

A New Species of *Calisto* from Hispaniola with a Review of the Female Genitalia of Hispaniolan Congeners (Satyridae)

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Abstract. *Calisto ainigma*, new species, is described from a unique holotype female collected at Jarabacoa, Dominican Republic in 1985. Female genitalia, not previously studied in *Calisto*, are compared for twenty-two Hispaniolan congeners. Of all congeners, wing patterning in *C. ainigma* only slightly resembles *C. elelea* Bates, a species of limited Haitian distribution. Female genitalia suggest the two may be distant sister species.

Introduction

The diversity of the satyrid genus *Calisto* is remarkable. With the recent work of Schwartz (1983a, 1983b, 1987 [in press]) Schwartz and Gali (1984) and Gali (1985), twenty-five *Calisto* species are recognized as occurring on Hispaniola. Eleven of these result from work of Schwartz and Gali in seldom collected areas of Hispaniola and represent endemic taxa with extremely limited known geographic ranges. This latter characteristic of *Calisto* led Schwartz and Gali (1984, p. 10) to suggest the discovery of further endemic *Calisto* from Hispaniola as inevitable. Generically, *Calisto* are endemic to the Antilles and characterized by each of the islands exhibiting various endemic species (Munroe, 1950). Given the increasing diversity of *Calisto* taxa recognized as occurring on Hispaniola (11: Bates, 1935, 1939; 12: Michener, 1943; 14: Clench, 1943a, 1943b; Riley, 1975; 20: Schwartz and Gali [see p. 1]; 25: Gali, 1985) it may be anticipated that when adequately sampled, Cuba may also yield a diversity of *Calisto* taxa. With the appearance of

Schwartz's (1983a; 1987 [in press]) treatments of Hispaniola butterflies, an ample amount of data concerning the taxonomy and distributions of Hispaniolan *Calisto* has now been accumulated.

Characteristic of the results of Schwartz and Gali's work has been documentation that among the few cosmopolitan Hispaniolan *Calisto* (like *confusa* Lathy and *obscura* Michener) there occurs a number of other endemic species characterized by (a). marked wing pattern differences from the previously known congeners and slight, if any, sexual dimorphism and (b). extremely limited local known distributions often marked by restriction to a single known locality or limited habitat. The former results from the lack of comprehensive collecting prior to the work of Schwartz and Gali; the latter reflects the often extreme fragmentation of the native habitats of the island, remnants of which are now often only found in very limited undisturbed areas of inaccessible topography. This latter factor also seems to explain the lack of any recent association of specimens with the names *C. montana* and *C. micheneri* Clench (1943a, b). The holotypes of these species have been illustrated by Riley (1975) but both are from localized and remote localities from which no further specimens have been taken in recent years.

Hitherto, all studies of *Calisto* have examined characters solely of the wing and male genitalia. Given the recent accumulation of studies of *Calisto* cited above, an examination of female genitalia of the group is requisite and timely. Further, such an examination has been required by the collection in the Central Cordillera in 1985 of a female specimen of *Calisto* (hereinafter in introduction referred to as "the Jarabacoa female") with wing pattern quite unlike any previously known taxon of the genus (Albert Schwartz, pers. comm). Matusik captured the specimen while he and Johnson were collecting along a stream near Jarabacoa, La Vega Province, Dominican Republic, June 26, 1985. A perfectly fresh specimen, it had attracted attention because amongst extremely common *C. obscura* and *C. confusa* which "flash" brown and submarginal white when flying, this specimen was markedly yellowish. Upon capture, the several unique traits noted in the following diagnosis were obvious and further heightened interest in the specimen. Unfortunately, due to pre-arranged itinerary the collectors had to leave the area that day; they returned with additional local collectors a week later but concerted *Calisto* collecting yielded no further examples.

