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The Geometridae (Lepidoptera) of the Galapagos Islands¹

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ABSTRACT

The moths of the family Geometridae are represented in the Galapagos Islands by a relatively small number of species; only three were recorded in the literature prior to 1970. The number now stands at 13, with one of these being an unidentified species. Of the remaining 12, nine are endemic to the archipelago; the other three are common, wide-ranging species that occur throughout most of the New World.

It is postulated that most of the geometrid moths were carried to the islands by winds; a few may have been introduced by man.

Descriptions and keys for the adults, and male and female genitalia are given for the identified species; they are also illustrated. Brief early stage notes and food plant records are given when known. *Perizoma* (?) *perryi* and *Semiothisa cruciata isabelae* are described as new.

INTRODUCTION

The moths of the family Geometridae from the Galapagos Islands are relatively few in number and poorly known. The earliest record with which I am familiar is "one specimen of a Geometrid larva collected on Chatham Island" (Howard, 1889-1890, p. 196). Warren described two endemic species in 1904 and 1905. Schaus, in 1923, was the first person to attempt

¹ Contribution number 144 of the Charles Darwin Foundation for the Galapagos Isles.

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an inclusive listing of the members of this family, and he included three species. It was almost 50 years until the next papers appeared; Herbulot, in 1970 and 1971, brought the total number of geometrids to 10, as he described six new species or subspecies, and added one previously described to the fauna. The present paper summarizes all the above information, plus adding two species and one subspecies to this insular group.

Thirteen species of Geometridae are known to occur in the Galapagos Islands; one is represented by a single female in poor condition; it has not been classified beyond placing it to subfamily. Of the 12 other species, all but three are endemic to the archipelago. These three are common, wide-ranging species that occur throughout most of the New World. All the endemics, with two exceptions, are known to occur on at least two of the islands; most are to be found on many of the islands.

One can only speculate on the reason(s) why so large and widespread a family as the Geometridae are represented in the Galapagos by so relatively few species. This family is one of the largest to be found in the New World. The species range in size from very small to large, as the lengths of the forewings are from less than 4 mm. to about 50 mm.; some females are apterous, but not one of these is known from the archipelago. Many of the species are weak fliers, particularly the smaller ones; one species of *Cyclophora* and two of *Eupithecia* are represented on the islands, and they undoubtedly fall into this category. Other species are known to be relatively strong fliers; the three species known also to occur on the mainland probably belong among the strong fliers, and could represent rather recent arrivals on the islands. It is believed probable that most of the species of geometrids were blown out to the islands from the mainland, and that this has happened on several occasions. The earliest arrivals that survived were those that probably became endemic to the islands. It is quite possible that numbers of other species were blown to the archipelago but did not survive.

Rafting is often considered to be a means of settling islands. The Galapagos Islands are between 500 and 600 miles away from the nearest portion of South or Central America. It is thought unlikely that rafting played a role in populating the islands with geometrid moths, as their life histories would undoubtedly be too short for them to survive so long a trip. In addition, it is possible that man may have accidentally introduced one or more species to the islands.

One interesting coincidence is the occurrence of two endemic species of *Thyriniteina* in the Galapagos Islands, plus another pair of endemic species of the genus *Holochroa* Hulst on the Tres Marias Islands off the west coast of Mexico. In 1961 I revised the Nacophorini, which includes both of these closely related genera. At that time no species in either genus was known

to occur anywhere except on the mainland; *Thyriniteina* was known to extend from southern South America to southern Texas, and *Holochroa* from the southwestern United States to west central Mexico (Rindge, 1961). Since then Herbulot (*op. cit.*) has described *Thyriniteina infans* and *umbrosa*; and I have named the two species of *Holochroa* (Rindge, 1970).

The Spanish names for the various islands have been used throughout the paper. The following is a list of those names, with their English equivalents:

<i>Spanish</i>	<i>English</i>
Balra	South Seymour
Española	Hood
Fernandina	Narborough
Floreana	Charles
—	Gardner-near-Charles
—	Gardner-near-Hood
Genovesa	Tower
Isabela	Albemarle
Pinta	Abingdon
Pinzón	Duncan
Rábida	Jervis
San Cristóbal	Chatham
San Salvador (Santiago)	James
Santa Cruz	Indefatigable
Santa Fe	Barrington

MATERIALS AND METHODS

One of the difficulties encountered during the preparation of the present paper was the paucity of specimens. Several major institutions, some having other Galapagos Lepidoptera, either did not have any geometrids at all, or so few specimens that it was not worthwhile trying to locate them. I received negative responses to my inquiries on this subject from the authorities at the Canadian National Collection, Ottawa; the Carnegie Museum, Pittsburgh; the Los Angeles County Museum of Natural History; Lyman Entomological Museum, MacDonald campus of McGill University, Ste. Anne de Bellevue, Quebec; the Museum of Comparative Zoology, Harvard University, Cambridge; National Museum of Natural History, Smithsonian Institution; and the University of California, Davis. No geometrids were collected by the Allan Hancock Expeditions; they visited Santa Cruz Island in January, 1934, and Isabela Island in January, 1938. No nocturnal collecting was done ashore on either trip; the moths that were taken were captured aboard the ship, being attracted to its lights (John S. Garth, in letters).

Material was examined from the collections of the American Museum

of Natural History, the British Museum (Natural History) (in part only), the California Academy of Sciences, and of Robert Silberglied, now a graduate student at Harvard University. I have also included the specimens collected by the Edinburgh University Galapagos Expedition of 1968; this material is now in the Royal Scottish Museum, Edinburgh.

Distributional data is given in the present paper in an abbreviated style without indicating the collectors or the year of collection, thereby avoiding repetition; the information is summarized here listed by institution:

The American Museum of Natural History: The specimens from the Williams Galapagos Expedition of the New York Zoological Society, collected by William Beebe in March and April, 1923; this material served as the basis for the 1923 paper by Schaus. The same society also had moths collected during April, 1925. During October and November, 1935 and January, 1936, W. von Hagen collected on Santa Cruz Island. During May and June, 1965, Mrs. Jacqueline DeRoy collected on the same island.

The British Museum (Natural History): Only a limited portion of their material has been examined by me. The specimens include some caught by C. L. Collenette in July, 1924, on the St. George Expedition. The majority were taken in December, 1968, August, 1969, February, March, May, and November, 1970, and in January, 1971, by D. Weber, R. Perry, and T. de Vries.

The California Academy of Sciences: F. X. Williams collected during December, 1905, and March, August, and September, 1906. M. Willows, Jr. of the Templeton Crocker Expedition collected in June, 1932. In September, 1932 D. W. Snow and P. Leon were in the Galapagos Islands. The majority of the specimens were captured by D. Q. Cavagnaro and R. O. Schuster in January, February, March, April, and May, 1964. Ira L. Wiggins collected in February, 1967. Some of their material was sent to the British Museum (Natural History), and not examined by me; A. Hayes was kind enough to summarize these data by island, month, and number of specimens of each sex.

Royal Scottish Museum, Edinburgh: The specimens from the Edinburgh University Galapagos Expedition of August, September, and October, 1968 were determined by D. S. Fletcher, C. Herbulot, and E. C. Pelham-Clinton; their data were furnished me by the last-named individual. I have not seen any of these moths.

Robert Silberglied collected on a number of the islands in February, March, April, June, and August, 1970, utilizing ultra-violet "black light" to attract the moths.

I have also used the data given by Herbulot (1970, 1971). The material for his first paper was collected by Narcisse and Jeanne Leleup and is

deposited in the Royal Institute of Natural Sciences of Belgium, Brussels. The specimens for the 1971 paper were collected by Roger Perry, T. de Vries, and D. Weber; these specimens are deposited in the entomological collection of the British Museum (Natural History).

Each of the species included in this paper has a section entitled Distribution. It is noted here whether or not the species is an endemic; if not, a brief summary of its continental occurrence is given. This is followed by a listing of all known records, by individual islands; these data are taken both from the literature and from specimens examined by me. If it is a citation from the literature it is so indicated. The material that I have studied is listed by the number of specimens, their sex, and the collection in which they are located. The following abbreviations have been used:

AMNH, the American Museum of Natural History
 BMNH, British Museum (Natural History), London
 CAS, the California Academy of Sciences
 RP, Roger Perry
 RS, Robert Silberglied
 RSM, Royal Scottish Museum, Edinburgh

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The author acknowledges with thanks the aid and cooperation of the following colleagues who have allowed him to study specimens in their charge: P. H. Arnaud, Jr., of the California Academy of Sciences; A. Hayes and D. S. Fletcher, of the Department of Entomology, the British Museum (Natural History); E. C. Pelham-Clinton, of the Royal Scottish Museum, Edinburgh; R. Silberglied, now attending Harvard University.

I am also most grateful to Roger Perry, former director of the Charles Darwin Research Station, Academy Bay, Santa Cruz Island, and to T. de Vries of the Zoologisch Museum, Amsterdam. These two gentlemen not only collected extensively between February, 1967 and February, 1971 on the Galapagos Islands, but did much work with the rearing of many of the species of moths. Through the courtesy of the British Museum (Natural History) I have been permitted to use in this paper their collecting records, the food plants, and notes on the early stages.

