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Taxonomy and Natural History of the Microgastrine Genus *Alphomelon* Mason (Hymenoptera: Braconidae)

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Abstract.—The New World endemic genus *Alphomelon* Mason (Braconidae: Microgastrinae) is revised for the first time. This revision includes a redescription of the genus, redescriptions of its named species and descriptions of new species with illustrations of diagnostic characters, an illustrated key to *Alphomelon* species, and a summary of their natural history as parasitoids of hesperiid caterpillars. *Alphomelon* is a monophyletic group containing seventeen species, four of which were previously described: *Alphomelon disputabile* (Ashmead) (Argentina to U.S.A.), *A. nigriceps* (Ashmead) (Caribbean islands and surrounding countries), *A. talidicida* (Wilkinson) (Brazil to Costa Rica), and *A. conformis* (Muesebeck) (Venezuela to Costa Rica). Thirteen species are described as new: ***Alphomelon arecaphile*** **Deans** (Brazil to Costa Rica), ***A. brachymacher*** **Deans** (Brazil and Peru to Costa Rica), ***A. bromeliphile*** **Deans** (Costa Rica to Mexico), ***A. citroloma*** **Deans** (Argentina to Costa Rica), ***A. crocostethus*** **Deans** (Brazil to Colombia), ***A. melanoscelis*** **Deans** (Brazil to Mexico), ***A. nanosoma*** **Deans** (Brazil to Mexico), ***A. paurogenum*** **Deans** (Argentina and Chile), ***A. rhyssocercus*** **Deans** (Argentina to Panama), ***A. simpsonorum*** **Deans** (Paraguay to Costa Rica), ***A. pyrrhogluteum*** **Deans** (Argentina), ***A. winniewertzae*** **Deans** (Costa Rica to Canada), and ***A. xestopyga*** **Deans** (Costa Rica).

Distributed throughout most of the temperate and tropical New World, the members of the genus *Alphomelon* Mason parasitize skipper larvae (Hesperiidae) and are frequently collected and often reared. Although members of this genus are easy to recognize due to the white coloration on their genae (which gives the genus its name), identification at the species level has remained difficult owing to the absence of keys, adequate descriptions, and illustrations. This revision updates the classification of the species within *Alphomelon*, and includes a brief discussion of its taxonomic history, biology, and distribution together with descriptions of thirteen new species, redescriptions of four previously named species, illustrations of diagnostic characters, and a key to all species known to date.

Ashmead described two species of *Alphomelon* in 1900 from the island of St. Vincent in the Caribbean as *Urogaster nigriceps* Ashmead and *Urogaster disputabilis* Ashmead. In 1920 Muesebeck synonymized *Urogaster* under *Apanteles* Förster and reassigned *nigriceps* and *disputabilis* (renamed *disputabile*) accordingly. Since then only two other species have been described: *Apanteles talidicida* Wilkinson from Guyana (Wilkinson 1931) and *Apanteles conformis* Muesebeck from Venezuela (Muesebeck 1958). Mason's (1981) reclassification of *Apanteles* led to his creation of the new genus *Alphomelon* comprising *disputabile, nigriceps,* and *talidicida*. Mason apparently overlooked *conformis* when reassigning species, but morphology, color patterns, and biology suggest that it also belongs in *Alphomelon*.

Collections often contain many specimens of *Alphomelon*, particularly if they are rich in New World malaise trap samples. However, due to the paucity of microgastrine taxonomists and a lack of illustrations or keys these specimens are usually located in the "unsorted" drawers or lumped with *Apanteles*. This lack of expertise, in combination with the large influx of specimens from Janzen's caterpillar-parasitoid rearing project in northwestern Costa Rica (Janzen and Hallwachs 2002, Schauff and Janzen 2001, Burns and Janzen 2001), clarified the need for a taxonomic revision of *Alphomelon*.

NATURAL HISTORY AND DISTRIBUTION OF *ALPHOMELON*

Host records for the few reared specimens in major collections indicate that species of *Alphomelon* invariably parasitize hesperiine skipper larvae (Lepidoptera: Hesperiidae) feeding mostly on monocots. There is one doubtful rearing record from a dicot-eating caterpillar: DHJ voucher 98-SRNP-4564 (Janzen and Hallwachs 2002). The majority of museum records are from skipper larvae feeding on agricultural crops such as corn, sugar cane, bananas, and canna. Two of these hosts, *Lerema* sp. and *Calpodes ethlius*, are also reported to feed on peanuts (extraordinarily doubtful) and wheat (according to caterpillar food plant records in the USNM), but *Alphomelon* has never been recorded from skipper larvae on these host plants.

In contrast to the dearth of museum host records (which often have questionable accuracy), D. H. Janzen and W. Hallwachs' (2002) caterpillar-parasitoid rearing project in Costa Rica (voucher number information accessible at Janzen and Hallwach's website: ⟨http://janzen.sas.upenn.edu⟩) adds abundant and continuous new records of host caterpillars and food plants (see Table 1).

Alphomelon species exhibit a diverse array of ovipositor types ranging from short (the exserted portion shorter than the hind basitarsus; see Figure 6a,b) to long (the exserted portion as long as the hind tibia) with varying degrees of curvature. More than half the species are equipped with a "typical" ovipositor of medium length and medium curvature (Fig. 6c), including most of the reared species. Species also differ with respect to the number of spines (from one to four) on the tarsal claws (Fig. 3). Since skipper larvae typically live in leaf-rolls lined with silk (Hogue 1993), further exploration of their ovipositors and tarsal claws may provide clues into oviposition behavior, host species escape biology, and the host environment.

This genus occurs only in the New World (Mason 1981). The highest concentration of species are in Amazonia and southern Central America where hesperiids are also extremely speciose (Hogue 1993).

PHYLOGENETIC PLACEMENT OF *ALPHOMELON*

Mason (1981; also Walker et al. 1990) used morphological characters to place *Alphomelon* in the *Apanteles* genus-group (*Apanteles, Papanteles, Alphomelon,* and *Dasylagon*) within the tribe Apantelini. Reanalysis of morphology combined with molecular data (Mardulyn and Whitfield 1999, Whitfield et al. 2002) maintains this clade with *Alphomelon* as the sister group to *Apanteles, Dasylagon,* and/or *Dolichogenidea*. Available host information suggests that most species in these other three genera parasitize concealed microlepidoptera in rolled leaves (Mason 1981). *Alphomelon*, however, differs in parasitizing one subfamily of macrolepidoptera that also live in leaf rolls (Mason 1981).

MATERIAL

More than 2000 specimens were borrowed for this revision from the following institutions or individuals: (AEI) American Entomological Institute Collection, Gainesville, FL, USA, David B. Wahl; (CNC) Canadian National Collection, Bio-

systematics Research Centre, Agriculture Canada, Ottawa, Ontario, Canada, Henri Goulet; (DHJ) Department of Biology, University of Pennsylvania, Philadelphia, PA, USA, D. H. Janzen (these specimens were deposited in: AEI, CNC, INBIO, INHS, MCZ, TAMU, USNM, UWY); (INBIO) Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica, Carolina Godoy; (INHS) Illinois Natural History Survey, Champaign, IL, USA, Colin Favret; (HUMB) Alexander von Humboldt Biological Resources Research Institute, Bogotá, Colombia, Fernando Fernández; (MCZ) Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA, Stefan Cover; (NHM) Natural History Museum, London, UK, Mike Fitton; (TAMU) Texas A and M University, College Station, TX, USA, Robert A. Wharton; (UCD) University of California at Davis, Davis, CA, USA, Lynn Kimsey; (USNM) United States National Museum, Smithsonian Institution, Washington, DC, USA, David Smith; (UWY) University of Wyoming, Laramie, WY, USA, Scott R. Shaw. Included in this material were the holotypes for *A. disputabile*, *A. nigriceps*, and *A. conformis* from USNM. A cotype for *A. talidicida* was examined during a visit to NHM but not borrowed.

METHODS

Morphological terms follow those of Sharkey and Wharton (1997). Additional terms include: lunule (Mason 1981), stemmaticum (Shaw and Huddleston 1991), lateral and anterior scutellar furrows (to distinguish between scutellar furrows in Sharkey and Wharton 1997; see Fig. 1), medial scutellar area (area between lateral scutellar furrows; see Fig. 1), anterior propodeal area (propodeal areas anteriorly left and right of areola; see Fig. 1), posterior propodeal area (propodeal areas posteriorly left and right of areola; see Fig. 1), axillary projections (rugose projections apical to lunules; see Fig. 1), lateral metanotal depression (refers to pits left and right of posterior scutellar depression; see Fig. 1), and petiolar ridge (medial carina on petiole; see Fig. 1). Quicke et al. (1999) was used for ovipositor structural terms. Head width, medial ocellar diameter, lateral ocellar diameter, lateral ocellar line, posterior ocellar line, ocular ocellar line, hind tarsal length, and ovipositor sheath length followed those measurements used by Williams (1988).

Only specimens closely matching the holotype in all morphological aspects and/or males from the same series were designated and labeled as paratypes. All specimens examined for this revision were supplied with species determination labels before the loans were returned.

DIAGNOSTIC CHARACTERS AND SPECIES KEY

Although the conspicuous white coloration of the genae helps to define *Alphomelon*, one should not rely on that character alone for identification. Several species of Neotropical *Cotesia* (personal observation of museum collections and reared riodinid parasitoids) also have white patches on the genae, as do many *Dolichogenidea* and other genera in the Old World tropics (Mason 1981; personal observation). Additional characters that distinguish *Alphomelon* from other genera with white genae include: fully sclerotized hypopygium, presence of petiolar ridge, lack of wing areolet, and fully carinate propodeum with areola.

Color patterns are the most obvious and perhaps easiest characters to use for diagnosis of certain species. Conspicuous body segment coloration of orange or yellow helps distinguish between *A. nigriceps* (metasoma and mesosoma yellow), *A. crocostethus* (mesonotum orange), *A. pyrrhogluteum* (metasoma yellow), and *A. simpsonorum* (metasomal tergites I, II, and III yellow). The size of white spots on the genae also varies from moderately reduced (*A. winniewertzae*, *A. paurogenum*) to extensive (*A. bromeliphile*, *A. brachymacher*) (see Fig.

Table 1. Host and host plant information for *Alphomelon* species.

Alphomelon	Host Species	Host Plant Species	Host Plant Family	Reference
arecaphile	*Carystoides basoches*	*Chamaedorea costaricana* *Chamaedorea tepejilote*	Arecaceae	Janzen and Hallwachs 2001
	Synale cynaxa	*Chamaedorea costaricana* *Chamaedorea tepejilote*	Arecaceae	
brachymacher	no known host records			
bromeliphile	*Neoxeniades scipio*	*Bromelia pinguin* *Achmaea magdalenae*	Bromeliaceae	Janzen and Hallwachs 2001
citroloma	no known host records			
conformis	Hesperiinae	*Canna indica*	Cannaceae	Muesebeck 1958
	Hesperiinae	*Panicum pilosum*	Poaceae	(specimens in INBIO)
crocostethus	Hesperiinae	*Saccharum officinarum* (suger cane)	Poaceae	(specimens in USNM)
disputabile	*Lerema* spp.	*Oryza latifolia*	Poaceae	(specimens in USNM)
	Cymaenes trebius	(grass)	Poaceae	Janzen and Hallwachs 2001
melanoscelis	Hesperiinae	(grass)	Poaceae	Janzen and Hallwachs 2001
	Hesperiinae	(sedge)	Cyperaceae	
nanosoma	*Cobalopsis* sp.	*Oryza latifolia*	Poaceae	Janzen and Hallwachs 2001
nigriceps	Hesperiinae	*Canna* sp.	Cannaceae	(specimens in USNM)
	Hesperiinae	*Zea mays* (corn)	Poaceae	
paurogenum	no known host records			
pyrrhogluteum	no known host records			
rhyssocercus	no known host records			
simpsonorum	Hesperiinae	grass	Poaceae	Janzen and Hallwachs 2001
talidicida	*Talides sergestus*	*Heliconia latispatha*	Heliconiaceae	Janzen and Hallwachs 2001
	Talides sinois	*Heliconia latispatha* *Musa cavendishii*	Heliconiaceae Musaceae	Janzen and Hallwachs 2001
winniewertzae	*Calpodes ethlius*	*Thalia geniculata*	Marantaceae	Janzen and Hallwachs 2001
	Euphyes sp. *Euphyes vestris*	?	?	(specimens in USNM)

Table 1. Continued.

Alphomelon	Host Species	Host Plant Species	Host Plant Family	Reference
xestopyga	*Calpodes ethlius*	*Maranta arundinacea*, *Calathea macrosepela* *Thalia geniculata*	Marantaceae	Janzen and Hallwachs 2001
		Canna indica	Cannaceae	
	Rhinthon cubana	*Maranta arundinacea*, *Calathea macrosepela* *Calathea lutea*	Marantaceae	Janzen and Hallwachs 2001
	Saliana fusta	*Maranta arundinacea* *Calathea macrosepela*	Marantaceae	Janzen and Hallwachs 2001
	Cynea irma	*Maranta arundinacea* *Calathea panamensis*	Marantaceae	Janzen and Hallwachs 2001
	Quinta cannae	*Thalia geniculata*	Marantaceae	Janzen and Hallwachs 2001

4). Additional characters include coloration of legs (completely orange or barred with black), wings (smoky or hyaline), ovipositor (reddish-orange or yellow), and face (with a light brown spot or completely black). Although these color patterns appear to be largely diagnostic, one should use caution when relying on color characters alone since temperature during development is known to influence adult appearance in braconids (Liu and Carver 1982).

Other diagnostic morphological characters frequently referred to in this revision concern hind wing vein cu-a curvature (see Fig. 2), tarsal claw spine number (see Fig. 3), ovipositor length and curvature (see Fig. 6), lunule shape, tegula shape and color, propodeal sculpturing (areola open or closed anteriorly), metasomal tergite I and II shape, and sculpturing of the head and mesoscutum.

Larval characters were not examined in this revision due to limited availability of cast skins for most species, but Penteado-Dias (1985) describes larval features for one species in the genus.

In the key to species, values given in parentheses refer to the percentage of specimens examined exhibiting that particular characteristic. The phrase "cheek patches" refers to the white spots on genae. The current abundance of species in museum collections (the museums mentioned under Material) is designated as: rare (fewer than 10 total specimens), uncommon (10–20 specimens), common (20–100 specimens), or abundant (more than 100 specimens). A brief description of the species' natural history and range follows the species names in the key. Since most males (>75%) are difficult to identify unambiguously to species, the key is based on female specimens.

KEY TO FEMALE NEW WORLD SPECIES OF *ALPHOMELON*

1 Mesonotum orange-yellow; tarsal claws with 1 spine (Fig. 3a); wings infumated; cheek patches reduced (Fig. 4f), with white not extending to post-genal part of occiput 2
– Mesonotum dark brown to black; tarsal claws variable; wings variably colored; cheek patches variable 3

2 Metasoma and mesosoma yellow-orange .... ***A. nigriceps* (Ashmead)**

(Common. Solitary parasitoid reared from *Calpodes* spp. on *Canna indica* and unidentified sp. on corn (*Zea mays*). Distributed throughout Caribbean islands and countries/states surrounding Caribbean and reaching as far north as North Carolina, U.S.A.)

– Metasoma black, mesosoma with mesonotum only orange .. ***A. crocostethus* Deans, n. sp.**
(Uncommon. Solitary parasitoid reared from hesperiid on sugar cane (*Saccharum officinarum*). Distributed from southern Caribbean islands to Colombia, and Brazil)

3 Metasoma with at least lateral tergites and sternites (except hypopygium in some) yellow; petiole rectangular and elongate (Fig. 5a); posterior portion of hind wing cu-a angled toward body (Fig. 2c); tarsal claws with 2 spines (Fig. 3b) 4
– Metasoma entirely brown to black; petiole variable; hind wing cu-a variable; tarsal claws with 1–4 spines 6

4 Metasoma entirely yellow except medial ⅓ of hypopygium and tergum VII black; mesopleuron nitid except for setae ..... ***A. pyrrhogluteum* Deans, n. sp.**
(Rare. Biology unknown. Collected in Argentina only)
– Metasoma less than 50% yellow; mesopleuron punctate 5

5 Petiole and tergites I–III yellow; petiolar ridge weakly represented; malar space not convex; pale cheek patch not extending to clypeus ..... ***A. simpsonorum* Deans, n. sp.**
(Rare. Solitary parasitoid reared from Hesperiinae on a grass (Poaceae) in Costa Rica. Distributed from Costa Rica to Paraguay)
– Petiole and Tergites I–III black; medial petiolar ridge strongly represented; malar space distinctly convex; pale cheek patch extending to clypeus (Fig. 4c) (80%) ..... ***A. citroloma* Deans, n. sp.**
(Common. Biology unknown. Distributed from Costa Rica to Argentina)

6 Exserted portion of ovipositor shorter than hind basitarsus (Fig. 6a,b); tarsal claws with 4 spines (Fig. 3d); hind wing cu-a strongly curved towards body (Fig. 2b); cheek patches extending onto clypeus (Fig. 4a,b) (75%) 7
– Exserted portion of ovipositor longer than hind basitarsus (Fig. 6c,d,e); tarsal claws variable; hind wing cu-a variable; cheek patches variable 8

7 Ovipositor less than ½ length of basitarsus (Fig. 6a), orange in color; ovipositor sheaths expanded apically (Fig. 6a); face black (Fig. 4b); antennae dark brown ..... ***A. brachymacher* Deans, n. sp.**
(Common. Biology unknown. Distributed from Costa Rica to Ecuador, Peru and Brazil.)
– Ovipositor longer than ½ length of basitarsus (Fig. 6b), yellow-orange in color; ovipositor sheaths not expanded apically (Fig. 6b); face with light brown spot (Fig. 4a); antennae light brown ..... ***A. bromeliphile* Deans, n. sp.**
(Rare. Gregarious parasitoid reared from *Neoxeniades scipio* on *Bromelia pinguin* and *Achmaea magdalenae* (Bromeliaceae) in Costa Rica. Distributed from southern Mexico to Costa Rica)

8 Hind legs black except basal ½ of tibia orange; body size large (~5mm); tarsal claws with 4 spines (Figure 3d); petiole costate with ridge strongly represented (Figure 5b) ..... ***A. melanoscelis* Deans, n. sp.**
(Common. Solitary parasitoid reared from hesperiines on grasses (Poaceae) in Costa Rica. Distributed from southern Mexico to Brazil)
– Hind leg coloration variable but femur never completely black; body size variable (85% <5mm); tarsal claws with 1–4 spines; petiole variable 9

9 Cheek patches neither extending onto the clypeus nor to the occiput (Fig. 4g,h) (90%), if extending to occiput then mesoscutum and head strongly punctate; tarsal claws with 1 spine (Fig. 3a); hind wing cu-a angled posteriorly towards body (Fig. 2c) 10
– Cheek patches extending to occiput and often onto clypeus (75%); tarsal claws variable; hind wing cu-a variable 11

10 Wings darkly infumated (75%); head, mesoscutum, and medial scutellar area weakly

punctate; apical 1/5 of hind tibia and femur black; labrum black ..... ***A. paurogenum*** **Deans, n. sp.**
(Uncommon. Biology unknown. Collected in Argentina and Chile)

– Wings hyaline; head, mesoscutum and medial scutellar area strongly punctate; hind femur and tibia entirely orange; labrum yellow ..... ***A. winniewertzae*** **Deans, n. sp.**
(Common. Solitary parasitoid reared from *Calpodes ethlius* on *Thalia geniculata* (Marantaceae) in Costa Rica and Euphyes spp. in Texas, U.S.A. Widely distributed throughout eastern U.S.A. and Canada south to Costa Rica.)

11 Tarsal claws with 1 spine (95%; Fig. 3a); cheek patches not extending onto clypeus (75%); hind wing vein cu-a angled posteriorly towards body (Fig. 2c) ..... ***A. disputabile*** **(Ashmead)**
(Abundant. Solitary parasitoid reared from *Lerema* spp. on *Oryza latifolia* (Poaceae), *Cymaenes trebius* on grasses (Poaceae), and perhaps once on *Nisoniades castolus* (a pyrgine hesperiid) on *Vernonia patens* (Asteraceae) in Costa Rica. Widely distributed from Texas, U.S.A., throughout Caribbean, south to Argentina)

– Tarsal claws with 2–4 spines; cheek patches usually extending onto clypeus (75%); hind wing vein cu-a variable 12

12 Tegulae black; petiolar ridge strongly bifurcating (Fig. 5c) ..... ***A. conformis*** **(Muesebeck)**
(Uncommon. Reared from hesperiid on *Canna indica* (Cannaceae) in Venezuela. Distributed from Costa Rica to Venezuela.)

– Tegulae translucent-yellow; petiolar ridge not strongly bifurcating 13

13 Petiole strongly costate (Fig. 5d); tergite II rugose raised, medially (Fig. 5d) ..... ***A. rhyssocercus*** **Deans, n. sp.**
(Uncommon. Biology unknown. Distributed from Panama to Argentina)

– Petiole not strongly costate; tergite II rugulose or nitid 14

14 Ovipositor thicker than ½ basitarsus width (Fig. 6d), hind wing cu-a straight (Fig. 2d); tegulae whitish; stigma triangular (Fig. 2a) ..... ***A. arecaphile*** **Deans, n. sp.**
(Common. Gregarious parasitoid reared from *Carystoides basoches* and *Synale cynaxa* on *Chamaedorea* spp. (Arecaceae) in Costa Rica. Distributed from Costa Rica to Brazil.)

– Ovipositor thinner than ½ basitarsus width; hind wing cu-a variable, but not straight; tegulae yellow; stigma rounded (Fig. 2b) 15

15 Petiole with ridge present (Fig 5c); ovipositor straight, long, and thin, ⅓ as thick as hind basitarsus, with exerted portion >1.4× hind basitarsus length (Fig. 6e); hind wing cu-a strongly angled at midpoint towards body (Fig. 2e); body size medium to large (~4–5mm) ..... ***A. talidicida*** **(Wilkinson)**
(Common. Gregarious parasitoid reared from *Talides* spp. on *Heliconia* (Heliconiaceae) and *Musa* spp. (Musaceae) in Costa Rica. Distributed throughout Caribbean islands and from Costa Rica to Brazil)

– Petiole with only an inconspicuous depression (Fig. 5e,f); ovipositor obviously decurved, ½ as thick as hind basitarsus, with exerted portion <1.4× hind basitarsus length; hind wing cu-a variable; body size small to medium 16

16 Hind wing vein cu-a evenly curved towards body (Fig. 2f); body size small (<3mm); tarsal claws with 2 spines (Fig. 3b); ovipositor ½ as thick as hind basitarsus; cheek patches not extending onto clypeus (90%); petiole mostly nitid with petiolar ridge represented by slight depression (Fig. 5e) ..... ***A. nanosoma*** **Deans, n. sp.**
(Common. Gregarious parasitoid reared from *Cobalopsis* sp. on grass (Poaceae) in Costa Rica. Distributed from Mexico to Ecuador and Brazil)

– Hind wing cu-a sharply angled at midpoint towards body (Fig. 2e); body size medium (3–4mm); tarsal claws with 3–4 spines (Fig. 3c, d); ovipositor ⅓ as thick as hind basitarsus; cheek patches extending onto lateral portions of clypeus (as in Fig. 4d); petiole rugulose, slightly punctate with petiolar ridge represented by raised bump with slight depression (Fig. 5f) ..... ***A. xestopyga*** **Deans, n. sp.**

(Abundant. Gregarious parasitoid reared from *Calpodes ethlius* on *Maranta arundinacea, Calathea macrosepela, Thalia geniculata* (Marantaceae) and *Canna indica* (Cannaceae), *Rhinthon cubana* on *Maranta arundinacea, Calathea macrosepela,* and *Calathea lutea* (Marantaceae), *Saliana fusta* on *Maranta arundinacea* and *Calathea macrosepela* (Marantaceae), and *Cynea irma* on *Maranta arundinacea, Calathea panamensis, Quinta cannae,* and *Thalia geniculata* (Marantaceae). Distributed throughout southern Central America.)

Alphomelon Mason

Alphomelon Mason 1981:54. Type species: *Alphomelon disputabilis* (Ashmead), by Mason.

Diagnosis.—Genae with white coloration. Face with prominent ridge medially. Forewing without areolet. Propodeum areolated. Tarsal claws pectinate. Hypopygium evenly sclerotized.

Description.—Head: Brown to black with white coloration on genae. Head broad in frontal view, usually punctate, setose with spreading hairs, always with nitid frons occiput and vertex. Prominent ridge arising between antennal sockets and continuing ventrally to point 0.5 between antennal shelf and clypeus. *Antennae:* Light brown to black, as long as body. Placodes in two rows. *Mouthparts:* Mandible with two teeth: one pointed (dorsal), one rounded (ventral). *Eyes and Ocelli:* Eyes silver (red or dull gray in older specimens) stiffly setose with short hairs. Ocelli clear to translucent red, subequal in size with median ocellus immeasurably (85%) smaller. *Mesosoma:* Propleuron anteriorly punctate and setose with hairs arising from depressions, posteriorly nitid. Pronotal polished band nitid anteriorly and substrigulate posteriorly. Pronotal furrows rugose. Area posterior to pronotal furrows punctate and setose. Epimeron deeply impressed dorsally. Mesoscutum punctate (85%) broader than long. Anterior scutellar furrow represented by line of impressed pits. Lateral scutellar furrows widening apically. Lunules nitid. Axillary projections costate-rugose. Lateral metanotal area areolate-rugose dorsally and nitid ventrally. Propodeum sculptured and areolated. *Legs:* Variably patterned with black, brown, yellow, and white, covered with short, stiff setae. Tibiae with short spines randomly distributed throughout surface. Tarsal claws pectinate with 1–4 spines. *Wings:* Setose with hairs more dense apically. Forewing without areolet. Hamuli consisting of 3 spines basally and 3 hooks distally. *Metasoma:* Petiole with short bifurcating carina present medially (if no carina then shallow depression present). Medial tergite II trapezoidal to rectangular, nitid to rugulose. Tergite I spiracle surrounded with long thickened setae. Hypopygium evenly sclerotized. *Genitalia:* Ovipositor tapering apically, slightly depressed dorsally basal to tip and slightly expanded at tip. Ventral valve with 2–4 teeth apically. Ovipositor sheaths evenly setose with stiff spreading setae at the desclerotized tips.

Biology.—Parasitoids of hesperiine hesperiids.

Alphomelon arecaphile Deans, new species

(Fig. 6d)

Diagnosis.—Tegulae whitish, hind wing cu-a straight, ovipositor thick (0.6× basitarsus width), reared from skippers (*Carystoides basoches* and *Synale cynaxa*) on palms (Arecaceae) (Janzen and Hallwachs 2000).

Female.—Head: Dark brown to black except white coloring on genae extending from anterior tentorial pits to bottom edge of eye, ventrally to mandible and posteriorly to occiput, not extending onto clypeus. Head round, 1.15× wider than high, setose with flexible setae, not punctate, nitid occiput, frons and vertex. Face 2.35× wider than clypeus. Clypeus 1.33× wider than high. Line between anterior tentorial pit and eye 0.5× line between eye and

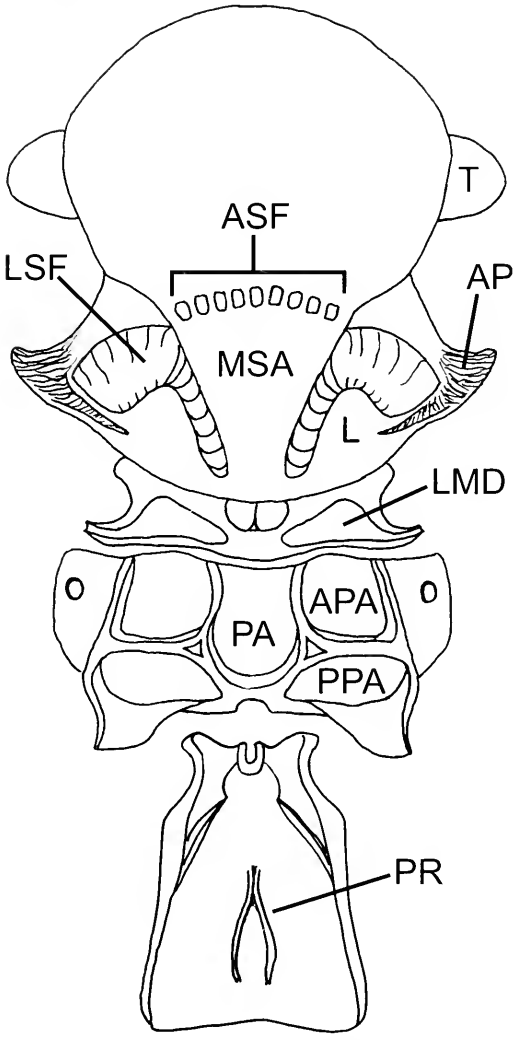

Fig. 1. Morphological terms, *Alphomelon*. (T) tegula, (ASF) anterior scutellar furrow, (LSF) lateral scutellar furrow, (AP) Axillary projections, (MSA) medial scutellar area, (L) lunule, (LMD) lateral metanotal depression, (APA) anterior propodeal area, (PA) propodeal areola, (PPA) posterior propodeal area, (PA) petiolar ridge.

mandible with malar space slightly convex. *Eyes and Ocelli:* Eyes 1.7× higher than wide. Ocelli colorless, translucent, subequal in size. Stemmaticum slightly raised and broadly triangular with posterior-ocellar line 3.6× lateral-ocellar line. Ocular-ocellar line 1.1× posterior-ocellar line. *Antennae:* Dark brown, as long as body. *Mouthparts:* Mandibles brown, setose with stiff hairs. Labrum dark brown and broadly cleft (appearing not cleft in some). Maxillary palps whitish-yellow, labial palps brown. *Mesasoma:* Black. Tegulae whitish yellow and translucent, brown at base, 2.15× wider than long, semicircular. Mesoscutum 1.1× wider than long, evenly punctate. Medial scutellar area evenly but slightly punctate, elongate and triangular with anterior scutellar furrow 0.9× length of medial scutellar area. Anterior scutellar furrow sub-linear with 7–8 pits, 2.2× longer than line between lateral scutellar furrows. Axillary projections with sculpturing arising at apical 0.33 lunule base. Lunules triangular and 1.85× wider at the base than high. Lateral scutellar furrows costate basally, becoming rugulose apically with apical edge equal to lunule base width. Mesopleuron evenly minutely punctate except nitid areas dorsad and ventrad sternaulus. Mesonotum nearly nitid, except setose raised area (8–10 setae) posterior to posterior scutellar depression. Lateral metanotal depressions nearly rectangular becoming broader apically, with rugulose surface. Posterior scutellar depression small, 2× wider than long, divided medially with carina. Anterior propodeal areas rugose. Posterior propodeal areas nitid with 1–2 small carinae. Anterior propodeal areas not well separated from posterior propodeal areas. Areola U-shaped, nearly open with only a small carina, minutely rugulose, 1.8× wider than high. propodeal spiracle hairs difficult to distinguish from other setae. *Forelegs:* Honey-yellow except dark brown coxae and trochanters. Tarsal claws light brown. Arolia dark brown. *Mid-legs:* Honey-yellow except dark brown coxae and trochanters. tarsal claws light brown. Arolia dark brown. *Hind legs:* Coxae dark brown to black, trochanters dark brown, trochantellae honey-yellow, femur honey-yellow except apical 0.2 brown. Tibiae 5× longer than wide, yellowish-brown except basal 0.15 white and apical 0.1 brown. Tibial

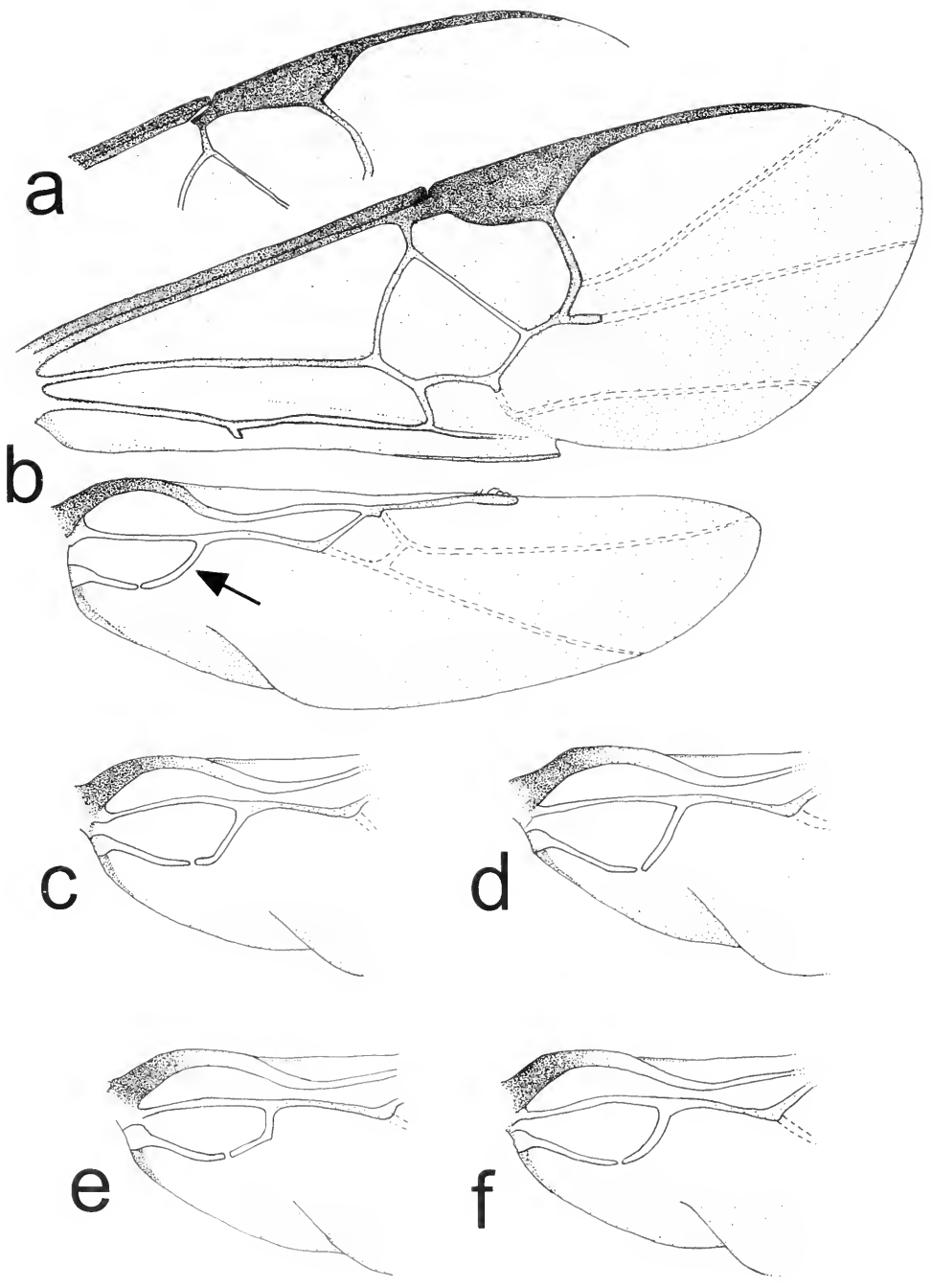

Fig. 2. Wing venation, *Alphomelon*. (a) stigma elongate, triangular (b) stigma not elongate and typical forewing venation with hind wing showing strongly curved cu-a (arrow), (c) cu-a curved posteriorly towards body, (d) cu-a straight, (e) cu-a strongly angled medially towards body, (f) cu-a evenly curved.

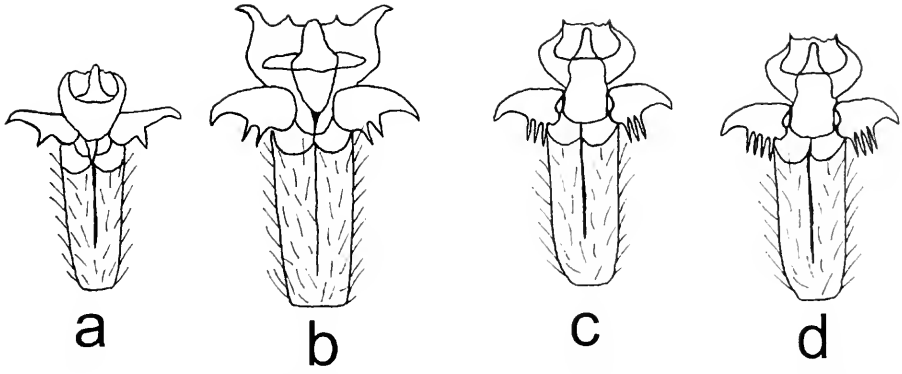

Fig. 3. Tarsal claw variation, Alphomelon. (a) Claw with one spine, (b) with two spines, (c) with three spines, (d) with four spines.

spurs white, interior spur 1.6× longer than exterior spur. Basitarsus 4.25× longer than wide, yellow evenly fading to brown. Remaining tarsomeres brown. Tarsal claws light brown with 1 spine. Arolia dark brown. *Wings:* Setose with membrane pubescence slightly more dense apically. Stigma elongate. Veins brown dorsally and ventrally. Hind wing cu-a straight with slight bending at midpoint towards body. *Metasoma:* Dark brown to black, lateral tergite I brown. Petiole trapezoidal with posterior edge 1.3× anterior edge and petiole length 1.5× posterior edge, rugulose with posterior 0.25 sparsely setose. Petiolar ridge represented, 0.33× as long as petiole length with line between bifurcating ridge arms 0.25× posterior petiole edge. Medial tergite II rugulose, trapezoidal with medial area expanded slightly anteriorly and posteriorly, anterior edge 0.8× posterior edge, and length 0.4–.45× anterior edge. Hypopygium evenly setose. *Genitalia:* Ovipositor 0.6× as thick as hind basitarsus, reddish-orange, with exerted portion 1.7× longer than hind basitarsus, ventral valve with 4 teeth. Ovipositor sheaths thick, straight with sharply angled tips, tips desclerotized, dark brown interior and exterior.

Male.—Legs with more orange and less brown coloration, wing veins lighter brown becoming clear basally.

Cocoon.—Tight, smooth white cocoons linked to other cocoons with fine strands of silk.

Biology.—Gregarious parasitoids of hesperiines (*Carystoides basoches* and *Synale cynaxa*) feeding on palms (Arecaceae: *Chamaedorea* spp.). Reared in intermediate elevation rainforest in northwestern Costa Rica (Janzen and Hallwachs 2002) and central Costa Rica.

Etymology.—The name "arecaphile" is derived from the host plant family (Arecaceae) and the Greek word for "lover" –phile.

Holotype.—COSTA RICA: Area de Conservación Guanacaste: Sector Cacao: Gongora: 560m: 95-SRNP-9593: (1♀, USNM).

Paratypes.—COSTA RICA: Area de Conservación Guanacaste: Sector San Cristobal: Quebrada: 660m: 98-SRNP-7272: (1♀, AEI); COSTA RICA: Area de Conservación Guanacaste: Sector Cacao: Gongora: 560m: 95-SRNP-9593: (1♂, USNM, 1♀, INHS); COSTA RICA: Area de Conservación Guanacaste: Sector San Cristobal: Sendero Catarata: 720m: 98-SRNP-6805: (1♀,♂, CNC); 98-SRNP-6805 (1♂, INHS); COSTA RICA: Birri: reared from hesperiid on "pacaya": 7-X-1996 A. Gonzales (1♀, INHS); COSTA RICA: Area de Conservación Guanacaste: Sector Cacao: Gongora: 560m: 95-SRNP-9593 (1♀, INBIO); 97-CALI-030 (1♀, INBIO); 96-RIOS-383 (5♀, INHS); COSTA RICA: Area de Conservación Guanacaste: Sector Cacao: Estación

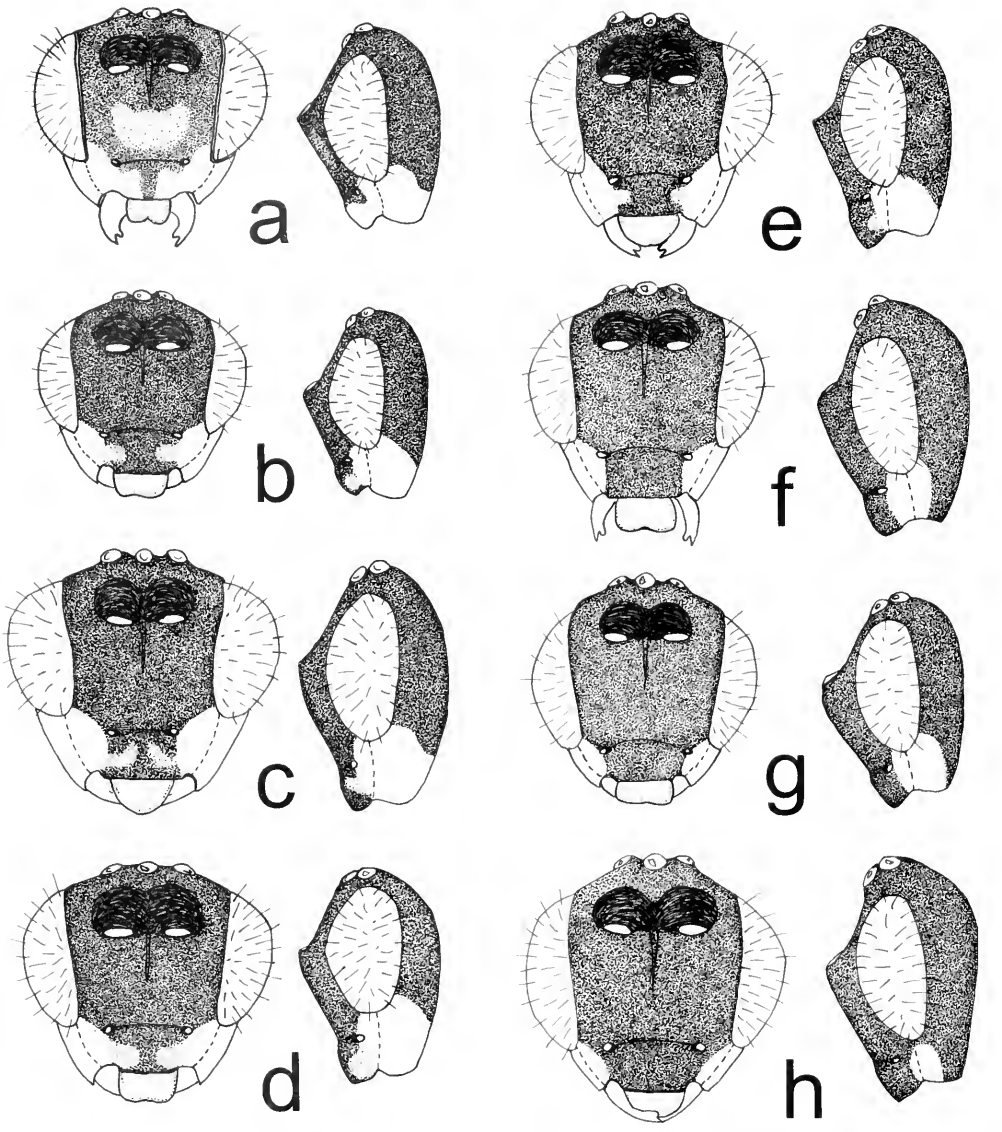

Fig. 4. Head color patterns, *Alphomelon*. Frontal and sinistral views of *Alphomelon* heads; (a) *A. bromeliphile* n. sp., (b) *A. brachymacher* n. sp., (c) *A. citroloma* n. sp., (d) *A. talidicida* (Wilkinson), (e) *A. disputabile* (Ashmead), (f) *A. nigriceps* (Ashmead), (g) *A. winniewertzae* n. sp., (h) *A. paurogenum* n. sp.

Cacao: 1120m: 97-SRNP-967 (1♀, 1♂, INHS); COSTA RICA: Limón: 4 km. NE. Bribri: 50m: malaise trap: [IX–XI]-1989 coll. Paul Hanson (1♀, UWY).

Other material examined.—COSTA RICA: Area de Conservación: Sector San Cristobal: Quebrada: Cementario: 660m: 98-SRNP-7055: (1♀, 1♂); 98-SRNP-7272 (1♀, 1♂); Sector San Cristobal: Sendero: Catarata: 720m: (2♀, 2♂ each 98-SRNP-6805, 98-SRNP-6806); Sector Cacao: Gongora: 560m: (2♀, 1♂, 95-SRNP-9593); Sector Cacao: Estación Cacao: 1120m: (1♀, 1♂, 97-SRNP-967); Area de Conservación Guanacaste: Rincón Rainforest: Camino Rio Francia: (1♀, 1♂, 00-SRNP-21106); 97-RIOS-001 (7♀); 97-CALI-030 (1♀); 96-RIOS-383 (8♀); 96-C.MORAGA-246 (3♀,

1♂); Riparion: 29-VIII-1977 (1♀, AEI); S. Rosa National Park: coll. 19-VII-1977 D. Janzen (1♀, AEI); San José: San Pedro: UCR Reserva Ecológica: Leonel Oviedo: 1150m: reared 15-X-1999 Kenji Nishida (6♀, INHS); BRAZIL: Utinga: Belem: coll. XII-1966 S. J. Oliviera (1♀, AEI).

Alphomelon brachymacher Deans, new species
(Figs. 4b, 6a)

Diagnosis.—Hypopygium expanded posteriorly, ovipositor very short and barely exerted. Mandibles concealed in head behind labrum. Hind wing cu-a vein strongly curved towards body.

Female.—Head: Dark brown with white coloring on genae barely reaching onto clypeus, extending from anterior tentorial pits ventrally to mandible edge, and posteriorly to occiput. Head 1.3× wider than high, appearing compressed, evenly punctate except nitid vertex, frons, and occiput. Face 2.15× wider than clypeus. Clypeus 2× wider than high. Malar suture 1.4× longer than line between eye and anterior tentorial pit, malar space slightly convex. *Antennae:* Light brown, slightly shorter than body. *Eyes and Ocelli:* Eyes 1.65× higher than wide. Ocelli translucent honey-yellow to honey orange, subequal in size. Stemmaticum slightly raised and broadly triangular with posterior-ocellar line 3.5× longer than lateral-ocellar line and ocular-ocellar line equal to posterior-ocellar line. *Mouthparts:* Mandibles brown, setose with long stiff hairs, usually concealed behind labrum and difficult to see. Labrum brown and slightly cleft medially. Palps yellow, setose. *Mesosoma:* Dark brown. Tegulae translucent yellow, setose, 2× wider than long. Mesoscutum 1.25× wider than long, punctate with depressions more dense anteriorly. Medial scutellar area trapezoidal, smooth, with anterior scutellar furrow 2.25× longer than line between lateral scutellar furrows, and medial scutellar area length equal to anterior scutellar furrow length. Anterior scutellar furrow slightly curved with 5–6 pits. Lateral scutellar furrows carinate basally becoming rugulose and widening distally with distal edge rounded and 0.5× as wide as lunule base. Lunules semicircular, 3× wider at the base than long. Axillary projections with sculpturing arising at distal edge of lunule base. Mesopleuron punctate and setose except nitid dorsad and ventrad the sternaulus. Metanotum nitid except sparsely setose raised area posterior to posterior scutellar depression. Lateral metanotal pits skewed-teardrop shaped with slightly rugulose surface. Posterior scutellar depression 2× wider than long, barely divided medially. Propodeum laterally areolate-rugose with anterior propodeal areas rugose, posterior propodeal areas and areola nearly nitid. Areola nearly open with only shallow carinae represented, diamond shaped, 1.6× higher than wide. Spiracular hairs obvious. *Fore-legs:* Uniformly honey-yellow except brown coxae and light brown trochanters. Tarsal claws deep red. Arolia brown. *Mid-legs:* Uniformly honey-yellow to honey-orange except brown coxae and trochanters, and light brown trochantellae. Tarsal claws deep red. Arolia brown. *Hind legs:* Coxae dark brown. Trochanters and trochantellae light brown. Femur honey-yellow to honey-orange except apical 0.2 light brown. Tibiae honey-orange except basal 0.2 whitish and apical 0.1 brown, 5.2× longer than wide. Basitarsi honey-yellow evenly fading to light brown apically, 4× longer than wide. Tarsomeres uniformly light or dark brown. Tarsal claws reddish brown, pectinate with 4 spines. Arolia dark brown. *Wings:* Hyaline, setose with hairs more dense apically. Veins brown dorsally, white ventrally. Stigma broad. Hind cu-a strongly curved towards body. *Metasoma:* Petiole dark brown, rectangular, 4× longer than posterior edge, acutely rugulose, glabrous except sparsely setose posterior 0.25. Petiolar ridge strongly represented (75%) and bifurcating, 0.5× as long as petiole, 0.2×

as wide as posterior petiole edge. Medial tergite II short, sparsely setose, smooth, trapezoidal with anterior edge 3× tergite length and posterior edge 1.2× longer than anterior edge. Medial tergites II–III orange. Lateral tergites I–II light brown. Remaining tergites and sternites dark brown. Hypopygium uniformly setose, elongate posteriorly. *Genitalia:* Ovipositor straight to slightly decurved, orange with exerted portion less than 0.5× hind basitarsus length and 0.3× as wide as basitarsus width. Sheaths with brown exterior and white interior, densely setose, desclerotized at tips, and expanded apically.

Male.—Unknown.

Cocoon.—Unknown.

Biology.—Collected in rainforest.

Etymology.—The name is derived from the Greek roots "brachy-" meaning short and "-macher" meaning sword. It refers to the very short ovipositor.

Holotype.—COLOMBIA: Amazonas: PNN Amacayacu Matamata: 3° 23′ N, 70° 06′ W: malaise trap: [11–13]-XI-2000: coll. A. Parente (1♀, USNM).

Paratypes.—PERU: Avispas: [1–15]-X-1962: coll. R. D. Shenefelt (2♀, AEI); COLOMBIA: Amazonas: PNN Amacayacu: Mocagua: 3° 23′ 01″ N, 70° 06′ 01″ W: 300m: malaise trap: [8–15]-V-2000: coll. A. Parente (1♀, HUMB); COLOMBIA: Casanare: Yagauzul Cusiana pozo M (P. B.) Caño: La Arenosa: 600m: malaise trap: 24-IX-1995: coll. F. Fernandez (1♀, INHS); ECUADOR: 3 km. N Tena: [V–VI]-1993: coll. S. Borror and G. Fisher (1♀, TAMU); COSTA RICA: Heredia: 3 km. S. Puerto Viejo: OTS—La Selva: (100m): [16–30]-IX-1992: coll. P. Hanson (1♀, TAMU); COSTA RICA: Heredia: Est. Biol. La Selva: 50–150m: 10.26N, 84.01W: coll. VIII-1992 (2♀, UWY); coll. (1–15)-IX-1992 P. Hanson (1♀, UWY).

Other material examined.—BRAZIL: Mato Grosso: Sinop: coll. II-1976 O. Roppa (2♀, CNC); coll. X-1974 M. Alvarenga (1♀, CNC); coll. XI-1975 M. Alvarenga (1♀, CNC); Nova Teutonia: 27° 11′ S, 52° 23′ W: 300–500m: coll. 1-IV-1961 F. Plaumann (1♀, CNC); E. Santo: Linhares: coll. IX-1972 M. Alvarenga (1♀, CNC); Para: Jacareacanga: coll. XII-1968 M. Alvarenga (1♀, AEI); ECUADOR: 3km. N Tena: coll. (V–VI)-1993 S. Borrer and G. Fisher (2♀, TAMU); Pich: S. Domingo: 47km. S. R. Palenque: 200m: coll. (18–30)-V-1975 Peck (1♀, CNC); PERU: Avispas: coll. IX-1962 R. D. Shenefelt (2♀, AEI); coll. (1–15)-X-1962 R. D. Shenefelt (1♀, AEI); Madre de Dios Dept.: Avispas: 400m: coll. (12–20)-IX-1962 L. E Peña (1♀, CNC).

Alphomelon bromeliphile Deans, new species

(Figs. 4a, 6b)

Diagnosis.—Exerted portion of ovipositor short, less than or equal to the length of the hind basitarsus. Most (95%) with pale spot covering central part of face. White coloration of genae extending onto the clypeus leaving only middle third of clypeus brown.

Female.—Head: Brown with light brown area covering central part of face and white coloring on genae extending from the anterior tentorial pit posteriorly to occiput and anteriorly onto lateral one third of clypeus. Head slightly (1.25×) wider than high, appearing compressed, with malar suture 1.75× longer than distance from eye to anterior tentorial pit, surface evenly punctate and setose with flexible setae emerging from indentations, except nitid frons, occiput, and vertex. Face 2.3× wider than clypeus. Clypeus 2× wider than high. Malar space slightly convex. *Antennae:* Light brown, roughly as long as body. *Eyes and Ocelli:* Eye 1.7× higher than wide. Ocelli translucent honey yellow with lateral ocelli slightly (1.25×) wider than median ocellus. Stemmaticum slightly raised and broadly triangular with posterior ocellar line 2.7× lateral ocellar line. Ocular ocellar line equal to posterior ocellar line. *Mouthparts:* Mandibles brown, setose with long stiff, hairs. Labrum light brown to yellow, flattened with slight cleft

medially. Palps light brown to yellow. *Mesosoma:* Dark Brown. Tegulae translucent yellow, slightly punctate, semicircular, 2× wider than long. Mesoscutum 1.33× as wide as long, punctate with depressions more dense anteriorly. Medial scutellar area 0.85× as long as anterior scutellar furrow, trapezoidal with anterior scutellar furrow 2× longer than line between lateral scutellar furrows, slightly punctate and sparsely setose. Anterior scutellar furrow sublinear with 8 pits, 2.1× as long as line between lateral scutellar furrows. Lateral scutellar furrows carinate basally becoming rugulose apically, narrowing with apical edge 0.6× as wide as line between lateral scutellar furrows. Lunules semicircular, 2.5× wider than long. Axillary projections with sculpturing arising distal to lunule base. Mesopleuron punctate with long setae emerging from depressions except in nitid area dorsad and ventrad sternaulus. Metanotum nitid except for sparsely setose (4–6 setae) raised area behind posterior scutellar depression. Posterior scutellar depression 2× as wide as long, divided centrally. Lateral metanotal pits ovular, rugose. Propodeum laterally areolate-rugose. Anterior propodeal areas rugose. Surface inside areola and posterior propodeal areas rugulose. Propodeal areola U-shaped to sub-triangular, closed (95%), 1.2× as long as wide. Spiracular hairs present as stiff setae bent at tips. *Forelegs:* Uniformly honey-yellow except brown coxae. Tarsal claws reddish brown. Arolia dark brown. *Mid-legs:* Uniform honey-yellow except light brown trochanters, trochantellae, brown coxae, white basal 0.2 tibiae, and white tibial spurs. Tarsal claws reddish brown. Arolia dark brown. *Hind legs:* Coxae dark brown. Trochanters dark brown. Trochantellae light brown. Femur honey yellow except brown apical 0.2. Tibiae honey yellow except white basal 0.2 and brown apical 0.2 (rarely uniform honey yellow). Tibial spurs white, interior spur 1.7× longer than exterior spur. Tibia 2× as long as basitarsus. Basitarsus 4.5× longer than wide, brown except basal 0.33 white. Tarsomeres 2–5 brown. Hind tarsal claw reddish brown, pectinate with 4 spines. Arolia dark brown. *Wings:* Hyaline. Setose with membrane pubescence slightly more dense apically. Forewing veins uniform brown dorsally and whitish ventrally. Stigma not elongate. Hind wing cu-a strongly and evenly curved. *Metasoma:* Petiole dark brown, rugulose, glabrous except sparsely setose posterior 0.33. Petiole rectangular and 1.62× longer than posterior edge. Medial ridge 0.5× as long as petiole, bifurcation weakly represented. Lateral tergites I–III yellow to light brown. Remaining tergites brown. Tergite II trapezoidal, nitid with sparse setosity. Anterior edge of tergite II 2× as long as tergite II length. Posterior edge of tergite II 1.4× as long anterior edge. Hypopygium glabrous ventrally. *Genitalia:* Ovipositor honey yellow, with exerted portion less than or equal to hind basitarsus length, straight with slight tapering posteriorly, less than 0.5× as wide as hind basitarsus. Ovipositor sheaths punctate, setose, and brown exteriorly, white interiorly. Ovipositor sheath tips yellow, desclerotized.

Male.—As females except legs often more uniformly honey-yellow. Apical .25 of petiole often tapering.

Cocoon.—Surrounded by copious amounts of fine white silk.

Etymology.—The name id Greek for "bromeliad lover" referring to the habit of parasitizing skipper larvae on bromeliads.

Biology.—Gregarious parasitoids of *Neoxeniades scipio* (Hesperiidae: Hesperiinae) on *Bromelia pinguin* and *Aechmaea magdalenae* (Bromeliaceae). Reared in dry forest and rainforest in the Area de Conservación Guanacaste in northwestern Costa Rica (Janzen and Hallwachs 2002).

Holotype.—COSTA RICA: Area de Conservación Guanacaste: Sector Orosi: Rio Tempisquito Sur: 400m: 96-SRNP-945: (1♀, USNM).

Paratypes.—COSTA RICA: Area de Con-

servación Guanacaste: Sector Orosi: Rio Tempisquito Sur: 400m: 96-SRNP-945: (1♂, USNM); COSTA RICA: Puntarenas: Rd. to Rincon: 10km West of Pan-American Highway: 100m: coll. III-V-1986 Hanson and Gauld (1♀, UWY); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Area Administrativa: 280m: 95-SRNP-10742: (1♀, CNC); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Area Administrativa: 280m: 95-SRNP-11201: (1♀,♂, INBIO); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Laguna Escondida: 290m: 93-SRNP-8346: (1♀, AEI); COSTA RICA: Area de Conservación Guanacaste: 95-SRNP-10903 (1♀, 1♂ UWY).

Other material examined.—MEXICO: Chiapas: Muste: 440m: near Huixtla: Malaise trap: coll. X-1970 Welling (1♀, CNC); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Laguna Escondida: 290m: (1♀, 1♂ each for 93-SRNP-8345, 93-SRNP-8346, 93-SRNP-8427); Costa Rica: Area de Conservación Guanacaste: Sector Santa Rosa: Area Administrativa: 280m: (1♀, 1♂ each for 95-SRNP-10705, 95-SRNP-10740, 95-SRNP-10742, 95-SRNP-10903, 95-SRNP-11201); Area de Conservación Guanacaste: Sector Orosi: Vado Rio Tempesquito: 520m: (1♀, 1♂, 96-SRNP-1009); Area de Conservación Guanacaste: Sector Orosi: Rio Tempesquito Sur: 400m: (1♀, 1♂, 96-SRNP-1009); Area de Conservación Guanacaste: Sector Santa Rosa: Area Administrativa: 280m: (1♀, 1♂, 99-SRNP-18549); Area de Conservación Guanacaste: Sector Santa Rosa: Quebrada Costa Rica: 250m: E. Cantillano (1♀, 1♂, 99-SRNP-17863).

Alphomelon citroloma Deans, new species

(Figs. 4c, 5a, 6c)

Diagnosis.—All lateral metasomal tergites and sternites yellow with medial tergites dark brown. Petiole parallel sided, rectangular, with ridge strongly represented.

Female.—Head: Dark brown with white genal patches extending from anterior tentorial pits posteriorly to occiput, dorsally to edge of eye, ventrally to edge of mandible, extending as light brown spots onto lateral 0.33 areas of clypeus. Head slightly elongate, 1.2× wider than high, obscurely punctate. Face 2× wider than clypeus. Clypeus 1.6× wider than high. Malar suture 2.25× longer than line between anterior tentorial pit and eye. Malar space slightly convex. *Eyes and Ocelli:* Eyes 1.6× higher than wide. Ocelli translucent-yellow, subequal in size. Stemmaticum raised slightly, broadly triangular with posterior-ocellar line 3× lateral-ocellar line and ocular-ocellar line 1.2× posterior-ocellar line. *Antennae:* brown to light brown, as long as body. *Mouthparts:* Mandibles brown, setose with fine stiff hairs. Labrum brown to light brown, flattened ventrally. Palps yellow. *Metasoma:* Dark brown. Tegulae semicircular, translucent-yellow, 2× wider than long. Mesoscutum evenly punctate and setose, 1.3× wider than long. Medial scutellar area triangular, obscurely punctate, as long as anterior scutellar furrow. Anterior scutellar furrow straight with 7–8 pits, 2.6× linger than line between lateral scutellar furrows. Lateral scutellar furrow costate basally, becoming rugulose and wider apically with apical edge 0.8× lunule base width. Lunules 0.5× longer than base width, nearly triangular. Axillary projections with sculpturing arising at lateral 0.33 lunule base. Mesopleuron evenly punctate and setose except for nitid area dorsad and ventrad the sternaulus. Mesonotum obscurely scabriculous to nitid except rugulose surface inside lateral metanotal pits and raised setose (~15 setae) area posterior to posterior scutellar depression. Posterior scutellar depression 2.5× wider than long, not completely divided medially. Lateral metanotal pits skewed tear-drop shape. Anterior propodeal areas rugose. Posterior propo-

deal areas obscurely rugulose. Areola open and rugose anteriorly, obscurely rugulose posteriorly, U-shaped, 1.7× longer than wide. Spiracular setae present in dense clusters anteriorly. *Forelegs:* Honey-yellow except brown to dark brown coxae. Tarsal claws light brown. Arolia brown. *Mid-legs:* Honey-yellow except brown to dark brown coxae. Tarsal claws light brown. Arolia brown. *Hind legs:* Coxae dark brown to black. Trochanters light brown. Trochantellae light brown basally becoming yellow apically. Femurs honey-yellow except apical 0.25 brown. Tibiae honey-yellow except basal 0.2 whitish and apical 0.1 brown, 4.67× longer than wide. Tibial spurs white, interior spur 1.75× longer than exterior spur. Basitarsi whitish basally fading evenly to light brown posteriorly, 4.5× longer than wide. Remaining tarsomeres light brown to brown. Tarsal claws brown with 2 spines. Arolia brown. *Wings:* Membranes hyaline. Veins light brown dorsally, whitish ventrally. Hind wing cu-a just posterior to mid-point curved back towards body. *Metasoma:* Medial tergites brown except yellow posterior edges of medial tergites III–VII. Lateral tergites and sternites yellow. Hypopygium brown. Petiole rectangular, 1.67× longer than posterior edge, glabrous except posterior 0.33 sparsely setose. Petiolar ridge prominent, 0.5× as long as petiole, 0.25× as wide as posterior edge. Medial tergite II, lacunose-rugulose, 0.25× as long as anterior edge, raised slightly medially, rectangular with anterior edge 0.95× posterior edge. Hypopygium evenly sparsely setose. *Genitalia:* Exerted portion of ovipositor 1.1× longer than hind basitarsus, orange, weakly decurved, 0.33× as thick as hind basitarsus. Ventral valve with 2 teeth. Sheaths brown externally, whitish internally, evenly setose, desclerotized apically.

Male.—Similar in all respects.

Cocoon.—Unknown.

Etymology.—The name is derived from the Greek roots "citro-" meaning citrus and "-loma" meaning fringe. The name refers to the yellow posterior edges on the medial tergites.

Biology.—All specimens were collected from low to intermediate elevation neotropical rainforest.

Holotype.—ARGENTINA: Horco Molle: Tuc.: coll. (15–19)-I-1966 L. A. Strange (1♀, USNM).

Paratypes.—ARGENTINA: Horco Molle: Tuc.: coll. (15–19)-I-1966 L. A. Strange (1♀, USNM); ARGENTINA: Horco Molle: Tuc.: coll. [7–13]-III-1966 L. A. Strange (2♀, USNM); COSTA RICA: Puntarenas: R. F. Golfo Dulce: 3km SW Rincon: 10m: coll. II-1992 P. Hanson (1♀, UWY); COSTA RICA: Puntarenas: Golfo Dulce: 3km SW Rincon: 10m: coll. X-1991 P. Hanson (4♀, 2♂, UWY); Puntarenas: San Vito Estac. Biol.: Las Alturas: 1500m: coll. VI-1992 P. Hanson (1♀, UWY); COSTA RICA: Puntarenas: R. F. Golfo Dulce: 24km W Piedras Blancas: 2000m: coll. XII-1992 P. Hanson (1♀, TAMU); ECUADOR: Pichincha: nr. Santo Domingo: Tinalandia: 680m: coll. 7-II-1983 L. Huggert (1♀, CNC).

Other material examined.—BOLIVIA: La Paz: Rio Zongo: 1400–1900m: coll. XII-1984 L. Peña (1♀, AEI); BRAZIL: Caruaru: Pernambuco: coll. IV-1972 M. Alverenga (5♀, 3♂, CNC); Rondonia: Faz Rancho Grande: 62km S Ariquemes: coll. (12–22)-XI-1991 E. M. Fisher (2♂, TAMU); Est. Rio de Janiera: Silva Jardim: coll. VIII-1974 F. M. Oliviera (1♀, CNC); Represa: Rio Grande: Guanabara: coll. XII-1967 M. Alvarenga (2♀, AEI); ECUADOR: Pichincha: 16km SE Santo Domingo: Tinalandia: 680m: coll. 1975 S. and J. Peck (12♀, 12♂, CNC); Tinalandia: 800m: coll. 2-II-1983 L. Masner and M. Sharkey (8♀, 7♂, CNC); PANAMA: Las Cumbres: coll. 9-XII-1981 H. Wolda (1♀, 1♂, CNC); coll. (3–10)-II-1982 H. Wolda (1♀,♂, CNC); PARAGUAY: Carumbé: 1-II-1966 (4♀, 3♀, AEI); TRINIDAD: Curepe: coll. 28-VII-1978 (1♀, 1♂, CNC); Simla: coll. (18–20)-VIII-1969 Howden (1♀, CNC); VENEZUELA: Merida: Merida City: coll. 3-V-1981 L. Masner

(1♂, CNC); Yacambu: 1200m: coll. 13-V-1981 H. Townes (1♀, AEI).

Alphomelon conformis (Muesebeck)
(Fig. 5c)

Apanteles conformis Muesebeck 1958:444–445. USNM Holotype #63071 examined.

Diagnosis.—Tegulae black. petiolar ridge strongly bifurcating with carinae reaching edges of petiole.

Female.—Head: Black, except white spots on genae extending from anterior tentorial pits to edge of mandible posteriorly to occiput and anteriorly to edge of clypeus. Slightly punctate except nitid frons, vertex, and occiput, setose with very fine hairs. Head round, 1.2× wider than high, malar suture 1.6× longer than line between anterior tentorial pit and eye. Malar space not convex. Face 2× wider than clypeus. Clypeus 2× wider than high. *Antennae:* Brown, as long as body. *Eyes and Ocelli:* Eye 1.8× higher than wide. Ocelli translucent orange. Lateral ocelli 1.2× wider than median ocellus. Stemmaticum slightly raised, broadly triangular with posterior-ocellar line 2.25× lateral-ocellar line, ocular-ocellar line equal to posterior-ocellar line. *Mouthparts:* Mandibles dark brown, setose with short stiff hairs. Labrum orange to light brown, not cleft medially. Maxillary palps yellow. Labial palps brown. *Metasoma:* Tegulae black, opaque, rarely brown (10%), 2.25× wider than long, rounded but skewed posteriorly. Mesoscutum evenly punctate, 1.5× wider than long. Medial scutellar area 0.85× longer than length of anterior scutellar furrow, smooth and setose with long hairs. Anterior scutellar furrows straight with 8 pits, 2.9× longer than line between lateral scutellar furrows. Lateral scutellar furrows basally carinate becoming nitid and expanded apically, apical edge 0.75× as long as lunule base width. Lunules reduced, rounded, 2× wider at the base than long. Axillary projections with sculpturing arising at midpoint of lunule vase. Mesopleuron evenly punctate anteriorly becoming minutely punctate posteriorly, nitid dorsad and ventrad the sternaulus. Metanotum obscurely rugulose to nitid, setose (~10 setae) on raised area posterior to posterior scutellar depression. Posterior scutellar depression 2× wider than long, not divided medially. Lateral metanotal depressions rugulose, nearly rectangular with rounded edges. Anterior propodeal areas rugose. Areola nearly square to V-shaped, rugulose, closed, 1.25× longer than wide. Posterior propodeal areas minutely rugulose. Spiracular setae present, stiff, bent at tips. *Forelegs:* Uniformly honey-yellow except brown coxae and trochanters, light brown trochantellae. Tarsal claws reddish-brown. Arolia dark brown. *Mid-legs:* Uniformly honey-yellow except brown coxae, trochanters, trochantellae, and apical 0.25 of femur. Tarsal claws reddish-brown. Arolia dark brown. *Hind legs:* Coxae, trochanters dark brown. Trochantellae brown. Femur yellow-orange basally fading evenly to dark brown apically. Tibiae yellow-orange except apical 0.25 dark brown, 4.5× longer than wide. Tibial spurs white, interior spur 1.5× longer than exterior spur. Basitarsi yellow-orange fading evenly to brown apically, 5× longer than wide. Remaining tarsomeres brown. Tarsal claws reddish-orange with 2 spines. Arolia dark brown. *Wings:* Hyaline. Veins light brown dorsally and ventrally. Stigma not elongate. Hind wing cu-a strongly curved towards body with point of curvature anterior to mid-point of vein. *Metasoma:* Terga I–III brown, remaining terga dark brown. Petiole rectangular, 2× longer than the posterior edge, rugulose and glabrous except sparsely setose posterior 0.3. Petiolar ridge strongly represented, widely bifurcating with diverging carinae reaching petiole edge, ridge 0.5× as long as petiole, distance between diverging carinae 0.33× posterior petiole edge. Medial tergite II, nearly nitid, trapezoidal with anterior edge 0.75–.8× as long as posterior edge, 0.33× as long as

anterior edge. Hypopygium evenly setose except nitid medially. *Genitalia:* Ovipositor slightly decurved, exerted portion 1.5× as long as hind basitarsus, 0.5× as wide as hind basitarsus width. Sheaths dark brown, evenly setose, desclerotized at tips, white interiorly.

Male.—Legs lighter with less brown coloration. Petiolar ridge reduced in some males (25%). Wing veins light yellow. Medial tergite II rarely rugulose (25%).

Biology.—Reared as gregarious parasitoid of unidentified hesperiid on *Canna indica* (Cannaceae) in Venezuela and as solitary parasitoid of unidentified hesperiine on *Panicum pilosum* (Poaceae) in Costa Rica. All collection records are from neotropical rainforest.

Holotype.—VENEZUELA: El Valle: reared 8-III-1939 C. H. Ballou (1♀). (#63071 USNM).

Paratypes.—VENEZUELA: El Valle: reared 8-III-1939 C. H. Ballou (17♀, 1♂, USNM). All are from same rearing record as holotype.

Other material examined.—VENEZUELA: Tucucu: Zulia: coll. 26-IV-1981 H. K. Townes (1♀, AEI), Yacambú: 1200m: coll. 7-V-1981 H. K. Townes (1♀, AEI); BRAZIL: Represa: Rio Grande: Guarabara: coll. X-1967 M. Alvarenga (1♂, AEI); COSTA RICA: reared Cali D.H. Janzen, DHJ voucher #97-CALI-229 (1♂, INBIO).

Alphomelon crocostethus Deans, new species

Diagnosis.—Mesonotum orange. Wing membranes strongly infumated. Hind legs more than 50% dark brown.

Female.—Head: Black except genae with white coloration extending from anterior tentorial pits anteriorly to the lateral edge of clypeus, ventrally to edge of mandible and posterior to line 0.5 way between malar suture and occiput. Head obscurely punctate, appearing round, 1.2× wider than high. Face 1.9× wider than clypeus. Clypeus 2.2× wider than high. Malar suture 1.6× as long as line between anterior tentorial pit and eye. Malar space not appearing convex. *Antennae:* black, slightly shorter than body. *Eyes and Ocelli:* Eyes 1.7× higher than wide. Ocelli transparent yellow, subequal in size. Stemmaticum slightly raised, broadly triangular with posterior-ocellar line 2.25× lateral-ocellar line and ocular-ocellar line 1.2× posterior-ocellar line. *Mouthparts:* Mandibles dark brown, setose with stiff hairs. Labrum brown, not cleft. Palps light brown. *Mesosoma:* Brown to black except mesoscutum honey-orange. Tegulae semicircular, setose, transparent orange to brown, 2× wider than long. Propleuron brown near cervix fading to orange ventrally and posteriorly. Mesoscutum setose, punctate anteriorly, becoming smooth posteriorly, 1.3× wider than long. Medial scutellar area smooth, setose, triangular, 1.1× longer than anterior scutellar furrow. Anterior scutellar furrow straight with 6–7 pits, 2.6× longer than line between lateral scutellar furrows. Lateral scutellar furrows costate basally becoming smooth and broader apically with apical edge 0.9× lunule base width. Lunules triangular, 1× as long as wide at base. Axillary projections with sculpturing arising distal to lunule. Mesopleuron obscurely punctate, setose except nitid area dorsad and ventrad the sternaulus. Metanotum nitid except setose raised area posterior to posterior scutellar depression. Posterior scutellar depression 2.5× wider than long, divided medially. Lateral metanotal depressions skewed tear-drop shaped, setose and rugulose. Propodeum laterally areolate-rugose. Surface inside anterior propodeal areas and areola rugose. Areola nearly closed anteriorly by shallow carina, U-shaped, 1.67× longer than wide. Posterior propodeal areas rugulose. Propodeal spiracles with conspicuous clusters of setae anteriorly. *Forelegs:* Honey-yellow except brown coxae, trochanters, and trochantellae. Tarsal claws reddish-brown. Arolia light brown. *Mid-legs:* Uniform brown except dark brown coxae, white tibial spurs (50% with

basal 0.7 of tibiae and 0.5 femurs yellow). Tarsal claws brown. Arolia light brown. *Hind legs:* Coxae, trochanters dark brown. Trochantellae brown. Femurs brown (50% with basal 0.7 honey-yellow). Tibiae brown except basal 0.2 whitish, 5.2× longer than wide. Tibial spurs white, internal spur 1.75× longer than external spur. Basitarsi uniformly dark brown, 5.67× longer than wide. Remaining tarsomeres dark brown. Tarsal claws dark brown with 1 spine. Arolia light brown. *Wings:* Membranes infumated. Veins brown dorsally, whitish ventrally. Hind wing cu-a angled posteriorly towards body. *Metasoma:* Brown to dark brown. Petiole costate, glabrous except posterior 0.3 sparsely setose, trapezoidal and 1.3× as long as posterior edge. Petiolar ridge represented by bifurcating carina, 0.4× as long as petiole, width between bifurcating arms 0.25× posterior edge width. Medial tergite II trapezoidal with posterior edge 1.3× anterior edge, 0.25× as long as posterior edge. Hypopygium evenly setose. *Genitalia:* Exerted portion of ovipositor 1–1.3× length of hind basitarsus, reddish-orange, weakly decurved, 0.5× as thick as hind basitarsus. Sheaths brown externally, whitish internally, straight, evenly setose, desclerotized at tip.

Male.—Unknown.

Cocoon.—Straight with tufts of thick silk trailing both ends.

Etymology.—The name is derived from the Greek roots "croco-" meaning orange and "-stethus" meaning chest. It refers to the orange colored mesoscutum.

Biology.—Reared form unidentified hesperiid on sugar cane (Poaceae: *Saccharum officinarum*) in Jamaica. All collection records are from lowland neotropical rainforest.

Holotype.—JAMAICA: Moneymusk Estate: coll. VIII-1959 F. D. Bennett (1♀, USNM).

Paratypes.—BRAZIL: Represa Rio Grande: Guanabara: coll. VII-1972 F. H. Oliviera (1♀, CNC); COLOMBIA: Choco: 5° 50′ N, 76° 20′ W: 2050m: coll. 13-IX-1972 J. Helava (1♀, CNC); COLOMBIA: Bolivar: Colegio: coll. 9-III-1965 M. J. West (1♀, AEI); PUERTO RICO: San Juan: coll. 12-III-1934 Anderson and Mills (1♀, USNM).

Other material examined.—BOLIVIA: Prov. Sara.: coll. Steinbach (1♀, MCZ); BRAZIL: Guanabara: Represa Rio Grande: coll. V-1967 M. Alvarenga (2♀, AEI); coll. VI-1967 M. Alvarenga (2♀, AEI); coll. X-1967 M. Alvarenga (2♀, AEI); coll. VII-1972 F. Olivara (1♀, AEI); Pocos de Caldas: Minas Gerais: coll. VII-1972 O. Roppa and E. C. Becker (1♀, AEI); Linhares: E. Santo: coll. IX-1972 M. Alvarenga (2♀, AEI).

Alphomelon disputabile (Ashmead)
(Fig. 4e)

Urogaster disputabilis Ashmead 1900:284. USNM Holotype #6446 examined.

Diagnosis.—Tarsal claws with 1 spine. Wing membranes hyaline. Hind wing cu-a angled posteriorly towards body. White spots on genae extending to but not onto clypeus.

Female.—Head: Head dark brown to black except white spot on genae extending from anterior tentorial pits anteriorly to edge of clypeus, dorsally to base of eye, ventrally to mandible and posteriorly to occiput. Head obscurely punctate, appearing round in frontal view, 1.25× wider than high. Face 2.25× wider than clypeus. Clypeus 1.55× wider than high. Malar suture 1.5× longer than lone between anterior tentorial pit and eye. Malar space flush. *Antennae:* Brown, slightly longer than body. *Eyes and Ocelli:* Eye 1.85× higher than wide. Ocelli translucent-yellow, subequal in size. Stemmaticum slightly raised, broadly triangular with posterior-ocellar line 3× lateral-ocellar line and ocular-ocellar line 1.1× posterior-ocellar line. *Mouthparts:* Mandibles black to dark brown, setose with stiff hairs. Labrum dark brown, not cleft medially. Palps hon-

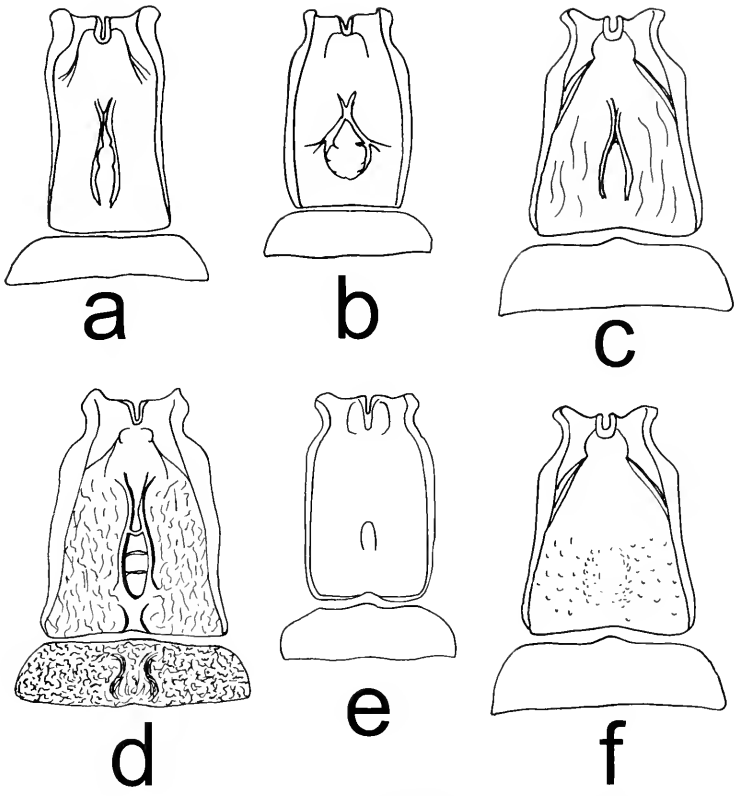

Fig. 5. Petiole and metasomal tergite II variations, *Alphomelon*. (a) *A. citroloma* n. sp., (b) *A. melanoscelis* n. sp., (c) *A. conformis* (Muesebeck), (d) *A. rhyssocercus* n. sp., (e) *A. nanosoma* n. sp., (f) *A. xestopyga* n. sp.

ey-yellow. *Mesosoma:* Black. Tegulae translucent-yellow, 1.75× wider than long, semi-circular, setose with long setae. Mesoscutum obscurely punctate, 1.25× wider than long. Medial scutellar area obscurely punctate, 0.9–1.0× as long as anterior scutellar furrow. Anterior scutellar furrow straight with 6–8 pits, 3× longer than line between lateral scutellar furrows. Lateral scutellar furrows costate basally becoming obscurely rugulose and wider apically with apical edge 0.5× lunule base width. Lunules semicircular, 1.8× wider at the base than long. Axillary projections with sculpturing arising at distal 0.33 lunule base. Mesopleuron punctate, setose except nitid area distal and ventrad the sternaulus. Mesonotum rugulose except smooth, setose (~15 setae) raised area posterior to posterior scutellar depression. Posterior scutellar depression ovular, 2.25× wider than long, divided medially. Lateral metanotal depressions skewed tear-drop shape, setose, rugulose. Anterior propodeal areas rugose. Areola rugose and nearly closed with shallow carina anteriorly, rugulose posteriorly, U-shaped, 1.8× longer than wide. Posterior propodeal areas rugulose. Spiracular hairs present as dense cluster anteriorly. *Forelegs:* Honey-orange except brown coxae. Tarsal claws reddish-brown. Arolia brown. *Mid-legs:* Honey-orange except brown coxae. Tarsal claws reddish-brown. Arolia brown. *Hind legs:* Coxae dark brown. Trochanters brown. Trochantellae orange. Femurs honey-orange except brown apical 0.2–.25. Tibiae honey-orange except basal 0.15 whitish, apical 0.15 brown, 4.75× longer than wide. Tibial spurs white, interior

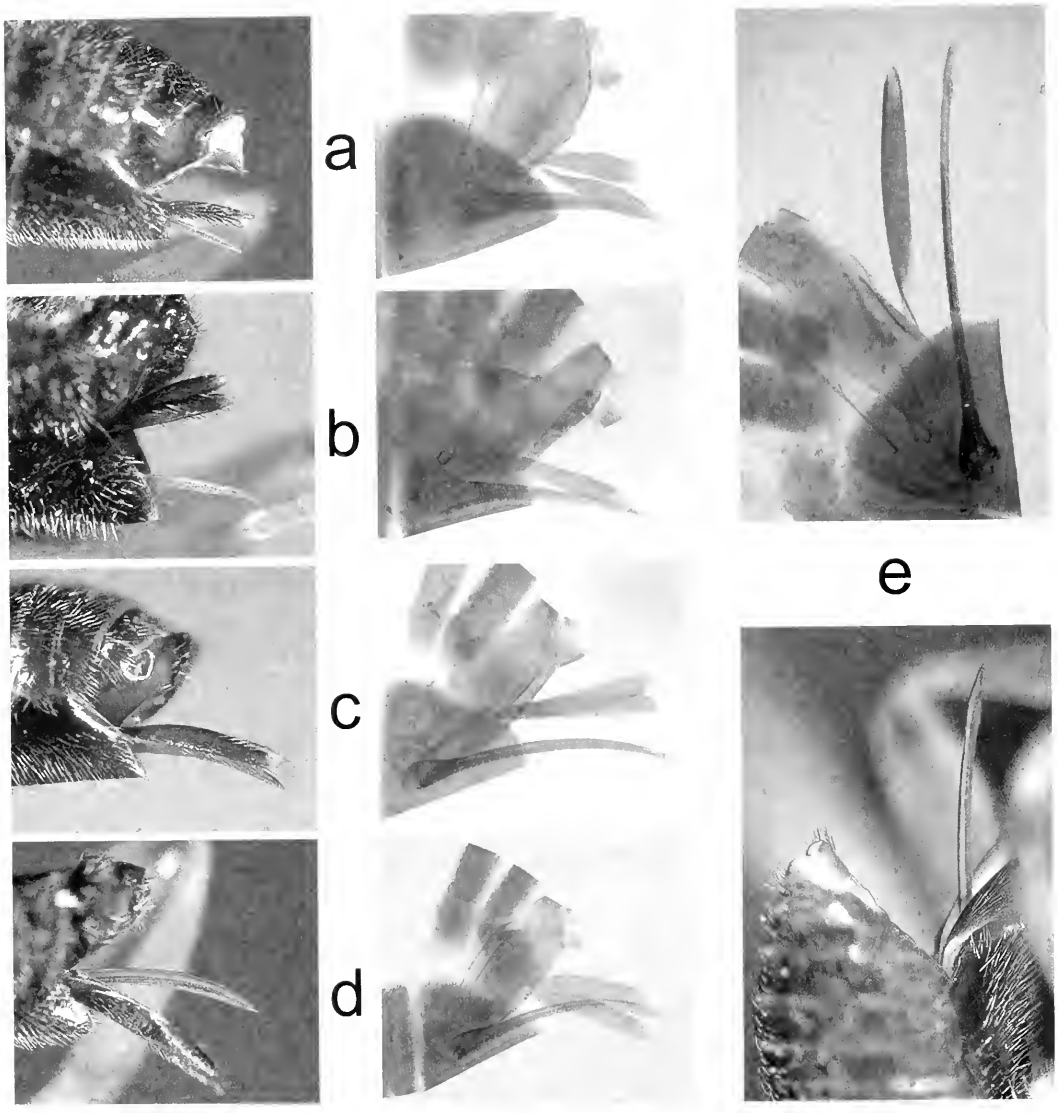

Fig. 6. Ovipositor variation, *Alphomelon*. Photograph of pinned specimen (left) and mounted genitalia (right); (a) *A. brachymacher* n. sp., (b) *A. bromeliphile* n. sp., (c) *A. citroloma* n. sp., (d) *A. areacphile* n. sp., (e) *A. talidicida* (pinned genitalia top, mounted genitalia bottom).

spur 1.6× longer than exterior spur. Basitarsus yellow basally fading evenly to dark brown. 5.2× longer than wide. Remaining tarsomeres brown. Tarsal claws brown with 1 spine. Arolia brown. *Wings:* Membrane hyaline. Stigma not elongate. Veins brown dorsally, white ventrally. Hind wing cu-a angled posteriorly towards body. *Metasoma:* Dark brown. Petiole trapezoidal, rugulose, 1.33× as long as posterior edge, glabrous except sparsely setose posterior 0.33. Petiolar ridge prominent, 0.5× as long as petiole, 0.2× as wide as posterior edge. Medial tergite II trapezoidal, smooth to confused-rugulose, slightly raised medially, anterior edge 0.8× posterior edge, 0.35× as long as anterior edge. Hypopygium evenly setose. *Genitalia:* Ovipositor orange, slightly decurved, exerted portion 1.2× longer than

hind basitarsus, 0.5× as thick as hind basitarsus. Ventral valve with 2 teeth. Sheaths straight, evenly setose, brown externally, whitish internally, desclerotized at tips.

Male.—As females except stigma clear or white, wing veins light brown to clear, legs more completely orange, body smaller.

Cocoon.—Unknown.

Biology.—Reared as parasitoid from *Leremia* spp. on *Oryza latifolia* (Poaceae) and *Cymaenes trebius* on grasses (Poaceae) in Costa Rica. Collection localities include both rainforest and dry forest.

Holotype.—GRENADA: Mount Gay Estate: Leeward side: coll. H. H. Smith (1♂, #6446 USNM).

Other material examined.—ARGENTINA: La Plata: coll. 30-I-1966 H. and M. Townes (1♀, AEI); coll. 11-XII-1965 H. and M. Townes (1♀, AEI); coll. 24-I-1966 H. and M. Townes (1♀, AEI); La Plata: Fac. Agronomia: coll. (X–XI)-1968 C. Porter (1♂, UWY); BELIZE (labeled BRITISH HONDURAS): Middlesex: 125m: coll. 20-III-1965 E. C. Welling (1♂, CNC); coll. 20-IV-1965 E. C. Welling (1♀, 1♂, CNC); coll. 6-X-1965 E. C. Welling (2♂, CNC); coll. 8-X-1965 E. C. Welling (1♀, CNC); BELIZE (1♀, 4♂, USNM); C. A.: Toledo Dist.: Blue Creek: 89° 3′ W 16° 12′ N: coll. 25-I-1982 A. T. Finnamore (1♂, CNC); BOLIVIA: Chulumani: Yungas: 1700m: coll. (19–20)-XII-1955 L. E. Pena (1♀, CNC); BRAZIL: Guanabara: Represa: Rio Grande: coll. VI-1967 M. Alvarenga (3♀, AEI); coll. IV-1966 M. Alvarenga (1♀, AEI) Utinga: Belem: coll. XII-1966 S. J. Oliviera (1♀, AEI); Teresopolis: coll. 12-III-1966 H. and M. Townes (2♀, AEI); Nova Teutonia: 27° 11′ S 52° 23′ W: coll. 12-IV-1966 F. Plaumann (1♀, CNC); coll. II-1965 F. Plaumann (1♀, CNC); coll. XII-1968 F. Plaumann (1♀, CNC); Sinop: Mato Grosso: coll. X-1974 M. Alvarenga (1♀, CNC); Para: coll. Baker (3♂, USNM); COSTA RICA: Escazu: coll. 26-V-1987 H. and M. Townes (2♂, AEI); Heredia: 3km S Puerto Viejo: OTS-La Selva: 100m: coll. (16–30)-IX-1992 P. Hanson (5♀, 6♂, UWY); coll. X-1992 P. Hanson (4♀, 4♂, UWY); Est. Biol. La Selva: 50–150m: 10.26N, 84.01W: coll. VIII-1992 (9♀, 9♂, UWY); CUBA: Havana: coll. Baker (5♂, USNM); Camaguay: coll. at light 1957 (1♂, USNM); DOMINICA: Clark Hall: coll. (11–20)-I-1965 W. W. Wirth (2♂, USNM); coll. (21–31)-I-1965 W. W. Wirth (2♂, USNM); ECUADOR: Tinalandia: 800m: coll. 2-II-1983 L. Masner and M. Sharkey (4♀, 1♂, CNC); GUATEMALA: Yepocapa: Chimaltenango: coll. 11-II-1948 H. Dalmat (1♂, USNM); Escuintla: coll. 20-VIII-1975 N. L. H. Krauss (2♂, USNM); MEXICO: Jalapa: coll. Crawford (1♀, 3♂, USNM); Tabasco: 20km W Cardenas: coll. 14-IX-1981 D. Letourneau (1♀, TAMU); Yucatan: Merida: Xmatkuil: coll. (25–28)-V-1996 Wharton and Leon (1♀, TAMU); Merida: coll. XI-1961 N. L. H. Krauss (1♀, USNM); Ver.: Sontecomapan: coll. 20-VI-1969 W. R. M. Mason (1♂, CNC); NICARAGUA: Puerto Cabezas: coll. VII-1971 J. Maldonado (1♀, USNM); PANAMA: Magarita: Canal Zone: coll. VI-1960 S. Braeland (1♀, AEI); Las Cumbres: coll. (20-I)–(2-II)-1982 H. Wolda (1♀, 2♂, CNC); (26–30)-XI-1981 (5♂, CNC); PARAGUAY: Colonia Pirareta: coll. (23–24)-XII-1971 L. E. Pena (1♀, CNC); ST. VINCENT: reared 19-II-1983 (3♂, USNM); TRINIDAD: CIBC: reared 5-III-1983 (2♂, USNM); Curepe: coll. 10-III-1978 (2♀, CNC); coll. 28-VII-1978 (4♂, CNC); Arancuez Est.: coll. 19-II-1961 N. Gopaul (1♀, CNC); USA: Texas: Hidalgo Co.: McAllen: reared 5-X-1979 R. O. and C. A. Kendall (1♂, USNM); reared 4-XI-1979 R. O. and C. A. Kendall (1♀, USNM); reared 16-X-1979 R. O. and C. A. Kendall (1♀, USNM); McAllen: Valley Botanical Garden: coll. (27-VII)–(8-IX)-1973 C. C. Porter (7♀, 3♂, USNM); VENEZUELA: Puerto Cabello: coll. (9–16)-II-1940 P. Anduze (1♀, USNM); San Esteban Valley: Las Quiguas: (1–8)-I-1940 P. Anduze (1♀, USNM); Zulia: El Tucuco: Sierra de Perija: black light: coll. (28–29)-I-1978 J. B. Heppner (1♂, USNM).