Fig. 1. Female genitalia of Hispaniolan *Calisto*. Format, each entry, above: papillae anales, lateral view; below: genital plate, ductus bursae and corpus bursae, ventral view. A. *C. elelea* (AMNH), Sierra de Baoruco, 12 km. from Las Abejas on Las Abejas highway, Dominican Republic [D. R.], 400 m., May, 1984, D. Matusik; B. *C. ainigma*, holotype (AMNH); C. *C. obscura*, paratype (AMNH), Puerta Plata, D. R., 7–8 May 1915; D. *C. confusa* (AMNH), Trujillo City, D. R., 1946, A. L. Stillman; E. *C. debarriera* (AMNH), 10 km. SE Constanza, D. R., 1270 m., D. Matusik; F. *C. batesi*, same data as A.; G. *C. lyceia* Bates (MCZ), Isla Saone, D. R.; H. *C. tragia* (ASC), 1–4 km. WNW

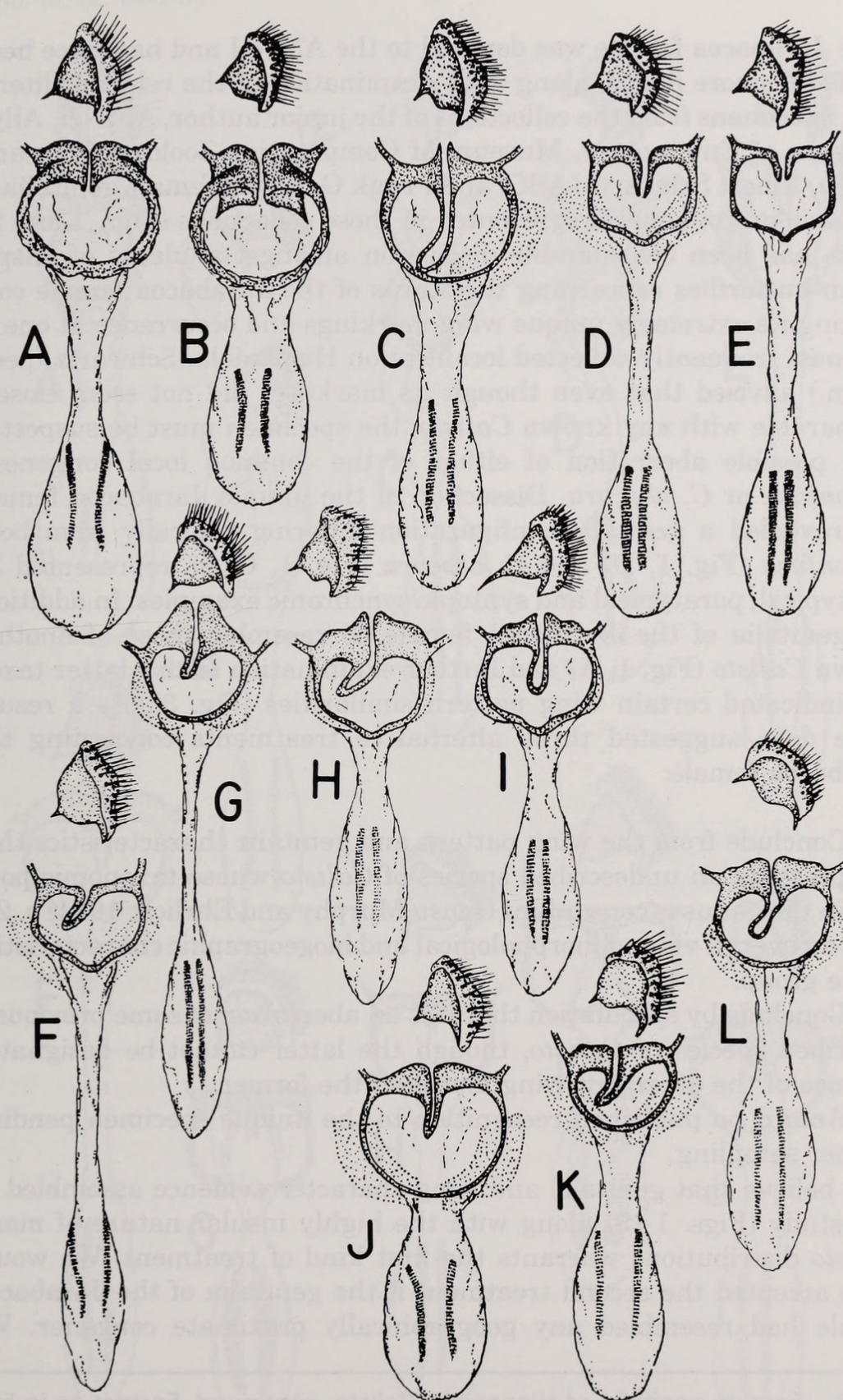


Fig. 1. (Cont). Scierie, Sud-Est, Haiti [H], 2000 m., 4 September 1984, A. Schwartz; I. *C. micrommata* (ASC), 2 km. NE Puesto Piramide 204, La Estrelleta, D. R., 1700 m., 16 July 1983, A. Schwartz; J. *C. sommeri* (AMNH), 38 km. marker, 2 km right turn to Nursery, highway to Las Abejas, D. R., 1600 m., May, 1984, D. Matusik; K. *C. hysia* Godart (AMN), Paradis, D. R., 600 m., 15 August 1932; L. *C. grannus* (ASC), 21 km. SE Constanza, La Vega, D. R., 2500 m., 10 July 1980, A. Schwartz.

The Jarabacoa female was donated to the AMNH and has since been studied in more detail, along with examination of the relevant literature, specimens from the collections of the junior author, AMNH, Allyn Museum of Entomology, Museum of Comparative Zoology (Harvard) (MCZ), Albert Schwartz (ASC) and Frank Gali, and female genitalia of Hispaniolan congeners represented in these collections (Figs. 1 and 2). There has been considerable discussion amongst students of Hispaniolan butterflies concerning the status of the Jarabacoa female considering its extremely unique wing markings and occurrence at one of the most frequently collected localities on Hispaniola. Schwartz (pers. comm.) advised that even though its markings did not seem closely comparable with any known *Calisto*, the specimen must be suspected as a possible aberration of either of the common local congeners, *C. confusa* or *C. obscura*. Dissection of