KEY TO SPECIES

BASED ON MORPHOLOGY AND MACULATION

1. Vein M_2 of hind wings well developed, tubular 2
 Vein M_2 of hind wings a slightly thickened fold, or absent (*Ennominae*)
 7
- 2(1). Veins Sc and R of hind wings fused near base for less than one-quarter

- of length of cell; small species, with length of forewing 6 to 7 mm.; males with pectinate antennae (Sterrhinae) . . . *Cyclophora impudens*
- Veins Sc and R of hind wings fused for more than one-quarter of length of cell; small to large species; when small, males without pectinate antennae (Larentiinae) 3
- 3(2). Small species, with length of forewing 5 to 9 mm. 4
- Larger species, with length of forewing more than 10 mm. 5
- 4(3). Palpi extending beyond eye by more than diameter of eye; males without hair pencil at base of underside of forewing *Eupithecia leleupi*
- Palpi extending beyond eye by less than diameter of eye; males with elongate hair pencil near base of forewing on under surface
- *Eupithecia perryvriesi*
- 5(3). Smaller species, with length of forewing 10 to 15 mm. 6
- Larger species, with length of forewing 20 to 25 mm. . . *Hydria affirmata*
- 6(5). Upper surface with forewings brown, hind wings white
- *Perizoma* (?) *perryi*
- Upper surface with all wings brown *Disclisioprocta stellata*
- 7(1). Males with pectinate antennae 8
- Males with simple, ciliate, or fasciculate antennae 11
- 8(7). Males smaller than females, with length of forewing 8 to 10 mm., as compared with 11 to 16 mm. 9
- Sexes of equal size 10
- 9(8). Males dark brown; females grayish brown to brown
- *Thyrinteina umbrosa*
- Males and females grayish white. *Thyrinteina infans*
- 10(8). Males with upper surface of wings dark brown, females buff to orange brown *Oxydia lignata*
- Males with upper surface of wings blackish brown, with orange mid-costal spot, females grayish brown *Sphacelodes vulneraria*
- 11(7). Forewings with outer margin incised below apex, and with hind wing angulate at vein M_3 ; upper surface of wings brown and gray . . 12
- Forewings with outer margin gently rounded, and with hind wings weakly extended at vein M_3 ; upper surface of wings dark gray and gray
- *Semiothisa cerussata*
- 12(11). Upper surface of wings grayish to brownish gray; under surface with broad brown outer band on all wings . . . *Semiothisa cruciata cruciata*
- Upper surface of wings pale grayish white to pale ochre; under surface without outer brown band *Semiothisa cruciata isabelae*

BASED ON MALE GENITALIA AND SECONDARY SEXUAL CHARACTERS¹

1. Coremata present *Disclisioprocta stellata*
- Coremata absent 2
- 2(1). Abdomen with ventral surface of last segment in form of sclerotized or partly sclerotized plate 3

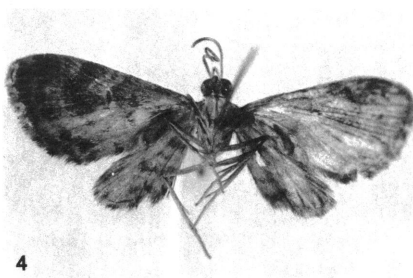
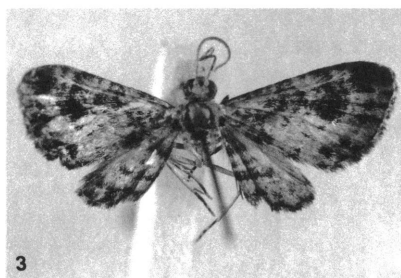
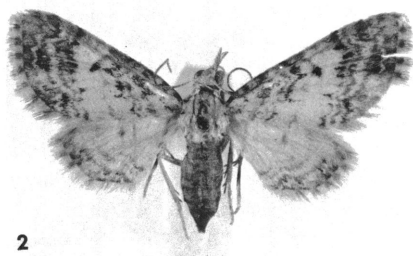
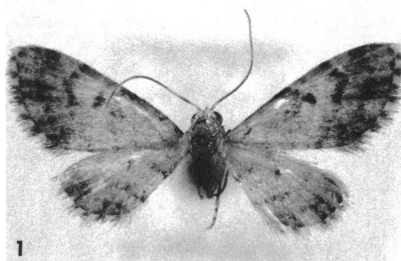
¹ The males of *Perizoma* (?) *perryi* are unknown; the genitalia of both *Hydria affirmata* and *Sphacelodes vulneraria* from the Galapagos Islands have not been studied, but are included based on mainland specimens.

- Abdomen with ventral surface of last segment unmodified 6
- 3(2). Ventral surface of last segment mostly sclerotized, with terminal cleft only 4
- Ventral surface of last segment mostly membranous, with a pair of lateral, rodlike extensions 5
- 4(3). Valve with anterior portion rounded apically; vesica with elongate spine *Semiothisa cruciata*
- Valve with anterior portion angulate; vesica without elongate spine *Semiothisa cerussata*
- 5(3). Valves slender, tapering, with apical one-half narrower than basal half *Eupithecia perryvriesi*
- Valves of equal width, apical portion not narrowed and attenuate *Eupithecia leleupi*
- 6(2). Valves having both costa and sacculus with sclerotized, tubelike extensions of equal size extending entire length of valve *Cyclophora impudens*
- Valves having only costa sclerotized 7
- 7(6). Saccus extremely long and slender; very large and broad pair of hairlike tufts present *Sphacelodes vulneraria*
- Without both of above characters 8
- 8(7). Uncus elongate, tapering to point 9
- Uncus short, broad, apically bifurcate 10
- 9(8). Uncus broad, triangular *Hydria affirmata*
- Uncus long, slender *Oxydia lignata*
- 10(8). Juxta with short, bifurcate extension posteriorly, in length about one-third of length of juxta, broader than long and not more heavily sclerotized than juxta itself *Thyriniteina infans*
- Juxta with elongate, usually bifurcate extension posteriorly, in length equal to, or longer than, length of juxta, longer than broad and more heavily sclerotized than juxta itself *Thyriniteina umbrosa*

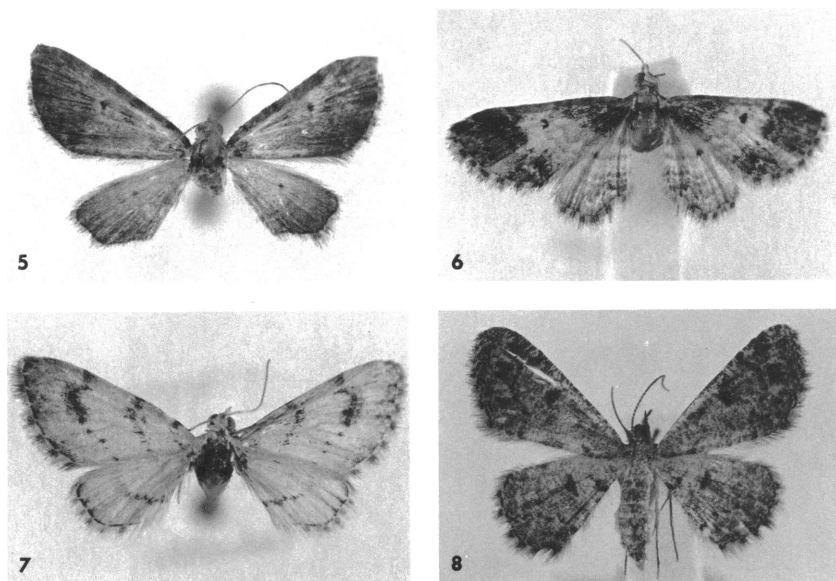
BASED ON FEMALE GENITALIA

1. Ductus seminalis arising from posterior end of corpus bursae near junction with ductus bursae 3
- Ductus seminalis not as above 2
- 2(1). Ductus seminalis arising from slender tube at right side anteriorly of corpus bursae *Eupithecia perryvriesi*
- Ductus seminalis arising from extension of ductus bursae to right of corpus bursae *Eupithecia leleupi*
- 3(1). Corpus bursae with membranous, swollen sac extending anteriorly of large corpus bursae *Hydria affirmata*
- Corpus bursae without anterior sac 4
- 4(3). Corpus bursae with strongly developed signum 5
- Corpus bursae without signum, or with weakly developed signum 7
- 5(4). Ductus bursae long, curved, ribbonlike *Disclisioprocta stellata*
- Ductus bursae short, slightly wider than long 6
- 6(5). Ductus bursae long, slender, smoothly membranous, tending to be slightly swollen in region of signum *Semiothisa cruciata*
- Ductus bursae with narrow, longitudinally striate posterior region, and

- with broadly swollen anterior region *Oxydia lignata*
- 7(4). Posterior margin of eighth abdominal sternite U-shaped, curved anteriorly around ostium 8
- Eighth sternite not as above. 9
- 8(7). Ductus bursae about twice as long as wide, tubelike *Thyriniteina umbrosa*
- Ductus bursae about as long as wide, tapering to point anteriorly *Thyriniteina infans*
- 9(7). Corpus bursae very long and slender 10
- Corpus bursae short, with swollen, membranous anterior portion . . . 11
- 10(9). Corpus bursae gradually and evenly increasing in width, with surface membranous, finely and minutely punctate; length about 2.5 mm. *Cyclophora impudens*
- Corpus bursae with sclerotized striations on right side posteriorly, of more or less even width throughout; length 4.5 to 5.5 mm. *Sphacelodes vulneraria*
- 11(9). Corpus bursae with short, membranous, posterior region and large, swollen anterior portion *Semiothisa cerussata*
- Corpus bursae with narrow, sclerotized posterior region almost as long as swollen, anterior membranous portion *Perizoma* (?) *perryi*



FIGS. 1-4. Adults. 1, 2. *Eupithecia leleupi* Herbulot. 1. Female, Academy Bay, Santa Cruz Island, August, 1970 (R. Silberglied; RS). 2. Female, Pinta Island, November, 1970 (BMNH). 3, 4. *Eupithecia perryriesi* Herbulot. 3. Male, upper surface, Corazon Verde, Isabela Island, January, 1971 (BMNH). 4. Male, lower surface, same specimen. All $\times 4$.



FIGS. 5-8. Adults. 5-7. *Eupithecia perryviesi* Herbulot. 5. Female, Santo Tomas, Isabela Island, August, 1969 (D. Weber; BMNH). 6. Female, Santa Cruz Island, February-March, 1970 (BMNH). 7. Female, Pinta Island, November, 1970 (BMNH). 8. *Cyclophora impudens* (Warren), female, Academy Bay, Santa Cruz Island, August, 1970 (R. Silberglied; RS). All $\times 4$.

STERRHINAE¹

Cyclophora impudens (Warren)

Figures 8, 24, 39

Perixera impudens WARREN, 1904, p. 487.

