parasa shirleyae* Epstein & Corrales, ♂, Holotype, (INBIOCRI 003169848), 18, *Parasa shirleyae* Epstein & Corrales, ♀, Paratype, (INBIOCRI 002363924), 19, *Euclea mesoamericana* Epstein & Corrales, ♂, Holotype, lowland form, (INBIOCRI 001147504), 20, *Euclea mesoamericana* Epstein & Corrales, ♂, high altitude form, (INB 0003154045), 21, *Euclea mesoamericana* Epstein & Corrales, ♀, montane form, (97-SRNP-1552), 22, *Euclea mesoamericana* Epstein & Corrales, ♀, high altitude form, (INB0003217052), 23, *Euclea zurquicola* Epstein & Corrales, ♂, Holotype, (INBIOCRI 000617476), 24, *Euclea zurquicola* Epstein & Corrales, ♀, Paratype, (INBIOCRI 000617465), 25, *Euclea microcippus* Epstein & Corrales, ♂, Holotype, (INBIOCRI 002724012), 26, *Euclea microcippus* Epstein & Corrales, ♀, Paratype, (INBIOCRI 001286648), 27, *Euclea gajentaani* Epstein & Corrales, ♂, Holotype, (INBIOCRI 003206037), 28, *Euclea gajentaani* Epstein & Corrales, ♀, Paratype, (99-SRNP-13717), 29, *Euclea costaricana* Epstein & Corrales, ♂, (INBIOCRI 003206012), 30, *Euclea costaricana* Epstein & Corrales, ♂, (INBIOCRI 003053169), 31, *Euclea costaricana* Epstein & Corrales, ♀, Paratype, (INBIOCRI 001121151), 32, *Euclea josepsi* Epstein & Corrales, ♂, Holotype, (INBIOCRI 002510919), 33, *Talima beckeri* Epstein & Corrales, ♂, Holotype, (INBIOCRI 001147398), 34, *Talima beckeri* Epstein & Corrales, ♀, Paratype, (01-SRNP-2673), 35, *Talima weissi* Epstein & Corrales, ♂, Holotype, (INBIOCRI 001140303), 36, *Talima weissi* Epstein & Corrales, ♀, Paratype, (INBIOCRI 001120776), 37, *Talima erojasi* Epstein & Corrales, ♂, (INBIOCRI 001149821), 38, *Talima erojasi* Epstein & Corrales, ♀, Holotype, (INBIOCRI 002502823), 39, *Natada delgadoi* Epstein, ♂, Holotype, (INBIOCRI 002596580), 40, *Natada delgadoi* Epstein, ♀, Paratype, (INBIOCRI 002363901).





FIGURES 41-55. Adults of new species of Costa Rican Limacodidae (note: specimens are not to scale; please see typical forewing lengths in text): 41, *Phobetron guzmanae* Epstein & Corrales, ♂, Holotype, (INBIOCRI 001115612), 42, *Isochaetes dwagsi* Epstein & Corrales, ♂, Holotype, (00-SRNP-10265), 43, *Isochaetes dwagsi* Epstein & Corrales, ♀, Paratype, (97-SRNP-1596), 44, *Isochaetes dwagsi* Epstein & Corrales, ♀, Paratype, (INB0003217053), 45, *Isochaetes kenjii* Epstein & Corrales, ♂, Paratype, (INBIOCRI 002579951), 46, *Isochaetes kenjii* Epstein & Corrales, ♀, Paratype, (INBIOCRI 001120413), 47, *Isochaetes tapantiensis* Epstein & Espinoza, ♂, Holotype, (INBIOCRI 003035209), 48, *Vipsophobetron davisi* Epstein, ♀, Paratype, (INB0003224310), 49, *Isochaetes heevansi* Epstein, ♂, Holotype, (INB 0003438812), 50, *Prolimacodes montanus* Epstein, ♂, Holotype, (INBIOCRI 002602493), 51, *Prolimacodes montanus* Epstein, ♀, Paratype, (02-SRNP-24455), 52, *Dichromapteryx saborioi* Epstein & Corrales, ♂, Holotype, (INBIOCRI 001665037), 53, *Dichromapteryx saborioi* Epstein & Corrales, ♀, Paratype, (INBIOCRI 001665035), 54, *Perola aenea* Epstein & Corrales, ♂, Holotype, (INBIOCRI 000065695), 55, *Epiperola browni* Epstein & Espinoza, ♀, Holotype, (INBIOCRI 002607893).

***Talima erojasi* Epstein and Corrales, new species**

Figs. 37–38, 80

Diagnosis. Larger and darker than other Central American *Talima* with reddish-brown forewing and hindwing such as *T. rubicolor*. *Talima erojasi* cannot be distinguished from South American *T. flexilinea* (Dyar) without dissection.

Holotype ♀ *Talima erojasi*

Description. Forewing length 11.0 mm (male); 13.2 mm (female). Male: forewing (Fig. 37) dark reddish brown with gray marginal border darker along inner border (body destroyed by ants after photo was taken by Corrales). Antenna bipectinate

along basal half. Female: forewing (Fig. 38) dark as in male, but less reddish; marginal band dark in apical third and near tornus with lighter brown in between. Hindwing dark brown. Dorsum of thorax with dark reddish brown scales. Antenna flagellomeres covered with yellow scales. Labial palpus equal in length with vertical width of eye. Proboscis present. Frons and labial palpus yellow. Forecoxa with narrow row of yellow scales at base alternating with reddish brown scales in middle and yellow at distal end. Tarsi yellow-orange on ventral surface of all segments; dorsum with elongate pilose reddish brown scales. Hindleg with long pilose reddish-brown scales on dorsum of tibia. Abdomen dark brown above and yellow-orange below with papillae anales surrounded by yellow-orange scales.

Female genitalia (Fig. 80) with antrum and ductus bursae narrow and unsclerotized. Ductus bursae once coiled and corpus bursae unknown (destroyed during prep.). Ostium bursae narrow with posterior lobe in close proximity; lobe in form of thin heavily sclerotized plate, slightly emarginated at median. Dorsum of 8th segment complex with anterior margin sclerotized and extended below 7th segment, and pair of raised lobes with dense sensory setae in middle of segment. Dorsal part of papillae anales angulate laterad; ventral part narrowed to rounded lobe. Lateral lobes on 8th segment present. Anterior apophysis short; posterior apophysis broad, curved toward dorsum.

Remarks. Specimens of *T. flexilinea* from the Guianas are similar in appearance to Costa Rican specimens of *T. erojasi*. The holotype of *T. flexilinea* from St. Jean Maroni, French Guiana is a female, making comparison of dissected female genitalia important in determining whether the Costa Rican material represents a new species. *Talima erojasi* differs from the *T. flexilinea* in the presence of two dorsal lobes anterior to the papillae anales versus one, and the sclerotized plate posterior to the ostium bursae, which sticks up off the 8th segment and is not directly fused to it as in *T. flexilinea*. An additional female specimen from Kartabo, Guyana (CMNH) was found to be intermediate between the Costa Rican and French Guiana specimens, sharing the two dorsal lobes with *T. erojasi* and the fusion of the sclerite posterior to the ostium bursae with *T. flexilinea*.

Etymology. This species is named for parataxonomist and rancher Elias Rojas, the collector of the three known specimens. Rojas collected over 650 Limacodidae between 1990–1998, particularly at Pococí, Hitoy Cerere and Tortuguero sites in Limón Province.

Distribution. This species is only known from the Caribbean slope of Costa Rica in Limón Province from 10 to 200 m.

Material examined. 3 specimens (1 ♂, 2 ♀)

Holotype ♀, Costa Rica: Limón Province: Pococí, Rita, Sector Cedrales de la Rita, 3 km N del Puente Río Suerte, Ruta Puerto Lindo, 10m, E. Rojas, Mar 1997, (INBio), (INBCRI 002502823).

Paratypes. Costa Rica: Limón Province: Pococí, Colorado, Sector Cerro Cocorí, 30 km N de Cariari, 100–200m, E. Rojas, 1 ♀, Apr 1991, (INBio), (INBCRI 001112268),

Other material examined. Costa Rica: Limón Province: Pococí, Rita, Sector Cedrales de la Rita, 3 km N del Puente Río Suerte, Ruta Puerto Lindo, 10m, E. Rojas, ♂, Jun 1996, (INBio), (INBCRI 001149821)[specimen with only wings remaining][note: image in Fig. 37 taken prior to body being destroyed by ants].

***Natada* complex: Genus *Natada* Walker**

The genus *Natada* and the broader complex of genera related to it has been recently reviewed elsewhere (Corrales and Epstein 2000; 2004). The description of an additional species of *Natada* makes it the most speciose genus of Limacodidae in Costa Rica with 19 species, and 43 species in the neotropics. The type species of *Natada* is an Asian species, *Natada rufescens* Walker.

***Natada delgadoi* Epstein, new species**

Figs. 39–40, 85, 87



Holotype ♂ *Natada delgadoi*



Paratype ♀ *Natada delgadoi*

Diagnosis: Dark smoky gray with paler subapex of forewing; very similar in appearance to dark specimens of *Natada caria* (Druce), except *N. delgadoi* lacks any hint of forewing discal spot and is larger in size. Long labial palpus (>2X vertical eye width) and distinct apical segment (rather than hidden by scales) atypical of New World species of *Natada*. Male genitalia of *N. delgadoi* easily separated from *N. caria* by absence of elaborate juxtal processes. This absence unusual in New World *Natada*.

Description. Forewing length 8.8 mm (male); 12.5 mm (female). Male forewing (Fig. 39) dark smoky gray with hint of dark line from costal margin near apex to outer margin near tornus; scales flattened, giving off reflective sheen. Discal spot absent. Subapical area beyond dark line and hindwing lighter gray. R_3 and R_4 branch off of R_2 . Female (Fig. 40) similar in color and wing pattern, but larger in size and with filiform antenna. Male antenna bipectinate, tapering to short rami in distal third. Labial palpus > 2X vertical width of eye with apical segment easily visible; bent from penultimate segment, directed to anterior. Proboscis absent in male and well developed in female. Head, fore- and midleg with dark scales. Hindleg and body below wings with lighter scales; hind tibial spurs: 0-2-4.

Male genitalia (Fig. 85): uncus apex slightly upturned and claw directed ventrally. Gnathos with base short relative to horizontal arm; extends almost as far as uncus apex. Valva digitate and angled upward reaching just beyond apex of uncus. Transtilla with membranous and setose cap. Aedeagus with basal and distal arms at right angles and of nearly equal length; apex rounded and capitate with two dense clumps of spines.

Female genitalia (Fig. 87): ductus bursae shorter than corpus bursae. Ostium bursae recessed and roughly cube shaped. Antrum of ductus bursae weakly sclerotized tube with longitudinal wrinkles. Signum absent. Papillae anales with sinuate lateral margin bulging in middle. Dorsum of 8th segment sclerotized; lateral lobes visible. Anterior apophysis straight, obliquely angled toward dorsum, parallel to posterior apophysis.

Remarks. The distinct apical segment of the labial palpus is similar to that found in *Natada minuscula* Corrales and Epstein. A proboscis that is well developed in the female and vestigial or absent in the male occurs throughout Limacodidae, although this condition is rare in New World *Natada* (Corrales and Epstein 2000). This same character state occurs in *Natada ceres* (Druce), which occurs in Mexico and Guatemala.

Etymology. This species is named for INBio parataxonomist Roberto Delgado. In addition to the two specimens of this *Natada* species, Delgado has collected around 500 Costa Rican limacodids. These include a number of rare or unique limacodids at the Tapantí Reserve and other localities such as Estación Altamira (Puntarenas Prov.) and Estación Cuatro Esquinas (Limón Prov.).

Distribution. *Natada delgadoi* is only known from two specimens collected at the same site within the Tapantí Reserve, Costa Rica. It is the first of two new species described herein that are known exclusively from this reserve. The other is *Isochaetes tapantiensis* (see below). A third species with broader distribution, *Parasa shirleyae*, has only been collected at Tapantí within Costa Rica.

Material examined. 2 specimens (1 ♂, 1 ♀).

Holotype ♂, COSTA RICA: Cartago: Río Grande de Orosi, desde Puente Río Dos Amigos hasta la Represa, 1400–1800m, R. Delgado, Nov 1997, (INBCRI 002596580).

Paratype. COSTA RICA: Cartago: Río Grande de Orosi, desde Puente Río Dos Amigos hasta la Represa, 1400–1800m, R. Delgado, ♀, Oct 1995, (INBCRI 002363901).

Natada varablancana Epstein, new species

Fig. 86

Holotype ♂ *Natada varablancana*

Diagnosis. Similar to other light brown Central American *Natada* with faint forewing band, but without hint of discal spot or second band running from subapex to outer margin as in *N. monteverdensis* Corrales & Epstein, *N. nindla* Dyar or *N. miradora* Dyar.

Description. Forewing length 10.43 mm (male); female unknown. Forewing light brown with diffuse, transverse black band

parallel to outer margin from subapex along costa, displaced toward base along CuP vein. Scattered black scales on each side of band. R_3 and R_4 branch off of R_2 in the basal fourth between the apex and discal cell. Hindwing grayish brown, darker than forewing. Thoracic dorsum with orange-brown scales. Abdomen with light orange-brown scales, broader than piliform, on anterodorsal median, followed by mixed light and dark brown from middle to posterior end, above, and mostly light brown below. Male antenna broadly bipectinate to apex; scape below with white scale patch. Labial palpus with bent apical segment; 2X vertical eye width. Proboscis absent. Foreleg with light brown scales (note: other legs missing).

Male genitalia (Fig. 86): uncus obliquely angled upwards in apical fourth with claw far to anterior below; y-shaped lobes at apex. Gnathos short, only reaching half distance of uncus. Valva with undulating ventral margin much longer than dorsal margin with deep concavity near narrow apex; inner face densely setose in distal third. Transtilla with medial process above aedeagus and lateral lobe on each side, all heavily sclerotized. Juxta a simple vertical plate that connects to lateral lobes of transtilla from below. Aedeagus with basal and distal arms forming dorsal hump; hump fused with median of transtillar plate cephalad. Distal arm forms long, thin, narrow process that curves upward to gnathos. Vinculum with concavity along anterior border below articulation of dorsal valve base; wider than saccus at ventrum.

Remarks. Although more unusual, the different character sets of the male genitalia of *N. varablancana* match up with different neotropical species. The extensive transtilla implies relationship with *N. caria*, *N. cecilia* Corrales & Epstein or *N. incandescens* Dyar. The upcurved distal arm of the aedeagus is similar to that found in *N. nindla* and *N. monteverdensis*, though more elongate.

Etymology. The name is derived from the village near where the holotype was collected.

Distribution. This species is only known from outside the shelter located at the “2000 m site” of the ALAS transect in Heredia Province.

Material examined. 1 specimen (1 ♂).

Holotype ♂, Costa Rica: Heredia Province: 6 km ENE Vara Blanca, 1950–2050m, K. Nishida, MV light, 15 Mar 2002, (INBio), (INB 000324270).

***Phobetron* Complex: *Phobetron* Hübner, *Isochaetes* Dyar, and *Vipsophobetron* Dyar**

The *Phobetron* complex is perhaps the most unusual group New World Limacodidae, having bizarre features in the immature stages, some which look like small tarantulas or spun glass. These caterpillars have given them strange names such as monkey slugs or hag moths. For all of its notoriety, the *Phobetron* complex has a relatively small number of species, ranging from North to South America. With the addition of six more species, only known from Costa Rica, to those reported by Becker & Epstein (1995), there are now 22 species known from the neotropics. This number will rise when several species in *Euphobetron* Dyar are moved to *Phobetron* (Epstein in prep). The neotropical genera include *Phobetron* Hübner, *Isochaetes* Dyar, *Vipsophobetron* Dyar and *Microphobetron* Dyar. *Alarodia* Möschler, *Leucophobetron* Dyar, and *Heuretes* Grote & Robinson, the three remaining genera, occur in the southeastern U.S. and/or the Caribbean (Epstein and Miller 1989).