the unique Jarabacoa female has revealed a genitalic configuration differing radically from both *C. confusa* (Fig. 1, D) and *C. obscura* (Fig. 1, C) as represented by topotypical, paratypical and syntopic/synchronic examples. In addition, the genitalia of the Jarabacoa female do resemble those of another known *Calisto* (Fig. 1, A) and further examination of this latter taxon has indicated certain wing pattern similarities (Fig. 3). As a result, these data suggested three alternative treatments concerning the Jarabacoa female:

1. Conclude from the wing pattern and genitalic characteristics that it represents an undescribed species of *Calisto* whose taxonomic position in the genus is concordant (*sensu* Murphy and Ehrlich, 1984, p. 27) with an overall view of morphological and biogeographic characteristics of the group.
2. Conclude by speculation that it is an aberration of some previously described species of *Calisto*, though the latter cannot be designated because of the divergent wing morph of the former.
3. Accord no published recognition to the unique specimen pending further sampling.

We believe that genitalic and wing character evidence assembled in this study (Figs. 1–3) along with the highly insular nature of many *Calisto* distributions warrants the first kind of treatment. We would have accepted the second treatment if the genitalia of the Jarabacoa female had resembled any geographically proximate congener. We

Fig. 2. Female genitalia of Hispaniola *Calisto*, continued. Format as in Fig. 1. A. *C. arcas* (ASC), 14 km. SE Constanza, La Vega, D. R., 2100 m., 20 July 1985, A. Schwartz (small letters referenced in text); B. *C. crypta* Gali (AMNH), Monte Christi, D. R., 13 March 1931, A. L. Stillman; C. *C. franciscoi* (ASC), 8 km. ESE Canoa, Barahona, D. R., 28 July 1985, A. Schwartz; D. *C. hendersoni* (ASC), 4 km. E El Limon, Independencia, D. R., 2 April 1984, A. Schwartz; E. *C. schwartzi* (AMNH), same data as Fig. 1, J; F. *C. clydoniata* (ASC), 2 km. NE Puesto Piramid 204, La Estrelleta, D. R., 1400 m., 13 August 1983, A. Schwartz; G. *C. galii* (ASC), 10 km. SE Constanza, D. R., 1800 m.,