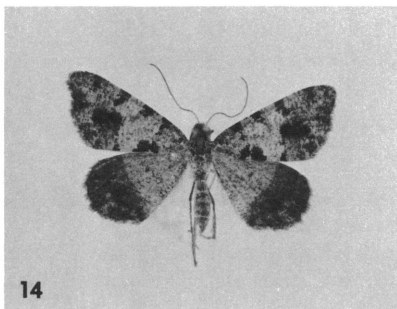
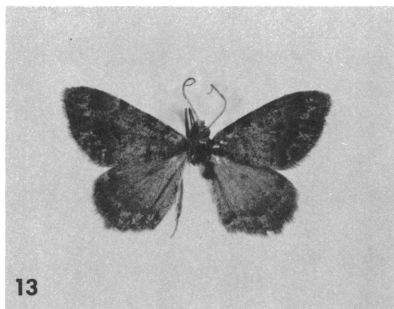
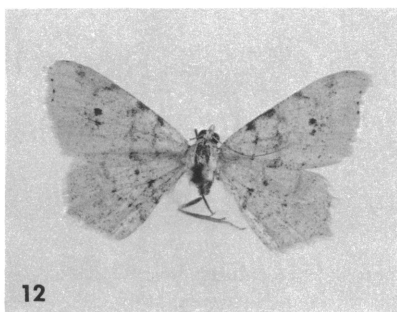
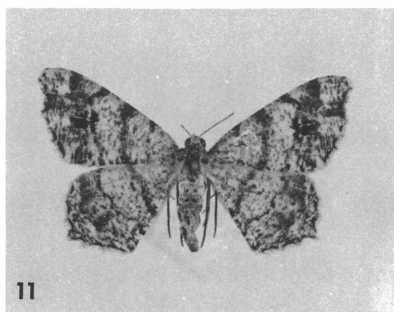
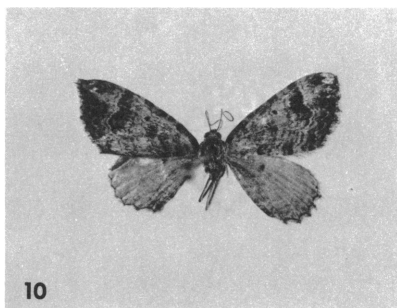
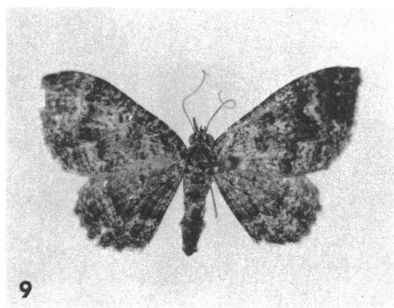
Perixera ? *impudens*: SCHAUS, 1923, p. 28.

Cosymbia impudens: LINSLEY AND USINGER, 1966, p. 162.

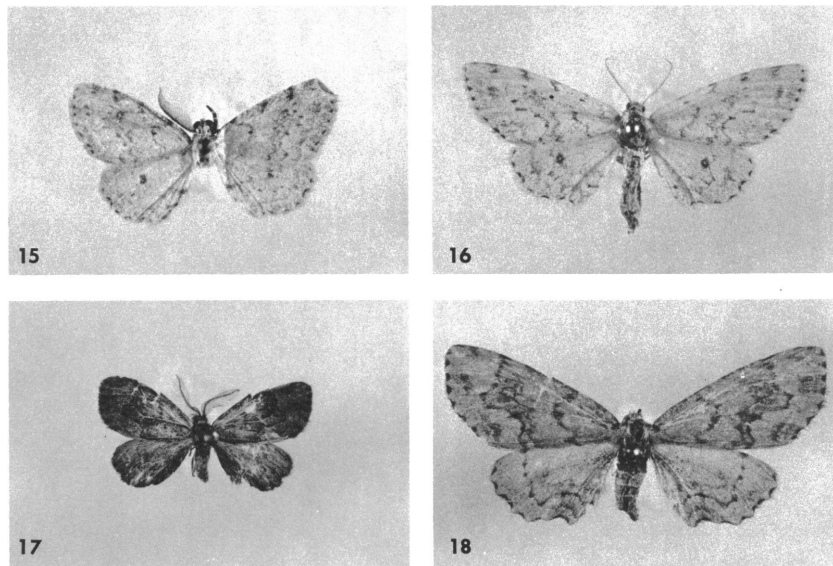
Cyclophora impudens: HERBULOT, 1970, p. 18; 1971, p. 11.

ADULTS: Antennae of males pectinate for about two-thirds their length; those of females appearing simple, but very shortly ciliate below. Both sexes with very long palpi extending well beyond front, being twice as long as eye. Upper surface of wings with color and pattern rather variable; color ranging from pale brown (usually in older specimens) to darker brown and dark gray; maculation of forewings usually rather weakly

¹ There is one female in poor condition, from Asilo de la Paz, elevation 360 m., Floreana Island, January, 1971, that I have not been able to identify. This specimen is in the collection of the British Museum (Natural History).



FIGS. 9-14. Adults. 9. *Disclisioprocta stellata* (Guenée), male, Baltra Island, April 23, 1923 (W. Beebe; AMNH). 10. *Perizoma* (?) *perryi*, new species, holotype, female, Corazon Verde, Isabela Island, January, 1971 (BMNH). 11. *Semiothisa cruciata cruciata* Herbulot, female, Santa Cruz Island, January-February, 1970 (Perry and deVries; BMNH). 12. *Semiothisa cruciata isabelae*, new subspecies, allotype female, Corazon Verde, Isabela Island, January, 1971 (BMNH). 13, 14. *Semiothisa cerussata* Herbulot. 13. Male, Academy Bay, Santa Cruz Island, February 19, 1964 (R. O. Schuster; CAS). 14. Female, Santa Cruz Island, May, 1970 (Perry and deVries; BMNH). All $\times 1.5$.



FIGS. 15-18. Adults. 15, 16. *Thyrinteina infans* Herbulot. 15. Male, east slope, Santa Cruz Island, April 16, 1964 (D. Q. Cavagnaro; CAS). 16. Female, Floreana Island, July 31, 1924 (C. L. Collenette; BMNH). 17, 18. *Thyrinteina umbrosa* Herbulot. 17. Male, Horneman Farm, Santa Cruz Island, February 16, 1964 (D. Q. Cavagnaro; CAS). 18. Female, Table Mountain, Santa Cruz Island, April 16, 1964 (D. Q. Cavagnaro; CAS). All $\times 1.5$.

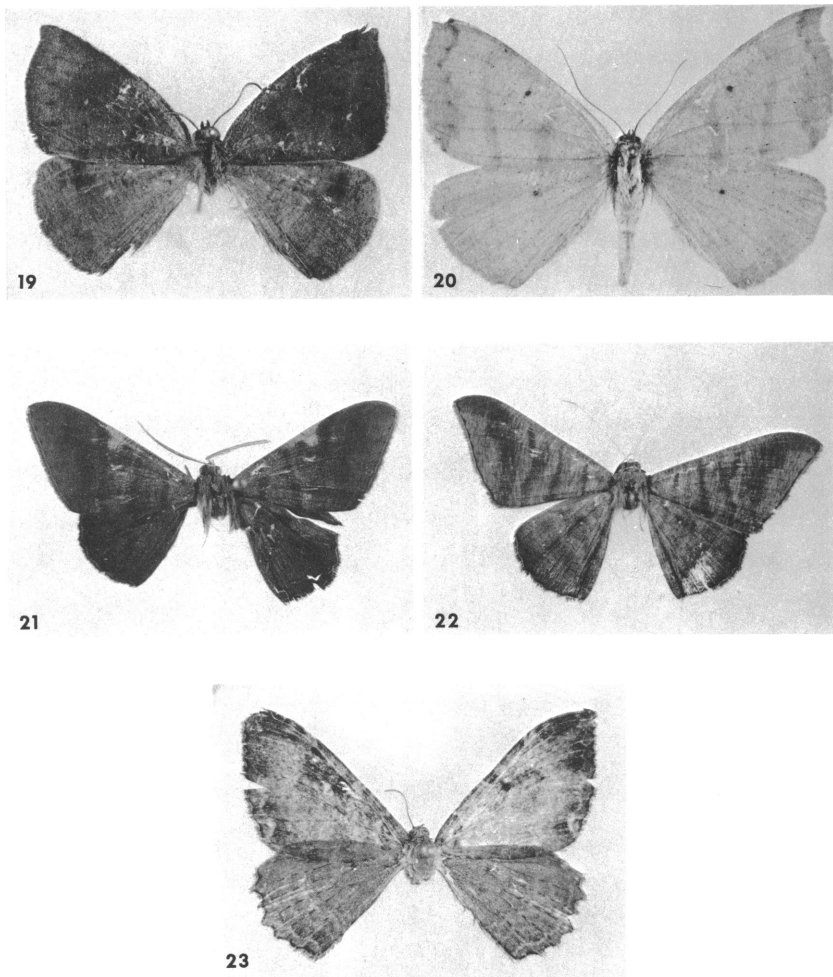
represented, with dark t. a. and t. p. lines, prominent, large discal spot, and more or less mottled subterminal area. Hind wings similar in color and pattern to primaries. Under surface gray or light brown, with little or no maculation. Length of forewing, 6 to 7 mm.

MALE GENITALIA: Valves very distinctive, triangular in outline, truncate apically, and having both costa and sacculus sclerotized, tubelike, and of equal size and length.

FEMALE GENITALIA: Sterigmal area tapered anteriorly. Ductus bursae scarcely differentiated. Ductus seminalis arising on right side at junction of ductus bursae and corpus bursae. Latter quite long, gradually and evenly increasing in width anteriorly; signum absent.

EARLY STAGES: Larva variable in color, being cream, yellow, or green with bold, darker green, olive or reddish brown markings. Pupa also variable, being buffy to dark brown, with yellow, green, or orange on abdomen. Pupae are attached to leaves of host plant.