The arrangement of forewing radial veins in the *Phobetron* complex is variable with R_3 and R_4 stalked off of R_2 or R_5 . Likewise, male antennae are variable, ranging from entirely bipectinate, bipectinate only at the base, unequal pectinations (=rami) on a flagellomere, or flattened filiform. The first example of the serrate condition in this complex is reported below (e.g., *Isochaetes heevansi*). Female antenna is filiform. Labial palpus typically has an elongate apical segment, while the proboscis is well formed. Male genitalia have a claw at end of the uncus or to the anterior. Adults in all known species have two pair of spurs on the hind tibia. The valva is often narrow and round at the apex. Large sclerotized lobes are laterad to the aedeagus or at the base of the valva (Epstein and Miller 1989). Female genitalia have a signum that is often small and oval when present.

This is the only group of limacodids known to possess hairy larvae. The presence of long deciduous tubercles in the dorsal row is quite distinctive in Lepidoptera. These tubercles can be translucent or opaque with a variety of colored branched setae. The larvae in the *Phobetron* complex are only known as solitary feeders. Cocoons can look like larvae when shed tubercles are incorporated (e.g., *Phobetron*).

Dyar (1899) considered *Phobetron*, *Isochaetes* and *Alarodia* to be a group at the base of a larger group that included genera with spiny larva. Epstein (1996) suggested, based on pupal data, that *Phobetron* may be more closely allied with lineages with smooth larvae (e.g., *Prolimacodes*), while other groups with smooth larvae may be closer to spiny genera.

Phobetron guzmanae Epstein and Corrales, new species

Figs. 41, 94

Holotype ♂ *Phobetron guzmanae*

Diagnosis. Similar in appearance to South American species *Euphobetron moorei* (Kirby) but much darker in color, with less distinct bands on forewing. Basal process on valva much less developed in *P. guzmanae* than in *E. moorei*.

Description. Forewing length 8.0 mm (male); female unknown. Forewing (Fig. 41) orange brown with series of

mostly indistinct bands descending from costa; darkest band near base surrounding narrow white line near inner margin. A pale spot with yellow and white scales edged with dark brown scales at end of discal cell. Yellow and brown scales along margins, including fringe. R_3 and R_4 connect to R_2 near R_5 . Hindwing dark grayish brown with matching abdomen. Collar behind head with white scales, remaining thoracic dorsum with mixture of white and yellow-brown scales. Male antenna bipectinate with pectinations nearly equal in length to apex. Labial palpus upcurved with white scales (apical segment appears to be lost on each). Proboscis present. Maxillary palpus one segmented. A paired, medial lobe present between bases of labial palpi; lobe without sensilla and nearly equal in length to basal segment of labial palpus. Cream scales between coxa and labial palpus, and on foreleg. Mid- and hindleg mixture of light and dark scales. Two pair of hind tibial spurs; each pair of unequal length.

Male genitalia (Fig. 94): uncus claw at apex, hooking downward at 45° angle. Gnathos angled downward with slight upcurve near apex, reaching middle of uncus; with short base, not bent at angle with distal arm. Valva narrow and digitate with narrowest part in middle third; dorsal margin with basal process directed to posterior. Juxta with paired short lateroventral processes and paired long medioventral processes, below aedeagus. Aedeagus modestly sinuate; apical processes absent. Saccus wider than ventral vinculum to dorsum, and equal in width to vinculum near basal lobe of valva.

Remarks. Placement of this species in *Phobetron* rather than *Isochaetes* is based on the similarity of the male genitalia to *Phobetron hipparchia* (Cramer) and *P. pithecium* (J. Smith). This includes the increased length and shift of the tegumen to the posterior, while the uncus and gnathos are relatively shortened. Other neotropical species that are presently in *Euphobetron*, including *E. aquapennis* Dyar and *E. moorei*, will be moved to *Phobetron* based on this genitalic structure and other features (Epstein in prep.).

Male wing pattern and genitalic features suggest that *P. guzmanae* is most closely related to the South American species *E. moorei* and an undescribed species from Rondonia, Brazil (V.O. Becker Collection).

Etymology. This species is named in honor of Rosa Guzmán, the INBio parataxonomist who collected the specimen. Guzmán collected nearly 350 limacodids, from the Carara Biological Reserve.

Distribution. This species is only known one locality in the rainforest lowland of the Pacific slope in Puntarenas Province, Costa Rica.

Material examined. 1 specimen (1 ♂).

Holotype ♂, Costa Rica: Puntarenas Province: Estación Quebrada Bonita, Reserva Biol Carara, R. Guzmán, 50m, May 1993, (INBio), (INBCRI 001115612).

***Isochaetes dwagsi* Epstein and Corrales, new species**

Figs. 6, 42–44, 88, 95



Holotype ♂ *Isochaetes dwagsi*

Diagnosis. Variable pattern with dark and light individuals. Distinctive light submedial bar extends from discal cell to inner margin. Most easily confused with *I. rufescens* (Schaus) but separated by smaller, less distinct submarginal spots and no pale apical patch along outer margin. Male antenna of *I. dwagsi* bipectinate to apex with equal length rami on same flagellomere; *I. rufescens* has unequal pairs of rami and serrate subsegments at apex.

Description. Forewing length 9.5–10.0 mm (males)

and 11.0 mm (female).

Forewing (Figs. 42–44) variable with some individuals having dark gray-brown ground color and others orangish brown. Forewing pattern of irregular bands with dark areas surrounded by light yellow-brown patches or bands. Dark spot near base of discal cell. Pale submedial patch surrounded by darker scales with postmedial spots between M_3 and CuA_1 . Submarginal band grayish brown (dark individuals). Bluish-white scales scattered along edges of bands and veins. Forewing fringe alternating between dark and light with dark between veins. R_3 and R_4 branch off of R_2 near to discal cell or close to R_5 (high elevations). Hindwing grayish brown in all specimens. Thoracic dorsum and head with dark brown scales mixed with scattered pale blue-white scales. Male antenna bipectinate to apex with rami equal length on each flagellomere. Labial palpus elongate with orangish brown scales; $>2.5X$ vertical eye width. Proboscis present. Fore- and midleg femur and tibia dark brown above with scattered light blue scales and yellow or orange brown below; hindleg with pale yellow femur and tibia with brown tarsi (note: all legs yellow in light individuals). Four hind tibial spurs subequal in length within each pair.

Male genitalia (Fig. 95): uncus horizontal above; well-developed claw anterior to apex. Gnathos angled downward approximately 30° relative to uncus; narrowed above and below in apical fourth and upcurved at apex. Valva long and digitate reaching beyond

uncus; concave along ventral margin in basal third. Transtilla and juxta simple. Aedeagus straight with longitudinal sclerite in apical fifth forming an appressed hook at apex. Saccus small, triangulate to posterior; extended short distance to anterior.

Female genitalia (Fig. 88): sclerotized antrum with longitudinal wrinkles, curved to left (viewed below); narrow at connection to ostium bursae. Ductus bursae beyond antrum much shorter than antrum. Corpus bursae about equal length to antrum; signum absent. Ostium bursae weakly sclerotized. Lateral lobes on 8th segment small, but visible. Papillae anales kidney shaped with margin more broadly toothed in ventral half along with longer and more sparse setae. Anterior and posterior apophyses both curved toward dorsum at apex.

Larva. Bluish-green caterpillar (Fig. 6) with translucent tubercles radiating out laterally with size gradually increasing from anterior to middle segments and then decreasing to posterior. Setae on tubercles pilose rather than spiny. Middle of dorsum has yellow band alternating with dark spots surrounded by green on each segment (this may be present only in late instars). Abdominal segments 1–8 each have globular tubercle on dorsal crest (D1) fused with more elongate tubercle directly below (D2). Although fused together, each pair member has two roots that attach to body. These tubercles easily detach from body. D1 tubercles often have dark or brown blotches in middle or apical portions, at least in later instars. All SD tubercles and tubercles on T2 and T3 small. T2 and T3 each have two D and one SD tubercle, whereas A9 has only has one tubercle, presumably a D. Difficult to separate from *I. rufescens* in Central America.

Larval hostplants. *Mosquitoxylum jamaicense* (Anacardiaceae), *Crossopetalum parviflorum* (Celastraceae)(67 records), Combretaceae, Flacourtiaceae, *Calatola costaricensis* (Icacinaceae), *Symplocos naniflora* (Symplocaceae) (99 records, 7 plant families) (all records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. This is another example of a species in which most of the adult specimens examined have come from larvae reared in Guanacaste National Park. The males of *I. dwagsi* have a tendency to become greasy, which made the first specimens that came to our attention difficult to place in a genus.

One reared male specimen (01-SRNP-22900) has a forewing length of only 5.6 mm. The wings are nearly black without any markings other than the scattered bluish-white scales.

Etymology. This species is named after David L. Wagner (University of Connecticut). Wagner, whose nickname is “Wags,” is a specialist in leaf-mining Lepidoptera. He has been actively involved in Costa Rican biodiversity projects since the mid-1990’s, having collected and prepared a large number of limacodids through the ALAS project.

Distribution. *Isochaetes dwagsi* has been found at elevations ranging from 500–2050 m with most found between 1000–1200 m. Known primarily from the forests of the Guanacaste Cordillera but also from Heredia Province at 2000 m near Vara Blanca and Alajuela Province from 1000 m at San Ramón, Angeles, R.B. Alberto Brenes, Sector Catarata.

Material examined. 36 specimens (17 ♂, 19 ♀).

Holotype ♂, Costa Rica: Guanacaste Province: Sendero Derrumbe, 1220m, H. Ramirez, 27 Sep 2000 [eclosion date], (00-SRNP-10265).

Paratypes. Costa Rica: Alajuela Province: San Ramón, Angeles, R.B. Alberto Brenes, Sector Catarata, 800m, G. Carballo, 1 ♂, Nov 1994, (INBio), (INBCRI 002114148); Guanacaste Province: Parque Nacional Guanacaste: Vado Cucaracho, O. Espinoza, 1 ♂, 06 Jan 2002, (01-SRNP-22900), Sendero Corredor, 620m, G. Sihezlar, 1 ♂, 19 Nov 2002, (02-SRNP-19594), Sendero Palo Alto, 570m, G. Sihezlar, 1 ♀, 28 Oct 2002, (02-SRNP-19271), Rio Blanco Abajo, 500m, C. Cano, 1 ♀, 2 Aug 2002, (02-SRNP-1474), Sendero Nayo, 1090m, M. Pereira, 1 ♂, 24 Aug 2001, (01-SRNP-6981), 1 ♀, 25 Sep 2001, (01-SRNP-7092), H. Ramirez, 1 ♀, 28 Aug 2001, (01-SRNP-7081), 1 ♂, 25 Sep 2001, (01-SRNP-7083), Sendero Arenales, 1080m, H. Ramirez, 1 ♂, 28 Aug 2001, (01-SRNP-6999), 1 ♂, 24 Aug 2001, (01-SRNP-7000), 1 ♂, 31 Aug 2001, (01-SRNP-7002), F. Quesada, 1 ♀, 16 Jun 2003, (02-SRNP-24387), Sendero Abajo, 1020m, H. Ramirez, 1 ♀, 7 Sep 2001, (01-SRNP-7102), M. Pereira, 1 ♀, 3 Sep 2001, (01-SRNP-7109), 1 ♂, 28 Aug 2001, (01-SRNP-7110), 1 ♀, 28 Aug 2001, (01-SRNP-7117), Estación Cacao, 1150m, R. Moraga, 2 ♀, 2 Sep 1997, (97-SRNP-1595), 8 Sep 1997, (97-SRNP-1596), Sendero Circular, 1185m, H. Ramirez, 1 ♀, 10 Sep 2002, (02-SRNP-9977), H. Ramirez, 1 ♀, 9 Sep 2002, (02-SRNP-9979), Sendero Derrumbe, 1220m, H. Ramirez, [same label data as holotype], 4 ♂, 27 Sep 2000, (00-SRNP-10265), 28 Aug 2001, (01-SRNP-7066), 19 Jun 2002, (01-SRNP-21176), (01-SRNP-21458), 30 Aug 2001, (01-SRNP-7076), 5 ♀, 20 May 2001, (00-SRNP-23681), 15 Aug 2002, (01-SRNP-21174), 24 Aug 2001, (01-SRNP-7061), 26 Aug 2001, (01-SRNP-7063), 2 Sep 2001, (01-SRNP-7067), Liberia, Mayorga, Estación Cacao, 2 km SW de Cerro Cacao, 900-1000m, C. Chavez, 1 ♂, Sep 1991, (INBCRI 000356860), W. Hallwachs, 1 ♀, May 1992, (INBCRI 000879174); Heredia: 6 km ENE Vara Blanca, 1950-2050 m, D. Wagner, 1 ♂, 10 Feb 2002, (INB 3215809), ALAS, 1 ♂, 21 Feb 2002, (INB 0003220124), J. Powell & J. Brown, 1 ♀, (INB 0003217053)

***Isochaetes kenjii* Epstein and Corrales, new species**

Figs. 7, 45–46, 89



Holotype ♀ *Isochaetes kenjii*

Diagnosis. Only Central American limacodid species having forewing with light submarginal v-shaped pattern pointing to base. Forewing of female with unique dense gray bar bordered with cream-colored fringe along tor-nus. Male antenna similar to *I. dwagsi*, which has equal-sized

rami in each flagellomere (see above). Hind tibial spur pairs largely unequal in size within a pair, which separates *I. kenjii* from *I. dwagsi*, which has subequal spurs.

Description. Forewing length 9.5 mm (male); 11.5–13.2 mm (female).

Forewing (Figs. 45–46) dark brown and gray. Submarginal light v-shaped pattern pointing to base with upper ray between M_1 and M_2 and the lower ray between M_2 and M_3 ; scales white (female) or brownish yellow (male). R_3 and R_4 branch off of R_2 nearer to discal cell than apex. Male with dark submedial patch, not found in female. Female with zig-zag medial and basal bands from costa to inner margin with dark and light brown; male with more diffuse pattern. Female more distinctly marked inside tornus than male, with dense gray patch, edged with white line of scales on outer border next to cream-colored fringe; dense gray with white along outer edges in subapical region, but interrupted by dark brown scales along veins. Forewing fringe dark, intermixed with cream in apical half, in contrast to cream along tornus in female; dark and light scales intermixed for entire fringe in male. Inner margin has extended lobe with light gray or brown and white scales. Base of wing and thoracic dorsum in anterior two-thirds with mix of white scales and shades of brown; lighter female with mostly shades of brown and few white scales intermixed. Posterior third of thoracic dorsum with tuft of orangish-brown scales. Hindwing dark brown with outer fringe scales cream or white, and inner fringe scales dark brown. Male antenna bipectinate to near apex with paired rami equal in length. Labial palpus 2X vertical eye width; scales cream-colored ventral and dark brown dorsal and lateral (male) or dark brown throughout (female). Male with collar of cream scales below head and legs with mix of light and dark scales; female as in male, except darker collar, or darker throughout with scattered white scales especially on dorsum of midtibia. Four hind tibial spurs distinctly different in size among each pair.

Male genitalia (note: INBio preparation used for description presently unaccounted for and was not illustrated): uncus narrowed in distal third with apex pedunculate with downcurved spine. Gnathos arms directed ventrad between transtillar processes; flattened and of equal width throughout, rounded at apex. Transtillar processes directed ventrad; divided into two spines at apex. Valva digitate, narrow throughout with round apex. Aedeagus short, curved in basal half; apex simple.

Female genitalia (Fig. 89): antrum moderately to weakly sclerotized with several longitudinal bands; ductus bursae wider beyond antrum, broadly grading into corpus bursae as in *I. rufescens*. Signum single and triangulate (Costa Rica) or elongate and transverse (Mexico). Ostium bursae wide and round with large lobe to posterior between ventral margin of papillae anales. Anterior apophysis very short, extended only slightly beyond anterior margin of 8th segment. Papillae anales with larger setae in ventral third along with an irregular, dentate margin. Dorsum of 8th segment sclerotized and raised along posterior margin behind papillae anales. Small dorsomedial lobe between and below papillae anales.