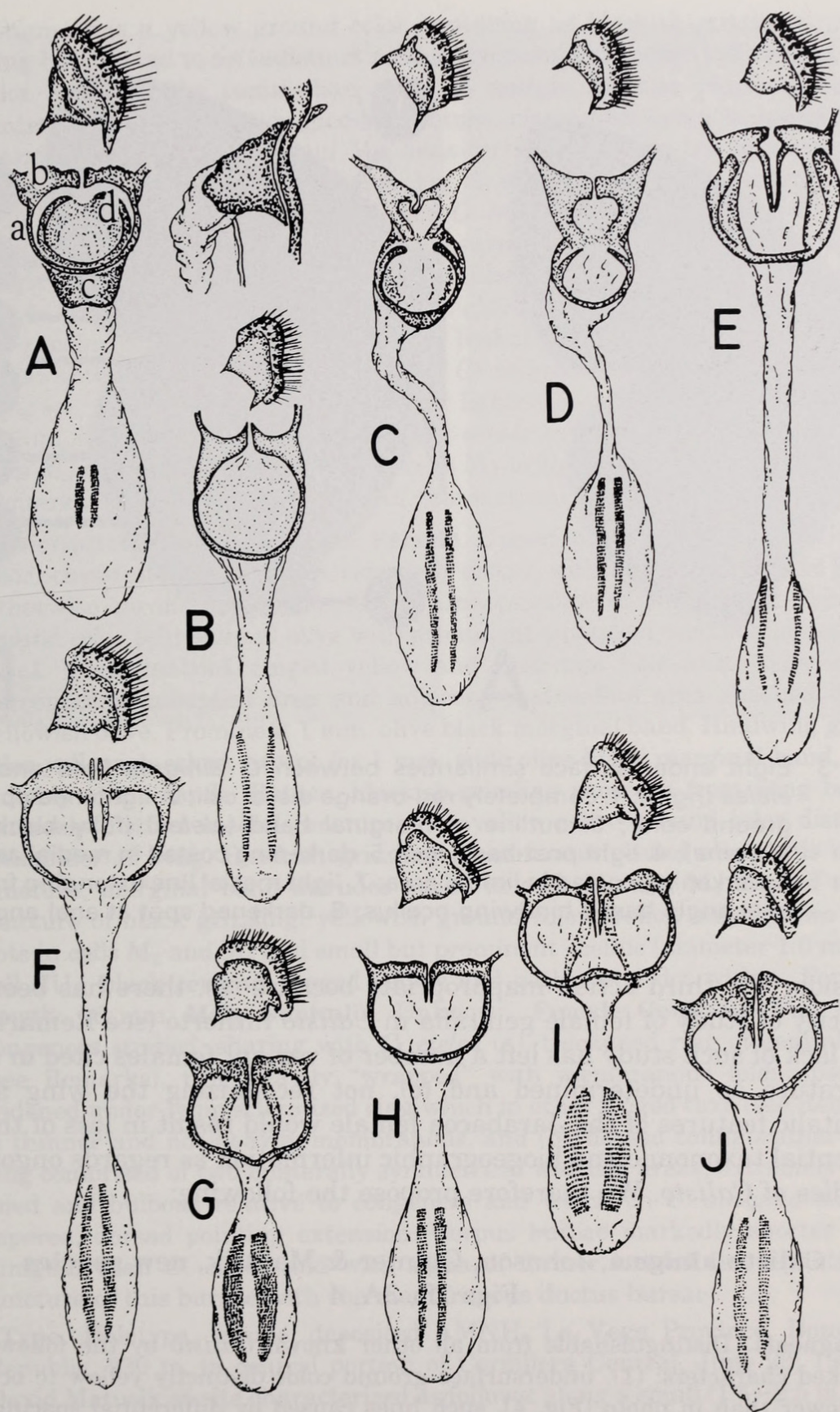


Fig. 2. (Cont). 9 July 1980, A. Schwartz; H. *C. clenchi* Schwartz and Gali (ASC), 5 km, Ne Los Arroyos, Pedernales, D. R., 1800 m., 30 June 1983, A. Schwartz; I. *C. chrysaoros* Bates (ASC), 5 km. NE Los Arroyos, Pedernales, D. R., 1800 m., 4 October 1983, A. Schwartz; J. *C. neiba* Schwartz & Gali (ASC), 15 km. S. Elias Pina, La Estrelleta, D. R., 1100 m., 26 July 1981, A. Schwartz.

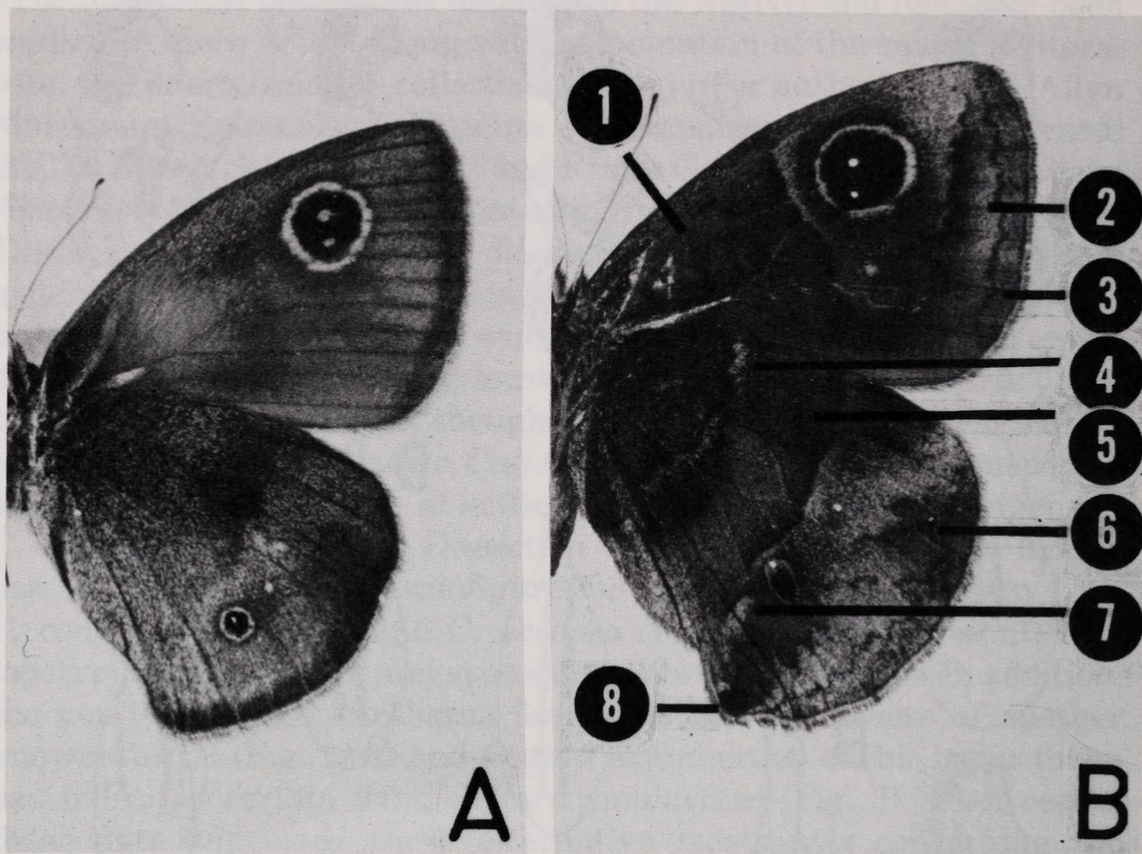


Fig. 3 Eight under surface similarities between *C. ainigma* (left) and *C. elelea* (right). 1. completely red-orange discal cell; 2. lightened apical ground color; 3. outline of marginal band (*elelea*) (fully black in *ainigma*); 4. light post-basal line; 5. darkening costad in medial area; 6. darkening costad in limbal area; 7. light mesial line extending from anal angle basad hindwing ocellus; 8. darkened spot at anal angle.