FOOD PLANTS: *Acacia macracantha* Willdenow (Leguminosae), *Croton scoul-*



FIGS. 19-23. Adults. 19, 20. *Oxydia lignata* (Warren). 19. Male, Horneman Farm, Santa Cruz Island, June 26, 1965 (J. DeRoy; AMNH). 20. Female, same data, June 28, 1965 (AMNH). 21, 22. *Sphacelodes vulneraria* (Hübner). 21. Male, Horneman Farm, Santa Cruz Island, May 7, 1964 (D. Q. Cavagnaro; CAS). 22. Female, same data, March 25, 1964 (CAS). 23. *Hydria affirmata* (Guenée), female, Horneman Farm, Santa Cruz Island, June 28, 1965 (J. DeRoy; AMNH). All $\times 1.25$.

eri J. D. Hooker (Euphorbiaceae), and *Cordia lutea* Lamarck (Boraginaceae).

DISTRIBUTION: This is one of the most widespread geometrids in the

Galapagos, and it is an endemic. *Española Island*: east side of peninsula at coast, north of summit, elevation ± 2 m., April (6 ♀, RS). *Floreana Island*: Las Cuevas, at coast, elevation ± 10 m., April (1 ♀, RS). "*Gardner Island*" (? Gardner-near-Floreana or Gardner-near-Española): (Warren, 1904). *Genovesa Island*: April (1 ♀, AMNH). *Isabela Island*: Tagus Cove, April (Schaus, 1923); San[to] Tomás, elevation 1200 feet [366 m.], August (1 ♀, CAS). *Pinzón Island*: June (1 ♂, 5 ♀, CAS); northeast anchorage behind tiny islet, elevation ± 10 m., April (2 ♀, RS). *San Cristóbal Island*: Punta Pitt (beach of Cerro Pitt), elevation ± 5 m., April (4 ♀, RS); "Terrapin Road," salt lagoon at coast, elevation ± 5 m., April (4 ♂, 12 ♀, RS). *San Salvador Island*: April (Schaus, 1923); settlement, September (RSM). *Santa Cruz Island*: Conway Bay, April (Schaus, 1923; 4 ♂, AMNH); Darwin Research Station, Academy Bay, February, March, August, September, October (6 ♀, RS; RSM). *Santa Fe Island*: northeast anchorage area, below cliff, April (1 ♀, RS).

LARENTIINAE

Disclisioprocta stellata (Guenée)

Figures 9, 25, 40

Scotosia stellata GUENÉE, 1857, p. 443.

Eucosmia stellata: SCHAU, 1923, p. 28.

Camptogramma stellata: LINSLEY AND USINGER, 1966, p. 162.

Disclisioprocta stellata: HERBULOT, 1970, p. 18; 1971, p. 11.

ADULTS: Antennae of males shortly serrate and doubly fasciculate; those of female simple. Palpi of both sexes extending well beyond front. Upper surface of all wings dark brown, with numerous blackish wavy lines, and with discal spot usually represented on forewings at least; some sexual dimorphism in color present, with males tending to have basal and outer areas slightly paler than median area, with females being more unicolorous. Under surface buff or pale brownish gray, with black outer cross line and discal dots on all wings, and with apical area of forewing darkened. Length of forewing, 12 to 15 mm.

MALE GENITALIA: Apex of uncus bifurcate. Valves very large, narrowed basally, with sacculus a sclerotized, rounded, apically pointed free arm. Aedeagus very long, slender, somewhat curved. Coremata strongly developed.

FEMALE GENITALIA: Ductus bursae sclerotized, elongate, curving, flattened, with ductus seminalis arising at its anterior end. Corpus bursae with narrower, tubelike posterior extension, then forming large, membranous, elliptical sac; signum large, circular or semicircular, with from six to eight stout spinelike projections directed inwardly into corpus bursae.

EARLY STAGES: Larva pale greenish to grayish brown, with fine black markings.

FOOD PLANTS: *Cryptocarpus pyriformis* Humboldt, *Pisonia floribunda* J. D. Hooker, and *Commicarpus tuberosus* Lamarck (all Nyctaginaceae).

DISTRIBUTION: This species occurs throughout much of the New World, from the southern United States to southern South America, and the Antilles. It is widespread in the Galapagos and is usually the most conspicuously abundant species in the islands. *Baltra Island*: April (Schaus, 1923; 1 ♂, 1 ♀, AMNH). *Española Island*: April (1 ♂, AMNH). *Fernandina Island*: (RP). *Floreana Island*: (RP). *Genovesa Island*: April (3 ♂, 7 ♀, AMNH); south side of island, 200 yards [183 m.] from beach, in flight trap among *Bursera graveolens*, February (7 ♂, 2 ♀, CAS); no date (1 ♂, AMNH). *Isabela Island*: Tagus Cove, elevation \pm 10 m., March (1 ♀, RS); Punta Albemarle, southwest of old U. S. radar site, elevation \pm 10 m., March (1 ♂, 12 ♀, RS). *Pinta Island*: September (1 ♂, CAS). *Santa Cruz Island*: November (1 ♀, AMNH); Conway Bay, April (Schaus, 1923; 4 ♀, AMNH); Darwin Research Station, Academy Bay, February, March, June, July, August, September, October, November (Herbulot, 1970; RSM; 6 ♂, 27 ♀, RS); Academy Bay, May, June (11 ♂, 3 ♀, AMNH). *Santa Fe Island*: (RP). *San Salvador Island*: James Bay, east side near lagoons, elevation \pm 2 m., March (2 ♂, 9 ♀, RS).

REMARKS: Specimens from the Galapagos agree quite well in color and pattern with examples from the mainland, although they appear to average slightly smaller in size. The genitalia of specimens from both areas appear indistinguishable.

Hydria affirmata (Guenée)

Figures 23, 26, 41

Scotosia affirmata GUENÉE, 1857, p. 447. BOISDUVAL AND GUENÉE, 1858, pl. 9, fig. 2. *Rheumaptera affirmata*: HERBULOT, 1971, p. 11.

ADULTS: Antennae of both sexes simple. Palpi barely extending beyond frontal tuft. Upper surface of wings with color and maculation basically similar to preceding species, but *affirmata* browner in color, with grayish white tornal spot, and being much larger. Males with portion of anal margin of hind wings enlarged to contain specialized scales. Under surface of wings brown, with reduced cross lines but with discal spot present. Length of the forewing, 20 to 25 mm.

MALE GENITALIA (BASED ON MAINLAND SPECIMENS): Uncus elongate, triangular, ending in single point. Saccus arm shorter than that of *stellata*. Aedeagus short, thick, and straight; vesica with spinose area. Coremata absent.

FEMALE GENITALIA: Ductus bursae straight and relatively short. Ductus seminalis arising on left side at posterior end of corpus bursae, and extending transversely across to right side. Corpus bursae elongate, with anterior end spinose, and possessing small, separate membranous sac at anterior end.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

DISTRIBUTION: Apparently widespread from Brazil to Mexico. In the Galapagos, it is known at present from four female specimens. *Isabela Island:* Santa Tomas, elevation 350 m., August (Herbulot, 1971). *Santa Cruz Island:* April (2 ♀, CAS); Horneman Farm, elevation 200 m., June (1 ♀, AMNH).

REMARKS: It is possible that more than one species is presently going under the name *affirmata*. A study of some genitalic dissections from a number of localities in South and Central America would indicate this possibility.

Eupithecia leleupi Herbulot

Figures 1, 2, 27, 28, 42

Eupithecia leleupi HERBULOT, 1970, p. 19, fig. 3 (male genitalia); 1971, p. 12.

ADULTS: Antennae of males very shortly ciliate; those of females appearing simple. Palpi of both sexes very long, extending beyond eye by more than diameter of eye. Upper surface of wings grayish brown, with forewings having more or less distinct cross lines, prominent, dark discal spot, and median area may or may not be pale grayish white. Hind wings paler than forewings, and with reduced maculation. Under surface of wings gray and suffused with brown scaling apically on forewings. Length of forewing, 5 to 7 mm.

MALE GENITALIA: Uncus long and slender, terminating in simple spine-like point. Valves symmetrical, with costal swelling, and elongate, narrow, sclerotized valvular ridge. Aedeagus slightly curved; vesica with two longitudinal, sclerotized pieces, one shorter. Prominent hair pencils present. Ventral plate consisting of two, very long and narrow sclerotized strips extending length of segment, each arising from swollen base, with bases connected by very slender bar.

FEMALE GENITALIA: Ductus bursae about as long as corpus bursae, membranous, having posterior atrium, with ductus then angled to join corpus bursae. Ductus seminalis arising from extension of ductus bursae, curving anteriorly and then dorsoposteriorly, sharply narrowing near junction of ductus bursae and corpus bursae. Latter approximately ovate,

completely and evenly spined with exception of necklike junction with ductus bursae.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

DISTRIBUTION: This species is an endemic. *Pinta Islnd*: Elevation 630 m., November (1 ♂, 1 ♀, BMNH). *Rábida Island*: November (1 ♀, BMNH). *San Salvador Island*: Elevation 600 m., July (Herbulot, 1971). *Santa Cruz Island*: Darwin Research Station, Academy Bay, March, August, October, November (Herbulot, 1970; RSM; 1 ♂, 1 ♀, RS); "several examples of both sexes" (Herbulot, 1971).

