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Two new species of *Chionodes* Hübner from Ecuador, with a summary of known Galapagos records of Gelechiidae (Lepidoptera)

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Two new species of *Chionodes* Hübner from Ecuador, with a summary of known Galapagos records of Gelechiidae (Lepidoptera). - Two new species of the genus *Chionodes* Hübner, 1825 (Lepidoptera, Gelechiidae) from Ecuador are described and illustrated. *Chionodes stefaniae* sp. n. occurs in the Galapagos on the islands of Floreana, Isabela, Pinta, Pinzon, Rabida, San Cristobal, and Santa Cruz, where it is believed to be endemic. *Chionodes manabiensis* sp. n. occurs on the Ecuadorian coast in Machalilla National Park. The previous Galapagos records of *Aristotelia howardi* Walsingham, 1909, and *Stegasta bosqueella* Chambers, 1875 were erroneous. *Stegasta zygotoma* Meyrick, 1917 is reported from the Galapagos for the first time. Altogether, five species records of Gelechiidae are now considered valid for the Galapagos.

Keywords: Lepidoptera - Gelechiidae - new species - *Chionodes* - endemic - Galapagos Islands - Manabi.

INTRODUCTION

The Gelechiidae represent one of the largest families of Lepidoptera with more than 4,530 species described (Hodges, 1998). Kaila (2004: 322) reported that the monophyly of the group is supported by 12 synapomorphies of which one is unique, i.e. the presence on the forewing of a row of narrow scales ventrally on vein R in females only. Genus *Chionodes* Hübner, 1825 is found throughout the Holarctic region and in the Neotropics. The largest number of species occurs in North America and in the mountain zones of the Palearctic region including the Arctic (Huemer & Sattler, 1995). An apparent apomorphy for *Chionodes* is the presence of a caecum on the phallus (Hodges, 1999: 15). In his revision of the North American species, Hodges (1999: 20, 24, 25) recognized and characterized six species-groups for the 187 species occurring in America North of Mexico and the 21 species in the Neotropical region. The two species described here belong to the phalacrus-group which already contains five described species in the Neotropics (i.e., south of the U.S.A.): *C. argosema* (Meyrick, 1917) described from the Ecuadorian Andes, *C. consona* (Meyrick, 1917) described from Peru, *C. donatella* (Walker, 1864) described from Jamaica, *C. eburata*

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(Meyrick, 1917) described from Colombia, and *C. phalacrus* (Walsingham, 1911) described from Mexico. Two undescribed species from Brazil were also recorded to belong to this group by Hodges (1999: 165). The known host plants of the group are in the Malvaceae: *Abutilon*, *Hibiscus*, *Malacothamnus*, *Malvastrum*, *Sida*, *Sidalcea*, *Sphaeralcea*, and *Wissadula* (Hodges, 1999).

As part of a project to document the entire microlepidopteran fauna of the Galapagos, dissected specimens of the Gelechiidae species collected by Bernard Landry (BL) in the Galapagos were critically examined by him with the help of Dr Klaus Sattler at the Natural History Museum, London, England (BMNH) in 2000. Among them was a new species of *Chionodes* which was used as an outgroup to study the evolution of the Galapagos endemic genus *Galagete* Landry (Autostichidae; Schmitz *et al.*, submitted). And while searching for potential taxa possibly related to *Galagete* at Machalilla National Park, on the coast of continental Ecuador, north of Guayaquil, Patrick Schmitz (PS) came upon another new species of *Chionodes* that proved to be different, yet very similar to the Galapagos species and to a few other described species. These two new species are described below.

So far only four valid species of Gelechiidae have been reported for the Galapagos. Schaus (1923) reported *Aristotelia howardi* Walsingham, 1909, and *Stegasta bosqueella* Chambers, 1875. However, we can report here that these two records were erroneous and respectively represent *Aristotelia naxia* Meyrick, 1926, described from the Galapagos, and *Stegasta zygotoma* Meyrick, 1917, described from Colombia, Ecuador, and Peru, and for which Clarke (1969) selected a lectotype from Ecuador, Huigra, 4,500 ft. The two erroneous records and *A. naxia* were subsequently listed also by Linsley & Usinger (1966) along with *Gelechia protozona* Meyrick, 1926 and *G. gnathodoxa* Meyrick, 1926, which Landry (2002) transferred to the Autostichidae. The other previous gelechiid records are those of the widespread invasives *Sitotroga cerealella* (Olivier, 1789) and *Tuta absoluta* (Meyrick, 1917) in Causton *et al.* (2006). Collections hold at least 12 more Gelechiidae species from the Galapagos, and they will be treated in a forthcoming paper.