Alphomelon melanoscelis Deans, new species
(Fig. 5b)

Diagnosis.—Body large (~5mm), robust, with black legs and elongate face.

Female.—Head: Black except genae with white coloration extending from anterior tentorial pits posteriorly to the occiput, and from base of eye to base of mandible. Surface evenly punctate and setose with flexible setae emerging from impressions, except nitid frons, occiput, and vertex. Head slightly wider (1.1×) than long appearing slightly elongate with malar suture 1.9× the distance between anterior tentorial pit and eye. Malar space flat, not convex. Face 2× as wide as clypeus. Clypeus 1.6× wider than high. *Antennae:* Dark brown to black, as long as body. *Eyes and Ocelli:* Eye 1.65× higher than wide. Ocelli translucent yellow, sub-equal in size. Stemmaticum broadly triangular with posterior-ocellar line 2× lateral-ocellar line. Ocular ocellar line 1.5× larger than posterior-ocellar line. *Mouthparts:* Mandibles reddish brown to dark brown, setose with stiff hairs. Labrum, dark brown, flattened, semicircular. Palps stiffly setose, yellow to light brown. *Mesosoma:* Black. Tegulae opaquely yellow, slightly punctate, semicircular, 2× wider than long. Mesoscutum 1.33× wider than long, punctate with depressions deeper and more dense anteriorly. Medial scutellar area triangular, as long as anterior scutellar furrow, and punctate with long setae emerging from depressions. Anterior scutellar furrow sub-straight with 7–8 pits, 3.1× longer than line between lateral scutellar furrows. Lateral scutellar furrows carinate basally, becoming rugose and wider apically with apical edge 0.6× wider than lunule base. Axillary projections rugose with sculpture arising near middle of lunule base. Lunules triangular, nitid, 2.33× wider at base than long. Mesopleuron punctate and setose except dorsal and ventral areas around sternaulus. Metanotum nitid except setose, punctate raised area posterior to posterior scutellar depression. Posterior scutellar depression 1.67× wider than long, not fully divided in center. Lateral metanotal depressions rugose, rectangular with rounded edges. Lateral metanotal area areolate-rugose dorsally and nitid ventrally. Propodeum strongly rugose, setose except rugulose/glabrous posterior propodeal areas. Surface inside areola obscurely rugose. Anterior propodeal areas rugose. Areola hexagonal and complete, as long as wide. Pits where longitudinal carinae of areola meet transverse carinae. Propodeal spiracular setae difficult to distinguish from other propodeal setae. *Forelegs:* Coxae black, trochanters and trochantellae dark brown. Femurs, tibiae, tarsi, honey-orange, punctate, setose. Tarsal claws reddish brown. Arolia black. *Mid-legs:* Coxae black, trochanters and trochantellae dark brown. Femurs brown. Tibiae and tarsomeres light brown, densely setose with short, stiff hairs. Basal 0.2 of tibia and basal 0.3 of basitarsus whitish. Tarsal claws pectinate, reddish brown. Arolia black. *Hind legs:* Coxae, trochanters, trochantellae, and femurs black. Tibiae with basal 0.25 whitish fading to dark brown, 5.6× longer than wide. Tibial spurs white, interior spine 1.75× as long as exterior spine. Basal 0.2 basitarsi whitish becoming dark brown distally, setose with short, stiff hairs. Basitarsi 4.5× as long as wide. Tarsomeres dark brown, setose with short, stiff hairs. Tarsal claws reddish-brown, pectinate with 4 spines. Arolia black. *Wings:* Membranes hyaline, setose, becoming more dense apically. Veins uniformly dark brown. Stigma not elongate. Hind wing cu-a slightly angled posterior to middle. *Metasoma:* Petiole black, slightly rugulose-lacunose, glabrous except posterior 0.33 with sparse setosity, rectangular with posterior edge 0.75× as long as total petiole length. Petiolar ridge bifurcating with arms connecting posteriorly, 0.4× as long as petiole, .25× as wide between bifurcat-

ing carinae as posterior petiole edge. Central area within ridge arms depressed to form ovular area. Area surrounding tergite I spiracle densely setose with stiff setae. Lateral tergite I light brown, remaining tergites dark brown to black. Tergite II slightly trapezoidal to nearly rectangular with posterior edge 1.2× anterior edge and length 0.3× length of anterior edge. Tergite II rugulose with slightly raised medial area. Hypopygium evenly setose. *Genitalia:* Ovipositor weakly decurved, reddish-orange, tapering slightly posteriorly, exerted portion as long as hind basitarsus, 0.5× as thick as hind basitarsus width. Ovipositor sheaths black, punctate, and evenly setose, with whitish interior. Ovipositor sheath tips desclerotized.

Male.—Unknown.

Cocoon.—Unknown.

Etymology.—The name is derived from the Greek roots "melano-" meaning black and "-scelis" meaning legs. It refers to the darkened leg coloration.

Biology.—Reared as parasitoid of unidentified hesperiines on grasses (Poaceae) and sedges (Cyperaceae) in Costa Rica. The collection localities include both rainforest and dry forest sites.

Holotype.—COSTA RICA: Heredia: Est. Biol. La Selva: 10.26N, 84.01W: 50–150m: huertos Malaise trap set by G. Wright: coll. (II–IV)-1993 P. Hanson (1♀, UWY).

Paratypes.—BRAZIL: Mato Grosso: Sinop: malaise trap: coll. X-1974 M. Alvarenga (1♀, CNC); BRAZIL: Mato Grosso: Sinop: 12° 31′ S, 55° 37′ W: coll. X-1976 M. Alvarenga (1♀, AEI); BRAZIL: Alagoas: Murici: coll. V-1984 F. M. Oliveira (1♀, AEI); COSTA RICA: Puntarenas: Golfo Dulce: 24km W Piedras Blancas: 200m: coll. XII-1991 P. Hanson (1♀, UWY); COSTA RICA: D. H. Janzen rearing DHJ voucher #97-RIOS-193 (1♀, INBIO); COSTA RICA: Heredia: 3km S. Puerto Viejo: OTS: La Selva: 100m: coll. X-1992 P. Hanson (3, UWY); Puntarenas: San Vito: Estac. Biol. Las Alturas: 1500m: coll. V-1992 P. Hanson (1, UWY); Puntarenas: Golfo Dulce: 24km W Piedras Blancas: 200m: coll. XII-1991 P. Hanson (1, UWY); Puntarenas: Golfo Dulce: 3km SW Rincon: 10m: coll. X–XII-1990 (1, UWY); coll. X-1991 P. Hanson (1, UWY); coll. XII-1991 P. Hanson (1, UWY); MEXICO: Tabasco: 20km W Cardenas: coll. 31-VIII-1981 D. Latourneau (1♀, TAMU); VENEZUELA: Merida: Merida City: coll. 3-V-1981 L. Masner (1, INHS).

Other material examined.—All♀: MEXICO: Tabasco: 20km W Cardenas: coll. 31-VIII-1981 D. Latourneau (2, TAMU); COSTA RICA: (1 each 97-RIOS-193, 97-RIOS-295, 97-CALI-231, 96-CMORAGA-407); BRAZIL: Mato Grosso: Sinop: coll. XI-1975 M. Alvarenga (2, CNC); X-1974 (1, CNC); BELIZE: Middlesex: 125m: coll. 12-VI-1965 E. C. Welling (1, CNC); 25-IV-1965 (2, CNC).

Alphomelon nanosoma Deans, new species
(Fig. 5e)

Diagnosis.—Body small (<3mm). Petiole smooth with petiolar ridge represented only as small depression.

Female.—Head: Brown except white spot on genae extending ventrally to mandible, dorsally to edge of eye, anteriorly to clypeus edge, and posteriorly to occiput. Head appearing round, 1.2× wider than high, smooth, finely setose. Face 2.25× wider than clypeus. Clypeus 1.6× wider than high. Malar suture 1.4× line between anterior tentorial pit and eye. Malar space slightly convex. *Eyes and Ocelli:* Eyes 1.5× higher than wide. Ocelli subequal in size, translucent light yellow. Stemmaticum slightly raised, broadly triangular with posterior-ocellar line 4× lateral-ocellar line and ocular-ocellar line 1.2× posterior ocellar line. *Antennae:* Brown to light brown, as long as body. *Mouthparts:* Mandibles brown, setose with short stiff setae. Labrum light brown to brown, flattened ventrally. Palps light brown to yellow. *Metasoma:* Brown. Tegulae translucent light brown, 1.67× wider than long, semi-

circular. Mesoscutum punctate anteriorly and laterally becoming slightly punctate medially, 1.5× wider than long. Medial scutellar area triangular, 0.85× as long as anterior scutellar furrow. Anterior scutellar furrow 2.25× as long as line between lateral scutellar furrows, slightly curved towards anterior with 8 pits. Lateral scutellar furrows costate basally, becoming rugulose and broader apically with apical edge 0.7× lunule base width. Lunules triangular, 2× wider at base than long. Axillary projections with sculpturing arising at distal 0.25 lunule base. Mesopleuron obscurely punctate, evenly setose except nitid area dorsad and ventrad the sternaulus. Mesonotum minutely rugulose except rugulose lateral metanotal depressions and smooth, setose (~10 setae) raised area posterior to posterior scutellar depression. Posterior scutellar depression round, 2.33× wider than long, nearly fully divided medially. Lateral metanotal depressions tear-drop shaped. Anterior propodeal areas rugose. Areola closed and rugose anteriorly, obscurely rugulose posteriorly, hexagonal, 1.6× longer than wide. Posterior propodeal areas rugulose. Spiracle hairs present in tufts anteriorly. *Forelegs:* Honey-yellow except light brown coxae and trochanters. Tarsal claws and arolia brown. *Mid-legs:* Honey-yellow except light brown coxae, trochanters, and trochantellae. Tarsal claws and arolia brown. *Hind legs:* Coxae dark brown. Trochanters brown. Trochantellae brown basally fading to yellow apically. Femurs honey-yellow except posterior 0.25 brown. Tibiae brownish-yellow except basal 0.2 whitish and apical 0.15 brown, 4.6× longer than wide. Tibial spurs white, interior spur 1.6× longer than exterior spur. Basitarsi yellowish-brown, 5.15× longer than wide. Remaining tarsomeres yellowish-brown. Tarsal claws brown with 2 spines. Arolia brown. *Wings:* Membranes hyaline. Stigma not elongate. Fore-wing veins brownish dorsally, whitish ventrally. Hind wing veins whitish. Hind wing cu-a evenly curved towards body. *Metasoma:* Brown except light brown lateral tergite I and light brown medial tergite II in some (30%). Petiole trapezoidal, nearly nitid, glabrous except posterior 0.2 sparsely setose, 1.4× longer than posterior edge. Petiole edge represented only as slight depression (may be difficult to observe) or slight bump. Medial tergite II trapezoidal, smooth, sparsely setose, with anterior edge 0.75× posterior edge, 0.33× as long as anterior edge. Hypopygium evenly and densely setose. *Genitalia:* Ovipositor yellow, 1.4× longer than hind basitarsus, 0.4× as thick as hind basitarsus, decurved apically. Sheaths straight, evenly setose, brown exteriorly, white interiorly.

Male.—As females but smaller with lighter colored wing veins.

Cocoon.—Unknown.

Biology.—Reared as gregarious parasitoid of *Cobalopsis* sp. on *Oryza latifolia* (Poaceae) in Costa Rica. Collection localities include both dry forest and rainforest sites.

Etymology.—The name is derived from the Greek roots "nano-" meaning dwarf and "-soma" meaning body. It refers to the small size of this species.

Holotype.—COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Bosque San Emilio: 300m: 93-SRNP-7564: (1♀, USNM).

Paratypes.—BRAZIL: Sinop: M. Grosso: 12° 31′ S, 55° 37′ W: coll. II-1976 M. Alvaranga (1♀, AEI) COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Bosque San Emilio: 300m: 93-SRNP-7564: (1♂, USNM, 1♀, INHS); COSTA RICA: Santa Rosa Nat'l. Park: 300m: malaise trap: site #SE: 5.0: coll. [18-XI]–[8-XI]-1986 I. D. Gauld and D. H. Janzen (1♀, INBIO); COSTA RICA: Cartago: Turrialba: grounds of IICA: malaise trap: [3–5]-VI-1976 M. Wasbauer (1♀, INHS); COSTA RICA: Guanacaste: Santa Rosa National Park: regenerating woodland (<10 years old): 300m: ex. Townes (style) malaise,

H3-O (direct sun daily, wet): [6–27]-IX-1986 I.D. Gauld (1♀, UWY).

Other material examined.—COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Bosque San Emilio: 300m: 93-SRNP-7564: (2♀, 1♂); Puntarenas: Golfito: coll. 13-VI-1976 M. Washbauer (1♂, INHS); ECUADOR: Pich.: S. Domingo: 47km S R. Palenque: 200m: coll. (18–30)-V-1975 (6♀, CNC); TRINIDAD: Curepe: coll. 11-VII-1978 (5♀, CNC); PANAMA: Las Cumbres: coll. (3–10)-II-1982 H. Walda (3♀, CNC); MEXICO: Chiapas: nr. Huixtla: 440m: coll. X-1970 Welling (2♂, CNC); BRAZIL: Mato Grosso: Caceres: coll. X-1984 M. Alvarenga (2♀, AEI).

Alphomelon nigriceps (Ashmead)
(Fig. 4f)

Urogaster nigriceps Ashmead 1900: 284. USNM Holotype #6443 examined.

Diagnosis.—Body honey orange except black head, dark brown ovipositor sheaths, distal 0.25 hind tibiae, tarsomeres, brown mid-tarsomeres. Wings infumated.

Female.—Head: Black, punctate except nitid frons, vertex, and occiput. Genae with whitish area from anterior tentorial pit extending posteriorly, ending 0.5 way between malar suture and occiput, extending dorsally to edge of eye and ventrally to base of mandible. Head 1.1× wider than long. Face 2× as wide as clypeus. Malar suture 1.85× line from eye to anterior tentorial pit. Malar space not convex. *Antennae:* Black, as long as body. *Eyes and Ocelli:* Eye 1.75× longer than wide. Ocelli translucent red (older specimens) to yellow or almost clear. Median ocellus subequal in size to lateral ocelli. Stemmaticum slightly raised and broadly triangular with posterior-ocellar line 2.5× lateral-ocellar line. Ocular-ocellar line equal to posterior-ocellar line. *Mouthparts:* Mandibles brown to reddish brown, setose with stiff hairs. Labrum light brown (Texas) to dark brown or black, flattened to slightly cleft ventrally. Palps honey-yellow. *Mesosoma:* Honey-yellow. Tegulae 1.75× wider than long, honey-yellow, semicircular, and setose. Propleuron honey-yellow with darker coloration anteriorly near cervix or nearly entirely black in some continental specimens (Brazil). Mesoscutum punctate with depressions deeper and more dense anteriorly, 1.33× wider than long. Medial scutellar area elongate triangular, 1.2× longer than anterior scutellar furrow, with anterior scutellar furrow 3× as long as line between lateral scutellar furrows. Anterior scutellar furrow sublinear with 6–7 pits. Lateral scutellar furrows costate basally becoming obscurely rugulose and broader apically with apical edge 0.75× as wide as lunule base. Lunules 1.5× wider at the base than high, triangular to subtriangular. Anterior axillary projections rugulose with sculpture arising apically to lunules. Mesopleuron punctate and setose, except nitid area dorsad and ventrad sternaulus. Metanotum glabrous, nitid except for setose (~10 setae) raised area posterior to posterior scutellar depression. Posterior scutellar depression 2× wider than long, flattened posteriorly, not divided medially. Lateral metanotal depressions rugulose and setose. Propodeum laterally areolate-rugose. Surface inside anterior propodeal areas, areola, and posterior propodeal areas glabrous and rugulose. Propodeal areola diamond shaped to hexagonal, closed. Propodeal carinae setose. Area anterior to propodeal spiracle densely setose with long, curved setae. *Forelegs:* Coxae, trochanters, trochantellae honey-yellow, some continental (Belize, Brazil, Peru, Argentina) with dark brown to black coxae, trochanters, and trochantellae. Femurs honey-yellow. Tibiae honey yellow with distal 0.2 in some specimens dark brown. Antennal cleaners and tarsomeres honey yellow to light brown. Tarsal claws reddish brown. Arolia black. *Mid-legs:* Honey-yellow. Same as fore-legs except coxae, trochanters, trochantellae never darkly colored. *Hind legs:* Coxae, trochanters, trochantellae honey yellow (trochanters, tro-

chantellae brown from Argentina). Femurs honey-yellow, turning brownish distally. Tibiae honey yellow with distal 0.25 dark brown, 4.4× longer than wide. Basitarsus 5× longer than wide, dark brown with basal 0.5 lighter. Remaining tarsomeres dark brown. Tarsal claws reddish brown with one spine. Arolia black. *Wings:* Membranes smoky, setose with setosity becoming slightly more dense apically. Veins uniformly dark brown dorsally, whitish colored ventrally. Hind wing cu-a angled posteriorly towards body. *Metasoma:* Petiole honey-yellow, rugulose-lacunose, glabrous except for sparsely setose posterior 0.3×, trapezoidal with posterior edge 0.85–1× petiole length. Petiolar ridge strongly raised, 0.5× as long as petiole length, 0.25× as wide as posterior petiole edge. Tergite I spiracle sparsely surrounded by long setae. All other tergites honey-yellow (may be light reddish brown in some continental specimens (e.g., Florida, South Carolina, USA). Tergite II very slightly rugulose, broadly trapezoidal with anterior edge 0.9× posterior edge and TII length 0.3× anterior edge length. Hypopygium evenly setose, honey yellow. *Genitalia:* Ovipositor slightly longer (1.1–1.6×) than hind basitarsus, weakly decurved. Ovipositor sheaths evenly setose with stiff erect, fanning hairs apically, black or dark brown externally, whitish internally. Basal 0.25 of ovipositor sheath light brown, nitid.

Male.—Unknown.

Cocoon.—Unknown.

Biology.—Solitary parasitoids reared from *Calpodes ethlius* on *Canna indica* (Cannaceae) and unidentified hesperiid on corn (Poaceae: *Zea mays*).

Holotype.—WEST INDIES: St. Vincent: coll. H. H. Smith. (USNM #6443).

Other material examined.—All ♀: COLOMBIA: Vichada PNN: Tuparo Cerro Tomás: 5° 21′ N 67° 51′ W: malaise trap: 140m: [19–29]-VI-2000 coll. W. Villalba (HUMB); WEST INDIES: Grenada: Mount Gay Estate: Leeward Side: coll. H. H. Smith (USNM); St. Lucia: malaise trap coll. 1970's (2 specimens, CNC); St. Vincent: reared 19-II-1983 (2 specimens, USNM); Sandy Bay: reared 28-X-1983 (USNM); CUBA: Havana: Havana: coll. Baker (5, USNM); Agr. de Cuba: Est. Cont.: coll. 26-II-1921 J. Acuna (USNM); DOMINICA: Point Casse: coll. 22-IX-1964 P. J. Spangler (USNM); coll. J. Maldonado (USNM); 0.2 mi. east Point Casse: coll. V-1966 R. J. Gagne (USNM); Clarke Hall: malaise trap: coll. (21–31)-III-1965 W. W. Wirth (USNM); (21–31)-I-1965 (USNM); St. Chiltern: coll. 2-XI-1966 A. B. Gurney (USNM); USA: Florida: Key Largo: coll. 27-III-1957 H. V. Weems, Jr. (USNM); Texas: Hunt Co.: Clymer Prairie: 3.5mi WNW Celeste: coll. 9-VII-1991 R. J Cecora (TAMU); TRINIDAD: San Fernando: Golconda Estate: coll. 19-X-1918 H. Morrison (USNM); BELIZE (USNM); VENEZUELA: Guarico Hato Masaguaral: 144km S Calabozo: coll. 11–19-V-1985 Menke and Carpenter (USNM); CURAÇAO: Willemstad: coll. 4-XII-1983 G. E. Bohart (CNC); PERU: Madre de Dios: Puerto Maldonado: coll. 31-I-1984 L. Huggert (CNC); BRAZIL: Rondonia: Fazena Rancho Grande: 62km S Ariquemes: coll. (12–22)-XI-1991 L. G. Bezark (TAMU). ARGENTINA: Miss. Dos de Mayo: coll. 6-III-1967 (CNC).

Alphomelon paurogenum Deans, new species

(Fig. 4h)

Diagnosis.—Wings infumated, body black. Genal patches reduced, reaching neither the occiput, the anterior tentorial pits, nor the clypeus.

Female.—Head: Black, except white spots on genae reduced, centered on malar sutures reaching neither the anterior tentorial pits, the clypeus, nor the occiput, acutely punctate with flexible setae arising from depressions. Face 2× wider than clypeus. Head appearing round, 1.2× wider than high, with malar suture 1.7× line from eye to anterior tentorial pit. Malar space flat, not convex. Clypeus 1.9×

wider than high. *Antennae:* Dark brown to black, as long as body. *Eyes and Ocelli:* Eyes 2× higher than wide. Ocelli translucent orange, subequal in size. Stemmaticum slightly raised and broadly triangular with posterior-ocellar line 2.75× lateral-ocellar line, and ocular-ocellar line equal to posterior-ocellar line. *Mouthparts:* Mandibles black to dark brown, setose with stiff hairs, palps brown to dark brown. Labrum black, broadly cleft medially. *Mesasoma General:* Tegulae orange to brown, translucent, 2.1× wider than long, semicircular. Mesoscutum punctate with depressions more dense anteriorly, 1.4× wider than long. Medial scutellar area obscurely punctate, triangular, 1.1× longer than anterior scutellar furrow. Anterior scutellar furrow straight with 8–10 pits, 3.25× longer than line between lateral scutellar furrows. Lateral scutellar furrows carinate basally becoming rugulose and broadening apically with apical edge 0.6× wider than lunule base width. Lunules semicircular, 1.3× wider at the base than long. Axillary projections with sculpturing arising at distal 0.33 of lunule base. Mesopleuron minutely punctate, nitid dorsad and ventrad the sternaulus. Metanotum scabriculous, glabrous except raised area posterior to posterior scutellar depression setose (~10 hairs). Posterior scutellar depression 2× wider than long, divided medially by carina. Lateral metanotal depressions skewed-teardrop shape, carinate-rugose. Propodeum confused rugulose except minutely rugulose areola and posterior propodeal areas. Areola nearly closed with short carina, U-shaped, 1.67× longer than wide. *Forelegs:* Honey-yellow except brown coxae and trochanters. Tarsal claws brown. Arolia dark brown. *Midlegs:* Honey-yellow except dark brown coxae and trochanters and light brown trochantellae. Tarsal claws brown. Arolia dark brown. *Hind legs:* Coxae and trochanters dark brown to black. Trochantellae light brown. Femurs yellow-orange except apical 0.15 brown. Tibiae yellow-orange except basal 0.2 white, apical 0.15 brown, 5.1× longer than wide. Tibial spurs white, interior spur 1.5× longer than exterior spur. Basitarsus yellow basally fading evenly to dark brown posteriorly, 5× longer than wide. Remaining tarsomeres dark brown. Tarsal claws reddish brown with 1 spine. Arolia dark brown. *Wings:* Infumated, veins dark brown dorsally, whitish ventrally. Stigma not elongate. Hind wing cu-a angled basally to the midpoint towards body. *Metasoma:* Petiole dark brown to black, trapezoidal, 1.25× longer than posterior edge, punctate-costate with posterior 0.33 sparsely setose. Petiolar ridge present, 0.5× as long as petiole, bifurcating with distance between carinae 0.15× ridge length. Remaining tergites and sternites brown. Medial tergite II obscurely confused-rugulose, nearly rectangular with posterior edge 1.1× longer than anterior edge, and length 0.33× as long as anterior edge. Hypopygium evenly setose. *Genitalia:* Ovipositor brown-orange, slightly decurved with exerted portion 1.1× length of hind basitarsus, 0.5× as wide as hind basitarsus width. Sheaths straight, evenly setose, desclerotized at tip, brown interiorly and exteriorly.

Male.—Wings hyaline, with veins clear to translucent yellow except brown stigma and light brown r + 2RS + 2M. Hind basitarsus and tarsomeres orange in some (50%).

Cocoon.—Unknown.

Biology.—All records are from extratropical habitats in Argentina and Chile.

Etymology.—The name is derived from the Greek root "pauro-" meaning little, and the Latin word "genum" meaning cheek. This name refers to the small cheek patch size in this species.

Holotype.—ARGENTINA: B. Aires: La Plata: Fac. Agronomía: coll. (X–XI)-1968 C. Porter (1♀, MCZ).

Paratypes.—1♂, same data as holotype (MCZ); 2♀, same data except coll. [18–30]-XI-1968 and 22-XII-1968 (MCZ); ARGENTINA: La Plata: coll. 15-XII-1965 H. and

M. Townes (1♀, AEI); CHILE: El Portezuela: S. Colima: coll. XI-1978 L. Peña (1♀, 1♂ AEI).

Other material examined.—Same data as holotype except: coll. 22-XII-1968 (1♀, 1♂, MCZ), coll. (X–XI)-1968 (4♀, 3♂, MCZ), and coll. (18–30)-XI-1968 (2♀, MCZ); La Plata: coll. 15-XII-1965 H. and M. Townes (1♀, AEI); CHILE: Renaico: malleco: coll. 6-XII-1970 T. Cekalovic (1♂, AEI); El Portezuela: S. Colina: coll. XI-1978 L. Peña (1♀, 1♂, AEI); La Obra: Stgo: coll. XII-1978 Luis Peña (1♀, AEI); Concepcion: coll. 3-II-1909 P. Herbst (1♀, 1♂, AEI).

Alphomelon pyrrhogluteum Deans, new species

Diagnosis.—Metasoma entirely yellow except black medial tergite VII and medial black stripe on hypopygium. Mesopleuron not punctate.

Female.—Head: Back except white coloring on genae extending from anterior tentorial pits to bottom edge of eye, ventrally to mandible and posteriorly to occiput, not extending onto clypeus. Head triangular in appearance, 1.2× wider than high, slightly punctate. Face 2× wider than clypeus. Clypeus 1.5× wider than high. Line between anterior tentorial pit and eye 0.5× line between eye and mandible with malar space flush. *Antennae:* Brown, as long as body. *Eyes and Ocelli:* Eyes 1.7× higher than wide. Ocelli translucent honey-yellow, lateral ocelli 1.2× wider than median ocellus. Stemmaticum slightly raised and broadly triangular with posterior-ocellar line 2.25× longer than lateral-ocellar line and ocular-ocellar line 1.2× posterior ocellar line. *Mouthparts:* Mandibles dark brown, setose with stiff hairs. Labrum light to dark brown, not cleft. Palps orange to light brown. *Mesosoma:* Tegulae semicircular, translucent yellow, 2× wider than long. Mesoscutum 1.25× wider than long, punctate anteriorly and laterally, becoming sparsely punctate medially. Medial scutellar area evenly slightly punctate, trapezoidal, 1.2× longer anterior scutellar furrow. Anterior scutellar furrow sublinear to slightly curved with 8–9 pits, 2.6× longer than line between lateral scutellar furrows. Lateral scutellar furrows carinate basally becoming rugulose apically with apical edge 0.6× lunule base width. Lunules triangular and 1.2× wider at the base than high. Axillary projections with sculpturing arising at middle lunule base. Mesopleuron not punctate to obscurely punctate with nitid areas dorsad and ventrad sternaulus. Metanotum nitid to obscurely scabriculous, except setose raised area (12 setae) posterior to posterior scutellar depression. Lateral metanotal depressions skewed-teardrop shape with rugose surface. Posterior scutellar depression nearly circular, 1.6× wider than long, not fully divided medially. Anterior propodeal areas rugose. Posterior propodeal areas rugulose. Anterior propodeal areas rugose. Areola U-shaped, nearly open with only a small carina anteriorly, rugose to obscurely costate. Propodeal spiracle hairs difficult to distinguish from other setae. *Forelegs:* Honey-orange except black coxae. Tarsal claws orange. Arolia black. *Mid-legs:* Honey-orange except black coxae and dark brown trochanters. Basitarsus light brown becoming darker on apical tarsomeres. Tarsal claws reddish-brown. Arolia black. *Hind legs:* Coxae black, trochanters dark brown, trochantellae honey-orange, femur honey-orange. Tibiae elongate, 6.67× longer than wide, honey-orange except basal 0.25 white and apical 0.15 brown. Tibial spurs white, interior spur 1.75× longer than exterior spur. Basitarsus whitish basally fading evenly to dark brown apically, 5.5× longer than wide, yellow evenly fading to brown. Remaining tarsomeres dark brown. Tarsal claws brown with 1 spine. Arolia black. *Wings:* Hyaline, setose with hairs more dense apically. Stigma slightly elongate. Veins brown dorsally and light brown ventrally. Hind wing cu-a curved basally towards body. *Metasoma:* Honey-yellow to honey-orange except

black medial-ventral stripe on hypopygium and medial tergites VI–VII. Petiole punctate, setose on posterior 0.25, rectangular, 2× longer than posterior petiole edge. Petiolar edge present, bifurcating, 0.25× as long as petiole, distance between bifurcating ridges 0.5× as long as ridge length. Medial tergite II slightly punctate, trapezoidal, 0.45× as long as anterior edge, with posterior edge 1.5× as long as anterior edge. Hypopygium evenly setose. *Genitalia:* Ovipositor orange, evenly decurved, exerted portion 2× as long as hind basitarsus, 0.5× as wide as basitarsus width, tapering posteriorly. Sheaths straight, evenly setose, desclerotized at tips, interior and exterior brown.

Male.—Unknown.

Cocoon.—Unknown.

Biology.—All records are from extratropical Argentina.

Etymology.—Name derived from Greek roots "pyrrho-" meaning orange and "-gluteo" meaning tail, referring to the coloration of the metasoma.

Holotype.—ARGENTINA: Jujuy: Posta Lozano: coll. (21–23)-III-1969 C. C. Porter (1♀, MCZ).

Paratypes.—ARGENTINA: Villa Nogués: coll. 25-XII-1965 H. and M. Townes (1♀, AEI); Jujuy: Posta Lozano: coll. (29-X)–(4-XI)-1968 C. Porter (1♀, MCZ); Cerro: San Bernardo: Salta: coll. 27-III-1968 C. Porter (1♀, MCZ).

Alphomelon rhyssocercus Deans, new species
(Fig. 5d)

Diagnosis.—Medial tergite II densely rugose with raised medial area. Body highly setose giving specimens silvery, hairy appearance.

Female.—Head: Black to dark brown, deeply punctate and setose. Frons, occiput, and vertex nitid. Genae white with coloration extending posteriorly to edge of eye and to occiput and ventrally to edge of mandible. Head 1.2× wider than high, appearing slightly elongate with malar suture 2× as long as line between anterior tentorial pit an eye edge. Face 2.5× wider than clypeus. Clypeus 1.5× wider than long with light brown patches laterally (Ecuador). *Antennae:* Brown, as long as body. *Eyes and Ocelli:* Eyes 1.7× longer than wide. Ocelli honey yellow, subequal in size. Stemmaticum slightly raised an broadly triangular with posterior-ocellar line 3× longer than lateral-ocellar line. Posterior-ocellar line 0.9× longer than ocular-ocellar line. *Mouthparts:* Mandibles dark reddish-brown, uniformly setose with stiff long hairs. Labrum brown, ventrally flattened with no cleft. Palps setose, honey-yellow. *Mesosoma:* Black to dark brown. Tegulae light brown to brown, semicircular, setose, 2× wider than long. Mesoscutum 1.15× wider than long, deeply punctate with depressions more dense anteriorly. Setose with setae arising from depressions and becoming longer posteriorly. Medial scutellar area as long as anterior scutellar furrow, punctate and setose with long, curved setae arising from depressions, triangular with anterior scutellar furrow 2.5× longer than line between lateral scutellar furrows. Anterior scutellar furrow curved with 8 pits. Lateral scutellar furrows costate basally becoming obscurely rugulose and broader apically with edge 0.85× as wide as lunule base. Lunules nitid, triangular with base width 1.67× lunule length. Axillary projections rugose with sculpturing arising as trench in the lateral 0.5 of lunule base. Mesopleuron deeply punctate, villous with long setae arising from depressions, area dorsad and ventrad to the sternaulus nitid. Metanotum obscurely rugulose, glabrous except for setose lateral metanotal depressions and raised area posterior to posterior scutellar depression. Posterior scutellar depression 2.75× wider than long, divided centrally. Lateral metanotal depressions tear-drop shaped and rugose. Propodeum setose, rugose. Propodeal areola U-shaped, obscurely costate, open dorsally. Posterior propodeal areas glabrous,

rugulose. Area anterior to propodeal spiracle with tuft of thickened setae bent at tip. *Forelegs:* Honey-yellow except brown coxae and trochantellae. Tarsal claws reddish brown, pectinate with two spines. Arolia dark brown. *Mid-legs:* Color as forelegs except distal 0.25 of femur and 0.15 of tibia brown. *Hind legs:* Coxae, trochanters black to dark brown. Trochantellae honey orange, setose. Femur with basal 0.2–.5 honey-yellow, distal 0.2–.5 dark brown. Tibiae 2.5× longer than basitarsus with basal 0.2 white, distal 0.2 dark brown (almost entirely honey-yellow in some specimens). Tibial spurs densely setose, white, interior spur 1.3× longer than exterior spur. Basitarsus dark brown except basal 0.25× whitish, 5× longer than wide. Remaining tarsomeres dark brown. Tarsal claws reddish brown pectinate with 2 spines. Arolia dark brown. *Wings:* Veins uniformly brown. Membrane hyaline. Setosity becoming more dense apically. Hind cu-a slightly curved posteriorly towards body. *Metasoma:* Petiole black to light brown, trapezoidal, tapering slightly anteriorly, 1.1× longer than posterior edge, costulate, posterior 0.5 setose. Petiolar ridge strongly raised anteriorly, 0.5× as long as petiole, bifurcating arms connecting posteriorly (weakly in some specimens) forming elongate, elliptical depressed area, 0.2× as wide as posterior edge. Tergum I spiracle surrounded by setae. Medial tergites brown (II and III in specimens from Panama light brown). Medial tergite II rectangular, anterior edge subequal to posterior edge, rugose with medial area raised. Medial tergites with setae extending past posterior edges. Ventral and lateral tergites obscurely variolate anteriorly (may be difficult to see in some specimens unless metasoma is inflated). Hypopygium evenly setose except glabrous medially. *Genitalia:* Ovipositor reddish orange, weakly decurved, as long as hind basitarsus. 2–3 teeth weakly represented on ventral valve. Ovipositor sheaths whitish internally, dark brown and evenly setose externally with spreading stiff setae distally.

Male.—Little variation, body slightly smaller, antennae longer than female.

Cocoon.—Unknown.

Biology.—All records are from rainforest.

Etymology.—The name is derived from the Greek roots "rhysso-" meaning wrinkled and "-cercus" meaning tail. The name refers to sculpturing on medial tergite II.

Holotype.—ECUADOR: Pich.: Rio Palengue R. S.: 200m: coll. 2-II-1983 Masner and Sharkey (1♀, CNC).

Paratypes.—ARGENTINA: B. Aires: LaPlata (Fac. Agronomía): [X–XI]-1968: coll. C. Porter (2♀, INHS); COSTA RICA: Puntarenas: Golfito: malaise trap 8AM–5PM: 27-VI-1976 M. Wasbauer (1♀ INHS); COSTA RICA: Puntarenas: R.F. (=Reserva Forestal) Golfo Dulce: 5 km. W. Piedras Blancas: 100m: malaise trap [XI–XII]-1992 coll. Paul Hanson (1♀, UWY); ECUADOR: Pich.: Tinalandia: 800m.: coll. 2-II-1983 Masner and Sharkey (1♀, CNC); PERU: Tingo Maria: Rio Palengue: coll. [20–27]-I-1968 A. Garcia and C. Porter (1♀, MCZ); PERU: Lima: Chosica: coll. 15-XII-1984 Lars Huggert (1♂, AEI); TRINIDAD: St. George: Maracas Bay Village: coll. 21-III-1985 G. F. and J. F. Hevel (1♂, USNM).

Other material examined.—ECUADOR: Pich.: Rio Palengue R. S.: 200m: coll. 4-II-1983 Masner and Sharkey (3♀, 4♂, CNC); VENEZUELA: Puerto Cabello: coll. P. Anduze (5–6)-II-1940 (1♂, USNM); Patanemo: coll. (5–11)-III-1940 P. Anduze (1♀, USNM); COLOMBIA: Valle Colombia: 17km S of Cali: 1000m in weeds: coll. 10-IV-1971 Eberhard and Garcia (1♂, CNC); TRINIDAD: Curepe: malaise trap: coll. VIII-1978 (1♂, CNC); 29-XII-1977 (1♀, CNC); Mucurapo: coll. 22-II-1961 N. Gopaul (1♂, CNC); PANAMA: Las Cumbres: malaise trap: coll. (26–30)-XI-1981H. Wolda (2♂, CNC).

Alphomelon simpsonorum Deans, new species

Diagnosis.—Yellow to light brown coxae. Medial tergites I–III yellow.

Female.—Head: Black except white spots on gena extending from anterior tentorial pit posteriorly to occiput, dorsally to edge of eye, ventrally to base of mandible, and anteriorly to edge of clypeus. Head smooth, setose, round, 1.15× wider than high. Face 2.5× wider than clypeus. Clypeus 1.3× wider than high. Malar suture 1.67× longer than line between anterior tentorial pit and eye. Malar space very slightly convex. *Antennae:* Dark brown, as long as body. *Eyes and Ocelli:* Eyes 1.7× higher than wide. Ocelli clear and colorless to translucent-orange (older specimens), subequal in size. Stemmaticum slightly raised, broadly triangular with posterior-ocellar line 3.33× lateral-ocellar line. Ocular-ocellar line 1.1× posterior-ocellar line. *Mouthparts:* Mandibles dark brown, setose with long stiff hairs. Labrum not cleft medially, dark brown to brown. Palps honey-yellow. *Mesosoma:* Dark brown to black. Tegulae translucent-yellow, semicircular, smooth, 1.7× wider than long. Mesoscutum 1.4× wider than long, punctate anteriorly becoming sparsely punctate laterally and smooth medially. Medial scutellar area smooth, triangular, 1.2× longer than anterior scutellar furrow. Anterior scutellar furrow straight with 6 pits, 2.4× longer than line between lateral scutellar furrows. Lateral scutellar furrows costate basally becoming rugulose and wider apically with apical edge 0.6× lunule base width. Lunules rounded-triangular, 2.5× wider at base than high. Axillary projections with sculpturing arising at lateral 0.33–.5 lunule base. Mesopleuron obscurely punctate, setose except nitid area dorsad and ventrad sternaulus. Mesonotum nitid except sparsely setose (5–10 setae) raised area posterior to posterior scutellar depression. Lateral metanotal depressions skewed tear-drop shape, rugose, setose. Posterior scutellar depression ovular, 2.67× wider than long, not completely divided medially. Anterior propodeal areas rugose. Areola rugulose, nearly closed anteriorly with shallow carina, 1.5× longer than wide. Posterior propodeal areas rugulose. Propodeal spiracular hairs present as cluster anterior to spiracle. *Forelegs:* Entirely honey-orange to honey-yellow (10% with coxae light brown). Tarsal claws and arolia brown. *Mid-legs:* Entirely honey-orange to honey-yellow (50% with basal 0.5 coxae light brown). Tarsal claws and arolia brown. *Hind legs:* Coxae entirely honey-orange (33%), with basal 0.5 light brown (33%), or entirely light brown (33%). Trochanters, trochantellae, and femurs honey-orange. Tibiae honey-orange except basal 0.15 whitish, interior 0.15 brown, 4.5× longer than wide. Tibial spurs white, interior spur 1.7× exterior spur. Basitarsus honey-yellow basally fading evenly to light brown apically, 5.8× longer than wide. Remaining tarsomeres light brown. Tarsal claws brown with 2 spines. Arolia brown. *Wings:* Membranes hyaline. Setose with setosity more dense apically. Veins brown dorsally and whitish ventrally. Stigma not elongate. Hind wing cu-a angled posteriorly towards body. *Metasoma:* Petiole yellow to brownish-orange, parallel sided, rectangular, 2× longer than posterior edge, smooth, glabrous except posterior 0.25 setose. Petiolar ridge present, 0.3× as long as petiole, 0.25× as wide between bifurcating arms as posterior edge. Lateral tergite I light yellow. Medial tergites II and III honey-yellow to honey-orange. Medial tergite II trapezoidal, 0.4× as long as anterior edge, anterior edge 0.7× posterior edge. Lateral tergites II–VII honey-yellow. Sternites honey-yellow. Medial tergites IV–VII brown. Hypopygium evenly setose, yellow with medial area brown. *Genitalia:* Exerted portion of ovipositor 1–1.25× as long as hind basitarsus, 0.33–.43 as wide as hind basitarsus, slightly decurved posteriorly, honey-orange. Sheaths

black, smooth, evenly setose, desclerotized at tips.

Male.—Unknown

Cocoon.—Unknown.

Biology.—Reared as solitary parasitoid from unidentified hesperiine on grass (Poaceae) in Costa Rica. All records are from rainforest sites.

Etymology.—This species is named in honor of television's Simpson family for helping the author maintain a positive attitude throughout his educational endeavors.

Holotype.—BRAZIL: Nova Teutonia: 27° 11′ S, 52° 23′ W: 300–500m: coll. I-1965 Fritz Plaumann (1♀, CNC).

Paratypes.—BRAZIL: Campina Grande: nr. Curitiba: coll. 22-II-1966 H. and M. Townes (1♀, AEI); 11-II-1966 (1♀, AEI); 16-II-1966 (1♀, AEI); PARAGUAY: Salto del Guaira: coll. XII-1971 L. E. Peña (1♀, CNC); COSTA RICA: voucher #97-CALI-128: (1♀, INBIO); COSTA RICA: Puntarenas: R.F. Golfo Dulce: 3 km. SW. Rincon: 10m: malaise trap: [X–XII]-1990 coll. Paul Hanson (1♂, UWY).

Other material examined.—BRAZIL: coll. III-1957 Fritz Plaumann (1♀, CNC); coll. III-1968 Fritz Plaumann (1♀, CNC).

Alphomelon talidicida (Wilkinson)

(Figs. 4d, 6e)

Apanteles talidicida Wilkinson 1931:75–90. Cotypes from NHM and USNM examined.

Diagnosis.—Ovipositor >1.5× hind basitarsus, straight. Hind wing cu-a strongly angled medially towards body. White spots on genae extending onto clypeus as dull yellow-brown coloration.

Female.—Head: Dark brown except white coloration on gena extending from anterior tentorial pit posteriorly to occiput, dorsally to edge of eye, ventrally to mandible base, anteriorly onto clypeus as light brown coloration. Head slightly punctate, 1.2× wider than high. Face 2.6× wider than clypeus. Clypeus 1.5× wider than high. Malar suture 1.44× line between anterior tentorial pit and eye. Malar space not convex. *Antennae:* Dark brown, as long as body. *Eyes and Ocelli:* Eye 1.67× higher than wide. Ocelli clear, sub-equal in size. Stemmaticum slightly raised, triangular with posterior-ocellar line 2.33× lateral-ocellar line. Ocular-ocellar line 1.4× posterior-ocellar line. *Mouthparts:* Mandibles reddish-brown, setose. Labrum brown, flattened ventrally. Palps honey-yellow. *Mesosoma:* Dark brown to black. Tegulae translucent honey-yellow, 2.25× wider than long, semicircular. Mesoscutum 1.4× wider than long, anterior 0.6 punctate and setose, posterior 0.4 smooth and glabrous anterior to anterior scutellar furrow. Medial scutellar area triangular, smooth, setose, 0.8× longer than anterior scutellar furrow. Anterior scutellar furrow straight with 8–10 pits, 2.4× longer than line between lateral scutellar furrows. Lateral scutellar furrows obscurely costate basally becoming nearly nitid and wider apically with apical edge 0.4× lunule base width. Lunules short, semicircular, 4× wider at base than high. Axillary projections with sculpturing arising at lateral 0.2 lunule base. Mesopleuron punctate, setose except for nitid area dorsad and ventrad the sternaulus. Mesonotum nitid except rugulose lateral metanotal pits and setose (~10 setae) raised area posterior to posterior scutellar depression. Lateral metanotal depressions skewed tear-drop shaped. Posterior scutellar depression 2× wider than long, divided medially (difficult to see full division). Anterior propodeal areas and area anterior to areola rugose. Posterior areas and areola nearly smooth to obscurely rugulose. Areola closed anteriorly with shallow carina, U-shaped, 1.25× longer than wide. Cluster of setae present anterior to propodeal spiracles. *Forelegs:* Honey-yellow except brown coxae and light brown trochanters. Tarsal claws reddish-brown. Arolia black. *Mid-legs:* Honey-yellow except brown coxae and light brown trochanters. Tarsal claws reddish-brown. Arolia black. *Hind*

legs: Coxae dark brown. Trochanters brown. Trochantellae honey-yellow. Femurs honey-yellow except apical 0.15 brown. Tibiae honey-yellow except basal 0.15 whitish, apical 0.15 brown, 4.9× longer than wide. Tibial spurs white, interior spur 1.6× longer than exterior spur. Basitarsi whitish basally fading evenly to brown apically, 4.3× longer than wide. Remaining tarsomeres brown. Tarsal claws reddish-brown with 2 spines. Arolia black. *Wings:* Narrow. Membranes hyaline. Stigmas not elongate. Veins brown dorsally, whitish ventrally. Hind wing cu-a strongly angled medially back towards body. *Metasoma:* Dark brown. Petiole trapezoidal, 1.4× longer than posterior edge, glabrous except posterior 0.25 sparsely setose. Petiolar ridge present, 0.4× as long as petiole, 0.2× as wide between bifurcating arms as posterior edge. Medial tergite II smooth, trapezoidal, sparsely setose, orange brown (50%), 0.3× as long as anterior edge, posterior edge 1.4× anterior edge. Hypopygium evenly setose. *Genitalia:* Exerted portion of ovipositor orange-yellow, straight, 1.65× longer than hind basitarsus, 0.33× as wide as hind basitarsus, ventral valve with 2 teeth. Sheaths straight, evenly setose, brown exteriorly, whitish interiorly, with tips desclerotized.

Male.—As female but smaller with lighter wing veins. Stigmas solid brown.

Cocoon.—Unknown.

Biology.—Reared as gregarious parasitoid from *Talides sergestus* and *Talides sinois* on *Heliconia latispatha* (Heliconiaceae) and *Musa cavendishii* (Musaceae), in rainforest in Costa Rica.

Holotype.—GUYANA (labeled BRITISH GUIANA): Plan. Blair-Mont: Berbice: reared 2-II-1924 H. E. Box (1♀, NHM). Holotype labeled as cotype. Specimens designated by Wilkinson as cotypes from same series deposited in USNM should be considered paratypes.

Other material examined.—BELIZE (labeled BRITISH HONDURAS): Middlesex: 125m: coll. 25-III-1965 E. C. Welling (1♀, CNC); BRAZIL: Utinga: Belem: coll. XII-1966 S. J. Oliviera (2♀, AEI); Sinop: Mato Grosso: coll. X-1976 M. Alvarenga (1♀, CNC); coll. XI-1975 M. Alvarenga (1♀, CNC); coll. II-1976 O. Roppa (1♀, CNC); Caruaru: Pernambuco: coll. IV-1972 M. Alvarenga (1♀, CNC); 900m: coll. IV-1972 M. Alvarenga (1♀, AEI); Sao Paulo: Galia Est.: coll. VII-1974 F. M. Oliviera (2♀, AEI); M. G.: Caceres: coll. XI-1974 M. Alvarenga (2♀, AEI); COLOMBIA: Putumayo: 0° 50′ N 76° 30′ W: 400m: coll. 30-XI-1972 J. Helava (1♀, CNC); COSTA RICA: La Lola: coll. 12-VIII-1961 (1♀, AEI); Heredia: Est. Biol. La Selva: 10.26N, 84.01W: 50–150m: coll. (II–IV)-1993 P. Hanson (1♀, UWY); 3km S Puerto Viejo: OTS-La Selva: 100m: coll. (1–15)-IX-1992 P. Hanson (4♀, UWY); coll. X-1992 P. Hanson (2♀, UWY); Limon: 4km NE Bribri: 50m: coll. (IX–XI)-1989 P. Hanson (1♀, UWY); Guanacaste: Area de Conservación Guanacaste: Sector Cacao: Gongora: 560m: DHJ voucher #'s 94-SRNP-10491, 95-SRNP-9791, 98-SRNP-3502: reared D. H. Janzen et al. (>10♀, >10males, DHJ); Rancho Harold: 720m: DHJ voucher #97-SRNP-2000: reared D. H. Janzen et al. (1♀, 1♂); Sector San Cristobal: Potrero Bufalo: 560m: DHJ voucher #97-SRNP-6718: reared D. H. Janzen et al. (1♀, 1♂, DHJ); Sector El Hacha: Sendero a Casa Numero 3: reared 11-VIII-2000 R. Moraga (1♀, 1♂, DHJ voucher #00-SRNP-3708); reared 18-VIII-2000 R. Moraga (1♀, 1♂ DHJ voucher #00-SRNP-3889); Alajuela: Sector San Cristobal: Sendero Perdido: reared 18-VII-2000 J. M. Perez (1♀, 1♂, DHJ voucher #00-SRNP-12084); Sector San Cristobal: Cemeterio Viejo: reared 27-IX-2000 F. Quesada (1♀, 1♂, DHJ voucher #00-SRNP-12975); ECUADOR: Pich.: S. Domingo: 47km S R. Palenque: 200m: coll. (18–30)-V-1975 Peck (7♀, CNC); coll. (22–31)-VII-1976 S. and J. Peck (1♀, CNC); 22-VII-1976 S. and J. Peck (1♀, CNC); Pichincha: 16km SE Sto. Domingo: Tinalandia: 500m: coll. (4–14)-VI-1976 S. and J. Peck (1♀, CNC); 680m: coll. 1975 S. and J. Peck

(2♀, CNC); Napo: Limoncocha: 250m: coll. (15–28)-VI-1976 S. and J. Peck (1♀, CNC); GUYANA: Plan. Blair-Mont: Berbice: reared 2-II-1924 H. E. Box (4♀, 1♂, USNM); MEXICO: Oax.: Metate: 85.5km SW Tuxtpec: 900m: coll. 18-X-1962 H. and M. Townes (1♀, AEI); Chiapas: Muste: near Huixtla: 440m: coll. X-1970 Welling (1♀, CNC); PANAMA: Las Cumbres: coll. (3–10)-II-1982 H. Wolda (1♀, CNC); PERU: Quincemil: coll. (20–30)-X-1962 R. D. Shenefelt (3♀, AEI); coll. (10–15)-XI-1962 R. D. Shenefelt (2♀, AEI); TRINIDAD: St. Augustine: reared IV-1950 F. J. Simmonds (4♀, 2 USNM, 2 CNC); VENEZUELA: Zulia: El Tucuco: 200m: coll. IV-1981 L. Masner (1♀, CNC).

Alphomelon winniewertzae Deans, new species

(Fig. 4g)

Diagnosis.—Face strongly punctate, genae compressed with small white patches, labrum yellow, mesoscutum evenly and strongly punctate, legs mostly uniform orange-yellow.

Female.—Head: Black, except genae white with coloration extending posteriorly from anterior tentorial pit to line 0.5 way between malar suture and occiput and ventrally to edge of mandible, never extending onto clypeus or to occiput, foveolate with setae arising from depressions except nitid frons, occiput, and vertex. Setosity slightly more dense between antennae and surrounding stemmaticum. Face 2× wider than clypeus. Head 1.25× wider than high, appearing compressed with malar suture 2× longer than line between anterior tentorial pit and eye, malar suture appearing. Clypeus 2.5× wider than high. *Eyes and Ocelli:* Eyes 1.6× longer than wide. Ocelli clear to honey-yellow, subequal in size. Stemmaticum, broadly triangular with posterior ocellar line 3.33× longer than lateral ocellar line. Ocular ocellar line equal to posterior ocellar line. *Antennae:* Brown, as long as body. *Mouthparts:* Mandibles light brown to black, evenly setose on outer edge. Labrum yellow, 2.5× wider than long, slightly cleft medially. Palps light yellow, evenly setose with stiff hairs. *Mesosoma:* Black. Tegulae 2× wider than long, yellow, translucent, semicircular. Mesoscutum 1.25× wider than long, densely and evenly foveolate, densely setose with setae arising from depressions. Medial scutellar area triangular with length as long as anterior scutellar furrow, punctate, setose with long setae arising from depressions. Anterior scutellar furrow 2.75× line between lateral scutellar furrows, straight with 8–10 pits. Axillary projections with sculpturing arising at midpoint of lunule base. Lunules elongate and rounded, with base width 1.5× height. Lateral scutellar furrows broader at base and at distal edge; distal edge 0.67× lunule base width. Mesopleuron deeply punctate, setose with hairs arising from depressions, nitid dorsad and ventrad the sternaulus. Metanotum nitid, glabrous except for sparsely setose lateral metanotal pits and raised area posterior to medial metanotal depression. Posterior scutellar depression flattened, shallow and barely divided medially, ovular, 3× wider than long. Lateral metanotal depressions ovular, rugose. Propodeum areolate-rugose except carinate areola and rugulose posterior propodeal areas. Anterior propodeal areas strongly rugose. Propodeal areola U to V-shaped, open anteriorly. Area anterior to propodeal spiracle with sparse tuft of stiff setae (difficult to distinguish). *Forelegs:* Honey-yellow except light brown coxae. Tarsal claws light brown to reddish brown, one spine. Arolia dark brown. *Mid-legs:* Honey-yellow except light brown coxae. Tarsal claws light brown to reddish brown, one spine. Arolia dark brown. *Hind legs:* Honey-yellow except dark-brown to black coxae. Coxae strongly punctate. Tibia 2× longer than basitarsus. Tibial spurs white, setose, interior spur 1.67× longer than exterior spur. Basitarsus light brown to honey-yellow, 6× longer than wide. Tar-

someres light brown, occasionally entirely honey-yellow (30%). Tarsal claws light brown to reddish brown, one spine. Arolia dark brown. *Wings:* Veins whitish ventrally, mostly brown dorsally. Membrane hyaline, setose with setosity slightly more dense apically. Stigma slightly elongate. Hind cu-a slightly and evenly curved. *Metasoma:* Petiole black to brown, rugulose, setose on posterior 0.33, 1.2× longer than posterior edge. Sub-rectangular, tapering only slightly anteriorly, posterior edge 1.5× length of petiolar ridge. Petiolar ridge raised strongly anteriorly, bifurcating arms connected posteriorly forming elongate teardrop shape. Tergites dark brown to brown, setose. Tergite II rugulose, trapezoidal with posterior edge 1.3× anterior edge. Medial tergites with setae extending past posterior edges. Ventral and lateral tergites obscurely variolate anteriorly (difficult to observe unless metasoma is inflated). Hypopygium setose except ventrally glabrous. *Genitalia:* Ovipositor decurved, reddish orange, 2× longer than hind basitarsus, 0.56× as thick as hind basitarsus width. Ovipositor sheaths evenly setose, brown externally, whitish internally, with long, stiff setae at desclerotized tips.

Male.—Smaller, wing veins whiter, stigma pale to clear.

Cocoon.—Unknown.

Biology.—Reared from *Calpodes ethlius* on *Canna indica* in Costa Rica and *Euphyes* sp. on unknown plant in USA. This species ranges from Costa Rican dry forest through variable habitats to Canada.

Etymology.—This species is named in remembrance of Winnifred I. Wertz for her inspiration, love, and unconditional support.

Holotype.—USA: Virginia: Louisa Co.: 4 mi. S. Cuckoo: coll. (1–18)-VIII-1987 J. Kloke and D. R. Smith (1♀, USNM).

Paratypes.—USA: Arkansas: Montgomery Co.: NW at Mt. Ida: F. R. W58A: Womble 1658-16: malaise trap: coll. (14–21)-VI-1994 C. Lewis (2♀, INHS); USA: Virginia: Louisa Co.: 4 mi. S. Cuckoo: malaise trap: coll. [28-V]–[5-VII]-1987 J. Kloke and D. R. Smith (1♂, USNM); USA: Virginia: Louisa Co.: 4 mi. S. Cuckoo: coll. (1–18)-VIII-1987 J. Kloke and D. R. Smith (1♀, USNM); USA: Texas: Kerrville: 12-V-1988: coll. H. and M. Townes (1♀, AEI); Texas: Fredericksburg: coll. 19-V-1988 H. and M. Townes (1♀, AEI); Texas: Brazos Co.: College Station: Lick Creek Park: [2–16]-V-1988: coll. Wharton and Praetorius (1♀, TAMU); Texas: Kerr Co.: Center Point: [7–13]-VIII-1987: coll. Wharton and Praetorius (1♀, TAMU); COSTA RICA: Area de Conservación Guanacaste: Sector Horizontes: Bejuco: 180m: (1♀, 93-SRNP-5334, INHS); Area de Conservación Guanacaste: (1♀, 94-SRNP-7382, INHS); USA: Ohio: Hocking Co.: Pine Creek: Rt. 11: malaise trap: coll. 5-IX-1987 J. B. Whitfield (1♀, INHS);.

Other material examined.—CANADA: Ontario: Marmora: coll. 8-VII-1952 C. Boyle (1♀, CNC); USA: Florida: Liberty Co.: Torreya S.P.: coll. 8-X-1980 L. Masner and B. Bowen (1♀, (4♂, CNC); Kansas: Lawrence: coll. 13-VIII-1896 Hugo Kahl (1♂, USNM); Jefferson Co.: Sarcoxie Wash: coll. 7-VIII-1896 Hugo Kahl (1♀, USNM); Massachusetts: coll. C. F. Baker (1♀, USNM); Michigan: Midland Co.: coll. 9-VIII-1951 R. R. Dreisbach (1♀, USNM); North Carolina: Bertie Co.: near Cahaba: malaise trap: coll. 2-VI-1976 N.C.D.A. (1♀, CNC); Tennessee: Lexington: Natchez Trace S. P.: malaise trap: coll. 9–11-VI-1972 G. Heinrich (1♀, CNC); Texas: Kerr Co.: Center Point: malaise trap: coll. (7–13)-VIII-1987 Wharton and Praetorius (2♀, TAMU); Brazos Co.: College Station: Lick Creek Park: coll. (2–16)-V-1988 Wharton and Praetorius (1♀, TAMU); Hidalgo Co.: McAllen: Valley Botanical Garden: coll. (1–13)-VI-1973 C. C. Porter (1♀, USNM); Hidalgo Co.: McAllen: Valley Botanical Garden: coll. 27-VIII–8-IX-1973 C. C. Porter (1♀, USNM); Big Bend National Park: Oak Spring: 4500ft.: coll. 14-V-1959 W. R. M. Mason (1♀, CNC); Dallas: cotton: coll.

13-X-1906 Hunter (1♀, USNM); Waco: cotton: coll. 15-IX-1939 P. A. Glick (1♂, USNM); Virginia: Louisa Co.: 4 mi. S Cuckoo: malaise trap: coll. (1–18)-VIII-1987 J. Kloke and D. R. Smith (4♀, USNM); Virginia: Louisa Co.: 4 mi. S Cuckoo: malaise trap: coll. 28-V–5-VI-1987 J. Kloke and D. R. Smith (1♂, USNM); Virginia: Louisa Co.: 6 mi. S Cuckoo: coll. 2-IX-1987 P. Thomas and D. R. Smith (1♂, INHS); Washington D.C.: coll. 19-VIII-1911 Fred K. Knab (1♀, USNM); MEXICO: Guadalajara: coll. Crawford (1♀, USNM); Veracruz: 3 mi. W Cardena: coll. 4-VII-1971 Clark, Murray, Hart, and Schaffner (1♀, TAMU); BRAZIL: 1956 (1♀, USNM).

Alphomelon xestopyga Deans, new species
(Fig. 5f)

Diagnosis.—Hind wing cu-a strongly angled at midpoint towards body. Petiolar ridge represented as a slight depression with petiole rugulose and slightly punctate. White spots on genae extending onto clypeus as dull yellow-brown coloration. Tarsal claws with 3–4 spines. Ovipositor evenly decurved.

Female.—Head: Dark brown except white coloration on gena extending from anterior tentorial pit posteriorly to occiput, dorsally to edge of eye, ventrally to mandible base, anteriorly onto clypeus as light brown coloration. Head slightly punctate, 1.1× wider than high. Face 2.1× wider than clypeus. Clypeus 1.5× wider than high. Malar suture 1.75× line between anterior tentorial pit and eye. Malar space not convex. *Antennae:* Brown, as long as body. *Eyes and Ocelli:* Eye 1.8× higher than wide. Ocelli clear to slightly yellow, sub-equal in size. Stemmaticum slightly raised, triangular with posterior-ocellar line 3× lateral-ocellar line. Ocular-ocellar line 1.0× posterior-ocellar line. *Mouthparts:* Mandibles reddish-brown, setose. Labrum light brown, flattened ventrally to slightly cleft. Palps orange-yellow. *Mesosoma:* Dark brown to black. Tegulae translucent honey-yellow, 2.0× wider than long, semicircular. Mesoscutum 1.3× wider than long, punctate and setose except medial area smooth and glabrous. Medial scutellar area triangular, smooth, setose, 0.8× longer than anterior scutellar furrow. Anterior scutellar furrow straight with 7–8 pits, 3× longer than line between lateral scutellar furrows. Lateral scutellar furrows obscurely costate basally becoming rugulose and wider apically with apical edge 0.4× lunule base width. Lunules short, triangular, 2× wider at base than high. Axillary projections with sculpturing arising at lateral 0.2 lunule base. Mesopleuron punctate, setose except for nitid area dorsad and ventrad the sternaulus. Mesonotum nitid except rugulose lateral metanotal pits and setose (~10 setae) raised area posterior to posterior scutellar depression. Lateral metanotal depressions skewed tear-drop shaped. Posterior scutellar depression 2× wider than long, divided medially (difficult to see full division). Anterior propodeal areas and area anterior to areola rugose. Posterior areas and areola nearly smooth to obscurely rugulose. Areola closed anteriorly with series of carinae, U-shaped, 1.25× longer than wide. Cluster of setae present anterior to propodeal spiracles. *Forelegs:* Honey-yellow except brown coxae and light brown trochanters. Tarsal claws reddish-brown. Arolia brown. *Mid-legs:* Honey-yellow except brown coxae and light brown trochanters. Tarsal claws reddish-brown. Arolia black. *Hind legs:* Coxae dark brown. Trochanters brown. Trochantellae honey-yellow. Femurs honey-yellow except apical 0.2 brown. Tibiae honey-yellow except basal 0.15 whitish, apical 0.10 brown, 4.9× longer than wide. Tibial spurs white, interior spur 1.4× longer than exterior spur. Basitarsi whitish basally fading evenly to light brown apically, 4.0× longer than wide. Remaining tarsomeres brown. Tarsal claws reddish-brown with 3 (50%) or 4 (50%) spines. Arolia black. *Wings:* Membranes hyaline. Stigmas

slightly elongate. Veins brown dorsally, whitish ventrally, becoming clear basally. Hind wing cu-a strongly angled medially back towards body. *Metasoma:* Dark brown. Petiole rectangular, 1.4× longer than posterior edge, glabrous except posterior 0.3 sparsely setose, rugulose and slightly punctate. Petiolar ridge represented as slight depression. Medial tergite II smooth, trapezoidal, brown, posterior 0.5 sparsely setose, 0.3× as long as anterior edge, posterior edge 1.4× anterior edge. Hypopygium evenly setose. *Genitalia:* Exerted portion of ovipositor orange-yellow, evenly decurved, 1.0× as long as hind basitarsus, 0.33× as wide as hind basitarsus, ventral valve with 2 teeth. Sheaths straight, evenly setose, brown exteriorly, whitish interiorly, with tips desclerotized.

Male.—As female, but smaller with lighter wing veins. Stigmas solid brown. Color patterns on legs with lighter shades of yellow and brown.

Cocoon.—Unknown.

Biology.—Reared as gregarious parasitoid from *Quinta cannae* on *Thalia geniculata*, from *Cynea irma* on *Maranta arundinacea* and *Calathea panamensis*, from *Saliana fusta* on *Maranta arundinacea* and *Calathea macrosepala*, from *Rhinthon cubana* on *Maranta arundinacea, Calathea lutea,* and *Calathea macrosepala*, from *Calpodes ethlius* on *Thalia geniculata, Maranta arundinacea, Calathea macrosepala,* and *Canna indica* in dry forest in Costa Rica (Janzen and Hallwachs 2002), and collected in rainforest malaise traps.

Etymology.—The name is derived from the Greek roots "xesto-" meaning polished and "-pyga" meaning rump. It refers to the petiole sculpturing.

Holotype.—COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Cafetal: 300m: 92-SRNP-4006: (1♀, USNM).

Paratypes.—COSTA RICA: Guanacaste: Area de Conservación Guanacaste: Sector Santa Rosa: Cafetal: 300m: 92-SRNP-4006: (1♂, USNM); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Cafetal: 300m: 92-SRNP-4011: (1♀, CNC); COSTA RICA: Guanacaste: Area de Conservación Guanacaste: Sector Santa Rosa: Cafetal: 300m: DHJ voucher #92-SRNP-4011: reared 27-VII-1992 D. H. Janzen et al. (1♂, CNC); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Cafetal: 300m: 92-SRNP-2757: (1♀, INBIO); COSTA RICA: Area de Conservación Guanacaste: Sector Santa Rosa: Cafetal: 300m: 92-SRNP-3991: (1♀, AEI); COSTA RICA: Area de Conservación Guanacaste: Sector Horizontes: Bejuco: 180m: #95-SRNP-8368: (1♀, UWY); COSTA RICA: Heredia: 3km. S Puerto Viejo: OTS La Selva: 100m: malaise trap: [1–15]-IX-1992 coll. P. Hanson (4♀, UWY); COSTA RICA: Heredia: 3km. S Puerto Viejo: OTS La Selva: 100m: malaise trap: X-1992 coll. P. Hanson (3♀, UWY); COSTA RICA: Limon: 4km NE Bribri: 50m: malaise trap: IV–VI-1990 coll. P. Hanson (1♀, UWY); COSTA RICA: Guanacaste: Cerro el Hacha: NW Volcán Orosi: 300m: malaise trap 1988 (1♀, UWY). COSTA RICA: Area de Conservación Guanacaste: 92-SRNP-4929 (1♀, INHS), 93-SRNP-6610 (1♀, 1♂, INHS), 92-SRNP-4040 (1♀, 1♂, INHS), 96-SRNP-10081 (1♀, 1♂, INHS), 97-SRNP-9479 (1♀, 1♂, INHS), 97-SRNP-9503 (1♀, 1♂, INHS), 97-SRNP-9840 (1♀, 1♂, INHS), 92-SRNP-4013 (1♀, 1♂, UWY), 92-SRNP-0414 (1♀, UWY), 92-SRNP-4033 (1♀, 1♂, UWY), 92-SRNP-4034 (1♀, 1♂, UWY), 92-SRNP-4037 (1♀, 1♂, UWY), 92-SRNP-4132 (1♀, 1♂, UWY), 92-SRNP-4392 (1♀, 1♂, UWY), 92-SRNP-4407 (1♀, 1♂, UWY), 93-SRNP-3739.1 (female), 93-SRNP-4416 (1♂, UWY), 93-SRNP-5194 (1♂, UWY), 93-SRNP-5203 (1♀, UWY), 93-SRNP-6226 (1♂, UWY), 93-SRNP-6228 (1♀, UWY), 93-SRNP-6229 (1♀, 1♂, UWY), 93-SRNP-6234 (1♀, UWY), 95-SRNP-8365 (1♀, UWY), 98-SRNP-5304 (1♂, UWY); COSTA RICA: Cartago Prov.: Turrialba: malaise trap: coll. 11-VI-1976 M. Wasbauer (1♀, INHS).

Other material examined.—COSTA RICA: Area de Conservación Guanacaste: (at

least one ♀, ♂ each for the following) **87-SRNP**-1008; **91-SRNP**: 2279, 2519, 2722, 2728; **92-SRNP**: 2324, 2743, 2744, 2746, 2747, 2756, 2757, 2758, 2760, 2763, 2767, 2768, 2769, 3394, 3404, 3919, 3988, 3990, 3991, 3994, 3996, 3999, 4002, 4006, 4007, 4011, 4012, 4013, 4014, 4017, 4021, 4030, 4033, 4034, 4037, 4038, 4039, 4040, 4127, 4132, 4144, 4145, 4392, 4407, 4928, 4929, 4932, 4937, 4941, 4945, 4954; **93-SRNP**: 1014, 3739.1, 3743, 4416, 5194, 5201, 5203, 5207, 5216, 5219, 5220, 5221, 5738, 6226, 6228, 6229, 6234, 6428, 6431, 6433, 6439, 6446, 6447, 6458, 6459, 6464, 6470, 6606, 6610, 6611, 6662, 6987, 6989, 7345; **94-SRNP**: 7378, 7383, 7395, 7396, 8346; **95-SRNP**: 4237, 4238, 4239, 8100, 8354, 8365, 8368, 8376, 8381; **96-SRNP**: 8351, 8352, 8445, 8447, 8451, 8912, 8913, 8914, 8915, 8916, 8917, 8918, 8919, 8920, 8921, 8923, 8924, 8925, 8927, 9136, 9141, 9144, 9148, 9283, 9877, 9878, 9879, 9881, 9882, 9883, 9884, 10081, 10591; **97-SRNP**: 9257, 9261, 9265, 9267, 9469, 9479, 9485, 9503, 9833, 9835, 9838, 9840, 4740; **98-SRNP**: 5288, 5298, 5299, 5300, 5301, 5304, 5507, 5509, 5511, 00-SRNP-3568; COSTA RICA: Ctgo. Turrialba: 600m: coll. II-80 H. and A. Howden (1♀, CNC).

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Host-specificity and Hyperparasitoids of Three New Costa Rican Species of *Microplitis* Foerster (Hymenoptera: Braconidae: Microgastrinae), Parasitoids of Sphingid Caterpillars

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Abstract.—Three new species of parasitoid wasps (Braconidae: Microgastrinae) from Costa Rica are described: ***Microplitis espinachi* Walker, n. sp.**; ***Microplitis figueresi* Walker, n. sp.** and ***Microplitis marini* Whitfield, n. sp.** Two parasitoids of Sphingidae are redescribed for comparison with the three new species: *Microplitis ceratomiae* Riley and ***Microplitis chacoensis* (Cameron) (=*Microplitis ayerzai* Brethes, New Synonymy)**. The ichneumonid wasp ***Acrolyta stroudi* Gauld, n. sp.,** and the chalcidid wasp ***Conura convergea* Delvare, n. sp.** are also described; both are hyperparasitoids of prepupae in newly spun cocoons of *M. espinachi* and *M. figueresi*. The mesochorine ichneumonid hyperparasitoid *Mesoschorus angustistigmatus* Dasch, a hyperparasitoid of *M. espinachi* and *M. espinachi* larvae while still inside the caterpillar, is redescribed. The seasonal biology and host specificity of the *Microplitis* and associated hyperparasitoids is discussed in the context of the extensive caterpillar and parasitoid inventory data for the Area de Conservación Guanacaste (ACG) in northwestern Costa Rica. *M. espinachi* is a dry forest parasitoid of *Agrius cingulata, Sphinx merops* and nine species of *Manduca* (all Sphingidae), all when in the most open and insolated habitats and on a variety of host plants; it does not search for other common species of *Manduca* or other Sphingidae in slightly shadier microhabitats a few meters away. The extremely similar *M. figueresi* parasitizes *Erinnyis ello* and *Erinnyis crameri* (Sphingidae) in slightly shadier older woody succession (only a few meters from the microhabitat occupied by *M. espinachi*), and conspicuously does not parasitize *Erinnyis oenotris* or the tens of other species of sphingid caterpillars in the same habitat. *M. figueresi* finds *E. ello* on seven different species of food plants, and *E. crameri* on two others (but does not parasitize *E. crameri* on an insolated third). Neither species of *Microplitis* extends from the ACG dry forest into the contiguous cloud forest or rain forest, even though their host caterpillars do. While *E. ello* is a common pest in commercial cassava plantations, *M. figueresi* does not appear to have followed this host into this highly insolated habitat. Both species are highly univoltine and pass the last two thirds of the rainy season and six-month dry season in an extremely tough silk cocoon in the litter. In the ACG, *M. marini* is a parasitoid of only *Xylophanes tersa* in very insolated low herbaceous vegetation in mid-elevation rainforest and lower elevation cloud forest, and does not parasitize at least 15 other species of *Xylophanes* in the adjacent forest understory.

The Area de Conservacion Guanacaste (ACG) in northwestern Costa Rica contains 110,000 ha of dry forest and associated wetter ecosystems that are being restored, developed and conserved for their ecosystem services and biodiversity (Janzen 1988a, 1988b, 1993, 1998a, 1998b, 1999a, 1999b, 2000a, 2000b, 2001a, 2001b;

⟨http://www.acguanacaste.ac.cr⟩, ⟨http://janzen.sas.upenn.edu/caterpillars/RR/rincon_rainforest.htm⟩). As part of the biodiversity development of these wildlands, the ACG is conducting, in collaboration with the taxonomic community, a thorough inventory of its biodiversity so as to set up that biodiversity for nondamaging use (e.g., Janzen 1996a, 1996b). Such inventory encounters many undescribed species, and simultaneously reveals a sketchy outline of their natural history and the ecological patterns to which they contribute (e.g., Dangerfield et al. 1996, Gauld and Janzen 1994, Sharkey and Janzen 1995, Woodley and Janzen 1995, Miller et al. 1997, Janzen and Gauld 1997, Janzen et al. 1998, Zitani et al. 1998, Burns and Janzen 1999, Burns and Janzen 2001, Schauff and Janzen 2001, Lachance et al. 2001). Inventory also connects the newly encountered species with other better-known species, thereby allowing increased inferential understanding of all of their natural histories, just as does cladistics.

One of the foci of the ACG biodiversity inventory has been dry forest macrolepidoptera caterpillars (Janzen 1985, 1988a, 1993) and their parasitoids (e.g., Gauld and Janzen 1994, Gauld et al. 1992, Dangerfield et al. 1996, Sharkey and Janzen 1995, Woodley and Janzen 1995, Janzen and Gauld 1997, Janzen et al. 1998, Zitani et al. 1998, Schauff and Janzen 2001, Burns and Janzen 2001; ⟨http://janzen.sas.upenn.edu⟩). Caterpillars of Sphingidae (Janzen 1984, 1986) have been frequently encountered in the inventory process, and then reared in captivity to obtain their parasitoids. In this paper we describe three new species of microgastrine braconid wasp parasitoids, and their ichneumonid and chalcidid hyperparasitoid wasps, that parasitize the ACG dry forest sphingid caterpillars (Figs. 1–5, 8), and compare them with *Microplitis ceratomiae*, a well-known North American sphingid parasitoid (Fig. 6), and with *M. chacoensis* (Fig. 7), a widespread but poorly known South American species with similar biology. We also use natural history information from the ACG inventory to begin to elucidate how these parasitoids interact with their hosts.

NATURAL HISTORY AND METHODS OVERVIEW

The ACG dry forest, lying on the coastal plain and plateaus between the Pacific Ocean and the Cordillera Guanacaste 20–40 km to the east (Janzen 2002a, 2002b, Burns and Janzen 2001), contains about 78 species of Sphingidae that annually have one or more generations during the 6-month rainy season (mid-May to December; Janzen 1993). More than 14,000 caterpillars of all but five of these species have been located in the wild and reared in various numbers (Janzen and Hallwachs 2002). Among these reared caterpillars are four common species of *Erinnyis* (*Erinnyis ello, Erinnyis alope, Erinnyis crameri, Erinnyis oenotrus*), two rare species of *Erinnyis* (*Erinnyis obscura, Erinnyis lassauxi*), eight common species of *Manduca* (*Manduca rustica, Manduca florestan, Manduca lefeburii, Manduca barnesi, Manduca lanuginosa, Manduca dilucida, Manduca muscosa, Manduca occulta*), and two rare species of *Manduca* (*Manduca sexta, Manduca hannibal*). Several of these species, and a few other Sphingidae (*Sphinx merops, Agrius cingulata*) are frequently parasitized by two species (described below) of very host-specific small braconid wasps in the cosmopolitan genus *Microplitis* (Table 1). Another rare sphingid caterpillar, *Xylophanes tersa*, is attacked by a third closely related species of *Microplitis* (also described below) at the mid-elevation interface of dry forest with cloud forest. All three of these *Microplitis* are closely related to *Microplitis ceratomiae*, a widely distributed North American sphingid parasitoid, and to *M. chacoensis* (Cameron), a similarly widespread South American

Table 1. Intensity of attack by *Microplitis figueresi* and *Microplitis espinachi* for 5,853 wild-caught caterpillars of the 19 species for which at least one attack has been recorded in the dry forested Sector Santa Rosa of the Area de Conservación Guanacaste. Neither species of *Microplitis* attcked another 8,159 wild-caught sphingid caterpillars of 54 other species in the same habitat. Another 70,000-plus wild-caught caterpillars of more than 1,650 species in the same habitat did not yield either species of *Microplitis* (source: Janzen and Hallwachs 2002).

Braconid species	Sphingid species	Number reared	Percent attacked by *Microplitis*	% Identified to species
Microplitis figueresi	*Erinnyis crameri* (Schaus)	501	23	74
	Erinnyis ello (Linnaeus)	481	26	76
	Erinnyis lassauxii (Boisduval)	11	9 (n=1)	100
	Xylophanes turbata (Edwards)	1120	0.09 (n=1)	100
Microplitis espinachi	*Agrius cingulata* (Fabricius)	70	9	100
	Cocytius duponchel (Poey)	164	1.3 (n=3)	100
	Erinnyis ello (Linnaeus)	481	1.2 (n=6)	100
	Manduca barnesi (Clark)	87	1.1 (n=1)	100
	Manduca corallina (Druce)	75	8	100
	Manduca dilucida (Edwards)	654	0.7 (n=3)	100
	Manduca florestan (Stoll)	395	2.5	100
	Manduca hannibal (Cramer)	3	100 (n=3)	100
	Manduca lanuginosa (Edwards)	847	0.1 (n=1)	86
	Manduca lefeburii (Guer.-Men.)	143	30	100
	Manduca muscosa (Roth. & Jord.)	74	11	81
	Manduca occulta (Roth & Jord.)	96	10	100
	Manduca rustica (Fabricius)	219	15	100
	Manduca sexta (Linnaeus)	49	2 (n=1)	100
	Perigonia ilus Boisduval	370	1.6 (n=6)	100
	Sphinx merops Boisduval	13	15 (n=2)	100

species that also parasitizes sphingids. The braconids that parasitize *Erinnyis* and *Manduca* in the ACG dry forest are in turn hyperparasitized by a species of *Conura* (Chalcididae, described below) and two species each of *Acrolyta* and *Mesochorus* (Ichneumonidae). These caterpillars are also parasitized by a small fauna of other wasps and parasitic flies (Tachinidae), but they are not treated extensively here.

Microplitis parasitoids of *Manduca* and *Erinnyis* caterpillars in the ACG dry forest are usually first noticed when a full-sized last instar sphingid caterpillar "hangs up" on a branch in its rearing container or on a twig among the foliage of its food plants in the wild. On the following morning (after daybreak) the wasp larvae are encountered wiggling their way through multiple holes they have made in the back of the caterpillar (Fig. 1). The holes close rather than lead to caterpillar blood loss and the caterpillar body remains turgid, physiologically alive (but motionless unless poked, when it violently turns toward the contact) and clinging tightly to the substrate. The caterpillar usually dies and falls from the substrate 1–2 days after the *Microplitis* larvae have emerged.

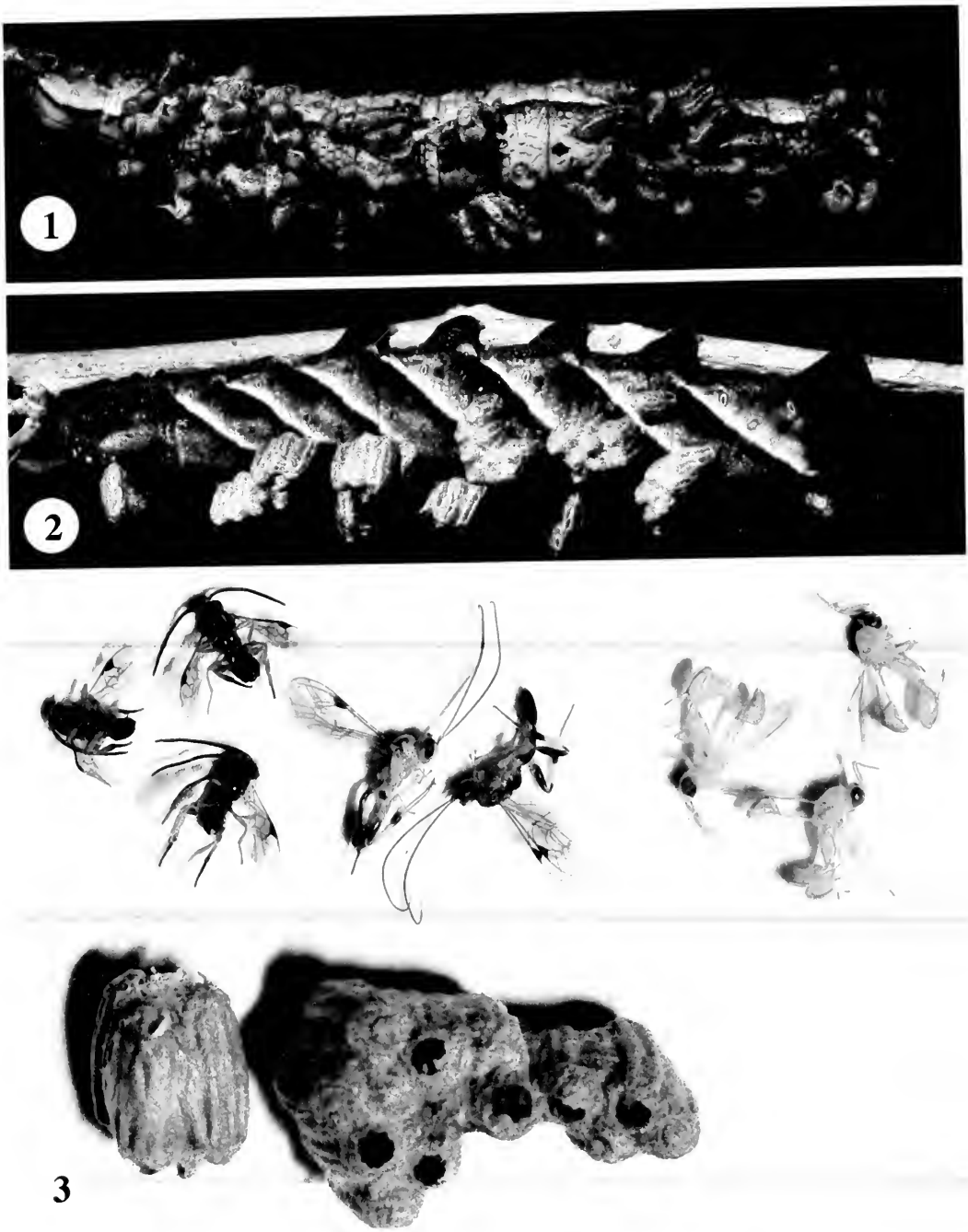
Each newly emerged *Microplitis* larva from *Manduca* and *Erinnyis* immediately begins to spin its cocoon while still (lightly) attached by its posterior end to the back of the caterpillar. There are usually many tens of larvae spinning in clumps over their emergence holes, approximately erect at right angles to the caterpillar cuticle, with the result that any given cocoon is lightly to firmly attached to several other adjacent cocoons by the coincident sticking and drying of their silk glue (Fig. 2). A single larva can, however, spin a normal cocoon without the presence of other larvae, especially if it is still attached to

the caterpillar. On the other hand, the other species of *Microplitis* described here emerge in patches and thus very tightly side-by-side, to form a very distinctive dense solid block of cocoons tightly glued to the caterpillar cuticle, with their long axis at right angles to the caterpillar cuticle (Figs. 4–7).

If the caterpillar with its newly emerged wasp larvae is not perturbed during the day of emergence, essentially all of the larvae successfully spin cocoons. In nature, the hard cocoons are incorporated into the litter as the caterpillar decomposes. When rearing in the laboratory, once the cocoons are hard it is best to gently pull them off the back of the caterpillar and put them in a clean dry bottle with their voucher label, and set them aside for eclosion. If left with the now dead and rotting caterpillar and other detritus in the rearing bag, the effects of decomposition may kill the wasp larvae even in hard and well-formed cocoons. A few of the *Microplitis* (and hyperparasites) may eclose within several weeks or even 1–2 months, but the great majority will not eclose until the beginning of the next year's rainy season.

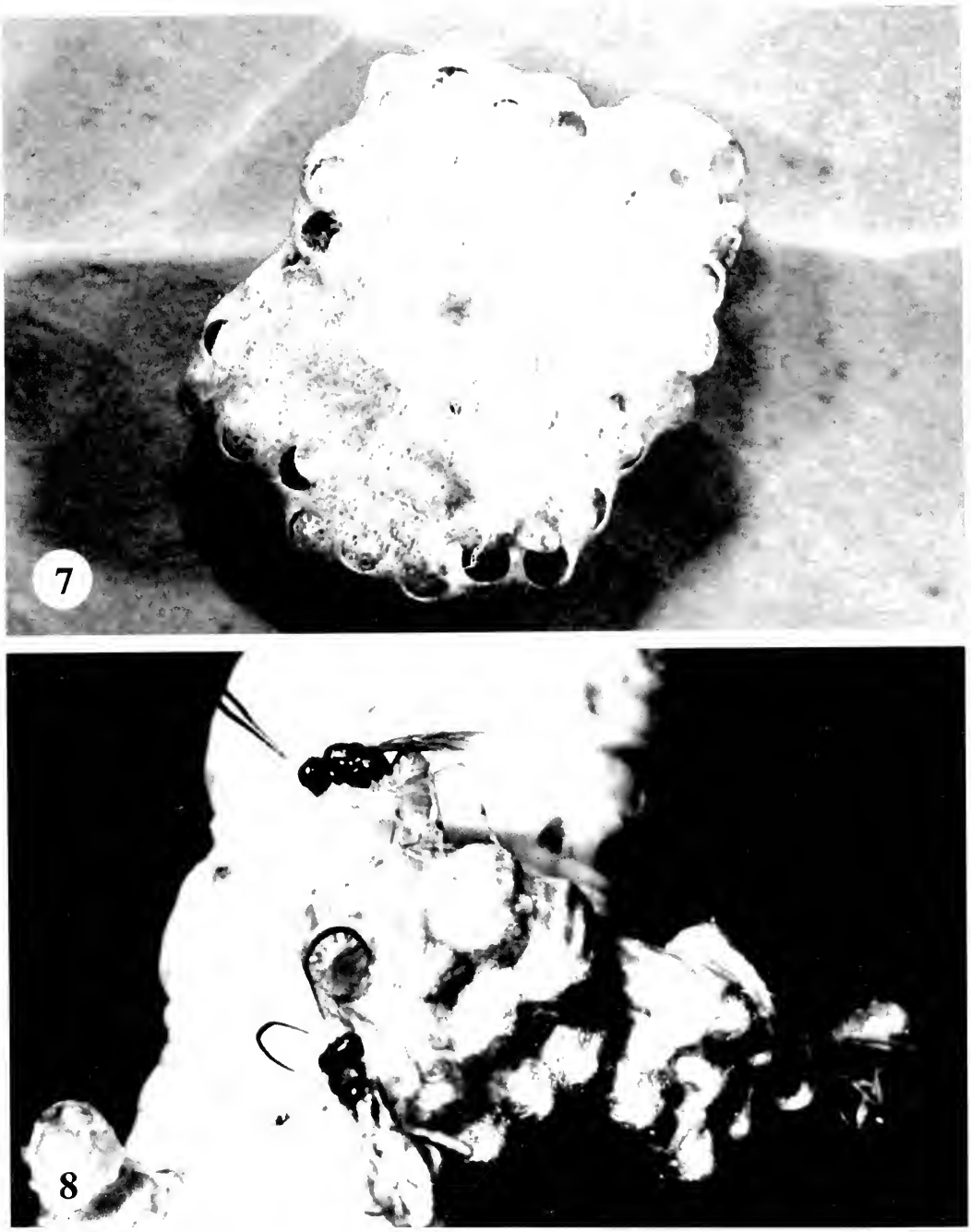
Not all broods of *Microplitis* larvae encountered in this inventory have generated an adult *Microplitis* that can be sent off for identification, owing to hyperparasitization, to bad husbandry, or to the cocoons being discarded because of the high maintenance cost of holding them for a year to record eclosion dates and obtain vouchers (however, their very distinctive cocoons are easily distinguished from those of any other parasites). All such cases are restricted to the four (of the 18) host caterpillar species with very large sample sizes of parasitization, and this has resulted in only 76% to 86% of the wasps being identifiable to species (Table 1). However, in these four cases there is no basis to suspect or assume that those *Microplitis* that did not survive to adults were of any other species than their conspecifics in the same species of host caterpillars, though this remains a remote possibility in the case of the *Microplitis* in *Erinnyis ello* since in 5% of the cases they were indeed *M. espinachi* instead of the usual *M. figueresi* (Table 1). The same ecological conclusions are reached whether just the species-vouchered percent parasitizations are used, or whether those only generically identified are assumed to be the same species as their congenerics reared from the same species of caterpillar. All records of *Microplitis marini* discussed here are based on adults identified by J. B. Whitfield (though its very distinctive cocoons and high host specificity probably render this unnecessary), and all hyperparasite records discussed are based on adults identified by I. D. Gauld or G. Delvare.

In this paper we make use of the percentages of caterpillars attacked or the numbers of cases of *Microplitis* attack. These data are meant to be used only for the specific questions addressed. This use takes into account the fact that the collecting underpinning this study was conducted with the goal of qualitative species-level inventory, rather than planned statistical sampling or demographic monitoring. For example, there are only 70 *Agrius cingulata* rearing records to compare with 613 *Manduca dilucida* and 847 *Manduca lanuginosa* records, but this ratio has no bearing on the relative abundance of these three species of caterpillars in the wild in the ACG dry forest habitat (but says much of the relative ease of finding them on their respective food plants). On the other hand, the fact that only one *Microplitis* was reared from the hundreds of *Manduca lanuginosa* caterpillars captured on nine species of host plants, and none reared from hundreds of equally haphazardly located *Erinnyis oenotrus* caterpillars on one species of host plant, does allow the robust conclusion that these two species of sphingids are not successfully used by *Microplitis* even though many of their congeners living only a few meters away are often attacked by *Microplitis*.



Figs. 1–3. 1, Last instar larva of *Erinnyis ello* with newly emerged prepupal *Microplitis figueresi* larvae, just beginning to spin (84-SRNP-683). 2, Last instar larva of *Manduca occulta* with newly spun cocoons of *Microplitis espinachi* still attached to its back (93-SRNP-1906). 3, *Microplitis espinachi* (upper left), *Mesochorus microstigmatus* (upper center), *Conura convergea* (upper right), and cocoons (lower center) with *Microplitis espinachi* exit holes from *Manduca lefeburiii* (92-SRNP-2496).

Figs. 4–6. 4, *Microplitis marini* hard and tough cocoons firmly stuck to the back of a last instar *Xylophanes tersa* (97-SRNP-1395). 5, *Microplitis marini* cocoons spun on back of *Xylophanes falco* on *Bouvardia glabra*, Box Canyon, Arizona (photo courtesy Jim Tuttle). 6, *Microplitis ceratomiae* cocoons on back of undetermined sphingid larva, Sierra Co., nr. Sierraville, California (photo by David Wagner and Jim Whitfield).



