

The Chloropidae (Diptera) of the Galápagos Islands, Ecuador

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Thirteen species of Chloropidae are recorded from the Galápagos Islands, Ecuador. Seven new species are described: *Diplotoxa loma* sp. n. (subfamily Chloropinae); *Conioscinella empheria* sp. n.; *Gaurax gethosyne* sp. n.; *Hippelates alyscus* sp. n.; *Liohippelates baptipalpis* sp. n.; *Olcella anaclasta* sp. n.; *Olcella lupina* sp. n. (subfamily Oscinellinae). Another species in the genus *Apallates* is apparently undescribed, but there is insufficient information to justify a formal description. *Monochaetoscinella anonyma* is recorded for the first time from the archipelago. Four species previously recorded from the archipelago were also identified: *Cadrema pallida*; *Conioscinella galapagensis*; *Elachiptera cultrata*; *Liohippelates galapagensis*. Previously published Galápagos records of *Liohippelates pusio* apparently refer to *L. galapagensis*. A key to the Galápagos species of Chloropidae is given. Geographic affinities of the Galápagos chloropid fauna are similar to those of other Diptera from the archipelago, with few pantropical species, some species also found in the northern Neotropical and southern Nearctic regions, and endemic species apparently with Neotropical sister groups.

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Introduction

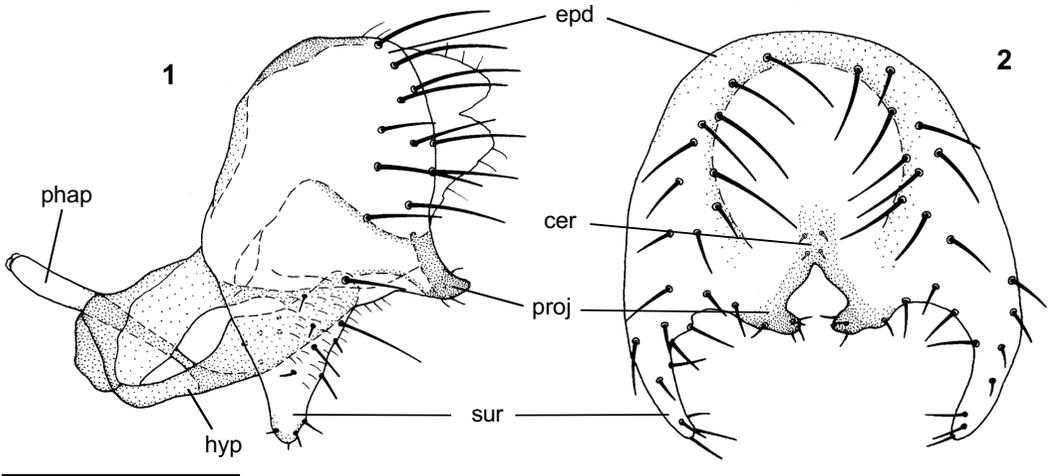
Like many families of Diptera, the Chloropidae of the Galápagos Islands are incompletely known. Only four species of Chloropidae have been previously recorded from the archipelago: the endemic species *Conioscinella galapagensis* (Curran, 1932), *Liohippelates galapagensis* (Curran, 1932) and *Elachiptera cultrata* Wheeler & Forrest, 2002; and the widespread species *Cadrema pallida* (Loew, 1866) (Curran 1932, 1934, Wheeler & Forrest 2002). Coquillett's (1901) and Johnson's (1924) records of *Liohippelates pusio* (Loew, 1872) from the islands actually refer to *L. galapagensis*. Additional surveys of Galápagos insects in the 1960s, especially by the California Academy of Sciences, and an ongoing inventory of Galápagos arthropods since the 1980s by S. B. Peck and colleagues (Peck 1996, Peck et al. 1998) have resulted in the collection of more than 1200 specimens of Chloropidae, representing 13 species. In this paper, the chloropid fauna of the Galápagos is

revised, including the description of seven new species.

Material and methods

Specimens examined are housed in the following institutions (acronyms used in the text are in parentheses): Bernice P. Bishop Museum, Honolulu, HI, USA (BPBM); California Academy of Sciences, San Francisco, CA, USA (CAS); Canadian National Collection of Insects, Ottawa, ON, Canada (CNC); Lyman Entomological Museum, McGill University, Ste-Anne-de-Bellevue, QC, Canada (LEM); National Museum of Natural History, Washington DC, USA (USNM); Zoological Museum, Oslo University, Oslo, Norway (ZMO).

Most specimens collected were preserved in 70% ethanol and subsequently critical point dried using liquid CO₂ or hexamethyldisilazane. Preparations of genitalia were made by removing the



Figures 1-2. *Diplotoxa loma*: (1) Male genitalia, lateral. (2) Male genitalia, posterior. Abbreviations: cer - remnant of cerci; epd - epandrium; hyp - hypandrium; phap - phallapodeme; proj - posteroventral projection; sur - surstylus. Scale bar = 0.1mm.

abdomens of mounted specimens (older air-dried specimens were first relaxed in high humidity) and clearing them in 85% lactic acid heated in a microwave oven for 1-2 30-second intervals separated by a cooling period. Cleared abdomens were then placed in glycerin for further dissection and examination. Dissected abdomens were stored in glycerin in plastic microvials pinned beneath the source specimen.

Key to species of Chloropidae of the Galápagos Islands

1. Wing with costa extending to R₄₊₅; crossvein dm-cu absent *Diplotoxa loma*
- Wing with costa extending to M₁₊₂; crossvein dm-cu present 2
2. Arista broad, sword shaped; scutellum trapezoidal; body mostly yellow.....*Elachiptera cultrata*
- Arista narrow, rarely enlarged at base; scutellum rounded posteriorly; body colour variable..... 3
3. Hind tibia with apical or pre-apical ventral spur at least as long as tibial diameter..... 4
- Hind tibial spur absent or much shorter than tibial diameter 8
4. Thorax yellow in ground colour 5
- Thorax black in ground colour..... 6
5. Hind tibial spur as long as basitarsus; frontal triangle shining; scutum dorsally with pale reddish stripes *Cadrema pallida*
- Hind tibial spur less than half as long as basitarsus; frontal triangle dull; scutum dorsally with black stripes *Hippelates alyscus*
6. Scutum dull; eyes hairy; hind tibial spur equal

- in length to tibial diameter *Apallates* sp.
- Scutum shining; eyes bare; hind tibial spur longer than tibial diameter 7
7. Legs yellow; frontal triangle with sides straight or nearly so, extending slightly past middle of frons; palp black basally, yellow distally *Liohippelates baptipalpis*
- Legs partly brown, hind femur and tibia darkest; frontal triangle with sides concave, extending almost to anterior margin of frons; palp entirely yellow..... *Liohippelates galapagensis*
8. Vibrissal angle strongly produced; proboscis greatly elongate, sclerotized, geniculate (as in Fig. 17)..... 9
- Vibrissal angle rounded or only slightly projecting; proboscis not greatly elongate 10
9. Scutum with deeply incised longitudinal lines of punctures; thoracic pleurites entirely pruinose except for area between mid and hind coxa. Postgena very broad, posteroventral angle less than 90° (Fig. 17); palp as long as head; many setae on frons and gena arising from distinct punctures *Olcella anaclasta*
- Scutum without deeply incised lines of punctures; thoracic pleurites with broad shining stripe. Postgena not as broad, posteroventral angle greater than 90° (Fig. 20); palp at most 0.7 times as long as head, setae on head not arising from distinct punctures *Olcella lupina*
10. Frontal triangle shining; notopleuron with 1 anterior and 1 strong posterior bristle..... 11
- Frontal triangle dull; notopleuron with 1 anterior and 2 strong posterior bristles 12
11. Frons with 1 outstanding fronto-orbital bristle; scutellum black *Monochaetoscinella anonyma*
- Frons with several long fronto-orbital setae; scutellum yellow *Gaurax gethosyne*

12. Male cercus short, blunt, not projecting (Fig. 3-4); surstylus parallel-sided in lateral view (Fig. 3) *Conioscinella empheria*
 - Male cercus projecting as triangular lobe (Fig. 5-6); surstylus broadest basally in lateral view (Fig. 5) *Conioscinella galapagensis*

Subfamily Chloropinae

Diplotoxa loma Wheeler & Forrest, sp. n.