Larva. Yellow-green caterpillar (Fig. 7) with dorsal longitudinal band and tubercles distinct from *I. rufescens* and *I. dwagsi*. May be similar to *I. heevansi* (see below). Dor-

sum with median of thoracic segments brown and A1–A9 with yellow-orange ovals bisected by a thin longitudinal white stripe surrounded by a dark band; stripe narrows between segments with a small violet spot at each juncture. On edge of dorsal ovals, small dorsal D1 tubercles fuse with more elongate and lateral D2 tubercles (note: connection of these tubercles to body and tubercle structure on T2, T3 and A9 match *I. dwagsi*, see above). Dorsal tubercle on A1 mostly orange-brown with black apex; more elongate than on A2 and curved more dorsad and to anterior than other D abdominal tubercles. Setose dorsal tubercles on A2–A3, A5 and A7 all with distal half with banded pattern beginning with narrow yellow and black at base, followed by salmon color for most of remainder, infused with yellow and finally a black band with white apex. Other dorsal tubercles have only narrow band of yellow and black with white apex.

Larval hostplant. *Nectandra* sp. (Lauraceae) (Z. Fuentes collector).

Remarks. A similar species with v-shaped forewing markings from Peru [Santo Domingo, Carabaya, 6500 ft (BMNH)] has been examined, but it has distinctly different male genitalia. The first male we examined of this species in the INBio collection from Cerro Cacao was missing an abdomen. The other specimen, collected earlier by Janzen and Hallwachs, was given to INBio at a later date. Unfortunately, subsequent to the dissection and description, we have been unable to locate the preparation.

The caterpillar (Fig. 7) was from Buen Amigo, Monteverde, 1300m. Although it did not emerge from the cocoon, the adult female was fully developed and the distinct genitalia clearly matches those from other specimens collected at lights.

Etymology. This species is named in honor of Kenji Nishida, a graduate student at the University of Costa Rica from Matsubara-city, Osaka, Japan. Nishida, an expert in gall-making Lepidoptera, has shown great dedication to rearing and imaging species of Costa Rican Zygaenoidea.

Distribution. *Isochaetes kenjii* is known from Costa Rica and Veracruz, Mexico, mostly from 700–1000 m. In Costa Rica it has been in montane localities in the northern half of the country and from one lowland site in the central Pacific region at Carara.

Material examined. 8 specimens (2 ♂, 6 ♀).

Holotype ♀, Costa Rica: Guanacaste Province: Estación Pitilla, 9 km S Santa Cecilia, 700m, C. Moraga, 19 May–3 Jun 1993, (INBio), (INBCRI 001341669).

Paratypes. Costa Rica: Guanacaste Province: 4 km E Casetilla, Rincon Nat. Pk, 750m, D.H. Janzen & W. Hallwachs, 1 ♂, 22 May 1982, (INBio), (INBCRI 002579951), Liberia, Mayorga, Estación Cacao, 2 km SW de Cerro Cacao, 900–1000m, C. Chavez, 1 ♂, Sep 1991, (INBio), (INBCRI 000356861), Finca La Luz, W side Volcán Cacao, 1000m, D.H. Janzen & W. Hallwachs, 1 ♀, 3–8 Aug 1986, (INBCRI 001120413); Puntarenas Province: Estación Quebrada Bonita, Garabito, Reserva Biol Carara, 0–100m, J.C. Saborio, 1 ♀, Nov 1992, (INBCRI 00841484); Mexico: Veracruz: Cordoba, J.S. Buckett, M.R. & R.C. Gardner, 1 ♀, 25 Jul 1966, (UCB), (EMEC 51036), Fortin de las Flores, 1010m, J.A. Chemsak, E. & J. Linsley, & J. Powell, 7–12 Jul 1974, (UCB), (EMEC 51037).

Other material examined. Costa Rica: Puntarenas: San Luis, Monteverde, Buen Amigo, 1300m, Z. Fuentes, 1 ♀, 28 Oct 1996, [spun cocoon: 3 Dec 1996], (96-JFCM-16), (INBio).

***Isochaetes heevansi* Epstein, new species**

Figs. 49, 96



Holotype ♂ *Isochaetes heevansi*

Diagnosis. Similar to several Central American limacodid species with clear patches on fore- and hindwing, including *Phobetron hipparchia*, *Vipsania melanois* (Dyar), *Natada semivitrea* (Schaus), and *Euclea bidiscalis* Dyar. Only species among this group of species that has unipectinate male antenna and with short rami.

Description. Forewing length 8.4–9.8 mm (males)[note smaller specimen reared]; female unknown. Male forewing narrow and elongate (Fig. 49). Both wings black with nearly clear patches, stippled with tiny scales nearly perpendicular to wing surfaces. Leading edge of forewing patch below discal cell, near median and extended along M_2 to submargin; patch extends down to CuA_2 . Forewing R_3 and R_4 branched off of R_5 near R_2 . Small white patch of scales at end of discal cell and scattered white scales in subapical area. Hindwing patch from along leading edge of discal cell from near base, extended along M_1 to near outer margin; patch extends down to near CuP . Hindwing R_s and M_1 forked beyond midpoint between discal cell and outer margin. Fringes of both wings with mix of black and gray scales. Thoracic dorsum and entire abdomen covered with black scales. Male antenna unipectinate with short, ciliate rami. Labial palpus 1.8X vertical eye width; apical segment acuminate, dark brown, and almost half length of middle segment; scales on ventromedian of middle segment white and lateral margin dark brown. Proboscis coiled. Region between head and foreleg and forecoxae covered with white scales. All tarsi dark red-brown at base and white at distal end above. Tibial spurs 0-2-4; hindleg with basal pair nearly equal and distal pair distinctly different in size and length (inner spur approximately 2X longer and much wider).

Male genitalia (Fig. 96): claw of uncus anterior of apical margin on dorsum; apex weakly emarginate. Gnathos extended midway to apex of uncus with distal arm straight along ventral margin and upcurved at apex; dorsum of distal arm concave until distal third with several bumps near apex. Valva narrows in medial third, widening to a broader, round apex; inner face covered with dense setae on distal third. Region surrounding aedeagus membranous and without lobes. Juxta a horizontal plate without a process. Aede-

gus an oblong oval with rounded base and apex equal in length to valva; cornuti absent. Saccus short, directed to posterior.

Larva. Caterpillar of *I. heevansi* appears similar to *I. kenjii* (Fig. 7) (based on field description by G. Sihezar). Presently no larval images or specimens are known for *I. heevansi*.

Larval hostplants. One known caterpillar of *I. heevansi* reared on *Nectandra martinicensis* (Lauraceae) (record from: D. H. Janzen and W. Hallwachs 2004).

Remarks. This species is provisionally placed in *Isochaetes*. It was initially thought by Epstein to belong in the *Natada* complex, prior to the discovery of the larva. The adult is similar in appearance to *Isa diana* (Druce) and *Natada semivitrea*, members of this generic complex with translucent patches on their wings. However, a combination of adult characteristics of the head, wing venation, tibial spurs, and genitalia more closely link *I. heevansi* with either the *Phobetron* or *Prolimacodes* complexes. While the antenna and labial palpus closely match species found in the *Prolimacodes* complex, the presence of tubercles in late instars, as found in *I. heevansi*, does not occur in this group. Furthermore, the male genitalia in *I. heevansi* are similar to those found in *Isochaetes dwagsi* (Fig. 95) and *Vipsophobetron davisii* (Fig. 98), which include a narrow valva and a linear-globular aedeagus. The male antenna of *I. heevansi* is different from any species presently placed in *Isochaetes* or other genera in the *Phobetron* complex. However, the short unipectinate form may be intermediate between the bipectinate condition found in many *Phobetron* and *Isochaetes* and the flat filiform antenna found in *I. tapantiensis* and *Vipsophobetron davisii* (see below). The male genitalia also differ from genera in the *Prolimacodes* complex in lacking transtillar lobes dorsal of the aedeagus, as found in *Prolimacodes* (Fig. 99) or *Venadicodia* Dyar (Corrales and Epstein 1997), or the processes on the ventral valva found in *Dichromapteryx* Dyar (Figs. 100, 101) or *Semyra*. The disparity in size between hind tibial spur pairs is similar to those found in *Phobetron guzmanae* and *Isochaetes kenjii*, however, the condition appears to be variable within the complex (e.g., *I. dwagsi*).

There is an undescribed species in the genus *Semyra* from Rondonia, Brazil (VOB collection) with a very similar pattern on the wings and scale pattern on the body to *I. heevansi*. However, the species has typical bipectinate male antenna, forewing venation, and distinct genitalic features (e.g., upturned apex of aedeagus) that place it in *Semyra*.

It is likely that *I. heevansi* is sexually dimorphic with the female lacking the clear patches in the wings, as is the case in other similar limacodid species in various genera worldwide. There appears, however, to be at least one exception to the rule. The African species *Zarachella specularis* Jordan, although known only from the female, is dark with clear patches similar to those found in *I. heevansi* (Jordan 1915).

Etymology. Named in memory of hymenopterist and ethologist Howard Ensign Evans, a professor and undergraduate advisor to the senior author at Colorado State University from 1973–77. Evans inspired a number of students, including Epstein, to become systematic entomologists.

Distribution. *Isochaetes heevansi* is known from two specimens found in forests on the Caribbean slope of Costa Rica, from 400–700 m in elevation.

Material examined. 2 specimens (2 ♂).

Holotype ♂, COSTA RICA: Limón: Hitoy Cerere, Calavera Danta, 400–500m, M. Moraga & L. Chavarria, 14 Mar 2002, (INBio), (INBCRI 003438812).

Paratype. COSTA RICA: Alajuela: Quebrada Cementerio, Sector San Cristobal, 700m, O. Espinoza, 6 Mar 2003 [eclosion date], (02-SRNP-19900).

***Isochaetes tapantiensis* Epstein and Espinoza, new species**

Figs. 47, 97



Holotype ♂ *Isochaetes tapantiensis*

Diagnosis. Unique combination of characters among Central American Limacodidae include: tortriciform forewing, elongate labial palpus, filiform male antenna, fused $R_3 + R_4$ branched off of R_2 . Radial vein arrangement separates *I. tapantiensis* from *Vipsania* Dyar, an unrelated

neotropical genus with some similar characters (see “Remarks” below).

Description. Forewing length 7.1 mm (male); female unknown. Forewing (Fig. 47) brownish yellow with oblique dark brown band from apex to middle of inner margin; scattered yellowish-orange medial scales. Costal margin convex with apex slightly produced and outer margin narrow. R_3 and R_4 fused, coming off of R_2 nearly midway between discal cell and apex; R_5 split back to posterior but connected to discal cell. Hindwing light yellow, but shade darker along outer margin. Legs and body with pale-yellow scales. Male antenna flattened filiform. Labial palpus elongate and directed horizontally; 2.6X vertical eye width. Proboscis present. Tibial spur pairs elongate and of equal length; nearly half length of tibia.

Male genitalia (Fig. 97): uncus with slight dorsal hump; gently upcurved to beyond midpoint and then more steeply to a well developed claw at apex. Gnathos short, angled downward from base and curved to posterior at apex. Juxta with pair of narrow, horizontal processes directly below aedeagus. Aedeagus short and slightly upcurved along ventrum of globular base; apex with only hint of sclerotized patches. Valva digitate, of equal width throughout, and rounded at apex; densely setose on inner surface with small process on ventral margin directed to near aedeagus apex. Saccus directed to anterior, triangulate and upcurved at apex.

Remarks. At present a case could be made to place this species in either *Isochaetes* or *Vipsophobetron*. The labial palpus, size, and more even length of spur pairs more fit the

former, whereas the male antenna fits the latter. This becomes the first species in *Isochaetes* with filiform male antenna. However, there is already evidence of rami reduction in the genus: unipectinate and subequal rami occur in *Isochaetes marinna* Dyar and *I. rufescens*. Phylogenetic analyses and additional data will be needed to better draw the limits between these two genera and others in the *Phobetron* complex.

The first impression of *I. tapantiensis* is of the North American species *Tortricidia testacea* Packard, however, this is only suggested by the wing pattern and narrow body width. Structurally, the combination of the male flattened filiform antenna, elongate labial palpus and paired juxtal processes are reminiscent of species in the neotropical genus *Vipsania* Druce. However, species in *Isochaetes* also have an elongate labial palpus and a tendency for R₃ and R₄ to branch off of R₂, rather than R₅, as is the case in *Vipsania*. The globular aedeagus more closely fits *Isochaetes* and other members of the *Phobetron* complex (e.g., *Alarodia* and *Heuretes*) than *Vipsania*, which has a more elongate rod. Although this is a unique example of a fused R₃ and R₄ in the *Phobetron* complex, other species such as *Heuretes picticornis* Grote & Robinson have R₃ and R₄ branched close to the apex (Epstein and Miller 1990).

Etymology. This species is named for the biological reserve where it was collected.

Distribution. *Isochaetes tapantiensis* is only known from a single specimen that was collected at 1400 m in the Tapantí Reserve.

Material examined. 1 specimen (1 ♂).

Holotype ♂, Costa Rica: Cartago Province: Tapantí, Sendero La Pava, R. Delgado, 1400m, Apr 1999, (INBio), (INBCRI 003035209).

***Vipsophobetron davis* Epstein, new species**

Figs. 48, 90, 98



Holotype ♂ *Vipsophobetron davis*

Paratype ♀ *Vipsophobetron davis* (INB0003224310)

Diagnosis. Among smallest species of neotropical Limacodidae. Brown forewing and male genitalia, including absence of juxtal spine, separate *V. davis* from *Microphobetron rebella* Dyar, only New World limacodid species of comparable size without bipectinate antennae.

Description. Forewing length 4.4–5.3 mm (male)[smaller wild caught, larger reared holotype]; 6.8–7.1 mm (female)[smaller wild caught, larger reared]. Forewing (Fig. 48) chocolate brown without appreciable pattern; scattered lighter scales in discal cell and median area. R_3 and R_4 branch near apex. Male forewing R_3+R_4 connected to R_2 at discal cell; R_5 in line with anterior discal cell. Female with nearly twice male in forewing size with R_3 and R_4 connected to R_2 near discal cell; R_5 split back to posterior. Hindwing similar in color to forewing, but more uniform brown. Scales over dorsum of thorax and abdomen brown. Male and female antenna filiform; male flagellomeres flattened and broader. Labial palpus directed upward with short apical segment; $>1.5X$ vertical eye width. Proboscis present. Tibial spur pairs with long member twice as long as short one. Legs with mostly brown scales on male and pale yellow scales on female.

Male genitalia (Fig. 98): uncus horizontal above; claw weakly developed and anteroventral to apex. Gnathos with distal arm only slightly angled downward, extended half distance of uncus; apex upturned. Valva digitate, nearly equal width beyond base; setose on inner surface. Aedeagus sinuate with basal arm globular and distal arm curved upward and to right; apex simple and vesica without cornuti. Saccus more directed to anterior; rounded triangulate.

Female genitalia (Fig. 90): weakly sclerotized antrum; ductus bursae and corpus bursae about equal in length. Signum absent. Papillae anales more broadly toothed in dorsal half of lateral margin; left and right lobe combined round in circumference. Anterior apophysis elongate; both anterior and posterior apophyses curved toward dorsum.

Larva. Caterpillar green with a yellow medial stripe on dorsum (from description of a gusanero, no image available).

Larval hostplant. Three caterpillars found in 2003 on *Geonoma ferruginea* (Araceae) (records from: D. H. Janzen and W. Hallwachs 2004).