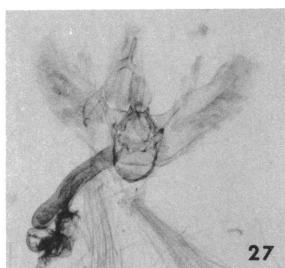
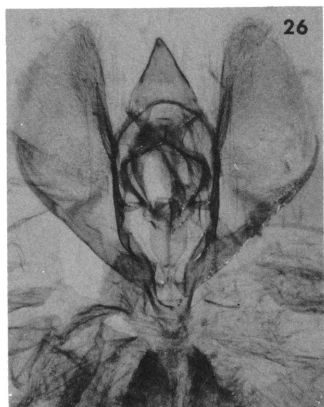
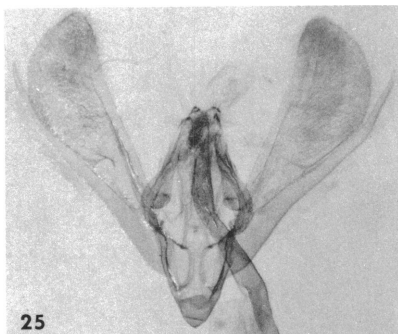
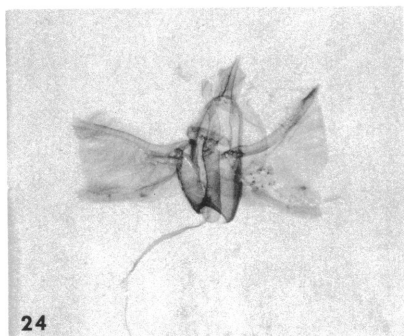
REMARKS: There appear to be some differences in color and maculation in the populations from the various islands. However, so few specimens have been studied that it is not possible, at this time, to say whether or not this is individual or subspecific variation. The pair from the Darwin Research Station at sea level is small, rather weakly marked, and have brownish gray scaling distally on the forewings. Those from the higher elevations of Pinta Island are slightly larger, and two of the three are more heavily marked and have more dark gray scaling on the forewings; the other female resembles closely the pair from Santa Cruz Island. The single specimen from Rábida Island is a uniformly colored pale grayish brown, and lacks the more or less prominent, pale gray, median area of the forewings of the other specimens; it could easily be mistaken for *perryvriesi*.

Eupithecia perryvriesi Herbulot

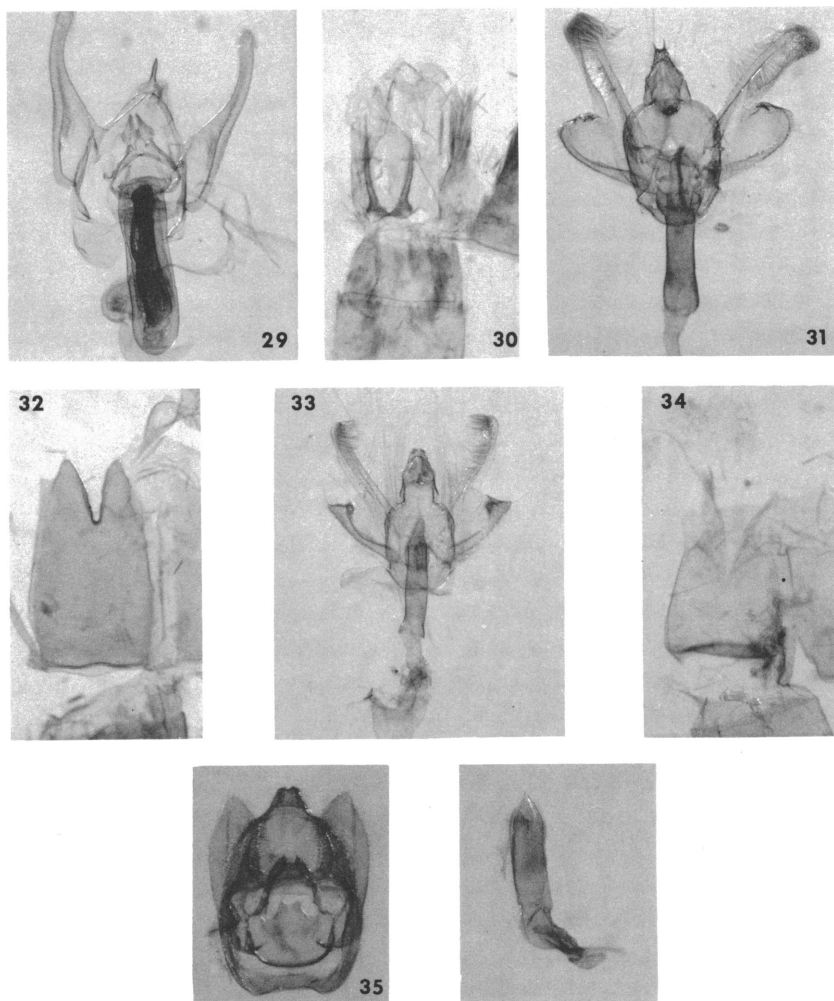
Figures 3, 4, 5-7, 29, 30, 43

Eupithecia perryvriesi HERBULOT, 1971, p. 12, figs. 1-4, (male, female genitalia).

ADULTS: Antennae of males ciliate, cilia being longer than those of *leleupi*; those of females very shortly ciliate, with longer posterior pair of setae on each segment. Palpi of both sexes shorter than those of *leleupi*, not extending beyond eye by more than diameter of eye. Males distinguishable by presence of elongate, dense, narrow hair pencil near base of underside of forewing; costal margin of hind wing broadly enlarged and swollen to contain large groove, presumably being used to enclose hair pencil. Upper surface of wings variable in color, with most specimens being brown, and having variable number of black, blackish brown, or grayish brown scales; maculation also variable in strength; discal dot of forewings usually represented. Females more variable in both color and pattern than males, being similar to males, unicolorous brown, pale ocher with just the cross lines showing, or dark brown with broad pale gray median area. Under surface of wings varying from gray to grayish brown; forewings with or without



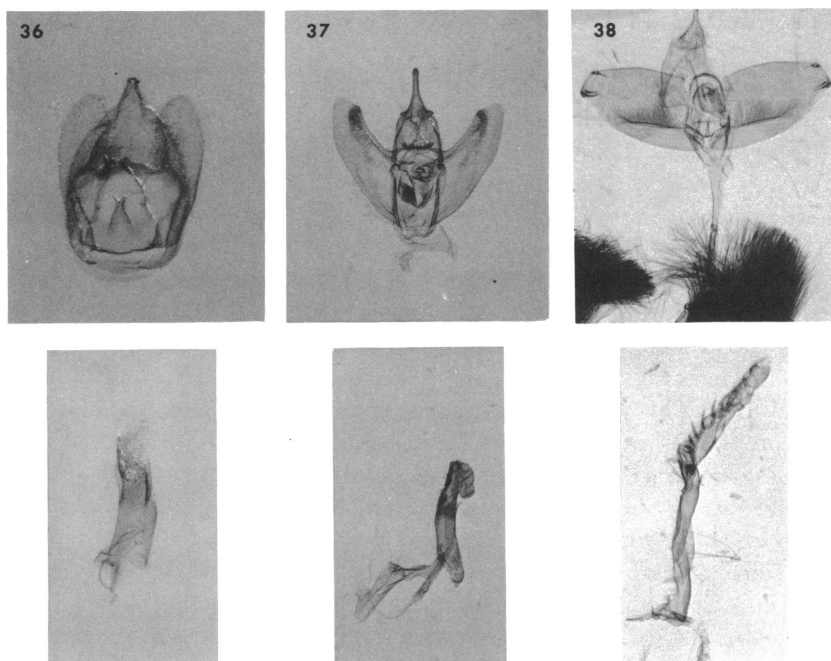
FIGS. 24-28. Male genitalia. 24. *Cyclophora impudens* (Warren), Conway Bay, Santa Cruz Island, April 1, 1923 (AMNH). 25. *Disclisioprocta stellata* (Guenée), Academy Bay, Santa Cruz Island, June 8, 1965 (J. DeRoy; AMNH). 26. *Hydria affirmata* (Guenée), Nuevo Teutonia, Brazil, July 16, 1948 (F. Plaumann; AMNH). 27, 28. *Eupithecia leleupi* Herbulot, Academy Bay, Santa Cruz Island, March 13, 1970 (R. Silberglied; RS). 27. Genitalia. 28. Ventral plate.



FIGS. 29-35. Male genitalia. 29, 30. *Eupithecia perryvriesi* Herbulot, Corazon Verde, Isabela Island, January, 1971 (BMNH). 29. Genitalia. 30. Ventral plate. 31, 32. *Semiothisa cruciata cruciata* Herbulot, Santa Cruz Island, December, 1968 (Perry and deVries; BMNH). 31. Genitalia. 32. Ventral plate. 33, 34. *Semiothisa cerussata* Herbulot, Academy Bay, Santa Cruz Island, February 19, 1964 (R. O. Schuster; CAS). 33. Genitalia. 34. Ventral plate. 35. *Thyrineina infans* Herbulot, east slope, Santa Cruz Island, April 16, 1964 (D. Q. Cavagnaro; CAS).

t. p. line represented. Length of the forewing, 7 to 9 mm.

MALE GENITALIA: Uncus long, very slender, and terminating in single



FIGS. 36–38. Male genitalia. 36. *Thyriniteina umbrosa* Herbulot, Horneman Farm, Santa Cruz Island, February 16, 1964 (D. Q. Cavagnaro; CAS). 37. *Oxydia lignata* (Warren), Horneman Farm, Santa Cruz Island, June 28, 1965 (J. DeRoy; AMNH). 38. *Sphacelodes vulneraria* (Hübner), Petionville, Haiti, June 15, 1930 (AMNH).

spinelike point. Valves very long, attenuate, narrowing distally; saccular swelling present. Aedeagus relatively broad; vesica containing numerous, elongate spines, many arising from broad sclerotized basal area and extending almost entire length of aedeagus, and with posterior group of numerous short spines. Ventral plate consisting of two, very long and slender sclerotized rods, swollen basally, with basal portions slenderly united medially.

FEMALE GENITALIA: Ductus bursae short, membranous, and funnel-like. Ductus seminalis arising from elongate, tapering protuberance on right side of corpus bursae at anterior end; protuberance curving and ductus extending posteriorly from its end. Corpus bursae elongate, posteriorly membranous, having some longitudinal striations, becoming sclerotized medially, with variable number of spines in row along basal portion of protuberance on right side, with left margin more or less concave, either simple or with several spines, with left anterior end more or less membra-

nous, swollen, with or without area being covered with small stellate spines.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

DISTRIBUTION: This species is also an endemic. *Isabela Island*: Santo Tomas, elevation 350 m., August (Herbulot, 1971; 1 ♀, BMNH); Corazon Verde, Volcan Sierra Negra (= Santo Tomas), elevation 360 m., January (1 ♂, 3 ♀, BMNH); Cerro Azul, elevation 700 m., October (Herbulot, 1971); Darwin Volcano, elevation 860 m., November (Herbulot, 1971). *Pinta Island*: Elevation 630 m., November (1 ♂, 1 ♀, BMNH). *San Salvador Island*: Elevation 600 m., July (Herbulot, 1971). *Santa Cruz Island*: January–March (Herbulot, 1971); February–March (1 ♀, BMNH).