Figs. 7–8. 7, *Microplitis chacoensis* (Cameron) emerged cocoon mass from *Manduca* sp., Villa de Cura, Venezuela (photo by J. Whittfield). 8, *Acrolyta stroudi* ovipositing in cocoons of *Microplitis espinachi* (93-SRNP-2227).

A second methodological complexity is that if a wild-caught caterpillar is brought into captivity and reared in a plastic bag (see methods at http://janzen.sas.upenn.edu), it is protected from further oviposition (or other kinds of attack) by parasitoids and hyperparasitoids. This means that "percent attack" figures for laboratory-reared wild-caught caterpillars will always be lower, and variably lower depending on the caterpillar age at time of capture, than is the case in nature. The major exception to this statement is the case where a caterpillar is captured after the instar in which parasite oviposition occurs but before the stage at which the parasite emerges or ecloses. Our collection methods preclude the discovery of parasitoids that attack sphingid pupae or *Microplitis* cocoons directly rather than ovipisiting into sphingid larvae.

Rearing *Microplitis* (but not its hyperparasites) requires a minimum of a year, since many of the species discussed here pass many months of the rainy and dry seasons as dormant prepupae or pupae. In nature, they are tied to eclosion dates by both internal physiological processes and externally received cues. ACG inventory rearing is done in plastic bags and glass bottles in open-air rearing barns (http://janzen.sas.upenn.edu) but these air temperatures only approximate those in nature, since the temperatures to which the cocoons are subject in nature are also determined by evaporative cooling and heat retention by moist litter. The result is that eclosion dates in captivity are indicators but do not precisely mirror the phenology of free-living siblings.

SPECIES DESCRIPTIONS

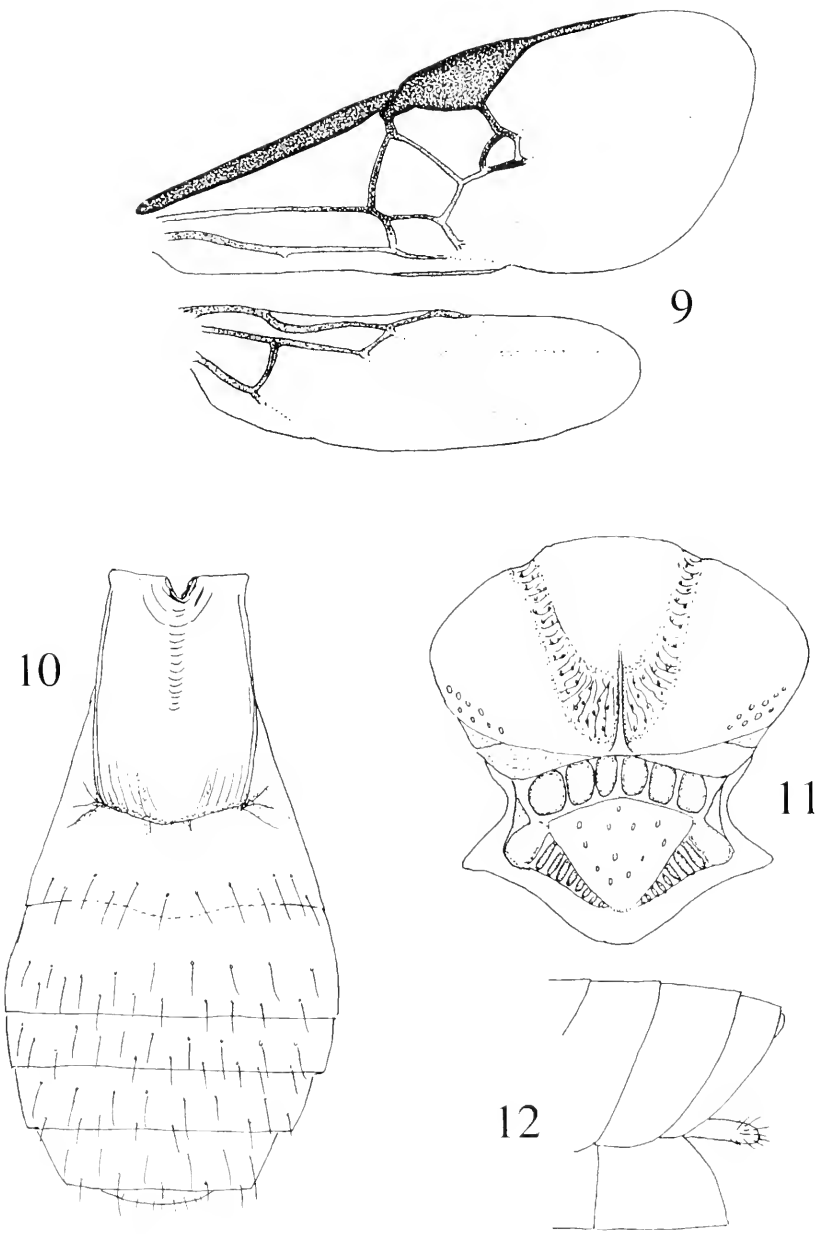
BRACONIDAE

The Microgastrinae is one of the largest subfamilies of Braconidae, with an estimated world fauna of 5,000–10,000 species. Mason (1981) presents the first keys to the currently defined genera from which *Microplitis* can be distinguished; Whitfield (1997) provides a fully illustrated key to the New World genera of Microgastrinae including *Microplitis*.

Microplitis espinachi Walker, new species

(Figs. 2–3, 9–12, 17, 21, 22)

Female.—Color: General body color black except: pedicel and scape brown, legs variable but usually light brown to yellow; hind femora and tibia infuscate on apical third; tarsi dark brown; fore wing veins almost all pigmented; tergite I of metasoma and tergite II medially sometimes dark brown. *Head:* Face rugose punctate; labrum prominent with an apical shelf which forms a lip, the mandibles forming a margin to this labral lobe; eyes hairy; frons shiny and faintly punctate; ocelli large, their diameter about equal to the distance between the lateral and anterior ocellus. Antennae almost as long as body; basal half of flagellum thick, apical half tapering toward apex. *Mesosoma:* Mesonotum (Figs. 11, 17) shiny, finely punctate, rugose on anterolateral margins; notaulices complete, broad and rugose anteriorly; coalescing posteromedially into a rugose area which is often also foveolate, this area divided by a longitudinal carina. Scutellum shiny, faintly punctate. Metanotum with large setose anterolateral lobes (Fig. 19). Propodeum rugose, divided by a prominent median longitudinal carina (Fig. 19). *Metasoma:* Tergite I parallel sided on anterior two thirds, shiny with a shallow depression medially; posterior third raised, faintly punctate laterally, shiny medially and constricted where it joins tergite II. Median field of tergite II faintly indicated by two ill-defined depressions anteromedially, when visible they are directed towards the posterolateral margins; a posterolateral irregular row of hairs present, sometimes formed into two rows. Remaining tergites shiny with scattered hairs. Hypopygium large. Ovipositor sheaths short and just visible beyond the



Figs. 9–12. *Microplitis espinachi* Walker, n. sp. 9, wings. 10, Metasoma in dorsal view. 11, Mesoscutum and scutellum in dorsal view. 12, Apex of female metasoma, lateral view showing hypopygium and ovipositor sheaths.

hypopygium in most dead specimens. Ovipositor (Fig. 21) bearing 4 teeth distally, second valvulae constricted medially. Hind tibia with a few scattered spines on outer margin. Hind tarsi laterally compressed, basal tarsomere the longest, as long as the total length of the following three segments, tibial spurs subequal, less than half the length of the basal tarsal segment. *Wings:* Fore wing (Figs. 9, 22) with stigmal vein R1 thick and about 1.5 times the length of the distance between the

apex of R1 and spurious vein 3Rs. Areolet sometime variable in shape but usually 1Rs is curved and longer than 2Rs which is shorter than r-m and distally angled at their junction, r-m less pigmented and subequal with 2M, 2rs+m often faintly pigmented and subequal with 2M.

Male.—Similar to female except antennal segments longer.

Cocoon.—Figs. 2, 3. Brownish, ribbed, spun in small groups on the back of the host caterpillar.

Material examined.—**Holotype female:** Costa Rica, Guanacaste Pr., Guanacaste Conserv. Area. D.H. Janzen, Voucher Specimen Database, rearing voucher 93-SRNP-1895, host *Manduca occulta* feeding on *Cestrum glanduliferum*. Deposited in U. S. National Museum, Washington, D.C. **Paratypes:** 761 females and 562 males have been deposited in INBio, U. S. National Museum, Washington, The Natural History Museum, London, and Canadian National Collection, Ottawa. REARED SPECIMENS: 7m, 83-SRNP-726; 3f & 7m, 84-SRNP-660.1; 2m, 84-SRNP-931; 2f & 2m, 84-SRNP-1127; 4f & 1m, 84-SRNP-813; 6f & 4m, 86-SRNP-232; 1m, 86-SRNP-321; 1f & 1m, 86-SRNP-330; 1f & 5m, 87-SRNP-529; 6f & 9m, 87-SRNP-556; 12f & 17m; 87-SRNP-557; 22f & 25m, 87-SRNP-558; 19f & 9m, 87-SRNP-559; 16f & 2m, 87-SRNP-566; 46f & 16m, 87-SRNP-573; 7f & 1m, 87-SRNP-677; 1f & 37m, 87-SRNP-582; 5f & 2m, 89-SRNP-489; 8f & 2m, 89-SRNP-575; 1f & 1m, 89-SRNP-617; 1f & 1m, 90-SRNP-771; 1f & 1m, 90-SRNP-1129; 20f & 3m, 91-SRNP-799a; 1f, 91-SRNP-799b; 12f & 19m, 91-SRNP-899; 1f & 2m, 91-SRNP-936; 13f & 1m, 91-SRNP-1007a; 6f & 1m, 91-SRNP-1007b; 2m, 91-SRNP-1007c; 1m, 91-SRNP-1141; 7m, 91-SRNP-1242; 6f & 3m, 91-SRNP-1271a; 12f & 1m, 91-SRNP 1271b; 1f & 1m, 91-SRNP 1273a; 2f, 91-SRNP-1273b; 8f & 1m, 91-SRNP-1273c; 1f & 1m, 91-SRNP-1275a; 6m, 91-SRNP-1275b; 1f & 3m, 91-SRNP-1275c; 7m, 91-SRNP-1275d; 3f & 2m, 91-SRNP-1409; 12f & 14m, 91-SRNP-1706; 5m, 91-SRNP-1848; 10f & 3m, 91-SRNP-1969; 30f & 14m, 92-SRNP-1604; 4f & 4m, 92-SRNP-1607; 29f & 26m, 92-SRNP-2135; 11f & 11m, 92-SRNP-2156; 12f & 3m, 92-SRNP-2333; 3f & 8m, 92-SRNP-2515; 14f & 19m, 92-SRNP-2516; 7f & 7m, 92-SRNP-2518; 5f & 3m, 92-SRNP-2519; 18f & 9m, 92-SRNP-2668; 17f & 3m, 92-SRNP-2699; 21f & 7m, 92-SRNP-2712; 5f & 15m, 92-SRNP-2726; 14f & 4m, 92-SRNP-2740; 11f & 6m, 92-SRNP-2773; 7f & 6m, 92-SRNP-3382; 20f & 38m, 92-SRNP-3414; 14f & 4m, 93-SRNP-1644; 12f & 9m, 93-SRNP-1808; 3f, 93-SRNP-1820; 3f & 1m, 93-SRNP-1891; 12f & 15m, 93-SRNP-1893a; 1f, 93-SRNP-1893b; 5f & 15m, 93-SRNP-1894; 22f & 9m, 93-SRNP-1895; 32f & 9m, 93-SRNP-1896; 10f & 19m, 93-SRNP-1897; 38f & 22m, 93-SRNP-1906; 21f & 1m, 93-SRNP-1939; 17f & 8m, 93-SRNP-1989; 15f & 4m, 93-SRNP-2185; 6f & 1m, 93-SRNP-2228; 5f & 1m, 93-SRNP-2229; 23f & 12m, 93-SRNP-2332; 2f & 3m, 93-SRNP-2445; 15f & 11m, 93-SRNP-2450.

Etymology.—This species is named after Carlos Espinach in recognition of his nine years of tireless efforts to locate major economic resources for the conservation of Costa Rican wildland biodiversity, his long struggle to facilitate former President Jose Maria Figueres Olsen to be elected, and his support of the Area de Conservacion Guanacaste's efforts to incorporate a portion of Finca Pasmompa.

Comments.—This species corresponds to "*Microplitis* n. sp. 1" in the phylogenetic study by Whitfield et al. (2002). Under that name, DNA sequence data for the 16S, COI and 28S genes have been deposited in GenBank with accession numbers AY044197, AY044211 and AY044222, respectively.

Microplitis figueresi Walker, new species

(Figs. 1, 13–16, 18, 20, 23–25)

Similar to *M. espinachi* except: face smoother, narrower between the eyes, shorter distance from antennal sockets to clypeus; mesoscutum with ill-defined no-

taulices (Fig. 18), smooth posteromedially but with a faint longitudinal ridge often present; ovipositor (Fig. 20) bearing only three teeth distally, second valvulae distal to the medial constriction, broader and shorter; fore wing with areolet of different shape (Figs. 23–25) more variable than *M. espinachi* but usually with r-m slightly shorter than 2M; median field of tergite II usually with lateral margins present which are almost parallel sided and directed towards the posterior margin.

Material examined.—**Holotype female:** Costa Rica, Guanacaste Pr., Guanacaste Conserv. Area. D.H. Janzen, Voucher Specimen Database, rearing voucher 92-SRNP-1643, host *Erinnyis ello* feeding on *Sebastiana pavoniana*. Deposited in U. S. National Museum, Washington, D.C. **Paratypes:** 209 females and 175 males have been have been deposited in INBio, U. S. National Museum, Washington, The Natural History Museum, London, and Canadian National Collection, Ottawa. REARED SPECIMENS: 1f & 1m, 84-SRNP-248; 1f & 1m, 84-SRNP-255; 1f & 1m, 84-SRNP-257; 2f, 84-SRNP-292; 1f & 1m, 84-SRNP-344; 71f & 34m, 84-SRNP-687; 1f & 1m, 86-SRNP-62.1; 1f & 1m, 86-SRNP-119.1; 33f & 13m, 88-SRNP-116; 9f & 3m, 88-SRNP-160; 2f, 90-SRNP-160; 1f & 2m, 90-SRNP-166; 10f & 18m, 90-SRNP-170; 2m, 90-SRNP-214; 1f & 1m, 91-SRNP-572; 2f & 1m, 91-SRNP-70; 1f & 6m, 91-SRNP-813a; 1f, 91-SRNP-813b; 3m, 91-SRNP-813c; 4f & 2m, 91-SRNP-900a; 1f & 1m, 91-SRNP-900b; 3f, 91-SRNP-901a; 1f & 1m, 91-SRNP-901b; 1f, 91-SRNP-911; 3f, 92-SRNP-1520; 10f & 11m, 92-SRNP-1522; 14f & 38m, 92-SRNP-1643; 3f & 7m, 92-SRNP-2127; 16f & 11m, 92-SRNP-2155; 2f & 5m, 92-SRNP-2256; 6f & 8m, 93-SRNP-1645; 5f & 1m, 93-SRNP-1834; 1f & 1m, 93-SRNP-1837.

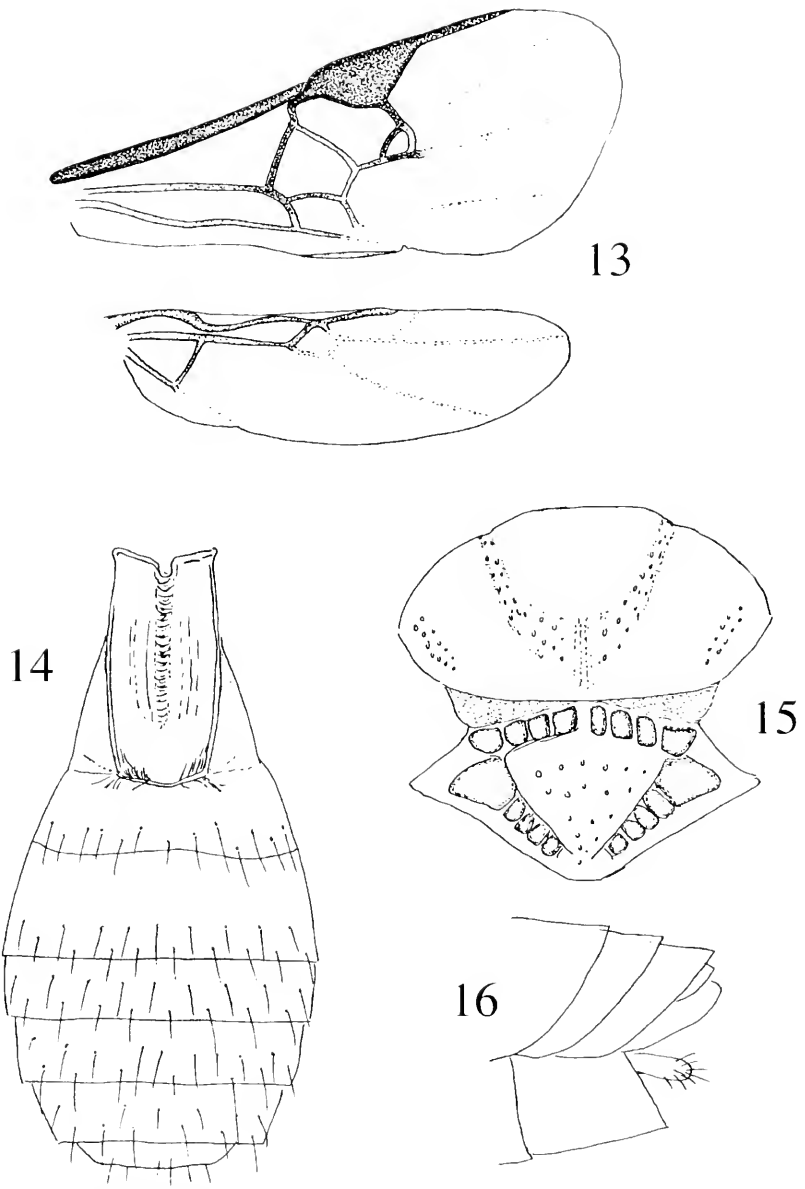
Etymology.—This species is named after former President Jose Maria Figueres Olsen in recognition of his enormous contribution to the survival of wild biodiversity in Costa Rica and his concern for the improvement of the quality of life for the custodians of that biodiversity. It is especially apt that this species is a potential biological control agent of *Erinnyis ello*, the cassava hornworm, since former President Figueres served as Costa Rica's Minister of Agriculture and Ranching before he became president.

Comments.—This species corresponds to "*Microplitis* n. sp. 2" in the phylogenetic study by Whitfield et al. (2002). Under that name, DNA sequence data for the 16S, COI and 28S genes have been deposited in GenBank with accession numbers AY044198, AY044212 and AY044223, respectively.

Microplitis marini Whitfield, new species

(Figs. 5, 28–31)

Female.—Body length 3.5 mm. Fore wing length 3.6 mm. *Color:* General body color black, except lighter brown/yellowish labial and maxillary palps, all femora and tibiae, fore and mid tarsi, hind basitarsi, and lateral semimembranous margins of first metasomal tergum. Wings hyaline to faintly smoky, veins including stigma generally pigmented dark brown, with (RS + M)b and 1m-cu paler. *Head:* Face relatively flat and wider than tall, slightly bulging medially, coarsely punctate to punctulorugose. Vertex with posterior ocelli at posterior edge of weak smoother depression that includes medial ocellus. All ocelli distinctly farther apart from each other than their own diameters. Antennae evenly thick, slightly longer than entire body length. *Mesosoma:* Mesonotum (Fig. 30) coarsely punctate with smoother regions laterally and anteromedially; notaulices complete, foveolate and merging posteriorly into a broad foveolate area nearly bisected by hint of obsolescent medial carina. Scutellum with sparse punctures, separated from mesoscutum by scrobe with four large pits. Metanotum with broad anterolateral setose lobes. Propodeum strongly and evenly rugose, di-



Figs. 13–16. *Microplitis figueresi* Walker, n. sp. 13, Wings. 14, Metasoma in dorsal view. 15, Mesoscutum and scutellum in dorsal view. 16, Apex of female metasoma, lateral view showing hypopygium and ovipositor sheaths.

vided by prominent medial longitudinal carina. *Metasoma:* Tergite I (Fig. 29) relatively parallel-sided up to broadly rounded apex, just slightly less than twice as long as broad, sparsely puncate along anterolateral margins and laterally on rounded apex, with distinct but shallow longitudinal medial groove over anterior 0.6–0.7. Median field of tergite II not obviously indicated except at extreme anterolateral corners. Tergite II and remaining terga with usually 2 irregular rows of setae posteriorly. Hypopygium relatively short but not distinctly truncate apically

(Fig. 31). Ovipositor sheaths short, blunt, apically hairy, projecting only to about end of hypopygium. *Legs:* Hind tibiae slightly thickened, with scattered thicker spines on outer faces. Hind basitarsus approximately as long as next two tarsomeres combined. Hind tibial spurs subequal in length, outer one slightly thicker. *Wings:* Fore wing (Fig. 28) R1 extending about 1.5 times as far beyond stigma as distance from its distal tip to end of 3RS fold. Stigma evenly dark brown, without basal lighter spot. Areolet large and quadrangular, angle between 3RSa and r-m sharp and distinct.

Male.—Similar to female except antennal segments longer relative to body.

Cocoon (Figs. 5, 6).—Rusty-colored, tough, cemented together in blocks on the back of host caterpillar.

Material examined.—**Holotype female:** COSTA RICA: Guanacaste Prov., Area de Conservacion Guanacaste, Sector Cacao, Arenales, 19-VI-1997, Benigno Guadamuz, reared ex *Xylophanes tersa* (Linnaeus), (host plant not known but all other rearing records are Rubiaceae), Voucher Specimen Database, rearing voucher 97-SRNP-1395. Deposited in U. S. National Museum, Washington, D.C. **Paratypes:** 5 females, 2 males, same data as holotype. Also 1 male, COSTA RICA: Guanacaste Prov., Area de Conservacion Guanacaste, Sector Cacao, Est. Cacao, 18-VI-1995, coll. "gusaneros", reared ex *Xylophanes tersa* (host plant not known but all other rearing records are Rubiaceae), Voucher Specimen Database, rearing voucher 95-SRNP-847. Deposited in INBio, U. S. National Museum, Washington, The Natural History Museum, London and Canadian National Collection, Ottawa. **Other material:** COSTA RICA: Malaise trapped, wild caught specimens from Universidad de Costa Rica and INBio.: 1f Fca. Cafrosa. Est. Las Mellizas, P.N. Amistad, 1300m. Prov. Punt. COSTA RICA. M. Ramirez. Mar 1991. L-S-316100, 596100; 3f, Costa Rica: Puntarenas, San Vito, Estac. Biol. Las Alturas, 1500m, ii.1992, Paul Hanson; 1f, Costa Rica: Puntarenas, San Vito, Estac. Biol. Las Alturas, 1500m, i.1992, Paul Hanson. ARIZONA: Pima Co., Box Canyon, 14 females, 1 male, 1-IX-2000, J. P. Tuttle, host fifth instar larva of *Xylophanes falco* on *Bouvardia glabra* Polak., emerged 9-IX-2000.

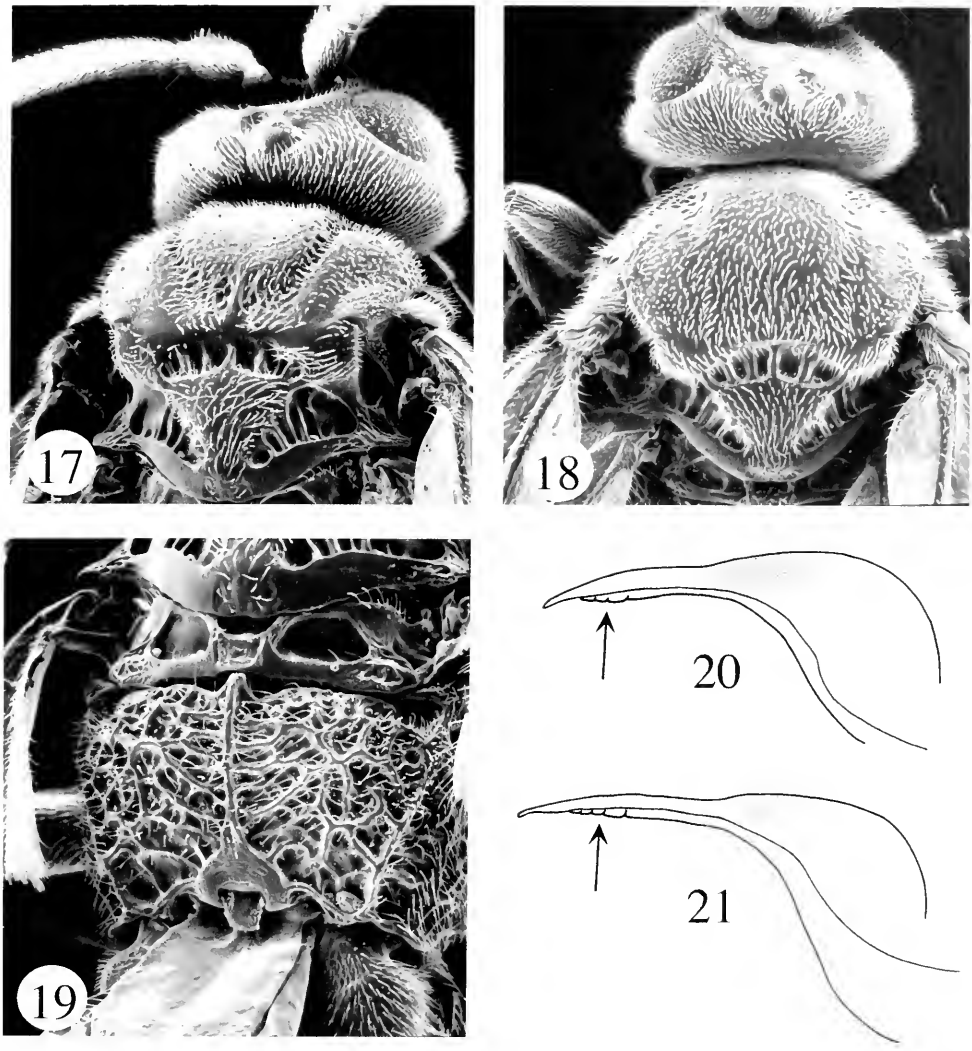
Etymology.—This species is dedicated to Sr. Sigifredo Marín Zuñiga, the former Director of the Area de Conservación Guanacaste (ACG), in recognition of three decades of dedicated service to the ideals and process of the Costa Rican Servicio de Parques Nacionales, in recognition of the guidance of the ACG through rough waters by him and his family from 1987 to the present, and in recognition of his explicit efforts to conserve the medium-elevation tropical habitats in which this species occurs.

Comments.—This species corresponds to "*Microplitis* n. sp, 3" in the phylogenetic study by Whitfield et al. (2002). Under that name, DNA sequence data for the 16S, COI and 28S genes have been deposited in GenBank with accession numbers AY044199, AY044213 and AY044224, respectively.

The *M. marini* records from Arizona, while appearing geographically disjunct, are from the same subgroup of the host genus—*Xylophanes*—which occurs throughout the regions between Arizona and Costa Rica. Although clearly similar in many respects to both *M. espinachi* and *M. figueresi*, (especially the former), this third new species appears to be most closely related to the nearctic species *M. ceratomiae* Riley and the South American species *M. chacoensis* (Cameron) (see comparisons below). Additionally, the three species spin very similar cocoon masses on the backs of their host caterpillars (see Figs. 4–7). Brief redescriptions of both related species are provided below for comparison.

Microplitis ceratomiae Riley
(Figs. 6, 32–35)

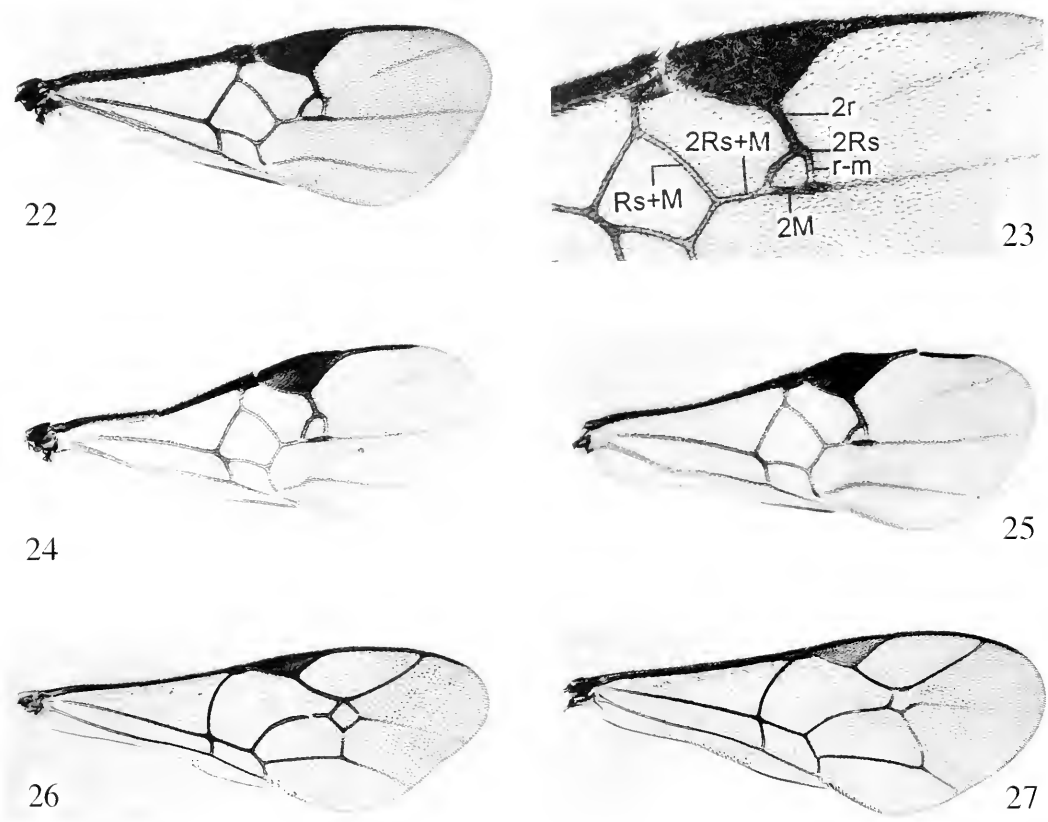
Microplitis ceratomiae Riley, 1881. Type, U.S. National Museum, examined.



Figs. 17–21. 17, *Microplitis espinachi* mesonotum illustrating complete notaulices. 18, *Microplitis figueresi* mesonotum illustrating ill-defined notaulices. 19, *Microplitis espinachi* thorax illustrating large setose anterolateral lobes on the metanotum and the propodeum divided by a prominent median logitudinal carina. 20, *Microplitis figueresi* ovipositor. 21, *Microplitis espinachi* ovipositor.

Microplitis waldeni Viereck, 1917. Type Connecticut Agricultural Experiment Station, examined. Synonymized by Muesebeck (1922).

Female.—Body length 3.1–3.6 mm. Fore wing length 3.2–3.6 mm. *Color:* General body color black, except lighter brown/yellowish labial and maxillary palps, scapes and pedicels, all femora and tibiae, fore and mid tarsi, hind proximal portion of basitarsi, and lateral semi-membranous margins of first metasomal tergum. Wings hyaline to very faintly smoky, veins including stigma generally pigmented dark brown, with (RS + M)b, 1m-cu and portions of areolet veins paler. *Head:* Face relatively flat and wider than tall but slightly bulging medially, coarsely punctate to punctulorugose. Vertex with posterior ocelli at the posterior edge of weak faint depression that includes medial ocellus. Posterior ocelli slightly farther from anterior ocellus than their own diameters. An-



Figs. 22–27. 22, *Microplitis espinachi*. 23–25, *Microplitis figueresi*, showing variation in shape of areolet. 26, *Mesochorus angustistigmatus*, showing areolet closed distally. 27, *Acrlyta stroudi*, showing areolet open distally.

tennae evenly thick, slightly longer than entire body length. *Mesosoma:* Mesonotum (Fig. 34) coarsely puncate with smoother regions laterally and anteromedially; notaulices complete, foveolate and merging posteriorly into broad foveolate area bisected posteriorly by distinct medial carina. Scutellum with sparse punctures, separated from mesoscutum by scrobe with 6–8 large pits. Metanotum with broad anterolateral setose lobes. Propodeum strongly and evenly rugose, divided by prominent medial longitudinal carina. *Metasoma:* Tergite I (Fig. 33) broadening posteriorly up to broadly rounded apex, with bulging lateral margins, just slightly less than 1.33 as long as broad, distinctly puncate near posterolateral margins, with distinct but shallow longitudinal medial groove over anterior 0.4–0.5. Median field of tergite II not always obviously indicated except at extreme anterolateral corners, but if so, this field is suggested by two weak subparallel grooves that would indicate a narrow median field. Tergite II and remaining terga with usually 2 irregular rows of setate posteriorly. Hypopygium relatively long, not especially truncate apically (Fig. 35). Ovipositor sheaths short, blunt, apically hairy, projecting only to near end of hypopygium or often less. *Legs:* Hind tibiae slightly thickened, with scattered thicker spines on outer faces. Hind basitarsus slightly longer than next two tarsomeres combined. Hind tibial spurs subequal in length, outer one slightly thicker. *Wings:* Fore wing (Fig. 32) R1 extending about halfway from stigma to

end of 3RS fold. Stigma evenly dark brown, without basal lighter spot. Areolet large, subtriangular to weakly quadrangular, angle between (usually very short) 3RSa and r-m obtuse, often indistinct.

Male.—Similar to female except antennal segments longer.

Cocoon.—(Fig. 6). Orange-brown to somewhat pinkish brown, tough and stiff and usually closely glued together into clusters on the back of the host corpse as in *M. marini* (and in *M. chacoensis* below).

Material examined.—We have examined material from Arkansas, Missouri, Texas, California, Oregon, and Michigan, reared from *Ceratomia amyntor* (Geyer), *Paonias myops*, *Sphinx kalmiae*, *Sphinx canadensis*, and deposited in the Illinois Natural History Survey and the U. S. National Museum. Marsh (1979) also lists *Manduca sexta* (L.) and other species of *Sphinx* as hosts, but we have not been able to confirm these first-hand.

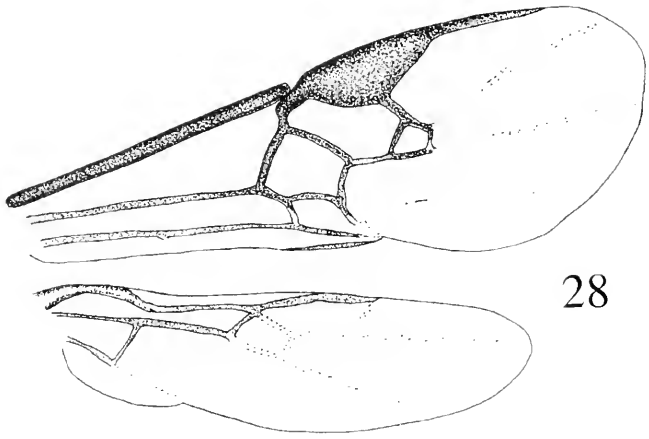
Comments.—This species has the broadest first metasomal tergite in this species complex, and should be easily distinguishable on that basis, in addition to the apparent geographical disjunction to the north of the other species referred to here. In other respects, this species strongly resembles the South American species *M. chacoensis* as well as the new species *M. espinachi* and *M. marini*. It is not yet known how far south the distribution of *M. ceratomiae* extends; the New World fauna is currently being revised by JBW. From the variation in cocoon types reported for this species, it appears at least possible that *M. ceratomiae* could itself ultimately prove to be a complex of morphologically similar but biologically distinct species.

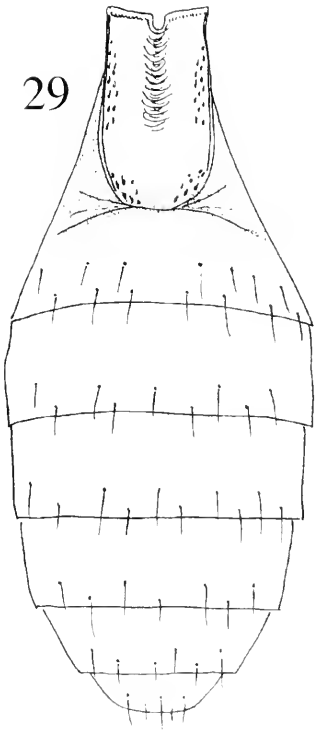
Microplitis chacoensis (Cameron)
(Figs. 7, 36–39)

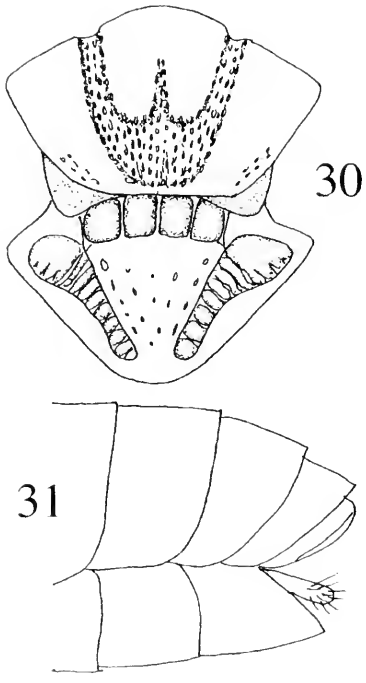
Microgaster chacoensis Cameron, 1908. Type Natural History Museum, London, examined.

Microplitis ayerzai Brèthes, 1910. Type National Natural History Museum, Buenos Aires, examined. **New Synonymy.**

Female.—Body length 3.1–3.4 mm. Fore wing length 3.2–3.7 mm. *Color:* General body color orange-brown, except darker brown (sometimes nearly black) head and margins of metanotum. Wings (Fig. 36) nearly uniformly but not intensely smoky, veins including stigma generally pigmented dark brown, with (RS + M)b, 1m-cu and portions of areolet veins paler. *Head:* Face relatively flat and wider than tall but slightly bulging medially, coarsely punctate to punctulorugose. Ocelli not set in weak depression. Posterior ocelli slightly farther from anterior ocellus than their diameters. Antennae rather evenly thick, approximately same length as body. *Mesosoma:* Mesonotum (Fig. 38) coarsely puncate with smoother regions laterally and anteromedially; notaulices complete, shallow but distinctly sculptured, and merging posteriorly into a broad, weakly sculptured depression bisected posteriorly by a distinct medial carina. Scutellum with sparse punctures, separated from mesoscutum by scrobe with 4 large pits. Metanotum with broad anterolateral setose lobes. Propodeum strongly and evenly rugose, divided by prominent medial longitudinal carina. *Metasoma:* Tergite I (Fig. 37) broadening posteriorly up to about 0.7 of length, then tapering slightly to blunt apex, with weakly bulging lateral margins, 1.4–1.53 as long as broad, nearly sculptureless and polished throughout, with distinct but shallow longitudinal medial groove over anterior 0.4–0.5. Median field of tergite II not always obviously indicated except at extreme anterolateral corners, but if so, this field is suggested by two weak subparallel grooves that would indicate a narrow median field. Tergite II and remaining terga with usually 2 irregular rows of setae posteriorly. Hypopygium relatively long, not especially truncate apically (Fig. 31). Ovipositor sheaths short, blunt, apically hairy, projecting only to near end of hypopygium or often less. *Legs:* Hind tibiae slightly thickened,

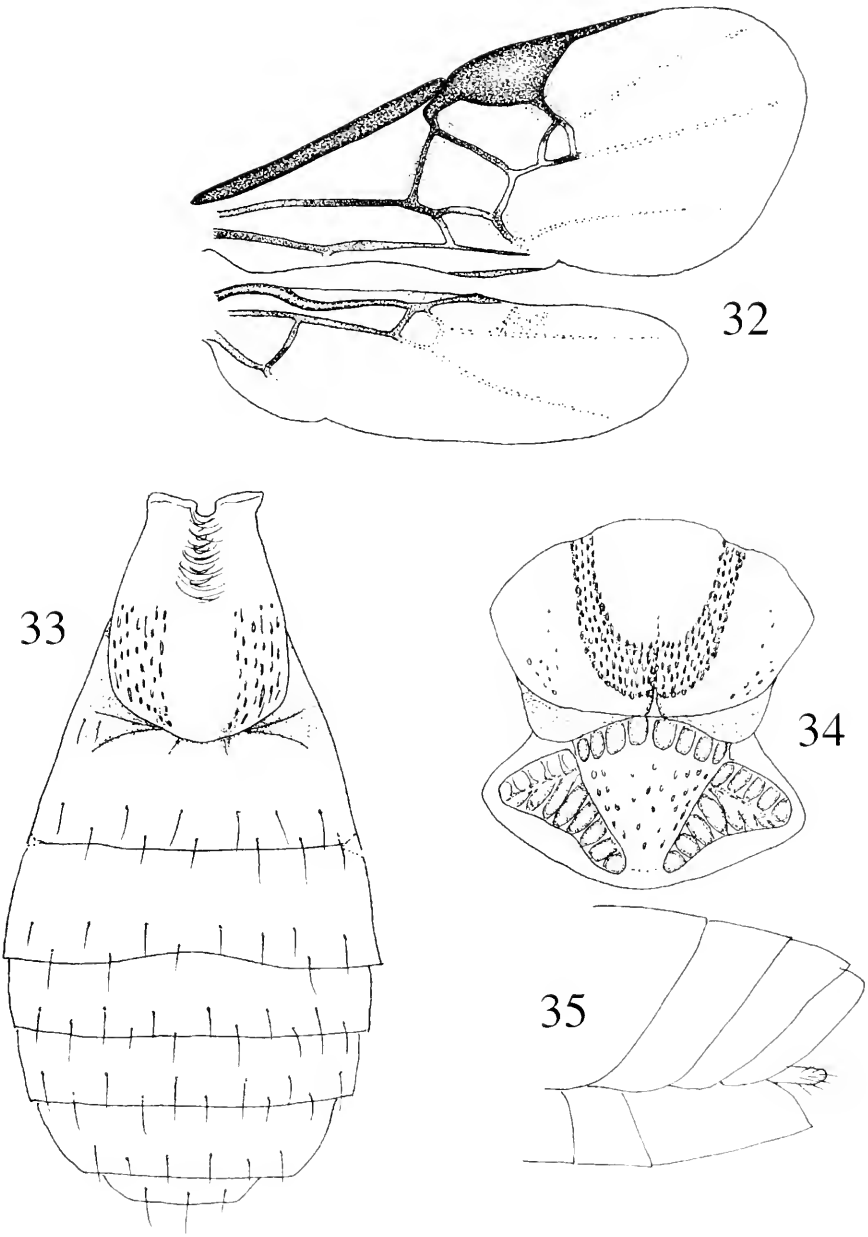






Figs. 28–31. *Microplitis marini* Whitfield, n. sp. 28, wings. 29, metasoma in dorsal view. 30, mesoscutum and scutellum in dorsal view. 31, apex of female metasoma, lateral view showing hypopygium and ovipositor sheaths.

with scattered thicker spines on outer faces. Hind basitarsus slightly longer than next two tarsomeres combined. Hind tibial spurs subequal in length, outer one slightly thicker. *Wings:* Largely infuscate (Fig. 36). Fore wing R1 extending about halfway from stigma to end of 3RS fold. Stigma evenly dark brown, without basal lighter spot. Areolet large, subtriangular to weakly quadrangular, angle between



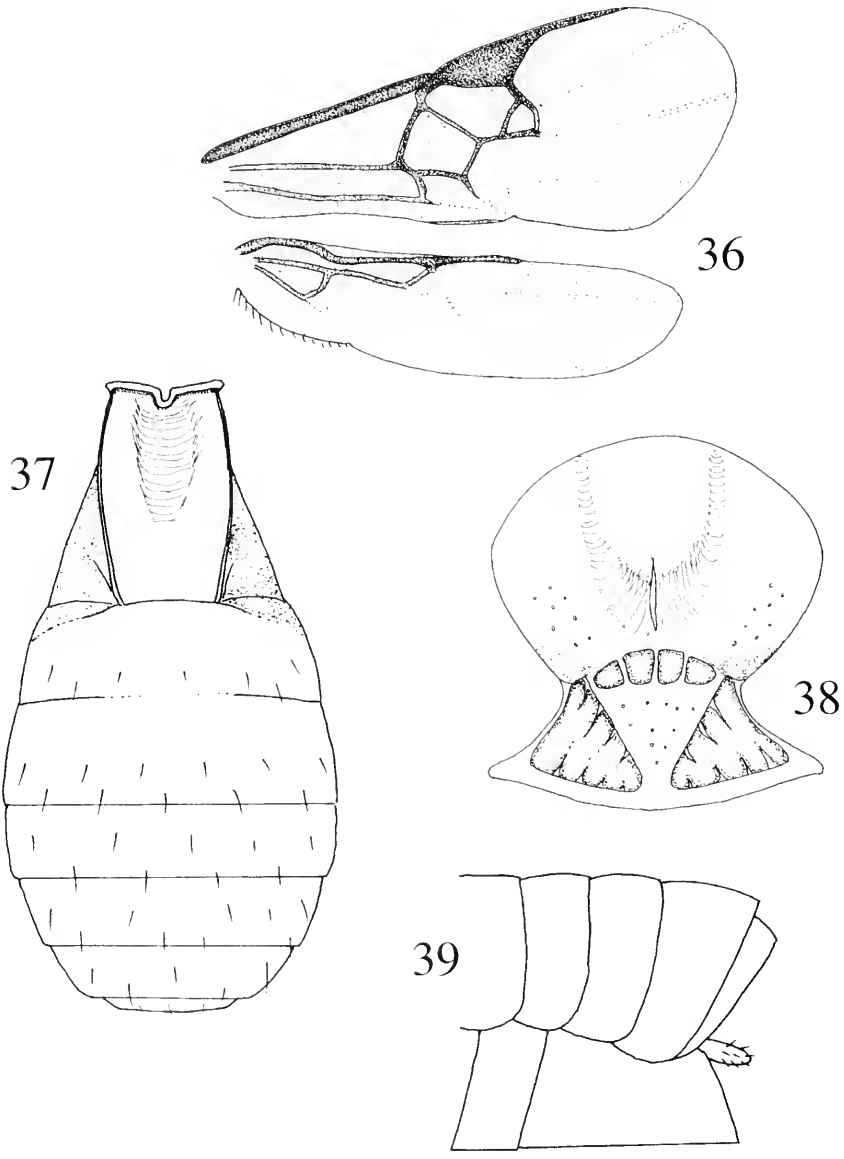
Figs. 32–35. *Microplitis ceratomiae* Riley. 32, Wings. 33, Metasoma in dorsal view. 34, mesoscutum and scutellum in dorsal view. 35, Apex of female metasoma, lateral view showing hypopygium and ovipositor sheaths.

(usually very short) 3RSa and r-m obtuse, often indistinct.

Male.—Similar to female except antennal segments longer.

Cocoon (Fig. 7).—Orange-brown, relative tough and stiff, glued together in tight clusters on the corpse of the host caterpillar as in *M. ceratomiae* and *M. marini*.

Material examined.—In addition to the types, we have examined material from Argentina, Brazil, Paraguay, Uruguay, Trinidad and Venezuela, reared principal-



Figs. 36–39. *Microplitis chacoensis* (Cameron). 36, Wings. 37, Metasoma in dorsal view. 38, Mesoscutum and scutellum in dorsal view. 39, Apex of female metasoma, lateral view showing hypopygium and ovipositor sheaths.

ly from *Manduca sexta* (the tomato hornworm) and *Manduca rustica*, but also with isolated records from *Erinnyis ello* and *Agrius cingulatus* (Fabricius) (the sweet potato hornworm). The cocoons are spun in a tight, pale tan mass nearly identical to that of *M. ceratomiae* (Fig. 6).

Comments.—It is clear from all of the material examined, as well as the identical host records, that *Microplitis ayerzai* Brethes is conspecific with Cameron's *M. chacoensis*. Due to the striking orange-brown coloration and dark wings, this species appears superficially very distinctive, but closer inspection reveals that many of its morphological details strong-

ly resemble those of *M. ceratomiae* and *M. espinachi*.

It is not yet known how far north the distribution of *M. chacoensis* extends; the known distribution suggests that it could be present in the eastern (wetter) portions of Panama and Costa Rica. So far our rearings of the known hosts that far north have produced only the other species covered here.

ICHNEUMONIDAE

Acrolyta stroudi Gauld, new species
(Figs. 8, 27)

Female.—Fore wing length 3.0–3.2 mm. Mandible evenly tapered with upper tooth distinctly the longer; malar space 0.9 times as long as basal mandibular width; clypeus truncate apically, weakly convex, apically smooth grading to punctate basally; lower face centrally slightly swollen, punctate; lateral ocellus separated from eye by about 1.1 times its own maximum diameter; occipital carina joining hypostomal carina more or less at the base of the mandible. Antenna with 20–22 flagellomeres the basal three long and slender the remainder forming a weakly defined club, which is ventrally flattened. Mesosoma with mesoscutum, anteriorly steeply rounded, centrally flattened, punctate with fine granulation between punctures; notaulus weak, only impressed anteriorly; scutellum smooth and punctate finely; mesopleuron polished and punctate, centrally longitudinally striate; metapleuron polished and sparsely punctate. Propodeum, in profile, abruptly declivous, anterior and posterior transverse carinae close together, strong, centrally arched forwards, subparallel with the intervening area longitudinally rugose/striate; posterior part with weak lateral longitudinal carinae, centrally transversely rugose/striate; pleural carina complete, otherwise longitudinal carinae absent. Legs unspecialized; hind femur about 4.5 times as long as deep. Fore wing with vein *3rs-m* entirely absent so areolet is open externally; *cu-a* slightly distal to base of *Rs&M* (Fig. 27); hind wing with distal abscissa of *Cu*1 weak but discernible. Metasoma deplanate; tergite I evenly broadened posteriorly, dorsally longitudinally striate; tergite II posteriorly 1.6–1.7 times as broad as long, punctostriate; succeeding tergites with progressively weaker punctures; ovipositor 1.1 times as long as hind tibia, laterally compressed. Head, mesosoma and tergite I of metasoma black, with mandibles and other mouthparts, tegula and extreme posterior corner of pronotum yellow; antenna yellowish with the swollen flagellomeres (i.e. 4+) infuscate grading to black distally; uniformly yellowish; metasoma with tergites II+ orange-yellow; ovipositor sheath infuscate. Wings hyaline, pterostigma golden yellow.

Male.—Similar to female, but with flagellum slender, setaceous; tergite II with a distinct elliptical thyridium; subgenital plate large and weakly sclerotized, conspicuously shortly hirsute; gonosquama apically rounded. Coloration, as female, but with tergite II, distal end of hind tibia and hind tarsus infuscate.

Material examined.—**Holotype:** female, Costa Rica: Guanacaste Prov., Santa Rosa National Park, (rearing reference # 93-SRNP-2227), 1993 (Janzen and Hallwachs) (INBio). **Paratypes:** 1 female, 1 male, same locality and data as holotype (INBio), 2 females, same locality and data as holotype (Natural History Museum, London).

Etymology.—This species is named in honor of Steven Stroud in recognition of his enormous support for forest conservation in the Rincon Rainforest expansion of the Area de Conservación Guanacaste.

Remarks.—This species runs to *Acrolyta* in Townes (1969) key. However, it is rather distinctive, in having both a swollen female flagellum and in having the strong, close and subparallel transverse propodeal carinae. There are no described species of this genus in the Neotropics, although there are several species described

in the closely related genus *Isdromas*, all of which have the occipital carina joining the hypostomal carina further away from the mandibular base. *Acrolyta*, and species placed in related genera in the acrolytine Phygadeuontini (= Acrolytina *sensu* Townes, 1969) are commonly parasitoids of the cocoons of small ichneumonoids (Carlson, 1979), as is the case with *Acrolyta stroudi* as a parasitoid of cocoons of these small braconids (see below).

Mesochorus angustistigmatus Dasch
(Figs. 3, 26)

Mesochorus angustistigmatus Dasch, 1974: 277. Holotype, Brazil (Canadian National Collection, Ottawa), examined.

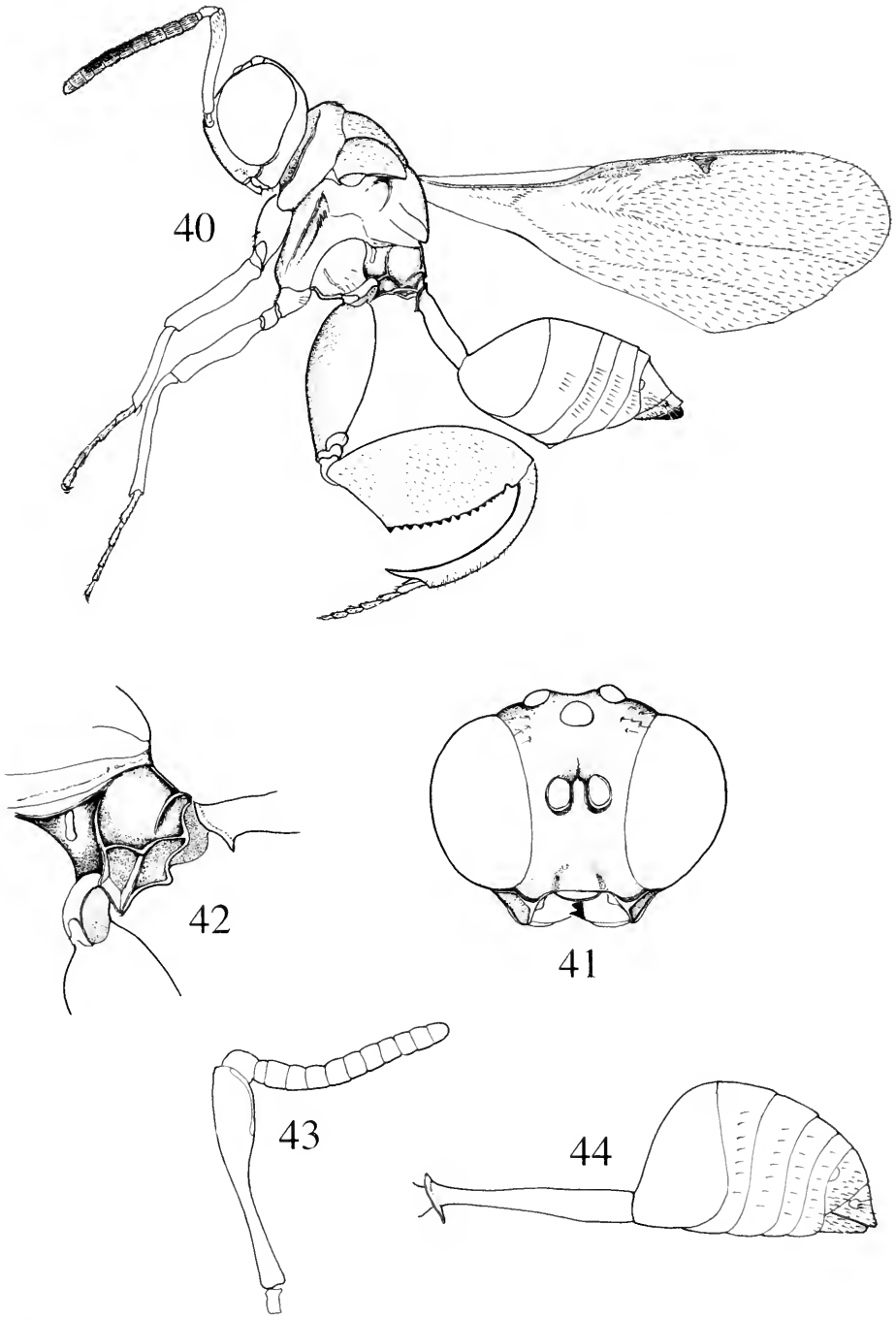
Redescription.—Fore wing length 2.8–3.5 mm; mandible strongly tapered with upper and lower teeth subequal in length; malar space broad, striate, about 1.0 times basal mandibular width; lower face about 1.0 times as broad as high, coarsely and sparsely punctate, with strong median vertical ridge; subantennal ridge weakly dipped medially; frons weakly shagreened, impunctate; ocelli small, lateral one separate from eye by 1.6–1.83 its own maximum diameter; vertex without a groove from lateral ocellus to eye; occipital carina complete, antenna with 30–33 long slender flagellomeres. Mesosoma with mesoscutum polished and finely punctate; mesopleuron similar but more sparsely punctate; scutellum strongly rounded; propodeum polished, completely carinate, with area superomedia hexagonal, about 1.4 times as long as broad. Metasoma polished, tergite I with fine longitudinal striations, remaining tergites smooth; female with ovipositor sheath long and slender, projecting beyond apex of metasoma by 0.7 times length of hind tibia. Yellowish brown species with head and mesosoma dorsally slightly darker; propodeum and tergite I generally blackish brown; tergite II white with anterior and anterolateral margins infuscate; tergite III anteriorly pallid, posteriorly broadly infuscate; tergites IV+ dark. Legs yellowish brown, hind coxa and trochanter slightly darker; distal apex of tibia blackish. Fore wing hyaline, pterostigma reddish brown.

Remarks.—*Mesochorus angustistigmatus* is one of approximately 15 species of *Mesochorus* known to occur in Costa Rican dry forests. It differs from other species in a) having the ocelli small and widely separate from the eye, b) the characteristic shape of the area superomedia, c) having a long slender ovipositor sheath, and d) coloration, particularly the colour pattern of the first three metasomal tergites. This species is easily distinguished in the field from *Acrolyta stroudi* in that the latter has a red-orange gaster and black head and thorax.

CHALCIDIDAE

Conura convergea Delvare, new species
(Figs. 3, 40–44)

Holotype female.—3.6 mm. Body entirely bright-yellow (note: specimens kept in alcohol and subsequently dried can be pale yellow and even white on pronotal collar, mesoscutum along notauli, most of scutellum, propodeum, meso- and metapleuron, petiole), as well as tegula, legs, scape, pedicel flagellum in part. Last segment of hind tarsi slightly darkened. First 3 funicular segments entirely yellow, funicle 4 darkened dorsally, funicle 5 to 7 blackish dorsally as well as basal part of first segment of clava, remaining part of flagellum yellow. Teeth of mandibles and valvulae of ovipositor black. Veins of forewing pale. Wings hyaline. Pilosity of the body entirely yellow, that of wing black. *Head:* Head slightly wider than thorax (82:75), 1.8 times as wide as long (82:45). Frons regularly convex in lateral outline. Height of head 66, of eyes 50. Oral fossa 29. Mandible formula 2.3. Lower edge of mandibles with translucent flange. Clypeus well delimited through submedian impres-



Figs. 40–44. *Conura convergea* Delvare n. sp. 40, Female habitus. 41, Female head in frontal view. 42, Female propodeum in lateral view. 43, Male antenna. 44, Male petiole and gaster.

sions. Lower face densely and superficially alutaceous. Malar space very short, 10 at sulcus which is evident and ± bordered behind by complete carina; inner carina missing. Gena bordered posteriorly by narrow translucent flange above mandible corner, flange quickly obliterated. Antennae inserted well above lower ocular line, distance between antennal toruli and lower margin of clypeus 33 malar space (30: 10). Inner margins of eyes strongly convergent ventrally. Transverse diameter of eyes 24 in front view, 36 in lateral view. Narrowest distance between them (at mid distance between antennal toruli and lower ocular line) 29. Broadest distance between eyes, on top of vertex 50. Interantennal projection visible as a narrow plate delimited laterally by faint ridges along the inner margins of toruli. Antennal scrobes shallow. Adscrobal area alutaceous with a few and shallow piliferous punctures. Head relatively globular when viewed dorsally. Ocellar triangle forming a slightly obtuse triangle. POL much greater than OOL (13:8), latter about as large as diameter of posterior ocelli (9). Scape 46, exceeding vertex for about one third of its own length, not enlarged at apex and slightly curved in lateral view. Pedicel + flagellum slightly longer (87:82) than the width of head. Pedicel 9, as long as each of the five first funicular segments; following segments very slightly shortened, last one 7.5. Each funicular segment with two rows of elongate sensilla. Clava 13, with hemispherical apex. *Mesosoma:* Length 100, width of collar 65, of mesoscutum 75, of scutellum 40. Collar not margined anteriorly, rounded off. Mesonotum alutaceous, the network delimiting transverse meshes. In addition to mid lobe of the mesoscutum with shallow piliferous punctures, the background sculpture merging to squamose posteriorly. Lateral lobes without punctures, scutellum with very shallow ones, especially laterally. Scutellum about as long as the mesoscutum (37:38), distinctly convex. Propodeum nearly hemispherical in shape between the spiracular sulci, mostly alutaceous in this region, only short rugae merging from the median carina. Costulae nearly in same line and forming a very obtuse angle with the latter. Postero-subventral carinae forming about a right angle with spiracular carinae. Hind coxae 80, convex dorsally in lateral view at the base. Hind femur slightly more than twice as long as wide (97:46), bearing about 20 short teeth, first one slightly longer than the following ones; inner tooth very short. Apical spine of hind tibia about 2.5 times as long as width of tibia (22:9). Forewing 2.5 3 as long as wide. Costal cell 80, marginal vein 46, postmarginal vein 54. Stigmal vein 8.5, very short. Pilosity fairly dense. Basal cell with line of hairs just behind submarginal vein, otherwise mainly bare. Area between marginal vein and Rs+M (latter visible as line of hairs) with only a few hairs on its dorsal surface. *Petiole and gaster.* Petiole 0.4 as long as mesosoma (40: 100), with a complete, oblique, basal flange. Gaster slightly longer than the mesosoma (110:100). First tergite (31) less than one third as long as the gaster. Epipygium short, shorter than its own width (12:17). Apex of hypopygium slightly less than half the length of the gaster.

Male.—Mostly similar to the female. Distinctive characters are as follows. Whole flagellum yellow. Last two segments of mid and hind tarsi blackish. Length of head 48, width 78. Scape 66, yet longer than in female and enlarged at apex. Sensillar plate as a line on ventral edge of scape where it is enlarged. Pedicel + flagellum 68. Funicular segments subquadrate, only first one very slightly longer than wide. Petiole about 0.7 times as long as the thorax (72:100), gaster 80.

Material examined.—**Holotype female:** COSTA RICA: Guanacaste Prov, Area de Conservacion Guanacaste, Sector Santa Rosa, 250 m, ex *Microplitis espinachi* ex *Manduca lefeburii*, adult eclosion on 28.VI.1993 (D. H. Janzen & W. Hallwachs,

ref. 93-SRNP-2445, in U. S. National Museum). **Paratypes:** 36 females, 10 males same data as holotype; 12 females same data as holotype but adult eclosion on 27.VI.1993 (ref. 93-SRNP-2450); 5 females same data as holotype but adult eclosion 08.VII.1993 (ref 93-SRNP-2450); 8 females same locality and collectors, ex *Microplitis figueresi* ex *Erinnyis ello*, adult eclosion on 08.VII.1993 (in U. S. National Museum, American Entomological Institute, Canadian National Collection, Natural History Museum, London, MNHN, CIRAD (Montpellier), INBio). COSTA RICA, Guanacaste, Santa Rosa National Park, San Emilio I–II 1987 (1 female) and XII 1986 (1 female) in INBio (malaise trap, I. D. Gauld, D. H. Janzen and W. Hallwachs, collectors).

Remarks.—This new species belongs to the *immaculata* group as defined by Delvare (1992:213) and more precisely to the *immaculata* subgroup. The closest described species is *Conura* (*Ceratosmicra*) *camescens* Delvare, for a long time known as *Ceratosmicra flavescens* Cameron (Cameron 1913; De Santis 1979). The latter species differs in having a very faint (even absent) malar carina, the shorter scape, only slightly exceeding vertex, POL relatively shorter, absence of piliferous punctures on mesonotum, etc. The body is also orange rather than yellow.

There are also many undescribed species that are similar to *Conura convergea*. Comparison with them shows that the main diagnostic characters for *C. convergea* (apart from those shared with other members of the *immaculata* group and subgroup and already mentioned by Delvare 1992) are: 1) the presence of a malar groove and carina, 2) the converging eyes, 3) the ocellar triangle and relative proportions of OOL and POL, 4) the very long scape which noticeably exceeds the vertex, 5) the special coloration of the flagellum of the female, 6) the pilosity of the fore wing, 7) the dorsal outline of the hind coxa near its base, and 8) the relative proportions of the petiole and gaster. The appearance of the interantennal projection is also unique within the *immaculata* group.

KEY TO *MICROPLITIS* AND ASSOCIATED SPECIES OF PARASITOIDS OF SPHINGID CATERPILLARS IN COSTA RICAN DRY FOREST (ALSO INCLUDES THE NEARCTIC *M. CERATOMIAE* AND SOUTH AMERICAN *M. CHACOENSIS* FOR COMPARISON)

1 Fore wing with no enclosed cells present (Fig. 40) ..... ***Conura convergea* Delvare sp. n.**
– Fore wing with enclosed cells (e.g., Figs. 22–27) 2

2 Fore wing without vein 2m-cu and without distal abscissa of Rs enclosing marginal cell; vein RS + M present separating submarginal and discal cells (Fig. 23) 3
– Fore wing with vein 2m-cu complete; distal abscissa of Rs complete, enclosing a triangular marginal cell; veins Rs + M broadly incomplete so submarginal and discal cells are broadly confluent (Figs. 26, 27) 7

3 Body color, except often head, orangish brown; wings mostly infuscate (Fig. 36) ..... ***Microplitis chacoensis* (Cameron)**
– Body color, especially mesosoma, black; wings mostly hyaline 4

4 Mesonotum with notauli complete, broad and rugose, coalescing posteriorly into a rugose or foveolate area often bisected by posterior medial longitudinal carina (Fig. 17); metasomal tergite I less than twice as long as broad at broadest point (Figs. 10, 33, 37) ... 5
– Mesonotum with notauli indicated strongly only on anterolateral margins, smoother posteriorly (Fig. 18) but often with a faint medial longitudinal carina present; metasomal tergite I usually slightly more than twice as long as broad (Fig. 14) ..... ***Microplitis figueresi* Walker, sp. n.**

5 Metasomal tergite I only about 1.2–1.33 as long as broad, with strongly bulging lateral margins (Fig. 33); areolet in fore wing usually somewhat subtriangular, or at least not sharply quadrangular (Fig. 32) (may not occur in Costa Rica) ..... ***Microplitis ceratomiae*** **Riley**

– Metasomal tergite I approximately 1.53 as long as broad, with weakly bulging or subparallel lateral margins; areolet in fore wing usually clearly quadrangular due to relatively long and angled 3Rsa (Figs. 9, 28) 6

6 Tergite I relatively smooth over posterolateral surface (Fig. 10); posterior confluent region of notauli bisected by strong medial carina (Figs. 11, 17) ..... ***Microplitis espinachi*** **Walker, sp. n.**

– Tergite I punctate posterolaterally and near lateral margins over anterior 0.6 (Fig. 29); posterior confluent region of notauli with only very weak medial carina, although foveolate sculpturing often extends anteromedially where this carina would be (Fig. 30) ..... ***Microplitis marini*** **Whitfield, sp. n.**

7 Fore wing with a completely delineated rhombic areolet; hind wing with distal abscissa of Cu1 entirely absent; female with a large subgenital plate that in side view is triangular; male with distal end of clasper extended as an elongate spine-like process .. ***Mesochorus***

– Fore wing lacking r-m2, thus without a delineated areolet; hind wing with distal abscissa of Cu1 complete; female with a small, rounded subgenital plate; male with distal end of clasper gently rounded ..... ***Acrolyta***

NATURAL HISTORY OF *MICROPLITIS* AND ITS PARASITOIDS IN THE ACG DRY FOREST

Microplitis figueresi.—This 3 mm long black microgastrine braconid (Fig. 3) is unambiguously a specialist at parasitizing the caterpillars of just two species of Sphingidae, *Erinnyis ello* and *Erinnyis oenotrus*, of the many species in ACG dry forest (Table 1) (once there are more rearing records for *Erinnyis lassauxii*, it may be found to also parasitize this species). *Microplitis figueresi* has not been encountered outside of the ACG, despite massive and multi-habitat Malaise trapping in Costa Rica by two decades of intensive Hymenoptera inventory (I. D. Gauld and P. Hanson, personal communication) and sporadic rearing of caterpillars throughout Mesoamerica.

There is no sign of *M. figueresi* in the wetter ACG habitats (cloud forest and rain forest and intergrades), despite that one of its two major hosts, *Erinnyis ello*, is a common pest caterpillar on commercial and feral cassava (*Manihot esculenta* Crantz (Euphorbiaceae)) in these wetter habitats. Since this wasp apparently has not been reared previously from this very widespread neotropical agricultural pest caterpillar, *M. figueresi* might well be found to be endemic to the dry forests of the Costa Rican Pacific coastal plain, once the neotropical Hymenoptera fauna is well known. It may well not even venture out of the dry forest into the agroscape dotted with small scale cassava plantations, though it is a parasite of *E. ello* feeding on cassava growing on the forest edge and abandoned farmsteads in the ACG dry forest.

Nearly all the specimens of *Microplitis figueresi* reared to date from *E. ello* have been from caterpillars feeding on the early rainy season leaves of the dry forest understory tree *Sebastiania pavoniana* Mueller. Arg. (Euphorbiaceae; known in most Costa Rican biodiversity literature as *Sebastiania confusa* Lundell) (Table 2). The other primary host for *M. figueresi*, *Erinnyis crameri* feeding on *Stemmadenia obovata* K. Schum. (Apocynaceae), is very common in the exact same forest, living just a few meters from the *Sebastiania pavoniana* attacked

Table 2. Food plants of the caterpillars that were parasitized by *Microplitis figueresi* in the ACG dry forest Sector Santa Rosa (source: Janzen and Hallwachs 2002).

Sphingidae	Food plant family	Food plant species	Percent parasitized	Number of rearings
Erinnysis ello	Apocynaceae	*Forsteronia spicata*	33	6
	Caricaceae	*Carica papaya*	20	5
	Euphorbiaceae	*Euphorbia colletioides*	50	2
	Euphorbiaceae	*Euphorbia schlechtendalii*	6	136
	Euphorbiaceae	*Manihot aesculifolia*	22	9
	Euphorbiaceae	*Manihot esculenta*	7	76
	Euphorbiaceae	*Sebastiania pavoniana*	51	206
Erinnyis crameri	Apocynaceae	*Rauvolfia tetraphylla*	3	37
	Apocynaceae	*Stemmadenia obovata*	23	377
Erinnyis lassauxii	Asclepiadaceae	six species	9	11

by *M. figueresi*. The host records in Table 2 offer a clue as to why *M. figueresi* does not appear to have moved into the *Erinnyis ello-Manihot*-rich agroscape. The two heavily parasitized hosts live side-by-side in the shady undestory of 10–80-year old secondary successional forest. However, the other three *M. figueresi* host records with a usefully large sample size (*Euphorbia schlectendalii* Boiss., *Manihot esculenta*, *Rauvolfia tetraphylla* Linnaeus) were all growing in strongly insolated young successional vegetation, much as is a *Manihot esculenta* plantation, and have very low percent attack by *M. figueresi*.

Based on rearing wild-caught first and second instar caterpillars of *Erinnyis ello* and *E. crameri* in captivity, *Microplitis figueresi* can oviposit in first and second instar *Erinnyis* caterpillars, but this observation does not negate the possibility that it may also oviposit in caterpillars in their later instars as well. Irrespective of when oviposition occurs, as few as 40 to as many as 150 *M. figueresi* larvae begin to feed and grow in the middle/late days of the last (fifth) instar of the parasitized caterpillar. Prior to this late last instar stage, crude exploratory dissections did not locate the very small and presumably first instar wasp larvae.

The prepupal wasp larvae emerge from the caterpillar (Fig. 1) by burrowing through the dorsal cuticle during a 1–3 hour period, usually in the first hours of daylight. At this time the caterpillar is often on the underside of its support twig, but need not be for successful emergence. Each larva exits through its own hole. The holes are scattered along the dorsal side of the caterpillar (not clumped as in *Microplitis marini*, Fig. 4–5). The hole seals (or is sealed by the larva), and there is no noticeable loss of fluid by the caterpillar. The larvae exit the caterpillar at the stage in the last larval instar that would be 1–3 days before the caterpillar would become a prepupa if it were not parasitized. Each wasp larva spins a very tough and hard individual beige/gray silk cocoon side-by-side but not perfectly adjacent to other cocoons, while attached to the cuticle by its posterior end (Figs. 2, 3). The glue on the silk of one cocoon often sticks strongly to an adjacent cocoon, leading to a mass of cocoons lightly and irregularily stuck together. The cocoons are very much harder and tougher (and thus characteristic of the cocoons of most *Microplitis*) than are those of other similar-sized microgastrine braconids (e.g., *Apanteles*, *Cotesia*, *Parapanteles*, and *Glyptapanteles*), the occupants of which do not remain dormant for many months

A few hours before the wasp larvae exit from the caterpillar, the caterpillar ceases to feed and walks a few decimeters to a few meters from the place of feeding

(which often takes it off the food plant), and perches motionless, usually on the underside of a stem (Fig. 1–2). A consequence is that the wasp cocoons are generally encountered "stuck" to the dorsal side of the upside-down caterpillar (Fig. 2). The finished hard coccons may be knocked off into the litter by movement of the vegetation. Alternatively, when the caterpillar "dies" 1–3 days later and falls to the litter, the cocoons are incorporated into the litter through normal decomposition processes. If the newly emerged larvae are knocked off the caterpillar, sometimes they successfully spin a normal-appearing cocoon in the litter.

The batch of 20–100 or more *Microplitis* larvae that emerge from a single caterpillar may well be from a single ovipositing wasp, but this assumption deserves further testing through genetic fingerprinting. A *Microplitis* wasp has never been observed ovipositing during this inventory, but then again, an explicit effort has not been made to observe oviposition. In all of the hundreds of cases of parasitism by *Microplitis figueresi* (or *Microplitis espinachi* or *Microplitis marini*) found in this inventory, in no case has the caterpillar produced small numbers (e.g., 1–10) of larvae. However, other species of *Microplitis* in the ACG dry forest habitat have one larva per caterpillar, but their hosts are small Noctuidae such as *Coenipita bibitrix* Huebner (Janzen and Hallwachs 2002).

While a few of the wasps in the batch of cocoons from a single caterpillar may eclose 2–6 weeks after cocoon spinning, the great majority of *M. figueresi* larvae remain as dormant prepupae in their very hard and thick-walled cocoons for 11–13 months until shortly before and during the beginning of the next rainy season (May–June, see records in http://janzen.sas.upenn.edu for actual eclosion dates in the ACG dry forest). This timing of eclosion places the adult wasps in the habitat during the month (May–June) when their host species of *Erinnyis* caterpillars, as well as the non-host species of *Erinnyis*, initiate the first, and usually only, generation of the year in this dry forest. For the most part, *M. figueresi* is univoltine in the ACG dry forest, just as is its host caterpillar.

Wasp eclosion is apparently triggered by the drop in temperature that is generated by the oncoming rain at the end of the long dry season, a change that the wasp prepupae do perceive through a closed glass bottle exposed to ambient temperatures in the rearing barns. This temperature drop is also used by many other insects in this forest as an activity cue (Janzen 1987a, 1993). Newly-eclosed (and unfed) wasps survive only 1–2 days in a clean dry bottle, but presumably live for weeks when circulating freely in the habitat in search of mates and hosts, with access to food. Since there appears to be only one major generation per year, it appears as though the wasps must die within a few weeks of eclosion. While the few *Microplitis* individuals that eclose a few weeks after spinning may have a second generation on the laggard tail of the host caterpillar population's primary annual generation, none of the very few sphingid larvae encountered after July have been parasitized by *Microplitis*.

In 1978–2001 the ACG dry forest inventory (Sector Santa Rosa) reared 14,012 wild-caught sphingid caterpillars in 73 species. Of these, 26% of *Erinnyis ello* (n = 481) and 23% of *Erinnyis crameri* (n = 501) caterpillars were parasitized by *M. figueresi* (except for one case of the very rare sphingid *Erinnyis lassauxii*, and one naturally occurring "error" among 1,120 *Xylophanes turbata* rearings; Table 1). *M. figueresi* is unambiguously a specialist parasite whose population survives primarily on just these two species of *Erinnyis* out of the potentially available 73 other species of sphingid caterpillars in the ACG dry forest. (When a larger sample of *Erinnyis lassauxii* has been inventoried, it may well be found that it is a third host for *M. fi-*

gueresi). While not enough caterpillars of three other *Erinnyis* have been reared to comment on (*Erinnyis yucatana* (Druce), *Erinnyis obscura* (Fabricius), *Erinnyis domingonus* (Butler), *Erinnyis alope* (Drury)), the 92 rearing records of *Erinnyis oenotrus* have produced no *Microplitis* records. This is an outstanding result because *E. crameri* feeds on *Stemmadenia obovata* growing within a few meters of *E. oenotrus* (and even *Erinnyis ello*) feeding on *Forsteronia spicata* G. F. W. Mey. There is no way to determine at this stage whether *M. figueresi* simply does not oviposit in or notice *Erinnyis oenotrus*, or whether *E. oenotrus* is resistant to *M. figueresi*. The ACG dry forest caterpillar inventory rears all species of wild-encountered macrocaterpillars and there is no suggestion that *Microplitis figueresi* parasitizes caterpillars in other families (more than 70,000 wild-caught rearing records of more than 1,650 species in http://janzen.sas.upenn.edu).

Erinnyis ello and *Erinnyis crameri* share habitat and season but do not share food plants. In this dry forest, free-ranging *Erinnyis ello* caterpillars are found feeding on the leaves of the species in Table 2 and on leaves of *Hippomane mancinella* Linnaeus, *Sapium thelocarpum* K. Schum and Pittier, *Euphorbia tirucali* Linnaeus, and *Mabea occidentalis* Benth. (Euphorbiaceae), *Forsteronia spicata* (Apocynaceae), *Manilkara chicle* (Pittier) Gilly and *Chrysophyllum brenesii* Cronquist (Sapotaceae), and *Licania arborea* Seem. (Chrysobalanaceae). All but the last species are latex-producers. However, to date only *Erinnyis ello* caterpillars feeding on those food plants in Table 2 have been parasitized by *M. figueresi*, all of which are latex-producing plant families. Caterpillars of *Erinnyis ello* found on their other food plants may also be found to be attacked by *M. figueresi* in years to come, since the inventory sample to date contains less than 10 records of caterpillars for each of these other food plants. *Erinnys crameri*, however, does appear to have one regular food plant on which it is not attacked by *M. figueresi*. There are 85 records of *E. crameri* from *Rauvolfia ligustrina* R. and S. (Apocynaceae), a rare shrub occurring in one small patch in a heavily insolated site; no *E. crameri* caterpillar feeding on this plant was attacked. It is also significant that there is only a single record of *M. figueresi* from *Erinnyis crameri* on *Rauvolfia tetraphylla*. This does demonstrate that *M. figueresi* larvae can survive in the microhabitat of *Erinnyis crameri* feeding on *Rauvolfia* (very toxic to vertebrates), and therefore the strikingly low percent attack of caterpillars feeding on *Rauvolfia* is probably due to some ecological factor (as mentioned above in reference to *Erinnyis ello*). Both species of *Rauvolfia* live in very insolated early stages of secondary succession.

The single record of *Microplitis figueresi* from a *Xylophanes turbata* caterpillar feeding on *Hamelia patens* Jacq. (Rubiaceae) (in the same forest that is the source of all the other records reported here) is probably an ovipositional "error". The inventory through 2001 has reared 1,120 wild caught *Xylophanes turbata* caterpillars in the ACG dry forest. We feel comfortable with the conclusion that *Microplitis figueresi* is not a normal parasite for this species of caterpillar and that this record does not reflect any "generalist tendencies" by *M. figueresi*. However, this ovipositional "error" makes it clear that this braconid can, at least occasionally, develop in the tissues of this caterpillar (as can a number of other species of hymenopteran and dipteran parasites) and we suspect in other species as well. Were the wasp to find itself in a habitat lacking its usual hosts, a jump to another species of sphingid might require little more genetic change than becoming able to smell it or at least recognize it as a potential host when encountered.

In the ACG dry forest, *Microplitis figueresi* "shares" *Erinnyis ello* with 3 species of Tachinidae (*Drino piceiventris* (Walker), *Blepharipa fimbriata* (Wulp), *Belvosia* sp. 7), one species of Ichneumonidae (*Crypto-*

phion espinozai Gauld), and another microgastrine braconid (*Cotesia* sp.) (http://janzen.sas.upenn.edu). However, out of 481 caterpillars, only 5% had these other parasites (all of which are found much more frequently in a short list of other species of caterpillars, species that should be viewed as their "usual" hosts) while 26% were parasitized by *M. figueresi*. *M. figueresi* is unambiguously the primary specialist killer of *Erinnyis ello* caterpillars in the ACG forest.

In like manner, *M. figueresi* "shares" *Erinnyis crameri* with three species of Tachinidae (*Drino piceiventris, Belvosia* sp. 7, Mystery genus 1, sp. 1) and one species of Ichneumonidae (*Cryptophion espinozai*). Again, as was the case with *Erinnyis ello*, out of 501 *Erinnyis crameri* caterpillars only 10% had these other parasites (all of which, except for Mystery genus 1, sp. 1, are found more frequently in a short list of other species of caterpillars) while 17% were parasitized by *M. figueresi*. Furthermore, almost all of these were in caterpillars feeding on *Stemadenia obovata*. Again, when the caterpillar is feeding on *Stemadenia obovata*, *M. figueresi* is the primary specialist killer of *Erinnyis crameri* in the ACG dry forest.

Seen from the other side of the interaction, the *M. figueresi* population in the ACG dry forest is entirely sustained by the population of the caterpillars of *Erinnyis ello* (primarily on *Sebastiana pavoniana*) and *Erinnyis crameri* (on *Stemadenia obovata*). The absence of *M. figueresi* from the rearings of *Erinnyis oenotrus* (n = 92) is particularily striking since it lives only a few meters from larvae of *E. ello* and *E. crameri*.

No *Microplitis figueresi* (or *Microplitis espinachi* for that matter) have been encountered to date in more than 3,400 rearings of wild-caught Sphingidae caterpillars collected from the rain forests and cloud forests in the wetter eastern end of the ACG (including 130 *Erinnyis* and 117 *Manduca* rearing records), from which we conclude that it (and *Microplitis espinachi*) is entirely a "dry forest" wasp. The largely univoltine seasonality of its breeding biology is compatible with this conclusion.

In ACG dry forest, *Erinnyis crameri* is even more thorougly univoltine than is *E. ello*, and has only one generation per year (and this occurs during the first half of the rainy season). Just as does *E. ello*, it migrates out of the ACG dry forests after eclosing from its pupae in July and early August. Its pupae never become dormant under open-air ambient temperature conditions in the ACG. It has other generations in the lowland to mid-elevation rain forests in other parts of Costa Rica, before returning to the ACG dry forests with the first rains of the following year. It is unknown if *Microplitis figueresi* occurs in or parasitizes *Erinnyis crameri* in its wetter rainforest haunts, but it is unlikely since this wasp has not been found there during any of the extensive Malaise trapping done in these other areas (I.D. Gauld and P. Hanson, personal communication). The dormancy biology of *Microplitis figueresi* also suggests that this wasp does not migrate to other habitats when its host does.

Erinnyis ello also has only one large generation a year in the ACG dry forests (in the first half of the rainy season). However, very rarely a caterpillar of this species is found in the second half of the rainy season, probably the offspring of a few adults that did not migrate away at this time. The few *Microplitis figueresi* wasps (less than 2%) that eclose 2–6 weeks after spinning may represent a phenological polymorphism and have a second generation on these few *Erinnyis ello* caterpillars (however, there are no records of such to date) or may simply be "phenological accidents" that die without further reproduction, or both.

The *M. figueresi* larvae in *E. ello* and *E. crameri* are parasitized by *Mesochorus augustistigmatus* (Ichneumonidae) (Figure 3) wasps while the braconid larvae are still inside the caterpillar. Since such hyperparasitization cannot occur once the cat-

erpillar is in captivity, and may well not occur until the *M. figueresi* larvae have grown to a large size during a few days in the middle of the last instar, the low frequency of *M. angustistigmatus* hyperparasitization (5 out of 250 rearings of *M. figueresi*) may be a severe underestimate of the frequency in nature. In all cases the hyperparasitoid wasps emerged from the braconid cocoons 2–3 weeks after *M. figueresi* spun their cocoons. Given this lack of larval dormancy by *M. angustistigmatus*, this species probably hyperparasitizes other species of ichneumonoids in other species of caterpillars as well. *M. angustistigmatus* is also a parasitoid of *Microplitis espinachi* in *Manduca* caterpillars, again with the same low frequency as encountered with *M. figueresi*.

Microplitis figueresi larvae usually emerge from their host caterpillars during mid-morning hours and by dusk have spun a hard strong cocoon. From noon to dusk, these newly spun cocoons are located by *Conura convergea* (Chalcididae), a small stocky yellow wasp (Fig. 3). The wasp oviposits directly into the newly spun cocoons, presumably ovipositing into or on the prepupa inside. *C. convergea* never emerges from cocoons produced from caterpillars that have been in captivity until the time that the *Microplitis* larvae have emerged, from which we conclude that the chalcidid never oviposits into the braconid larvae inside the caterpillar. *Microplitis* cocoons produced in captivity and placed out in the forest the second day after spinning do not attract *C. convergea*, while fresh ones do. The behavior of ovipositing (or arriving to oviposit) only at the time of its host's cocoon spinning or new molt from the prepupa to pupa (in non-cocooning species) is commonplace among similar species of Chalcididae encountered during the ACG caterpillar inventory.

C. convergea emerge from the *Microplitis* cocoons in late June or July, in the first half of the rainy season and within 2–4 weeks of spinning by *Microplitis*. There is no indication of prepupal or pupal dormancy. While there are *Microplitis* cocoons in the litter throughout the remaining rainy season and dry season, they presumably lack the odor cues that would allow them to be used for multiple generations of *C. convergea*. Presumably *C. convergea* locates the newly spun cocoons of other species of braconids for subsequent generations during the remainder of the year. That none have been reared from other cocoons in the inventory is probably due to having collected almost no wild-spun braconid cocoons (the very large number of braconids reared from the caterpillar inventory are spun in captivity by larvae emerging from wild-caught caterpillars). *C. convergea* parasitizes *Microplitis espinachi* cocoons in exactly the same manner as it does those of *M. figueresi*.

Microplitis espinachi.—This 3 mm long black microgastrine braconid (Fig. 3) is unambiguously a specialist at parasitizing the caterpillars of six species of *Manduca* (*M. corallina*, *M. rustica*, *M. lefeburii*, *M. muscosa*, *M. occulta*, *M. hannibal*), and *Agrius cingulata* and *Sphinx merops* (Table 1), among the many species of Sphingidae in ACG dry forest. As with *Microplitis figueresi*, which it resembles very closely, *Microplitis espinachi* has not been encountered outside the ACG dry forest, despite massive and multi-habitat Malaise trapping in Costa Rica by two decades of intensive Hymenoptera inventory (I. D. Gauld and P. Hanson, personal communication) and sporadic rearing of caterpillars throughout Mesoamerica.

The breeding biology of *Microplitis espinachi* is essentially identical to that described above for *Microplitis figueresi* above, except for the species of caterpillars that it parasitizes, and that it appears to frequent caterpillars in slightly more open and insolated places. Also, the cocoons of the two species (Fig. 2–3, 8) are not morphologically distinguishable in color,

shape, size or the pattern of the way they stick together.

As mentioned above, the 1978–2000 ACG dry forest inventory has reared 12,994 wild-caught sphingid caterpillars of 73 species through the end of 2000. Of these, only 6 species of *Manduca* (out of 2,644 *Manduca* caterpillar rearings of 11 species), *Sphinx merops* (13 rearings), and *Agrius cingulata* (70 rearings) are frequently parasitized by *Microplitis espinachi*. The 6 *Microplitis espinachi* records from *Erinnyis ello*, the 3 from *Cocytius duponchel*, and the 6 records from *Perigonia ilus* (Table 1) are natural "errors" in the same sense as is the single record of *Microplitis figueresi* reared from *Xylophanes turbata*. We conclude that *Microplitis espinachi* is a specialist dry forest parasite on certain species of *Manduca* and species in the two genera *Sphinx* and *Agrius* (which are monospecific in the ACG).

The species of *Manduca, Agrius* and *Sphinx* that are parasitized by *Microplitis espinachi* share habitat (old fields, very young secondary succession, pasture edges) but only occasionally overlap on species of food plants. They live in the more insolated and drier part of the overall habitat, in contrast to the hosts of *Microplitis figueresi* parasitizing the *Erinnyis* species feeding on foliage of *Sebastiana pavoniana* and *Stemmadenia obovata* in the more shady understory of older secondary succession. However, it is commonplace to find all five of these genera of sphingid caterpillars living within a few meters of each other in essentially the same habitat.

In the ACG dry forest, many rearings of *Manduca rustica, M. muscosa, M. corallina, M. lefeburii, M. occulta* and *M. hannibal* have generated *Microplitis espinachi* records in significant numbers. However, *Manduca lanuginosa* (n = 847, one *Microplitis*), *M. dilucida* (n = 654, three *Microplitis*), and *M. florestan* (n = 395, ten *Microplitis*) are conspicuously under-used despite their food plants and caterpillar locations being thoroughly intertwined with those of the six *Manduca* species that are most heavily used by *M. espinachi*. This may be due to extreme habitat specialization by *M. espinachi*. All ten records of *M. espinachi* on *Manduca florestan*, and all 31 records for parasitized *Manduca rustica*—the caterpillars of both may be found from deep shade to fully insolated sites—were from individual plants less than 2 meters tall and with fully insolated crowns. *Manduca lanuginosa* caterpillars are virtually always on plants growing in light shade on forest edges rather than in full sun, and they have no *M. espinachi* records at all.

The 9–15% parasitization of *Agrius cingulata* and *Sphinx merops*—the former feeding on insolated Convovulaceae crowns and the latter on insolated herbaceous mints (Lamiaceae) and *Lantana camara* Linnaeus (Verbenaceae) bushes—reinforces our perception of this pattern of host choice. All three of the natural "errors" recorded in Table 1 (*Cocytius duponchel, Erinnyis ello, Perigonia ilus*) were individual caterpillars in very insolated circumstances. The five records from *E. ello* were all from caterpillars on the crowns of *Manihot* and *Carica* growing in full sun less than two meters above the ground. However, this needs to be counterbalanced by the observation that there are at least 10 other species of sphingid caterpillars that also occur in insolated ACG dry forest habitats and have not (yet) been found attacked by *M. espinachi*. Also, the records of *M. espinachi* on *Manduca lefeburii* on *Casearia corymbosa* Kunth., *Casearia arguta* H. B. and K. and *Casearia sylvestris* Sw. (Flacourtiaceae) are all from caterpillars living within crowns of plants on forest edge or even in the forest edge understory.

While *M. figueresi* parasitizes caterpillars feeding on plants with milky latex (Table 2), the hosts of *M. espinachi* appear to have nothing in common: Annonaceae, Asteraceae, Bignoniaceae, Caricaceae, Convolvulaceae, Euphorbiaceae, Flacour-

tiaceae, Rubiaceae, Solanaceae, Verbenaceae (http://janzen.sas.upenn.edu).

The two "errors" of parasitization of *Cocytius duponchel* caterpillars (feeding on Annonaceae) are instructive. In both cases, the *M. espinachi* larvae emerged over a period of 48 hours and each individual larva struggled for nearly a half hour to get through the thick cuticle. Many of the wasp larvae failed to spin normal tightly closed and strong-walled cocoons.

