

Evolution, Comparative Morphology,
and Identification of the Eumaeine
Butterfly Genus *Rekoa* Kaye
(Lycaenidae: Theclinae)

ROBERT K. ROBBINS

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 498

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SMITHSONIAN INSTITUTION PRESS

Washington, D.C.

1991

ABSTRACT

Robbins, Robert K. Evolution, Comparative Morphology, and Identification of the Eumaeine Butterfly Genus *Rekoa* Kaye (Lycaenidae: Theclinae). *Smithsonian Contributions to Zoology*, number 498, 64 pages, 116 figures, 17 tables, 1991.—I revise the hairstreak butterfly genus *Rekoa*, describe and quantify many aspects of eumaeine morphology, and discuss the evolutionary biology of *Rekoa*. This genus contains some of the most common, widespread, and nomenclaturally confused species of eumaeine butterflies.

A provisional *Thereus* Section of the Eumaeini consists of *Rekoa*, *Thereus*, *Arawacus*, *Contrafacia*, and an undescribed genus. *Rekoa*, *Thereus*, and *Arawacus* form a monophyletic lineage, and their characterization leads to the following nomenclatural changes: *Arawacus* Kaye, 1904 = *Polyniphes* Kaye, 1904; *Thereus* Hübner, 1819 = *Noreena* Johnson, MacPherson, and Ingraham, 1986; and *Rekoa* Kaye, 1904 = *Heterosmaitia* Clench, 1964. *Arawacus* is accorded priority over *Polyniphes*, and *Dolymorpha* Holland, 1931 is a synonym of *Arawacus*, as others have proposed.

Rekoa contains seven species and the following new synonyms: *R. malina* Hewitson, 1867 = *R. phrynisca* Burmeister, 1878; *R. palegon* Cramer, 1780 = *R. cyrriana* Hewitson, 1874 = *R. ulia* Dyar, 1913; *R. zebina* Hewitson, 1869 = *R. orses* Godman and Salvin, 1887 = *R. guadala* Schaus, 1902; *R. bourkei* Kaye, 1925 = *R. abeja* Johnson and Matusik, 1988; *R. marius* Lucas, 1857 = *R. spurina* Hewitson, 1867 = *R. ericusa* Hewitson, 1867 = *R. brescia* Hewitson, 1868 = *R. voconia* Hewitson, 1869; *R. stagira* Hewitson, 1867 = *R. erenea* Hewitson, 1867 = *R. volana* Hewitson, 1869 = *R. lydia* Kirby, 1871 = *R. thoana* Hewitson, 1874 = *R. carioca* Ebert, 1965. Lectotypes are designated for *R. cyrriana*, *R. zebina*, *R. guadala*, *R. marius*, *R. spurina*, *R. ericusa*, *R. brescia*, *R. voconia*, *R. stagira*, *R. erenea*, *R. timaea* Hewitson, 1869, *R. volana*, and *R. thoana*. No species was described in *Rekoa*, and *R. meton* (the type species of *Rekoa*) is the only one that had been transferred to it.

I describe, illustrate, and code 47 characters of the head, wings, abdominal integument, and genitalia of *Rekoa*. Almost half of the characters are quantitative, and are coded with a modified form of gap coding. Because eumaeine morphology is so poorly known, the morphology section is hypertrophied, particularly by quantitative descriptions of antennae, androconia, and genitalia. There are two qualitatively distinct kinds of forewing androconial clusters in *Rekoa*: scent pads (restricted to the Eumaeini) with a chamber between the wing membranes and scent patches with the wing membranes fused except at the base of each androconium.

Parsimony analysis of the character matrix yields a network of 78 steps with a consistency index of 0.885. Consistency among quantitative characters, with the exception of genital ones, is nearly as good as that for qualitative ones. The network is rooted using the outgroup parsimony criterion.

The phylogeny serves as a framework for discussing *Rekoa* biogeography and evolution. Most *Rekoa* species are habitat generalists, but specialization for drier habitats evolved once as did restriction to lower elevations and specialization for higher elevations. *Rekoa* species are relatively dispersive and widespread, with four species occurring from northern Mexico to southern Brazil. Larvae are polyphagous on plant reproductive parts, but the majority of foodplant records for three *Rekoa* species are Leguminosae and Malpighiaceae whereas they are Compositae for *R. palegon*. There are two distinct ventral wing pattern phenotypes and two different genitalic phenotypes, but the change in wing pattern evolved at a different point than the change in genitalic phenotype. An effective "false head" wing pattern evolved once.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging in Publication Data

Robbins, Robert K.

Evolution, comparative morphology, and identification of the eumaeine butterfly genus *Rekoa* Kaye (Lycaenidae: Theclinae) / Robert K. Robbins

p. cm. — (Smithsonian contributions to zoology ; no. 498)

Includes bibliographical references.

Supt. of Docs. no.: SI 1.27:498

1. *Rekoa*. I. Title. II. Series.

QL1.S54 no. 498 [QL561.L8] 591 s-dc20 [595.78'9] 89-600292 CIP

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Evolution, Comparative Morphology, and Identification of the Eumaeine Butterfly Genus *Rekoa* Kaye (Lycaenidae: Theclinae)

Robert K. Robbins

Introduction

Phylogenetic relationships among the New World hairstreak butterflies (Lycaenidae: Theclinae: Eumaeini) are poorly understood. About 80% of the species are placed in *Thecla* Fabricius, a genus that does not belong to the Eumaeini (Eliot, 1973). Eliot (1973) listed available generic names for the tribe. Those species that have been placed in genera valid for the Eumaeini will be found in Clench (1961, 1964a,b, 1966, 1970, 1971, 1975a, 1978), Field (1967a,b), Nicolay (1971a,b, 1976, 1977, 1979, 1980, 1982), and Robbins (1987). Identification of species has been difficult because the numerous illustrations of new species in Cramer (1775–1782), Stoll (1791), Hewitson (1862–1878), and Draudt (in Seitz) (1919–1920) often do not clearly show distinguishing characters. In addition, the pioneering attempt of Godman and Salvin (1887–1901) to make an identification key to the species of Central America has not been improved upon by later workers. The inability to identify species has hindered potentially exciting research on the behavior, ecology, evolution, and biogeography of this species rich tribe (an estimated 1100 New World species plus about 60 Palearctic ones).

Although the primary purpose of this paper is to revise the eumaeine genus *Rekoa* Kaye, a secondary purpose is to detail morphology of the genus as a reference for future revisions. In the past, authors (e.g., Riley, 1958:284–285; Seitz, 1919:740) attributed the chaotic state of eumaeine systematics to the remarkable morphological homogeneity of these butterflies. Perhaps it is more accurate to say that knowledge of eumaeine comparative morphology is in its infancy. For example, variation in form of the antennae, labial palps,

abdominal integument, and female papillae anales, to mention but a few structures, have not been used in generic revisions. I believe that detailing morphology is the key to working out eumaeine phylogeny, and it is the intent of this paper to make a first step in that direction.

Lack of a eumaeine higher classification has been, and remains, another serious stumbling block to progress on the systematics of eumaeine genera. Defining the limits of a genus and rooting a cladogram of relations require at least a rudimentary theory of systematic relations between that genus and its closest relatives. The most recent lycaenid higher classification (Eliot, 1973) divides the eumaeines in two groups, neither of which is monophyletic (Robbins, 1987). For this revision I solve the outgroup problem by reporting preliminary results on the *Thereus* Section of the Eumaeini, in which I place *Rekoa*.

ACKNOWLEDGMENTS.—For donating specimens of *Rekoa* and related genera to the Smithsonian Institution, I thank Robert Busby, Curtis Callaghan, Charles Covell, Dennis Currutt, Robert Eisele, Loran Gibson, Jeffrey Glassberg, William Howe, John Hyatt, Roy Kendall, Ross Layberry, William McGuire, Michael McInnis, Stanley Nicolay, Paul Opler, David Pinder, Richard Rozycki, John Shuey, Gordon Small, and Bo Sullivan. For providing unpublished information on the biology of these butterflies, I thank Matthew Cock, Priya Davidar, Philip DeVries, the late Francisco Fernandez-Yepez, William Haber, Daniel Janzen, Andre Lima-Carvalho, Paul Opler, Nelcy Ruiz-Carrillo, Gordon Small, and Kim Steiner. For lending me specimens from their private collections, I thank Richard Anderson, Daniel Bogar, Robert Busby, John MacDonald, Steven MacDonald, Bruce MacPherson, and Roy Kendall. For commenting upon the manuscript, I thank Keith Brown, John Burns, John Eliot, Don Harvey, Gerardo Lamas,

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John MacDonald, Robert Poole, Jerry Powell, and Gordon Small. For reading and commenting upon the manuscript in great detail, I am indebted to James Miller and to J. Boling Sullivan. For illustrative aid, I thank George Venable and especially T. Britt Griswold, who provided advice on artistic matters beyond "the call of duty." For technical assistance with the SEM, I am grateful to Brian Kahn, Susann Braden, and Heidi Wolf. I gratefully acknowledge Vic Krantz for technical photographic assistance.

For allowing me access to collections, I thank the curators and institutions listed below (with institutional abbreviations that I use throughout the paper).

AME	Allyn Museum of Entomology (Dr. Lee Miller, Dr. Jacqueline Miller)
AMNH	American Museum of Natural History (Dr. Fredrick Rindge)
ANSP	Academy of Natural Sciences Philadelphia (Mr. Skip Glenn)
BMNH	British Museum (Natural History) (Mr. Richard Vane-Wright, Mr. Philip Ackery)
CIBC	C.A.B. International Institute of Biological Control (Dr. Mathew Cock)
CMNH	Carnegie Museum of Natural History (Dr. John Rawlins, Dr. Ginter Ekis)
CU	Cornell University (Dr. James Leibherr)
IZA	Instituto de Zoología Agrícola, Maracay, Venezuela (Dr. Francisco Fernandez-Yepey)
LACM	Los Angeles County Museum (Mr. Julian Donahue)
MCZ	Museum of Comparative Zoology (Dr. Deane Bowers)
MJP	Museo de Historia Natural "Javier Prado," Lima, Peru (Dr. Gerardo Lamas)
MGA	Museu Anchieta, Porto Alegre, Brazil (Ms. Carla Maria Penz)
NMNH	National Museum of Natural History, Smithsonian Institution
RNHL	Rijksmuseum van Natuurlijke Historie (Dr. Rienk de Jong)

Genus *Rekoa* Kaye

Although well represented in major museum and private collections, *Rekoa* species are consistently misidentified and placed in other genera. Many are common residents of disturbed neotropical habitats, and are widely distributed, ranging from the Texas-Mexico border to Argentina, Paraguay, and southern Brasil. Two species, *R. palegon* and *R. marius* occur in southern Texas, where *R. marius* has been misidentified under a variety of names. *Rekoa palegon* has been collected on St. Vincent, but had not been recorded as a member of the Antillean fauna (Riley, 1975). As a result of repeated misidentifications, the seven *Rekoa* species have been named 26 times.

There are several reasons for these misidentifications. Interspecific differences in wing pattern among sympatric species (*R. marius*, *R. stagira*, *R. zebina* Hewitson) are slight (Figures 81, 82, 85, 86, 92–97, 99–104, 105–110). Some wing pattern characters, particularly in *R. meton* and *R. marius*, undergo broad clinal changes over thousands of kilometers so that specimens at the ends of these clines have very different wing patterns (Figures 64–69, 99–104). Some type specimens have been mislabelled. *Rekoa palegon* was described from

Africa, but is wholly New World. The type of *R. marius* is labelled "Cuba," but the species is not otherwise known to occur there. The type of *R. spurina* is labelled "Amazonas," but its wing pattern is typical of Central American specimens.

The generic classification of *Rekoa* is also muddled. Kaye (1904) proposed *Rekoa* for *meton* Cramer, but Draudt (in Seitz, 1919–1920) retained *R. meton* and relatives in the catchall genus, *Thecla*. Clench (1964a, 1970) placed a number of species—some of which I put in *Rekoa*—first in *Heterosmaitia* Clench and then in *Thereus* Hübner, but Clench's *Thereus* is polyphyletic, as I discuss below. Clench never published on *R. meton*, and apparently was unaware of its relationship to some of his *Thereus* species. Indeed, the wing pattern of *R. meton* differs from most of its congeners, and has not been previously associated with them.

The major purposes of this revision are to (1) present morphological and biological information on each species, (2) give a key that will allow rapid and accurate specific identification, (3) correct the nomenclature of *Rekoa* species, (4) analyze morphological and biological information phylogenetically, and (5) discuss *Rekoa* evolution. As mentioned, a secondary purpose is to further our knowledge of eumacine morphology, which is very poorly known. The scanning electron microscope (SEM) provides an opportunity to increase greatly our understanding of eumacine structures. Thus, I detail some *Rekoa* morphology, even when it does not vary within the genus, because it will serve as a standard for comparison with other genera. I also detail my methods for preparing SEM specimens in the hopes that others will improve upon them.

PHYLOGENETIC PLACEMENT

I propose a "*Thereus* Section" of the Eumacini for those genera, including *Rekoa*, in which the male genitalia vinculum has an anterior process that abuts the anterior end of the dorsal brush organs (Figures 41–50) ("coremata" of Clench, 1964a, 1970; and Stempffer, 1967). Further, the groove on the outer side of the vinculum becomes the posterior border of the process (Figures 41, 42). The *Thereus* Section contains more than 60 species, five phylogenetically valid genera (one undescribed), and nine nomenclaturally available generic names: *Arawacus* Kaye, *Dolymorpha* Holland, *Polyniphes* Kaye, *Rekoa* Kaye, *Heterosmaitia* Clench, *Thereus* and *Noreena* Johnson, MacPherson, and Ingraham, *Contrafacia* Johnson, and *Orcya* Johnson. The last two genera are subjective synonyms because I consider their types to be the same species.

Shape and length of the vinculum process varies within the *Thereus* Section. In some species, such as *Thereus pedusa* Hewitson, the process is unusually long and extends far anterior of the vinculum. It is absent in a few species with brush organs, such as *Rekoa malina*, and in those species of *Arawacus* that lack brush organs. Generic placement of these species is based on other characters restricted to those genera.

Superficially similar anterior vinculum processes associated

with brush organs occur in *Atlides*, *Theritas* Hübner, *Arcas* Swainson, *Pseudolycaena* Wallengren, *Evenus* Hübner, and *Brangas* Hübner. However, in the *Thereus* Section, the vinculum process projects dorsally and borders the anterior part of the brush organs, while in the others it projects laterally inwards under the brush organs. Further, the groove on the outer surface of the genital capsule becomes the posterior border of the process in the *Thereus* Section but not in the others.

Clench's (1970) *Thereus* is polyphyletic. The species *neora* Godman and Salvin has a vinculum process that does not have the outer groove as its posterior edge and that lies under the brush organs. Consequently, it does not belong to the *Thereus* Section, and I place it in *Brangas* because it shares both wing pattern (a red spot in the ventral forewing discal cell) and genitalic character states (form of the anterior vinculum process, shape of the female genitalia cervix) with it. The species *lausus* Cramer and *oppia* Godman and Salvin belong to *Thereus*, as I have characterized it below, while I transfer the remaining species to *Rekoa*.

GENERIC LIMITS AND OUTGROUPS

I provisionally unite *Thereus*, *Rekoa*, and *Arawacus* in a monophyletic subset of the *Thereus* Section. The ductus seminalis in these genera arises from a posterior pouch of the corpus bursae dorsal to the ductus bursae (Figures 56–63). Further, there are sclerotized processes on the sides of the pouch that arise from the anterior end of the ductus bursae, but they do not extend to the dorsal surface of the pouch (Figure 56). The processes do not occur (presumably lost) in *Rekoa marius* and *R. stagira* (Figures 62, 63), and are reduced in size in a few species, such as *Thereus pseudarcuata* Giacomelli. Similar pouches of the corpus bursae occur in other eumaeine genera, such as *Chalybs* Hübner, *Ipidecla* Dyar, and *Electrotrymon* Clench, but they lack the sclerotized processes.

I characterize *Arawacus* by (1) papillae anales constricted subterminally, and (2) larvae feed on the foliage of *Solanum* (Solanaceae). I have not found the first character state in other eumaeines. Some other eumaeines feed on the reproductive parts of solanaceous plants (e.g., Zimmerman, 1958), but not on foliage. I recognize 19 species in *Arawacus*. All share the first character state, and the 11 species that have been reared share the second.

Polyniphes and *Dolymorpha* are synonyms of *Arawacus*. As first revisor, I accord *Arawacus* priority over *Polyniphes* (Kaye described both in 1904) because *Arawacus* is more widely used. The name *Arawacus jada* appears in the North American butterfly literature (Miller and Brown, 1981; Scott, 1986). The genus *Arawacus* has been used for "false head" butterflies (*A. superspecies aetolus*) (Robbins, 1980, 1981). The synonymy of *Dolymorpha* was noted previously, but without supporting evidence (Miller and Brown, 1981).

I characterize *Thereus* by (1) a pair of sclerotized

invaginations on the membrane attached to the ventro-lateral sides of the papillae anales, (2) a pair of ventro-lateral brush organs (often inconspicuous) in addition to the pair of dorsal ones, and (3) the number of antennal nudum segments (as defined in character 2 of the morphology section) in females being greater than that in males by five or more segments.

Thereus contains 27 species. Of these, all but two share the first character state, which is unique among the eumaeines so far as I am aware. The second is shared by all but three. Males of some *Chalybs* species also have four brush organs, but they lack the anterior vinculum process of the *Thereus* Section. All *Thereus* species share the third character state although I have not seen females for a few of the species. I synonymize *Noreena* to *Thereus* because the type species of each possesses the three character states above.

I characterize *Rekoa* by (1) signa that are oval or transversely elongate at the wall of the corpus bursae (Figures 52, 56–63), (2) anterior part of the bursa copulatrix twisted dextrally about 90 degrees at a membranous part of the ductus bursae so that the ductus seminalis arises on the right lateral side of the ductus bursae (Figures 56–63), and (3) tip of ventral cornutus enlarged, and expanded laterally with more than one row of teeth on the dorsal surface (Figures 43–50).

These three character states occur in all seven *Rekoa* species, but similar structures are found in some species of the *Thereus* Section. *Arawacus tarania* Hewitson and *Thereus ortalus* Godman and Salvin have signa similar to those in *Rekoa*, but their signa differ in being longer than wide. The ventral cornutus in *Arawacus* and *Thereus* is not laterally expanded and has at most, one row of dorsal teeth. The second character state is provisional because it appears to have evolved independently within *Thereus*. Marked asymmetry in the eumaeine bursa copulatrix usually is associated with development of teeth in the male genitalia (Robbins, unpublished). In *Rekoa*, there are teeth on the ventral cornutus, while those *Thereus* species with the third character state have teeth on the dorsal end of the penis shaft. Because of this difference, I provisionally suggest that the third character state evolved convergently in each genus.

Phylogenetic relations among genera in the *Thereus* Section are unclear, and resolution awaits more detailed work on each genus. Because I do not know whether the sister group of *Rekoa* is *Arawacus*, *Thereus*, or both, I use both as my outgroup in this paper.

PROPOSED CLASSIFICATION

This synonymic list summarizes the classification of *Rekoa*. I use Comstock and Huntington (1959–1964) as a nomenclatural reference but correct the date for *Rekoa myrtillus* Cramer from 1784 to 1782. I list nomenclatural citations in the Literature Cited. Each synonym not listed in Comstock and Huntington is designated a "new synonym." Where appropriate, I follow the superspecies nomenclature form in the Code of Zoological Nomenclature (Article 6b).

Genus *Rekoa* Kaye, 1904= *Heterosmaitia* Clench, 1964, new synonym*R. meton* (Cramer), 1779= *R. augustus* (Fabricius), 1793*R. malina* (Hewitson), 1867, new combination= *R. phrynisca* (Burmeister), 1878, new synonym*R. palegon* (Cramer), 1780, new combination= *R. myrtillus* (Cramer), 1782= *R. juicha* (Reakirt), 1866= *R. cyrriana* (Hewitson), 1874, new synonym= *R. ulia* (Dyar) 1913, new synonym*R.* (superspecies *zebina*) *zebina* (Hewitson), 1869, new combination= *R. orses* (Godman and Salvin), 1887, new synonym= *R. guadala* (Schaus), 1902, new synonym*R.* (superspecies *zebina*) *bourkei* (Kaye), 1925, new combination= *R. abeja* (Johnson and Matusik), 1988, new synonym*R. marius* (Lucas), 1857, new combination= *R. spurina* (Hewitson), 1867, new synonym= *R. ericusa* (Hewitson), 1867, new synonym= *R. brescia* (Hewitson), 1868, new synonym= *R. voconia* (Hewitson), 1869, new synonym*R. stagira* (Hewitson), 1867, new combination= *R. erenea* (Hewitson), 1867, new synonym= *R. timaea* (Hewitson), 1869, a secondary homonym of *Psuedolycaena timaeus* Felder and Felder, 1864–1867= *R. volana* (Hewitson), 1869, new synonym= *R. lydia* (Kirby), 1871, objective replacement name for*R. timaea* (Hewitson), 1871, new synonym= *R. thoana* (Hewitson), 1874, new synonym= *R. carioca* (Ebert), 1965, new synonymKey to the Species of *Rekoa*

1. Ventral forewing crossed by two or more brown bands and lacking a white and black postmedian line [Figures 65, 72, 76] 2
 Ventral forewing lacks brown bands but has white and black postmedian line [Figures 82, 88, 93, 106] 4
2. Ventral forewing postmedian band disjointed at vein M3 [Figures 76, 78, 80] *R. palegon*
 Ventral forewing postmedian band continuous at vein M3 [Figures 65, 67–69, 72, 74] 3
3. Base of dorsal hindwing vein Rs covered with brown (occasionally blue) scales [Figures 71, 73] *R. malina*
 Base of dorsal hindwing vein Rs covered with white scales [Figures 64, 66] *R. meton*
4. Ventral hindwing lacking pale blue scales in submarginal spot of cell Cu2-2A or if present, restricted to basal part of the spot [Figures 106, 108–110] *R. stagira*
 Ventral hindwing with pale blue scales in submarginal spot of cell Cu2-2A, from submarginal line to the margin 5
5. Length of male genital saccus (ventral aspect) greater than 0.60 mm [Figure 49, Table 12]. Female corpus bursae with lightly sclerotized longitudinal striations surrounding the signa [Figure 62] *R. marius*
 Length of male genital saccus (ventral aspect) less than 0.60 mm [Figures 47, 48, Table 12]. Female corpus bursae lacking lightly sclerotized longitudinal striations surrounding signa [Figures 60, 61] 6
6. Antilles. Right prong of dorsal penile cornutus absent or reduced to a bump [Figure 48]. Lamella postvaginalis lacking distal spines [Figure 61] *R. bourkei*
 Mexico to Costa Rica. Right prong of dorsal penile cornutus greater than 0.018 mm [Figure 47]. Lamella postvaginalis with two distal spines [Figure 60] *R. zebina*

The four “look-alike” species, *R. marius*, *R. stagira*, *R. zebina*, and *R. bourkei*, usually can be identified without reference to genital preparations. *Rekoa bourkei* is the only Antillean species, and *R. stagira* can almost always be

identified by the ventral hindwing character in the Key. *Rekoa marius* and *R. zebina* overlap from Mexico to Costa Rica, where males can be immediately distinguished by the wider dorsal border at the apex of the forewing and more elongate

dorsal forewing androconial pad of *R. zebina* (Figures 34, 36, 81, 92). Females of these two species are difficult to identify by wing pattern. If there are submarginal red spots on the dorsal hindwing, then the specimen is *R. marius*. Females of *R. zebina* tend to have more red under the ventral hindwing postmedian line in cell 2A-3A than those of *R. marius* (Figures 86, 95), but this character is not always reliable. Fortunately, the female genitalia are distinctive (Figures 60, 62), and the presence or absence of spines on the lamella postvaginalis can be scored *in situ* by brushing off the scales surrounding the ostium bursae.

NOMENCLATURE

Rekoa Kaye, 1904: Kaye (1904) described *Rekoa*, and included only one species, *Papilio meton* Cramer, 1779 (which is the type species by original designation). Kaye briefly characterized the genus, but no one else has improved upon his description.

Heterosmaitia Clench, 1964: Clench (1964a) described *Heterosmaitia* using a variety of characters, and designated *Thecla bourkei* Kaye, 1925, as type species. Clench (1970) then synonymized *Heterosmaitia* to *Thereus*. I have given reasons why I consider *Heterosmaitia* to be a synonym of *Rekoa*, not *Thereus*.

DISTRIBUTION

Rekoa is restricted to the neotropics from southern Texas (United States) south to Uruguay and Argentina (vicinity of Buenos Aires). It occurs on Jamaica, Hispaniola, and St. Vincent in the Antilles and on many offshore islands, specifically Roatan and Bonacca (Honduras), Coiba and Taboga (Panama), Margarita (Venezuela), and Trinidad and Tobago.

I list locality, elevation, and date collected of specimens from the collections listed in the Acknowledgments. I plot distribution on maps (Figures 70, 83, 84, 91, 98, 111), but sometimes use one dot for two or more neighboring localities. A double question mark (??) in the locality list means that I did not plot that record because I could not determine its exact location. The list in Brown (1979) was an invaluable aid in finding many obscure localities, and when there were alternate spellings for a locality, I used the spelling in that work.

ECOLOGY AND BEHAVIOR

HABITAT.—I recognize three axes in the habitat niche of *Rekoa* species: mean annual rainfall, elevation, and habitat disturbance. I divide eumacine hairstreaks into dry area specialists (those restricted to habitats with a pronounced dry season and with usually less than 250 cm annual rainfall), wet habitat specialists (habitats with usually more than 200 cm

annual precipitation), and generalists, which are found in both areas. With respect to elevation, I divide them into lowland species (rarely over 1000 m elevation), highland species (rarely under 800 m elevation, except occasionally in low elevation foothills or in temperate lowlands at the edges of the tropics), and generalists, which occur in both areas. Although these habitat divisions based on rainfall and elevation are arbitrary, I found that they correspond to the distributions of many eumacines. Habitat disturbance is difficult to measure, and for now, my comments on disturbance are subjective. I note the habitat niche for *Rekoa* in each species account. Within the genus, there are specialists and generalists with respect to rainfall and elevation.

DISPERSAL.—Hairstreak dispersal has been recognized at three sites in the Neotropics. Beebe (1949a,b, 1950a,b, 1951a-c) recorded many orders of insects migrating through Portachuelo Pass (1100 m), Aragua, Venezuela, and noted 18 hairstreak species. The Pass has since been extensively collected for migrating eumacines by the late Fernandez-Yepey and colleagues (specimens in the IZA collections) and by Nicolay and myself (specimens in the NMNH). Close to 120 hairstreak species are known to disperse through Portachuelo Pass. The second site is a ridge adjoining Cerro Campana (400–600 m), Panama, where dry-season trade winds blow hairstreaks across the ridge. Robbins and Small (1981) listed the species that have been found being dispersed. The third site is at Monteverde National Park (Costa Rica), where insects migrate through passes over the continental divide at 1500–1600 m. Haber is working at this site, and I have identified the species that he found in the first year of research. All three sites are similar in that the majority of individuals dispersing are females (60%–75%), and dispersal usually takes place only when there is strong wind. Some *Rekoa* have been found at dispersal sites, while others have not.

A second measure of dispersal is sympatry (e.g., Nelson and Platnick, 1981). If speciation requires allopatry, then sympatry means that dispersal has occurred. Five of the seven *Rekoa* species are sympatric throughout much of Central America.

A third dispersal measure is presence of phenotypically non-divergent specimens on offshore islands—those within 150 km of the mainland. If a species regularly disperses to an island, then gene flow should retard differentiation. On the other hand, if presence on offshore islands results from tectonic events and marked changes in sea level, then long isolation should produce phenotypically divergent populations. Such divergent populations on offshore islands occur in some eumacines, such as *Tmolus echiom* Linnaeus and *Strymon yojoa* Hewitson (Robbins, unpublished). Although *Rekoa* species occur on many offshore islands, they are not distinguishable from mainland populations. As knowledge of eumacine biology increases, it will be interesting to see if this measure of dispersal is correlated with the previous two, as it appears to be in *Rekoa*.

SEASONALITY.—Adults of *Rekoa* species occur throughout

TABLE 1.—Character matrix for seven *Rekoa* species and for outgroup genera (labelled "Outgroups"). Missing information for *Rekoa* species is coded 9. When all or none of the character states occurs in the outgroup genera, it is also coded 9. All characters and their states are discussed in the text.

Taxa	Characters																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<i>meton</i>	1	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	1	0	1	0
<i>malina</i>	0	0	0	1	0	1	1	1	1	0	0	1	1	0	0	0	1	0	1	1	1	0	1	0
<i>palegon</i>	1	0	0	0	0	2	2	1	2	0	0	1	0	0	0	0	1	0	1	1	1	0	1	0
<i>zebina</i>	1	0	1	0	1	3	3	1	1	1	1	2	1	2	2	1	1	1	0	0	0	1	0	1
<i>bourkei</i>	1	0	9	0	1	3	3	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1
<i>marius</i>	2	1	2	0	0	3	4	1	1	1	0	1	1	0	0	0	1	0	0	0	0	1	0	1
<i>stagira</i>	2	1	2	0	0	3	4	1	1	1	0	1	1	0	0	0	1	0	0	0	0	1	0	1
Outgroups	9	9	9	9	0	9	1-4	9	9	9	9	1	1	9	0,2	9	9	9	9	9	9	9	9	9

the year except for those species at about 35° south latitude whose flight periods are limited to the southern summer. Further, adults show no seasonal dimorphism, as do some *Thereus* species.

LARVAL FOODPLANTS, PARASITIDS, AND ANT MUTUALISMS.—Four *Rekoa* species (*R. marius*, *R. palegon*, *R. stagira*, *R. zebina*) have been reared from field-collected larvae, and I list individual records under species accounts. Larvae were usually found feeding on floral buds or flowers, occasionally on leaves. As appears to be true for some other eumaeines (Robbins and Aiello, 1982), I suspect that oviposition and early instar feeding is restricted to buds, flowers, and fruits, while last-instar larvae eat leaves when plant reproductive tissues are unavailable.

Rekoa species are polyphagous on an array of unrelated dicotyledons. Larval foodplant records include Boraginaceae, Compositae, Combretaceae, Leguminosae, Malpighiaceae, Melastomataceae, Ochnaceae, Polygonaceae, Solanaceae, Ulmaceae, and Verbenaceae. *Rekoa marius* is recorded from 7 plant families, and *R. palegon* from 5 families. Robbins and Aiello (1987) noted that many flower-feeding lycaenids are exceedingly polyphagous on unrelated plant families. *Rekoa marius* and *R. palegon*, the only *Rekoa* species with more than 3 foodplant records, fit this pattern.

Rekoa immature stages are not yet useful for systematic work because of the paucity of preserved material. I know of no preserved eggs, larvae, or larval head capsules. However, while the larva of *R. zebina* is purple, that of *R. palegon* is spiny and green (Figures 112–114). There are pupal cases from which adults eclosed for the four reared species, but I find no obvious qualitative interspecific differences in pupal sclerites. Diapause of immature stages is unrecorded, as is the case with all known neotropical eumaeines. Records for length of pupal period (8, 8, 9, and 12 days) are typical of non-diapausing eumaeines (Robbins and Aiello, 1982).

Parasitoid and ant mutualism records for *Rekoa* immatures are scanty. Costa Lima (1947) noted that the larvae of *R. marius* (as *Thecla ericusa*) are parasitized by wasps of the genus *Tetrastichus* (Eulophidae). There are no other records

of immature stages being parasitized. Most eumaeine hairstreak larvae are associated with ants in a facultative presumed mutualism (Robbins and Aiello, 1982; Chew and Robbins, 1984). Although larvae of *R. palegon* have organs for myrmecophily (Malicky, 1969, 1970), no *Rekoa* larvae have yet been recorded being tended by ants in the field.

ADULT NECTAR SOURCES.—I record nectar sources under each species account. These records come from specimens in the collections that I examined and from published sources. Because most collectors do not note whether a specimen was collected on a flower, let alone the plant name, these records represent a small subsample of those adult foodplants used.

MATING BEHAVIOR.—Males of most neotropical eumaeines set up "courting territories" (often referred to as perching or territorial behavior) for approximately two hours a day (Robbins, 1978), a behavior that is usually easily identified (Powell, 1968; Alcock, 1983). Males fly around each other and then return to a perch in their territories. If a female enters the territory, the male courts her. Copulating pairs are found during territorial times and succeeding hours. I found male *R. stagira* perching up to 4 m high on the vegetation of disturbed hilltops between 1230 and 1400 hours, but there are no records of territorial behavior for other *Rekoa* species nor for time at which copulating pairs were found. Male odors, presumably pheromones used during courtship, are recorded for *R. palegon* (chocolate-like odor, Longstaff, 1909).

It is puzzling that territorial behavior for male *R. marius* and *R. palegon* has not been recorded. Gordon Small, who has studied Panamanian butterflies for more than 20 years, never observed males of these very common species perching. I unsuccessfully looked for male territorial behavior on hilltops and elsewhere at all times of day during an 18-month tenure in Panama. I suspect that the lack of records is because *R. marius* and *R. palegon* perch at dawn or dusk in the tops of trees where they would be difficult to observe. If so, then copulating pairs should be found between dusk and mid-morning. However, it is possible that their mating systems are different from other eumaeines and are thus not readily recognized. Careful observation is needed.

TABLE 1.—Continued.

Taxa	Characters																					
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
<i>meton</i>	0	0	0	0	3	0	0	2	2	0	2	1	0	1	0	0	1	4	0	0	1	1
<i>malina</i>	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	4	0	0	0	0
<i>palegon</i>	0	0	0	0	1	1	1	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0
<i>zebina</i>	1	1	1	1	0	1	1	1	0	1	1	0	1	0	1	2	1	2	1	0	0	0
<i>bourkei</i>	1	1	1	1	0	1	1	0	0	0	1	0	1	0	1	3	0	1	1	0	0	0
<i>marius</i>	1	1	1	1	0	1	1	0	2	0	1	0	1	0	1	1	0	1	3	0	1	0
<i>stagira</i>	1	1	1	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	3	0	1	0
Outgroups	9	9	9	9	0-1	9	0	9	9	0	9	9	9	9	9	0-2	0	1-2	9	0	0	0

WING PATTERN AND PREDATION.—Eumaeines with different wing patterns are attacked differently by predators (Robbins, 1981). Using specimens collected at Villavicencio, Colombia, I found that species with well-developed “false head” wing patterns at the anal angle—determined by convergent lines, a tail and contrasting anal angle coloration, and an acute anal angle—were almost 5 times as likely to show evidence of an unsuccessful predator attack as other hairstreaks. According to the criteria that I used for ranking patterns (Robbins, 1981), *Rekoa meton* and *R. palegon* have “good” false head wing patterns (rank 2), while *R. stagira* and *R. marius* (as *R. ericusa*) have “average” ones (rank 3). In the species accounts, I note proportion of specimens with predator inflicted wing pattern damage to the anal angle for the four *Rekoa* species that I collected in Villavicencio.

MORPHOLOGY AND CHARACTER STATE DISTRIBUTIONS

CODING METHODS.—I coded both qualitative and quantitative morphological variation. Characters and states are numbered, and missing information is designated with a “9.” The resulting matrix of character information is presented in Table 1. I also coded the states that occur in outgroup genera *Arawacus* and *Thereus*. Those characters for which all or none of the states occur in the outgroups provide no information for rooting the *Rekoa* network and are designated with a “9.”

Much of the interspecific variation among *Rekoa* species is quantitative. Rather than ignore the information content of these characters, as is traditional in lepidopteran revisions, I converted this variation into phylogenetic information because I believe that morphological detail is the key to understanding species-level evolution. I counted or measured various morphological parts, mostly using a binocular microscope at 50 or 100 power with an ocular scale, and then converted measured distances to millimeters. I measured specimens from throughout the range of a species so that I could recognize geographical variation. For characters such as size, I used a

random number table to select the specimens measured. I calculated sample means, standard deviations, and sample sizes.

