

A REVIEW OF *CHALODETA* STICHEL WITH A REVISION OF THE
CHELONIS GROUP (LEPIDOPTERA: RIODINIDAE)

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Abstract.—An overview of the Neotropical riodinid genus *Chalodeta* Stichel is presented which defines the taxon, delineates its member species, and discusses its systematic position within the tribe Riodinini. A revision of the *Chalodeta chelonis* group includes notes on the taxonomy and biology of its species, and illustrations of the adults and male and female genitalia (where known) of all taxa. Four species are recognized, including two that are previously described, *C. chelonis* (Hewitson 1866) and *C. chaonitis* (Hewitson 1866), and two that are described here, *C. chitinosa*, n. sp., and *C. chlosine*, n. sp. The taxon *stilbos* Stichel 1910, is synonymized with *C. theodora* (C. and R. Felder 1862) (n. syn.).

Key Words: *Chalodeta*, *Charis*, Neotropics, Riodinini, taxonomy

The monophyly of most genera in the Riodinidae has never been critically assessed, but to do so is vitally important if the family's classification is to become a predictive tool in broader evolutionary studies. The purpose of this paper is two-fold. The first is to provide an overview and diagnosis for the small riodinid genus *Chalodeta* Stichel 1910, which has historically often been confused with other genera in the tribe Riodinini (*sensu* Harvey 1987), particularly *Charis* Hübner [1819], delineate its constituent species, and discuss its systematic position, biogeography, and biology. *Chalodeta* is hypothesized here to consist of two monophyletic groups, and the second purpose of this paper is to present a revision of one of these, the *chelonis* group, whose true species diversity has previously gone undetected. It consists of two named species, *C. chelonis* (Hewitson 1866) and *C. chaonitis* (Hewitson 1866), and two additional species, widely sympat-

ric with *C. chaonitis*, that are described here. All four *chelonis* group species are illustrated here, while adequate color figures of all *theodora* group species may be found in d'Abrera (1994) (*C. theodora* (C. and R. Felder 1862) and *C. lypera* (Bates 1868)) and Hall and Willmott (1998) (*C. pescada* Hall and Willmott 1998 and *C. panurga* Stichel 1910).

METHODS

Dissections were made using standard techniques, abdomens being soaked in hot 10% potassium hydroxide solution for approximately five minutes, and subsequently stored in glycerol. Specimens dissected are indicated in the material examined sections with an asterisk. Morphological terms for genitalia follow Klots (1956) and Eliot (1973), and the terminology for wing venation follows Comstock and Needham (1918). The protocol for listing material examined follows Hall (1999).

Chalodeta chelonis group specimens have been examined and their locality data recorded in the following collections, whose acronyms are used throughout the text. Only locality data are given in the species accounts of described taxa, but full label data are given for new species.

AME	Allyn Museum of Entomology, Florida Museum of Natural History, Sarasota, FL, U.S.A.
BD	Collection of Boyce Drummond, Florissant, CO, U.S.A.
BMNH	The Natural History Museum, London, U.K.
JHKW	Collection of Jason Hall and Keith Willmott, Washington, DC, U.S.A.
MUSM	Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru
RPM	Reading Public Museum, Reading, PA, U.S.A.
SMF	Senckenberg Museum, Frankfurt, Germany
SMTD	Staatliches Museum für Tierkunde, Dresden, Germany
USNM	National Museum of Natural History, Smithsonian Institution, Washington, DC, U.S.A.
ZMHU	Zoologische Museum für Naturkunde, Humboldt Universität, Berlin, Germany
ZSM	Zoologische Staatssammlung, Munich, Germany

