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**Autor:** Landry, Bernard / Roque-Albelo, Lazaro / Matthews, Deborah L.

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Supplemental additions to the Pterophoridae (Lepidoptera) of the Galapagos Islands (Ecuador) with description of a new species of *Adaina* Tutt

BERNARD LANDRY<sup>1</sup> (BL), LAZARO ROQUE-ALBELO<sup>2</sup> (LR) & DEBORAH L. MATTHEWS<sup>3</sup> (DLM)

We present descriptions and illustrations for *Adaina scalesiae* sp. n., including larva and pupa, and for the female of *Platyptilia vilema* Landry, both endemic species to the Galapagos. Larvae of *A. scalesiae* were reared from leaves of six species of *Scalesia* and one of *Lecocarpus*, all Galapagos endemic Asteraceae. We give new island records for *Megalorhipida leucodactyla* (Fabricius), *Bipunctiphorus nigroapicalis* (Landry & Gielis), *Postplatyptilia huigraica* Landry & Gielis, *P. minima* Landry & Gielis, *Stenoptilodes brevipennis* (Zeller), *Exelastis pumilio* (Zeller), *Hellinsia cristobalis* (Landry & Gielis), *H. devriesi* (Landry & Gielis), and *H. nephogenes* (Meyrick). We also give a first hostplant record for *S. brevipennis* and a second for *P. huigraica*.

Presentamos descripciones e ilustraciones para *Adaina scalesiae* sp. n. (adulto, larva y pupa) y la hembra de *Platyptilia vilema* Landry, ambas especies endémicas de Galápagos. Las larvas de *A. scalesiae* fueron criadas en hojas de seis especies de *Scalesia* y una de *Lecocarpus*, todas ellas Asteraceae endémicas. Presentamos nuevos reportes de islas para *Megalorhipida leucodactyla* (Fabricius), *Bipunctiphorus nigroapicalis* (Landry & Gielis), *Postplatyptilia huigraica* Landry & Gielis, *P. minima* Landry & Gielis, *Stenoptilodes brevipennis* (Zeller), *Exelastis pumilio* (Zeller), *Hellinsia cristobalis* (Landry & Gielis), *H. devriesi* (Landry & Gielis) y *H. nephogenes* (Meyrick). En adición, presentamos el primer record de planta huésped para *S. brevipennis* y el segundo para *P. huigraica*.

Key words: Lepidoptera, Pterophoridae, Ecuador, Galapagos Islands, larva, pupa, hostplants, taxonomy, new records, new species.

INTRODUCTION

This is the third contribution to our knowledge of the pterophorid fauna of the Galapagos Islands (see Landry & Gielis 1992; Landry 1993). Since 1993, specimens of Pterophoridae have been collected or reared on the Galapagos by LR and other staff members of the Charles Darwin Research Station, Santa Cruz, Galapagos (CDRS). Specimens were also collected by BL in 2002 and 2004 (with P.

<sup>1</sup> Muséum d'histoire naturelle, C. P. 6434, CH-1211, Geneva, Switzerland  
bernard.landry@mhn.ville-ge.ch

<sup>2</sup> Charles Darwin Research Station, A.P. 17-01-3891, Quito, Ecuador; and Biodiversity and Ecological Processes Research Group, Cardiff School of Biosciences, Cardiff University, PO Box 915, Cardiff CF10 3TL, United Kingdom  
lazarro@fcdarwin.org.ec

<sup>3</sup> Department of Entomology and Nematology, IFAS, University of Florida, Gainesville FL 32611, U.S.A.  
dmlo@gru.net

Schmitz, Geneva, Switzerland), and a few more, collected in 1971 were recovered and studied in The Natural History Museum, London, England (BMNH). From these newly available specimens we are able to give the description of a new species of *Adaina* which was misidentified as *Adaina ambrosiae* (Murtfeldt) in Landry & Gielis (1992) and Landry (1993), but which we knew presented some differences in the larvae. Examination of the lectotype and of other North American specimens of *A. ambrosiae* showed that there are also differences in the adults that clearly justified the description of a new species, which is presented below along with descriptions of the last instar larva and pupa. Setal nomenclature and abbreviations for segments follow Stehr (1987) and Heinrich (1916).

In addition, we describe and illustrate the previously unknown female of *Platyptilia vilema* Landry, and we give new hostplant and distribution records for all Galapagos Pterophoridae species except *Lantanophaga pusillidactyla* (Walker), *Stenoptilodes juanfernandicus* Landry & Gielis, and *Stenoptilodes gielisi* Landry. For the island of Isabela, we also give new records from volcanoes Alcedo and Wolf. The distribution data are summarized in Table 1. The number of species in the Galapagos remains at 15. Hostplant names are from Lawesson *et al.* (1987). Previous Galapagos records are from Landry & Gielis (1992) and Landry (1993).

Other than the above-mentioned BL, BMNH, DLM, LR, and CDRS, the following acronyms are used: CNC for Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Canada; CUIC for Cornell University Insect Collection, Ithaca, New York, U.S.A.; and MHNG for "Muséum d'histoire naturelle de Genève", Geneva, Switzerland. In the list of paratypes of *Adaina scalesiae* sp. n., the information is presented chronologically for each island, which are cited in alphabetical order, and recorded as found on the labels, but abbreviated words are spelled out in square brackets when first encountered, except for cardinal points and distances, which are not spelled out; dates are standardized and all Latin names italicized.

#### RECORDS AND DESCRIPTIONS

##### ***Megalorhipida leucodactyla* (Fabricius, 1794)**

This is the species reported as *Megalorhipida defectalis* (Walker) in recent Galapagos literature. The synonymy was introduced by Karsholt & Gielis (1995). New island records are: Fernandina, Pinzon, and San Cristobal (CDRS, MHNG). Additional localities on Isabela are the base and NE slopes of Alcedo (March, April, and June, CDRS and MHNG). With specimens collected on 13 islands, *M. leucodactyla* is now the most widespread plume moth species in the archipelago. Fig. 16 shows a mature larva of this species.

##### ***Platyptilia vilema* B. Landry, 1993**

This species has been found only on the islands of Isabela and Pinta, although on the latter, a single specimen was encountered. On Isabela it was known previously from the slopes of Sierra Negra and Volcan Darwin, but additional specimens were collected also on Alcedo (200 and 300 m, March, April, and October) and Volcan Wolf (500 m, May) (CDRS). Specimens were reared from leaves of *Darwinio-*

*thamnus tenuifolius* (Hook. f.) (Asteraceae) on Alcedo (Roque-Albelo 2003), but the voucher specimens were lost. *Platyptilia vilema* is in danger of extinction if the destruction of *Darwinothmanus* species by *Icerya purchasi* Maskell (Homoptera, Margarodidae) cannot be controlled (Roque-Albelo 2003). The female was previously unknown and we present the following description on the basis of one specimen collected on Volcan Darwin, 300 m, 6.iii.2000, LR (CDRS).

*Description* (n=1). Habitus as in male (see Landry 1993), but wingspan larger : 24 mm. Frenulum with one acanthus. Female genitalia (Fig. 11). Papillae anales small, moderately setose. Intersegmental membrane IX-X with membranous, rounded sac protruding beyond papillae anales dorsally. Apophyses posteriores slender, extended shortly anterad of posterior margin of tergite VII. Tergite VIII well developed, slightly shorter than wide. Sternite VII extended posteriorly almost to posterior margin of tergite VIII, with lateral margins converging apically. Ostium central, at apical margin of sternite VII. Sterigma a pair of small round plates flanking ostium. Ductus bursae a long and narrow sclerotized tube of almost even girth reaching segment VI, followed by a shorter membranous section of about 1/3 length of sclerotized section. Ductus seminalis at junction of ductus bursae and corpus bursae. Corpus bursae a large, more or less quadrangular sac, about as long as sclerotized portion of ductus bursae, with a pair of long and slightly curved cornuti set in wide scobinate patches of corpus wall.

### ***Bipunctiphorus nigroapicalis* (Landry & Gielis, 1992)**

This species was originally placed in genus *Platyptilia*, although that assignment was uncertain. Gibeaux (1994) transferred it to his genus *Bipunctiphorus*, which is otherwise known from Japan, Kenya, Nepal, Réunion, and Tanzania. This generic placement was confirmed by Gielis (2003). The species is here reported as new from the island of Floreana (360 m, BMNH) and from the slope of Alcedo on Isabela (570 m, October, CDRS).

### ***Postplatyptilia huigraica* Landry & Gielis, 1992**

This widespread Neotropical species had been reported in the Galapagos only from Isabela (Volcan Darwin, Sierra Negra). We report new records from Santa Cruz at the CDRS (november, CDRS), Los Gemelos (May, MHNG), and the transition zone (March, MHNG; September, one reared on *Hyptis mutabilis* (A. Rick) Brig., Lamiaceae, CDRS). The latter hostplant record is new and is the second known for this species, the other being *Hyptis spicigera* Lam. On Isabela the species was also found on Alcedo (400 m, April, MHNG).

### ***Postplatyptilia minima* Landry & Gielis, 1992**

This Galapagos endemic was known from Isabela (Sierra Negra), and Pinta. We report new records from Santa Cruz (transition zone, 5 km North of Puerto Ayora, September) and from Isabela on Alcedo (292 m, March; 400 m, April; 1100 m, October) and Volcan Darwin (400 and 900 m, March) (CDRS, MHNG).



1



2

Figs 1-2. Adults of *Adaina* species: 1, Lectotype of *A. ambrosiae* (Murtfeldt); 2, Holotype of *A. scalesiae* sp. n.