consider the third action inappropriate because (a). there has been a paucity of study of female genitalia in *Calisto* hitherto (see Remarks), (b). lack of such study has left a number of variant females cited in the literature as undetermined and (c). not recognizing the wing and genitalic features of the Jarabacoa female would result in loss of their potential taxonomic and biogeographic information as regards ongoing studies of *Calisto*. We therefore propose the following:

***Calisto ainigma*, Johnson, Quinter & Matusik, new species**
Figs 1B, 3A, 4

Diagnosis. Distinguishable from all other known *Calisto* by the following marked characters: (1). undersurface ground color distinctly yellow to ochre [yellower than in photo (Fig. 4), such hues caused by differential spacing of deep brown scales amongst bright yellow scales], not brown or grey as on congeners; (2). both wing undersurfaces with wide (1 mm.) olive-black marginal band, not occurring on any congener; (3). aside from unique marginal band, hindwing lacking any bands (congeners variously have postbasal medial, postmedial and/or submarginal bands of various colors and/or a dark basal disc with its distad margin bandlike [*C. montana*, *C. micheneri*]). Rather, *C.*

ainigma has a yellow ground color appearing as blackish-grizzled from the wing base distad to an indistinct medial juncture with purer yellowish ground color distad in the postmedian areas to margin. Intense blackish-grizzling centered costad along this medial juncture, along with invasion basad of the marginal line in cells M_1 and M_2 , adds further oddity to the pattern; latter suffusions resemble *C. elelea* Bates (Fig. 3) which is otherwise banded; (4). as only in *C. montana*, *C. micheneri*, and *C. tragia* Bates, hindwing with single ocellus [cell CU_1] devoid of any obvious surrounding patterning [not with [a]. single ocellus surrounded by various maculation expansive distad (*C. confusa*, *C. obscura*, *C. hysia* Bates, *C. elelea*, *C. clydoniata* Schwartz and Gali) or [b]. two ocelli, one at each end of the limbal area (*C. grannus* Bates, *C. micrommata* Schwartz and Gali, and *C. sommeri* Schwartz and Gali)]; *C. ainigma*, like *C. elelea*, has distinctly lighter ground color based cell CU_1 ocellus, in latter a band; (5). hindwing undersurface with two white dots in cells M_2 and M_3 (not with three in cells M_2 to R_S as in *C. galii* Schwartz [see Remarks for further significance of this feature].

Description. Male. Unknown. **Female.** Uppersurface of the Wings: Ground color ochre-tinted olive brown, especially distad, with wings darker olive basad. Otherwise no distinctive markings. Undersurface of the Wings: Forewing ground color ochre-tinted olive with prominent subapical ocellus [diameter 2.8 mm.], black centrad, ringed yellow and with two blue-white dots within. Surrounding subapical area and adjacent postmedian area sheened lighter yellowish olive. Prominent 1 mm. olive black marginal band. Hindwing ground color yellowish-ochre; except for 1 mm. wide olive-black marginal band, without any other bands. Rather, blackish-grizzling proceeds from wing base to variously distinct medial juncture with yellow-ochre ground color distad on remainder of wing. Blackish grizzling concentrates costad along this medial juncture; marginal band intrudes basad in cells M_2 and M_1 . Distad medial juncture of black grizzling, yellowish ground color broken only by two white dots in cells M_2 and M_3 and small but prominent ocellus [diameter 1.0 mm.] in cell CU_2 , black centrad, ringed yellow and with white dot within. Forewing length: 16 mm. **Male Genitalia.** Unknown. **Female Genitalia.** Fig. 1B. Of congeners studied, sharing with *C. elelea* (a). thickened ring of genital plate (see Remarks), ring heavily “wrapped” with membranous folds obscuring widened under-lying sclerotized ring which in other ringed taxa (see Remarks) is thinner and not heavily membranous, and (b). dorsad configuration of the ring comprised of two bilaterally symmetrical widened areas, extremely thickened and bulbous relative to congeners and which on *C. ainigma* shows a tapered, dorsad pointing extension. Corpus bursae markedly shorter on *C. ainigma* than *C. elelea* and with signa of former located far cephalad the juncture of this bursae with the membranous ductus bursae.