(Figs 1-2)

Description. – Total length 1.4-2.0 mm. Frons pale yellow, roughly as long as broad, slightly narrowed anteriorly; frontal triangle pale yellow except for black ocellar tubercle, subshining, not clearly differentiated from rest of frons; antenna mostly yellow; first flagellomere orbicular, with dorsobasal black spot; arista black, pubescent, thickened basally, tapering apically; occiput brown medially; face pale yellow; eye with short, sparse ommatrichia, long axis diagonal; gena pale yellow, 0.25 times height of eye, higher posteriorly; vibrissal angle not projecting; palp and proboscis short, pale yellow. Cephalic chaetotaxy: 4 reclinate to slightly latero-clinate fronto-orbital setae, the posterior two longer and stronger; several moderately long medio-clinate to proclinate interfrontal setulae (some of these forming the margin of the frontal triangle); ocellar bristles strong, proclinate, divergent; postocellar bristles short, convergent; inner and outer vertical bristles well-developed, the outer longer; fine dark setulae present along occipital margin; pale setulae present on lower margin of gena; vibrissa long, pale. Scutum pale yellow, sparsely pruinose, with five brown stripes; median stripe on anterior two-thirds, lateral stripes extending from postpronotum to level of dorsocentral bristles, supraalar stripes extending from notopleuron to level of postalar bristle; scutum approximately as long as broad; postpronotum yellow with brown spot; scutellum pale yellow, rounded, broader than long; thoracic pleurites pale yellow except for brown spot around anterior spiracle, brown lower half of katepisternum, black spot on meron, and dark stripes on anterior margins of anepisternum and anepimeron. Thoracic chaetotaxy: 1 postpronotal, 1 weak anterior and 2 strong posterior notopleural, 1 dorsocentral, 1 postalar, 1 pair of widely separated apical scutellar and 1 shorter pair of lateral scutellar bristles; postpronotum, scutum, and katepisternum setulose; scutellum without

setulae. Legs dark yellow. Wing length 1.3-1.5 mm, second costal sector 1.0-1.1 times as long as third costal sector; cross-vein dm-cu absent. Halter white. Abdominal tergites pale brown, setulose and shining.

Male postabdomen (Fig. 1-2): Terminalia mostly pale yellow, subshining; surstylus fused with epandrium; surstylus short, triangular in lateral view, with several setae and setulae on posterior half; posteroventral margin of epandrium with short, dark projection (see Remarks); fused cerci (mesolobus) desclerotized, present only as 3-4 short, stout setae.

Type material. – Holotype ♂: ECUADOR: GALÁPAGOS ISLANDS: SANTA CRUZ: 4km N Bellavista, MediaLuna 620m, 14.v-13.vii.1985, S. & J. Peck, Miconia zone, FIT (CNC). Paratypes: 28♂, 73♀, same data as holotype (CNC, LEM).

Etymology. – The species name is from the Spanish *loma* (hill), referring to the high elevation of the type locality.

Remarks. – This species would key to *Elliponeura* Loew, 1869 in existing keys to chloropid genera, based on the lack of crossvein dm-cu. The presence or absence of this crossvein, however, is weak justification for recognition of a separate genus and the distinction between *Elliponeura*, *Pseudopachychaeta* Strobl, 1902 and *Diplotoxa* Loew, 1863 is so tenuous that Spencer (1986) combined all three under *Diplotoxa*. A comprehensive systematic revision of this group of “genera” is badly needed, but for the present we follow Spencer and recognize only the genus *Diplotoxa*. Sabrosky & Paganelli’s (1984) record of an undescribed species of *Elliponeura* from the Galápagos Islands probably refers to this species.

The male cerci of Chloropinae are usually fused into a single median structure (mesolobus). Spencer (1977) divided the New Zealand species of *Diplotoxa* s.l. into three groups based on variation in the male cerci: Group I with a typical chloropine mesolobus; Group II with the cerci separate (as in most Oscinellinae) and conspicuously long and dark; and Group III with the cerci absent. *Diplotoxa loma* would belong to Spencer’s Group II, based on the separate dark projections (Fig. 2). However, we suggest that the dark projections of Spencer’s Group II species are not the true cerci but, instead, are novel structures derived from the posteroventral epandrial margin and/or the subepandrial sclerite. In *D. loma*, three or four short setae arising from sockets are visible at high magnification in the same location as the

mesolobus in most Chloropinae. These setae apparently mark the location of a secondarily desclerotized mesolobus in *D. loma* and possibly the New Zealand species of Groups II and III (although we have not examined those species).

Given what is known of the biology of other species of *Diptotoxa* s.l. in the New World, *D. loma* is probably phytophagous in the flower heads of sedges (Cyperaceae).

Subfamily Oscinellinae

Apallates sp.

Material examined. – ECUADOR: GALÁPAGOS ISLANDS: SANTA CRUZ: 1♂, 1km E Charles Darwin Research Station, lagoon, littoral, 30.iii-7.iv.1989, malaise, Peck & Sinclair (CNC); 2♂, 1♀, Academy Bay, Darwin Research Station, sweeping coastal plants, 25.i.1964, D. Q. Cavagnaro & R. O. Schuster (CAS).

Remarks. – This is the first record of the genus *Apallates* Sabrosky, 1980 from the Galápagos. Although it is apparently undescribed, this species is similar to a number of described but poorly differentiated Neotropical species and we cannot be sure of its status without consideration of several additional species. Accordingly, we prefer to leave this species undescribed pending a complete revision of the Neotropical *Apallates*.

Cadrema pallida (Loew, 1866)

Hippelates pallida Loew 1866: 184
Prohippelates pallidus: Curran, 1934: 159

Material examined. – ECUADOR: GALÁPAGOS ISLANDS: BALTRA [as S. Seymour I.]: 1♂, 6♀, 11.vi.1932, M. Willows, Jr., Templeton Crocker Exped., 1932 (CAS); 1♂, 2♀, same data except 11.vii.1932 (CAS); ISABELA: 1♀, Pto. Villamil, 7.iii.1989, intertidal rocks, B. J. Sinclair (CNC); SANTA CRUZ: 1♂, 3♀, Tortuga Bay, littoral, 29.i.1989, B. J. Sinclair, MV lights (CNC); 1♂, 4♀, Darwin Research Station, 0m, littoral zone, 28.iv.1991, J. Heraty (CNC); 1♀, Charles Darwin Research Station, arid zone, 16.i.1989, MV lights, B. J. Sinclair (CNC); 1♀, Academy Bay, Darwin Research Station, sweeping coastal plants, 25.i.1964, D. Q. Cavagnaro & R. O. Schuster (CAS); 1♀, Academy Bay, Darwin Research Station, 26.i.1964, R. O. Schuster (CAS); 1♂, Academy Bay, at light, 17.ii.1964, P. D. Ashlock (BPBM).

Remarks. – Although Curran (1934) recorded *C. pallida* from the Galápagos, Sabrosky & Paganelli (1984) did not list the species from the islands, nor did they cite Curran (1934). This species is pantropical, with records from North, Central and

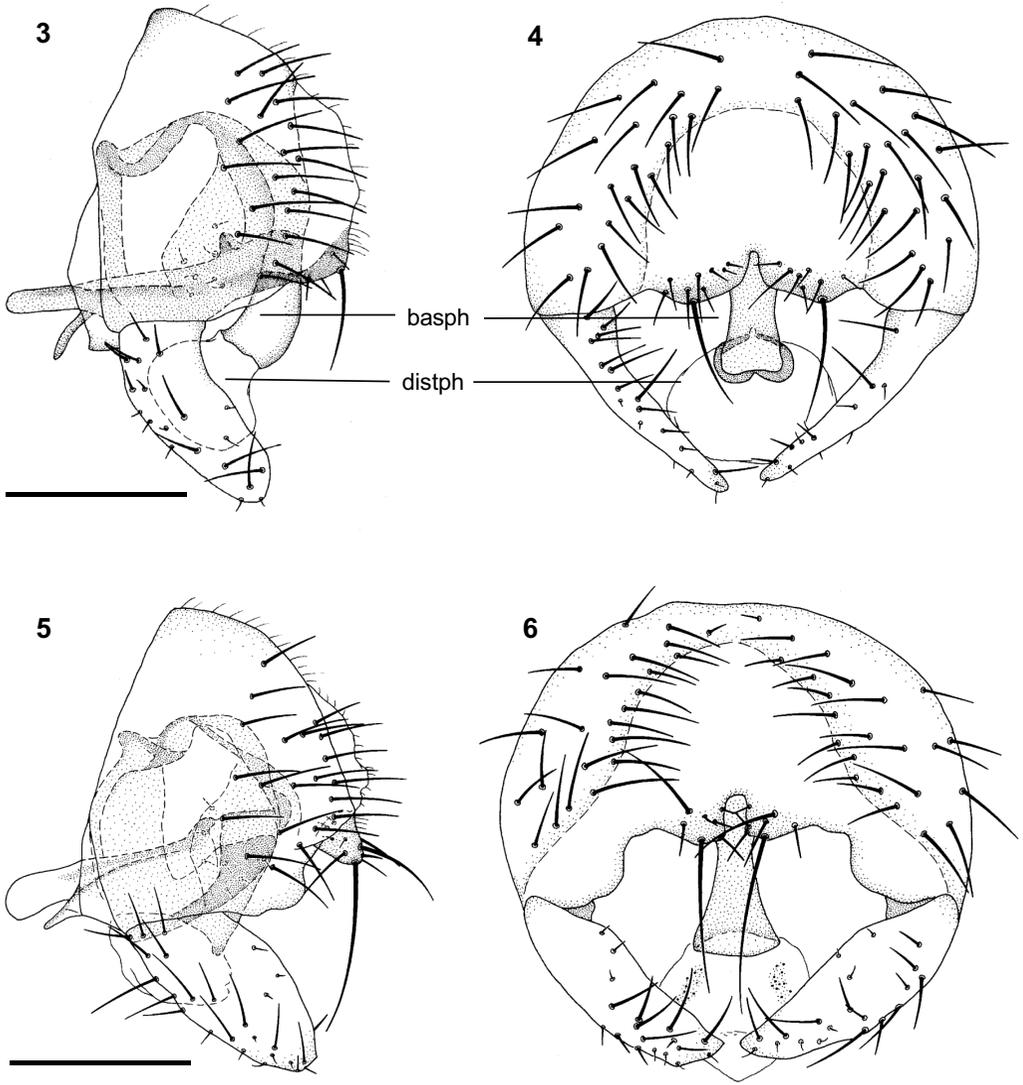
South America, Australia, Africa and islands in the Pacific, Atlantic and Indian oceans. The 11 July 1932 record from Baltra is most likely an error on the specimen label; the correct date is probably 11 June 1932 (as for other specimens from the same locality). Nartshuk (2002) illustrated the male genitalia of *C. pallida*.