***Stenoptilodes brevipennis* (Zeller, 1874)**

This widespread Neotropical species was previously known in the Galapagos from only five specimens in 1993 (Landry 1993). These had been collected on Isabela (Sierra Negra) and Santa Cruz. The number of specimens available from the Galapagos is now tripled. New island records are Floreana (360 m, January, BMNH; 340 m, May, CDRS), Marchena (April, CDRS), Pinzon (April, MHNG), and San Cristobal (75 and 169 m, March, MHNG). Moths were also collected on Alcedo, Isabela (200 m, April, MHNG; 300 m, October, CDRS). Four specimens collected as larvae on the grounds of the CDRS were reared from *Capraria peruviana* Benth. (Scrophulariaceae) (CDRS). This is the first hostplant record for this species.

***Exelastis montischristi* (Walsingham, 1897)**

In the literature pertaining to the Galapagos, this species was previously known as *Exelastis cervinicolor* (Barnes & McDunnough, 1913). The synonymy of *E. cervinicolor* with *E. montischristi* was made available by Gielis (1993). Although this was not mentioned *per se* by the author it was an unintentional omission (C. Gielis, pers. comm to BL). This species, which is found also in the Antilles and Florida, U.S.A., is the second most widespread plume moth of the Galapagos with records from 11 islands. We have no new island record, but on Isabela, in addition to being known from Sierra Negra and Volcan Darwin, we add Alcedo (lowlands and 1100 m, October, CDRS; 483 m, March, MHNG; beach, April, MHNG) and Volcan Wolf (1220 m, May, CDRS).

***Exelastis pumilio* (Zeller, 1873)**

In March 2004 we collected a specimen of this species on San Cristobal (elev.: 75 m), which represents a new island record. In addition, we collected a specimen on Isabela, near shore at the base of volcan Alcedo.

***Adaina ambrosiae* (Murtfeldt, 1880)****Figs 1, 3, 5, 7, 9, 12, 14, 25, 27**

This species was described from Missouri, U.S.A., but it is also known from the Virgin Islands (Gielis 1992) and was mentioned from the Galapagos islands by Gielis (1992), Landry & Gielis (1992), and Landry (1993). However, a closer examination of North American material, including the lectotype, designated by Barnes & Lindsey (1921), showed that the Galapagos material is different and belongs to a new species, described below. The lectotype, deposited in CUIC, bears the following labels: 1- "Type" (hand-written in black ink on white paper); 2- "From/ Ambrosia/ 9/30.96" (hand-written as label no. 1); 3- "Murtfeldt Coll./ Cornell Univ./ Lot 451/ Sub. 1028" (typed, except for hand-written "1028," in black ink on white card stock); 4- "LECTOTYPE/ Cornell U./ No. 541.1" (typed, except for number, in black ink on red card stock); 5- "*Oedematophorus* [sic]/ *ambrosiae*/ Murtf./ Lectotype ♂/ B. + L. Nov. 3, 1920" (hand-written in black ink on white card stock with red double border); 6- "BL 1604 ♂" (hand-written on green paper).

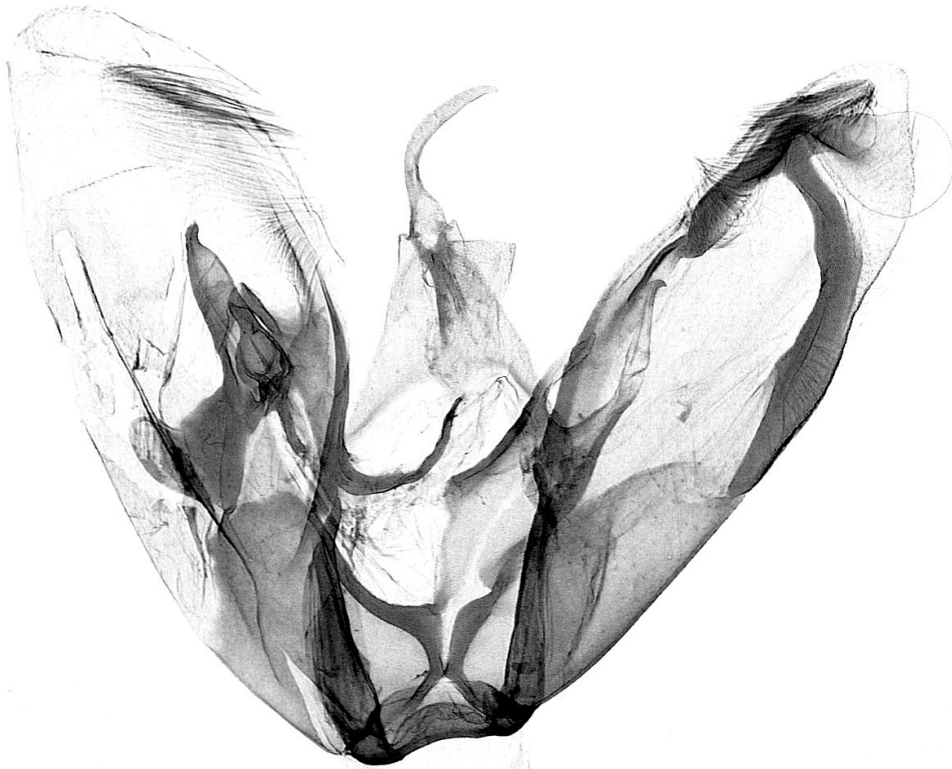
***Adaina scalesiae* sp. n.****Figs 2, 4, 6, 8, 10, 13, 15, 18-24, 26, 28***Adaina ambrosiae* (Murtfeldt, 1880): Gielis (1992: 379-381, Figs 3, 20), Landry & Gielis (1992: 19-21, Figs 14, 25, 38), Landry (1993) (misidentifications)

*Type material.* Holotype: ♂ with the following labels. 1- "ECU[ADOR], GALAPAGOS/ Isabela, ± 15 km N[orth]/ P[uer]to Villamil, 25.v.1992/ M[ercury] V[apour] L[amp], leg[it]. B[ernard]. Landry" (typed on white card stock); 2- "HOLOTYPE/ *Adaina/ scalesiae/* Landry, Roque & Matthews" (hand-written on red card stock). Deposited in the CNC.

Paratypes: 30 ♂, 46 ♀ from Ecuador, Galapagos Islands. **FERNANDINA.** 1 ♀, North side, 1300 m, S 00° 21.862', W 091° 34.308', 15.i.2002, U[ltra] V[iolet] L[ight], L. Roque & C. Causton (CDRS). **FLOREANA.** 2 ♂ (one dissected, slide BL 1615), Scalesias near Cerro Pajas, GPS: elev. 329 m, S 01° 17.743' W 90° 27.111', 12.iv.2004, uvl, leg[it]. P. Schmitz; 1 ♀, Criada en *Scalesia villosa*, 31.vii.1999, M. Gadner; 2 ♂, 1 ♀, Cerro Pajas, ex larva en *Scalesia pedunculata*, 26.xii.1998, L. Roque; 1 ♀, Cerro Pajas, ex larva en hojas de *Scalesia pedunculata*, 27.xii.1998, L. Roque (CDRS, MHNG). **GARDNER** [near Española]. 1 ♀, Larva criada en *Lecocarpus lecocarpoides*, 30.viii.2001, R. Boada (CDRS). **ISABELA.** 1 ♂, V[olcan] Darwin, Ex larva en hojas de *Scalesia microcephala*, 13.ii.1999, L. Roque; 1 ♀, V. Darwin, 1200 m, 15.ii.1999, U.V.L., No. 99.19, L. Roque; 2 ♀, V. Darwin, 700 m, Criada en *Scalesia microcephala*, 4.iii.2000, L. Roque; 1 ♀, V. Darwin, 300 m s[obre el] n[ivel del] m[ar], 6.iii.2000, UVL-W[hite] L[ight] Trap, LR #2000-012, L. Roque; 1 ♀, V. Alcedo, North East side, 900 m, Guayabillos camp, 16.iv.2002, uvl, L. Roque & B. Landry; 3 ♀, V. Darwin, 630 m elev[ation]., 16.v.1992 (1 ♀), 17.v.1992 (2 ♀), M[ercury] V[apour] L[amp], leg. B. Landry; 1 ♀, V. Darwin, 1240 m elev., 19.v.1992, MVL, leg. B. Landry; 1 ♂ (dissected, slide BL 1613), 1 ♀, n[ear] Tagus Cove, 100 m elev., 21.v.1992, MVL, leg. B. Landry; 1 ♀ (dissected, slide BL 1614), same data as holotype; 1 ♂, V. Darwin, 600 m elev., emerg[ed]. 28.v.1992, ex larva on *Scalesia microcephala*, leg. B. Landry (BMNH, CNC, MHNG). **PINTA.** 1 ♂, 2 ♀, Plaja Ibbeston [sic], 13.iii.1992 (2 ♀), 14.iii.1992 (♂), MVL, leg. B. Landry; 3 ♂, 1 ♀, arid zone, 14.iii.1992 (1 ♂, 1 ♀), 15.iii.1992 (2 ♂) MVL, leg. B. Landry; 1 ♀, 400 m elev., 17.iii.1992, leg. B. Landry; 1 ♂, ± 50 m elev., 20.iii.1992, MVL, leg. B. Landry; 2 ♂ (one dissected, slide BL 1611), ± 15 m elev., 21.iii.1992, MVL, leg. B. Landry (BMNH, CDRS, CNC, MHNG). **SAN CRISTOBAL.** 2 ♀ (1 dissected, slide MHNG 2852), near Loberia, GPS: elev. 14 m, S 00° 55.149' W 89° 36.897', 16.iii.2004, uvl, leg. B. Landry, P. Schmitz; 2 ♂ (one dissected, slide BL 1536), La loberia, ex larva en hojas de *Scalesia gordilloi*, 12.ix.1998, No 99.28, C. Causton (CDRS, MHNG). **SANTA CRUZ.** 1 ♂, 1 ♀, Los Gemelos, Ex larva en hojas de *Scalesia pedunculata*, 17.i.1999, L. Roque; 2 ♀, Los Gemelos, En hojas *Scalesia pedunculata*, 17.i.2002, R. Boada; 1 ♀, Los Gemelos, Ex larva en hojas de *Scalesia pedunculata*, 18.i.1999, No. 99.25, L. Roque; 3 ♂ (1 dissected, slide CNC-MIC 3795), 7 ♀ (2 dissected, slides CNC-MIC 3794, 3796), Los Gemelos, 25.i.1989 (1 ♀), 31.i.1989 (3 ♂, 6 ♀), MVL, B. Landry; 1 ♂, 1 ♀, Tortuga Res[erve]. W S[an]ta Rosa, 6.ii.1989, MVL, B. Landry; 1 ♂, low agriculture zone, GPS: S 00° 42.132' W 90° 19.156', 13.iii.2004, uvl, leg. B. Landry, P. Schmitz; 2 ♀, Finca S[teve]. Devine, 17.iii.1989, MVL, B. Landry; 1 ♂, C[harles] D[arwin] R[esearch] S[tation] base of El Barranco, GPS: S 00° 44.305' W 90° 18.105', 18.iii.2004, uvl, leg. B. Landry, P. Schmitz; 3 ♂, 2 ♀, Finca Vilema, 2 km W Bella Vista, 1.iv.1992, MVL, leg. B. Landry; 1 ♀, Los Gemelos, 23.v.1981, Y. Lubin; 1 ♀ (dissected, slide BL 1118), Los Gemelos, at light, 25.v.1998, C. Covell, L. Roque; 1 ♂, 4 ♀ (1 dissected, slide MHNG 2853), Los Gemelos, 27.v.1992, MVL, leg. B. Landry; 2 ♂ (one dissected, slide BL 1537), 2 km W Punta Nuñez, 29.vii.2001, Ex larva en *Scalesia retroflexa*, R. Boada; 1 ♂, 2 ♀, Los Gemelos, Criada en *Scalesia pedunculata*, 11.ix.2001, Emergio 6.x.2001, R. Boada (CDRS, CNC, MHNG).