I used a modified form of gap coding (Mickevich and Johnson, 1976) to convert quantitative measurements to discrete character states. Because sample means that differ by one standard deviation or more are significant with a sample size of 9 (t-test, 0.05 type I error), I used gaps of one standard deviation to convert quantitative results to qualitative character states. My method differs from that of Mickevich and Johnson in that they used medians and a pooled standard deviation as their gap criterion, while I used means and the arithmetic average of the standard deviations of the means being compared. This modification is more sensitive to heterogeneity among sample standard deviations. I determined transformation series by quantitative distance among character states. For example, the three states for character 1 below (antennal segment numbers) have mean values of 28.7, 32.0, and 34.3 segments. Thus, the transformation series is State 0 (28.7)—State 1 (32.0)—State 2 (34.3); the change from state 0 to state 1 is one step and the change from state 0 to state 2 is two steps.

ANTENNAE.—Antennal morphology has been used sparingly in lycaenid systematics despite considerable variation. Jordan (1898) described lycaenid antennal morphology, but did not look at variation within the family. Clench (1955) measured the ratio of longest shaft segment to average club segment, and noted that species with higher ratios tend to have more abrupt antennal clubs. Forbes (1957) classified lycaenid antennae into three types by the extent of the nudum (unscaled area), reported that females often have a more extensive nudum than males, and listed representative genera with each antennal type. At the tribe and subfamily level, Eliot (1973) counted number of segments, noted club shape and extent of the nudum, and measured the ratio of length to width of central shaft segments. No one has used antennal variation to infer phylogeny within a lycaenid tribe or genus.

I quantified antennal morphology for *Rekoa* species. I counted number of segments using a binocular microscope at $\times 50$ and measured lengths using an ocular scale at $\times 100$. I list

TABLE 2.—Number of antennal segments for *Rekoa* species and sexes. Because of small sample size, the sexes of *R. bourkei* are pooled.

Species	Sex	Mean	Standard deviation	Sample size	Range	Character state
<i>R. meton</i>	M	31.6	1.50	19	28–34	1
	F	32.4	1.92	8	30–35	1
<i>R. malina</i>	M	28.0	0.71	5	27–29	0
	F	29.1	0.64	8	28–30	0
<i>R. palegon</i>	M	32.1	1.13	8	30–33	1
	F	32.4	1.06	8	31–34	1
<i>R. zebina</i>	M	31.8	1.91	8	29–35	1
	F	31.9	1.25	8	30–34	1
<i>R. bourkei</i>	M, F	32.3	1.15	3	31–33	1
<i>R. marius</i>	M	34.6	1.24	9	34–36	2
	F	33.8	1.04	8	32–35	2
<i>R. stagira</i>	M	34.2	1.62	10	31–36	2
	F	34.4	1.41	8	32–36	2

below characters that vary among *Rekoa* species. They do not exhaustively describe *Rekoa* antennal variation, but are a first attempt to incorporate antennal morphology in generic revisions. Although these characters may not vary independently, no two species have identical character state distributions.

1. *Mean Number of Segments* (Table 2): Mean number of segments (0) less than 30, (1) between 30 and 33, (2) more than 33. As Eliot (1973) noted, segment numbers vary intraspecifically and may even differ between left and right antennae. Significant sexual dimorphism in mean segment number occurs only in *R. malina*, with an average difference of 1.1 segments. The distributions of this and succeeding characters are summarized in Table 1 for *Rekoa* species and outgroups *Thereus* and *Arawacus*.
2. *Mean Number of Male Nudum Segments* (Table 3): Mean number of segments (0) less than 14.5, (1) more than 15.0. To quantify nudum extent, I measured number of segments from the antennal end to the first segment with a complete ventral row of scales. This number is greater in females except for approximate equality in *R. malina* and *R. palegon*. Because the distribution of character states is sexually dimorphic, I scored number of male and female nudum segments as distinct characters. In both sexes, the nudum occurs in isolated ventral patches on most stalk segments, but is usually more extensive in females.
3. *Mean Number of Female Nudum Segments* (Table 3): Mean number of segments (0) less than 14.5, (1) between 14.5 and 16.0, (2) more than 18.0. I could not score *R. bourkei* because only one female had an unbroken club (17 nudum segments).
4. *Mean Length of Club Segment* (Table 4): Mean

TABLE 3.—Number of apical nudum antennal segments for *Rekoa* species and sexes. See text for counting method. Because of small samples of *R. bourkei*, both antennae for each specimen were counted and the result averaged. Because of sexual dimorphism, the number of male segments is a separate character from the number of female segments.

Species	Sex	Mean	Standard deviation	Sample size	Range	Character state
<i>R. meton</i>	M	13.6	1.30	8	12–16	0
<i>R. malina</i>	M	12.7	1.30	5	12–15	0
<i>R. palegon</i>	M	12.6	1.19	8	11–14	0
<i>R. zebina</i>	M	14.0	0.76	8	13–15	0
<i>R. bourkei</i>	M	14.0	0.71	2	13–15	0
<i>R. marius</i>	M	15.9	0.83	8	15–17	1
<i>R. stagira</i>	M	15.7	1.58	9	13–18	1
<i>R. meton</i>	F	15.3	0.46	8	15–16	1
<i>R. malina</i>	F	13.0	1.07	8	12–15	0
<i>R. palegon</i>	F	13.1	1.46	8	11–15	0
<i>R. zebina</i>	F	15.4	0.52	8	15–16	1
<i>R. bourkei</i>	F	17.0	–	1	17	9
<i>R. marius</i>	F	19.3	1.28	8	18–21	2
<i>R. stagira</i>	F	19.5	1.77	8	17–22	2

length (0) less than 0.145 mm, (1) more than 0.145 mm. I measured length of the fifth segment from the end of the antenna. This length is not sexually dimorphic. Although the length of this club segment does not differ by an average of one standard deviation between female *R. stagira* and female *R. malina*, I scored them as separate character states because they differ by this amount when the mean values are not rounded off, as they are in Table 4.

5. *Mean Length of Longest Shaft Segment* (Table 5): Generally, the longest antennal segment was near the middle of the shaft. Although this character does not appear to be sexually dimorphic, the length in male *R. meton* is almost significantly greater than in female *R. meton*. However, further sampling (increase in sample size from 8 to 15) resulted in a

TABLE 4.—Length in mm of fifth from last apical club segment in *Rekoa* species and sexes.

Species	Sex	Mean	Standard deviation	Sample size	Range	Character state
<i>R. meton</i>	M	0.16	0.017	8	0.14–0.18	1
	F	0.16	0.014	8	0.14–0.18	1
<i>R. malina</i>	M	0.16	0.034	5	0.14–0.21	1
	F	0.15	0.017	8	0.13–0.17	1
<i>R. palegon</i>	M	0.12	0.009	8	0.11–0.14	0
	F	0.12	0.008	8	0.11–0.13	0
<i>R. zebina</i>	M	0.13	0.005	8	0.12–0.14	0
	F	0.13	0.008	8	0.12–0.14	0
<i>R. bourkei</i>	M, F	0.13	0.009	3	0.12–0.14	0
<i>R. marius</i>	M	0.13	0.009	8	0.12–0.15	0
	F	0.14	0.008	8	0.12–0.15	0
<i>R. stagira</i>	M	0.14	0.009	9	0.12–0.15	0
	F	0.14	0.014	8	0.11–0.15	0

TABLE 5.—Length in mm of longest antennal shaft segment in *Rekoa* species and sexes.

Species	Sex	Mean	Standard deviation	Sample size	Range	Character state
<i>R. meton</i>	M	0.41	0.031	15	0.33–0.47	0
	F	0.38	0.046	8	0.33–0.45	0
<i>R. malina</i>	M	0.38	0.035	5	0.33–0.42	0
	F	0.36	0.013	8	0.35–0.38	0
<i>R. palegon</i>	M	0.37	0.032	8	0.31–0.40	0
	F	0.35	0.026	8	0.29–0.36	0
<i>R. zebina</i>	M	0.48	0.036	8	0.45–0.55	1
	F	0.46	0.026	8	0.44–0.50	1
<i>R. bourkei</i>	M,F	0.46	0.074	4	0.36–0.53	1
<i>R. marius</i>	M	0.38	0.044	8	0.33–0.44	0
	F	0.37	0.059	8	0.27–0.44	0
<i>R. stagira</i>	M	0.36	0.041	9	0.32–0.44	0
	F	0.34	0.042	8	0.29–0.42	0

decreased deviation from equality. Mean length (0) less than 0.43 mm, (1) greater than 0.43 mm. The gap between *R. bourkei* and male *R. meton* is just shorter than an average one standard deviation, but I coded them as separate characters because of the small sample size and relatively large standard deviation for *R. bourkei*. Character state 0 occurs in all outgroup species with the possible exception of *Thereus gabathana* Strand, whose shaft segment length is about 0.43 mm, but only one male and one female have been available for examination.

EYES.—Eumacine eyes are hairy (setae located at the vertices of ommatidia), but are sparsely so in *Arawacus* and some other genera (Eliot, 1973). Eyes of *R. meton* have few setae (Figures 1, 2), and large portions of the eye are “smooth.” Eyes of other *Rekoa* species are more hairy and hairiness

appears to vary interspecifically, but I have been unable to code this quantitative variation. The relatively smooth eyes of *R. meton* are similar to those of *Arawacus lincoides* Draudt and *A. separata* Lathy.

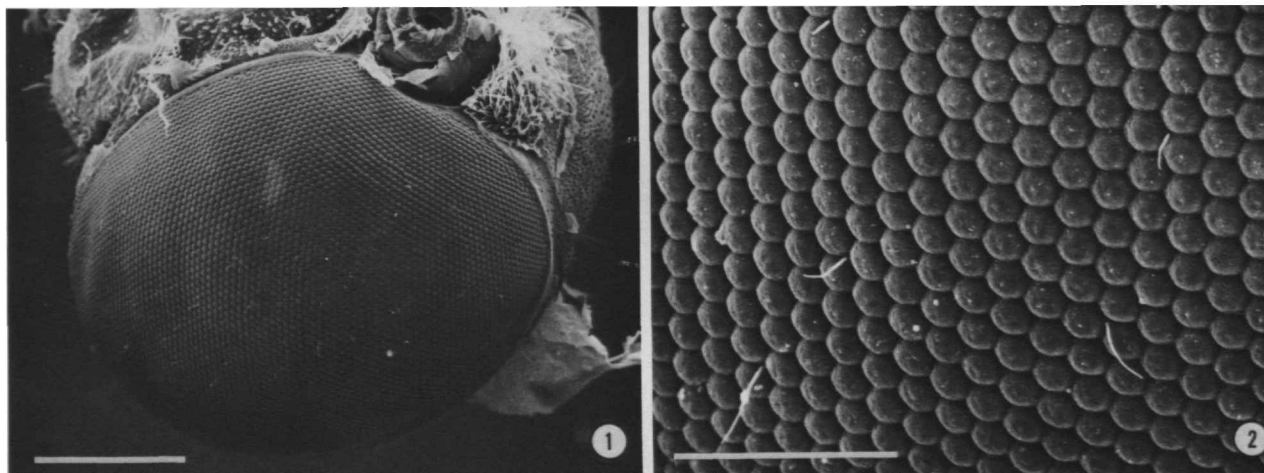
THIRD SEGMENT OF LABIAL PALP.—The tip of the lepidopteran third labial palp segment is invaginated into an inner sac containing a presumed sensory organ (Rath, 1887, 1888). This structure occurs in both “higher” and “lower” Lepidoptera (Davis, 1967), including Lycaenidae, and I illustrate a cross section of the third palpal segment for *R. palegon* (Figure 3). The function and comparative morphology of this structure in the Lycaenidae have not been described.

I previously reported (Robbins, 1987) sexual dimorphism in length of the labial palp third segment of *Trichonis* (Eumacini), and noted the widespread occurrence of this dimorphism in the tribe. I measured length of this segment in *Rekoa* using an ocular scale at $\times 100$ and found that it is sexually dimorphic in *Rekoa* except for *R. meton* populations occurring from Mexico to Costa Rica. The length of the male palp of *R. meton* varies geographically, and is significantly longer in the northern part of its range than the southern part. The distribution of character states is also sexually dimorphic, and I scored third palpal segment length as two characters.

6. *Length of Male Third Palpal Segment* (Table 6): Mean length (0) less than 0.46 mm, (1) 0.46–0.54 mm, (2) 0.54–0.63 mm, (3) greater than 0.63 mm.

7. *Length of Female Third Palpal Segment* (Table 6): Mean length (0) less than 0.49 mm, (1) 0.49–0.60 mm, (2) 0.60–0.78 mm, (3) 0.78–0.97 mm, (4) greater than 0.97 mm.

PROBOSCISES.—The eumacine proboscis has not been described in detail. In *Rekoa*, the shaft is coiled 4 or 5 times



FIGURES 1, 2.—Compound eye of male *R. meton*: 1, sparse distribution of setae (“hairs”) at vertices of ommatidia (scale = 400 μm); 2, detail of Figure 1 (scale = 100 μm).

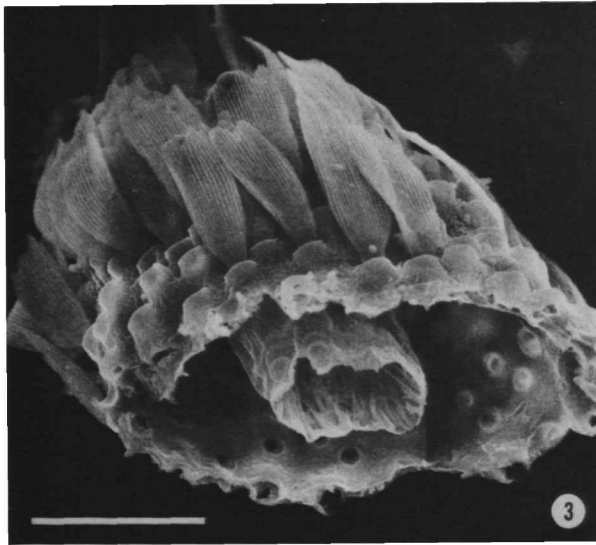


FIGURE 3.—Cross section of third labial palp segment of female *R. palegon* (scale 38 = μm).

(Figure 4) and has parallel, but irregular, grooves on the side (Figures 5, 6). There are smooth wall sensilla stylonica (Davis, 1986) on the lateral and inner surfaces of the shaft, while non-socketed cuticular processes are restricted to the inner surface (Figures 5, 6). Ribbed sensilla stylonica (Davis, 1986) occur on the last 1 to 1½ coils of the proboscis (Figures 4, 7–9). They vary in size and shape, and appear to be non-socketed. I find no interspecific or sexual variation of these structures in *Rekoa*.

Eliot (1973) preliminarily examined the lycaenid proboscis, and noted that differences appear to form groupings at higher taxonomic levels (subfamily, family). I agree. Although I did not examine a great many species, I found little structural variation in the Theclinae, Lycaeninae, or Polyommatainae, while the proboscis differed rather substantially in *Feniseca* (Miletinae), *Curetis* (Curetinae), Riordinidae, and Nymphalidae. Although Eliot stated that some neotropical eumaeines have better developed sensory hairs on the “inner surface” of the shaft than other Theclinae, I did not see such differences using a SEM.

LEGS.—*Rekoa* have typical eumaeine legs. Male foretarsi are fused, lack pretarsal claws, and possess A-Type trichoid sensilla (spines) and B-Type trichoid sensilla (Robbins, 1988). The mid- and hindlegs of both sexes have one pair of tibial spurs with scales. As with many eumaeines, tarsal claws are “bifid” (Figure 10), a character that also occurs in the Pieridae (Clench, 1955) and Aphnaeini (Lycaenidae) (Eliot, 1973). Although leg lengths vary quantitatively, I did not record this variation.

WING SIZE, SHAPE, AND VENATION.—I measured wing size as the length from the forewing apex to the base of the discal cell (Table 7). Sexual dimorphism in size was statistically

TABLE 6.—Length of third palpal segment (in mm). Male and female lengths treated as separate characters because of sexual dimorphism. Lengths for male *R. meton* varied geographically.

Species	Sex	mean	Standard deviation	Sample size	range	Character state
<i>R. meton</i>						
Mex.-CR	M	0.43	0.040	9	0.36–0.49	0
Panama	M	0.34	0.046	8	0.29–0.42	0
S. Amer.	M	0.33	0.034	9	0.29–0.38	0
<i>R. malina</i>	M	0.49	0.039	8	0.42–0.55	1
<i>R. palegon</i>	M	0.59	0.052	16	0.49–0.68	2
<i>R. zebina</i>	M	0.69	0.048	9	0.60–0.76	3
<i>R. bourkei</i>	M	0.67	0.090	3	0.59–0.73	3
<i>R. marius</i>	M	0.69	0.078	10	0.55–0.77	3
<i>R. stagira</i>	M	0.71	0.078	9	0.58–0.84	3
<i>R. meton</i>						
Mex.-CR	F	0.45	0.087	9	0.31–0.55	0
Panama	F	0.43	0.069	8	0.35–0.55	0
S. Amer.	F	0.42	0.077	8	0.35–0.56	0
<i>R. malina</i>	F	0.53	0.069	8	0.45–0.67	1
<i>R. palegon</i>	F	0.67	0.072	17	0.53–0.82	2
<i>R. zebina</i>	F	0.90	0.072	9	0.78–0.98	3
<i>R. bourkei</i>	F	0.88	0.064	2	0.84–0.93	3
<i>R. marius</i>	F	1.07	0.074	10	0.93–1.16	4
<i>R. stagira</i>	F	1.04	0.080	9	0.93–1.20	4

significant only for *R. malina*, but mean female size was greater than mean male size for every species. I suspect that larger sample sizes would show significant sexual dimorphism for all species.

There is little variation in wing venation (Figures 11–22), but, unlike some eumaeines, forewing vein R3 is not stalked with vein M1, and forewing vein M2 arises slightly closer to M1 than to M3.

At hindwing vein Cu2, the wing margin juts outwards in all species, and there is a slight indentation in the outer margin at vein 2A. Presence or absence of a tail at hindwing vein Cu1 is the only wing shape character that I coded.

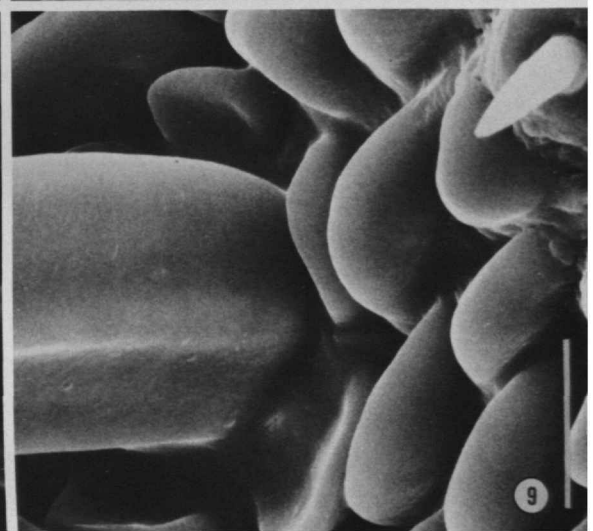
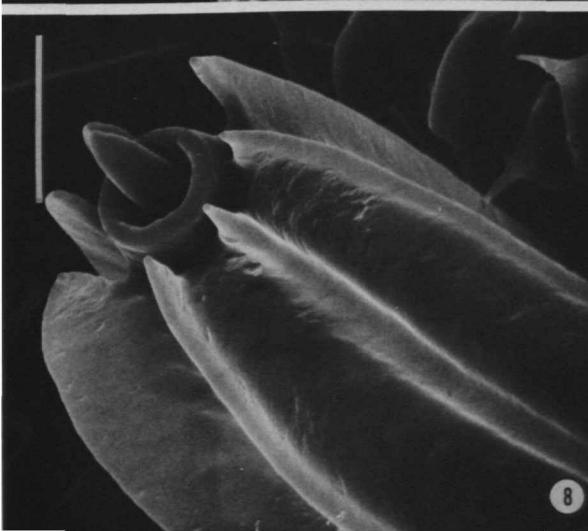
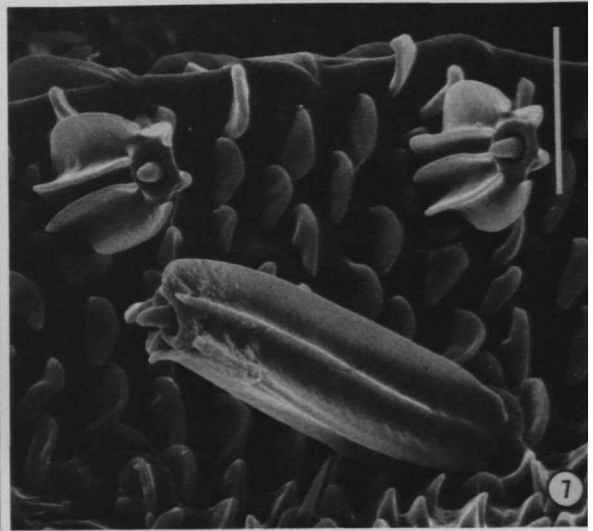
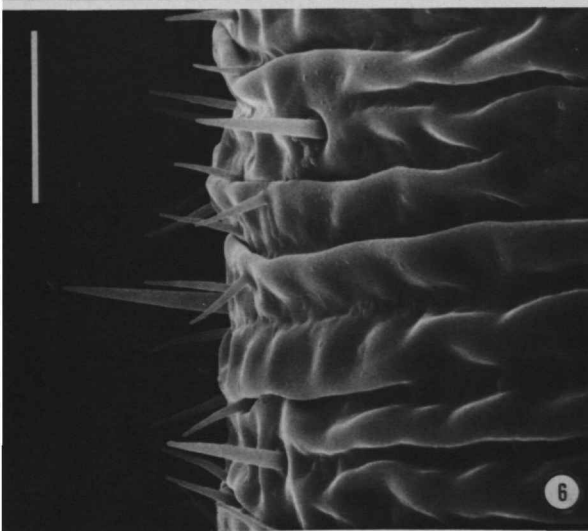
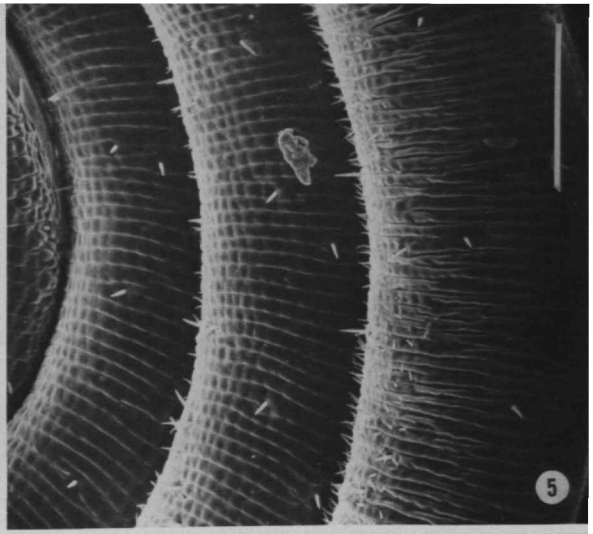
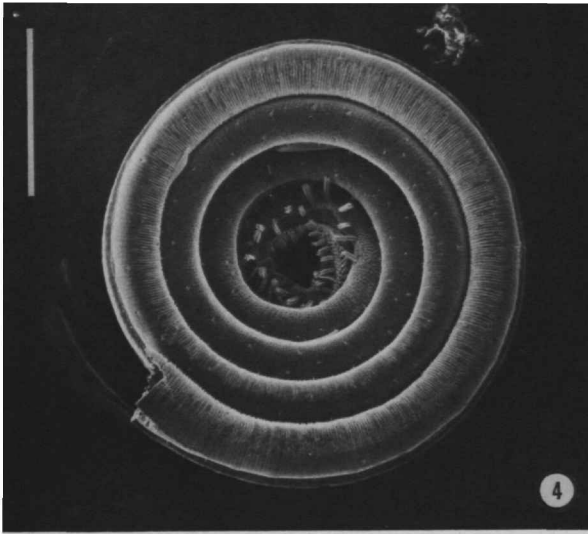
8. Mean Male Forewing Length (Table 7): (0) greater than 16.5 mm, (1) less than 16.5 mm.

9. Mean Female Forewing Length (Table 7): (0) greater than 17.0 mm, (1) 14.3–17.0 mm, and (2) less than 14.2 mm.

10. Tail at Hindwing Vein Cu1 (Figures 11–22): (0) no tail, (1) with a tail.

ANDROCONIA.—Superficially, androconial variation in *Rekoa* is straightforward. All species have a distal patch at the upper

FIGURES 4–9.—Proboscises of *Rekoa*: 4, coiled proboscis of *R. malina* with ribbed sensillae stylonica at distal end (scale = 0.27 mm); 5, shaft of *R. marius* showing distribution of smooth walled sensillae stylonica on lateral and inner surfaces and distribution of cuticular outgrowths on inner surface (scale = 60 μm); 6, shaft inner surface of *R. marius* with smooth walled sensillae stylonica and cuticular outgrowths (scale = 10 μm); 7, three ribbed sensillae stylonica at proboscis tip of *R. marius* showing variation in shape (scale = 15 μm); 8, *R. marius* tip of ribbed sensilla stylonica (scale = 6 μm); 9, *R. marius* ribbed sensilla stylonica showing non-socketed base (scale = 4.3 μm).



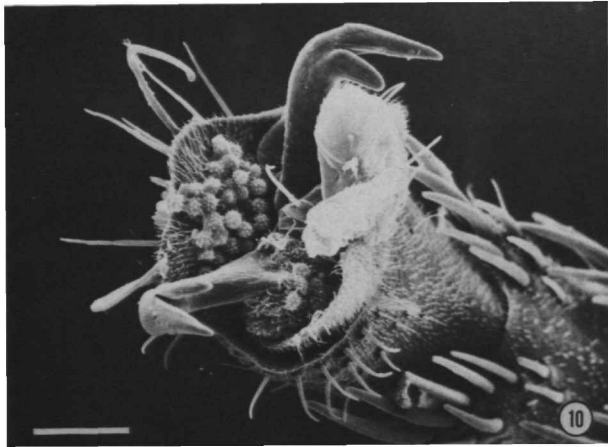


FIGURE 10.—Hind tarsal claws of male *R. meton* showing “bifid” shape (scale = 100 μ m).

end of the dorsal forewing discal cell. *Rekoa malina* and *R. stagira* have an additional basal black patch within the discal cell, while in *R. marius*, the black patch may be present or absent. However, androconial variation is more complex than this. I outline my methods for examining androconia and androconial clusters, and present background information needed to explain variation within *Rekoa*.

I prepared androconial clusters for examination under the scanning electron microscope (SEM) using the following technique. I removed the wing from the butterfly, wetted it in 70% ethanol, soaked it in 5.25% sodium hypochlorite until the wings cleared, removed scales with a small brush, and cut the wings with a razor blade across the androconial cluster. I then mounted the wing vertically on stubs so that they could be

TABLE 7.—Length in mm of forewing from apex to base of discal cell in *Rekoa* species and sexes. Male and female sizes treated separately because distribution of character states is sexually dimorphic.

Species	Sex	Mean	Standard deviation	Sample size	Range	Character state
<i>R. meton</i>	M	17.7	1.20	9	16.5–19.5	0
<i>R. malina</i>	M	13.4	0.95	9	12.5–14.5	1
<i>R. palegon</i>	M	13.2	0.97	9	11.5–15.0	1
<i>R. zebina</i>	M	15.6	0.81	9	14.5–17.0	1
<i>R. bourkei</i>	M	13.7	2.31	3	11.0–15.0	1
<i>R. marius</i>	M	14.4	1.50	9	11.5–16.0	1
<i>R. stagira</i>	M	14.9	1.08	10	13.0–17.0	1
<i>R. meton</i>	F	18.7	1.42	9	16.5–21.0	0
<i>R. malina</i>	F	14.9	1.11	9	13.5–17.0	1
<i>R. palegon</i>	F	13.6	1.13	9	11.5–15.0	2
<i>R. zebina</i>	F	16.3	1.04	9	15.0–18.0	1
<i>R. bourkei</i>	F	15.2	1.04	3	14.0–16.0	1
<i>R. marius</i>	F	15.1	1.04	9	13.5–16.5	1
<i>R. stagira</i>	F	15.2	1.44	9	13.0–18.0	1

viewed in cross section. Although an SEM is the best way to examine the fine structure of androconial clusters, some of the structures described below can be seen with a binocular microscope at $\times 100$.

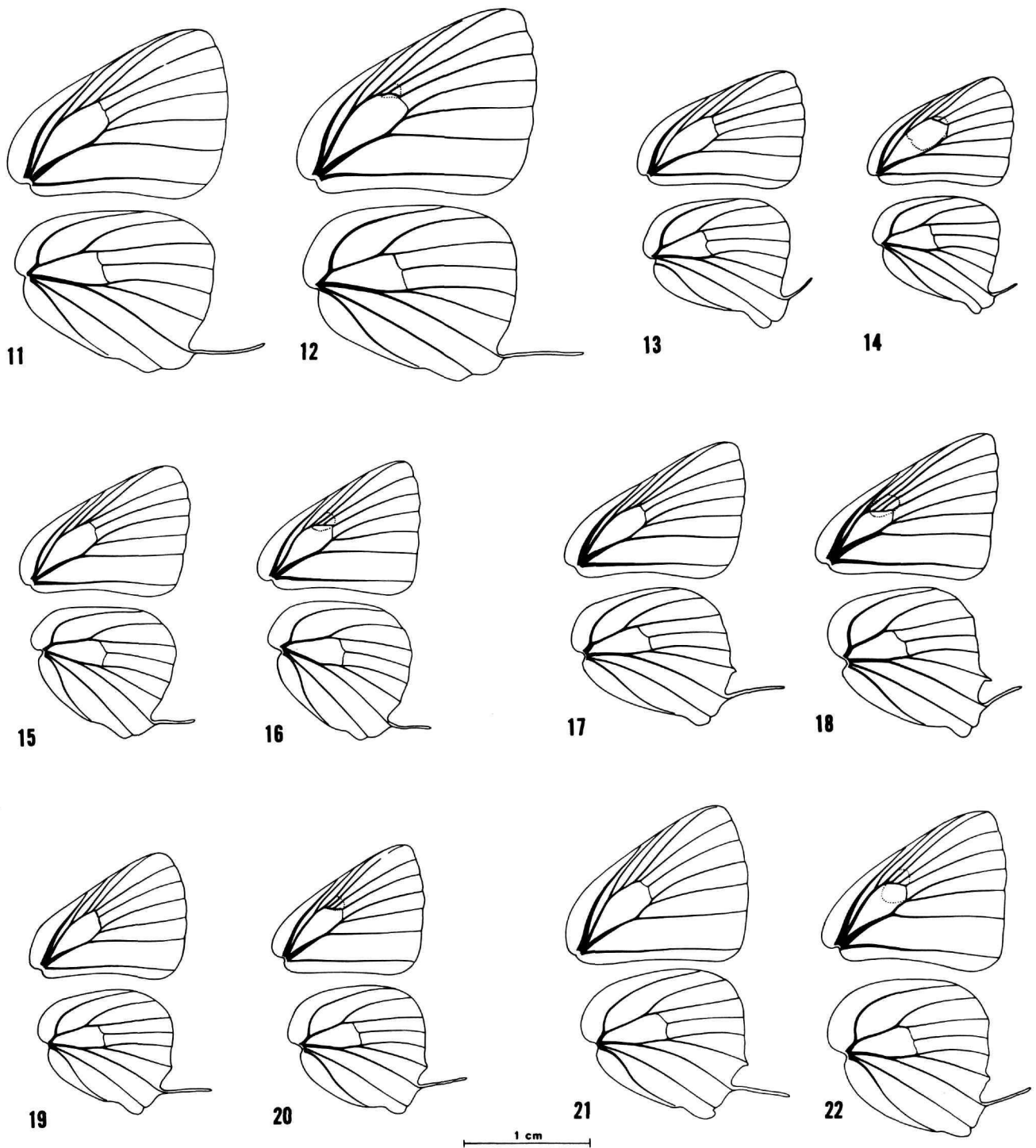
I prepared androconia for measurement by touching them with the clean tips of fine forceps, to which they adhered, and by dipping the forceps into a drop of 70% ethanol on a microscope slide. After the ethanol evaporated, the androconia laid flat on the slide (with few exceptions) and could be measured at $\times 100$ using transmitted light.

Clench (1975b) classified hairstreak dorsal forewing androconial clusters as “scent pads” or “scent patches.” According to Clench, scent pads are sharply outlined and have a thickened underlying area on the wing membrane, while scent patches have a vague outline and lack modification of the underlying wing membrane. Although it might seem that scent pads and patches represent extremes along a morphological continuum, I discovered that they are qualitatively distinct. I elaborate the differences between pads and patches, and suggest that the term “androconial clusters” be applied to those groups of eumaeine androconia for which it has not been determined whether they are pads or patches.

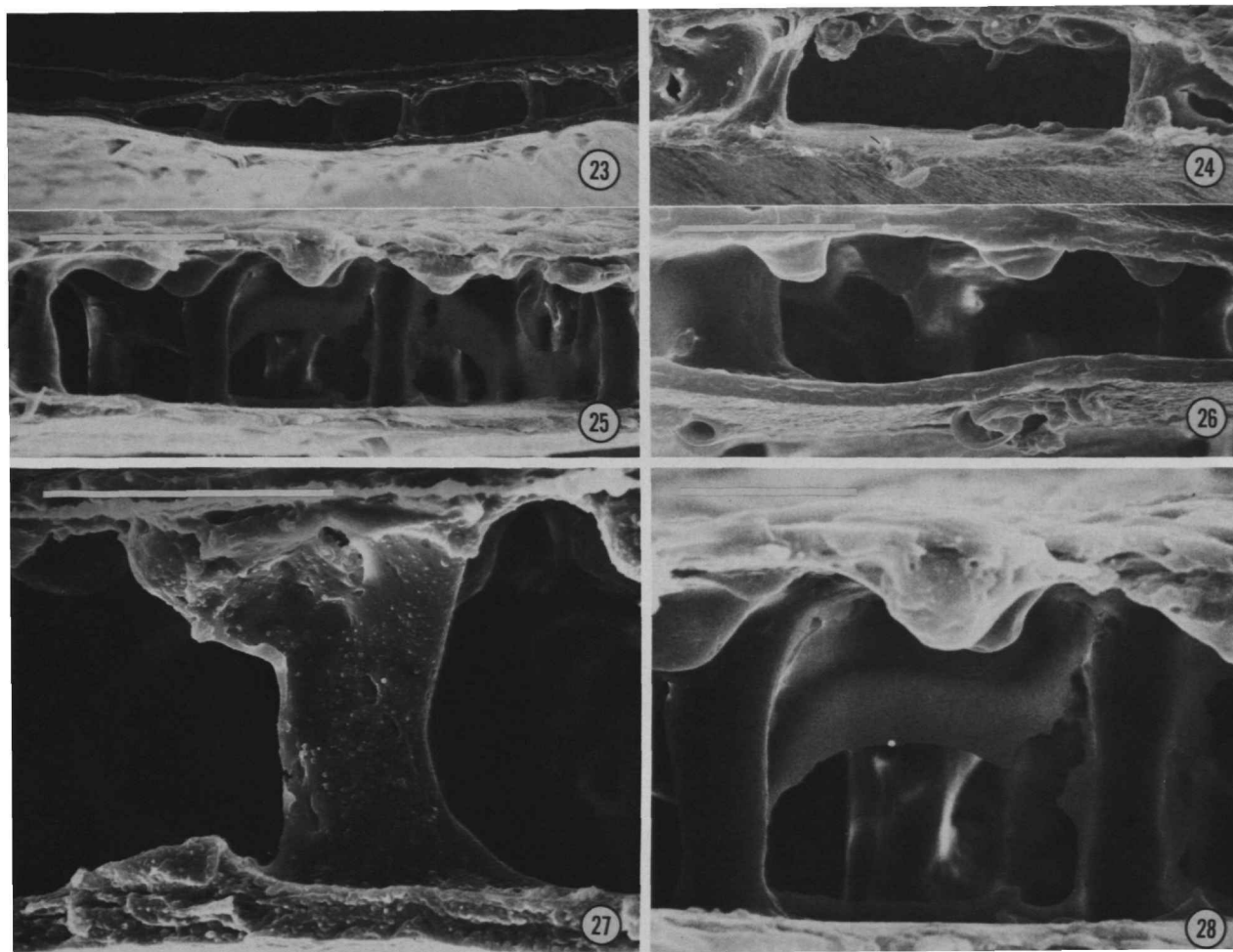
Thomas (1893) histologically described eumaeine hairstreak scent pad morphology, and I independently discovered it using the SEM. The dorsal and ventral wing membranes of scent pads are separate, forming a pocket within the wing (Figures 23–28) that is wider than 15 μ m at the center. Normally in Lepidoptera, the wing membranes are fused. Columnar structures separate the wing membranes and presumably prevent them from collapsing. Invaginations of the dorsal membrane contain androconial stalks and scent cells. The wing pocket is probably filled with haemolymph, which provides nutrients for the scent cells, which in turn, produce pheromone. The edges of the scent pad are sharply outlined by the extent of the intermembrane pocket.

