Zootaxa 3621 (1): 001–082
www.mapress.com/zootaxa/

Monograph

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3621.1.1
http://zoobank.org/urn:lsid:zoobank.org:pub:99CC048E-C555-4178-8932-70E93A3B255C

ZOOTAXA

3621

Revision of the genus *Erythromelana* Townsend (Diptera: Tachinidae) and analysis of its phylogeny and diversification

DIEGO J. INCLAN[1] & JOHN O. STIREMAN III[2]

Department of Biological Sciences, Wright State University, Dayton, OH, USA 45435.
[1]current address: Dipartimento Di Agronomia Animali Alimenti Risorse Naturali e Ambiente (DAFNAE), Università degli Studi di Padova, Viale dell'Università 16, 35020 Legnaro (Padova), Italy. E-mail: diegojavier.inclanluna@studenti.unipd.it
[2]E-mail: john.stireman@wright.edu

Magnolia Press
Auckland, New Zealand

Accepted by J. O'Hara: 17 Dec. 2012; published: 11 Mar. 2013

DIEGO J. INCLAN & JOHN O. STIREMAN III

Revision of the genus *Erythromelana* Townsend (Diptera: Tachinidae) and analysis of its phylogeny and diversification

(*Zootaxa* 3621)

82 pp.; 30 cm.

11 Mar 2013

ISBN 978-1-77557-114-8 (paperback)

ISBN 978-1-77557-115-5 (Online edition)

FIRST PUBLISHED IN 2013 BY

Magnolia Press

P.O. Box 41-383

Auckland 1346

New Zealand

e-mail: zootaxa@mapress.com

http://www.mapress.com/zootaxa/

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

TABLE OF CONTENTS

ABSTRACT

The Neotropics harbor an enormous diversity of tachinid flies (Diptera: Tachinidae), yet the fauna remains poorly understood. This is especially true of the tribe Blondeliini, which is particularly diverse in this region and in great need of taxonomic attention. Here, the Neotropical blondeliine genus *Erythromelana* Townsend is revised. This genus is widely distributed from southern Mexico to northern Argentina, with the Andes being a hotspot of diversity. Known hosts belong to the genus *Eois* Hübner (Lepidoptera: Geometridae). This revision includes the redescription of three previously described species and the description of 11 new species based on characteristics of adults and immatures. The new species are *E. arciforceps* sp. nov., *E. catarina* sp. nov., *E. convexiforceps* sp. nov., *E. cryptica* sp. nov., *E. curvifrons* sp. nov., *E. distincta* sp. nov., *E. ecuadoriana* sp. nov., *E. eois* sp. nov., *E. leptoforceps* sp. nov., *E. napensis* sp. nov., and *E. woodi* sp. nov. A morphological database of 62 characters was constructed to assess morphological variation within and among species and species groups using Principal Components Analysis. Means and medians for these morphological traits were calculated to infer phylogenetic relationships using parsimony. Additionally, a maximum likelihood phylogenetic analysis was performed using COI mtDNA sequences for a subset of eight species. Nominal species *E. obscurifrons* (Wulp) is treated as a *nomen dubium* within *Erythromelana*. Two species previously assigned to *Erythromelana* appear to represent distinct genera with unclear relationships to this genus and are reinstated as monotypic genera: *Myiodoriops marginalis* Townsend and *Euptilodegeeria obumbrata* (Wulp), revived status. Biological and phylogenetic data are used to infer modes of diversification within *Erythromelana*.

Key words: Tachinidae, Blondeliini, Andes Mountains, Neotropical, *Eois*, PCA, speciation mode

INTRODUCTION

The parasitic family Tachinidae is one of the most diverse families of Diptera (Belshaw 1993, Irwin *et al*. 2003), with almost 10,000 described species classified into over 1500 genera (Brown 2001, Irwin *et al*. 2003, O'Hara 2011). Tachinids are well represented in all zoogeographic regions. Approximately 34% of the described species are from the Neotropical Region, 19% are Palearctic, 16% are Nearctic, 12% are Afrotropical, 10% are Australasian, and 9% are from the Oriental Region (Guimarães 1971, Irwin *et al*. 2003, O'Hara 2011). However, only Tachinidae of the Palearctic and Nearctic Regions are well known, with perhaps 90% of their species documented (Stireman *et al*. 2006). In contrast, the Neotropics possess a highly diverse fauna with 2864 described species (Guimarães 1971) belonging to 819 genera (O'Hara 2011). Yet, the current number of described species in this region represents only a small portion of the total fauna (Brown 2005, Stireman *et al*. 2006, O'Hara 2011). This is despite the fact that in terms of described species, the Tachinidae are the largest family of Diptera in the Neotropical Region (Amorim *et al*. 2002). Conservative evaluations suggest that total Neotropical tachinid biodiversity is at least twice the current number of described species (Stireman *et al*. 2006).

The purpose of the present study is to systematically revise and analyze the Neotropical tachinid genus *Erythromelana* Townsend (Exoristinae: Blondeliini). The tribe Blondeliini is distributed nearly worldwide, but is most diverse in the New World where it represents about 10% of the 1345 described species of Nearctic tachinids (O'Hara & Wood 2004) and probably a larger percentage of the Neotropical fauna (Wood 1985). Wood's (1985) revision the Blondeliini of North and Central America, which resulted in 177 new generic synonyms and 321 new species combinations, was a dramatic step forward in establishing a usable and coherent classification of New World Blondeliini, but the South American fauna remains in a state of disarray. The vast fauna of this region, along with the prodigious number of scarcely separable genera erected by Townsend (1934–1942), has resulted in much taxonomic confusion, making it difficult to ascertain relationships and identify genera. The diversity and morphological homogeneity of the Blondeliini make this group one of the most taxonomically difficult of tachinid tribes.

Townsend (1919a) described *Erythromelana* based on one female and one male collected from Jaen Province in Peru, which he named *E. jaena*. No subsequent work on *Erythromelana* was published until Wood's (1985) Blondeliini revision. In this work, Wood diagnosed *Erythromelana* as medium-sized flies, characterized by the following traits: eye large and haired or bare, parafacial bare and extremely narrow, postgena and gena narrow, postpronotum with two bristles, abdominal mid-dorsal depression on syntergite 1+2 not extending to hind margin, and broad variability in the abdominal color from fully yellow to black-silver. Wood (1985) included in *Erythromelana* the former genera *Minthomyia* Townsend, *Euptilodegeeria* Townsend, and *Myiodoriops* Townsend, and recognized four additional species: *E. marginalis* (Townsend), *E. nigrithorax* (Wulp), *E. obscurifrons* (Wulp), and *E. obumbrata* (Wulp). No further work on *Erythromelana* has been published since Wood (1985). Here, a comprehensive revision of the genus across its Neotropical range is presented, including description of 11 new species.

A continuing caterpillar-parasitoid biological inventory project in the eastern Andes of Ecuador has resulted in the rearing of a great number of Lepidoptera and parasitoid species (Stireman *et al*. 2009, Dyer *et al*. 2012). One aim of this project is the study of interactions between species in the plant genus *Piper* L. (Piperales: Piperaceae), their specialist caterpillar herbivores in the genus *Eois* Hübner (Lepidoptera: Geometridae), and the parasitoids of *Eois* (Wilson *et al*. 2012). Over seven years, more than 100 morphospecies of *Eois* have been reared from 40 species of *Piper* (Connahs *et al*. 2009, Rodriguez-Castañeda *et al*. 2010). From these *Eois* species, 28 specimens of *Erythromelana* were reared, most of which belonged to undescribed species (Stireman *et al*. 2009). An understanding of the species limits, diversity, and relationships of *Erythromelana* complements the ecological and systematic research on their *Eois* hosts and *Piper* host plants, providing an opportunity to create a detailed systematic perspective of a tri-trophic community.

The present work has three major objectives. First, a comprehensive revision of *Erythromelana* is conducted. Second, the composition and phylogenetic relationships of species in the genus are analyzed using morphological and molecular data. Third, the factors that may have been involved in the diversification of *Erythromelana* species are explored by examining patterns of geographic distribution and host use.