Remarks. This species could be placed in *Vipsophobetron* or *Microphobetron*. *Vipsophobetron* was chosen because the forewing radial vein R_5 is split back in the female, but not the male, the condition found in *Vipsophobetron marona* Dyar, the type species of *Vipsophobetron*. In *Microphobetron rebella* the R_5 is split back in both sexes. These two genera are likely to be synonyms, with *Vipsophobetron* the senior of the two (Epstein in prep).

The discovery of caterpillars that produced males and a female from the same host plant confirms the sexes were properly associated for this sexually dimorphic species.

Etymology. This species is named in honor of the collector of one paratype, Don R. Davis of the National Museum of Natural History, Smithsonian Institution. Although Davis is more known for his work on more primitive groups of Lepidoptera, he produced the checklist for North American Limacodidae (Davis 1983). Davis first suggested Limacodidae as a dissertation topic to the senior author in 1984 and later served as his postdoctoral advisor.

Distribution. Only known on the Caribbean slope of Costa Rica from La Selva Biolog-

ical Station and from Sector San Cristobal in the ACG. The first specimen that came to our attention was a male collected in the canopy by malaise trap at La Selva.

Material examined. 5 specimens (3 ♂, 2 ♀).

Holotype ♂, Costa Rica: Alajuela Province: Sendero Perdido, Sector San Cristobal, 620m, E. Araya, 26 Dec 2003 [eclosion date], (03-SRNP-34374),

Paratype. Costa Rica: Heredia Province: Finca La Selva, Puerto Viejo de Sarapiquí, malaise trap, *Coumarouna oleifera*, D.R. Perry, 1 ♂, 11–12 Jun 1975, (LACM), (INBCRI 001121328), Estación La Selva, D.R. Davis, 50–150 m, 1 ♀, 16 Apr 2003, (INBio), (INBCRI 003224310); Alajuela Province: Sendero Perdido, Sector San Cristobal, 620m, E. Araya, 1 ♂, 27 Dec 2003 [eclosion date], (03-SRNP-34375), 1 ♀, 28 Dec 2003 [eclosion date], (03-SRNP-34376).

***Prolimacodes* complex**

The *Prolimacodes* complex (Epstein 1996) is a New World and primarily tropical group that includes *Prolimacodes*, *Semyra*, *Euphobetron* (in part), *Venadicodia*, *Tanadema*, and *Dichromapteryx*. Two other neotropical genera, *Claphidia* Dyar and *Hepialopsis* Dyar, should also be included. Characteristics of this complex are described by Corrales and Epstein (1997), while many of the known features of late-instar larvae are detailed under the genus *Prolimacodes* below.

Genus *Prolimacodes* Schaus

There are six species of *Prolimacodes*, including the one new species reported here, to go along with the species recognized by Becker and Epstein (1995). They are distributed from southeastern Canada to northern South America. Among the first Lepidoptera species to appear at lights at dusk, *Prolimacodes* have a distinctive forewing pattern with a dark triangular or semicircular brown patch that borders the entire costal margin (Figs. 50–51). The patch parallels the shape of the wing with its broadest point extended to near the torus or the middle of the inner margin. Near the base of the wing it forms a narrow band along the costa until it reaches the thorax. The patch sharply contrasts with the light brown or silvery-white region along the outer and inner margins. The antenna is slightly serrate in males and threadlike in females. The apical segment of the labial palpus, slightly angled toward median, is less distinct than that of *Venadicodia* due to overlapping scales with the second segment. The forewing radial veins R_3 and R_4 are stalked off of the R_2 near the apex.

The male genitalia of *Prolimacodes* have a well-developed transtilla and a horizontally curved aedeagus (Fig. 99). The valva is densely setose on the inner surface and has a sclerotized lower margin (= sacculus). In the female genitalia, the 8th segment is recessed into

the 7th, creating a cavity between the two segments. Along the ventrum the large transverse and sclerotized ostium bursae is sunk beneath the 7th segment. The antrum is sclerotized and asymmetrical, while the ductus bursae is coiled with the ductus seminalis attached just beyond the antrum. The anterior apophysis is positioned somewhat dorsad and recurved at the tip. The posterior apophyses are curved to the sides with their ends located near to the anterior apophyses. While the disk-shaped papillae anales with convex lateral margins in *Prolimacodes* is typical of the complex, the triangulate dorsal margin in the genus is characteristic.

The smooth caterpillars in *Prolimacodes* are variable in dorsal pattern among the middle to late instars, which is most similar to *Semyra*. This variability does not appear to occur in *Venadicodia caneti* Corrales & Epstein (compare images of all three genera in Janzen and Hallwachs 2004). *Prolimacodes* caterpillars can often be separated from *Semyra* by having a half moon shape rather than a triangulate shape when viewed from the side. Some populations of *P. badia* (Hübner) in North America have been shown to have one or two humps on the dorsal margins of the middle abdominal segments (Dyar 1896). The caterpillars of *Prolimacodes* are broader than *Venadicodia* from their ventrum to the highest dorsal point in the middle abdominal segments.

Prolimacodes appears to be most similar to *Venadicodia* in adult structures, and we believe they are closely related (Corrales and Epstein 1997). Characteristics shared between the two genera include the slightly serrate male antennae, a horizontally curved aedeagus in the males, and a sclerotized antrum that corresponds in shape in the females. The shape of the forewing patch can be extremely variable. This has led to a number of synonyms in this genus.

***Prolimacodes montanus* Epstein, new species**

Figs. 8, 50–51, 91, 99



Holotype ♂ *Prolimacodes montanus*

Diagnosis. Confused with either *P. triangulifera* Schaus or *P. badia* [= *P. undifera* (Walker)] in Costa Rica due to intermediate features of dark-brown forewing patch, which is slightly convex toward its outer margin in *P. montanus*, as in *P. badia*, but more angulate in lower portion, as in *P. triangulifera*. Other forewing characters more similar to *P. triangulifera*: narrow band of white scales along

margin of patch at base of forewing; a light sheen along costal margin; absence of discal spot. Characters of male genitalia of *P. montanus* distinct from *P. triangulifera* include:

uncus claw at apex (atypical for genus); single median juxta process rather than dual processes; two prong ventral process on valva (Fig. 98).

Description. Forewing length 13.5–16.3 mm (male); 15.6–18.1 mm (female)[note: lower and upper ends of ranges from reared and wild caught specimens, respectively]. Forewing (Figs. 50–51) with typical *Prolimacodes* pattern: dark brown patch with leading edge along costa covering majority of wing, extended from apex to near middle of inner margin with border convex relative to outer margin; beyond middle of inner margin, patch curves back to near costa, leaving narrow strip along costa in basal fourth of wing. Margin of dark patch has thin white line. Contrasting light brown submarginal area contiguous with basal light region; scattered dark scales in this area. Hindwing, thoracic dorsum and head (including labial palpus) slightly darker brown than submarginal forewing, but lighter than forewing patch. Male antenna has pronounced serrations, as in *P. triangulifera*. Labial palpus 1.7X vertical eye width. Proboscis present. Scales on foreleg and femora of midleg darker brown than tibia and tarsi of mid- and hindleg.

Male genitalia (Fig. 99): well-developed claw on end of uncus. Gnathos extends to midpoint of uncus; apex upcurved. Juxta with single medial process below aedeagus. Transtilla has three pair of dorsal lobes: one pair of medial lobes divided by gnathos and another medial pair to anterior near vinculum; third pair in between other two with each member hooked toward valva (lacks pair of round anterodorsal processes, as in *P. triangulifera*). Aedeagus sinuate with base angled to mid section and apex curved from left to right (dorsal view); single stout spine at apex. Vesica without cornuti. Valva with dense setae on inner surface; sclerotized two pronged lobe in middle of valva in apical third, contiguous with sclerotized lower margin of valva. Saccus triangular to posterior, between valvae, and truncate along anterior margin.

Female genitalia (Fig. 91): sclerotized ostium bursae broad and rectangular with an oval, unsclerotized vestibule on the ventral median of ostium bursae. Antrum of ductus bursae coiled and sclerotized; directed to dorsum from base, then angled to right and angled toward unsclerotized ductus bursae (ventral view). Ductus seminalis connects to membranous ductus bursae just beyond antrum. Corpus bursae ovoid and equal in length to ductus bursae beyond sclerotized antrum. Signum transverse with groove between upper and lower lips. Eighth segment covered by 7th segment on all sides (typical of genus). Dorsum of 8th segment a sclerotized plate, undivided at median. Dorsum between 7th and 8th segments with small oval sclerotized depression at median. Papillae anales with dorsal margin forming triangulate apex. Between ostium bursae and papillae anales a ridge extends to middle of 8th segment. Anterior apophysis and apex of posterior apophysis curved to dorsum with notch between ventral base of anterior apophysis and ostium bursae.

Larva. Shape of late instar caterpillar typical of genus and complex (Fig. 8). Color and pattern variable. One individual (Fig. 8) yellowish green on dorsum with very dark band across crest on segment A3. Raised border between dorsum and lateral side more yellow

with hints of orange on either side of dark band and on “tail.” Pale in color on lateral aspect and areas near anterior and posterior ends of dorsum. Another individual completely green and without dark band.

Larval hostplants. Caterpillars of *P. montanus* have been found on three species of Lauraceae: *Persea americana*, *Nectandra salicina* and *Nectandra hihua* (Janzen and Hallwachs 2004).

Remarks. The intermediate attributes of the forewing (see above) and assortment of other genitalic features found in *P. badia* and *P. triangulifera* suggest that *P. montanus* could be a hybrid of the other two species. However, hybridization seems unlikely because there are closer similarities in genitalia between pairs of males and females from different localities than you would predict could occur at random. Furthermore, although there are similarities of character states between *P. montanus* and the other two species, there are also consistent differences. For example, female genitalia of *P. montanus* are very close to *P. badia* except the corpus bursae appear to be relatively much smaller in proportion to the rest of the bursa copulatrix, and the dorsal margin of the papillae anales are triangulate, as in *P. triangulifera*. Male genitalia of *P. montanus* share the single juxta process and inner lobe on the valva with *P. badia*, however, other characters of the uncus and transtilla differ. Moreover, there are other species of *Prolimacodes* with a similar juxta that are also distinct (e.g., *P. trigona* (H. Edwards)).

Etymology. The name *montanus* reflects the occurrence of this species in mountain environments.

Distribution. *Prolimacodes montanus* is presently only known from the northern half of Costa Rica, occurring at elevations above 1000 m from Estación Cacao in the north to Vara Blanca to the south.

Material examined. 5 specimens (3 ♂, 2 ♀).

Holotype ♂, COSTA RICA: Puntarenas Province: San Luis, Finca Buen Amigo Monteverde, 4 km S de la Reserva, 1040m, Z. Fuentes, 25–31 Mar 1998, (INBCRI 002602493).

Paratypes. COSTA RICA: Guanacaste Province: Casa Fran, 1140m, R. Franco, 1 ♂, 5 Sep 1997, (97-SRNP-1328), Sendero Arenales, Sector Cacao, 1980m, D.H. Janzen, 1 ♂, 13 Aug 2003, (03-SRNP-4762), Estación Cacao, 1150m, F. Quesada, 1 ♀, (02-SRNP-24455); Heredia Province: 6 km ENE Vara Blanca, 2000m, ALAS, 1 ♀, 13 Apr 2002, (INBio, ALAS), (INBCRI 003219814).

Genus *Dichromapteryx* Dyar

The neotropical genus *Dichromapteryx* has five species, including a new one described below. As its name implies, *Dichromapteryx* is distinguished by a forewing with two zones that grade from light to dark. The forewing is lavender brown and is divided diagonally from the mid costa to the tornus. The apical zone can be with a lighter hue than the basal

region, though the difference is rather slight in the Costa Rican species. The forewing radial veins have an arrangement in which R_3 and R_4 are stalked off of R_2 near the apex. The antennae are serrate in males and filiform in females. The labial palp is upcurved, reaching beyond the vertex and the proboscis is easily visible in both sexes. There are raised scale bundles on the metathorax. The legs have a 0-2-4 spur formula that is found throughout the *Prolimacodes* complex. The largest species in the genus is also the type species *D. dimidiata* Dyar from the Guianas with a forewing length of 11.0 mm (male) and 15.0 mm (female). The male genitalia have a valva that is covered with long setae on the inner surface. There is often an elongate sclerotized process on the lower part of the valva and a smaller lobe, setose pouch or process at the base of the valva. The female genitalia have a coiled ductus bursae (Fig. 92). The signum is either present or absent.

The early stages of species in this genus are unknown. Dyar (1905, 1935) associated *Dichromapteryx* most closely to *Tanadema*, whereas Forbes (1942) considered this genus to be near *Prolimacodes*. *Dichromapteryx* ranges from Guatemala to Brazil and Peru. None of the species are known to have synonyms.

Dichromapteryx saborioi Epstein and Corrales, new species

Figs. 52–53, 92, 100–101



Holotype ♂ *Dichromapteryx saborioi*

Diagnosis. Superficial characters do not separate *D. saborioi* from *D. didyma* Dyar. Male genitalia in *D. saborioi* distinguished from *D. didyma* by less developed claw at apex of uncus and shorter, broader ventral plate on valva with two processes, rather than one. Ventral valva process in *D. didyma* more elongate, extending to apex of valva. Dorsal process at base of valva in *D. saborioi* not found in *D. didyma*. Signum absent in female genitalia of *D. saborioi*; present in *D. didyma*.

Description. Forewing length 8.4–10.2 mm (male); 11.8–12.1 (female). Forewing (Figs. 52–53) dark purple-brown, bisected by pale gray band from mid-costa to tornus; apical half of a paler hue than basal half. Area near apex with scales red-brown. R_3 and R_4 connect to R_2 midway from apex to discal cell. Hindwing matching apical forewing in hue. Dorsum of body with three bundles of flat, reddish-brown scales; first at posterior end of thorax, followed by bundles at base and posterior end of abdomen. Male antenna serrate with each flagellomere covered with ciliate sensilla. Labial palpus with middle segment upcurved and apical segment along medial margin; $>1.6 \times$ vertical width of eye. Proboscis present. Head, labial palpus, fore- and midleg all dark reddish-brown; hindleg lighter brown. Tibial spurs subequal in length.

Male genitalia (Figs. 100–101): uncus apex with simple, narrow claw, or emarginated without claw. Gnathos with basal arms not fused until near apex, narrow and directed downward from base with apex reflexed upward and rounded; extended to mid-uncus. Valva divided into two parts: flexible dorsal portion, densely setose along inside; ventral smooth sclerotized plate arising from vinculum. Ventral plate has posterodorsal directed process near base; medially curved spine at apex. Dorsal portion of valva with an additional process along upper margin at base, dorsomedially curved and parallel to vinculum; process covered with long setae on inner surface. Aedeagus a narrow, straight rod without any spines at apex. Juxta a sclerotized oval plate directed posterodorsad; emarginate on dorsum. Saccus directed to posterior.

Female genitalia (Fig. 92): antrum sclerotized. Ductus bursae a straight tube in basal portion, coiled in distal portion beyond connection to ductus seminalis; signum absent. Ductus seminalis connected midway between ostium bursae and corpus bursae. Ventral portion of 8th segment covered with microsetae, including ostium bursae; forms an m-shaped ridge from bases of anterior apophyses with emarginated middle contiguous with sclerotized antrum. A second ventral ridge with microsetae found between ostium bursae and papillae anales, extending laterally beneath papillae. Papillae anales diskshaped; on dorsum, small medial lobe connects papillae. Dorsum of 8th segment sclerotized, smooth and flattened; weakly sclerotized medially. Anterior apophysis short, located far dorsad; curved slightly ventrad. Posterior apophysis straight, medial to anterior apophysis.

Remarks. *Dichromapteryx saborioi* is sympatric with *D. didyma*. Among six localities in common, *D. saborioi* was captured in much greater numbers in wet lowlands along the Pacific, whereas *D. didyma* was collected more in northern Costa Rica and above 500 m. It appears that *D. didyma*, found as far north as Guatemala, has a more northern distribution than *D. saborioi*. Although *D. didyma* was reported from Barro Colorado Island (= BCI) by Forbes (1942), it is possible that the specimens he examined were *D. saborioi*, as suggested by two BCI specimens that were examined for our study (see below).