REVIEW OF *CHALODETA*

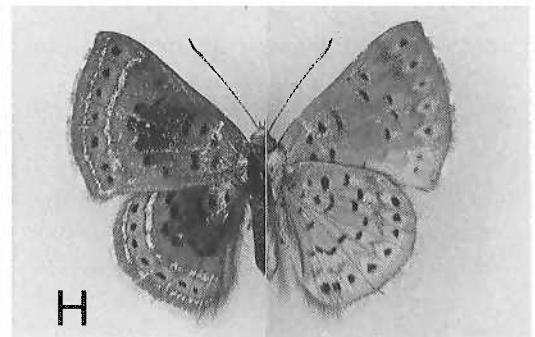
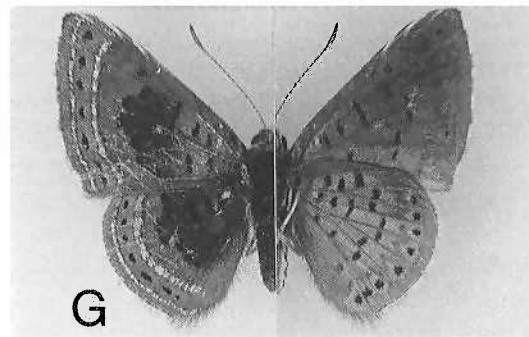
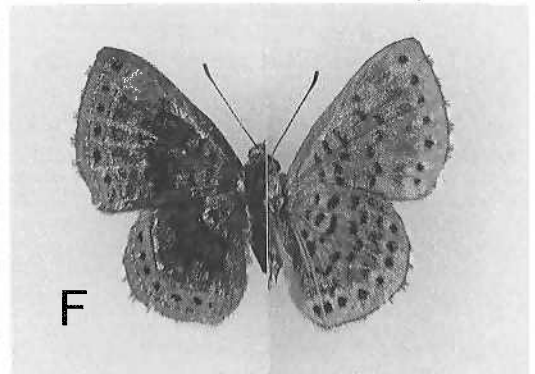
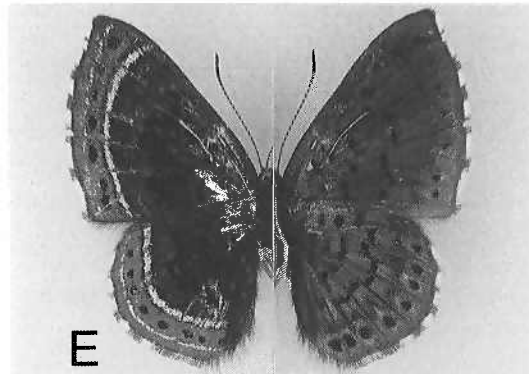
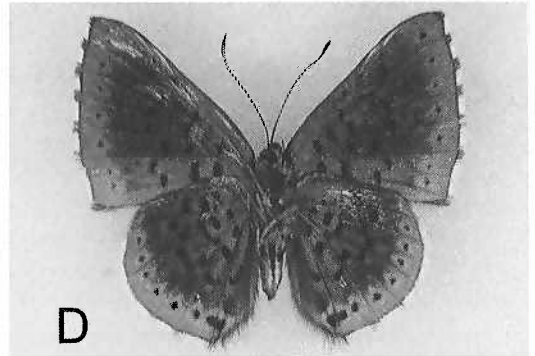
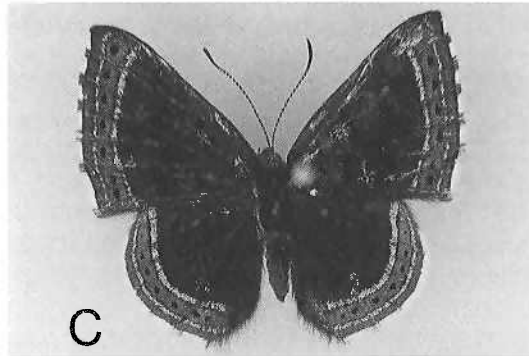
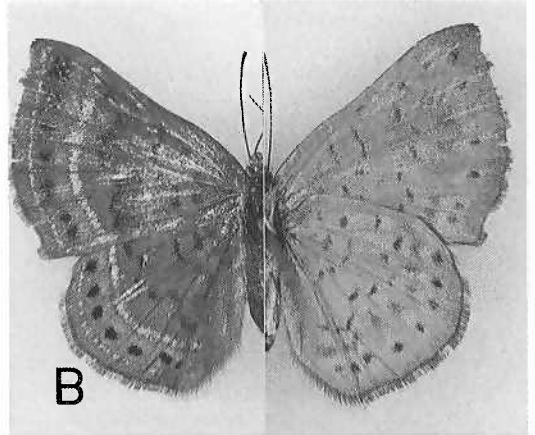
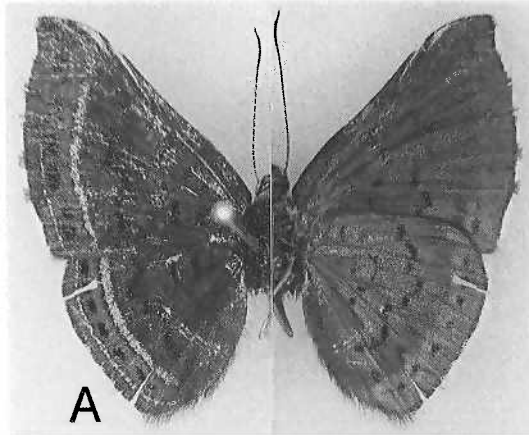
Chalodeta Stichel 1910

Chalodeta Stichel 1910b: 15. Type species by original designation: *Charis theodora* C. and R. Felder 1862: 72.