REMARKS: This species, like the preceding one, is quite variable. There is a considerable amount of individual variation in the one male and four females from Isabela Island. The male and two of the females are similar in color and pattern, being strongly patterned ochraceous brown and black; the remaining two females tend to be a rather unicolorous brown, with some pale gray scaling medially. The pair from Pinta Island is much more unicolorous brown than are the ones from Isabela. The female from Santa Cruz Island (without additional locality data) is the most aberrant specimen examined; the upper surface of the forewings is a dark brown, with a broad, sharply contrasting, grayish white median area.

***Perizoma (?) perryi*, NEW SPECIES**

Figures 10, 44

DIAGNOSIS: Easily distinguished from all other Galapagos geometrids by the broad, dark median area of the forewing, outlined distally by a pale ochraceous band.

MALE: Unknown.

FEMALE: Head with front dull black, having brown band medially, tufted ventrally; palpi extending beyond eye distance equal to diameter of eye, with mixed dark brown and dark grayish brown scales; antennae finely ciliate below; chaetosema present as rather large, separate patches posteriad of each antennal base. Thorax brown above; paler below; legs with mixed ochraceous and dark brown scales. Abdomen grayish brown above, with row of dark scales on each segment; below slightly paler and without transverse bands.

UPPER SURFACE OF WINGS: Forewings varying from gray, with numerous, more or less complete, narrow black cross bands, and with ochraceous brown, dark brown, and blackish brown scales (holotype), to almost entirely dark brown and blackish brown, without cross bands except for

narrow, inconspicuous t. a. line (paratype) and broader, white t. p. line (present in both specimens); discal dot black, elongate; outer portion of median area, especially anteriorly, very dark and contrasting with t. p. line; subterminal area blackish brown anteriorly, dissected by broad, pale line from apex to t. p. line; s. t. line white, narrow, outwardly angled in cells; terminal line black, narrowly interrupted by veins; fringe concolorous with wing, darkened at vein endings. Hind wings grayish white, posteriorly covered with grayish brown scales; traces of cross lines present along anal margin; discal spot present; terminal line black; fringe concolorous with wing, darkened opposite vein endings.

UNDER SURFACE OF WINGS: Forewings grayish brown, with numerous brown scales; cross lines indicated by black costal spots, with t. p. line broad, present in anterior part of wing; apical area darkened. Hind wings grayish brown, heavily and evenly covered with dark brown and brownish black scales; faint traces of discal spot and extradiscal line present; outer area of both wings in some cases suffused with ochraceous scaling.

LENGTH OF FOREWING: 10 mm. (holotype and paratype).

MALE GENITALIA: Unknown.

FEMALE GENITALIA: Sterigma simple; ductus bursae broad, slightly tapered anteriorly, with length slightly shorter than anterior width; ductus seminalis arising ventroposteriorly from membranous portion of corpus bursae; latter with sclerotized, elongate, posterior portion, gradually decreasing in diameter anteriorly and curving or twisted to right before joining rounded, membranous anterior portion; signum absent.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

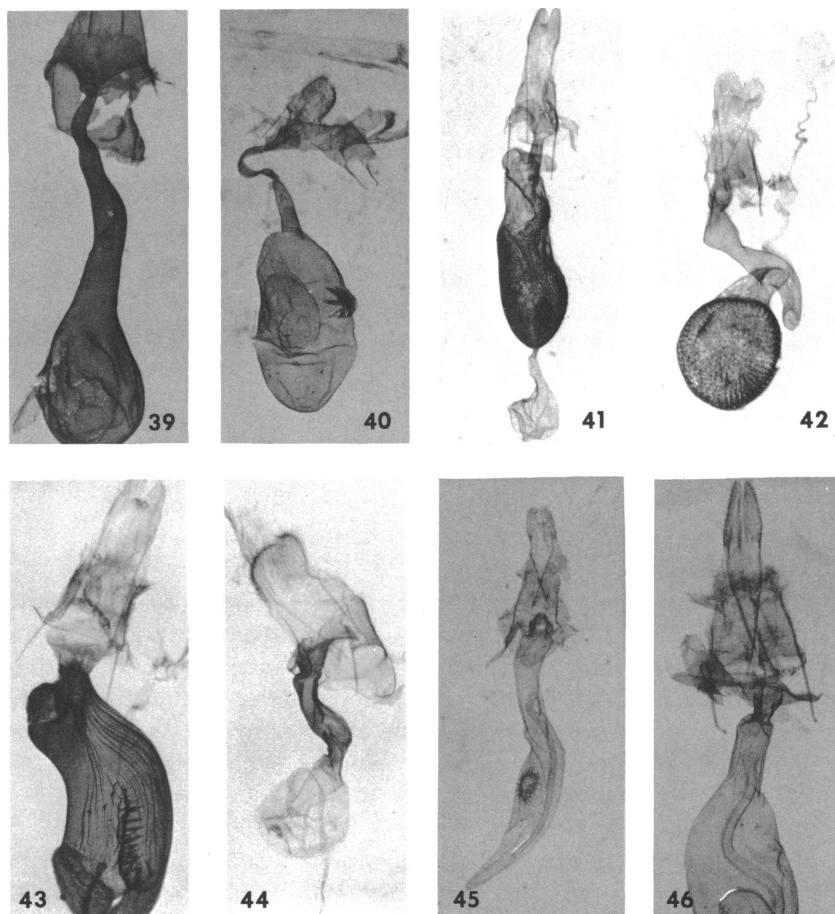
TYPES: Holotype, female, and paratype, female, Corazon Verde, Volcan Sierra Negra (= Santo Tomas), elevation 360 m., Isabela Island, Galapagos Islands, January, 1971. The genitalia of the holotype are mounted on slide FHR No. 16577.

Both type specimens are in the collection of the British Museum (Natural History).

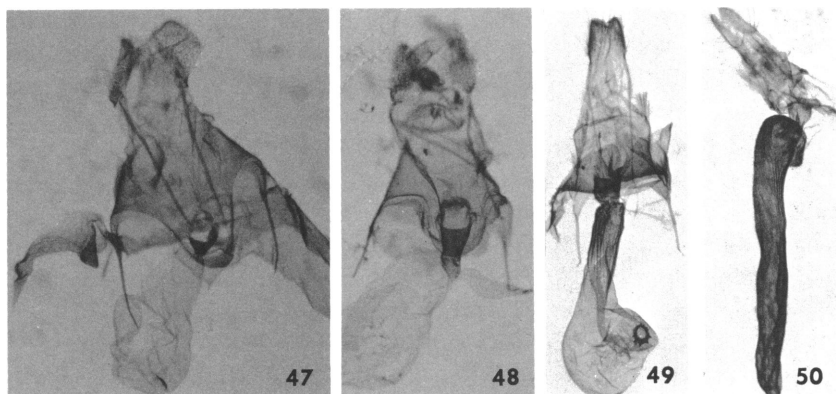
DISTRIBUTION: This endemic species is known only from the type locality on Isabela Island.

REMARKS: A more exact generic placement of this species will have to await additional material, particularly males. In addition, a revisionary study of the Neotropical species assigned to *Perizoma* and related genera is badly needed.

ETYMOLOGY: This species is named for Mr. Roger Perry, the former director of the Charles Darwin Research Station, who did such fine work with the Lepidoptera when he was in the Galapagos Islands.



FIGS. 39-46. Female genitalia. 39. *Cyclophora impudens* (Warren), Pinzon Island, June 7, 1932 (M. Willows, Jr.; AMNH). 40. *Disclisioprocta stellata* (Guenée), Academy Bay, Santa Cruz Island, June 4, 1965 (J. DeRoy; AMNH). 41. *Hydria affirmata* (Guenée), Horneman Farm, Santa Cruz Island, June 28, 1965 (J. DeRoy; AMNH). 42. *Eupithecia leleupi* Herbulot, Rábida Island, November, 1970 (BMNH). 43. *Eupithecia perryviesi* Herbulot, Corazon Verde, Isabela Island, January, 1971 (BMNH). 44. *Perizoma* (?) *perryi*, new species, holotype, Corazon Verde, Isabela Island, January, 1971 (BMNH). 45. *Semiothisa cruciata cruciata* Herbulot, Academy Bay, Santa Cruz Island, February 24, 1964 (Cavagnaro and Schuster; CAS). 46. *Semiothisa cerussata* Herbulot, Horneman Farm, Santa Cruz Island, June 26, 1965 (J. DeRoy; AMNH).



FIGS. 47-50. Female genitalia. 47. *Thyriniteina infans* Herbulot, Horneman Farm, Santa Cruz Island, July 1, 1965 (J. DeRoy; AMNH). 48. *Thyriniteina umbrosa* Herbulot, Horneman Farm, Santa Cruz Island, March 25, 1964 (D. Q. Cavagnaro; CAS). 49. *Oxydia lignata* (Warren), Horneman Farm, Santa Cruz Island, June 25, 1965 (J. DeRoy; AMNH). 50. *Sphacelodes vulneraria* (Hübner), Horneman Farm, Santa Cruz Island, March 26, 1964 (D. Q. Cavagnaro; CAS).

ENNOMINAE

Semiothisa cruciata Herbulot

Semiothisa cruciata HERBULOT, 1970, p. 21, figs. 4, 5 (male, female genitalia); 1971, p. 14.