MATERIALS AND METHODS

Materials

This revision is based on 581 adults including 28 reared specimens (see Stireman *et al*. 2009 regarding the latter). All reared specimens were obtained from host caterpillars collected within ca. 20 km of the Yanayacu Biological Station and Center for Creative Studies (YBS) (Stireman *et al*. 2009, Dyer *et al*. 2012). This station is located at 2200 m in the Quijos Valley, Napo Province, in the northeastern Ecuadorian Andes (00°36′S 77°53′W). YBS is part of one of the largest intact altitudinal gradients in the eastern Andes from 250 to 5000 m. Acronyms used in the text for the museums and private collections from which specimens were borrowed appear below, with their names and respective curators.

BMNH	Natural History Museum, Department of Entomology, London, UK; N.P. Wyatt.
CNC	Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada; J.E. O'Hara.
DMW	Private collection of D.M. Wood, Ottawa, Ontario, Canada.
JOS	Private collection of J.O. Stireman, Wright State University, Dayton, Ohio, USA.
INBio	National Biodiversity Institute of Costa Rica, Department of Entomology, Santo Domingo de Heredia, Costa Rica; M. Zumbado.
NMNH	National Museum of Natural History, Department of Entomology, Smithsonian Institution, Washington, USA; N.E. Woodley.
PCE	Private collection of P. Cerretti, Verona, Italy.
QCAZ	Museo de Zoología QCAZ, Sección Invertebrados, Pontificia Universidad Católica del Ecuador, Quito, Ecuador; C. Keil.

Examination and illustration

Adult specimens were examined with a Nikon SMZ1000 stereoscopic microscope equipped with an ocular micrometer and a digital Nikon Coolpix 8800 camera. To create images with a greater depth of field, 30 to 50 photos of each specimen/structure at different focal points were taken. Final photos were compiled into a single image using the image stacking software CombineZM. Male and female terminalia photos were taken using a depression slide with glycerin. Line drawings were made based on digital photos using Adobe Illustrator CS2 12.0.1. Scale bars are included wherever size information was recorded.

Terminology and species description format

Descriptions and redescriptions of *Erythromelana* species follow terminology used in the Manual of Central American Diptera (Cumming & Wood 2009). In addition, the terms proposed by O'Hara (1989) for the male abdominal sternum 5 as shown in Figure 33 were used. The cerci, in posterior view, exhibit variation in shape among species. To describe this variation, the terms used by Wood (1987) were followed. Specifically, the cerci were divided into three main regions: (1) upper lobes, (2) medial section, and (3) apical cleft as shown in Figure 61. The author for all new species described here is senior author Inclan.

Dissection of male and female terminalia

Male terminalia of tachinids provide some of the best characters for taxonomic studies at the species level. Dissections were performed according to the procedure described by O'Hara (2002). Briefly, this procedure involves the removal of the abdomen of an adult specimen, partial clearing of it in 10% NaOH, dissection of terminalia, reattachment of the abdomen to the specimen, extra clearing of the terminalia in 100% lactic acid, and finally storage of the terminalia in a microvial with glycerin (O'Hara 1989, 2002). After the dissection, the shape of the male and female terminalic structures were characterized and measured.

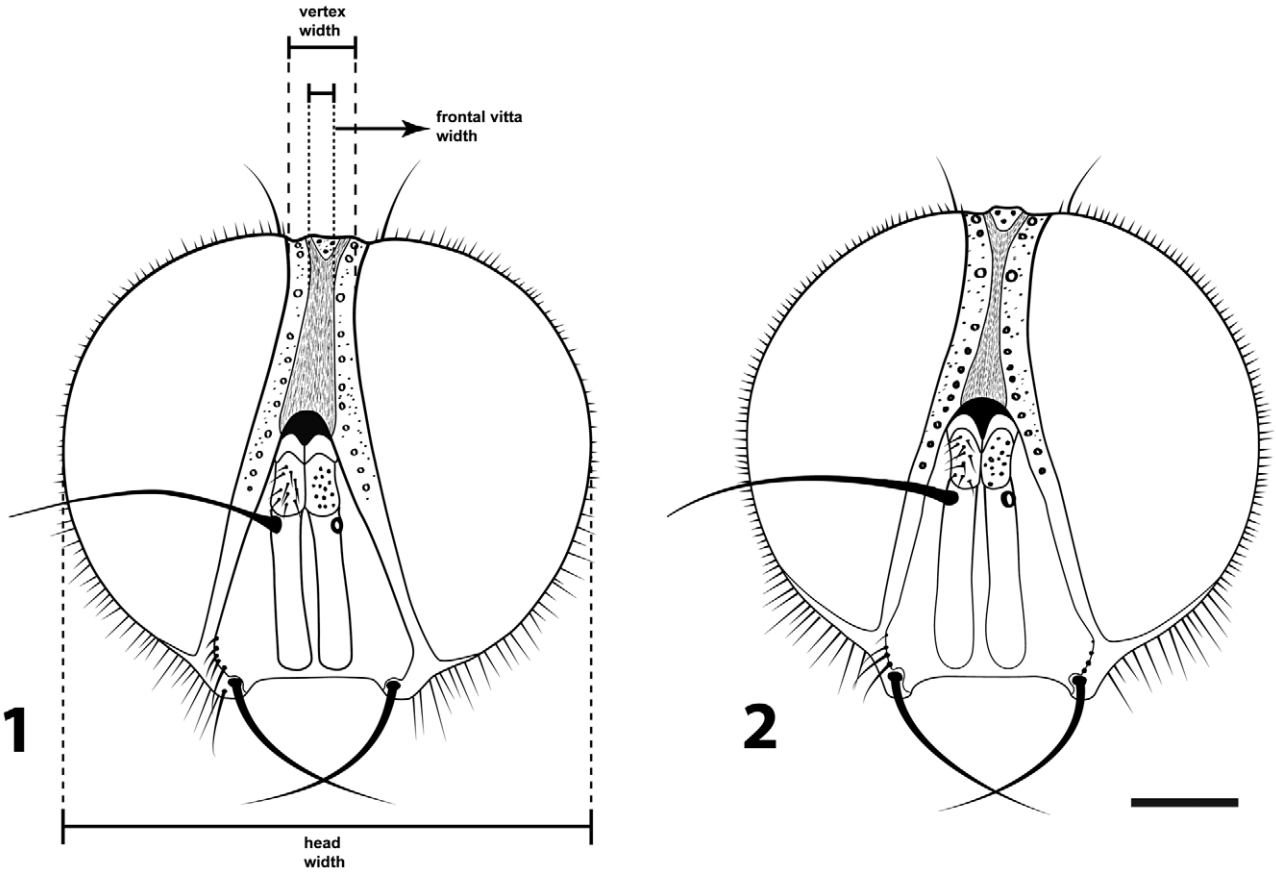
Preparation of puparia and cephalopharyngeal skeletons

The puparium was partially cleared in 15% NaOH and then transferred to a watch glass containing glycerin for study. Because puparia were often surrounded by host larval remains, cephalopharyngeal skeletons of second instar tachinid larvae were often located on the external puparial surface in addition to the cephalopharyngeal skeletons

of third instars inside puparia. Any host remains were removed and retained. After study, the puparium, the larval cephalopharyngeal skeletons and the host remains were stored in glycerin in a microvial pinned under the specimen.