Diagnosis and systematic position.—*Chalodeta* species are small to medium-sized riodinids (forewing length 10 mm [*theodora*] to 16 mm [*chelonis*]) with compact wing shapes, often slightly falcate forewing apices, and rounded hindwings. The dorsal surface is typically brown with

one (all *theodora* group species except *theodora*) or two (all *chelonis* group species and *theodora*) submarginal blue or greenish silver lines, three dark brown markings in the discal cell, and discal, postdiscal and submarginal bands of dark brown spots. The ventral surface is typically iridescent blue or purple in males and brown in females and has similar markings to the dorsal surface except no silver submarginal lines are present (see Figs. 1A–H). The fringe of both wings is often entirely white. All members of the often confused genus *Charis* except the misplaced *ocellata* group (Hall and Harvey, in prep.) have two dorsal submarginal silver lines, and all except one have some ventral submarginal silver markings. The exception is a recently described member of the *Charis gynaea* group (Hall and Harvey 2001), which was figured by DeVries (1997) as “*Chalodeta candiope*” and presumably placed by him in *Chalodeta* because of its lacks of ventral silver markings.

The male genitalia of all *Chalodeta* species (see Figs. 2A–D, 3) possess the deep notch in the anterior margin of the tegumen characteristic of the tribe Riodinini. The uncus is rectangular and in *chelonis* group species typically forms a small bifurcate posterior projection medially along the dorsal margin. The falces and tegumen are of average size and shape for the tribe, and the vinculum is evenly narrow and somewhat arched medially. The aedeagus is characteristically short, narrow and straight, unlike that of *Charis* and most other riodinine species, in which it is long and variably asymmetrically curved; no cornuti are present. The structure of the posteriorly elongate pedicel is unique. It is tightly appressed to the aedeagus, its tip forms a ventrally directed plate, and its basal ventral margin is unsclerotized. The ventral tip contains elongate spines around its perimeter in *chelonis* group species, but only very small spines (*lypera* only) or no spines in *theodora* group species. The valvae of the two *Chalodeta* species groups are very distinct.



Those of the *chelonis* group (Fig. 2) have a small narrow lower process that is unsclerotized at its base and a posteriorly elongate upper process that typically has a medial dorsal projection and long broad spines at the tip of both upper projections (only *chitinosa* lacks a dorsal upper process). The transtilla is connected to the upper valve process only at its base and is narrow and very posteriorly elongate with two upwardly curving brachia at its tip. Valvae of the *theodora* group (Fig. 3; see also male genital illustration of *C. pescada* in Hall and Willmott 1998) have an entirely sclerotized lower process and an upward and slightly outwardly directed upper process with no spines. The transtilla is connected to the upper valve process along its entire length, creating a broad concave dorsal plate that narrows to a small bifurcate and grooved tip within which the tip of the aedeagus is confined.

The female genitalia (see Figs. 4A–C) differ slightly between the two species groups. Those of the *chelonis* group have an elongate corpus bursae with elongate invaginated spine-like signa and a large area of sclerotization on the eighth abdominal sternite that is often medially desclerotized. The known females of the *theodora* group have a rounded corpus bursae with the signa either forming rectangular invaginations with an elongate base at the wall of the corpus (*theodora*) or two sclerotized bands at the wall of the corpus (*lypera*), and a small area of sclerotization on the eighth abdominal sternite. In all species, the ductus bursae is relatively short and unusual in extending to the dorsal tip of a posteriorly elongate ostium bursae. The position in all *Chalodeta* species of the small ventral sclerotized plate in the ductus bursae at the

opening of the corpus bursae instead of immediately before the ostium (creating an elongate ductus seminalis parallel to the ductus bursae) is not known elsewhere in the tribe.

As indicated above, despite a superficial external similarity (including the possession of hairy eyes), the genital morphology does not suggest a particularly close relationship between *Chalodeta* and *Charis* within the Riodinini, although the presence of most wing pattern elements in the species of these genera suggests they are both relatively basal within the tribe. Currently very little is known about relationships between genera in the Riodinini and what makes the pursuit of this knowledge all the more difficult is the relative lack of conservative characters. While the tremendous interspecific variation in genitalia provides good diagnostic characters at the species and species-group levels, it acts to confound the elucidation of relationships at the generic level and above. The other putatively basal riodinine genera which still possess most wing pattern elements are *Metacharis* Butler 1867, *Dachetola* Hall 2001, *Calephelis* Grote and Robinson 1869, *Caria* Hübner 1823, *Amphiselenis* Staudinger 1887, *Lasaiia* Bates 1868, and *Exoplisia* Godman and Salvin 1886. However, the male genitalia of all but the first two of these genera possess pedicels tipped with the typical riodinine scobinate patch. *Chalodeta* may be most closely related to *Metacharis* and *Dachetola*, which possess a somewhat similar wing pattern devoid of ventral silver, and a posteriorly elongate “rod”-like pedicel and a simple strap-like pedicel respectively.