Etymology. This species is named for Juan Carlos Saborio, an INBio parataxonomist. Saborio collected the holotype of this species and over 1000 specimens of Costa Rican limacodids, primarily at Sirena and Quebrada Bonito biological stations.

Distribution. *Dichromapteryx saborioi* is known from Costa Rica and Panama. It is found in rainforest lowlands of both slopes in Costa Rica, mostly below 200 m (95% of material examined). In Guanacaste and San Jose Provinces several specimens have been found between 500–1000 m.

Material examined: 284 specimens (276 ♂, 8 ♀).

Holotype ♂, Costa Rica: Puntarenas: Estación Quebrada Bonita, 50m, J. Saborio, Oct 1993, (INBCRI 001665037).

Paratypes. Costa Rica: Guanacaste Province: Cope Tila (piedras), 500–600m, G. Rodriguez, 1 ♂, Jan 2000, (INBio), (INBCRI 003313130); Tilarán, Tierras Morenas, 700–800m, G. Rodriguez, 1 ♂, Nov 1993, (INBio), (INBCRI 001956506), Sector Las Pailas,

4.5 km SW del Volcán Rincón de la Vieja, 800–900m, D. Garcia, 1 ♂, 27 Jul–15 Aug 1992, (INBio), (INBCRI 00812458), Liberia, Mayorga, Estación Cacao, 2 km SW de Cerro Cacao, 900–1000m, W. Hallwachs, 1 ♂, May 1992, (INBio), (INBCRI 000879175), Estación Pitilla, 9 km S Santa Cecilia, 600–700m, C. Moraga, 1 ♂, 6–17 Sep 1993, (INBio), (INBCRI 001614539); Heredia Province: Sarapiquí, La Virgen, P.N. Braulio Carrillo, Estación Magsasay, 100–200m, R. Aguilar, 1 ♂, May 1991, A. Fernandez, 1 ♂, Jul 1991, (INBio), (INBIOCRI: 1320565, 1377802); Limón: Pococí, Rita, Sector Cedrales de la Rita, 3 km N del Puente Río Suerte, Ruta Puerto Lindo, 0–100m, E. Rojas, 2 ♂, 17–31 Jul 1995, Sep 1995, (INBio), (INBIOCRI: 2236125, 2308688); Pococí, Colorado, Estación Cuatro Esquinas, R. Delgado, 1 ♂, Oct 1990, (INBio), (INBCRI 000277571); Pococí, Colorado, Sector Cerro Cocorí, 30 km N de Cariari, 100–200m, E. Rojas, 3 ♂, Apr 1991, (INBio), (INBIOCRI: 222165, 641137, 641193), 4 ♂, Aug 1991, Jan 1991, 10–30 Sep 1992, Nov 1993, (INBio), (INBIOCRI: 588809, 678313, 982980, 1652656), 9.4 km. W. de Bribri, 0–100m, D.H. Janzen & W. Hallwachs, 1 ♂, 9–11 Jun 1983, (INBio), (INBCRI 001118884); Puntarenas Province: Sirena, Corcovado Nat. Pk., Osa Peninsula, 0–100m, A. Picado, 1 ♂, 6–12 Apr 1995, (INBio), (INBCRI 002196505), D.H. Janzen & W. Hallwachs, 3 ♂, 5–11 Jan 1981, (INBio), (INBIOCRI: 1118927, 1118931, 1121075), G. Fonseca, 1 ♂, Apr 1992, 3 ♂, Dec 1989, (INBio), (INBIOCRI: 790445, 189928, 189931, 189935), 7 ♂, Mar 1991, May 1991, May 1993, Nov 1989, Nov 1991, Oct 1989, Sep 1991, (INBio), (INBIOCRI: 674582, 328525, 1204987, 114152, 351610, 289357, 357788), J.C. Saborio, 2 ♂, Aug 1991, (INBio), (INBIOCRI: 421935, 421939), R. Blanco, 1 ♂, Apr 1989, (INBio), (INBCRI 0081812), Golfito, Jiménez, Albergue Cerro de Oro, 100–200m, E. Fletes, 1 ♂, 24–28 Sep 1995, (INBio), (INBCRI 002339772), Golfito, P.N. Piedras Blancas, Estación El Bonito, alrededor de est., 100–200m, B. Espinoza, 1 ♂, 17–20 Apr 2001, (INBio), (INBCRI 003340408), Osa, Sierpe, Rancho Quemado, 200–300m, F. Quesada, 3 ♂, Nov 1991, (INBio), (INBIOCRI: 419597, 708690, 708694), 1.8 mi W Rincon, Osa Peninsula, J.P. Donahue & C.L. Hogue, ♂, 30 Jan 1971, (LACM), (INBCRI 001121077), Fila Esquinas, 35 km S. Palmar Norte, 100–200m, D.H. Janzen & W. Hallwachs, ♂, 7–8 Jan 1983, (INBio), (INBCRI 001118928), Estación Esquinas, Peninsula de Osa, 0–100m, J. Quesada, 1 ♂, Apr 1993, 2 ♂, Dec 1993, 3 ♂, Feb 1993, 3 ♂, Mar 1994, 1 ♂, May 1993, 2 ♂, Nov 1993, 3 ♂, Oct 1993, (INBio), (INBIOCRI: 1967036, 1827056, 1827105, 1691476, 1691686, 1691689, 1772412-13, 1772415, 1176876, 1179082, 1179107, 1670171, 1670200, 1670498), M. Segura, 4 ♂, Dec 1993, 1 ♂, Mar 1994, 5 ♂, Oct 1993, (INBio), (INBIOCRI: 1853181-2, 1853187-8, 1757197, 1665661-3, 1665667, 1665670), Osa, Sierpe, 0.2 km N.W. de la Estación Esquinas., 0–100m, M. Segura, 1 ♂, Apr 1994, 2 ♂, May 1994, (INBio), (INBIOCRI: 1773605, 1999946-47), J. Quesada, 2 ♂, Jun 1994, (INBio), (INBIOCRI: 2003509-10); P. N. Manuel Antonio 120 m, Quepos, 0–100m, G. Varela, 3 ♂, Dec 1990? 1 ♂, Nov 1990, (INBio), (INBIOCRI: 222708, 663362, 663520, 532951); Aguirre, Quepos, P. N. Manuel Antonio, 0–100m, G. Varela, 1 ♂, Sep 1991, 1 ♂, Dec 1991, 3 ♂, Nov 1992, 1 ♂, Dec 1991, 1 ♂, Jun

1991, 1 ♂, May 1991, 6 ♂, Aug 1991, 1 ♂, Jun 1991, 2 ♂, Feb 1993, 1 ♂, Oct 1993, (INBio), (INBIOCRI: 493856, 528599, 821676, 821679, 821683, 1112275, 1293999, 1312139, 1317067, 1317379, 1317411, 1317469, 1317586, 1317588, 1390359, 1743644, 1743772, 1998548), A.C.P.C, Garabito, Tarcoles, Estación Quebrada Bonita, 100–200m, R. Guzmán, 4 ♂, Aug 1993, 1 ♂, Oct 1995, (INBio), (INBIOCRI: 1968833, 1968892, 1969021, 1969024, 2364563), J.C. Saborio, 10 ♂, Oct 1994, (INBio), (INBIOCRI: 2045226, 2045232-36, 2045239-41), 8 ♂, Nov 1994, (INBio), (INBIOCRI: 2054894-97, 2054905-06, 2054910-11), 7 ♂, Dec 1994, (INBio), (INBIOCRI: 2113424-29, 2113431); Garabito, Reserva Biol Carara, Estación Quebrada Bonita, 50m, E. Bello, 2♂, Jul 1990, (INBio), (INBIOCRI: 241373, 241599), J. Corrales, 1 ♂, 12 Mar 1994, (INBio), (INBIOCRI: 001678679), J.C. Saborio, 1 ♂, Apr 1994, 2 ♂, Aug 1992, (INBio), (INBIOCRI: 1775955, 856381, 856457), 6 ♂, Aug 1993, (INBio), (INBIOCRI: 1669196-98, 1669200-02), 4 ♂, Dec 1992, (INBio), (INBIOCRI: 905179, 905209, 905211, 905222), 1 ♀, 6 ♂, Feb 1993, (INBio), (INBIOCRI: 1370145, 1370169, 1370171-73, 1370175), 9 ♂, Jan 1993, (INBio), (INBIOCRI: 1359650, 1359693, 1359717, 1359719, 1359722, 1359733, 1359740, 1359754, 1359761), 10 ♂, Jan 1994, (INBio), (INBIOCRI: 1842346, 1842386, 1842411, 1842441, 1842450, 1842456, 1842460, 1842472, 1842483, 1842496), 1 ♂, Jul 1993, 4 ♂, Jun 1993, (INBio), (INBIOCRI: 1684730, 1184807-08, 1184815-16), 1 ♂, 1 ♀, Mar 1994, 2 ♂, May 1993, (INBio), (INBIOCRI: 1681432, 1681460, 1198759, 1198849), 1 ♂, Nov 1992, 11 ♂, Nov 1993, (INBio), (INBIOCRI: 841364, 1969976, 1969980, 1969982, 1970032-33, 1970044, 1970062, 1970066, 1970080, 1970084, 1970087), 1 ♀, 9 ♂, Oct 1993, (INBio), (INBIOCRI: 1665035, 1665023-27, 1665029, 1665039, 1665044, 1665053 [note: same label data as holotype), 1 ♂, Sep 1992, (INBio), (INBIOCRI: 000989805), 1 ♀, 10 ♂, Sep 1993, (INBio), (INBIOCRI: 1655600, 1655358-60, 1655384, 1655398, 1655401, 1655484, 1655571, 1655604, 1655622), R. Guzmán, 1 ♀, 18–29 Oct 1992, 1 ♂, 24–29 Sep 1992, 5 ♂, 4–26 Jan 1993, (INBio), (INBIOCRI: 917373, 836774, 1329721, 1329892, 1329905, 1329909, 1329912), 2 ♂, Apr 1993, 1 ♂, Apr 1996, 1 ♂, Aug 1995, 3 ♂, Dec 1993, 2 ♂, Dec 1994, 1 ♂, Dec 1995, 4 ♂, Feb 1995, (INBio), (INBIOCRI: 1358580, 1358737, 2373466, 2326618, 1727193, 1727207-08, 2128541, 2128543, 2445360, 2193908, 2193920, 2193940, 2193949), 7 ♂, Jan 1994, (INBio), (INBIOCRI: 1939706, 1939711, 1939732, 1939762, 1939769-70, 1939773), 2 ♂, Jan 1995, 1 ♂, Jul 1993, 3 ♂, Jun 1993, (INBio), (INBIOCRI: 2243550, 2243600, 1128382, 1170879, 1170945, 1171038), 1 ♂, Jun 1996, 5 ♂, Mar 1993, (INBio), (INBIOCRI: 2465433, 1378739, 1378788, 1378828, 1378844, 1378862), 2 ♂, Mar 1994, 2 ♂, Mar 1995, 1 ♂, Mar 1996, 1 ♂, May 1994, 4 ♂, Nov 1993, (INBio), (INBIOCRI: 1754084, 1754111, 2195159, 2195167, 2383178, 1891424, 1187093, 1187157, 1187182, 1187193), 8 ♂, Oct 1993, (INBio), (INBIOCRI: 1631571, 1631584, 1631595, 1631599-602, 1631640), 2 ♂, Oct 1994, 3 ♂, Sep 1993, 1 ♂, Sep 1994, (INBio), (INBIOCRI: 2118106, 2118197, 1660544, 1660545-46, 2021119), R. Zuniga, 1 ♀, Apr 1989, 1 ♂, Aug 1990, 1 ♂, Dec 1989, 2 ♂, Jun 1990, 1 ♂, Jun 1991, 1 ♂, Oct 1989, (INBio), (INBIOCRI: 17924,

1373854, 178230, 637108, 637130, 590548, 212736); Sector Laguna Meandrica, 100–200m, R. Zuniga, 1 ♀, Jun 1990, (INBio), (INBCRI 000065350); San José Province: A.C.C.V.C, Vázquez de Coronado, Cascajal, P.N. Braulio Carrillo, Estación Carrillo, 500–600m, I. Chacon, 1 ♂, Sep 1984, (INBio), (INBCRI 001118882); Panama: Canal Zone: Barro Colorado Island, N. McFarland, 1 ♂, 12 Jul 1958, (LACM), D. Q. Cavagnaro & M.E. Irwin, 1 ♂, 24 Jul 1963, (CAS), (USNM ENT: 169329, 171303).

***Perola* complex: *Perola* Walker and *Epiperola* Dyar**

The *Perola* complex occurs in the New World tropics north to southern Texas and Arizona. It includes *Perola* Walker, *Epiperola* Dyar, *Paleophobetron* Dyar, and *Blazia* Schaus. The new species herein bring the species totals to 39 for *Perola* and 19 for *Epiperola* (Becker & Epstein 1995). Adults in the complex can be easily confused with Megalopygidae or the *Natada* complex due to male antennae that are bipectinate to the apex and, in the former case, the short labial palpus and woolly appearance of the wings in some of the species. At present the relationship between the *Perola* complex and others either in the neotropics or in the Old World tropics is unknown. The smooth larvae with a posterior “tail” on the 9th abdominal segment are similar to those in the *Prolimacodes* complex, at least in late instars, except they bear a unique elongate anterior protuberance on the mesothorax, which resembles the posterior “tail.” The pupa of *Perola producta* Dyar, if it is in fact typical of the group, is similar to Old World Chrysopolomines in that it doesn’t fracture along the eye (Epstein 1996).

The *Perola* complex is separated from all New World Limacodidae by the presence of forked CuA₁ and CuA₂ veins on the forewing of most species. Males and females hold their front legs forward and above the head, while standing on middle and hindlegs. Forewings often have a submarginal line or band with R₃ and R₄ stalked off of R₅. The male antenna is entirely bipectinate with broad rami at the base and continuing to near the apex. The female antenna has rami, either short or long as in males. All known species appear to lack a proboscis. Tibial spur formulae are 0-2-4 (*Perola* and *Blazia*) or 0-2-2 (*Epiperola* and *Paleophobetron*). However, it seems likely that this distinction will break down based on examination of other morphological characters. Male genitalia in the complex have a claw at the end of the uncus, a valva that is often elliptical or triangulate, and a hairy anellus with one or two dorsal lobe(s). The lobe(s) may be considered homologous with transtilla. Female genitalia often have a signum with one or several small oval parts on the corpus bursae and a papillae anellus that is narrowed on the dorsal margins.

Dyar (1926) published a key to *Perola*. Some of these species were considered synonyms by Epstein and Becker (1994).

Perola aenea Epstein and Corrales, new species

Figs. 54, 102

Holotype ♂ *Perola aenea*

Diagnosis. Similar to *Perola brevicornis* Dyar, except much darker overall with more brown (exception: *P. aenea* from Veracruz, Mexico); forewing in *P. brevicornis* dark only at base and along costa. Postmedial line of *P. aenea* with smooth contour versus webbed appearance between M and CuA veins in *P. brevicornis*. Dark subcostal spot near base more distinct in *P. aenea* than in *P. brevicornis*. *Perola aenea* with anellus lobe of male genitalia ending in

narrow spine and gnathos apex dentate; both more sharp than in *P. brevicornis*.