Conioscinella empheria

Wheeler & Forrest, sp. n.

(Figs 3-4)

Description (male only). – Total length 1.6-2.1 mm. Frons mainly yellow, sometimes darker (grey-brown) posteriorly; frontal triangle grey, 0.4-0.5 times length of frons; frons including frontal triangle dull; antenna mainly yellow; first flagellomere reniform, darkened on dorsal half or more; arista short, black; occiput grey-brown; face yellow to pale brown, with carina; eye with short, dense ommatrichia; gena yellow on anterior two-thirds or more, grey-brown posteriorly, 0.3 times height of eye; vibrissal angle projecting slightly in most specimens; palp yellow; proboscis brown, sclerotized, geniculate. Cephalic chaetotaxy: 7-8 short, reclinate fronto-orbital setae; several proclinate to mediocline interfrontal setulae; ocellar and postocellar bristles short, cruciate; inner and outer vertical bristles slightly longer than surrounding setulae; setulae along occipital margin and on ventral one-third to one-half of gena; vibrissa slightly longer than subvibrissal setulae. Scutum and scutellum heavily pruinose, dark grey-brown; scutum longer than broad; postpronotum and notopleuron dull, usually paler than scutum; scutellum rounded apically, broader than long; thoracic pleurites variable in colour, ranging from yellow to dark brown; posterodorsal half of anepisternum, anterodorsal half of anepimeron, and ventral corner of katepisternum at least sparsely pruinose. Thoracic chaetotaxy: 1 (occasionally 2) postpronotal, 1 anterior and 2 posterior notopleural, 1 dorsocentral, 1 postalar, and 1 intrapostalar bristles; scutellum with 1 pair of convergent apical and 1 or 2 pairs of subapical bristles; postpronotum, scutum and scutellum densely and uniformly setulose; katepisternum with a few fine setulae. Legs yellow or variably darkened with brown (see Remarks). Wing length 1.3-1.8 mm; second costal sector 1.5-1.75 times length of third costal sector; dm-cu oblique, not parallel



Figures 3-4. *Conioscinella empheria*: (3) Male genitalia, lateral. (4) Male genitalia, posterior. Figures 5-6. *Conioscinella galapagensis*: (5) Male genitalia, lateral. (6) Male genitalia, posterior. Abbreviations: basph - basiphallus; distph - distiphallus. Scale bars = 0.1mm.

with r-m. Halter white. Abdominal tergites brown, setulose, subshining; sternites paler brown, setulose.

Male postabdomen (Fig. 3-4): Terminalia yellow to pale brown, with short, dense pubescence; ventral margin of epandrium almost straight between surstylus and cercus in lateral view; surstylus parallel-sided, evenly curved in lateral

view; cercus short, blunt, with a single long seta situated far from median cleft.

Type material. - Holotype ♂: ECUADOR: GALÁPAGOS ISLANDS: ESPAÑOLA: Bahía Manzanilla, 5-10.vi.85, S. & J. Peck, littoral cryptocarpus & Prosopis, FIT, malaise (CNC). Paratypes: BARTOLOME: 1♂, lava bed in contact with mangrove swamp, N. end of island, 5' alt., 3.ii.1967, I. L. Wiggins (CAS); ESPAÑOLA: 14♂, Bahía Manzanilla, 5-

10.vi.1985, S. & J. Peck, littoral cryptocarpus & Prosopis, FIT, malaise (CNC, LEM); 8♂, same data except Prosopis grove behind beach, carrion traps (CNC); 1♂, Punta Juarez, 10-12.ii.1967, I. L. Wiggins, trap among *Lycium minimum*, *Prosopis doleis* and *Cryptocarpus pyriformus* (Gubarsbia) (CAS); FLOREANA: 2♂, littoral zone, 23.iii.1989, sweeping white-sand beach, B. J. Sinclair (CNC); 1♂, Black Beach, 21-28.iii.1989, 10m, littoral-arid FIT, Peck & Sinclair (CNC); GENOVESA: 3♂, S. side of island 200 yds. from beach, 4-6.ii.1967, I. L. Wiggins, in flight trap among *Bursera graveolens* (CAS); ISABELA: 3♂, Villamil, 1km W, 2-15.iii.1989, FIT, littoral scrub on sand, 1m, Peck & Sinclair (CNC); SAN CRISTÓBAL: 43♂, Puerto Baquerizo, south beach, 21.ii.1989, marine iguana nesting sites, littoral, B. J. Sinclair (CNC, LEM); SANTA CRUZ: 1♂, 1km E Charles Darwin Research Station (lagoon), littoral, 30.iii-7.iv.1989, malaise, Peck & Sinclair (CNC); SANTA FE: 5♂, 4.iv.1989, B. J. Sinclair, sweeping sea lion beach (CNC); 1♂, littoral zone, yellow pan trap, 4-6.ii.1989, B. J. Sinclair (CNC); 2♂, 3-6.vi.1989, B. J. Sinclair, sea lion dung trap in littoral zone (CNC); 1♂, littoral beach malaise, 4-6.iv.1989, Peck & Sinclair (CNC).

Etymology. – The species name is from the Greek *empheres* (resembling, like), referring to the great similarity between this species and the sympatric *C. galapagensis*.

Remarks. – More than 280 female specimens of *Conioscinella* Duda, 1929 from 14 islands (Baltra, Bartolomé, Española, Floreana, Genovesa, Isabela, Marchena, Pinta, Rábida, San Cristóbal, Santa Cruz, Santa Fe, Seymour, Wolf) were not included in the list of paratypes or specimens examined because the two species of *Conioscinella* recorded from the Galápagos can only be distinguished on the basis of male genitalic characters. There is considerable variation in leg colour within *C. empheria*, in which the legs vary from yellow to mostly dark brown. The darkest specimens of *C. empheria* were taken from a mixed series of both species on San Cristóbal, where they were clearly distinguishable from the yellow-legged *C. galapagensis*. In series from other islands, comprising only *C. empheria*, most specimens had bright yellow legs similar to those of *C. galapagensis*. The possible occurrence of character displacement in sympatric populations of these two species would be worthy of further study.

Conioscinella galapagensis (Curran, 1932)

(Figs 5-6)

Oscinella galapagensis Curran, 1932: 357.

Conioscinella galapagensis: Sabrosky & Paganelli, 1984: 10.

Redescription (male only). – As for *C. empheria*

except as follows: total length 1.4-1.8 mm; anepisternum, anepimeron, katapisternum and meron always brown; legs usually entirely yellow (see Remarks under *C. empheria*).

Male postabdomen (Figs 5-6): ventral margin of epandrium tuberculate between surstylus and cercus in lateral view; surstylus broadest in basal half, not curving in lateral view; cercus projecting as triangular lobe, with long seta at distal end.

Type material examined. – Holotype ♀: ECUADOR: GALÁPAGOS ISLANDS: FLOREANA: Post Office Bay, Seaside, 12-14.xi.1925, A. Wollibaek (ZMO). Paratypes: 4♀, same data as holotype (ZMO).