Type. Holotype, female, deposited AMNH, La Vega Province, Dominican Republic, 930 m. in central portion of Cordillera Central, June 26, 1985, by David Matusik at site characterized as follows: along a small (1.5–2.5 m. wide) stream currently running between the Hotel Pinar Dorado’s group of “cabanas” and the highway that proceeds from the immediate entrance to the hotel grounds about 4 km. northwest to central Jarabacoa (which is expanding its outer perimeter by active outlying home development). Stream crosses a fenced cattle grazing break between the stands of Australian Pine which border it west along the highway and east east of the cabanas. Specimen taken in grass

along this stream about 300 meters north of the hotel and its entrance to the highway (e.g. ca. 4 km. southeast of Jarabacoa).

Remarks. Schwartz (1983a, fig. I, J) and Schwartz and Gali (1984) mention variant females which they either associate as aberrants with known *Calisto* taxa or which show facies leading them to conclude "another species of *Calisto* presumably occurs in the Cordillera Central" (Schwartz and Gali, 1984, p. 10). Concerning these, and undescribed taxa currently being described by Schwartz or Schwartz and his colleagues, Schwartz (pers. comm.) has assured us that none is similar enough to the facies of *C. ainigma* to warrant discussion here. The genitalic survey conducted during this study warrants the following general remarks.

Characters of the female genitalia apparently provide a far more useful reference for *Calisto* than those of males. Male genitalia of *Calisto*, which have been reviewed to some extent by nearly all authors cited herein, are mostly alike. Minor but consistent differences have been cited, particularly by Michener and Schwartz *et al.*, to distinguish various taxa which also have distinctive wing pattern characters. Within *Calisto*, as presently defined, the only radically divergent male genitalia amongst Hispaniolan taxa occur in *C. elelea*, *C. pulchella* Lathy, *C. arcas* and *C. raburni* Gali. As can be seen in Figs. 1 and 2, such divergence is reflected in the female genitalia of both *C. elelea* and *C. arcas*, though the former is more like other *Calisto*. *C. pulchella* is not figured because its female genitalia are so divergent as to suggest lack of recognizable homology with other taxa presently placed *Calisto*, a matter presently under study. *C. raburni* is recently described and its female unknown.

Two general genital plate configurations are apparent in *Calisto* studied, those with two obvious components and those with only one. Other taxa are intermediate between these extremes. *C. arcas* (Fig. 2A) best exemplifies a two component structure: a sclerotized ring (Fig. 2A, a) with a sculptured dorsal crown (Fig. 2A, b) and a sclerotized ductal tube (Fig. 2A, c) with dorsad "horns" (Fig. 2A, d). In *C. franciscoi* Gali and *C. hendersoni* Gali (Fig. 2C, D) apparent remnants of these horns appear within a configuration otherwise characterized by distinct separation of the ring and crown. *C. schwartzi* Gali (Fig. 2E) exhibits remnants of the horns closely allied with the ring and crown combination. In the remaining *Calisto* (Fig. 1, 2F, F-J) the ring, closely combined with the crown, forms a generalized configuration. However, within this group some taxa exhibit a sclerotized loop within the ring (Fig. 1C, F-L), or without a loop, variously developed cephalad pointing prongs (Fig. 1, A, B, D-J). The particular structure characterizing *C. elelea* and *C. ainigma* has been described in the above description. Within *Calisto* there are also apparent differences in the configurations of the papillae anales, ductus bursae and corpus bursae with its associated signa. It is likely that these characters will prove very useful in examining the taxonomic and biogeographic relations of the *Calisto* endemic to various Antillean islands. Such a study is in progress. At present it is important to note that female genitalic characters corroborate the species statuses accorded the numerous presently recognized species in Hispaniola, and particularly of interest those named very recently by Schwartz and Schwartz and Gali [see p. 1]. The only exception might be *C. confusa* and *C. debarriera* Clench which, though considered full species on biological grounds (Schwartz, pers. comm.) are very similar compared to other congeners. As regards the often