Morphological characterization and measurements

Morphological characterization included the creation of a database of continuous and discrete characters for individual specimens. Morphological traits of 210 specimens were measured, including 80 females and 130 males. Additionally, the terminalia from 100 specimens were dissected, including 30 females and 70 males. For each specimen, 99 characters including 32 continuous and 67 discrete characters were recorded. Twenty-five of these characters correspond to the head, 41 to the thorax, eight to the abdomen, and 25 to the terminalia. Continuous characters were transformed into ratios to control for differences in overall body size, which can vary widely within tachinid species (O'Hara 2002). These data were used in a principal components analysis (PCA) to examine species separation in morphospace, for the (re)description of species, and phylogenetic analysis of the genus. In species descriptions, the number of specimens for which particular characters were measured is given by "N". Means "mean" and medians "m" are reported for continuous characters and discrete characters, respectively. For phylogenetic analysis, ratios were converted into discrete values as states. To transform the continuous values, the distributions of each ratio were plotted as histograms and then each distribution was divided into subgroups representing a specific range. When possible, the division of states was based on discontinuities or apparent troughs in the distributions. Finally, a discrete value was assigned to each subgroup. All characters recorded in this study, including ratios calculated for continuous characters, are listed and described in Appendix 1.

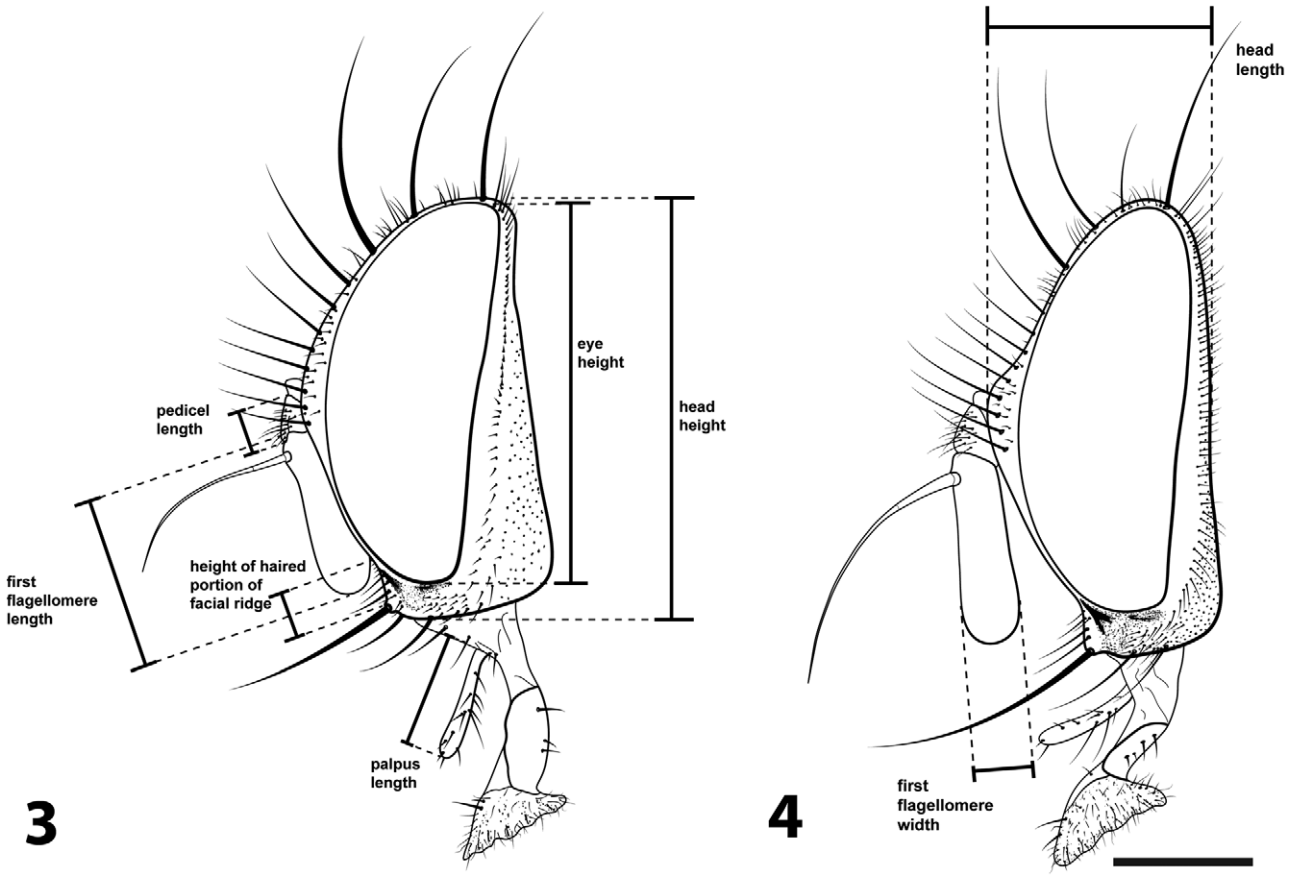


FIGURES 1–2. 1. Frontal view of the head of male *E. leptoforceps* sp. nov., showing head measurements taken for descriptive purposes. **2.** Frontal view of the head of male *E. curvifrons* sp. nov. Scale bar = 1.0 mm.

Citation of specimen label data

The format of O'Hara (2002) was followed for the citation of label information. In summary, data of each type specimen and other specimens examined are cited exactly as they appear on the label, with each line separated by a

diagonal slash (/) and information for each individual label enclosed in parentheses. Additional information not appearing on the label is enclosed within brackets. Finally, the depository is cited in parentheses.



FIGURES 3–4. 3. Lateral view of the head of male *E. leptoforceps* sp. nov. **4.** Lateral view of the head of male *E. curvifrons* sp. nov. Both show head measurements taken for descriptive purposes. Scale bar = 1.0 mm.

Distribution maps

Maps were created using SimpleMappr (Shorthouse 2010), which uses coordinates in decimal degrees as latitude and longitude to create point distribution maps. For specimens with labels that did not include coordinates, Google Earth was used to obtain the approximate latitude and longitude of given localities.

Principal Components Analysis (PCA)

A principal components analysis (PCA) was performed on morphological characters to explore whether *Erythromelana* species and species groups could be easily distinguished with external morphology. Increasing distance between specimens in the PCA ordination space is an indicator of greater dissimilarity. Therefore, a cluster of specimens in the PCA ordination can be interpreted as preliminary evidence of the existence of species, subspecies, and/or genus groups. This analysis was used as an exploratory technique to examine morphological discontinuities among taxa, and the final grouping of species was not based exclusively on these results.

Two PCAs were performed to explore the potential generic limits of *Erythromelana* and to examine differentiation of taxa within the genus, respectively. In the first data set, 62 characters from 197 specimens were included, consisting of 67♀ and 102♂ of *Erythromelana sensu stricto* (*s.s.*), 2♀ and 10♂ of the former *Euptilodegeeria*, and 6♀ and 5♂ of the former *Myiodoriops* (taxa synonymized with *Erythromelana* by Wood 1985). Additionally, 2♀ and 3♂ of *Phyllophilopsis pallidicornis* (Bigot) were included as a blondeliine genus known to be distinct from *Erythromelana*. One goal of this analysis was to examine the placement of taxa formerly included in *Euptilodegeeria* and *Myiodoriops* and assess whether they cluster with other species of *Erythromelana*. In the second data set, 45 characters from 169 *Erythromelana s.s.* specimens (67♀ and 102♂) were included. These two data sets only incorporated information on non-terminalic structures. The full data sets are available from Dryad (http://www.datadryad.org/).

The PCAs were calculated using the function "prcomp" in the statistical software R (R Development Core Team 2010). To standardize the continuous and discrete characters, values of each variable were scaled by dividing each measurement by their root-mean-square. The resulting PCA ordination was plotted using the function "ordiplot" in the statistical package *vegan* in R (Oksanen *et al*. 2007). Simultaneously, the 95% CIs for each group were plotted using the function "ordiellipse" in the *vegan* package (Oksanen *et al*. 2007).

Phylogenetic analysis

Morphological data

A matrix of morphological characters was compiled for each *Erythromelana* species. This matrix only included characters from males due to the difficulty of associating females with their conspecific males. Fifty-six characters were included in the matrix, of which 43 and 13 corresponded to external and terminalic morphology respectively. Means and medians were used for continuous and discrete characters respectively. All continuous characters were transformed into discrete states as described in the morphological characterization section. All of the recognized *Erythromelana* species were included and *E. cryptica* was divided into four groups based on geography. In addition, three outgroup taxa were included: *Euptilodegeeria obumbrata*, *Euptilodegeeria* sp. and *Myiodoriops marginalis*. See Appendix 2 for the complete data set.