ADULTS: Antennae of males weakly serrate and ciliate; those of females simple, each segment having posterior pair of lateral setae. Palpi extending beyond front. Hind tibia of male swollen and with hair pencil; those of female simple. Forewings with outer margin incised below apex, and hind wings angulate at vein M_3 . Upper surface of wings varying from pale ocher to grayish and brownish gray, with median area tending to be somewhat paler in some specimens; both cross lines and median shade line usually present, although variable in strength; most specimens having some black scaling in middle of wing distad of t. p. line, and some females tending to have this more strongly developed than in males. Hind wings similar in color and pattern to forewing but lacking black spotting. Under surface similar to upper surface but may or may not be more contrasting in color, with broad brown outer band on all wings. Length of the forewings, 10 to 12 mm.

MALE GENITALIA: Typically *Semiothisa*-like, with paired dorsal spines from uncus. Valves bifurcate, with elongate posterior arm straight, of equal width, and rounded apically; broad anterior portion rounded, with

posterior margin somewhat flattened and having small raised ridge with one or two small median points. Aedeagus a simple tube, with vesica having narrow, elongate, sclerotized strip, and small, weakly sclerotized, rounded area. Abdomen with ventral row of setae on third segment, and last segment evenly split for one-third its length.

FEMALE GENITALIA: Sterigma a dorsal, sclerotized strip, with posterior projection from ventral side. Ductus bursae sclerotized, very short, not clearly differentiated. Ductus seminalis arising on right side of posterior end of corpus bursae. Latter membranous, long, slender, and tending to be slightly swollen in region of large, rounded stellate signum.

EARLY STAGES: Larva green, with purple legs.

FOOD PLANT: *Scutia spicata* Willdenow (Rhamnaceae).

DISTRIBUTION: Endemic. At present it is known from Isabela and Santa Cruz islands; each has a local subspecies.

REMARKS: This species is quite variable in color and maculation but usually can be recognized by the shape of the wings.

Semiothisa cruciata cruciata Herbulot, new status

Figures 11, 31, 32, 45

Semiothisa cruciata HERBULOT, 1970, p. 21, figs. 4, 5 (male, female genitalia); 1971, p. 14.

ADULTS: Upper surface of wings varying from grayish to brownish gray, with median area tending to be pale gray in most specimens; black spotting usually represented in middle of forewings on and distad of t. p. line, but variable in strength. Under surface of wings more contrasting in color than upper surface; both sexes with broad brown outer band on all wings.

MALE GENITALIA: As described for the species.

FEMALE GENITALIA: As described for the species.

DISTRIBUTION: *Santa Cruz Island:* January, October, November (3 ♀, AMNH); December, 1968, January–February, 1970 (1 ♂, 1 ♀, BMNH); Darwin Research Station, Academy Bay, January, February, March, June, August, September, October, November (Herbulot, 1970; RSM; 13 ♂, 13 ♀, CAS; 3 ♂, 4 ♀, RS).

***Semiothisa cruciata isabelae*, NEW SUBSPECIES**

Figure 12

DIAGNOSIS: Paler in color and with less heavily marked wings both above and below than in nominate *cruciata*.

ADULTS: Upper surface of wings varying in color from pale grayish white to pale ocher; two specimens (holotype and allotype) with unicolorous wings, while the two paratypes have darker scaling in outer

portion of the wing, brown in male and gray in female; black spotting in middle of forewings varying from very slight to prominent. Under surface of wings similar to upper surface; broad brown outer band of nominate *cruciata* absent.

MALE GENITALIA: As described for the species.

FEMALE GENITALIA: As described for the species.

TYPES: Holotype, male, and allotype, female, Corazon Verde, elevation 360 m., Volcan Sierra Negra (= Santo Tomas), Isabela Island, Galapagos Islands, January, 1971. The genitalia of the holotype are mounted on slide FHR No. 16516; those of the allotype, on No. 16651. Paratypes: one male and one female, same data as above.

The holotype, allotype, and both paratypes are in the collection of the British Museum (Natural History).

DISTRIBUTION: Known only from Isabela Island.

REMARKS: All four specimens differ from one another in coloration and degree of shading by dark scales. Nevertheless, each is immediately separable from the moths of the same species from Santa Cruz Island.

ETYMOLOGY: The name of this subspecies is that of the island on which the moth occurs, being a noun in the genitive case.

Semiothisa cerussata Herbulot

Figures 13, 14, 33, 34, 46

Semiothisa cerussata HERBULOT, 1970, p. 23, fig. 1 (female genitalia); 1971, p. 14.

ADULTS: Antennae of males lengthily fasciculate; those of females simple, with each segment bearing posterior pair of lateral setae. Palpi extend beyond front. Hind tibia of male swollen and having hair pencil; those of female simple. Forewings of male with outer margin gently rounded, and females having very slight concave section below apex; hind wings of both sexes weakly extended at vein M_3 . Upper surface of wings gray; male uniform in color, getting darker just before t. p. line, and having latter made up of elongate grayish white cellular spots. Female with much more contrastingly marked forewings than male, with dark, well-defined t. a. and t. p. lines; median line indicated by large black spots on costa and inner margin; median area much paler than outer area, latter having, in some specimens, a large black spot. Hind wings of both sexes gray, becoming darker distally. Under surface grayish brown, with outer portion of wings slightly (male) or heavily (female) darkened. Length of forewings, 9 to 10 mm.

MALE GENITALIA: Uncus with paired dorsal spines. Valves bifurcate, with elongate posterior arm very slightly curved, of equal width, and rounded apically; broad anterior portion angulate, with raised, triangular

projection at apex, and with low saccular ridge. Aedeagus a simple tube, somewhat tapered apically; vesica with small sclerotized piece medially. Abdomen with ventral row of setae on third segment, and posterior segment broadly incised for about one-fourth its length, and having rounded lobes on each side.

FEMALE GENITALIA: Sterigma a dorsal, transverse, sclerotized strip. Ductus bursae sclerotized laterally, and slightly narrowed anteriorly. Ductus seminalis arising ventrally at posterior end of corpus bursae. Latter membranous, with narrowed posterior, weakly striate area, and gently swollen, larger anterior portion. Signum absent.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

DISTRIBUTION: This species is an endemic one and known from only one island. *Santa Cruz Island:* May (1 ♀, BMNH); Darwin Research Station, Academy Bay, January, February (Herbulot, 1970, 1971; 1 ♂, CAS); Horneman Farm, elevation 200 m., June (3 ♀, AMNH).

REMARKS: This species is less commonly represented in collections than is *cruciata*. As far as can be told from the limited material available, sexual dimorphism in the pattern of the wings is more strongly developed in the present species than in the preceding one.

Thyrintina infans Herbulot

Figures 15, 16, 35, 47

Thyrintina infans HERBULOT, 1970, p. 24, fig. 2 (male genitalia); 1971, p. 14.

ADULTS: Antennae of males with very long pectinations (longer on one side of antennal shaft than on other) extending almost to end of structure; those of females shortly pectinate and white. Process of fore tarsus in female is very short, being about one-fourth or one-fifth length of segment. Upper surface of wings white, with scattered grayish brown or brownish scales; cross lines usually rather weakly represented; t. a. line angular; t. p. line outwardly projecting on veins M_3 and Cu_1 , and again on anal vein, with smaller teeth on most of other veins; discal dots varying from being solid black and prominent, to circular and gray, to obsolescent on all wings. Hind wings similar in color and maculation to forewings, but lacking basal line. Under surface white, with forewings being suffused with gray; maculation obsolescent or absent. Sexes alike in color and maculation but not in size. Length of forewings of males, 9 to 10 mm., that of females, 13 to 16 mm.

MALE GENITALIA: Uncus short and broad, with apex having two widely separated points. Valves short and simple. Anellus having posterior margin produced medially and broadly bifurcate, with length of this extension

being less than half length of anellus. Processes of anellus represented by elongate posterior pair only, these having small basal tooth, and apex extended into point. Aedeagus apically pointed and having area of spinules on one side; vesica with small, pointed, sclerotized piece.

FEMALE GENITALIA: Sterigma with very elongate, U-shaped lamella antevaginalis, slightly widened anteriorly. Ductus bursae triangular in outline, quite short, not extending beyond lamella antevaginalis. Corpus bursae with signum either obsolescent or absent.

EARLY STAGES: Caterpillar pale gray with reddish brown markings.

FOOD PLANTS: *Cordia lutea* Lamarck (Boraginaceae); *Maytenus obovatus* J. D. Hooker (Celastraceae).

DISTRIBUTION: Endemic. *Fernandina Island*: west side, elevation 1100 feet [335 m.], February (2 ♂, 1 ♀, CAS). *Floreana Island*: July (1 ♂, 1 ♀, BMNH). *Isabela Island*: Darwin Volcano (1 ♂, BMNH; Herbulot, in letter). *San Salvador Island*: James Bay, about 1 km. south near Sugarloaf, elevation \pm 20 m., March (1 ♀, RS); July (3 ♂, 1 ♀, BMNH). *Santa Cruz Island*: Darwin Research Station, Academy Bay, January, February, March, October, November (Herbulot, 1970, 1971; 2 ♀, CAS; 1 ♀, RS); Horneman Farm, elevation 200 m., June, July (2 ♀, AMNH), elevation 220 m., March (1 ♀, CAS); east slope, elevation 160 m., April (1 ♂, 1 ♀, CAS); grassland, elevation 750 m., April (1 ♀, CAS). *Santa Fe Island*: (RP).

REMARKS: The records of Mr. Perry, including those for the early stages and food plants, as well as the ones pertaining to distribution, should be checked to be certain they are referable to this species and not the following one.

There is less individual variability in *infans* than there is in the following species. The present one has some variation in the amount of grayish brown scaling on the upper surface of the forewings, and hence there is a difference in the strength of the cross lines and discal dots. All the specimens examined have been much paler in color than the respective sexes of *umbrosa*; this is especially noticeable in the males.

Thyriniteina umbrosa Herbulot, new status

Figures 17, 18, 36, 48

Thyriniteina infans umbrosa HERBULOT, 1971, p. 14.