MATERIAL AND METHODS

The 57 specimens forming the basis of this study were collected mostly by BL during three expeditions to the Galapagos in 1989, 1992, and 2002. Other specimens were collected by both of us during two more expeditions on the archipelago in 2004 and 2005, and by PS in the Galapagos and in Machalilla National Park in 2006. Seven additional specimens come from the collection of the Invertebrates Department of the Charles Darwin Research Station, Santa Cruz Island, Galapagos (CDRS). In addition to this institution, specimens will be deposited in the Natural History Museum, London, England (BMNH), the Canadian National Collection of Insects, Ottawa, Canada (CNC), and the Muséum d'histoire naturelle, Geneva, Switzerland (MHNG).

The manner of giving the label data of the holotypes and paratypes is presented in Landry (2006) and so are the methods used for specimen collecting, genital preparation, forewing length measurement, and illustrations. The terminology regarding genitalia follows Hodges (1999).

DESCRIPTIONS

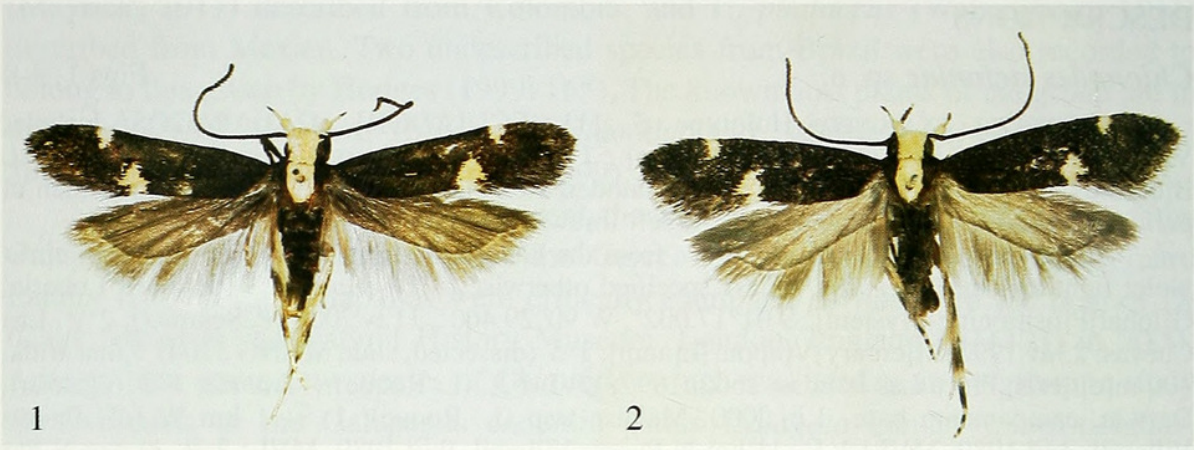
Chionodes stefaniae sp. n. Figs 1, 3-8

MATERIAL EXAMINED: Holotype ♂, [1] "ECU[ADOR]., GALAPAGOS/ Isabela, V[olcan]. Darwin/ 630 m[eters] elev[ation]., 17.v.1992/ M[ercury]V[apour]L[amp], *leg[it].* B[ernard]. Landry". [2] "HOLOTYPE/ Chionodes/ stefaniae/ Schmitz & Landry". Specimen in perfect condition except for small hole in left forewing. Deposited in MHNG.