Scent patches, on the other hand, have the dorsal and ventral wing membranes fused or nearly so (Figure 29). The wing membranes are slightly separated near wing veins, but by less than 2 μ m. They are also separated at the base of individual androconia by about 5 μ m. At many places within a scent patch, the wing membranes are completely fused. Presumably, there is enough space for haemolymph to seep through and supply nutrients to the scent cells. It needs to be confirmed histologically that scent cells occur at the base of eumaeine scent patch scales. Because scent patch androconia are not restricted to an intermembrane pocket, their edges need not be sharply outlined, in accordance with Clench’s observation.

The presence of scent pads is phylogenetically significant. Scent pads occur in *Thereus* Section genera (*Thereus* and *Rekoa*, but not *Arawacus*), and in other unrelated genera such as *Satyrium* Scudder (Thomas, 1893), *Ipidecla*, and *Atlides* (Robbins, unpublished). The columnar structures and wing membrane invaginations apparently do not occur in other families (e.g., Hesperiiidae, Nymphalidae (Danainae), Thomas



FIGURES 11-22.—Wing venation of *Rekoa*: 11, female *R. meton*; 12, male *R. meton*; 13, female *R. malina*; 14, male *R. malina*; 15, female *R. palegon*; 16, male *R. palegon*; 17, female *R. zebina*; 18, male *R. zebina*; 19, female *R. marius*; 20, male *R. marius*; 21, female *R. stagira*; 22, male *R. stagira*.



FIGURES 23–28.—Cross section of *Rekoa* forewing scent pad showing space between wing membranes with support columns and invaginated pouches that contain scent cells and androconial bases (dorsal surface up): 23, *R. stagira* (scale = 100 μm); 24, *R. malina* (scale = 27 μm); 25, *R. marius* (scale = 30 μm); 26, *R. palegon* (scale = 20 μm); 27, detail of support column in *R. stagira* (scale = 20 μm); 28, enlargement of Figure 25 (scale = 13.6 μm).

(1893); Pieridae, Rutowski (1977), see Boppré (1984) for other references). Superficial examination with a binocular microscope indicates that these structures occur in many eumaeines, but not in other thecline tribes. If scent pads are restricted to the Eumaeini, their presence may be a defining character state for the tribe or for a large clade within it.

Dorsal forewing scent patches appear to occur widely in the Eumaeini as well as in the closely related Deudorigini. Additionally, those few androconial clusters on other parts of the wings that I have examined are also scent patches (ventral forewing of *Arawacus sito* Boisduval, dorsal hindwing of *A. separata* Lathy).

In *Rekoa*, the distal androconial cluster is a scent pad (Figures 30–37), is gray-silver (yellow-white in *R. meton*, often black in whole or part in *R. zebina*), covers the apical portion of the discal cell, extends beyond the cell from vein R2 to M2, and occurs in all *Rekoa* species (Figures 12, 14, 16, 18, 20, 22). In *R. palegon*, the scent pad is composed of two parts, each with androconia of different size (Table 10), so that it often appears duplex to the naked eye (Figure 75), but not under higher magnification (Figures 32, 33). Because *Arawacus* species do not have scent pads, I use *Thereus* as the outgroup for the following scent pad characters.

11. *Scent Pad Size* (Table 8): I measured the width of

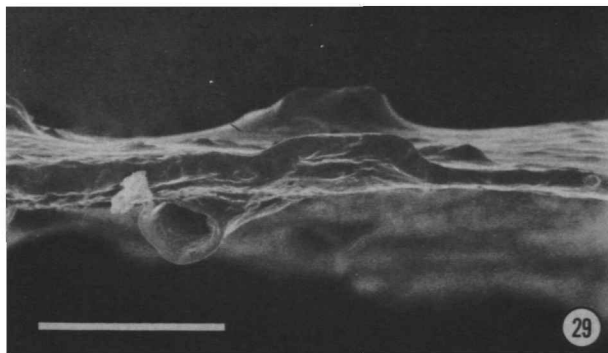


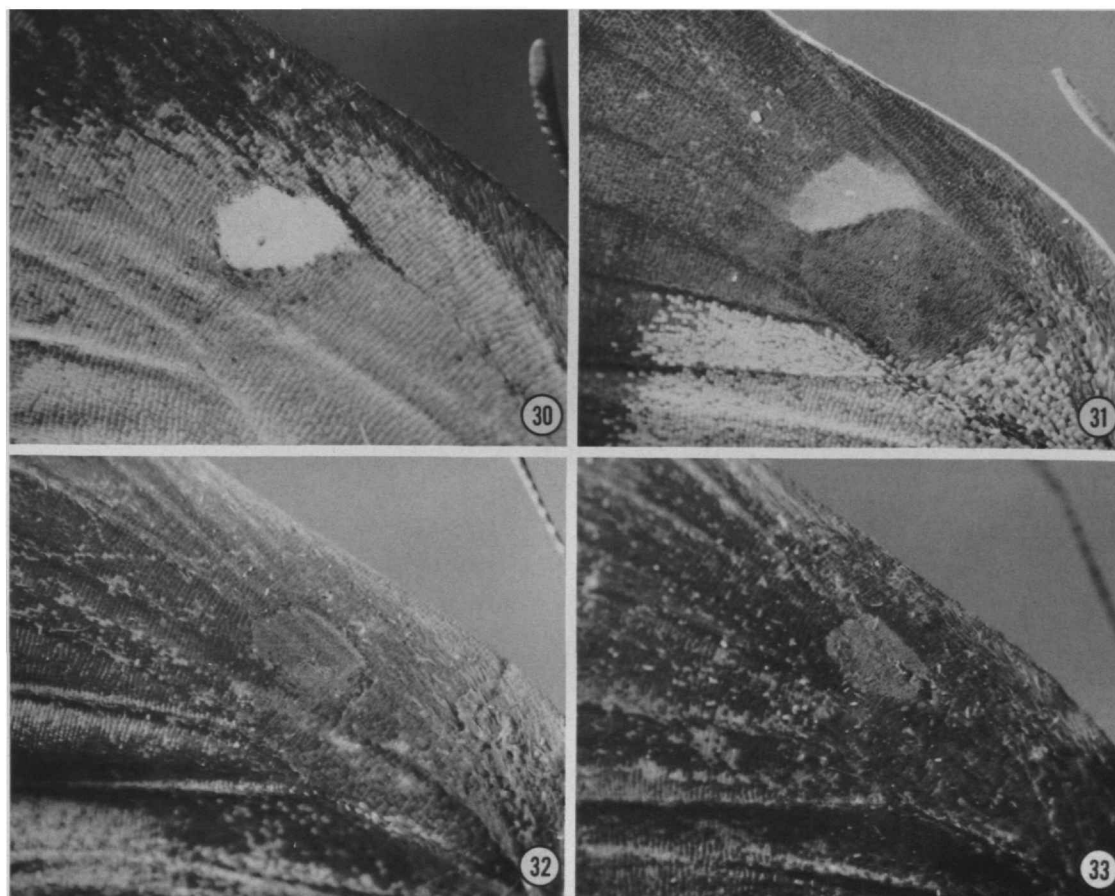
FIGURE 29.—Cross section of *R. malina* forewing scent patch showing fused wing surfaces (dorsal surface up, scale = 15 μ m).

TABLE 8.—Width in mm of dorsal forewing androconial pad in *Rekoa* species.

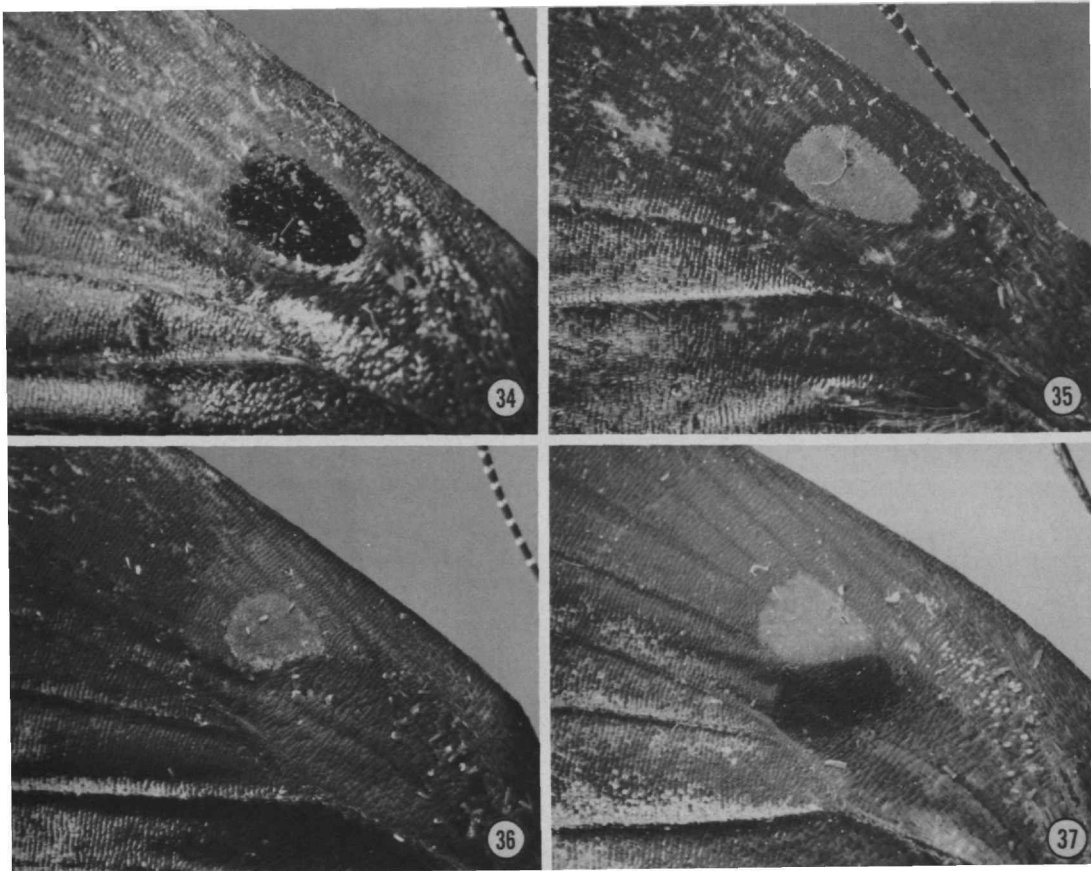
Species	Mean	Standard deviation	Sample size	Range	Character state
<i>R. meton</i>	1.4	0.41	9	0.7–1.8	0
<i>R. malina</i>	1.2	0.16	9	0.9–1.4	0
<i>R. palegon</i>	1.6	0.24	9	1.2–1.8	0
<i>R. zebina</i>	2.4	0.23	9	2.1–2.7	1
<i>R. bourkei</i>	2.2	0.41	3	1.7–2.6	1
<i>R. marius</i>	1.4	0.35	9	1.0–1.9	0
<i>R. stagira</i>	1.5	0.13	10	1.3–1.7	0

the scent pad along vein M1 and its imaginary projection into the discal cell. (0) less than 1.9 mm, (1) more than 1.9 mm.

12. *Scent Pad Color* (Figures 30–37): Color of the pad in situ is (0) yellow-white, (1) gray-silver, or (2) gray-silver, sometimes black in whole or part.



FIGURES 30–33.—*Rekoa* dorsal forewing androconial clusters: 30, scent pad of *R. meton* (Mexico); 31, gray scent pad and charcoal scent patch of *R. malina* (Brazil); 32, scent pad of *R. palegon* (Panama); 33, scent pad of *R. palegon* (western Peru).



FIGURES 34–37.—*Rekoa* dorsal forewing androconial clusters: 34, scent pad of *R. zebina* (Mexico) showing black androconia found in some specimens; 35, scent pad of *R. bourkei* (Jamaica); 36, scent pad, but no scent patch, of *R. marius* (Panama); 37, gray scent pad and black scent patch of *R. stagira* (Panama).

13. "Duplex" Scent Pad (Figure 75): (0) Scent pad divided in two distinct groups, one within the discal cell and one beyond it, (1) scent pad not divided in distinct groups. A duplex scent pad does not occur in *R. malina*, *R. stagira*, and *R. marius* because the basal cluster in these species is a scent patch, not a scent pad.

To measure scent pad androconium size, I took separate samples from within and beyond the discal cell. Because *R. palegon* has a duplex scent pad, this step was necessary to assess variation. I measured length and width at $\times 100$ of one androconium within the discal cell and one beyond it for eight specimens of each species (three for *R. bourkei*). For outgroup comparison, I measured three basal and three distal androconia from one specimen of each of four *Thereus* species.

14. Length of Scent Pad Androconia within the Discal Cell (Table 9): Mean length (0) less than 0.14 mm,

(1) 0.14–0.16 mm, (2) greater than 0.16 mm.

15. Length of Scent Pad Androconia beyond the Discal Cell (Table 9): Mean length (0) less than 0.12 mm, (1) 0.12–0.15 mm, (2) greater than 0.15 mm.

TABLE 9.—Length in mm of scent pad androconia in *Rekoa* species. Statistics from discal cell androconia are before slash while those from beyond discal cell are after slash. Statistic t_s is calculated from a paired comparisons t-test; asterisk (*) designates significant differences with a Type I error of 0.05.

Species	Mean	Standard deviation	Sample size	t_s
<i>R. meton</i>	0.13/0.13	0.008/0.008	8	0.354
<i>R. malina</i>	0.11/0.11	0.010/0.006	8	0.468
<i>R. palegon</i>	0.11/0.11	0.008/0.009	8	0.058
<i>R. zebina</i>	0.17/0.16	0.015/0.016	8	1.208*
<i>R. bourkei</i>	0.15/0.14	0.016/0.012	3	1.000
<i>R. marius</i>	0.12/0.11	0.015/0.009	8	0.574
<i>R. stagira</i>	0.11/0.11	0.009/0.007	8	0.504

16. *Length of Scent Pad Androconia within Discal Cell Significantly Longer Than Those beyond It* (Table 9): Although similar to the previous two characters, it has a different character state distribution. I measured significance at the 0.05 level using a paired comparisons t-test. (0) significantly different, (1) not significantly different.
17. *Width of Scent Pad Androconia within the Discal Cell* (Table 10): Mean width (0) less than 0.037 mm, (1) greater than 0.037 mm. There were no significant gaps among the widths of androconia beyond the discal cell (Table 10).
18. *Width of Scent Pad Androconia within Discal Cell Significantly Wider Than Those beyond It* (Table 10): Again, this character has a different distribution of states than measures of width. (0) significantly different, (1) not significantly different.

In *Rekoa*, the basal androconial cluster is a scent patch (Figure 29), black (Figures 31, 37), and restricted to the discal cell (Figures 14, 22). It occurs in *R. malina* and *R. stagira*, may be present or absent in *R. marius*, and is lacking in other species. The basal androconia of *R. malina* have an indentation along their sides and are narrower than those of *R. stagira* and *R. marius*. I am not sure whether the patch of *R. malina* is homologous with that of the other two, and do not code characters for the patch. Scent patches occur in both *Arawacus* and *Thereus*.

WING PATTERN.—There are two major wing patterns within *Rekoa*. *Rekoa meton*, *R. malina*, and *R. palegon* have bands on the ventral wings, while the remaining species have a single white and black postmedian line (Figures 64–69, 71–82, 85–90, 92–97, 99–110). There are no extant intermediates between these two groups, which is probably why these species were placed in four different species groups (Draudt, 1919–1920). Characters 19–28 each have two states, one shared by the banded species and one by the unbanded ones. Both wing pattern types occur in the outgroup genera.

Rekoa meton, *R. palegon*, *R. stagira*, and *R. marius* have wing patterns that vary geographically, and some of these geographical variants have been named. I discuss interspecific wing pattern variation here, and detail intraspecific variation under the species accounts.

19. *Dorsal Hindwing Anal Lobe*: (0) red, (1) a combination of neutral colors, usually tan, gray, and black.
20. *Ventral Hindwing Anal Lobe*: (0) red and black, (1) a combination of neutral colors, usually tan, gray, and black.
21. *Ventral Hindwing Black Pupiled Red Cubital Spot*: (0) present, (1) absent.
22. *Ventral Hindwing Submarginal Band*: (0) yellow-tan, (1) gray-brown.
23. *Ventral Forewing*: (0) with a black and white

TABLE 10—Width in mm of scent pad androconia in *Rekoa* species. Statistics from discal cell androconia are before slash while those from beyond the discal cell are behind slash. Statistic t_p is calculated from a paired comparisons t-test. Asterisk (*) designates significant differences with a Type I error of 0.05.

Species	Mean	Standard deviation	Sample size	t_p
<i>R. meton</i>	0.036/0.034	0.0024/0.0034	8	0.840*
<i>R. malina</i>	0.043/0.039	0.0064/0.0054	8	0.882*
<i>R. palegon</i>	0.057/0.035	0.0081/0.0053	8	3.004*
<i>R. zebina</i>	0.046/0.042	0.0054/0.0062	8	0.645
<i>R. bourkei</i>	0.041/0.036	0.0045/0.0045	3	1.000
<i>R. marius</i>	0.051/0.040	0.0116/0.0080	8	1.297*
<i>R. stagira</i>	0.055/0.040	0.0064/0.0080	8	1.774*

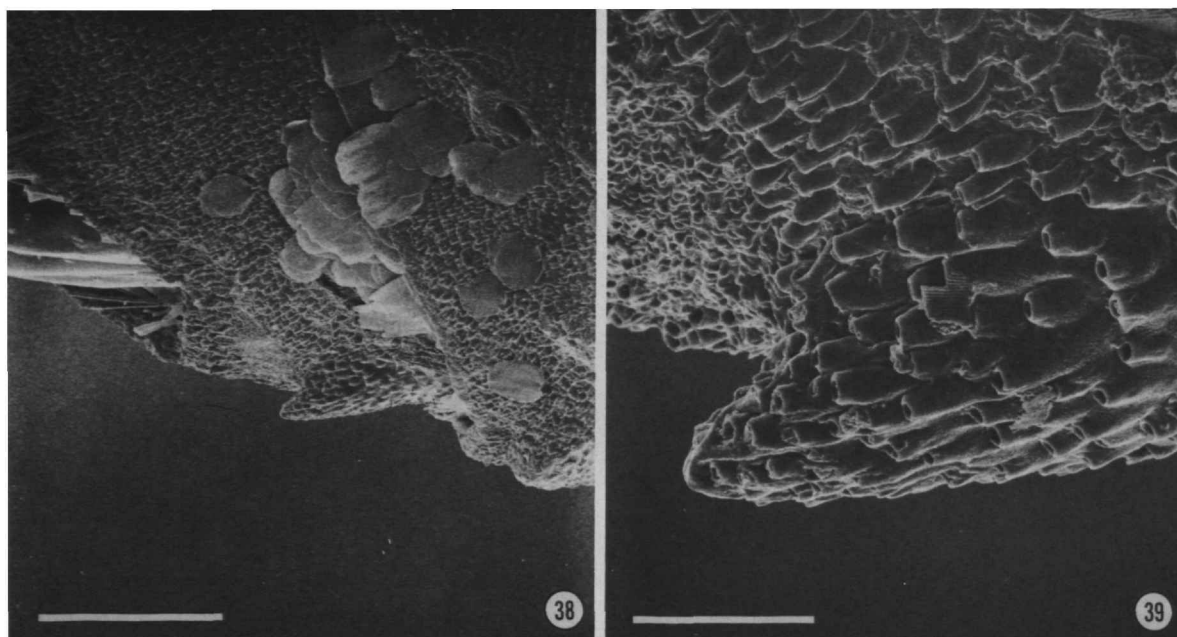
postmedian line from R3 to Cu2, (1) with a brown band from about R1 to Cu2.

24. *Brown Ventral Forewing Discal Bar*: (0) present, (1) absent.
25. *Brown Band across Forewing Discal Cell from SC to CU1*: (0) present, (1) absent.
26. *Brown Ventral Hindwing Discal Bar*: (0) present, (1) absent.
27. *Brown Basal Band across Ventral Hindwing from SC+R1 to Approximately CU2*: (0) present, (1) absent. This character varies clinally in *R. meton*; I code it as present because it is in exactly the same position as the basal band in *R. malina* and is likely homologous.
28. *Ventral Hindwing Postmedian Line below Vein RS*: (0) a brown band edged distally with white, (1) a black line edged distally with white.
29. *Postmedian Line in Ventral Hindwing Cell SC+R1-RS*: (0) a black and white dash co-linear with the postmedian line below it, (1) a brown band, basal to the postmedian line but distal to the discal cell band, (2) a brown band, above or basal to the discal cell band, (3) a brown "eyespot" circled with black, basal to the discal cell band.

Character 29 is of particular interest because I hypothesize, via my transformation series, that the distinctive "eyespot" pattern element of *R. meton* evolved from the piece of postmedian line in cell Sc+R1-Rs and that *R. palegon* and *R. malina* show the transition.

30. *Female Dorsal Ground Color*: (0) blue or white, (1) gray-brown, often with a dusting of blue scales.

ABDOMEN.—In *Rekoa* males, the venter of the eighth abdominal segment is membranous except for a small, sclerotized, posterior pointing process (Figures 38, 39). Piliform scales (Figure 40), sometimes darker than surrounding scales, originate on the process, but I find no trichoid sensilla that might be chemosensory. Although this process has not



FIGURES 38, 39.—Distal abdominal venter of male *R. meton*: 38, eighth abdominal segment in center with ventral process, some scales not removed (scale = 0.3 mm); 39, enlargement of Figure 38 (scale = 60 μ m).

been previously described, it occurs sporadically throughout the Eumaeini, Riodinidae (*Thisbe*), and Nymphalidae (*Anaea*). I speculate that the posterior edge of the female seventh abdominal segment fits in the space between the process and the male eighth segment during copulation.

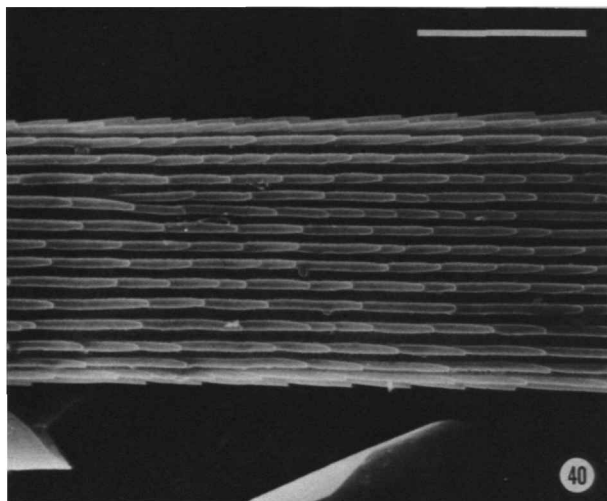


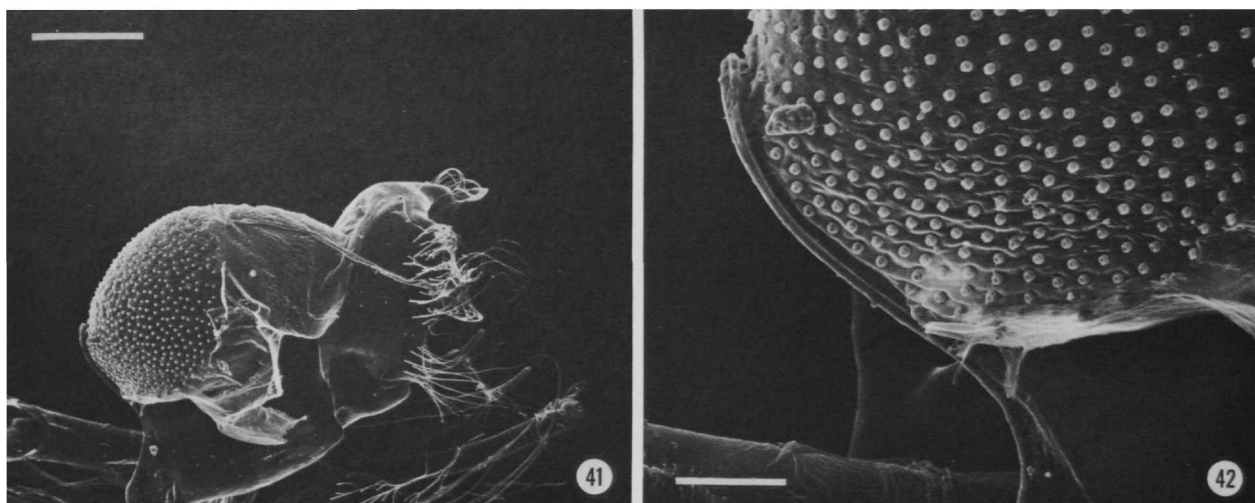
FIGURE 40.—Detail of piliform scale on male *R. palegon* eighth abdominal segment (scale = 10.7 μ m).

I did not code variation in abdominal terga and sterna. The anterior edge of the male eighth tergum projects slightly anteriorly, as it does in many other eumaeine genera, but it is curved, and there is no obvious way to measure it. Although many eumaeines lack sterna, *Rekoa* species have them on some abdominal segments. However, these sterna are lightly sclerotized, and their edges are often not clearly defined.

Another variable feature of the *Rekoa* abdomen is sclerotized intersegmental pouches on the abdominal venter. An external, posterior-pointing pouch occurs sporadically among eumaeines between the second and third segments. It is well developed in *R. meton*, but in other species it may be poorly developed (*R. zebina*), absent (*R. marius*), or sexually dimorphic in its expression (*R. palegon*). Another pouch that is more distinct and easier to score is a heavily sclerotized, semicircular pouch between the female sixth and seventh segments. It is internal and points anteriorly. The only *Thereus* Section species, besides those in *Rekoa*, where it occurs is "*Thecla*" *buccina* Druce. I code its presence or absence.

31. *Ventral, Sclerotized, Anterior Pointing Internal Pouch between Female Sixth and Seventh Abdominal Segments*: (0) absent, (1) present.

MALE GENITALIA.—There are two distinctive male and female genital groups within *Rekoa*, but they are different than the wing pattern groups. *Rekoa meton* and *R. malina* form the



FIGURES 41, 42.—Male genitalia of *R. stagira*: 41, lateral view of dorsal part of genitalia showing anterior process of vinculum and the brush organ (scale 400 μ m); 42, detail of Figure 41 showing pouch at base of each androconium (scale = 100 μ m).

first group, while the remaining species form the second. Clench (1970) discovered the male genital similarity between *R. palegon* and the unbanded *Rekoa* species, and considered them congeners. The female genitalia repeat this pattern.

I prepared male genitalia for examination following standard procedures. I soaked abdomens wetted in ethanol in 10% potassium hydroxide for 18–24 hours, rinsed them with water, and dissected them in a mixture of glycerine and water. I tore the abdominal integument laterally, and separated the membrane connecting the eighth abdominal segment to the vinculum at its connection. After cleaning both the genitalia and abdominal integument, I usually stained the genitalia with chlorozal black, which colors membrane, particularly the manica (membrane attaching the penis to the valves). On some specimens, I removed one brush organ (sensu Eliot, 1973) to allow examination of structures supporting the brush organ. Likewise, much of the membrane connecting the genitalia to the abdomen was removed so I could better see the structures

under it. I switched the genitalia to glycerine for examination and measurement of structures at various magnifications.

I scored qualitative and quantitative genital characters. Genital structures have rarely been measured in lycaenid systematics, and there was no model for me to follow in choosing quantitative characters. Thus, I selected structures that show interspecific variation and that were easy to measure—flat with clear-cut edges. I did not measure height and width of either the genital capsule or the brush organs because these structures are curved and difficult to measure. The measurements that I took do not account for all the interspecific genital variation, but are a first attempt to use some of this quantitative variation for phylogenetic inference. The qualitative characters that I scored are similar to those used in other lycaenid revisions. I label male genital structures and show the lengths that I measured in Figure 43.

32. *Valve Length* (Table 11): The valves are complex

TABLE 11.—Length (in mm) of male genital valve in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	1.47	0.113	8	2
<i>R. malina</i>	1.20	0.085	8	1
<i>R. palegon</i>	1.07	0.044	8	0
<i>R. zebina</i>	1.20	0.069	8	1
<i>R. bowrkei</i>	1.07	0.073	4	0
<i>R. marius</i>	1.04	0.054	8	0
<i>R. stagira</i>	1.05	0.068	8	0

TABLE 12.—Length in mm of the male genital saccus in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	0.78	0.029	8	2
<i>R. malina</i>	0.60	0.057	8	0
<i>R. palegon</i>	0.55	0.072	8	0
<i>R. zebina</i>	0.49	0.059	8	0
<i>R. bowrkei</i>	0.46	0.050	4	0
<i>R. marius</i>	0.78	0.067	8	2
<i>R. stagira</i>	0.70	0.050	8	1

TABLE 13.—Length in mm of the internal penis in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	1.38	0.082	8	0
<i>R. malina</i>	1.36	0.063	8	0
<i>R. palegon</i>	1.30	0.113	8	0
<i>R. zebina</i>	1.47	0.078	8	1
<i>R. bourkei</i>	1.26	0.118	4	0
<i>R. marius</i>	1.30	0.104	8	0
<i>R. stagira</i>	1.34	0.073	8	0

three-dimensional structures that are fused ventrally and dorsally where they attach to the manica. Unlike most Lepidoptera, their internal surface is clear, appearing to be membranous, but does not stain with chloroal black. Valve shape is tremendously variable intraspecifically, and must be used with great caution as a source of species character states. I measured valve length in ventral aspect, an unambiguous measurement. (0) mean length less than 1.12 mm, (1) 1.12–1.32 mm, and (2) greater than 1.32 mm.

33. *Saccus Length* (Table 12): Saccus shape is also highly variable intraspecifically. I measured saccus length in ventral aspect. (0) mean length less than 0.65 mm, (1) 0.65–0.74 mm, and (2) greater than 0.74 mm.
34. *Length of Internal Penis* (Table 13): I measured this length in lateral aspect from the anterior end of the penis to the point on the ventral penis where the manica attaches. (0) mean length less than 1.42 mm, (1) greater than 1.43 mm.
35. *Length of External Penis* (Table 14): I measured this length in lateral aspect from ventral attachment of the manica to the ventral posterior tip of the penis. (0) mean length less than 1.71 mm, (1) 1.71–2.28 mm, and (2) greater than 2.28 mm.
36. *Length of Dorsal Capsule* (Table 15): I measured this distance in dorsal aspect from the notch between the labides to the anterior edge of the

TABLE 14.—Length in mm of the external penis in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	2.59	0.137	8	2
<i>R. malina</i>	1.98	0.122	8	1
<i>R. palegon</i>	1.66	0.064	8	0
<i>R. zebina</i>	1.89	0.059	8	1
<i>R. bourkei</i>	1.76	0.073	4	1
<i>R. marius</i>	1.85	0.130	8	1
<i>R. stagira</i>	1.82	0.054	8	1

TABLE 15.—Length (in mm) of dorsal male genital capsule in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	0.46	0.041	8	1
<i>R. malina</i>	0.34	0.028	8	0
<i>R. palegon</i>	0.31	0.037	8	0
<i>R. zebina</i>	0.31	0.022	8	0
<i>R. bourkei</i>	0.31	0.028	4	0
<i>R. marius</i>	0.32	0.030	8	0
<i>R. stagira</i>	0.30	0.023	8	0

medial tegumen. (0) mean length less than 0.40 mm, (1) greater than 0.40 mm.

37. *Ventral Process of Tegumen*: Many eumacines have a process that arises from the lateral part of the tegumen and that lies under the valves. (0) present, (1) absent.

38. *Anterior Process of Vinculum*: Except for *R. malina*, *Rekoa* species have a process on the anterior vinculum that is situated anterior to the brush organs (Figures 41–50). (0) present, (1) absent.

All *Rekoa* species have brush organs (sensu Eliot, 1973) (Figures 41–50). There is a pouch (Figure 42) at the base of each seta that probably contains a secretory cell. *Rekoa* penes have two cornuti that vary interspecifically. Because it was difficult to evert the vesica, I coded only major differences in the cornuti. The dorsal cornutus appeared to vary in its location with respect to the ventral cornutus, but because the vesica was sometimes partially everted, I could not score it accurately.

39. *Teeth on Ventral Cornutus*: The posterior end of the ventral cornutus is expanded and has teeth on its dorsal surface. (0) teeth in indistinct rows restricted to medial area of the cornutus, (1) teeth restricted to lateral edges of the cornutus. Neither character state is found in the outgroup genera, and the form of this cornutus characterizes *Rekoa*.

40. *Posterior Tip of the Dorsal Cornutus*: (0) posteriorly twisted to the left with the lateral apices flared into short processes, (1) with two posterior pointing prongs, the right one of equal or longer length than the left one, (2) with two posterior pointing prongs, the right one reduced to half or less the length of the left one, and (3) with one posterior pointing prong, the right one reduced to a bump or completely absent. The first state occurs in *R. meton* and *R. malina*, but because the cornutus is twisted posteriorly, it may appear to end in a sharp point, particularly in *R. meton*. The second character state occurs in *R. palegon*, *R. marius*, and *R. stagira*. In the first species, the prongs are almost of equal length. The third character state is restricted to *R.*

zebina, while the fourth occurs in *R. bourkei*. The difference in the shape of this cornutus is one of the best ways to distinguish male *R. bourkei* from *R. zebina*. However, the series of the former is short, and may not accurately represent variation.

FEMALE GENITALIA (Bursa Copulatrix).—The female genitalia of *Rekoa* are complex asymmetrical three-dimensional structures with apomorphies that characterize the genus and provide information on its systematic position. As with the male genitalia, I have chosen quantitative characters—to augment qualitative ones—using the criterion that they can be unambiguously measured. I prepared the female genitalia in much the same manner as the males, but usually left the papillae anales connected to the abdominal integument so that I could better view the lamella postvaginalis. I label structures and note distances measured in Figure 56.

The genital plates surrounding the posterior end of the ductus bursae vary interspecifically (Figures 56–63), but this variation is not easily used for phylogenetic inference. Like the male genitalic valves and saccus, they are intraspecifically highly variable, particularly the shape of the dorsal genital plates and their spines, when present. The genital plates are curved structures and consequently, are difficult to measure accurately. In most species of *Rekoa*, *Thereus*, and *Arawacus*, the left dorsal plate does not extend as far posteriorly as the right one. This asymmetry is best developed in *R. bourkei* and *R. zebina*, but expression varies intraspecifically in others such as *R. stagira*. I coded variation of the lamella postvaginalis in one character.

41. *Lamella Postvaginalis*: (0) without posterior pointing spines, (1) with two posterior pointing spines. Character state 1 is restricted to *R. palegon* and *R. zebina*, and does not occur in *Thereus* or *Arawacus*. However, the spines in these two species differ greatly in size (Figures 59, 60), and it is not clear that they are homologous.

A membranous area divides the ductus bursae into posterior and anterior sclerotized segments. The posterior segment tapers anteriorly, sometimes with a pointed process on the right ventral surface extending into the membranous area. The ductus is strongly twisted dextrally at the membranous area so that the bursa copulatrix anterior to the membranous area is rotated approximately 90 degrees. This extreme asymmetry occurs in all *Rekoa* species and some *Thereus* species, but if it evolved independently, as I argued earlier in this paper, then it is a derived state characterizing *Rekoa*. The dorsal surface of the anterior sclerotized ductus bursae is concave, a widespread, but previously unreported, eumaeine character. I made three measurements of the ductus bursae, but one of them, width just posterior to the membranous area, had no gaps despite interspecific variation.