debated species status of *C. hysius* ssp. *batesi* Michener (Clench, 1943b; Schwartz, 1983a; Riley, 1975), female genitalia appear to provide a moderately strong argument supporting *C. batesi*'s specificity.

The similarity in female genitalic facies of *C. ainigma* and *C. elelea* was unanticipated. The latter species has a highly insular distribution limited to montane areas surrounding Port-au-Prince, Haiti. Subsequently noted similar-

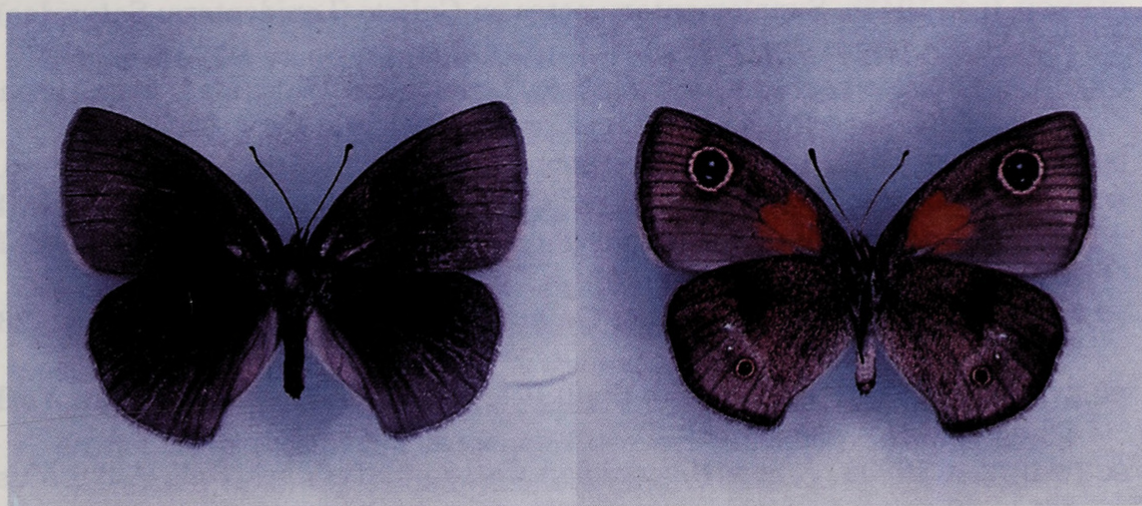


Fig. 4. Holotype female, *Calisto ainigma*, new species. Left, upper surface of the wings; Right, under surface of the wings.

ities in certain aspects of the wings patterns of *C. elelea* and *C. ainigma* (Fig. 3) are likewise suggestive and have invited the conclusion that the facies of *C. ainigma* is not so extraordinary as originally presumed by us and other workers familiar with Hispaniolan *Calisto* (e.g. Schwartz, pers. comm.). Male genitalia of *C. elelea* are distinctive such that among *Calisto* Brown and Heineman (1972, based on Michener, 1943) placed this species within a monotypic species group. It will be of extreme interest whether the male of *C. ainigma*, once discovered, further corroborates *C. ainigma*'s placement with *C. elelea* as a sister taxon.

Etymology. The name is Greek for "enigma", referring to the curious wing pattern, occurrence at the often collected Jarabocoa area, and unanticipated suggested sister species relationship to *C. elelea*. Upon the suggestion of Schwartz and Gali (1984) and Gali (1985) species names in this paper have been made to conform to the feminine gender of the name *Calisto*. A single exception is *C. grannus*, the origin of which name Schwartz states is indeterminate.

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