Other material examined. – ECUADOR: GALÁPAGOS ISLANDS: DARWIN: 1♂, 29.i.1964, D. Q. Cavagnaro (CAS); ESPAÑOLA: 2♂, Punta Juarez, 10-12.ii.1967, I. L. Wiggins, trap among *Lycium minimum*, *Prosopis doleis* and *Cryptocarpus pyriformus* (Gubarsbia) (CAS); FLOREANA: 11♂, several hundred ♀, Post Office Bay, 8.xii.1925, A. Wollibaek (ZMO); ISABELA: 19♂, Puerto Villamil, coastal pools, 7.iii.1989, brackish, B. J. Sinclair (CNC, LEM); 4♂, Puerto Villamil, arid zone, 5.iii.1989, 5m, MV-lights, B. J. Sinclair (LEM); PINTA: 6♂, littoral zone, 2m, carrion traps, 14-20.iii.1992, S. Peck (LEM); SAN CRISTÓBAL: 10♂, Puerto Baquerizo, south beach, 21.ii.1989, marine iguana nesting sites, littoral, B. J. Sinclair (CNC); 1♂, Puerto Baquerizo, arid zone, 20.ii.1989, sweeping, B. J. Sinclair (CNC); SANTA FE: 1♂, 4.iv.1989, B. J. Sinclair, sweeping sea lion beach (CNC); WOLF: 4♂, 1.ii.1964, D. Q. Cavagnaro (CAS); 1♂, 31.i-01.ii.1964, P. D. Ashlock (BPBM).

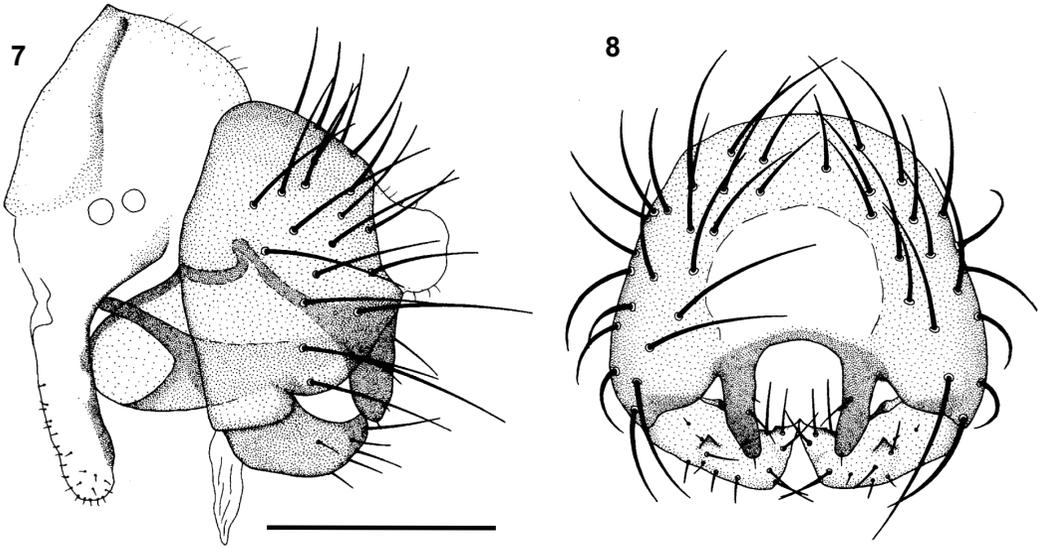
Remarks. – Although the holotype and paratypes are all females, there is a long series of specimens in the ZMO collected at the same time and locality. All male specimens in that series are conspecific and our definition of this species is based on those specimens. See Remarks under *C. empheria* for notes on the difficulty in identifying female specimens.

Elachiptera cultrata Wheeler & Forrest, 2002

Elachiptera cultrata Wheeler & Forrest, 2002: 2.

Remarks. – This species can easily be distinguished from all other recorded Galápagos chloropids on the basis of the broad, flattened arista, the mainly yellow body, and the trapezoidal scutellum. Wheeler & Forrest (2002) provided characters for distinguishing *E. cultrata* from other species of *Elachiptera* Macquart, 1835.

This species apparently belongs to a New World group of yellow or reddish species of *Elachiptera*. Many published records of species in this group are from low-lying habitats, often coastal or other-



Figures 7-8. *Gaurax gethosyne*: (7) Male postabdominal segments 6-8 and genitalia, lateral. (8) Male genitalia, posterior. Scale bar = 0.1mm.

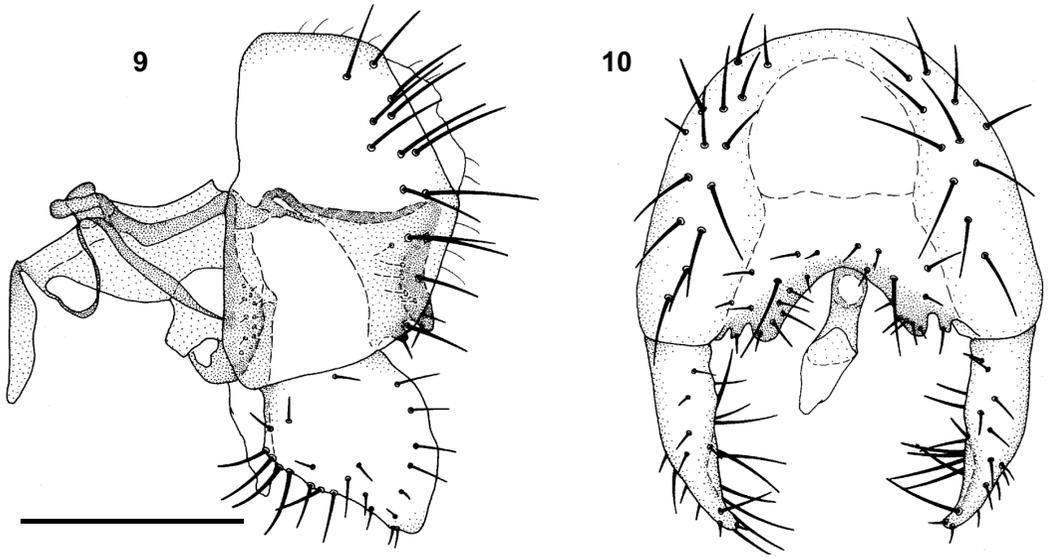
wise arid. The habitats from which *E. cultrata* was collected were more diverse, although primarily humid, ranging from the Arid Zone near the coast, through the Transition, *Scalesia*, *Miconia* and Pampa Zones up to elevations of 1000m. Specimens were collected in native habitats as well as disturbed agricultural areas and guava forest. Complete label data were provided by Wheeler & Forrest (2002) and we have since examined two additional specimens (SANTA CRUZ: 1♂, Bella Vista, 10km N Academy Bay, 21.ii.1964, P. D. Ashlock (BPBM); 1♀, 8km N Academy Bay, abandoned garden, 24.i.1964, P. D. Ashlock (BPBM)).

Despite its apparently broad habitat preference, *E. cultrata* was primarily collected (117 of 121 specimens) on two large islands (Santa Cruz, Isabela) with long-term permanent human habitation and extensive habitat disturbance. Only four specimens were collected from other islands (Floreana, Seymour) in the course of a large scale, multi-year survey of Galápagos insects. This apparent association with human-altered islands and absence from undisturbed islands may indicate that the species has been introduced from elsewhere, probably western South America or Central America, by human activity. Finding *E. cultrata* in Central or South America would lend support to that possibility.

***Gaurax gethosyne* Wheeler & Forrest, sp. n.**

(Figs 7-8)

Description. – Total length 1.7-2.3 mm. Frons shining, yellowish brown anteriorly, darker brown posteriorly; frontal triangle including ocellar tubercle polished brown, not clearly delimited anteriorly; first flagellomere reniform, entirely yellow in male, black at apex in female; arista with basal segments yellow, terminal segment dark; occiput dark brown, pruinose; face yellow, without carina; eye apparently bare, with only scattered short setulae, iridescent, long axis diagonal; gena mostly shining brown, with black margin, 0.08 times height of eye; vibrissal angle and parafacial shining yellow; vibrissal angle not projecting; palp black; proboscis short, with brown sclerotization. Cephalic chaetotaxy: 5 reclinate fronto-orbital setae, increasing in length posteriorly; single row of setulae on border of frontal triangle; 1 pair of longer cruciate interfrontal setulae near anterior margin of frons; ocellar and postocellar bristles quite long, erect, cruciate; inner and outer vertical bristles long, the outer stronger; short setulae along occipital margin; longer setulae along genal margin, the posterior 2 hairs notably longer; vibrissa slightly longer than subvibrissal setulae. Thorax entirely polished brown except for pale



Figures 9-10. *Hippelates alyscus*: (9) Male genitalia, lateral. (10) Male genitalia, posterior. Scale bar = 0.1mm.

yellow scutellum and slight pruinosity around wing base; scutum approximately as long as broad, with faint pattern of lighter brown postsutural dorsocentral and narrower supraalar stripes, merged posteriorly; scutellum rounded apically, broader than long; thoracic pleurites lighter brown than postpronotum and scutum. Thoracic chaetotaxy: 1 postpronotal, 1 anterior and 1 posterior notopleural, 1 dorsocentral, 1 postalar, 1 pair of apical and 1 pair of shorter subapical scutellar bristles; 1 weak katepisternal bristle; postpronotum, scutum, and katepisternum with long setulae; scutellum microsetulose along margin and laterally at base. Fore leg (including coxa) yellow, tarsus darker; mid and hind leg with coxa and basal third to half of femur yellow, rest of leg brown to black. Wing length 1.5-2.0 mm; second costal sector 1.2-1.4 times length of third costal sector; cell r_1 broad, but less so than in most Nearctic species of *Gaurax*. Halter white. Abdominal tergites pale brown, syntergite 1+2 very pale medially; tergites evenly microsetulose and with scattered longer setulae; sternites very pale, with long setulae.