History of classification.—Stichel (1910a) described the genus *Chalodeta* to

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Fig. 1. *Chalodeta* adults (dorsal surface on left, ventral surface on right, unless otherwise stated). A, ♂ *C. chelonis*, Petrópolis, S.E. Brazil (USNM). B, ♀ *C. chelonis*, Petrópolis, S.E. Brazil (USNM). C, Holotype ♂ *C. chlosine*, dorsal surface, Pakitza, Peru (USNM). D, Holotype ♂ *C. chlosine*, ventral surface. E, Holotype ♂ *C. chitinosa*, Tingo Maria, Peru (USNM). F, Allotype ♀ *C. chitinosa*, Pakitza, Peru (USNM). G, ♂ *C. chaonitis*, Parque do Gama, S.E. Brazil (USNM). H, ♀ *C. chaonitis*, Parque do Gama, S.E. Brazil (USNM).

include the species *theodora*, *lypera*, *panurga*, *chaonitis*, and *calagutis* Hewitson 1871, designating the first of these as the type species, but subsequently added *chelonis*, *epijessa* Prittwitz 1865, *azora* Godart [1824] (Stichel 1910b) and *speusippa* Schaus 1928 (Stichel 1930–31). The taxon *virido* Lathy 1958, was added to *Chalodeta* by Rebillard (1958) as a subspecies of *chelonis*, but subsequently raised to species rank by Callaghan (1995). In his first riodinid catalog, Bridges (1988) placed *calagutis* in *Charis*, presumably inadvertently, although *calagutis* and the remaining members of the *ocellata* group are actually generically distinct from *Charis* (Hall and Harvey, in prep.). d'Abbrera (1994) confused the generic status of *Chalodeta* by combining it with *Charis* in his pictorial overview of the family, stating: "Some workers follow Stichel (1910) in separating certain species in this group into the genus *Chalodeta* Stichel, 1910. . . . This writer considers this confusing and unnecessary and will retain them all in *Charis* Hübner." However, Bridges (1994) retained *Chalodeta* distinct from *Charis*. Most recently, DeVries (1997) synonymized *speusippa* with *lypera*, Hall and Willmott (1998) described *pescada*, and Hall (2001) transferred *virido* and *azora* (with *epijessa* as a synonym) to *Dachetola*. Since two species are newly described here, I recognize eight species for *Chalodeta* in the systematic checklist below. *Chalodeta theodora* is highly variable even within populations, and as the name *stilbos* Stichel 1910 does not represent a geographically discrete phenotype, it is synonymized with *C. theodora*. A dash "—" indicates a synonym.

Chalodeta Stichel 1910

chelonis group

chaonitis (Hewitson 1866)

chelonis (Hewitson 1866)

chitinsosa Hall, n. sp.

chlosine Hall, n. sp.

theodora group

lypera (Bates 1868)

—*speusippa* Schaus 1928

panurga Stichel 1910

pescada Hall and Willmott 1998

theodora (C. and R. Felder 1862)

—*stilbos* Stichel 1910, n. syn.

—*calligramma* (Rebillard 1958)

KEY TO SPECIES OF *CHALODETA* (MALES)

No key is given for females as those of *C. chlosine*, *C. pescada* and *C. panurga* are not known.

1. Dorsal submargin with one silverish colored line 2
- Dorsal submargin with two silverish colored lines 4
- 2(1). Ventral surface prominently iridescent blue 3
- Ventral surface brown with faint purple iridescence *lypera*
- 3(2). Dorsal surface with dark shades of iridescent blue *panurga*
- Dorsal surface brown *pescada*
- 4(1). Dorsal submarginal lines closely spaced, narrow and bluish silver 5
- Dorsal submarginal lines distantly spaced, broad and greenish silver *theodora*
- 5(4). Dorsal postdiscal line with no dark shading proximally 6
- Dorsal postdiscal line with dark shading proximally 7
- 6(5). Forewing length typically 16 mm, forewing apex strongly falcate, ventral purple iridescence strong *chelonis*
- Forewing length typically 13 mm, forewing apex weakly falcate, ventral purple iridescence weak *chlosine*
- 7(5). Dark shading proximal to dorsal postdiscal line narrow, distal portion of dorsal wings brown *chitinsosa*
- Dark shading proximal to dorsal postdiscal line broad, distal portion of dorsal wings greenish brown *chaonitis*