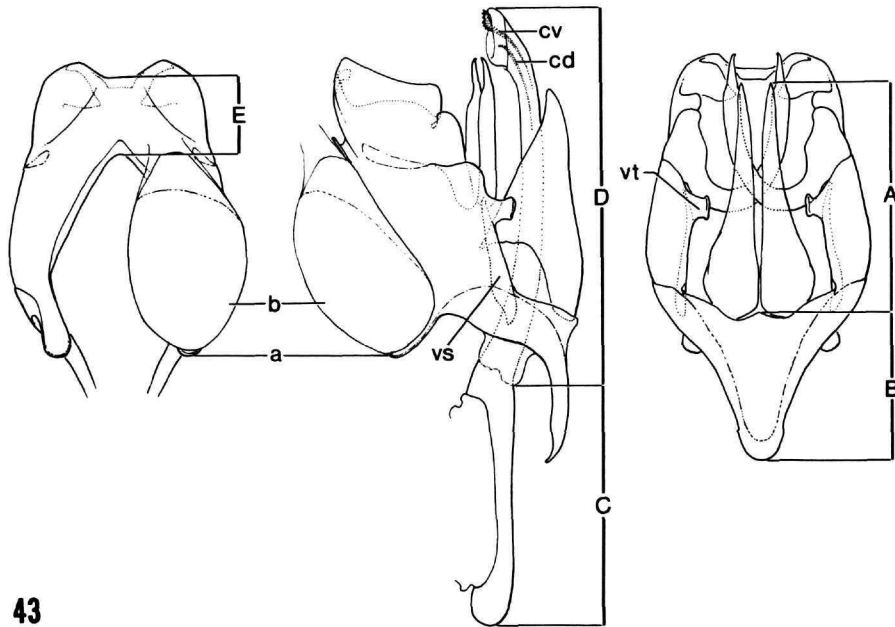
TABLE 16.—Length in mm of posterior sclerotized part of female ductus bursae in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	0.75	0.071	8	1
<i>R. malina</i>	0.27	0.047	8	0
<i>R. palegon</i>	0.88	0.054	8	1
<i>R. zebina</i>	0.98	0.131	8	2
<i>R. bourkei</i>	0.79	0.067	4	1
<i>R. marius</i>	0.81	0.089	8	1
<i>R. stagira</i>	0.78	0.090	8	1

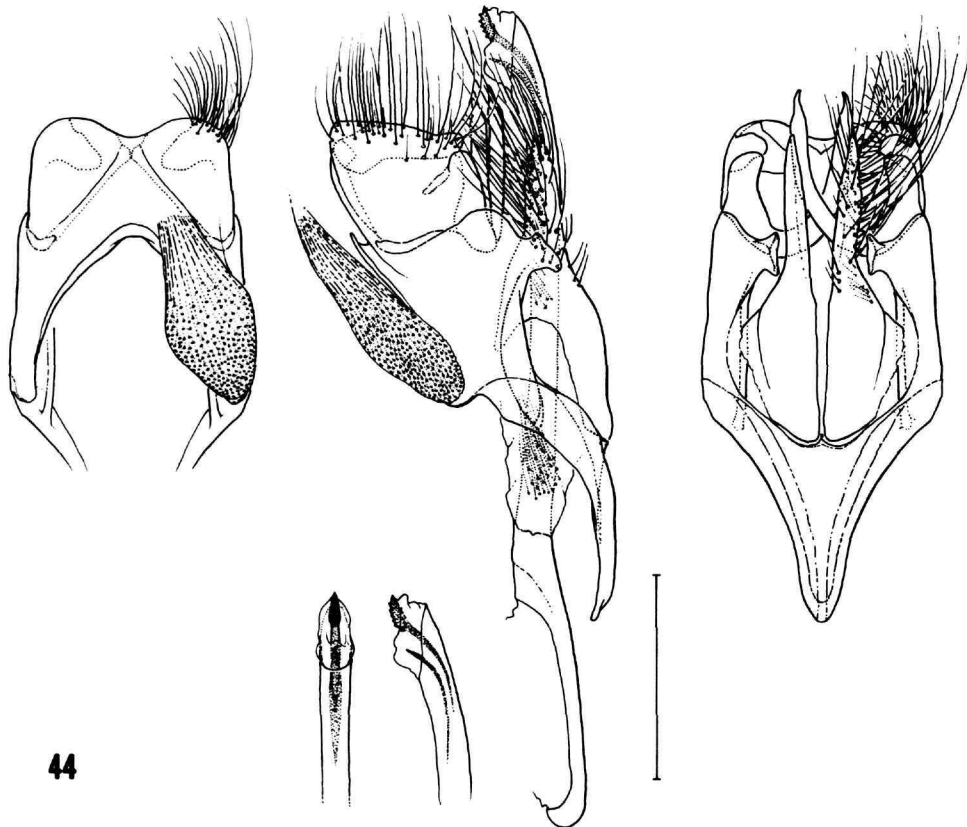
42. *Length of the Posterior Sclerotized Segment of the Ductus Bursae* (Table 16): I measured (at $\times 50$) from the posterior edge of the ductus bursae along the medial dorsal line to the narrowest part of the segment (Figure 56). Length (0) less than 0.51 mm, (1) 0.65–0.93 mm, (2) greater than 0.93 mm.
43. *Length of the Anterior Sclerotized Segment of the Ductus Bursae Measured (at $\times 50$) along the Left Side of the Segment (actually the ventral surface rotated 90 degrees)* (Table 17): Because this structure is sometimes curved, I measured the distance between the two points shown in Figure 56. Length (0) less than 0.66 mm, (1) 0.66–0.76 mm, (2) 0.76–0.86 mm, (3) 0.86–1.00 mm, (4) greater than 1.15 mm.
44. *Anterior End of the Ductus Bursae* (Figures 51, 59, 60): (0) with no internal teeth, (1) with 1–3 small internal teeth. The latter character state, which is unique in the Eumaeini, is restricted to *R. zebina* and *R. palegon*. There is one tooth on the left side of the ductus bursae of *R. zebina*. The number of teeth varies (not geographically) from 1–3 in *R. palegon*, but most specimens have three. Although the internal teeth may be difficult to see, they do not occur in *R. bourkei* except for the only known Hispaniolan female. The teeth possibly prevent penetration of the penis into the corpus bursae.

TABLE 17.—Length in mm of anterior sclerotized part of female ductus bursae in *Rekoa* species.

Species	Mean	Standard deviation	Sample size	Character state
<i>R. meton</i>	1.28	0.080	8	4
<i>R. malina</i>	1.30	0.096	8	4
<i>R. palegon</i>	0.61	0.059	8	0
<i>R. zebina</i>	0.82	0.067	8	2
<i>R. bourkei</i>	0.71	0.047	4	1
<i>R. marius</i>	0.93	0.049	8	3
<i>R. stagira</i>	0.89	0.027	8	3

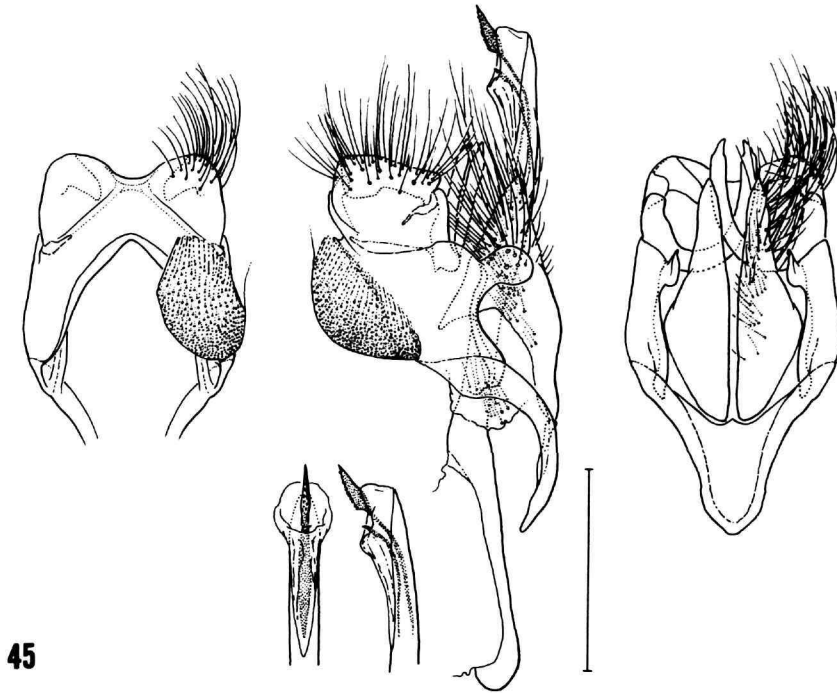


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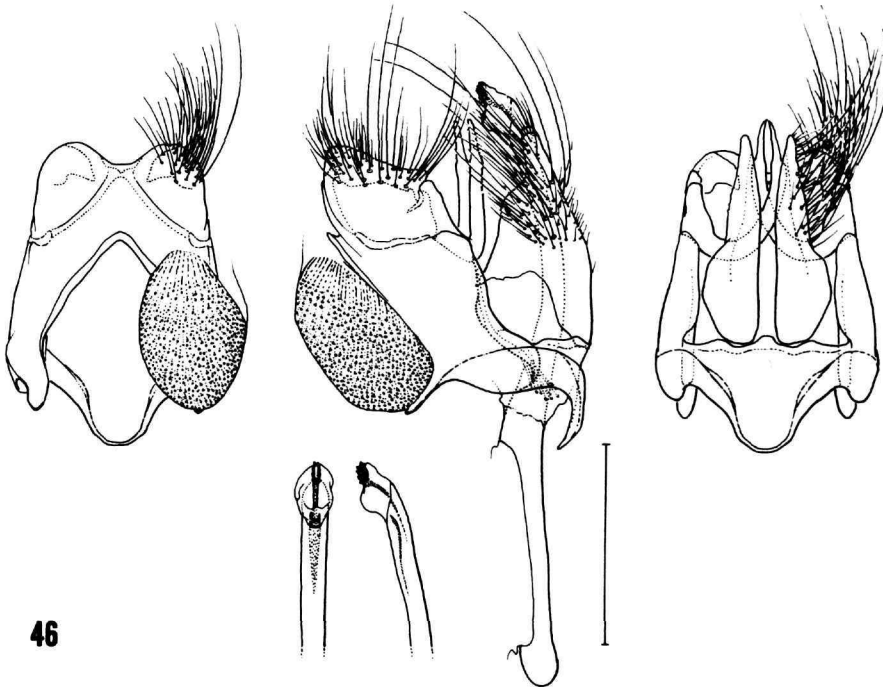


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FIGURES 43-46.—Male genitalia of *Rekoa* in dorsal, lateral (with penis), and ventral aspect—with setae and brush organs drawn on right side—and penis tip in lateral and dorsal aspect (scale = 1 mm): 43, genital structures and measured distances: a = anterior process of vinculum, b = brush organ, cd = cornutus dorsal,

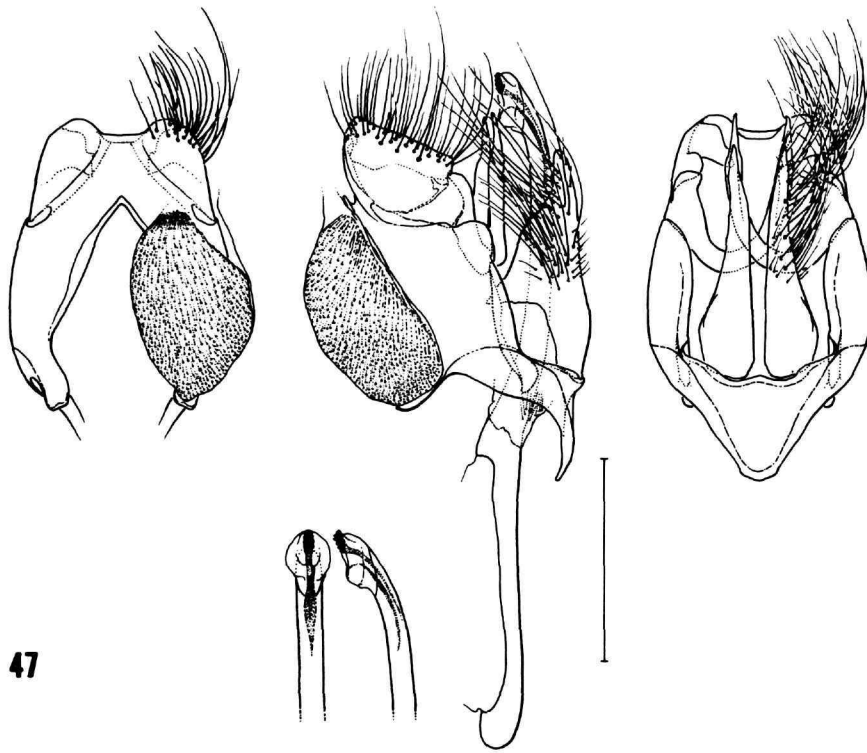


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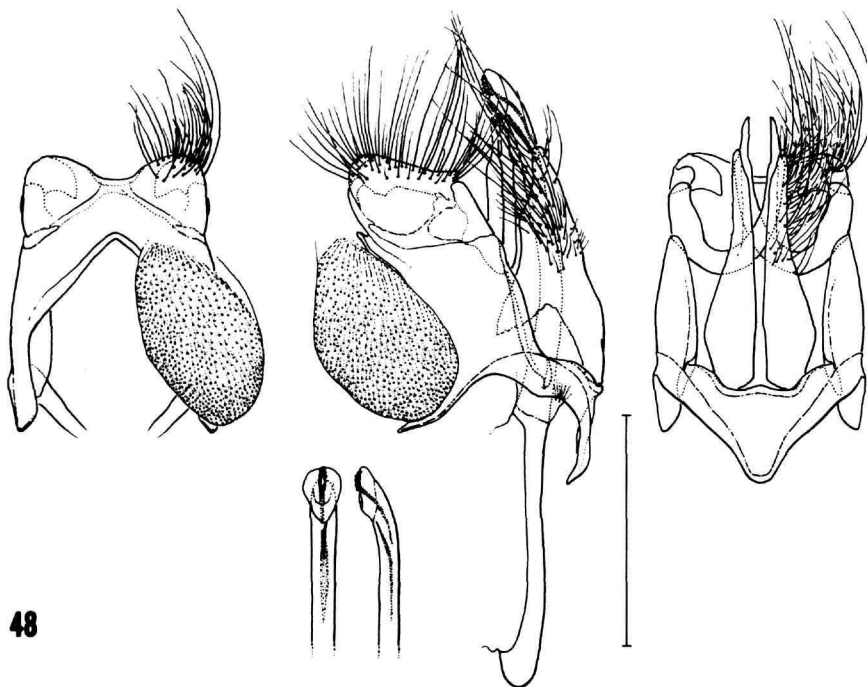


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cv = cornutus ventral, vs = vinculum strut, vt = ventral process of tegumen, A = valve length, B = saccus length, C = internal penis length, D = external penis length, E = dorsal capsule length; 44, *R. meton*; 45, *R. malina*; 46, *R. palegon*.

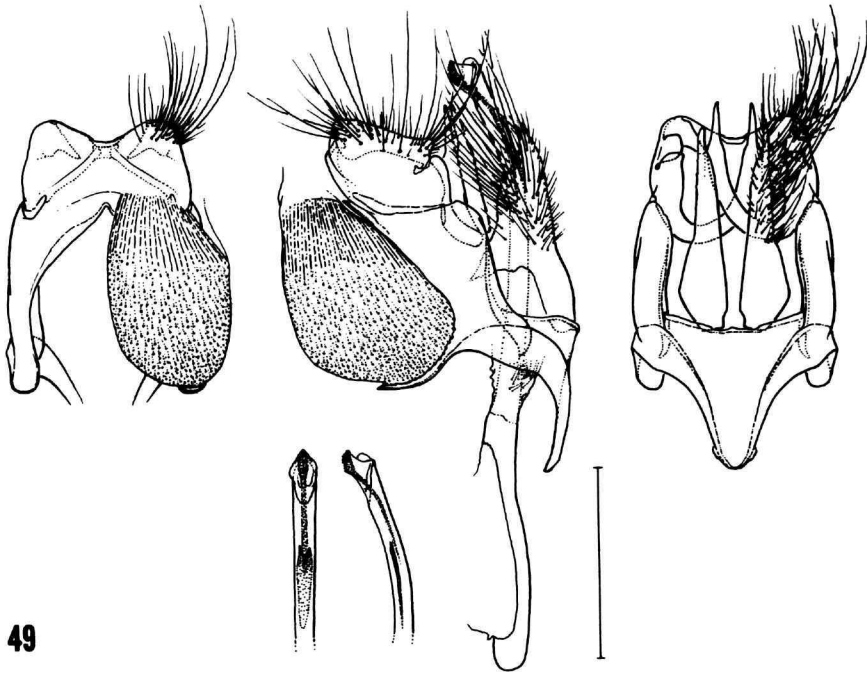


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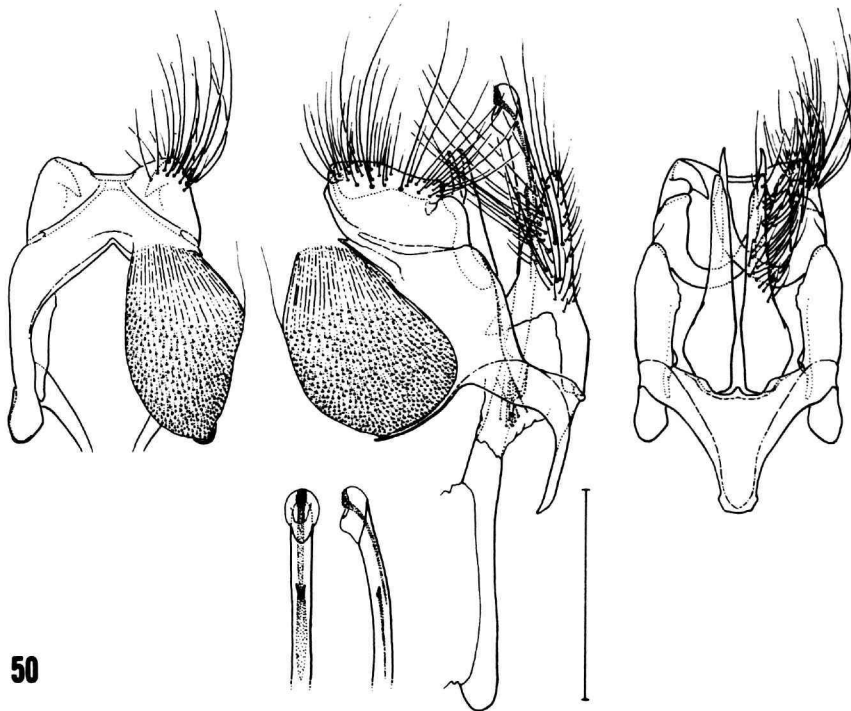


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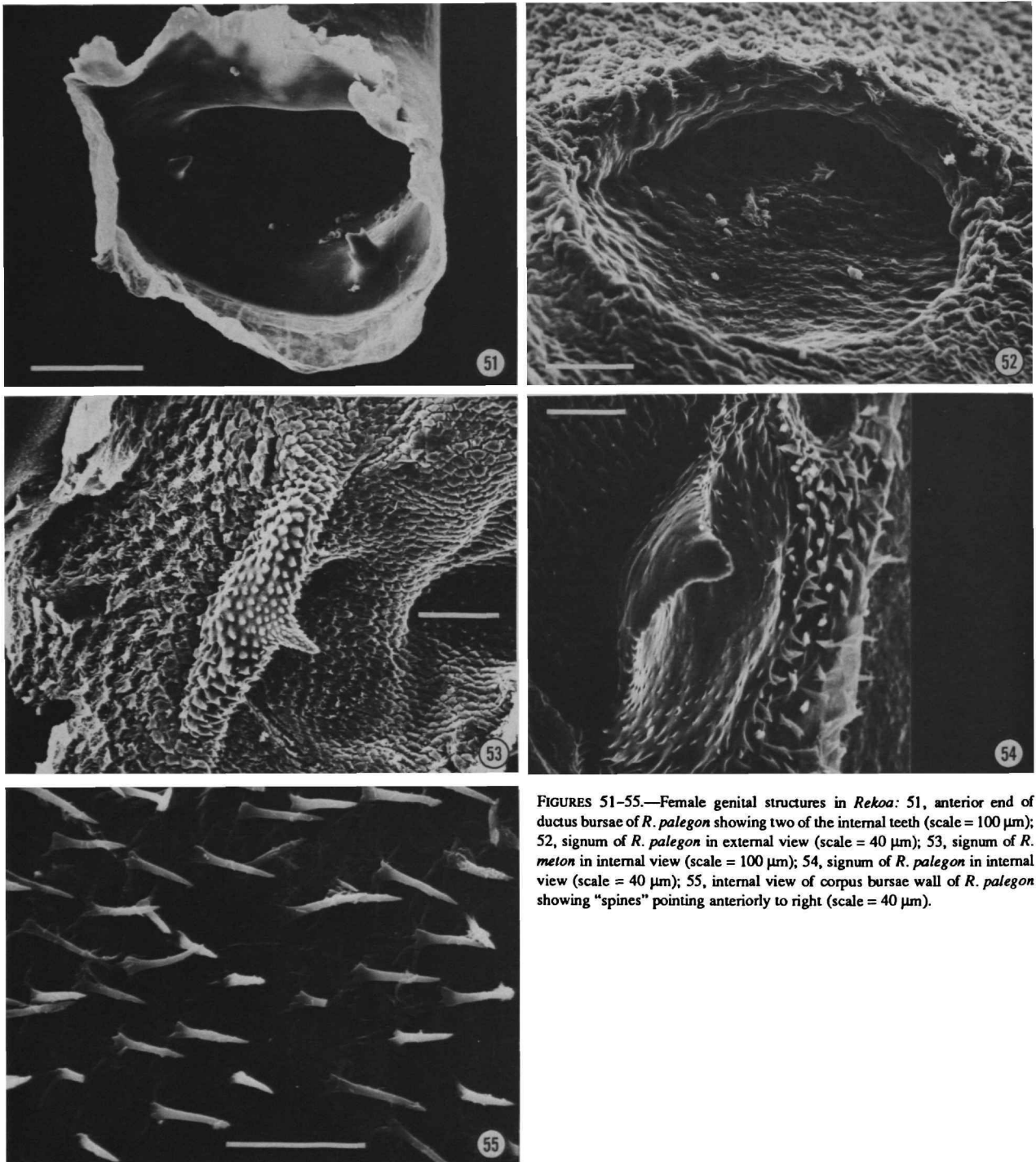
FIGURES 47-50.—Male genitalia of *Rekoa* in ventral, lateral (with penis), and dorsal aspect—with setae and brush organs drawn on right side—and penis tip in lateral and dorsal aspect (scale = 1 mm): 47, *R. zebina*; 48, *R. bourkei*; 49, *R. marius*; 50, *R. stagera*.



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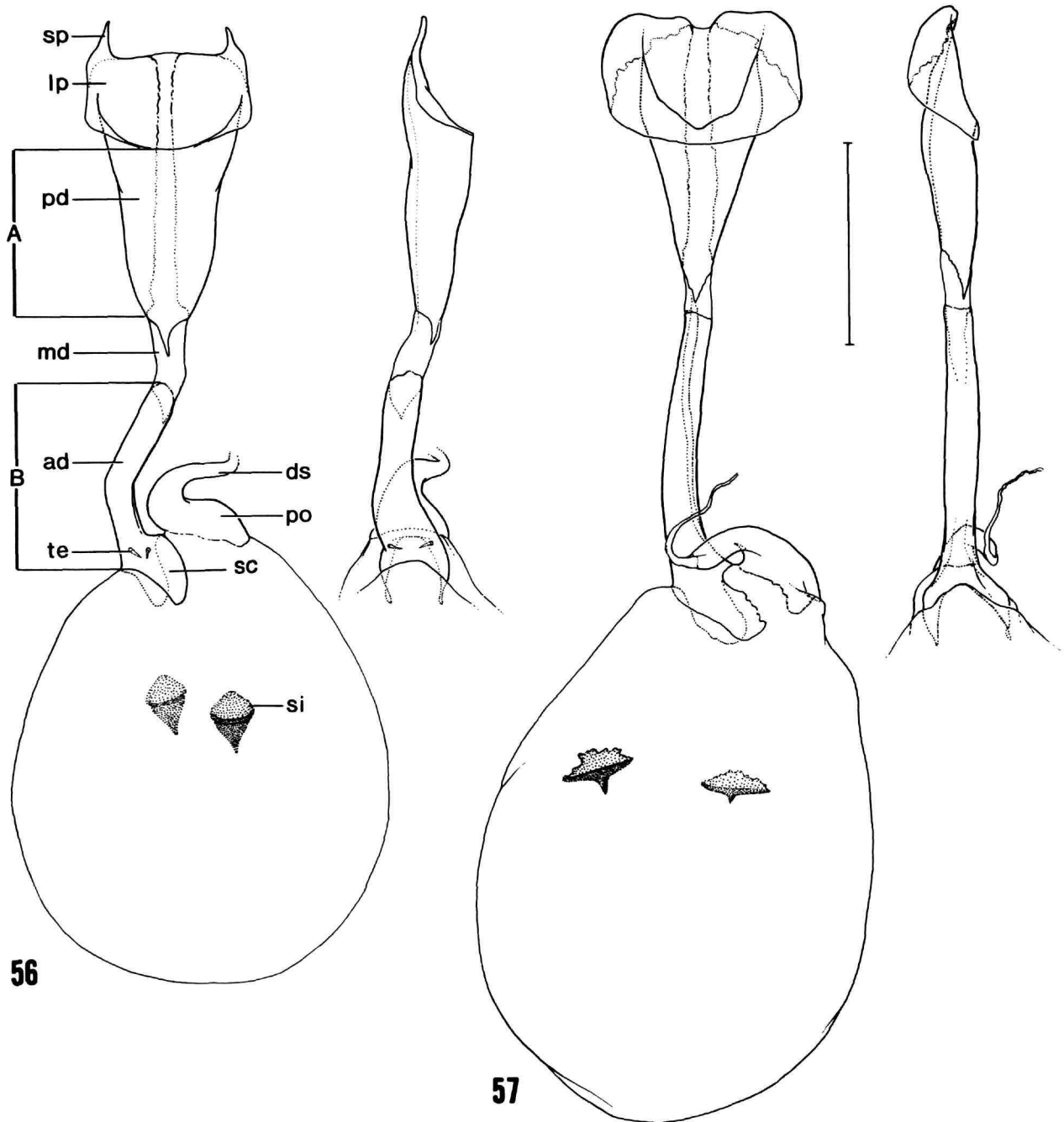
FIGURES 51-55.—Female genital structures in *Rekoa*: 51, anterior end of ductus bursae of *R. palegon* showing two of the internal teeth (scale = 100 μ m); 52, signum of *R. palegon* in external view (scale = 40 μ m); 53, signum of *R. meton* in internal view (scale = 100 μ m); 54, signum of *R. palegon* in internal view (scale = 40 μ m); 55, internal view of corpus bursae wall of *R. palegon* showing "spines" pointing anteriorly to right (scale = 40 μ m).

The posterior corpus bursae forms a pouch, sometimes lightly sclerotized, that is dorsal to the ductus bursae (Figures 56–63). The ductus seminalis arises from the posterior end of the pouch, and sclerotized patches occur laterally at the base of the pouch, just above the anterior end of the ductus bursae (Figure 56). This female genital structure occurs only in *Rekoa*, *Arawacus*, and *Thereus*, but the sclerotized patches apparently have been lost in *R. stagira* and *R. marius*. In *Rekoa* and some *Thereus* species, the corpus bursae pouch is situated on the right side of the butterfly because of the dextral rotation of the female genitalia.

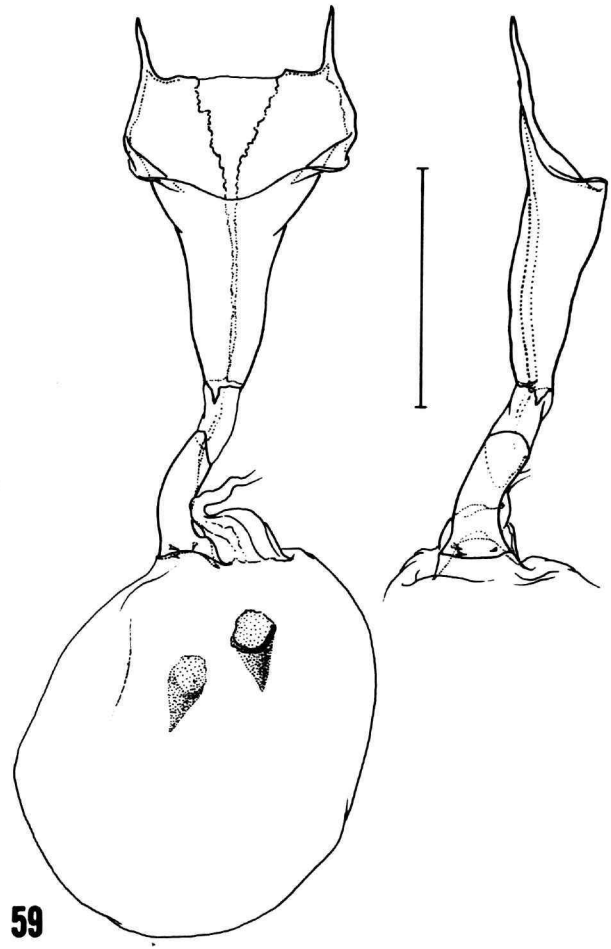
Signa on the corpus bursae characterize *Rekoa*. They are hollow sclerotized structures (Figure 52) pointing anteriorly into the corpus bursae. They are oval or transversely elongate at the wall of the corpus bursae, unlike the longitudinally elliptical or slit-shaped structures normally occurring in eumacines. Further, the anterior half of the signa, both on the corpus wall and the internal projection (spine), is more heavily sclerotized than the posterior half. Although these oval or transverse signa are unique in the *Thereus* Section, the signa of *Arawacus tarania* and *Thereus ortalus* are structurally similar to that of *Rekoa*. The signa have the same heavy anterior sclerotization, and at the wall of the corpus bursae are almost oval, but are about 1.5 times longer than wide.

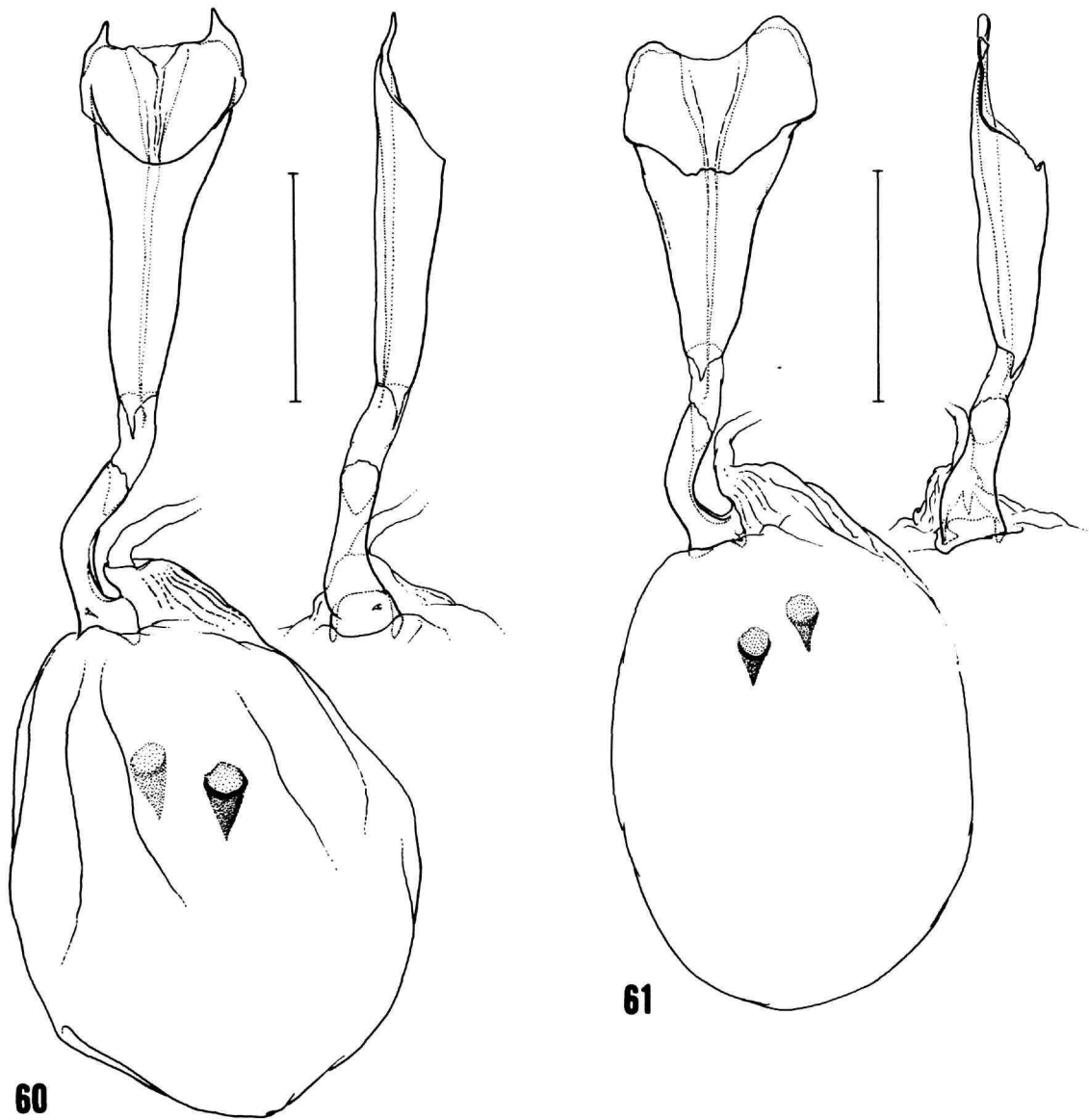
The interior wall of the corpus bursae is covered with small, anterior pointing, sharp teeth (Figure 55). These teeth and the signa may prevent the spermatophore from drifting posteriorly, where it could easily block the entrance of the ductus seminalis and render the female sterile. It is not known if the interior wall of the corpus bursae of other Lepidoptera are also covered with small sharp processes.

45. *Corpus Bursae* (Figures 62, 63): (0) without a round area of lightly sclerotized lines surrounding the signa, (1) with a round area of lightly sclerotized lines surrounding the signa, centered anterior to the signa.
46. *Interior Projection of Signa* (often called a "Spine") (Figures 56–63): (0) shaped like a flattened cone, (1) shaped like a brace sign. The signa are more flattened (using an SEM) than they appear to be under a light microscope (Figures 53, 54).
47. *Shape of Signa at the Wall of the Corpus Bursae* (Figures 56–63): (0) oval or nearly so, (1) transversely elongate. The latter state occurs only in *R. meton* although the shape in some specimens of *R. malina* could be interpreted as intermediate between *R. meton* and the remaining *Rekoa* species.