Male postabdomen (Fig. 7-8): Sternite 6 apparently present, forming a complete ventral band fused laterally with synsternite 7+8; ventral medial region of sternite 6 projecting ventrally as a pale

ventral processes anterior to epandrium. Epandrium not greatly enlarged relative to abdomen; epandrium dark brown with dense long hairs. Surstylus roughly rectangular in posterior view, pointed at ventral medial corner, with additional tooth-like projection on posterior surface. Phallus long, cylindrical, membranous. Cercus long, black, well-sclerotized.

Type material. – Holotype σ : ECUADOR: GALÁPAGOS ISLANDS: ISABELA: Sto. Tomas, 4-15.iii.1989, 300m, humid forest Malaise, Peck & Sinclair (CNC). Paratypes: SANTA CRUZ: 3 σ , 1 ϕ , Academy Bay, Darwin Research Station, sweeping coastal plants, 25.i.1964, D. Q. Cavagnaro & R. O. Schuster (CAS).

Etymology. – The species name is a noun in apposition derived from the Greek *gethosyne* (delight, joy), referring to the attractive appearance of this fly and the excellent condition of the holotype.

Remarks. – Although most Nearctic species of *Gaurax* Loew, 1863 are distinguished by the possession of an enlarged epandrium, the male genitalia of this species are not greatly enlarged. There is a range of development in the size of the epandrium among other undescribed Neotropical species of *Gaurax*. Other than the size of the epandrium, the genitalia are typical of New World

species of *Gaurax*. Cell r_1 is also narrower than in most Nearctic species of *Gaurax*, but similar to the Neotropical species.

***Hippelates alyscus* Wheeler & Forrest, sp. n.**

(Figs 9-10)

Description. – Total length 1.6 mm. Frons yellow, dull, slightly longer than broad; frontal triangle including ocellar tubercle black, sparsely pruinose, about 0.5 times length of frons; antenna yellow at least ventrally, variably darkened dorsally; first flagellomere suborbicular; arista dark, slender; occiput yellow, variably infuscated; face yellow, without carina; eye densely short-haired; gena yellow, 0.2 times height of eye; vibrissal angle not projecting; palp and proboscis yellow; proboscis short, mostly unsclerotized. Cephalic chaetotaxy: 5-7 short, reclinate fronto-orbital setae; numerous short interfrontal setulae on anterior of frons and forming single row along border of frontal triangle; ocellar bristles short, erect, convergent; postocellar bristles longer, convergent to cruciate; inner and outer vertical bristles equal in length to postocellars; setulae along occipital margin and ventral half of gena; vibrissa not differentiated from subvibrissal setulae. Scutum yellow, pruinose, with five black stripes; broad median stripe on anterior two-thirds to three-fourths, lateral stripes extending from postpronotum to level just beyond end of median stripe, narrow paler supraalar stripes extending from notopleuron to level of postalar bristle; scutum as long as broad; postpronotum and scutellum yellow, pruinose; scutellum rounded apically, broader than long; thoracic pleurites pruinose on dorsal half, shining below, yellow except for large ventral black spot on katapisternum, dark anterior margins of anepisternum and anepimeron, and black posterior margin of meron. Thoracic chaetotaxy: 1-2 postpronotal, 1 anterior and 2 posterior notopleural, 1 dorsocentral, 1 postalar, 1 intrapostalar, 1 pair of long and strong apical and 2 pairs of shorter, weaker subapical scutellar bristles; postpronotum, scutum, scutellum and katapisternum setulose. Legs mostly yellow; tarsi and distal portions of tibiae variably darkened; hind tibia with curved pre-apical ventral spur, approximately equal in length to diameter of tibia. Wing length 1.3-1.5 mm; second costal sector 1.5-1.8 times length of third costal sector. Halter white. Abdominal tergites brown, moderately long-haired; sternites paler, setulose.

Male postabdomen (Fig. 9-10): Epandrium brown, with long hairs on posterior surface; surstylus broad, black, with anterior fringe of long setae; cercus bilobed, with 1 long seta and several short setae.

Type material. – Holotype ♂: ECUADOR: GALÁPAGOS ISLANDS: FERNANDINA: Cabo Hammond, 0m, 3.v.1991, J. Heraty, beach grasses (CNC). Paratypes: ISABELA: 1♂, 1♀, arid zone, 5.iii.1989, B. J. Sinclair, sweeping (CNC).

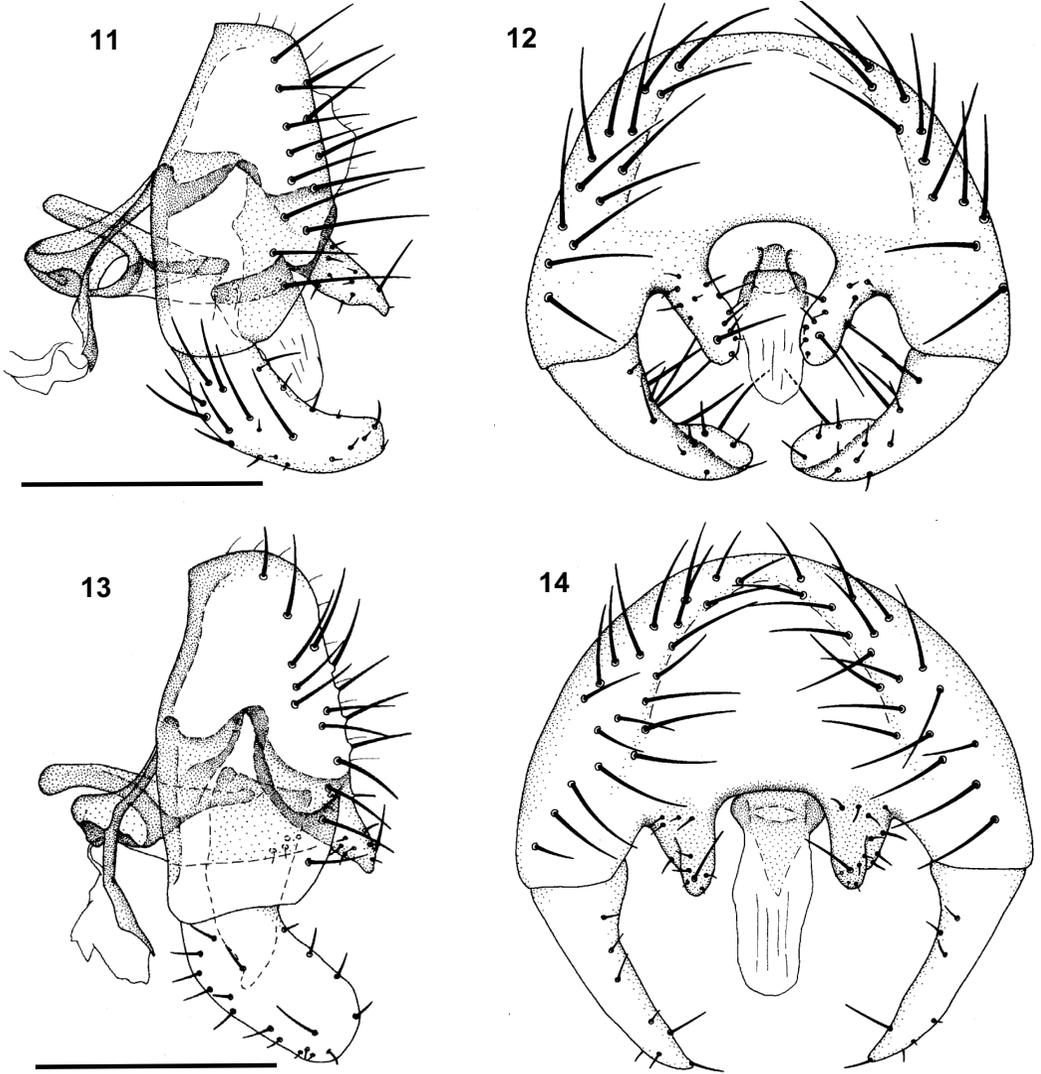
Etymology. – The species name is from the Greek *alysko* (wander uneasily), referring to the combination of characters that left this species suspended between at least three poorly defined genera for much of this study.

Remarks. – This species belongs to a group of species that have been assigned by some authors to the genus *Olcanabates* Enderlein, 1911. Although Paganelli & Sabrosky (1993) treated the two genera as synonyms, this was not based on phylogenetic analysis and further study of the generic limits is required. For the present, we prefer to recognize a broader concept of *Hippelates* Loew, 1863.