Biogeography.—*Chalodeta* species are distributed throughout the Neotropics, from Mexico to west Ecuador, throughout the Amazon basin and Guianas, and extend as far as southeastern Brazil (see Fig. 5). Two species, *C. panurga* and *C. pescada* exclusively inhabit lower premontane forest (Hall and Willmott 1998), while the remainder inhabit wet lowland rainforest and may also extend into lower premontane habitats (e.g., *C. lypera*, *C. theodora* and *C. chelonis*). The highest number of species occurs in the five northern and central Andean countries, where all species but *C.*

chelonis, a southeastern Brazilian endemic, should occur. Only *C. lypera* and *C. chaonitis* are known to occur west of the Andes and throughout the Guianas.

Biology.—All *Chalodeta* species except *C. theodora* are uncommon to very rare. Males are rarely encountered perching in small groups on hilltops, along streambanks or shaded forest paths at a variety of heights above the ground and usually in the early morning or early to late afternoon; they make rapid sorties and rest only briefly on the tops of leaves with their wings half open (Brévignon and Gallard 1998, Hall and Willmott, unpubl. data). Males are most frequently encountered in rotting fish baited canopy and subcanopy traps (Hall and Willmott 2000), suggesting that males are infrequently seen because they perch in the canopy. Two species, *C. lypera* and *C. chaonitis* have been recorded visiting flowers (Brévignon and Gallard 1998, Hall and Willmott 2000). The early stages are known for two species, *C. lypera* (incorrectly referred to as *C. chelonis* by Kaye 1921) and *C. chaonitis*, which have been recorded feeding on young leaves and flowers of plants in the Melastomataceae, Passifloraceae and Sterculiaceae (Kaye 1921, Kirkpatrick 1954, DeVries et al. 1994). The larvae bear long tufts of lateral setae and the pupae are squat and bulbous with a broad cremaster (DeVries 1997).

REVISION OF *CHALODETA CHELONIS* GROUP

Chalodeta chelonis (Hewitson 1866)
(Figs. 1A, B; 2A; 4A; 5)

Charis chelonis Hewitson 1866: pl. 57, fig. 9. TL: Rio de Janeiro, S.E. Brazil. Syn-type ♂ BMNH [examined].

Identification and taxonomy.—Typical forewing length: male 16 mm; female 15 mm. This species is readily distinguished by its large size, pointed wing shape, prominently falcate forewing apex and more uniformly pale iridescent purple ventral surface with weakly defined markings. The lack of dark shading proximal to the dorsal

postdiscal bands occurs elsewhere only in *C. chlosine* (described below), which also has very similar male genitalia and appears to be its closest relative. The two species are distinguished in that species account.

Biology.—Unknown.

Distribution.—This species appears to be endemic to the northern states of southeastern Brazil.

Material examined.—BRAZIL: *Espírito Santo*, No specific locality 1 ♂, 1 ♀ BMNH; *Minas Gerais*, Campo Belo 3 ♀ ZMHU; Maromba 2 ♂ BMNH; 1 ♂ SMF; Leopoldina 1 ♂, 1 ♀ ZMHU; 1 ♂, 1 ♀ SMTD; *Rio de Janeiro*, Rio de Janeiro 1 ♂, 1 ♀ BMNH; 1 ♂ SMTD; 1 ♀ SMF; Nova Friburgo 1 ♂ BMNH; Laguna de Sacuarema 2 ♂, 1 ♀ BMNH; Petrópolis 3 ♂*, 1 ♀* USNM; Itatiaia 6 ♂, 3 ♀ SMF; No locality data 1 ♂ ZMHU. No locality data 3 ♂, 1 ♀ BMNH; 1 ♀ ZMHU; 1 ♀ SMF.

Chalodeta chlosine Hall, new species (Figs. 1C, D; 2B; 5)

Description.—Male: Forewing length 13 mm. Forewing costal margin approximately straight, distal margin slightly convex; hindwing rounded. **Dorsal surface:** Forewing ground color brown with subtle greenish iridescence at oblique angle; three black marks in discal cell, one at base of cell Cu1, two towards base of cell Cu2; a disjointed black postdiscal band extends from vein 2A to costa and is proximally kinked in cell Cu1 and distally kinked in cell R4+5; two parallel submarginal silver lines encompass area of dark orange-brown scaling containing a single black spot in each of cells Cu1 to R4+5 and two in cell Cu2, dark orange-brown at distal margin; fringe brown with white scaling at distal tips of veins Cu2 to R4+5. Hindwing same as forewing except postdiscal band proximally kinked in cells Cu1 and M3, and fringe entirely white. **Ventral surface:** Differs from dorsal surface in following ways: Ground color pale gray brown overlaid with purple iridescence, distal margins gray without iridescence and