ADULTS: Antennae of males with very long pectinations, being slightly longer than those of *infans*; those of females simple basally, becoming serrate medially, and varying in color from grayish white to brown. Process of fore tarsus in female one-half length of segment. Upper surface of wings dark brown or dark grayish brown in male, with most specimens having little or no maculation. Females variable in color, ranging from

grayish white to various degrees of brown and brownish gray; forewings with cross lines usually present; t. a. line varying from angulate to rounded, often enlarged on veins; t. p. line similar in course to that of *infans* but more irregular in course; discal spots either absent or very weakly represented. Hind wings of both sexes similar to forewings, tending to have rounded discal spot present. Under surface varying from immaculate dark grayish brown in males to grayish white, with variable amount of dark gray or grayish brown scaling in females. Length of forewings of males, 8 to 9 mm., and that of females, 11 to 16 mm.

MALE GENITALIA: Uncus tapering, apical portion constricted ventrally, and having two small points. Valves short and simple. Anellus with posterior margin sclerotized and strongly produced, apex variable, being a slightly enlarged point, two diverging points, or two widely separated points; length of this extension ranging from equal to, to one and one-half times as long as, length of anellus. Single process of anellus very long and slender, with elongate basal tooth and long, digitate posterior process. Aedeagus with posterior end sclerotized and tapering to long slender point, and having spinose area basad thereof; vesica unarmed.

FEMALE GENITALIA: Sterigma having U-shaped lamella antevaginalis much shorter than that of *infans*, with length of this structure about equal to length of its segment; in preceding species U-shaped extension about three times as long as segment. Ductus bursae an elongate, sclerotized tube extending anteriorly of lamella antevaginalis. Signum absent, or weakly developed.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

DISTRIBUTION: This species is an endemic one. *Fernandina Island:* Elevation 400 m. (Herbulot, 1971; 1 ♂, BMNH). *Isabela Island:* Wolf Volcano, January (Herbulot, 1971); Corazon Verde, Volcan Sierra Negra (= Santo Tomas), elevation 360 m., January (1 ♀, BMNH). *San Salvador Island:* Elevation 7000 feet [2134 m.], December (1 ♀, CAS). *Santa Cruz Island:* Horneman Farm, elevation 200 m., June (3 ♀, AMNH), elevation 220 m., February, March, April, May (4 ♂, 31 ♀, CAS); Table Mountain, elevation 440 m., April (3 ♂, 20 ♀, CAS); grassland, elevation 750 m., April (8 ♀, CAS).

REMARKS: The holotype, in the collection of the British Museum (Natural History), has been dissected by Fletcher; this is Geometridae genitalia slide No. 8008. A sketch of these genitalia was made; a study of this proves that *umbrosa* is a species distinct from *infans*.

The seven males of this species from Santa Cruz Island are much browner than is the single male from Fernandina; the latter has much

grayer wings. The amount of individual variation in the series of females from Santa Cruz is quite extensive; the specimens vary from an almost pure white with a dark median and spotted sub-terminal area to examples that are almost entirely dark brown or grayish brown. In all cases, every specimen examined of this species has been darker than any example of *infans* that I have seen.

Sphacelodes vulneraria (Hübner)

Figures 21, 22, 38, 50

Brotis vulneraria HÜBNER, 1823, p. 23, figs. 319, 320 (male).

ADULTS: Antennae of males shortly bipectinate; those of females simple. Palpi large, rising to middle of eye, and extending well beyond front. Sexes dimorphic in pattern on upper surface of wings; males having all wings blackish brown, with more or less weakly defined cross lines, and with orange-brown median costal spot; females tending to have wings paler than in males, with more grayish brown scaling, to have more clearly defined cross lines, and to lack costal spot. Under surface of wings bluish gray in both sexes, with broad, dull black border to all wings.

MALE GENITALIA (BASED ON MAINLAND SPECIMENS): Valves broad and flat, and with several spines at the outer angles. Saccus extremely long and very narrow. Vesica with longitudinal row of spines. Very large and broad pair of hairlike tufts being most obvious feature.

FEMALE GENITALIA: Ductus bursae longer than wide, membranous. Ductus seminalis arising on right side from swollen area extending across posterior end of corpus bursae. Latter long and slender, with area of sclerotized striations posteriorly. Signum absent.

EARLY STAGES: This species has not been reared on the Galapagos Islands.

FOOD PLANTS: Unknown.

DISTRIBUTION: This species occurs from the southern United States to southern South America. Only two specimens from the Galapagos Islands are known to me. *Santa Cruz Island:* Horneman Farm, elevation 220 m., March, May (1 ♂, 1 ♀, CAS).

REMARKS: The males are quite constant in their color and maculation throughout the range of the species. The single Galapagos male, however, has the orange-brown median costal spot greatly reduced, and of a duller color than in any other male that I have seen. Unfortunately the specimen was damaged while being shipped, and the abdomen was not located; consequently the genitalia have not been studied. The female looks similar to mainland specimens, but the maculation of the upper surface of the

wings is more clearly defined than in most specimens. More material is needed before the exact status of this Galapagos population of *vulneraria* can be decided.

Oxydia lignata (Warren)

Figures 19, 20, 37, 49

Sericosema lignata WARREN, 1905, p. 362. SCHAUS, 1923, p. 28. LINSLEY AND USINGER, 1966, p. 162.

Oxydia lignata: HERBULOT, 1971, p. 15.

ADULTS: Antennae of both sexes simple; those of females more slender than in males. Palpi projecting well beyond front. Sexes dimorphic in color of upper surface of wings, with males dark brown and females varying from cream colored to various shades of yellowish brown. Forewings having two cross lines represented in varying degrees of intensity, ranging from obsolescent to broad and prominent; t. a. line curving across wing; t. p. line outwardly angled below costa, then extending straight across wing; discal dots usually present on all wings. Hind wings either concolorous with forewings, or slightly paler, and with extradiscal line more or less represented. Under surface of wings basically similar to upper surface but with reduced maculation. Length of forewings of males ranging from 16 to 18 mm., of females from 20 to 23 mm.

MALE GENITALIA: Uncus long, slender, and curved. Gnathos truncate medially, with row of elongate teethlike spines. Valves having sclerotized costa, with broad row of thick setae extending down inner face of valve. Short broad furca situated on left side, its oblique apex thickly covered with elongate, sclerotized setae. Aedeagus rather short and broad, with sclerotized posterior point; exerted vesica roughly shaped like inverted U, with two adjacent areas of short setae on left side, short diagonal row near end of aedeagus, and longitudinal row posterior of the first. Ventral surface of third abdominal segment without transverse row of setae.

FEMALE GENITALIA: Sterigma sclerotized, fairly wide. Ductus bursae quite short. Ductus seminalis arising on right side posteriorly of corpus bursae. Latter elongate, with long, slender posterior portion having longitudinal striations, and shorter, more membranous, rounded anterior portion bearing small signum.

EARLY STAGES: Larva pale brown with more or less continuous merging pattern of red-brown and black. Pupa a somewhat mottled brown.

FOOD PLANT: *Clerodendron molle* Humboldt (Verbenaceae).

DISTRIBUTION: This species is an endemic one. *Fernandina Island*: February (6 ♂, CAS). *Isabela Island*: southeastern part of the island (Warren, 1905); Iguana Cove, March (1 ♀, CAS). *San Cristóbal Island*: April

(Schaus, 1923). *San Salvador Island*: (RP). *Santa Cruz Island*: Academy Bay, June (2 ♂, 2 ♀, AMNH); Darwin Research Station, Academy Bay, February, March (2 ♀, CAS); Horneman Farm, elevation 200 m., June (9 ♂, 19 ♀, AMNH), elevation 220 m., February, March, April (40 ♀, CAS); Table Mountain, elevation 440 m., April (6 ♀, CAS); grassland, elevation 750 m., April (6 ♀, CAS); February, March, April, May (27 ♂, 69 ♀, CAS).

REMARKS: The coloration of the wings in the males is quite constant, whereas in the females it is quite variable. The maculation is also noticeably more variable in the females than in the males.

LITERATURE CITED

- BOISDUVAL [J. B. A. D. de], AND [A.] GUENÉE
1858. *Histoire naturelle des insectes. Species général des lépidoptères. Phalénites*. Paris, atlas, pp. 1-6, pls. 1-22.
- GUENÉE, A.
1857. *Histoire naturelle des insectes. Species général des lépidoptères*. Paris, vol. 10, 584 pp.
- HERBULOT, C.
1970. *Lepidopteres Geometridae des Iles Galapagos* recueillis par M. et Mme. N. Leleup. *Lambillionnea*, vol. 69, pp. 17-25, 3 figs.
1971. *Deuxieme note sur les Lepidopteres Geometridae des Isle Galapagos*. *Ibid.*, vol. 71, pp. 11-15, 3 figs.
- HOWARD, L. O.
1889-1890. Scientific results of explorations by the U. S. Fish Commission Steamer Albatross. No. V.-Annotated catalogue of the insects collected in 1887-'88. *Proc. U. S. Natl. Mus.*, vol. 12, pp. 185-207.
- HÜBNER, Jacob
[1819-] 1823. *Zuträge zur Sammlung Exotischer Schmettlinge [sic]*. Augsburg, Zwentes Hundert, pp. 32+[8], figs. 201-400.
- LINSLEY, E. G., AND R. L. USINGER
1966. *Insects of the Galápagos Islands*. *Proc. California Acad. Sci.*, vol. 33, pp. 113-196, 1 table.
- RINDGE, FREDERICK H.
1961. A revision of the Nacophorini (Lepidoptera, Geometridae). *Bull. Amer. Mus. Nat. Hist.*, vol. 123, pp. 87-154, figs. 1-26, pls. 18-23.
1970. Moths of the genus *Holochroa* (Lepidoptera, Geometridae) from the Tres Mariás Islands, Mexico. *Amer. Mus. Novitates*, no. 2422, pp. 1-7, 7 figs.
- SCHAUS, W.
1923. *Galapagos Heterocera* with descriptions of new species. *Zoologica*, vol. 5, pp. 21-48.
- WARREN, W.
1904. New Thyrididae and Geometridae from the Oriental regions. *Novitates Zool.*, vol. 11, pp. 483-492.
1905. New American Thyrididae, Uraniidae, and Geometridae. *Ibid.*, vol. 12, pp. 307-379.