*Immature material examined.* One vial containing 2 last instar larvae, 3 larval exuviae, and 4 pupae in alcohol. Labels: 1 - "[Galápagos] Pinta, 15.iii.[19]92, larves sur [larvae on] *Scalesia* sp."; 2 - "Food-plant is *Scalesia incisa* Hook. f. (Asteraceae)" [wrongly identified, see Life history below]; 3 - "2 pupae 19.iii"; 4 - "*Adaina ambrosiae* (Murt.), Det. B. Landry 1993" (BL collection (CNC)).

*Diagnosis.* *Adaina scalesiae* (Fig. 2) is very similar to *Adaina ambrosiae* (Fig. 1) in wing markings and color, but can be separated from it by its smaller size (5.63 - 6.63 mm in forewing length (n=45) as opposed to 6.88 - 8.44 mm (n=6, lectotype = 8.31 mm), in the male genitalia by its larger and curved harpe on the left valva (compare Figs 5 and 6), and in the female genitalia by the shape of tergum VIII at its base (see Figs 14 and 15). In the Galapagos *Adaina scalesiae* is most similar to *Hellinsia devriesi* (Landry & Gielis), but the latter is a bigger species (forewing



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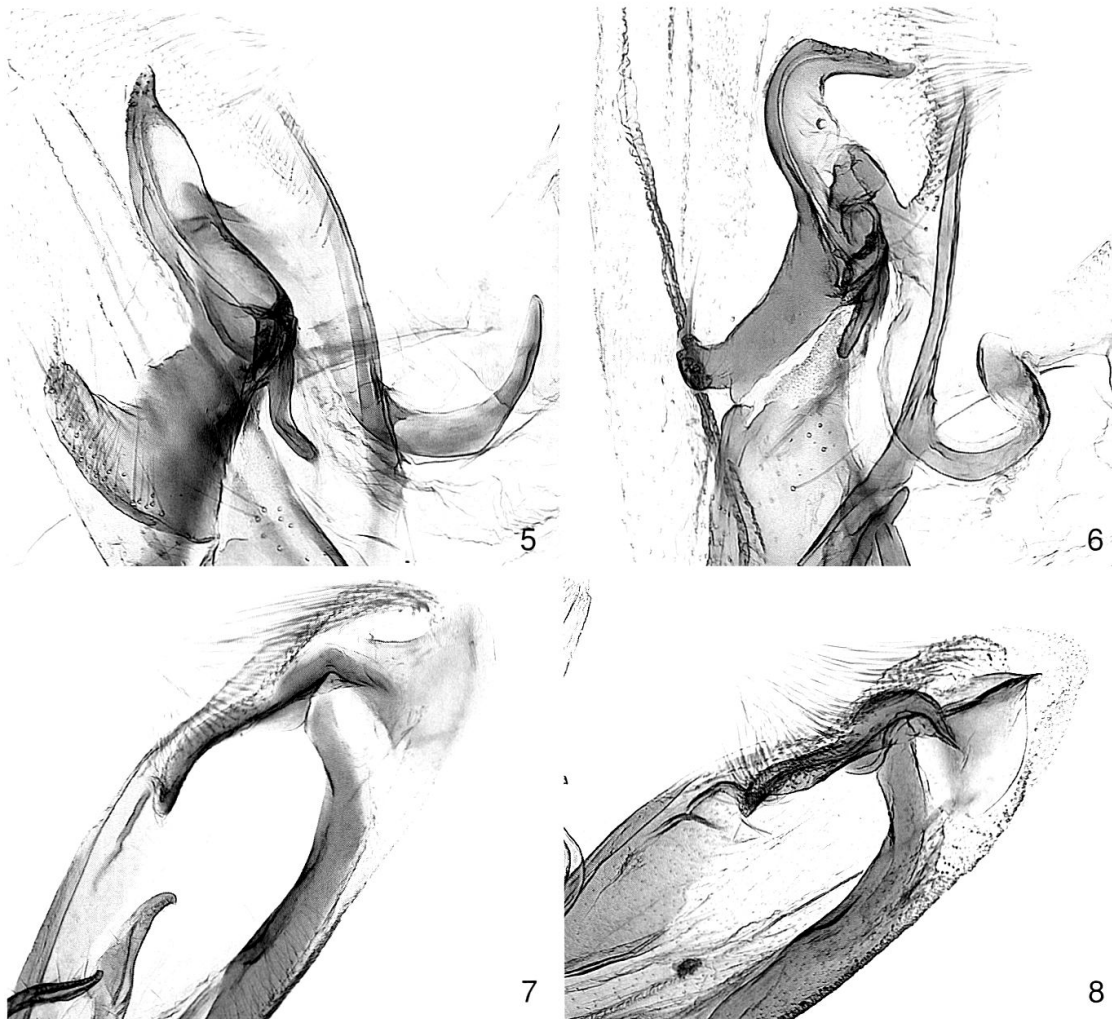


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Figs 3-4. Male genitalia of *Adaina* species without aedeagus: 3, *A. ambrosiae* lectotype; 4, *A. scaleisiae*, paratype from Santa Cruz (slide BL 1537, CDRS).

length = 6.88 - 8.44 mm), its forewings have an ochreous tinge, its forewing lobes are apically colored dark greyish-brown, and the abdomen usually bears a dorso-median dark brown line from the apex of the second segment to the apex of the penultimate segment. In case of doubt, a dissection will provide the answer as the genitalia of *H. devriesi* bear obvious differences (see Landry & Gielis, 1992: Fig. 29 for the female, and Bigot & Deknuydt, 1998: Fig. 1a-b for the male). In the larva, the body plan of *Adaina scalesiae* is similar to that of *A. ambrosiae*, but can be distinguished by having slightly shorter lateral fringe setae relative to body width and distinctly more barbellate as opposed to spiculate lateral setae. The individual barbs on these setae are about 0.1 mm, at least twice the length of those on *A. ambrosiae*. Primary D setae are simple, short, thin, and directed anterad or laterad close to the body in *A. scalesiae* (Fig. 24) as opposed to spiculate, long, robust, and erect in *A. ambrosiae* (Fig. 25). Seta D1 on A8 similar to D1 on A7, not reduced as in *A. ambrosiae*. Sclerites associated with D setae darker and joined or partly joined at midline on A1-A8 in *A. scalesiae* (Fig. 26), lighter and distinctly separate at midline in *A. ambrosiae* (Fig. 27). The dorsal setae are solitary in *A. scalesiae*, while a few minute secondary setae are present on the D tubercles of *A. ambrosiae*. Numerous other less obvious differences include the less prominently exerted spiracles of *A. scalesiae* and differing patterns of minute sclerotized spots and cuticular granulations. The pupa is generally very similar to that of *Adaina ambrosiae*, the differences being much less apparent than those between the larvae of the two species. Primary and secondary setae slightly more spiculate on *A. scalesiae*. Lateral fringe setae of wing and abdomen a bit shorter than on *A. ambrosiae*. Primary setae D1 and D2 erect in *A. scalesiae*, somewhat recurved anterad and posterad in *A. ambrosiae*. Dark markings present on anterior margin of mesothorax, posterior third of mesothorax, and area anterad and surrounding A2 spiracle in *A. scalesiae*, markings faint or absent in *A. ambrosiae* except for a dark circular area immediately surrounding A2 spiracle. Ventral surface of body with secondary setae of thoracic appendages and antenna slightly longer and more abundant on *A. scalesiae* than on *A. ambrosiae*. A longitudinal row of minute secondary setae present on coxal sclerite of foreleg in *A. scalesiae*, absent in *A. ambrosiae*.