The suite of caterpillars regularily attacked by *Microplitis espinachi* is also attacked by a small zoo of Tachinidae (*Drino rhoeo* (Walker), *Drino piceiventris, Metavoria* spp., *Leschenaultia* sp. 12, *Chetogena scutellaris* (Townsend), *Belvosia* sp. 6), Ichneumonidae (*Tricyphus respinozai* Ward and Gauld, *Cryptophion manueli* Gauld) and Eulophidae (*Euplectrus walteri* Schauff). However, there is only one braconid record (*Glyptapanteles* sp.) other than *Microplitis espinachi.* This record is probably in itself a "natural error". None of these species of tachinids is highly host-specific, while the parasitic Hymenoptera are.

Conura convergea (Fig. 3) chalcidids attack the cocoons of *Microplitis espinachi* just as they do the cocoons of *Microplitis figueresi. Mesochorus angustistigmatus* likewise attacks *Microplitis espinachi* just as it does *Microplitis figueresi.* There is also one record of a tiny perilampid wasp that emerged from the cocoons of *M. espinachi* from a *Manduca rustica* brought into captivity long before its *Microplitis* larvae emerged from the caterpillar. This single record out of hundreds of *Microplitis* records may suggest that this is a generalist hyperparasite, or at least that this host is not part of its normal host range.

Newly spun *Microplitis espinachi* cocoons are sought at night by females of *Acrolyta stroudi* (Ichneumonidae), while the caterpillar is still "alive" and hanging motionless on a twig (Fig. 8). It is not known if older cocoons can be located by this wasp. The cluster of *Microplitis espinachi* cocoons in Fig. 8 had eleven female *Acrolyta* wasps walking over its surface. Each wasp was territorial about its set of 5–10 cocoons and did not permit the others to walk onto them. The wasps remained in place, walking and ovipositing, throughout the perturbations of capturing the caterpillar, breaking off its branch, and carrying it in a plastic bag for an hour bouncing on a belt loop, and through an hour of photography in the laboratory. Oviposition was directly into the end or side of the cocoon. The daughter wasps eclosed 16–24 days later. There was no suggestion of dormancy. This wasp probably parasitizes other species of ACG dry forest Braconidae in the cocoon stage. This wasp has been seen on only three occasions, but it is a candidate to be a parasite of *Microplitis figueresi* as well.

Microplitis marini.—Only one other species of gregarious *Microplitis* has been encountered among parasite rearings from more than 162,000 wild-caught caterpillars in the ACG dry forest, rain forest, cloud forest, and intergrades. Of 71 rearing records of *Xylophanes tersa* (Sphingidae), only 7 last instar larvae produced *Microplitis marini* (http://janzen.sas.upenn.edu). The rearing records range from 500–1000 m rainforest to cloud forest, but always in early stages of succession (*Xylophanes tersa* feeds on herbaceous Rubiaceae in insolated sites). *M. marini* has been reared from no other species of caterpillar in Costa Rica; in Arizona it has been reported from *X. falco* (Fig. 5), a close congener of *X. tersa.* The single other Costa Rican rearing record of *M. marini* is from a last instar *Xylophanes tersa* caterpillar from near the town of Las Alturas at 1,000 m elevation on the Pacific side of Costa Rica (Marianella Segura, personal communication). This habitat is identical to that of 5 of the 7 ACG *M. marini* records, and the same habitat from which came the three single Malaise trap records of *M. marini* cited under its description above.

Microplitis marini cocoons are distinctive

for their rust red color and for being spun in a tightly packed solid clump (Fig. 5). The clumps result from the larvae emerging through the caterpillar cuticle in 1–3 patches, rather than scattered along the back of the caterpillar as is the case with *M. figueresi* and *M. espinachi*. This clump of cocoons is "glued" very tightly to the back of the caterpillar as well as to each other, and cannot be pulled off without tearing the cuticle of the caterpillar. They are formed on the caterpillar when it is standing upright (rather than hanging below the branch as is normal for *M. figueresi* and *M. espinachi*), *X. tersa* caterpillars often perch upright on the ground and on very low vegetation, both when unparasitized and when the *M. marini* larvae are emerging.

Fifty-four of the 71 ACG rearing records for *Xylophanes tersa* are from dry forest. Since *M. marini* parasitized none of them, it is likely that it is not a dry forest wasp. It has never been collected in more than 30 Malaise trap-years of ACG dry forest. It may, however, be significant that the habitat of its host in the rain forest, cloud forest, and intergrades—very early secondary succession—is the driest, sunniest and warmest microhabitat available. There is no suggestion that it parasitizes any of the other 15-plus species of *Xylophanes* (from more than 1,300 wild-caught rearings) and many tens of other species of Sphingidae that occupy the ACG rainforest and cloud forest. It is hyperparasitized by a single unidentified species of *Mesochorus* (Ichneumonidae).

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Review of *Chaetomymar* Ogloblin, with Description of a New Species in the Hawaiian Islands (Hymenoptera: Mymaridae)

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Abstract.—The Old World genus *Chaetomymar* Ogloblin, with 11 nominal species, is reviewed and a key to 10 species is presented. ***Polynema dei* Girault** is transferred to ***Chaetomymar*** as ***C. dei* (Girault), comb. nov.** ***Chaetomymar indopeninsularis* (Mani and Saraswat), stat. rev.**, is removed from synonymy under *C. bagicha* (Narayanan, Subba Rao and Kaur). ***Chaetomymar sophoniae*, sp. nov.**, is described from eggs of the two-spotted leafhopper, *Sophonia rufofascia* (Kuoh and Kuoh), in the Hawaiian Islands. It most likely originated from the Oriental region, possibly southern China. *Acanthomymar* is synonymized under *Polynema* and its type species transferred as ***P. nigrum* (Subba Rao), comb. nov.**

In 1987, the two-spotted leafhopper, *Sophonia rufofascia* (Kuoh and Kuoh) (Cicadellidae), was found in the Hawaiian Islands and is now widespread on the larger islands in the chain (Jones et al. 2000, Yang et al. 2000). Shortly thereafter, a mymarid was reared from its eggs (Johnson et al. 2001). It represents a new species of *Chaetomymar* Obloblin, misidentified initially as *C. bagicha* (Narayanan, Subba Rao, and Kaur) by Beardsley and Huber (2000). The mymarid was presumably introduced accidentally into Hawaii together with its host, almost certainly from the Oriental region. More recently, *S. rufofascia* was found in California (Garrison 1996) and Tahiti (Polhemus 2001). Because the mymarid is the most important egg parasitoid of *S. rufofascia* in Hawaii and may eventually be introduced intentionally into other areas as a biological control agent, it is described here. To place the new species into context, the described species of *Chaetomymar* are keyed and notes on some of them given. Because previous authors have suggested that *Acanthomymar* Subba Rao may be a synonym of *Chaetomymar* it is also discussed and its type species, *A. nigrum* Subba Rao, is redescribed as *Polynema nigrum* (Subba Rao), comb. nov.

METHODS

About 220 point or card-mounted specimens and 45 slide-mounted specimens were examined from the Natural History Museum, London (BMNH), Bernice P. Bishop Museum (BPBM), University of California, Berkeley (CISC), Canadian National Collection (CNCI), University of Hawaii at Manoa (CTAM), Biological Control Research Institute, Fujian Agricultural and Forestry University, Fuzhou (FAFU), Indian Agricultural Research Institute, New Delhi (IARI), Museo de la Plata, La Plata (MLPA), Plant Protection Research Institute, Pretoria (PPRI), Queensland Museum (QMBA), University of California, Riverside (UCRC), and National Museum of Natural History, Washington, DC (USNM). Colour and body length of both sexes were described from critical point dried and card- or point-mounted specimens. Other features were described from slide mounted material. The scanning electron micrographs were cleaned and compiled into plates using

Adobe Photoshop. All measurements are in micrometers and include the mean, usually followed in parentheses by the range, sample standard deviation, and number of specimens measured. Primary type measurements are tabulated separately and are not included in the species descriptions. Abbreviations are: F = funicle segment in females or flagellomere in males; FW = forewing, HW = hind wing, LMS = longest marginal setae, Gt = gastral tergum, POL = distance between posterior ocelli. Key features are based on specimens examined except for *C. tayalum* and *C. gracile*. Key features for these are taken from the original descriptions.

Chaetomymar Ogloblin

Chaetomymar Ogloblin, 1946: 277 (original description); Ogloblin, 1952: 137 (placement of *Chaetomymar* in Bruchomymarini); Annecke and Doutt 1961: 34 (diagnosis); Subba Rao, 1970: 668 (comparison with *Acanthomymar*); Schauff, 1984: 57 (diagnosis, relationships); Hayat, 1992: 85 (comparison with *Acanthomymar* and *Himopolynema*); Hayat and Anis 1999a: 18 (comparison with *Himopolynema*); Triapitsyn and Berezovskiy 2002: 2 (distribution).

Type species.—*Chaetomymar kusnezovi* Ogloblin, by *original* designation.

Diagnosis.—Body of female mostly yellow, clava dark brown; body of male light brown. Face with toruli separated from vertex by at least one torular diameter and subantennal grooves absent. Vertex with numerous short, strong, blunt setae. Female clava brown, contrasting with yellowish funicle, and with 7 longitudinal sensilla. Female funicle at most with only 1 longitudinal sensillum, on F6. Scape smooth on medial and lateral surfaces. Pronotum with several pairs of long, strong setae and spiracle on a short stalk. Propleura broadly abutting anteriorly, the prosternum thus "closed" anteriorly. Axilla each with long, strong, blunt seta extending at least to level of posterior margin of scutellum. Metanotum usually hidden medially under posterior margin of scutellum. Scutellum with placoid sensilla in posterior half and much closer to lateral margin than to each other, and usually with a minute seta near lateral margin just outside each placoid sensillum. Propodeum with 1–3 pairs of setae and sometimes a short median carina extending from short nucha up to half the distance to dorsellum. Forewing with posterior margin distinctly sinuate behind marginal vein and just beyond. Marginal vein linear, with anterior and posterior margins parallel, and both proximal and distal macrochaetae present. Stigmal vein with basal placoid sensillum next to apical group of 4 sensilla, thus forming a curved line of 5 sensilla. Petiole joined to gastral tergum.

Ogloblin (1946), Annecke and Doutt (1961), Schauff (1984), and Hayat and Anis (1999b) discussed features of *Chaetomymar* that appeared to define the genus. These and other apparently distinctive features are summarized above. However, as with most mymarids, any one feature may also occur in other, sometimes unrelated, genera so most or all the features should be present before assigning a specimen to *Chaetomymar*. The two most readily visible features of *Chaetomymar*, namely, the yellow body colour in females and the long axillar setae, also occur in other genera, e.g., the New World genus *Neomymar* Crawford, so these features alone are inadequate to define *Chaetomymar*. However, the axillar setae in *Chaetomymar* usually extend the length of the scutellum, often much more, whereas in other genera they are usually shorter than the scutellum length.

Distribution.—*Chaetomymar*, as defined here, is an Old World genus with 11 nominal species from the eastern Palearctic (west to Arabian peninsula), Afrotropical, Oriental, and Australian regions. Yoshimoto (1990) incorrectly included *Chaetomymar* in his New World list. Specimens under this name in the CNCI were found to belong to other genera and I have not

found any other western hemisphere specimens that could be identified as *Chaetomymar*, as defined here.

Hosts.—Cicadellidae: *Penthimiola bella* (Stål)—*C. gracile* Prinsloo and *C. lepidum* Annecke and Doutt (Prinsloo 1986); *Sophonia rufofascia, S. pallida* (Melichar) and *S. furcilinea* (Kuoh and Kuoh)—*C. sophoniae* sp. n.; *Hishimonus sellatus* (Uhler)—*C. hishimoni* Taguchi (Taguchi 1975). Lymantriidae: *Euproctis flexuosa* Snellen—*C. elisabethae* (Ferrière) (Ferrière 1931). Lyonetiidae: *Leucoptera* sp. (coffee leaf miner)—*C. lepidum* (Subba Rao 1970). Hosts have been reported for almost half the described species, which is surprising for a genus with few, uncommonly collected individuals. The records from Cicadellidae are considered reliable whereas those from Lepidoptera, if correct, are exceptional because Mymaridae normally do not parasitize members of this order.

Discussion.—*Chaetomymar* belongs to a group of genera that Ogloblin (1952) placed in Bruchomymarini and Annecke and Doutt (1961) placed in Mymarini. Ogloblin (1952) had classified *Chaetomymar* in Bruchomymarini on the basis of 2 pairs of propodeal setae. His tribal classification was based on few characters that are not sufficiently reliable to group the genera meaningfully. Thus, species with only one pair of propodeal setae, e.g., *C. hishimoni, C. tayalum* Taguchi (Taguchi 1975), and *C. bagicha* (Hayat 1992), would key to Ogloblin's Polynematini, whereas those with at least two pairs, e.g., *C. elisabethae, C. kusnezovi*, and *C. gracile*, would key to Ogloblin's Bruchomymarini.

Schauff (1984) narrowed down the relationships of *Chaetomymar* to five genera—*Stephanodes* Enock, *Polynema* Haliday, *Acmopolynema* Ogoblin, *Mymar* Curtis, and *Neomymar*, based on his study of Holarctic genera. Hayat (1992) and Hayat and Anis (1999b) referred to these (but not *Neomymar*, which does not occur in India, the area they treated), *Narayanella* Subba Rao and *Himopolynema* Taguchi as the *Polynema* group, following Soyka's (1956) designation (for the 11 nominal genera that Soyka considered as related to *Polynema*). Here, I further reduce the number of genera in the *Polynema* group by excluding *Stephanodes*, which differs by several features including absence of the proximal macrochaeta on the marginal vein (Huber and Fidalgo 1998), and *Mymar* and *Neomymar*, which have the toruli abutting against the transverse trabecula or almost so. The genera in the Old World closest to *Chaetomymar* are probably *Polynema, Himopolynema, Acanthomymar*, and perhaps *Acmopolynema*. None of these are particularly well defined at present. The gap between them is small compared to many other mymarid genera, and species such as *Acmopolynema unimaculatum* Hayat and Anis, only tentatively assigned to *Acmopolynema* (Hayat and Anis 1999b), seem to bridge the gap with a mosaic of features that occur in one or more of the other genera.

Subba Rao (1970) contrasted his genus *Acanthomymar* specifically with *Chaetomymar*. New (1976) pointed out the resemblance of *Acanthomymar* to some Australian *Polynema*. *Acanthomymar nigrum* Subba Rao, the only species in the genus, differs from *Chaetomymar* species as follows. Propodeum without trace of median carina above base of petiole (but some *Chaetomymar* also lack the carina). Scutellum with placoid sensilla in anterior half and closer to each other than to lateral margin. Stigmal vein with basal placoid sensillum separated from apical group of 4 sensilla and located just basal to distal macrochaeta. Clava same colour as funicle, with 9 or 10 longitudinal sensilla. Funicle without sensory ridges on F6. Body and appendages dark brown. *Acanthomymar* otherwise has most of the features of *Chaetomymar*, particularly the long, blunt setae on the thorax. Hayat (1992) suggested that *Acanthomymar* might prove to be a synonym of *Chaetomymar*. Hayat and Anis (1999b) suggested that the only feature of possible ge-

neric value separating *Acanthomymar* from *Chaetomymar* was the position of the placoid sensilla on the anterior half of the scutellum in *Acanthomymar* instead of the posterior half, as in *Chaetomymar*. *Acanthomymar* also has most of the features of some species placed in *Polynema* (as *Maidliella*) by Debauche (1949), particularly the anterior position of the scutellar placoid sensilla and the dark brown or black body colour. Unfortunately, Debauche did not describe mesosomal setation for any of the 13 Afrotropical species he treated, other than to say that the thorax except the pronotum is glabrous and the propodeum is smooth. Because the mesoscutal and axillar setae are sometimes almost transparent Debauche may have failed to notice them. He did, however, mention the placoid sensilla. These vary in position from well in front of the middle to near the posterior margin of the scutellum. In addition, two of the Afrotropical *Polynema* species have the basal placoid sensillum of the stigmal vein separated from the apical group, as in *A. nigrum*. At least two others have short, blunt, nail-like setae on the anterior margin of the forewing base and behind the marginal vein, also as in *C. nigrum*.

What should be done with *Acanthomymar*? Four possibilites could be argued for almost equally. Either *Acanthomymar* could be synonymized under *Polynema*. Or some African *Polynema* could be transferred to *Acanthomymar*, which should be kept as a valid genus. Or *Acanthomymar* could be synonymized under *Chaetomymar* and some *Polynema* should also be transferred to *Chaetomymar*. Or *Acanthomymar* and *Chaetomymar* could both be synonymized under *Polynema*, and treated perhaps as subgenera or species groups. It seems best at present to synonymize *Acanthomymar* as syn. nov. under *Polynema* and transfer its only species to *Polynema* as *Polynema nigrum* (Subba Rao), comb. nov. The merit of this choice is that *Chaetomymar*, as defined here, will then include only species whose females have mainly yellow bodies and contrasting dark antennal clava. Females, at least, are then all fairly easily distinguished from *Polynema* species (including *Acanthomymar*) on colour alone.

The species of *Chaetomymar* fall into two groups; those with brown-banded wings and those with clear wings. Within each the species are difficult to distinguish. In addition to presence and shape of wing bands, the number and position of the propodeal setae, and proportions of the scutellum are useful species characters. More material of most species is needed to determine the reliability of these characters.

KEY TO DESCRIBED *CHAETOMYMAR* SPECIES

1 Forewing with two brown bands, one medial and one apical (Figs. 25–33) 2
Forewing uniformly clear, without brown bands (Figs. 34–38) 5

2(1) Forewing with area between dark anterior and posterior margins of apical band almost as dark throughout, with basal demarcation of the band straight (Figs. 28, 29, 32) ... 3
Forewing with area between dark anterior and posterior margins of apical band mostly clear except at wing apex, with basal demarcation of apical brown band strongly concave (Figs. 25–27, 30, 31, 33) 4

3(2) Forewing with basal margin of apical brown band perpendicular to long axis of wing (Figs. 28, 32); face with about 10 setae below each torulus (Fig. 3) ..... ***sophoniae* Huber, sp. nov.**
Forewing with basal margin of apical brown band oblique, so the dark area is shorter along posterior margin of wing than along anterior margin (Fig. 29); face with about 15 setae below each torulus ..... ***indopeninsularis* (Mani and Saraswat)**

4(3) Forewing with apical brown band distinctly wider along anterior margin at apex than along posterior margin (Figs. 25, 31) ..... ***bagicha* (Narayanan, Subba Rao and Kaur)**
Forewing with apical brown band at most only slightly wider along anterior margin at apex than along posterior margin and wing apex (Figs. 30, 33) ..... ***dei* (Girault)**
5(1) Propodeum with one pair of setae (Fig. 7) 6
Propodeum with two pairs of setae 7
6(5) Female clava without crescent-shaped, transverse sensillum ..... ***hishimoni* Taguchi**
Female clava with a crescent-shaped, transverse sensillum ..... ***tayalum* Taguchi**
7(5) Forewing relatively narrow, length/width almost 7.8 (Fig. 34) ..... ***elisabethae* (Ferrière)**
Forewing relatively broad, length/width at most 6.2 8
8(7) Forewing length/width 6.2 (Fig. 35) ..... ***kusnezovi* Ogloblin**
Forewing length/width about 5.7 (Fig. 36) 9
9(8) Propodeum with submedian setae much closer to each other than to sublateral line .... ***lepidum* Annecke and Doutt**
Propodeum with submedian setae closer to sublateral setae than to each other .... ***gracile* Prinsloo**

Chaetomymar gracile Prinsloo

Chaetomymar gracile Prinsloo, 1986: 348 (original description).

Type material.—Holotype ♀ (PPRI), not examined.

Comments.—Prinsloo (1986) noted differences in the structure and proportions of the antennal segments between *C. lepidum* and *C. gracile*. These differences may be more apparent than real because the female antenna of *C. lepidum* is illustrated in dorsal view (Annecke and Doutt 1961) whereas that of *C. gracile* is illustrated in lateral view. The excellent illustrations by Annecke and Doutt (1961) and Prinsloo (1986) of both species show the key feature (number of propodeal setae) used above.

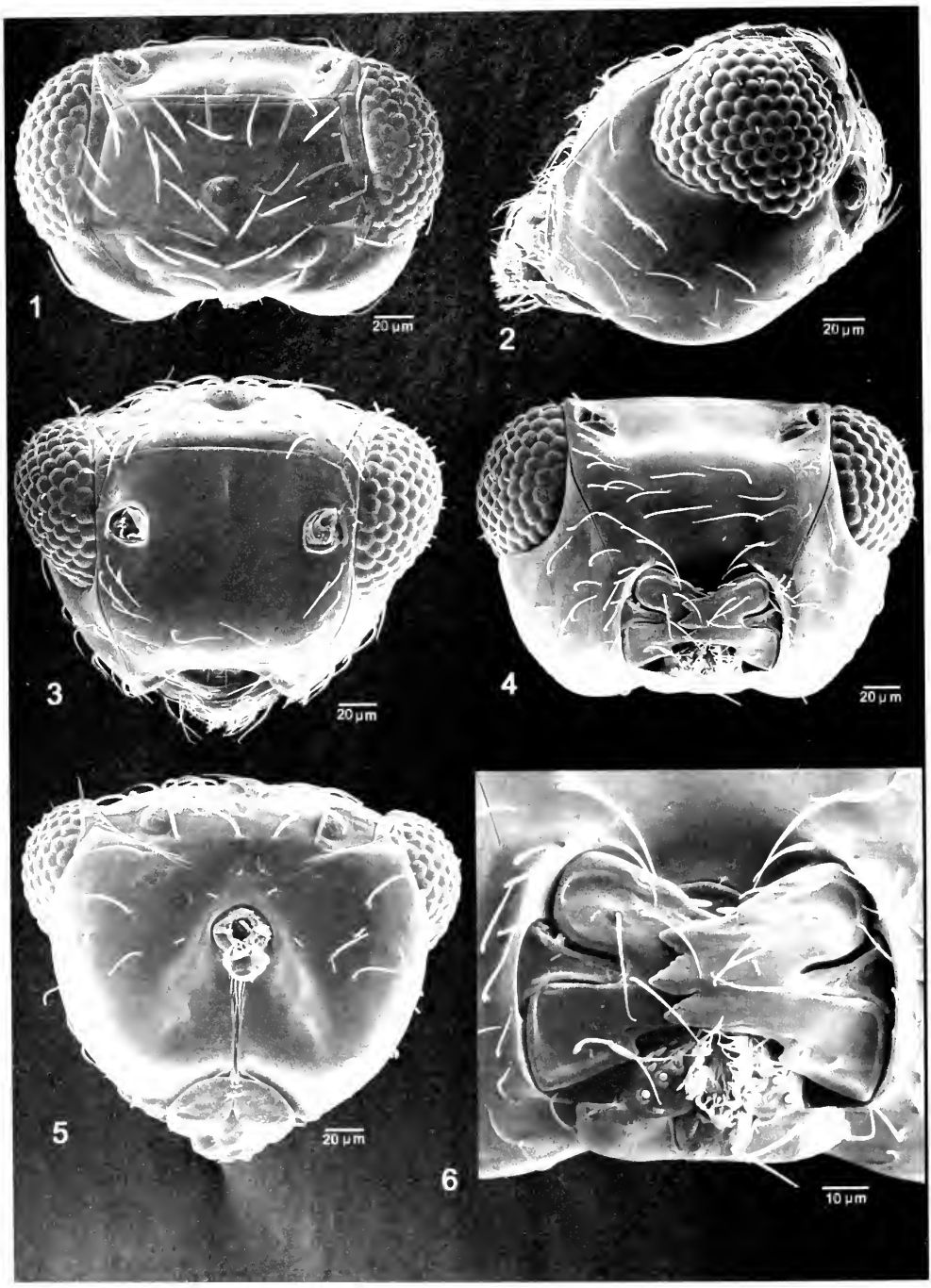
Chaetomymar hishimoni Taguchi

Chaetomymar hishimoni Taguchi, 1975: 111 (original description); Schauff, 1984: 57 (list); Triapitsyn & Huber, 2000: 613 (key).

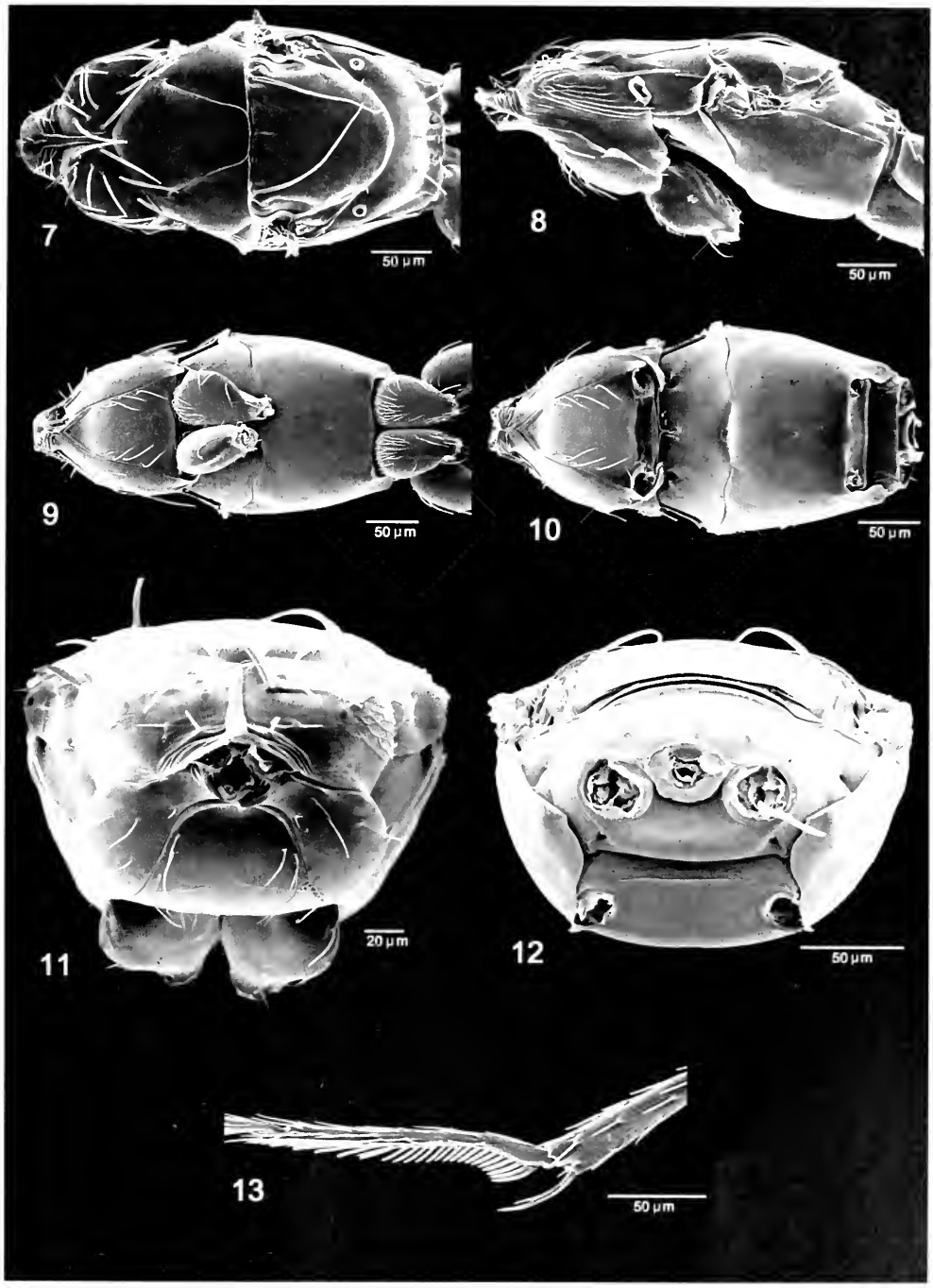
Type material.—The type specimens of this species, reared from *Hishimonus sellatus*, are lost according to Mr. Toshio Muroi, Kyushu University, and Dr. Kenzou Yamagishi, Meijo University (pers. comm.). Dr. Tetsusaburo Tachikawa (in litt. to Mr. Muroi) believes the types have been destroyed.

?Other material.—JAPAN: Fukuoka, ?Sept.1967, K. Yasumatsu, ex. overwintering eggs of *H. sellatus* on mulberry (2♀♀, CISC). CHINA: Fujian, Jiangle, 10.x.1991, N.Q. Lin [determined as *C. hishimoni* by Xu Mei] (1♀, CNCI).

Comments.—The two slide-mounted specimens from Fukuoka may represent *C. hishimoni* but differ from the original description as follows. Forewing with two brown bands (Fig. 27), extreme apex of hind wing brown, bases of F2 and F3 narrowly brown (no mention of brown banding in original description), body honey yellow (brown in description), slightly darker than light yellow scape, pedicel and funicle, legs and petiole. Propodeum with 2 and 2 propodeal setae (1 and 1 in description and illustration) but on the laterally mounted specimen only 1 seta in total is visible. Vertex with 11 or 12 setae on each side (13 in description). Clava with 4 apical and 2 medial sensilla (Fig. 41) (also with subapical sensilla in description). The specimen from Jiangle is similar to the Fukuoka specimens, but has only one pair of propodeal setae, positioned as in the original illustration of *C. hishimoni*. It appears to have only 6 sensory ridges on the clava, instead of seven. Taguchi's



Figs. 1–6. *Chactoxynnax sophonae*, Hawaiian Is., Oahu, head. 1, Dorsal. 2, Lateral. 3, Anterior. 4, Ventral. 5, Posterior. 6, Mouthparts.



Figs. 7–13. *Chactomymar sophonae*, Hawaiian Is., Oahu. 7–12. Mesosoma. 7, Dorsal. 8, Lateral. 9, 10, Ventral with and without coxae. 11, Anterior. 12, Posterior. 13, Foretibial spur.

Table 1. Measurements (in m) of primary types of nominal species of Asian *Chaetomymar*, except *C. tayalum* and *C. hishimoni* whose types are lost. Abbreviations used: Co. = Coxa; Fem = femur; FW = forewing; HT = holotype; HW = hind wing; L = length; LTS = longest marginal setae; LT = lectotype; Ovip. = ovipositor; Tib. = tibia; Tr. = trochanter; W = width. Some measurements could not be made because parts were missing or not clearly visible. Measurements of structures positioned obliquely are inaccurate and are indicated by "≈".

Nominal species	Type	Head	Mesosoma		Ovip.	Ovipositor/	Forewing				
		W	W	L	L	hind tibia	L	W	L/W	LMS	Venation L
sophoniae	HT	220	163	124	370	1.10	838	126	6.65	155	211
bagicha	HT	≈298	≈278	≈144	346	0.98	910	155	5.85	183	257
deccana	HT	238	≈229	—	281	1.02	730	119	6.11	187	177
indopeninsularis	HT	332	—	206	412	0.90	1146	182	6.30	252	225
elisabethae	HT	239	—	150	271	0.64	1181	152	7.78	218	270
kusnezovi	HT	257	211	133	≈273	—	1030	180	5.72	210	260

measurement of F6, greater than F5, is clearly an error. F6 should be shorter than F5, as he illustrated. Otherwise, the measurements of the two Fukuoka specimens fall within the limits given by Taguchi.

The reduced thickness of the apical brown band on the forewing (compare Figs. 27, 30, and 33) of the Fukuoka and Jiangle specimens is similar to *C. bagicha* and, particularly, to *C. dei*. In contrast, the complete absence of a propodeal carina in the Fukuoka and Jiangle specimens, exactly as in Taguchi's illustation of *C. hishimoni*, shows that *C. hishimoni* is different from *C. bagicha* and *C. dei*, both of which have propodeal carina. *Chaetomymar bagicha* was collected "sweeping luzerne and mulberry". *Chaetomymar hishimoni* was reared from *H. sellatus*. The two Fukuoka specimens were reared from *H. sellatus* on mulberry. This might suggest that *C. hishimoni* might be a junior synonym of *C. bagicha*, as both species were collected on mulberry, but the propodeal differences suggest that they are indeed different species. A better option, given the loss of the type series, is to designate one of the two Fukuoka specimens as neotype of *C. hishimoni*, based on a similar propodeal structure and assuming that the other differences between the Fukuoka specimens and the original description of *C. hishimoni* are due to variation. Finally, if Taguchi's description is accurate and one assumes no variation then it appears that the two Fukuoka specimens represent a third species reared from *H. sellatus*, different from *C. hishimoni* and *Himopolynema hishimonus* Taguchi (Taguchi 1977). More reared material of *Chaetomymar* from *H. sellatus* and other hosts, preferably from mulberry in the type localities of *C. hishimoni* in Japan (Ayabe, Kyoto Pref., Akakura, Niigata Pref. and Seto, Aichi Pref.), is needed to assess variation more thoroughly before

Table 1. Extended.

Hind wing				Foreleg								
								Tarsus				
L	W	LMS	Vein L	Co.	Tr.	Fem.	Tib.	Total	1	2	3	4
773	20	120	226	91	71	226	304	367	184	70	55	55
803	18	146	238	98	54	272	273	337	137	87	53	53
636	19	125	187	77	46	205	197	254	98	66	45	45
1096	26	185	319	108	72	329	307	401	168	106	76	55
968	13	172	301	94	60	309	334	296	241	112	71	68
827	25	208	272	95	≈62	≈223	296	340	139	77	64	56

Table 1. Extended.

	Middle leg									Hind leg							
					Tarsus									Tarsus			
Nominal species	Co.	Tr.	Fem.	Tib.	Total	1	2	3	4	Co.	Tr.	Fem.	Tib.	Total	1	2	3
sophoniae	87	70	245	307	366	185	71	52	55	96	71	≈391	337	374	212	64	47
bagicha	91	67	281	340	381	180	90	57	51	125	79	309	373	380	193	81	57
deccana	62	49	201	260	292	128	68	46	46	87	57	229	263	295	139	65	46
indopeninsularis	88	64	318	401	488	240	106	74	65	157	84	394	445	478	256	95	68
elisabethae	89	70	334	450	501	258	101	75	62	168	79	370	428	512	285	94	65
kusnezovi	87	66	≈264	413	362	167	77	63	59	109	83	≈332	427	329	164	70	52

determining the status of *C. hishimoni* and, if necessary designating a neotype from that material.

Chaetomymar kusnezovi Ogloblin
(Figs. 35, 46)

Chaetomymar kusnezovi Ogloblin, 1946: 277 (original description); Taguchi, 1975: 113 (comparison with *C. hishimoni*); Schauff, 1984: 57 (mistakenly reported from Europe); Triapitsyn and Huber, 2000: 613 (key); Triapitsyn and Berezovskiy, 2002: 3 (new record).

Type material.—Holotype ♀ (MLPA), examined. Labelled as follows 1. "*Polynema Chaetomymar kuznezovi* ♀ A.O. Typus Nikolsk Ussurijskij Ussurij Oblast' vi.1926. N.N.K." 2."3920". The year on the type slide is different from that given in the original description, i.e., 1928.

Other material.—RUSSIA. Primorskii krai: Gornotayozhnoye, 21–31.vii.2000, M.V. Michailovskaya (1♀ on point, UCRC). CHINA. Liaoning: Shenyang, 8.vii.1992, N.Q. Lin (1♀, on slide, CNCI).

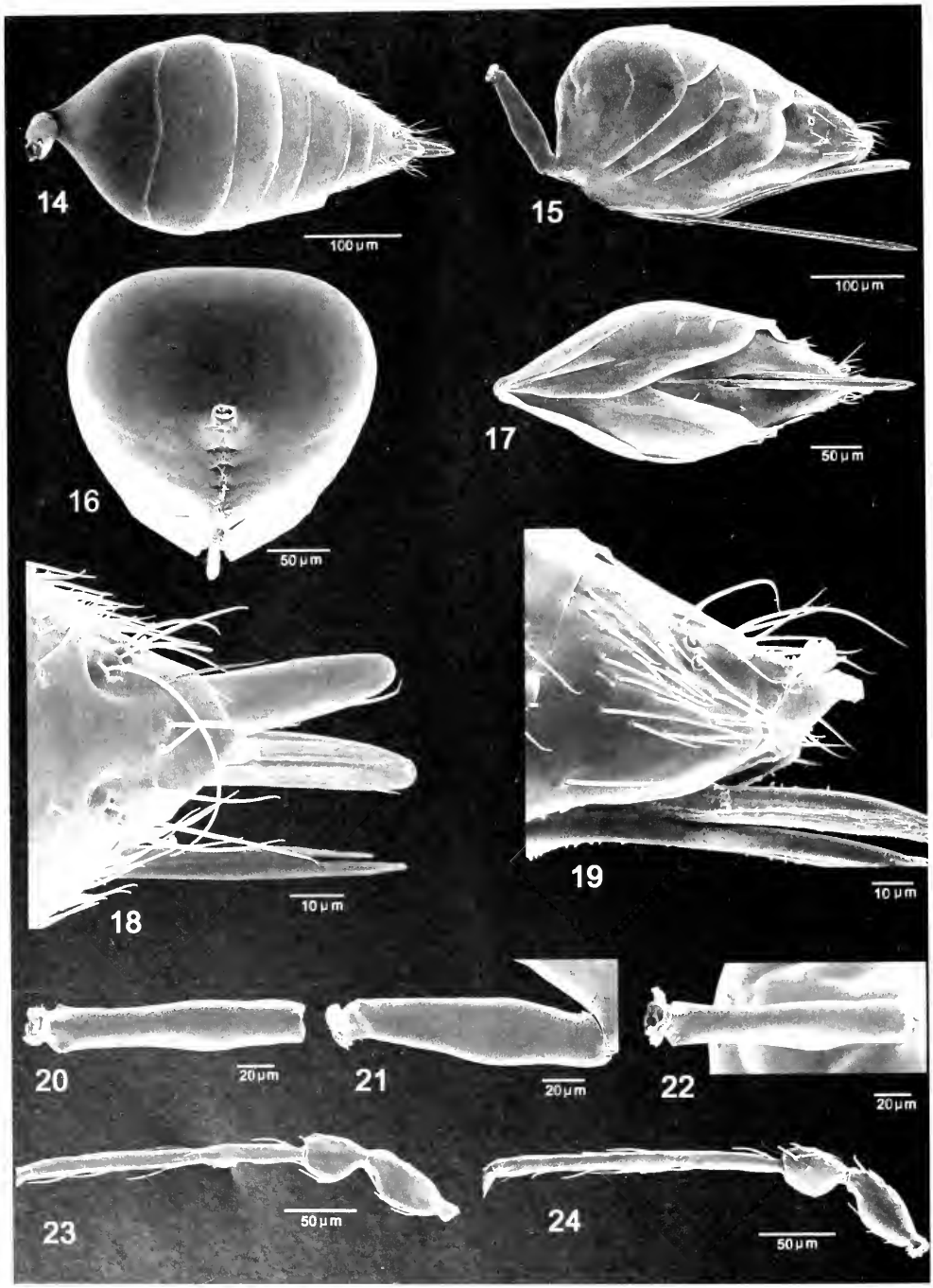
Comments.—The Russian female was collected in a Malaise trap about 18 km SE of the type locality. The axillar seta is very strong and thick and it agrees perfectly with the holotype (S. Triapitsyn, pers. comm.). The Chinese female, tentatively assigned here to *C. kusnezovi*, is smaller, has narrower wings (FW length/width = 7.3) and lacks the sublateral pair of propodeal setae. The thickness of the axillar setae cannot be determined because they are broken off but the submedian pair of propodeal setae are very closed together and almost touching the posterior margin of the propodeum, as in *C. kusnezovi*.

Chaetomymar lepidum Annecke and Doutt
(Figs. 36, 51)

Chaetomymar lepidum Annecke and Doutt, 1961: 54 (original description); Subba Rao, 1970: 665 (new distribution records—Tanzania, South Africa, host—*Lencoptera*); Schauff, 1984: 57 (list); Prinsloo, 1986: 347 (host record); Viggiani, 1989: 146 (male genitalia).

Table 1. Extended.

Scape		Pedicel		Funicle article 1		2		3		4		5		6		Clava	
L	W	L	W	L	W	L	W	L	W	L	W	L	W	L	W	L	W
77	31	55	30	80	13	126	13	125	15	84	16	65	18	62	22	156	45
102	32	57	29	79	—	157	—	149	—	107	—	72	—	69	—	160	—
82	29	48	29	58	12	121	13	108	13	80	14	51	17	53	22	131	49
102	39	68	33	90	14	178	15	176	17	138	17	104	20	86	27	176	58
84	—	65	—	93	14	196	14	181	16	172	17	90	17	94	21	188	≈46
142	—	68	—	108	14	144	15	127	15	100	16	72	19	63	26	185	62



Figs. 14–24. *Chaetomymar sophoniae*, Hawaiian Is., Oahu. 14–19. Metasoma. 14, Dorsal. 15, Lateral. 16, Anterior. 17, Ventral. 18, 19, Apex of gaster, dorsal and lateral. 20–22, Petiole dorsal, lateral and ventral. 23, 24, Female scape-F2, medial and lateral views.

Type material.—Holotype ♀ (PPRI), not examined. One male paratype (MLPA) was examined.

Comments.—Annecke and Doutt excluded 9 specimens from their type series that differed in several minor features from the type series, and, particularly, the presence of 3 pairs of propodeal setae. The number and position of propodeal setae are important features for distinguishing species of *Chaetomymar*, but some variation occurs. The specimens may represent a new species.

Chaetomymar bagicha (Narayanan, Subba Rao and Kaur)

(Figs. 25, 26, 39, 40, 48)

Polynema bagicha Narayanan, Subba Rao and Kaur, 1960: 886 (original description); Narayanan and Subba Rao 1961: 667 (additional descriptive features).

Acmopolynema bagicha; Mani, 1989: 1411 (redescription); Subba Rao and Hayat, 1983: 131 (checklist, transfer to *Acmopolynema*); Fidalgo, 1989: 6 (reasons for removing *C. bagicha* from *Acmopolynema*).

Chaetomymar bagicha; Hayat, 1992: 85 (transferred from *Polynema* to *Chaetomymar*).

Mymarilla deccana Mani and Saraswat, 1973: 109 (original description).

Polynema deccana; Subba Rao, 1976: 89 (transferred to *Polynema*); Subba Rao and Hayat, 1983: 131 (synonymy under *bagicha*).

Type material.—Holotype ♀ (of *bagicha*) (IARI), examined. On slide, labelled as follows: 1."Mymaridae.8 IARI Entom Div *Polynema bagicha*. col. R.R.K 10/5/57." 2."Holotype *Poly. bagicha* No. 8." (written in black ink directly on slide). A red circle with "Holotype ♀" written on it has been added to indicate its primary type status. The specimen is uncleared, complete but slightly crushed, under a large coverslip ringed in black (mounting medium therefore probably water soluble). Allotype ♂ (IARI), with similar labelling as holotype but "Delhi, 17/8/57" replaces the collector abbreviation. The original description gives the allotype date as the collection locality and date for the holotype; this is assumed to be an inadvertent error. Although no locality is given on the holotype slide it is assumed to have been collected at the same place as the allotype, as indicated in the original description. The remaining two females and one male were not examined.

Holotype ♀ (of *deccana*) (USNM), examined. On slide, labelled as follows: 1. "Mani & Saraswat holotype Mymarilla deccana" [written in black ink directly on slide]. 2."School of Entomology St. John's College Agra—2 India". 3. "5-1. Bhorgat Dam: Poona Coll. Mani & party 6.iii.1972". 3."Holotype". The specimen is uncleared and flattened under one coverslip.

Other material examined.—INDIA: Delhi, 11.v.1985, J. LaSalle (2♀ on cards, 1♀ on slide, and 5♂ on cards, 2♂ on slides, CNCI). SRI LANKA: Central Gannoruwa Wet Zone, 20.vi.1987, A. Wijesekara, crop (1♀, USNM); NE Alawakumbura Madura Oya, 26.vi.1988, A. Wijesekara, on weeds (1♀, USNM).

Diagnosis.—This species is distinguished from *C. dei* by the wider dorsoapical brown part of the apical band on the forewing, and the presence of a longitudinal sensillum on F6 in females. It is distinguished from *C. sophoniae* and *C. indopeninsularis* by the brown apical band being distinctly darker anteriorly and posteriorly than medially (Fig. 25), such that the basal margin of the band appears strongly concave (band more uniformly coloured and with almost straight basal margin in *C. sophoniae*).

Female.—Holotype measurements given in Table 1. *Colour.* Bright yellow except brown to dark brown are median part of each trabecula, apex of ovipositor, apical quarter of hind femur, tarsomere 4 of all legs. Forewing with the basal brown band mainly along posterior margin and apical one much wider along anterior than posterior margins and its medial area mainly hyaline, the basal margin of the band thus

strongly concave. Hind wing with apical margin dark brown. Funicle segments uniformly yellowish except F5 and F6 almost white in the female from NE Alawakumbura Madura Oya. *Head:* Width 235 (n = 1). Vertex with about 36 short, thick, white setae. Occiput with 3 and 3 thick setae dorsally and about 5 and 5 finer setae ventromedially and laterally. Gena below eye with about 17 moderately coarse setae. Face laterally below each torulus with about 19 and 19 moderately coarse setae. *Antenna:* Length measurements (n = 1) are: scape 84; pedicel 54, F1–F6 72, 141, 131, 98, 62, 62, clava 150. Clava and F6 with 7 and 1 longitudinal sensilla, respectively (Fig. 39). *Mesosoma:* Prothorax with about 12 and 12 thick, blunt, white setae mainly in posterior half. Mesoscutum between notauli with 1 and 1 short, very fine setae midway between anterior and posterior margins and lateral panels of mesoscutum with 1 thick long seta sublaterally. Scutellum with 1 and 1 thick setae almost at anterior margin next to (or perhaps on) axilla. Propodeal seta midway between anterior and posterior margins and medial to spiracle, and almost reaching posterior margin. *Wings:* Forewing (Fig. 25) length (n = 1) = 827, width = 142, FW length/width = 5.83, LMS = 190. Hind wing length 753, width 19, LMS = 123. *Metasoma:* Petiole length 137 (n = 1). Gt_{2-7} each with 1 and 1 minute setae midway between median and lateral margin. Gt_8 with spiracle and 3 and 3 moderately long setae behind spiracle. Gt_9 with about 13 setae lateral to cercus. Sternum with about 13 and 13 setae lateral to apex of ovipositor. Ovipositor length 305 (n = 1), 0.91 times as long as hind tibia.

Male.—Similar to female except as follows. Body length 829 (range 742–922, ssd = 67, n = 5). Colour generally darker. Yellow, except brown to dark brown are F3–F11 (progressively darker), median part of each trabecula, vertex, apical third of hind femur, apical tarsomere of all legs, Gt_1 medially, most of Gt_5 and all of Gt_6. Forewing very slightly narrower: FW length/width = 5.74 (5.67–5.81, n = 2). Flagellum length = 923 (883–971, n = 3). Length/width of F6 = 3.31 (3.19–3.35, 0.11, n = 3). Gt_6 without spiracle and 1 and 1 minute setae. Gt_7 with 6 and 7 setae lateral to cercus and 1 and 1 setae close together on flat median projection between cerci. Gs_7 with 2 and 2 setae lateral to genitalia and 2 and 2 at apex. Another 2 and 2 setae occur medioventrally and laterally on the ventral median projection of sclerite (or perhaps on an extrusion of the crushed genitalia of paratype?). Genitalia with aedeagus bent ventrally at a right angle at about its midpoint. Genital capsule length 55.

Chaetomymar dei (Girault), comb. nov.

(Figs. 30, 33, 43, 50)

Polynema dei Girault, 1922: 104 (original description); New 1976: 5 (notes on holotype, measurements, illustrations); Dahms 1983: 215 (locality data for holotype).

Type material.—Holotype ♂ (QMBA), examined.

Other material examined.—AUSTRALIA: Northern Territory: 53 km SSW Darwin, 12°52′10.5″S 130°35′04.4″E, 25.viii–1.ix.1998, M. Hoskins, mango patch, Malaise trap (1♀ & 1♂ on slides, CNCI). Queensland: Blackfellow Creek, 3 km N. Edmonton, 17°00′S 145°46′E, 27.iv.1997, C.J. Burwell (1♂ on point, QMBA); Cairns, 1.iv.1991, J.D. Pinto, wooded riparian, sweeping (1♀ & 3♂♂ on points, CNCI). PAPUA NEW GUINEA: Central Province: near Eicogo ≈40 km E. Port Moresby, 28.xii.1985, G. Gordh, rainforest, sweeping (1♂, CNCI).

Comments.—New (1976) illustrated and measured the forewing and antennae based on the male holotype and a female collected by Girault (and labelled "cotype") but not mentioned in the original description. The holotype forewing (Fig. 33) and a forewing and female and male antennae from specimens that likely represent *C. dei* collected near Darwin are illustrated (Figs. 30, 43, 50).

Diagnosis.—Forewing with apical brown area broader anteriorly than posteriorly, and almost divided into two parts at extreme apex of wing where the clear area extends almost to wing apex (Fig. 33). In *C. sophoniae* and *C. bagicha* the apical band, especially along the anterior margin, is wider. The male holotype has a distinctly wider forewing than the female "co-type". This appears to be a secondary sexual difference, as it seems to occur also in other species as well.

Chaetomymar indopeninsularis (Mani and Saraswat), stat. rev.

(Figs. 29, 44)

Polynema indopeninsularis; Mani and Saraswat, 1973: 119 (original description); Subba Rao and Hayat, 1983: 131 (synonymy under *bagicha*).

Type material.—Holotype ♀ (USNM), examined. On slide, labelled as follows: 1."School of Entomology St. John's College Agra-2 India". 2."5-20 Berijam Lake: Kodaikanal Hills Coll. Mani & Party 5.iv.1972". 3. "HOLOTYPE". 4."Mani & Saraswat" (written on slide). 5. "*Polynema indopeninsularis* HOLOTYPE" (written on slide).

Diagnosis.—This species is removed from synonymy under *C. bagicha* on the basis of the much more extensive dark band at the forewing apex (Fig. 29) and its larger size. An antenna is figured (Fig. 44) and its measurements given in Table 1. Although this species has about the same number of setae on the head as *C. bagicha* (22 setae on vertex, 15 and 15 on lower face, 18 and 18 on malar area) I think it is sufficiently distinct to warrant species distinction.

Chaetomymar sophoniae Huber, sp. nov.

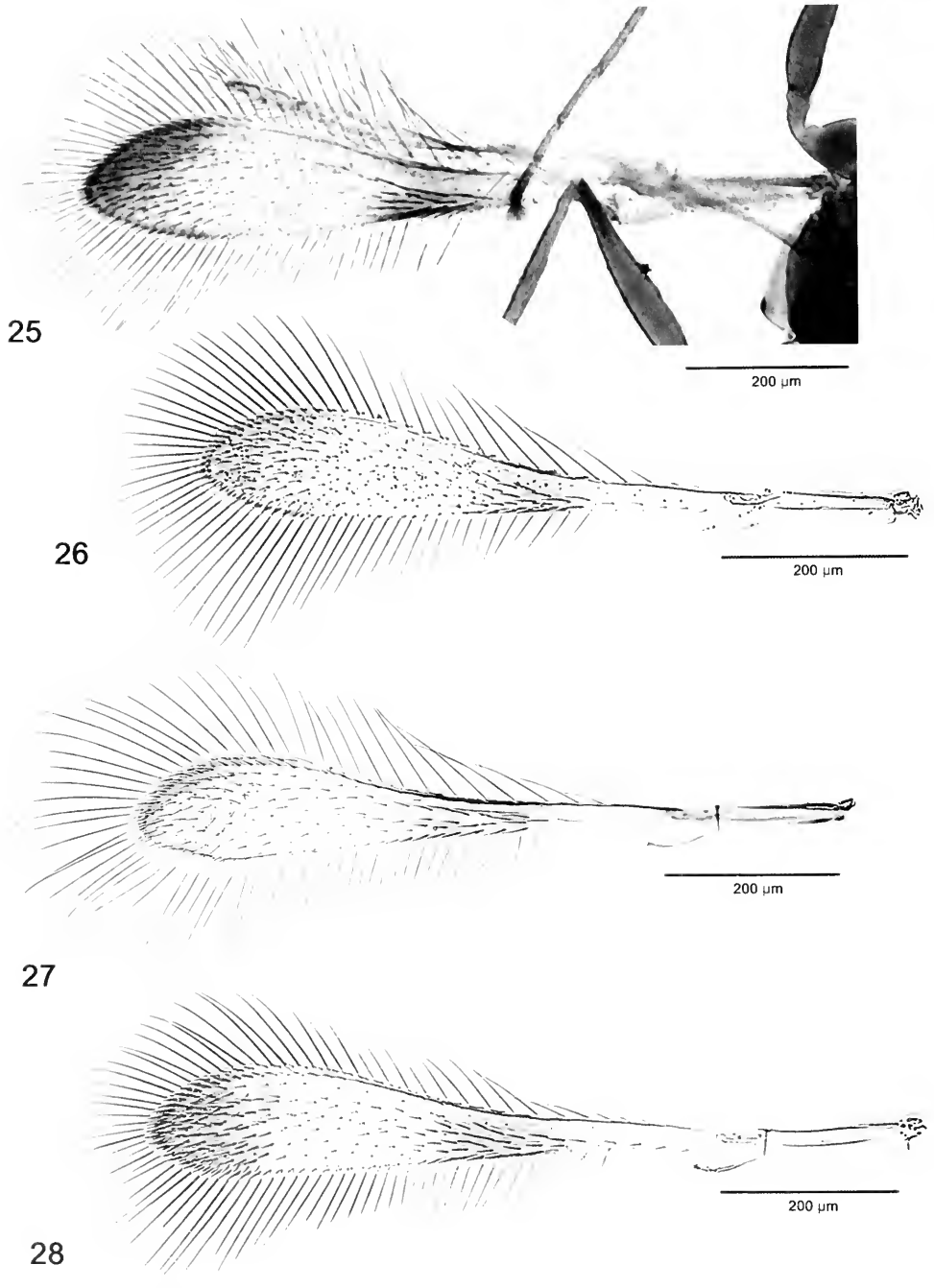
(Figs. 1–24, 28, 32, 42, 49)

Chaetomymar bagicha (Narayanan, Subba Rao, and Kaur); Beardsley and Huber, 2000: 12 (misidentification);

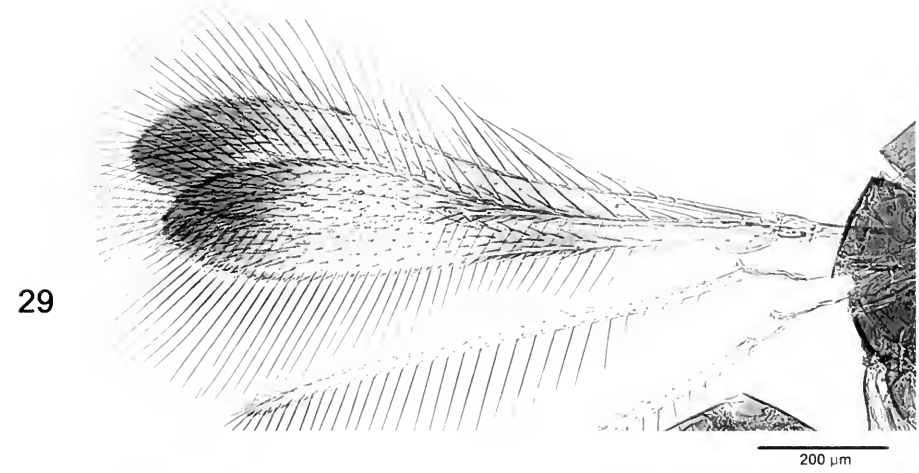
Chaetomymar sp. nr. *bagichi* [sic]; Alyokhin et al. 2001: 664 (40% parasitism rate on *S. rufofascia*).

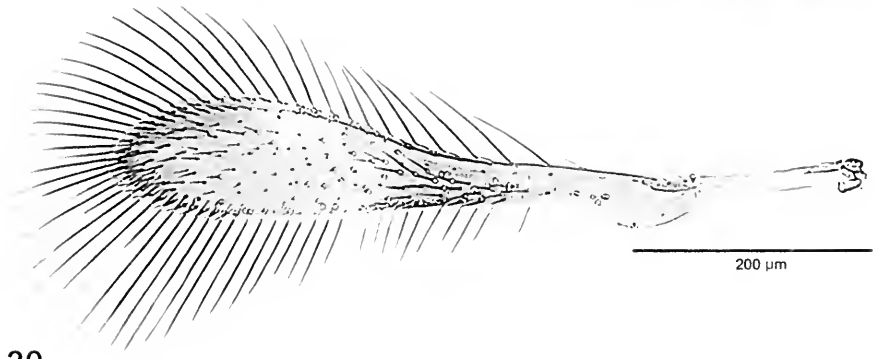
Type material.—Holotype ♀ (CNCI), cleared and slide-mounted in Canada balsam under 4 coverslips and labelled: 1."*Chaetomymar sophoniae* Huber HOLOTYPE ♀ dorsal". 2."Hawaiian Islands Oahu I., Maunawili Valley, X.1995, P. Follett, on *Cibotium splendens* (tree fern)". PARATYPES. 155 females and 21 males (31 on slides and about 8 used for scanning electron microscopy, remainder on card- or point-mounts). HAWAIIAN ISLANDS. Hawaii I.: Hilo, 25.x.1999, P. Yang (12♀♀, ♂ on points, 1♀ on slide, UCRC); Hilo, Wailuku River State Park, 100m, 25.x.1997, P. Yang (10♀♀ on cards, BPBM); hwy. 11, milepost 44, S. of Hilo, 10.x.1997, P. Yang (1♀ on card, BPBM); Volcanoes National Park, Kipuka Kahalii, 900m, 14.xi.1997, P. Yang (24♀♀, 2♂♂, on cards, BPBM), Kipuka Puaulu, 1200m, 17.x and 26.xi.1997, P. Yang (6♀♀, 2♂♂ on cards, BPBM), Puhimau Crater, 1100m, 12.ix.1997, P. Yang (6♀♀, 2♂♂ on cards, BPBM), Research Station, 1200 m, 24.x.1997, P. Yang (1♀ on card, BPBM), Kealakomo, 3.x.1997, P. Yang (1♀ on card, BPBM). Oahu I.: Maunawili Trail, 21.xi. 1995, P. Yang and 20.xii.1995, P. Follett (2♀♀, BPBM), 3.xi.1999, P. Yang (66♀♀ & 1♂ on points, 1♀ on slide, BMNH, CNCI, FAFU, UCRC, USNM). CHINA. Fujian: Fuzhou, vi.2000, N.Q. Lin, ex. *Sophonia pallida* and *S. furcilinea* (24♀♀ and 13♂♂ on cards and slides, CNCI); Fuzhou, Jinshan, 3.x.1999, Y.Q. Chen (1♂ on slide, CNCI) [determined as *C. bagicha* by Xu Mei]. INDIA. Uttar Pradesh: 14 km NE Haridwar, 17.v.1985, J. LaSalle (1♂ on card, CNCI).

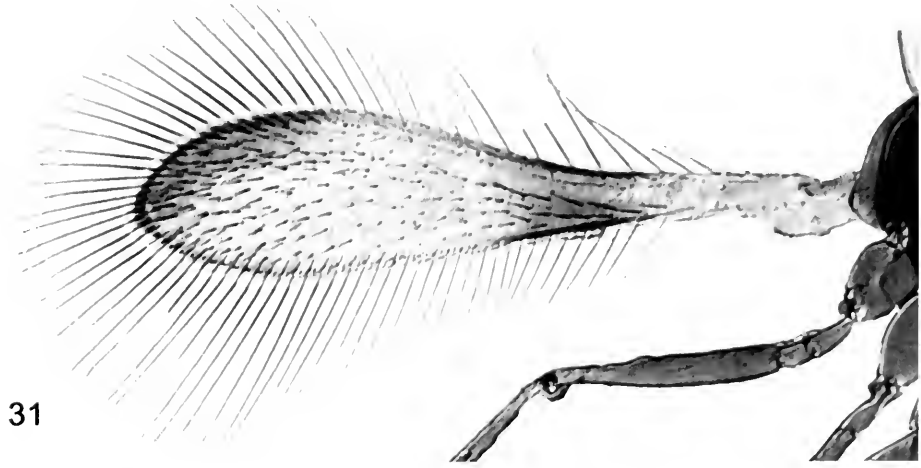
Other material examined.—The specimens dissected and used for scanning electron micrographs, seven broken females from Maunawili and Hilo collected at the same time as the respective paratypes, and 5 teneral specimens still partly in their host eggs from Wailiku River Stater Park and Volcanoes National Park, Kipuka Kahalii



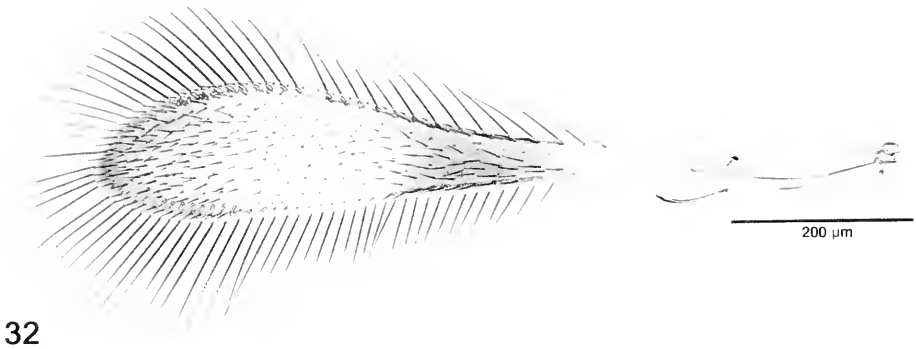
Figs. 25–28. *Chactonymar* spp., forewings. 25, *C. bagicha*, holotype ♀. 26, *C. deccana*, holotype ♀. 27, *C. ?hishimoni*, ex. *Hishimonus sellatus* on mulberry, Japan, Fukuoka. 28, *C. sophoniae*, holotype ♀.







Figs. 29–31. *Chaetomymar* spp., forewings. 29, *C. indopeninsularis*, holotype ♀. 30, *C. dei*, Australia, 53 km SSW Darwin, 25.viii–1.ix.1998, M. Hoskins. 31, *C. bagicha*, allotype ♂.



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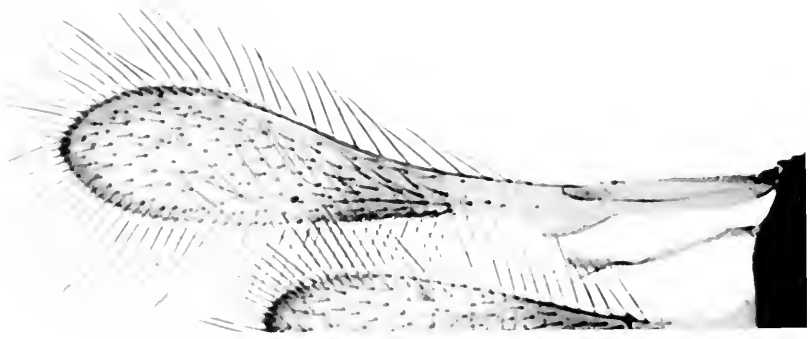

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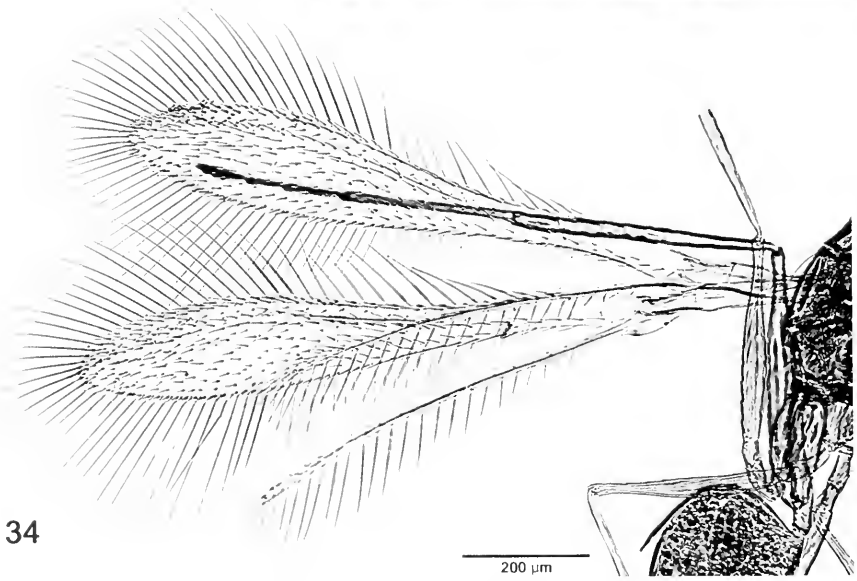

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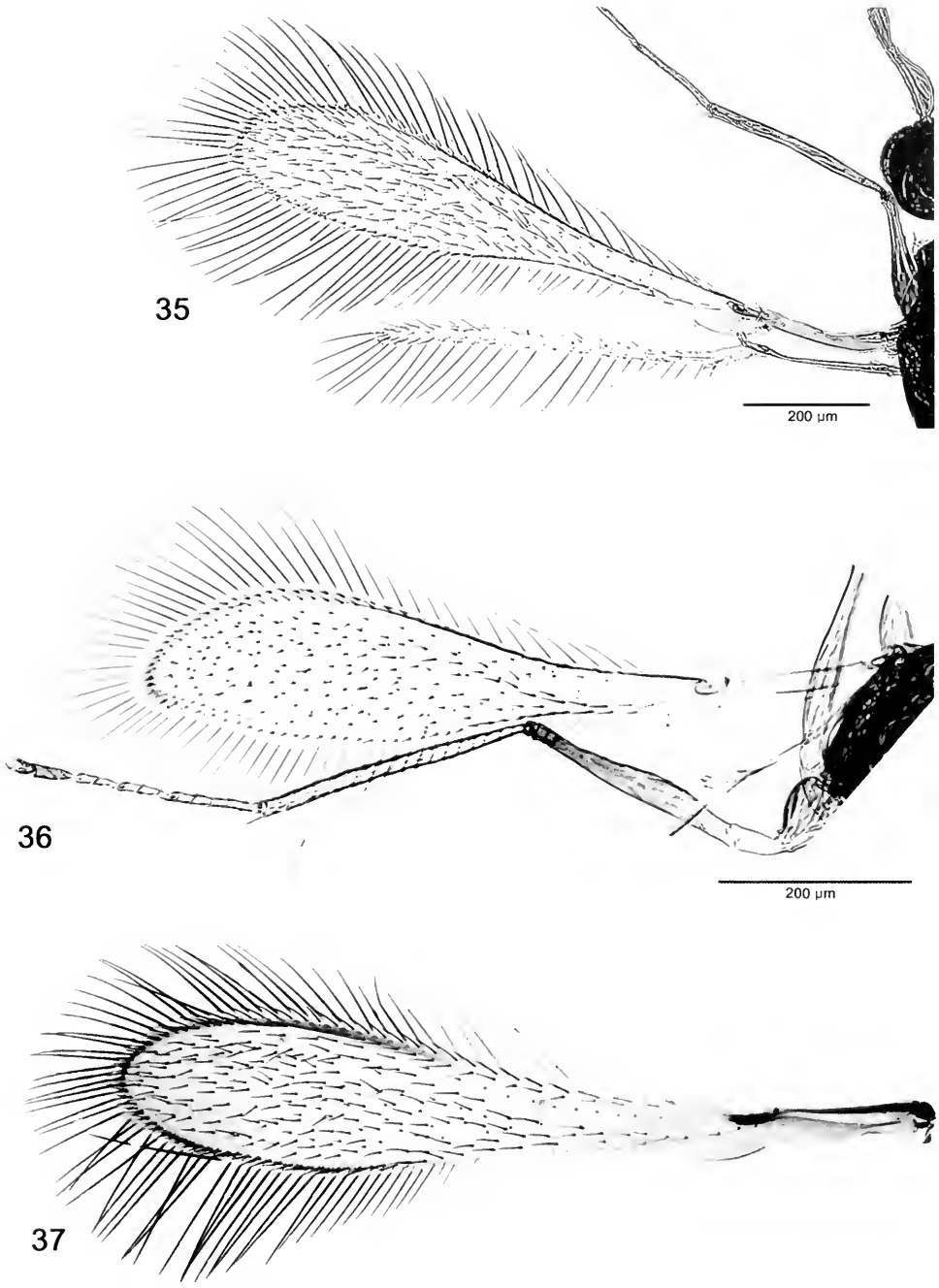
Figs. 32–34. *Chactomymar* spp., forewings. 32, *C. sophoniae* ♂ Hawaii, Oahu, Maunawili Trail, 20.xii.1995, P. Follett. 33, *C. dei*, holotype ♂. 34, *C. elisabethae*, holotype ♀.



Figs. 35–38. *Chaetomymar* and *Acanthomymar* spp., forewings. 35, *C. kusnezovi*, holotype ♀. 36, *C. lepidum*, paratype ♀. 37, *Acanthomymar nigrum*, paratype ♀.

on 25.x and 14.xi.1997, repectively (BPBM) are not designated as paratypes because of their poor condition.

Diagnosis.—*Chaetomymar sophoniae* differs from *C. bagicha* and *C. dei* by the apical forewing band (Figs. 28, 32). This band is U-shaped, with the medial margin strongly concave in the latter two species but has

the medial margin straight in *C. sophoniae*. *Chaetomymar sophoniae* differs from *C. indopeninsularis* by the number of setae on head. In *C. sophoniae*, there are about 10 and 10 setae on the face below the toruli, about 5 and 5 on the malar space, and about 34 on vertex. In *C. indopeninsularis*, 15 and 15 on face, about 17 and 17 on malar space, and about 40 setae on vertex.

Chaetomymar sophoniae was initially identified as *C. bagicha* (Beardsley and Huber 2000). As more material of both species became available for study and the limits of variation could be better assessed it appeared that two species were involved. Virtually no variation in the size and intensity of the apical brown spot was found in the Hawaiian specimens. However, the apical brown band on the forewing varies more in extent in the Chinese specimens than in the Hawaiian specimens, in some more resembling the band of *C. bagicha*. Little variation was found in the few additional specimens of *C. bagicha* seen, suggesting that wing pattern is fairly reliable for separating the two species. The two species are very close, however, and may eventually prove to be one, variable species, that may also include *C. dei*.

Female.—Body length 897 (666–973, 63, n = 26). Colour of body honey yellow, with variable brown suffusion on scutellum posteriorly, propodeum, and Gt_{3-6}. Trabeculae and clava brown. Legs lighter that body, yellowish-white except for brown apical tarsomere, and sometimes with brownish suffusion on hind femur. Forewing (Fig. 28) with two transverse brown bands, one apically and one medially, with the basal margin of apical band almost straight and the area between dark anterior and posterior margins almost as dark throughout. Hind wing with extreme apex brown. *Head:* Width = 223 (214–229, 5, n = 7). Vertex (Fig. 1), back of head (Fig. 5) and gena (Figs. 2, 4) with blunt setae. Face (Fig. 3) with more pointed setae. Mandible (Fig. 6) with 3 teeth. *Antenna:* Length measurements (n = 9 or 10): scape 76 (69–86, 6); pedicel 52 (48–55, 2), F1–F6 71 (58–78, 6), 124 (99–135, 11), 124 (104–137, 9), 81 (71–91, 7), 59 (53–65, 4), 61 (53–67), clava 160 (152–173, 7). Clava with seven and F6 with one longitudinal sensilla (Fig. 42). Both medial and lateral surfaces of scape smooth (Figs. 23, 24). *Mesosoma:* With setae as in Figs. 7–12, and smooth, without evident surface sculpture except laterally on pronotum (Fig. 11). Mesoscutum (Fig. 7) length = 134 (122–149, n = 8), width = 172 (169–173, n = 3). Propodeum (Figs. 7, 12) with median carina extending almost halfway towards dorsellum and with 1 and 1 setae much closer to hind coxal foramen and median carina than to spiracle. *Wings*: Forewing measurements (n = 10): length = 831 (750–888, 44), width = 123 (108–133, 9), FW length/width = 6.8 (6.0–7.87, 0.59), LMS = 221 (127–175, 16). Hind wing (n = 9) length (n = 10) 742 (629–817, 54), width (17 (14–19, 2), LMS = 123 (107–138, 13). *Metasoma:* Gaster smooth (Figs. 14–19), with Gt_1 the largest tergum. Petiole joined to tergum (Fig. 15) and surrounded by Gt_1 (Fig. 16). Petiole length = 132 (112–150, 17, n = 5), smooth and without ventral longidudinal suture (Figs. 20–22). Ovipositor length = 362 (318–395, 26, n = 7), averaging 1.16 times length of hind tibia. Spiracle present on Gt_6 (Fig. 15). *Legs*: Foretibial spur with fork in apical half and inner tine about half length of outer tine (Fig. 13). Coxae (Fig. 9) setose ventrally.

Male.—Similar to female except as follows. Body length 788 (742–845, 46, n = 5). Colour generally darker than in female. Head except vertex and tips of mandibles, yellow; vertex honey colored; tips of mandibles reddish brown; flagellum brown except basal segment slightly lighter, scape and pedicel yellow, propleura yellow, rest of mesosoma brown, slightly lighter (honey coloured) anteriorly; procoxa, metacoxa and petiole almost white, mesocoxa and remainder of all legs very pale yellow except for black apical tarsomere; gaster black apically, honey yellow

basally. Forewing (Fig. 32) wider than that of female; FW length/width (n = 3) 5.94 (5.90–5.98). Antenna (Fig. 49) with flagellum length 938 (920–947, 15). Length/width of F6 2.8 (2.69–2.93, 0.12).

Biology.—The known hosts are three *Sophonia* species: *S. rufofascia*, *S. pallida* and *S. furcilinea*. *Chaetomymar sophoniae* is a solitary parasitoid and appears to parasitize its hosts regardless of the plant species in which the eggs are laid. Host plants from which parasitized eggs of *S. rufofascia* were collected include *Myrica faya*, *Dodonea viscosa*, *Metrosideros polymorpha*, *Cibotium splendens*, and cultivated guava, *Psidium guajava*.

Etymology.—The specific epithet refers to the host genus from which the mymarid has been reared.

Discussion.—*Chaetomymar sophoniae* is very close to *C. bagicha* and *C. dei*. It differs by having a distinctly more extensive brown apex to the forewing and more setae on the vertex in front of the anterior ocellus. If the female described by Girault as *dei* is indeed conspecific with the male type of this species, then the antennal proportions of the female are different from those of *C. sophoniae*.

Chaetomymar elisabethae (Ferrière)
(Figs. 34, 45)

Polynema elisabethae Ferrière, 1931: 294 (original description).

Chaetomymar elisabethae; Subba Rao and Hayat, 1983: 134 (transfer to *Chaetomymar*).

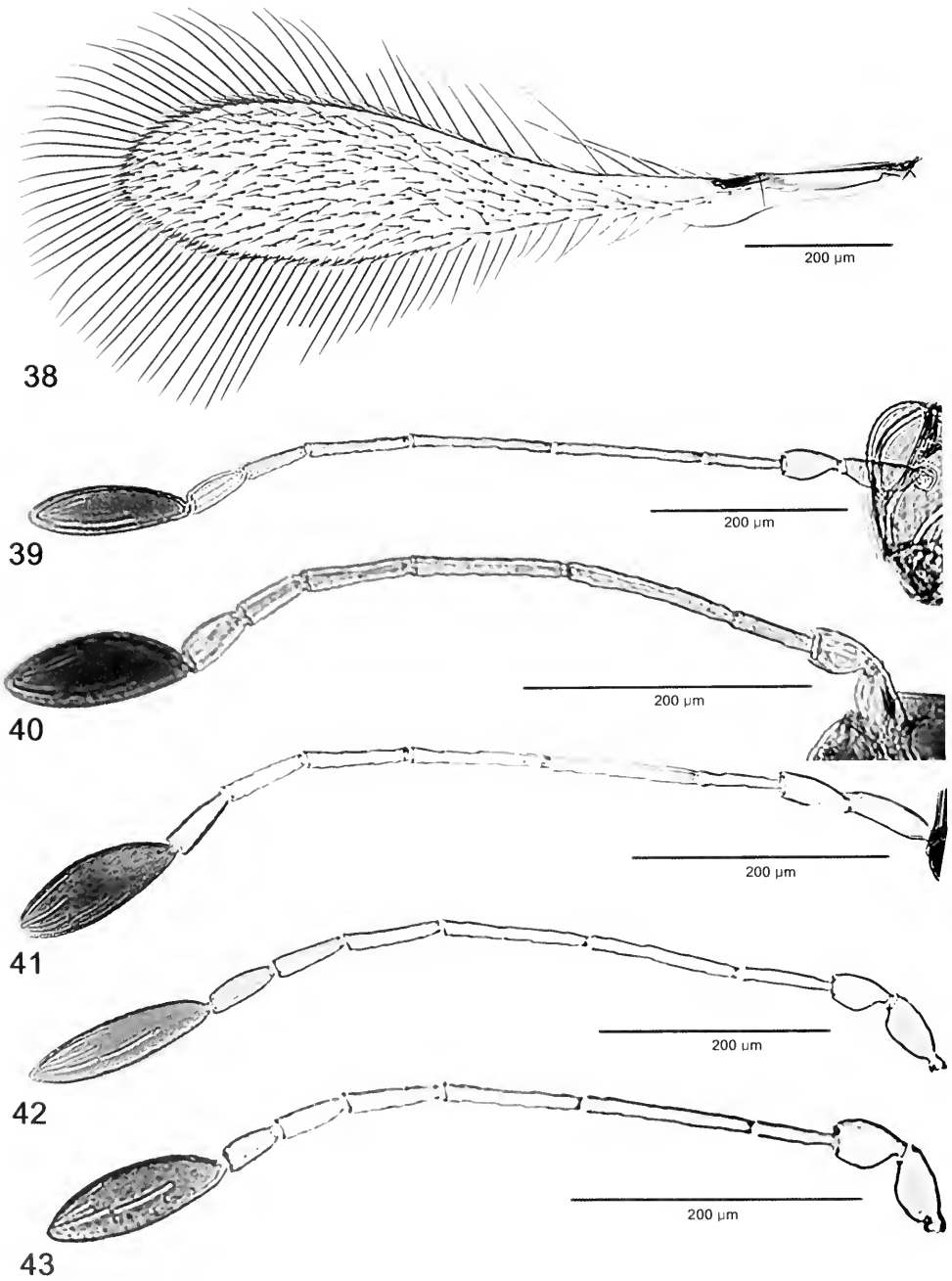
Type material.—Holotype ♀ (BMNH), examined. Slide-mounted but uncleared, in Canada balsam and labelled: 1."Java, Buitenzorg, vii.1925, R. Menzel. Ex. oeufs de *Euproctus flexuosa*". 2."Mymaridae: *Polynema elisabethae* sp.n. Ch. Ferrière det. Type." 3. "Holo-type" (white circle with red border).

Other material examined.—CHINA. Fujian: Jiangle, 10.x.1991, N.-Q. Lin (1♀, CNCI).

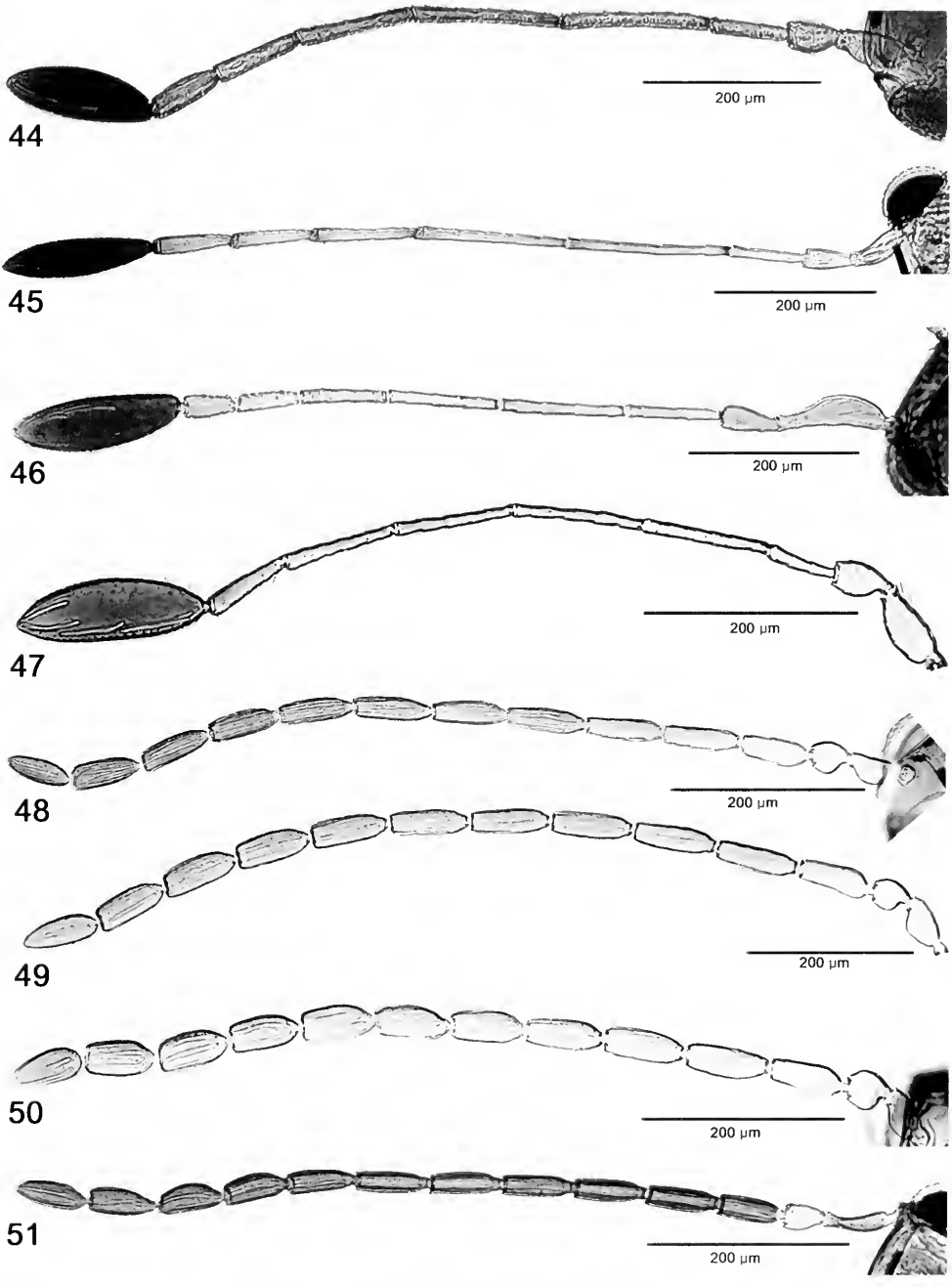
Diagnosis.—Simiar to *C. kusnezovi* but forewing more slender, FW length/width at least 7.7 (5.7 in *kusnezovi*), supraorbital seta 1.3 POL (only about 0.3 POL in *kusnezovi*), base of F2–F6 narrowly brown (base of F2–F3 and perhaps F4 narrowly brown in *kusnezovi*).

Female.—Body length 1105 (holotype). *Head:* Head width 260 (n = 1). Face with 11 and 11 setae below toruli. Vertex with 3 and 3 setae in a line behind transverse trabecula, 2 and 2 setae lateral to median ocellus, 2 and 2 setae between median and lateral ocelli, but close to latter, a line of 4 setae behind median ocellus, 2 and 2 setae behind lateral ocelli. Supraorbital seta long (about 1.3 POL), erect, thick and blunt apically, as in *Neomymar*. Malar area with 13 setae. *Antenna:* Length measurements: scape length 105, pedicel 66, F1–F6 98, 192, 186, 128, 94, 92, clava 180. *Mesosoma:* Pronotum with 2 and 2 setae along posterior margin, 4 and 4 along anterior margin, and 1 and 1 (the longest setae) medially near the spiracle. Lateral panel of mesonotum with 1 seta in posterolateral corner. Axillar seta reaching apex of scutellum. Notauli at least as wide as propodeal spiracle. Scutellum with placoid sensilla slightly posterior to midway between anterior and posterior margins and apparently without minute lateral setae. Metanotum with 1 and 1 short setae submedially. Propodeum with short median carina extending less than one-quarter distance towards dorsellum and with 2 and 2 propodeal setae, the submedian pair closer to each other than to spiracle and closer to posterior margin of dorsellum than to posterior margin of propodeum. *Wings:* Forewing length 1155, width 149, FW length/width 7.73, LMS 226. Hindwing length 947, width 19, LMS about 151. *Metasoma:* Petiole length 196. Ovipositor length 266.

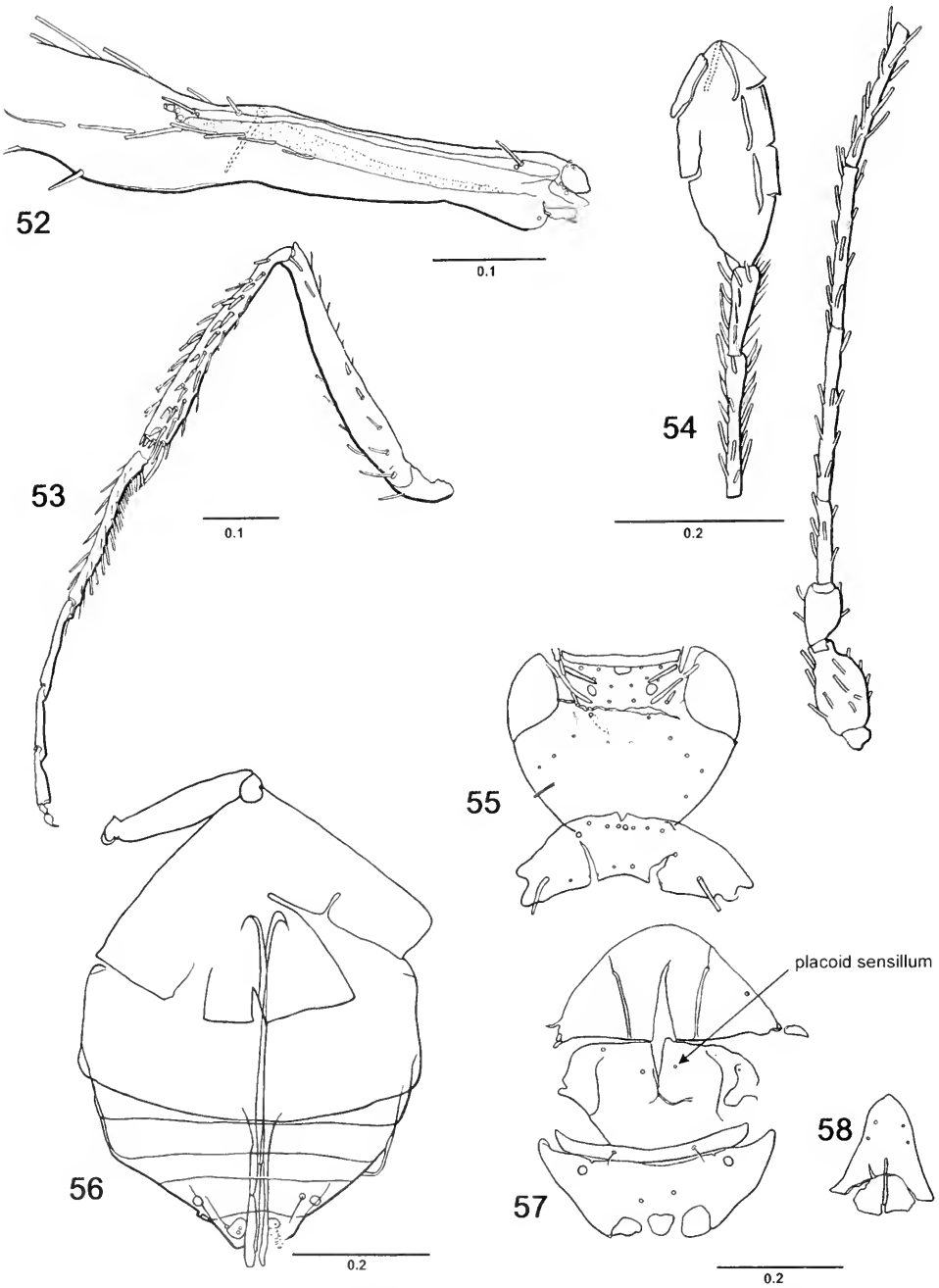
Comments.—The specimen from China extends the species range considerably from the type locality (Buitenzorg, now Bogor) in Indonesia.



Figs. 38–43. *Chaetomymar* spp., ♀ antennae. 38, *Polynema* (= *Acanthomymar*) sp., Kenya, Mpala Research Centre, Isecheno, 1–9.x.1999, R. Snelling. 39, *C. bagicha*, India, Dehli, 11.v.1985, J. LaSalle. 40, *C. deccana*, holotype ♀. 41, *C. ?hishimoni*, ex. *Hishimonus sellatus* on mulberry, Japan, Fukuoka. 42, *C. sophoniae*, holotype. 43, *C. dei* Australia, 53 km SSW. Darwin, 25.viii–1.ix.1998, M. Hoskins.



Figs. 44–51. *Chaetomymar* spp., ♂ antennae. 44, *C. indopeninsularis*, holotype. 45, *C. elisabethae*, holotype. 46, *C. kusnezovi*, holotype. 47, *Chaetomymar* (= *Acanthomymar*) sp. Kenya, Mpala Research Centre, Isecheno, 1–9.x.1999, R. Snelling. 48, *C. bagicha*, India, Dehli, 11.v.1985, J. LaSalle. 49, *C. sophoniae*, Hawaii, Oahu, Maunawili Trail, 20.xii.1995, P. Follett. 50, *C. dei* Australia, 53 km SSW. Darwin, 22–29.ix.1997, M. Hoskins. 51, *C. lepidum*, paratype.



Figs. 52–58. *Acanthomymar nigrum*, paratype ♀. 52, Forewing base. 53, Foreleg. 54, Antenna. 55, Head (posterodorsal) and pronotun. 56, Petiole + gaster. 57, Mesosoma dorsal (excluding pronotum). 58, Prosternum.

Polynema nigrum (Subba Rao), comb. nov.

Acanthomymar nigrum Subba Rao, 1970: 669 (original description); Hayat and Anis, 1999b: 307 (holotype condition).

Type material.—Holotype ♀ (BMNH), examined. Labelled as follows: 1. "*Acanthomymar nigrum* n.g. & n.sp. B.R. Subba Rao det. 1969". 2."Holo-type" (small round label on red background). 3."B.M.Type Hym. 5.2089". 4."C.I.B.C.(E.A.) No. 057". 5."Uganda Kasengejje: X.63 E.D.L. Matera B.M.1970-1 JJE". The medium in which the ♀ holotype is mounted (?gum chloral) is now almost black so the type is scarcely visible except as an outline. Although it is entire and apparently intact it is useless for study until it can be remounted. The single paratype female, slide mounted in Canada balsam, bears the same locality data as the holotype. Two forewings, one hindwing and two antennae are under one coverslip. The partly crushed head and metasoma are detached from the gaster and several legs, also detached, are under the second coverslip. Hayat and Anis (1999b) corrected some discrepancies in the original description of this species. I redescribe it below based on study of the slide-mounted paratype, on the assumption that it is conspecific with the holotype. The paratype locality is spelled "Kasengjje" and is numbered "C.I.B.C. (E.A.) No. 057.

Diagnosis.—Body dark brown, almost black; wings without dark markings Forewing base (Fig. 52), scape, pedicel and funicle (Fig. 54), and foreleg (Fig. 53) with short stout, blunt setae.