Paratypes, Ecuador: 19 ♂, 29 ♀, from the Galapagos Islands, collected with an ultraviolet light and by B. Landry, unless specified otherwise. – *Floreana*: 1 ♀, close to Loberia, G[lobal]P[ositioning]S[ystem]: S 01°17.002', W 90°29.460', 11.iv.2004 (P. Schmitz); 2 ♀, Las Cuevas, 23.iv.1992, M[ercury]V[apour]L[amp]; 1 ♂ (dissected, slide MHNG 3204), Zona arida, 300 m[e]t[er]s, Finca Las Palmas, 26.xii.1997, UVL-F.L. (L. Roque). – *Isabela*: 1 ♂, V[olcan]. Darwin, campamento base, 1.iii.2000, Malaise trap (L. Roque); 1 ♀, 1 km W [of] Puerto Villamil, 3.iii.1989, MVL; 1 ♀, 11 km N Puerto Villamil, 9.iii.1989, MVL; 2 ♀, 11 km N Pto Villamil, 13.iii.1989, MVL; 1 ♂ (dissected, slide MHNG 3201), NE slope [Volcan] Alcedo, Los Guayabillos camp, GPS: elev[ation]. 869 m, S 00°24.976' W 91°04.617', 2.iv.2004, 4h00-5h30 (B. Landry, P. Schmitz); 1 ♀, [Volcan] Alcedo, lado NE, 200 m, camp arida alta, 14.iv.2002 (B. Landry, L. Roque); 2 ♀, [Volcan] Alcedo, lado NE, 400 m, camp pega-pega, 15.iv.2002 (B. Landry, L. Roque); 1 ♀ (dissected, slide MHNG 3208), [Volcan] Alcedo, lado NE, low arid zone, bosq[ue]. palo santo, 18.iv.2002 (B. Landry, L. Roque); 3 ♂, V. Alcedo, 570 m elev., 11.x.1998 (L. Roque). – *Pinta*: 1 ♂ (dissected, slide MHNG 3202), 1 ♀, 200 m elev., 16.iii.1992, MVL; 1 ♀, 400 m elev., 17.iii.1992, MVL; 1 ♀, N 00°34.476', W 90°45.102', 372 m elev., 16.iii.2006 (P. Schmitz, L. Roque); 1 ♂, 400 m elev., 18.iii.1992, MVL; 3 ♀, N 00°34.591', W 90°45.137', 421 m elev., 18.iii.2006 (P. Schmitz, L. Roque). – *Pinzon*: 1 ♀ (dissected, slide PS028), 01.v.2003 (L. Roque). – *Rabida*: 1 ♀, Tourist trail, 3.iv.1992, MVL. –*San Cristobal*: 1 ♀ (dissected, slide MHNG 3209), antiguo botadero, ca. 4 km SE Pto Baquerizo, GPS: 169 m elev., S 00°54.800', W 089°34.574', 25.ii.2005; 1 ♂ (dissected, slide MHNG 3203), near Loberia, GPS: elev. 14 m, S 00°55.149', W 89°36.897', 16.iii.2004 (B. Landry, P. Schmitz). – *Santa Cruz*: 1 ♂, Tortuga Res[erve]., W [of] Santa Rosa, 6.ii.1989, MVL; 1 ♀, NNW [of] Bella Vista, GPS: 225 m elev., S 00°41.293', W 090°19.665', 18.ii.2005 (B. Landry, P. Schmitz); 1 ♀, E[stacion]. C[ientifica]. C[harles]. D[arwin]., 7.iii.1992; 1 ♀, transition zone, recently cut road, GPS: S 00°42.528', W 90°18.849', 12.iii.2004 (B. Landry, P. Schmitz); 1 ♀, El Barranco, ECCD, 13.iii.2000, MVL Trap (L. Roque); 1 ♂, Finca S[teve]. Devine, 17.iii.1989, MVL; 1 ♂, ECCD, El Barranco, S 00°44.291', W 90°18.107', 22 m elev., 23. iii.2006 (P. Schmitz); 2 ♂, Finca Vilema, 2 km W [of] Bella Vista, 1.iv.1992, MVL; 1 ♀, C[harles] D[arwin] R[esearch] S[tation], [El] Barranco, 20 m elev., 30.iv.2002; 4 ♂ (one dissected, slide MNHG 3212), 3 ♀ (one dissected, slide MHNG 3207), Los Gemelos, 27.v.1992, MVL; 1 ♂, Barranco, CDRS, 23.x.2001 (L. Roque). Deposited in the BMNH, CDRS, CNC, and MHNG.

ETYMOLOGY: We are pleased to name this species in honour of Stefania Bertoli-Schmitz for her love and support to PS through the last seven years.

DIAGNOSIS: Among the species of *Chionodes*, *C. stefaniae* is similar in wing pattern to *C. argosema*, *C. donatella*, *C. manabiensis* sp. n., *C. mariona* (Heinrich, 1921), and *C. petro* Hodges, 1999 of the phalacrus-group of Hodges (1999). In male genitalia, *C. stefaniae* differs from *C. argosema*, *C. donatella*, *C. mariona*, and *C. petro* in having a shorter mesial projection of the uncus and short, curved and rather stout valval projections as opposed to long and thin projections in *C. argosema* (Clarke, 1969), and short and straight projections in the other three species (Hodges, 1999). Furthermore, *C. stefaniae* differs from *C. donatella*, *C. mariona*, and *C. petro* in having the male abdominal tergum VIII wider than long versus about twice as long as wide (Hodges, 1999: pl. W figs 16, 17, 20), and in the female, there is a modification at the posterior margin of tergum VII while modifications occur at the posterior margin of abdominal tergum VI and anterior margin of tergum VII in the other species (Hodges,