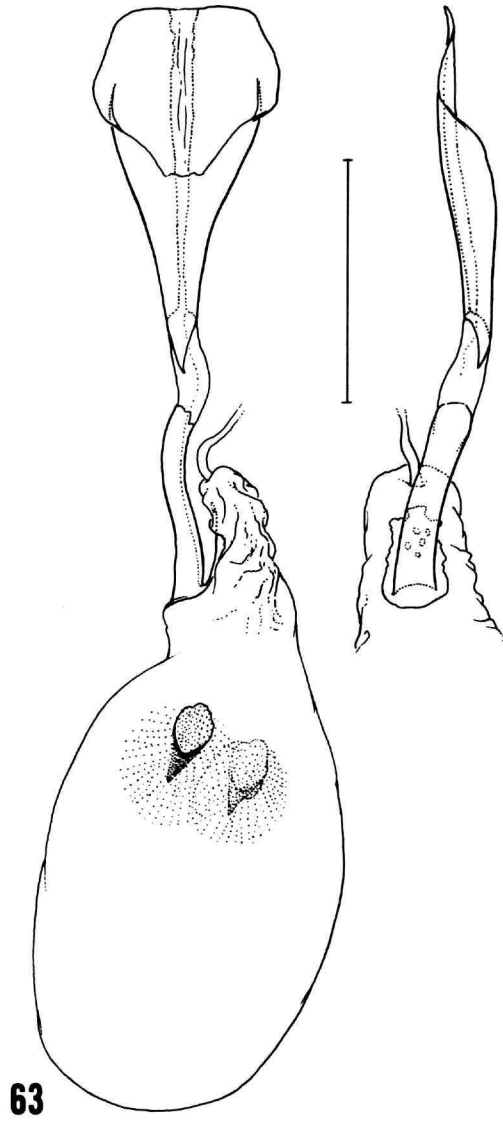
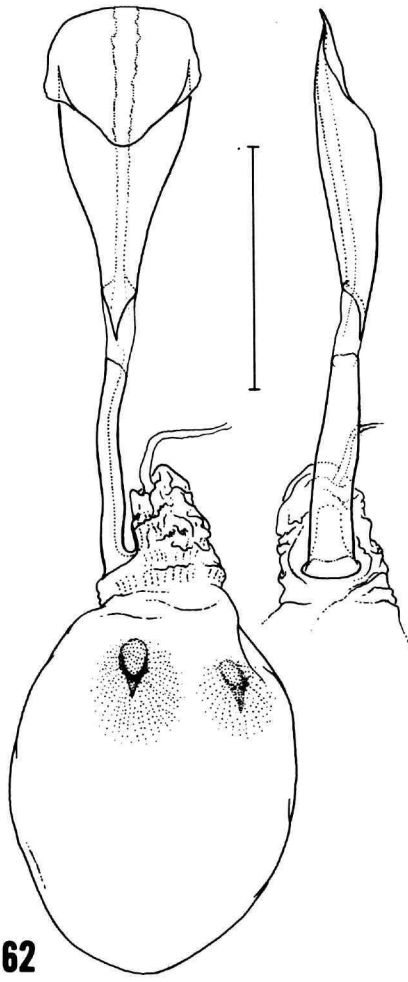


FIGURES 56-59.—Female genitalia of *Rekoa*, ductus bursae in left lateral view and entire bursa copulatrix in ventral aspect (scale = 1 mm): 56, genital structures and measured distances: ad = anterior ductus bursae, ds = ductus seminalis, lp = lamella postvaginalis with spines (sp), md = membranous area of ductus bursae, pd = posterior ductus bursae, po = dorsal posterior pouch of corpus bursae, sc = sclerotized process on lateral side of pouch, si = signum, te = teeth at anterior end of ductus bursae, A = length of posterior ductus bursae, B = length of anterior ductus bursae; 57, *R. meton*; 58, *R. malina*; 59, *R. palegon*.





FIGURES 60-63.—Female genitalia of *Rekoa*, ductus bursae in left lateral view, and entire bursa copulatrix in ventral aspect (scale = 1 mm): 60, *R. zebina*; 61, *R. bourkei*; 62, *R. marius*; 63, *R. stagira*.



Rekoa meton Cramer

NOMENCLATURE.—*Papilio meton* Cramer, 1779: Cramer (1779–1780) described and illustrated a Surinamese male of *P. meton*. Although the figure shows a specimen with two hindwing tails (there should be one), it can be confused with no other hairstreak species. There is a male with one tail in the Rijksmuseum van Natuurlijke Historie (Leiden) that fits the original figure and that can be designated a lectotype if one is ever deemed necessary.

Hesperia augustus Fabricius, 1793: Fabricius (1793) described *H. augustus* from an "American" female with a brief description. Butler (1870) synonymized this species to *P. meton*. Although no type specimen is known (Zimsen, 1964), Jones' unpublished figure of *H. augustus* in the BNMH library supports this synonymy.

GEOGRAPHICAL VARIATION.—As is true for *R. stagira* and *R. marius*, the ventral wing pattern of *R. meton* varies geographically (Figures 65, 68, 69). Three major wing pattern characters vary, each of which changes in different geographic regions. First, females from southern Brazil (Rio de Janeiro south to Santa Catarina) are blue above, while those from central Brazil (Minas Gerais) and Paraguay have only a blue tinge and those from further north are white. Second, the basal line on the ventral hindwing is present in specimens south of about 20° S latitude, is present in about half of the specimens across the Amazon basin from Peru to the Guianas, and is absent in Central American specimens. Third, specimens from the Amazon basin have a light yellow patch in the middle of the ventral hindwing that contrasts with the remainder of the wing. In specimens to the south and north of the Amazon Basin, the patch is usually darker so that it does not contrast with the rest of the wing.

IDENTIFICATION.—Identification of *R. meton* has never posed a problem. Although the ventral wing pattern of specimens in the south part of the range could be confused with that of *R. malina*, *R. meton* is larger, usually has an "eyespot" at the base of the ventral hindwing, has a different wing shape, and has the base of dorsal hindwing vein Rs covered with white scales as opposed to the brown or blue scales of *R. malina* (Figures 64–69, 71–74).

GEOGRAPHIC DISTRIBUTION (Figure 70), **TEMPORAL DISTRIBUTION**, AND **ELEVATION** (format explained on page 5).—**MEXICO:** *San Luis Potosi:* 14 mi S Valles (19 Dec), Valles (2 Jul), Tamazunchale (7 Aug). *Hidalgo:* 8 mi S Tamazunchale (2 Aug), Arroyo de Los Patos (??, 25 Dec), Puerto de Caballo (29 Jul), Tamaulipas (??, 7 Apr). *Puebla:* Xicototec (14 Jun). *Veracruz:* Presidio (May, Jun, 22 Jul), Cordoba, Atoyac, Misantla, Santa Lucrecia (= Jesus Carranza) (24 Sep), Jicaltepec (Jun), Dos Amates (20 Aug), 2 mi SE Coatzacoalcos (18 Jan), Coatepec, Catemaco (17 Jun, 21 Jun–1 Aug), Tapalapan (Sep), Paso San Juan, Jalapa. *Sinaloa:* Mazatlan. *Colima:* Comala (2100 ft, 10 May). *Michoacan:* Uspero. *Guerrero:* Rincon (2800 ft), Tierra Colorada (2000

ft). *Oaxaca:* Soyolapan el Bajo–Mpio Comaltepec (20 Oct), Chiltepec (28 Sep). *Tabasco:* Tepescuintle Mpio Tenosique (10 Aug). *Chiapas:* 10 km W Union Jaurez (29 Dec).

GUATEMALA: *Retalhuleu:* San Sebastian. *Izabal:* Cayuga, Quirigua (Mar). *Alta Verapaz:* Choctun, Polochic Valley. *Baja Verapaz:* S. Geronimo, Cubulco. *Santa Rosa:* Barbereno (1300 m, Aug), Chiquimulilla, Guazacapan.

BELIZE: *Stann Creek District:* Melinda (50 ft, 30 Aug–4 Sep); from Ross (1964).

EL SALVADOR: *San Salvador:* Santa Tecla (6, 8, 14, 17, 21, 22, 25 Jan, 4, 10, 13 Feb). *Cuscatlan:* Rosario (25, 26 Dec). *San Salvador:* San Salvador.

HONDURAS: *Cortes:* San Pedro Sula, El Jaral (2100 ft, 9, 14, 21, 27 Aug, 17, 23 Sep); from Monroe et al. (1967).

NICARAGUA: *Rio San Juan:* Chontales.

COSTA RICA: *Alajuela:* San Mateo (Feb), 6 km W Atenas (1500 m, 10 Feb). *Guanacaste:* Avangarez (2 Jul). *Cartago:* Turrialba (2000 ft, 25 Jun), Irazu (6000–7000 ft), Juan Vinas (2500–3500 ft, May, Nov). *Limon:* Guapiles (Jun). *San Jose:* San Jose (Feb, Mar, Aug), Escazu (Jan), S. Francisco (4500 ft). ??: Juan Virico (2500 ft, Jan).

PANAMA: *Chiriqui:* Bugaba (800–1600 ft), Potrerillos (3600 ft, 30 Jan, 29, 30 Feb, 5, 6 Mar), No further data. *Veraguas:* Calobre. *Canal Area* (formerly Canal Zone): Madden Forest (6, 8, 9 Feb, 27 Mar), Farfan (2 Feb), Paraiso (3 Jun), Summit (1 Apr). *Panama:* Bayano (8 Feb), Cerro Campana (600m, 6 Jan).

SURINAM: *Paramaribo:* Paramaribo (Aug). *Brokopondo:* Berg-en-Dal (May). ??: Boschland (May, There are two towns in Surinam by this name).

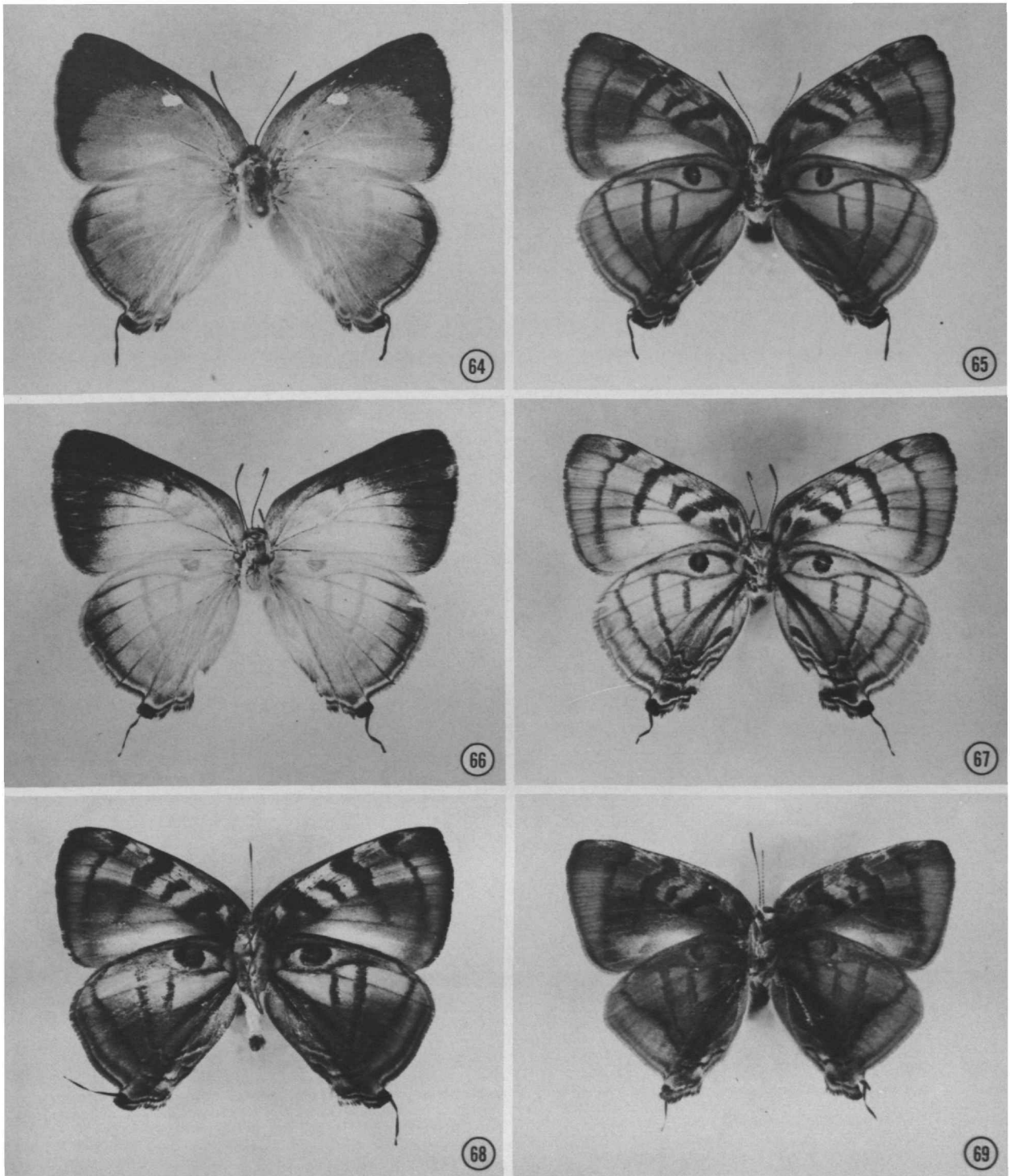
FRENCH GUIANA: *Guyani:* St. Jean, Nouveau Chantier (May). *Inini:* St. Georges (Sep, Oct).

GUYANA: No further data.

TRINIDAD: *Caroni:* Tabaquite (26 Feb, 26 Mar, Jun; from Barcant, 1970), Brasso (21 Mar, 2 Apr), Piarco (15 Oct). *St. George West:* St. Ann's Valley (400 ft, Jan). *St. George East:* Caparo Valley–Pt. of Spain (Jan), D'Abadie (19 Apr). *Victoria:* Morne Diable (Dec); from Barcant (1970). ??: Maturan (??, Sep).

VENEZUELA: *Tachira:* Rio Frio (600 m, 10 Sep). *Merida:* Merida. *Trujillo:* Haciendita, near Valera (25 Aug). *Carabobo:* Las Quiguas (Jun), Valencia, near Aguirre (19 Jan), Puerto Cabello. *Aragua:* Rancho Grande (1100 m, 19, 29 May), Turmero (466 m, 13 Nov), El Limon (450 m, 3 Apr, 17 Oct). *Distrito Federal:* Caracas. *Miranda:* Caracas–Qda. Camburi (1000 m, 27 Dec). *Cojedes:* Hato Mata Clara (??, 12–16 Apr). *Nueva Esparta:* La Sierra (29 Aug). *Bolivar:* Caura River (3 Feb), Suapure (10, 16 Jan; 3 Feb).

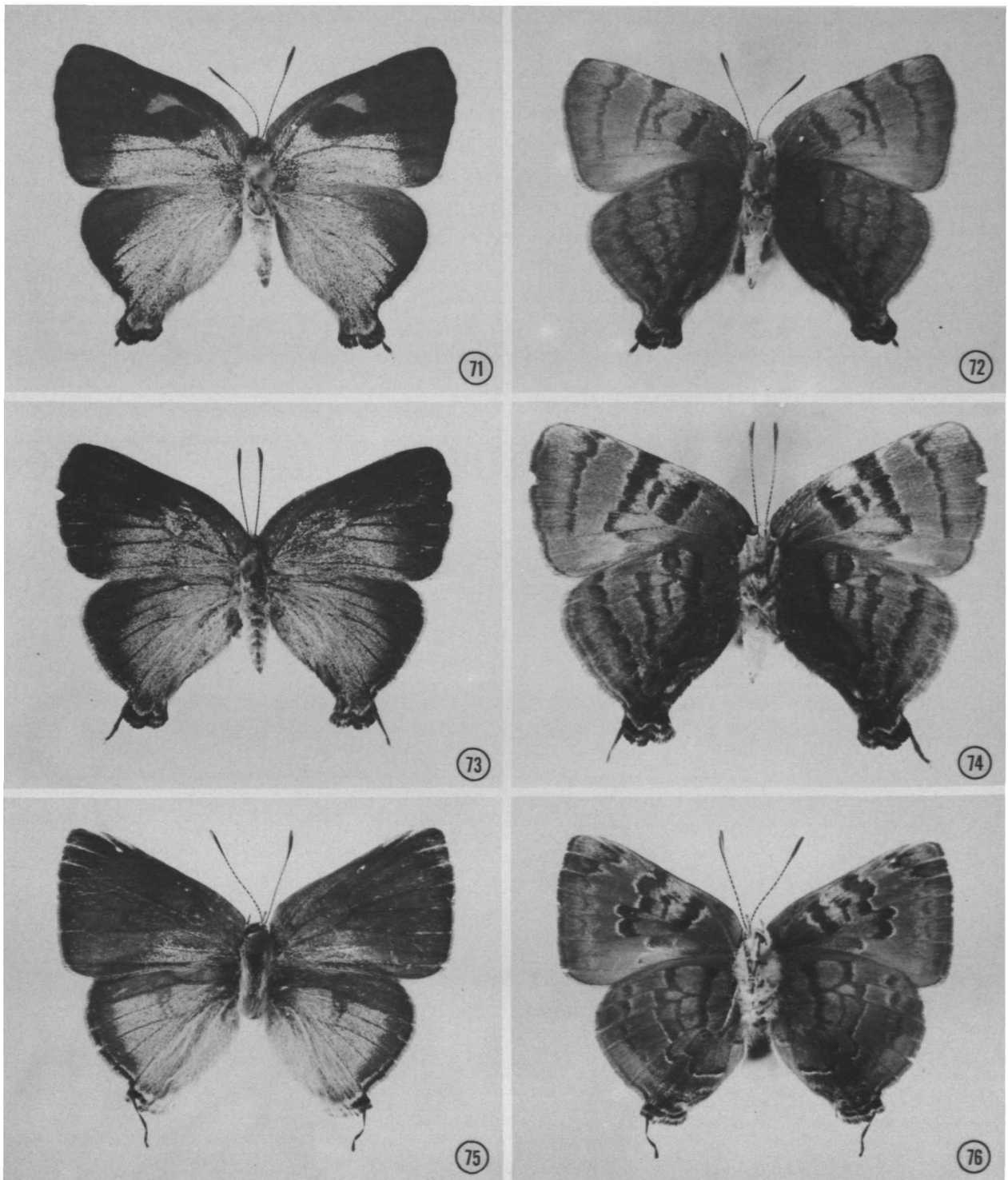
COLOMBIA: *Valle:* Cali (1000 m, 19 Feb; 2, 8 Aug), R. Dagua, Espejuelo, near Cali (Mar, Apr). *Cauca:* Corinto. *Risaralda:* Santa Rita–Cauca R., Santa Cecelia (800 m, Feb). *Tolima:* Melgar (1200 ft, 11 Jun). *Cesar:* Rio Los Clavos (350 m, Aug). *Magdalena:* Atanquez (850 m, Jul), Punta del Este–Sierra Nevada de Santa Marta (??, 900–1200 m, Sep),



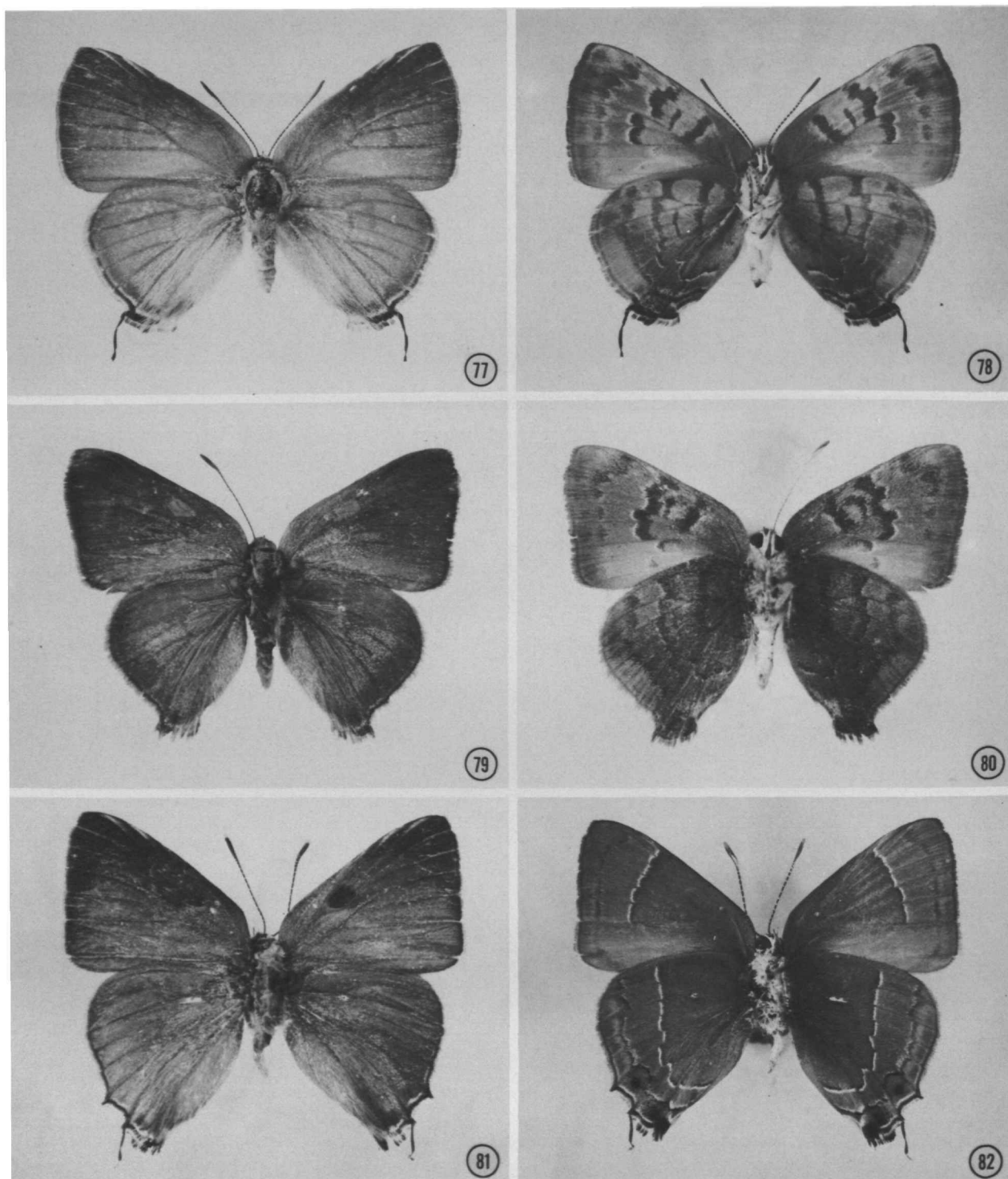
FIGURES 64-69.—*Rekoa* wing pattern: 64, dorsal male *R. meton* (Mexico); 65, ventral male *R. meton* (Mexico); 66, dorsal female *R. meton* (Guatemala); 67, ventral female *R. meton* (Guatemala); 68, ventral male *R. meton* (Meta, Colombia); 69, ventral male *R. meton* (Santa Catarina, Brazil).



FIGURE 70.—Distribution of *R. meton*.



FIGURES 71-76.—*Rekoa* wing patterns: 71, dorsal male *R. malina* (Brazil); 72, ventral male *R. malina* (Brazil); 73, dorsal female *R. malina* (Brazil); 74, ventral female *R. malina* (Brazil); 75, dorsal male *R. palegon* (Panama); 76, ventral male *R. palegon* (Panama).



FIGURES 77-82.—*Rekoa* wing patterns: 77, dorsal female *R. palegon* (Panama); 78, ventral female *R. palegon* (Panama); 79, dorsal male *R. palegon* (western Peru); 80, ventral male *R. palegon* on (western Peru); 81, dorsal male *R. zebina* (Mexico); 82, ventral male *R. zebina* (Mexico).

Minca (2000 ft, May, Jun). *Meta*: Villavicencio (500 m, 1500 ft, 1800 ft, 18 Jun; 2, 3, 5, 6, 10, 12, 13, 15–17, 19, 20, 22–26, 28, 29, 31 Jul; 1, 3, 4, 6, 7 Aug), Rio Negro (750 m, 2400 ft, 15 Jan, 17 Aug). *Amazonas*: Leticia. *Cundinamarca*: La Junta (??). *Boyaca*: Muzo. ??: Honda, Santa Fe de Bogota.

ECUADOR: *Imbabura*: Paramba (3500 ft, Apr). *Pichincha*: Toachi Occidente (800 m, 9 Jul), Quito, Alluriquin (= Tinalandia, = 12 km E Santo Domingo) (700 m, 2000 ft, 19 Apr; 29, 30 Jun; 28 Aug). *Chimborazo*: Naranjapata (1850 ft, Nov), Dos Puentes (1700 ft). *El Oro*: No further data (Jun). *Bolivar*: La Chima–Rio de Las Juntas (Jun, Jul).

PERU: *Huanuco*: Tingo Maria (800 m, 23 Jun). *Junin*: Chanchamayo (2000–7500 ft), La Merced (Nov), Rio Colorado (2500 ft). *Cuzco*: Cosnipata Valley. *Puno*: La Union to S. Domingo (2000–6500 ft, Jan, wet), Chaquimayo (2500–3000 ft), Yahuarmayo (1200 ft, Feb, Mar).

BOLIVIA: *Santa Cruz*: Las Juntas (Dec), Buenavista, (Jun), Portachuelo–R. Palmetilles (Apr), Rio Surutu (350 m). *La Paz*: Coroico (20 Apr).

PARAGUAY: *Guaira*: Villarica. *Paraguari*: Sapucay (Jul, Oct–Dec).

BRAZIL: No further data (9, 20 Mar). *Amazonas*: São Paulo de Olivenca, Tonantins, Tefe. *Maranhão*: No further data. *Ceara*: No further locality data (Aug). *Mato Grosso*: Chapada (??, Jan, Apr, Sep), Nivac (??, Feb). *Goiás*: 163 km W Jatai–S. Rita Araguaia (850 m, 21 May), Maranhão (700 m, 15 Aug), from Brown and Mielke (1967). *Distrito Federal*: (All records from Brown and Mielke, 1967) Sobradinho Woods (1050–1150 m, 13 Aug), Jardim Zoologico (1020 m, 8 Jun), Brasilia Country Club (1200 m, 11 Jun). *Minas Gerais*: Lassance (9 Nov), Sao Jacinto Valley (Dec), Parque Rio Doce (25 Jul). *Espirito Santo*: No further data. *Rio de Janeiro*: Sto. Antonio do Brotos–Distrito de São Fidelis, Guapimirim (7 Jul), Laguna de Sacuarema (Aug, Sep). *São Paulo*: No further locality data (2300 ft). *Santa Catarina*: Joinville (9 Jan, 10; 20 Jul; 11 Aug; 28 Sep), Saltobach (??, Apr), São Bento do Sul–Rio Vermelho (700 m, 10 May), Blumenau.

ECOLOGY AND BEHAVIOR.—Habitat: *Rekoa meton* occurs throughout most of the neotropics from sea level to 2000 m elevation in wet and dry habitats, but rarely above 1000 m at the north and south extremes of its range.

Dispersal: *Rekoa meton* appears to be a moderately dispersive species. Two females have been collected at Portachuelo Pass (Rancho Grande), and one female at the Cerro Campana ridge. It occurs on Isla Margarita and Trinidad, but is not recorded from other offshore islands.

Foodplant Records: There are no larval foodplant records nor have nectar sources used by adults been noted.

Territoriality: I suspect that males perch in the early afternoon. More than 15 years ago in Melgar (Colombia), before I knew that male hairstreaks set up mating territories, I saw males in the early afternoon landing on the tops of bushes about 4–5 m high. The similar observations of Barcant (1970) lead me to believe that the specimens I saw in Melgar were

territorial males.

Wing Pattern and Predation: Of 37 specimens collected at Villavicencio, Colombia (Robbins, 1981), 9 showed symmetrical wing damage indicative of an unsuccessful predator attack to the hindwing anal angle.

Rekoa malina Hewitson, new combination

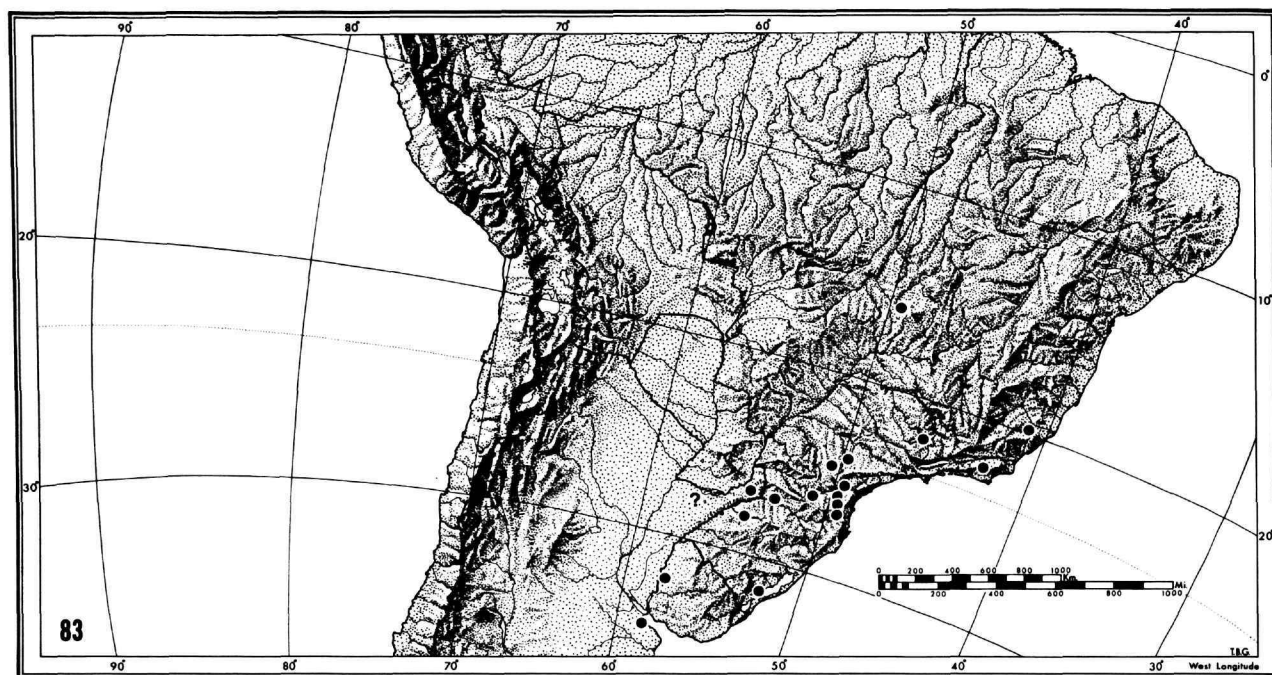
NOMENCLATURE.—*Thecla malina* Hewitson, 1867: Hewitson (1862–1878) described and illustrated *Thecla malina* from a Brazilian male in the W.W. Saunders collection. The type should be in the BMNH or the Oxford University Collection. I did not find in at the BMNH, nor was it segregated as a type in Oxford. However, Hewitson's illustrations of ventral and dorsal wing surfaces make identification of *T. malina* unambiguous. The placement of *T. malina* in *Rekoa* is a new combination.

Thecla phrynisca Burmeister, 1878: Burmeister (1878, 1879) described *Thecla phrynisca* from two females collected in Corrientes Province, Argentina, and illustrated the ventral wings. He differentiated it from *R. meton* and *R. palegon*. Although Draudt (1919–1920) suggested that it might be a form of *R. meton*, the illustrated specimen has the wing shape of *R. malina*. Further, there are three specimens of *R. malina* labelled "*T. phrynisca* Burmeister" in the Strecker Collection in the Allyn Museum of Entomology. According to a catalog of the Strecker Collection, the specimens were sent from G. Ruscheweyh in Buenos Aires, and had been identified by Burmeister as *T. phrynisca*. On these bases, I suggest the new synonym, *Thecla malina* Hewitson = *Thecla phrynisca* Burmeister. A type specimen may be found at the Museo Argentino de Ciencias Naturales Bernardino Rivadavia in Buenos Aires.

GEOGRAPHIC DISTRIBUTION (Figure 83), TEMPORAL DISTRIBUTION, AND ELEVATION.—ARGENTINA: *Corrientes*: (no further data); from Burmeister (1878). *Misiones*: (no further data); from Hayward (1963). *Buenos Aires*: San Fernando (Apr).

BRAZIL: *Distrito Federal*: Parque do Gama (1000 m, 17 Jun). *Espirito Santo*: Santa Teresa (Apr, 900 m). *Minas Gerais*: Pocos de Caldas (1200–1400 m, Feb, Apr, May); from Ebert (1969). *Rio de Janeiro*: Nova Friburgo (Feb). *São Paulo*: No further data (2300 ft), Borhumi (??), Itarare (2500 ft, Mar). *Parana*: Castro (2900 ft, Apr–Jun, Oct), Fernandez Pinheiro (2600 ft, Apr), Iguacu (Feb, Mar), São Jose dos Pinhais (800 m, 14 Mar), Curitiba (850 m, 31 May), Vossoroça–Tijucas do Sul (850 m, 2 Mar). *Santa Catarina*: Blumenau (Apr), Nova Teutonia (300–500 m, 6 May; 1, 3, 5, 9, 15, 16, 28 Jun; 5, 14 Nov), São Bento do Sul–Rio Vermelho (800–850 m, 13, 15 Mar; 2 May; 5 Aug), São Bento do Sul–Mato Preto (12 Apr). *Rio Grande do Sul*: Guarani (13 Jan), Pelotas (27 Mar; 19, 21, 23 Apr; 1 May).

URUGUAY: *Paysandu*: Paysandu (Feb, Mar); from Biezanko et al. (1957).

FIGURE 83.—Distribution of *R. malina*.

Burmeister's report of two females from Corrientes Province, Argentina, is somewhat anomalous. Most known specimens have been collected in highlands, but this province lacks mountainous areas. Perhaps the specimens are from the cooler southern part of the province.

IDENTIFICATION.—Males of *R. malina* are easily distinguished from other *Rekoa* by the large black scent patch in the discal cell. Females of *R. malina* can be distinguished from females of *R. meton* by their more elongate hindwings (Figures 66, 73), smaller size (Table 7), usual lack of an "eyespot" on the ventral hindwing costa (Figures 67, 74), and brown or blue scales covering the dorsal base of dorsal hindwing vein Rs. They are easily differentiated from other *Rekoa* females by their more extensive dorsal blue wing color.

ECOLOGY AND BEHAVIOR—Habitat: The great majority of elevation records indicate that *R. malina* occurs primarily above 800 meters in the northern part of its range (Serra do Mar), but at lower elevations in the temperate south. If this pattern is correct, then *R. malina* is the only *Rekoa* species that does not occur in tropical lowlands. *Rekoa malina* appears to be most common during the first half of the year, but has been collected all year round in the northern parts of its range. I have not collected *R. malina*, and know of no published accounts of its biology.

***Rekoa palegon* Cramer, new combination**

NOMENCLATURE:—*Papilio palegon* Cramer, 1780: Cramer

(1779–1780) briefly described and figured a female from Sierra Leone, Africa. Although Hübner (1819) synonymized it with *P. myrtilus* Cramer from Surinam (in the genus *Oenomaus* Hübner), he did not question the African type locality. Prittwitz (1865) noted that *palegon* (in genus *Thecla*) occurs in Rio de Janeiro. Hewitson (1862–1878) listed it from Rio de Janeiro and Para, Brazil, and Godman and Salvin (1887–1901) gave its range as southern Mexico to southeastern Brazil. The original figure in the BMNH library is a good representation of this neotropical species, and cannot be confused with any other species in Africa or the neotropics. There are no potential lectotypes in London at the BMNH or in Leiden at the Rijksmuseum van Natuurlijke Historie (R. de Jong, pers. comm.), but identification is clear.

Papilio myrtilus Cramer, 1782: Cramer (1780–1782) described and illustrated a Surinamese female. Hübner (1819) synonymized it to *Oenomaus palegon*. I compared the original figures of *P. palegon* and *P. myrtilus* in the BMNH library, and agree that they are synonyms that cannot be confused with any other species. No potential lectotypes are known in London or Leiden.

Thecla juicha Reakirt, 1866: Reakirt (1866) described *T. juicha* from a Mexican female (near Veracruz), and Godman and Salvin (1887–1901) synonymized it to *T. palegon*. Although no type specimen is known, the detailed original description cannot refer to any other Mexican eumaeine.

Thecla cyrriana Hewitson, 1874: Hewitson (1874) described *T. cyrriana* from a Peruvian male. He then figured it

(1862–1878), noting that the type is from his collection—via Mathew—and that it differs but slightly from *T. palegon*. There is one specimen in the BMNH that fits the original description, and I designate it lectotype. It had been segregated in the BMNH type collection. The type represents the clinal form of *R. palegon* that occurs from Loja, Ecuador, south along the dry western slopes of Peru. Clench (1967) suggested that the type locality is either Callao or Paita, Peru.

Thecla ulia Dyar, 1913: Dyar (1913) briefly described *T. ulia* from a female from Cantas, Peru, and compared it to the unrelated *T. gamma* H.H. Druce. There is one specimen in the NMNH that fits the original description. It has a USNM type label, and I consider it to be a holotype. Like *T. cyrriana*, it represents the western Peru form of *R. palegon*.