*Description.* MALE (n=31) (Figs 2, 4, 6, 8, 10). HEAD with labial palpi porrect, not extended beyond eye, vestiture mixed brown, dark brown, and white. Fronto-clypeus with short, mostly brown, appressed scales. Vertex scales appressed, whitish beige with greyish brown at their apex. Occiput with short, dark brown appressed scales and thin, long, apically widened and notched, dark brown (longest) and whitish-beige scales. Antenna with slender, erect, and deeply cleft whitish-beige scales except for first few flagellomeres also with some white and dark brown appressed scales. THORAX mostly whitish beige with scales apically tinged with greyish brown at their apex, especially on anterior half. Foreleg coxa pale chestnut-brown with few white and dark brown scales; femur dark brown with thin, white longitudinal stripes, especially on distal half; tibia dark brown with white scales forming small patches laterally near base and middle, thin longitudinal stripe between about 1/4 and 1/2, narrow diagonal stripe near 3/4, and on ventral surface and apex; tarsomere I dark brown with white scales at apex and at base, sometimes forming longitudinal stripes; tarsomeres II-V greyish beige with sometimes darker brown or greyish-brown scales dorsally. Midleg coxa with dark brown and whitish-beige scales; femur dark brown with thin, longitudinal white stripe and some scattered white scales; tibia with dark brown and white stripes, mostly dark brown at

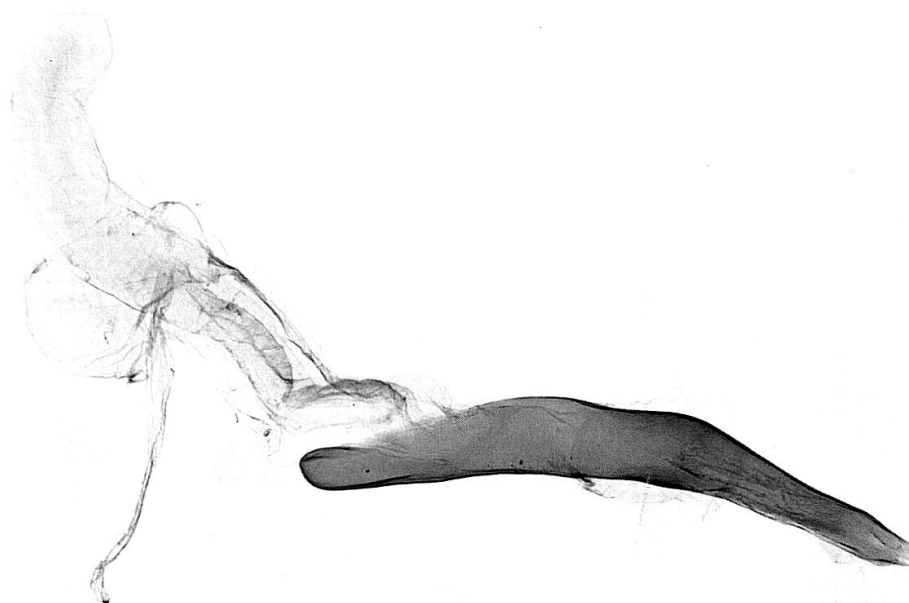


Figs 5-8. Male genitalia of *Adaina* species: 5, details of left valva of *A. ambrosiae*, specimen from Florida (slide BL 1608, CNC); 6, Same for *A. scalesiae*, paratype from Pinta (slide BL 1611, CNC); 7, Details of right valva of *A. ambrosiae*, same specimen as Fig. 5; 8, Same for *A. scalesiae*, same specimen as Fig. 6.

bases of spines, white apically; tarsomere I mostly dark brown on distal half and white with dark brown stripes on basal half; tarsomeres II-V greyish beige with greyish brown mostly on distal half of each tarsomere. Hindleg coxa white; femur appearing speckled with most scales dark brown with their base paler, whitish beige, also with scattered white scales; tibia as femur; tarsomere I mostly dirty white with dark brown at base and dark brown to chestnut-brown mostly toward distal half; tarsomeres II-IV white with few greyish-brown scales at apex of each tarsomere; tarsomere V entirely white. FOREWING length 5.81 - 6.63 mm (Holotype = 6.31 mm); mostly whitish beige with many scales brown at their apex; costa on basal half with row of brown scales with their apex paler; with thin chestnut-brown stripe from wing base to middle of first lobe, sometimes with more extended chestnut-brown along costal half and in first lobe; with dark brown triangular patch before white-lined cleft, rectangular patch along costa at base of first lobe, smaller square patch on costa near middle of lobe, yet smaller patch on costa subapically, and sometimes in middle of wing submedially; sometimes with slightly more extensive dark brown scaling along inner margin before triangular patch, on distal half of second lobe,



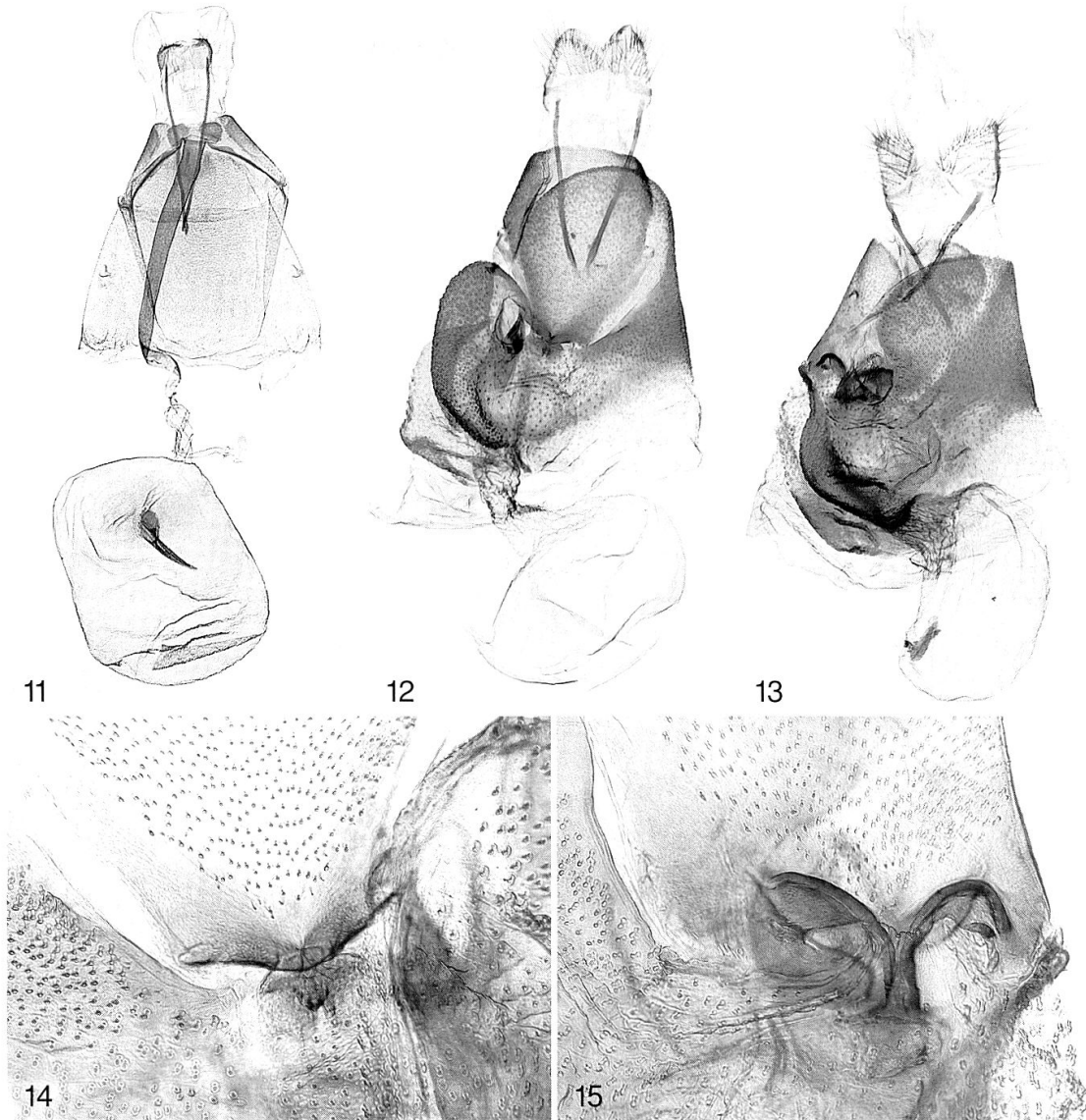
9



10

Figs 9-10. Aedeagus of *Adaina* species: 9, *A. ambrosiae*, same specimen as Fig. 5; 10, *A. scalesiae*, same specimen as Fig. 4.

and along cubital fold subbasally; fringe of first lobe on inner margin mostly dark brown to greyish brown interrupted by small white areas subapically and apically; fringe of second lobe mostly greyish brown interrupted by very small white areas on inner margin at about 2/3, subapically, and at apex. HINDWING unicolorous greyish brown with concolorous fringe; frenulum with one acanthus. ABDOMEN dorsally whitish beige, with some scales brown or chestnut-brown at their apex, and with dark brown spot medially at hind margin of first six segments, rarely absent on segments I and III-VI; laterally whitish beige with extensive chestnut-brown scaling toward base and dark brown toward apex, including genitalia, or with series of more or less conspicuous chestnut-brown, dark brown and white stripes; ventrally whitish



Figs 11-15. Female genitalia of Pterophoridae species (11-13, ventral views; 14-15, dorsal views): 11, *Platyptilia vilema* Landry (slide BL 1530, CDRS); 12, *Adaina ambrosiae*, specimen from Florida (slide BL 1612, CNC); 13, *A. scalesiae*, paratype from San Cristóbal (slide MHNG 2852, MHNG); 14, *A. ambrosiae*, dorsal connection between segments VII and VIII, same specimen as Fig. 12; 15, *A. scalesiae*, same structures as Fig. 14, same specimen as Fig. 13.

beige with dark brown longitudinal stripe medially, or dark brown median spots at apex of segments, or mostly brown with scales paler at their apex.