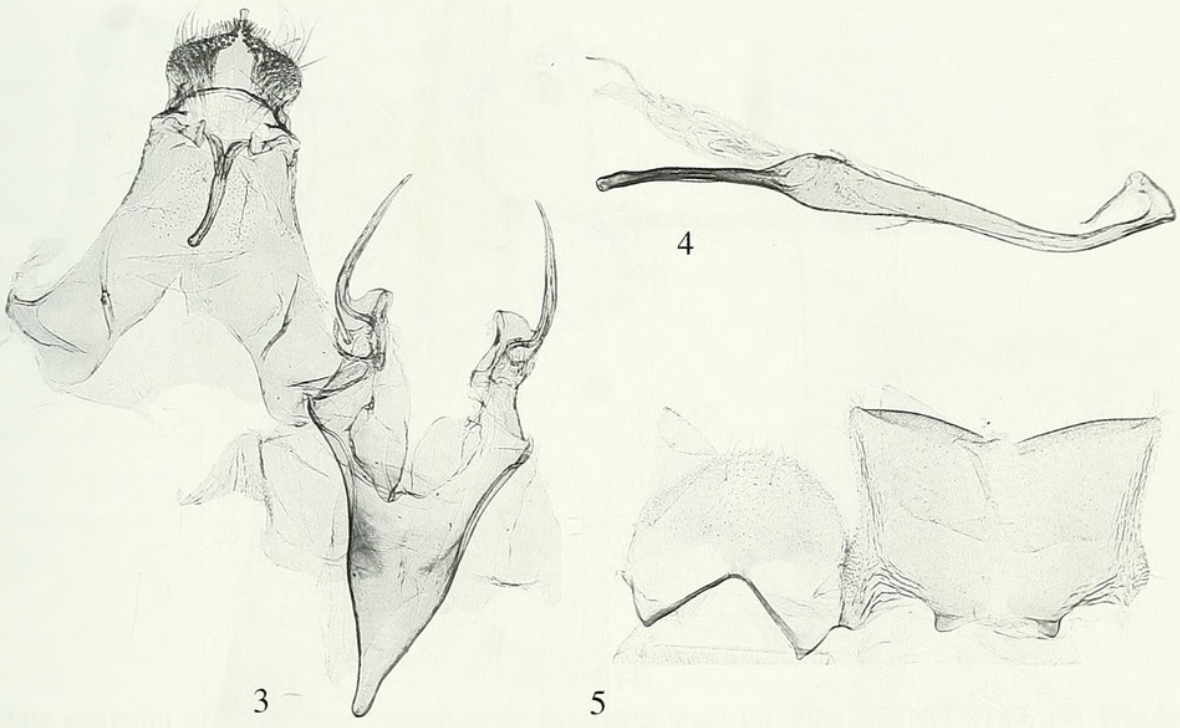


FIGS 1-2
Holotypes of *Chionodes* spp. (1) *C. stefaniae*. (2) *C. manabiensis*.

1999: pl. VV figs 11-13). *Chionodes stefaniae* differs from *C. manabiensis* in several characters mentioned in the Diagnosis and Description of this species, below.

DESCRIPTION: *MALE* (n=20) (Figs 1, 3-5): Head off-white with yellowish orange scales on forehead. Haustellum dark brown; maxillary palpus off-white, 4-segmented. Labial palpus dark brown on first segment; second segment off-white to yellowish orange with broad scale brush; third segment off-white to yellowish orange, slender, dark brown on distal 1/3 to 1/2. Antennal scape dark brown with white scales ventrally; flagellum dark brown. Thorax off-white, tegula and metathorax dark brown. Foreleg coxa, tibia, femur and tarsomeres dark brown with white at apices of tarsomeres I and V. Midleg and hindleg femora and tibiae dark brown at base, apices 1/3 off-white; spurs white; tarsomeres I-V mostly dark brown with white at apex of each segment. Wingspan: 9.3-11.0 mm (Holotype: 11.0 mm). Forewing dark brown with pair of prominent off-white patches with yellowish orange scales on costal margin at 3/4 and on inner margin at end of fold; sometimes with slightly darker brown markings visible as two small spots submedially in middle, one above the other, and another spot post-medially above second off-white patch; with some scattered off-white scales between patches, on termen, and around both small spots; fringe dark brown. Hindwing dark greyish brown, fringe pale greyish brown. Abdomen dark brown dorsally, off-white ventrally; tergum VIII with more thickly sclerotized anterior margin a broad inverted V, with posterior margin broadly rounded; sternum VIII with lateral margins slightly convex and with conspicuous striae, anterior margin bearing pair of submesial lobes, posterior margin with broad and short rounded lateral lobes (apically folded on Fig. 5).