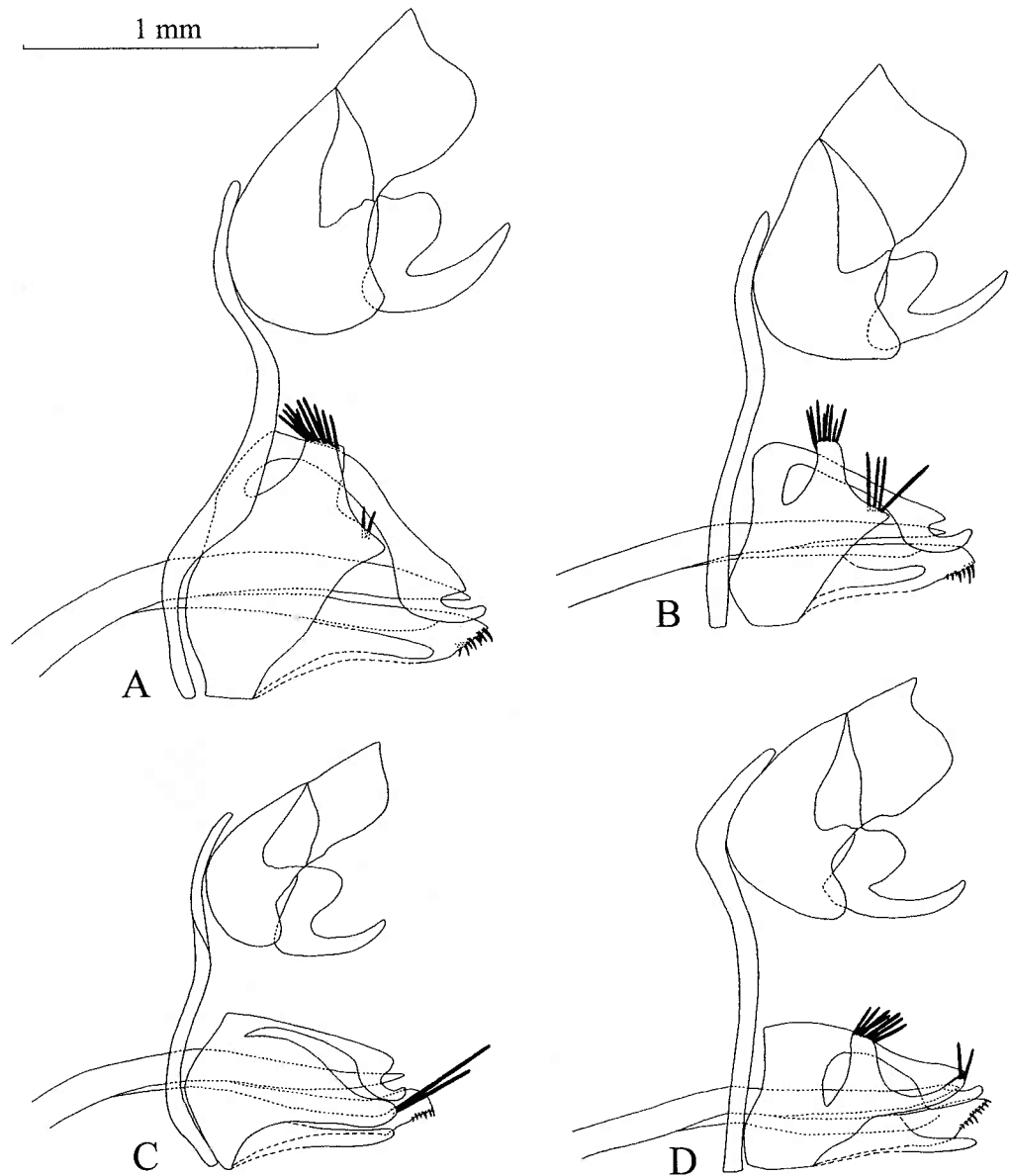


Fig. 2. Male genitalia in lateral view. A, *Chalodeta chelonis*. B, *C. chlosine*. C, *C. chitinsa*. D, *C. chaonitis*.

with undulating proximal margin, silver submarginal lines absent.

Head: Labial palpus brown. Eye brown and densely setose with brown scaling at margins. Frons brown. Antennal segments black with white scaling at base; club black, tip orange brown.

Body: Dorsal surface of thorax and abdomen dark brown, ventral surface pale

brown; tegula brown. Legs brown with some iridescent purple setae.