**MALE GENITALIA** (n=6) (Figs 4, 6, 8, 10). Uncus of medium length, slender, broadly curved ventrad, sharply pointed apically. Tegumen slender, dorsal connection narrow, about 1/2 length of narrow arms. Valvae asymmetrical: right valva narrower, slightly shorter, narrowly rounded rather than broadly rounded, and more darkly sclerotized than left valva. Right valva with inwardly directed, narrow sclerotized crest set with moderately long setae toward and along dorsal margin, from about 2/3 and prolonged subapically by broadly rounded scoop-like projection extended slightly beyond ventral margin; ventral margin with narrow, darkly sclerotized band from before middle and curved subapically toward dorsal margin

before scoop-like projection. Left valva with stout, short harpe curved medially at right angle, associated with pair of short, rounded projections of slightly variable shape and directed ventrally and basally, most laterad projection free and adorned with some setae; with long, free sclerotized band on dorsal margin from base of harpe, directed and curving mediobasally; on dorsal surface medially with thin sclerotized band from base to about 4/5. Vinculum narrow. Arms of juxta asymmetrical, the right arm longer, bigger, and curved. Aedeagus slightly longer than 1/2 length of valva, narrow, slightly down-curved, slightly narrowed beyond middle; vesica without spicules or cornuti; coecum penis about 1/4 length of aedeagus, aligned with its long axis.

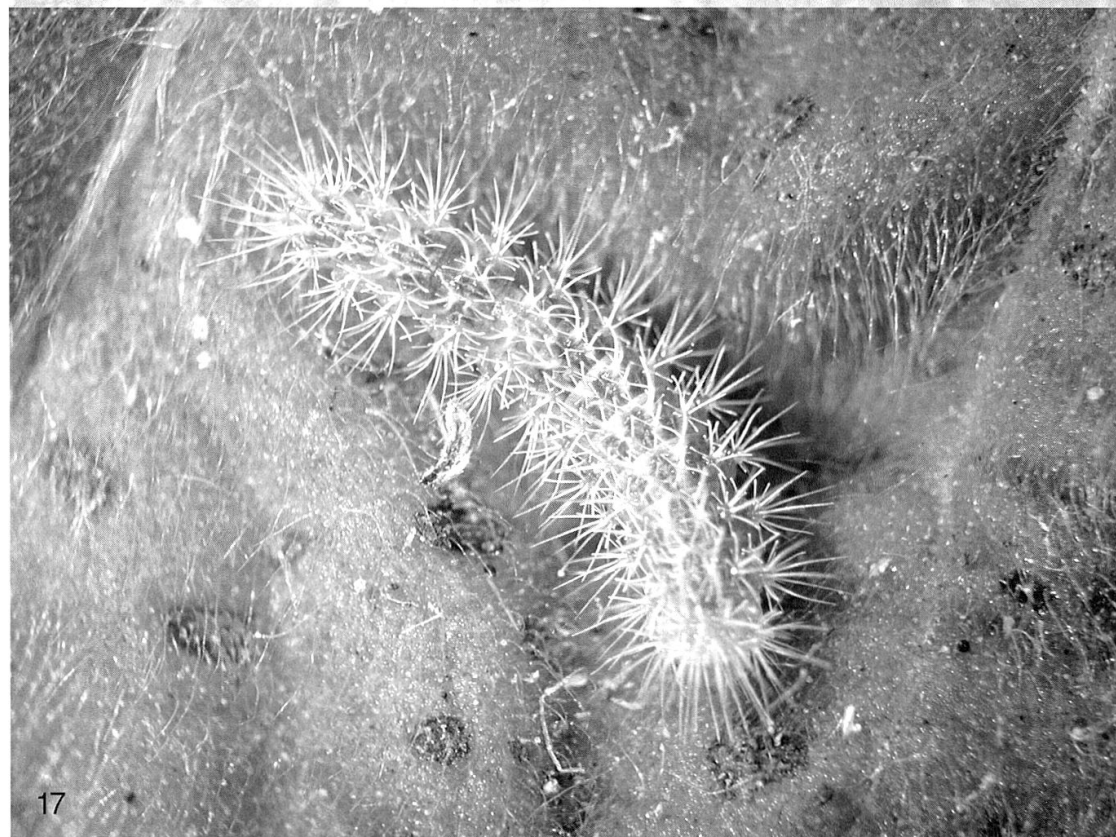
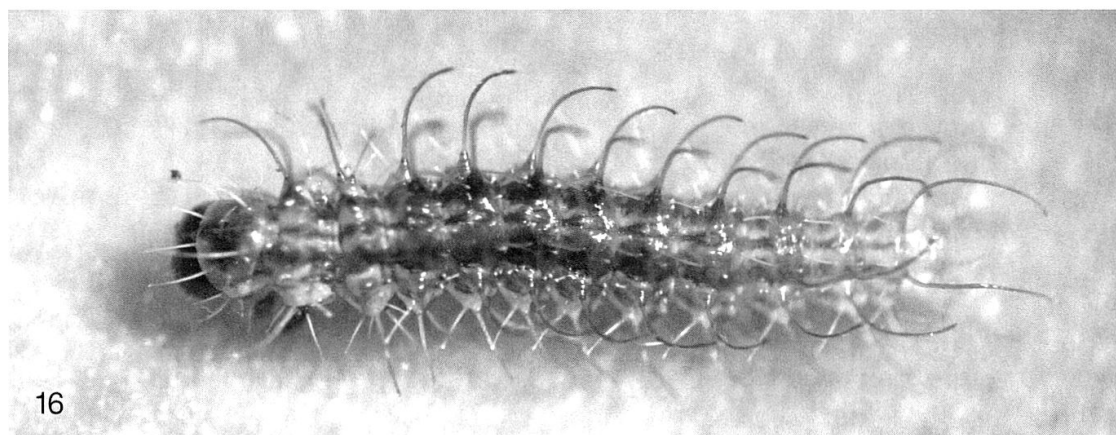
FEMALE (n=46) (Figs 13, 15). Antenna with scales appressed, colored as in male. FOREWING color as in male; forewing length 5.63 - 6.44 mm. HINDWING frenulum with two acanthae. FEMALE GENITALIA (n=5) (Figs 13, 15). Papilla analis short and rounded with short to moderately long setation on whole surface, with narrow sclerotized band along basal margin from base of posterior apophysis to ventral edge. Posterior apophysis slender, straight or slightly curved, extended to about posterior 1/3 of segment VIII. Segment VII reduced, fused with sternum VIII and distorted, with lip-like rounded extension on left side at base of ostium. Tergum VIII large, shield-like, with pair of short, narrow projections at base medially (where tergum VIII fuses with narrow tergum VII, on opposite side of ostium), associated inside abdomen with short, narrow apophyses and more or less peanut-shaped projection. Ostium to left of middle, moderately wide. Ductus moderately wide, with smooth surface adorned with pair of elongate striae on inside of distal 1/4 (toward ostium), strongly wrinkled on proximal 3/4 (toward corpus bursae), extended to base of segment VII, with delicate secondary pouch near ostium. Corpus bursae bean-shaped, about as long as ductus, with ductus seminalis inserted at proximal end.

FINAL INSTAR LARVA (n=2) (Figs 18-21, 22-24, 26). Maximum length 7 mm, width 1.2 mm (excluding setae). Lateral setae on verrucae forming conspicuous fringe around body. Lateral fringe setae long, up to 1.9 mm, 1.6x body width; D and SD setae relatively short, lengths less than 0.5x body width. Primary D and SD setae distinct and solitary; L and SV setae on verrucae with similar secondary setae. Setae clear, primary D and SD setae clear or brownish tinged. Lateral, anterior, and posterior fringe setae conspicuously barbellate, remaining setae simple.

HEAD hypognathous. Anterior aspect round. Width 0.60 – 0.62 mm (n=2) [penultimate instar 0.43 mm (n=1)]. Cranium (Figs 18, 19) uniformly pigmented, light brownish yellow in preserved material; stemmata dark. Adfrontal sclerite extending dorsad to vertex, ventrad to a point just short of anteclypeus. Pore AFa present. Lateral adfrontal suture length about 2x epicranial suture and about 1.5x clypeal width. Setae AF1, AF2, F1, C2, and L1 lengths not exceeding 0.5x clypeal width. Seta P1 length about 0.75x clypeal width; A1 just less than 1x clypeal width. Seta AF1 closer to AF2 than to F1. Seta P1 laterad and slightly ventrad of AF1. Labrum (Fig. 20) with 4 setae, without conspicuous notch, ventral margin slightly concave. Mandible (Fig. 21) 6-toothed, length just exceeding maximum width. Distal seta replaced by pore, proximal seta length about 0.6x mandible width.