Male genitalia (n=4) (Figs 3, 4). Uncus with broadly rounded anterobasal lobes with stout setae ventrally and few hairlike setae on apical margins; with small, blunt, apicomesial projection. Median hook of gnathos rather long and thin, slender from base to apex, upturned and pointed apically. Dorsal connection of tegumen wide; pedunculi short and broad, shorter than vinculum. Valva with long and slender sickle-like projection of 1/2-1/3 X length of tegumen; with small recurved knob at lateral base of each projection; sacculus short, with few setae at base ventrally. Vinculum tapering to narrowly rounded saccus. Phallus narrow, with distinct, sclerotized rim around



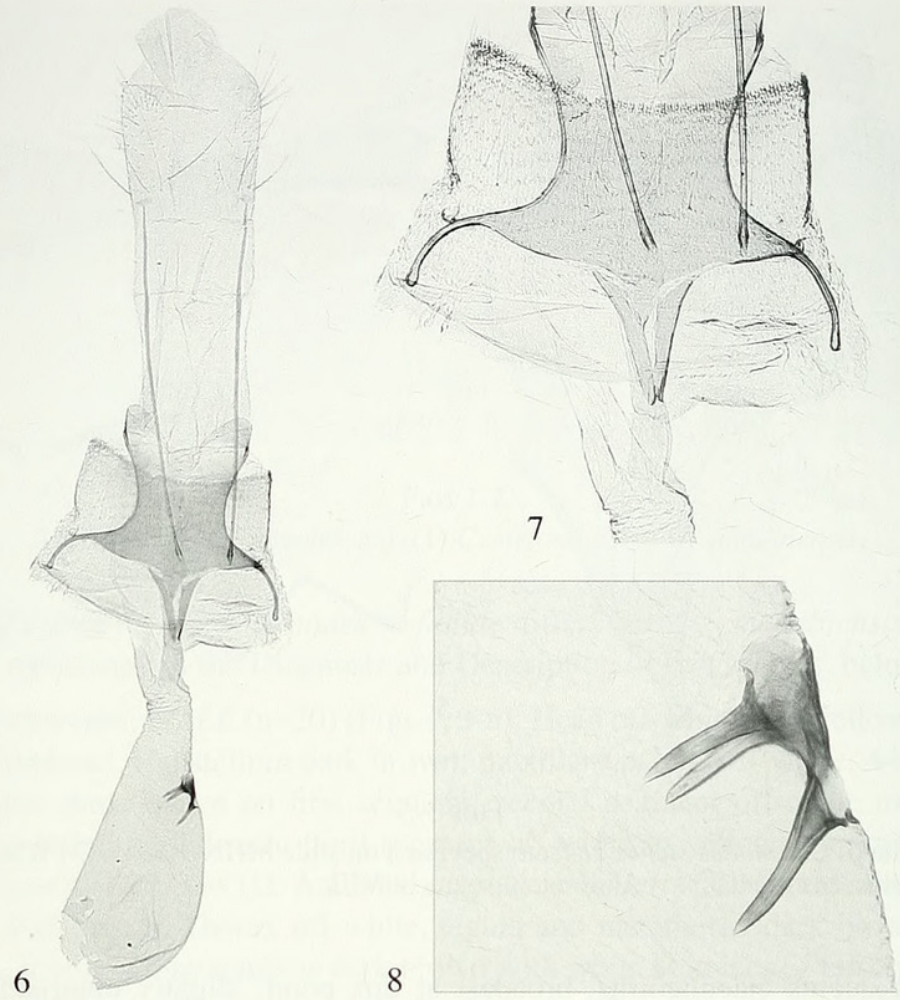
FIGS 3-5
Male genitalia of *Chionodes stefaniae* from specimen on slide MHNG 3201. (3) Whole genitalia without phallus. (4) Phallus; (5) Abdominal segment VIII.

opening of ductus ejaculatorius, broadest at this point; slightly upturned at 5/6 of length; with long, rodlike caecum of about 1/3 X length of phallus; vesica without spines or cornuti.