Genitalia (Fig. 2B): Uncus rectangular, posterior dorsal margin produced into two small points medially; falces of average size and shape for family, small, deep semicircular notch in anterior margin of tegumen; vinculum narrow and ribbon-like, extends dorsally over anterior portion of tegumen;

aedeagus relatively short, narrow and straight with pointed tip; pedicel extends from a point on aedeagus one-third distance from base to tip as narrow weakly sclerotized tube to form short posterior projection tipped with a heavily sclerotized oval plate with short spines around ventral perimeter, ventrally unsclerotized except at tip; valvae consist of a short, rounded lower process that is unsclerotized at its base and an upper process with dense patches of long spines apically and on a small posteriorly projecting section medially, posteriorly elongate transtilla connected to dorsal anterior portion of upper valvae process and forms two small, upwardly curving rounded posterior projections at tip.

Female: Unknown.

Type material.—Holotype: ♂*, PERU: *Madre de Dios*, Parque Nacional Pakitza, 11°55'48"S 71°15'18"W, 340 m, 30 Sept 1991 (O. Mielke) (USNM).

Paratypes: COLOMBIA: *Putumayo*, 1 ♂: Río Mulato, Mocoa, 29 Mar 1929 (ZMHU). *Amazonas*, 1 ♂: Florida, Sept 1931 (G. Klug) (BMNH). ECUADOR: *Napo*, 1 ♂*: Tena, 1°01'S 77°49'W, 550 m, 6–10 Nov 1988 (R. Robbins) (USNM). 1 ♂*: Apuya, km 20 Tena-Puyo rd., 600 m, 6 Dec 1996 (K. Willmott) (JHKW). PERU: *Loreto*, 1 ♂: Río Pacaya, Lower Río Ucayali, Aug 1912 (BMNH). *Junín*, 1 ♂: Chanchamayo (ZSM). *Madre de Dios*, Parque Nacional Pakitza, 11°55'48"S 71°15'18"W, 340 m (USNM), 1 ♂: 14 Oct 1991 (R. Robbins), 1 ♂: 15 Oct 1991 (G. Lamas), 1 ♂*: 20 Oct 1991 (M. Casagrande). 1 ♂: Boca Río La Torre, 20 Oct 1983 (G. Lamas) (MUSM). *Puno*, 2 ♂: Yahuarmayo, 1,200 ft, Feb/Mar 1912 (H. & C. Watkins) (BMNH). BOLIVIA: *La Paz*, 1 ♂: Mapiri (SMTD). BRAZIL: *Mato Grosso*, 1 ♂*: Diamantino, Alto Rio Arinos, 14°13'S 56°12'W, 24 Sept 1989 (E. Furtado) (USNM). 3 ♂: Cuiabá (BMNH). 1 ♂: "Mato Grosso" (Zobry & Wolter) (BMNH).

Etymology.—The species name is a eu-

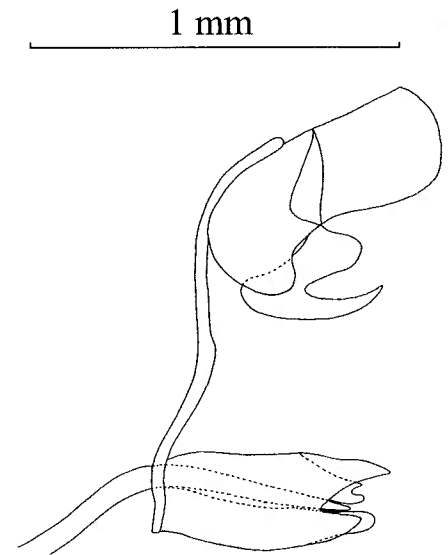


Fig. 3. Male genitalia in lateral view of *Chalodeta theodora*.

phonious anagram of "chelonis," the name of its most closely related species.

Diagnosis.—*Chalodeta chlosine* is superficially most similar to *C. chaontits* and *C. chitinosa* (described below), but lacks dark shading proximal to the dorsal postdiscal bands and has different genitalia (see those species accounts for further details). It appears to be most closely related to the southeastern Brazilian endemic *C. chelonis*, but is smaller, has a more rounded wing shape, a less falcate forewing apex, and more prominent ventral markings. The male genitalia do not differ consistently.

Biology.—*Chalodeta chlosine* is the rarest of the Amazonian *chelonis* group species. The ratio of *chlosine*, *chitinosa*, and *chaonitis* specimens examined in collections, respectively, is 2:7:10. An Ecuadorian male was attracted to a canopy trap baited with rotting fish.

Distribution.—This species is currently known only from the western Amazon, from Ecuador to Bolivia and into southwestern Brazil.