A parsimony analysis of the character matrix was performed using PHYLIP ver. 3.69 (Felsenstein 2005). In PHYLIP, the SEQBOOT module was first used to produce 1,000 data sets from our original matrix by bootstrap resampling. Next, PARS was used to find the most parsimonious tree using a multistate discrete-characters parsimony method (Felsenstein 2005). The following parameters were used from the default settings in PARS. First, on the Jumble option (J), a random odd number was selected as a seed and the replicate number was set to 100; this allowed the program to try 100 different random orders of species in constructing the trees and save the best trees among all 100 runs for each data set. Second, *Eu. obumbrata* was specified as the Outgroup option (O). Third, the Threshold option (T) was set as six; therefore, when the number of steps counted in a character was greater than six, it was set to be the threshold value rather than the actual number of steps. This option down-weights characters that are highly homoplasious. Finally, on the Weights option (W), the information from the terminalia characters was emphasized by assigning them a weight of two. The CONSENSE module was used to compute a majority rule consensus tree over all bootstraps. Finally, the software MEGA5.05 (Tamura *et al.* 2011) was used to explore and edit the most parsimonious tree(s).

Molecular phylogeny

DNA was extracted from the right hind leg of 20 specimens that were placed in alcohol after collection and from 50 pinned-dried specimens of varying ages. The Puregene Core Kit A (QIAGEN Sciences Inc., Germantown, MD, USA) was used for DNA extraction following the manufacturer's protocols. The mitochondrial gene CO1 was amplified using the primers LepF1 (5'–ATTCAACCAATCATAAAGATATTGG–3'), LepR1 (5'–TAAACTTCTG GATGTCCAAAAAATCA–3'). For the PCR amplification, the general procedure described in Stireman (2002) and Smith *et al*. (2006) was followed. In particular, the PCRs were performed in 30 µl reactions volumes using a thermocycling profile of one cycle of 2 min at 94°C; 36 cycles of 30 sec at 94°C, 60 sec at 45°C, and 60 sec at 72°C; and a final cycle of 6 min at 72°C. The PCR products were sent to the UAGC (The University of Arizona Genetics Core) where the samples were run on an Applied Biosystems 3730XL DNA Analyzer in 96–well format. Alignable COI sequences were recovered for 17 specimens corresponding to eight males and nine females. These sequences were manually aligned and edited using CodonCode Aligner 3.5 (CodonCode Corporation, Dedham. MA, USA). In addition to these *Erythromelana* specimens, 14 sequences of other blondeliine species were included, of which ten were obtained from the GenBank database (Benson *et al*. 2000) and the rest were sequenced by us. All the new sequence data generated in this study were uploaded to the GenBank database and their respective accession numbers are reported in Appendix 3. A Maximum Likelihood phylogenetic analysis of these sequences was conducted using MEGA 5.05 (Tamura *et al*. 2011) with 500 bootstrap replicates. *Tachinomyia nigricans* Webber was included as an outgroup because it is outside of the Blondeliini (in the Exoristini), but within the Exoristinae.

Diversification

Potential patterns and processes of diversification of *Erythromelana* were examined based on rearing records of 28 specimens and locality information of 554 specimens. Specifically, the roles of host associations and geographic distribution in the diversification process of *Erythromelana* species were evaluated. All information on host associations was obtained from the YBS caterpillar-parasitoid biological inventory (Stireman *et al*. 2009, Dyer *et al*. 2012). From this inventory, we extracted information on the caterpillar host and their host plant for each reared specimen. This information included species level taxonomic identification for a few specimens, whereas for most specimens host identification was based on morphospecies groups. Host associations of *Erythromelana* species were examined with respect to phylogenetic relationship. Geographic distributions (based on label data) were examined to assess species overlap, and evaluate if major geographic barriers separate closely related species. Altitudinal information was also considered to explore if elevational differences might be a source of population isolation and speciation. Patterns of host association and the geographic distribution were compared to evaluate the role of host use versus geography in the diversification of *Erythromelana* species.

SYSTEMATICS OF THE GENUS *ERYTHROMELANA*

Erythromelana Townsend, 1919

Erythromelana Townsend, 1919a: 174. Type species: *Erythromelana jaena* Townsend, 1919a, by original designation; Guimarães, 1971: 106; Wood, 1985: 39–40; Wood & Zumbado, 2011: 1403.

Minthomyia Townsend, 1919b: 564. Type species: *Minthomyia abdominalis* Townsend 1919b, by original designation; Guimarães, 1971: 41; Wood, 1985: 39–40 (as synonym of *Erythromelana*).

Diagnosis

In general, members of this genus are medium-sized flies, about 5–8 mm long, with large eyes, very narrow and bare parafacials, and narrow postgenae and genae. They possess relatively gracile bodies, long wings, a blackish thorax, long legs, and their abdominal coloration ranges from all yellowish-orange to all black, without strong banding.

Erythromelana can be recognized within the Blondeliini by a combination of characters. On the head, the fronto-orbital plate of the female bears 2 proclinate outer orbital setae, which are absent in the male. The inner orbital and vertical setae are well differentiated from the frontal setae, and ocellar setae may be present or absent. The eyes are sparsely to densely haired. The lower margin of the face extends to the level of the vibrissae, and the vibrissae are located at the extreme anteroventral corner of the head (as in Figs. 3, 4). The extremely narrow parafacial and anteroventrally located vibrissae, serve to distinguish *Erythromelana* from most other genera of Blondeliini (although not clearly from *Anoxynops* Townsend, *Phyllophilopsis* Townsend, *Trigonospila* Pokorny and the former genera *Euptilodegeeria* and *Myiodoriops* subsumed into *Erythromelana* by Wood (1985)). The chaetotaxy of the thorax of *Erythromelana* is somewhat variable, characterized mainly by: a setose prosternum, postpronotum with 2 or 3 setae, katepisternum with 2 or 3 setae, first postsutural supra-alar small or absent, scutellum with apical setae absent; wing equal to or longer than body length, vein R_{4+5} setose only at the base, and vein R_1 setose or bare. On the abdomen, the mid-dorsal depression does not extend to the hind margin of tg1+2 and discal seta, if present, are only found on tg5. The male terminalia generally resemble other Blondeliini (e.g., *Lixophaga* Townsend). The apical lobes of sternite 5 may be rounded (as in Fig. 33) or pointed apically and bear 1 or 2 long well-developed setae in some species (Fig. 41, as in *Lixophaga*). The shape of the cerci are variable and useful in differentiating many species (as in Figs. 48, 50, 52, 56). In females, the fifth sternite is rectangular and either covered with well-developed setae on more than the posterior 2/3 (as in Fig. 75), or with 2 pairs of well-developed setae close to the posterior margin (as in Fig. 78).

Redescription

Redescribed from 104 males (including the lectotype *E. jaena*) and 68 females, unless otherwise noted as “N”.

Length: males, 5.4–8.4 mm (mean = 6.7 mm), females, 5.0–7.3 mm (mean = 6.1 mm).