FEMALE (n=29): Colour as in male. Antenna slightly thinner than that of male. Female wingspan: 8.7-10.9 mm. Tergum VII apically modified, with low, median depression associated with thin canal directed proximally.

Female genitalia (n=5) (Figs 6-8). Papillae anales slightly longer than wide. Posterior apophyses long, straight, very slightly enlarged at apex (about 2.4 X length of papillae), reaching base of antrum. Anterior apophyses partly fused with antrum, free proximal section arising from lateral margin of antrum near base, down curved with slightly enlarged apex. Antrum well developed with short, longitudinal sclerotized band in dorsal wall; also with heavily sclerotized lateral bands of about half length of ductus bursae and fused toward apex, with left band bent toward right one. Ductus bursae short, of medium girth (width = 0.2-0.25 X its length), slightly constricted at apex of lateral bands of antrum. Inception of ductus seminalis at base of corpus bursae. Corpus bursae elongate, widening and rounded at proximal end, with light scobination; signum situated posteriad middle of corpus bursae, triangular with heavily sclerotized, inwardly directed, large spine arising from each angle, sometimes with small extra spine.

BIOLOGY: The moths were collected at light in February, March, April, May, October, and December from sea level to 869 m.



FIGS 6-8

Female genitalia of *Chionodes stefaniae* from specimen on slide MHNG 3207. (6) Whole genitalia. (7) Segment VII. (8) Signum.

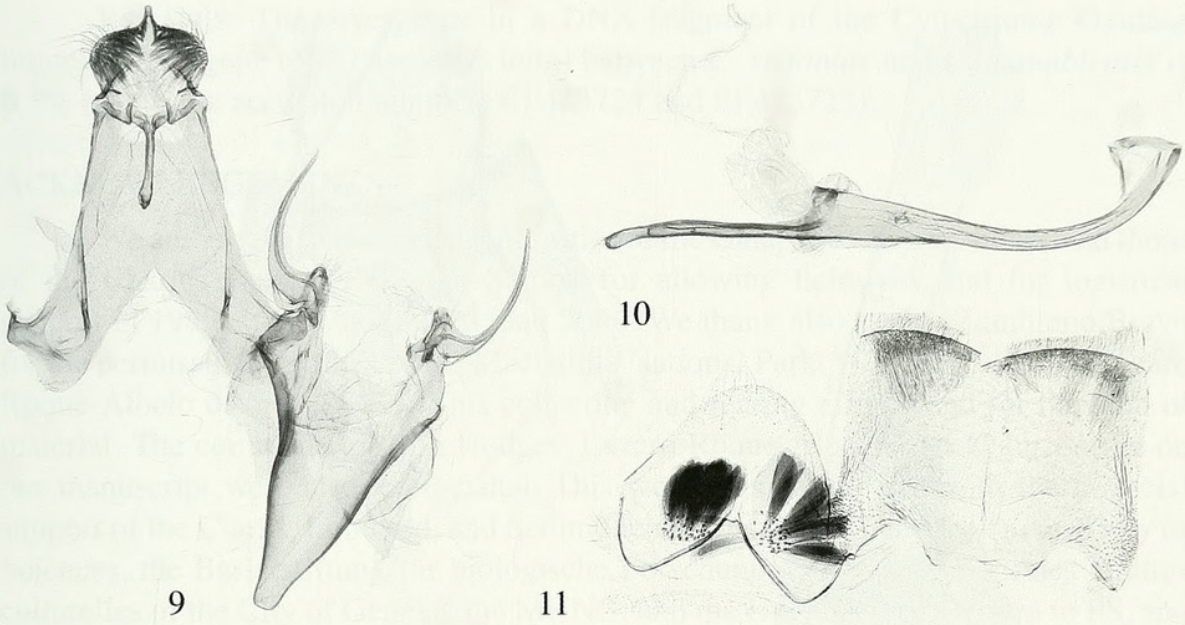
DISTRIBUTION: Currently known only from the Galapagos islands of Floreana, Isabela, Pinta, Pinzon, Rabida, San Cristobal, and Santa Cruz; presumed to be endemic to the archipelago.

REMARKS: This species and the following one are apparently more closely related to each other than to any of the other *Chionodes* species on the basis of the short mesial projection of the uncus, the curved and rather short valval projections, the wide abdominal tergum VIII of the male, and the modified posterior margin of tergum VII of the female.