SYNONYMS AND NEW COMBINATIONS.—*Rekoa myrtilus* and *R. juicha* have previously been synonymized to *R. palegon*, while *R. cyrriana* and *R. ulia* have not. These represent new synonyms. None of these species has been previously placed in *Rekoa*, and they are new combinations.

GEOGRAPHICAL VARIATION.—There is little geographical variation between Central American specimens and South American ones east of the Andes (Godman and Salvin, 1887–1901)—the *R. palegon* phenotype—but specimens from the dry area along the west coast of Peru north to Loja, Ecuador, differ—the *R. cyrriana* phenotype. I found three consistent differences between these phenotypes. First, the male dorsal forewing border is considerably narrower at the apex in the *R. cyrriana* phenotype (Figures 75, 79). Second, these males have the pale blue-white scaling on the dorsal hindwing more restricted, but this character is highly variable in this and other *Rekoa* species. Third, the bands crossing the ventral wings are less distinct, although highly variable, than in other specimens of *R. palegon* (Figures 76, 78, 80). Specimens from El Oro Province, Ecuador, are geographically and phenotypically intermediate. El Oro specimens have the reduced male dorsal forewing border of the *R. cyrriana* phenotype, but have the *R. palegon* phenotype for the other two characters. This distribution of character states indicates clinal differentiation rather than phylogenetic splitting, and thus I do not accord the *R. cyrriana* phenotype nomenclatural recognition.

IDENTIFICATION.—Identification of *R. palegon* does not pose a problem (cf. Identification Key).

GEOGRAPHIC DISTRIBUTION (Figure 84), TEMPORAL DISTRIBUTION, AND ELEVATION.—UNITED STATES: *Texas*: Hidalgo County, Santa Ana National Wildlife Refuge, near Alamo (9 Nov); reported in Kendall (1970).

MEXICO: *Tamaulipas*: Antiguo Morelos (??, 17 Jul), 10 mi W Victoria (5000 ft, 2 Sep), Gomes Farias (280–700 m, 800 ft, 9 Jan; 7 Sep), 13 mi NW Tampico (26 Jan). *San Luis Potosi*: Valles (6, 12 Jul), Tamazunchale (14 Jun; 18 Jul; 7 Aug), Paliuta Canyon (21 Sep), Laurel Canyon–Axtla Junction (25 Jun), El Platanito (??, 6 Jul), El Salto (17 Aug), Cd. Mante (22 Jun). *Hidalgo*: Jacala (18 Jul). *Puebla*: Tehaucan (Apr). *Veracruz*: No further locality data (2 Dec), Atoyac (Apr–Jun),

Jalapa, Cordoba (Apr, Jun—as larva and as adult), 5 mi SE Cordoba (15, 16 Jun), Motzorongo (Jul), Tlapacoyan (25 Jul), Santa Rosa (May, Jul), Veracruz–Boca del Rio (Dec), Coatepec, Orizaba (May), 2 mi SE Coatzacoalcos (18 Jan), Jicaltepec (3 Jul), Jesus Carranza (8 Jun), San Andreas Tuxtla (500 ft, 30 Aug), Mocambo (4 Nov), Fortin de Las Flores (29 Jul), Catemaco (17 Jun), Presidio (May, Jun). *Nayarit*: Compostela (780 m, Aug), Zapata (??, 900 m, Aug). *Jalisco*: Guadalajara (Oct), Ajijic (Dec). *Colima*: Colima (1600 ft, Mar, Apr, Aug, Dec). *Guerrero*: Venta de Zopilote, Rincon (2800 ft). *Morelos*: Cuernavaca (Jun). *Oaxaca*: S. Jose Chiltepec (May). *Tabasco*: Teapa. *Yucatan*: Valladolid, Chichen Itza (Apr, Aug, Dec), Piste (Aug). *Chiapas*: Cd. Cuauhtemoc (9 Feb), W San Cristobal (92°45'W, 16°45'N) (15 Dec), Lagos de Montebello (5000 ft, 15 May), Bombona (1500 ft, Sep), Santa Elena (?? several in Chiapas, 1000 ft, Jun), San Quintin (Sep), Pichucalco (Jul).

GUATEMALA: *Guatemala*: Guatemala City (Jul). *Izabal*: Cayuga (Dec), P. Barrios. *Alta Verapaz*: Polochic Valley, Chacoj. *Sacatepequez*: Duenas. *Baja Verapaz*: Cubulco, S. Geronimo (3000 ft). *Santa Rosa*: Guazacapan (Mar, Apr, Jun), Chiquimulilla (Jun). *Retalhuleu*: S Sebastian.

BELIZE: *Cayo*: Bent Pine Fire Lookout (??, 850 m, Aug). *Stann Creek*: Middlesex (May).

EL SALVADOR: *San Salvador*: Santa Tecla (6, 14, 17, 21, 22, 25, 26 Jan; 4–6, 10, 13 Feb; 17, 21 Dec). *Cuscatlan*: Rosario (26 Dec).

HONDURAS: *Copan*: Copan (Feb). *Cortes*: San Pedro Sula. *Islas de La Bahia*: Roatan Bay Island (20–26 Apr), Bonacca Island (9–15 Apr).

NICARAGUA: *Rio San Juan*: Chontales. *Zelaya*: Cape Gracias (Jan). *Managua*: Managua (14–15 Nov).

COSTA RICA: *Cartago*: Pejivalle (2400 ft, Mar), Sitio (May). *Heredia*: Mt. Redonodo (Jan). *San Jose*: Higuito–Cerro Tablazo (1500 m, 1600 m, 12 Jan; 12 Feb; 20 Mar), Desamparados (1130 m, 11 Jan), Carrillo (Apr). *Guanacaste*: 5 km NW Canas (50 m, 6 Feb; 17 Mar; 11, 16, 17, 22, 25 Jun; 12, 15, 25 Sep), 8 km NW Bagaces (100 m, 29 Jun; 22 Sep), Parque Santa Rosa (5 Jul as larva). *Alajuela*: 6 km W Atenas (1500 m, 10 Feb), M. Poas (Apr).

PANAMA: *Chiriqui*: Volcan Baru (5000–9000 ft). *Veraguas*: Calobre, San Francisco (4500 ft). *Cocle*: El Valle (Jan). *Canal Area* (formerly Canal Zone): Paraiso (27 Oct; 14 Dec), Ft. Sherman (Apr, Jun), Cocoli (11 Nov), Frijoles (11 Jun), Farfan (27 Dec; 6 Jan; 13 Feb), Madden Forest (7, 8, 27 Feb; 4 Mar), Gatun (21 Feb), Summit (30 Nov; 25 Dec). *Panama*: 3 km N Chepo (250 m, 10 Feb), Cerro Campana (500 m, 4, 7 Jan; 1, 10, 16, 18, 23, 10, 16 Mar).

FRENCH GUIANA: *Guyane*: Maroni (Mar), St. Laurent, St. Jean, Cayenne (Dec), Nouveau Chantier (Mar, May). ??: Fort George (??, Sep, Oct).

SURINAM: *Paramaribo*: Paramaribo (Oct, Nov).

GUYANA: *East Demerara–West Coast Berbice*: Kingston (??), Rio Demerara, Georgetown. *Mazaruni–Potaro*: Mazaruni



FIGURE 84.—Distribution of *R. palegon*.

(Sep), Quonga.

ST. VINCENT: No further locality data (Feb). Riley (1975) did not record *R. palegon* from the Lesser Antilles. The specimen on which this record is based is in the BMNH.

TRINIDAD: *St. George West*: Fondes Amandes Rd. (Mar), Port of Spain, Botanical Gardens (17 Jan), Maupertuis Rd. (1350 ft, Apr), St. Ann's (Mar, Nov–Dec), Maraval (7 May larva). *St. George East*: Simla (4 Feb, found as larva), Caparo. *St. Andrew*: Manzanilla (0 ft, Jan). *Caroni*: Tabaquite. ??: St. Augustine (??, 25 Feb as larva, Mar as larva, 7 May larva).

TOBAGO: No further locality data (Feb).

VENEZUELA: *Yaracuy*: Aroa (400 m, 2 Jun). *Carabobo*: San Esteban, Puerto Cabello, Las Quiguas (Nov–Mar), near Aguirre (??, 19 Jan), Valencia. *Aragua*: Turmero (466 m, 17 Jun), Maracay (900 m, Dec), El Limon (450 m, 5 May, found as larva), Portachuelo Pass (1100 m, 28, 29 May; 5, 9, 12, 16, 21 Jun), 35 mi W Caracas (1800 ft, 1 Apr). *Distrito Federal*: Caracas (6 Feb, found as larva), vicinity Caracas (3600 ft, 4000 ft, 4200 ft, 29 Mar; 4 Apr). *Miranda*: 10 mi E Caracas (2200 ft, 4 Apr). *Bolivar*: Ciud. Bolivar (Sep), Suapure (9 Jan; 6 Feb; 16 Jul).

COLOMBIA: *Valle*: Cali (1000 m Jan, Feb), Juntas (Dec–Jan), Espejuelo, near Cali (Mar, Apr). *Cauca*: Popayan (1700 m). *Magdalena*: Cacagualito (1500 ft, May), Don Diego (100 ft); Onaca (2000 ft). *Risaralda*: Distrito de Pereira, Santa Rita–Cauca R. *Cundinamarca*: Cananche (??, Sep), Farallones (6200 ft, 7500 ft, 2 Mar). *Meta*: Villavicencio (500 m, 1500 ft, 1800 ft, 14 Jun; 3, 8, 14, 16, 19, 23, 24, 26, 27, 29 Jul; 1, 4, 5, 7 Aug). *Tolima*: Melgar (1200 ft, 11 Jun). *Caqueta*: Florencia (2400 ft, 22 Jan). *Amazonas*: Leticia (8 Apr). ??: Bogota a Beunaventura (Dec–Feb), Env. Bogota.

ECUADOR: *El Oro*: No further locality data (Jun), 9.5 km W Pinas (900 m, Jun). *Loja*: Vilcabamba (1600 m, May), Environs de Loja. *Imbabura*: Pambaba (Feb–May, 3500 ft, dry season). *Pastaza*: Mera (1000 m, 8 Mar). *Chimborazo*: Naranjapata (1850 ft, Nov). *Zamora-Chinchi*: Cumbaratza (12 Jun), Zamora (1–5 Jun).

PERU: *Lima*: Lima (Jan; 30 Apr; 2, 9, 15 May), Chosica (850 m, 2000 ft, 2800 ft, 3, 4 May; 12 Sep), Callao. *Junin*: Satipo, Chanchamayo (1000 m, Jun–Aug, Oct–Dec), Chanchamayo–La Merced (Nov), Rio Perene. *Pasco*: Huancabamba–Cerro de Pasco (6000–10000 ft). *Puno*: La Oroya–Carabaya (3100 ft, Sep), La Union–R. Huacamayo–Carabaya (2000 ft, Nov, wet season), San Gaban (2500 ft, Mar–Apr). *Cuzco*: Callanga (1500 m). *San Martin*: Tarapoto (May–Aug). *Huanuco*: Tingo Maria (800 m, 25 Jun). *Arequipa*: Cantas (2000 ft, Nov; type of *Thecla ulia*). Lamas (1977) records *Thereus palegon cyrriana* from Lambayeque Province to Lima Province.

BOLIVIA: *Santa Cruz*: Santa Cruz (Feb–May), Rio Surutu (350 m), Buenavista, Prov. del Sara (750 m, 450 m, Feb, May, Jun, Nov), Las Juntas. *Cochabamba*: Yungas del Espiritu Santo, 5 days N from Cochabamba (12 Sep 1899). *La Paz*: Coroico (20 Apr), Cusilluni (May), Chulumani (Dec).

PARAGUAY: *Guaira*: Villarrica (Jan, Feb, Apr, Dec). *Paraguari*: Sapucay (Feb, Mar, May, Nov). *Caaguazu*: San Jose. *Central*: Patino cue Paraguay (Feb). *Boqueron*: Estancia Cooper Alto Paraguay. ??: No further locality data (Nov, Dec).

ARGENTINA: *Santa Fe*: Villa Ana (Feb), Villa Ana–F.C.S. Fe (Apr). *Tucuman*: Laguna de Malvinas (380 m, Mar). *Entre Rios*: No further locality data (Sep). *Misiones*: Haut-Parana, San Ignacio (Apr). *Corrientes*: Corrientes. *Chaco*: Near Resistencia (Jul). *Formosa*: Formosa (Jun). *Salta*: Pichanal (4 Jun; 25 Apr), no further locality data (Apr). *Jujuy*: San Pedro, W of Bypass 34 (650 m, 17 Jul). Hayward (1950) records *R. palegon* (as *T. myrtilus*) from the provinces of Buenos Aires, Chaco, Corrientes, Misiones, Salta, Santa Fe, Tucuman.

BRAZIL: *Para*: No further locality data (Jan–Mar), Tapajos, Santarem, Juruti. *Amapa*: Upper Rocana, N. Para (Jul). *Amazonas*: Tefe, Tonantins, S. Paulo de Olivenca, São Joao Solimoes (??). *Ceara*: No further data. *Paraiba*: Joao Pessoa (8 Feb; 28 Jun; 12 Oct; 7 Nov; 7, 28 Dec). *Pernambuco*: Garanhuns (900 m, 22 Feb). *Mato Grosso*: Cuiaba, Chapada (??, Sep). *Mato Grosso do Sul*: Rio Taquari, near Pedro Gomes (350 m, 28 Aug). *Bahia*: S. Antonio da Barra (??). *Distrito Federal*: (All records from Brown and Mielke, 1967) Fercal, 24 km N Rodoviaria (840 m, 17, 18 Aug), Brasilia Country Club (1200 m, 11 Jun), Parque do Gama (1100 m, 9 Jun). *Goiás*: Vianopolis (1000 m, Mar); from Brown and Mielke (1967). *Minas Gerais*: Pocos de Caldas (1200–1400 m, Mar, May); from Ebert (1969), São Jacinto Valley (Jan), Paracatu (4 Mar); from Brown and Mielke (1967), Leitao, km 142 Curvelo (700 m, 12 May), Sabara–Belo Horizonte–Rio das Velhas, Sete Lagoas (May). *Espirito Santo*: No further data. *Rio de Janeiro*: Organ Mts, Laguna de Sacuarema (Aug–Sep), Restinga Jacarepagua (10 Jun), Rio de Janeiro (19 Mar as larva), Marica (May larva), Corcovado, Petropolis, Angra Aduhyba (??, Jun), Tijuca (Dec), Canto Gallo (??). *São Paulo*: Maua (May), Campinas (16 Jan), Santos (21 Jul; 25 Sep). *Parana*: Iguacu (Jan), São Paulo (??, 2300 ft), Castro. *Santa Catarina*: Blumenau, Nova Teutonia (300–500 m, 30 Apr; 8 May; 8 Jun), São Bento do Sul–Rio Vermelho (20 Apr), Florianopolis (Jan), Joinville (10–200 m, 26 Mar; 14, 17, 21, 24, 28, 30 Apr; 4, 31 May, 15 Jun; Aug; 26 Oct; 23 Dec). *Rio Grande do Sul*: Pelotas (20 Jan, 1 Feb, Mar, Apr, 1 May, Jun), Northeastern R.G. S.

ECOLOGY AND BEHAVIOR.—Habitat: *Rekoa palegon* may be the most widely distributed eumaeine species. It occurs from southern Texas, USA, to Buenos Aires Province, Argentina, in wet and dry areas from sea level to above 2000 m. It has successfully invaded the dry western coast of Peru and been collected once in the Lesser Antilles.

Dispersal: *Rekoa palegon* is a dispersive species. It has been collected eight times at Portachuelo Pass (all females), five times at Monteverde (four females), and is found frequently at the Cerro Campana ridge. It occurs on Roatan Bay Island (Honduras), Bonacca Island (Honduras), Trinidad, Tobago, and

St. Vincent in the Lesser Antilles. Except for specimens from western Peru and southern Ecuador, *R. palegon* shows no geographical variation. It is sympatric with its sister clade.

Larval Foodplants: I identified the adults of reared specimens below except for two published records and those records from correspondence with Dr. M.J.W. Cock, an entomologist with the C.A.B. International Institute of Biological Control (CIBC).

- Boraginaceae:** *Cordia*. Female. Trinidad: St. Augustine. Leg. F.J. Simmonds. Ex. larva, Mar 1948. Larva on *Cordia* flowers Simmonds, a former director of CIBC, worked on *Cordia curassavica*, according to Dr. Cock. In NMNH.
- Compositae:** *Chromolaena odorata* (= *Eupatorium odoratum*). Male. Trinidad: Simla. Leg. R.E. Crutwell. Ex. larva, 4 Feb 1970. Larva on flowers. In BMNH. Record published in Crutwell (1974).
- Compositae:** *Chromolaena odorata* (= *Eupatorium odoratum*). Female. Venezuela: D.F.: Caracas. Leg. Fernandez Y. Ex. larva, 6 Feb 1950. In IZA with pupal case.
- Compositae:** "*Eupatorium*" *iresinoides*. Reared from flowers by R.E. Crutwell in Trinidad. Published in Crutwell (1974).
- Compositae:** *Mikania hoehnei*. Female. Brazil: Rio de Janeiro: Marica (Restinga). Leg. Lima-Carvalho. Ex. larva, Jun 1986. Larva on inflorescence. In NMNH with pupal case.
- Compositae:** *Mikania micrantha*. Male. Trinidad: Parrylands. Reared from flowers by M.J.W. Cock. Ex. larva, Mar 1980. Published in Cock (1982). In coll. M.J.W. Cock with pupal case and cast larval skin.
- Compositae:** *Mikania viifolia*. Reared from flowers by M.J.W. Cock in Trinidad. Record from correspondence with M.J.W. Cock (CIBC).
- Compositae:** *Senecio confusus*. Female. Trinidad: St. Augustine. Leg. E. McC. Callan. Ex. larva, 25 Feb 1946. Larva on flowers. In NMNH.
- Compositae:** *Senecio* sp. Reared from flowers. In collection of University of West Indies. Record from correspondence with M.J.W. Cock (CIBC).
- Compositae:** *Veronia cinera*. Reared from flowers by M.J.W. Cock in Trinidad. Record from correspondence with M.J.W. Cock (CIBC). Probably in CIBC Trinidad collection.
- Compositae:** "asters." Female. Trinidad: St. Augustine. Leg. L.T. Lee. Ex. larva, 7 May 1949. Larva on flowers. In NMNH.
- Compositae:** Male. Brazil: Rio de Janeiro: Rio de Janeiro. Leg. Lima-Carvalho. Ex. larva, 19 Mar 86. Larva on inflorescence. In NMNH.
- Solanaceae:** *Solanum nigrum*. Brazil: Rio Grande do Sul: Pelotas: published in Biezanko, Bertholdi, and Baucke (1949). Biezanko specimens of *R. palegon* in NMNH are properly identified.
- Solanaceae:** *Solanum tuberosum*. Female. Venezuela: Aragua: El Limon: 450m. Leg. J.A. Gonzalez. Ex. larva, 5 May 1970. Larva on shoots of imported potatoes to be planted. In IZA with pupal case.
- Ulmaceae:** *Trema micrantha*. Male. Costa Rica: Guanacaste: Parque Santa Rosa. Leg. D. Janzen. Ex. larva, 5 Jul 1982. Pupated 7 Jul, eclosed 15 Jul. Larva spiny green, looks just like a limacodid. In Janzen Collection on loan to NMNH.
- Verbenaceae:** *Lantana camara*. Female. Mexico: Veracruz: Cordoba. Leg. N.L.H. Krauss. Ex. larva, Jun 1955. Larva on flowers. In NMNH with pupal case.
- Verbenaceae:** *Lantana camara*. Male. Trinidad: St. Augustine. Leg. N.L.H. Krauss. Ex. larva, May 1958. Larva on flowers. In NMNH with pupal case.

Bourquin (1945) reared specimens that he identified as *Rekoa palegon* from the leaves of *Solanum pseudocapsicum*, but I believe that he actually reared *Arawacus ellida*. He illustrated a reared male and female, and both are *A. ellida*. Further, specimens in the NMNH that he labelled "*Thecla palegon*" are *A. ellida*.

Larvae and Ants: Malicky (1969, 1970) noted that "*Thecla*"

palegon has a honey gland on the 7th abdominal segment of the larva as well as perforated cupolas, which he considered to be the most important structure mediating larval-ant myrmecophily. However, I know of no records of ants attending *R. palegon* larvae.

I have not had the opportunity to examine preserved larvae of *R. palegon*, but through the courtesy of M.J.W. Cock, figure the larva and pupa in nature (Figures 112–114). The figures confirm Janzen's "spiny green" description of the larva.

Adult foodplants: Adults sip nectar from a variety of flowers, including *Cordia inermis* and *C. dentata* (Boraginaceae) in Costa Rica, *Clibadium* flowers (Compositae) in Panama, and *Veronia scorpiodes* (?) flowers (Compositae) in Venezuela, from Longstaff (1908).

Territoriality and Pheromones: Males of *R. palegon* have not been recorded setting up mating territories. Longstaff (1909) noted that males have a chocolate odor, but it is so faint that it is imperceptible to me.

Wing Pattern and Predation: Of 18 specimens collected at Villavicencio, Colombia (Robbins, 1981), one showed symmetrical wing damage indicative of an unsuccessful predator attack to the hindwing anal angle.

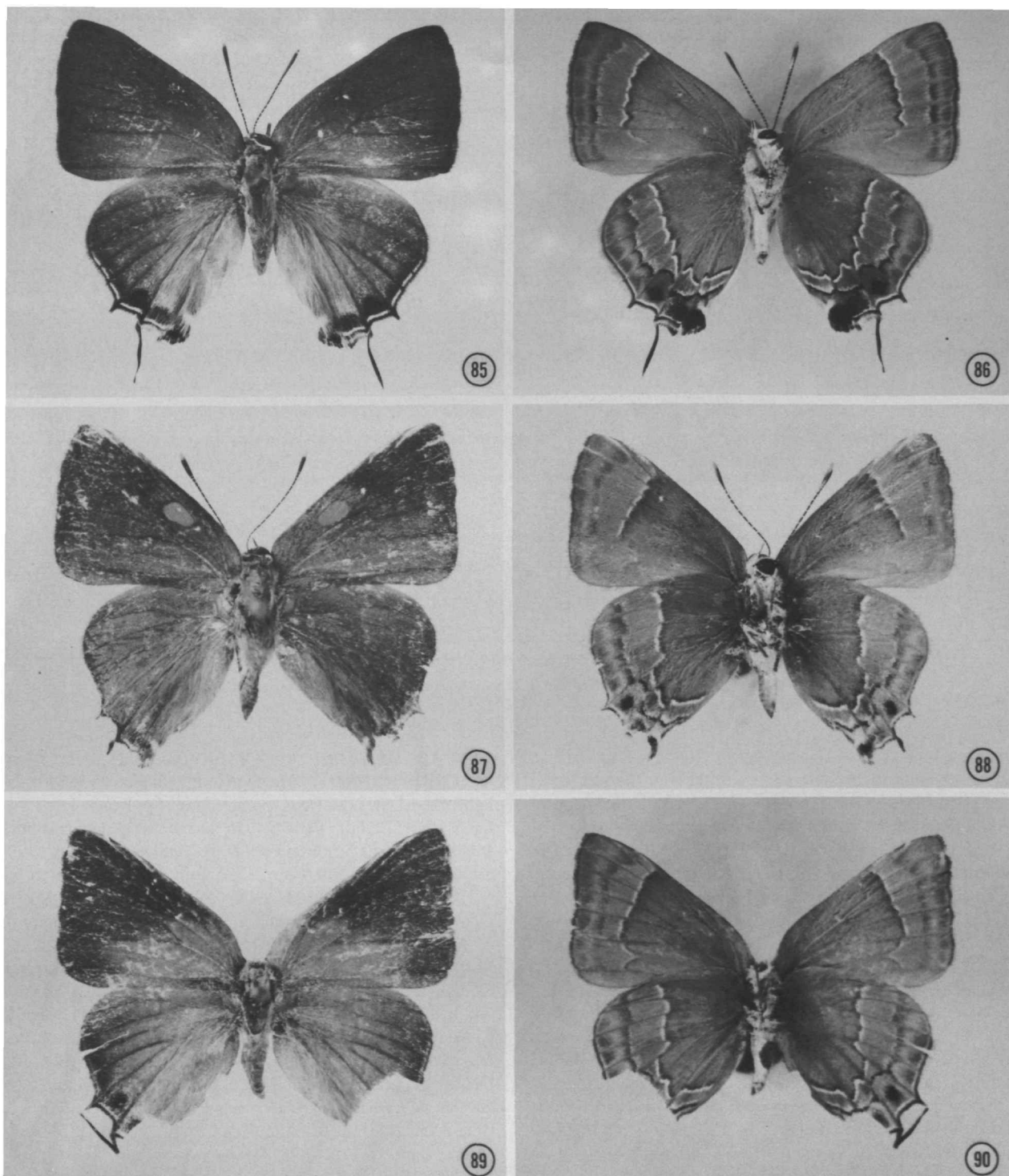
Rekoa zebina Hewitson

NOMENCLATURE.—*Thecla zebina* Hewitson, 1869: Hewitson (1862–1878) described and illustrated *Thecla zebina* from a Nicaraguan "male" in his own collection. However, both description and illustration refer to a female. There is one Hewitson Collection female labelled "*Thecla zebina*" in the BMNH from Nicaragua that fits the original description and figure exceedingly well and that had been segregated as the type of *Thecla zebina*. I designate it lectotype.

Thecla orses Godman and Salvin, 1887: Godman and Salvin (1887–1901) described and illustrated *Thecla orses* from a single Guatemalan male. I examined this holotype, which is the only known specimen of *T. orses*, in the BMNH. Although Godman and Salvin compared it to *Thecla brescia* (a synonym of *R. marius*), I believe it to be a small, slightly aberrant *R. zebina*. It differs from most *R. zebina* specimens in its small size, more diffuse dorsal forewing border, smaller scent pad, and smaller and more orange ventral hindwing cubital spot. However, the position of the scent pad, the thick apical dorsal forewing border, and morphology of the male genitalia are the same as *R. zebina*. Further, small male aberrants with diffuse dorsal borders occur in other eumacine genera, such as *Atlides* and *Evenus*.

Thecla guadala Schaus, 1902: Schaus (1902) described *Thecla guadala* from Mexico (Guadalajara). There is one specimen of each sex with type labels in the NMNH. Both are the same species as *R. zebina*. I designate the male a lectotype.

SYNONYMS AND NEW COMBINATIONS.—*Rekoa zebina*, *R. orses*, and *R. guadala* represent new combinations. The former



FIGURES 85-90.—*Rekoa* wing patterns: 85, dorsal female *R. zebina* (Costa Rica); 86, ventral female *R. zebina* (Costa Rica); 87, dorsal male *R. bourkei* (Jamaica); 88, ventral male *R. bourkei* (Jamaica); 89, dorsal female *R. bourkei* (Jamaica); 90, ventral female *R. bourkei* (Jamaica).

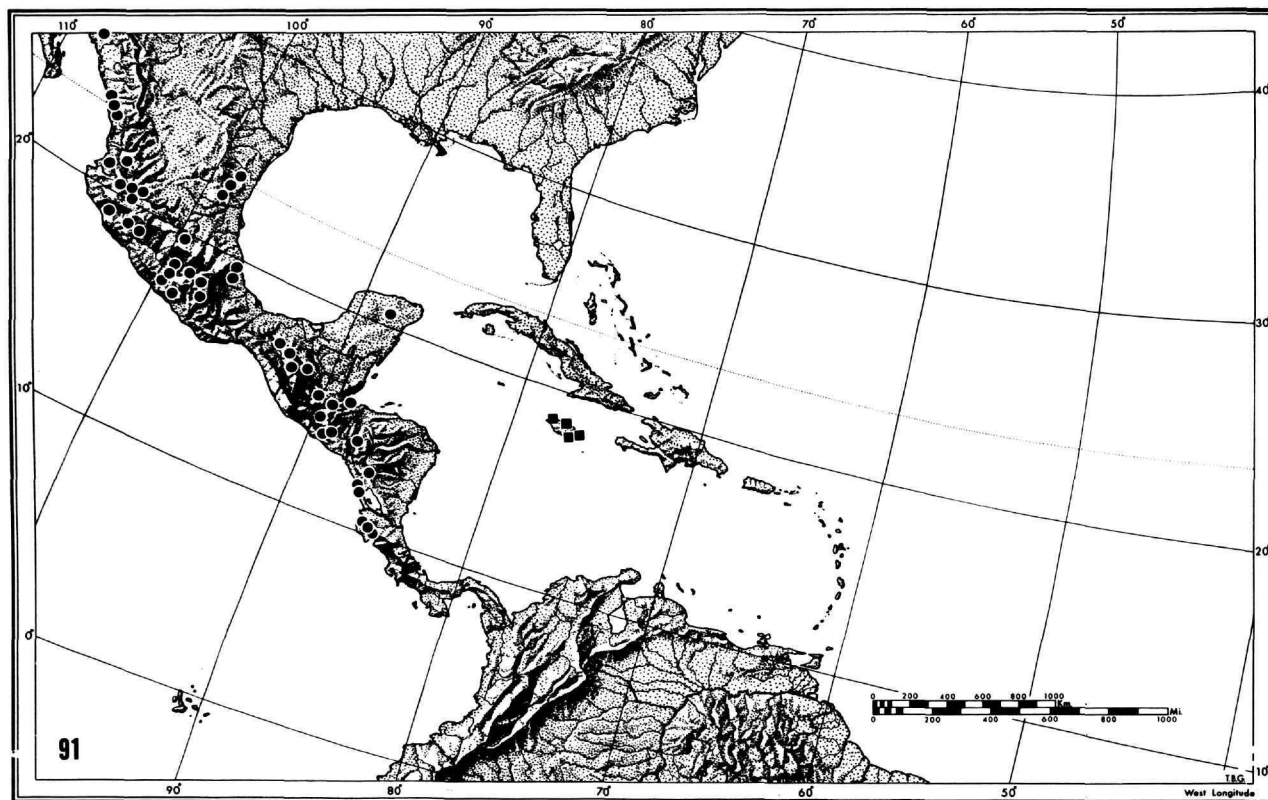


FIGURE 91.—Distribution of *R. zebina* (circles) and *R. bourkei* (squares), which was also recently collected in the Dominican Republic.

two are switched from *Thecla*. Clench (1964a, 1970) changed *Thecla guadala* to *Heterosmaitia* and then to *Thereus*, and I move it to *Rekoa*. The synonym *Thecla zebina* Hewitson (= *Thecla orses* Godman and Salvin), is a new synonym.

IDENTIFICATION.—*Rekoa zebina* is distinguished from *R. stagira* by the blue submarginal spot on the ventral hindwing, as noted in the Key. Males of *R. zebina* have a broad black border at the apex of the dorsal forewing, which distinguishes them from males of *R. marius*. Females of these two species are more difficult to tell apart. If the specimen has a submarginal red spot on the dorsal hindwing, it is *R. marius*. If the orange-red under the postmedian line at the ventral hindwing inner angle is lacking, again it is *R. marius*. However, *R. marius* is variable for both of these characters, and to identify positively a female as *R. zebina*, it is necessary to brush away the scales surrounding the ostium bursae. There will be spines on the lamella postvaginalis if it is *R. zebina* and no spines if it is *R. marius* or *R. stagira*. *Rekoa bourkei* is the closest relative of *R. zebina*, and has a virtually indistinguishable wing pattern. Under my discussion of the former species, I give genital characters for separating them.

GEOGRAPHIC DISTRIBUTION (Figure 91), TEMPORAL DIS-

TRIBUTION, AND ELEVATION.—MEXICO: *Tamaulipas*: 10 mi W of Victoria (5000 ft, 2 Sep, 16 Aug), Jaumave (3200 ft, 29 Feb), Cd. Mantes (20 Dec), Gomes Farias (16 Jul, 24 Dec). *San Luis Potosi*: El Salto Falls (24 Oct). *Veracruz*: Jalapa, Presidio (May, Aug), El Chorreadero (Jul). *Sonora*: Alamos (Jul). *Sinaloa*: Venadio (?), Loberas Summit, 5 mi NE Potrerillos (1820 m, Aug), 6 mi N Mazatlan (Aug). *Nayarit*: Compostela (May). *Jalisco*: Lake Chapala, Bolanos, Ajijic (5300–5400 ft, 4, 7, 9 Dec), Guadalajara (types of *Thecla guadala*) (Oct), Mirador (600 ft, Jul–Aug). *Colima*: Comala (2100 ft, Oct), Colima (2800 ft, Mar). *Michoacan*: Acahusto (3000 ft, 19 Aug), 8.5 mi S Uruapan (1520 m, Aug). *Distrito Federal*: Ciudad Mexico (8100 ft). *Puebla*: Acatlan (Aug), Atlixco (Jul). *Morelos*: (no further locality, 7000 ft), Cuernavaca (Feb, Jul, Oct), Yau-tepec (Jun, Jul), 1 mi S of Xochicalco ruins (Aug), Ixtapan de La Sal (Jul). *Guerrero*: Venta de Zopilote (2800 ft, Oct), Rincon (2800 ft, Sep), Acahuizotla (Jul, Oct), Mexcala (Aug), 2 mi W Colotlipa (Aug). *Oaxaca*: (no further data). *Chiapas*: San Quintin (10 Jan), Mts. near Las Casas, S. Cristobal de Las Casas (8000 ft, Jan), HW 190, km 25 W of Tuxtla Gutierrez, Cd. Cuautemac (= Cuauhtemoc). *Yucatan*: Piste (Aug, Nov).

GUATEMALA: *Izabal*: Cayuga (Jan), P. Barrios. *Alta Verapaz*: Polochic Valley. *Baja Verapaz*: San Geronimo (3000 ft, type of *Thecla orses*). *Jutiapa*: Barranca Honda (20 Feb). ??: Central valleys.

EL SALVADOR: *San Salvador*: Santa Tecla (900 m, 14, 17 Jan; 6, 10 Feb; Mar, May, Nov, Dec). *Cuscatlan*: Rosario (29 Dec).

HONDURAS: *DC*: Valle de Angeles, El Encuentro (8 Aug).

NICARAGUA: No further data (type of *Thecla zebina*). *Managua*: Pochomil (Jan, Jul), within 20 km of Managua (Feb, Mar, Apr, Jul). *Matagalpa*: Cd. Dario (Jul).

COSTA RICA: *Guanacaste*: La Pacifica, 4 mi NW Canas (3 Jul), Hac. La Pacifica, 5 km NW Canas (50 m, 16, 17, 20, 25 Apr; 3 May; 4, 16 Jun; 1, 3, 19 Jul), 2 km SE Liberia (28 Feb, ex. larva), 8 km NE Bagaces (100 m, 20 Apr, 4 Sep).

There is one specimen labelled "Ecuador" from the Hewitson Collection in the BMNH. There is little question that the specimen is mislabelled.

Although *R. zebina* has not been collected in southern Texas or Arizona, it is likely that it will eventually be found in the United States. Specimens have been caught several times at Cd. Victoria (Tamaulipas), which is less than 275 km south of Texas, and collected once in Sonora, about 500 km south of Arizona. The dry intervening habitats, in both cases, should not be a barrier to dispersal. Freeman (1950a) recorded it (as *Strymon zebina*) from Pharr, Texas. I examined the specimen on which this record is based, and it is a female *R. marius*, as are all "unbanded" *Rekoa* specimens collected in Texas.

ECOLOGY AND BEHAVIOR.—Habitat: *Rekoa zebina* has been collected in every month of the year at elevations from sea level to almost 2500 m. It occurs in areas to the east and west of Mexico's central plateau south to Chiapas and Yucatan, through the dry seasonal areas of Guatemala, and then south along the dry seasonal Pacific side of Central America to Guanacaste Province, Costa Rica. The common factor in its distribution is that it occurs in relatively dry areas. *Rekoa zebina* has not penetrated Costa Rica's Osa Peninsula (Pacific slope) and Atlantic slope, which have an annual precipitation above 300 cm (Coen, 1983; Hartshorn, 1983). These wet areas apparently form the southern barrier to the distribution of *R. zebina*.