***Liohippelates baptipalpis*
Wheeler & Forrest, sp. n.**

(Figs 11-12)

Description. – Total length 1.8-2.3 mm. Frons dark yellow anteriorly, grading to dark brown or black posteriorly, subshining, usually with some pruinosity bordering frontal triangle; frontal triangle including ocellar tubercle polished, dark brown to black, with sides straight or slightly concave, 0.6-0.7 times length of frons; antenna yellow; first flagellomere suborbicular, usually slightly infuscated dorsally; arista pale basally, darkened distally; occiput black, pruinose; face dark yellow, with weak carina; eye bare; gena 0.2 times height of eye, yellow to black, shining, microscopically striate, with darker, polished margin; vibrissal angle not projecting; palp black basally, yellow distally; proboscis sclerotized, brown to black, geniculate but not elongate. Cephalic chaetotaxy: 1-2 short, weak, anterior and 4-5 longer, stronger, posterior reclinate fronto-orbital setae; several proclinate to medioclinate interfrontal setulae on anterior of frons and forming single row of setulae along border of frontal triangle; ocellar and postocellar bristles erect, cruciate; inner vertical bristles approximately equal in length to postocellars; outer vertical bristles slightly longer and stronger; setulae along occipital and genal margins; vibrissa



Figures 11-12. *Liohippelates baptipalpis*: (11) Male genitalia, lateral. (12) Male genitalia, posterior. Figures 13-14. *Liohippelates galapagensis*: (13) Male genitalia, lateral. (14) Male genitalia, posterior. Scale bars = 0.1mm.

approximately twice as long as subvibrissal setulae. Thorax entirely shining black except for pruinosity around wing base and base of scutellum; scutum slightly longer than broad; scutellum rugose, slightly broader than long, subconical. Thoracic chaetotaxy: 1-3 weak postpronotal, 1 weak, erect intrahumeral, 1 anterior and 2 posterior-notopleural, 1 dorsocentral, 1 postalar, and 1

weak intrapostalar bristles (the latter may be indistinguishable from surrounding setulae); scutellum with 1 pair of cruciate apical and 2 or more pairs of much shorter subapical bristles, all borne on short tubercles; postpronotum, scutum, scutellum, and katepisternum setulose; setulae in median and dorsocentral rows of scutum slightly divergent, 3-4 rows of setulae between median and dorsocen-

tral rows. Legs pale yellow; hind tibia with strongly curved preapical ventral spur, longer than diameter of tibia. Wing length 1.6-2.1 mm; second costal sector 1.7-1.9 times length of third costal sector. Halter white. Abdominal tergites sparsely pruinose, setulose; syntergite 1+2 mostly pale yellow, remaining tergites and sometimes posterolateral corners of syntergite 1+2 brown; sternites very pale, setulose.

Male postabdomen (Figs 11-12): Epanthium long-haired; surstylus curved posteromedially, tapering distally, with several long setae on anterior half; cercus elongate, projecting posteroventrally, cerci convergent in posterior view, each with one long seta and several short setae; phallus short, membranous.

Type material. – Holotype ♂: ECUADOR: GALÁPAGOS ISLANDS: SANTA CRUZ: 1 km E Charles Darwin Research Station, lagoon, littoral, 30.iii-7.iv.1989, malaise, Peck & Sinclair (CNC). Paratypes: BARTOLOMÉ: 1♀, lava bed in contact with mangrove swamp, N. end of island, 5' alt., 3.ii.1967, I. L. Wiggins (CAS); ISABELA: 1♂, 10♀, Puerto Villamil, 7.iii.1989, intertidal rocks, B. J. Sinclair (CNC, USNM); SANTA CRUZ: 2♂, 9♀, 1 km E Charles Darwin Research Station, lagoon, littoral, 30.iii-7.iv.1989, malaise, Peck & Sinclair (CNC, LEM, USNM); 1♂, 1♀, Academy Bay, ECCD, 30m, arid zone, thornscrub, malaise-FIT, 10.v-14.vii.1985, S. & J. Peck (CNC); 2♀, Charles Darwin Research Station, littoral zone, 4-9.ii.1989, dung trap, B. J. Sinclair (CNC); 1♀, Academy Bay, Darwin Research Station, sweeping coastal plants, 25.i.1964, D. Q. Cavanaugh & R. O. Schuster (CAS); 1♀, Academy Bay, Darwin Research Station, 7.ii.1964, R. O. Schuster (CAS).

Etymology. – The species name is derived from the Greek *bapto* (dip, dye) and *palpis*, referring to the yellow distal portion of the palps.

Remarks. – This species may be distinguished from the externally similar *Liohippелates collusor* (Townsend, 1895) by the bicoloured palps (all yellow in *L. collusor*), presence of six small but distinct tubercles on the scutellum (only very small apical tubercles in *L. collusor*), and usually more extensive yellow on the frons (only anterior margin yellow in *L. collusor*). Because of the similarity between the two species, recent records of *L. collusor* from other Pacific islands, such as Hawaii (Beardsley & al. 1999) should be treated with caution.

Liohippелates galapagensis (Curran, 1932)

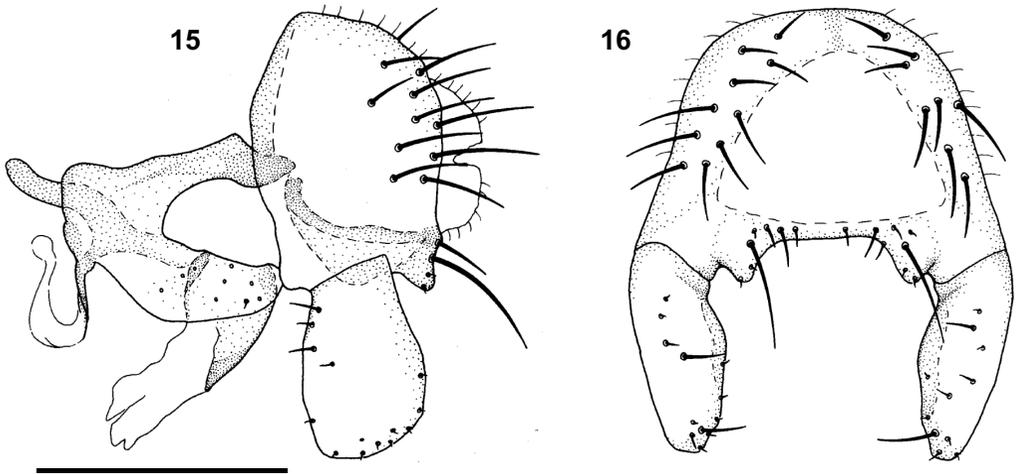
(Figs 13-14)

Hippelates galapagensis Curran, 1932: 356.

Liohippелates galapagensis: Sabrosky & Paganelli, 1984: 21.

Liohippелates pusio of Coquillett, 1901

Redescription. – Total length 1.2-2.4 mm. Frons subshining, mainly dark yellow, grading to brown at vertex; frontal triangle including ocellar tubercle polished, dark brown to black, with sides distinctly concave, extending in narrow point almost to anterior margin of frons; antenna mostly yellow; first flagellomere suborbicular, infuscated on dorsal half; arista brown, palest basally; occiput black, pruinose; face yellow, with weak carina; eye bare; gena 0.14-0.19 times height of eye, yellow, shining, microscopically striate, with polished brown margin; vibrissal angle not projecting; palp yellow; proboscis sclerotized, brown, geniculate but not elongate. Cephalic chaetotaxy: 1 to several short, weak, anterior and 4-5 longer, stronger, posterior reclinate fronto-orbital setae; several proclinate to mediocline interfrontal setulae on anterior of frons and forming single row of setulae along border of frontal triangle; ocellar bristles short, reclinate, convergent; postocellar bristles short, erect, convergent to cruciate; inner vertical bristles only slightly stronger than surrounding setulae; outer vertical bristles approximately equal in length to postocellars; setulae along occipital and genal margins; vibrissa approximately 3 times as long as subvibrissal setulae. Thorax entirely shining black except around wing base and posterior margin of scutum; scutum slightly longer than broad; scutellum somewhat rugose, rounded apically, slightly broader than long. Thoracic chaetotaxy: 1 weak postpronotal, 1 anterior and 2 posterior notopleural, 1 dorsocentral, 1 postalar, and 1 weak intrapostalar bristles (the latter may be indistinguishable from surrounding setulae); scutellum with 1 pair of cruciate apical bristles borne on short tubercles and 2 pairs of short subapical bristles; postpronotum, scutum, scutellum, and katepisternum setulose; setulae in median and dorsocentral rows of scutum slightly divergent, 3-4 rows of setulae between median and dorsocentral rows. Fore leg and all tarsi mostly yellow; fore femur and distal tarsomeres sometimes with some brown; remainder of legs various shades of yellow through brown, hind leg darkest; hind tibia with strongly curved preapical ventral spur, longer than diameter of tibia. Wing length 1.2-2.1 mm; second costal sector 1.8-2.0 times length of third costal sector. Halter white. Abdominal tergites shining, setulose; syntergite 1+2 mostly pale yellow, with



Figures 15-16. *Monochaetoscinella anomyma*: (15) Male genitalia, lateral. (16) Male genitalia, posterior. Scale bar = 0.1mm.

brown lateral margins and a faint brown median spot; tergites 3-5 mostly brown, medially with yellow anterior and posterior margins; sternites very pale, setulose.