THORAX: Prothorax (Fig. 22) with primary setae XD1, XD2, SD1, and SD2 arranged in a nearly straight, compact, uniform row along anterior margin dorsad of L verruca. Primary XD and SD seta, along with 3 or more shorter secondary setae forming anteriorly projecting fringe, obscuring head in dorsal aspect. Anterior fringe

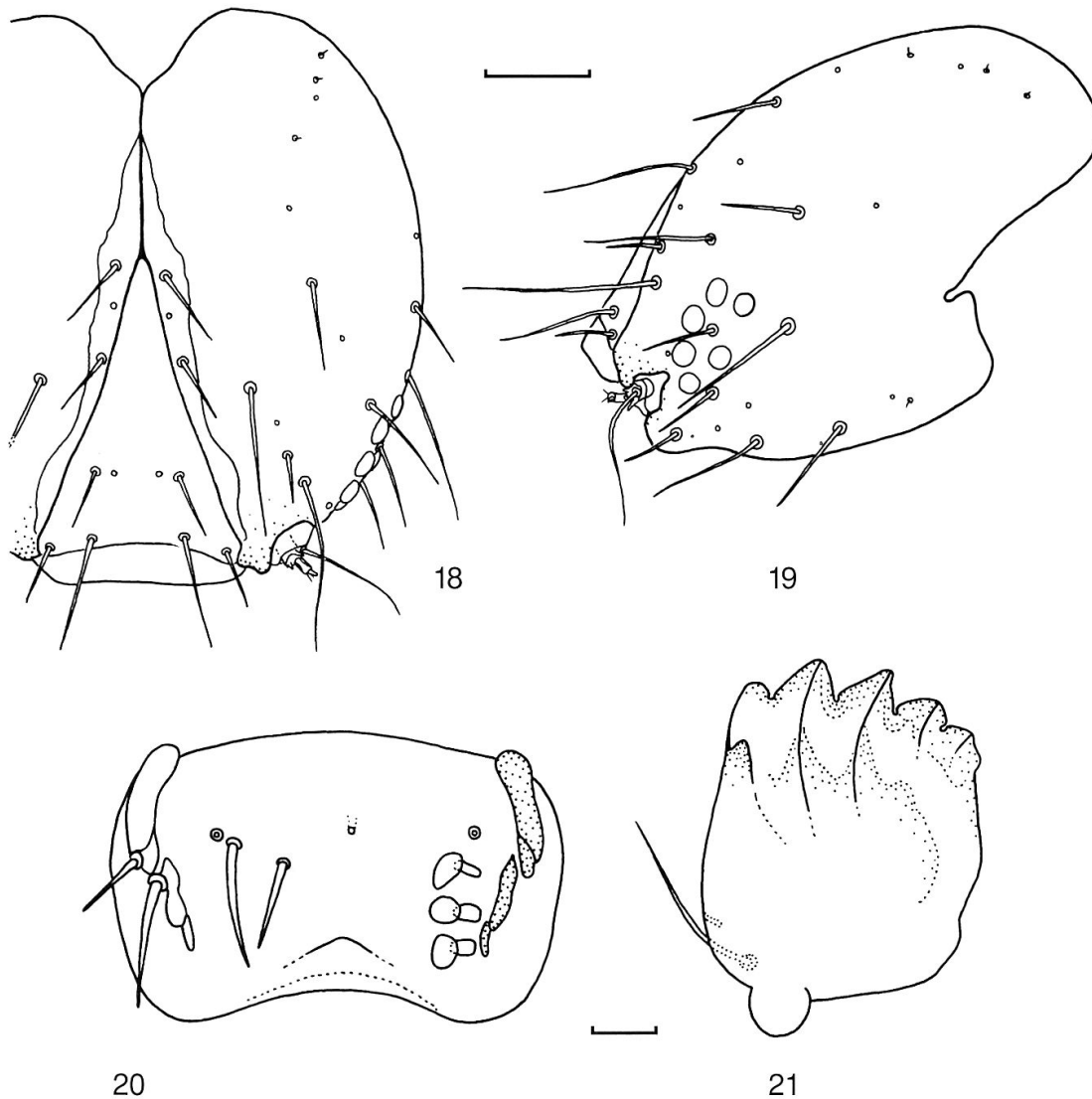
setae barbellate, XD and SD setae lengths about 0.72 mm, 0.7x T1 width (fully developed larva), 1.5x T1 length (anterior-posterior). Setae D1 and D2 solitary. Seta D1 set posterad about 0.25x from anterior margin and closer to midline than relative distance from anterior margin, directed anterad, close but not appressed to body. Seta D1 length about 0.43 mm, form simple, not visibly spiculate (40x magnification); D1 tubercle minute, not distinctly sclerotized. Seta D2 similar to D1 but about 0.3x shorter, positioned about 0.5x from anterior margin and slightly laterad of D1, directed anterolaterad close to body. An aggregate of 3 or more minute, lightly sclerotized spots present along midline near D1. Cuticular granulations also lightly sclerotized along midline posterad of D2, along T1 posterior margin, surrounding spir-



Figs 16-17. Larvae of Galapagos Pterophoridae: 16, *Megalorhipida leucodactyla* (Fab.); 17, *Hellinsia nephogenes* (Meyrick).

acle, and extending anterad in a narrow strip along dorsal base of L verruca. Lateral verruca crescent-shaped, with anterior bulge exceeding T1 anterior margin. A fan of 40-50 short to very long barbellate setae radiating from verruca. The most dorsal setae on verruca (about 12) arranged in a compact arc-shaped row, projecting laterad in a single plane, lengths reaching 1.8 mm near middle, decreasing at anterior and posterior ends of row. Setae more ventrally placed on verruca decreasing in length, spiculate to smooth. Spiracle dorsally placed posterad of L verruca near T1 posterior margin. Spiracle exerted, tubular with moderately sclerotized collar, peritreme round. Subventral verruca hidden in dorsal aspect, round, slightly elevated, with about 10-15 minute to medium length setae, lengths up to 0.48 mm. Segments T2 (Fig. 23) and T3 with setae D1 and D2 approximate, D2 just posterolaterad of D1. Seta SD2 directly posterad of SD1, SD setae set slightly more apart than D setae. Setae D1, D2, and SD1 lengths subequal, about 0.25 mm, directed anterad; SD2 about 0.14 mm, directed laterad. Dorsum of T1-T2 covered with lightly sclerotized cuticular granulations except for L verruca, a rectangular hyaline area surrounding D setae, and an oblong hyaline area surrounding SD setae. A tiny dark spot at midline between D1 setae on T2, more developed on T3. A small dark spot also near base of D setae on T2 and another posterad of D setae. Lateral verrucae as on T1 but smaller and with fewer setae, longest setae reaching 1.9 mm. A tiny secondary verruca with a fan of 5 minute to medium barbellate setae present posterad of main L verruca. These setae appearing compressed, with dentate as opposed to setiform barbs. Subventral verruca as on T1.

ABDOMEN dorsum covered with lightly sclerotized cuticular granulations. Segments A1-A8 (A3, Figs 24, 26) with setae D1 and D2 on separate sclerites but sclerites (D1 and D2 right and left sides) coalesced, forming a dark quadrate patch near the center of each segment. Setal tubercles on sclerites small. Setae D1 and D2 lengths subequal (0.12-0.22 mm); D2 posterad and slightly laterad of D1; D1 directed anterad, D2 posterolaterad. Seta SD1 on hyaline patch laterad of D2, directed anterad, length similar or slightly less than D1. Spiracles as on T1 but more central on segment, about 0.5x from anterior margin, centered dorsad of L verruca, posterolaterad of SD1 on A1-A7, closer and more directly posterad of SD1 on A8. Lateral verrucae as on thorax. Main (L1-L2) lateral verruca shifted more posterad on A8. A small secondary verruca posterad of main L verruca on A1-A7, with about 5 short to minute setae on A1-A5, 2-3 on A6-A7, replaced by 1 or 2 similar type setae at posterior end of main L verruca on A8. Segments A1-A8 with a small round L3 verruca bearing 7-10 short to medium simple setae. Subventral verruca on A1-A8 small, round, 3-12 setae present, dorsad of proleg on A3-A6. Prolegs elongate, length about 2.5x width, with 7-9 crochets arranged in a mesopenellipse. Three minute V setae present mesad at proleg base. Seta V1 solitary or with another shorter seta on remaining abdominal segments. Segment A9 dorsum smaller than A8; D setae closer together on 1 small darkly sclerotized rectangular tubercle on posterior half of segment. Tubercles and sclerites (right and left) not joined at midline. Seta D1 on A9 similar in length to D1 on A8; D2 almost one-third longer on A9 than on A8 and slightly thicker. Segment A9 with both SD1 and SD2 present. Seta SD1 length similar to D1; SD1 laterad of D1 on anterior side of tubercle bearing SD2. Seta SD2 barbellate, thicker than SD1, and very long, reaching 2.4 mm, in plane with lateral fringe setae of A8. Lateral verruca reduced on A9, with setae L1 and L2 barbellate, less than 0.5x SD2 length, with about 5 shorter setae ventrad of L1 and L2. Verruca L3 absent. One small verruca with about 4 short setae present between L verruca and seta V1 (transversally aligned between L3 and SV verruca

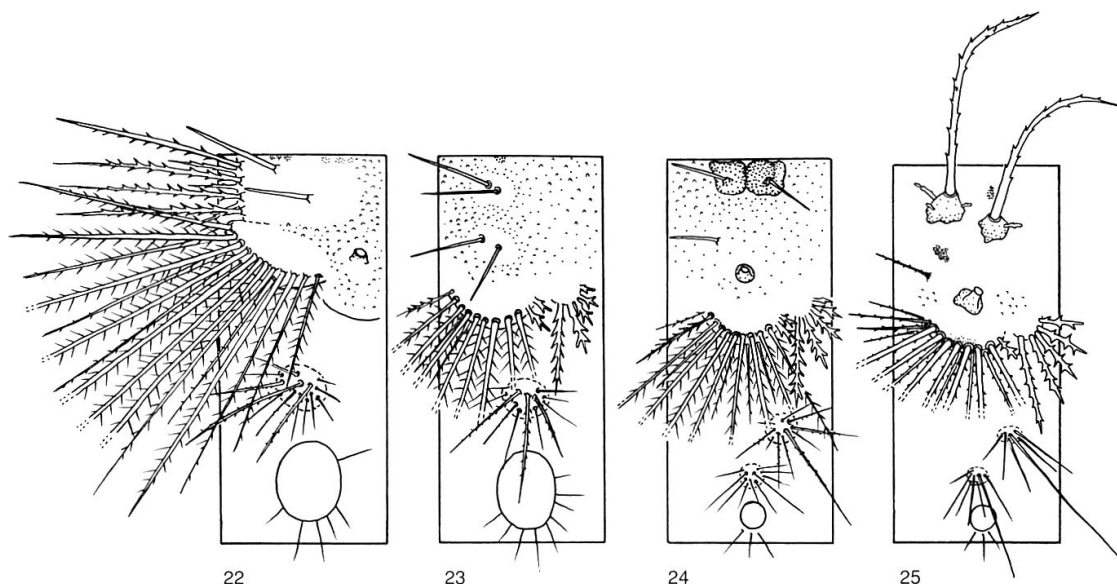


Figs 18-21. Larval head of *Adaina scalesiae*: 18, Frontal view of cranium, scale line = 0.125 mm; 19, Lateral view of cranium, same scale as Fig. 18; 20, Labrum, epipharyngeal surface on right, scale line = 0.03 mm; 21, Right mandible, same scale as Fig. 20.

of A8). Anal plate with several tiny dark sclerotized spots. Seta D1 simple, short, erect, about 0.3x from caudal margin. Remaining primary and secondary setae mostly long, barbellate, forming thick caudal fringe. Anal proleg with 10-12 crochets, several short setae present.