Female.—Body length ≈1600 m (head ≈170, gaster 679, mesosoma ≈530, petiole 234). *Head:* Malar sulcus and subantennal sulci absent. Labrum with 2 setae. Frontal sulci extending to mouth margin. Torulus separated from transverse trabecula by at least its own diameter. Mandible with 3 teeth. Gena below eye with 14 and 16 setae. Face smooth, with 9 and 10 setae in two vertical rows laterally and sublaterally. Eye margin dorsally with 1 short, strong, blunt seta anteriorly and 1 posteriorly. Vertex without depressions around ocelli, with 4 short, strong, blunt setae in row just behind posterior ocelli and 4 and 4 others between and lateral to ocelli as well as 1 and 1 sensoria just anterior to posterior ocelli. Occiput smooth, without sulci above foramen but apparently with oblique extensions from posterior apex of lateral trabeculae, with about 5 and 5 finer but still apparently blunt setae laterally. *Antenna:* Length measurements: scape 129; pedicel 78, F1–F6 95, 196, 185, 177, 163, 104, clava –. F6 with one longitudinal sensillum (Fig. 54). *Mesosoma:* Pronotum entire, with spiracle at posterolateral angle, on a short stalk, with posterior row of 4 and 3 setae (one seta not formed), anterior row of 4 and 3 setae (one seta not formed) and 1 and 1 setae between these rows. Prosternum bell-shaped, partly longitudinally divided medially, with 2 and 2 setae in anterior half. Mesoscutum normal, with 1 and 0 (not developed) seta on lateral lobe. Notauli ending at slightly enlarged pit before anterior margin, then continuing to margin as fine slit. Scutellum smooth, undivided, without setae or transverse row of foveae, and with placoid sensilla not widely separated. Prepectus triangular. Axillae in line with anterior margin of scutellum, each with 1 distinct medial and 1 small lateral seta. Metanotum not hidden, bandlike, with 1 and 1 submedial and 1 and 1 lateral setae. Propodeum with slight notch on anterior margin just anteromedial to spiacle, smooth, with 1 and 1 submedian setae. *Wings:* Forewing length 1522, width 277, FW length/width 5.5, LMS 272. *Metasoma:* Petiole with 1 and 1 minute setae ventrolaterally and apparently with ventral longitudinal groove. Gaster with spiracle on Gt_6. Cerci with 4 setae. Ovipositor not exserted. Relative lengths of Gt_1–Gt_6: 56.5: 35.5:22.1:7.1:6.4:6.7.

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A Peculiar New Genus of Locally Abundant Australian Thynninae (Hymenoptera: Tiphiidae)

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Abstract.—The new thynnine tiphiid genus ***Hathynnus*** **Kimsey** is described from southern and eastern Australia, based on the species *Thynnus pygmaeus* Turner (type of the genus), *Thynnus rubromaculatus* Turner, and 15 new species: ***Hathynnus aestus, aquilonius, austrinus, cardaleae, cobarensis, earos, eyrensis, fuscatus, moorensis, nanus, occidentalis, orarius, piligaensis, striatus*** and ***theros***. ***Hathynnus rubromaculatus*** **(Turner)** and ***H. pygmaeus*** **(Turner)** are **new combinations**.

Turner (1910) placed *Thynnus rubromaculatus* Turner and *Thynnus pygmaeus* Turner among other species, in the genus *Asthenothynnus* Turner. *Asthenothynnus* was later synonymized under *Aeolothynnus* Ashmead by Brown (1997) and as discussed by Kimsey (1999). However, *rubromaculatus, pygmaeus* and several undescribed species lack a number of diagnostic features of *Aeolothynnus*, including, in the male, the ventrally grooved hypopygium, elongate apical prementum brush, nearly asetose stipes, vertex with red sublateral spot, and laterally notched pronotal carina. Females of these species lack a W-shaped transverse carina across the first metasomal tergum, lack an elongate tuft on either side of the epipygial plate and lack the accompanying tuft of setae on the adjacent sternum typical of *Aeolothynnus*. Thus a new genus, *Hathynnus*, is proposed for these species. Preliminary phylogenetic analyses of relationships among the Australian genera places *Hathynnus* as basal to the *Iswaroides* group of genera, which includes *Iswaroides* Ashmead, *Aspidothynnus* Turner, *Doratithynnus* Turner and *Epactiothynnus* Turner among other genera. Autapomorphies of *Hathynnus* include the elongate and strongly narrowed female metasomal sternum VI, ligulate male hypopygium, odd laterally compressed and slender genital capsule, obsolescent gonobase, and arcuate penis valves.

Hathynnus does not show particularly close relationships to other thynnine genera, although it shares some apomorphies with *Arthrothynnus* Brown and *Chilothynnus* Brown. These three genera have the brushy basal labial palpomeres, and the gonobase reduced in *Arthrothynnus* and *Chilothynnus* to a narrow basal ring and in *Hathynnus* obsolescent, reduced to a narrow membranous rim. *Hathynnus* can be distinguished from these genera in the males by the ligulate hypopygium (apically or at least laterally dentate in *Chilothynnus* and *Arthrothynnus*), strongly laterally compressed male genital capsule, aedeagus with distinctive ventral expansion, ecarinate epipygium, obsolescent antennal lobes, cylindrical flagellomeres (versus arcuate), and in females by the narrow, impunctate pygidium and apical metasomal sternum. There is also a superficial resemblance to *Aeolothynnus* as the males and females of both taxa are small to tiny wasps, which can be found in great abundance on flowering *Eucalyptus*.

MATERIALS AND METHODS

For the sake of brevity the abbreviation "MOD" is used for midocellus diameter and "PD" for puncture diameter as a measure of punctation density. Ocellocular distance is the minimum distance between the hindocellus and the closest eye margin, measured in midocellus diameters. The aedeagus in this group consists of a dorsal column with abbreviated apical "strap" or lobe, and ventral expansion that extends nearly the entire length of the aedeagus. The volsella lies across the base of the paramere and is narrowed medially, with an enlargement or lobe on the dorsal and ventral ends. Clypeal dimensions are measured by comparing the greatest width with the length measured medially from the dorsal margin to the apical margin. Finally, the interantennal distance is measured from the edge of the inner rims of the antennal sockets.

Type and non-type specimens were borrowed from and are deposited in the following collections: ADELAIDE—South Australian Museum, Adelaide, Australia (D. B. Hirst); BRISBANE—Queensland Museum, Brisbane, Australia (C. Burwell); CANBERRA—Australian National Insect Collection, CSIRO, Canberra, Australian Capitol Territory (J. Cardale); COLLEGE STATION—Entomology Collection, Texas A&M University, College Station, USA (E. Riley); DAVIS—Bohart Museum of Entomology, University of California, Davis, USA (S. L Heydon); LONDON—the Natural History Museum, London, England (S. Lewis); MELBOURNE—Museum Victoria, Melbourne, Australia (Ken Walker); PERTH—Western Australian Museum, Perth (T. Houston); SYDNEY—Australian Museum, Sydney, New South Wales (M. Moulds). Type repositories are indicated by the city of the collection in parentheses following the type data.

Hathynnus Kimsey, new genus

Male.—Body length 6–8 mm (Fig. 2). *Head* (underside as in Fig. 3): clypeus with or without impunctate medial longitudinal carina or welt, apical truncation narrower than distance between antennal sockets; antennal lobes obsolescent; hypostomal plate large, with occipital and hypostomal carinae broadly separated; stipes arcuate, with short marginal fringe; basal palpal segments fringed, with dense erect setae; flagellum without tyloids, first and second flagellomeres less than twice as long as broad; vertex without red spot between hindocellus and eye. *Mesosoma:* pronotal disk with anterior margin marked by transverse swelling or broad ridge, ridge without sublateral indentation or notch; mesopleuron with scrobal sulcus present and extending across mesopleuron; propodeum sloping obliquely from metanotum to petiolar socket; coxae globular and finely setose; legs unmodified. *Metasoma:* tergum I about as broad as long, gently convex subapically, sternum I medially flat to convex; terga I–VI and sterna II–V with subapical transverse sulcus broadly U-shaped; terga III–V without subspiracular sulcus; epipygium with longitudinal medial impunctate band and impunctate convex apex; hypopygium ligulate (as in Figs. 32, 33). *Genital capsule:* strongly compressed laterally (as in Figs. 26, 27); gonocoxa dorsoapically produced into single lobe; gonobase (basal ring) obsolescent, remains broadly attached to gonocoxa in lateral view as narrow membranous rim; paramere apically rounded to subacute; aedeagus with short apical lobe and well-developed ventral expansion; volsella broad, with ventral and dorsal lobes; penis valve slender, narrowly tapering and apically acute or capitate, often bending strongly ventrally. *Color:* black to dark brown, with yellow to whitish, and orange or red markings.

Female.—Mesosoma: pronotal disk without medial sulcus; scutellum without anteromedial lobe; propleuron flat; forecoxae usually not separated by pit, except in *cobarensis*; metanotum obsolescent. *Metasoma:* pygidium elongate, parallel-sided and

Fig. 1. Distribution map of *Hathynnus* species in Australia.

usually narrow, apex narrowly rounded or truncate (Figs. 34–36); sternum VI 2–6× as long as wide at apex, apex narrowly rounded or truncate (Figs. 30, 31).

Type species.—*Thynnus pygmaeus* Turner 1908.

Etymology.—The generic name, *Hathynnus*, is a nonsense combination of letters added to the commonly used suffix in this tribe—"thynnus". The name is assumed to be masculine.

Included species.—*Hathynnus aestus* Kimsey, new species; *H. aquilonius* Kimsey, new species; *H. austrinus* Kimsey, new species; *H. cardaleae* Kimsey, new species; *H. cobarensis* Kimsey, new species; *H. caros* Kimsey, new species; *H. eyrensis* Kimsey, new species; *H. fuscatus* Kimsey, new species; *H. moorensis* Kimsey, new species; *H. nanus* Kimsey, new species; *H. occidentalis* Kimsey, new species; *H. orarius* Kimsey, new species; *H. piligaensis* Kimsey, new species; *Thynnus pygmaeus* Turner, new combination; *Thynnus rubromaculatus* Turner, new combination; *H. striatus* new species, and *H. theros* Kimsey, new species.

Distribution.—The genus apparently occurs in all Australian states except Northern Territory and Tasmania (Fig. 1).

Discussion.—The most unusual external features of *Hathynnus* are the ligulate male hypopygium and the narrowed female apical metasomal segment. A similar con-

figuration of the male hypopygium is seen only in some South American genera including *Zeena* Kimsey and *Mesothymnus* Kimsey. Additional diagnostic features in the males include the absence of tyloids on the flagellomeres, flagellomeres less than twice as long as broad, strongly laterally compressed genital capsule, aedeagus with reduced apical lobe and large ventral expansion, obsolescent gonobase and subspiracular sulcus restricted to metasomal terga I and II. Females have the apical metasomal sternum generally elongate and strongly narrowed apically.

KEY TO MALES OF THE SPECIES OF *HATHYNNUS*

1 Clypeus without medial longitudinal, impunctate carina or welt (Fig. 7) 2
– Clypeus with medial longitudinal, impunctate carina or welt (Figs. 4–6) 6

2 Propodeal punctures contiguous and transversely striatiform above petiolar socket 3
– Propodeal punctures circular and separated by 1 PD or more above petiolar socket 4

3 Face without pale markings, or pale markings restricted to small spots on vertex; paramere narrowly tapering and apically acute (Fig. 14); hypopygium broadly rounded apically, apicomedially flattened or slightly indented ..... ***cyrensis* Kimsey**
– Face extensively marked with white or yellow bands and spots along eye margins, on clypeus and vertex and above antennal sockets; paramere broad and apically broadly rounded (Fig. 23); hypopygium apicomedially angulate or produced .. ***striatus* Kimsey**

4 Propodeum with medial yellow to pale yellow spot; ocellocular distance 3.5 MOD wide; paramere apically broadly rounded (Fig. 22) ..... ***rubromaculatus* (Turner)**
– Propodeum without medial yellow to pale yellow spot; ocellocular distance 4 MOD wide; paramere apically acute or truncate 5

5 Flagellomere I longer than broad; legs red to orange; paramere apically truncate; aedeagus with lateral projection and ventral expansion as wide or wider than dorsal column (Fig. 12) ..... ***cobarensis* Kimsey**
– Flagellomere I as long as broad; legs brown; paramere apically acute; aedeagus without lateral projection and ventral expansion generally narrower than dorsal column (Fig. 11) ..... ***cardaleae* Kimsey**

6 Interantennal area with medial longitudinal carina and elevated, with V-shaped swelling or ridge (as in Fig. 5); frons strongly convex, one-third to one-half as wide as eye width in side view 7
– Interantennal area without medial longitudinal carina, not elevated and without V-shaped swelling or ridge; frons usually flattened, less than one-third as wide as eye width in side view 9

7 Facial punctures irregularly spaced, 1–4 PD apart (Fig. 5); propodeum with punctures about 1 PD apart; clypeus black, without yellow markings; face without yellow band along inner eye margin; propodeum without lateral yellow spot ... ***occidentalis* Kimsey**
– Facial punctures dense and nearly contiguous (as in Fig. 6); propodeal punctures contiguous above petiolar socket; clypeus half or more yellow; face with partial or complete yellow band along inner eye margin; propodeum with large lateral yellow spot 8

8 Face with continuous yellow band along inner eye margin from clypeus to hindocelli; clypeus mostly yellow except for black mark near anterior tentorial pit ..... ***moorensis* Kimsey**
– Face with yellow band along inner eye margin interrupted medially; clypeus about half yellow, largely black medially ..... ***orarius* Kimsey**

9 Propodeal punctures above petiolar socket striatiform, without polished interspaces and often between transverse ridges or striae 10
– Propodeal punctures above petiolar socket circular, not striatiform with polished interspaces and without transverse ridges or striae 11

10 Propodeum with large yellow medial spot; interantennal area broadly rounded, without medial carina ..... ***piligaensis*** **Kimsey**
– Propodeum without yellow medial spot; interantennal area with medial longitudinal carina ..... ***austrinus*** **Kimsey**

11 Frons convex in profile; scutal punctures 0.5–1.0 PD apart; facial punctures 0.5 PD apart or less 12
– Frons flattened in profile; scutal punctures 1–3 PD apart; facial punctures usually 1–3 PD apart 14

12 Propodeum highly polished, with tiny circular punctures separated by polished interspaces, punctures more than two PD apart ..... ***nanus*** **Kimsey**
– Propodeum not appearing polished, with large circular or striatiform punctures 0.5–1.0 PD apart 12

13 Propodeal punctures striatiform; eye with incomplete yellow stripe along inner margin; ocellocular distance less than 4 MOD wide ..... ***theros*** **Kimsey**
– Propodeal punctures circular; eye with complete yellow stripe along inner margin; ocellocular distance more than 4 MOD wide ..... ***aestus*** **Kimsey**

14 Hypopygium apicomedially notched or indented (Fig. 33); frons with punctures contiguous to 0.5 PD apart ..... ***aquilonius*** **Kimsey**
– Hypopygium apically rounded, margin convex (as in Fig. 32); frons with punctures 1 PD apart or more 15

15 Propodeum without pale spots, or only with traces of lateral spot; paramere apically narrowly acute, apical half slender and almost digitate (Fig. 15) ..... ***fuscatus*** **Kimsey**
– Propodeum with yellowish medial and lateral spots; paramere subtriangular with broadly rounded or acute apex, apex not slender or digitate (as in Figs. 13, 21) 16

16 Sternum I strongly bulging medially; clypeus with small punctures about 0.5 PD apart near dorsal margin, nearly impunctate elsewhere; frons punctures shallow, 1–3 PD apart ..... ***pygmaeus*** **Turner**
– Sternum I flattened medially; clypeus with contiguous small punctures near dorsal margin, becoming larger and 0.5–1.0 PD elsewhere; frons punctures clearly impressed, 0.5–1.0 PD apart ..... ***earos*** **Kimsey**

Hathynnus aestus Kimsey, new species

Figs. 1, 8

Male.—Body length 7 mm. *Head:* clypeus with short, impunctate, medial longitudinal welt, clypeal punctures smaller on upper third than on frons, remainder only slightly smaller than on frons, punctures 0.5–1.0 PD apart; frons with punctures 0.5–1.0 PD apart, impunctate between eye and antennal socket, except band of small and nearly contiguous punctures right along eye margin; vertex punctures 0.5–1.0 PD apart; clypeus greatest width twice length; interantennal distance 2.6 MOD wide; ocellocular distance 4.8 MOD; flagellomere I as long as broad; flagellomere II 1.4× as long as broad; flagellomeres III–IV 1.5× as long as broad; flagellomere XI twice as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 2–3 PD apart; metanotum nearly impunctate; propodeal punctures circular and nearly contiguous, without transverse ridges or striae above petiolar socket; mesopleural

punctures nearly contiguous dorsally, with broad subventral impunctate band. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 3–4 PD apart; epipygium with impunctate medial longitudinal band and irregular, large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 8): paramere broadly triangular, with rounded apex; volsella with large, acute ventral lobe, more than half as long as paramere; aedeagus with ventral expansion as wide as primary column; penis valves reaching apex of ventral aedeagal expansion. *Color:* black, with yellow and orange markings; face with yellow band along eye margin and ventral margin of clypeus, with yellow spot adjacent to each antennal socket; mandibles yellow basally, becoming reddish brown apically; gena with yellow spot behind eye margin and yellow band extending part way along posterior eye margin from mandible; pronotum with transverse anterior and posterior yellow bands; tegula yellow; scutum, scutellum and metanotum with large medial yellow spot; propodeum with small sublateral yellow spot; mesopleuron with anterior U-shaped yellow spot and posterior ovoid one; mid and hindcoxae with two dorsal longitudinal yellow bands; terga II–VI with lateral comma-shaped yellow mark; terga II–III reddish brown dorsally; sterna II–V with small yellow lateral mark; legs reddish brown with yellow mark near apex of fore and midfemora; wing membrane untinted, costa and stigma yellowish brown, rest of veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Western Australia: 5 km n Hopetoun, 27 Dec. 1994, 33°41.612S 120°11.244E, R. B. & L. S. Kimsey, ex *Eucalyptus*, WA122701 (PERTH).

Etymology.—The species name, *aestus*, refers to the presence of this wasp in the summer; Latin, masculine adjective.

Discussion.—This is one of eight species with a short, longitudinal medial clypeal ridge or welt. Among these species, *aestus* most closely resembles *aquilonius* based on the closely punctate clypeus and frons, and penis valves more than two-thirds as long as aedeagus, and *nanus* based on the circular and not striatiform propodeal punctures and red legs. Additional diagnostic features include the ocellocular distance 4.8 MOD and propodeal punctures nearly contiguous medially.

Hathynnus aquilonius Kimsey, new species

Figs. 1, 9

Male.—Body length 5.5 mm. *Head:* clypeus with short longitudinal, impunctate, medial carina, punctures similar in size to those on frons, punctures contiguous to 0.5 PD apart; frons with punctures 1–4 PD apart between eye and antennal socket; vertex punctures irregular, 0.5–1.0 PD apart; clypeus greatest width twice length; interantennal distance 2.6 MOD wide; ocellocular distance 4.2 MOD; flagellomere I 1.2× as long as broad; flagellomere II 1.4× as long as broad; flagellomeres III–IV 1.6× as long as broad; flagellomere XI 2.3× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 2–4 PD apart; metanotum nearly impunctate; propodeal punctures striatiform and contiguous to 0.5 PD apart; mesopleural punctures 0.5–1.0 PD apart below wing fossa, with subventral broad impunctate band. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 3–4 PD apart; epipygium with impunctate medial longitudinal band, and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 9): paramere dorsal margin angulate subapically, with subacute apex; volsella with large, flat, round ventral lobe; aedeagus with ventral expansion narrower than dorsal column; penis valve longer than ventral expansion. *Color:* black, with yellow and orange markings; face with yellow mark along lower inner eye margin and along dorsal eye margin near hindocelli; mandible yellow, becoming reddish brown apically; posterior eye margin with

short interrupted yellow band along lower margin; pronotum with transverse anterior and posterior spots; legs dark brown becoming paler on tibiae and tarsi; propodeum with tiny posterolateral yellow spot; terga and sterna II–V with small lateral yellow spot; wing membrane untinted, costa and stigma yellowish brown, rest of veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Queensland: Carnarvon National Park, Mt. Moffatt, 24°52.26S 148°01.19E, Irwin & Gaimari, 22 Nov. 1995 (BRISBANE).

Etymology.—The name, *aquilonius*, refers to the most northerly distribution of this species relative to others in the genus; Latin, masculine adjective.

Discussion.—*H. aquilonius* shares the dense punctation of the clypeus and frons and long penis valves with *aestus*. The two species differ in coloration; *aquilonius* has fewer pale markings and lacks the complete pale band along the inner eye margin of *aestus*, a feature also seen in *fuscatus*, *theros*, *occidentalis* and *orarius*. Additional diagnostic features of *aquilonius* are the ocellocular distance 3.8 MOD, paramere with angulate dorsal margin, and volsella with a large, ovoid ventral lobe.

Hathymus austrinus Kimsey, new species

Figs. 1, 10

Male.—Body length 4.5–6.0 mm. *Head:* clypeus with impunctate, longitudinal, medial welt reaching apex, punctures smaller than on frons, punctures 0.5–1.0 PD apart; frons with punctures 0.5–1.0 PD apart, impunctate between eye and antennal socket; vertex punctures 0.5–1.0 PD apart, dorsolaterally nearly impunctate; interantennal distance 2.3 MOD wide; clypeus greatest width 1.8× length; ocellocular distance 3.8 MOD; flagellomere I 1.2× as long as broad; flagellomere II 1.6× as long as broad; flagellomeres III–IV 1.7× as long as broad; flagellomere XI twice as long as broad. *Mesosoma:* pronotal, scutal, scutellar and metanotal punctures 4–6 PD apart; propodeal punctures circular and 0.5–1.0 PD apart; mesopleural punctures 1.0 PD apart, except impunctate in broad, subventral band. *Metasoma:* terga and sterna polished, punctures obscure, 4–6 PD apart; epipygium with impunctate medial longitudinal band, and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 10): paramere posterior margin strongly convex, with subtruncate apex; volsella ventral lobe broad, flat and apical angle subacute; aedeagus with ventral lobe about as broad as dorsal column; penis valve more than half as long as aedeagus. *Color:* black to brown, with pale yellow markings; face with yellow band along inner eye margin, with yellow spot adjacent to each antennal socket and clypeus submedially; mandible yellow basally becoming reddish brown apically; gena with short yellow band along lower posterior eye margin and oval mark behind upper eye margin; pronotum with transverse anterior and posterior yellow bands; scutum, scutellum and metanotum with large medial yellow spot; tegula yellow; mesopleuron with large U-shaped yellow anterior spot and posterior ovoid one; propodeum with sublateral yellow spot; coxae with one or two longitudinal dorsal yellow bands; femora basally dark brown, apically reddish brown or yellow; tibiae and tarsi reddish brown; terga II–VI with comma-shaped yellow lateral spot; sternum II–IV with small pale lateral spot; wing membrane untinted, costa and stigma brown, paler medially, rest of veins brown.

Female.—Body length 2–4 mm. *Head:* parallel-sided in front view to bulging dorsolaterally, with one long hair above each eye and eye-sized oval depression behind eye. *Mesosoma:* pronotal disk without medial sulcus; scutellum without anteromedial lobe; propleuron flat; forecoxae not separated by pit; metanotum obsolescent. *Metasoma:* pygidium with elongate, narrow and parallel-sided carina-enclosed

posterior plate, apex broadly truncate or medially notched, with lateral flap; sternum VI as long as broad, apex broadly rounded.

Type material.—Holotype ♂: Western Australia: 20 km w Esperance, 33°43'S 121°25'E, 27 Dec. 1994, R. B. & L. S. Kimsey, ex *Eucalyptus*, WA122706 (PERTH). Paratypes: 4♂♂, 7♀♀, same data as holotype (DAVIS, PERTH).

Etymology.—The name *austrinus* refers to the southern distribution of the species in Australia; Latin, masculine adjective.

Discussion.—This species is one of four, including *occidentalis*, *moorensis* and *orarius* that have a strongly developed longitudinal clypeal carina. Unlike the first two species, *austrinus* does not have the interantennal area elevated with a V-shaped carina or ridge, and the propodeal punctures are circular and separated, not striatiform and contiguous. Other diagnostic features of *austrinus* include the paramere with an angulate dorsal margin and subtruncate apex, and aedeagus with broad ventral expansion. *H. austrinus* differs from *orarius* in the less densely punctate frons and clypeus, and propodeal punctures circular and not striate.

Hathymus cardaleae Kimsey, new species

Figs. 1, 11

Male.—Body length 4.0–4.5 mm. *Head:* clypeus without longitudinal medial carina or welt, punctures contiguous medially to 0.5 PD apart; frons with punctures 0.5–1.0 PD apart, becoming nearly impunctate between eye and antennal socket; vertex punctures 0.5–1.0 PD apart; clypeal apex equal to interantennal distance and 0.33 clypeal width; interantennal distance 2.8 MOD; clypeus greatest width 2.2× length; ocellocular distance 4 MOD; flagellomere I 1.2× as long as broad; flagellomere II 1.5× as long as broad; flagellomeres III–IV 1.4–1.6× as long as broad; flagellomere XI 1.7× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 1–3 PD apart; metanotum nearly impunctate; propodeal punctures circular and 0.5–1.0 PD apart; mesopleural punctures nearly contiguous below wing fossa, sparser and 0.5–1.0 PD apart ventrally and posteriorly, with broad subventral impunctate band. *Metasoma:* terga and sterna finely shagreened, punctures obscure and 4–6 PD apart; epipygium with impunctate medial longitudinal stripe, and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 11): paramere subtriangular, with acute apex, dorsal margin strongly convex; volsellar dorsal lobe rounded, ventral lobe ovoid, with angled apex; aedeagus with ventral expansion as broad as or somewhat narrower than dorsal column; penis valve slender and less than half as long as aedeagus. *Color:* black, with whitish and brown markings; mandible whitish, with reddish apex; face with thin, whitish band along inner eye margin extending dorsally toward, but not reaching, hindocellus; posterior eye margin with whitish band extending nearly halfway up eye and small spot above; pronotum with whitish band along anterior and posterior margins; tegula brown; scutum with ovoid whitish spot between notauli; scutellum with triangular medial spot and smaller anterolateral one; metanotum whitish medially; propodeum with whitish lateral spot; mesopleuron with irregular anterior whitish spot; coxae, mid and hindfemora dark brown; forefemur dark brown, with brownish yellow apex; rest of legs brown.

Female.—Unknown.

Type material.—Holotype ♂: Australian Capital Territory: Canberra, 4–10 Jan. 1999, Wharton & Woolley, malaise trap (CANBERRA). Paratype, 1 ♂, same data as holotype (COLLEGE STATION).

Etymology.—The species is named in honor of Jo Cardale who has made so much of this research possible.

Discussion.—*H. cardaleae* resembles *cobarensis* and *rubromaculatus* based on the lack of a clypeal carina, frons punctures

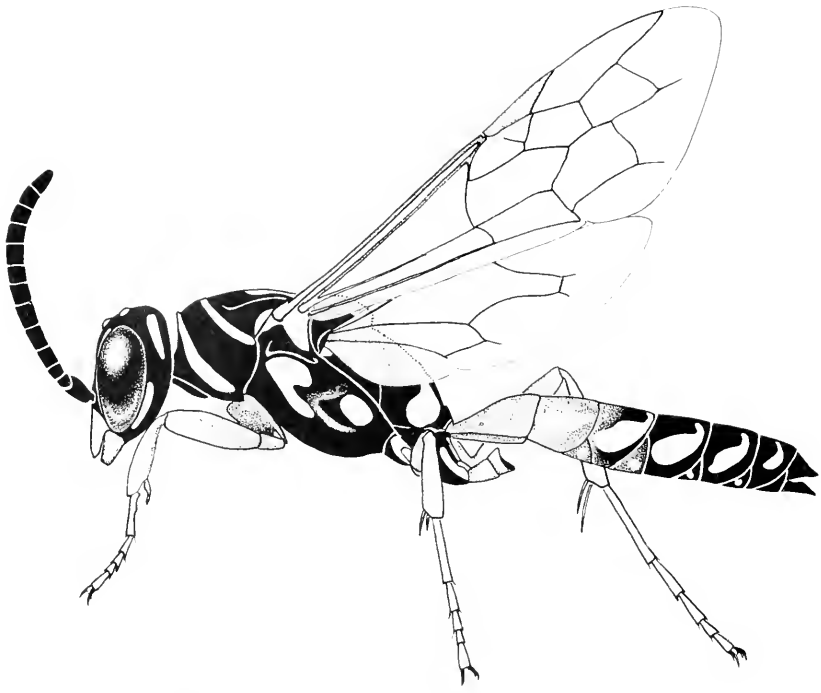


Fig. 2. Side view of male *Hathynnus cobarensis* Kimsey, with closest hindleg removed.

less than 2 PD apart, flagellomere III less than 1.8× as long as broad, propodeum with circular punctures, paramere with acute apex and penis valves long and slender. It differs from these species in having brown legs (not red), propodeal punctures generally less than 1 PD apart, clypeus without yellow markings, ocellocular distance 4 MOD wide and clypeus about twice as broad as long. The type specimens are darkly colored, resembling *fuscatus*, which differs in having a well-developed clypeal carina.

Hathynnus cobarensis Kimsey, new species

Figs. 1, 2, 12

Male.—Body (Fig. 2) length 5.0–6.5 mm. *Head:* clypeus with longitudinal medial welt becoming obsolescent on lower third of clypeus, punctures tiny and nearly contiguous medially to nearly impunctate laterally; frons with punctures 1–3 PD apart becoming nearly impunctate between eye and antennal socket; vertex punctures 1–4 PD apart; clypeus greatest width 3.2× length; ocellocular distance 4 MOD; flagellomere I as long as broad; flagellomere II 1.6× as long as broad; flagellomeres III–IV 1.7–1.8× as long as broad; flagellomere XI 1.8× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 2–5 PD apart; metanotum nearly impunctate; propodeal punctures 0.5–1.0 PD apart; mesopleural punctures 0.5–1.0 PD apart below wing fossa, becoming sparser ventrally and posteriorly. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 4–6 PD apart; epipygium with impunctate medial longitudinal stripe, and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 12): paramere subtriangular, with truncate apex; volsella dorsal lobe bilobate, ventral lobe elongate, with sharply angled apex; aedeagus with ventral expansion as broad as or broader than dorsal column; penis valve slender and more than two-thirds as long as aedeagus. *Color:* black, with yellow and orange markings; clypeus yellow,

with partial medial longitudinal black stripe and dorsal margin black between tentorial pits; mandible yellow, with reddish apex; face with yellow band along inner eye margin extending dorsally toward, but not reaching hindocellus, and large yellow spot above and between eye and antennal socket, some specimens with tiny yellow spot in middle of vertex; posterior eye margin with yellow band extending nearly halfway up eye and elongate dorsal yellow spot; pronotum with yellow band along anterior and posterior margins; tegula yellow on inner half; scutum with large rectangular yellow spot between notauli and yellow band along subventral margin; scutellum with large medially lobed medial spot and smaller anterolateral one; metanotum yellow medially and along anterior margin; propodeum with large yellow lateral spot extending toward midline; mesopleuron with large irregular anterior and oval posterior yellow spots; mid and hindcoxae yellow dorsally; fore and midfemur orange, yellow apicoventrally, hindfemur orange, tibiae inner surface orange, outer surface yellow; foretarsi red; mid and hindtarsi dark brown; tergum I red becoming black basally; sternum I black, segments II–III reddish; segments IV–V dark brown to black, terga II–VI with comma-shaped lateral yellow spot, sterna with small apicolateral yellow spot; wing membrane untinted, costa and stigma orange, rest of veins brown.

Female.—Unknown.

Type material.—Holotype ♂: New South Wales: 180 km w Cobar, 4 Nov. 1992, L. S. and R. B. Kimsey (SYDNEY). Paratypes, 3♂♂, same data as holotype; 1♂, same data as holotype, except 35 km s Cobar (DAVIS, SYDNEY).

Etymology.—The species name, a noun in apposition, refers to the closest town, Cobar, to the collection sites of the type series.

Discussion.—*H. cobarensis* and *pygmaeus* are the largest bodied species of *Hathymnus*, but have few other similarities. A number of species, including *cobarensis*, *rubromaculatus* and *striatus*, lack a medial clypeal carina and are sparsely punctate, with the clypeal punctures well separated and the propodeal punctures circular and separated, not striatiform nor contiguous. The male genital capsule is distinctive in *cobarensis*, with a basally very broad and apically truncate paramere, aedeagus with ventral expansion almost twice as wide as dorsal column, and slender dorsally bilobate volsella. This species can be readily separated from other species lacking a clypeal carina by the male genitalia.

Hathymnus earos Kimsey, new species
Figs. 1, 13

Male.—Body length 3–4 mm. *Head:* clypeus with longitudinal, medial carina, punctures slightly smaller than on frons, punctures 0.5–1.0 PD apart dorsally becoming nearly impunctate laterally; frons with punctures 1–3 PD apart becoming impunctate between eye and antennal socket; vertex punctures 1–3 PD apart; clypeus greatest width 2.5× length; interantennal distance 2.3 MOD wide; ocellocular distance 4 MOD; flagellomere I as long as broad; flagellomere II 1.4× as long as broad; flagellomeres III–IV 1.5× as long as broad; flagellomere XI 2.3× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 1–2 PD apart; metanotum impunctate; propodeal punctures striatiform and contiguous; mesopleural punctures small and nearly contiguous below hindwing, becoming sparsely punctate anteriorly, posteriorly and ventrally, punctures 2–4 PD apart. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 4–6 PD apart; epipygium with impunctate medial band, and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 13): paramere dorsal margin strongly convex, apex narrowly rounded; volsella ventral lobe rounded, dorsal lobe subrectangular, with acute apical angle; penis valve small and digi-

tate, less than half as long as aedeagus. *Color:* black to brown, with pale yellow markings; face with yellow band along inner eye margin, yellow spot above each antennal socket; clypeus yellow except medially; mandible yellow becoming reddish brown apically; gena with short yellow band along lower posterior eye margin and dorsal ovoid mark behind upper eye margin; pronotum with transverse anterior and posterior bands; scutum, scutellum and metanotum with large medial yellow spot; tegula yellow; propodeum with large yellow lateral spot; mesopleuron with large anterior U-shaped yellow spot and posterior ovoid one; mid and hindcoxa with two longitudinal dorsal bands; forelegs and rest of midleg reddish brown; hindtrochanter, femur and tibia reddish brown; tarsus brown; terga II–V with pale comma-shaped lateral mark; sternum II with small pale lateral mark; wing membrane untinted, costa and stigma brown, pale medially, rest of veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Victoria: 49 km e Murrayville, 16 Nov. 1992, L. S. & R. B. Kimsey, ex *Eucalyptus* (MELBOURNE).

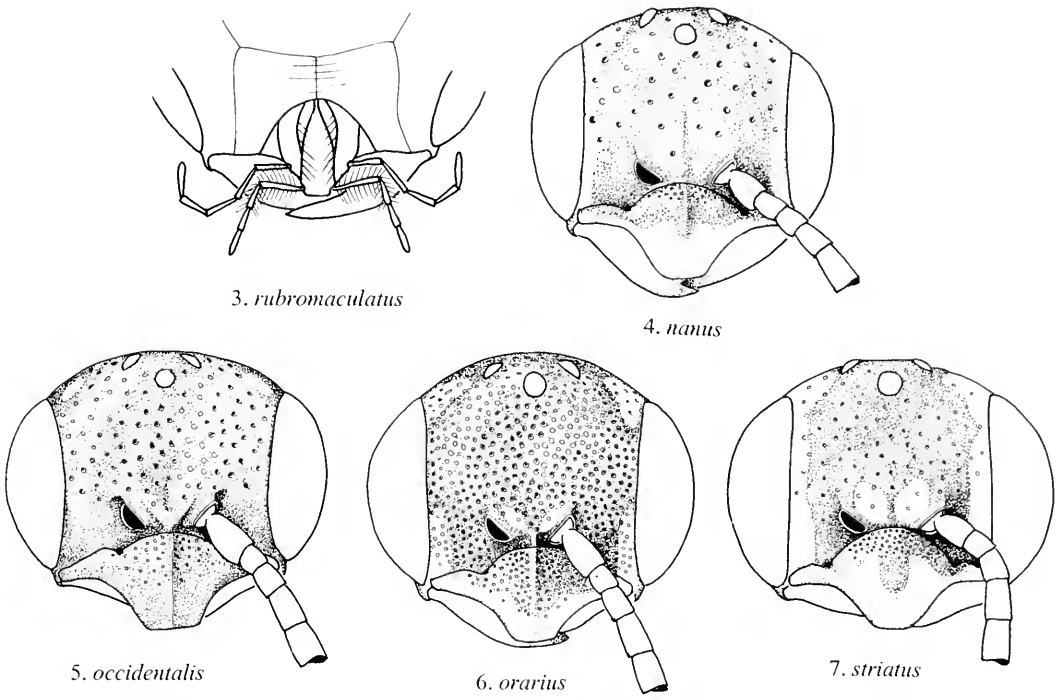
Etymology.—The species name, *caros,* refers to the presence of this species in the spring months; Greek, noun in apposition.

Discussion.—This species is closest to *nanus, fuscatus* and *theros,* based on the sparsely punctate clypeus, striatiform propodeal punctures and incomplete clypeal carina. Distinguishing features of *caros* include the very small penis valve, which is less than one-third the length of the aedeagus, clypeus more than twice as wide as long, paramere dorsal margin strongly convex and volsella with the dorsal part subrectangular.

Hathynnus eyrensis Kimsey, new species

Figs. 1, 14, 25, 26, 36, 28

Male.—Body length 3.5–5.0 mm. *Head:* clypeus without medial carina or welt, punctures tiny, punctures 0.5–1.0 PD apart, sparser laterally; frons and vertex punctures much larger than clypeal ones, 1–3 PD apart, frons impunctate between eye and antennal socket; clypeus greatest width 2.2× length; ocellocular distance 5 MOD; flagellomere I as long as broad; flagellomere II 1.3–1.4× as long as broad; flagellomeres III–IV 1.6–1.7× as long as broad; flagellomere XI twice as long as broad. *Mesosoma:* pronotum nearly impunctate, except along posterior margin punctures 2–3 PD apart; scutal punctures 1–3 PD apart; scutellar punctures 2–4 PD apart; metanotum impunctate; propodeal punctures contiguous to 0.5 PD apart and striatiform; mesopleuron punctures 0.5–1.0 PD apart, becoming sparser ventrally. *Metasoma:* terga and sterna finely shagreened, punctures obsolescent; epipygium with broad impunctate medial longitudinal band and laterally with sparse large punctures. *Genital capsule* (Figs. 14, 25, 26): paramere subtriangular, with acute, pointed apex; gonocoxal dorsal apex truncate; volsella with large ovoid dorsal lobe and ventral lobe narrow and nearly parallel-sided; aedeagus ventral expansion narrower than dorsal column; penis valve slender and less than half as long as aedeagus. *Color:* black to brown, with whitish markings; clypeus whitish, with partial medial longitudinal black stripe and dorsal margin black between tentorial pits; mandible pale, with reddish apex; face with whitish band along inner eye margin extending dorsally toward, but not reaching hindocellus and large whitish spot above and between eye and antennal socket, sometimes with tiny whitish spot in middle of vertex; posterior eye margin with whitish band extending nearly halfway up eye and elongate dorsal spot; pronotum with whitish band along anterior and posterior margins; tegula whitish on inner half; scutum with large whitish ovoid spot between notauli and whitish band along lateral margin; scutellum with large medially lobed whitish medial spot



Figs. 3–7. *Hathymus*, male heads. 3, Ventral view. 4–7, Front view, with partial right antenna.

and smaller anterolateral one; metanotum whitish medially and along anterior margin; propodeum with small, ovoid whitish lateral spot; mesopleuron with large irregular anterior and oval posterior whitish spots; coxae black, with small whitish apical spot, rest of legs yellowish brown; metasoma dark brown to black, terga II–IV or VI with whitish, comma-shaped lateral spot; wing membrane untinted, costa yellow, rest of veins brown.

Female.—Body length 2.5–4.0 mm. *Head:* ovoid, broader than long. *Mesosoma:* pronotal disk quadrate and strongly elevated above anterior collar, with 6–8 long setae and medial sulcus; scutum obsolescent; scutellum with anteromedial lobe; metanotum well-developed, broadly separating scutellum from propodeum; propodeum ovoid and evenly convex, with scattered long hairs; propleuron strongly bulging ventromedially; forecoxae broadly separated by large, deep medial pit (Fig. 28). *Metasoma:* tergum VI with long sublateral carinae, area between carinae broadly oval with broadly rounded apex (Fig. 36); sternum VI about 3× as long as broad at apex, apex broadly rounded.

Type material.—Holotype ♂: South Australia: 20 km n Elliston, Talia Caves, 14 Nov. 1992, L. S. Kimsey (ADELAIDE). Paratypes: 19♂♂, 35♀♀, same data as holotype; 12♂♂, same data as holotype except 30 km n Elliston (ADELAIDE, CANBERRA, DAVIS).

Etymology.—The species name refers to the collection site of the type series on the Eyre Peninsula.

Discussion.—The smaller body size (3–6 mm) and dark coloration of male *eyrensis* shows a close resemblance to *striatus*. However, male *eyrensis* can be immediately distinguished by the acutely pointed paramere, lack of a clypeal carina, long penis valve, striatiform propodeal punctation, sparsely punctate frons, and large ocellocular distance. Female *eyrensis* differ from other *Hathymus* by the ventrally

bulging propleuron, forecoxae broadly separated by a deep pit, and the pygidium ovoid, without long adjacent brushes of setae.

Hathynnus fuscatus Kimsey, new species

Figs. 1, 15

Male.—Body length 3.5 mm. *Head:* clypeus with short, longitudinal, medial welt, clypeal punctures smaller than on frons, dorsally 0.5–1.0 PD apart, nearly impunctate apically; frons with punctures 0.5–1.0 PD apart, impunctate between eye and antennal socket; vertex punctures 1–6 PD apart; clypeus greatest width 2.5× length; interantennal distance 2.3 MOD wide; ocellocular distance 4.3 MOD; flagellomeres I and II 1.1× as long as broad; flagellomeres III–IV 1.3× as long as broad; flagellomere XI 1.5× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 1–2 PD apart; metanotum nearly impunctate; propodeal punctures circular and contiguous to 0.5 PD apart; mesopleural punctures contiguous below hindwing fossa, becoming 0.5–1.0 PD apart elsewhere. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 4–6 PD apart; epipygium with impunctate medial longitudinal band, and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 15): paramere subtriangular, with narrowly acute apex; volsella slender, with elongate, ovoid dorsal and ventral lobes; aedeagus ventral expansion more than half width of dorsal column; penis valve broad and folliaceous. *Color:* black to dark brown, with few pale yellow or muddy whitish markings; vertex with pale mark between hindocellus and dorsal eye margin; mandible pale brown becoming darker toward apex; pronotum with pale transverse anterior and posterior bands; scutum, scutellum and metanotum with pale medial mark; tegula reddish; mesopleuron with small anterior and smaller posterior oval spots; propodeum with sublateral pale spot; legs dark brown, becoming paler on tarsi; terga III–IV with pale brownish lateral mark; wing membrane untinted, veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Western Australia: 110 km nw Williams, 32°19'S 116°13'E, 15 Jan. 1995, R. B. & L. S. Kimsey, ex *Eucalyptus* (PERTH).

Etymology.—Among *Hathynnus* species, *fuscatus* is the most darkly colored, with minimal pale markings. The species name refers to this blackish coloration; Latin, masculine adjective.

Discussion.—This small, dark-colored species, with its partial clypeal carina, sparsely punctate frons and acute paramere resembles *nanus* and *eyrensis*, although *eyrensis* lacks a clypeal carina. Features that distinguish *fuscatus* from these and other species include the lack of pale maculation on the face and metasoma, dark brown legs, slender volsella and striatiform propodeal punctures.

Hathynnus moorensis Kimsey, new species

Figs. 1, 16

Male.—Body length 6 mm. *Head:* clypeus with prominent longitudinal, medial carina reaching apex, punctures slightly smaller than on frons and contiguous; subantennal sclerite with medial longitudinal carina connected to V-shaped swelling between antennal sockets; frons with punctures 0.5 PD apart, punctures much smaller between eye and antennal socket and 0.5 PD apart; vertex punctures 0.2–1.0 PD apart; clypeus greatest width 2.2× length; interantennal distance 1.8 MOD wide; ocellocular distance 3.5 MOD; flagellomere I 1.2 as long as broad; flagellomere II 1.6× as long as broad; flagellomeres III–IV 1.7× as long as broad; flagellomere XI 2.3× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 0.2–0.5 PD apart; metanotum punctures 2–4 PD; propodeal punctures striatiform and contiguous; mesopleural punctures contiguous below wing fossa,

becoming sparser ventrally and posteriorly, with impunctate subventral band. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 4–6 PD apart; epipygium with broad impunctate, medial, longitudinal band and irregular large punctures laterally, 0.5–1.0 PD apart, apex broadly translucent. *Genital capsule* (Fig. 16): paramere broadly triangular, with subacute apex; aedeagus with ventral expansion about as wide as dorsal column; penis valve small, digitate and less than half as long as aedeagus; volsella with apically rounded ventral and dorsal lobes. *Color:* black, with yellow and reddish brown markings; face with broad yellow band along inner eye margin; clypeus yellow; frons with V-shaped yellow mark between antennal sockets; gena with yellow band along lower posterior eye margin and large mark behind upper eye margin; pronotum with transverse anterior and posterior transverse yellow bands; scutum, scutellum and metanotum with large medial yellow spot; tegula yellow; mesopleuron with large irregular anterior yellow spot and posterior ovoid one; propodeum with ovoid lateral yellow spot and small medial one; terga II–VI with large lateral comma-shaped yellow spot; sterna II–V with small lateral yellow spot; coxae black, with yellow anterior or dorsal bands; fore and midfemora and tibiae reddish brown, with yellow markings; tarsi reddish brown; hindfemur, tibia and tarsus reddish brown; wing membrane untinted, costa and stigma yellowish brown, rest of veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Western Australia: 70 km n Gingin, Moore River National Park, 31°04.269S 115°44.328E, R. B. & L. S. Kimsey, 1 Jan. 1995, WA010104 (PERTH).

Etymology.—The species is named after the Moore River National Park, the type collection site.

Discussion.—This species has a well-developed clypeal carina, like *occidentalis* and *austrinus* and a V-shaped carina between the antennal sockets, as in *occidentalis*. It also has the coarsely punctate frons and striatiform propodeal punctures seen in *orarius*. The configuration of the clypeal/interantennal carina and small dorsal aedeagal lobe are unique to *moorensis*.

Hathynnus nanus Kimsey, new species

Figs. 1, 4, 17

Male.—Body length 4 mm. *Head:* face (Fig. 4) very shiny; clypeus with impunctate, longitudinal, medial carina, punctures smaller than on frons, punctures 1–4 PD apart; frons with shallow punctures 2–4 PD apart, impunctate between eye and antennal socket; vertex punctures 2–4 PD apart; clypeus greatest width 2.3× length; interantennal distance 2.6 MOD wide; ocellocular distance 4.6 MOD; flagellomere I as long as broad; flagellomere II 1.5× as long as broad; flagellomeres III–IV 1.8× as long as broad; flagellomere XI 1.9× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 2–6 PD apart; metanotum impunctate; propodeum nearly impunctate medially, punctures tiny and 1–6 PD apart; mesopleural punctures 1.0 PD apart below wing fossa, 4–6 PD apart ventrally and posteriorly. *Metasoma:* terga and sterna finely shagreened, punctures obscure; epipygium largely impunctate and polished, with few scattered punctures laterally. *Genital capsule* (Fig. 17): paramere subtriangular, with narrow, acute apex; aedeagus with ventral expansion slightly broader than dorsal column; penis valve about half as long as aedeagus; volsella ventral lobe large and ovoid, dorsal lobe much smaller and apically acute. *Color:* dark brown to black, with muddy pale yellow markings; face with pale band along inner eye margin, with small pale spot above antennal socket; ventral half of clypeus pale, mandible pale yellow becoming reddish brown apically; gena with pale band along lower half of posterior eye margin and elongate pale spot behind upper eye margin; pron-

otum with transverse pale posterior and anterior bands; scutum, scutellum and metanotum with pale medial spot; tegula yellowish brown; mesopleuron with anterior elongate pale spot and ovoid posterior one; propodeum with small posterolateral pale spot; legs brown becoming paler toward tarsi; terga II–VI with pale comma-shaped lateral spot; sterna II–IV with trace of pale lateral mark; wing membrane untinted, costa and stigma pale brown, rest of veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Western Australia: 8 km n Northampton, 27°41'S 114°41'E, 4 Jan. 1995, R. B. & L. S. Kimsey, WA0101402, ex *Eucalyptus* (PERTH).

Etymology.—This is the smallest of the *Hathymus* species, thus the species name *nanus*, meaning little or dwarf; Latin, masculine adjective.

Discussion.—A number of *Hathymus* species share the incomplete clypeal carina, sparse clypeal and frons punctation and circular propodeal punctures seen in *nanus*, including *fuscatus*, *theros* and *caros*. *H. nanus* can be distinguished from these and other species by the sparsely punctate face and propodeum, and greater ocellocular distance of more than 4.5 MOD.

Hathymus occidentalis Kimsey, new species

Figs. 1, 5, 18

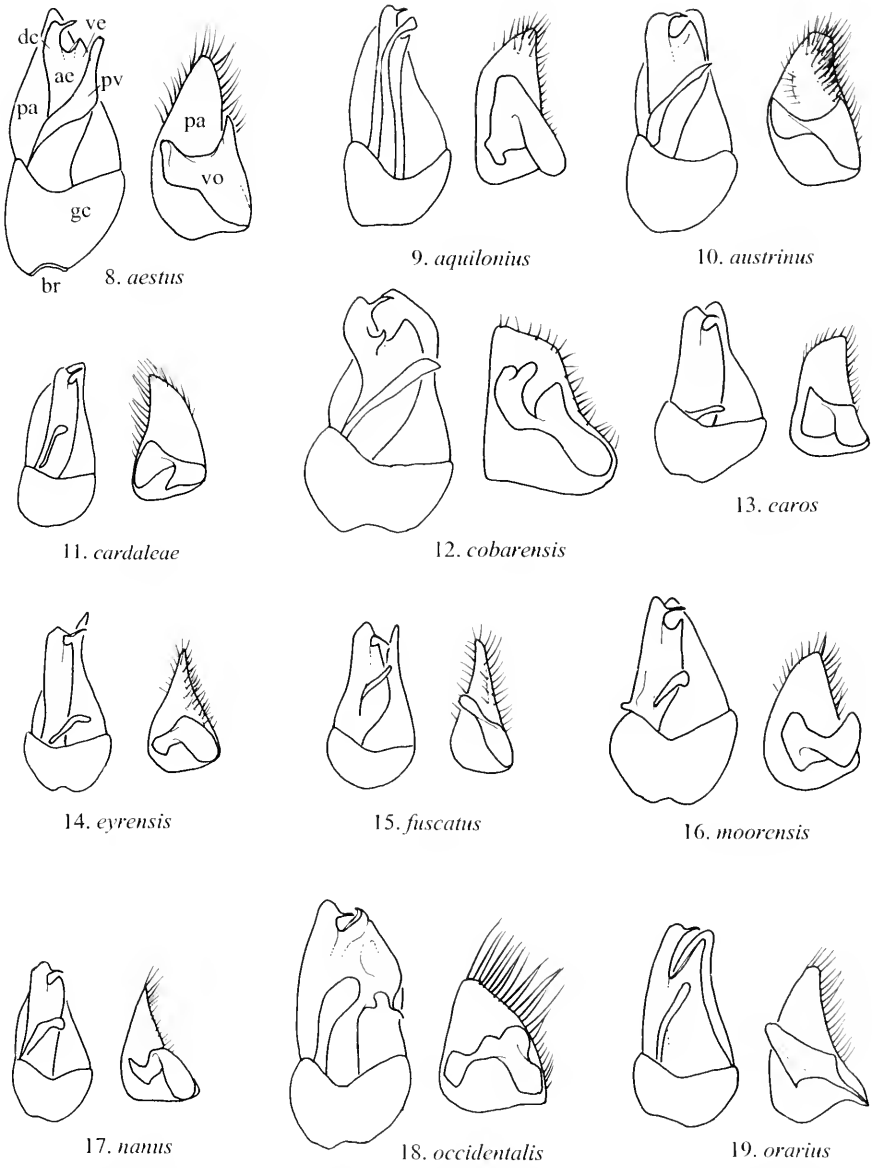
Male.—Body length 4–6 mm. *Head* (Fig. 5): clypeus with prominent longitudinal, medial carina extending to clypeal apex, punctures smaller than on frons, 0.5–1.0 PD apart; frons with punctures 0.5–1.0 PD apart, nearly impunctate between eye and antennal socket; vertex nearly impunctate; clypeus greatest width 2.3× length; interantennal distance 2.4 MOD wide; ocellocular distance 5.3 MOD from nearest eye margin; flagellomere I as long as broad; flagellomeres II–IV 1.5× as long as broad; flagellomere XI 1.7× as long as broad. *Mesosoma:* pronotal, scutum and scutellum impunctate medially; metanotum impunctate; propodeum shiny, punctures tiny and separated by 4–6 PD; mesopleural punctures 1–2 PD apart below wing fossa, mesopleuron becoming nearly impunctate ventrally and posteriorly. *Metasoma:* terga and sterna polished, punctures obscure; epipygium with impunctate medial longitudinal band and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 18): paramere broadly subtriangular, with convex ventral margin and rounded apex; aedeagus with ventral expansion elaborate, with ventral projection, and more than twice as wide as dorsal column; volsella ventral lobe almost dumbbell-shaped, dorsal lobe capitate; penis valve about half as long as aedeagus and apically capitate. *Color:* black, with yellow and reddish brown markings; face with small yellow spot between dorsal eye margin and hindocellus; mandible brown; pronotum with partial transverse anterior yellow band, interrupted medially, with posterolateral yellow mark; scutum with small posteromedial yellow spot; tegula yellow; scutellum and metanotum with medial yellow spot; trochanters and basal half of femora dark brown; rest of legs reddish brown; terga III–VI with elongate lateral yellowish spot; sterna III–V with small lateral ovoid yellow spot; wing membrane untinted, veins brown.

Female.—Unknown.

Type material.—Holotype ♂: Western Australia: Yallingup, 20 Dec. 1994, R. B. & L. S. Kimsey, WA122001, ex *Eucalyptus* (PERTH). Paratypes: 1 ♂, Yallingup, 22 Dec. 1979, R. M. Bohart, ex *Melilluca* (DAVIS); 1 ♂, Western Australia, 300 km n Bunbury, 30 Oct. 1982, W. F. Chamberlain (COLLEGE STATION).

Etymology.—The species name, *occidentalis*, refers to the western distribution of the species in Australia; Latin, masculine adjective.

Discussion.—This species shares the well-developed clypeal carina and V-shaped interantennal welt with *moorensis*. Other species with a well-developed clyp-



Figs. 8–19. *Hathymus*, inner view of male genital capsule,, with closest paramere removed (left), with inner surface of paramere showing volsella (right). Abbreviations are: ae = aedeagus, br = basal ring, dc = aedeagus dorsal column, gc = gonocoxa, pa = paramere, pv = penis valve, ve = aedeagus ventral expansion, vo = volsella.

eal carina are *austrinus* and *orarius*. Additional diagnostic characteristics include the incomplete inner eye margin yellow band (shared with *orarius*), nearly impunctate propodeum, and the ocellocular distance 5 MOD or wider.

Hathymus orarius Kimsey, new species

Figs. 1, 6, 19

Male.—Body length 4.5–6.0 mm. *Head*: face (Fig. 6); clypeus with longitudinal, medial carina reaching apex, punctures slightly smaller than on frons and 0.5 PD

apart; frons with punctures 0.5 PD apart, sparser between eye margin and antennal socket; vertex punctures 1 PD apart; clypeus greatest width 1.4× length; interantennal distance 1.8 MOD wide; ocellocular distance 3.8 MOD; flagellomere I 1.1 as long as broad; flagellomere II 1.5× as long as broad; flagellomere III 1.3× as long as broad; flagellomeres IV–XI lost. *Mesosoma:* pronotal and scutal punctures 1–2 PD apart; scutellar punctures 2–4 PD apart; metanotum impunctate; propodeal punctures striatiform and contiguous, between transverse ridges; mesopleural punctures dense and contiguous, with more sparsely punctate subventral band. *Metasoma:* terga and sterna finely shagreened, punctures obsolescent; epipygium with impunctate medial longitudinal band and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 19): paramere subtriangular, with dorsal margin concave and apex acute; aedeagus broadest basally, with ventral expansion about twice as wide as dorsal column; volsella ventrally tapering to acute apex, angulate apicomedially, dorsally subtriangular with rounded apex; penis valve slender and more than half as long as aedeagus. *Color:* black to dark brown, with yellow and reddish brown markings; face with yellow band along inner eye margin interrupted medially and with small yellow spot above antennal socket; clypeus with lower half yellow; mandibles yellow becoming reddish brown apically; gena with short yellow band along lower posterior eye margin and ovoid yellow spot behind upper eye margin; pronotum with transverse anterior and posterior yellow bands, anterior band interrupted medially; scutum, scutellum and metanotum with large yellow medial spot; tegula yellow; mesopleuron with anterior C-shaped to linear anterior yellow spot and ovoid posterior one; propodeum with ovoid posterolateral yellow spot; fore and midleg coxae brown (forecoxa with yellow ventral band), femora basally brown and apically yellow, tibiae and tarsi yellow; hindleg orange, becoming brown on tarsi, coxa with dorsal yellow band; metasomal segments dark brown, except II and III reddish brown; terga II–VI with ovoid lateral yellow spot; sterna III–V with small ovoid lateral yellow spot; wing membrane untinted, veins brown, except costa basally yellow.

Female.—Unknown.

Type material.—Holotype ♂: New South Wales: 2 km w Wandell, 4–5 Nov. 1995, M. E. Irwin, D. K. Yates & D. Gaimari, coastal scrub heath, 28°45.22S 153°25.40E (SYDNEY). Paratype ♂, same data as holotype (DAVIS).

Etymology.—The species name, *orarius* (= coastal), refers to the presence of this species in the coastal scrub of New South Wales; Latin, masculine adjective.

Discussion.—The well-developed clypeal carina aligns *orarius* with *austrinus*, *occidentalis* and *moorensis* as discussed under those species. It can be distinguished from these and other species by the combination of the closely punctate frons, densely striatiform propodeal punctures, eye with incomplete inner stripe, ocellocular distance less than 4 MOD and interantennal distance about 1.8 MOD.

Hathymus piligaensis Kimsey, new species

Figs. 1, 20

Male.—Body length 6 mm. *Head:* clypeus with short, impunctate, longitudinal, medial carina, smaller than on frons, punctures 0.2–0.5 PD apart; frons with punctures 0.2–0.5 PD apart, punctures tiny between eye and antennal socket and about 1 PD apart; vertex punctures 2–6 PD apart; clypeus greatest width 2.1× length; interantennal distance 2.8 MOD wide; ocellocular distance 4.2 MOD; flagellomere I 1.3 as long as broad; flagellomere II 1.5× as long as broad; flagellomeres III–IV 1.8× as long as broad; flagellomere XI 2.3× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 2–6 PD apart; metanotum nearly impunctate; pro-

podeal punctures circular and nearly contiguous; mesopleural punctures contiguous below wing fossa, becoming 1–2 PD apart ventrally and posteriorly, except for a broad impunctate band laterally. *Metasoma:* terga and sterna finely shagreened, punctures obscure, 2–4 PD apart; epipygium with impunctate medial longitudinal band and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 20): paramere ventral margin concave, with truncate apex; aedeagus with ventral expansion slightly more than half as wide as dorsal column; penis valve slender and about half as long as aedeagus; volsella longer than width of paramere, protruding dorsally, ventral lobe broad and flat, with acute apical angle, dorsal lobe ovoid, with acute apical angle. *Color:* black to dark brown, with yellow and orange markings; face with yellow band along inner eye margin, yellow spot above each antennal socket and yellow band along clypeal apical margin; gena with short band along lower posterior eye margin and ovoid spot behind upper eye margin; mandibles yellow becoming reddish brown apically; pronotum with transverse anterior and posterior yellow bands; scutum with large yellow medial spot; scutellum with bell-shaped medial and smaller lateral yellow spots; metanotum with medial and lateral yellow spots; mesopleuron with C-shaped anterior and ovoid posterior yellow spots; propodeum with large ovoid medial and lateral yellow spots; coxae with extensive yellow markings; fore and midleg: femora basally orange apically yellow, tibiae and tarsi orange; hindleg trochanters and tarsi brown, rest of leg orange; metasoma brown except segments II and III reddish medially, terga II–VI with lateral comma-shaped yellow mark; sterna II–VI with small lateral yellow spot; wing membrane untinted, veins brown, except costa yellow basally.

Female.—Unknown.

Type material.—Holotype ♂: New South Wales: 35 km s Narrabri, Piliga Scrub State Forest, 2 Nov. 1992, R. B. & L. S. Kimsey (CANBERRA).

Etymology.—The species is named after the collection site in the Piliga Scrub State Forest.

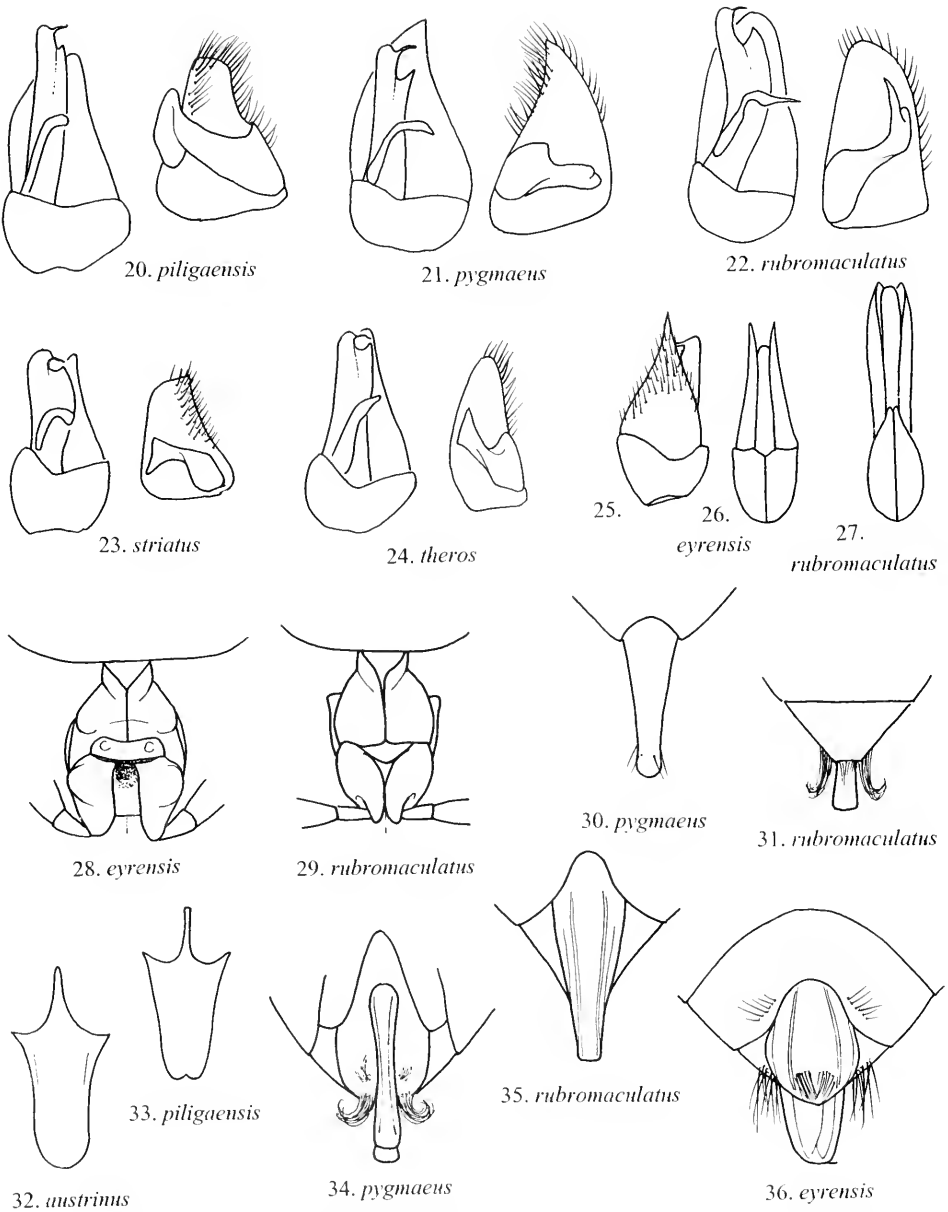
Discussion.—Four species, *pygmaeus, piligaensis, cardaleae* and *aquilonius,* have an incomplete clypeal carina and frontal punctures 0.5–2.0 PD apart. *H. piligaensis* also has a medial propodeal spot like *pygmaeus.* It can be distinguished from these species by the combination of the circular propodeal punctures, volsella broader than the paramere, interantennal distance less than 3 MOD and ocellocular distance more than 4 MOD.

Hathymus pygmaeus (Turner), new combination

Figs. 1, 21, 30, 34

Thymus pygmaeus Turner 1908:117. Holotype ♂; Australia: Victoria (LONDON).

Male.—Body length 6–8 mm. *Head:* clypeus with partial longitudinal medial carina or welt, with punctures 0.5–1.0 PD sublaterally, nearly impunctate medially, frons and vertex with punctures 1–2 PD apart (punctures larger than on clypeus), nearly impunctate along eye margin; clypeus greatest width 2.7× length; interantennal distance 2 MOD; ocellocular distance 4 MOD; flagellomere I as long as broad; flagellomere II 1.4× as long as broad; flagellomeres III–IV 1.6× as long as broad; flagellomere XI 1.8× as long as broad. *Mesosoma:* pronotal and scutal punctures 1–3 PD apart, with highly polished interspaces; scutellar punctures 3–5 PD apart; metanotum nearly impunctate; propodeal punctures uniform, 0.5–1.0 PD apart, becoming striatiform laterally; mesopleural punctures nearly contiguous below hindwing, becoming larger and sparser anteriorly and ventrally, with impunctate subventral band. *Metasoma:* terga and sterna finely shagreened, nearly impunctate, punctures obscure; epipygium with im-



Figs. 20–36. *Hathynnus*. 20–24, Inner view of male genital capsule, with closest paramere removed (left), with inner surface of paramere showing volsella (right). 25–27, Male genital capsule: 25, Side view, 26–27, Dorsal view. 28–29, Ventral view of female prothorax. 30–31, Ventral view of female apical metasomal segments. 32–33, Male hypopygium. 34–36, Dorsal view of female apical metasomal segments.

punctate longitudinal medial band and broadly impunctate apex, laterally with irregular punctures. *Genital capsule* (Fig. 21): paramere subtriangular and apically acute, broadest at base; gonocoxal dorsoapical margin concave medially; aedeagal ventral expansion one-half to two-thirds as broad as dorsal column; volsella apically narrowed and weakly bilobate, basally enlarged and rounded, lying along basal fourth of paramere; penis valve arched ventrally, slender and tapering api-

cally. *Color:* black, with yellow and reddish markings; head with yellow band encircling eye, except interrupted along upper posterior eye margin, yellow mark over each antennal lobe; clypeus yellow laterally; mandible yellow with red margin; pronotum with transverse anterior and posterior marginal bands; scutum with trilobate or quadrate medial yellow spot; scutellum with trilobate medial spot and lateral yellow one; metanotum yellow medially, with yellow lateral band along anterior margin; mesopleuron with large unilobate or bilobate anterior spot and with or without one or two smaller posterior yellow spots; propodeum with large longitudinal medial (sometimes absent) and circular lateral yellow spots; coxae with some yellow markings; legs red and yellow to brown, becoming browner on tarsi; wing membrane untinted; veins pale brown becoming very yellow in stigma; metasomal segment I blackish, sometimes red apically, segments II–III red to dark brown; segments IV–VI blackish, terga and sterna of segments II–VI with comma-shaped yellow lateral spot; segment VII black.

Female.—Body length 3–4 mm, same as *eyrensis* except: *Mesosoma:* pronotal disk without medial sulcus; scutellum without anteromedial lobe; propleura flat; forecoxae not separated by pit; metanotum obsolescent. *Metasoma:* pygidium elongate, narrow and parallel-sided, apex narrowly rounded or truncate (Fig. 34); sternum VI 6× or more as long as wide at apex, apex narrowly rounded or truncate (Fig. 30).

Material studied.—226♂♂, 79♀♀ from Western Australia: Toodyay, Brookton, 4 km n Porongorup, 78 km n Gingin, Northam, Bridgetown, 6 km w Gingin, 20 km w Esperance. Specimens were collected in the months of October through January.

Discussion.—Male *pygmaeus* are relatively large-bodied and brightly colored members of the genus, resembling those of *cobarensis* as discussed under that species. They also resemble *piligaensis* based on the short penis valves, medial propodeal spot and well separated punctures on the frons. Additional diagnostic features of male *pygmaeus*, which will separate them from male *piligaensis* and other species, are the striatiform propodeal punctures, aedeagus with ventral expansion as wide as dorsal column, and apically acute paramere. Females have the long narrow pygidium and apical metasomal sternum seen in *rubromaculatus*, but lack the long mustache-like brush on either side of the pygidium typical of female *rubromaculatus*.

Hathynnus rubromaculatus (Turner), new combination

Figs. 1, 3, 22, 27, 29, 31, 35

Thynnus rubromaculatus Turner 1908:118. Syntype ♂♂; Australia: New South Wales, Wattle Flat; Victoria (LONDON).

Male.—Body length 2.5–4.0 mm. *Head:* venter (Fig. 3); clypeus without medial longitudinal carina or welt, punctures tiny, 1–2 PD apart sublaterally, sparser medially; frons and vertex punctures 1–2 PD apart, punctures considerably larger than on clypeus, 2–3 PD apart along eye margin; clypeus greatest width 2.0–2.3× length; interantennal distance 3.0–3.2 MOD; ocellocular distance 3–4 MOD; flagellomere I as long as broad; flagellomere II 1.5–1.7× as long as broad; flagellomeres III–IV 1.7–1.9× as long as broad; flagellomere XI 2.0–2.2× as long as broad. *Mesosoma:* pronotal punctures 2–5 PD; scutal punctures medially 2–5 PD apart, laterally 1–2 PD apart, interspaces highly polished; scutellar punctures 3–6 PD apart; metanotum nearly impunctate; propodeal punctures uniform, 0.5–1.5 PD apart, slightly striatiform laterally; mesopleural punctures 0.5 PD below hindwing, becoming sparser anteriorly and ventrally, with impunctate subventral band. *Metasoma:* terga and sterna finely shagreened, nearly impunctate, punctures tiny and obscure; epipygium broadly impunctate medially and sparsely punctate laterally. *Genital capsule*

(Figs. 22, 27): paramere broadly rounded apically, broadest across basal half; aedeagus with ventral expansion as broad as dorsal column; volsella dorsal part bilobate, with inner lobe slender and acute, outer lobe large and broadly rounded, ventral part subovoid; penis valve slender and arched ventrally, apex narrowly elongate and subtriangular. *Color:* body black, with yellow and reddish brown markings: head with yellow band encircling eye, except interrupted along upper posterior eye margin and yellow mark over position of antennal lobe; clypeus yellow laterally; mandible yellow, with red margin; pronotum with transverse anterior and posterior marginal bands; scutum with oval medial yellow spot; scutellum with trilobate medial and lateral yellow spots; metanotum yellow medially, with yellow lateral band along anterior margin; mesopleuron with large uni- or bilobate anterior and with or without smaller posterior yellow spots; propodeum with large longitudinal medial (sometimes absent) and circular lateral yellow spots; coxae with some yellow markings; legs red and yellow to brown, becoming browner on tarsi; wing membrane untinted; veins pale brown becoming yellow on stigma; metasomal segment I blackish basally, sometimes red apically, segments II–III red to dark brown, terga and sterna with comma-shaped lateral yellow spot; segments IV–VI blackish, terga and sterna with comma-shaped yellow lateral spot; segment VII black.

Female.—Same as *eyrensis*, except for the following: Body length 2–3 mm. *Mesosoma:* pronotal disk not strongly elevated above collar, without medial sulcus; prothoracic venter (Fig. 29); scutellum without anteromedial lobe; scutum obsolescent. *Metasoma:* sternum V with long mustache-like tuft of setae on either side of sternum VI; sternum VI narrower than in *pygmaeus*, apex broadly truncate and strongly bent ventrally (Fig. 31), length about 4× width of apex; pygidium narrower than in *pygmaeus* (Fig. 35).

Material studied.—196♂♂; specimens were studied from South Australia: Keith, Bondowie and Western Australia: Stirling Range; these were collected in the months of December and January.

Discussion.—Male *rubromaculatus* lack a medial clypeal carina, the frons punctures are 0.5–2.0 PD apart, and volsellar modifications are similar to those of *cobarensis* as discussed under that species. They can be distinguished from *cobarensis* males by the apically broadly rounded paramere (truncate in *cobarensis*), narrower aedeagal ventral expansion and propodeum with a medial yellow spot. Female *rubromaculatus* have a mustache-like brush subtending the pygidium, similar to that of *pygmaeus*.

Hathymus striatus Kimsey, new species

Figs. 1, 7, 23

Male.—Body length 4 mm. *Head:* face (Fig. 7); clypeus without longitudinal, medial carina or welt, clypeal punctures as large as on frons, 1 PD apart; frons with punctures 2–3 PD apart, nearly impunctate between eye and antennal socket; vertex punctures 1–2 PD apart; clypeus greatest width 2.1× length; interantennal distance 2.4 MOD wide; ocellocular distance 3.8 MOD; flagellomere I 1.1× as long as broad; flagellomere II–VI 1.6× as long as broad; flagellomere XI 2.2× as long as broad. *Mesosoma:* pronotal, scutal and scutellar punctures 1–2 PD apart; metanotum impunctate; propodeal punctures contiguous and striatiform above petiolar socket and 1 PD apart dorsally; mesopleural punctures 0.5–1.0 PD apart below wing fossa, becoming sparser (1–3 PD apart) ventrally, anteriorly and posteriorly, with impunctate subventral band. *Metasoma:* terga and sterna finely shagreened, punctures obsolescent; epipygium with impunctate medial longitudinal band and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 23): paramere broadest basally, ventral margin

concave, dorsal margin strongly convex, apex appearing subtruncate; penis valve strongly arched and about half as long as aedeagus; aedeagus ventral expansion 1.0–1.53 as broad as dorsal column; volsella ventral lobe rounded, dorsal lobe subtriangular, with apical angle. *Color:* black, with pale yellow and orange markings; face with broad pale yellow band along inner eye margin, apical half or more of clypeus pale yellow; frons with yellow spot above each antennal socket; gena with short pale yellow band along lower posterior eye margin and ovoid pale yellow spot behind upper eye margin; pronotum with transverse anterior (interrupted medially) and posterior pale yellow bands; scutum, scutellum and metanotum with large medial pale yellow spot; mesopleuron with large bilobate anterior pale yellow spot and ovoid posterior one; propodeum with large ovoid lateral pale yellow spot; coxae with pale yellow dorsal spot; rest of legs orange, with tarsi brown; metasoma dark brown, except segments II–III reddish; terga II–VI with comma-shaped lateral pale yellow spot; sterna II–V with small lateral pale yellow spot; wing membrane untinted, veins brown, with base of costa pale, yellowish.

Female.—Unknown.

Type material.—Holotype ♂: South Australia: 25 km e Waikerie, 7 Nov. 1992, R. B. & L. S. Kimsey (ADELAIDE).

Etymology.—The species name, *striatus*, refers to the transversely striate punctures on the propodeum; Latin, masculine adjective.

Discussion.—Males of *eyrensis* and *striatus* share a number of modifications; both lack a clypeal carina, frons punctures are more than 3 PD apart, the paramere is apically slender and acute, and the propodeum has striatiform punctures. The most distinctive feature of *striatus* is the shape of the paramere, with the dorsal margin strongly convex and ventral margin concave.

Hathynnus theros Kimsey, new species
Figs. 1, 24

Male.—Body length 4 mm. *Head:* clypeus with short longitudinal, medial ridge, not reaching apex, clypeal punctures smaller than on frons, 1 PD apart; frons with punctures 1–4 PD apart, impunctate between eye and antennal socket; vertex impunctate; clypeus greatest width 3× length; interantennal distance 2 MOD wide; ocellocular distance 3.8 MOD; flagellomere I 1.1× as long as broad; flagellomere II 1.4× as long as broad; flagellomeres III–IX lost. *Mesosoma:* pronotal, scutal and scutellar punctures 1–2 PD apart; metanotum impunctate; propodeal punctures circular and 0.5 PD apart; mesopleural punctures contiguous to 0.5 PD apart below hindwing, becoming sparser (1–2 PD apart) elsewhere, except for broad impunctate subventral band. *Metasoma:* terga and sterna finely shagreened, punctures obsolescent; epipygium with impunctate medial longitudinal band and irregular large punctures laterally, 0.5–1.0 PD apart. *Genital capsule* (Fig. 24): paramere slender, broadest submedially, with broadly rounded apex; aedeagus ventral expansion about as broad as dorsal column; volsella ventral lobe with rounded apical angle, dorsal lobe with acute apical angle. *Color:* black to dark brown, with pale yellow and reddish brown markings; face with yellow band along inner eye margin and small spot above antennal socket; gena with short yellow band along lower posterior eye margin and ovoid yellow spot behind upper eye margin; clypeus with small yellow spot laterally; pronotum with transverse anterior (interrupted medially) and posterior yellow bands and small yellow lateral spot; tegula yellow; scutum, scutellum and metanotum with large medial yellow spot; mesopleuron with irregular anterior and posterior ovoid yellow spots; propodeum with small posterolateral yellow spot and smaller medial one; mid and hindcoxae

brown, with small yellow dorsal stripe; fore and midfemora basally reddish brown apically yellow, tibiae and tarsi yellowish brown; hindfemur dark brown, rest of leg reddish brown; metasoma brown, except segments I–III reddish, terga II–VI with comma-shaped yellow mark; sterna IV and V with small lateral pale spot; wing membrane untinted, veins yellow.

Female.—Unknown.

Type material.—Holotype ♂: South Australia: Sherlock, 24 Dec. 1981, R. W. Thorp (ADELAIDE).

Etymology.—The name refers to the presence of the species in the spring months; *theros* = spring; Greek, noun in apposition.

Discussion.—The short clypeal carina and sparsely punctate frons are found in *theros*, *earos*, *fuscatus* and *nanus*. *H. theros* can be distinguished from these species by the combination of the rounded paramere apex, eye with incomplete inner stripe, ocellocular distance less than 4 MOD wide and clypeus about 3× as broad as long.

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A Preliminary List of the Encyrtidae (Hymenoptera: Chalcidoidea) of Cuba, with Descriptions of Two New Species

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Abstract.—Fifty-one genera and 50 species of Encyrtidae are recorded from Cuba, including 21 genera and 17 species new to Cuba. Two species, ***Copidosoma cubense*** **López** and ***Forcipestricis yrmae*** **López**, are described as new. ***Holcencyrtus gordhi*** **(Trjapitzin and Trjapitzin)** is a **new combination** from *Coelaspidia* Timberlake.

The chalcidoid family Encyrtidae includes mainly primary endoparasitoids or hyperparasitoids of other arthropods, with a few species having been recorded as predators of eggs of Coccidae (Noyes et al. 1997). Many examples of successful biological control programs using encyrtids are known (Dean et al. 1979, van den Bosch et al. 1982, Noyes and Hayat 1994).

Despite the undoubted importance of Encyrtidae in biological pest control, very little information has been published on this group in Cuba. Alayo and Hernández (1978) summarize previous contributions to the study chalcidoids and list 20 genera of Encyrtidae as occurring in Cuba. Records of a few additional species were added later by Hernández and Ceballos (1993), Hernández et al. (1993a, 1993b) and Ceballos and Hernández (1995). A brief account of Cuban Encyrtidae was also provided by Trjapitzin and Sitdikov (1993) who also described a species from Cuba as new to science (*Encyrtus kerzhneri* Trjapitzin and Sitdikov).

Other than these works, all genera recorded from Cuba are included in a key to the Neotropical genera of Encyrtidae compiled by Noyes (1980). Further useful information on the family, including distribution and host relationships can be found in Tachikawa (1963, 1970), De Santis (1964), Noyes and Hayat (1984), Noyes (1988) and Noyes and Hanson (1996).

The purpose of this study is to add to the work of Alayo and Hernández by providing additional records of Encyrtidae of Cuba based on recent publications as well as collections made by Drs. Lubomir Masner and Stuart Peck (1995–1996) in Santiago de Cuba, and more recently by myself from various parts of the country.

Abbreviations for depositories: CNCI (Canadian National Collection of insects, Canada, Ottawa); BMNH (The Natural History Museum, London, England, UK); CENSA (National Centre of Animal and Plant Health, La Habana, Cuba).

The records listed below take the following format: encyrtid taxon: locality in Cuba, published reference or depository for material; host, reference if published record.

LIST OF ENCYRTIDAE OF CUBA

(*indicates new record)

**Accrophagus* sp.—Santiago de Cuba (Jardín Botánico), BMNH; parasitoid of Pseudococcidae (Hemiptera) (Noyes 1980).

Adelencyrtus sp.—Cienfuegos, Alayo and Hernández (1978); parasitoid of Diaspididae (Hemiptera) (Noyes 1980).

**Adelencyrtus moderatus* (Howard).—San-

tiago de Cuba (Jardín Botánico, Caney) (det. J. S. Noyes), BMNH; parasitoid of Diaspididae (Hemiptera): *Aspidiella sacchari* (Hall 1988), *Aspidiotus glomeratus* (Noyes and Hayat 1994), *Aulacaspis takarai, Aulacaspis tegalensis, Duplachionaspis phragmitis* (Trjapitzin 1989).

**Adelencyrtus odonaspidis* Fullaway.—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes), BMNH; parasitoid *Odonaspis ruthae* (Hemiptera: Diaspididae) (Noyes and Hayat 1994), *Duplachionaspis sansevieriae* (Hemiptera: Diaspididae) (Trjapitzin 1989) and also recorded doubtfully as a parasitoid of *Antonina graminis* (Hemiptera: Pseudococcidae) (De Santis 1979).

**Aenasius caeruleus* Brues.—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes), BMNH.

Aenasius lucidus (Kerrich).—Rio Cauto, Kerrich (1967), De Santis (1979); parasitoid of *Phenacoccus solani* (De Santis 1979, Noyes and Hayat 1994), and other Pseudococcidae (Hemiptera) (Noyes 1980).

Aeptencyrtus bruchi De Santis.—La Habana, Guanabo, Trjapitzin (1999), Santiago de Cuba (Jardín Botánico), BMNH; parasitoid of *Antonina graminis* and *Saccharicoccus sacchari* (Hemiptera: Pseudococcidae) (De Santis 1983, Noyes and Hayat 1994).

Ameromyzobia bulyginskayae Trjapitzin.—[locality unknown], Trjapitzin (1971).

**Anagyrus fusciventris* (Girault).—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes), BMNH; mainly a parasitoid of *Pseudococcus longispinus* (Hemiptera: Pseudococcidae), but also recorded from *Maconellicoccus hirsutus, Pseudococcus calceolariae, P. montanus, P. gallicola* and *Ripersia palmarum* (Hemiptera: Pseudococcidae) (Noyes and Hayat 1994).

Anagyrus saccharicola Timberlake.—[locality unknown], Hernández et al. (1993a); parasitoid of *Saccharicoccus sacchari* (De Santis 1979, Hernández and Ceballos 1993a, Noyes and Hayat 1994), *Kirithenkella sacchari* (Hemiptera: Pseudococcidae) (Herting 1972, Noyes and Hayat 1994), *Pseudococcus* spp. (Hemiptera: Pseudococcidae) (Noyes and Hayat 1994).

**Anicetus annulatus* Timberlake.—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes), BMNH; recorded as a parasitoid of various soft scale (Hemiptera: Coccidae) (Thompson 1954, Peck 1963, Herting 1972, Trjapitzin 1989, Noyes and Hayat 1994).

Aphycus sp.—[locality unknown], Alayo and Hernández (1978); parasitoid of Pseudococcidae and Coccidae (Hemiptera) (Thomson 1954, Herting 1972, Noyes and Hayat 1994).

**Apsilophrys* sp.—Santiago de Cuba (Jardín Botánico), BMNH; polyembryonic parasitoid of caterpillars of Gelechiidae (Lepidoptera) (Noyes 1980).

**Arhopoidiella* sp.—Santiago de Cuba (Gran Piedra), BMNH.

**Blepyrus insularis* (Cameron).—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes), BMNH; a parasitoid of *Ferrisia virgata* and some other mealybugs (Hemiptera: Pseudococcidae) (De Santis 1979, Noyes and Hayat 1994).

**Bothriocraera* sp.—La Habana (San José de las Lajas); ex *Pseudococcus longispinus* Maskell (det. M.A. Martinez), CENSA; parasitoid of various Pseudococcidae (Hemiptera) (Noyes 1980).

Carabunia myersi Waterston.—[locality unknown], Waterston (1928); a parasitoid of Cercopidae (Hemiptera) (Noyes 1980) and record from *Clastoptera flavidorsa* (De Santis 1979); *Clastoptera globosa* (De Santis 1989); *Clastoptera undulata* (Herting 1972, De Santis 1979); *Epicranion* sp. (De Santis 1979).

**Cerchysiella insularis* (Howard).—Santiago de Cuba (Gran Piedra) (det. J. S. Noyes) BMNH; parasitoid of *Carpophilus hemipterus* (Coleoptera: Nitidulidae) (Noyes and Hayat 1994), *Lobiopa insularis* (Coleoptera: Nitidulidae) (De Santis 1983).

**Cerchysiella scutellata* Howard.—Santiago

de Cuba (Gran Piedra, Jardín Botánico, Caney) (det. J. S. Noyes), BMNH; parasitoid of *Carpophilus hemipterus* (Coleoptera: Nitidulidae) (Noyes and Hayat 1994) and *Stelidota geminata* (Coleoptera: Nitidulidae) (LaSalle and Gordh 1985).

Cheiloneurus praenitens Waterston.—San José and Santiago de las Vegas, Ceballos and Hernández (1995); secondary parasitoid of *Coccus hesperidum* (Hemiptera: Coccidae) (Kochetova and Guryanova 1976).

Cheiloneurus pulvinariae Dozier.—[locality unknown], De Santis 1979; secondary parasitoid of various soft scales and margarodids (Hemiptera: Coccidae and Margarodidae) (Peck 1963, Herting 1972, De Santis 1979, Hall 1988).

**Chrysoplatycerus* sp.—Santiago de Cuba (Caney), BMNH; parasitoid of Pseudococcidae (Hemiptera) (Noyes 1980).

**Coccidencyrtus* sp.—Santiago de Cuba (Jardín Botánico), BMNH; parasitoid of Diaspididae (Hemiptera) (Noyes 1980).

Coccidoctonus dubius Girault.—[locality unknown], Trjapitzin and Sitdikov (1993); parasitoid of *Saissetia oleae* (Hemiptera: Coccidae) (Noyes and Hayat 1994).

Coccidoxenoides peregrinus (Timberlake).—[locality unknown], Hernández et al. (1993b), parasitoid of Pseudococcoidea (Hemiptera) (Noyes 1980).

Comperia merceti (Compere).—[locality unknown], De Santis (1979); parasitoid of *Blattella germanica* (Dictyoptera: Blattellidae) (De Santis 1979); *Periplaneta americana* (Dictyoptera: Blattidae) (Hagenbuch et al. 1988); *Supella longipalpa* (Dictyoptera: Blattellidae) (De Santis 1979); *Supella supellectilium* (Dictyoptera: Blattellidae) (Herting 1971).

**Copidosoma cubense* sp. nov. [description below].—Santiago de Cuba (Caney, Gran Piedra, Ires Arroyos); host unknown.

**Copidosoma floridanum* (Ashmead).—Santiago de Cuba (Caney, Ires Arroyo, Gran Piedra) (det. J. S. Noyes), BMNH; mainly polyembryonic parasitids of caterpillars of Plusiinae (Lepidoptera: Noctuidae) (Noyes 1988a, 1988b), (see also De Santis 1967, Herting 1976, Hayat 1986, Trjapitzin 1989, Noyes and Hayat 1994).

Copidosoma truncatellum (Dalman).—[locality unknown], De Santis (1979); a parasitoid of caterpillars of Amphipyrinae (Lepidoptera: Noctuidae) and Hepialidae (Lepidoptera), and probably erroneously recorded from caterpillars of Plusiinae (Lepidoptera: Noctuidae) (Noyes 1988b) (see also Thompson 1954, Peck 1963, Herting 1976, De Santis 1979, Noyes 1980, Trjapitzin 1989). The record from Cuba is probably a misidentification of *Copidosoma floridanum* (see Noyes 1988b).

**Copidosomopsis* sp.—Santiago de Cuba (Jardín Botánico, Gran Piedra); polyembryonic parasitoid of Pyralidae and Tortricidae (Lepidoptera) (Lepidoptera) (Noyes 1980).

Diversinervus elegans Silvestri.—[locality unknown], De Santis (1983); parasitoid of various Coccidae (Hemiptera) (Thompson 1954, Herting 1972, Trjapitzin 1989).

Encyrtus infelix Embleton.—[locality unknown], Thompson (1954); recorded as a parasitoid of soft scale (Hemiptera: Coccidae), most notably *Coccus hesperidum* and *Saissetia* spp. (Thompson 1954, Peck 1963, Prinsloo 1991, Blumberg and Goldenburg 1992).

Encyrtus kerzhneri Trjapitzin and Sitdikov.—La Habana, Caimito, Trjapitzin and Sitdikov (1993).

**Exoristobia* sp.—Santiago de Cuba (Jardín Botánico, Caney, Ires Arroyos), BMNH; parasitoid of Syrphidae and Tachinidae (Diptera) (Noyes 1980).

**Forcipestricis yrmae* sp. nov. [description below].—Santiago de Cuba (Jardín Botánico, Caney, Gran Piedra, Ires Arroyos); host unknown.

Gahaniella saissetiae Timberlake.—[locality unknown], Thompson (1954); secondary parasitoid of Coccidae and Pseudococ-

cidae (Hemiptera) via other Encyrtidae (Noyes 1980).

**Helegonatopus pseudophanes* Perkins.—Santiago de Cuba (Gran Piedra) (det. J. S. Noyes), BMNH; in general hyperparasitoid of Dryinidae (Hymenoptera) parasitizing Auchenorrhyncha (Hemiptera) (Noyes 1980).

Holcencyrtus gordhi (*Coelaspidia*) (Trjapitzin and Trjapitzin), **comb. nov.**—La Habana, Guanabo, Trjapitzin and Trjapitzin (1995).

Homalopoda cristata Howard.—[locality unknown], De Santis and Fidalgo (1994); parasitoid of *Aspidiotus secretus* (Hemiptera: Diaspididae) (Thompson 1954); *Ceroplastes giganteus* (Hemiptera: Coccidae) (Herting 1972, De Santis 1983).

Homalotylus terminalis Say.—[locality unknown], Peck (1963); a parasitoid of the larvae of Coccinellidae and Chrysomelidae (Coleoptera) (Thompson 1954, Peck 1963, De Santis 1979, Noyes 1980).

Isodromus iceryae Howard.—[locality unknown], De Santis (1979); parasitoid of larvae of Chrysopidae and Hemerobiidae (Neuroptera) (Peck 1963, Herting 1978 and Noyes 1980).

Ixodiphagus hookeri (Howard).—[locality unknown], (Peck 1963); a parasitoid of ticks (Acarina: Ixodidae) (Peck 1963, Herting 1971, De Santis 1979 and Trjapitzin 1989).

Leptomastidea abnormis (Girault).—[locality unknown], Hernández and Ceballos (1993); parasitoid of Pseudococcidae (Hemiptera) (Herting 1972, Noyes 1980 and Noyes and Hayat 1994).