Male postabdomen (Figs 13-14): Epandrium long-haired; surstylus curved posteromedially, parallel-sided distally, with several short setae; cercus elongate, projecting posteroventrally, cerci parallel in posterior view, each with one long seta and several short setae; phallus membranous.

Type material examined. – Holotype ♀: ECUADOR: GALÁPAGOS ISLANDS: FLOREANA: Post Office Bay, 20-30.ix.1925, A. Wollebaek (ZMO). Paratypes: 2♀, FLOREANA: Post Office Bay, Seaside, Ranvik, 10-20.xi.1925 (ZMO).

Other material examined. – 114♂, 315♀ from the following islands and localities: Bartolomé, Española (Bahía Manzanilla, Punta Juárez), Floreana (Black Beach, island record only), Genovesa (south side of island), Isabela (Puerto Villamil, near Punta Tortuga), Marchena (SW Playa), Pinta, San Cristóbal (Puerto Baquerizo), Santa Cruz (Academy Bay, Charles Darwin Research Station, Bella Vista Trail), Santa Fe (all months from January to June) (CAS, CNC, LEM).

Remarks. – C. W. Sabrosky (in litt.) considered *L. galapagensis* a possible synonym of *Liohippelates incompletus* (Becker, 1912) from Peru. Although the two species are externally similar there are minor differences; unfortunately, the lectotype of *L. incompletus* is a female so male genitalic characters cannot be compared. We prefer to treat *L.*

galapagensis as currently recognized, pending examination of male specimens of *L. incompletus* from the type locality. Coquillett's (1901) record of *L. pusio* from the Galápagos refers to *L. galapagensis* (C. W. Sabrosky, in litt.); specimens identified by Johnson (1924) as *L. pusio* may also be this species, but they were not examined.

Specimens examined in this study were collected primarily in the Littoral Zone, including large series from marine iguana nesting sites and sea lion beaches. Specimens were also collected in the Arid Zone and Transition Zone, and agricultural areas on several islands.

Monochaetoscinella anomyma

(Williston, 1896)

(Figs 15-16)

Oscinis anomyma Williston, 1896: 423.

Monochaetoscinella anomyma: Duda, 1930: 107.

Material examined. – ECUADOR: GALÁPAGOS ISLANDS: ISABELA: 1♂, 1♀, Guava-pampa zone, 600m, 4.iii.1989, B. J. Sinclair (CNC); SAN CRISTÓBAL: 1♂, 1km E Sierra San Janquin, agriculture-pasture, 13.ii.1989, B. J. Sinclair (CNC).

Remarks. – This species is widespread in the southern Nearctic (Arizona, Texas, Florida, Mexico), Central America, the West Indies and South America as far south as northern Argentina. This is the first record from the Galápagos and

almost certainly represents a recent introduction to agricultural areas of the archipelago from the Neotropical region.

***Olcella anaclasta* Wheeler & Forrest, sp. n.**

(Figs 17-19)

Description. – Total length 1.5-1.9 mm. Frons punctate, pruinose, grey-brown posteriorly, yellow anteriorly, longer than broad, projecting anteriorly; frontal triangle including ocellar tubercle grey-brown, slightly darker than or indistinguishable from rest of frons, pruinose, about 0.5 times length of frons; antenna yellowish ventromedially, grey-brown dorsally and laterally; first flagellomere reniform; arista short, grey-brown, appearing bare except at very high magnification; occiput dark grey-brown; face short, with pronounced carina; lunule forming triangular plate between antennae; eye with very short ommatrichia, long axis diagonal; gena pale yellow anteriorly, grey-brown posteriorly and often along genal margin, 0.2 times height of eye, higher posteriorly; vibrissal angle less than 90 degrees, projecting to same extent as frons; palp and proboscis remarkably slender and elongate; palp pale yellow, as long as head; proboscis brown, well-sclerotized, geniculate; labellum 1.5-1.6 times length of head. Cephalic chaetotaxy: 5 short, reclinate fronto-orbital setae; several proclinate interfrontal setulae on anterior of frons; single row of setulae forming border of frontal triangle; ocellar and postocellar bristles pale, erect or slightly reclinate, convergent; inner vertical bristles not easily distinguished from surrounding setulae; outer verticals longer, pale; setulae present on occipital and genal margins; vibrissa short, pale. Scutum grey, densely pruinose and punctate, with three deeply incised brown lines of punctures, the median one narrowest and not always apparent; scutum approximately as long as broad; postpronotum and scutellum densely pruinose, concolorous with scutum; scutellum flattened dorsally and blunt apically; thoracic pleurites grey to brown, mostly pruinose except for area between mid and hind coxa. Thoracic chaetotaxy: 1-3 postpronotal bristles, usually 1 longer than others, 1 anterior and 2 posterior notopleural, 1 dorsocentral, 1 postalar, 1 intrapostalar, 1 pair of short apical and 2 pairs of shorter subapical scutellar bristles; postpronotum, scutum and scutellum setulose; katapisternum with a few short setulae. Legs yellow to brown.

Wing length 1.2-1.6 mm; second costal sector 1.8 times length of third costal sector; dm-cu oblique, not parallel with r-m. Halter white. Abdominal tergites 1-5 brown (at least on anterior half), setulose, subshining; sternites pale yellow, setulose.

Male postabdomen (Figs 18-19): Epandrium subshining, mainly yellow, pale brown anterodorsally, short-haired; cercus and surstylus mainly yellow, subshining; surstylus long, curved, narrowed distally, with a few long setae medially; cercus triangular in posterior view, pointed apically; phallus long, membranous.

Type material. – Holotype ♂: ECUADOR: GALÁPAGOS ISLANDS: PINTA: 220m, sticky traps, 08.ii.1982, Y. Lubin (CNC). Paratypes: GENOVESA: 2♀, S. side of island 200 yards from beach, 4-6.ii.1967, I. L. Wiggins, in flight trap among *Bursera graveolens* (CAS); PINTA: 29♂, 220m, sticky traps, 08.ii.1982, Y. Lubin (CNC, LEM).

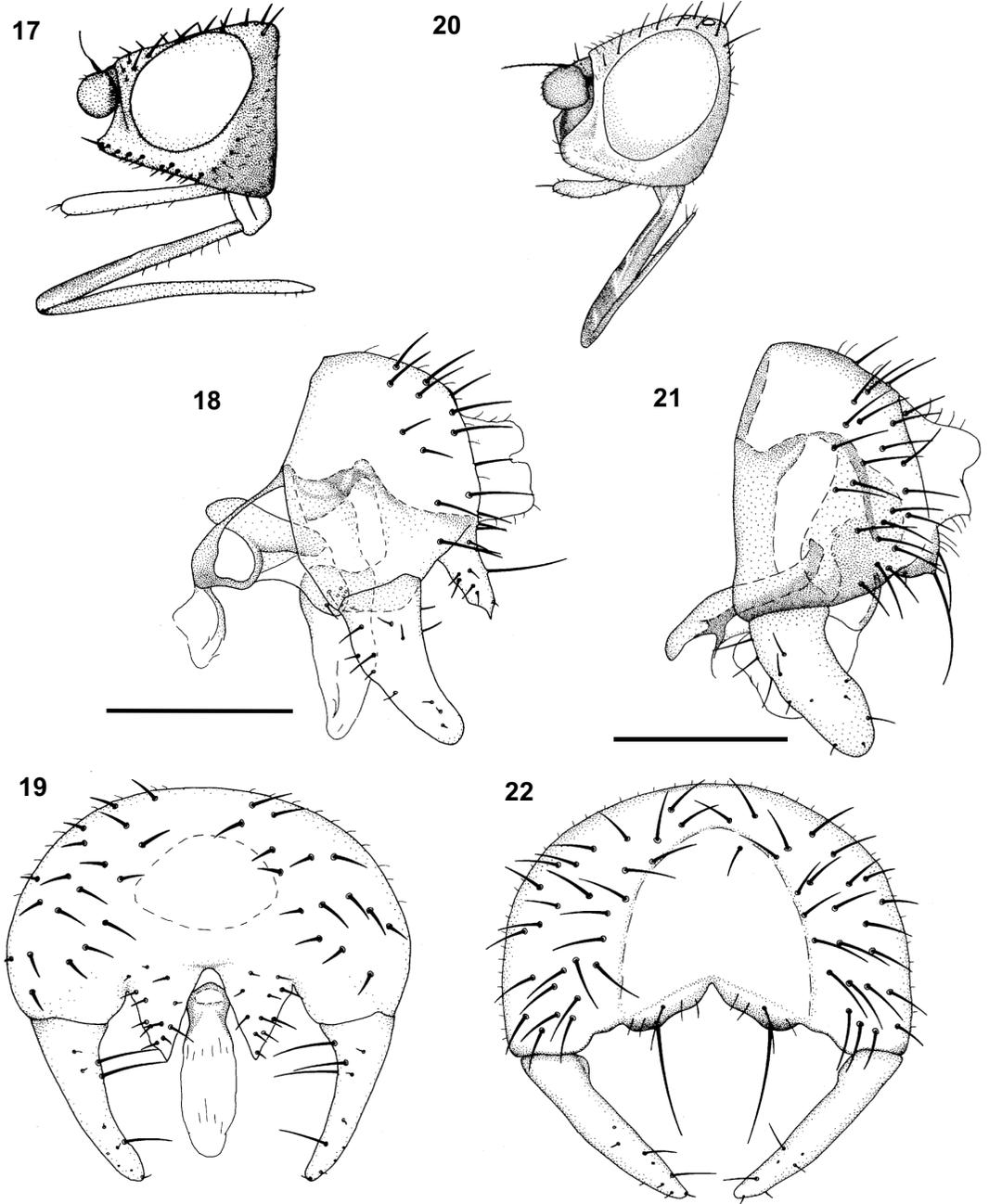
Etymology. – The species name is from the Greek *anaklastos* (bent back), referring to the greatly elongate, geniculate mouthparts.