Head: Parafacial brown in ground color, covered with silver or dull silver pruinescence. Fronto-orbital plate and vertex black in ground color, covered with dull silver pruinescence (which can appear grayish from

certain angles), usually with a faint golden pruinescence (visible only in lateral view). Frontal vitta usually entirely black, sometimes fading to dark-brown toward antenna. Pedicel black and first flagellomere black, covered with fine microtrichia, and appearing grayish. Arista long, with minute setae, black with brown on basal 1/3 or less, thickened only on basal 1/4 or less. Eye sparsely to densely haired, ommatrichia about as long as 2–7 eye facets. Eye 0.83–0.97 head height in male, 0.77–0.92 in female. Vertex width 0.12–0.24 head width in male, 0.13–0.32 in female. Width of frontal vitta 0.14–0.50 vertex width in male, 0.20–0.57 in female. Length of first flagellomere 0.36–0.59 head height in male, 0.35–0.60 in female. Width of first flagellomere 0.15–0.30 (N = 82) head length in male, 0.20–0.29 (N = 32) in female. Pedicel length 0.19–0.38 length of first flagellomere in male, 0.22–0.37 in female. Fronto-orbital plate with 5–12 medioclinate frontal setae in male, 3–7 in female; 2 reclinate inner orbital setae (rarely with 1 extra small seta) in both sexes, rarely with only 1 seta in female; female with 2 proclinate outer orbital setae, male without outer orbitals. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter varied from barely to well differentiated from the row of postocular setae in both sexes. Inner orbital and vertical setae usually about twice the length of frontal setae. Ocellar setae proclinate or absent. Parafacial bare and extremely narrow with the narrowest point equal to or narrower than the basal width of the palpus in both sexes. Parafacial width 0.02–0.08 (N = 82) head length in male, 0.02–0.07 (N = 32) in female, and 0.08–0.42 (N = 82) first flagellomere width in male, 0.09–0.28 (N = 32) in female. Facial ridge with hairs on basal 1/4 or less, and lower margin of face descending to the level of vibrissa. Subvibrissal ridge short, usually with 3 or fewer setae; postgena narrow, with a distinct but small genal dilation. Palpus coloration varied from fully yellow to brown-yellowish with black at bases; usually sparsely haired with base usually bare, but varied from just apically to fully dorsally bare; rectilinear, or slightly curved inward medially; usually almost uniform in width, but sometimes slightly to substantially broadened at the apex.

Thorax: Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 or 5 black vittae; the inner 2 or 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Prosternum with several hair-like setae in middle. Postpronotum with 2 setae, rarely with 1 small additional seta (*E. woodi* usually with 3 setae); Proepisternum bare. Katepisternum with 2 or 3 setae. Scutum with 1 or 2 presutural acrostichal setae, rarely with 1 additional small seta; postsutural acrostichal setae varied from 1 to 3, rarely with 1 or 2 additional small setae; 2 presutural dorsocentral setae, occasionally with 1 additional small seta; 2 or 3 postsutural dorsocentral setae, usually with 1 or 2 additional small setae; 1 presutural intra-alar seta, occasionally with 1 additional small seta; 3 postsutural intra-alar setae; 1 presutural supra-alar seta, rarely with 2; 2 or 3 postsutural supra-alar setae, and first postsutural supra-alar small or absent. Scutellum with a pair each, of well-developed divergent subapical and basal setae; a pair of moderately developed lateral setae, shorter than subapicals and curved medially; discal setae usually absent, sometimes with 1 hair-like pair; and without apical setae.

Legs usually entirely black, rarely with dark yellowish on medial section of the front and hind tibiae. Tarsal claws longer than 5th tarsomere in male and shorter than 5th tarsomere in female (although shorter in both sexes of *E. ecuadoriana*). Mid tibia with 1 anterodorsal seta, 2 posterodorsal setae, and 1 ventral seta. Hind tibia with anterodorsal setae uneven in length and not closely spaced; 2 well-developed posterodorsal setae, rarely with 1 or 2 additional shorter seta; anteroventral setae varied from 2 to 9 well-developed setae. Upper and lower calypteres brownish yellow. Wing length usually subequal to body length or longer. Wing varied from completely hyaline to dark or light fumose on cells c, sc, r_1, r_{2+3}, and r_{4+5}. Wing vein R_{4+5} dorsally setose only at base, and R_1 dorsally setose on about apical half on *E. ecuadoriana* and *E. distincta*. Vein M smoothly curved at bend and ending at wing margin anterior to wing tip, separately from vein R_{4+5}.

Abdomen: Coloration varied from fully yellow to fully black, but several species with abdomen mostly black with yellow laterally on tg1+2 to tg4. Transverse bands of sparse white pruinosity sharply demarcated on specimens with a black abdomen, scarcely visible to naked eye on specimens with a yellow abdomen. Mid-dorsal depression of tg1+2 not extending to hind margin. One pair of median marginal setae on tg1+2 and tg3; a row of median marginals on tg4 and tg5; 1 pair of lateral marginal setae on tg1+2 and tg3; and discal setae present as an irregular row on tg5, or absent. Sternites completely overlapped by tergites.

Male terminalia: Sternite 5 with median cleft smoothly U or V-shaped; inner margin with minute setae; apical lobe rounded or pointed apically with a single long well-developed seta present, rarely with 2 setae, or absent. Sternite 5 usually slightly concave on anterior margin of basal plate. Hypandrial arms separated. Pregonite curved anteriorly and tapered to a narrow rounded tip, with setae along posterior margin. Postgonite short and paddle-like, almost parallel-sided with rounded apex. Epiphallus small, usually difficult to see between the pregonites. Surstylus with small hairs on inner and outer surfaces (with well-developed setae on inner surface of *E. distincta*), or completely bare. Surstylus, in lateral view, varied in shape from almost straight to slightly concave on anterior or posterior margins; usually ending in a broad rounded apex, occasionally truncate. Surstylus and cercus usually subequal in length, sometimes cercus shorter than surstylus. Cercus, in lateral view, varied from straight to slightly concave along anterior margin and from slightly concave to strongly carinate on posterior margin, ending in a nearly truncate or rounded apex. When a carina is present on the posterior margin of the cercus, it ends abruptly or gradually producing a right or obtuse angle, respectively. In posterior view, cerci slightly to abruptly constricted on apical 1/3; dorsal inner margin of the cerci on the medial section rarely with small pointed processes; upper lobe varied from shorter, subequal to, or longer than the medial section or apical cleft; medial section and apical cleft dorsally flat or with a slight depression on the medial section, extended to an internal twist in the apical cleft of *E. cryptica*, *E. catarina*, *E. convexiforceps*, and *E. distincta*; apical cleft slightly to well defined; and apices of the cerci linear or curved, with tips pointing distally or directed medially, respectively.

Female terminalia: Sternite 5 rectangular, middle of anterior margin slightly concave, covered with well-developed setae on more than posterior 2/3, or with 2 pairs of strong setae near posterior margin. Sternite 5 usually about twice as long as wide. Sternite 6 with several setae on posterior corners. Tergite 6 well developed, present as two lateral sclerites, with strong setae along posterior margin. Sternite 7 with a distinctive elongate medial lobe on the anterior margin, with several small setae on posterior corners. Tergite 7 present as two lateral sclerites, with small setae along posterior margin. Sternite 8 usually small and bare, difficult to distinguish from the surrounding membrane; sometimes absent. Tergite 8 bare, well developed laterally, strongly narrowed dorsally, joining at the ventral margin with the postgenital plate; dorsally with a distinctive narrow lobe on the medial section of the anterior margin in *E. distincta*. Tergite 10 between the cerci, small and bare, usually rhomboid in shape. Postgenital plate with several small setae on posterior tip. Cercus usually slightly narrowed at base, with several setae apically.

Puparium: Cylindrical and of uniform diameter along length. Region between posterior spiracles relatively smooth. Posterior spiracles positioned high, above middle of the puparium in lateral view (Figs. 97–99), in contrast to the medial position of many other Blondeliini (e.g., *Compsilura* Bouché). Posterior spiracles scarcely raised above the surface of puparium, and slightly raised in *E. ecuadoriana*. Each posterior spiracular disc with three slits. Ventral surface of puparium with several minute spines forming cells and rings, except in *E. ecuadoriana* where it bears long spine-like hairs.

Cephalopharyngeal skeleton: The second and third instar skeletons consist of three well-defined segments: mouth hooks, the intermediate region, and dorsal and ventral cornu. The second instar has more prominent mouth hooks than the third instar. The ventral cornu of the third instar has an additional anterior projection not found in the second instar.