PUPA (n=4) (Fig. 28). Maximum length 7 mm, width (T2) 1.44 mm. Primary and secondary setae present, minutely spiculate, including those on venter. Primary D and SD setae long, reaching 1.25 mm, on verruca-like tubercles with shorter secondary setae. Longitudinal rows of short to minute secondary setae present on wings. Setae on lateral row of moderate length, forming fringe along wing. Abdomen with lateral setae on flange-like verrucae, seta lengths exceeding fringe setae of wing. Spiracle on A2 prominently exserted, tubular with a flared base, darkly sclerotized.

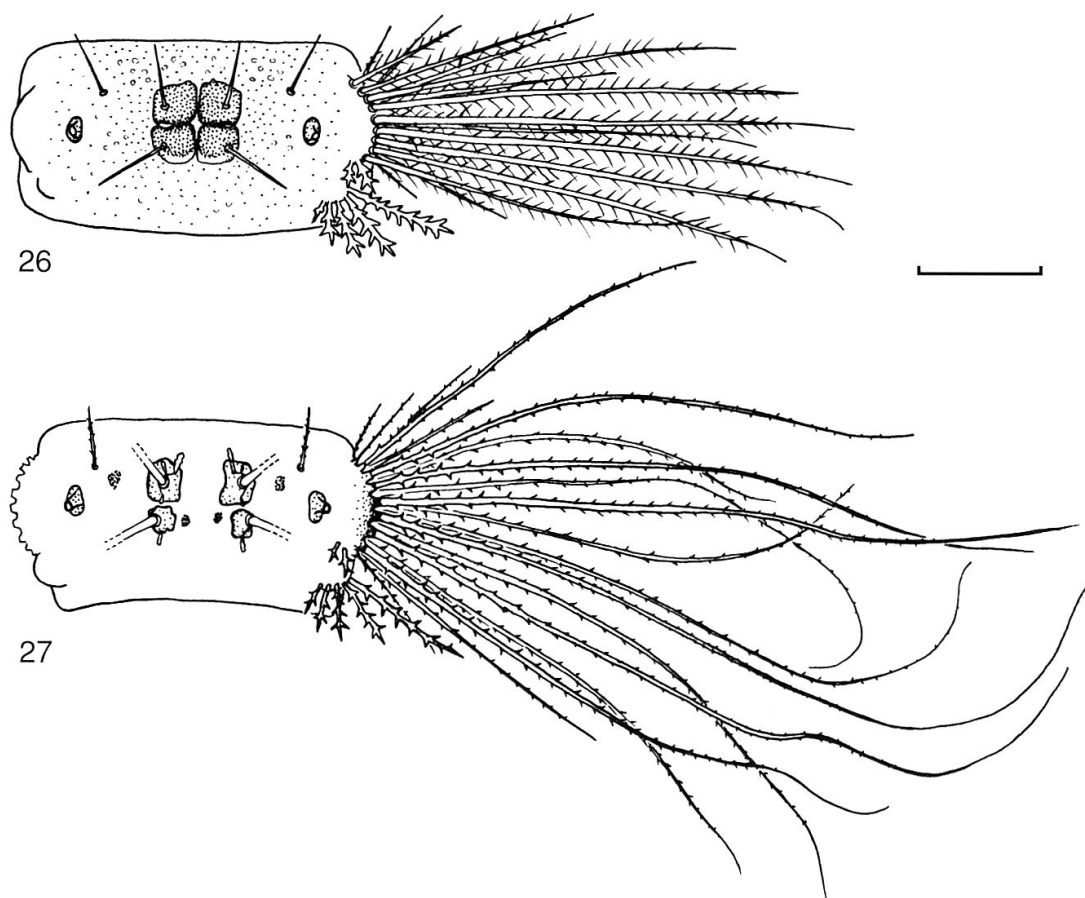
HEAD. Vertex obscure. Front with AF1 and AF2 on lateral rise near antenna base; lengths subequal, about 0.72 mm. Six or more shorter setae also present on rise, lengths less than 0.5x primary AF setae. Several short to minute setae present on dorsum of front, a few on venter along cephalic margin with 1 projecting posterad over gena. Venter of front not protruding. Seta F1 laterad on front near anterior extent of gena, projecting anterolaterad, length about 0.48 mm. A secondary seta



Figs 22-25. Chaetotaxonomic maps of *Adaina* larvae: 22, *A. scalesiae*, segment T1; 23, *A. scalesiae*, segment T2; 24, *A. scalesiae*, segment A3; 25, *A. ambrosiae*, segment A3.

present just mediad of F1, projecting anterad, length about 0.20 mm. Clypeus with 1 short seta laterad (0.36 mm). Pilifers distinct, partly joined at meson. Gena with 1 short seta near maxilla base, length just less than clypeal seta. Eye pieces distinct. Sculptured eye with 2 setae; anterior seta as long as genal seta, posterior seta as long as clypeal seta. Maxilla without setae, base extending to about 0.5x T2 leg length, about even with A3 anterior margin. Distal tip of maxilla exposed between T2 legs, extending from foreleg apex to a point even with or just short of midleg apex. Antenna exceeding forewing tip, nearly reaching T2 leg apex, a row of short to minute setae extending along entire length. Setae at antenna base longer (about 2x length at tip), 2 additional rows flanking main row above gena and eye, contributing to cephalic fringe.

THORAX. Pronotum surface covered with numerous minute to short secondary setae. Three long primary setae present: D1 near midline, 0.5x from anterior margin; D2 laterad and slightly posterad of D1, between D1 and spiracle; 1 SD seta on lateral margin. Seta D1 about 0.65 mm, D2 about 0.60 mm, SD seta about 0.96 mm. Foreleg extending to about 0.92x T2 leg length, reaching anterior 0.3x of A5. Anterior third of foreleg with double row of minute setae, a single row extending to about 0.75x. Coxa of foreleg exposed, with a row of about 8 minute setae. Prothoracic spiracle embedded in T2 anterior margin, slightly exserted, moderately sclerotized. Dorsum of mesothorax villous. Tegular region of mesothorax gently rounded, not producing a noticeable keel or carina. Anterior margin and posterior third sclerotized. Secondary setae arising from sclerotized posterior third also dark. Primary D



Figs 26-27. Larvae of *Adaina* species, comparison of A3 dorsum and relative lengths of lateral setae: 26, *A. scalesiae*; 27, *A. ambrosiae*, scale line = 0.5 mm.

and SD setae long. Setae D1 and D2 erect, longitudinally aligned, just laterad of midline. Setae SD1 and SD2 approximate, laterad of D1 near alar furrow, directed laterad. Primary D and SD setae subequal, lengths reaching 1.5 mm. Forewing base with numerous minute setae, a verruca-like cluster of about 4 short setae present anterolaterad. Forewing with several longitudinal rows of minute to short setae marking veins and wing margins. The lateral rows forming fringe with setae up to 0.6 mm, lengths gradually decreasing posterad to A3. Forewing apex reaching anterior third of A5. Midleg nearly reaching A5 posterior margin. Midleg transversally striated, without setae. Metathorax with D1 and D2 moderately long, about 0.72 mm, close together near anterior margin, longitudinally aligned, erect but diverging anterad and posterad. Setae SD1 and SD2 close together, at anterolateral angle, lengths about 0.43 mm. Numerous minute to short secondary setae present on dorsum, especially just laterad of midline; 1 or more setae posterad of D2 distinctly longer than others. Hindwing with longitudinal row of short to minute setae. Hindwing apex about even with A2 spiracle. Hindlegs longitudinally aligned beneath maxilla, tarsal apex exposed where just exceeding maxilla.