The habitat preference of *R. zebina* for areas with a marked dry season and annual rainfall usually below 250 cm is apparently shared with *R. bourkei*, but is otherwise unique in the genus. The widespread species of *Rekoa* occur in the same xeric areas as *R. zebina*, as well as in more mesic habitats.

Larval Foodplant: *Rekoa zebina* has been reared once from *Andira* (Leguminosae). The larva is purple, unlike that of *R. palegon*, but may be similar to the undescribed larvae of *R. stagra*, *R. bourkei*, and *R. marius*. The unpublished data are as follows: Costa Rica: Guanacaste Province: 2 km SE Liberia. Leg. P. Opler. Ex. mature larva, 28 Feb 1974. Eclosed 14 Mar 1974. Swept from flowers. Larva same purple color as flowers. In NMNH with pupal case.

Adult Foodplants: Adult *R. zebina* nectar on a variety of flowers. They have been collected on *Cordia* (Boraginaceae) in Mexico and on *Cordia dentata*, *C. inermis*, *C. panamensis*, *Baltimora* (Compositae), *Karwinskia* (Rhamnaceae), and *Trigonia floribunda* (Trigoniaceae) in Costa Rica. Most were collected in the morning before 1030 h.

Territoriality: Perching times of male *R. zebina* have not been recorded, but because males sip nectar in the morning, they probably set up mating territories in the afternoon.

Rekoa bourkei Kaye

NOMENCLATURE.—*Thecla bourkei* Kaye, 1925: Kaye (1925) described *Thecla bourkei* from a Trinidadian female in Bourke's Collection in the Oxford Museum. Kaye (1931) later corrected the type locality to Jamaica, and illustrated a male. The type apparently has been lost (Comstock and Huntington, 1959), but Kaye's illustration makes identification unambiguous. *Thecla bourkei* is the type species of *Heterosmaitia*; its change to *Rekoa* is a new combination.

Heterosmaitia abeja Johnson and Matusik, 1988: Johnson and Matusik (1988) described this species from a male and female collected in the Dominican Republic. I examined the types (in CMNH) for each of the 47 coded characters in this paper that did not require a standard deviation or removal of androconia, and found no difference from those of *R. Bourkei* except for Character 44. This evidence is the basis for synonymy. Further, none of the character states that the authors used to differentiate *R. abeja* is unique to that species. Indeed, the relationship of *R. abeja* to *R. bourkei* and *R. zebina* will remain unclear until there are enough specimens to assess variation. The phylogenetic analysis and distribution map for *R. bourkei* were prepared before information on the types of *R. abeja* was available to me.

GEOGRAPHIC DISTRIBUTION (Figure 91), TEMPORAL DISTRIBUTION, AND ELEVATION.—JAMAICA: *Cornwall*: Trelawny, Baron Hill (1200 ft, Jan, 16 Jun, Oct); from Brown and Heineman, 1972, Duncans (25 Jan), Hanover-Lucea (Jun); from Brown and Heineman (1972). *Middlesex*: Ocho Rios (Dec), St. Ann, Rio Bueno (30 Dec), St. Ann, Islington (20 Feb); from Brown and Heineman (1972). *Surrey*: St. Andrew and Kingston, Constant Spring (Jan), St. Andrew and Kingston, Sandy Gully (8 Jul); from Brown and Heineman (1972), St. Thomas, 1 mi E of Lysson (6 Sep); from Brown and Heineman (1972). DOMINICAN REPUBLIC: *Pedernales*: Las Abejas (1250 m, 10, 15 Jul).

IDENTIFICATION.—Riley (1975) stated that *R. bourkei* has "a few distant relatives on the mainland," but it is very closely related to *R. zebina*. The best differentiating character is locality. In the morphology section, a few statistical and two qualitative distinguishing characters are noted. Female *R. bourkei* lack spines on the lamella postvaginalis, while they are present in *R. zebina*. The dorsal cornutus in the penis of *R. bourkei* has the right prong lost or reduced to a small bump,

while it is not lost in *R. zebina*.

ECOLOGY AND BEHAVIOR.—Habitat: Little is known about the habitat preferences of *R. bourkei*. It occurs mainly in the Jamaican lowlands (Brown and Heineman, 1972) up to about 375 m. Most of the areas where it occurs receive less than 250 cm annual rainfall (Brown and Heineman, 1972), much like *R. zebina*. It appears to fly throughout the year. The specimens from the Dominican Republic were collected at 1250 m.

Rekoa marius Lucas

NOMENCLATURE.—*Thecla marius* Lucas, 1857: Lucas (1857) described *Thecla marius* from a Cuban specimen in Boisduval's Collection. He noted that the name was a Boisduval manuscript name, and incorrectly attributed the name to him. The description was poor, no type specimen was known, and no one had recognized the name as a species in Cuba or elsewhere (Gundlach, 1881; Druce, 1907; Bates, 1935; Comstock and Huntington, 1943; and Torre Y Callejas, 1971).

I found the type specimen of *T. marius* Lucas (Figures 96, 97). The Boisduval Collection was obtained by Oberthuer (except for North American types, Horn and Kahle, 1935–1937), whose collection then went to the BMNH. There is a female specimen in the BMNH with the following labels: (1) a small handwritten green one "Cub," (2) a printed label "Ex. Musaeo Dris Boisduval," (3) a printed label "Ex. Oberthuer Coll. Brit. Mus. 1927-3.,," and (4) a handwritten "Marius ♀ mihi." The last label was presumably written by Boisduval, but comparison with his handwriting was not conclusive (Horn and Kahle, 1935–1937). I consider this specimen to be the type of *T. marius*, and designate it lectotype.

Thecla marius is the earliest name for the species. If it upset stability, the name might easily be suppressed by application to the International Commission on Zoological Nomenclature. However, *T. spurina* and *T. ericusa*, the next available names, have been confused for years (e.g., Druce, 1905; Freeman, 1950a). I believe that resurrecting *T. marius* is the simplest solution to the nomenclatural confusion.

Thecla spurina Hewitson, 1867: Hewitson (1862–1878) described and illustrated *Thecla spurina* from an Amazonian female in his collection. He also mentioned a variant specimen in the collection of Bates that lacks the dorsal hindwing orange spot between the tails. There is a single female labelled "Amazon" in the BMNH Collection that fits the original illustration of the first specimen. It had been separated in the BMNH type collection, and I designate it lectotype. The latter potential type from Bates' collection cannot be recognized today because Hewitson presented so little information on it.

The type specimen of *T. spurina* is incorrectly labelled. The specimen did not have a locality label in 1905 (Druce, 1905), but now has "Amazon" handwritten in faint black ink, a label that represents a batch of dubiously labelled Hewitson Collection specimens. For example, other incorrectly labelled specimens with localities in faint ink include the male and

female types of *Thecla silumena* Hewitson—labelled "Ecuador," but only known from southern Brazil and Paraguay, and the male type of *Thecla ocrida* Hewitson—labelled "Amazon," but only known from Central America (as opposed to the female type, which is a different species and which is Amazonian). Although museum pests have eaten most of the abdomen of the *R. spurina* type specimen, including its genitalia, the wing pattern is that of a Central American *R. marius*.

Thecla spurina has often been treated as a senior synonym of *R. stagira* rather than a junior synonym of *R. marius*. Druce (1905) admirably corrected synonymy among the names that I list under *R. stagira*, but mistakenly associated *R. spurina* as its senior synonym. Draudt (1919–1920) followed this mistake, as did most others.

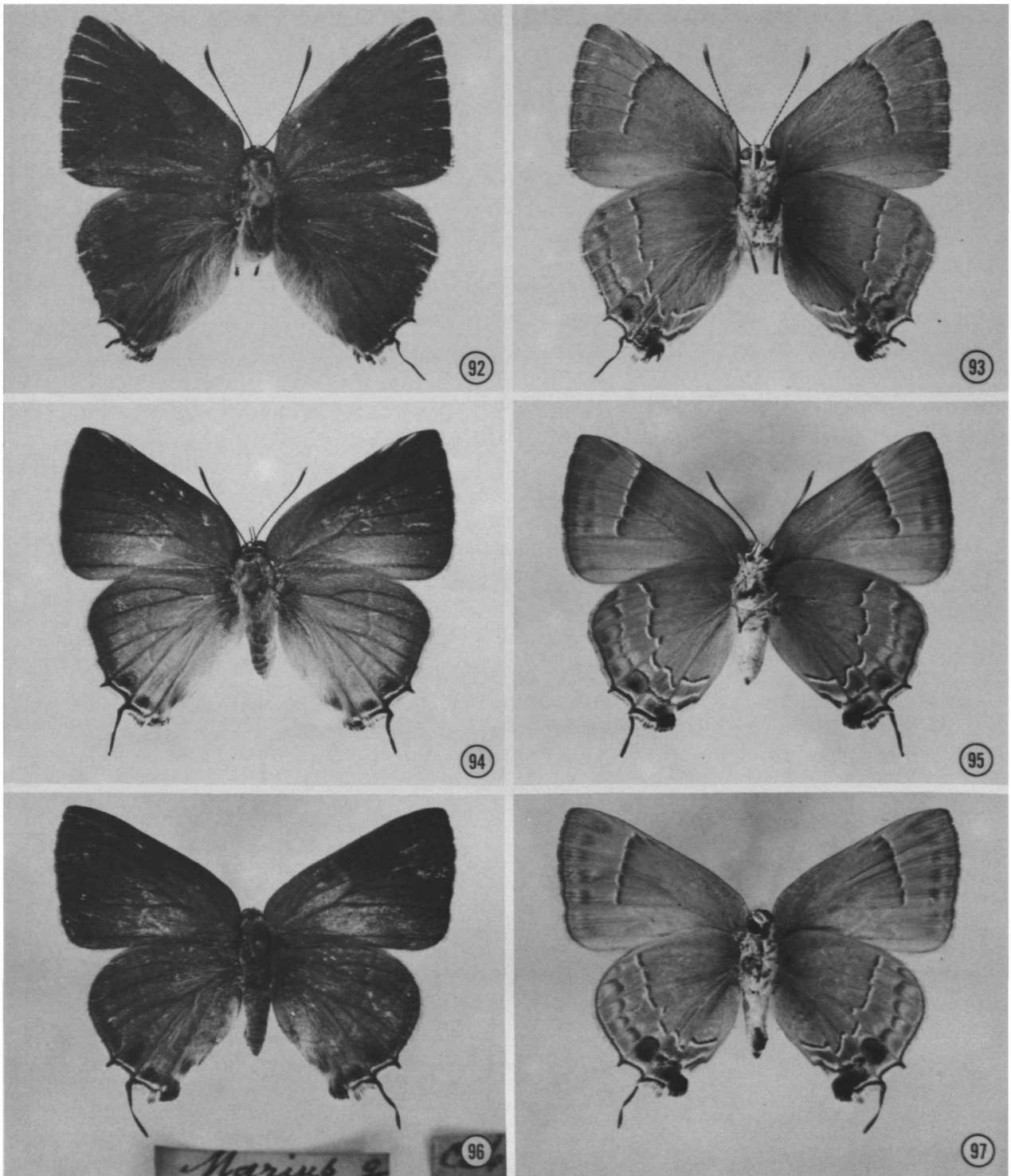
Thecla ericusa Hewitson, 1867: Hewitson (1862–1878) described and figured *Thecla ericusa* from a Brazilian female in the W.W. Saunders Collection. There is one specimen in the BMNH that fits this description, and I designate it lectotype. It had been segregated in the BMNH type collection. The phenotype of Brazilian *R. marius* is distinctive, so these populations can be readily recognized.

Thecla brescia Hewitson, 1868: Hewitson (1868) described and (1862–1878) illustrated *Thecla brescia* from a Mexican male in his collection. There is one male of this species from Mexico in the BMNH, which I designate lectotype. It had been segregated in the BMNH type collection. Hewitson (1862–1878) appropriately noted that "I fear that this is only another variety of *T. Stagira* [sic], a species that has given me a good deal of trouble." Indeed, he named *R. marius* and *R. stagira* nine times between 1867–1874. Godman and Salvin (1887–1901) noted that *R. brescia* males are easily separated from those of *R. stagira*, but they confused the females.

Thecla voconia Hewitson, 1869: Hewitson (1862–1878) described and illustrated the male of *Thecla voconia* from a specimen of unknown locality in his collection. This specimen is exceedingly similar in ventral wing pattern to the type of *T. ericusa*, as Druce (1905) noted. Hewitson must have previously returned the type of *T. ericusa* to Saunders, and forgotten what it looked like. There is one male in the BMNH that fits the original description; I designate it lectotype.

SYNONYMY AND NEW COMBINATIONS.—Because *R. marius* has been an unknown species, the following are new synonyms: *Thecla marius* Lucas = *Thecla spurina* Hewitson = *Thecla ericusa* Hewitson, = *Thecla brescia* Hewitson = *Thecla voconia* Hewitson. Because none of the species has previously been placed in *Rekoa*, their transfer to *Rekoa* creates new combinations.

GEOGRAPHICAL VARIATION.—The ventral wing pattern, particularly the postmedian line, and basal androconial patch of *R. marius* vary geographically. In Central American specimens, the postmedian line is smooth (Figures 93, 95, 97, 99, 102), while in southern Brazil, it is interrupted at the wing veins. The smoothness of the line begins to break down in



FIGURES 92-97.—*Rekoa* wing patterns: 92, dorsal male *R. marius* (Mexico); 93, ventral male *R. marius* (Mexico); 94, dorsal female *R. marius* (Panama); 95, ventral female *R. marius* (Panama); 96, dorsal female holotype of *R. marius*; 97, ventral female holotype of *R. marius*.



FIGURE 98.—Distribution of *R. marius*.

specimens from northern Venezuela and eastern Colombia (Figures 100, 103), becomes more disjointed to the south, and reaches its most disjointed state in Mato Grosso (Brazil) and Paraguay (Figures 101, 104).

Size of the ventral hindwing cubital spot also varies geographically. It is largest in Costa Rica and diminishes slightly in size to the north and south—particularly in males—and by eastern Colombia, it is greatly reduced. There is little further reduction in size from the Amazon to the southern limits of its range.

The presence and extent of the basal androconial patch varies within a locality and geographically. It is present most often in specimens along the eastern Andes from Venezuela to Peru, but within one locality (Villavicencio, Colombia), there is every intergrade from absence to full expression. The basal androconial patch is as well developed in some specimens from eastern Peru as it is in *R. stagara*. Clinal variation in a scent patch has been previously noted in *Parrhasius orgia* Hewitson (Nicolay, 1979).

As a result of geographical variation, particularly in the ventral postmedian line, the ventral wing patterns from Mexico and Brazil differ. I believe that this variation is responsible, at least in part, for the repeated description of this species. Also, males in which the basal androconial patch are developed have often been confused with *R. stagara* in museum collections.

IDENTIFICATION.—Both sexes are distinguished from the closely related *R. stagara* on the ventral hindwing by their pale blue scales in submarginal spot Cu1-2A extending to the margin, while in *R. stagara* this spot usually contains no pale blue scales or only a few at the basal edge. Males of *R. marius* are distinguished from all other *Rekoa* males by their androconia. I give character states to distinguish females of *R. marius* from those of *R. zebina*, the only other species likely to cause confusion, under that species.

GEOGRAPHIC DISTRIBUTION (Figure 98), TEMPORAL DISTRIBUTION, AND ELEVATION.—I detail records from Texas for those North America lepidopterists interested in the fauna north of Mexico.

UNITED STATES: *Texas*: Hidalgo County, McAllen (male on 14 Sep 1972, male on 21 Oct 1971, both on loan to Roy Kendall from Frank D. Fee); Pharr (female on 25 Nov 1945, female on 14 Dec 1935, specimens cited by Freeman (1950b), both on loan to Roy Kendall from CMNH). No further data (male in BMNH).

MEXICO: *Tamaulipas*: Sierra Cucharas (10 Nov), Paso del Abra (??, 2 Jan; 14, 15 Nov), Gomes Farias (500 m, 16 Jul; 14, 24 Dec), Taylor Ranch NW Cd. Mante (5 Jan), Galeana Canyon (??, Sep), Victoria (Aug, Oct), 10 mi W Victoria (5000 ft, 2 Sep). *San Luis Potosi*: Ciudad Valles (20 Jun; 17, 18 Oct), El Platanito (6 Jul), El Salto Falls (17 Jul, Aug). *Hidalgo*: Jacala (Jul), 43.6 mi N Jacala (21 Aug). *Veracruz*: Orizaba (26 Aug), Jalapa, Atoyac, Cordoba, Coatepec (Oct), Catemaco (May–Oct), Presidio (Feb–Apr, Jun, Aug, Sep), Jicaltepec (Aug), Dos Amates (Aug), El Chorreadero (Jul). *Morelos*: 6 mi S Amacuzac (Aug), Yautepec (Sep), Huajintlan (Jul).

Sinaloa: 9 mi N Mazatlan (Aug), 6 mi N Mazatlan, Mazatlan, Venadio (??), Quila (Jul). *Nayarit*: 3 mi N Compostela (780 m, Aug), 3 mi SE Zapata (??, 900 m, Aug). *Jalisco*: Guadalajara (Aug). *Colima*: Colama (Apr), Colima (1600 ft, Aug, Sep), La Salada (??, 1000 ft, Apr, Jun), Coquimatlan (1000 ft, May). *Michoacan*: Apatzingan (1200 ft, 5 Aug). *Guerrero*: Sierra de Guerrero (??, Oct, Nov), Tierra Colorada (2000 ft, Oct), Venta de Zopilote (2800 ft, Oct), Rincon (2800 ft, Sep), Mexcala (Aug), Acahuizotla (Sep), 2 mi N El Treinta (Sep), No further data (Nov, Dec). *Oaxaca*: Chimalapa (Aug, Sep), S. Jose Chiltepec (May), Tehuantepec (Aug). *Campeche*: Yacasay (24 Aug). *Yucatan*: Merida (Aug), Hunucma (23 Jul), Piste (Jul, Aug, Sep), Chichen Itza (Jan, Aug). *Quintana Roo*: Xcan (Sep). *Chiapas*: Sta. Rosa Comitán (Jun, Jul), S. Cristobal de Las Casas (6800 ft, Jul), Cd. Cuantemac (= Ocotlan) (Jan, May), Bombona (Jul), Pichucalco (200 ft, Jul).

GUATEMALA: *Alta Verapaz*: Polochic Valley. *Baja Verapaz*: San Geronimo. *Izabal*: Quirigua (Mar, Jul). *Zacapa*: Zacapa (Aug). *Retalhuleu*: S. Sebastian. *Santa Rosa*: Guazacapan.

EL SALVADOR: *San Salvador*: Ilopango (500 m, Jan). *Santa Ana*: Cerro San Jacinto (800 m, Dec). *San Salvador*: Santa Tecla (900 m, Feb, Jun).

HONDURAS: *Cortes*: San Pedro Sula. *Atlantida*: La Ceiba.

NICARAGUA: *Matagalpa*: 3 mi S Matagalpa (Aug). *Managua*: Within 20 mi of Managua (Jan–Mar, May–Sep, Nov, Dec).

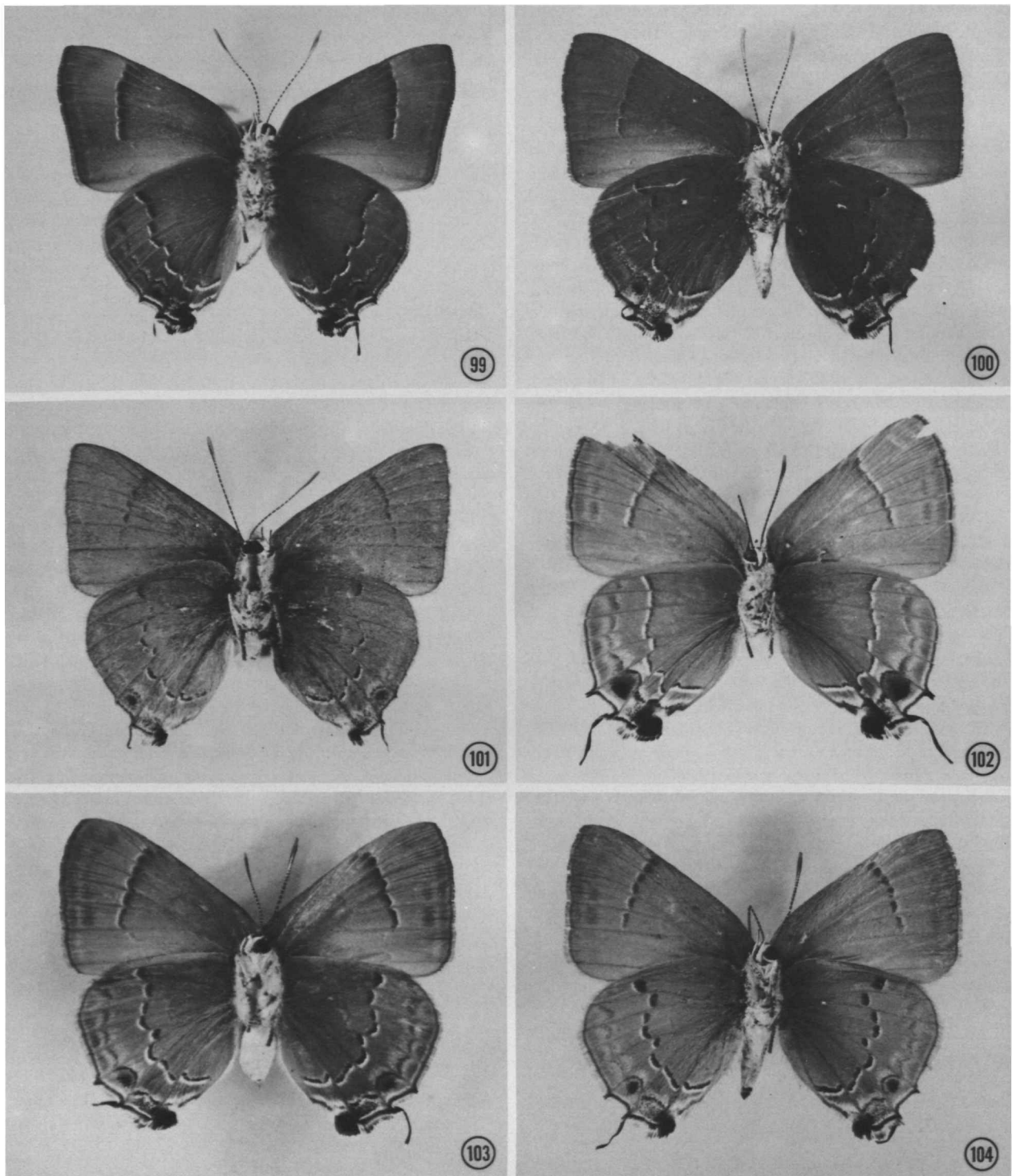
COSTA RICA: *San Jose*: Desamparados (1130 m, 21 Jan), Escazu (Jan), Santa Anna (Apr). *Puntarenas*: Puntarenas (Jun). *Guanacaste*: 5 km NW Canas, Hac. La Pacifica (50 m, 18, 20 Feb; 23 Mar; 16, 17 Apr; 20, 3, 7 May; 2, 3, 10, 15, 16, 25 Jun; 3, 4, 10, 16 Jul; Aug; 10 Sep), 8 km NW Bagaces (100 m, 20, 26, 23, 28 May; 5, 29, 30 Jun; 2, 6, 25 Jul; 22 Sep; 29 Dec), Parque Santa Rosa (Jun as larva), Avangarez (Jul).

PANAMA: *Canal Area* (formerly Canal Zone): Los Rios (3, 4, 11, 27 Feb; 31 Mar; 19 Apr), Miraflores (14–17 May, 7 Jun), Balboa (May), Arraijan Road (28 Feb), La Boca 2 (Feb), Cocoli (14 Apr, 16 Jun), Madden Forest (8, 9 Feb), Paraiso (9, 14, 22, 27 Jun; 3, 4, 9 Jul), Gamboa (Feb, May), Rodman (2, 6, 11 Feb; Mar), Ft. Clayton (Apr), Farfan (25 Dec), Frijoles (8 Apr, as larva), Gatun (11 Nov, as larva). *Veraguas*: Isla Coiba, near Camp El Maria (23 Feb). *Colon*: Pinya (100 m, Apr). *Panama*: Taboga (19 Apr), Cerro Campana (1500 ft, 2000 ft, 500 m, 7, 10, 20, 23, 25 Jan; 1, 3, 6, 9, 10, 16, 18, 23, 24, 27, 29 Feb; 3, 9, 10 Mar; 8, 18, 21, 23, 26 Dec).

TRINIDAD: *St. Andrew*: Manzanilla (Jan, Feb), Oropouche (1–9 Apr). *St. George East*: S. Joseph (1700 ft, Apr), 4 mi E Arima (Jul). *St. George West*: Hololo Mt Rd (15 Aug), Botanical Garden (20 Mar). *St. Patrick*: La Brea, Pitch Lake (20 May). *Caroni*: Piarco (Aug). ??: I.C.T.A. (Feb as larva), St. Augustine, Paradise Mt. (Feb as larva).

TOBAGO: (Jan, Feb; Feb as larva).

VENEZUELA: *Merida*: Merida (3000 m, May). *Carabobo*: Las Quiguas, Esteban Valley (Nov–Mar), Punta Palmita (460 m, 6 Jul, as larvae). *Aragua*: Cagua (24 Jun as larvae), Maracay (10 Nov, as larva), El Limon (450 m, 24 Mar; 22 Apr; 7 May;



FIGURES 99-104.—Geographical variation in ventral wing pattern of *R. marius*: 99, male (Panama); 100, male (Meta, Colombia); 101, male (Minas Gerais, Brazil); 102, female (Mexico); 103, female (Meta, Colombia); 104, female (Rio de Janeiro, Brazil).

19, 30 Sep; 22 Dec), Portachuelo Pass (1100 m, 11 May, 20 Aug). *Distrito Federal*: Naguayata (Aug), Caracas, Parque Sanabria (960 m, Sep), within 10 mi of Caracas (2200 ft, 3600 ft, 4 Apr). *Nueva Esparta* (Margarita): no further data. *Bolivar*: Suapure (22 Jun). This specimen is in the AME and is labelled a co-type of *madie* Weeks. It does not fit Weeks' (1906) description or figure even remotely. The type of *Thecla madie* is in the MCZ, fits the original description, and is unrelated to *Rekoa*. The specimen in the AME has no nomenclatural validity., Cd. Bolivar (Jun), Orinoco-Caicara (Mar).

COLOMBIA: *Amazonas*: Rio Tacana (??, 1-13 Nov). *Tolima*: Melgar (11 Jun), Cunday (30 Jul). *Boyaca*: Villa de Leiva (2100 m, 15 Jun). *Valle*: Palmira, Jimenez, W. Colombia (1600 ft, May). *Meta*: Villavicencio (500 m, 1800 ft, 3 Jul-7 Aug; Aug as larvae). ??: Corebo Taca (2 Oct).

ECUADOR: *Imbabura*: Paramba (3500 ft).

PERU: *Tumbes*: Puesto Campo Verde (700m, May). *Junin*: La Merced (2500 ft, Nov), Rio Colorado (2500 ft, Apr), Chanchumayo (2500-7500 ft), Satipo (Nov). *Loreto*: Cavallo-Cocho (May-Jul), Iquitos (2 Mar). *Huanuco*: vicinity Tingo Maria (Mar, May, Jul, Aug), no further data (Sep-Nov). *Madre de Dios*: Rio Tambopata near Puerto Maldonado (250 m, Aug). ??: R. Marnon, Tipishca (May).

BOLIVIA: *La Paz*: Chulumani (12 Dec), Coroico (May).

PARAGUAY: *Guaira*: Villarica (Jan, Dec). *Central*: Asuncion (Jul-Sep). *Cordillera*: Santisima Trinidad (May-Aug). *Caaguazu*: San Jose. *Boqueron*: Estancia Cooper Alto.

ARGENTINA: *Corrientes*: No further data. *Misiones*: Goa (??).

BRAZIL: *Para*: No further locality data (Nov), Obidos (Sep). *Amazonas*: São Paulo de Olivenca, (number of specimens labelled "Amazon"). *Mato Grosso*: Chapada (??, Sep, Nov), Cuiaba (1000 ft, May), Colegio Buriti Chap. Guimaraes (700 m, 25 May). *Mato Grosso do Sul*: Corumba (Apr), Urucum, 15 mi S of Corumba (650 ft, Apr). *Goiás*: 123 km W Jatai, Mineiros (950 m, 19 May), Serra Dourada (??, 23-26 Apr), Mun. Minicras, km 128 (??, 2 Aug). *Distrito Federal*: Brasilia Country Club (1200 m, 15, 16 May). *Minas Gerais*: near 7 Lagos (= Sete Lagoas, 24 Jul), Belo Horizonte (9 Apr), Sabara-Belo Horizonte, Belo Horizonte-Rio Rd km 442 (10 Apr). *Bahia*: No further data. *Pernambuco*: No further data. *Espirito Santo*: Baixo Guandu (200 m, Mar), Linhares (Feb), Conceicao da Barra (15-30 May, Jun). *Rio de Janeiro*: Rio de Janeiro (May), Rio das Ostras (= Banade São Joao) (Jun, Aug, Oct, Dec), Marica (larva in Jan, larva in Jun), Sacuarema (larva in Mar), Restinga Jacarepagua (May, 4 Jun, 20 Oct), Rio-Teresopolis Hwy., km 27 (3 Jun), Petropolis, Corcovado, Pau da Forma (??, 20-200 m, May), Ilha do Governador (23 Apr), Cabo Frio (Mar). *Parana*: Castro (2900 ft). ??: Rio de Velhao.

MISLABELED.—CUBA: A female in BMNH, type of *Thecla marius* Lucas.

JAMAICA: A female in BMNH.

AMAZON: Three females in BMNH with the Central

American phenotype, including the type of *Thecla spurina* Hewitson.

PERU: A female in AME with Central American phenotype.

All previous records of *R. zebina* and *R. spurina* from southern Texas refer to this species. It is the only "unbanded" *Rekoa* species that occurs in the United States.

The distribution of *R. marius* shows the "paradox" of Amazonian records. A hundred years ago, the Amazon was one of the best collected areas of South America. However, most of these specimens were labelled "Amazon" with no further data. Perhaps because this area was supposedly well collected long ago, modern records with accurate data are uncommon in collections. I have seen only two specimens from the Brazilian states of Para and Amazonas with accurate data. As a result, the distribution of many hairstreak species along the Amazon River is largely unknown.

ECOLOGY AND BEHAVIOR.—Habitat: *Rekoa marius* occurs widely over the neotropical lowlands (except for the west coast of Peru) and mountains up to 3000 m elevation in wet and dry disturbed habitats. The localities where it has been collected follow main roads, railroads, and rivers. Although this bias is partly due to ease of access, I suspect that the disturbance accompanying main thoroughfares is also an important determinant of its distribution. I have collected this species in Mexico, Panama, Venezuela, and Colombia, always in disturbed habitats.

Rekoa marius occurs in wet areas, unlike *R. zebina*, and breeds there as well. Larvae of *R. marius* were collected in Frijoles and Gatun (Panama, Canal Area, see below), and reared to adult. These localities receive more than 250 cm of rain annually (Rand and Rand, 1982).

Dispersal: Specimens of *Rekoa marius*, particularly females, have a modest propensity for dispersal. It is one of the most common hairstreak species being dispersed by dry season trade winds at the Cerro Campana ridge (Robbins and Small, 1981), where 90% of the specimens are females. Females have twice been collected "migrating" through Portachuelo Pass, Venezuela. Additionally, *R. marius* occurs on many continental islands with depauperate faunas, such as Isla Coiba (Panama), Taboga (Panama), Margarita (Venezuela), Trinidad, and Tobago. It is sympatric with its sister species, *R. stagira*.

Larval Foodplants: *Rekoa marius* has been reared many times from plants in a variety of families. Most of the records are published here for the first time. I identified reared butterflies in all cases below except for the record from Costa Lima (1947). Most of the specimens were reared from flowers, usually purple or yellow.

Combretaceae: *Terminalia catappa*. Male. Venezuela: Aragua: Maracay. *Leg. Fernandez Y. Ex. larva*, 10 Nov 1952. Larva on leaf. In IZA with pupal case.

Combretaceae: *Terminalia catappa*. 2 females. Venezuela: Aragua: Cagua. *Leg. V. Mendoza. Ex. larva*, 24 Jun 1963, eclosed 8 Jul 63. Larvae on fruits. In Fusagri Collection in IZA.

Leguminosae: *Bauhinia unguolata*. Female. Costa Rica: Guanacaste: Parque

- Santa Rosa: *Leg. P. DeVries*. Ex. larva, pupated 25 Jun 1978, eclosed 7 Jul 1978. Larva on young leaves. In CMNH.
- Leguminosae: *Canavalia ensiformis*. 2 males, 2 females. Colombia: Meta: Villavicencio. *Leg. Nayiber Ruiz*. Ex. larva, Aug 1985. Reared on leaves. In NMNH.
- Leguminosae: *Cassia occidentalis*. 2 males. Venezuela: Carabobo: Punta Palmita: 460M. *Leg. Fernandez Y.* Ex. larva, 6 Jun 1975, eclosed 23 Jul 1975. In IZA with pupal case.
- Leguminosae: *Cassia* species 1. Male. Brazil: Rio de Janeiro: Marica (Restinga). *Leg. Lima-Carvalho*. Ex. larva, Jun 1985. Larva on floral buds. In NMNH with pupal case.
- Leguminosae: *Cassia* species 2. Female. Brazil: Rio de Janeiro: Sacuarema. *Leg. Lima-Carvalho*. Ex. larva, 3 Mar 86. Larva on floral buds. In NMNH with pupal case.
- Leguminosae: *Dioclea guinensis*. Female. Trinidad: Paradise Mt. *Leg. F.D. Bennett*. Ex. larva, Jan 1955. Larva on flowers. In NMNH with pupal case.
- Leguminosae: *Gliciridia*. 3 males, female. Trinidad: I.C.T.A. *Leg. F.D. Bennett*. Ex. larva, Feb 1955. Larvae on flowers. Two males in CIBC Collection in Trinidad, male and female in NMNH with pupal cases.
- Leguminosae: *Gliciridia*. Female. Tobago. *Leg. F.D. Bennett*. Ex. larva, Feb 1955. Larvae on flowers. In NMNH with pupal cases.
- Malpighiaceae: *Stigmaphyllon lindenianum*. Male. Panama: Canal Area (formerly Canal Zone): Frijoles. *Leg. K. Steiner*. Ex. larva, 8 Apr 1980, pupated 13 Apr, eclosed 21 Apr. Larva on flowers. In NMNH. Published by Robbins and Aiello (1982) under *Thecla ericusa*.
- Malpighiaceae: *Stigmaphyllon lindenianum*. Female. Panama: Canal Area (formerly Canal Zone): Gatun. *Leg. K. Steiner*. Ex. larva, 11 Nov 1977, pupated 19 Nov, eclosed ? Larva on flowers. In NMNH. Published by Robbins and Aiello (1982) under *Thecla ericusa*.
- Malpighiaceae: *Stigmaphyllon* species. Male. Brazil: Rio de Janeiro: Marica (Restinga). *Leg. Lima-Carvalho*. Ex. larva, Jun 1986. Larva on floral buds. In NMNH with pupal case.
- Melastomataceae: *Marcetia taxifolia*. Male. Brazil: Rio de Janeiro: Marica (Restinga). *Leg. Lima-Carvalho*. Ex. larva, Jun 1985. Larva on floral buds. In NMNH with pupal case.
- Ochnaceae: *Ouatea cuspidata*. Male. Brazil: Rio de Janeiro: Marica (Restinga). *Leg. Lima-Carvalho*. Ex. larva, 10 Jan 1986. Larva on flower buds. In NMNH.
- Polygonaceae: *Antigonon leptopus*. Brazil. Larva on flowers. Published by Costa Lima (1947) under the name *Thecla ericusa*. Parasitized by *Tetrastichus* (Eulophidae).
- Verbenaceae: *Lantana camara*. 2 females. Venezuela: Carabobo: Punta Palmita: 460 m. *Leg. Fernandez Y.* Ex. larva, 6 Jul 1975, eclosed 21 Jul 1975: In IZA with pupal case.
- ?? Female. Mexico. Reared from larva in sugarcane stalk intercepted in Nogales, Arizona. In NMNH with pupal case. Very small individual.