Hosts: Twenty-eight *Erythromelana* specimens were reared from *Eois* spp. caterpillars (Lepidoptera: Geometridae), and one specimen from an unknown pyralid larva (Lepidoptera: Pyralidae). These specimens were reared from caterpillars collected within an approximately 20 km radius of YBS and ranging in elevation from 1500–3000 m on host plants in the genus *Piper* or related genera (Piperaceae), and one record from *Siparuna pyricarpa* (Monimiaceae).

Geographic distribution and seasonal occurrence

The genus *Erythromelana* is widely distributed in the Neotropical Region, from southern Mexico to northern Argentina (Figs. 112–117). There are large geographical gaps between records from Mexico and Costa Rica, specimens collected in southern Brazil and those collected along the Andes Mountains. These disjunct distributions are probably due to limited collecting effort in the Neotropical Region. Species occur in lowland tropical to montane tropical forest ranging from low elevations (e.g., Santa Catarina, Brazil, 300–500 m) to high elevations (e.g., Napo, Ecuador, 2000–3000 m). In particular, species with yellow abdomens appear to occur only in the

Andes Mountains, a region that probably contains more species of *Erythromelana* than any other area of the Neotropics. Adults have been collected and reared throughout the year.

ERYTHROMELANA SPECIES GROUPS

The known species of *Erythromelana* can be roughly separated into two primary groups, termed here the *E. jaena* and *E. cryptica* species groups (see PCAs sections below). These groups are distinguished by a combination of non-terminalic and terminalic structures as follows:

E. jaena species group

Species belonging to this group share two distinct states of the male terminalia. Specifically, sternite 5 has the apical lobes broadly rounded, with only small hair-like setae (sometimes similar in *E. woodi*) and the cerci are dorsally flat on the medial section in posterior view. Based on examination of other blondeliine taxa (*Lixophaga*, *Myiopharus* B. & B., *Anoxynops*, *Ptilodegeeria* B. & B., *Blondelia* Robineau-Desvoidy, *Chaetonodexodes* Townsend), these states likely represent the ancestral condition in the Blondeliini. In addition, most of the species have: bright yellow abdominal coloration (except *E. leptoforceps* and *E. nigrithorax*), 2 katepisternal setae (3 in *E. eois*, and rarely in *E. ecuadoriana*), first postsutural supra-alar seta absent, sternite 5 of female covered with several well-developed setae on more than posterior 2/3 (although similar in *E. woodi*), and cercus, in lateral view, slightly concave along posterior margin.

This group includes seven species, five with fully yellow abdomens, *E. jaena*, *E. abdominalis*, *E. curvifrons*, *E. ecuadoriana*, and *E. eois*; and two species with black and yellow abdomens, *E. leptoforceps* and *E. nigrithorax*.

E. cryptica species group

Species in this group share two likely synapomorphies of the male terminalia. In contrast to the species in the *E. jaena* group, the apical lobes of the sternite 5 are usually pointed, with a long well-developed seta (rarely absent in *E. woodi*); and a slight depression dorsally on the medial section, or a twist internally at the apical cleft of the cerci. Additionally, most of the species have: abdominal coloration mostly black with yellow laterally (rarely mostly yellow in *E. woodi*), 3 katepisternal setae (except *E. distincta* and rarely *E. woodi*), first postsutural supra-alar present (rarely absent in *E. cryptica*, absent in *E. convexiforceps*, *E. woodi*, and *E. distincta*), sternite 5 of female with 2 pairs of well-developed setae close to the posterior margin (except *E. woodi*), and cercus, in lateral view, strongly carinate on medial section of the posterior margin (except *E. arciforceps*, *E. napensis*, and *E. woodi*).
This group includes seven species, all with black abdomens with yellow laterally, *E. cryptica*, *E. catarina*, *E. convexiforceps*, *E. arciforceps*, *E. napensis*, *E. distincta*, and *E. woodi*; the latter rarely with a predominantly yellow abdomen.

KEYS TO *ERYTHROMELANA* SPECIES

Males

1. Abdomen dorsally yellow, or mostly yellow (as in Fig. 20); first postsutural supra-alar seta absent 2
1'. Abdomen dorsally black, or mostly black (as in Fig. 29); first postsutural supra-alar seta present or absent 7
2(1). Abdomen fully yellow 3
2'. Abdomen mostly yellow with black only on tg1+2 or on tg1+2 and tg4 (as in Fig. 19) 4
3(2). Vein R_1 dorsally setose on about apical half, katepisternum with 2 or 3 setae . . . . . *E. ecuadoriana* sp. nov.
3'. Vein R_1 dorsally bare, katepisternum with 3 setae . . . . . *E. eois* sp. nov.
4(2'). Abdomen mostly yellow with black on the anterodorsal margin and the mid-dorsal depression of tg1+2; palpus nearly linear, dorsally sparsely haired (as in Fig. 6) 5
4'. Abdominal coloration as above, but also with black on the posterodorsal margin of tg4; palpus curved inward medially, dorsally bare (Fig. 18). . . . . *E. woodi* sp. nov. (in part)
5(4). Fronto-orbital plate not concave (as in Fig. 3); width of frontal vitta about 1/4 the vertex width (as in Fig. 1); wing light or dark fumose on c, sc, r_1, r_{2+3}, and r_{4+5} cells 6
5'. Fronto-orbital plate slightly concave (Fig. 4); frontal vitta extremely narrow, the width about 1/7 the vertex width (Fig. 2); wing completely hyaline. . . . . *E. curvifrons* sp. nov.
6(5). Hind tibia usually with 6 or more well-developed anteroventral setae (rarely 5); and the apex of the cercus, in lateral view, ending in a truncate tip (Fig. 51). . . . . *E. jaena* Townsend

6'. Hind tibia usually with 4 well-developed anteroventral setae (rarely 5); and the apex of the cercus, in lateral view, ending in a rounded tip (Fig. 47) . . . . . *E. abdominalis* (Townsend)
7(1'). Katepisternum with 2 setae; first postsutural supra-alar seta absent 8
7'. Katepisternum with 3 setae; first postsutural supra-alar seta present or absent 11
8(7). Ocellar setae absent; st5 of male with the apical lobes rounded, each lobe with several small hair-like setae (as in Fig. 39) 9
8'. Ocellar setae present, proclinate; st5 with the apical lobes pointed, each lobe with a long well-developed seta (as in Fig. 41) 10
9(8). Medial section of the cercus, in posterior view, less than half the length of cercus, about 0.40 the cercus length (Fig. 66) . . . . . *E. leptoforceps* sp. nov.
9'. Medial section of the cercus, in posterior view, more than half the length of cercus, about 0.60 the cercus length (Fig. 67) . . . . . *E. nigrithorax* (Wulp)
10(8'). Vein R_1 dorsally setose; palpus almost straight, sparsely haired; surstylus ending in a very broad rounded apex (Fig. 59), inner surface with several well-developed setae (Fig. 72); posterior margin of the cercus, in lateral view, strongly carinate (Fig. 59) . . . . . *E. distincta* sp. nov.
10'. Vein R_1 dorsally bare; palpus slightly curved inward medially, dorsally bare; surstylus ending in a rounded tip (Fig. 60), inner surface with few small hair-like setae (Fig. 74); posterior margin of the cercus, in lateral view, slightly concave (Fig. 60) . . . . . *E. woodi* sp. nov. (in part)
11(7'). Posterior margin of the cercus, in lateral view, strongly carinate (as in Fig. 56) 12
11'. Posterior margin of the cercus, in lateral view, not strongly carinate, at most slightly concave (as in Fig. 60) 14
12(11). First postsutural supra-alar seta usually present, rarely absent; the carina on the medial section of the posterior margin of the cercus, in lateral view, ending gradually, forming an obtuse angle before the apical tip (as in Fig. 57); apices of the cerci, in posterior view, curved, with tips pointing medially (as in Fig. 71) 13
12'. First postsutural supra-alar seta absent; the carina on the medial section of the posterior margin of the cercus, in lateral view, ending abruptly, forming a nearly right angle before the rounded apical tip (Fig. 56); apices of the cerci, in posterior view, linear, with tips directed distally (Fig. 70) . . . . . *E. convexiforceps* sp. nov.
13(12). Apex of the cercus, in lateral view, ending in a nearly truncate tip (Fig. 57) . . . . . *E. cryptica* sp. nov.
13'. Apex of the cercus, in lateral view, ending in a rounded tip (Fig. 55) . . . . . *E. catarina* sp. nov.
14(11'). Palpus almost straight, sparsely haired (as in Fig. 6); first postsutural supra-alar seta present 15
14'. Palpus medially slightly curved inward, dorsally bare (Fig. 18); first postsutural supra-alar seta absent . . . . . *E. woodi* sp. nov. (in part).
15(14). Apex of the cercus, in lateral view, ending in a nearly truncate tip (Fig. 54); in posterior view, with length of upper lobe almost equal to length of the medial section and to the length of the apical cleft (Fig. 68) . . . . . *E. arciforceps* sp. nov.
15'. Apex of the cercus, in lateral view, ending in a rounded tip (Fig. 58); in posterior view, with upper lobe longer than medial section and almost equal to the length of the apical cleft (Fig. 73) . . . . . *E. napensis* sp. nov.