Leptomastix dactylopii Howard.—[locality unknown], Hernández and Ceballos (1993); parasitoid of Pseudococcidae (Hemiptera) (Peck 1963, Herting 1972, Noyes 1980, Trjapitzin 1989 and Noyes and Hayat 1994).

**Lirencyrtus* sp.—Santiago de Cuba (Jardín Botánico), BMNH.

Metaphycus helvolus Compere.—[locality unknown], Trjapitzin (1989); parasitoid of Coccidae, Diaspididae, Lacciferidae, and Eriococcidae (Hemiptera) (Noyes 1980).

Metaphycus portoricensis (Dossier).—[locality unknown], De Santis (1979); parasitoid of *Asterolecanium pustulans* (Hemiptera: Asterolecaniidae) (De Santis 1979).

Metaphycus stanleyi Compere.—[locality unknown], Ceballos and Hernández (1992); parasitoid of Coccidae (Hemiptera) (Ceballos and Hernández 1992).

Microterys nietneri (Motschulsky).—[locality unknown], Ceballos and Hernández (1991); parasitoid of various Homoptera (Trjapitzin 1989, Noyes and Hayat 1994), parasitoid of *Coccus hesperidium* and *Ceroplastes floridensis* (Hemiptera: Coccidae) (Ceballos and Hernández 1991).

**Neococcidencyrtus crouzelae* De Santis.—Santiago de Cuba (Caney) (det. J. S. Noyes), BMNH; parasitoid of *Diaspis echinocacti* (Hemiptera: Diaspididae) (De Santis and Fidalgo 1994); *Hemiberlesia rapax* (Hemiptera: Diaspididae) (De Santis 1967).

**Ooencyrtus calpodicus* Noyes.—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes), BMNH; parasitoid of eggs of *Calpodes ethlius* (Lepidoptera: Hesperiidae) (Noyes and Hayat 1994).

**Ooencyrtus latiscapus* Gahan.—Santiago de Cuba (Gran Piedra) (det. J. S. Noyes), BMNH; parasitoid of eggs of *Hemiceras rava* (Lepidoptera: Notodontidae) (De Santis 1979).

Ooencyrtus submetallicus (Howard).—[locality unknown], De Santis (1979); parasitoid of eggs of various Heteroptera (Hemiptera) (De Santis 1979, De Santis 1983, De Santis and Fidalgo 1994).

**Ooencyrtus syrphidis* Noyes.—Santiago de Cuba (Gran Piedra, Ires Arroyo, Jardín Botánico, Caney) (det. J. S. Noyes), BMNH; parasitoid of larvae of *Salpingogaster nigra* (Diptera: Syrphidae) (De Santis and Fidalgo 1994).

**Parablatticida* sp.—Santiago de Cuba (Caney, Gran Piedra, Ires Arroyos), BMNH.

Plagiomerus cyaneus (Ashmead).—[locality

unknown], Bruner (1929); parasitoid of Diaspididae (Hemiptera) (De Santis 1979 and Noyes 1980).

**Prochiloneurus* sp.—Pinar del Rio, CENSA; secondary parasitoid of Pseudococcidae and Coccidae (Hemiptera) (Noyes 1998).

Pseudaphycus angustifrons Gahan.—[locality unknown], Gahan (1946); parasitoid of *Dysmicoccus brevipes* (Hemiptera: Pseudococcidae) (De Santis 1979).

**Pseudectroma* sp.—Santiago de Cuba (Ires Arroyos), BMNH; parasitoid of Pseudococcidae (Hemiptera) (Noyes 1980).

Pseudhomalopoda prima Girault.—[locality unknown], De Santis (1979); parasitoid of various Diaspididae (Hemiptera) (Thompson 1954, Peck 1963, Herting 1972, De Santis 1979 and Noyes and Hayat 1994).

Psyllaephagus trioziphagus (Howard).—Artemisa, Noyes and Hanson (1996); parasitoid of *Trioza diospyri* (Ashmead) and *Mastigmas ernsti* (Hemiptera: Triozidae) (Noyes and Hanson 1996).

Psyllaephagus yaseeni Noyes.—Soroa, Noyes (1990); parasitoid of *Heteropsylla cubana* (Hemiptera: Psyllidae) (Noyes and Hanson 1996).

**Rhytidothorax* sp.—Santiago de Cuba (Jardín Botánico, Caney, Gran Piedra, Ires Arroyos), BMNH.

**Syrphophagus aphidivorus* (Mayr).—Santiago de Cuba (Jardín Botánico) (det. J. S. Noyes); BMNH; secondary parasitoid of Aphididae (Hemiptera) (Thompson 1954, Peck 1963, Herting 1972, Hayat 1986 and Trjapitzin 1989).

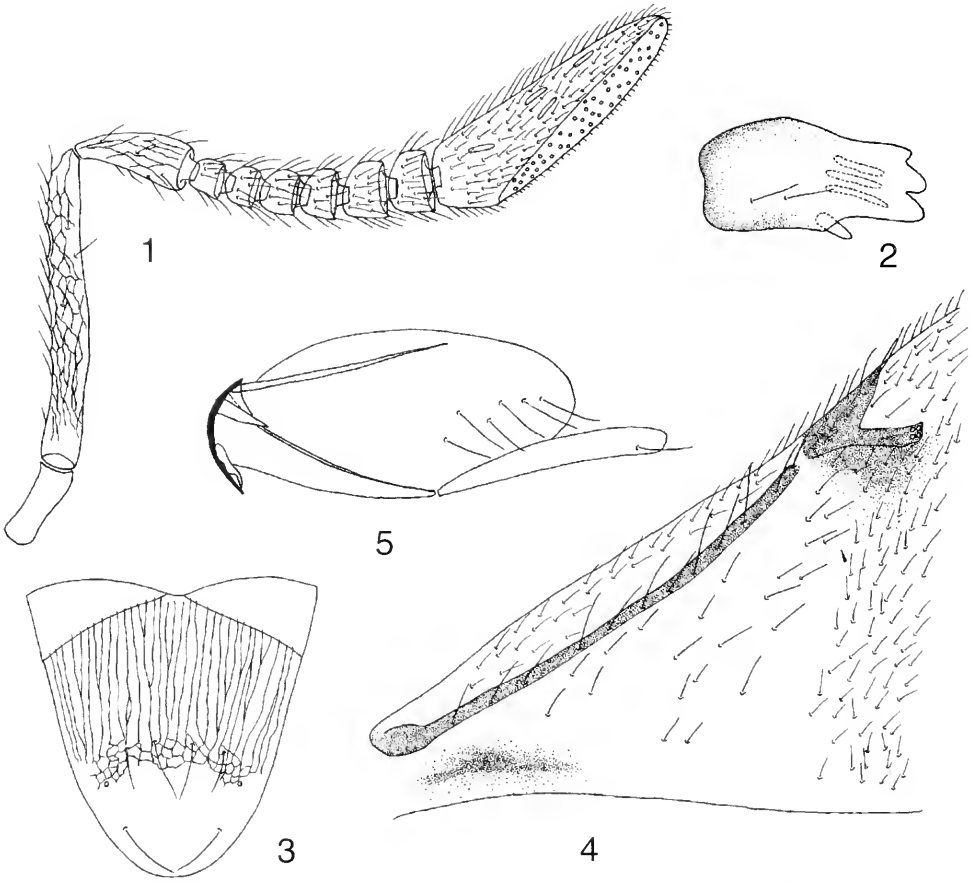
**Tachinaephagus* sp.—Santiago de Cuba (Jardín Botánico), BMNH; parasitoid of Diptera (Thompson 1954).

Trichomasthus portoricensis (Crawford).—[locality unknown], Thompson (1954); parasitoid of *Asterolecanium* (Hemiptera: Asterolecaniidae) (Noyes and Hayat 1994), *Ceroplastes cistuliformis*, *Saissetia oleae* (Hemiptera: Coccidae) (De Santis 1979), *Parasaissetia nigra* (Hemiptera: Coccidae) (De Santis and Fidalgo 1994).

DESCRIPTIONS OF NEW SPECIES

Copidosoma cubense López, sp. nov.
(Figs. 1–5)

Female (critical point dried holotype, on card).—Length 1.16 mm. Head black bright metallic purple, antenna brown with apical sensory area yellow, mesosoma black with mesoscutum bright metallic green, axillae, sides of mesosoma and base of scutellum concolorous with head, apex of scutellum metallic green, wings hyaline with venation brown and a small brown area on forewing below marginal vein, legs concolorous with base of gaster, except for hind legs yellow, with one quarter of femur and dorsum of tibia brown, apical tarsomere brown. Gaster orange, dorsum from cerci to apex and ventrally at apex dark brown. *Head:* More or less lenticular in lateral view, more than twice as long as deep, shiny with polygonally reticulate sculture with some inconspiscuous setae on frontovertex, compound eyes almost naked, nearly touching occipital margin, antennal scrobes shallow, torulus more than 2× as high as wide, antennal scape 6× as long as broad (Fig. 1), sparsely setose with more or less longitudinally striate sculpture, pedicel with similar sculpture as scape and about as long as funicular segments 1–3, is more than twice as long as broad, all funicle segments not longer than broad, clava entire, a little longer than funicle, apex of clava obliquely truncate, truncation considerably exceeds half length of clava, clava about 1.2× as long as truncation. Mandible tridentate (Fig. 2). Relative measurements: head width 40, head length 38, minimum frontovertex width 18, POL (post ocellar line) 12, OOL (ocellar-ocular line) 2, OCL (ocellar-occipital line) 0, OD (ocellar diameter) 3, eye length 22, eye width 19, malar space 16, scape length 24, maximum scape width 4. *Mesosoma:* Mesoscutum shiny, with polygonally reticulate sculpture like that of head but of larger mesh size and with longer setae. Scu-



Figs. 1–5. *Copidosoma cubense* sp. nov. ♀. 1, Antenna. 2, Mandible. 3, Scutellum. 4, Base of forewing. 5, Ovipositor.

tellum convex with longitudinally striate sculpture, its apex shiny and almost smooth but with very shallow polygonally reticulate sculpture (Fig. 3). Forewing 2.3× as long as broad (Fig. 4), linea calva not interrupted, postmarginal vein shorter than marginal, stigmal vein longer than postmarginal. Propodeum without sculpture. Relative measurements: forewing length 99, forewing width 42, hind wing length 66, hind wing width 18. *Gaster:* Shiny with apex setose, hypopygium reaching about ¾ along gaster, ovipositor not exserted (Fig. 5). Relative measurements: midtibia length 99, ovipositor length 70, gonostylus length 30.

Male.—Unknown.

Variation.—Length 1.0–1.21 mm. Specimens vary in the extent of the dark color at the apex of the gaster and also in the extent of the brown area on the hind tibia.

Material examined.—HOLOTYPE ♀: CUBA: Santiago, Gran Piedra, 1100 m, Isabelica, Mateo Station, 4–17.xii.1996, L. Masner. PARATYPES: 6 ♀, same data as holotype. Holotype in CNC, paratypes in BMNH, CENSA.

Comments.—*Copidosoma* is a very large cosmopolitan genus, containing more than 150 described species. *Copidosoma cubense* can be separated from the other species by the combination of the color of the gaster and sculpture of scutellum. In *cubense* the gaster is mainly orange and the sculpture of the scutellum is longitudinally striate. This combination does not occur in any of

the described species. Only very few species of *Copidosoma* have longitudinally striate sculpture on the scutellum and in all these the gaster is entirely dark and metallic, e.g. *varicornis* and related species (*Paralitomastix* s. l.).

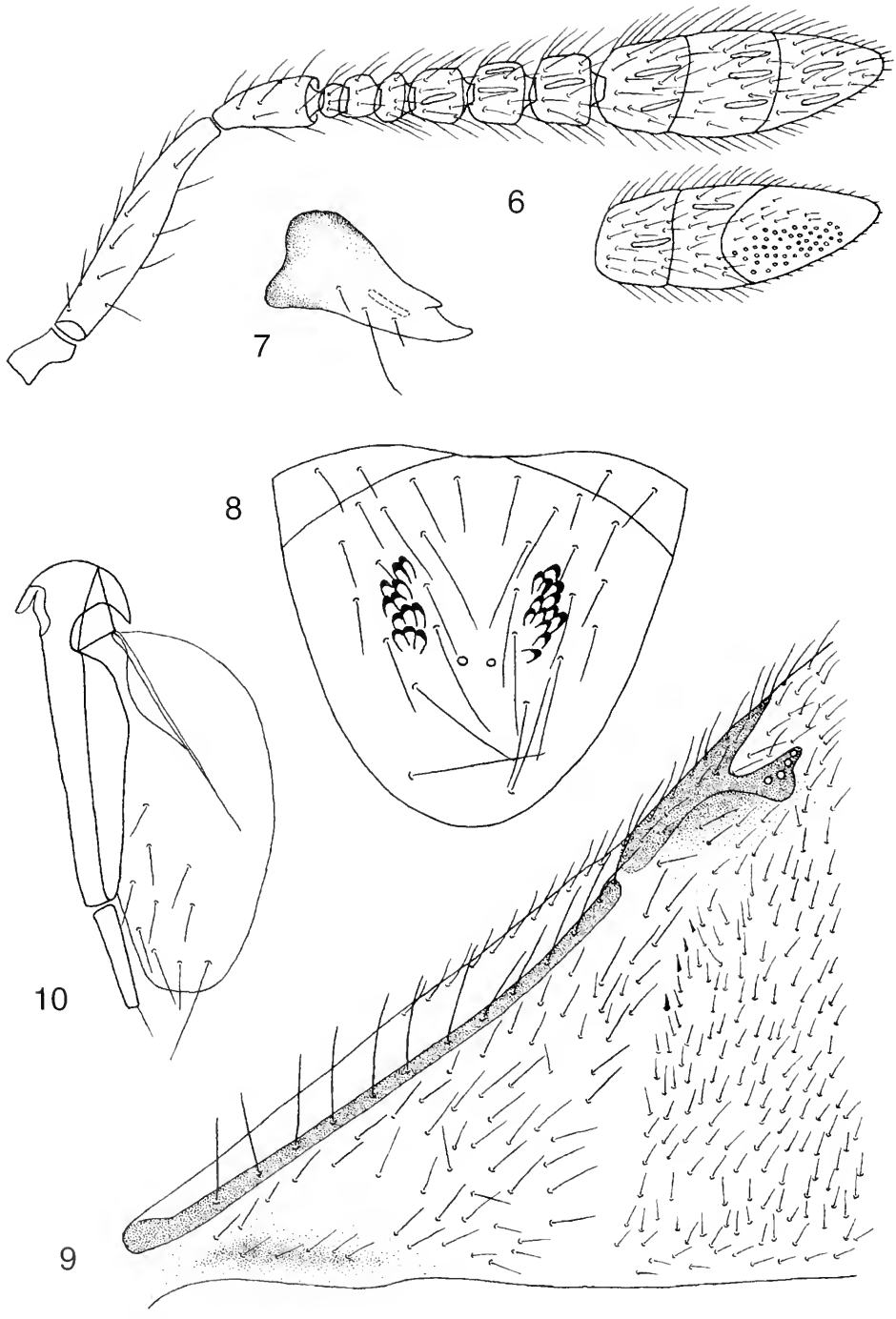
***Forcipestricis yrmae* López, sp. nov.**
(Figs. 6–13)

Female (critical point dried holotype on card).—Length 1.05 mm. Head dark brown, antenna with scape pale orange, funicle and clava brown, mesosoma dark brown, wings hyaline, with small brown area below marginal vein of forewing, venation of forewing brown, legs of same color as scape, metatibia with some brown area at apex, gaster dark orange with apex brown in dorsal view, in ventral view pale orange with base nearly yellow. *Head:* Subtriangular in lateral view, about 3.1× as broad as frontovertex which is smooth and shiny, without sculpture, setae on frontovertex dark brown, compound eyes setose, setae pale, ocelli forming an acute triangle. Scrobes well-defined and U-shaped. Torulus two times as high as wide. Posterior ocellus nearly touching compound eye. Antenna (Fig. 6) with scape 3.5× as long as broad, sparsely setose and about the same length as funicle, funicular segments wider than long, clava the same length as F2–F6, apex of clava obliquely truncate, truncation a little more than half length of clava, F1 almost anelliform, F2–6 gradually increasing in size, F6 2× as wide as F2. Mandible bidentate with two acute teeth (Fig. 7). Relative measurements: head width 37, head length 35, minimum frontovertex width 11, POL (post ocellar line) 5, OOL (ocellar-ocular line) 1, OCL (ocellar-occipital line) 2, OD (ocellar diameter) 3, eye length 23, eye width 19, malar space 14, scape length 15, maximum scape width 4. *Mesosoma:* Scutellum (Fig. 8) nearly completely smooth and shiny but with some shallow sculpture between pits, which form two small parallel submedian bands, two very long setae, each inserted at end of each group of pits and two more long setae inserted at apex of scutellum. Forewing (Fig. 9) about 2.3× as long as broad, marginal vein longer than broad, postmarginal vein shorter than marginal, and stigmal vein a little shorter than postmarginal; linea calva narrow and not interrupted. Propodeum very short and smooth without median sculpture. Relative measurements: forewing length 92, forewing width 42, hind wing length 60, hind wing width 17. *Gaster:* Mostly smooth and shiny with apex setose, ovipositor (Fig. 10) not exserted. Relative measurements: (slide-mounted paratype): midtibia length 74, ovipositor length 55, gonostylus length 30.

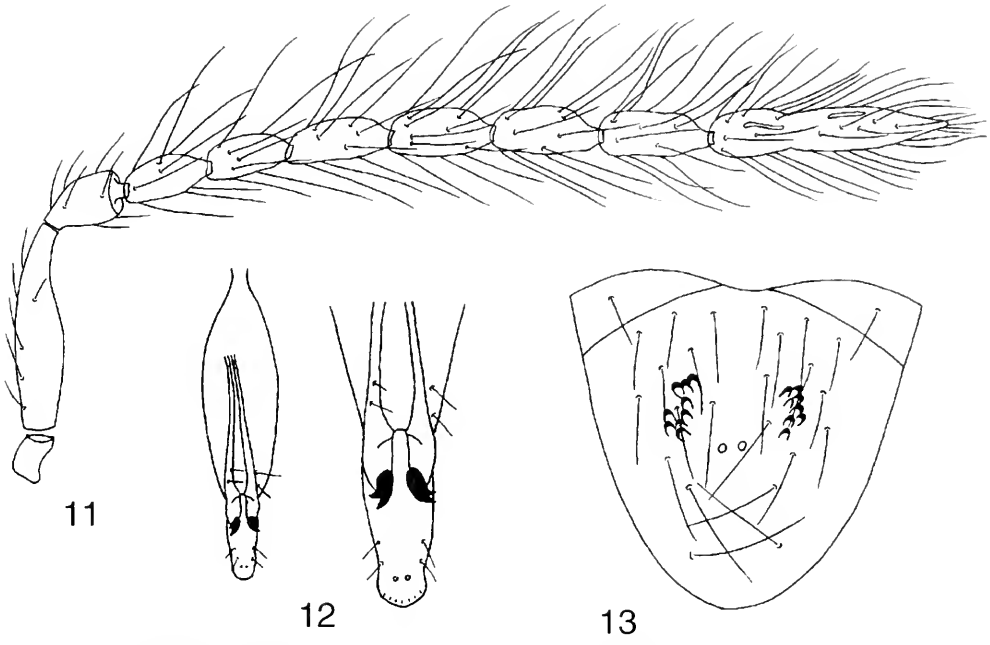
Male (card mounted paratype).—Length 0.84–0.97 mm. Similar to female except for structure of antenna (Fig. 11), color of gaster, and genitalia (Fig. 12). Mandible and scutellum (Fig. 13) similar. Gaster brown in dorsal view and dark orange in ventral view. Relative measurements (card mounted paratype): head width 34, head length 30, minimum frontovertex width 14, POL (post ocellar line) 5, OOL (ocellar-ocullar line) 2, OCL (ocellar-occipital line) 2, OD (ocellar diameter) 3, eye length 19, eye width 16, malar space 11, scape length 14, maximum scape width 4, forewing length 96, forewing width 36, hind wing length 63, hind wing width 15; (slide-mounted paratype): midtibia length 110, aedeagus length 41.

Variation.—There is slight variation except for the length of the female which varies from 0.85–1.11 mm and the gaster of the female is sometimes darker than described for the holotype.

Material examined.—HOLOTYPE ♀: CUBA: Santiago, Gran Piedra Isabelica, 7–17.xii. 1995, elfin forest, S. Peck. PARATYPES: CUBA, 1 ♂, same data as holotype; 6 ♀, Santiago, Gran Piedra Isabelica, xii.1995, 1100m elfin Forest, S. Peck; 10 ♀, 2 ♂, Santiago, Gran Piedra, Met. Radar, 8–17.xii.1995, Elfin Forest, S. Peck; 4 ♀, Santiago, Gran Piedra, 1100m, Isabelica Meteo



Figs. 6–10. *Forcipestricis yrmae* sp. nov. ♀. 6, Antenna. 7, Mandible. 8, Scutellum. 9, Base of forewing. 10, Ovipositor.



Figs. 11–13. *Forcipestricis yrmae* sp. nov. ♂. 11, Antenna. 12, Genitalia. 13, Scutellum.

Station, xii.1996, L. Masner; 15 ♀, Santiago, Gran Piedra Isabelica, Meteo Station, 4–17.xii.1996, 1100m, L. Masner; 1 ♀, Santiago, 16 Km NE Caney, 145m, 13.xii.1995, L. Masner; 1 ♀, Santiago, 5 Km NE, Siboney, Ires Arroyo, 150 m, creekbed, 18.xii.1995, L. Masner. Holotype in CNC, paratypes in CNC, BMNH, CENSA.

Comments.—*Forcipestricis* is a very large genus of mainly Neotropical distribution and probably contains more than 150 species (Noyes, pers. comm.), although to date only three species have been formally described, i.e. *F. gazeaui* Burks, *F. portoricencis* Gordh and *F. sordidus* (Howard).

Forcipestricis yrmae can be separated from these species by the color of the gaster, sculpture of the scutellum, distribution of the pits, and shape of the mandibles. In *yrmae* the gaster is largely orange, the scutellum is smooth with the pits placed in two distinct submedian groups, and the mandibles are bidentate. In all the named species the gaster is uniformly brown. *Forcipestricis portoricencis* and *sordidus* have the pits scattered, *gazeaui* has the scutellum strongly sculptured, and both *gazeaui* and *portoricencis* have tridentate mandibles.

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The Bee Genus *Doeringiella* Holmberg (Hymenoptera: Apidae): A Revision of the Subgenus *Pseudepeolus* Holmberg

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Abstract.—A revision of the subgenus of the epeoline cleptoparasitic bees *Pseudepeolus* Holmberg is presented. These bees occur in mesophytic areas of South America. Five species are recognized, two of which are described as new: ***Doeringiella (Pseudepeolus) carinata* sp. n.** and ***D. (P.) willinki* sp. n.** A neotype is designated for ***Pseudepeolus fasciatus* Holmberg,** type species of the subgenus. ***Doeringiella (Pseudepeolus) albifrons* (Smith) n. comb** is transferred from *Epeolus*. A phylogenetic analysis, key to the species, descriptions and illustrations are provided.

The genus *Doeringiella* Holmberg comprises a group of cleptoparasitic bees of the tribe Epeolini, subfamily Nomadinae. Its subgenus *Pseudepeolus* Holmberg is strictly South American, with species distributed in northern Argentina, Paraguay, eastern Perú, and Brazil. This subgenus is only found in mesophytic areas, contrary to the subgenera *Doeringiella s. str.* and *Triepeolus* Robertson, which, although having species that occur in mesophytic areas, have their maximal diversity in xerophytic areas of South and North America respectively. Nothing is known about the biology of *Pseudepeolus*.

Holmberg (1886) based his monotypic genus *Pseudepeolus*, and the type species *P. fasciatus* Holmberg, on a single male specimen that is no longer preserved. Since its description, the genus went unrecognized by other authors until recently (Roig-Alsina 1989). Roig Alsina (1989) suggested its close relationship to *Doeringiella*, and included in it a second species, *Doeringiella angustata* Moure. Michener (2000) included *Pseudepeolus* together with *Triepeolus* as subgenera of *Doeringiella*, a classification that is followed here, since it emphasises the close relationship and similarity of these three groups.

Each of the three subgenera of *Doeringiella* is characterized by a distinctive antennal scape. In *Doeringiella s. str.* the scape of both sexes has a sub-basal angle on the plical surface, except in some males which have spectacularly swollen scapes. In species of *Triepeolus* the scape is broadened apically, and the short barrel-shaped pedicel is frequently hidden within its apex. In *Pseudepeolus* the males have the scape flattened on the condylar surface, which is more or less concave, the plical surface being very narrow, a condition unique among bees.

Holmberg (1886) characterized *Pseudepeolus* as having only two submarginal cells, but both in the key to genera and in the generic description he mentioned the presence of a rudiment of the cross-vein 1r-m. As a matter of fact most examined specimens of *P. fasciatus* have three submarginal cells, a condition that is characteristic of the subgenus as a whole.

Moure (1954) recognized the group as distinctive, and named it as *Doeringiella* (*Stenothisa*). The only species that he studied, *D. angustata*, is fairly derived within the group. Several characters that he thought were diagnostic at the subgeneric

level, like the anteriorly narrowed second submarginal cell, the paraocular carina separating above from the eye margin, and the rudimentary apical fimbriae of hairs on the male sterna, represent derived conditions within *Pseudepeolus*.

In this contribution five species are recognized, two of which are described as new.

MATERIAL AND METHODS

Material studied, including types, was obtained from several collections. I am indebted to the following: American Museum of Natural History, New York, J. G. Rozen, Jr. (AMNH); Fundación e Instituto Miguel Lillo, Tucumán, M. V. Colomo (FIML); Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN); Museo de La Plata, La Plata, J. Schnack and A. Abrahamovich (MLP); National Museum of Natural History, Washington, R. J. McGinley (USNM); Natural History Museum, London, C. R. Vardy and C. Taylor (London); Universidade de São Paulo, Ribeirão Preto, J. M. F. Camargo (USP-RP); Universidade Federal do Paraná, Curitiba, J. S. Moure (UFPR). The acronyms are used below to indicate depositories of specimens.

Terminology for structures and pubescence patches follows Roig-Alsina (1989). For the description of the scape, the terms *condylar* surface and *plical* surface are used. Since the antenna rotates when it is extended forwards, it is inappropriate to speak about dorsal and ventral or anterior and posterior sides. The plical surface corresponds to the plane towards which the flagellum is flexed, and the condylar surface corresponds to that where the monocondylic articulation between scape and pedicel is located. In the descriptions the metasomal terga (T) and sterna (S) are identified with Arabic numerals.

The genital capsule and sterna seven and eight of males are similar among species. These structures are illustrated only for the type species (Figs. 8–10).

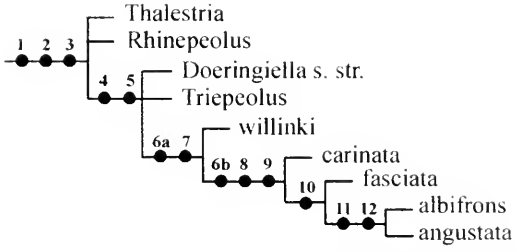
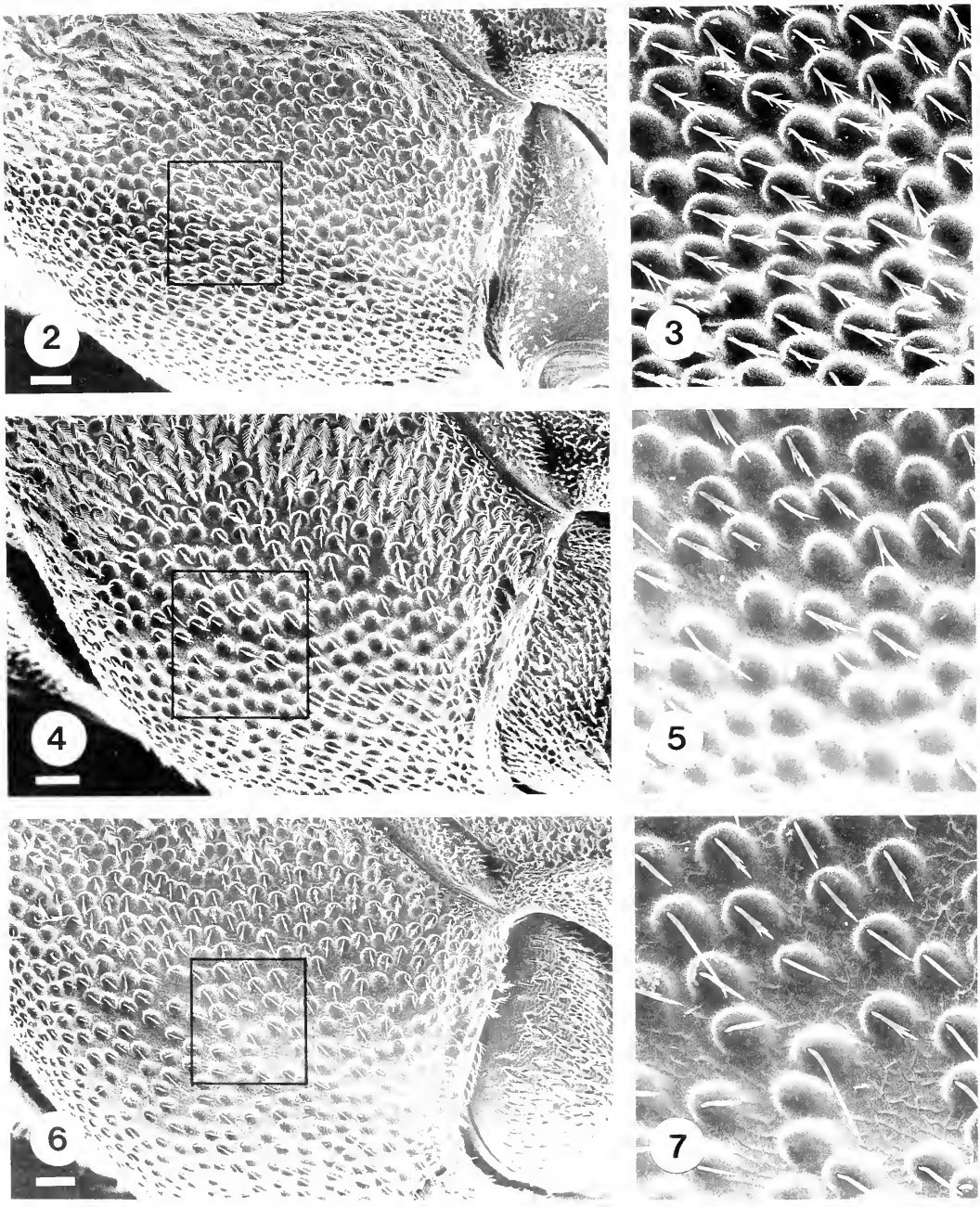


Fig. 1. Relationships of species of *Doeringiella* (*Pseudepeolus*) spp., and outgroups considered. Characters are numbered as in the text.

PHYLOGENETIC RELATIONSHIPS

Relationships among species of the subgenus *Pseudepeolus* are depicted in Fig. 1. The numbers in the figure correspond to numbers in parentheses following each character discussed in the text. The tree has been constructed by hand.

Outgroups.—The relative apomorphy of the states of each character is evaluated, comparing their condition to that in species of the subgenus *Doeringiella*, in species of the subgenus *Triepeolus*, and in the monotypic genera *Thalestria* Smith and *Rhinepeolus* Moure. The three genera, *Doeringiella*, *Thalestria*, and *Rhinepeolus*, form a well defined monophyletic group within the Epeolini, supported by the peculiar structure of the female sixth sternum and characteristics of the male genitalia. In the three genera the female sixth sternum has elongate lateral arms and the disc is membranous, except for a basal transverse bar (1). *Thalestria* shows a further autapomorphic stage of this character, since all that remains of the disc is a heavily sclerotized basal bar with no membranous part. In other epeolines the disc of the sternum is recognizable. The genital capsule of the males in the three genera has the gonocoxite with a large ventral lobe (2) (Fig. 8, vl). Such a lobe is moderate in other epeolines (i.e., *Epeolus* Latreille, *Rhogepeolus* Moure, and *Odyner-*



Figs. 2–7. *Doeringiella* (*Pseudepeolus*) spp. Lower part of mesopleuron (left) and detail of punctation (right). 2–3, *D. fasciata*. 4–5, *D. carinata*. 6–7, *D. angustata*. Scale = 100 μm.

opsis Schrottky), and small or absent in other nomadines. The three genera also share an elongate gonostylus, not curved at the base and without a dorsal protuberance (3), as is the case in other epeolines.

The monophyly of *Doeringiella* in the broad sense, is supported by characters of

the male genitalia. The ventral mesial margin of the gonocoxite has a conspicuous emargination (4) (Fig. 8, e) basal to the lobe mentioned above as character 2. In other epeolines the ventral mesial margin of the gonocoxite is straight. The dorsal connecting bridge of the penis valves in species of *Doeringiella* is reduced to a long bar (Fig. 8, b) between the widely separated bases of the penis valves (5). The dorsal bridge forms a plesiomorphic spatha in species of *Odyneropsis* and *Rhogepeolus*. In *Epeolus*, *Rhinepeolus*, and *Thalestria* the bridge is more or less reduced to a bar, but it is not elongate; the separation between the penis valves is equivalent to that in the genera having a spatha.

Relationships among species.—The monophyly of *Pseudepeolus* is supported by the flattened scape of the males (6); I have distinguished two stages of compression of the scape, as explained below. The monophyly of the subgenus is also supported by the shape of the genal area: the preoccipital carina (as seen in lateral view) separates dorsally from the eye margin (7), while in *Doeringiella s. str.* and *Triepeolus* the preoccipital carina approaches the top of the eye dorsally. In *Thalestria* and *Rhinepeolus* the lateral part of the preoccipital carina is more or less parallel to the eye margin.

The scape is flattened only on the proximal half of the condylar surface (6a) in one species of *Pseudepeolus* (Fig. 11); this is taken to be the basal condition of the character for the subgenus. In the remaining species the entire condylar surface is flattened (6b) (Figs. 12–13). In the latter case the upper rim of the scape is carinate near the point of articulation of the pedicel (8). These flattened scapes are unique among bees.

Males of most Epeolini have on the third to fifth sternum apical fringes of long, curved hairs. These fringes are well developed on S3–5 in *Rhinepeolus*, only on S5 in *Thalestria*, on S3–5 or S4–5 in *Triepeolus*, and on S3–5 or S3–4 in *Doeringiella s. str.* In most *Pseudepeolus* the fringes are rudimentary, the hairs being straight and barely surpassing the apex of the sterna (9). Michener (2000) indicated this feature as an apomorphy of *Pseudepeolus*, but the species *D. willinki* has well developed fringes on S3–4. Another feature indicated as apomorphic for the subgenus (Michener 2000) is the interrupted carina that borders the basitibial plate (10). Such a carina is complete in *D.* (*P.*) *willinki* and *D.* (*P.*) *carinata*.

Doeringiella albifrons and *D. angustata* are grouped by the shape of the paraocular carina, which separates from the eye margin above the level of the antennal socket and then approaches again and ends near the upper fifth of the eye, enclosing a bare area (11). This feature is not seen in the outgroups, which have the carina more or less parallel to the eye margin, as is the case in *D. willinki* and *D. carinata*. In *D. fasciata* the paraocular carina is intermediate, ending somewhat separated from the eye margin; this condition has been coded as plesiomorphic, but can be seen as transitional to the stage found in *albifrons* and *angustata*. These two species also share a marked reduction of the squamiform, appressed pubescence characteristic of most epeolines, the notaular spots and the transverse mesepisternal band being nearly absent (12).

KEY TO SPECIES OF SUBGENUS *PSEUDEPEOLUS* HOLMBERG

1 T2–3 with yellowish apical hair bands reaching posterior margins of terga (Fig. 17). Mesopleuron with dense, coalescent punctation over its entire surface (Figs. 2–3) ..... ***D. (Pseudepeolus) fasciata***

– T2–3 with yellowish or whitish apical hair bands separated medially from posterior margins

of terga (Figs. 14–16). Mesopleuron with punctation irregular; punctures on middle part of mesepisternum separated by interspaces 0.5× their diameter, or more (Figs. 4–7) ... 2

2 T1 extensively whitish pubescent, except dark pubescent on base, apical margin and transverse median oval on disc of tergum (Figs. 15–16). Middle part of mesepisternum with spaces between punctures shiny (Figs. 4–5) ... 3
– T1 at most with preapical band of pale hairs (Fig. 14). Middle part of mesepisternum with spaces between punctures tessellate (Figs. 6–7) ... 4

3 Paraocular area of female above level of antennal sockets with erect, long hairs, as long as or longer than antennal pedicel, which stand out among appressed, squamiform hairs. Scape of male with entire condylar surface flattened (Fig. 13) ... ***D. (Pseudepeolus) carinata***
– Paraocular area of female above level of antennal sockets without erect, long hairs; at most with a few erect hairs on the uppermost part, shorter than half antennal pedicel length. Scape of male with condylar surface flattened only on proximal half (Fig. 11) ... ***D. (Pseudepeolus) willinki***

4 T1 with preapical band of whitish hairs (Fig. 14); T4 with scattered whitish hairs, not forming conspicuous preapical band. Second submarginal cell narrowed anteriorly: anterior margin 0.5× as long as vein r, to distinctly petiolate ... ***D. (Pseudepeolus) angustata***
– T1 with lateral spot of whitish hairs, without preapical band; T4 with preapical band of pale hairs. Second submarginal cell with anterior margin 0.8–0.9× as long as vein r ... ***D. (Pseudepeolus) albifrons***

Doeringiella (Pseudepeolus) fasciata (Holmberg)

(Figs. 2–3, 8–10, 12, 17)

Pseudepeolus fasciatus Holmberg 1886: 285–286 (Holotype ♂, Formosa, IV-1885, destroyed). Neotype ♂, Argentina, Formosa, Riacho Pilagá, Ruta 11, 26 Km N Formosa, 11–12-VIII-1977, C. Porter, L. Stange, P. Fidalgo (MACN, present designation). Dalla Torre 1896: 333. Schrottky 1903: 183. Schrottky 1913: 264.

Doeringiella (Pseudepeolus) fasciata: Michener 2000: 630.

This species is easily distinguished by the pale metasomal hair bands reaching the apical margins of the terga (Fig. 17). These bands are present on T1–4 in the female and on T1–6 in the male. The pale hair bands, when present, are preapical in the other species of *Pseudepeolus*. *Doeringiella fasciata* is also characterized by the dense, close punctation of the integument (Figs. 2–3).

Based on Holmberg's (1886) detailed description it is possible to recognize this species with certainty, in spite of the loss of the type specimen. Nevertheless, with the purpose of fixing the meaning of the genus-level name *Pseudepeolus* Holmberg, I here designate a neotype specimen from the same geographical area of the lost type.

I have examined nearly fifty specimens of *D. fasciata* from several localities (Fig. 18), and most specimens have three submarginal cells. The few that present two submarginal cells, sometimes only on one wing, always have a rudiment of the crossvein 1r-m.

Male neotype.—Length 7.5 mm; length of forewing 7.0 mm. Punctures on scutum and scutellum (diameter 0.020–0.030 mm) coalescent; punctures on mesopleuron (diameter 0.025–0.035 mm) coalescent over its entire surface. Proportion of lower to upper interocular distance, 0.77:1. Proportion of interantennal to antennocular distance, 1.9:1. Elevation between antennal sockets bearing sharp, elevated frontal carina, which reaches anterior ocellus. Paraocular carina ending somewhat separated from eye margin near upper fifth of eye. Proportion of postocellar to ocellocu-

lar distance, 0.8:1. Proportion of scape, pedicel and first three flagellomeres, 2.75: 0.8:1:1.5:1.2. Scape strongly flattened (Fig. 12), with transverse median section triangulliform, without erect, long hairs; upper rim of condylar surface carinate. Labrum 1.7× as broad as long, with two median tubercles and three apical denticles, lateral ones somewhat carinate. Scutellum bigibbous, with longitudinal median impression; axilla short, base of axilla as long as outer margin. Second submarginal cell with anterior margin 0.33 (right)–0.2 (left)× as long as vein r. Apical fringes on S3–4 with straight hairs surpassing posterior margins of sterna, similar to that on S5. Pygidial plate with apical two thirds parallel-sided, apex rounded.

Distribution.—Argentina: Provinces of Formosa and Misiones. Brazil: States of Mato Grosso, Minas Gerais and São Paulo.

Material studied.—ARGENTINA. *Formosa*: ♂ Neotype, Riacho Pilagá, Ruta 11, 26 Km N Formosa, 11–12-VIII-1977, C. Porter, L. Stange, P. Fidalgo (MACN); 2 ♀ and 2 ♂, Riacho Pilagá, Ruta 11, 26 Km NO Formosa, 11-VIII-1977, C. Porter, L. Stange, P. Fidalgo (FIML). *Misiones*: 1 ♀ and 1 ♂, Monte Carlo, 12-VIII-1974, C. Porter, L. Stange (AMNH); 1 ♂, Loreto, 17-III-1949, A. Ogloblin (MLP). BRAZIL. *Mato Grosso*: 1 ♀ and 2 ♂, Itaum, Dourados, III-1974, M. Alvarenga (AMNH); 1 ♂, Rio Caraguatá, III-1953, F. Plaumann (MLP). *Minas Gerais*: 5 ♀ and 11 ♂, Araxá, III-1965 and IV-1965, C. & T. Elias (UFPR); 2 ♀ and 4 ♂, Passos, IV-1961, 1–7-IV-1962, 10–14-IV-1962 and IV-1963, C. Elias (UFPR); 5 ♂, Ibiá, 11–18-III-1965, C. Elias (UFPR); 1 ♀, Santa Rita de Cássia, V-1961, C. Elias (UFPR); 1 ♀ and 2 ♂, Sacramento, 26-III-1965, C. & T. Elias (UFPR). *São Paulo*: 1 ♀, Ribeirão Preto, 29-V-1972, P.S. Morais (USP-RP); 1 ♂, Cajurú, 6-IV-1985, Mazucato-Camargo (USP-RP).

Doeringiella (Pseudepeolus) albifrons (Smith), n. comb.

Epeolus albifrons Smith 1879: 104. Type ♀, Pará, Brazil (London, examined). Dalla Torre 1896: 327 (erroneously cited from "Paraná"). Schrottky 1903: 183 (idem). Schrottky 1913: 264 (erroneously cited from "Entre Ríos"). Ducke 1910: 103.

This species is distinguished by the reduction of the squamiform pubescence of the body. The metasomal bands of pale pubescence are very narrow on T2–3, and that on T1 is reduced to a small lateral spot; on T4 there is no defined band. The notaular spot and the transverse mesepisternal band, usually conspicuous in species of *Doeringiella*, are obsolescent. The punctation in *D. albifrons* is sparser than in the other species, see comments under *D. angustata*.

Female type.—Pattern of pale pubescence on metasoma as follows: T1 with lateral spot of yellowish hairs, no preapical band, T2–4 with narrow preapical band of yellowish hairs, T1–5 laterally with scattered whitish squamiform hairs. Punctures on hypoepimeral area separated by 0.2–0.5× their diameter, interspaces tessellate, below this area with band of dense punctures, and below this band punctures separated by tessellate interspaces, which in front of the middle coxa are 2 to 3× a puncture diameter. Punctures around ocelli small, dense, strongly contrasting with those of mesopleuron; narrow interspaces shiny. Proportion of lower to upper interocular distance, 0.78:1. Proportion of interantennal to antennocular distance, 1.75:1. Proportion of postocellar to ocellocular distance, 0.8:1. Paraocular carina separating from eye margin above level of antennal socket, then approaching again and ending near upper fifth of eye, enclosing bare area. Proportion of scape, pedicel and first three flagellomeres, 2.1: 0.5:1:1.3:1.1. Labrum twice as broad as long, with two median tubercles and three apical denticles, lateral ones somewhat carinate, median one obsolescent. Scutellum bigibbous, with longitudinal median impression; axilla short, base of axilla as long as its outer margin. Basitibial plate

poorly defined, bordering carina interrupted apically. Second submarginal cell with anterior margin 0.8× as long as vein r. S5 with apex not bent down.

Distribution.—Perú: Department of Loreto. Brazil: State of Pará.

Material studied.—BRAZIL. *Pará*: 1 ♀ type (London). PERÚ. *Loreto*: 1 ♀, Pucallpa, 22-XII-1950, J.M. Schuncke (London).

Doeringiella (Pseudepeolus) angustata Moure
(Figs. 6–7, 14)

Doeringiella (*Stenothisa*) *angustata* Moure 1954: 278–280, Fig. f. Syntypes 1 ♀ and 4 ♂, Curitiba, Paraná, Brasil (UFPR, examined).

Pseudepeolus angustatus: Roig Alsina 1989: 578. Roig Alsina 1991: 37.

Doeringiella (*Pseudepeolus*) *angustata:* Michener 2000: 630.

I consider tentatively this species as different from *D. albifrons*, until the study of more specimens allows a better interpretation of the variation of characters like wing venation, pubescence pattern, and sculpture of the integument. *Doeringiella albifrons* and *D. angustata* are morphologically similar. They share apomorphies such as the apically interrupted basitibial plate of the female, the paraocular carina conspicuously separated from the eye margin above the level of the antennal sockets, and the reduction of the pale pubescence. *Doeringiella angustata* is distinguished from *D. albifrons* by the presence of a pale preapical band of hairs on T1 (Fig. 14), as well as on T4, and by the denser punctation. In both species the punctation on the middle and lower parts of the mesopleuron is irregular, leaving tessellate interspaces (Figs. 6–7), but in *D. angustata* the punctures in front of the middle coxa are separated at most by 1–1.5× a puncture diameter, while in *D. albifrons* the interspaces can be 2 to 3× a puncture diameter. The interspaces on the frons and the scutum are dull and tessellate in *D. angustata*, but shinier and scarcely tessellate in *D. albifrons*.

Moure (1954) gives a detailed description of this species. The narrowing of the anterior margin of the second submarginal cell varies among individuals, as well as between the left and right forewing of some individuals; it varies from half as long as vein r to distinctly petiolate.

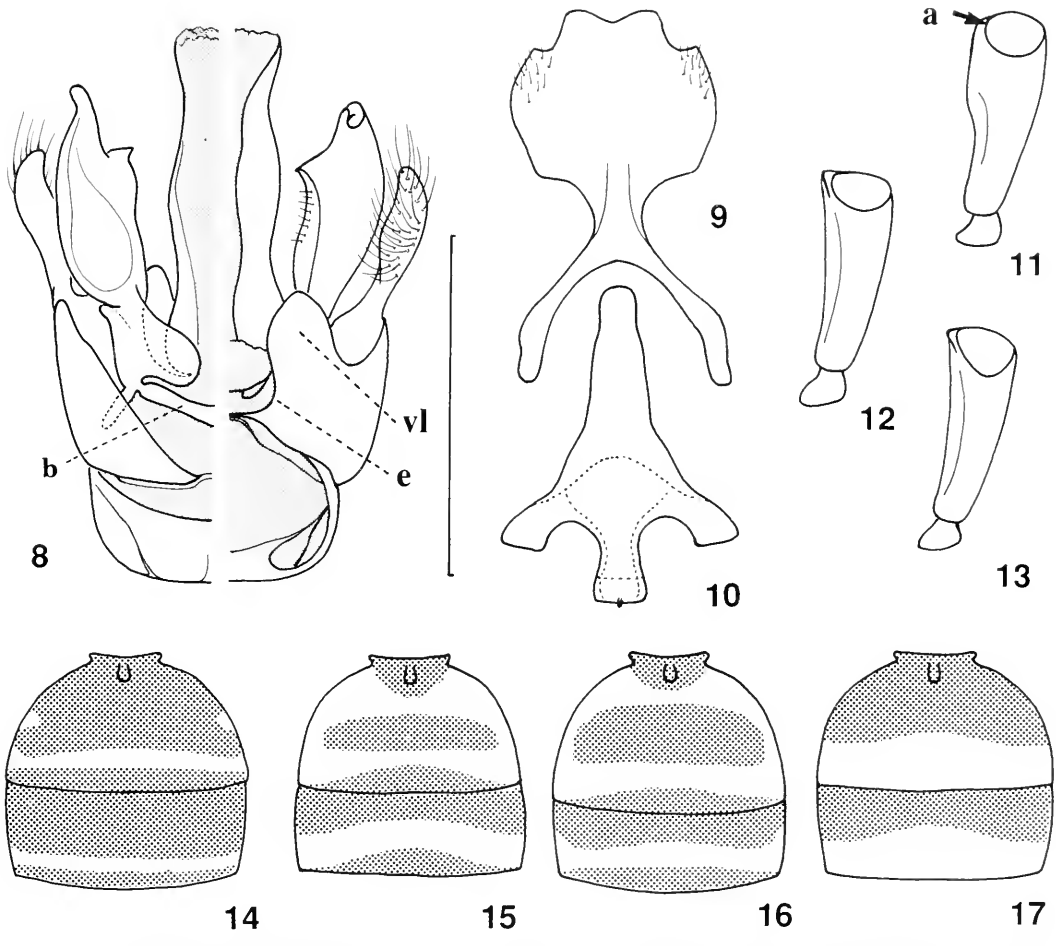
Distribution.—Brazil: States of Paraná, Santa Catarina and São Paulo.

Material studied.—BRAZIL. *Paraná*: type series, Curitiba, XI-1951, III-1953, XII-1953, I-1954, J.S. Moure (UFPR); 1 ♀, Alto Amparo, 2-IV-1967, P.D. Hurd (USNM). *Santa Catarina*: 1 ♀, Nova Teutonia, II-1952, F. Plaumann (MACN). *São Paulo*: 1 ♀, Itapeva, IV-1957, K. Lenko (UFPR).

Doeringiella (Pseudepeolus) carinata Roig-Alsina, sp. n.
(Figs. 4–5, 13, 16)

Diagnosis.—This species is distinguished by the transverse oval of dark pubescence surrounded by pale pubescence on T1 (Fig. 16), by the basitibial plate of the female with a complete apical margin, and by the shiny interspaces between punctures on scutum and mesopleuron. This species resembles *D. willinki* in the punctation and the vestiture pattern, but the transverse dark oval on T1 is smaller in *D. willinki* (Fig. 15). The male is easily distinguished from *D. willinki* by the scape with the entire condylar surface flattened, and the poorly developed apical fringes on S3–4, which have straight hairs; the female is distinguished by the strong frontal carina, the elevation between the antennal sockets having distinctly concave sides, and by the pubescence on the face, as mentioned in the key.

Male holotype.—Length 8.3 mm (paratypes, 7.5–9.0 mm); length of forewing 7.0 mm (paratypes, 6.6–7.3 mm). *Coloration.* Body black; except: scape, pedicel, first flagellomere and base of second, pronotal lobe, tegula and posterolateral angle of scutum pale reddish brown; condylar surface of antenna beyond base of second flagellomere brown; legs reddish brown be-



Figs. 8–17. *Doeringiella* (*Pseudepeolus*) spp. 8–10, *D. fasciata*, ♂. 8, Genital capsule (left, dorsal; right, ventral): b = dorsal bridge of penis valves; vl = ventral lobe; e = emargination. 9, S7, ventral. 10, S8, ventral. 11–13, Scape of ♂. 11, *D. willinki*: a = point of articulation of the pedicel. 12, *D. fasciata*. 13, *D. carinata*. 14–17, T1–2 of ♀, dark and pale pubescence represented by shaded and white areas respectively. 14, *D. angustata*. 15, *D. willinki*. 16, *D. carinata*. 17, *D. fasciata*. Scale Figs. 8–10 = 1 mm.

yond apices of coxae; mandible and pygidial plate dark reddish brown. Wings moderately infuscated except pale spot on forewing at end of closed cells; veins and pterostigma brown. *Vestiture*. Appressed, dense, whitish on: face around antennal sockets, gena close to upper third of eye; pronotal band including posterior margin of pronotal lobe; triangular notalular spot (broad close to pronotum); posterolateral angle of scutum; posterior median spot and lateral spot below axilla on scutellum; median and lateral spot on metanotum; T1 extensively, except dark spot surrounding metasomal articulation, dark apical margin and dark transverse median oval on disc of tergum, which is 3.2× broader than long (Fig. 16); T2–4 with broad apical pale bands, separated medially from margins of terga; T5–6 with broad apical pale bands. Greyish white, sparser pubescence on: clypeus, supraclypeal area, anterolateral angle of scutum, mesepisternum anteriorly, broad mesepisternal band, metapostnum laterally, postero-lateral angle of propodeum, underside of thorax, outer

surfaces of coxae, tibiae and basitarsi, and S2–5. Apical fringes on S3–4 with hairs slightly curved or straight, surpassing posterior margins of sterna. Remainder of head and thorax with sparse pale pubescence, except brownish on scutum. Pubescence of metasoma, other than mentioned pale maculations, brownish black. Posterior surface of propodeum mostly glabrous, with hairs restricted to postero-lateral angle. *Sculpture.* Punctures on scutum and scutellum (diameter 0.025–0.030 mm) separated by 0.2–0.5× their diameters, closer along the midline, interspaces smooth, shiny; punctures around ocelli smaller, also separated by 0.2–0.5× their diameter; middle of mesepisternum, below transverse band of hairs, with larger punctures (diameter 0.035–0.050 mm), also with smooth, shiny interspaces (Figs. 4–5); metapostnotum tessellate, dull, rugose close to metanotum; posterior surface of propodeum slightly tessellate, shiny. T1–5 with even, very small punctures, apical margins polished. *Morphology.* Eyes convergent below, proportion of lower to upper interocular distance, 0.74:1. Proportion of interantennal to antennocular distance, 1,6:1. Elevation between antennal sockets with sides concave, bearing sharp, elevated frontal carina. Paraocular carina ending near upper fifth of eye, slightly separating from eye margin above level of antennal socket. Proportion of postocellar to ocellocular distance, 0.9:1. Proportion of scape, pedicel and first three flagellomeres, 3: 0.75:1:1.25:1.10. Scape strongly flattened (Fig. 13), with transverse median section trianguliform, without erect, long hairs; upper rim of condylar surface carinate. Labrum 1.85× as broad as long, with two median tubercles and three apical denticles, lateral ones somewhat carinate. Scutellum bigibbous, with longitudinal median impression; axilla short, base of axilla as long as outer margin. Second submarginal cell with anterior margin 0.45× as long as vein r. Pygidial plate with apical two thirds nearly parallel-sided, apex rounded.

Female.—Length 8.8–9.0 mm; length of forewing 7.0–9.0 mm. Vestiture and coloration similar to those of male but dense whitish pubescence on face restricted to that around antennal sockets; clypeus and upper part of paraocular area with erect, stiff hairs as long as pedicel diameter. T6 with whitish pubescence surrounding dark pseudopygidial area. Punctation similar to that of male. Proportion of scape, pedicel and first three flagellomeres, 2.3: 0.6:1:1.5:1.3. Base of hind tibia with transverse carina forming apex of poorly defined basitibial plate. Second submarginal cell with anterior margin 0.4–0.7× as long as vein r. Fifth sternum with apex not bent down. Pseudopygidial area trapezoidal, as long as apical width.

Distribution.—Paraguay: Department of Cororo. Brazil: States of Bahia, Mato Grosso and São Paulo.

Material studied.—Male holotype: PARAGUAY, Río Ypané, Cororo, II-1979, M. Fritz (MACN). The following are paratypes: BRAZIL. *Bahia*: 1 ♂, Maracás, II-1963, F.M. Oliveira (UFPR). *Mato Grosso*: 1 ♂, Rio Caraguatá, III-1953, F. Plaumann (UFPR). *São Paulo*: 1 ♀ and 1 ♂, Cajurú, 6-IV-1985, Mazucato-Camargo (USP-RP); 1 ♀, Cassia dos Coqueiros, 12-IV-1986, M. Mazucato (USP-RP).

Doeringiella (Pseudepeolus) willinki Roig-Alsina, sp. n.

(Figs. 11, 15)

Diagnosis.—This species is recognized by the extended pale maculations, more extended than in any other species of the subgenus. It has a well developed mesepisternal band, conspicuous notaular spots, and broad metasomal bands. It can be confused with *D. carinata*, which has a similar pattern of pubescence (see comments in the diagnosis of this species). *Doeringiella willinki* is distinguished from other *Pseudepeolus* by features that represent plesiomorphies within the subgenus:

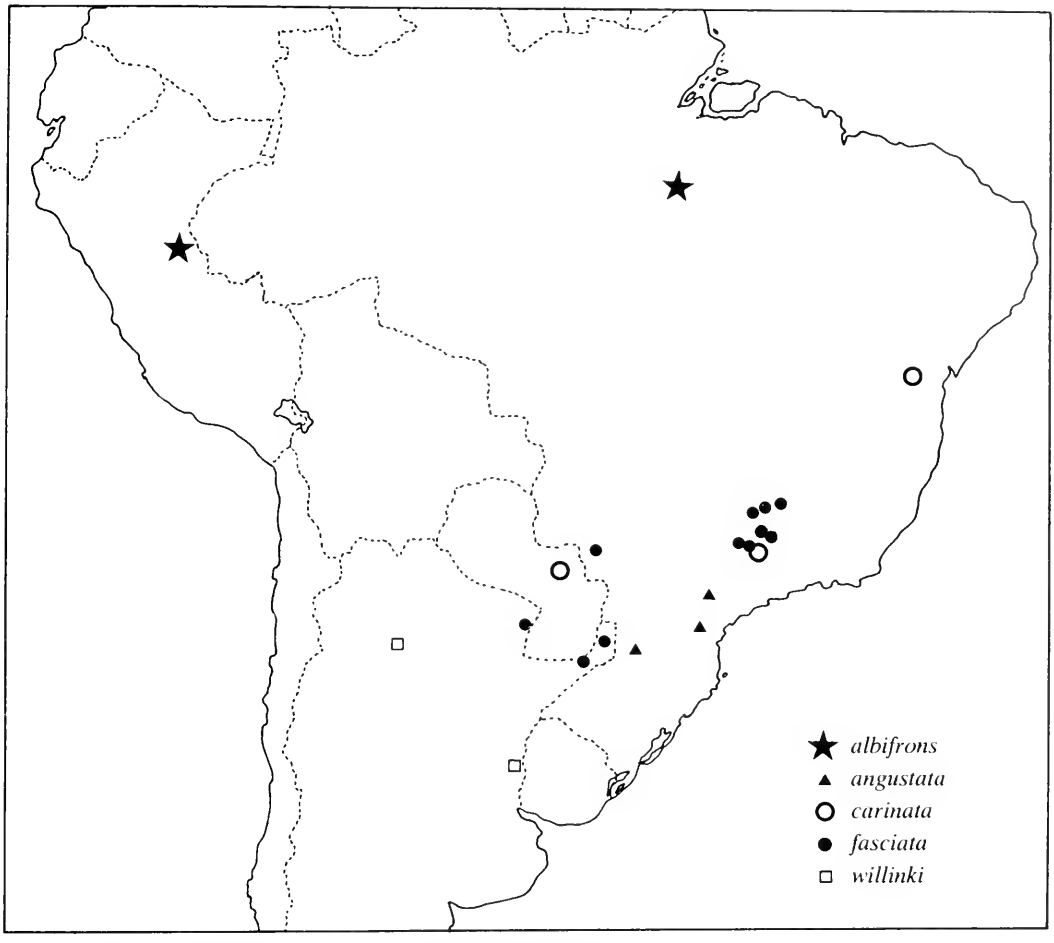


Fig. 18. Map showing distributions of *Doeringiella* (*Pseudepeolus*) spp. in South America.

the scape of the male is flattened only on the proximal half, its upper margin not being carinate, and the male S3–4 bear apical fringes of long, curved hairs.

Female holotype.—Length 8.8 mm; length of forewing 6.0 mm. *Coloration*. Integument of head, thorax and abdomen black; the following parts pale reddish brown: base of mandible, scape, pronotal lobe and tegula; antenna beyond scape brown; legs reddish brown beyond coxae, including tibial spurs. Wings amber, infuscated apically beyond closed cells; veins and pterostigma brown. *Vestiture*. Appressed, dense, yellowish white on the following parts: face around antennal sockets, pronotal band excluding pronotal lobes, triangular notalular spot (broad close to pronotum), posterolateral angle of scutum, posterior median spot and lateral spot below axilla on scutellum, median and lateral spot on metanotum, T1 extensively (except dark base, apical margin and transverse median oval on disc of tergum, Fig. 15), and apical broad bands on T2–4, separated medially from margins of terga. With greyish white, sparser pubescence on: clypeus, supraclypeal area, gena, around pronotal lobe, mesepisternum anteriorly and broad mesepisternal band, metapostnum laterally, postero-lateral angles of propodeum, underside of thorax, outer surfaces of coxae, tibiae and basitarsi, T5 laterally, and apical bands on S2–4.

Remainder of body with sparse pale pubescence, except brownish on scutum. Posterior surface of propodeum mostly glabrous, with hairs restricted to posterolateral angles. *Sculpture.* Punctures around ocelli small, coalescent; on scutum and scutellum punctures (diameter 0.025 mm) separated by 0.2–0.5× their diameter, interspaces smooth, shiny; mesepisternum below transverse band of hairs with larger punctures (diameter 0.03–0.04 mm) also with smooth, shiny interspaces; metapostnotum tessellate, dull; posterior surface of propodeum slightly tessellate, shiny. T1–4 with even, very small punctures, and polished apical margins. *Morphology.* Eyes convergent below, proportion of lower to upper interocular distance, 0.73:1. Proportion of interantennal to antennocular distance, 1.7:1. Elevation between antennal sockets with sides slightly concave, bearing frontal carina, which reaches anterior ocellus. Paraocular carina ending near upper third of eye in a blunt, punctured sector. Proportion of postocellar to ocellocular distance, 0.9:1. Proportion of scape, pedicel and first three flagellomeres, 2.5: 0.75:1: 1.5:1.25. Scape not flattened, with transverse median section roundish, without erect, long hairs. Labrum 1.8× as broad as long, with two median tubercles and three apical denticles, of which the lateral ones somewhat carinate and the median one obsolescent. Scutellum bigibbous, with longitudinal median impression; axilla short, base of axilla as long as its outer margin. Base of hind tibia with transverse carina forming apex of poorly defined basitibial plate. Second submarginal cell with anterior margin 0.8× as long as vein r. Fifth sternum with apex not bent down. Pseudopygidial area trapezoidal, 0.8× as long as its apical width.

Male.—Length 9.2 mm; length of forewing 6.3 mm. Vestiture and coloration similar to those of female but clypeus and labrum with dense whitish pubescence similar to that around antennal sockets; T5 and T6 with apical hair bands, that on T5 separated medially from margin of tergum; base and sides of pygidial plate with brown hairs; S3–4 with whitish apical fringes of curved, long hairs surpassing posterior margins of sterna. Punctation and proportions of head similar to those of female. Scape compressed on proximal half, where the condylar surface is flattened and somewhat concave (Fig. 11); upper rim of scape not carinate near point of pedicel articulation. Proportion of scape, pedicel and first three flagellomeres, 2.5:0.75:1:1.25:1. Second submarginal cell with anterior margin 0.5–0.7× as long as vein r.

Distribution.—Argentina: Provinces of Entre Ríos and Tucumán.

Material studied.—♀ holotype: ARGENTINA, *Entre Ríos*, Pronunciamiento, no date, Zelich (MACN). *Tucumán*: 1 ♂ paratype, 11 Km N Las Cejas, 22-II-1968, L. Stange (IFML).

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A Synopsis of the Sawflies (Hymenoptera: Symphyta) of America South of the United States: Tenthredinidae (Allantinae)

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Abstract.—The subfamily Allantinae of the Tenthredinidae is reviewed for the New World south of the United States. Six genera and 40 species are included. *Acidiophora* Konow includes 7 species in South America; *Empria* Lepeletier and Serville, 2 species in Mexico; *Ametastegia* A. Costa, 5 species from Mexico to Costa Rica and an introduced species in Chile and Argentina; *Antholcus* Konow, 1 species in Chile and Argentina; *Macremphytus* MacGillivray, 1 species in Mexico; and *Probleta* Konow, 24 species from southern Mexico to southern Brazil. New species are ***Ametastegia hansoni*** (Costa Rica), ***Probleta corana*** (Santa Catarina, Brazil), ***P. decorata*** (Costa Rica), ***P. grossoensis*** (Mato Grosso, Brazil; Colombia), ***P. malaisei*** (Santa Catarina and Paraná, Brazil), ***P. mazona*** (Amazonas, Brazil), ***P. nicklei*** (Peru), ***P. shannoni*** (Rio de Janeiro, Brazil), and ***P. siceva*** (Peru). ***Protoprobleta*** **Malaise** is a **new synonym** of ***Probleta*** **Konow**. Keys and descriptions are given for the genera and species.

This is the second part of the treatment of the family Tenthredinidae for America south of the United States. The first part (Smith, in press) included a key for identification of subfamilies and the subfamilies Nematinae, Heterarthrinae, and Tenthredininae. The Allantinae is the third largest subfamily of Tenthredinidae in the region south of the United States and here includes six genera and 40 species.

The format follows that of previous publications on the Symphyta of America south of the United States (Smith 1988, 1990, 1992, in press). The United States and Mexican border is arbitrarily chosen to compliment studies on America north of Mexico (e.g., the catalog by Smith 1979a). Depositories for specimens are given by city names as in the list in Smith (1988), and additional ones are in the Acknowledgments. An asterisk (*) in front of the original combination of a species indicates that I have seen the type. Extensive synonymies of some of the more common genera and species in the Nearctic Region are not included; they may be found in Smith (1979a, b). Wing terminology follows that of Huber and Sharkey (1993).

SUBFAMILY ALLANTINAE

The Allantinae are separated by the forewing venation (Figs. 1, 32, 58): veins M and 1m-cu parallel; veins M and Rs+M meet Sc+R at the same point; vein Rs+M near Sc+R straight, not sinuate; crossvein 2r present; vein 2A+3A complete, connected to 1A by an anal crossvein (a). Members of this subfamily also lack a epicnemium and have the propleurae either pointed or truncated on the meson. The lack of an epicnemium and straight vein Sc-R in the forewing separate Allantinae from those Selandriinae which have an anal crossvein in the forewing.

This subfamily is worldwide, except for Australia, and the greatest concentration of species occurs in eastern and south-

eastern Asia. Smith (1979b) revised the Nearctic fauna, treating 14 genera and 64 species. Of the six genera known to occur south of the United States, three, *Empria* Lepeletier and Serville, *Ametastegia* A. Costa, and *Macremphytus* MacGillivray are northern, but occur in Mexico and one, *Ametastegia*, as far south as Costa Rica. One genus, *Antholcus* Konow, occurs only in Chile and southern Argentina, and the other two, *Acidiophora* Konow and *Probleta* Konow are more widespread in the Neotropics. The genera discussed here are placed in the following three tribes (see also Smith 1979b):

Acidiophorini.—Tarsal claw trifid, without basal lobe. Stigma of forewing narrow and elongated and radial crossvein (2r) nearly straight. Each mandible bidentate. All species are impunctate and shining, with red and black colored thorax and fasciate wings. Benson (1938) established this tribe. Widespread in South America. Genus: *Acidiophora*.

Empriini.—Tarsal claw bifid, with or without basal lobe. Forewing normal, stigma not elongated and radial crossvein curved. Each mandible bidentate. Northern and Holarctic, with one genus, *Antholcus* in Chile and southern Argentina. Genera: *Empria, Ametastegia, Antholcus*.

Allantini.—Tarsal claw bifid, with basal lobe, rarely trifid. Forewing normal, stigma not elongated and radial crossvein curved. Mandibles asymmetrical, left mandible with at least two inner teeth and right mandible simple or with only one inner tooth. Clypeus usually deeply emarginated. *Probleta* is widespread whereas *Macremphytus* is Nearctic and occurs only in northern Mexico. Genera: *Probleta, Macremphytus*.

Hosts are known for very few of the species treated here. Common hosts for Nearctic species are *Salix* (Salicaceae), *Juglans* (Juglandaceae), *Betula, Alnus* (Betulaceae), *Cornus* (Cornaceae), *Rumex, Polygonum* (Polygonaceae) and *Fragaria, Rosa, Amelanchier, Rubus*, and other Rosaceae (Smith 1979a, b).

KEY TO GENERA OF ALLANTINAE SOUTH OF THE UNITED STATES

1 Tarsal claw trifid, without basal lobe (Fig. 3); forewing with vein 2r straight, stigma long and narrow (Fig. 1), fasciate, darkly infuscated at base and apex with contrasting hyaline band at center (South America) ..... ***Acidiophora* Konow**

– Tarsal claw bifid, with or without basal lobe (Figs. 23, 31, 49, 60), trifid in only three species of *Probleta*; forewing with vein 2r curved, stigma short, broad (Figs. 32, 58); wings not fasciate as above, but may be yellowish with apex black 2

2 Genal carina present; malar space as broad or broader than diameter of front ocellus; clypeus with shallow, V-shaped emargination (Figs. 22, 30) in *Ametastegia* and *Empria*, deeper and circular (Fig. 55) in *Macremphytus* (northern Mexico to Costa Rica) 3

– Genal carina absent; malar space linear or narrower than diameter of front ocellus; clypeus with shallow, V-shaped emargination (Fig. 48) in *Antholcus* or with circular, sometimes deep, emargination (Figs. 66, 68,70, 74, 76–78) in *Probleta* (southern Mexico to Chile) ... 5

3 Anal crossvein of forewing nearly perpendicular, at an angle of 60°–70° (Fig. 32); hind wing without cell M (Fig. 32); tarsal claw with basal lobe (Fig. 31) (each mandible bidentate) (Mexico, Central America) ..... ***Ametastegia* A. Costa**

– Anal crossvein of forewing oblique, at about a 45° angle to anal veins (as in Fig. 58); hind wing with or without cell M; tarsal claw with or without basal lobe (Figs. 23, 57) (Mexico) 4

4 Tarsal claw without basal lobe (Fig. 23); hind wing without cell M; abdomen black, usually with evident paired whitish spots on basal three or more terga (Fig. 24); clypeus shallowly emarginate (Fig. 22); each mandible bidentate ..... ***Empria* Lepeletier and Serville**

– Tarsal claw with basal lobe (Fig. 57); hind wing with cell M; abdomen reddish brown to orange, without whitish paired spots; clypeus deeply emarginate (Fig. 55); left mandible bidentate, right mandible simple (Fig. 56) ..... ***Macremphytus*** **MacGillivray**

5 Apical 4 antennal segments not reduced, segments beyond 3rd gradually decreasing in length (Fig. 47) and without ventral membranous areas; malar space narrow but distinct; pulvilli on hind tarsal segments 1–4; mandibles symmetrical, each bidentate (Chile, Argentina) ..... ***Antholcus*** **Konow**

– Apical 4 antennal segments reduced, together only slightly longer than 3rd segment (Fig. 59) and apical 4 with ventral membranous areas; malar space linear; pulvilli on hind tarsal segments 3 and 4; mandibles asymmetrical, left mandible with two inner teeth, right mandible with one inner tooth (Mexico to southern Brazil) ..... ***Probleta*** **Konow**

Tribe ACIDIOPHORINI

Genus *ACIDIOPHORA* Konow

Acidiophora Konow 1899: 361. Type species: *Acidiophora decora* Konow. By monotypy.
Acidiophophora: Konow 1908b: 161 (error).
Acideophora: Benson 1938: 366 (error).

Description.—Antenna long, slender, 1st and 2nd segments each longer than broad; 3rd and 4th segments subequal in length or 3rd slightly longer than 4th; apical 5 segments reduced, together subequal in length to segments 3 and 4 combined (Fig. 2); apical 4 segments with ventral membranous areas, elongate and extending length of each segment. Clypeus truncate to slightly convex; each mandible bidentate; malar space linear; no genal carina; eyes large, lower interocular distance less than eye length, eyes converging below; postocellar area as long as broad. Tarsal claws with 3 teeth, without basal lobe (Fig. 3); hind basitarsus longer than length of remaining tarsal segments combined; pulvilli on segments 2–4 of hind tarsus, small on segment 2. Forewing with anal crossvein oblique; veins M and 1m-cu subparallel; stigma long and narrow, 9–10× longer than broad; radial crossvein (2r) nearly perpendicular to stigma and straight (Fig. 1). Hind wing with cells Rs and M absent; anal cell sessile or with short petiole; apex of radial cell close to apical margin of wing; male without peripheral vein.

Remarks.—Species of *Acidiophora* are shining black with most or part of the thorax red and have darkly infuscated wings with a contrasting hyaline band at the center. The trifid tarsal claws, long stigma of the forewing, and straight radial crossvein of the forewing are distinctive for the genus. Also, the lightly sclerotized, fragile female ovipositors are all similar (Figs. 6–14) and unique to this genus. Smith (1972b) revised the genus, including six species from Brazil, Peru, and northeastern Argentina.

KEY TO SPECIES OF *ACIDIOPHORA*

1 Thorax, forecoxa, and all femora entirely orange (lance, Fig. 13, lancet, Fig. 14) ..... ***konowi*** **Smith**

– Thorax and foreleg mostly black, or at least mesosternum and mesoprescutum black 2

2 Mesopleuron entirely black; mesonotum entirely or mostly black, at most with lateral half of each lateral lobe orange 3

– At least upper ¼ or mesopleuron orange; mesonotum mostly orange 5

3 Forewing at base uniformly infuscated; pronotum and mesonotum black (lance, Fig. 6, lancet, Fig. 7; male genitalia, Figs. 15, 16) ..... ***bokoma*** **Smith**
– Infuscation at base of forewing with a central hyaline spot (Fig. 1); at least lower half of pronotum and usually lateral half of each lateral lobe orange 4

4 Anal cell of hind wing with short petiole (Fig. 1); mesonotum mostly black; pronotum except for lower half black (male genitalia, Fig. 18) ..... ***larira*** **Smith**
– Anal cell of hind wing sessile; lateral half of mesonotum orange, the black on mesonotum appearing as a broad longitudinal stripe; pronotum orange (lance, Fig. 8, lancet, Fig. 9; male genitalia, Fig. 17) ..... ***decora*** **Konow**

5 Only upper corner of mesopleuron orange; mesoscutellum black; anal cell of hind wing with short petiole, as in Fig. 1 (lance, Fig. 10; lancet, Fig. 11; male genitalia, Figs. 19, 20) ..... ***gecera*** **Smith**
– Upper half or third of mesopleuron and all mesoscutellum orange; anal cell of hind wing sessile 6

6 Upper half of mesopleuron orange; foreleg with base of coxa and femur entirely orange; Bolivia (lance, Fig. 12) ..... ***manni*** **Smith**
– Upper third of mesopleuron orange; foreleg black; Brazil ..... ***longipennis*** **(Cameron)**

Species

bokoma Smith. Brazil (Rio de Janeiro, Santa Catarina)

**Acidiophora bokoma* Smith 1972b: 421, figs. 4, 6, 7, 15, 16. ♀, ♂. "Brazilien, Nova Teutonia, 27° 11' B., 52° 23" L., 300–500 m." (Washington, ♀).—Smith 1979b: 11.

Remarks.—This is a mostly black species with the thorax almost entirely black except for the red tegula and small reddish areas on the upper margin of the mesepimeron, upper margin of metapleuron, and narrow line on anterior margin of pronotum. The basal portion of the forewing is uniformly infuscate, lacking a central hyaline area, and the anal cell of the hind wing is sessile. The lance and lancet are in Figs. 6, 7, and the male genitalia in Figs. 15, 16.

Material examined.—BRAZIL: Itatiaya, 700 m, Est. do Rio, 19-3-932 (1 ♀); holotype ♀ labeled "Brasilien, Nova Teutonia, 27°11'B, 52°23'L, 300–500 m, XI-17-1964, Fritz Plaumann"; about 15 other specimens from the type locality, collected in February, March, November, and December.

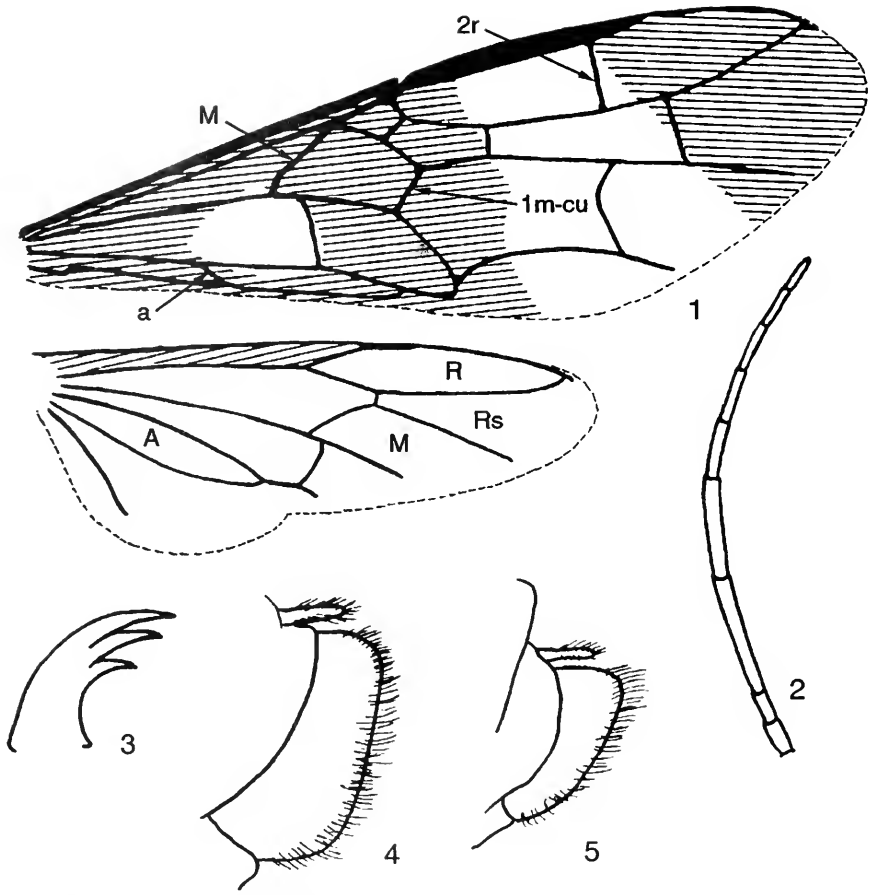
decora Konow. Argentina (Misiones); Brazil (Espirito Santo, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina).

**Acidiophora decora* Konow 1899: 361. ♂. "Brasilia (Rio Grande do Sul)" (Eberswalde, ♂).—Konow 1901: 61–62 (♀).—Konow 1905: 100.—Smith 1972b: 421–423, figs. 8, 9, 17 (♀, ♂; syn.: *nebulosa* Jörgensen).—Smith 1979b: 11.—Oehlke and Wudowenz 1984: 376 (holotype).

**Acidiophora nebulosa* Jörgensen 1913: 276–278, pl. 27, figs. 9, 10. ♂. "Monte de Bonpland" (La Plata, ♂).

Remarks.—The black mesopleuron, broad black longitudinal stripe on the mesonotum, red pronotum, sessile anal cell of the hind wing, and presence of a hyaline area in the basal infuscated portion of the forewing will distinguish this species. The lance and lancet are in Figs. 8, 9, and the male genitalia in Fig. 17.

The lectotype ♂ of *A. decora*, here designated to fix the identity of this species, is at Eberswalde, labeled "R. Grande do Sul," "Coll. Konow," "Typus [red]," and "Acidiophora decora Konow, Brasil." Konow did not state how many specimens he had, and there are two other specimens at Eberswalde, one of a different species de-



Figs. 1–5. *Acidiophora*. 1, Forewing and hind wing of *A. gecera*. 2, Antenna of *A. gecera*. 3, Tarsal claw of *A. gecera*. 4, Sheath of *A. bokama*. 5, Sheath of *A. gecera*.

scribed as *A. konowi* (Smith 1972b). Jörgensen described *A. nebulosa* from "Sólo un ♂"; the holotype ♂, at La Plata, is labeled "25-IX-10, Misiones, Bompland, Jörgensen," "Acidiophora nebulosa, n. sp." The left forewing is missing.

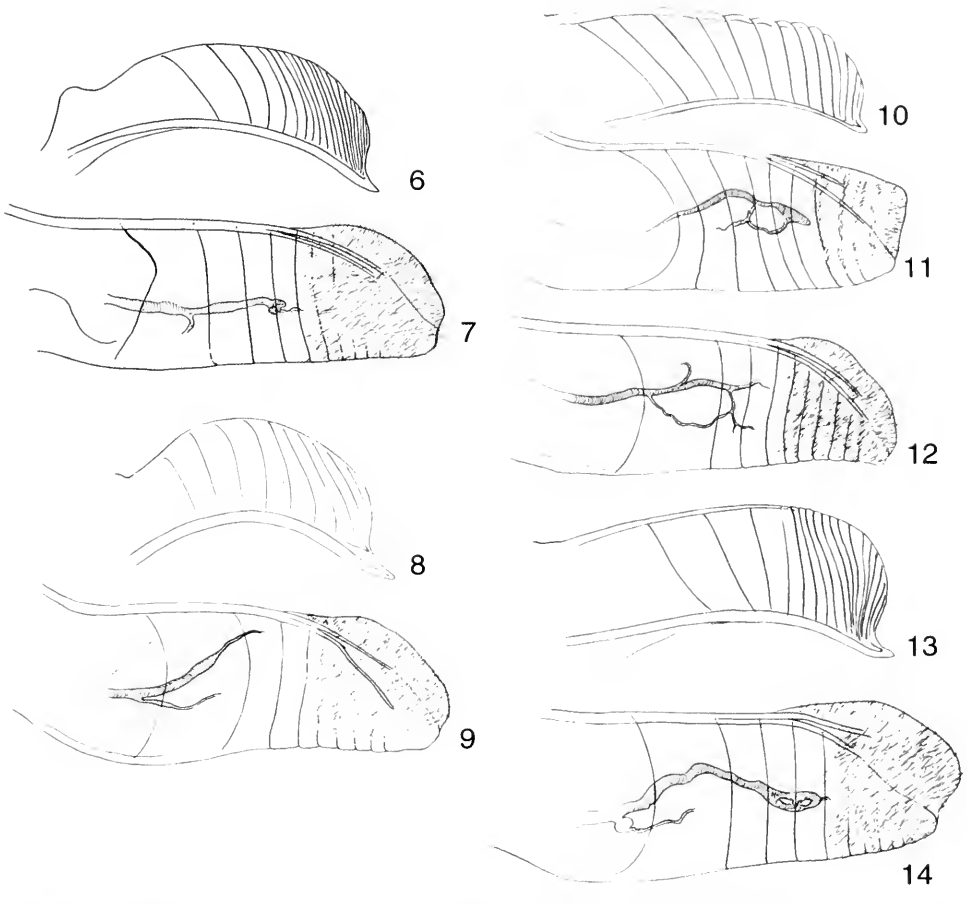
Material examined.—About 50 specimens in addition to types mentioned above; only states and months of capture are given: see Smith (1972b) for specific localities. ARGENTINA: Misiones (September). BRAZIL: Espirito Santo (February, October); Paraná (November); Rio Grande do Sul (type of *A. decora*); Rio de Janeiro (April, September, November); Santa Catarina (September, October).

gecera Smith. Argentina (Formosa); Brazil (Santa Catarina); Paraguay

**Acidiophora gecera* Smith 1972b: 423, figs. 1–3, 5, 10, 11, 19, 20. ♀, ♂. "Brasilien, Nova Teutonia, 27° 11′ B., 52° 23′ L., 300–500 m." (Washington, ♀).—Smith 1979b: 12.

Remarks.—The red mesonotum with the prescutum and scutellum black, red upper corner of the mesopleuron, and petiolate anal cell of the hind wing will distinguish this species. The lance and lancet are in Figs. 10, 11, and the male genitalia in Figs. 19, 20.

Material examined.—ARGENTINA: Formosa (1 ♀). BRAZIL: Holotype ♀ labeled



Figs. 6–14. *Acidiophora*, female ovipositors. 6, *A. bokoma*, lance. 7, *A. bokoma*, lancet. 8, *A. decora*, lance. 9, *A. decora*, lancet. 10, *A. gecera*, lance. 11, *A. gecera*, lancet. 12, *A. manni*, lancet. 13, *A. konowi*, lance. 14, *A. konowi*, lancet.

"Brasilien, Nova Teutonia, 27°11'B, 52°23'L, 300–500 m, 16-III-1966, Fritz Plaumann."; about 15 specimens, all from the type locality collected in February, March, and April (see Smith 1972b). PARAGUAY: Villarica (1 ♀).

konowi Smith. Bolivia; Peru

**Acidiophora konowi* Smith 1972b: 423–425, figs. 13, 14. ♀. "Vilcanota, Peru" (Eberswalde, ♀).—Smith 1979b: 12.—Oehlke and Wudowenz 1984: 390 (holotype).

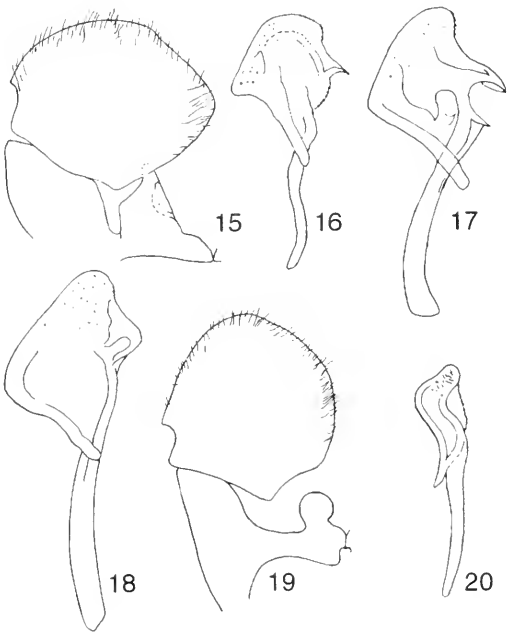
Remarks.—The red thorax, forecoxa, forefemur, basal hyaline spot in the basal infuscated area of the forewing, and sessile anal cell of the hind wing will distinguish this species. The lance and lancet are in Figs. 13, 14.

Material examined.—BOLIVIA: Chiquitos, Bolivia, 300 m, March 1918 (1 ♀, at Pittsburgh). PERU: Holotype ♀ labeled "Vilcanota, Peru," "Coll. Konow," and with the holotype name label.

larira Smith. Brazil (Rio de Janeiro)

**Acidiophora larira* Smith 1972b: 425, fig. 18. ♂. "Rio de Janeiro, Dist. Federal, Brasil" (Washington, ♂).—Smith 1979b: 12.

Remarks.—The mostly black thorax with some small reddish areas on the lower half of the pronotum, tegula, spot on lateral side of each mesonotal lateral lobe,



Figs. 15–20. *Acidiophora*, male genitalia. 15, *A. bokoma*, harpe and parapenis. 16, *A. bokoma*, penis valve. 17, *A. decora*, penis valve. 18, *A. larira*, penis vlve. 19, *A. gecera*, harpe and parapenis. 20, *A. gecera*, penis valve.

upper margin of mesepimeron, upper portion of metapleuron orange, and hyaline spot in center of basal infuscated area of the forewing will distinguish *A. larira* from other *Acidiophora*. The legs and abdomen are black, and the anal cell of the hind wing is petiolate. The male genitalia are in Fig. 18. I saw one female from "Rio de Jan." collected in November; the coloration is similar to that of the female.

Material examined.—BRAZIL: Holotype ♂ labeled "Rio de Janeiro, Dist. Federal, Brasil," "Setembro, 1938," "Servico Febro, Amarela, M.E.S., Bras.," "R.C. Shannon, coll."; Rio de Janeiro (1 ♀).

longipennis (Cameron). Brazil

**Taxonus longipennis* Cameron 1878: 141–142. ♀. "Brazil" (London, ♀).—Kirby 1882: 211.—Dalla Torre 1894: 112.—Konow 1905: 109.
Probleta longipennis: Konow 1908b: 161.
Acidiophora longipennis: Smith 1979b: 12.

Female.—Length, 10.0 mm. Head and antenna black. Thorax orange with triangular mark on mesoprescutum, mesosternum, and about lower two-thirds of mesopleuron black. Legs and abdomen black. Forewing with infuscation as in Fig. 1, with central hyaline spot in infuscated basal area of forewing. Anal cell of hind wing sessile.

Remarks.—I overlooked this species in my 1972b revision and did not realize it belonged to *Acidiophora* until I examined the type in 1978. I have not seen other specimens that resemble this species. The coloration is very close to *A. gecera* and *A. manni*, but closer to the latter as indicated in the key. The orange upper third of the mesopleuron, orange mesonotum except for the black mark on the prescutum, and the black legs appear to separate *A. longipennis* from the others. Since *A. longipennis* is from "Brazil" and *A. manni* is known only in Bolivia, there are apparent slight color differences, and I have not seen other specimens, I prefer to keep *A. longipennis* separate at present.

Material examined.—Holotype ♀, BM 1.362, labeled "Braz.," "Taxonus longipennis Cam., Type, Brazil."

manni Smith. Bolivia

**Acidiophora manni* Smith 1972b: 425–426, fig. 12. ♀. "Huachi, Beni, Bolivia" (Washington, ♀).—Smith 1979b: 12.

Remarks.—The red thorax with the mesosternum, lower half of the mesopleuron, and triangular spot on mesoprescutum black, presence of a central hyaline spot in the infuscated basal area of the forewing, and sessile anal cell of the hind wing will distinguish this species. The lancet is in Fig. 12.

Material examined.—BOLIVIA: Holotype ♀ labeled "Huachi, Beni, Bolivia, Wm. M. Mann," "September," "Mulford Bio. Expl. 1021-1922."

Tribe EMPRIINI

Genus *EMPRIA* Lepeletier and Serville

Empria Lepeletier and Serville 1828: 571. Type species: *Dolerus* (*Empria*) *pallimacula* Lepeletier. Desig. by Brullé 1846.

For the extensive generic synonymy, see Smith (1979b).

Description.—Antenna slender, 1st and 2nd segments each slightly longer than broad or 2nd segment about as long as broad, 3rd segment slightly longer than 4th segment; segments beyond 3rd gradually decreasing in length (Fig. 21); without ventral membranous areas on ventral side of apical segments. Clypeus shallowly emarginate, emargination usually broadly V-shaped, sometimes with small tooth at center (Fig. 22); malar space broad, nearly twice diameter of front ocellus; genal carina present, extending to top of eye; each mandible bidentate. Tarsal claw with or without inner tooth, without basal lobe (Fig. 23). Forewing with anal crossvein (a) oblique (similar to Fig. 58); first cubital crossvein (Rs) present or absent. Hind wing with cell M, cell Rs absent; anal cell petiolate; male without peripheral vein. Pulvilli on tarsal segments 1–4. Abdominal terga commonly with paired whitish spots (Fig. 24), not always obvious in some specimens.

Remarks.—*Empria* may be confused with *Ametastegia* in Mexico where both genera occur, but *Ametastegia* lacks cell M in the hind wing, has the anal crossvein of the forewing nearly perpendicular, has a basal lobe on the tarsal claws, and lacks whitish paired spots on the abdominal terga. *Empria* is a relatively large Holarctic genus with about 11 species in North America north of Mexico (Smith 1979b). Two species of this northern genus occur in Mexico. Hosts are not known for the two Mexican species, but Nearctic species feed on *Rosa, Fragaria, Potentilla, Rubus* (Rosaceae), *Betula, Corylus, Alnus* (Betulaceae), and *Salix* (Salicaceae) (Smith 1979a, b).