Adult Foodplants: Adult *R. marius* take nectar at a variety of flowers. Records in the literature and collections that I examined include *Euphorbia pulcherrima* (Euphorbiaceae) in Texas (Freeman 1950b, as *Strymon zebina*), and for Costa Rica; *Cordia panamensis* (Boraginaceae), *C. inermis*, *C. currasavica*, *C. dentata*, *Trigonia floribunda* (Trigoniaceae), *Croton? reflexifolius* (Euphorbiaceae), *Casearia nitida* (Flacourtiaceae), *C. aculeata*, *Thouinidium decandrum* (Sapindaceae), and *Simarouba glauca* (Simaroubaceae).

Wing Pattern and Predation: Of 48 specimens collected at Villavicencio, Colombia (Robbins, 1981), 3 showed symmetrical wing damage indicative of an unsuccessful predator attack, including one with a "beak" mark from the anal angle across the hindwings and forewings.

Rekoa stagira Hewitson

NOMENCLATURE.—*Thecla stagira* Hewitson, 1867, and *Thecla erenea* Hewitson, 1867: Hewitson (1862–1878) described and illustrated *Thecla stagira* from three males, which he considered varieties of the same species, and simultaneously named the second specimen *Thecla erenea*, a variety of *T. stagira*. The specimens were in the collections of the British Museum (locality not given), H.W. Bates (Santarem, Amazon), and W.C. Hewitson (Rio de Janeiro). Godman and Salvin (1887–1901) and Druce (1905) were unable to locate the type specimens.

The nomenclature of *Thecla stagira* and *T. erenea* is a mess. Hewitson badly confused this species with phenotypically similar species, and admitted that *T. stagira* gave him trouble. Godman and Salvin (1887–1901) and Druce (1905) noted that Hewitson put *T. stagira* labels on specimens of other species. Hewitson described this species five times in seven years.

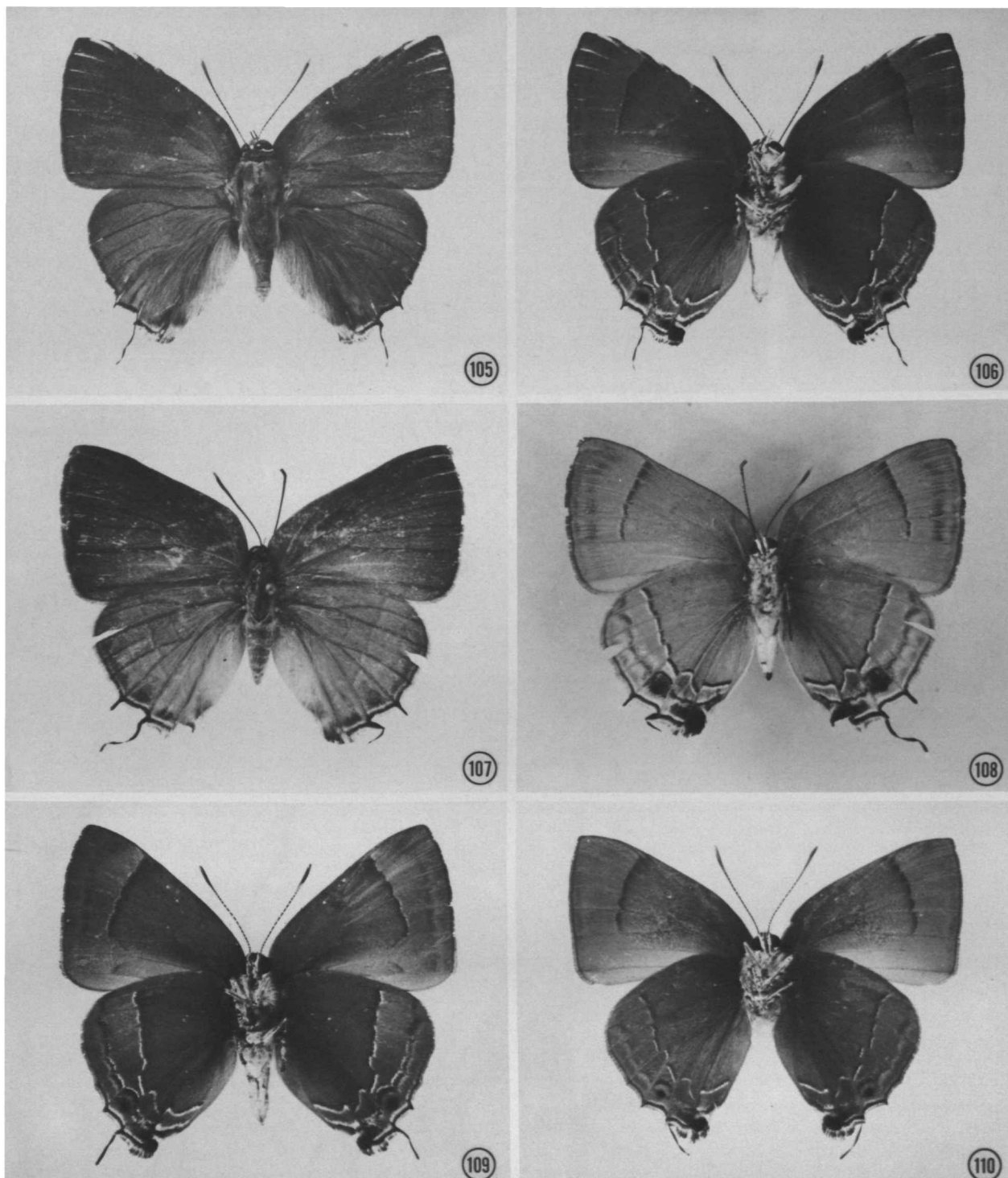
A male labelled "Santarem" was segregated in the BMNH type collection as the type of *T. stagira*. This specimen fits Hewitson's original figures of the first two type specimens, and I designate it lectotype of both *T. stagira* and *T. erenea*. I also accord priority to *T. stagira* over *T. erenea* because previous synonymies are unclear on this point. Hopefully, these actions will end nomenclatural confusion and promote stability.

Godman and Salvin (1887–1901) noted that the third type above is a different species from the other two. The illustration of this specimen is a good representation of *Thecla falerina*, a species that (1) Hewitson named in 1867 from the Amazon, (2) that does not belong in the *Thereus* Section of the Eumaeini, and (3) that does not occur in Rio de Janeiro, so far as I am aware. I (Robbins, 1987) listed its closest relatives. This species has not been associated with *T. stagira*, and my action above will prevent that from happening.

Thecla timaea Hewitson, 1869: Hewitson (1862–1878) described and illustrated *Thecla timaea* from a female in the collection of H.W. Bates from Para, Amazon. There is a specimen from Bates' Collection that is so labelled and that fits the original figure. This specimen had been segregated in the BMNH type collection as the type of *T. timaea*, and I designate it lectotype. Kirby (1871) made it a secondary homonym of *Pseudolycaena timaeus* Felder and Felder, a valid action. Thus, *T. timaea* is a homonym of *T. timaeus* and cannot be used.

Thecla volana Hewitson, 1869: Hewitson (1862–1878) described *Thecla volana* from a female in the collection of W.W. Saunders from the Amazon. An Amazonian female that was in the Saunders Collection and then the Grose Smith Collection before being transferred to the BMNH is labelled the type of *T. volana*. It fits the original figure and was segregated in the BMNH type collection. I designate it lectotype of *T. volana*.

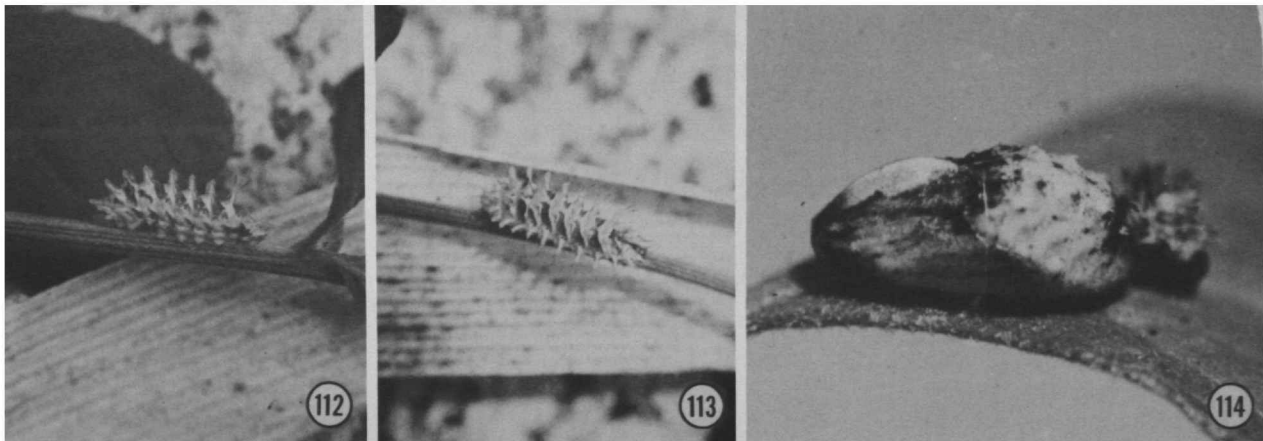
Thecla lydia Kirby, 1871: Kirby (1871) proposed *Thecla*



FIGURES 105-110.—Wing pattern of *R. stagira*: 105, dorsal male (Panama); 106, ventral male (Panama); 107, dorsal female (French Guiana); 108, ventral female (French Guiana); 109, ventral male (Nicaragua); 110, ventral male (Rio de Janeiro, Brazil).



FIGURE 111.—Distribution of *R. stagra*.



FIGURES 112–114.—Immatures of *R. palegon* from Trinidad (courtesy of M.J.W. Cock): 112, larva in lateral aspect; 113, larva in dorsal aspect; 114, pupa in lateral aspect.

lydia as a substitute name for the secondary homonym *Thecla timaea* Hewitson. Its type is the lectotype of *T. timaea*.

Thecla thoana Hewitson, 1874: Hewitson (1862–1878) described and illustrated this species from a Nicaraguan female in his collection. There is one Nicaraguan female in the BMNH that fits the original figure, and I designate it lectotype of *T. thoana*. It had been segregated in the BMNH type collection as the type of *T. thoana*.

Thecla carioca Ebert, 1965: Ebert (1965) described *T. carioca* as a subspecies of *T. spurina*. He designated a male holotype from Brazil, Guanabara (now Rio de Janeiro), Pao de Acucar. It is deposited in Curitiba, Brazil.

SYNONYMS AND NEW COMBINATIONS.—Hewitson (1862–1878) made *Thecla erenea* a synonym of *T. stagira*. Druce (1905) considered *T. stagira*, *T. volana*, and *T. timaea* synonyms of *T. spurina*. Draudt (1919–1920) followed Druce's synonymy, but added *T. lydia* to the list and made *T. erenea* an "insignificant form" of *T. spurina*. He also synonymized *T. thoana* to *T. brescia*. *Thecla spurina* and *T. brescia* belong to the synonymy of *T. marius*. The placement of *T. stagira* and its synonyms in *Rekoa* is a new combination for each.

GEOGRAPHICAL VARIATION.—The ventral wing pattern of *R. stagira* varies over its range. The major variable element is the ground color distal of the postmedian line. Specimens from Mexico to Nicaragua have lighter ground color distal of the postmedian line than basal to it, giving specimens a "two-tone" appearance (Figure 109). In Panama, the contrast in ground color between the distal and basal parts is less in the majority of specimens than it is further north (Figure 106), and some specimens show no difference in color. Specimens from Venezuela, Trinidad, and the Guianas show little, if any difference between the basal and distal ground color (Figure 108), while those from south of the Amazon Basin show no difference (Figure 110). As a result of this coloration,

specimens from northern Central America look different from Brazilian specimens, and it is undoubtedly the reason that *R. thoana* had not been associated with *R. stagira*.

IDENTIFICATION.—*Rekoa stagira* is most often confused with its close relative *R. marius*. The lack of pale blue scales in the ventral hindwing submarginal spot, as noted in the Key, differentiates *R. stagira* from the other unbanded *Rekoa* species. Those few specimens of *R. stagira* with pale blue scales in the spot have them restricted to the basal part of the spot.

GEOGRAPHIC DISTRIBUTION (Figure 111), TEMPORAL DISTRIBUTION, AND ELEVATION.—MEXICO: *Tamaulipas*: Gomes Farias (280–700 m, Jan). *San Luis Potosí*: Valles (26 Jun, Jul, Oct), Paltila (Dec). *Veracruz*: Jicaltepec (Mar), Presidio (Jan, Mar, May–Jul, Sep, Oct), Feronapa (??, Jun). *Colima*: Colima (1600 ft, Mar). *Oaxaca*: S. Jose Chiltepec (May). *Tabasco*: 2–8 mi E La Venta (Jan). *Guerrero*: Acahuizotla (Oct), Dos Arroyos (1000 ft, Sep). *Chiapas*: Comitán–Sta. Rosa (Mar, Jun).

GUATEMALA: *Peten*: Tikal (200 m, May). *Alta Verapaz*: Polochic Valley. *Izabal*: Quirigua (Sep, Nov), Cayuga (Aug).

EL SALVADOR: *La Libertad*: La Libertad (Jan, Feb).

HONDURAS: *Cortes*: San Pedro Sula.

NICARAGUA: *Managua*: Pochomil (Jan, Jul), Within 20 km of Managua (Feb–Apr; 19, 29 May; Jul; 15–23 Aug; 15 Sep). *Magalpa*: Cd. Dario (Jul). *Madriz*: Somoto (2000 ft, Sep).

COSTA RICA: *Limon*: Guapiles (May). *Heredia*: La Selva (found as larva 18 Apr).

PANAMA: *Chiriquí*: Bugaba. *Canal Area* (formerly Canal Zone): Los Rios (9, 24, 29 Jan; 3, 7, 21 Feb; 13, 30, 31 Mar; 2 Feb), Paraiso (30 Jan; 22, 24 Apr; 3 Jun; 9 Jul), Cocoli (13, 26 Jun), La Pita (10 Jun), Rodman (4 Feb), Madden Forest (8, 25 Feb; 4 Mar), Madden Dam (18, 25 Apr), La Boca (21–23, 25 Jan; 2 Feb), Chiva-Chiva Rd., near Paraiso (23 Jul), Gamboa

(10, 17 May; 4 Sep; 16 Dec), Gatun (18, 24 Apr; May; 8 Jun), Barro Colorado Island (14 Mar; 29 May; 29 Nov). *Colon*: Pina (200 m, Mar). *Panama*: Bayano (8 Feb), Cordillera de San Blas, N of El Llano (330 m, 1 Jan).

FRENCH GUIANA: *Guyane*: Cayenne (Mar, Dec), St Jean du Maroni (Jul), Nouveau Chantier.

SURINAM: *Paramaribo*: Paramaribo (Oct–Nov), no further locality data (Nov). *Saramacca*: Saramacca River. Afobaka (??, 7–12 Jan).

GUYANA: *East Berbice-Courentyne*: no further data. Maroni (a mistake; either French Guiana or Surinam).

TRINIDAD: *St. Patrick*: Pitch Lake (17 Apr). *St. George East*: Tacarigua (Nov), 4 mi E Arima (Jul). ??: Balaba Hill (??, Mar), no further data (Aug).

VENEZUELA: *Merida*: no further data. *Zulia*: Mision El Rosario (50 m, 12/13 Jan). *Carabobo*: Las Quiguas, Esteban Valley. *Bolivar*: Suapure (Jan). *Delta Amacuro*: Rio Acure.

COLOMBIA: *Valle*: Cali (3260 ft, 6, 20 Feb), Canas Gordas–Cali (1000 m, Sep, Nov). *Antioquia*: Casabe (across R. Magdalena from Barrancabermeja, 21 Jan; 28 Mar; 20 Apr; Nov). *Meta*: Villavicencio (500 m, 1800 ft, 3, 5, 6, 12, 16, 18, 19 Jul; 1 Aug). *Cesar*: Manaure. ??: Env. Bogota.

ECUADOR: *Pichincha*: Tinalandia (700 m, 26 May; 28 Aug). *El Oro*: No further locality data (Jun).

PERU: *Junin*: Satipo (Oct). *Madre de Dios*: Puerto Maldonado (290 m, 15 Oct).

BOLIVIA: *Santa Cruz*: Las Juntas, Sta. Cruz de la Sierra (450 m).

PARAGUAY: *Central*: Asuncion (Jul–Sep). *Cordillera*: Santisima Trinidad (Aug). *Paraguari*: Sapucay. ??: S. Paraguay, no further data (Mar).

ARGENTINA: *Misiones*: Goa (??).

BRAZIL: *Para*: No further data (female reared by A.M. Moss), Belem (12 Jan), Igarape-Acu (Jan, Feb, Dec), Santarem, Obidos (Aug), Tapajos. *Amazonas*: Igaribe (??), Tonantins, San Juan–Solimoes (??), Manaus, Tefe. *Ceara*: No further data (Aug). *Mato Grosso*: Chapada Campo (??), Colegio Buriti–Chapada Guimaraes (700 m, 25 May). *Minas Gerais*: Cabeceira do Corrego Leitao, 8 km from Belo Horizonte–Brasilia Hy on rd. to Curvelo (Apr). *Espirito Santo*: Conceicao da Barra (Jun), Linhares (Apr, May, Aug). *Rio de Janeiro*: Pao de Acucar (150 m, 5 Jul), Santa Teresa (100 m, 2 Apr), Restinga da Tijuca; the previous three localities from Ebert (1965). I believe that they are within the city of Rio de Janeiro, but cannot find them on maps. *Sao Paulo*: Mendes (??), There is one in Rio de Janeiro, Sorhuini (??), Araras (30 May). *Parana*: Londrina (4 Jun). *Santa Catarina*: Joinville (10–200 m, 22, 23 Apr), Massaranduba–Blumenau.

ECOLOGY AND BEHAVIOR.—Habitat: *Rekoa stagira* occurs throughout the wet and dry neotropical lowlands (except for western Peru) from Tamaulipas, Mexico, to Santa Catarina, Brazil, but differs ecologically from the other widespread *Rekoa* species. It is found in both disturbed and relatively

undisturbed habitats up to 1100 m elevation, whereas *R. marius* and *R. zebina* are more restricted to disturbed habitats, but at a wider range of elevations. *Rekoa stagira* has been reared at La Selva, Costa Rica—an area that receives more than 300 cm annual precipitation (Coen, 1983; Hartshorn, 1983), whereas *R. zebina* rarely occurs in areas with more than 250 cm annual precipitation. As a rough measure of rarity, I have not seen more than three specimens of *R. stagira* in a day in contrast to the more common *R. marius* and *R. palegon*.

Dispersal: *Rekoa stagira* does not seem to be very dispersive; it has not been collected at wind dispersal sites in Panama (Robbins and Small, 1981) or Venezuela (Robbins, unpublished), and with the exception of Trinidad, is unknown on continental islands.

Larval Foodplants: *Rekoa stagira* has been reared three times. I identified the specimens except the record in D'Araujo e Silva et al. (1967–1968).

Malpighiaceae: vine with yellow flowers. Male. Costa Rica: Heredia Province: La Selva. Leg. P. DeVries. Ex. larva, 18 Apr 1972, pupated 22 Apr 1972, eclosed 1 May 1972. Larva feeding on young leaves. In NMNH with pupal case.

Leguminosae. Brazil: Rio de Janeiro: Campos. Observation of Aristoteles Silva. Published in D'Araujo e Silva et al. (1967–1968) under the name *Thecla spurina*.

Brazil: Para. Female. Leg. A.M. Moss. No foodplant mentioned on specimen or in Moss' notes in the BMNH library. In BMNH with pupal case.

Adult Foodplants: The only nectar feeding record for *R. stagira* is on *Hamelia* flowers (Rubiaceae) in Panama.

Territoriality and Pheromones: Males of *R. stagira* set up mating territories on hilltops from 1230–1400 h, unlike *R. marius* and *R. palegon*, which do not set up mating territories on hilltops. I barely perceived a faint unrecognizable odor in males from Panama. The following records of territorial behavior are my observations in Panama's Canal Area (formerly Canal Zone). Specimens are deposited in the NMNH Collection.

Two males. Top of unnamed hill in Gamboa. 10 May 1979. 1400 h. Perching height 1–2 m.

Male. Top of unnamed hill in Gamboa. 17 May 1979. 1330 h. Perching height 4 m.

Male. Top of Cerro Pelado in Gamboa. 4 Sep 1979. 1320 h.

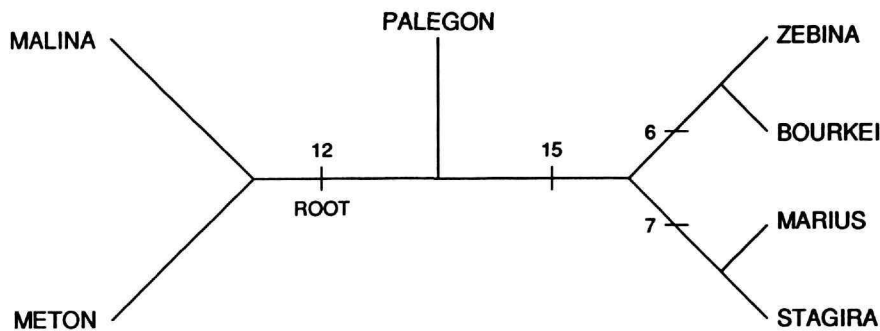
Male. Top of Cerro Pelado in Gamboa. 16 Dec 1979. 1230 h.

Male. Top of unnamed hill in Paraiso. 30 Jan 1980. 1400 h.

Wing Pattern and Predation: Of 6 specimens collected at Villavicencio, Colombia (Robbins, 1981), none showed symmetrical wing damage indicative of an unsuccessful predator attack to the hindwing anal angle.

Phylogenetic Analysis

The database for the phylogenetic analysis is the character matrix (Table 1), which contains 47 characters, 116 character



115

FIGURE 115.—Most parsimonious network to *Rekoa* species, (consistency index = 0.885). Numbers on network indicate number of characters that evolved at that point.

states, seven species, and outgroup data. There are 15 multistate characters. I used Swofford's PAUP version 2.4 software for phylogenetic analysis on PC-compatible computers for most of the analysis.

The most parsimonious network for *Rekoa* using the Branch and Bound option (Figure 115) contains 78 steps, and has a consistency index of 0.885. Seven characters are homoplastic, five (3, 15, 32, 41, 44) requiring one extra step and two (33, 43) requiring two extra steps. Running the qualitative multistate characters (12, 29, 40) with the Unordered option did not change the network because these characters are not homoplastic.

The most parsimonious 78-step network is well supported. In the PAUP run, the node for the group *R. meton* and *R. malina* is supported by 12 character state changes; that for *R. meton*, *R. malina*, and *R. palegon* by 15 changes; that for *R. zebina* and *R. bourkei* by 6 changes; and that for *R. marius* and *R. stagira* by 7 changes (Figure 115). Because a number of characters can be placed on the tree in different, but equally parsimonious ways, there is no unique number of changes supporting each node. However, the large number of character changes supporting each node coupled with a high consistency index is an indication that the network is a well-supported phylogenetic hypothesis. Further, the second shortest network (calculated using the Bsave option) requires 5 extra steps. The significance of the strong support for the 78-step tree is that I can confidently use it to test evolutionary hypotheses and to construct a classification.

Because quantitative characters have rarely been used in lycaenid phylogeny, I compare them with qualitative ones. Twenty two characters are quantitative measures of antennae, androconia, male genitalia, and female genitalia. The most parsimonious network for the quantitative characters is the same as the one for the entire data set, and has a consistency

index of 0.848. The consistency and informativeness of the quantitative measures of antennae, labial palps, and androconia suggest that these characters should be used far more extensively by lepidopterists. The most inconsistent quantitative characters are genital measurements (characters 32, 33, and 43 are homoplastic), which appear to change "quickly" over evolutionary time. They are thus good specific distinguishing structures, but not particularly good phylogenetic ones.

The 25 qualitative characters are primarily wing-pattern characters. The most parsimonious network for the qualitative characters is the same as the one for the entire data set, and has a consistency index of 0.938. Because change in the majority of qualitative wing-pattern characters occurred between the banded and unbanded species, I suspect that many of these changes are not independent.

The root of the most parsimonious network (Figure 115) is between the immediate ancestor of *R. meton* and *R. malina* and that of *R. palegon* (Figure 116). The distance between the outgroups and the root is 0 steps, and is the only root location that is 0 steps. The lineage on the right side of the cladogram evolved (point C, Figure 116) a ventral, sclerotized, anterior pointing pouch between the female sixth and seventh abdominal segments (character 31) that does not occur in *Thereus* or *Arawacus*. The lineage on the left side of the cladogram evolved (point A) a ventral hindwing postmedian band in cell Sc+R1-Rs displaced so that it is basal to the end of the discal cell (character 29). This displaced spot does not occur in the outgroup genera. Thus, rooting the network beyond points C or A would require at least one change in characters 31 or 29. Although I would prefer to have more information than these two characters for rooting the network, it will probably not be possible to do better until *Thereus* and *Arawacus* are revised.

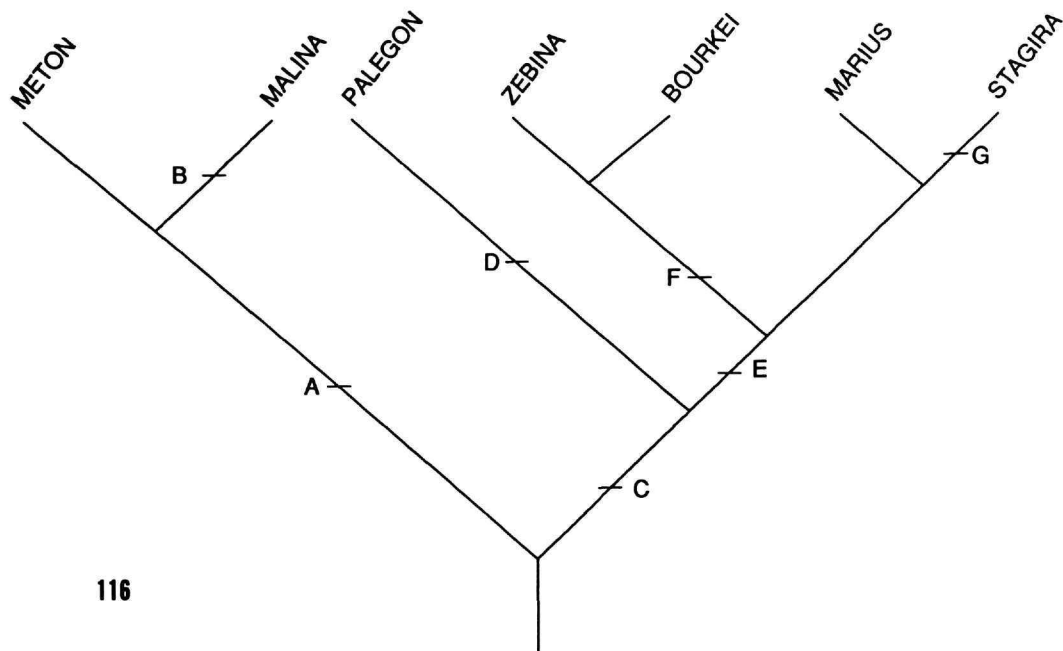


FIGURE 116.—Most parsimonious tree of phylogenetic relations among *Rekoa* species. Letters designate ancestral taxa (referred to in text).

Evolution

In this section, I discuss *Rekoa* evolution by superimposing biological traits on the cladogram to the species (Figure 116) (Coddington, 1988). Using parsimony to determine the character states of ancestors at the nodes of the cladogram, I estimated those points where each trait evolved.

HABITAT.—Most *Rekoa* species are elevation generalists, occurring from sea level to at least 2000 m. There are two exceptions. *Rekoa stagira* occurs only rarely above 1100 m elevation (lowland specialist), while *R. malina* does not occur in the tropical lowlands (upland/temperate climate specialist). In both cases, habitat specialization evolved from the more general condition (at points G and B, respectively, on the cladogram, Figure 116).

Most *Rekoa* species are also rainfall generalists, occurring in both dry and wet habitats. The exceptions are *R. zebina* and *R. bourkei*, which are usually restricted to habitats with less than 250 cm annual precipitation. The specialization evidently evolved from the general condition once (designated F, Figure 116).

These instances of elevation and rainfall habitat specialization are noteworthy because in each case, the distribution of the specialist lineage overlaps that of the generalist sister clade. For example, although *R. stagira* is a lowland specialist, its sister species, *R. marius*, is sympatric with it in the lowlands. There is no evidence that habitat specialization affected speciation or coexistence.

DISPERSAL.—Available evidence indicates that the widespread *Rekoa* species (*R. meton*, *R. palegon*, *R. marius*, and *R. stagira*) have a marked propensity for dispersal. Each is sympatric with its sister clade, occurs on offshore islands where it is undifferentiated, and has been found at wind-mediated dispersal sites (except *R. stagira*).

BIOGEOGRAPHIC PATTERNS.—Although a majority of *Rekoa* species are distributed throughout the Neotropics, there are several distribution patterns within the genus that are repeated in other hairstreaks or animals.

The distribution of *R. zebina*—from Mexico and Guatemala south, primarily along the Pacific side of Central America, to Guanacaste Province, Costa Rica (Figure 91)—mirrors that of many animals, such as terrestrial vertebrates, birds in particular, and hawk moths that are also restricted to seasonally dry habitats (Slud, 1964; Mueller, 1973; Schreiber, 1978). Other hairstreaks with a similar distribution include *Ministrymon clytie* Edwards, *Cyanophrys miserabilis* Clench, *C. goodsoni* Clench, *Strymon bebrycia* Hewitson, *S. cestri* Reakirt, *S. alea* Godman and Salvin, a new species of *Brangas*, *Arawacus sito* Boisduval, and a new species near "*Thecla*" *hesperitis* Butler and Druce.

Rekoa meton and *R. malina* represent another distribution pattern among hairstreaks. *Rekoa meton* occurs from Mexico to southern Brazil (Figure 70), primarily in the lowlands. *Rekoa malina*, its sister species, is restricted to Brazil's central planalto, coastal mountains, and temperate areas to the south (Figure 83). Other presumed sister-species pairs among the

hairstreaks with a similar distribution pattern are *Arcas imperialis* Cramer and *A. ducalis* Westwood, "*Thecla*" *rustan* Stoll and "*T.*" *polama* Schaus, *Theritas mavors* Hübner-*T. triquetra* Hewitson and *T. drucei* Lathy, "*Thecla*" *ligurina* Hewitson and "*T.*" species near *ligurina*, and *Contrafacia imma* Prittwitz and *C. muattina* Schaus. This pattern can be tested by determining whether these pairs are sister taxa. Further, I believe that other examples will be found as more eumacine genera are revised.

Although the biogeographic history responsible for the *R. meton*-*R. malina* distribution pattern is unknown, I suggest that these pairs speciated in the southern neotropics and that the widespread species, in this case *R. meton*, then spread northward. The evidence is as follows: There are two geographically variable wing pattern characters in *R. meton*. First, the ventral hindwing basal line is present in the southern part of its range, vestigial in central and northern South America, and absent in Central America. Because *R. malina* and *R. palegon* both have the ventral hindwing basal line, its loss in the northern half of the neotropics is a derived character state. Second, female dorsal ground color in *R. meton* is blue in southern Brazil, blue-tinted in Paraguay and central Brazil, and white everywhere else. The blue character state also occurs in *R. malina*, once again indicating that the northern populations of *R. meton* are derived from the southern ones. In general, these hypotheses can be tested when the widespread species is geographically variable (or composed of two or more parapatric species).

LARVAL FOODPLANTS AND MORPHOLOGY.—Larval foodplant data and morphology are recorded for four of the seven *Rekoa* species. *Rekoa marius* feeds on the flowers, fruits, and sometimes leaves of plants in seven families, but the Leguminosae and Malpighiaceae account for a majority (65%) of the records. *Rekoa stagira* and *R. zebina* are also recorded from these families, and this foodplant specificity probably evolved at cladogram point E (Figure 116). *Rekoa palegon*, on the other hand, eats plants in five families, but most of the records (65%) are Compositae. *Rekoa marius* is not recorded from Compositae, while *R. palegon* apparently does not eat Leguminosae or Malpighiaceae. Further, the unique spiny green larva of *R. palegon* is different from the unspined larvae of the other species (and other eumacines), and apparently evolved at point D (Figure 116). The hypothesis that sympatric eumacine larvae partition resources is falsified by the similarity in foodplants between *R. marius* and *R. stagira* and between these two species and *R. zebina*, whereas the differences between *R. palegon* and the others is consistent with it.

COURTSHIP BEHAVIOR.—There is little recorded information on *Rekoa* courtship behavior. Male territorial behavior is known only for *R. stagira*, but negative evidence indicates that its behavior is unique in the genus, and probably evolved at point G on the cladogram (Figure 116). This indicates that changes in courtship behavior might allow sister species to co-exist, as has been suggested in riodinid butterflies

(Callaghan, 1983).

WING PATTERN AND PREDATION.—I (Robbins, 1981) placed *R. meton* and *R. palegon*—the banded species—in rank 2 (good false head wing patterns), and *R. marius* and *R. stagira*—the unbanded species—in rank 3 (average wing patterns). However, *R. palegon* is attacked at a rate equivalent to the unbanded species (less than 7% of specimens with predator inflicted hindwing damage), while *R. meton* is attacked almost four times as frequently (24%). Because *R. malina* has virtually the same ventral wing pattern as sympatric populations of *R. meton*, I infer that at point A on the cladogram (Figure 116), an effective "false head" wing pattern evolved. The wing pattern of *R. palegon* is evidently more cryptic than directive, contrary to my earlier assumption. The *R. palegon* wing pattern also appears to be the primitive one in *Rekoa*, and is very similar to that of *Thereus pseudarcula* and of some *Arawacus*, such as *A. ellida* Hewitson. The marked change from the banded wing pattern to the unbanded one occurred at point E on the cladogram (Figure 116), but there is no evidence that this change affected predator attacks, as there is for the change at point A.

The striking ventral wing pattern of *R. meton* (Figure 65) is unlike that of other eumacines except *R. malina*. Particularly noteworthy is the eyespot at the base of hindwing cell Sc+R1-Rs. Eyespots or similar markings at the base of this hindwing cell have evolved repeatedly among the eumacines (Robbins, unpublished). It is currently unclear whether these eyespots influence predator attacks. However, I hypothesize that in each case, the eyespot evolved from a piece of the postmedian line in cell Sc+R1-Rs that was displaced basally. Indeed, there is no postmedian line segment in this cell in *Rekoa meton*. Further, the intermediate stages in the displacement process are reasonably clear (*R. palegon*, *R. malina*, see discussion in the Morphology Section). If this hypothesis is correct, then it should shed some light on the "rules" of wing pattern development in eumacines.

EVOLUTION OF SPECIES DIVERSITY.—Perhaps the most notable characteristic of *Rekoa* evolution is that ecological or behavioral differences evolved in at least one daughter species after almost every speciation event. At point A (Figure 116), an effective "false head" wing pattern that misdirects predator attacks evolved. At point B (Figure 116), the ancestor of *R. malina* became a habitat specialist in upland/subtropical climates. At point D (Figure 116), a spiny larva that feeds on composites evolved. At point F (Figure 116), the ancestor of *R. zebina* and *R. bourkei* became restricted to xeric habitats with a marked dry season. At point G, the ancestor of *R. stagira* evolved a mating system in which males set up territories on hilltops in the afternoon, and became a tropical lowland habitat specialist.

With only seven *Rekoa* species, it is not possible to say much about correlates of relative rates of increase in species diversity. However, outgroup genera *Thereus* and *Arawacus* have 27 and 19 species, respectively, so that a comparison of

ecological factors in these genera may give insight into the correlates of variable increases in species diversity. Two factors are immediately evident. Although four of the seven *Rekoa* species are widespread from the Tropic of Cancer to the Tropic of Capricorn, only two *Thereus* and no *Arawacus* species have

such a widespread distribution. Further, *Arawacus* larvae are restricted to feeding on the leaves of Solanaceae, in contrast to the usual flower feeding polyphagy among the Eumaeini. Evolution in these genera should be a revealing contrast to *Rekoa*.

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