Females

1. Abdomen yellow or mostly yellow (as in Fig. 20); first postsutural supra-alar seta absent 2
1'. Abdomen black or mostly black (as in Fig. 29); first postsutural supra-alar seta present or absent 6
2(1). Abdomen fully yellow 3
2'. Abdomen mostly yellow with black only on tg1+2 or on tg1+2 and tg4 (as in Fig. 19) 4
3(2). Vein R_1 dorsally setose, katepisternum with 2 or 3 setae . . . . . *E. ecuadoriana* sp. nov.
3'. Vein R_1 dorsally bare, katepisternum with 3 setae . . . . . *E. eois* sp. nov.
4(2'). Abdomen mostly yellow with black on the anterodorsal margin and the mid-dorsal depression of tg1+2; palpus almost straight, sparsely haired (as in Fig. 6) 5
4'. Abdomen as above, but with black also on the posterodorsal margin of tg4; palpus slightly curved inward medially, dorsally bare (Fig. 18) . . . . . *E. woodi* sp. nov. (in part)
5(4). Fronto-orbital plate not concave (as in Fig. 3); width of frontal vitta about 1/3 the vertex width; wing light or dark fumose on c, sc, r_1, r_{2+3}, and r_{4+5} cells . . . . . females of *E. jaena* Townsend and *E. abdominalis* (Townsend)
5'. Fronto-orbital plate slightly concave (Fig. 4); frontal vitta extremely narrow, the width about 1/5 the vertex width; wing hyaline . . . . . *E. curvifrons* sp. nov.
6(1'). Katepisternum with 2 setae; first postsutural supra-alar seta absent 7
6'. Katepisternum with 3 setae; first postsutural supra-alar seta present or absent 9
7(6). Ocellar setae absent . . . . . *E. leptoforceps* sp. nov. and *E. nigrithorax* (Wulp)
7'. Ocellar setae proclinate 8
8(7'). Vein R_1 dorsally setose; palpus almost straight, sparsely haired; st5 with 2 pairs of well-developed setae close to posterior margin (Fig. 78); tg8 dorsally with a distinctive narrow medial lobe on the anterior margin (Fig. 82) . . *E. distincta* sp. nov.
8'. Vein R_1 dorsally bare; palpus slightly curved inward medially, dorsally bare; st5 covered with several well-developed setae on more than posterior 2/3 (as in Fig. 75); tg8 strongly narrowed dorsally, without a lobe (as in Fig. 81) . . . . . *E. woodi* sp. nov. (in part)
9(6'). Palpus almost straight, sparsely haired (as in Fig. 17); st5 with 2 pairs of well-developed setae close to posterior margin (as in Fig. 78) . . . . . females of *E. cryptica* sp. nov., *E. catarina* sp. nov., *E. convexiforceps* sp. nov., *E. arciforceps* sp. nov., and *E. napensis* sp. nov.

9'. Palpus slightly curved inward medially, dorsally bare (Fig. 18); st5 covered with several well-developed setae on more than posterior 2/3(as in Fig. 75) . . . . . *E. woodi* sp. nov. (in part)

ERYTHROMELANA JAENA SPECIES GROUP

Erythromelana jaena Townsend

(Figs. 6, 11, 20, 25, 33, 51, 61, 87, 88, 94, 103, 112)

Erythromelana jaena Townsend, 1919a: 175; Guimarães, 1971: 106; Wood, 1985: 39–40.

Type material

Lectotype male, by fixation of Wood (1985: 39), labeled: "Huascaray Rdge [Ridge]/ Pr [Province] Jaen Peru/ 7000 ft 21–IX", "CHT Townsend/ coll", "Type/ No./ U.S.N.M [red label]", "Erythromelana/ jaena/ Det CHTT" (NMNH). Townsend (1919a: 175) described *E. jaena* from one male and one female. Wood's (1985: 39) mention of the "Holotype ♂" is accepted as a lectotype fixation for the single male in the type series.

Other material examined

Nine males. One male, labeled: "Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED/ Mayo [May]/ 14830 [rearing record number]", "Erythromelana/ jaena Townsend/ det. Inclan D.J.", terminalia and puparium stored in glycerin in a microvial pinned below specimen (CNC); one male, labeled: "Ecuador, Napo [Province]/ 7 km. s. [south] Baeza/ 20–25– II. 79/ G. &M. Wood 2000 m", "Erythromelana/ jaena Townsend/ det. Inclan D.J.", "DI11CA [specimen ID number]", terminalia stored in glycerin in a microvial pinned below specimen (CNC). Three males, as previous except ID number "DI05CA" (CNC), terminalia stored in glycerin in a microvial pinned below specimen; "DI268CA" (CNC); and "DI07CA", terminalia stored in glycerin in a microvial pinned below specimen (NMNH). Two males, as previous except date "28. III. 1983" and ID number "DI264CA" (CNC); and "DI02CA", terminalia stored in glycerin in a microvial pinned below specimen (QCAZ). Two males, as previous except location and date "8.5/ km E Papallacta/ 29. III. 1983" and ID number "DI266CA", terminalia stored in glycerin in a microvial pinned below specimen (JOS); and "DI256CA" (CNC).

Recognition

This species is morphologically very similar to *E. abdominalis* but is distinguished by differences in the tibial setae of the male hind leg and male terminalia. *Erythromelana jaena* usually has 6 or more well-developed anteroventral setae on the hind tibia and *E. abdominalis* usually has 4 setae. However, sometimes both species have 5 setae, making terminalic characters the only reliable way to distinguish these species. In lateral view, the cercus of *E. jaena* ends in a wide truncate tip, whereas the cercus of *E. abdominalis* ends in a narrower rounded point (Figs. 51, 47). The surstylus of *E. jaena* is markedly wider than that of *E. abdominalis*. In posterior view, the upper lobes of the cerci of *E. jaena* are notably thinner and longer than those of *E. abdominalis*. At present, there are no reliable characters to separate females of these two species (see discussion). The yellow abdomen of *E. jaena* and *E. abdominals* distinguish these species from *E. nigrithorax*, *E. leptoforceps* and all species in the *E. cryptica* species group that have a yellow with black abdomen. The remaining species in the *E. jaena* species group with a yellow abdomen can be separated from *E. jaena* and *E. abdominalis* by the presence of setae on R_1, 3 katepisternal setae, and the concave fronto-orbital plate.

Redescription

Redescribed from 7 males (including the lectotype), 1 puparium and 1 cephalopharyngeal skeletons of a third instar larvae; unless otherwise noted as "N".

Length: 6.8–7.6 mm (mean = 7.08 mm, N = 6).