KEY TO SPECIES OF *EMPRIA*

1 Antenna long, more than 2× head width, segments 5–8 about 2½× longer than broad; abdominal white spots faint; lancet with low, rounded serrulae and small anterior subbasal tooth (Fig. 25); male genitalia in Fig. 27 ..... ***eosa* Smith**

– Antenna stouter, less than 2× head width, segments 5–8 about 2× longer than broad; abdominal white spots distinct (Fig. 24); lancet with lobelike serrulae, each with a single large anterior subbasal tooth (Fig. 26); male genitalia in Fig. 28 .... ***mexicana* (Cameron)**

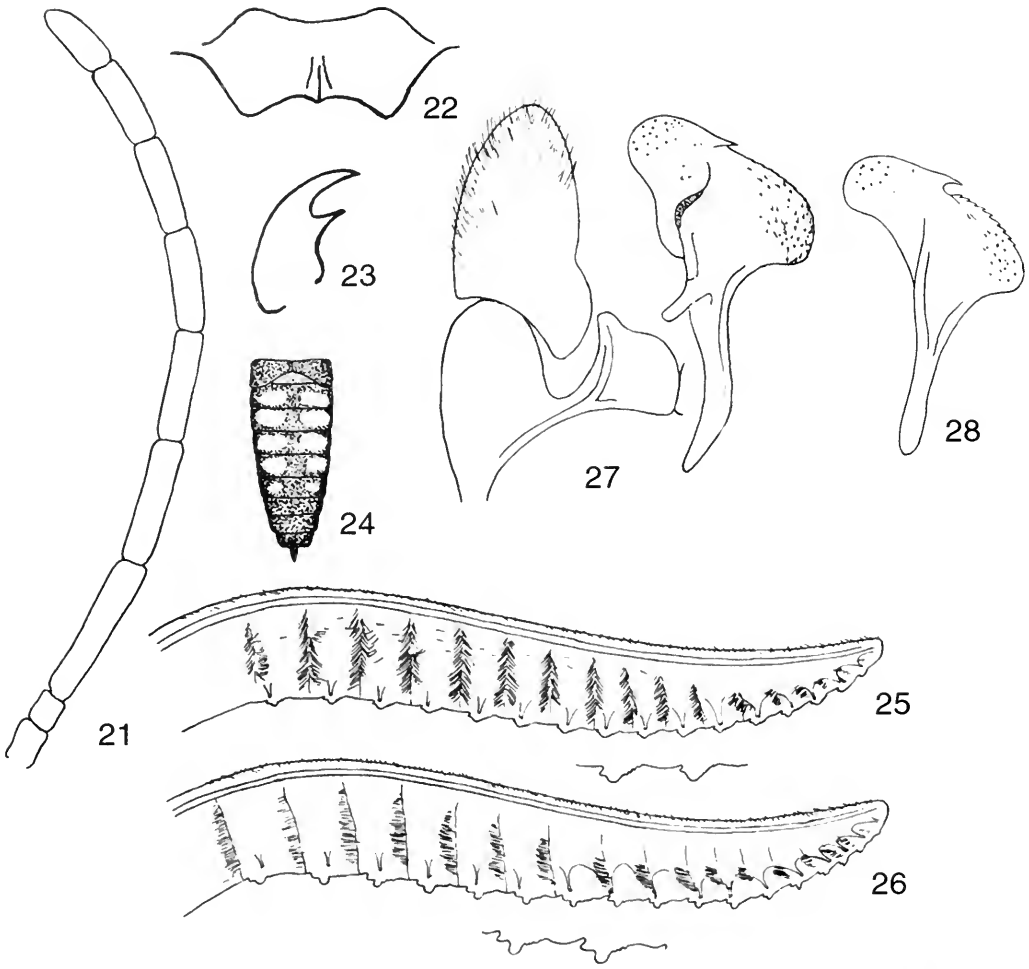
Species

eosa Smith. Mexico (D.F., Jalisco, México, Michoacán, Morelos, Veracruz)

**Empria eosa* Smith 1979b: 46–47, figs. 88, 92, 110, 111. ♀, ♂. "Tancitaro, Michoacán, Mexico, Alt. 11,000 ft., Hy. 58" (Champaign, ♀).

Female, male.—Length, female, 6.8–7.0 mm; male, 6.6–6.8 mm. Antenna and head black, labrum brownish. Thorax black with posterior margin of pronotum brownish; anterior edge of tegula may be white. Legs black with extreme apex of forefemur and all foretibia white. Abdomen black; posterior margin of each segment sometimes with narrow white band; paired white spots absent, at most represented by brownish areas on tergites 2–7. Wings darkly, uniformly infuscated; veins and stigma black. Antennal length more than 2× head width, usually about 2.4×. Lancet in Fig. 25; male genitalia in Fig. 27.

Remarks.—Unlike most species of *Empria*, the white spots on the dorsum of the abdomen are faint to absent in this species. The long antennae, lancet, and male genitalia should be used to separate this species from *E. mexicana*. It has been collected only at high elevations in central Mexico; label data that includes elevations are all 8300′ or above. One specimen was collected in a "pine grass" habitat.



Figs. 21–28. *Empria*. 21, Antenna of *E. cosa*. 22, Clypeus of *E. cosa*. 23, Tarsal claw of *E. cosa*. 24, Abdomen, dorsal, of *E. mexicana*. 25, Lancet of *E. cosa*. 26, Lancet of *E. mexicana*. 27, Harpe and parapenis, and penis valve of *E. cosa*. 28, Penis valve of *E. mexicana*.

Material examined.—MEXICO: Holotype ♀ labeled "Tancitaro, Michoacan, Mexico, Alt. 11,000 ft., Hy. 58, July 19, 1940, on Tessel, Hoogstraal and Knight." I have seen specimens from the states of Jalisco, México, Michoacán, Morelos, and Veracruz. All collections are from mid-June to August. See Smith (1979b) for specific localities.

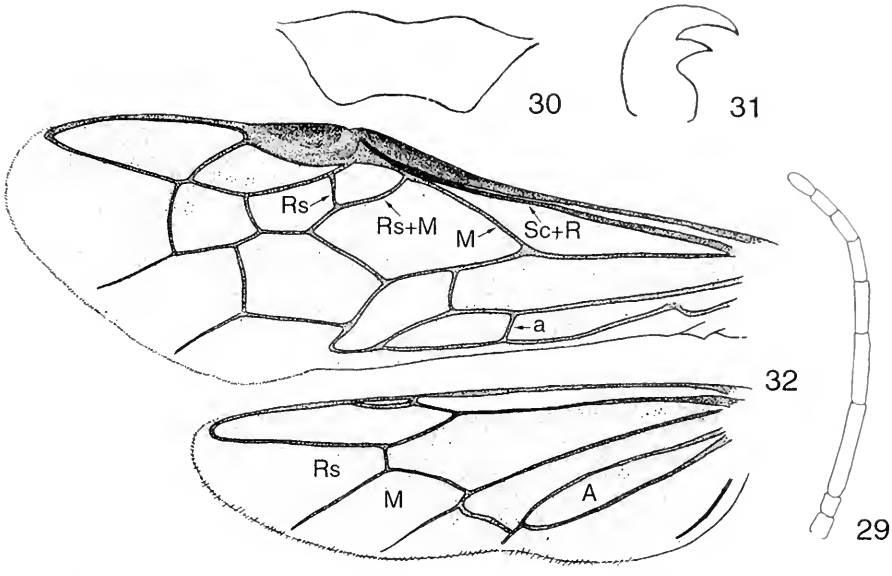
mexicana (Cameron). Mexico (Durango); U.S.A. (Arizona, New Mexico)

**Poecilosoma mexicana* Cameron 1883: 34, pl. 2, fig. 9. ♀. "Mexico, Milpas in Durango 5900 feet" (London, ♀).—Dalla Torre 1894: 128.—Konow 1905: 104.

Empria mexicana: Smith 1979a: 102.—Smith 1979b: 57–58, figs. 96, 108 (description; distribution; syn.: *arizonensis* Rohwer).

**Empria arizonensis* Rohwer 1910: 174. ♀. "Arizona" (Washington, ♀).—Ross 1936: 174 (as a syn of *E. obscurata* (Cresson)).

Female, male.—Length, female, 6.6–6.9 mm; male, 6.0–6.3 mm. Antenna and head black; labrum brownish. Thorax black with posterior margin of pronotum and tegula white. Legs black with extreme apex of forefemur, outer surface of foreti-



Figs. 29–32. *Ametastegia*. 29, Antenna of *A. glabrata*. 30, Clypues of *A. articulata*. 31, Tarsal claw of *A. articulata*. 32, Forewing and hind wing of *A. glabrata*.

bia, and basal quarter of midtibia and hind tibia white. Abdomen black, narrow white band sometimes present on posterior margin of each segment; paired white spots on tergites 2–5 or 2–6, sometimes brownish and not evident. Wings darkly, uniformly infuscated; veins and stigma black. Antennal length about 2× or less head width. Female lancet in Fig. 26; male genitalia in Fig. 28.

Remarks.—This species is also black, but the white spots on the dorsum of the abdomen are usually more evident than in *E. cosa*. See the preceding key for species separation. As *E. cosa*, this species also occurs at high elevations in Mexico, but in northern Mexico and southeastern United States.

Material examined.—MEXICO: Holotype ♀ of *P. mexicanus*, BM #1.361, labeled "Milpas, Mex., 5900 ft., Forrer" and with name labels. Other specimens only from the El Salto and La Cuidad areas in Durango, at elevations of 8200′ or higher. UNITED STATES: Holotype ♀ of *E. arizonensis* labeled "Ariz." See Smith (1979b) for specific localities; all collections are in June and July, with one in August.

Genus *AMETASTEGIA* A. Costa

Ametastegia A. Costa 1882: 198. Type species: *Ametastegia fulvipes* A. Costa. By monotypy.

For the extensive generic synonymy, see Smith (1979b).

Description.—Antenna moderately long, 2× or more head width, 1st and 2nd segments each as long as broad; 3rd segment longer than 4th segment; segments beyond third gradually decreasing in length (Fig. 29); without ventral membranous areas on apical segments. Clypeus shallowly emarginate, emargination truncate or shallowly U- to V-shaped, sometimes with tooth at center (Fig. 30); genal carina present, extending to top of eye; each mandible bidentate; malar space distinct, about as broad as diameter of front ocellus. Tarsal claw with short inner tooth and small, rounded basal lobe (Fig. 31); hind basitarsus subequal in length to or shorter than length of remaining tarsal segments combined; pulvilli on hind tarsal segments

1–4. Forewing with 1st cubital crossvein (Rs) present or absent (absent in Mexican and Central American species; present in species introduced into Chile and Argentina); anal crossvein (a) nearly perpendicular (Fig. 32). Hind wing without cells Rs and M; anal cell present, petiolate (Fig. 32); male without peripheral vein.

Remarks.—See the discussion under *Empria* for characters distinguishing *Ametastegia* from that genus. *Ametastegia* is a Holarctic genus with 15 species in North America (Smith 1979b). Four species are found in Mexico south to Costa Rica, and another has been introduced into Chile and Argentina. Host plants for Nearctic species include *Rumex*, *Polygonum* (Polygonaceae), *Viola* (Violaceae), and *Salix* (Salicaceae). Larvae prefer to bore into soft substances to form a pupal cell. These may be soft wood, stems of various plants, or fruit. If the host plant is near fruit orchards, such as apples or pears, mature larvae may bore into the fruit and form a cell to pupate. Damage to fruit is only from boring and forming a cell for a pupation site and is not caused by feeding. Because pupation sites are commonly in soft substances such as fruit, species are easily transported by commerce.

KEY TO SPECIES OF *AMETASTEGIA*

1 First cubital crossvein (Rs) of forewing present (Fig. 32) (black; labrum whitish; legs orange with extreme bases of coxae and hind tarsus black; lancet in Fig. 33; male genitalia in Figs. 43, 44); Chile, Argentina ..... ***glabrata* (Fallén)**
– First cubital crossvein (Rs) of forewing absent; Mexico to Central America 2

2 Abdomen black 3
– Abdomen partly orange or reddish brown 4

3 Coxae, trochanters, and basal portion of femora white; lancet in Fig. 34; male genitalia in Figs. 37, 38; mesepisternum with posteroventral white spot ..... ***articulata* (Klug)**
– Legs black, sometimes whitish on tibiae only; lancet in Fig. 35; male genitalia in Figs. 39, 40; mesepisternum black ..... ***mexicana* (Cameron)**

4 Abdomen orange with basal plates and apical 2 segments black; costa and stigma of forewing orange brown; legs orange with bases of coxae black; malar space equal to diameter of front ocellus; clypeus short, about 3× broader than long; head shining; male genitalia in Figs. 41, 42 ..... ***championi* (Cameron)**
– Abdomen variable, usually orange to reddish brown with basal plates and apical segments black, but may be mostly black with margins of terga or only a few terga reddish brown; veins and stigma of forewing black; legs whitish to orange with bases of fore- and midcoxae and most of hind coxa, apical third or so of hind tibia and tarsus blackish; malar space twice diameter of front ocellus; clypeus long, only about 2× broader than long; head roughened and dull between ocelli and antennae; male genitalia in Figs. 45, 46 (lancet in Fig. 36) ..... ***hansoni*, new species**

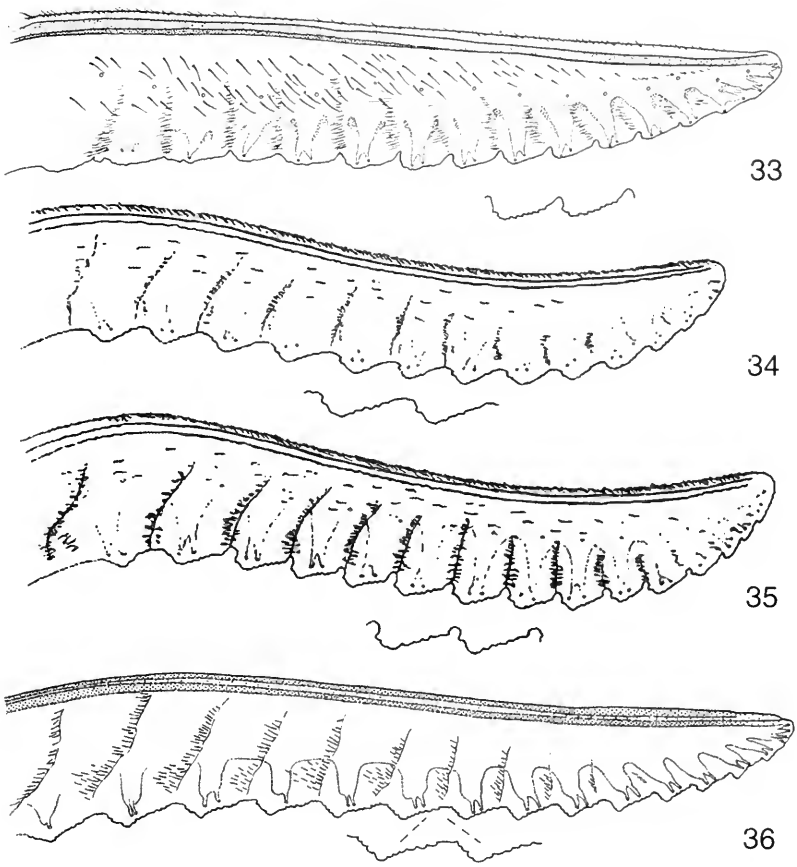
Species

articulata (Klug). Mexico (Oaxaca, Veracruz); Southeastern Canada and eastern United States west to Minnesota, Texas.

**Tenthredo (Emphytus) articulatus* Klug 1818: 284. ♂. "Baltimore in Nordamerika" (Berlin, ♂). Dating of Klug's descriptions from Taeger and Blank (1996).

Ametastegia articulata: Smith 1973a: 29.—Smith 1979a: 103.—Smith 1979b: 76–78, figs. 155, 166, 167, 179–184 (description, adults and larvae; hosts; syn.: *aztecus* Cameron).

**Emphytus aztecus* Cameron 1888: 163. ♂. "Mexico, Orizaba" (London, ♂).—Dalla Torre



Figs. 33–36. *Ametastegia*, female lancets. 33, *A. glabrata*. 34, *A. articulata*. 35, *A. mexicana*. 36, *A. hansoni*.

1894: 113.—Cameron 1899: 467.—Konow 1905: 105.

Host plants.—*Rumex* spp. and *Polygonum erectum* L. (Polygonaceae) have been recorded in the United States.

Female, male.—Length, female, 5.8–6.3 mm; male, 4.7–5.0 mm. Antenna and head black; clypeus whitish or black; labrum and maxillary and labial palpi whitish. Thorax black with posterior margin of pronotum white; tegula brownish to white; small white spot usually present on lower posterior margin of mesepisternum (sometimes absent). Legs usually white to yellow with extreme bases of coxae, apical half of hind tibia, and all hind tarsus black; occasionally legs mostly black with coxae, trochanters, and basal halves of femora white. Abdomen black, sometimes each segment with narrow white band on posterior margin; sheath black. Wings lightly, uniformly infuscated; veins and stigma black. Female lancet in Fig. 34; male genitalia in Figs. 37, 38.

Remarks.—See Smith (1979b) for further references and synonymy and notes on Klug's type. This is a common species in eastern North America. The few specimens I have seen from Mexico are identical to ones from the U.S.

Material examined.—MEXICO: Holotype ♂ of *E. aztecus*, BM #1.345, labeled "Emphytus aztecus Cam.," "Orizaba, H.H.S. & F.D.G., Dec. 1887."; Veracruz; Oaxaca, 2 mi NW Oaxaca, IV-13-53 (at Berkeley). See Smith (1979b) for United States records.

championi (Cameron). Guatemala

**Emphytus championi* Cameron 1883: 35, pl. 2, fig. 13. ♀. "Guatemala, Purula" (London, ♀).—Dalla Torre 1894: 114 (*championii*).—Konow 1905: 105.
Ametastegia championi: Smith 1972a: 258.—Smith 1979b: 80–81, figs. 171, 172.

Female, male.—Length, female, 8.0 mm; male, 4.8 mm. Antenna and head black. Thorax black with posterior margin of pronotum, tegula, and spot on mesepisternum whitish. Legs yellow orange with bases of coxae black; midtarsus, hind tarsus, apical third of hind tibia, extreme apex of midtibia, and apical 4 foretarsal segments lightly infuscated. Abdomen orange with basal plates and sheath black; in male, apical two abdominal segments and coxae black. Wings uniformly infuscated; veins and stigma black. Male genitalia in Figs. 41, 42.

Remarks.—The only female examined was the holotype. I did not examine the lancet.

Material examined.—GUATEMALA: Holotype ♀, BM #1.346, labeled "Purula, Guatemala, Champion" and with name labels; Baja Verapaz, 5 km E Purula, 1530–1650 m (1 ♂); Ingenio, April 28, 1926 (1 ♂).

I examined one female that is similar to *A. championi* but differs from the holotype by having black legs (except for white at the extreme apices of the femora and bases of the tibiae) and black wing venation. This could be a color variant, but I am unable to evaluate it because I could not compare the lancet to that of the holotype. The specimen is labeled "Guatemala, Depto. Quiche, 14° 55.176'N, 91° 06.342'W, south of Chichicastenango, Molino L. Tesoro, 1900 m, along Rio Selapec, M.E. Irwin, 20 May 1997," "Schlinger Foundation Guatemala Expedition May 1997" (at Eberswalde).

glabrata (Fallén). Argentina (Río Negro); Chile (Orsono, Valdivia); transcontinental in southern Canada and U.S.A; Europe to Siberia.

Tenthredo glabrata Fallén 1808: 108.
Ametastegia glabrata: Smith 1979a: 104.—Smith 1979b: 85–87, figs. 158, 168, 169 (description, distribution, hosts).—Carrillo et al. 1990: 5–7 (first record for Chile; biology).—Smith and Pérez 1995: 105.

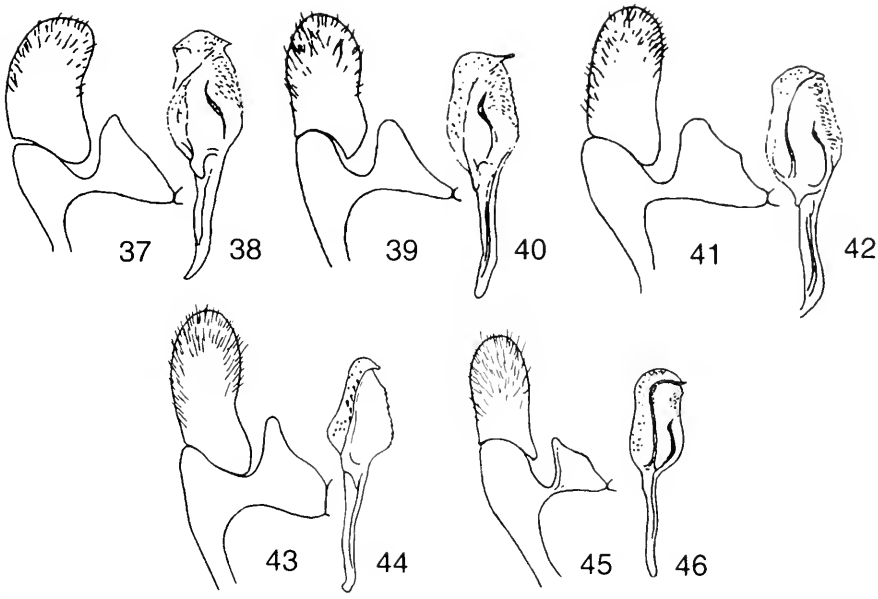
Host plants.—*Rumex crispus* L., *Rumex* spp., *Polygonum* spp. (Polygonaceae).

Female, male.—Length, female, 7.4–7.8 mm; male, 6.1–6.4 mm. Antenna and head black; labrum whitish. Thorax black. Legs orange with extreme bases of coxae and hind tarsus black. Abdomen black. Wings lightly, uniformly infuscated; veins and stigma black. Forewing with first sector of vein Rs present (Fig. 32). Female lancet in Fig. 33; male genitalia in Figs. 43, 44.

Remarks.—See Smith (1979b) for further synonymy, description, and distribution. This is a rather recent introduction into Chile (Carillo et al. 1990) and Argentina (first country record, see below). Several biological references to this species in the North American literature are Jack (1893), Dustan and Gilliatt (1916), Chittenden and Titus (1905), and Newcomer (1916). It is known as the "dock sawfly" (the "dock false-worm" in some early literature) and has gained significance as an occasional pest of apples. If the larval host is in the vicinity of fruit orchards, larvae may use the fruits as a pupation site thus lowering the quality of the fruit.

This is the only species of *Ametastegia* south of the United States with the first sector of vein Rs present in the forewing (Fig. 32).

Material examined.—ARGENTINA: Río Negro, El Bolsón, near plaza, 280 m, 9-XII-1997, U.p.t., C. and M. Vardy. CHILE: Orsono, 5–18–87, in stem Frambuesco (1 ♀); Valdivia, Dic. 1980; Aysen, Rio Simpson, I-24–1978 (1 ♀).



Figs. 37–46. *Ametastegia*, male genitalia. 37, *A. articulata*, harpe and parapenis. 38, Penis valve of *A. articulata*. 39, Harpe and parapenis of *A. mexicana*. 40, Penis valve of *A. mexicana*. 41, Harpe and parapenis of *A. championi*. 42, Penis valve of *A. championi*. 43, Harpe and parapenis of *A. glabrata*. 44, Penis valve of *A. glabrata*. 45, Harpe and parapenis of *A. hansoni*. 46, Penis valve of *A. hansoni*.

hansoni Smith, **new species.** Costa Rica

Ametastegia hansoni Smith

Female.—Length, 6.5–7.0 mm. Antenna and head black; palpi brownish. Thorax black with posterior margin of pronotum, tegula, and spot on ventroposterior mesepisternum white. Abdomen usually blackish with apical and lateral margins of terga and apical sterna orange to reddish brown; sometimes mostly reddish brown with basal plates and apical 3 or 4 segments black; sheath black. Legs whitish to orange with bases of fore- and midcoxae, hind coxa except narrow apical margin, apical third or so of hindtibia, and tarsi blackish, always darker than rest of legs. Wings moderately, uniformly black infuscated; veins and stigma black. Antennal length about 2.75× head width. Malar space twice diameter of front ocellus; clypeus long, only about 2× broader than long; postocellar area 1.3× broader than long. Head between ocelli and antenna roughened and dull. Hindbasitarsus subequal in length to length of remaining tarsal segments combined. Lancet in Fig. 36.

Male.—Length, 5.5 mm. Similar to female but usually abdomen more orange with basal plates and apical 3 or 4 segments black, but variation occurs as in female. Genitalia in Figs. 45, 46.

Holotype.—♀, "Costa Rica: Heredia: Vara Blanca, Finca Georgina, 2100 m, VII-VIII-1990, P. Hanson (INBio).

Paratypes.—COSTA RICA: Same data as holotype (2 ♀, 8 ♂); same data except for dates, V–VI-1990 (2 ♂), IX-1989 (1 ♂), XI–XII-1989 (1 ♂), III–IV-1990 (1 ♂); Sta Clara, Reventazon [with folded label "La Palma, 1600 m, IV-1905, P. Biolley"] (1 ♀); San José, Zurqui de Moravia, 1600 m, IV-1995, P. Hanson (1 ♂), same except VI-1995 (1 ♀); Quebrada Segunda, P.N. Tapanti, 1250 m, Prov. Cartago, G. Mora, Jun. 1992, L-N 194000, 560000, Costa Rica INBIO CRI000374857 (1 ♂). Deposited at INBio, Universidad de Costa Rica, Washington.

Etymology.—Named for Paul E. Hanson, Universidad de Costa Rica, San José, who

has done extensive surveys in Costa Rica and provided considerable study material.

Remarks.—The characters outlined in the key separate this species from *A. championi*, the species with which it is most likely to be confused, and other *Ametastegia*. The dull, roughened area of the head between the ocelli and antennae is not found in other species treated here; all have this area is smooth and shining. Most specimens were taken in Malaise traps on the edge of a strip of forest remaining in a ravine.

mexicana (Cameron). Guatemala; Mexico (Durango, Hidalgo, Jalisco, México, Michoacán, Puebla, Morelos, Querétaro).

**Emphytus mexicanus* Cameron 1883: 35. ♀. "Mexico" (Genève, ♀).—Dalla Torre 1894: 119.—Konow 1905: 106.

Ametastegia mexicana: Smith 1972a: 258.—Smith 1979b: 87–88, figs. 159, 175–176 (description, distribution).

Female, male.—Length, female, 6.3–6.8 mm; male, 5.8–6.1 mm. Antenna and head black; labrum and maxillary and labial palpi brownish to whitish. Thorax black with posterior margin of pronotum white and tegula brownish to black. Legs mostly black with extreme apex of forefemur and all foretibia and foretarsus white; sometimes midtibia and base of hind tibia white. Abdomen and sheath black. Wings uniformly, lightly infuscated; veins and stigma black. Female lancet in Fig. 35; male genitalia in Figs. 39, 40.

Remarks.—This species is most likely confused with *A. articulata*. In *A. mexicana*, the legs are mostly black, whereas in *A. articulata* the coxae, trochanters, and basal portions of the femora are white. *Ametastegia articulata* has been seen only from Veracruz and Oaxaca. Most *A. mexicana* are from localities further west and south. The genitalia are very similar. Further collections may resolve the species status of *A. mexicana*.

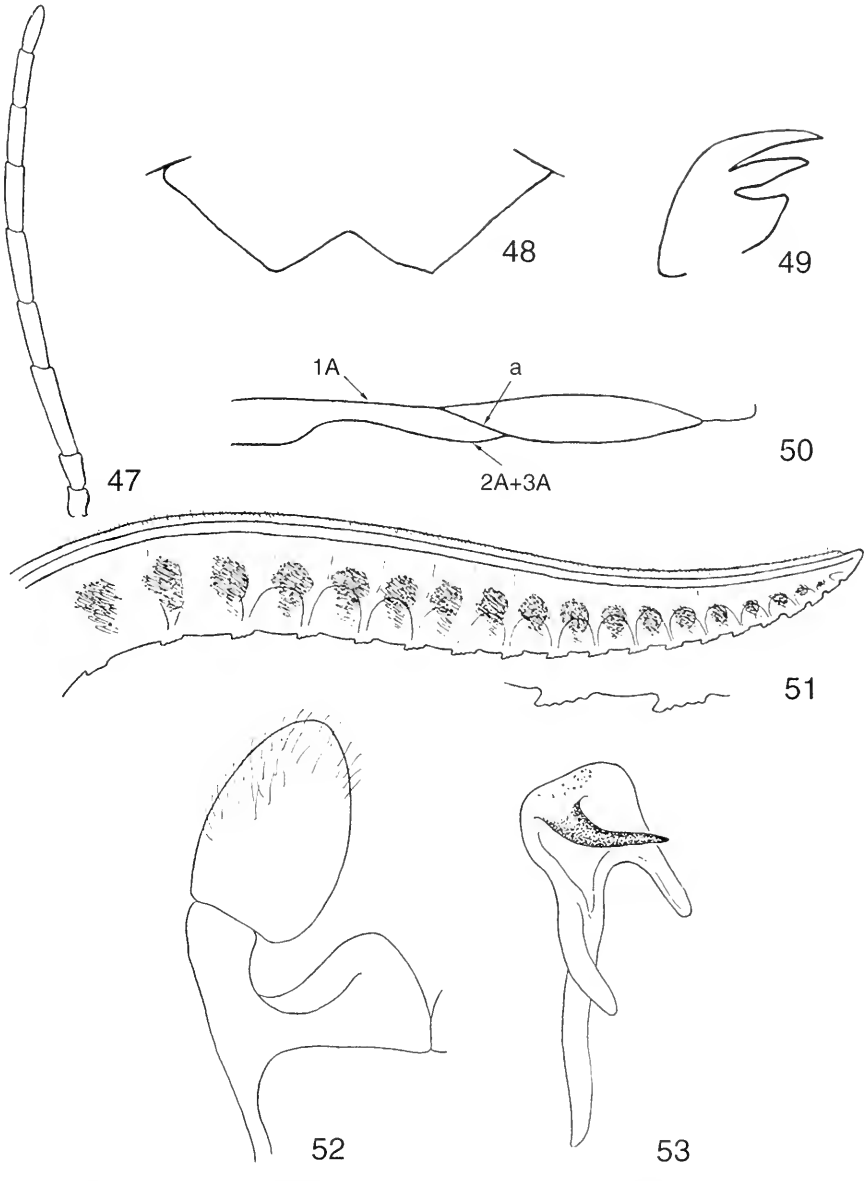
Three specimens are at Genève: a female labeled "Angang"; "TYPUS" [red]; "Emphytus mexicanus Cameron (Type)" [handwritten]; "Cameron exam."; a male labeled "Angang"; "S. nigredo var."; "Emphytus mexicanus Cam." [handwritten]; "Cameron exam."; and a male labeled "Strongyl. nigredo Norton" [handwritten]; "Angang." The specimen with the red "TYPUS" label is here designated lectotype to fix the identity of this species; this is the specimen stated by Smith (1979b) to be the holotype. The male labeled "Cameron exam" is a paralectotype. I am not certain Cameron examined the other male. The species was apparently confused with *Stomboceridea nigredo* (Norton) (Selandriinae).

Material examined.—GUATEMALA: Depto. Quiche, 14° 58.30'N, 91° 06.62'W, 5 km N. Chichicastenango, along Rio Xalbaqiej O Sepela, 1850 m, 20 May 1997, M. A. Metz, Schlinger Foundation Guatemala Expedition May 1997 (1 ♀; Eberswalde). MEXICO: I have seen specimens from Durango, Hidalgo, Jalisco, México, Michoacán, Puebla, Morelos, and Querétaro. See Smith (1979b, fig. 13) for specific localities. Few labels indicate elevation, but several specimens were taken at 8,500' which indicates this is a high elevation species. Collection dates are in April, May, July, August, and September, indicating several generations a year similar to Nearctic species of *Ametastegia*.

Genus *ANTHOLCUS* Konow

Antholcus Konow 1904: 3–4. Type species: *Tenthredo varinervius* Spinola. By monotypy.

Description.—Antenna slender, with 1st and 2nd segments each longer than broad; 3rd segment slightly longer than 4th segment; segments beyond 3rd gradually decreasing in length (Fig. 47); apical segments without ventral membranous areas. Clypeus with shallow V-shaped central emargination, not exceeding a third medial length of clypeus (Fig. 48); each mandible bidentate; malar space less than half diameter of front ocellus; genal carina ab-



Figs. 47–53. *Antholcus varinervius*. 47, Antenna. 48, Clypeus. 49, Tarsal claw. 50, Anal area of forewing. 51, Female lancet. 52, Male harpe and parapenis. 53, Male penis valve.

sent; eyes slightly converging below, lower interocular distance greater than eye length; postocellar area as long as broad. Tarsal claw bifid, inner tooth subequal in length to outer tooth, with acute basal lobe almost appearing as a 3rd tooth (Fig. 49); hind basitarsus slightly shorter than following segments combined; pulvilli on hind tarsal segments 1–4. Forewing with anal crossvein (a) oblique (Fig. 50); vein 2A+3A sometimes partially atrophied basal to junction of crossvein (variable in the single species). Hind wing with cell M present, cell Rs absent; anal cell petiolate, length of petiole subequal to greatest width of cell; apex of radial cell close to apical margin of wing; male with peripheral vein.

Remarks.—The shallowly emarginated clypeus, lack of a genal carina, bifid tarsal claws with a basal lobe, and bidentate mandibles will separate *Antholcus* from other Allantinae. The distinct oblique anal crossvein places *Antholcus* in the Allantinae, but it is most likely confused with *Trichotaxonus* of the Blennocampinae because of similar coloration. *Trichotaxonus* has the apex of the abdomen black, has long flexuous hairs on the head and thorax, and the anal crossvein of the forewing is absent or represented by a very short perpendicular vein. Smith (1973b) distinguished the two genera.

A single species occurs in central Chile and adjacent Argentina.

Species

varinervius (Spinola). Argentina (Chubut, Neuquén, Río Negro); Chile (Arauco, Cautin, Colchaqua, Concepción, Coquinbo, Curicó, Llanquihue, Linares, Malleco, Maule, Osorno, Santiago, Talca, Valdivia, Valparaiso).

Tenthredo varinervius Spinola 1851: 558–560. ♂. No locality. (Torino).

Mesoneura (♂) *varinervia*: Kirby 1882: 157, 397.

Antholcus varinervius: Konow 1904: 3 (*varinervis*).—Konow 1905: 100 (*varinervis*).—Enderlein 1920: 370 (*varinervis*).—Smith 1973b: 402–403, 407, Figs. 2, 5, 6, 8, 14 (separation from other genera of Tenthredinidae in Chile; type).—Smith 1979b: 10.—Smith and Pérez 1995: 105.

Zarca chilensis: Brèthes 1919: 51–52 (wing, fig. 12; ♀ only, ♂ is *Trichotaxonus coquimbensis* (Spinola) [Blennocampinae]).

Host plants.—A label on one specimen reads "*Crinodendron patagua.*" [*Crinodendron patagua* Molina; Tiliaceae]; another specimen was swept from *Baccharis* sp. (Asteraceae). Neither may be the true food plant. For references to "*Antholcus varinervis*" as a feeder on *Acaena* spp. (Rosaceae) and importation into New Zealand, see *Ucona acaenae* Smith (Blennocampinae) (Smith 1973b).

Female, male.—Length, female, 7.7–8.5 mm; male. 6.8–7.8 mm. Antenna and head black. Thorax black. Legs black with tibiae and tarsi orange. Abdomen orange. Wings moderately, uniformly infuscated; veins and stigma black. Female lancet in Fig. 51; male genitalia in Figs. 52, 53.

Remarks.—This species may be confused with *Trichotaxonus coquimbensis* (Spinola) (Tenthredinidae: Blennocampinae) because both are about the same size and color and have similar distributions. Other than differences in the subfamilies, *A. varinervius* has the head and thorax covered with short, straight hairs, shorter than the first antennal segment, and *T. coquimbensis*, has the head and thorax covered with long, flexuous hairs, longer than the first antennal segment and about as long as the first two antennal segments.

I could not locate Spinola's type. The interpretation is based on Spinola's description and the interpretation by Smith (1973b).

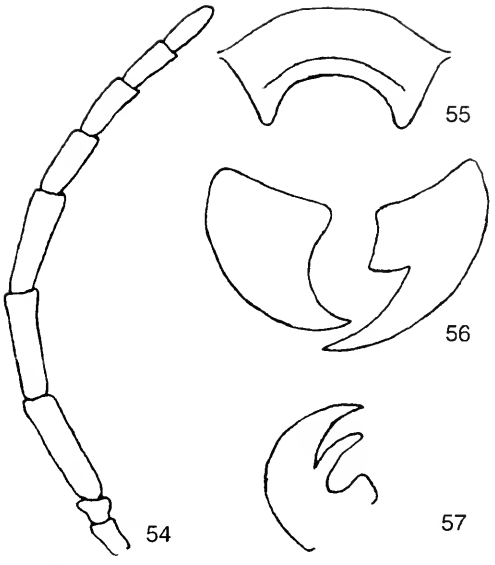
Material examined.—ARGENTINA: Largo Puelo, Chubut; Pucare, Neuquén; Llao Llao, Rio Negro; Bariloche, Rio Negro; El Bolson, Río Negro; Correntuso, Rio Negro; Cordoba, Fundo Malcao (province). CHILE: Many specimens from Coquimbo in the north, south to Llanquihue. I have seen specimens from the provinces of Arauco, Cautín, Colchaqua, Concepción, Coquinbo, Curicó, Llanquihue, Linares, Malleco, Maule, Osorno, Santiago, Talca, Valdivia, and Valparaiso. All specimens were collected from October to November.

Tribe ALLANTINI

Genus *MACREMPHYTUS* MacGillivray

Macremphytus MacGillivray 1908: 368. Type species: *Harpiphorus varianus* Norton. Orig. desig.

Description.—Antenna long, flagellum laterally compressed, each segment slightly expanded at its apex; 2nd segment as broad or broader than long; 3rd segment subequal to or slightly longer than 4th segment; segments beyond 4th gradually



Figs. 54–57. *Macremphytus testaceus*. 54, Antenna. 55, Clypeus. 56, Mandibles. 57, Tarsal claw.

decreasing in length (Fig. 54); without ventral membranous areas on apical segments. Clypeus circularly emarginate, emargination half or more its median length, with transverse ridge on anterior margin (Fig. 55); malar space equal to or greater than diameter of front ocellus; genal carina present to top of eye; left mandible with large subapical tooth, right mandible simple (Fig. 56). Meseipisternum rough to punctate. Tarsal claw with long inner tooth, nearly as long as outer tooth, and with acute basal lobe (Fig. 57); hind basitarsus longer than remaining tarsal segments combined; pulvilli on tarsal segments 1–4. Forewing with anal crossvein oblique, 1st cubital crossvein (Rs) absent, thus with three cubital cells. Hindwing with cell M present, cell Rs absent; anal cell petiolate, petiole short; male without peripheral vein in hind wing.

Remarks.—This is an exclusively Nearctic genus. Smith (1979b) included four species, and Koch (1988) added another from Texas and Mexico. Larvae of the eastern North American species feed on *Cornus* spp. (Cornaceae).

One specimen of *Macremphytus testaceus* (Norton), a species found in eastern Canada and United States, is labeled "Santiago de Cuba." The specimen is probably mislabeled.

Species

albitegularis Koch. Mexico; U.S.A. (Texas)

**Macremphytus albitegularis* Koch 1988: 200–201, figs. 1–3. ♀. "Dallas, Texas" (Berlin, ♀).

Remarks.—I have examined the holotype and paratype. The holotype is labeled "21308," "Dallas, Texas, Boll." [green], "Holotype" [red], and the paratype "14178." "Mexico, Koppe S." [green], "Paratype" [red], both with name labels. The holotype has the basal half of the hind femur white and the basal two-thirds of the hind tibia white, whereas the paratype has almost the entire hind femur black and only the basal third of the hind tibia white. However, eastern North American species show similar color ranges.

The almost entirely black color of *M. albitegularis* is similar to that of *M. tarsatus* (Say) of eastern North America, including Texas, but it is separated from *M. tarsatus* by the flat serrulae of the lancet (Koch 1988, figs. 2, 3) versus the deeper and more rounded serrulae of *M. tarsatus* (Smith 1979b, fig. 244). The flat serrulae resemble those of *M. testaceus* (Norton) as illustrated by Smith (1979b, fig. 245). *Macremphytus albitegularis* may be a synonym of *M. tarsatus*, but I prefer to list it separately until taxonomic problems in the genus are resolved.

Genus *PROBLETA* Konow

Probleta Konow 1908a: 86; 1908b: 161. Type species: *Probleta collariatus* Konow. By monotypy.

Probleta subg. *Epiprobleta* Malaise 1949: 24. Type species: *Epiprobleta bicoloratus* Malaise. Orig. desig. Described as a subgenus of *Probleta*, but "*Epiprobleta bicoloratus*" given as type species.

Protoprobleta Malaise 1949: 24, 30. Type species: *Protoprobleta fulvoniger* Malaise. Orig. desig. **New synonymy.**

Description.—Antenna slender, filiform, 1st and 2nd segments longer than broad; 3rd segment longer than 4th segment; apical 4 segments reduced in length, together slightly longer than 3rd segment (Fig. 59); apical 4 segments with ventral membranous areas. Clypeus deeply, circularly emarginate, emargination half or more medial length of clypeus, commonly almost to base of clypeus (Figs. 66, 68, 70, 72, 74, 76–78); labrum truncate and depressed, as broad as or broader than long, its base usually not covered by clypeus (see Figs. of clypeus); mandibles asymmetrical, left mandible with two large subbasal teeth, right mandible with two small subbasal teeth; genal carina absent; malar space linear. Tarsal claw with long inner tooth, slightly shorter than outer tooth and lateral to and appressed to outer tooth, the teeth not on a linear plane with the basal lobe; with acute basal lobe sometimes appearing as a third tooth (Fig. 60), or in three species claws trifid without basal lobe (Fig. 61); hind basitarsis subequal to or longer than length of following tarsal segments combined; pulvilli present only on tarsal segments 3 and 4. Forewing (Fig. 58) with anal crossvein (a) oblique; first cubital crossvein (Rs) present, thus with four cubital cells. Hind wing (Fig. 58) with anal cell sessile; cell M usually present (absent in one species) and cell Rs absent; male with peripheral vein.

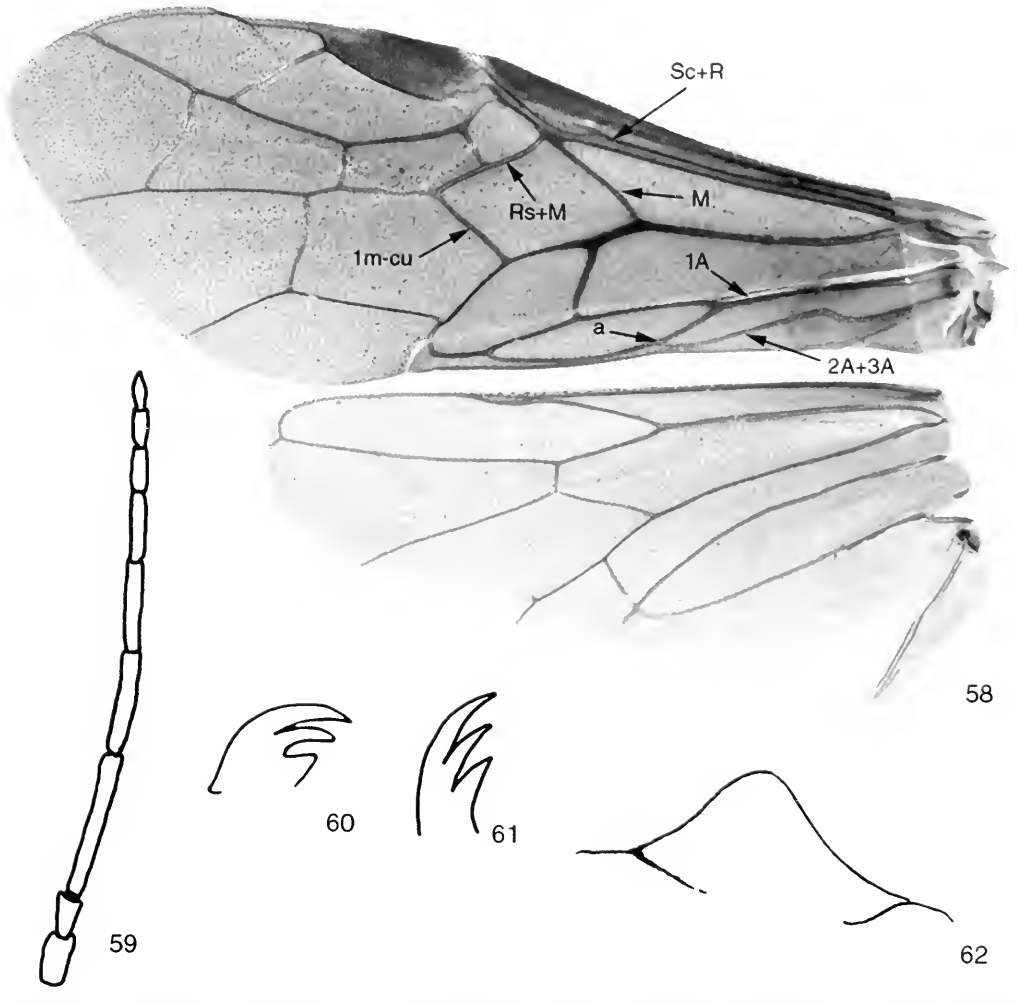
Remarks.—The deeply cleft clypeus and broad truncate labrum will separate *Probleta* from other genera of Allantinae. The subgenus *Epiprobleta* was described for one species, *E. bicoloratus,* which lacks cell M in the hind wing. Other than this, there is no basis for its recognition. Malaise (1963) retained it as a subgenus though he questioned the absence of M as a constant character. *Protoprobleta* was established by Malaise because of the slightly longer labrum, about as broad as long, the base of the labrum covered by the clypeus, the clypeal emargination only about half the medial length of the clypeus, shorter teeth of the left mandible, and more rounded basal lobe of the tarsal claw. He included two species, *P. fulvoniger* and *P. niger.* I do not believe these characters are sufficient to recognize it as a separate genus since there is variation in other species in the depth of the clypeal emargination, length of the labrum, and length of the teeth of the left mandible.

Konow (1908a, b) described several species of *Probleta,* and Rohwer (1911) designated *P. langei* Konow as type species. *Probleta,* however, was established with a single species, *collariatus,* on page 86 (1908a), and the description as a new genus with three new species, including *P. langei,* appeared two months later in the same journal (1908b). Thus, the genus is monotypic and the designation by Rohwer (1911) is incorrect.

Enderlein (1920) gave the type species of "*Netrocerus*" (emendation or error for *Netroceros* Konow, 1896, an African genus) as the Brazilian species *N. bilanx* Konow. This is an error because Rohwer (1911) had already designated the type species of *Netroceros* Konow as *Eriocampa* (*Netroceros*) *rufiventris* Konow from Africa.

Probleta is a rather large Neotropical genus that occurs from Mexico south to Peru and Brazil. Forsius (1925) and Malaise (1949) gave keys to species. A number of species are known only from one or several specimens, and more material is needed to determine extent of color variation and its stability for species distinction. For the material at hand, however, color appears relatively stable. I include 24 species in this genus, mostly from Brazil, Bolivia, Peru, and Paraguay. One species, *P. columbiana,* occurs as far north as southern Mexico, and another, *P. decorata,* in Costa Rica.

Other than color, characters for species include the antenna, head shape from above, clypeus, labrum, tarsal claws, female lancets, and male genitalia. The antennae of all species are of similar shape (Fig. 59) but the relative lengths of the



Figs. 58–62. *Probleta*. 58, Forewing and hind wing of *P. bicolor*. 59, Antenna of *P. bilanx*. 60, Tarsal claw of *P. bicolor*. 61, Tarsal claw of *P. nigropunctata*. 62, Sice view of mesoscutellum of *P. decorata*.

third and last four segments differ. The head from above may be narrow and rounded or broad behind the eyes, and the shape of the postocellar area differs. The clypeus has varying degrees in the depth of the emargination and the shape of the lateral lobes may differ. The labrum is of different shapes, and sometimes the base is exposed due to the depth of the clypeal emargination. Most species have the tarsal claws bifid with a basal lobe, but in three species, *P. nigropunctata*, *P. nicklei*, and *P. siccva*, the basal lobe is modified into an acute tooth, thus the claws are trifid, without a basal lobe. Differences in the female lancet (Figs. 79–90) appear to be good for species diagnosis. The shape of the male genital capsule and penis valve differ for those species examined. The penis valve of all species has some type of lateral spine.

Concerning the gender of the genus, Konow (1908a) stated "masculini generis," but *Probleta* must be feminine of the Greek word *probletos*, and it is therefore treated as feminine here.

KEY TO SPECIES OF *PROBLETA*

1 Wings yellow, sometimes with apices beyond stigma infuscated; basal half or more of stigma yellow to orange 2
– Wings clear or infuscated, not yellowish or bicolored; stigma dark brown to black 8

2 Mesoscutellum raised into a high conical projection (Fig. 62); thorax with mesonotum, mesopleuron, and mesosternum black (lancet similar to Fig. 82; male genitalia in Figs. 95, 96) ..... ***decorata*, new species**
– Mesoscutellum low, rounded to flat; thorax entirely orange yellow or orange yellow with mesoprescutum and mesosternum black 3

3 Legs orange, only apical 2 or 3 tarsal segments black (head and mouthparts black, wings distinctly infuscated apical to stigma; lancet in Fig. 79) ..... ***bilanx* (Konow)**
– Hind tarsus entirely black and apex of hind tibia may be black 4

4 Apex of hind tibia black 5
– Hind tibia entirely yellow to orange 6

5 Clypeus, labrum, and palpi white; postocellar area slightly longer than broad; head from above broad behind eyes (Fig. 73) lancet in Fig. 80, serrulae flat ..... ***grossoensis*, new species**
– Mouthparts black as rest of head; postocellar area broader than long; head from above narrowing behind eyes (Fig. 71); lancet in Fig. 81, serrulae rounded ..... ***gracilicornis* Konow**

6 First two antennal segments, antennal crests, supraclypeal area, and mouthparts pale orange to yellow; hind basitarsus longer than following tarsal segments combined ..... ***frenata* Konow**
– Antenna and head black, mouthparts brownish or black, labrum may be whitish; hind basitarsus subequal in length to following tarsal segments combined 7

7 Wings uniformly yellow, apices not noticeable infuscated; labrum brownish; antennal crests low, far apart, separated by distance about equal to breadth of one (Fig. 67); lancet in Fig. 82, long and slender ..... ***corana*, new species**
– Wings distinctly infuscated apical to stigma; labrum white; antennal crests high, close together, separated by distance less than breadth of one (similar to Fig. 69); lancet in Fig. 83, short and broad ..... ***columbiana* (Enderlein)**

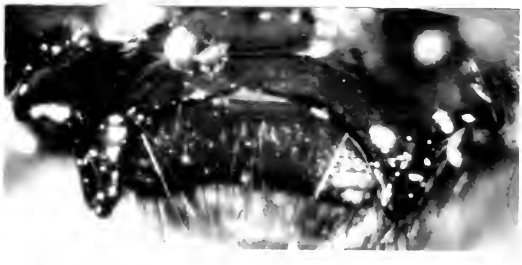
8 Thorax entirely yellow or orange, without black markings 9
– Thorax partly or entirely black 17

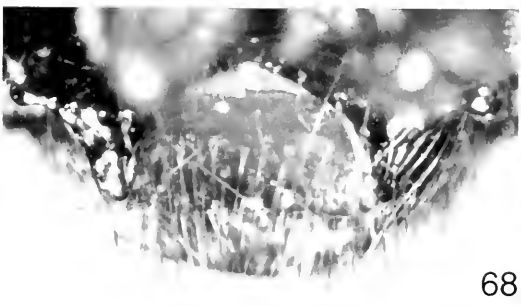
9 Hind wing with cell M absent; abdomen black, with basal sterna whitish (postocellar area longer than broad; basal ⅓ of hind tibia pale orange) ..... ***bicolorata* Malaise**
– Hind wing with cell M present; basal 1 or 2 abdominal segments or more entirely pale yellow to orange 10

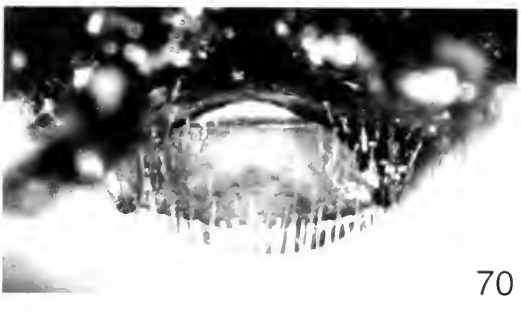
10 Hind tibia orange or with basal ⅓ to ⅔ orange and apically black 11
– Hind tibia entirely black 14

11 Only extreme apex of hind tibia ringed with black or apical ⅓ of hind tibia black on outer surface (lancet in Fig. 84; male genitalia in Figs. 93, 94; abdominal segments 5 to apex black) ..... ***wygodzinskyi* Malaise**
– Apical ¼ or more of hind tibia black 12

12 Clypeal emargination shallow, about half medial length and labrum as long as broad, its base covered by clypeus (similar to Fig. 77); apical ⅔ of hind tibia black ..... ***fulvoniger* (Malaise)**
– Clypeal emargination nearly to base of clypeus and labrum broader than long, its base







Figs. 63–70. *Probleta* spp., views of head and clypeus and labrum. 63, *P. collariata*, dorsal. 64, *P. nigropunctata*, dorsal. 65, *P. bicolor*, dorsal. 66, *P. bicolor*, clypeus and labrum. 67, *P. corana*, dorsal. 68, *P. corana*, clypeus and labrum. 69, *P. decorata*, dorsal. 70, *P. decorata*, clypeus and labrum.

exposed, not covered by clypeus (similar to Figs. 70, 72); apical ⅓ of hind tibia black 13

13 Small, about 7 mm long; head from above narrowing behind eyes, as in Fig. 63; Bolivia, Peru ..... ***disiunctiva* (Konow) (in part)**
– Larger, about 10 mm long; head from above broad behind eyes, as in Fig. 67; Brazil (Rio de Janeiro) (lancet in Fig. 85, with serrulae deep, rounded) ..... ***shannoni*, new species**

14 Clypeal emargination shallow, about half medial length of clypeus and labrum as long as broad, its base covered by clypeus (similar to Figs. 77, 78); tarsal claws with 3 teeth, without basal lobe (Fig. 61) 15
– Clypeal emargination nearly to base of clypeus and labrum broader than long, its base exposed, not covered by clypeus (similar to Figs. 70, 72); tarsal claws with 2 teeth and basal lobe (Fig. 60) 16

15 Head from above strongly narrowing behind eyes, similar to Fig. 63 (male genitalia in Figs. 103, 104); female unknown ..... ***nicklei*, new species**
– Head from above broad behind eyes, similar to Fig. 64 (lancet in Fig. 90); male unknown ..... ***siceva*, new species**

16 Terga black with basal plates and small spot on 2nd tergum pale orange; antenna slender, 6th segment 3× longer than broad ..... ***usta* Forsius**
– Basal segments of abdomen orange, segments 4, 5, or 6 to apex black; antenna stout, 6th segment about 2× longer than broad (lancet in Fig. 86; male genitalia in Figs. 99, 100) (head in Fig. 65; clypeus and labrum in Fig. 66) ..... ***bicolor* (Kirby)**

17 Clypeal emargination shallow, about half its medial length and labrum as long as broad, its base covered by clypeus (Fig. 77); thorax orange with mesoscutellum and metascutellum black ..... ***mazona*, new species**
– Clypeal emargination nearly to base of clypeus and labrum broader than long, its base exposed, not covered by clypeus (similar to Fig. 76); thorax with different combination of color 18

18 Thorax yellow orange, with only triangular spot on mesoprescutum and sometimes paired spots on mesosternum black (mid- and hind tibiae and tarsi black) 19
– Thorax with more black, usually part of mesepisternum or most of mesonotum or lobes of mesonotum black; mesosternum and lower ½–⅔ mesopleuron black in *albiventris* 20

19 Mesosternum pale orange; head from above narrow behind eyes (similar to Fig. 63); tarsal claws with 2 teeth and basal lobe (Fig. 60) (male genitalia in Figs. 107, 108) ..... ***disiunctiva* (Konow) (in part)**
– Paired black spots on mesosternum; head from above broad behind eyes (Fig. 64); tarsal claws with 3 teeth (Fig. 61) (lancet in Fig. 87; male genitalia in Figs. 97, 98) ..... ***nigropunctata* Malaise**

20 Thorax and abdomen black; clypeal emargination about half medial length of clypeus and labrum about as broad as long, its base covered by clypeus, similar to Fig. 77 (legs with femora, fore- and midtibiae, and basal ⅓ hind tibia orange) ..... ***niger* (Malaise)**
– Thorax and/or abdomen partly yellow or orange; clypeal emargination nearly to base of clypeus and labrum broader than long, its base not covered by clypeus, similar to Fig. 70 21

21 Seven basal abdominal segments and basal half of hind tibia pale orange; mesopleuron with paired black spots (mesonotum black in male, but anterolateral corners of mesoprescutum pale orange in female) ..... ***langei* Konow**
– Abdominal dorsum black or at least some black marking on lateral areas of 7 basal abdominal terga, and hind tibia either entirely black or basal third or half or more white

to pale orange; mesopleuron black with usually only upper corner of mesopleuron pale orange 22

22 Hind tibia and tarsus entirely black 23
– Hind tibia with basal third or half pale orange and apical half or ⅔ black, or only extreme apex black 24

23 Abdominal terga entirely black; mesonotum black or black with posttergite and small spots on anterolateral corners of prescutum and laterally on lateral lobes yellow orange; antennal crests low and far apart, separated by distance equal to breadth of one (Fig. 63); lancet in Fig. 88, with serrulae shallow; male genitalia in Figs. 105, 106 (abdomen black with venter and sometimes margin white to yellow; apical margins of segments white) ..... ***collariata*** **Konow**
– Basal 5 abdominal terga with lateral black spots; V-shaped mark on mesoprescutum, lateral edges of lateral lobes, posttergite and scutellum pale in male only; antennal crests high and close together, separated by distance of less than breadth of one (Fig. 64); lancet in Fig. 89, with serrulae deeper; male genitalia in Figs. 91, 92 ..... ***malaisei*****, new species**

24 Femora blackish, paler toward tibiae; tarsi blackish with indistinct pale orange ring on basal ⅓ of basitarsi; mesonotum orange; abdomen black above, venter white except for apical sternite and sheath ..... ***albiventris*** **Malaise**
– Femora pale orange; hind tarsus black except at base of basitarsus, only 3rd and 4th fore- and midtarsal segments blackish; mesonotum black with only V-mark on prescutum, posttergite, and metapleuron pale orange; abdomen black, basal 2 or 3 sterna paler to dark orange ..... ***sahlbergi*** **Malaise**

Species

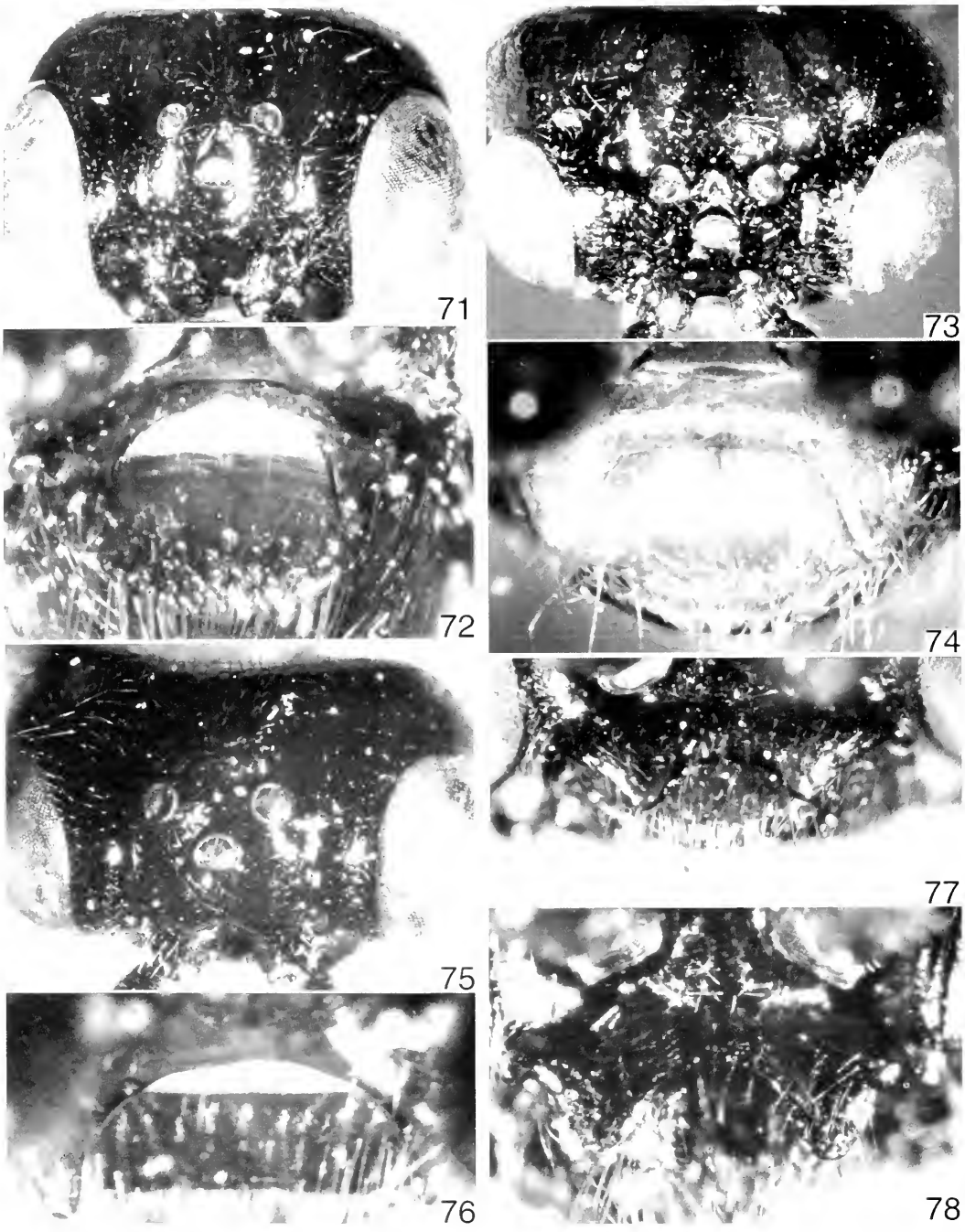
albiventris Malaise. Brazil (Bahia, Minas Gerais).

**Probleta albiventris* Malaise 1949: 30, fig. 7D. ♀. "Brazil (Bahia)" (Stockholm, ♀).—Smith 1979b: 11.

Female.—Antenna, head, and mouthparts black. Thorax orange; metanotum around cenchri blackish; mesosternum to lower half to two-thirds of mesepisternum black, upper third to half of mesepisterum and entire mesonotum orange except downturned lateral areas of lateral lobes blackish. Legs with coxae dark orange to blackish at bases; trochanters whitish; femora blackish, whitish at extreme apices; tibiae whitish, apical tip of hind tibia black; tarsi black with basal third or so of basitarsi orange. Abdomen black above, white below, white on venter extends to lateral areas of terga, from above appearing as a lateral white line; white on sterna extends to base of sheath. Wings very lightly uniformly infuscated; veins and stigma black. Antennal length about 1.5× head width; 6th segment 2.0× longer than broad. Clypeus with deep circular emargination for nearly ¾ medial length of clypeus, labrum 2.0× broader than long, with base exposed. Eyes small, lower interocular distance slightly longer than eye length; head from above broad behind eyes; antennal crests large, distance between them less than width of one (similar to Fig. 64). Hind basitarsus subequal in length to remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M.

Remarks.—Characteristic color features are the black dorsal and white ventral color pattern of the abdomen and the orange thorax with the black mesosternum and lower two-thirds of the mesepisternum.

Malaise described this species from "1 ♀." The holotype is labeled "Museum Paris, Brésil, Bahia, (ex. coll. A. David) R.



Figs. 71–78. *Probleta* spp., views of head and clypeus and labrum. 71, *P. gracilicornis*, dorsal. 72, *P. gracilicornis*, clypeus and labrum. 73, *P. grossensis*, dorsal. 74, *P. grossensis*, clypeus and labrum. 75, *P. malaisei*, dorsl. 76, *P. malaisei*, clypeus and labrum. 77, *P. mazona*, clypeus and labrum. 78, *P. nickleri*, clypeus and labrum.

Oberthur 1903"; "TYPUS" [red]; "Probleta albiventris type n. sp. Malaise det. 1947."

Material examined.—BRAZIL: Bahia (holotype); Araguari, MG, 1-X-1931, R. Spitz leg. (1 ♀; at Museu de Ciencias Naturais, Porto Alegre, RS, Brazil).

bicolor (Kirby). Brazil (Rio de Janeiro, Santa Catarina)

**Siobla bicolor* Kirby 1889: 142. ♀. "Theresopolis, Brazil" (London, ♀).—Dalla Torre 1894: 63.
Encarsioneura bicolor: Konow 1905: 119.
Probleta bicolor: Malaise 1949: 26–27.—Smith 1979b: 11.

Female, male.—Length, 7.8–8.2 mm. Antenna and head black. Thorax orange. Legs orange with segments 3 and 4 of fore- and midtarsi and hind tibia and hind tarsus black. Abdomen orange with segments 5 or 6 to apex and sheath black in female, abdominal dorsum blackish or blackish from tergum 3 to apex in male. Wings uniformly infuscate; veins and stigma black. Antennal length 1.5× head width; apical 4 antennal segments together 1.2× length of 3rd segment; 6th to 8th segments each about 2.0× longer than broad. Anterior margin of clypeus deeply circularly emarginated for about ¾ of its medial length, lateral lobes narrow and far apart (Fig. 66); anterior margin of labrum truncate, labrum about 3.0× broader than long, with base exposed (Fig. 66). Head from above narrowing behind eyes (Fig. 65); lower interocular distance subequal to eye length; postocellar area about as long as broad; antennal crests low and far apart, separated by distance greater than breadth of one (Fig. 65). Hind basitarsus subequal in length to length of remaining tarsal segments combined. Tarsal claws with basal lobe. Hindwing with cell M. Female lancet in Fig. 86, with serrulae very deep on about apical third, shallower on basal two-thirds; male genitalia as in Figs. 99, 100.

Remarks.—The holotype female is BM type #1.242, labeled "Siobla bicolor type," "Theresopolis 88-137."

Material examined.—BRAZIL: Theresopolis (holotype); Nova Teutonia, Santa Catarina: III-1948 (1 ♂); II-19-1956 (1 ♀); 25 Dec. [♂] 1962 (1 ♂); X-17-1964 (2 ♂); Feb. 1965 (2 ♂); Feb. 1966 (1 ♀, 1 ♂); X-1966 (1 ♀); XI-68 (1 ♂); III-1970 (2 ♀); May 7, 1977 (1 ♀); no date (1 ♀) (at Washington).

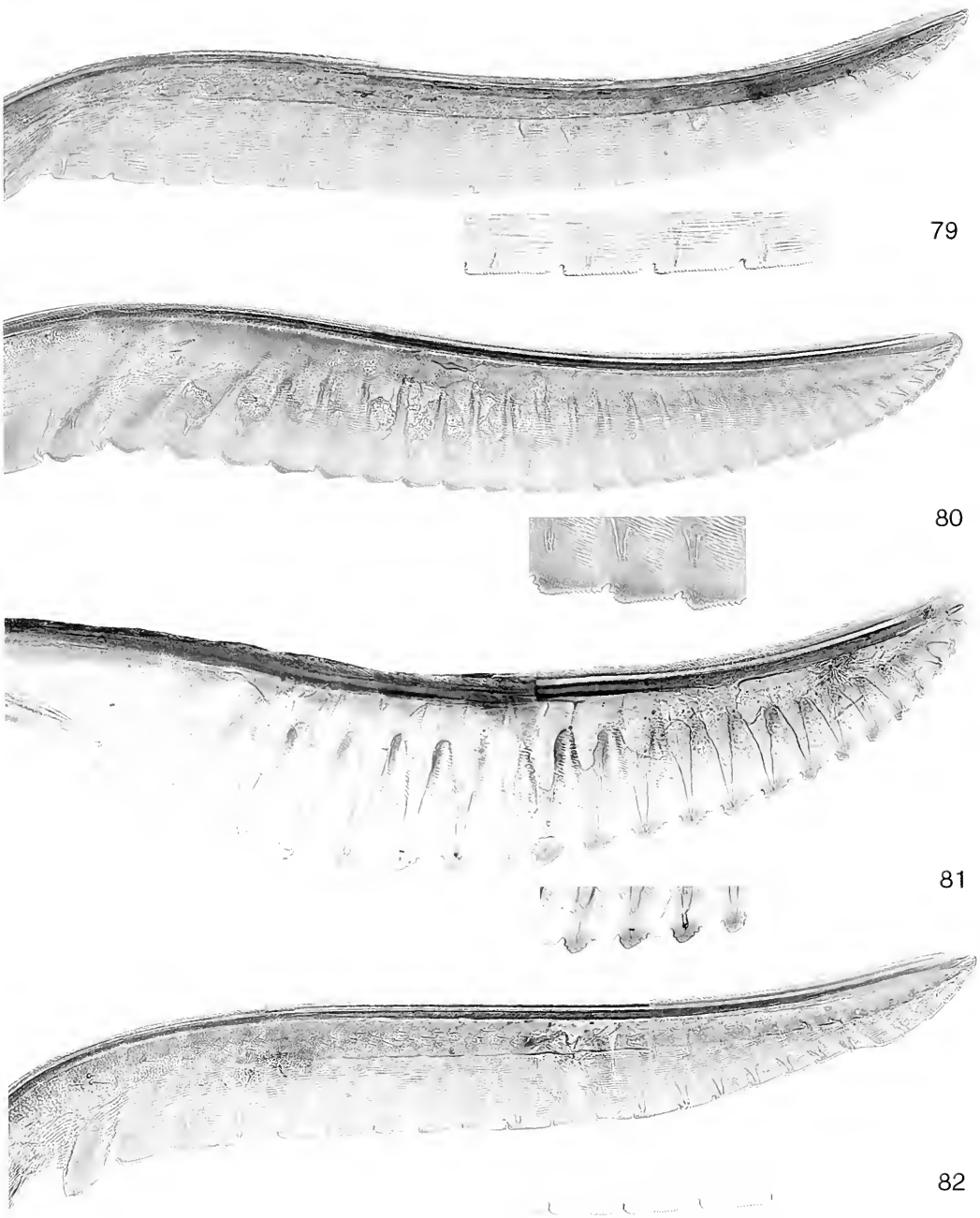
bicolorata Malaise. Brazil (São Paulo)

**Probleta bicolorata* Malaise 1949: 28, fig. 6E, 7B. ♀. "Brazil (Santos)" (Stockholm, ♀).—Smith 1979b: 11.

Female.—Antenna, head, and mouthparts black. Thorax orange. Legs orange with tip of midtibia; most of hind tibia except about basal third orange on outer surface and basal half on inner surface, mid- and hind tarsi except extreme base of basitarsi, and apical 3 segments of foretarsus black. Abdomen black with basal sternum whitish, center of basal plates suffused with paler dark orange. Wings lightly, uniformly infuscated; veins and stigma black. Antennal length 1.5× head width; 6th segment 2.0× longer than broad. Clypeus deeply, circularly emarginated for about ¾ its medial length; larbum with base exposed. Head from above broad behind eyes; postocellar area longer than broad; lower interocular distance about 1.2× eye length. Basal lobe of tarsal claw small, rounded. Hind basitarsus slightly longer than length of remaining tarsal segments combined. Hind wing without cell M.

Remarks.—This is the only known species of *Probleta* that lacks cell M in the hind wing though this may not be a constant character, as Malaise (1963) stated. Another characteristic is the basal lobe of the tarsal claw, which is smaller and not as acute as in most other species of *Probleta*.

Malaise described this species from "1 ♀." The holotype is labeled "Ilha Santo Amaro, nr. Santos, Brazil, G.E. Bryant, 27-IV-1912"; "coll. Malaise"; "TYPUS" [red]; folded label "Probleta bicolor Kby, Malaise dt. 1933" and on reverse "Type has:



Figs. 79–82. *Probleta*, female lancets. 79, *P. bilanx*. 80, *P. grossensis*. 81, *P. gracilicornis*. 82, *P. corana*.

one closed middle cell, postocellar area trifle wider than l, latr. fur. interrupt. middle"; "Epiprobleta n. gen. bicolorata n. sp. Malaise det 1947." I have not seen other specimens.

bilanx (Konow). Bolivia ?; Brazil (Paraná, Rio Grande do Sul, Santa Catarina); Paraguay.

**Eriocampa bilanx* Konow 1896: 51. ♀. "Brazil (Rio Grande do Sul)" (Eberswalde, ♀).—Ko-

now 1901: 66 (Bolivia).—Oehlke and Wudowenz 1984: 369 (holotype).

Netroceros bilanx: Konow 1905: 101.

Probleta bilanx: Konow 1908b: 161.—Forsius 1925: 27.—Malaise 1949: 26.—Smith 1979b: 11.

Female.—Length, 8.0–10.0 mm. Antenna, head, and mouthparts black. Thorax orange. Legs orange with apical 2 segments of foretarus and apical 3 segments of mid- and hind tarsus black. Abdomen orange with apical 3 segments and sheath black. Forewing yellow with apex beyond apex of stigma black; veins and stigma yellow in yellow area, black in black apex; hind wing yellowish with apex slightly darker to blackish. Antennal length about 1.6× head width; apical 4 segments 1.4× length of 3rd segment; 6th segment 2.0× longer than broad. Clypeus deeply emarginated for about ¾ of its medial length; lobes narrow, rounded at apices; labrum about 2.2× broader than long, exposed at base, anterior margin truncate. Head from above somewhat narrowing behind eyes (similar to Fig. 64); postocellar area subquadrate, about as long as broad; lower interocular distance subequal to eye length; antennal crests low, rounded, distance between them about equal to width of one. Hind basitarsus subequal in length to length of remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M. Female lancet in Fig. 79, with serrulae flat.

Remarks.—The coloration is close to *P. columbiana* which also has flat serrulae on the lancet, but those of *P. bilanx* are more distinct from each other.

Konow did not state how many specimen he had. The lectotype, here designated to fix the identity of the species, is the female at Eberswalde labeled "Rio-Grande do Sul, Brasil," "Coll. Konow," "Holotypus" (red), "Probleta bilanx Knw., Brasil.," "Typus" (red).

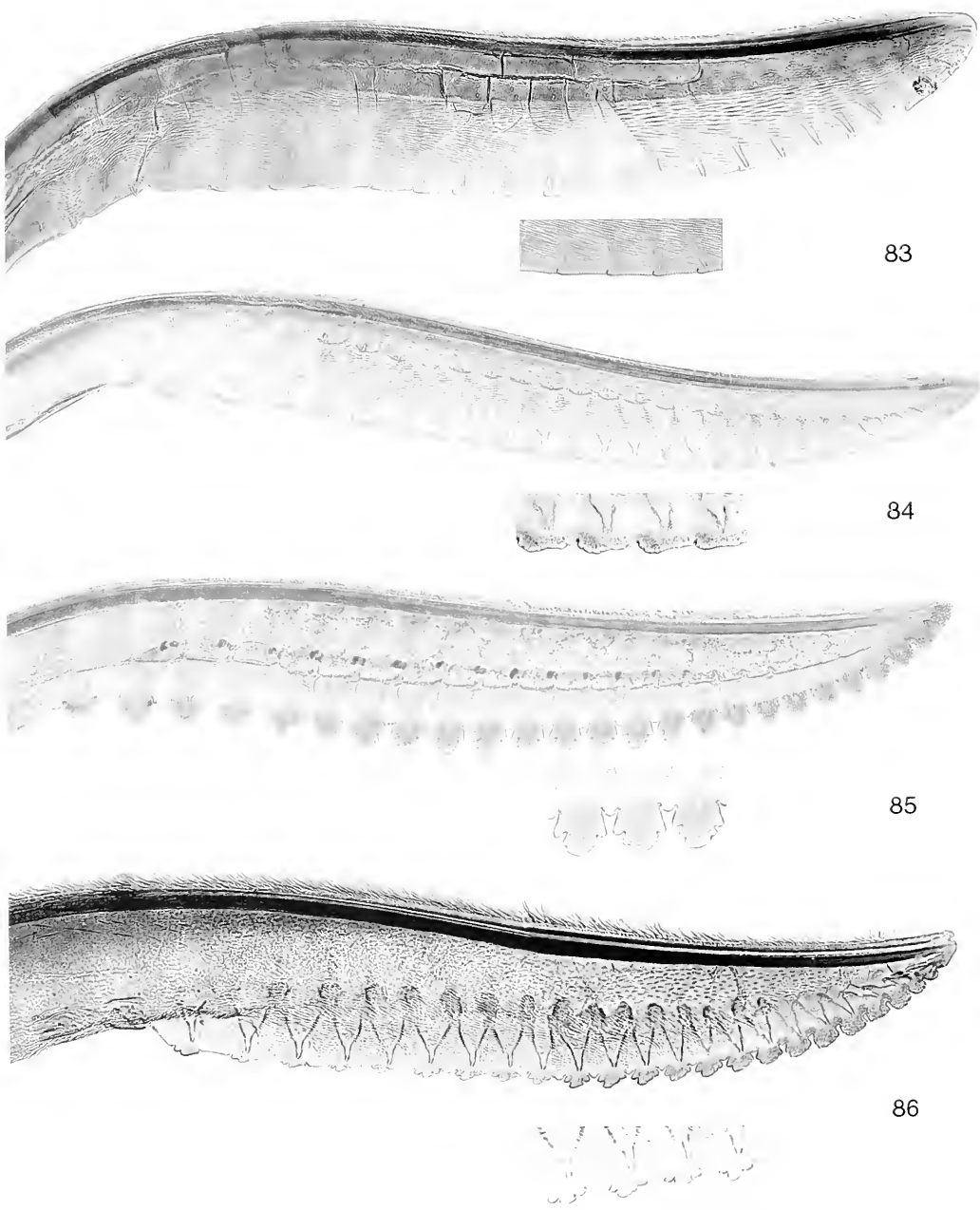
The record from Bolivia is from Konow (1901).

Material examined.—BRAZIL: Rio Grande do Sul (lectotype); Campina Grande nr. Curitiba, Brazil, II-19-66 (1 ♀, Townes Coll.). PARAGUAY: Dpto. Paraguarí: Parque Nacional Xbycuí, X.3.1984, R.T. Bonace (1 ♀, Asuncion).

collariata Konow. Brazil (Espirito Santo, Minas Gerais, Rio de Janeiro, São Paulo)

**Probleta collariatus* Konow 1908a: 86–87. ♂ (♀ misidentified). "Brasilia (Rio de Janeiro)" (Bruxelles, ♂).—Forsius 1925: 27.—Malaise 1949: 30, fig. 7F (Rio de Janeiro, Minas Geraes, and Espirito Santo).—Oehlke and Wudowenz 1984: 374 (♀ syntype at Eberswalde).—Smith 1979b: 11.

Female, male.—Length, 7.3–8.3 mm. Antenna and head black. Thorax mostly black, with pronotum, tegula, parapteron, upper and anterior margins of mesepisternum, central stripe on mesosternum, metapleuron, upper mesepimeron, anterolateral corners of mesoprescutum, scutellar appendage, and faint lateral margin of mesonotal lateral lobes yellow orange; scutellar appendage may be brownish. Legs yellow orange; hind tibia and hind tarsus black; apex of basitarsi and apical 3 or 4 segments of fore- and midtarsi blackish. Abdomen black with ventral 4–5 sterna yellow orange; terga 2 to 4 or 5 sometimes with small central dark orange spots; posterior margin of segments narrowly white. Wings uniformly hyaline to lightly infuscated; veins and stigma black. Antenna 1.8× head width; apical 4 antennal segments 1.3× longer than 3rd segment; 6th segment almost 3.0× longer than broad. Head from above strongly narrowing behind eyes (Fig. 63); postocellar slightly broader than long; lower interocular distance shorter, about 0.9×, than eye length; antennal crests low, far apart, separated by distance about equal to breadth of one (Fig. 63). Hind basitarsus subequal in length to remaining tarsal segments combined. Tarsal claw with basal lobe. Hind wing with cell M. Lancet in Fig. 88, with shallow, rounded serrulae; male genitalia in Figs. 105, 106.



Figs. 83–86. *Probleta*, female lancets. 83, *P. columbiana*. 84, *P. wygodzinskyi*. 85, *P. shannoni*. 86, *P. bicolor*.

Remarks.—Three specimens labeled as types of *collariatus* by Konow are at Bruxelles. The lectotype, here designated to fix the identity of this species, is a male labeled "Brésil 9-72"; "Coll. Camille Van Volexm"; "Probleta collariatus n. sp., type, det Konow 1907"; "Type" [red]; "Malaise n. 51"; and my lectotype label. The head is off the specimen and in a paper triangle next to it. Malaise's (1949) interpretation of *P. collariatus* was based on this specimen, and as first reviser of *Prob-*

leta, I follow his interpretation in designating this specimen as lectotype. The other two specimens, a male and a female, probably the female Konow described, are *Probleta sahlbergi* Malaise. The abdomen is off the male and in the same paper triangle as the head of the lectotype of *collariatus*. One female labeled as a syntype is at Eberswalde, labeled "Rio de Janeiro," "Coll. Konow," "Syntypus" (red), "Probleta collariatus Knw., Brasil," "Typus" (red); this specimen is a paralectotype.

Material examined.—BRAZIL: Teresópolis, III-12-66 (5 ♀, ♂), III-14-66 (3 ♀), II-13-66 (1 ♀, Townes Coll.); Campina Grande, nr. Curitiba, II-21-66 (1), II-14-66 (1 ♀, Townes Coll.); S.J. Barreiro, Serra do Bocaima, 1650 m, XI-68 (2 ♀, Townes Coll.); Rio de Janeiro, Govea, 10-XI-36, Mangabeira (1 ♂, Oswaldo Cruz); Repressa RG, GB, VII-72, F. M. Oliveira (1 ♀, Davis); Nova Friburgo, F. Germain, Février 1884 (1 ♀, Paris); Serra dos Orgãos, Teresopolis, R.J., I-21–26-69, C. Porter, A García (3 ♀, ♂, Cambridge); Serra da Bocaina, S.J. Barreiros, S.P., I-13–17-69, Porter, Garcia (1 ♀, Cambridge); Est. Biol. Boraceia, Salesópolis, São Paulo, 11-V-1961, K. Lenko (1 ♀, São Paulo); Campos do Jordão, S. Paulo, XI-1857, K. Lenko (1 ♀, Paraná); Rio de Janeiro, Paineiras [spelling ?], 30-6-1918, R. Fischer (1 ♀, Eberswalde).

A specimen at Tucumán is labeled "Sta. Cataline Mts., Arizona U.S.A., 8000 ft., VIII-[?], P. Wygodzinsky." It is probably mislabeled.

columbiana (Enderlein). Colombia; Ecuador; Mexico (Chiapas); Venezuela

**Netrocerus columbianus* Enderlein 1920: 371–372. ♀. "Columbien" (Warszawa, ♀).

Probleta columbianus: Malaise 1949: 26.—Smith 1979b: 11.

Female.—Length 9.5–10.5 mm. Antenna and head black with clypeus and mouthparts brownish, labrum white. Thorax orange. Legs orange, only mid- and hind tarsi black. Abdomen orange with apical 3 or 4 segments and sheath black. Forewing yellow with apical part (apex of stigma to apex of wing) black; hind wing similar; stigma and veins orange, black in apical infuscated part. Antennal length 1.8× head width; apical 4 segments about 1.1× length of 3rd segment; 6th segment 2.0× longer than broad. Lower interocular distance 1.2× greater than eye length; postocellar area about as long as broad; head from above broad, straight, not narrowing behind eyes; antennal crests high, close together, separated by distance less than breadth of one. Posttergite long, medial part roundly projecting. Hind basitarus subequal in length to remaining tarsal segment combined. Tarsal claws with basal lobe. Hind wing with cell M. Serrulae of lancet low, indistinguishable from each other (Fig. 83).

Remarks.—Enderlein described *N. columbianus* from "1 ♀." The holotype is labeled "Columbia, Pehlke"; "TYPE" [red]; "Netrocerus columbianus Enderl. ♀ type. Dr. Enderlein det 1918" [handwritten]. This is the northernmost species of *Probleta*, the northern record being from Chiapas, Mexico.

Material examined.—COLOMBIA: Holotype. ECUADOR: Guayas, Prov. Guayaquil, 50 m, 21–22.II.81 (1 ♀, Ottawa). MEXICO: Mexico, Chiapas, 2500', 17 m. N. Juixtla, 3 June 1969 (1 ♀, Ottawa). VENEZUELA: 42 km SE Maturin, Monagas, June 16, 1958 (1 ♀, Los Angeles); Guarico, Hato Masaguaral (44 km S Calabozo), May 11–19, 1985, Menke & Carpenter (1 ♀, Washington).

corana Smith, **new species.** Brazil (Santa Catarina)

Probleta corana Smith

Female.—Length, 9.0–10.0 mm. Antenna and head black; labrum and palpi brownish; apex of mandible dark reddish. Thorax orange yellow. Legs orange yellow with hind tarsus black and fore and mid-tarsi infuscated toward apices. Abdomen

orange yellow with apical 4 segments and sheath black, and 5th tergum black with central yellow spot. Wings uniformly faintly yellowish without noticeable infuscation toward apices; veins and stigma yellow to orange. Antennal length 1.7× head width, apical 4 segments 1.4× length of 3rd segment and equal to segments 4 and 5 combined, 6th segment about 2.0× longer than broad. Clypeus deeply cleft for about ⅕ of its medial length, lateral lobes narrow and far apart, labrum truncate, slightly more than 2.0× broader than long, its base exposed (Fig. 68). Head from above broad behind eyes (Fig. 67); postocellar about as long as broad; lower interocular distance slightly greater, less than 1.1×, eye length; antennal crests high and close together, separated by distance about equal to one (Fig. 67). Hind basitarsus subequal in length to following tarsal segments combined. Tarsal claw with basal lobe. Hind wing with cell M. Sheath narrow, rounded at apex in lateral view. Lancet in Fig. 82, with serrulae flat.

Male.—Unknown.

Holotype.—♀, "Brasilien, Nova Teutonia, 27° 11′ B., 52° 23′ L., 300–500 m, XI-12-1964, Fritz Plaumann" (Washington).

Paratypes.—BRAZIL: Same locality as holotype, X-6-1956 (1 ♀), 18.XI.1938 (1 ♀). (Washington, London).

Etymology.—As devised, the specific epithet is an arbitrary combination of letters and is to be treated as a noun.

Remarks.—This species is separated from other species with yellow wings by its entirely yellow wings, yellow hind tibia, black hind tarsus, and black antenna and head.

decorata Smith, **new species.** Costa Rica

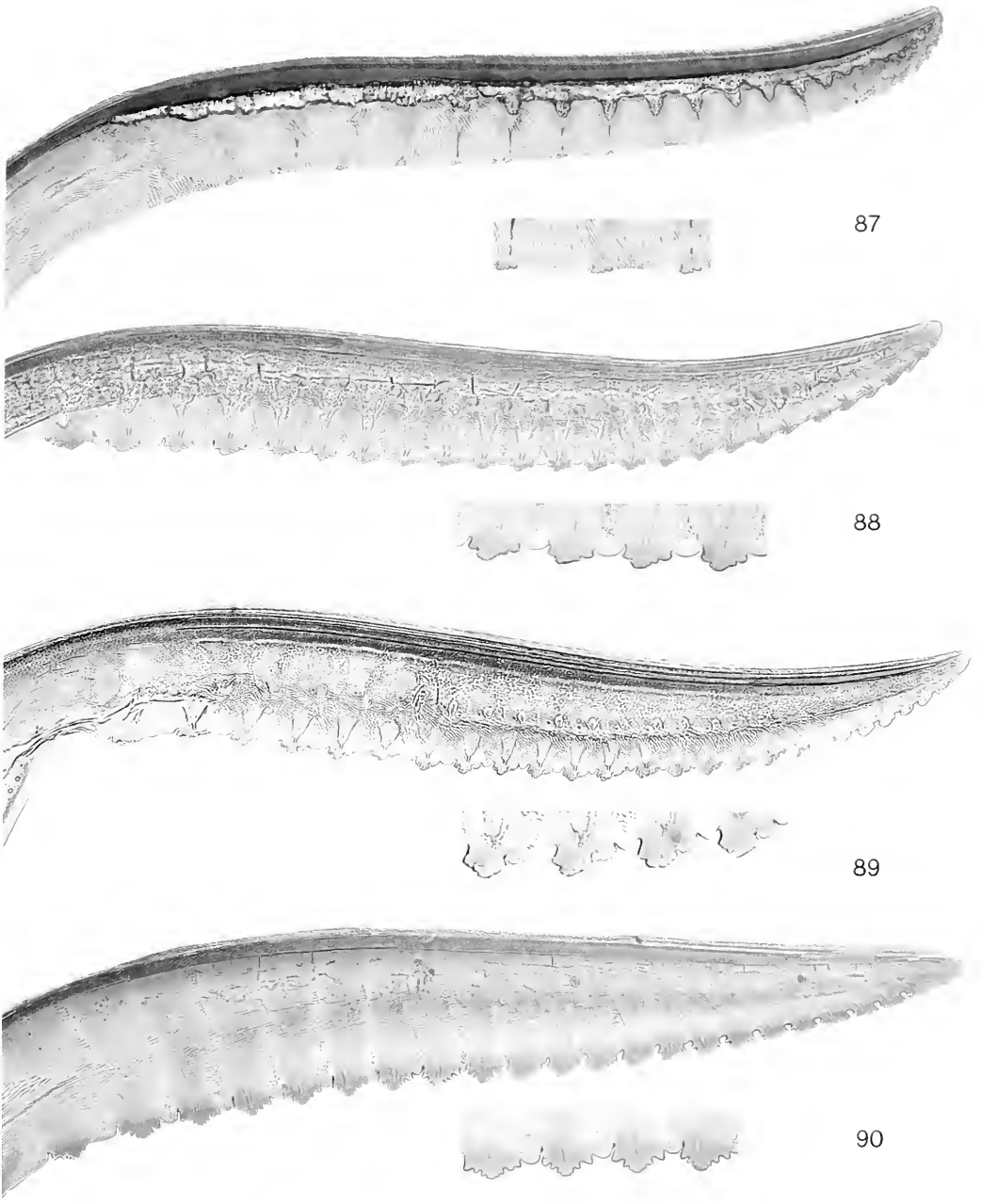
Probleta decorata Smith

Female.—Length, 10.0 mm. Antenna and head black; labrum brownish; maxilla and labium, including palpi, yellow orange. Thorax black with tegula and posttergite (especially at center) brownish; cervical sclerites whitish; pronotum (except brownish spot at center of each side), parapteron, metapleuron, and metanotum lateral to each cenchrus yellow. Legs yellow orange with foretarsal segments 2–4, midtarsal segments 2–4 (5th more brownish), and extreme apex of hind basitarsus and segments 2–5 of hind tarsus black. Abdomen yellow orange with segments 6 to apex and sheath black. Forewing yellow orange with apex from middle of stigma black; basal half of stigma yellow orange, apical half black; veins yellow in yellow part, black in black part; hind wing yellow with blackish apical to stigma; veins yellow in yellow part, black in black part. Antennal length 2.0× head width, apical 4 segments 1.3× length of 3rd segment; 6th segment about 2.0× longer than broad. Clypeus deeply, circularly emarginated for about ¾ of its medial length, lateral lobes narrow and far apart (Fig. 70); labrum with anterior margin subtruncate, nearly 3.0× broader than long, with base exposed (Fig. 70). Head from above broad behind eyes (Fig. 69); postocellar area about as long as broad; lower interocular distance 1.2× longer than eye length; antennal crests high and close together, separated by distance less than breadth of one (Fig. 69). Mesoscutellum sharply protuberant, produced into a high conical projection (Fig. 62). Hind basitarsus subequal in length to length of remaining tarsal segments combined. Tarsal claws with inner tooth shorter than outer tooth, with basal lobe. Hind wing with cell M. Lancet similar to Fig. 82, with serrulae flat.