Description. Forewing length 14.0–16.0 mm (male); female unknown. Forewing (Fig. 54) grayish brown with bronze sheen (Costa Rica) or gray (Mexico). Dark line from near apex branches in two places, boldest line angled midway through discal cell, other fainter line along postmedian to tornus. In some specimens postmedial line first convex to outer margin, then concave at posterior end; other specimens lower postmedial line nearly gone (Fig. 54). A faint, dark line connects with postmedial line along CuA₂, convex relative to discal cell. Subapical region beyond submarginal line with darker scales than in area to posterior. Small dark spot near Sc vein in basal fifth of forewing. Hindwing dark brown (Costa Rica) or light gray (Mexico). Vertex of head with pale yellowish-brown scales. Thoracic dorsum and abdomen mostly lighter brown than forewing with more yellowish brown at posterior end. Legs mixture of pale yellow, brown and dark brown scales. Basal pair of tibial spurs difficult to see without brushing scales. Labial palpus with mostly dark brown scales on laterodorsum and light yellow on ventrum; 1.3X vertical eye width.

Male genitalia (Fig. 102): uncus flat dorsoventrally and horizontal; apex strongly sclerotized with claw curved at oblique angle. Gnathos formed without usual bend between basal and distal arms, angled slightly downward and weakly upcurved at apex; serrate at apex above. Transtilla a single process on dorsum of setose anellus, directed to anterior, extending to ventrum of gnathos. Aedeagus basal and distal arms form n-shape with distal arm more gently sloped; short triangulate process above near apex. Valva triangulate with ventral margin upcurved and dorsum nearly horizontal; apex pinched above and below.

Remarks. Mexican specimens of *P. aenea* lack the bronze sheen found on those from Costa Rica.

Etymology. The name *aenea* refers to the bronze sheen on the forewing.

Distribution. *Perola aenea* is known from Veracruz, Mexico and Costa Rica. It has been found between 50–1600 m, although the majority of specimens are from around 800 m.

Material examined. 19 specimens (all ♂s).

Holotype ♂. Costa Rica: Limón: Pococí, Colorado, Estación Cuatro Esquinas, R. Delgado, Nov 1990, (INBIO), (INBCRI 000065695).

Paratypes. Costa Rica: Alajuela Province: Sector Colonia Palmareña, San Ramón, 700–800m, 1 ♂, J.C. Saborio, Oct 1995, (INBIO), (INBCRI 002428954); Cartago Province: Turrialba, 600m, 1 ♂, V.O. Becker, 3 Dec 1972, (VOB), (USNM ENT: 169577); Guanacaste Province: 4km E. Casetilla, Rincon Nat. Pk, 800–900m, 1 ♂, D.H. Janzen & W. Hallwachs, 18 Oct 1982, (INBIO), (INBCRI 001120017), A.C.G. La Cruz, P.N. Santa Rosa, 300–400m, 1 ♂, D.H. Janzen & W. Hallwachs, May 1985, (INBIO), (INBCRI 001119682), Sector Las Pailas, 4.5 km SW del Volcán Rincón de la Vieja, 800–900m, 1 ♂, K. Taylor, 15 May–11 Jun 1993, (INBIO), (INBCRI 001382310); Heredia Province: La Selva Biological Station, 50–150m, 1 ♂, D. Wagner, 28 Feb 2003, (INBIO), (INBCRI 003225583); Puntarenas Province: Estación Biología Las Cruces, 6 km SE San Vito, Rio Jaba, J. Powell, 1 ♂, 20–21 Jan 1993, (UCB), (EMEC 51007), A.C.L.A.P. Coto Brus, Estación Biol Las Alturas, 1300–1400m, 1 ♂, A. Sourakov, 3 Aug 1992, (INBIO), (INBCRI 002747756), A.C.L.A.P. Coto Brus, Zona Protectora Las Tablas, Estación Las Alturas, 1 km N de Las Alturas, 1500–1600m, 1 ♂, C. Snyder, 27 Jun 1992, (INBIO), (INBCRI 001146961), Estación Altamira, 1 km S del Cerro Biolley, 1400–1500m, 3 ♂, M. Segura, Dec 1994, 26 Feb–10 Mar 1995 (2 specimens), (INBIO), (INBIOCRI: 2091796, 2242520, 2242532), 1 ♂, R. Delgado, Jun 1994, (INBIO), (INBCRI 002510915), Sirena, Corcovado Nat. Pk., Osa Peninsula, 1 ♂, G. Fonseca, Apr 1991, (INBIO), (INBCRI 000216356), Zona Protectora Las Tablas, 1300–1400m, 2 ♂, M. Chinchilla, M. Segura, 22 Oct 1995, 25 Aug–25 Sep 1995, (INBIO), (INBIOCRI: 2343363, 2344633); Mexico: Veracruz: Estación Biológica Los Tuxtlas, 15–17 Oct 1987, 2 ♂, C. Beutelspacher, (UNAM).

***Epiperola browni* Epstein and Espinoza, new species**

Figs. 55, 93



Holotype ♀ *Epiperola browni*

Diagnosis. Distinguished from *Perola producta* by smaller size, more diffuse forewing pattern, presence of only 2 hind tibial spurs and bipectinate female antenna.

Description. Forewing length 12.5 mm (female); male unknown. Forewing (Fig. 55) elongate, yellowish orange with brown highlights from postmedian to base. R_3

and R_4 branch off of R_5 midway between apex and discal cell. Hindwing pale yellowish

orange. Female antenna bipectinate to apex with shorter rami at base. Body covered with dense pilose orange scales. Labial palpus directed slightly downward; 1.3X vertical eye width. Labial palpus and forecoxa with scattered dark brown scales. One pair of hind tibial spurs; equal in length.

Female genitalia (Fig. 93): bursa copulatrix small, about length of papillae anales; antrum narrow with longitudinal ridges. Corpus bursae, oval and weakly sclerotized, not differentiated from ductus bursae beyond ductus seminalis; signum absent. At base of spermatheca, off ductus seminalis and ductus communis, is a broad sack about equal in size to corpus bursae. A pair of large sebaceous glands connected to common oviduct caudad of spermatheca. Ventral margin of 8th segment with triangular pocket on each side of median, in front of ostium bursae. Pocket may be formed in part with 7th segment or intersegmental membrane. Dorsal part of 8th segment narrow. Lateral lobes present. Each lobe of papillae anales pear shaped with narrower dorsal half and smooth margins. Anterior apophysis broad at base, gradually narrowed to apex. Posterior apophysis narrower than anterior apophysis.

Remarks. This species is placed in *Epiperola* because it has only one pair of hind tibial spurs (see *Perola* complex above). The forewing shape and color is more like orange-scaled species in *Perola*, however, the females in these species have short unipectinate or serrate antennae.

Etymology. This species is named in memory of lepidopterist F. Martin Brown, known to his friends and colleagues as Brownie. Brown was an early mentor to the senior author, who was greatly influenced by his book "Colorado Butterflies" while growing up in the Rocky Mountain State. It is appropriate that a montane species be named for FMB.

Distribution. *Epiperola browni* is only known from the one high elevation site in Cartago Province, Costa Rica.

Material examined. 1 specimen (1 ♀).

Holotype ♀, Costa Rica: Cartago Province: El Guarco, Macizo de la Muerte, Sector de la Esperanza, Cerca de Torres del ICE, 2450m, B. Espinoza, 24 May 2002, (INBio), (INB-CRI 002607893).

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This paper would not have been possible without the support of the Department of Entomology, National Museum of Natural History, and the Plant Pest Diagnostics Branch, California Department of Food and Agriculture. Of equal importance has been INBio and its personnel, with special thanks to the parataxonomists who collected the material used for this work, as well as Dan Janzen, Winnie Hallwachs (U. Pennsylvania), and the staff and volunteers of the ACG, who have provided voucher specimens and most of the information on the biology of species presented herein. Thanks also go to José A. Herrera (INBio) and

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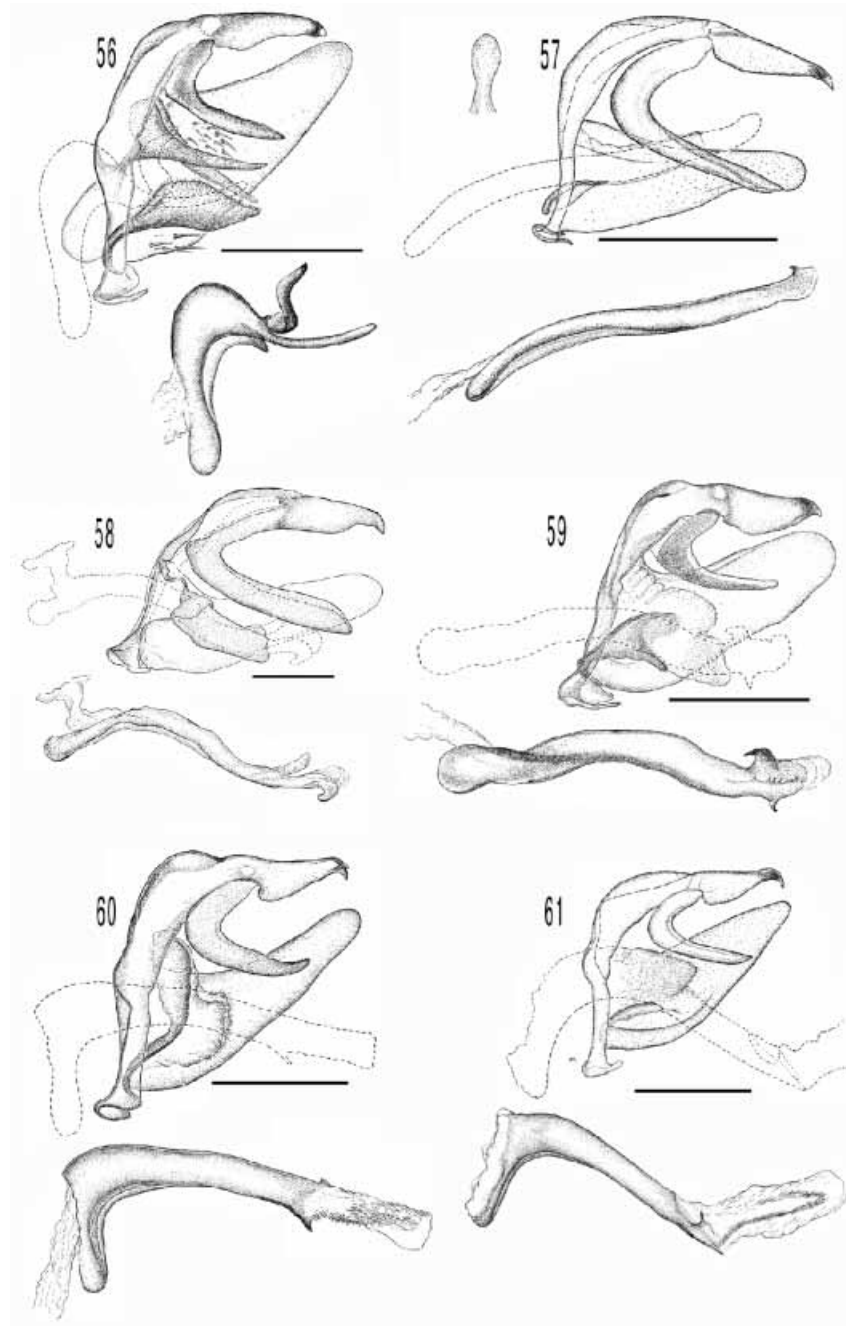
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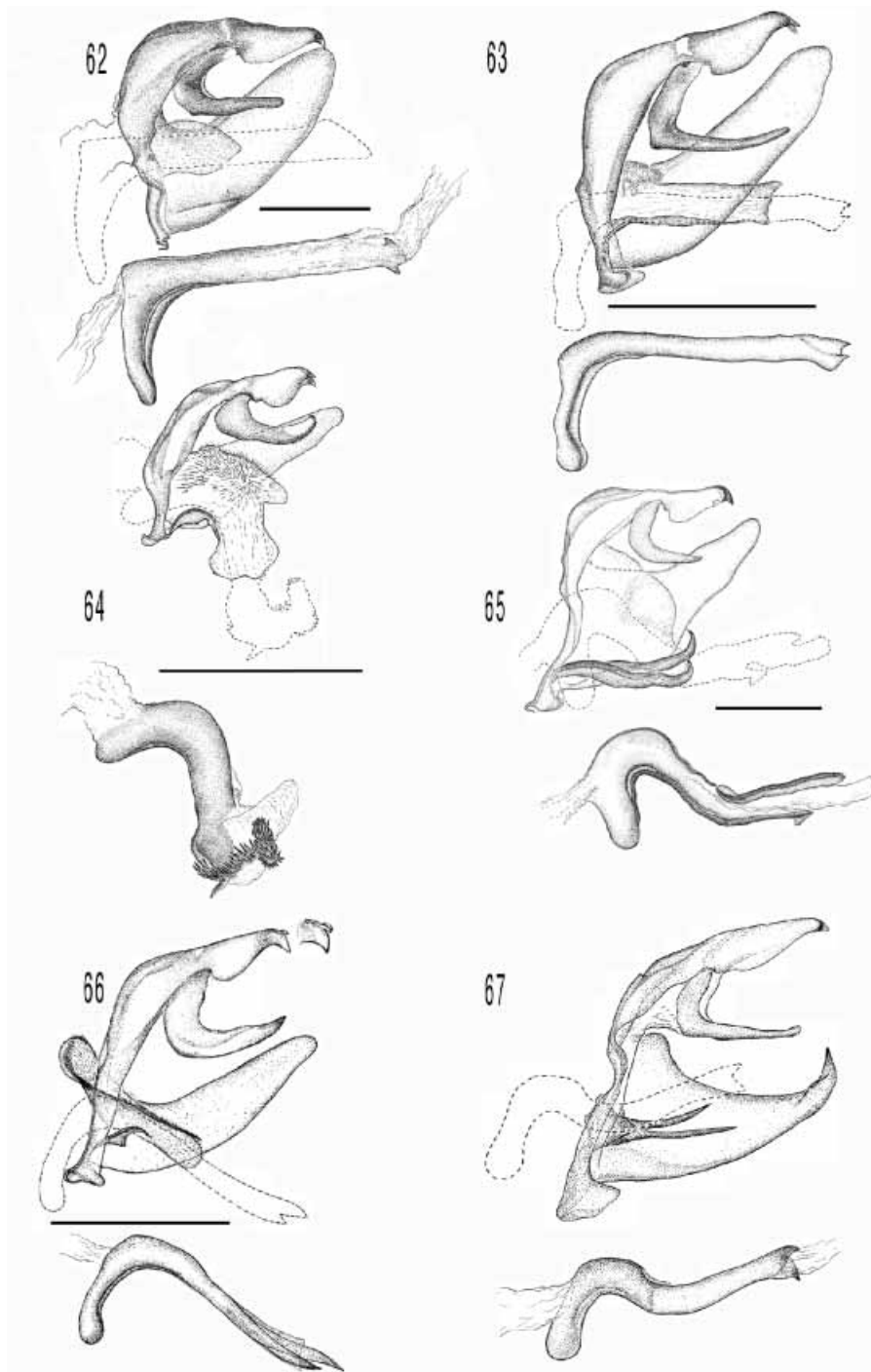
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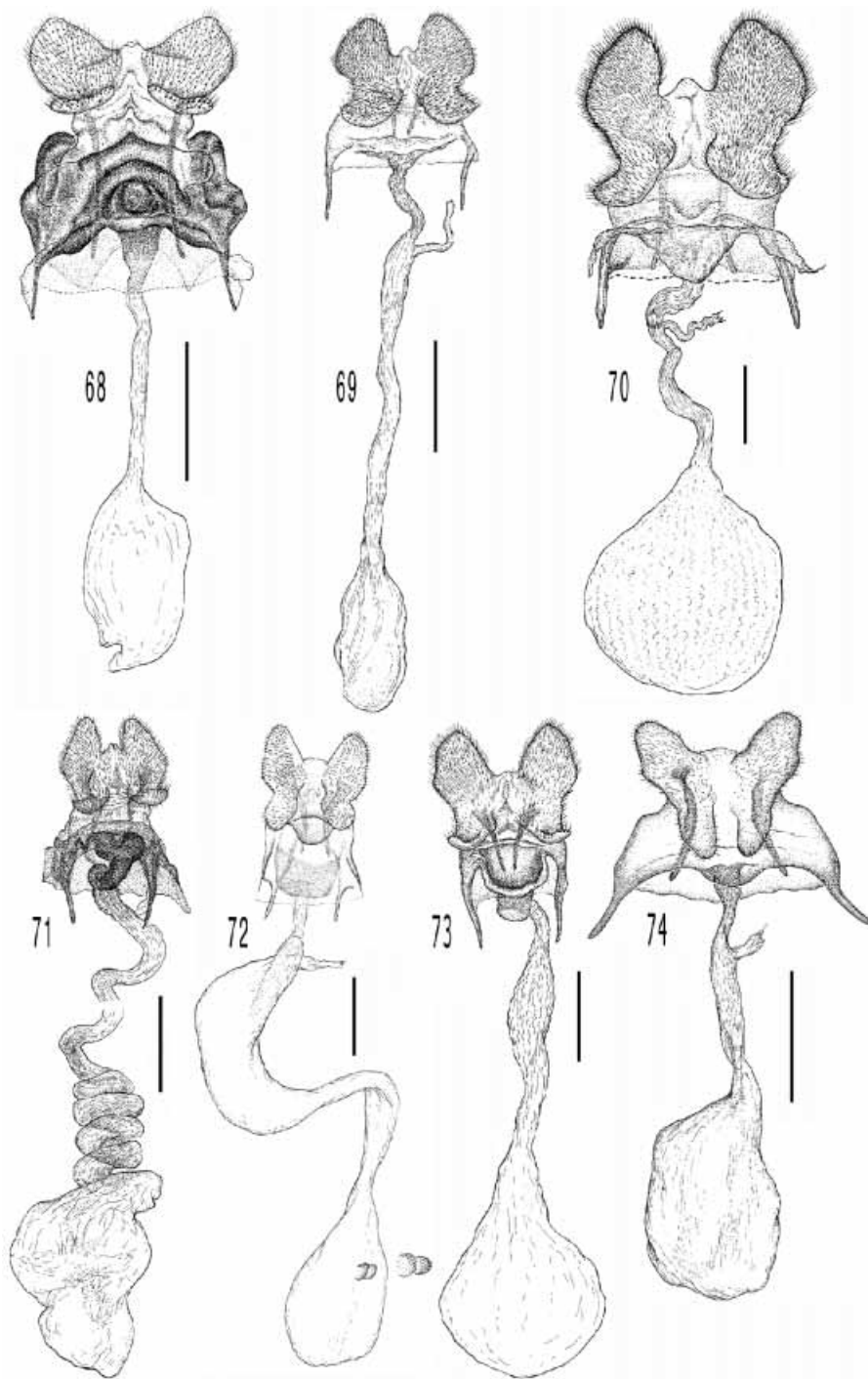
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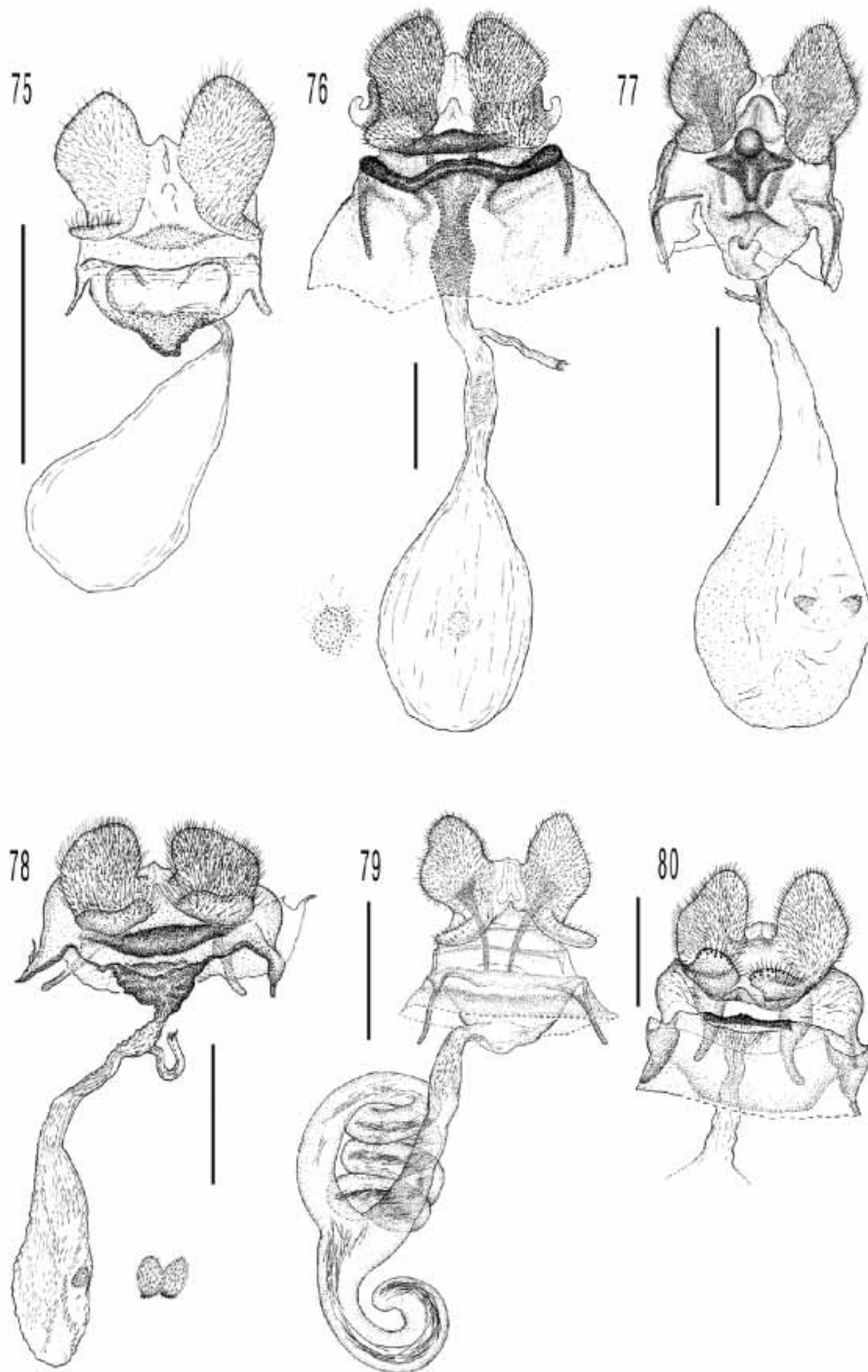
FIGURES 56–61. Male genitalia. 56, *Parasa figueresi*, Puntarenas Prov., Osa, Sierpe, Rancho Quemado, (INBIOCRI 000345910), 57, *Parasa sandrae*, Puntarenas Prov., Est. Quebrada Bonita, (INBIOCRI 001115813)[note: drawing of ventral aspect of gnathos], 58, *Parasa joanae*, Puntarenas Prov., Monteverde, San Luis, Fca. Buen Amigo, (INBIO3052743), [illustration by K. Phillips], 59, *Parasa shirleyae*, Cartago Prov., Estación Quebrada Segundo, (INBIOCRI 002117249), 60, *Euclia mesoamericana*, Puntarenas Prov., P.N. Corcovado, Est. Sirena, Playa Sirena, (INBIOCRI 001377035), 61, *Euclia mesoamericana*, Puntarenas Prov., Monteverde, Est. La Casona, (INBIOCRI 000946786).