Chionodes manabiensis sp. n. Figs 2, 9-14

MATERIAL EXAMINED: Holotype ♂, [1] "ECU[ADOR], Manabi, Parque nacional/ Machalilla, Los Frailes/ S 01°29.340', W 80°46.686/ 40 m[eters] elev[ation]., u[ltra] v[iolet] l[ight], 25.iv.2006/ *leg[it]*. P[atrick]. Schmitz". [2] "HOLOTYPE/ Chionodes/ manabiensis/ Schmitz & Landry". Specimen in perfect condition except for small notch in left hindwing. Deposited in MHNG.

Paratypes, Ecuador: 4 ♂, 3 ♀, from Manabi, collected at uvl by P. Schmitz. 1 ♀, Puerto Lopez, Hosteria Mandala, S 01°32.955', W 80°48.617', 10 m elev., 24.iv.2006; 3 ♂ (one dissected, slide MHNG 3187), with same data as holotype; 1 ♀ (dissected, slide MHNG 3210), Parque nacional Machalilla, Agua Blanca, S 01°31.421', W 80°46.081', 45 m elev., 26.iv.2006;



FIGS 9-11
Male genitalia of *Chionodes manabiensis* from specimen on slide MHNG 3187. (9) Whole genitalia without phallus. (10) Phallus. (11) Abdominal segment VIII.

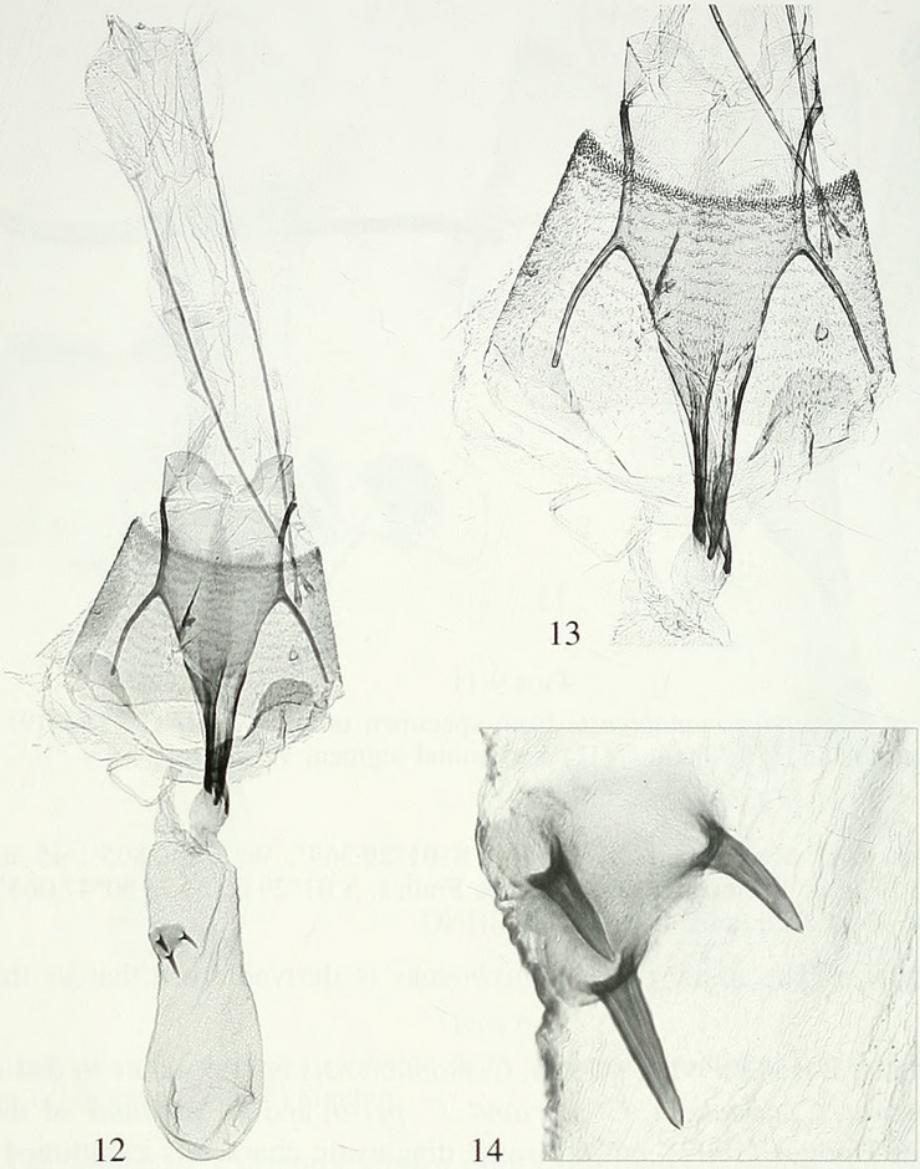
1 ♀, Parque nacional Machalilla, Los Frailes, S 01°29.369', W 80°46.805', 45 m elev., 27.iv.2006; 1 ♂, Parque nacional Machalilla, Los Frailes, S 01°29.053', W 80°47.064', 86 m elev., 28.iv.2006. Deposited in the BMNH and MHNG.