***Chalodeta chitinosa* Hall, new species**
(Figs. 1E, F; 2C; 4B; 5)

Description.—Male: Forewing length 14 mm. Forewing costal margin approximately

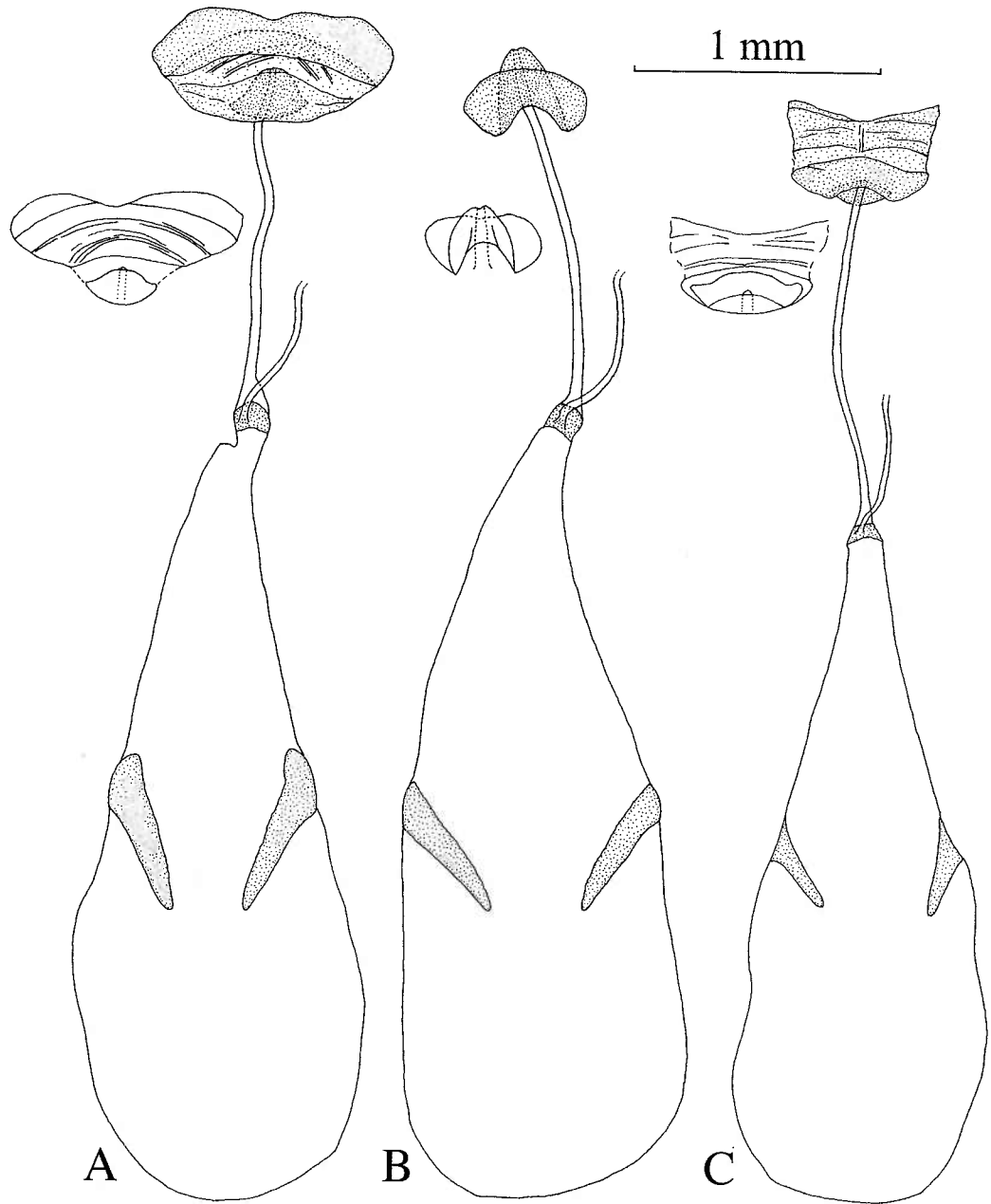


Fig. 4. Female genitalia. A, *Chalodeta chelonis*. B, *C. chitinoso*. C, *C. chaonitis*.

straight, distal margin slightly convex; hindwing rounded. *Dorsal surface*: Forewing ground color brown with subtle greenish iridescence at oblique angle; three black marks in discal cell, one at base of cell Cu1, two towards base of cell Cu2; a disjointed black postdiscal band extends from vein 2A

to costa and is proximally kinked in cells Cu1 and M3, black scaling extends proximally; two parallel submarginal silver lines encompass area of dark orange brown scaling containing a single black spot in each of cells Cu1 to R4+5 and two in cell Cu2, dark orange brown at distal margin; fringe