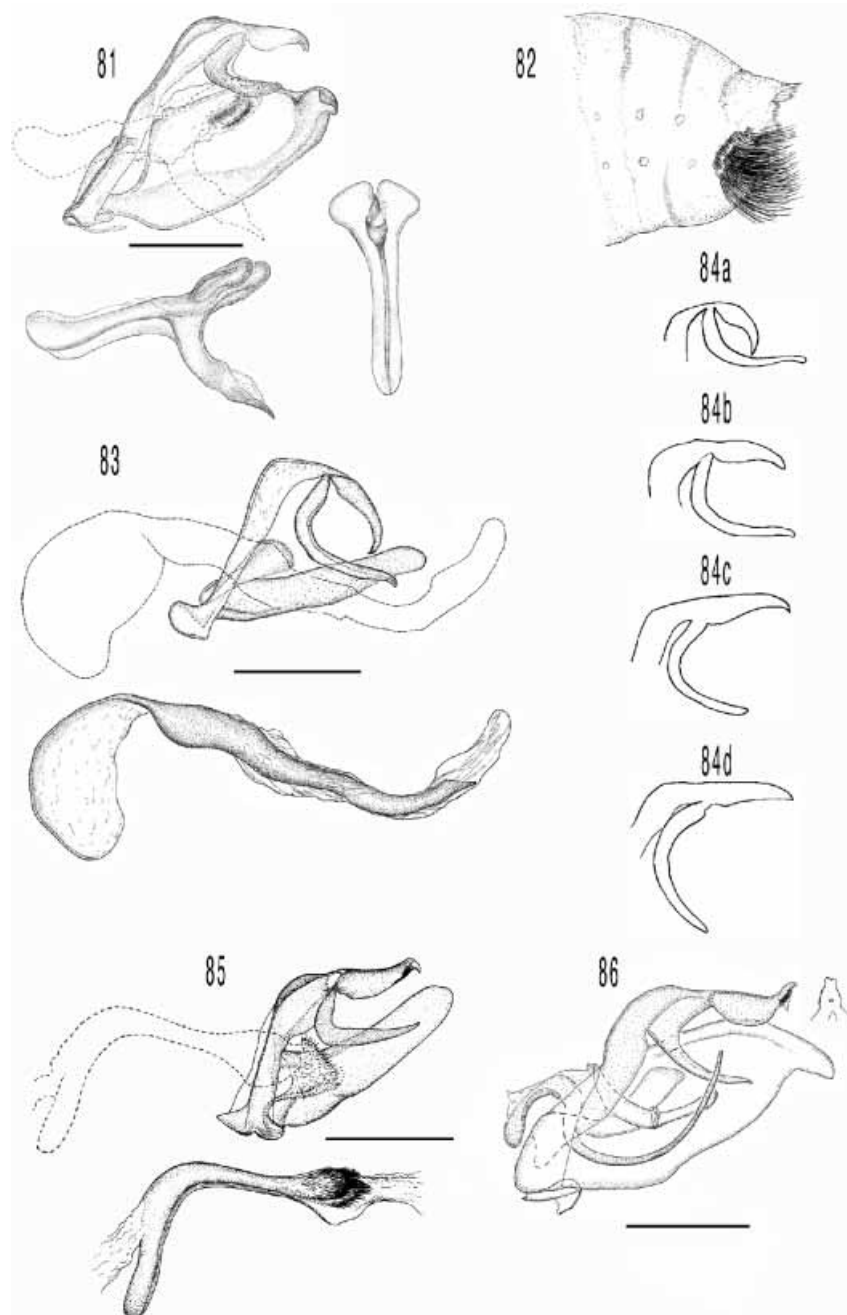
FIGURES 62–67. Male genitalia. 62, *Euclea mesoamericana*, Heredia Prov., Res. Biol. Chompipe, (INBIOCRI 001114949), 63, *Euclea zurquicola*, San José Prov., A.C.C.V.C, Vázquez de Coronado, Cascajal, P.N. Braulio Carrillo, Estación Zurquí, 500 m antes del Tunel Zurquí, (INBIOCRI 000617476), 64, *Euclea microcippus*, Heredia Prov., La Selva Biol. Sta. Puerto Viejo de Sarapiquí, MEE 118, (USNM169148), 65, *Euclea gajentaani*, Guanacaste Prov., Est. Pitilla, (INBIOCRI 000026693), 66, *Euclea costaricana*, Heredia Prov., Sarapiquí, La Virgen, P.N. Braulio Carrillo. Est. Magsasay, (INBIOCRI 001320467), 67, *Euclea josepsi*, San José Prov., Est. Santa Elena, Las Nubes, (INBIOCRI 002801160).



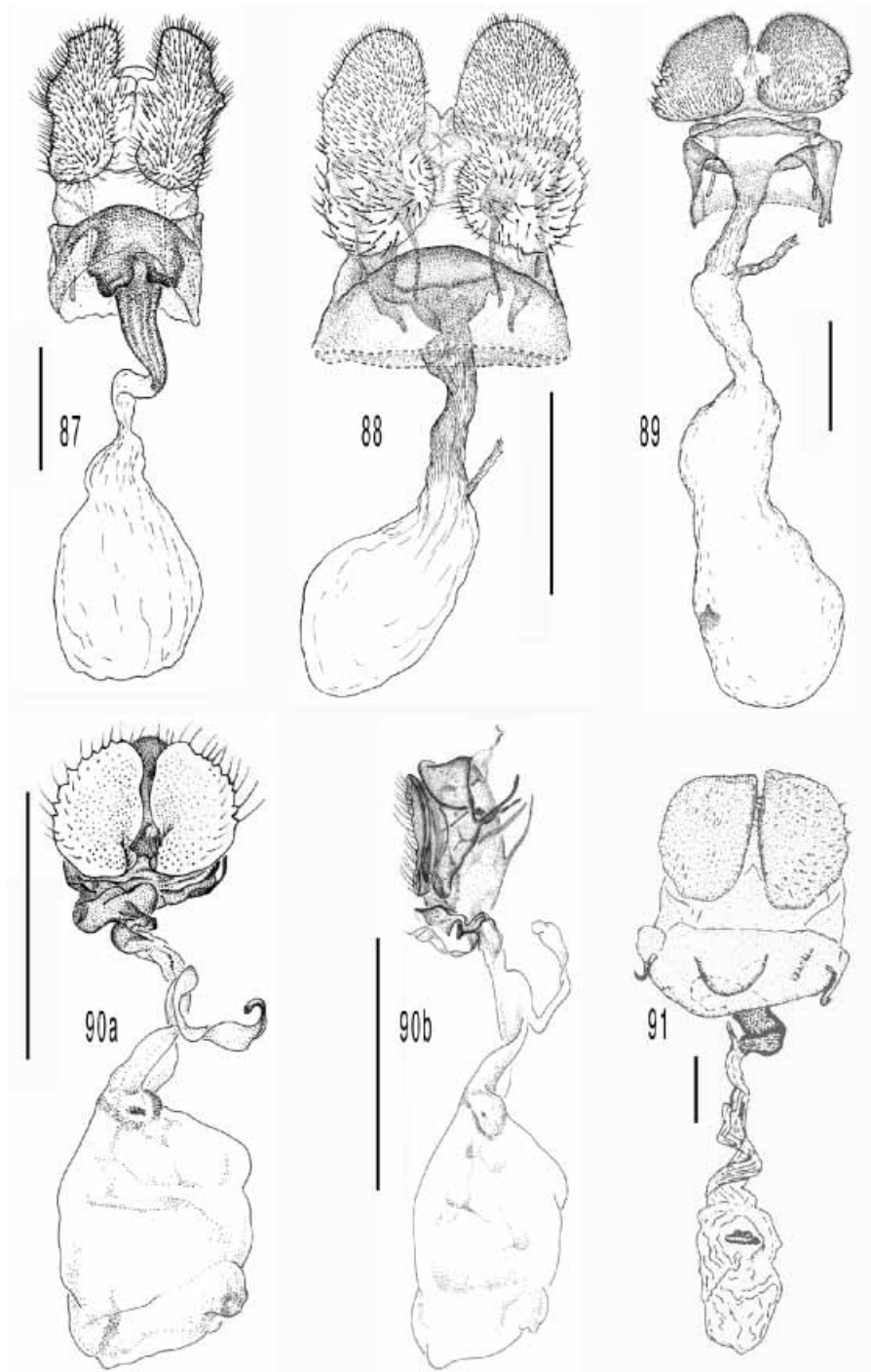
FIGURES 68–74. Female genitalia. 68, *Parasa figueresi*, Puntarenas Prov., Osa, Sierpe, Rancho Quemado, (INBIOCRI 000928532), 69, *Parasa sandrae*, Guanacaste Prov., Est. Cacao, (INBIOCRI 001109442), 70, *Parasa joanae*, Guanacaste Prov., Est. Pitilla, (INBIOCRI 001828396), 71, *Parasa shirleyae*, Cartago Prov., Río Grande de Orosi, (INBIOCRI 002363924), 72, *Euclea mesoamericana*, Guanacaste Prov., Est. Pitilla, (INBIOCRI 000617052), 73, *Euclea mesoamericana*, Guanacaste Prov., Est. Cacao, (INBIOCRI 000858674), 74, *Euclea zurquicola*, San José Prov., P.N. Braulio Carrillo, Est. Zurquí, (INBIOCRI 000617465).