Remarks. – Although the elongation of the head and mouthparts in *O. anaclasta* is more extreme than in other described species of *Olcella* Enderlein, 1911, there are undescribed species from Central America with intermediate degrees of development of the vibrissal angle, proboscis and palps.

***Olcella lupina* Wheeler & Forrest, sp. n.**

(Figs 20-22)

Description. – Total length 1.8-2.1 mm. Frons pale brown to dark grey-brown, entirely pruinose, 1.3-1.4 times as long as broad; frontal triangle grey, not clearly differentiated from rest of frons; antenna mostly grey-brown; first flagellomere reniform, usually with some yellow ventromedially; arista short, dark, appearing bare except at very high magnification; occiput dark grey, pruinose; face black on ventral margin, paler dorsally, with strong carina visible in lateral view; eye roughly round, with extremely short ommatrichia; gena dark grey posteriorly, pale brown anteriorly; 0.2-0.3 times height of eye, higher posteriorly; vibrissal angle strongly projecting; palp yellow, 0.7 times length of genal margin; proboscis dark, shining, geniculate, each segment 1.2 times length of genal margin. Cephalic chaetotaxy: 5-6 reclinate fronto-orbital setae; several proclinate interfrontal setulae and a row of setulae forming the



Figures 17-19. *Ocella anaclasta*: (17) Head, lateral. (18) Male genitalia, lateral. (19) Male genitalia, posterior. Figures 20-22. *Ocella lupina*: (20) Head, lateral. (21) Male genitalia, lateral. (22) Male genitalia, posterior. Scale bars = 0.1mm.

margin of the frontal triangle; ocellar and postocellar bristles convergent to cruciate, the postocellars slightly longer; outer vertical bristle approximately equal in length and strength to postocellars; inner vertical slightly shorter; genal margin with short, pale hairs; vibrissa pale, weak, but distinctly longer than subvibrissal setulae; palp with an outstanding seta at tip. Thorax entirely dark, pruinose except for shining metanotum and broad shining stripe on pleura (consisting of anteroventral margin of anepisternum, dorsal half of katepisternum, ventral spot on anepimeron, and anterior spot on meron); scutum slightly longer than broad, without incised lines of punctures; scutellum broader than long, rounded, not flattened dorsally. Thoracic chaetotaxy: 1 postpronotal, 1 anterior and 2 posterior notopleural, 1 long dorsocentral, 1 long postalar, 1 intrapostalar, 1 pair of long apical and 2 pairs of shorter subapical scutellar bristles (anterior pair shortest); postpronotum, scutum and scutellum setulose; katepisternum with a few short setulae. Legs mostly dark; coxae and femora brown or grey-brown, knees paler; tibiae and tarsi yellow to pale brown, fore tibia and tarsus palest. Wing with 2 fairly long, strong setae basally on C; wing length 1.8-2.0 mm; second costal sector 1.6-1.9 times length of third costal sector; dm-cu oblique, not parallel with r-m. Halter white. Abdominal tergites and sternites dark grey-brown, pruinose.

Male postabdomen (Figs 21-22): Epandrium brown, with short hairs; surstylus parallel-sided, evenly curved posteriorly in lateral view, with short setulae; cercus short, only slightly convex, with a single long seta; phallus long, membranous.

Type material. – Holotype ♂: ECUADOR: GALÁPAGOS ISLANDS: WOLF: 31.i-1.ii.1964, P. D. Ashlock (BPBM). Paratypes: DARWIN: 9♀, 29.i.1964, D. Q. Cavagnaro (CAS); WOLF: 3♂, 1♀, 1?, 31.i-1.ii.1964, P. D. Ashlock (BPBM); 5♀, 1.ii.1964, D. Q. Cavagnaro (CAS, LEM).

Etymology. – The species name is from the Latin *lupinus* (of wolves), referring to the type locality and to the large and menacing mouthparts of these flies.

Remarks. – The great similarity between the male genitalia of *O. lupina* and those of *C. empheria* (Figs 3-4) is indicative of a widespread problem in the generic classification of the Chloropidae. Although many species of *Ocella* and *Conioscinella* may be distinguished on the basis of external characters (e.g., long geniculate mouthparts, projecting vibrissal angle, incised lines on

scutum), there are species that are intermediate in all these characters. Furthermore, there are sometimes greater genitalic similarities between species currently assigned to different genera (as seen here) than between species within the same genus. The current limits of chloropid genera based on combinations of external characters will continue to break down as new species are described and will almost certainly not stand up to rigorous, comprehensive phylogenetic analyses at the species level.

Discussion

This study has more than tripled the number of known species of Chloropidae in the Galápagos Islands. The number of widespread chloropid species was lower than expected; however, given the increasing human traffic between the Galápagos and the mainland of South America, it is probable that additional synanthropic species of Chloropidae will be introduced to the islands, especially to disturbed agricultural areas.

The geographic affinities of the Galápagos chloropid fauna are similar to those of most other Diptera families in the region. *Cadrema pallida* is a pantropical species found in low-lying and coastal habitats on a number of oceanic islands and continental land masses. *Monochaetoscinella anonyma* is widespread in the New World tropics and subtropics. Both of these species were probably introduced by human activity. All other chloropid species are so far known only from the archipelago, but all show affinities to New World lineages, especially to those in the northern Neotropical region. *Elachiptera cultrata* is related to a group of species found from the southern United States to temperate South America (Wheeler & Forrest 2002). *Apallates* sp., *Liohippulates baptipalpis*, *L. galapagensis* and *Hippelates alyscus* all belong to New World taxa that are especially diverse in the southern Nearctic and northern Neotropics. *Ocella* is primarily a New World genus, with species similar to *O. anaclasta* and *O. lupina* in Central America. Although *Conioscinella*, as currently recognized, is cosmopolitan, *C. empheria* and *C. galapagensis* apparently belong to the northern Neotropical *C. soluta* group. The relationships of *Diplotoxa loma* and *Gaurax gethosyne* are more obscure; both genera are widespread, diverse and poorly defined. They are almost certainly not monophyletic as currently

defined and there is no information on phylogenetic relationships within either genus.

With additional collecting effort, at least some of the currently "endemic" chloropid species may also be found on the west coast of Central America or northern South America. This has been the case with the chyromyid fly *Aphaniosoma rabida* Wheeler, 1994 which was originally described from Isla Rábida (Wheeler & Sinclair 1994) but has also been collected at Playa Tamarindo, Guanacaste Province, Costa Rica (specimens in USNM).

Species of Chloropidae were not as restricted to the Littoral and Arid Zones as many other acalyptrate families recorded from the islands (e.g., Asteiidae (Forrest & Wheeler 2002), Canacidae (Wirth 1969), Carnidae (Wheeler 2000), Chyromyidae (Wheeler & Sinclair 1994)). The Galápagos chloropids, like those in other regions, have a wide range of habitat preferences and were collected in almost all habitat types in the archipelago, often in high numbers.

Acknowledgements

Our late colleague Curtis W. Sabrosky provided valuable advice on the identity of these species in the early stages of the study; this paper is dedicated to his memory. We thank Dr. B. J. Sinclair (Bonn, Germany) for his invitation to participate in the study of the Galápagos acalyptrate Diptera. J. M. Cumming (CNC), A. L. Norrbom (USNM), K. Ribardo (CAS) and G. Soli (ZMO) arranged loans of specimens. Fieldwork in the Galápagos by S. B. Peck and B. J. Sinclair was facilitated by the Galápagos National Park Service, Department of Forestry, Ministry of Agriculture, Ecuador and the Charles Darwin Research Station, Isla Santa Cruz. Funding was provided by the Natural Sciences and Engineering Research Council of Canada.

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