Male.—Length, 9.5 mm. Color similar to female. Genitalia as in Figs. 95, 96.

Holotype.—♀ "La Amistad, Sector Altamira, Cerro Biolley, Prov. Punta., Costa Rica, 1800 m, Nov. 1993, R. Delgado, L S 572400_332700, #2456," "Costa Rica INBIO CRI001 938715" (INBio).

Paratypes.—Costa Rica: Estac. Pitilla, 700 m, 9 km S Santa Cecilla, Guanac. Pr., Jul. 1988, GNP Biodiversity Survey 330200.380200, Costa Rica INBIO CRI000

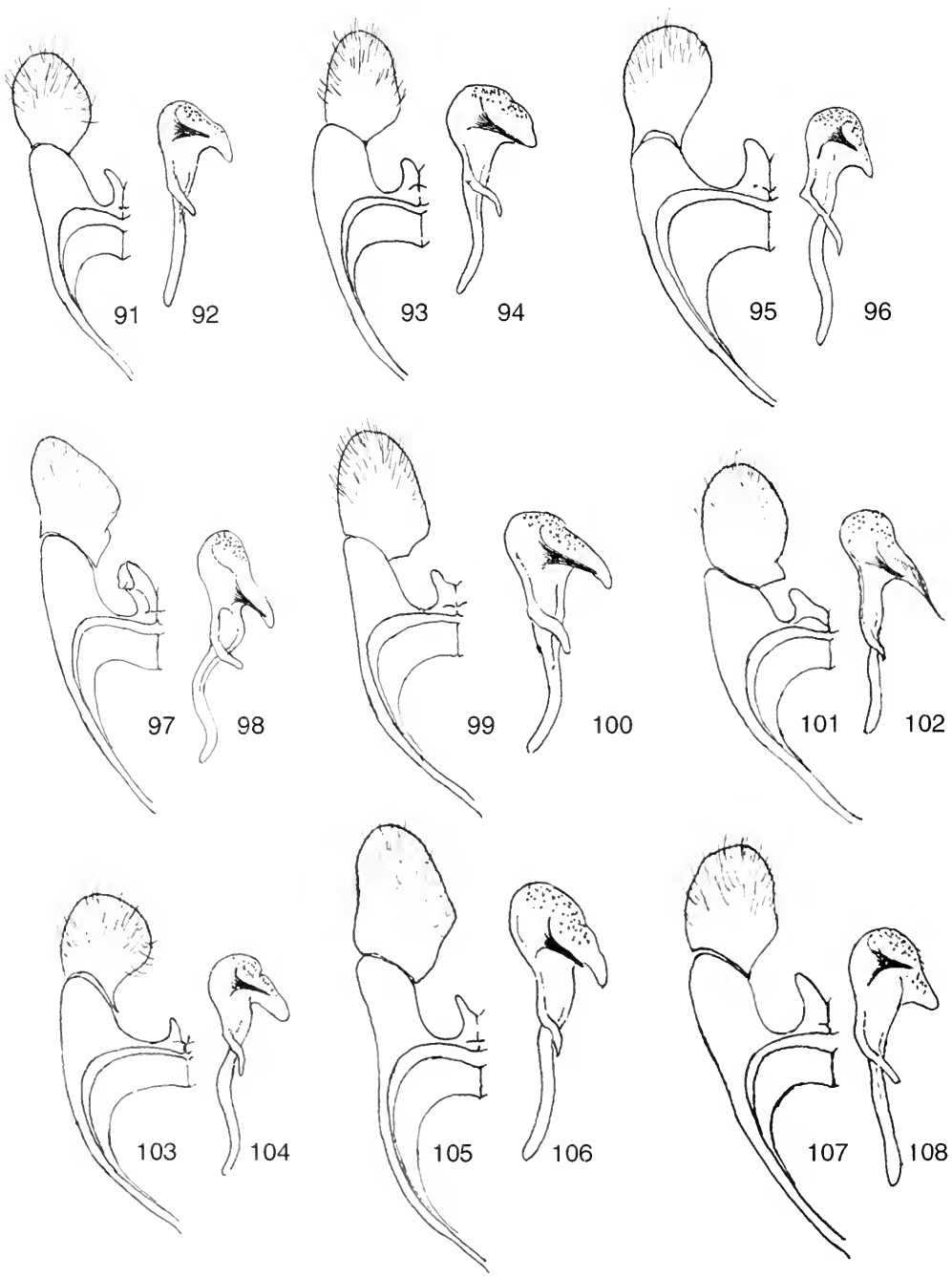


Figs. 87–90. *Probleta*, female lancets. 87, *P. nigropunctata*. 88, *P. collariata*. 89, *P. malaisei*. 90, *P. bicolor*.

129622 (1 ♀); San José, San Francisco, 1100 m, II-1988, col. P. Wiesner (1 ♂) (Washington; Universidad de Costa Rica).

Etymology.—The decorative bright, contrasting coloration of the body and wings is the basis for the name *"decorata."*

Remarks.—The bicolored wings with the black apical portion of the forewing beginning at the middle of the stigma, the most-



Figs. 91–108. *Probleta*, male genitalia. 91, Harpe and parapenis of *P. malaisei*. 92, Penis valve of *P. malaisei*. 93, Harpe and parapenis of *P. wygodzinskyi*. 94, Penis valve of *P. wygodzinskyi*. 95, Harpe and parapenis of *P. decorata*. 96, Penis valve of *P. decorata*. 97, Harpe and parapenis of *P. nigropunctata*. 98, Penis valve of *P. nigropunctata*. 99, Harpe and parapenis of *P. bicolor*. 100, Penis valve of *P. bicolor*. 101, Harpe and parapenis of *P. mazona*. 102, Penis valve of *P. mazona*. 103, Harpe and parapenis of *P. nicklei*. 104, Penis valve of *P. nicklei*. 105, Harpe and parapenis of *P. collariata*. 106, Penis valve of *P. collariata*. 107, Harpe and parapenis of *P. disunctiva*. 108, Penis valve of *P. disunctiva*.

ly black mesothorax, and the elevated, conical mesoscutellum separate this species from other *Probleta*. The high projection of the mesoscutellum is not known in other species of *Probleta*.

disiunctiva (Konow). Bolivia; Peru

**Eriocampa disiunctiva* Konow 1902: 140. ♀. "Peru (Vilcanota)" (Eberswalde, ♀).—Oehlke and Wudowenz 1984: 378 (holotype).
Netroceros disiunctivus: Konow 1905: 101 (*disjunctivus* in index, p. 152).
Probleta disiunctivus: Konow 1908b: 161 (*disjunctivus*).—Forsius 1925: 27.—Smith 1979b: 11.

Female, male.—Length, 7.0 mm. Antenna, head, and mouthparts black, apex of mandible reddish. Thorax orange, sometimes with a black triangular mark on mesoprescutum. Legs orange; foretarsus black with basitarsus entirely or with basal half orange; midtarsus with apex of segments 2–4 black, basitarsus with basal half orange; hind tarsus and about apical half of hind tibia black. Abdomen orange with apical 3 segments black. Wings uniformly, lightly infuscated; veins and stigma black. Antennal length 1.6× head width; apical 4 segments 1.4× length of 3rd segment; 6th segment about 2.0× longer than broad. Clypeus deeply, circularly emarginated for about ¾ its medial length, lateral lobes rounded (similar to Fig. 80); labrum about 2.3× broader than long, with base exposed and anterior margin nearly truncate. Head from above strongly narrowing behind eyes (similar to Fig. 63); postocellar area slightly longer than broad; lower interocular distance subequal to eye length; antennal crests high, separated by distance of much less than one. Hind basitarsus slightly longer than length of remaining segments combined. Tarsal claw with basal lobe. Hind wing with cell M. Male genitalia in Figs. 107, 108. Lancet not examined.

Remarks.—This species was not in Malaise's (1949) key. It is about 7.0 mm long, smaller than most *Probleta*. Because there is some variation in the amount of black on the mesonotum, I have taken it out in two places in the key. This species may be confused with *P. nigropunctata* and *P. shannoni* because of their similar coloration. Both those species are large, 10 mm or more in length, and *P shannoni* has large, lobelike serrulae (Fig. 85) and *P. nigropunctata* has very minute rounded serrulae which are far apart (Fig. 87).

Konow did not state how many specimens he had. The lectotype, here designated to fix the identity of this species, is the specimen at Eberswalde, labeled "Peru, Vilcanota," "Coll. Konow," "Holotype" (red), "Probleta disiunctiva Knw., Peru," and "Typus" (red). The abdomen is missing.

Material examined.—BOLIVIA: Santa Cruz, Buena Vista, 8.VII.1973 (1 ♀, Tucumán). PERU: Vilcanota (lectotype); Loreto, Pucalpa; Monson Valley, Tingo Maria, 4.VI.1963 (1 ♀, London); 20 mi W Pucallpa (1 ♀, San Francisco).

frenata Konow. Colombia; Peru; Surinam

**Probleta frenata* Konow 1908b: 163. ♂. "Peru (Pachitea)" (Eberswalde, ♂).—Forsius 1925: 27.—Malaise 1949: 26 (Surinam, Upper Maroni River).—Oehlke and Wudowenz 1984: 382 (♂ holotype).—Smith 1979b: 11.

Female, male.—Length, 8.0 mm. Antenna and head black with scape, pedicel, and antennal crests, and supraclypeal area orange; clypeus, except extreme base, and all mouthparts pale orange; apex of mandible dark brown. Thorax orange. Legs orange with segments 2–4 of midtarsus blackish and hind tarsus black except apex of 5th segment. Abdomen orange with posterior margin of 5th and segments 6 or 7 to apex black, anterior margin of 6th segment may be orange. Forewing yellow with apex from apex of stigma black; stigma and veins in yellow part orange, except subcosta and vein M black; veins black in black apex; hind wing yellowish with apex infuscated. Antennal length 1.5× head width; 6th segment 2.0× longer than broad; apical 4 segments about 1.6× lon-

ger than 3rd segment. Clypeus deeply emarginated for about ¾ its medial length, lobes narrow, somewhat triangular; labrum about 1.6× broader than long, exposed at base, anterior margin rounded. Head from above narrowing behind eyes; antennal crests high and closer together than width of one; lower interocular distance subequal to eye length; postocellar area about as long as broad. Hind basitarsus slightly longer than remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell.

Remarks.—From other species with forewings yellow and the apex black, *P. frenata* can be distinguished by its completely black hind tarsus and its orange yellow first and second antennal segments, antennal crests, supraclypeal area, and mouthparts.

Konow did not state how many specimens he had. The lectotype, here designated to fix the identity of the species, is the male at Eberswalde labeled "Pachitea, Peru," "Coll. Konow," "Holotypus" (red), "Probleta frenata Knw., Peru," "Typus" (red). The flagellum of both antennae are missing.

Material examined.—COLOMBIA: Amazonas, PNN Amacayacu Matamata, 3°23'S, 70°6'W, 150 m, Malaise 4/16/01–5/7/01, D. Chota, leg. M. 1875 (1 ♀; Instituto Humboldt, Bogotá). PERU: Pachitea (lectotype). SURINAM: Nickerie River, Blanche-Marie-Falls, Meteocamp, Surinam, 9–16-II-1971 (1 ♀, Leiden); Nassau Mts., Surinam, 9-III-1949 (1 ♀, Leiden); Suriname, 1.4.1962 (1 ♀, Leiden).

fulvonigra Malaise, **new combination.** Brazil (Rio de Janeiro)

**Protoprobleta fulvoniger* Malaise 1949: 30–31, fig. 5A, 6D, 8A. ♀. "Brazil (Grajahu near Rio de Janeiro)" (Stockholm, ♀).—Smith 1979b: 11.

Female.—Head and antenna black. Thorax orange. Legs orange with tarsi except spot on forebasitarsus, apical two-thirds of hind tibia, and apical half of midtibia black; foretibia indistinctly infuscated towards apex. Abdomen orange with 6th segment to apex and sheath black. Wings uniformly infuscated; veins and stigma black. Antenna with 6th segment 2.0× longer than broad. Labrum about as broad as long, anterior margin rounded, base covered by clypeus; clypeus shallowly incised, emargination about half medial length of clypeus. Postocellar area about as long as broad. Hind basitarsus subequal in length to following tarsal segments combined. Tarsal claws with basal lobe. Hindwing with cell M.

Remarks.—This is one of two species described in *Protoprobleta* by Malaise (1949), the other being *P. nigra*. Those previously placed in *Protoprobleta* were characterized by the shallower emargination of the clypeus (similar to Figs. 77, 78), about half the medial length of the clypeus, the base of the labrum covered by the clypeus, not exposed, and the labrum about as broad as long, not broader than long as in most *Probleta* species. Malaise described this species from "1 ♀." The holotype is labeled "8-6-1942 Grajahu, Rio de Janeiro, Lopes & Wygod."; "TYPUS" [red]; "Protoprobleta n. gen. fulvoniger n. sp. Malaise det 1944"; "96 79"; "Riksmuseum Stockholm." This type is the only specimen examined.

gracilicornis Konow. Brazil (Pará)

**Probleta gracilicornis* Konow 1908b: 162–163. ♀. "Brasilia (Pará)" (Eberswalde, ♀).—Forsius 1925: 27.—Malaise 1949: 26.—Oehlke and Wudowenz 1984: 385 (♂ holotype).—Smith 1979b: 11.

Female.—Length, 8.5 mm. Antenna, head, and mouthparts black. Thorax orange. Legs orange; foretarsus with apex of segments 1 and 2 and all of segments 3 and 4 black; midtarsus with segments 2–4 black; hind tarsus and extreme apex of hind tibia black. Abdomen orange with apical segment and sheath black. Forewing mostly hyaline, slightly darker beyond apex of stigma; costa and stigma yel-

low with extreme apex of stigma blackish, other veins brown; hind wing hyaline with all veins brown. Antennal length 1.8× head width; apical 4 segments about 1.6× longer than 3rd segment; 6th segment 2.0× longer than broad. Clypeus deeply, circularly emarginate, for over ¾ its medial length (Fig. 72); labrum about 2.0× broader than long, with base exposed (Fig. 72), and anterior margin slightly rounded. Head from above narrowing behind eyes (Fig. 71); lower interocular distance subequal to eye length; postocellar area slightly broader than long; antennal crests high, closer together than width of one (Fig. 71). Hind basitarsus slightly longer than length of remaining segments combined. Tarsal claws with basal lobe. Hind wing with cell M. Lancet in Fig. 81, serrulae rounded.

Remarks.—The rounded serrulae of the lancet differ from the flat serrulae of *P. corona*, *P. columbiana*, and *P. bilanx*, other species with partly yellow wings. Also in *P. gracilicornis* the thorax is entirely orange, the apex of the hind tibia is black, and the forewing is more hyaline with only the costa and base of the stigma orange. This species is near *P. disiunctiva*, but in *P. gracilicornis* the wings are usually clear with the base of the stigma pale orange and the hind tibia is black only at its extreme apex. In *P. disiunctiva*, half or more of the hind tibia is black and the wings are black.

Konow did not state how many specimens he had. The lectotype, here designated in order to fix the identity of the species, is a female at Eberswalde, labeled "Brasil, Para, 18.3.1902, Ducke," "Coll. Konow," "Holotypus" (red), "Probleta gracilicornis Knw., Brasil," "Typus" (red).

Material examined.—BRAZIL: Pará (lectotype); "Santarem" (1) and same with date Apr. 1919 (1) (both at Pittsburgh) and "Pará, Sta Isabel" (1 ♀, Belém). The specimen from Sta Isabel has the wings darker but the stigma is pale brown, the wings are slightly paler at the base, and only the extreme apex of the hind tibia is black.

grossoensis Smith, **new species.** Brazil (Mato Grosso)

Probleta grossoensis Smith

Female.—Length, 10.5 mm. Antenna and head black; clypeus, labrum, and palpi whitish; apex of mandible dark reddish. Thorax yellow orange. Legs yellow orange with midtarsus (except apical segments), apical ¼ hind tibia, and all hind tarsus black. Abdomen yellow orange with apical 4 segments and sheath black. Wings yellow with apices beyond stigma infuscate; veins reddish yellow and stigma except for extreme apex reddish yellow; veins in infuscated apex dark brown to black. Antennal length about 1.7× head width; apical 4 segments 1.6× length of 3rd segment, 6th segment 2× or less longer than broad. Clypeus deeply, broadly circularly emarginated for about ⅔ its medial length, lateral lobes rounded and far apart (Fig. 73); labrum with anterior margin slightly rounded, about 2.0× broader than long, its base not exposed. Head from above broad behind eyes (Fig. 73); lower interocular distance 1.1× greater than eye length; postocellar area slightly longer than broad; antennal crests high and close together, separated by distance less than breadth of one (Fig. 73). Hind basitarsus slightly longer, 1.1×, than length of remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M. Sheath rounded at apex in lateral view. Lancet in Fig. 80, with flat serrulae.

Male.—Unknown.

Holotype.—♀, "Jaciara, Mato Grosso, Brasil, Nov. 1963, M. Alvarenga" (Washington).

Etymology.—Named for the state where collected, Mato Grosso.

Remarks.—This species is separated from other *Probleta* species with yellow wings by the black apex of the forewing, the black hind tarsus, black apical quarter

of the hind tibia, the white labrum, clypeus, and palpi, flat serrulae, and broad head behind the eyes in dorsal view.

langei Konow. Brazil (Rio de Janeiro)

**Probleta Langei* Konow 1908b: 162. ♀. "Brasilia" (Eberswalde, ♀).—Forsius 1925: 27.—Malaise 1949: 29, fig. 5A, 6F (♂ allotype, Rio de Janeiro).—Oehlke and Wudowenz 1984: 391 (♂ holotype).—Smith 1979b: 11.

Female, male.—Length, 11.0–12.0 mm. Antenna and head black; basal 2 segments of labial palpus and 4th segment of maxillary palpus white. Thorax orange with meso- and metanotum mostly black in male, orange areas around sutures and spot on anterolateral corners of mesoprescutum and lateral, downturned areas of mesonotal lateral lobes in female; blackish spot on each side of posterior portion of mesosternum. Legs orange with apical 3 foretarsal segments, midtarsus, except base dark orange, hind tarsus, and apical half of hind tibia black. Abdomen orange with extreme posterior margin of 7th segment and apical 2 segments and sheath black. Wings hyaline to lightly uniformly infuscated; veins and stigma black. Antennal length nearly 2.0× head width; apical 4 segments 1.4× longer than 3rd segment; 6th segment about 2.2× longer than broad. Clypeus emarginated for about ¾ its medial length, lateral lobes narrow, somewhat triangular; labrum about 2.0× broader than long, exposed at base, anterior margin slightly rounded. Antennal crests low, rounded, separated by distance about equal to width of one; lower interocular distance subequal to eye length; postocellar area slightly broader than long, about quadrate. Hind basitarsus slightly longer than remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M. Apex of lancet with flat serrulae (as seen in type where lancet is slightly exposed).

Remarks.—Konow did not state how many specimens he had. The female at Eberswalde is hereby designated lectotype to fix the identity of the species; it is labeled "Brasilia Mus. Lange," "Coll. Konow," "Holotypus" (red), "Probleta Langei Knw., Brasil." "Typus" (red). Malaise designated a male allotype from "Brazil Rio de Janeiro" which is similar in coloration to the female. I have not seen specimens other than Konow's type. The infuscated wings, mostly black meso- and metanotum, deeply emarginated clypeus, the black apical two abdominal segments, and flat serrulae will help distinguish this species. It is separated from other species in the key to species.

malaisei Smith, **new species.** Brazil (Paraná, Santa Catarina)

Probleta malaisei Smith.

Female.—Length, 6.0–6.5 mm. Antenna, head and mouthparts black; apex of mandible dark reddish. Thorax yellow orange with mesosternum (except for mesal stripe), lower ⅔ mesepisternum, triangular spot on center of mesoprescutum (sometimes reduced or nearly absent), mesonotal lateral lobes, mesoscutellum, and metanotum except for central area, black. Legs orange yellow with midtarsus, hind tibia, and hind tarsus black; foretarsus infuscated. Abdomen yellow orange with terga 5 and 6 laterally, segments 7 to apex, and sheath black; small lateral dots on terga 2–4 black. Wings uniformly, moderately black infuscated; veins and stigma black. Antennal length 1.8× head width; apical 4 segments 1.3× length of 3rd segment; 6th segment stout, about as long as broad. Clypeus with deep, broadly oval emargination for nearly ⅕ its medial length, lateral lobes rounded, narrow, far apart (Fig. 76); labrum short, front margin truncate, more than 3.0× broader than long, with base exposed (Fig. 76). Head from above broad behind eyes (Fig. 75); postocellar slightly broader than long; antennal crests high, separated by distance of about equal to one (Fig. 75). Hind basitarsus slightly longer than length of fol-

lowing tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M. Sheath narrow, rounded at apex in lateral view. Lancet in Fig. 89, with rounded serrulae each with one large anterior subbasal tooth.

Male.—Length, 5.5 mm. Coloration similar to female except for mostly brownish mesoscutellum and abdomen which has hypandrium black and black lateral spots on each tergum becoming broader and coalescing at center toward apex. Genitalia as in Figs. 91, 92.

Holotype.—♀, "Brazil; Nova Teutonia, F. Plaumann, 20 Apr. 1966" (Washington).

Paratypes.—BRAZIL: Same locality as holotype, 19 Apr. 1966 (1 ♀), 28-III-1966 (1 ♂), V-1975 (1 ♂), V-1976 (3 ♂), May 1977 (1 ♀), Aug. 1977 (1 ♀); Paraná, Rincao, II-22-69, C. Porter, A. Garcia (1 ♀) (Washington, Cambridge).

Etymology.—Named for René Malaise who provided the first comprehensive study of this genus.

Remarks.—This species has the wings uniformly infuscate, the thorax partly black, the hind tibia black, and the serrulae rather deep with large anterior and posterior subbasal teeth. It resembles *P. collariata* except for the serrulae of the lancet with are much deeper in *P. malaisei* (see Figs. 88, 89).

mazona Smith, **new species.** Brazil (Amazonas).

Probleta mazona Smith.

Female.—Unknown.

Male.—Length, 7.0 mm. Antenna and head black with extreme tips of lateral lobes of clypeus and labrum more brownish. Thorax orange with mesoscutellum and metascutellum black. Legs orange with fore tibia and tarsus dark orange, mid- and hind tibiae and tarsi black, and extreme apex of hind femur black. Abdomen orange with segments 5 to apex black. Wings darkly, uniformily infuscated; veins and stigma black. Antennal length 1.6× head width; apical 4 segments 1.5× length of third segment. Clypeus shallowly emarginated, emargination about half medial length of clypeus, with rounded lateral lobes; labrum rounded, about 2.0× broader than long, its base covered by clypeus (Fig. 77). Head from above narrowing behind eyes; antennal crests low, far apart, separated by distance greater than breadth of one (Fig. 77). Hind basitarsus subequal in length to length of remaining tarsal segments combined. Tarsal claws with basal lobe. Genitalia in Figs. 101, 102.

Holotype.—♂, "Brasil: Amazonas, Hwy ZF2, km 20.7, ca 60 km N Manaus, 02°30'S, 060°15'W, 16 Aug. 79—Terra Firme," "Canopy fogging project, TRS#08. Col. by hand, Adis, Erwin, Montgomery et al. collectors" (Washington).

Etymology.—The name stems from Amazonas, lacking the first and last letters.

Remarks.—This species is separated from other species with the shallowly emarginated clypeus by its orange thorax with the mesoscutellum and metascutellum black and the black mid- and hind tibiae. This is the only species known with the dorsal process of the penis valve narrow and acute (Fig. 102) rather than rounded.

nicklei Smith, **new species.** Peru.

Probleta nicklei Smith.

Female.—Unknown.

Male.—Length, 8.2 mm. Antenna and head black. Thorax orange. Legs (forelegs missing) orange with tibiae and tarsi black and extreme apex of hind femur black. Abdomen orange with segments 6 to apex black Wings uniformly darkly infuscated; veins and stigma black. Antennal length 1.6× head width; apical 4 segments 1.4× length of 3rd segment; 6th segment slightly less than 2.0× longer than broad. Clypeus shallowly emarginated, emargination about half medial length of clypeus, with

rounded lateral lobes; labrum rounded, about 2.0× broader than long, its base covered by clypeus (Fig. 78). Head from above rounded and narrowing behind eyes (similar to Fig. 63); lower interocular distance subequal to eye length; postocellar area as long as broad; antennal crests low and far apart, separated by distance greater than one. Hind basitarsus slightly shorter than, .9×, length of remaining tarsal segments combined. Tarsal claw with 3 teeth, without basal lobe (Fig. 61). Genitalia in Figs. 103, 104.

Holotype.—♂, "Peru: Loreto Prov., 3°23'S, 72°46'W, Explorama Lodge, 80 km NE Iquitos on Rio Yanamono (1 km upriver from Rio Amazon) (D.A. Nickle & J.L. Castner, colls) VIII-31–IX-14-1996, EARTHWATCH Team 21," "Lake Trail, Canopy Fogging, Site 1, 6 am" (Washington).

Etymology.—Named for Dr. David A. Nickle, collector of the specimen and colleague in the Systematic Entomology Laboratory, USDA.

Remarks.—This is one of three species where the basal lobe of the tarsal claw is modified into a third tooth, the other species being *P. nigropunctata* and *P. siceva*. *Probleta nigropuncata* has the clypeus deeply emarginated with the base of the labrum exposed, and is a larger species (ca. 10 mm long). *Probleta siceva* has the head from above broad behind the eyes (similar to Fig. 64).

niger (Malaise), **new combination.** Brazil

**Protoprobleta niger* Malaise 1949: 31, fig. 8B. ♀. "Brazil (S. Rita)" (Stockholm, ♀).—Smith 1979b: 11.

Female.—Antenna and head black. Thorax black. Legs orange with apex of foretarsus, mid- and hind tarsi entirely, and apical two-thirds of hind tibia black. Wings uniformly infuscated. Antenna stout; 6th segment 1.5× longer than broad. Clypeus somewhat shallowly emarginated, emargination half or less medial length of clypeus; labrum about as broad as long, anterior margin rounded, base covered by clypeus. Postocellar area subquadrate. Hind basitarsus subequal in length to remaining tarsal segments combined.

Remarks.—The description is somewhat abbreviated because of incomplete notes on the type. This is one of two species described by Malaise with the more shallowly emarginated clypeus and long labrum (see Remarks under *P. fulvonigra*). However, three more species are known in this group. *P. mazona, P. nicklei*, and *P. siceva*. *Probleta niger* is distinguished from those species by its predominately black color. The thorax is entirely or mostly orange in the other species, and the tarsal claws of *P. nicklei* and *P. siceva* are trifid.

Malaise described this species from "1 ♀." The holotype is labeled "S. Rita"; "F. Sahlb."; "TYPUS" [red]; "Protobleta niger n. gen, n. sp. Malaise det 1944"; "97-79"; "Riksmuseum Stockholm." I have not seen additional specimens.

nigropunctata Malaise. Brazil (D.F., Minas Gerais)

**Probleta nigropunctatus* Malaise 1949: 29, fig. 8D. ♀. "Brazil (Minas Geraes)" (Stockholm, ♀).—Smith 1979b: 11.—Smith 1981: 288 (D.F.).

Female, male.—Length, female, 10.5 mm; male, 10.0 mm. Antenna, head, and mouthparts black, clypeus brownish. Thorax orange with triangular black spot on mesoprescutum, black spot on each side of mesosternum, and mesepimeron blackish. Legs orange with foretarsus and mid- and hind tibiae and tarsi black. Abdomen with basal 5 terga and basal 6 sterna orange, remainder of abdomen black. Wings nearly hyaline, very lightly, uniformly infuscated, veins and stigma black. Scattered punctures on head, especially postocellar area, genae, upper orbits and occipital area. Antennal length 1.6× head width; 6th segment stout, 1.5× longer than broad; apical 4 antennal segments 1.6× longer

than 3rd segment. Clypeus deeply emarginated for about ¾ its medial length; labrum 2.5× broader than long, with base exposed (similar to Fig. 70); head from above broad behind eyes (Fig. 64); postocellar area as long as broad; lower interocular distance 1.2× greater than eye length; antennal crests high and close together, separated by distance less than breadth of one (Fig. 64). Hind basitarsus slightly longer, 1.1×, than length of remaining segments combined. Tarsal claws with 3 teeth, basal lobe absent (Fig. 61). Hind wing with cell M absent. Lancet in Fig. 87, long, with 25+ serrulae and serrulae low, rounded, and far apart. Male genitalia in Figs. 97, 98.

Remarks.—This species, as well as *P. siceva* and *P. nicklei*, have trifid tarsal claws. *Probleta nigropunctata*, however, has a distinctive lancet which is long and has very low, rounded serrulae (Fig. 87), the thorax with the mesoprescutum black and with paired black spots on the mesosternum, and a very deeply emarginated clypeus exposing the base of the labrum.

Malaise described this species from "1 ♀." The holotype female is labeled "Minas Geraes"; "TYPUS" [red]; "Probleta nigripuncta type n. sp. Malaise det 1947."

Material examined.—BRAZIL: Minas Gerais (holotype). Res. Ecol. IBGE, D.F., Brazil, Km 0 Br 251, 14-III-1979, Braulio Dias, Tenda Malaise Tanque (1 ♀); same locality, 12-XII-85 (1 ♂); same locality, Tenda Malaise Cerrado, 28-II-1979 (1 ♀).

sahlbergi Malaise. Brazil (Rio de Janeiro)

Probleta collariata: Konow 1908a: 86–87 (1 ♀ and 1 ♂ only, other ♂ is lectotype of *P. collariatus*).

**Probleta sahlbergi* Malaise 1949: 30, fig. 7E. ♀. "Brazil (Petropolis near Rio de Janeiro)" (Stockholm, ♀).—Smith 1979b: 11.

Female.—Antenna, head, and mouthparts black. Thorax orange; sternum to lower ⅔ of mesepisternum (line on meson of sternum orange), most of mesepimeron except upper corner, mesonotum except V-shaped mark on mesoprescutum, posttergite, and extreme lateral margins of lateral lobes orange, and metanotum black. Legs yellow orange with segments 3 and 4 of mid- and hind tarsi and extreme tip of hindtibia and all hind tarsus black except basal third or so of basitarsus dark orange. Abdomen black with basal 3–4 sterna suffused with brown, paler than rest of abdomen. Wings very lightly uniformly infuscated black; veins and stigma black. Antennal length 1.7× head width; 6th segment 1.5× longer than broad. Lower interocular distance a little less than eye length. Eyes large, head from above narrowing behind eyes. Hind basitarsus equal in length to remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M.

Male.—Coloration similar to that of female except mesopleuron and mesonotum black; apical half to third of hind tibia black; and apical 3–5 fore- and midtarsal segments black.

Remarks.—This species is similar to *P. collariatus* except, in *P. collariatus*, the hind tibia and tarsus are entirely black.

Malaise described this species from "1 ♀." The holotype female is labeled "Petrop. Brs."; "F. Smith"; "TYPUS" [red]; "Colleriatus det Malaise 47" [top] "Probleta n. sp. ? ♀ Konow det." [reverse]; "Probleta sahlbergi type n. sp. Malaise det 1947."

Material examined.—BRAZIL: Itatiaya, 700 m, Est. do Rio, Brazil, "22-2-933" (1, Oswaldo Cruz). A male and a female labeled as types of *Probleta collariatus* from Rio de Janeiro (see *P. collariata*), are labeled "9-72, Rio Janeiro," "Coll. Camille Van Volxem," "Probleta collariata n. sp. Type det Konow 1907," "Type." The male has the abdomen missing, but it is in a paper triangle near the specimens and has extra labels "410" and "Probleta sahlbergi m. Malaise 57"; Petropolis (holotype).

shannoni Smith, **new species.** Brazil (Rio de Janeiro)

Probleta shannoni Smith.

Female.—Length, 10.2 mm. Antenna,

head, and mouthparts black; apex of mandible dark reddish. Thorax yellow orange. Legs orange yellow with apical ¼ hind tibia, hind tarsus, apical ⅓ midbasitarsus, midtarsal segments 2–4, and foretarsal segments 4 and 5 black. Abdomen yellow orange with lateral areas of tergum 5 and segments 6 to apex and sheath black. Wings uniformly darkly, black infuscated; veins and stigma black. Antennal length 1.5× head width; apical 4 segments 1.5× longer than 3rd segment and equal to segments 4 and 5 combined; 6th segment 2.0× longer than broad. Clypeus deeply emarginated for about ¾ its medial length; labrum 2.0× broader than long, its base exposed. Head from above broad behind eyes (similar to Fig. 67); postocellar area slightly longer, 1.1×, than broad; lower interocular distance slightly greater, less than 1.1×, than eye length; antennal crests high, close together, separated by distance of less than one. Hind basitarsus slightly longer, 1.1×, than length of following tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M. Sheath rounded at apex in lateral view. Lancet in Fig. 85, with deep, rounded serrulae.

Male.—Unknown.

Holotype.—♀, "Rio de Janeiro, Dist. Federal, Brazil," "Setembro 1938," "Servico Febre Amarela M.E.S., Bras." "R. C. Shannon coll." (Washington).

Etymology.—Named for the collector, R.C. Shannon.

Remarks.—This species is similar to *P. bicolorata* except the basal abdominal segments are orange yellow, only the apical ¼ of the hind tibia is black, and the lower interocular distance is about subequal to the eye length. The serrulae of the lancet are very deep (Fig. 85), much more so than those of most *Probleta*. From other species with infuscated wings and an entirely orange thorax, *P. shannoni* is separated by the partly orange hind tibia and the deep, rounded serrulae of the lancet.

siceva Smith, **new species.** Peru.

Probleta siceva Smith.

Female.—Length, 9.3 mm. Antenna (only scape and pedicel present) and head black. Thorax orange. Foreleg orange with tibia and tarsus a darker orange; mid- and hind legs orange with tibiae and tarsi black. Abdomen orange with segment 6 black above and segments 7 to apex black. Wings uniformly darkly infuscated; veins and stigma black. Clypeus shallowly emarginated, emargination about half medial length of clypeus, with rounded lateral lobes; labrum rounded, about 2.0× broader than long, its base covered by clypeus (similar to Fig. 78); head from above broad behind eyes (similar to Fig. 64); lower interocular distance slightly longer, 1.1×, than eye length; postocellar area about as broad as long; antennal crests low, far apart, separated by distance greater than width of one. Hind basitarsus subequal in length to length of remaining tarsal segments combined. Tarsal claw with 3 teeth, basal lobe absent (similar to Fig. 61). Hind wing with cell M present. Lancet in Fig. 90, serrulae pointed at apcies, with large subbasal teeth.

Male.—Unknown.

Holotype.—♀, "Huánuco Peru, Aug, coll. R. Ferreyna" (Cambridge).

Etymology.—The name is an arbitrary combination of letters and is to be treated as a noun.

Remarks.—The coloration of this species is close to *P. bicolor*, but *P. siceva* has a shallower emargination to the clypeus with the base of the labrum not exposed, tarsal claws with three teeth, and lower serrulae on the apical third of the lancet. *Probleta siceva* may be separated from *P. nicklei* by the head which is broad behind the eyes (similar to Fig. 64) (see key).

usta Forsius. Brazil

**Probleta usta* Forsius 1925: 26–27. ♀. "Südbrasilien" (Stockholm, ♀).—Malaise 1949: 27, fig. 7A.—Smith 1979b: 11.

Female.—Length, 9.0 mm. Head and antenna black; palpi brownish yellow. Thorax orange. Legs orange with apical segments of fore- and midtarsus blackish, hind tibia and hind tarsus black. Abdomen black with first segment orange, two following segments yellow at apices and in middle. Forewing clear in basal half; stigma and veins black. Antenna slender, 6th segment 3× as long as broad. Postocellar area subquadrate, very little longer than broad. Tarsal claw with basal lobe. Hind basitarsus subequal in length of following tarsal segments combined. Hind wing with cell M.

Remarks.—This species is close to *P. bicolor*, sharing the uniformly infuscated wings and entirely black hind tibia, but in *P. usta*, the abdomen is almost entirely black above and the antennae are slender with the 6th segment 3× longer than broad.

Forsius described this species from "1 ♀. Südbrasilien (F. Sahlberg leg.)." Malaise (1949) recorded it from Brazil (Petropolis near Rio de Janeiro). I have not seen additional specimens.

wygodzinskyi Malaise. Brazil (Paraná, Rio de Janeiro, Santa Catarina)

**Probleta wygodzinskyi* Malaise 1949: 28, fig. 7C. ♀, ♂. "Brazil (Rio de Janeiro and S:ta Catharina, Nova Teutonia)" (Stockholm, ♀).—Smith 1979b: 11.

Female, male.—Length, female 9.0–10.0 mm; male, 8.0 mm. Antenna, head, and mouthparts black. Thorax orange. Abdomen with segments 1–4 orange and 5 to apex black. Legs orange, with extreme apex of midtibia, apical third of hind tibia on outer surface, apical 3 foretarsal segments, and mid- and hind tarsi entirely black. Wings very lightly, uniformly infuscated; veins and stigma black. Antennal length 1.7× head width; 6th segment 2.0× longer than broad; apical 4 segments 1.5× length of 3rd segment. Clypeus deeply, circularly emarginated for ¾ of its medial length, lateral lobes rounded and far apart (similar to Fig. 66); labrum with anterior margin truncate, about 2.0× broader than long, with base exposed. Head from above narrowing behind eyes (similar to Fig. 67); lower interocular distance slightly longer, 1.2×, than eye length; postocellar area as long as broad; antennal crests high, close together, separated by distance of less than breadth of one. Hind basitarus slightly longer, less than 1.1×, than length of remaining tarsal segments combined. Tarsal claws with basal lobe. Hind wing with cell M present. Lancet as in Fig. 84, with serrulae low, rounded, close together. Male genitalia in Figs. 93. 94.

Remarks.—In *P. wygodzinskyi*, the wings are uniformly infuscate and the thorax entirely orange. It is separated from other species with this combination by having only the extreme apex of the hind tibia black or only outer surface of apical third black, and by comparison with the figures of the female lancets and male genitalia. Other species with this color combination have the apical quarter or more of the hind tibia entirely black.

Malaise described this species from "1 ♂, 1 ♀." The female is labeled "Rio de Janeiro, 3.194, Wygod. L."; "TYPUS" [red]; "Probleta wygodzinskyi, n. sp. Malaise det 1947." The male is labeled "Brasilien, Nova Teutonia, 27°11'B, 52°23'L., 25.3.1931 [?], Fritz Plaumann"; "Allotypus" [red]; "coll. Malaise"; "Probleta wygodzinskyi, n. sp. Malaise det. 1947." Because he did not designate a holotype, I am designating the female labeled as type as the lectotype in order to fix the identity of this species, and the male as a paralectotype.

Material examined.—BRAZIL: Rio de Janeiro (holotype); Nova Teutonia, Santa Catarina, Brazil, III.15.1938 (1 ♂, London); II-1966 (1 ♂); 15 Mar. 1966 (1 ♂) IV-1975 (1 ♀) (Washington); Paraná, Prudentópolis, II-23–25-69, C. Porter, A. Garcia (1 ♀, 1 ♂, Cambridge).

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Valid names are in roman, synonyms in *italic*.

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Food Plants and Life Histories of Sawflies of the Family Argidae (Hymenoptera) in Costa Rica, with Descriptions of Two New Species

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Abstract.—Food plants and biological information are given for 12 species of the family Argidae in Costa Rica: *Atomacera raza* Smith on *Malvaviscus* sp. (Malvaceae); *Eriglenum crudum* Konow on *Machaerium acuminatum* (Fabaceae); *Sericoceros gibbus* (Klug) on *Coccoloba guanacastensis* (Polygonaceae); *Sericoceros mexicanus* (Kirby) on *Coccoloba venosa* and *C. uvifera* (Polygonaceae); *Sericoceros vumirus* Smith on *Lonchocarpus minimiflorus* (Fabaceae); ***Themos mayi* Smith, n. sp.**, on *Meliosma idiopoda* (Sabiaceae); *Ptilia versicolor* (Klug) and *Trochophora lobata* (Erichson) on *Rourea glabra* (Connaraceae); ***Didymia jonesi* Smith, n. sp.**, on *Connarus* sp. (Connaraceae); *Sphacophilus janzeni* Smith on *Hymenaea courbaril* (Fabaceae); *Sphacophilus edus* Smith on *Heteropterys laurifolia* (Malpighiaceae); and *Durgoa mattogrossensis* Malaise on *Bauhinia ungulata* (Fabaceae). The male of *Durgoa mattogrossensis* is described for the first time. All species were reared in the Area de Conservación Guanacaste, Guanacaste Province, Costa Rica.

Little is known of the larval food plants and habits of most Neotropical sawflies. During the course of a Lepidoptera caterpillar inventory, the second author reared and collected information on the larvae of a number of species of sawflies from the Area de Conservación Guanacaste (ACG), which lies primarily in Guanacaste Province in northwestern Costa Rica. Details of the rearing records may be found on the website http://janzen.sas.upenn.edu and in Janzen (2000, 2001) and Burns and Janzen (2001). These rearings and notes are significant additions to our knowledge of Neotropical sawflies. Food plants of some species were recorded by Smith (1992, 1995), but life history notes were not included and several additional species have been reared since, including two new species described herein. We comment on 12 tropical species of the family Argidae.

Argidae, Pergidae, and Tenthredinidae are the three dominant families of Symphyta in the Neotropics. The Neotropical argid fauna was treated by Smith (1992) who recorded 5 subfamilies, 32 genera, and 356 species. In Costa Rica, 5 subfamilies (including the addition of Dielocerinae in this paper), 16 genera, and 40 species are known (Smith 1995). Argidae are recognized by the three-segmented antenna: scape, pedicel, and long, single-segmented flagellum. The flagellum is bifurcate in some males. At least 22 species in 13 genera of Symphyta have been reared in the ACG.

Two species of Argidae for which the food plants are known, *Scobina consobrina* (Norton) and *S. guatemalensis* (Dalla Torre), have been taken in Malaise traps in ACG but not reared. Both were reared previously from *Sida* sp. (Malvaceae), the former in Nicaragua and the latter in Veracruz, Mexico (Smith 1992).

Acronyms used are: INBio = Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica; USNM = National Museum of Natural History, Smithsonian Institution, Washington, DC, U.S.A. Voucher numbers associated with each reared adult are expressed as, for example, "99-SRNP-4547," and the voucher record may be obtained from the website at http://janzen.sas.upenn.edu.

ATOMACERINAE

Atomacera Say

Species of *Atomacera* are small, usually 5–6 mm in length, and are completely black or black with part of the thorax red. The male flagellum is simple, the tarsal claw has a single tooth and a large acute basal lobe, the forewing has an intercostal crossvein and the radial cell is open at its apex, and the hind wing lacks the anal cell. The genus occurs from southeastern Canada south to northern Argentina. Smith (1992) recorded 32 species from Mexico southwards. Nine species have been recorded from Central America and four of these from Costa Rica. The host for *A. pubicornis* (F.) from northern South America is recorded as *Ipomoea* sp. (Convolvulaceae) (Smith 1992).

Atomacera raza Smith

Atomacera raza is black with the pronotum, tegula, and mesonotum except scutellum red. It was described from Mexico and Costa Rica (Smith 1992). The single specimen reared from ACG is closest to this species, though there are slight differences in the lancet structure. From this specimen, it is difficult to determine whether it is *A. raza* or a new species. It is referred to *A. raza* for the present.

Distribution.—Costa Rica; Mexico (Veracruz).

Food plant and biology.—A single female (99-SRNP-4547) was reared on *Malvaviscus* sp. DHJ14038 (Malvaceae) foliage from shrubs on the rainforest margin in Sector San Cristobal, eastern ACG. The strong silk cocoon is dirty white, a blocky cylinder in shape, and glued to leaf litter. Ten days elapsed between cocoon spinning and eclosion.

ERIGLENINAE

Eriglenum Konow

Species of this genus are moderate sized, about 8–10 mm in length. Each mandible is three-toothed, the maxillary palpus and labial palpus are 6- and 4-segmented, respectively, the tarsal claws are simple, and the wings are usually black with the radial cell of the forewing closed and the intercostal crossvein present, and the hind wing with the anal cell present.

The genus includes four species (Smith 1992) and occurs from Mexico south to Paraguay and northern Argentina. Two species are known in Costa Rica. The food plant for *E. humeratum* Konow, a South American species known from Venezuela and Brazil to Paraguay and northern Argentina, is *Machaerium* sp. (Fabaceae) (Smith 1992).

Eriglenum crudum Konow
(Fig. 1)

This species is recognized by the uniformly black wings and black clypeus, scape, pedicel, tegula, and legs (see Smith 1992).

Distribution.—Brazil (Amazonas, D.F.); Costa Rica (Guanacaste); Honduras; Mexico (Chiapas).

Food plant and biology.—The larvae of *Eriglenum crudum* feed on newly expanding and young fully expanded leaf blades of *Machaerium acuminatum* Kunth (Fabaceae) (82-SRNP-738, 85-SRNP-404, 86-SRNP-465, 86-SRNP-465.1), a dry forest shrubby vine. While this plant is nearly evergreen, the larvae have been found feeding only during the first month of leaf life and occur at extremely low density. The food plant also occurs at low density. A group of 6–10 eggs are inserted into the margin

of the blade of the leaf, and the larvae feed side-by-side. Larvae of all instars are greenish and yellowish gray with black spots of various sizes (Fig. 1; see 85-SRNP-404 at http://janzen.sas.upenn.edu). From a distance, the feeding larva, hanging loosely and conspicuously on the edge of the leaf blade, resembles damaged leaf tissue. Larval development takes about 8 days. Six days elapse from cessation of feeding and cocoon spinning to eclosion of the adult.

Sericoceros Konow

Sericoceros are medium to large (mostly 8–11 mm in length), plump sawflies, with a very small head, smaller in width than the thorax. Smith (1992) recorded 20 species from the West Indies and Mexico south to northern Argentina. Four species occur in Central America, and three of these in Costa Rica. Hosts for other species are *Coccoloba* spp. (Polygonaceae) for *S. albicollis* (Klug) from northern South America and *S. krugii* (Cresson) from the West Indies (see Martorell 1941 for biology), and *Triplaris caracasana* Cham. (Polygonaceae) for *S. villetanae* Smith from Paraguay (Smith and Benítez Díaz 2001). All three Costa Rican species have been reared in the ACG.

Sericoceros gibbus (Klug)
(Figs. 2, 3)

This species has the head, abdomen, and hind legs black; thorax orange; fore- and midcoxae and forefemur orange; palpi orange; wings black but slightly more hyaline at apices; and the hind wing with the anal cell present.

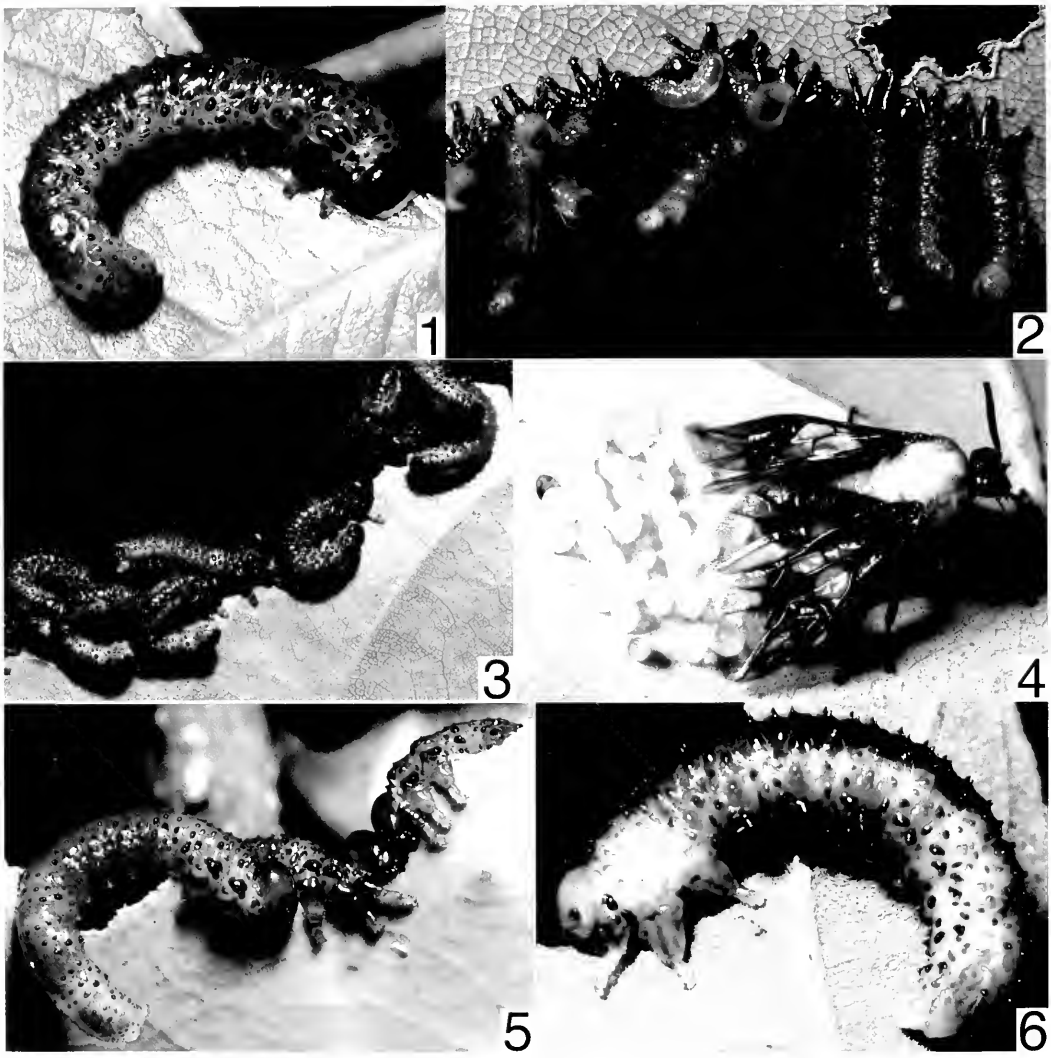
Distribution.—Bolivia, Brazil (Amapá, Amazonas, Ceará, Matto Grosso, Pará); Colombia, Costa Rica (Guanacaste), Guatemala, Guyana, Honduras, Mexico (Chiapas, Veracruz), Panama, Peru, Surinam, Venezuela (Smith 1992).

Food plant and biology.—This species has been recorded from *Coccoloba manzinellensis* Beurl. and *C. caracasana* Meisn. (Polygonaceae) in Panama (Kimsey and Smith 1985). A specimen from Panama is associated with a leaf with 20 oval eggs attached perpendicular to the surface (Smith 1992).

In the ACG dry forest, *Sericoceros gibbus* larvae are found occasionally feeding on new to very old mature leaves of *Coccoloba guanacastensis* W.C. Burger (Polygonaceae) during the rainy season. The food plant is a low density large tree, and all *S. gibbus* have been encountered on saplings less than 2 m tall. A single wasp lays groups of 20–30 orange to red eggs spaced regularly on the upper side of the leaf in a patch about 1 cm in diameter. She then remains with the eggs, as does the female of *Sericoceros mexicanus* (similar to Fig. 4; see below), until the larvae hatch. The larvae are gray green with small black platelike dots and feed side-by-side on the leaf margin (Figs. 2, 3; see 84-SRNP-1472 and 83-SRNP-1247 at http://janzen.sas.upenn.edu) through all instars. The tough silk cocoon is a brown, ovoid cylinder with rounded ends glued to leaf litter. About eight days elapse from cessation of feeding and cocoon spinning until eclosion of the adult, with the males eclosing one day before the females. While the food plant is evergreen in ACG dry forest, there is no hint of generations of this wasp during the dry season. A larva that spun its cocoon in the first few days of the dry season became dormant until two weeks after the rainy season began six months later (see 84-SRNP-2103 at http://janzen.sas.upenn.edu). Considered along with the observation that rainy season *S. gibbus* eclose within two weeks of spinning, this species probably has multiple generations during the rainy season and passes the dry season as a dormant prepupa in its cocoon.

Serococeros mexicanus (Kirby)
(Figs. 4, 5)

This species has the head black; thorax and abdomen orange; legs with coxae, trochanters, and femora orange with the tib-



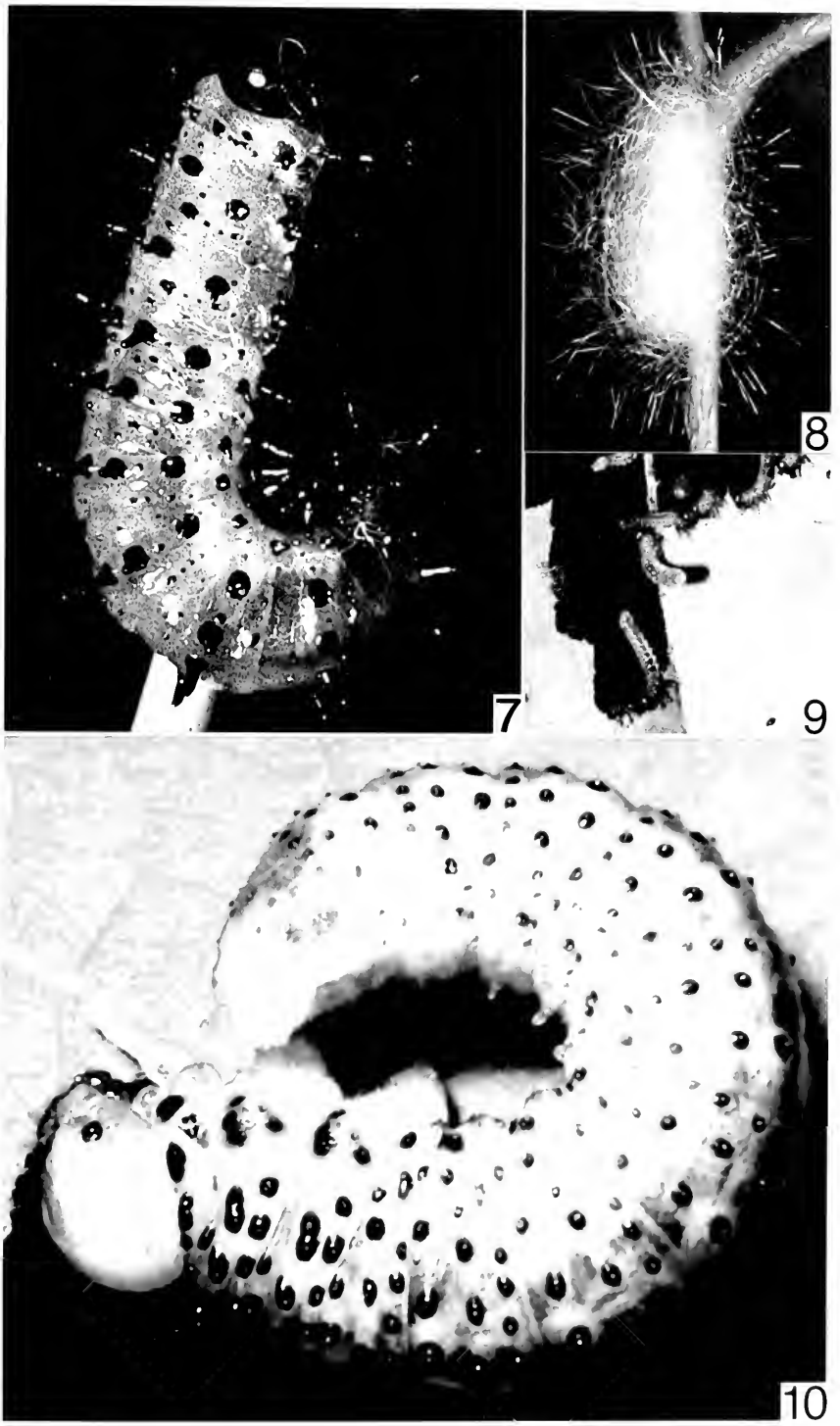
Figs. 1–6. Argidae. 1, Late instar larva of *Eriglenum crudum*. 2, Early instar larvae of *Sericoceros gibbus* on leaf edge; 3, Late instar larva of *S. gibbus*. 4, Adult female of *Sericoceros mexicanus* guarding eggs. 5, Larvae of *S. mexicanus*. 6, Larva of *S. vumirus*.

iae and tarsi black; wings hyaline with a black band below the stigma; and the hind wing without an anal cell. The antennae are short, with an antennal length to head width ratio of 4:3.

Distribution.—Costa Rica, El Salvador, Guatemala, Honduras, Mexico (Colima, Oaxaca, Veracruz), Nicaragua, Panama.

Food plants and biology.—This species has been reared from *Coccoloba uvifera* (L.) L., and *Coccoloba* sp. (Polygonaceae). A leaf with about 20 eggs on the surface is associated with a specimen from Veracruz, Mexico (Smith 1992).

In the ACG dry forest, the biology of *Sericoceros mexicanus* is similar to that described above for *Sericoceros gibbus*. The differences are that *S. mexicanus* eggs may be in patches of as many as 50–70 (each patch laid by one female) and turn from red to pink as they mature (see 84-SRNP-175B at http://janzen.sas.upenn.edu). The



Figs. 7–10. Argidae. 7, Larva of *Ptilia versicolor*. 8, Cocoon of *P. versicolor*. 9, Early instar larvae of *Didyma mattogrossensis*. 10, Late instar larva of *D. mattogrossensis*

egg patches are primarily on the undersides of the horizontally oriented leaves of *Coccoloba venosa* L. (Polygonaceae), while *S. gibbus* eggs are found on both sides of the largely pendant leaves of *C. guanacastensis*. The eggs of *S. mexicanus* cause the leaf to harden and discolor, and each egg leaves a darkened patch of tissue where it was attached. The female stands guard over the eggs until they hatch (Fig. 4). As groups of larvae consume the leaf (Fig. 5; see 84-SRNP-175C at http://janzen.sas.upenn.edu), they avoid the place where the eggs are or were attached. In addition to feeding on *Coccoloba venosa* (which occupies drier parts of the ACG dry forest than does the *Coccoloba guanacastensis* fed on by *S. gibbus*), *S. mexicanus* also has been found feeding on the coastal *Coccoloba uvifera* (89-SRNP-343 at http://janzen.sas.upenn.edu). The tough brown silk cocoon of *S. mexicanus* is an ovoid cylinder glued to litter, and the time from spinning to eclosion in the rainy season is 12–13 days.

Sericoceros mexicanus is parasitized by a medium-small tachinid, *Vibrissina* sp. (Diptera: Tachinidae), as are *S. vumirus* and *Durgoa mattogrossensis* (see below) (D. M. Wood, personal communication). The fly makes its puparium inside the sawfly cocoon, having emerged from the sawfly prepupa. There is one fly per sawfly, and the body mass of the fly appears to be about the same as that of the sawfly. Flies eclose from rainy season generations at about the same date as do the sawflies.

Sericoceros vumirus Smith
(Fig. 6)

This species has the head black; thorax and abdomen orange; mid- and hind tibiae with basal third white, apical two-thirds black; tarsi black; wings uniformly black; and the hind wing with the anal cell present.

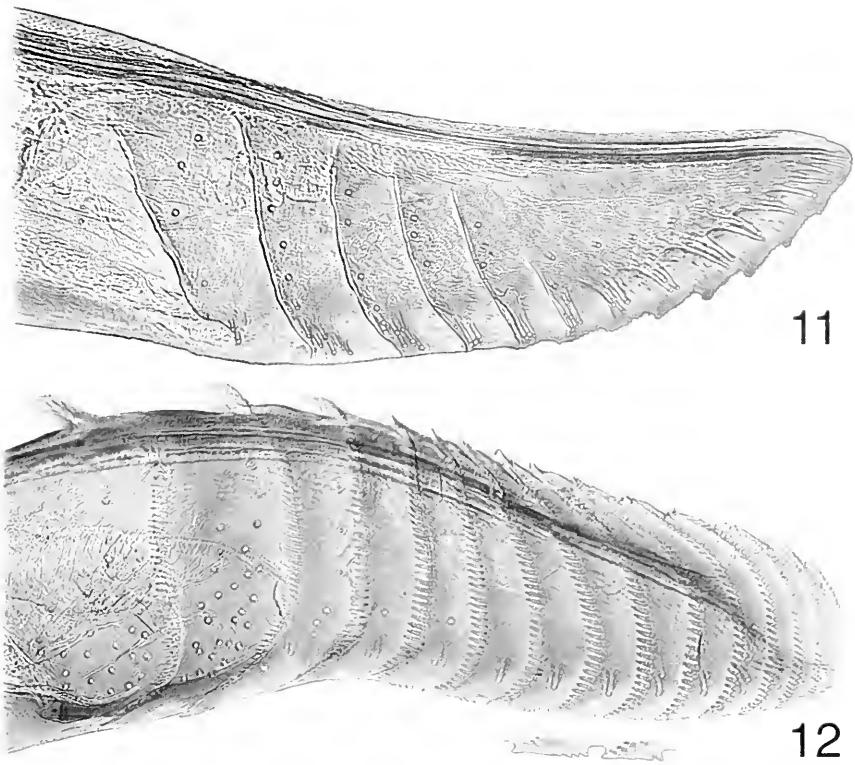
Distribution.—Costa Rica (Guanacaste); El Salvador, Mexico (Chiapas), Venezuela (Smith 1992).

Food plants and biology.—*Sericoceros vumirus* larvae occasionally are found feeding on new to very old mature leaves of *Lonchocarpus minimiflorus* Donn. Sm. (Fabaceae) in the ACG dry forest and on *Lonchocarpus guatemalensis* Benth. (Fabaceae) in the interface between ACG dry forest and rainforest, both in the rainy season. At present, the food plants are common, medium-sized trees in early to middle stages of secondary succession but will probably be rare once the ACG dry forest has returned to old-growth status after several centuries. *Lonchocarpus minimiflorus* is deciduous during the dry season, while *L. guatemalensis* is evergreen and grows in more moist habitats on the edge of the ACG dry forest. *Sericoceros vumirus* larvae are encountered from 2 to 4 m above ground feeding in small groups of 5–10 larvae in the early instars. Each group is presumably the result of a clutch of eggs from one female. Last instars are pinkish red on the thorax, posterior, and venter (dorsally dark green to pink) with small black platelike dots (Fig. 6; see 93-SRNP-7531 at http://janzen.sas.upenn.edu). They feed non-gregariously in the last instar. The tough silk cocoon is a brown, ovoid cylinder with rounded ends glued to leaf litter. The period from cocoon spinning until eclosion is 9–10 days, with no suggestion of prepupal or pupal dormancy during the rainy season. *Sericoceros vumirus* has at least two generations during the rainy season and probably passes the dry season as a dormant prepupa in its cocoon.

The parasitoid tachinid, *Vibrissina* sp., appears to have the same biology in *S. vumirus* as described above for *S. mexicanus*. This tachinid has been reared from *S. vumirus* feeding on both food plants.

DIELOCERINAE

This is the first record of a member of the Dielocerinae in Costa Rica and represents the northernmost record for the subfamily.



Figs. 11–12. Female lancets. 11, *Themos mayi*. 12, *Didymia jonesi*.

Themos mayi Smith, new species
(Fig. 11)

Female.—Length, 11.0–12.0 mm. Yellow, with apex of mandible, antenna, apex of sheath, outer surface of apical two-thirds to three-quarters and entire apex of tibiae, and all tarsi black; inner surface of apical tarsal segments yellow. Forewing black at base to about base of cell M and at apex from about two-thirds length of stigma, with broad yellow band at center; basal two-thirds of stigma and veins in yellow portion yellow; apical third of stigma and veins in dark portions black. Hind wing with basal third black and remainder hyaline, black extending a little more than half length of costa. Antennal length slightly longer than head width, with a ratio of 1.0:0.9. Lower interocular distance greater than eye length, with a ratio of 1.0: 0.6. Distances from eye to hind ocellus, between hind ocelli, and from hind ocellus to hind margin of head as 9:5:9. Tarsal claws bifid, with indistinct rounded basal lobe. Length of hind basitarsus subequal to length of remaining tarsal segments combined. Sheath short, broad; in lateral view straight at apex, in dorsal view uniformly broad with apex flat and blunt. Lancet as in Fig. 11.

Male.—Unknown.

Holotype.—♀, "Voucher: D. H. Janzen, G. W. Hallwachs, caterpillar (Lepidoptera) database, Area de Conservation Guanacaste, Costa Rica. http://janzen.sas.upenn.edu, 00-SRNP-9942" which has the detailed locality of Sendero Derrumbe, Estacion Cacao, Sector Cacao, ACG, 1100 m, 09/18/2000 (deposited at INBio).

Paratypes.—Same data as holotype except 00-SRNP-9944 (1 ♀); Estac. Cacao, 1000–1400 m, SW side Volcan Cacao, Guanac. Pr. Costa Rica, Mar. 1988 GNP Biod. Sur., 32330, 875700, bar code label:

Costa Rica INBIO CRI000022349 (1 ♀). Deposited at INBio and USNM.

Etymology.—This species is named for Philip F. May of Belmont, Massachusetts, in recognition of his magnificent support of the ACG since its inception in 1986.

Food plant and biology.—*Themos mayi* has been found six times as penultimate solitary larvae feeding on mature leaves of *Meliosma idiopoda* S. F. Blake (Sabiaceae) in old-growth forest understory at about 100 m elevation near the ACG Estación Biológica Cacao, where lower elevation rainforest blends into upper elevation cloud forest. It spins a tough, brown, ovoid cylindrical cocoon among leaf litter, and in the two successful rearings the time required from spinning to eclosion was 5–6 weeks. A female of what appeared to be *T. mayi* was observed tenaciously standing over a clutch of eggs fixed firmly to the leaf surface in the same general habitat where larvae had been found.

Remarks.—Smith (1992) included 12 species in *Themos*, all from South America from Venezuela to Brazil. This is the first species known from Central America and is the northernmost record for the genus. *Themos mayi* cannot be keyed through the first couplet of Smith's (1992) key. That couplet divides species into those with entirely hyaline wings and those with the wings black to purplish with a hyaline apex beyond the stigma. *Themos mayi* is the only known species with the forewing black at the base and apex with a broad yellow band at the center. That wing color pattern, coupled with the entirely yellow head, thorax, and abdomen, will separate this species from all others. The lancet is similar to those of other species, with the low, rounded serrulae most resembling those of *T. surinamensis* (Klug), *T. ochreus* Smith, and *T. concinnus* Mocsáry. However, all those species have very dark wings with the hyaline apex.

Recorded hosts for other species of *Themos* are *Luehea* sp. (Tiliaceae) for *T. malaisei* Smith from Brazil and Bolivia; *Eriotheca pubescens* (C. Martius & Zuccarini) Schott & Endlicher (Bombacaceae) for *T. olfersii* (Klug) from Brazil; and *Ceiba pentandra* (L.) Gaertn. (Bombacaceae) for *T. surinamensis* from Brazil, Ecuador, Surinam, and Venezuela (Smith 1992).

Maternal care is known for several species of *Themos*, which is consistent with the fact that all Dielocerinae exhibit this behavior. Dias (1975) gave a detailed account of the biology of *T. olfersii* in Brazil, including observations of maternal care.

STERICTIPHORINAE

Ptilia Lepeletier

The genus *Ptilia* occurs from Mexico to Brazil. Seven species are known. Two are known in Central America and both occur in Costa Rica. The other Costa Rican species, *P. peletieri* (Gray), is similar in size and color to *P. versicolor* but lacks a hyaline spot in the basal black portion of the forewing. *Ptilia peletieri* occurs in rainforests in southern Costa Rica, Panama, and northern South America, and its larval food plant is *Cnestidium rufescens* Planch. (Connaraceae) (Kimsey and Smith 1985).

Ptilia versicolor (Klug)

(Figs. 7, 8)

Ptilia versicolor has the head black; thorax orange with mesonotum, except scutellum, black; abdomen orange with apical 2–3 segments black; forewing black at the base and apex, yellow at center and the black basal part with a central hyaline spot. The antenna is 1.75 times as long as the head width, and the sheath is pointed at its apex in lateral view. Many specimens of *P. versicolor* have been reared, and this species also is collected frequently in Malaise traps in the dry forest of the ACG.

Distribution.—Belize, Costa Rica, Guatemala, Honduras, Mexico (Chiapas, Guerrero, Jalisco, Nayarit, Oaxaca, Quintana Roo, San Luis Potosí, Tamaulipas, Veracruz, Yucatan) (Smith 1992).

Food plant and biology.—The larvae of *P.*

versicolor feed solitarily on very young shoot tips and leaves of *Rourea glabra* Kunth (Connaraceae), an evergreen scanden shrub, in the ACG dry forest. Larvae are encountered during both the rainy and dry seasons. Even when starving, the larvae will not eat mature leaves of the food plant. Compared to other argid larvae, the larvae of *P. versicolor* are very agile and quickly walk over the surface of the plant to new shoot tips and very young leaves when they have eaten those on their branch. They are much more caterpillar-like than are larvae of other argids. The larvae are encountered most commonly during the month before and after the rains begin because that is when *R. glabra* is most actively producing new leaves. Although larvae feed solitarily, there commonly are 2–10 larvae on a single branch, which probably started from a single clutch of eggs. The last instar larva (Fig. 7; see 84-SRNP-117 at http://janzen.sas.upenn.edu) has a black head, and the anterior half of the body is very light gray while the posterior half is yellow orange; the entire larva is dotted with black platelets, each with a short spike in the center. *Ptilia versicolor* shares its food plant with *Trochophora lobata* (see below).

The ovoid, cylindrical cocoon (Fig. 8) is spun on a newly defoliated branchlet of the food plant, rather than in the litter as is commonplace with ACG Symphyta. It is very conspicuous on the plant, with its light translucent golden beige to gray color with numerous long thin black spikes. At first glance, its color, form, and apparent translucence give the impression of a ctenuchid moth cocoon from which the adult has eclosed, presumably a color pattern selected for by its value in deterring predation by birds. About nine days pass between cocoon spinning and eclosion, and there is no suggestion of dormancy during wet or dry seasons. This is the only species of sawfly in the ACG dry forest known to produce continuous generations as long as new food plant foliage is available.

Even though the larvae are inconspicuous, they can be found easily by searching for the pink-red new foliage of the food plant. They are present (at varying numbers) all year. No parasitoids have been reared from 66 individual rearings.

Trochophora Konow

The distinctive feature for species of *Trochophora* is the greatly enlarged jugal lobe of the hind wing (Smith 1992, figs. 663, 664). Two species are known, *T. lobata* from Costa Rica to Brazil and *T. opla* Smith from D. F., Brazil.

Trochophora lobata (Erichson)

Any small argid encountered (ca. 6.0 mm long) in Costa Rica with a huge jugal lobe to the hind wing is undoubtedly *T. lobata* or an undescribed species.

Distribution.—Brazil (Amazonas, Maranhão, Mato Grosso, Pará, Roraima); Costa Rica (Guanacaste), Guyana, Panama, Venezuela (Smith 1992).

Food plant and biology.—The larva of *Trochophora lobata,* like that of *P. versicolor* described above, feeds only on the reddish-pink, unexpanded leaves and shoot tips of *Rourea glabra* (Connaraceae) in the ACG dry forest. The larva is much smaller than that of *P. versicolor* and more pinkish yellow (but also has fine black dots). Its color matches the new leaves quite well; hence, it is not nearly as conspicuous as the larva of *P. versicolor.* From 5–10 *T. lobata* larvae may be found feeding on a single expanding branch end, and there can be several hundred on a single food plant, but the larvae do not feed side-by-side as is the case with, for example, *Sericoceros. Trochophora lobata,* like *P. versicolor,* is capable of consuming the entire new leaf crop on a *R. glabra* shrub (which, however, remains evergreen since the new leaves are produced in small spurts to add to the standing mature leaf crop).

The tough, hard brown cocoon is nearly

spherical and spun between leaves in the litter. The time from spinning to eclosion is 10–25 days, but in one case a prepupa or pupa remained dormant for five months of the rainy season (before being killed by accident). *Trochophora lobata* larvae have been found only in late April and early May in the ACG dry forest, at the time of maximum new leaf production by *R. glabra,* and 2–4 weeks before onset of the rainy season. However, because there is little sign of a prepupal or pupal dormancy, it is possible that there are successive generations during the rainy season on the low and continuous production of new leaves by their food plant. This possibility, however, is reduced by the seemingly thorough defoliation of these low density new leaves by *P. versicolor.*

While more than 50 individual *T. lobata* have been reared in the ACG dry forest, only one batch of larvae produced parasitoids. From this batch of ten last instar larvae collected from a single *R. glabra* plant, three sawflies eclosed 12 days after spinning, and, five months later, several ichneumonids (*Physotarsus adriani* Gauld, see Gauld 1997) eclosed. The wasp had oviposited in the sawfly larva, and the wasp larva emerged from the prepupa to spin its cocoon. The overwhelming majority of this wasp subfamily—Ctenopelmatinae—are koinobiont endoparasitoids of sawfly larvae (I. D. Gauld, personal communication).

Didymia jonesi Smith, new species
(Figs. 12–14)

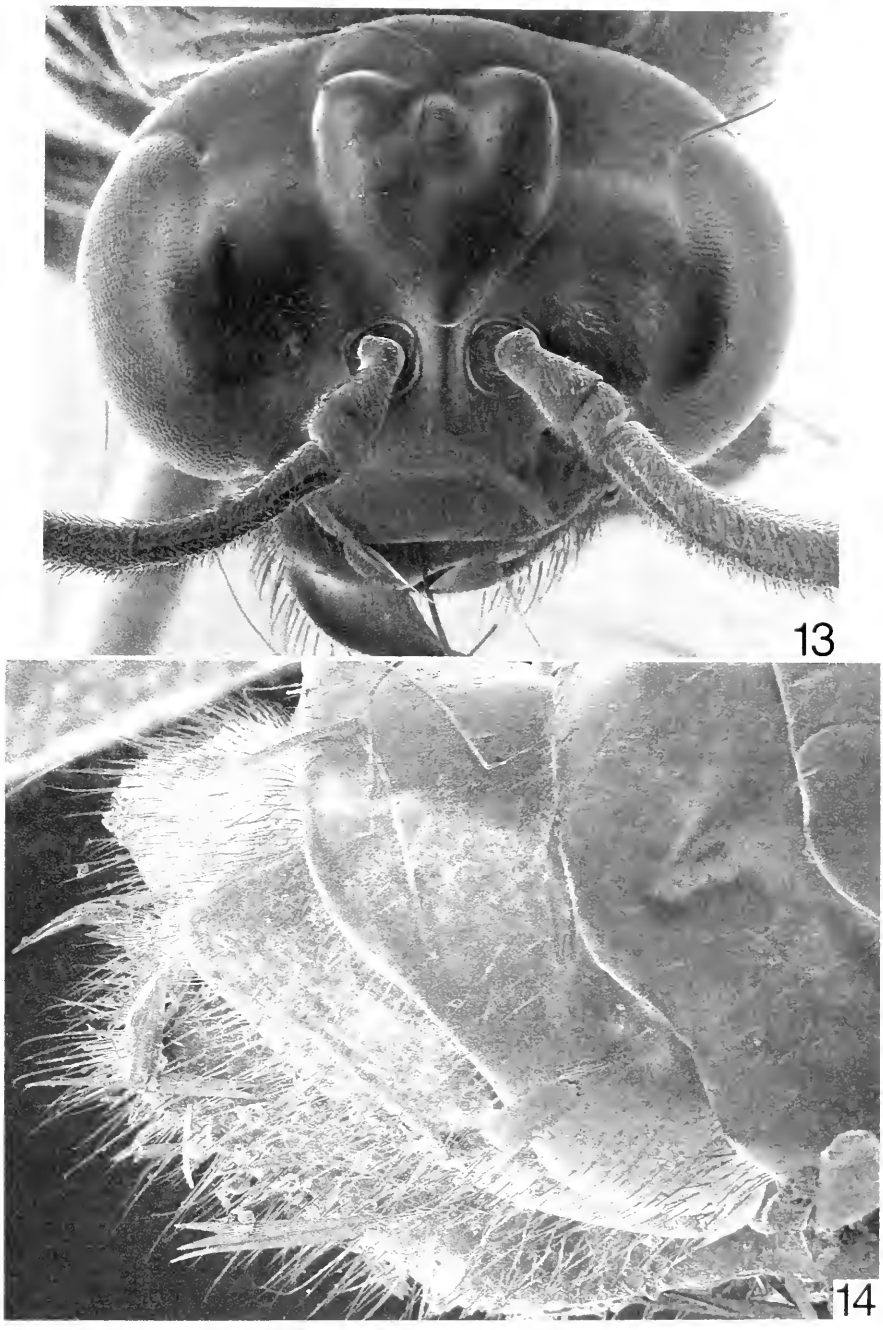
Female.—Length, 6.0 mm. Antenna, head, thorax, and legs black; apex of mandible reddish brown; outer surface of apex of forefemur, foretibia, and foretarsus white. Abdomen orange, about apical half of sheath black. Forewing with intercostal area, base of wing basal to base of cell M, and band below stigma black; area between base and band and apical to band hyaline; band below stigma nearly as broad as stigma at anterior but narrowing posteriorly; extreme apex of wing dusky, but not black. Hind wing hyaline with extreme base, intercostal area, and extreme apex dusky. Head and body shining and impunctate. Antennal length slightly longer than head width, ratio 1.00:0.95. Fourth segment of maxillary palpus short, broadened, about half length of fifth segment, fifth and sixth segment slender and about equal in length. Clypeus very shallowly, broadly emarginated, subtruncate. Eyes large and converging below, lower interocular distance subequal to eye length (Fig. 13). Distances between hind ocellus and eye, between hind ocelli, and between hind ocellus and posterior margin of head as 4.0:4.0:3.5. Forewing with radial cell closed, with apical accessory vein; apex of costa about as broad as intercostal area; first cubital crossvein (Rs) absent, thus with three cubital cells. Hind wing with cell R open at apex; anal cell present, with petiole length subequal to length of cell. Hind basitarsus subequal in length to length of remaining tarsal segments combined. Sheath uniformly slender in dorsal view, without laterally projecting scopae, rounded in lateral view (Fig. 14). Lancet as in Fig. 12, with low, flat serrulae and distinct annular spines.

Male.—Unknown.

Holotype.—♀, "Voucher: D. H. Janzen & W. Hallwachs, caterpillar (Lepidoptera) database, Area de Conservacion Guanacaste, Costa Rica. http://janzen.sas.upenn.edu, 00-SRNP-9026" which has the detailed locality of Sendero Toma Agua, Estacion Cacao, Sector Cacao, ACG, 1100 m, 02/29/2000 (deposited at INBio).

Paratypes.—Same data as for holotype except 00-SRNP-9027 (1 ♀); Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, K. Taylor, 31 mar–29 abr 1992, L-N 330200, 380200, bar code label: Costa Rica, INBIOCRI000523814 (1 ♀). Deposited at INBio and USNM.

Etymology.—This species is named in honor of Randy Jones in recognition of his



Figs. 13–14. *Didymia jonesi*. 13, Head, front view. 14, Apex of female abdomen, sheath at left.

massive support of INBio and the ACG since their inception in the late 1980's.

Food plant and biology.—This sawfly has been reared from larvae feeding on *Connarus* sp. (Connaraceae).

Remarks.—*Didymia* contains about 20 species, mostly from Brazil and Peru; two species are known from Panama. *Didymia unifasciata* Smith from Panama has been reared from *Rourea glabra* (Kimsey and

Smith 1985). Smith (1992) did not record this genus from Costa Rica, but two other species, *Didymia unifasciata* Smith and *D. nasuta* (Cameron), have been collected since.

With the orange abdomen and black thorax and legs, this new species runs to *D. tensa* Smith from D. F., Brazil, in couplet 12 of Smith's (1992) key. However, *D. tensa* has only abdominal segments 2–4 orange, and the female lancet is entirely different (see Smith 1992, fig. 364). The lancet and wing maculation of the new species resemble those of *D. nasuta* (Smith 1992, fig. 360), but *D. jonesi* can be distinguished by the black thorax, orange abdomen, and lancet, especially by the distinctly differentiated serrulae.

Sphacophilus Provancher

Sphacophilus is a large genus of 41 species, concentrated from southwestern United States to Central America, with a few species extending south to northern Argentina. About nine species occur in Central America, with five of these known from Costa Rica.

Sphacophilus janzeni Smith

Sphacophilus janzeni is small, about 5.5 mm long, black with red on the thorax except for the black mesopleuron; hyaline wings with the area below stigma black; sheath broad, with scopae; and lancet with annular hairs, serrulae with subbasal teeth, and dorsal and ventral halves different. This species was described from numerous specimens from Sector Santa Rosa of ACG, from rearing and Malaise trap collections (Smith 1992).

Distribution.—Costa Rica (Guanacaste).

Food plant and biology.—The small green larvae of *S. janzeni* commonly are encountered eating very new and still expanding leaves on small saplings (20–200 cm tall) of *Hymenaea courbaril* L. (Fabaceae), an occasional large evergreen tree once common in the ACG dry forest. The larvae fit securely into the inner margin of the bay being eaten out of the margin of the leaf (see 83-SRNP-970 in http://janzen.sas.upenn.edu). There may be as many as four larvae on a single leaflet (the food plant has two leaflets per leaf), but more commonly there are one or two. There can be 1–20 larvae scattered among the new leaves within the crown of a single sapling. The larvae eat only new and expanding leaves and, even if starving, will not feed on leaves more than about a month old. When a moth caterpillar, such as *Schausiella santarosensis* Lemaire (Saturniidae) or *Moresa valkeri* Schaus (Notodontidae), is feeding in the same foliage, it avoids the leaflets on which the sawfly larvae are feeding, but if starving will consume these leaves also. Larvae are encountered most easily when small saplings of *H. courbaril* are producing their new leaves in the month following the beginning of the rainy season, but larvae also are found on new leaves during the last two months of the rainy season (adult trees produce new leaf crops in the first month of the dry season, while small saplings have a flush of new leaves at the beginning of the rainy season and continue to produce some new leaves throughout the rainy season). No larvae have been found on new *H. courbaril* leaves in the dry season, even though new leaves are commonplace on saplings.

The tough brown ovoid cylindrical cocoons are glued to leaf fragments in the litter. There are 7–15 days from cocoon spinning to eclosion. There is no sign of dormancy even by larvae that spun cocoons late in the rainy season. Reproductively inactive adults are possibly the stage that passes the dry season.

Out of 26 efforts to rear *S. janzeni* larvae, three individuals were parasitized by *Boethus forresti* (Ichneumonidae, Tryphoninae, Tryphonini). The wasps eclosed 15–20 days after the *S. janzeni* cocoons were spun. The wasp larva spins its cocoon inside the *S. janzeni* cocoon. Tryphonini are koinobiont parasitoids of sawfly larvae;

the egg is attached externally, and the larva feeds externally on the cocooned prepupal sawfly larva (I. D. Gauld, personal communication).

Sphacophilus edus Smith

This species is similar to *S. janzeni*, but the mesepimeron and upper portion of the mesepisternum are red, the mesoscutellum is black, and the lower interocular distance equals the eye length. This species was described from specimens from Canal Zone, Panama (Smith 1992). The male is unknown.

Distribution.—Costa Rica; Panama.

Food plant and biology.—The last instars of *Sphacophilus edus* are yellowish with black dots on the thorax and abdomen and with brown heads, and feed side-by-side on relatively new foliage of *Heteropterys laurifolia* (L.) A. Juss (Malpighiaceae). *Heteropterys laurifolia* is an occasional evergreen vine on the banks of seasonal watercourses in ACG dry forest. Clutches of *S. edus* have been found only twice (two weeks before the beginning of the rainy season) despite intense searching of many individuals of the food plant during a decade of intense inventory (e.g., 00-SRNP-7510, 00-SRNP-7526, 00-SRNP-7521, 00-SNRP-7538 in http://janzen.sas.upenn.edu). The tough, brown, silk, nearly spheroidal cocoons are spun among litter, and it takes about 9 days from spinning to eclosion (n = 8). However, about 40 prepupae remained inactive in their cocoons and eventually died due to disease. In nature, it is possible that they remain dormant for a year until the food plant makes its next (annual) flush of new foliage. However, in captivity the pupae did not receive appropriate seasonal cues for further development.

A few individuals in both clusters of *S. edus* were parasitized by an undescribed species of *Proterops* (Braconidae, Ichneutinae). This wasp subfamily specializes in parasitizing Symphyta larvae (Sharkey and Wharton 1994), and this is the first Neotropical rearing record for *Proterops* (M. Sharkey, personal communication). In one clutch of hosts, the wasps required 15–20 days to eclose (n = 9), and in the other 61 days (n = 3). The wasp larva emerges from the prepupa of *S. edus* and spins its own cocoon inside that of *S. edus*.

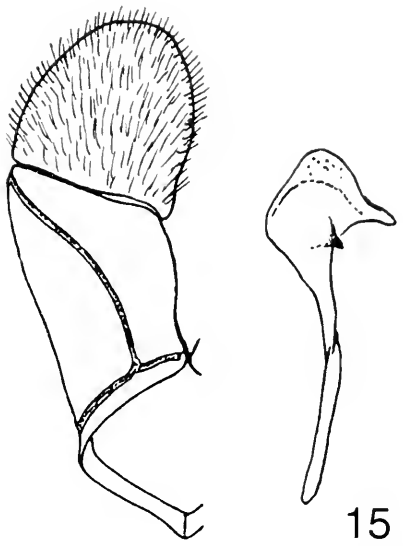


Fig. 15. Male genitalia of *Durgoa mattogrossensis*, ventral view of harpe and parapenis at left, lateral view of penis valve at right.

Durgoa Malaise

Durgoa includes four species in South America. Three are known only from Brazil. Costa Rica is the northernmost record for the genus.

Durgoa mattogrossensis Malaise
(Figs. 9, 10, 15)

The female of *Durgoa mattogrossensis* has the antenna and head black; thorax yellow; abdomen yellow with the apical tergum and sheath black; foreleg orange with the tibia and tarsus darker than the femur; and the mid- and hind coxae, trochanters, and femora orange with the tibiae and tarsi black; wings lightly, uniformly infuscated, slightly paler toward apex; veins and stigma black. The following is the first description of a male for the genus. There is

much more variation in the amount of black on the thorax and abdomen in the male than in the female. It will key to *D. mattogrossensis* in Smith's (1992) key, except that the thorax and abdomen are not entirely orange as described for the female.

Male.—Length, 8.5–9.0 mm. Antenna and head black. Thorax and abdomen mostly orange with cervical sclerites; narrow anterior margin of pronotum, tegula, spot on inner margin and lateral margin of each lateral lobe of mesonotum, large spot on mesoscutellum; metanotum and most of abdominal dorsum black. Amount of black variable, with cervical sclerites and dorsum of thorax and abdomen with smaller amounts of black or almost entirely orange. Wings uniformly, very lightly infuscated, slightly more hyaline at apex; veins and stigma black. Antennal length twice that of head width. Genitalia as in Fig. 15; penis valve with narrow dorsal lobe and with sclerotized laterally projecting spine.

Distribution.—Brazil (Bahia, Mato Grosso, Minas Gerais); Costa Rica; Peru; Venezuela (Smith 1992).

Food plant and biology.—A specimen from Bahia is labeled "on leaves of Leguminosae" (Smith 1992).

During its single annual generation, *Durgoa mattogrossensis* is the most conspicuous and easily located of all of the sawfly larvae of the ACG dry forest. It would be an ideal candidate for detailed ecological studies of a common and highly gregarious tropical dry forest sawfly. The first instar (Fig. 9) is dull gray green and gradually becomes more yellow and ostentatious as it matures through subsequent instars. The last instar is yellow to dull orange with small brown spots and a yellow-orange head with a brown "false eye" spot (Fig. 10; see 99-SRNP-10356 at http://janzen.sas.upenn.edu). Of the more than 100 species of Fabaceae in the ACG dry forest, *Bauhinia ungulata* L. (Fabaceae) is the only species used by the larvae of *D. mattogrossensis*. The plant is a very common shrub or small tree in dry forest secondary succession (though it might have been a much more scarce plant when confined to naturally-occurring disturbance sites). Adults eclose from underground cocoons in the first week of June, approximately three weeks after the beginning of the rainy season. Eggs are inserted in the margins of full-sized mature leaves at that time, and the larvae feed gregariously, side-by-side throughout development, eating leaves of all ages. However, if individual larvae are isolated in nature or the laboratory, they continue feeding and developing normally. If undisturbed, the larvae feed on a leaf until it is completely consumed (except for the thicker veins) and then walk to the next leaf and repeat the feeding process. Last instars are very sensitive to disturbance and readily drop off the foliage to the litter, where they burrow in to pupate below the litter in the top 1–5 cm of loose soil. The pupation chamber is ovoid, about 12 mm long, and lined with a dense layer of strong silk (to the outside of which is glued a 1–2 mm thick layer of dirt). The cocoons may be collected in massive numbers by digging through the upper soil immediately beneath large defoliated *B. ungulata*.

By late June there are millions of larvae defoliating their common food plant in central Sector Santa Rosa in ACG. A single 2 m tall *B. ungulata* can have as many as 300 *D. mattogrossensis* larvae feeding on it at one time. The intensity and thoroughness of defoliation is very heterogeneous within and between years. It is commonplace for one patch of *B. ungulata* to have no *D. mattogrossensis* larvae and another a few hundred meters away to be almost totally defoliated. Likewise, within a patch some plants are untouched, while others are fully defoliated. In some years, larvae occur in very low density (e.g., 1997, 2000), and in other years they are extremely abundant (e.g., 1999, 2001). By early

July, many of the larvae have dropped to the ground to spin their cocoons, but since there is a long period of egg laying well into mid-late June, and since some larvae grow slowly (apparently due to semi-starvation due to defoliation of their food plants by those who came before), last instar larvae may still be found as late as mid-July.

In nature, there is no indication of a second generation of *D. mattogrossensis* during the same rainy season as the first generation. In captivity, about 5% of the prepupae pupate shortly after spinning and eclose about one month after spinning, but the remainder stay in the prepupal state until the first month of the following rainy season (11–12 months after spinning), when they pupate and eclose shortly thereafter. In captivity (in dry glass bottles at ambient temperature), 10–20% of the prepupae do not respond to the onset of the first rainy season a year after spinning. These remain dormant until eclosing at the beginning of the second rainy season two years after spinning (some prepupae also die mummified, but it is not clear whether this is due to disease or failure to receive the appropriate eclosion cues in laboratory circumstances). However, in nature, with full wetting and chilling of the dormant prepupae in their cocoons in the soil, it is likely that all of the prepupae eclose about a year after spinning.

The larvae are infrequently attacked by two species of *Vibrissina* (Tachinidae). The fly larva remains dormant until the sawfly cocoon has been spun. It remains dormant in the apparently healthy *D. mattogrossensis* prepupa for 2–3 weeks, and then consumes the prepupa, emerges, and makes its puparium inside the sawfly cocoon. There is only one maturing fly larva per sawfly larva. The fly ecloses 1–2 weeks later, approximately 3–6 weeks after the sawfly spun its cocoon. However, in a few cases the fly waited 1–2 months before attacking the sawfly prepupa, and therefore eclosed 2–3 months after the sawfly spun its cocoon. While the great majority of *D. mattogrossensis* remain dormant in their cocoons for a year (and are thus univoltine), the flies do not. The flies therefore either have subsequent generations on other species of sawflies (and one of them does parasitize the larvae of *Sericoceros mexicanus* and *Serococeros vumirus*, see above) or survive 8–10 months as reproductively inactive adults. This pattern of parasitization implies that a single common species of host, *D. mattogrossensis*, may generate an enormous number of specialist tachinids that then are far more abundant attackers of other much rarer species of sawfly larvae than would be the case if the tachinid population were sustained only by the rare hosts (such as *Sericoceros*).

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