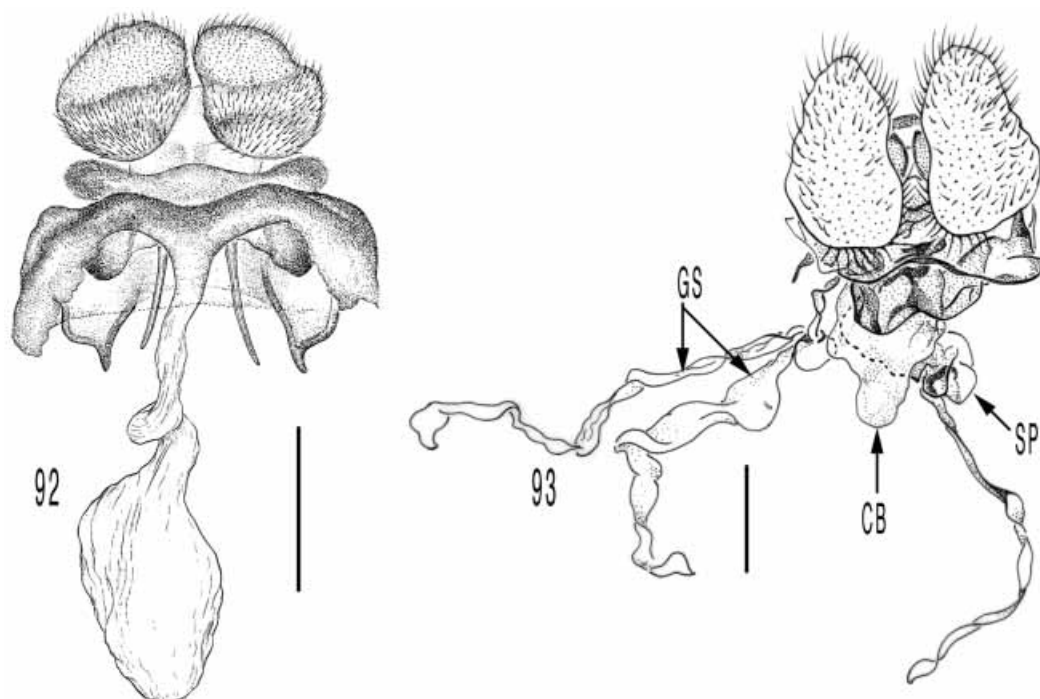
FIGURES 75–80. Female genitalia. 75, *Euclea microcippus*, Heredia Prov., La Selva, (INBIOCRI 001286648), [illustration by M. Epstein], 76, *Euclea gajentaani*, Guanacaste Prov., Est. Pitilla, (INBIOCRI 001828453), 77, *Euclea costaricana*, Puntarenas Prov., Est. Sirena, Playa Sirena, (INBIOCRI 000563226), 78, *Talima beckeri*, Guanacaste Prov., Sendero Corredor, USNM slide # 86170, (98-SRNP-6807), 79, *Talima weissi*, Guanacaste Prov., Est. Santa Rosa, (INBIOCRI 001119445), 80, *Talima erojasi*, Limón Prov., Pococí, Rita, (INBIOCRI 002502823).



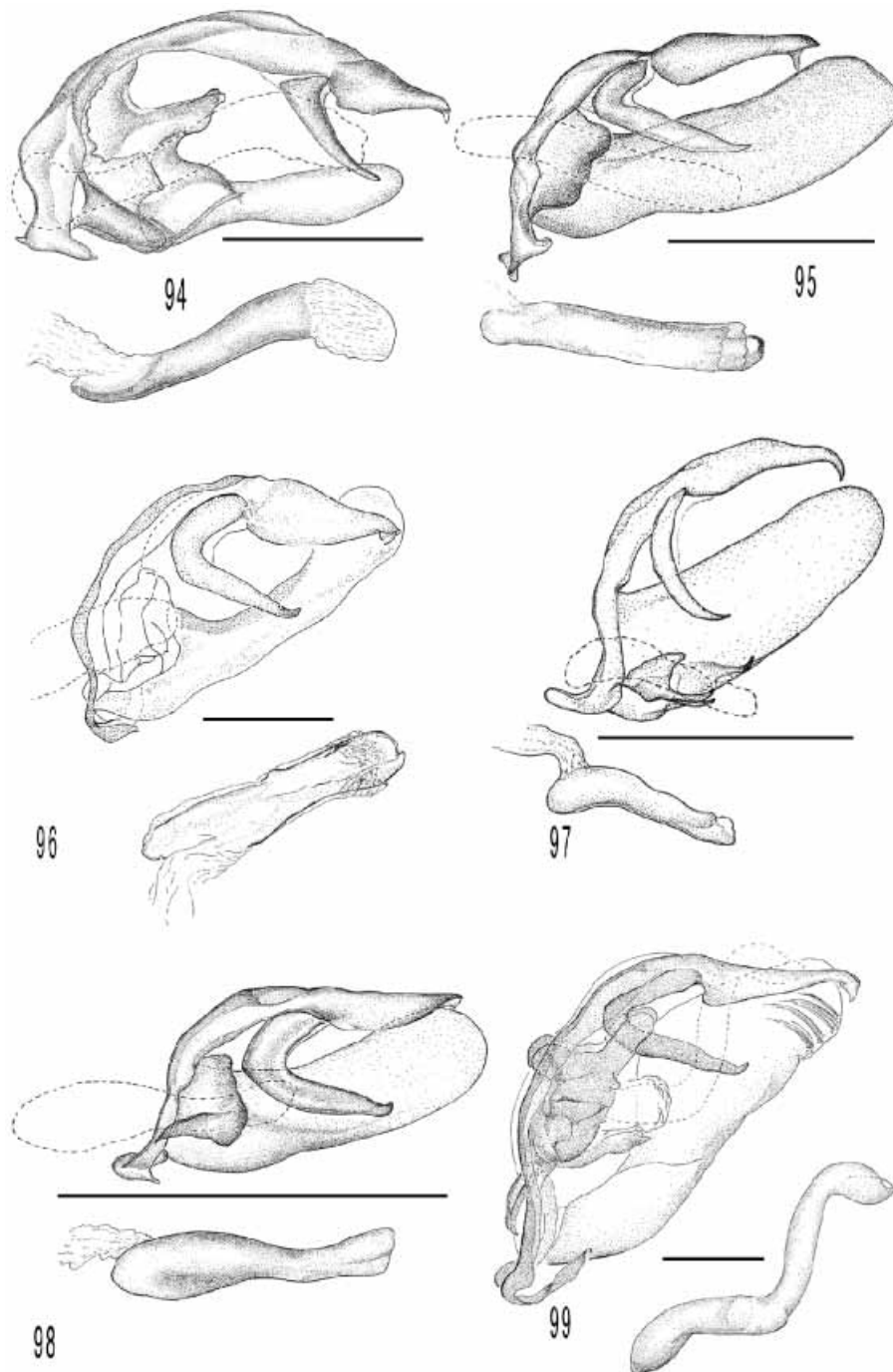
FIGURES 81–86. Male genitalia. 81, *Talima beckeri*, Cartago Prov., Turrialba, USNM slide 86048, (INBIOCRI1121331)[note: right illustration, ventral view of aedeagus], 82, *Talima weissi*, Guanacaste Prov., [abdomen with hair pencil], 83, *Talima weissi*, Guanacaste Prov., Est. Santa Rosa, (INBIOCRI 001119449), 84 a-d, *Talima weissi*, uncus and gnathos, 84a, Guanacaste Prov., Isla Cocinero, (INBIOCRI 000308481), 84b, Guanacaste Prov., Est. Santa Rosa, (INBIOCRI 001119449), 84c, Guanacaste Prov., La Cruz, Santa Elena, Est. Murciélago, (INBIOCRI 001852877), 84d, Heredia Prov., Santo Domingo, Santa Rosa, INBio, (INBIOCRI 001146226), 85, *Natada delgadoi*, Cartago Prov., Río Grande de Orosi, (INBIOCRI 002596580), 86, *Natada varablanca*, Heredia Prov., 6 km ENE Vara Blanca, (INBio), (INB 000324270) [right illustration, posterior view of uncus][illustration by M. Epstein].



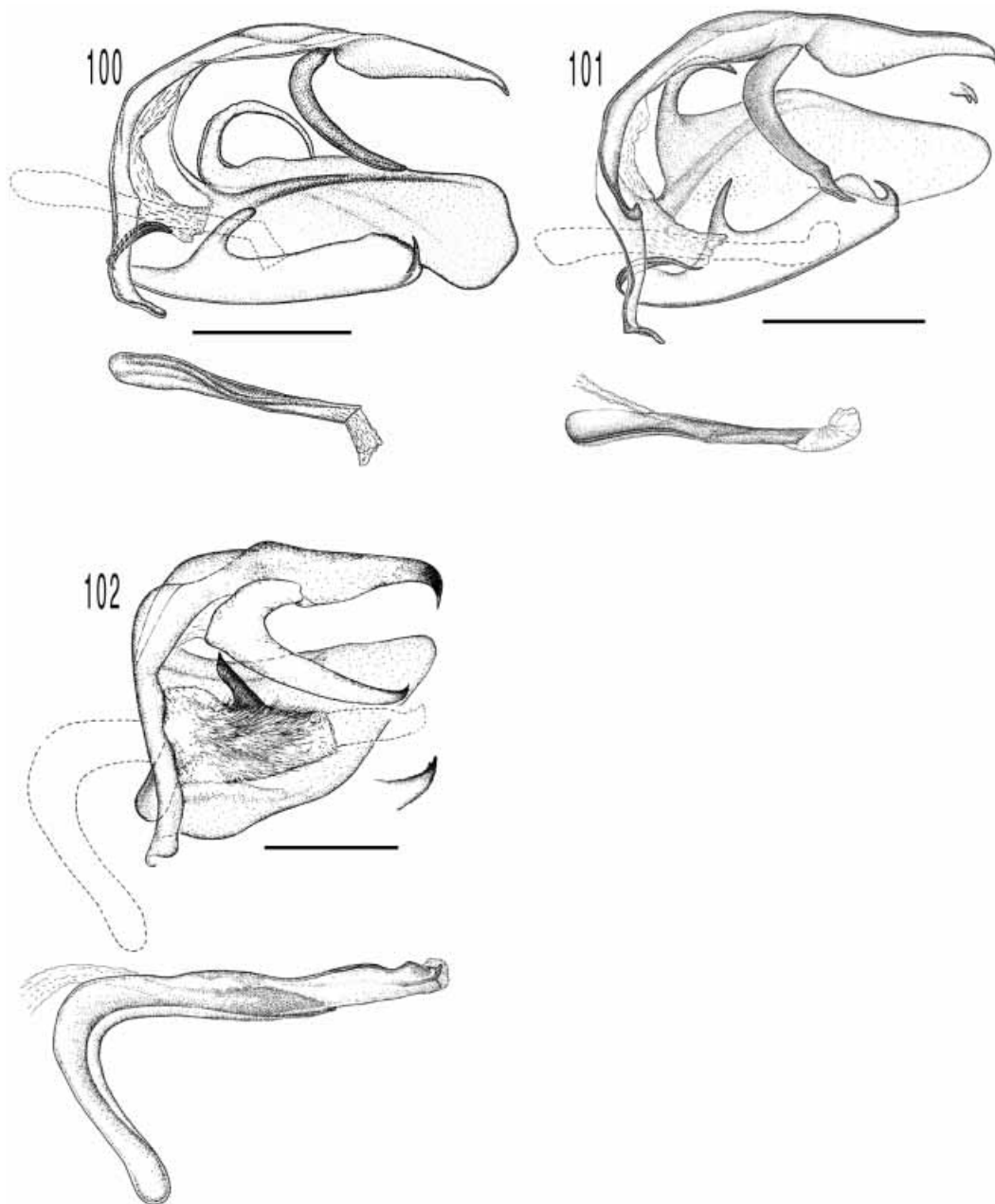
FIGURES 87–91. Female genitalia. 87, *Natada delgadoi*, Cartago Prov., Río Grande de Orosi, (INBIOCRI 002363901), 88, *Isochaetes dwagsi*, Guanacaste Prov., Est. Cacao, (INBIOCRI 000879174), 89, *Isochaetes kenji*, Guanacaste Prov., Fca. La Luz, USNM slide 29156, (INBIOCRI 001120413), 90 a–b, *Vipsophobetron davisi*, Heredia Prov., Est. La Selva, USNM slide 86201, (INB0003224310), 90a ventral view, 90b lateral view, [illustrations by K. Phillips], 91, *Prolimacodes montanus*, Guanacaste Prov., Rio Blanco, (99-SRNP-10377)[illustration by M. Epstein].



FIGURES 92–93. Female genitalia. 92, *Dichromapteryx savorioi*, Puntarenas Prov., Est. Sirena, Playa Sirena, (INBIOCRI 000328525), 93, *Epiperola browni*, Cartago Prov., El Guarco, Macizo de la Muerte, (INBIOCRI 002607893)(GS = sebaceous glands, CB = corpus bursae, SP = base of spermatheca) [illustration by K. Phillips].



FIGURES 94–99. Male genitalia. 94, *Phobetron guzmanae*, Puntarenas Prov., Garabito, Res. Carara, Est. Quebrada Bonita, (INBIOCRI 001115612), 95, *Isochaetes dwagsi*, Guanacaste Prov., Est. Cacao, (INBIOCRI 000356860), 96, *Isochaetes heevansi*, Limón Prov., Hitoy Cerere, (INB0003438812) [illustration by K. Phillips], 97, *Isochaetes tapantiensis*, Cartago Prov., Tapanti, Tapanti, Sendero La Pava, (INBIO3035209), [illustration by K. Phillips], 98, *Vipsophobetron davisi*, Heredia Prov., Fca. La Selva, slide MEE #119, (INBIO1121328), 99, *Prolimacodes montanus*, Guanacaste Prov., Casa Fran, (97-SRNP-1328), [illustration by K. Phillips].



FIGURES 100–102. Male genitalia. 100, *Dichromapteryx saborioi*, Puntarenas Prov., Fila Esquinas, INBIOCRI 001118928), 101, *Dichromapteryx saborioi*, (INBIOCRI 0011189828), 102, *Perola aenea*, Guanacaste Prov., 4.5 km SW del Volcán Rincón de la Vieja, (INBIOCRI 001382310).

About the author

Marc E. Epstein: Epstein's Ph.D., postdoctoral work, and subsequent research have focused on the systematics of Limacodidae and related moth families. He has been identifying Costa Rican Limacodidae since the mid-1980's from material primarily collected and reared by Dan Janzen and Winnie Hallwachs, and later by parataxonomists at INBio. His collecting and rearing experience with neotropical Limacodidae include participation in the ALAS transect study in Costa Rica and earlier visits to Venezuela, Brazil, and Peru.

Jorge F. Corrales: During his INBio career (1989-2000), Corrales developed a special fondness for the caterpillars of Costa Rican Limacodidae, taking an interest in raising and photographing them. He encouraged the parataxonomists throughout Costa Rica to recognize rare species and collect additional specimens as needed. Along with Epstein he worked with Alejandro Herrera to produce most of the genitalia drawings in this and three other publications on Costa Rican Limacodidae.