ETYMOLOGY: The name of *C. manabiensis* is derived from that of the type locality.

DIAGNOSIS: Based on wing pattern, *C. manabiensis* is impossible to distinguish from *C. argosema*, *C. donatella*, *C. mariona*, *C. petro*, and *C. stefaniae* of the phalacrus-group of Hodges (1999), but the same diagnostic characters mentioned under the diagnosis for *C. stefaniae* can be applied to separate *C. manabiensis* from *C. argosema*, *C. donatella*, *C. mariona*, and *C. petro*. *Chionodes manabiensis* differs from *C. stefaniae* in the slightly darker ground colour of the forewing, in the presence of a pair of patches of modified scales on abdominal tergum VIII of the males, in the female modification of tergum VII, which is located more medially and is associated with a low, elongate crest, and in genital characters as mentioned below.

DESCRIPTION: *MALE* (n=5) (Figs 2, 9-11): As *C. stefaniae*, except forewing and abdomen darker; wingspan: 9.0-10.0 mm (Holotype: 10.0 mm); abdominal tergum VIII more narrowly rounded apically, with pair of patches of modified scales, with anterior margins more rounded; abdominal sternum VIII slightly longer, less striated laterally, with lobes of anterior margin less heavily sclerotized.

Male genitalia (n=1) (Figs 9, 10). As in *C. stefaniae*, except uncus with more heavily sclerotized setae ventrally; tegumen longer than vinculum; long projection of valva less strongly bent and broader at base; small recurved lobe at base of projection slightly longer; sacculus shorter, with more setae ventrally; vinculum broader, especially at apex; phallus more broadly bent upward at 3/4 of length.



FIGS 12-14

Female genitalia of *Chionodes manabiensis* from specimen on slide MHNG 3210. (12) Whole genitalia. (13) Segment VII. (14) Signum.

FEMALE (n=3): As in *C. stefaniae*, except colour as in male of *C. manabiensis*; wingspan: 9.5-11.9 mm; modification of tergum VII located more medially and associated with low, elongate crest.

Female genitalia (n=1) (Figs 12-14). As in *C. stefaniae*, except papillae anales longer (1.5 X longer than broad); posterior apophyses longer (about 3.4 X length of papillae); antrum with sclerotized band in dorsal wall much longer, apically reaching beyond margin of sternum VII, proximally reaching apices of lateral bands and more thickly sclerotized; lateral bands narrow, tapering gradually, at least 2 X length of those of *C. stefaniae*, with left one bending over right one, free apically.

BIOLOGY: The adults were attracted to light in April from sea level to 86 m.

DISTRIBUTION: Currently known only from Machalilla National Park and the adjacent town of Puerto Lopez on the Ecuadorian coast (province of Manabi).

REMARKS: The divergence in a DNA fragment of the Cytochrome Oxidase mitochondrial gene (555 base pairs long) between *C. stefaniae* and *C. manabiensis* is 6.7% (GenBank accession numbers EF423724 and EF423725).

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APPENDIX

Resumen. Dos especies nuevas del género *Chionodes* Hübner en Ecuador con un resumen de las especies de Gelechiidae previamente reportadas para Galapagos (Lepidoptera). - Dos especies nuevas del genéro *Chionodes* Hübner, 1825 (Lepidoptera, Gelechiidae) de Ecuador son descritas e illustradas. *Chionodes stefaniae* sp. n. occurre en las Galápagos sobre las islas de Floreana, Isabela, Pinta, Pinzón, Rábida, San Cristóbal y Santa Cruz, donde parece ser endémica. *Chionodes manabiensis* sp. n. occurre en la costa ecuatoriana, Parque Nacional de Machalilla. Las menciónas anteriores de *Aristotelia howardi* Walsingham, 1909 y de *Stegasta bosqueella* Chambers, 1875 para Galapagos eran erróneas. *Stegasta zygotoma* Meyrick, 1917 es reportada en las Galápagos por la primera vez. En conjunto, cinco menciónas de especies de Gelechiidae ahora se consideran válidas para las Islas Galápagos.