ABDOMEN segments A1-A8 (A2-A3, Fig. 28) with primary D setae on separate verruca-like tubercles, each tubercle bearing up to 10 shorter secondary setae. Seta D2 posterolaterad of D1, directed slightly posterolaterad. Setae D1 and D2 lengths about equal, reaching 0.72 mm, a bit shorter on A1 and A8 with D1 shorter

than D2 on A1, D2 shorter than D1 on A8. A few minute setae (1-5) present near midline between D2 tubercles. Seta SD1 short (0.2 – 0.3 mm), lengths decreasing posterad, directed anterolaterad, just anterad of spiracle on A2-A7. One or 2 minute secondary setae posterad of SD1 (4 on A1). Spiracles darkly sclerotized, exserted, tubular. Spiracle on A2 at least 2x length of others and buttressed or flared at base, length about 0.19 mm. Lateral setae absent on A1. Segments A2-A7 with small round L1 verruca with up to about 14 short to minute setae, most about 0.24 mm. Verruca L1 just laterad of spiracle on A2-A7, near wing margin on A2. Segment A2 with posterolateral fringe of about 12 minute to short setae. Segments A3-A7 with

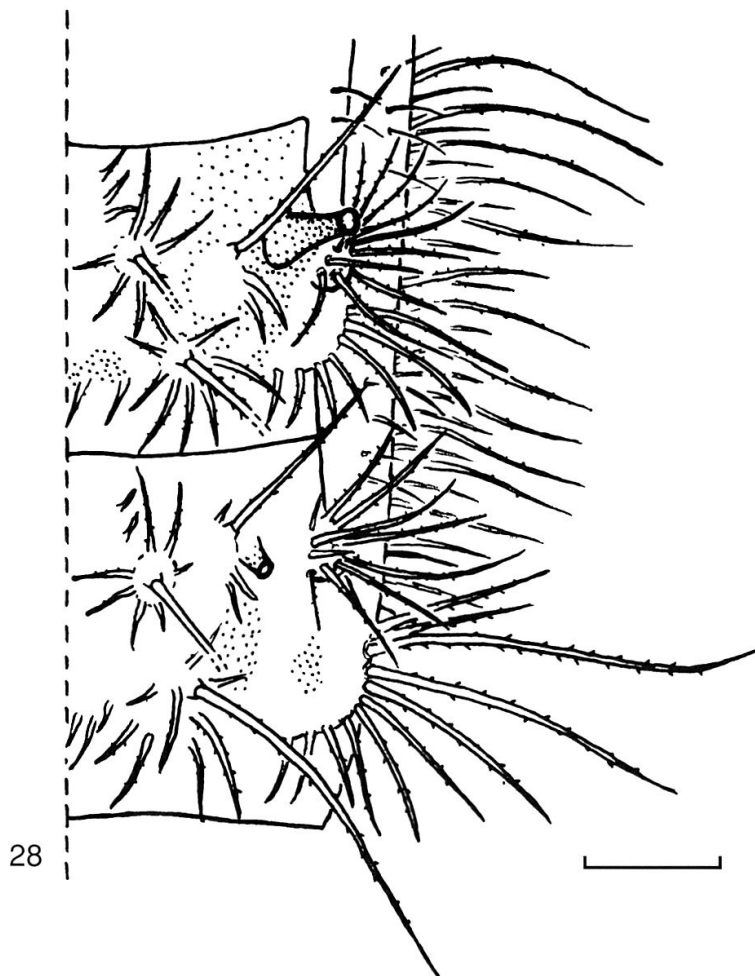


Fig. 28. Pupa of *Adaina scalesiae*, dorsal view of segments A2-A3, scale line = 0.2 mm.

fully developed L2 flange-type verruca bearing fan of about 16 minute to long setae (longest 0.72 mm). Segments A4-A7 with small round L3 verruca ventrad of L2 lateral flange verruca. One short SV seta on A4, 3 short SV setae longitudinally aligned on A5-A7. Segment A8 with setae generally shorter, spiracle absent. Verrucae L1 and L2 combined on A8, with setae about as long as L1 setae on preceding segments. Venter of A8 with 2 short setae representing L3 verruca, 2 minute SV setae at posterior margin. Posterior margin bordering ventral plate lightly sclerotized. Dorsum of A9 covered with numerous short to minute setae, primary setae difficult to distinguish. Dorsum of A10 with 2 short primary setae directed posterad

and with numerous short hooked hamuli. Caudal apex acute. Ventral plate (fused A9/A10 venter) with dense patch of hooked minute to short anterior hamuli centrally placed near A8 posterior margin. Minute hooked posterior hamuli numerous laterad at caudal tip. Scattered hamuli also present between anterior patch and anal slit.

*Life history.* Larvae of this species have been recorded to feed on leaves of *Scalesia microcephala* Robinson on Isabela and *S. incisa* Hook. f. (in fact *S. baurii* ssp. *hopkinsii* (Robinson) Eliasson; C.K. McMullen, pers. comm. to BL, 1994) on Pinta (Asteraceae) (Landry 1993). In addition, the caterpillars skeletonize the leaves of *Scalesia villosa* Stewart on Floreana, *Scalesia pedunculata* Hook. f. on Floreana and Santa Cruz, *Scalesia gordilloi* Hamann & Wium Andersen on San Cristobal, *Scalesia retroflexa* Hemsley on Santa Cruz, and *Lecocarpus lecocarpoides* Cronq. & Stuessy (Asteraceae) on Gardner near Española. Thus, six of the 15 known species of the endemic genus *Scalesia*, in addition to another species of Asteraceae, are used as hostplant by *A. scalesiae*. Other species of *Scalesia* and of Asteraceae should be investigated to complete the hostplant range of this plume moth in the Galapagos.

*Adaina scalesiae* was collected on the Galapagos islands of Fernandina (January), Floreana (April, July, December), Gardner near Española (August), Isabela (February-May), Pinta (March), San Cristobal (March, September), and Santa Cruz (January-May, July, September).

*Notes.* The specific name refers to *Scalesia* (Asteraceae), the main hostplants in the Galapagos. On the island of Pinta a pair of specimens were collected on Playa Ibbetson, which was misspelled on the labels. The moth reared on *S. baurii* ssp. *hopkinsii* (Robinson) Eliasson from Pinta (Landry 1993) is not included in the type series as its wings did not develop properly and its genitalia were not dissected; it is deposited in the MHNG.

### ***Hellinsia cristobalis* (Landry & Gielis, 1992)**

Recorded previously on four islands and under genus *Oidaematophorus*, this species is among the Galapagos endemics. New island records are Fernandina (1300 m, January, CDRS) and Floreana (360 m, January, BMNH; 329 m, April, MHNG). Although mentioned before from Isabela, it was not known from Alcedo, where we have records from elevations of 200, 300, 483, 570, 700, and 1100 m, the latter being the rim of the crater (March, April, October; CDRS, MHNG).

### ***Hellinsia devriesi* (Landry & Gielis, 1992)**

Described from six females in the genus *Oidaematophorus*, this species was presumed to be endemic until Bigot & Deknuydt (1998) found it on Martinique and described the male. New island records are Fernandina (Punta Mangle, June, CDRS) and Santa Cruz (highest elevations, May, June, and CDRS, December, CDRS). On Isabela, in addition to previous records from Sierra Negra, we report this species also from Alcedo (1100 m, CDRS) and Volcan Darwin (beach, June, CDRS). In the key, diagnosis, and description of *H. devriesi*, the dorsal abdominal markings are said to be a single longitudinal dark-brown patch on one subapical segment. However, based on additional specimens, this patch may be longer and may form a

median line from the apex of the second segment to the tip of the penultimate segment. This feature more easily separates this species from *A. scalesiae*, which only has small spots at the tip of most segments medially.

### *Hellinsia nephogenes* (Meyrick, 1926)

This endemic pterophorid is newly recorded from Fernandina (June, CDRS). It was reported previously in the genus *Oidaematophorus* Wallengren. Perry & de Vries (2003) record this species as *Pterophorus ?nephogenes* Meyrick. They mention having reared it from *Scalesia affinis* Hook. f. (although this had been mentioned already in Landry & Gielis, 1992), but also on *Rhyncosia minima* (L.) DC. (Fabaceae). The *Scalesia affinis* rearing records are correct as they are associated with voucher specimens, but the record from *Rhyncosia minima* must be considered dubious as there are no voucher specimens and this association of hosts from separate families is not very plausible. Fig. 17 represents a larva of this species on a leaf of *Scalesia affinis* for which the specimen was reared and is in the CDRS collection.

Table 1. Summary of the distribution of the Pterophoridae species on the islands of the Galapagos placed in decreasing order of surface area. In parentheses after each name is the number of hostplants known in the archipelago.

Species (hostplants)	Island														
	Isabela	Santa Cruz	Fernandina	Santiago	San Cristobal	Floreana	Marchena	Española	Pinta	Balra	Santa Fe	Pinzon	Genovesa	Rabida	Gardner at Española
<i>Megalorhipida leucodactyla</i> (2)	+	+	+	+	+	+	+	+	+	+		+	+	+	
<i>Lantanophaga pusillidactyla</i> (0)	+	+					+						+		
<i>Platyptilia vilema</i> (1)	+								+						
<i>Bipunctiphorus nigroapicalis</i> (0)	+	+			+	+			+						
<i>Postplatyptilia huigraica</i> (2)	+	+													
<i>Postplatyptilia minima</i> (0)	+	+							+						
<i>Stenoptilodes brevipennis</i> (1)	+	+			+	+	+					+			
<i>Stenoptilodes gielisi</i> (0)	+														
<i>Stenoptilodes juanfernandicus</i> (0)	+														
<i>Exelastis montichristi</i> (1)	+	+		+	+	+	+	+	+	+	+		+		
<i>Exelastis pumilio</i> (1)	+				+									+	
<i>Adaina scalesiae</i> (7)	+	+	+		+	+			+						+
<i>Hellinsia cristobalis</i> (0)	+	+	+	+	+	+			+						
<i>Hellinsia devriesi</i> (0)	+	+	+												
<i>Hellinsia nephogenes</i> (1)	+	+	+			+									

## CONCLUSIONS

We have now found Pterophoridae on 15 different islands of the Galapagos archipelago, the smallest of which being Gardner at Española. As the latter is the 22nd largest island with 0.58 km<sup>2</sup>, we can expect that some islands of larger size, such as Bartolome or Darwin also have a fauna of Pterophoridae, as undoubtedly do smaller ones, but these have yet to be sampled for micromoths.

In accordance with the theory of island biogeography (MacArthur & Wilson 1967), it is not surprising that Isabela, by far the largest island of the archipelago with 4588 km<sup>2</sup>, has the richest fauna of Pterophoridae. In fact, all 15 species known from the archipelago occur on Isabela. Isabela is also the richest island for many other Lepidoptera families (e.g. Arctiidae, Geometridae, Noctuidae).

We have collected only five species of Pterophoridae on the third largest island, Fernandina, no doubt because very little collecting has been performed on this island. Insufficient collecting also accounts for the current status of the known distribution of most other species as exemplified by the situation for *Stenoptilodes gielisi* Landry and *Stenoptilodes juanfernandicus* Landry & Gielis, which remain known from only one and two Galapagos specimens respectively.

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