Head (Figs. 6, 11): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence appearing grayish from certain angles. Vertex with faint golden reflections visible only in lateral view. Arista black with brownish on basal 1/4, thickened only on basal 1/6. Eye sparsely haired, ommatrichia about as long as 2 eye facets. Eye 0.85–0.90 (mean = 0.87, N

=6) head height. Vertex width 0.13–0.18 (mean = 0.16, N=6) head width. Width of frontal vitta 0.21–0.35 (mean = 0.28, N = 6) vertex width. Length of first flagellomere 0.38–0.45 (mean = 0.41, N = 6) head height. Width of first flagellomere 0.20–0.21 (mean =0.21, N = 9) head length. Pedicel length 0.30–0.33 (mean = 0.31, N = 6) length of first flagellomere. Fronto-orbital plate with 6–12 (m = 8) medioclinate frontal setae; 2 reclinate inner orbital setae (usually with 1 extra small seta), without outer orbitals. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter barely differentiated from the row of postocular setae. Ocellar setae usually absent; if present proclinate, but hardly differentiated from the adjacent setae. Parafacial bare and extremely narrow with the narrowest point nearly equal to or slightly wider than the width of the palpus at the base. Parafacial width 0.04–0.07 (mean = 0.06, N = 9) head length, and 0.20–0.35 (mean =0.27, N = 9) first flagellomere width. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.13–0.19 (mean = 0.15, N = 6) head height. Palpus yellowish, distally sparsely haired with base usually bare, apex slightly broadened, length 0.30–0.33 (mean = 0.31, N = 7) head height.

Thorax (Figs. 20, 25): Dorsocentral length 0.38–0.39 (mean = 0.38, N = 6) total body length. In dorsal view, thorax shiny black in ground color, presutural and postsutural scutum with thin white pruinescence (barely visible to the naked eye) revealing underlying black color. In lateral view, the presutural and postsutural scutum appears slightly grayish. Faint white pruinose stripes on presutural scutum leaving 4–5 black vittae; the inner 2–3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Postpronotum with 2 setae, rarely with 1 small additional seta. Katepisternum with 2 setae. Scutum with 1 presutural acrostichal seta, usually with 1 additional small seta; 2 postsutural acrostichal setae, usually with 1 additional small seta, rarely with 2; 2 presutural and 2 postsutural dorsocentral setae, usually with 1 or 2 additional small setae; 1 presutural and 3 postsutural intra-alar setae; 1 presutural supra-alar seta, rarely with 1 additional small seta; and 2 postsutural supra-alar setae, first postsutural supra-alar absent. Scutellar discal setae usually absent or with 1 small pair of hair-like setae.

Legs black, usually with front and hind tibiae yellowish. Tarsal claws longer than 5th tarsomere. Fore claw length 0.93–1.17 (mean = 1.02, N = 6) length of fore 5th tarsomere. Hind tibia with 2 well-developed posterodorsal setae; usually with 6 well-developed anteroventral setae, but varied from 5 to 7. Wing usually dark fumose at sc, $r_{1,}$ and r_{2+3} cells; and light fumose at c, r_{4+5}, and dm cells. Wing vein R_{4+5} dorsally with 2–3 setae at base. Vein M smoothly curved at bend and ending at wing margin, close to wing tip and separately from vein R_{4+5}.

Abdomen (Figs. 20, 25): Bright yellow in dorsal view with a black transverse band on anterior 1/5 of tg1+2 extending backward in the mid-dorsal depression. Transverse bands of sparse white pruinosity absent. Discal setae absent, 1 pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, and 1 pair of lateral marginal setae on tg1+2 and tg3.

Male terminalia (N = 6) (Figs. 33, 51, 61): Sternite 5 with median cleft smoothly U-shaped, inner margin with minute setae, apical lobes rounded apically, and anterior margin of basal plate slightly concave (Fig. 33). Apical lobe of st5 0.60–0.67 (mean = 0.64) st5 length. In lateral view, surstylus bare, slightly concave on anterior margin and nearly straight along posterior margin. Surstylus and cercus subequal in length. Cercus almost straight along anterior margin and slightly concave on posterior margin, ending in a nearly truncate tip forming a beak-like tip on anterior corner. In posterior view, cerci narrowly constricted on apical 1/3; upper lobes longer than medial section and more than double the length of the apical cleft; apical cleft well defined; and apices of the cerci linear, with rounded tips directed medially. Length of upper lobe of cercus 0.31–0.43 (mean = 0.34) cercus length, medial section 0.35–0.48 (mean = 0.43) cercus length (Figs. 51, 61).

Puparium (N = 1) (Figs. 87, 88, 94): Cylindrical and of uniform diameter along length. Region between posterior spiracles relatively smooth (Fig. 88). Posterior spiracles positioned high above middle of the puparium in lateral view, only slightly raised from the surface. Each posterior spiracular disc with three almost linear slits, gently curved toward the ends (Fig. 87). The ventral section is covered by many minute spinules forming bands of irregular cells (Fig. 94).

Cephalopharyngeal skeleton (N = 1) (Fig. 103): In the puparium preparation, only the cephalopharyngeal skeleton from the last instar was found. The mouth hooks are well developed, with a broad posterior section and anteriorly ending in a thin hook-like shape. Intermediate region with pronounced ventral spur, dorsal and ventral cornu average in size, with the dorsal cornu about twice as large as the ventral cornu.

Female: Unknown.

Host: One specimen was reared from the caterpillar *Eois* sp. nr. *olivacea* (Lepidoptera: Geometridae). The caterpillar was collected from YBS on the host plant *Piper baezanum* (Piperaceae). The third instar caterpillar was collected on 27th May 2006 and the adult fly was found 43 days later.

Geographic distribution and seasonal occurrence

The lectotype was collected from northern Peru and the rest of the specimens are from Ecuador (Fig. 112). *Erythromelana jaena* seems to occur at high elevations (Jaen, Peru, 2150 m; Napo, Ecuador, 2000–2600 m). This species could be distributed across the Andes Mountains, but how far north and south is unclear due to the lack of specimens collected from Colombia, Peru, Bolivia, and Chile. Specimens from Ecuador were collected from February to May, and the lectotype from Peru was collected in September.

Discussion

Erythromelana jaena and *E. abdominalis* can be separated based on differences in the male hind tibial setae and male terminalia. The number of anteroventral setae on the hind tibia in males can be used as a preliminary identification of this species; however, as mentioned in the recognition section, the number of setae varies and some specimens of both species have 5 setae. This character is still important as it is the only external character that can be used to identify these species. *Erythromelana jaena* and *E. abdominalis* types were recognized based on the presence of 4 and 6 anteroventral setae on the hind tibia respectively. The terminalia of the types were not dissected and the terminalia descriptions of these species are based on a series of specimens where the terminalia was dissected and associated with differences with the number of anteroventral setae on their hind tibia. Specifically, the distinct shape of the cercus and surstylus allow the reliable separation of the males of these two species. In contrast, descriptions of *E. jaena* and *E. abdominalis* females are not included in this revision because at this point there are no reliable characters (including terminalia) to associate females with males. There appear to be differences in the shape and size of the female palpus, where one group of females has a male-like palpus and the other group has a broader and larger palpus. DNA sequencing from these two female morphospecies suggests that they represent two distinct species. However, it is not possible to associate which group of females corresponds to *E. jaena* and *E. abdominalis* because of the lack of sequences for males (see phylogenetic section). Additionally, females cannot be linked to males based on geographic distribution because the two species are sympatric.

***Erythromelana abdominalis* (Townsend)**

(Figs. 5, 10, 19, 24, 34, 47, 62, 112)

Minthomyia abdominalis Townsend, 1919b: 564; Guimarães, 1971: 41.
Erythromelana abdominalis: Wood, 1985: 39–40.

Type material

Holotype male, labeled: “R [River?] Charape Peru/ 4500 ft 12–IX–11”, “CHT Townsend/ coll”, “Type No./ 22235/ U.S.N.M [red label]”, “Minthomyia/ abdominalis/ ♂/ Det CHTT” (NMNH).

Other material examined

11 males. One male, labeled: “Ecuador, Napo [Province]/ 7 km. s. [south] Baeza/ 20–25– II. 79/ G. &M. Wood 2000 m”, “Erythromelana/ abdominalis/ (Townsend)/ det. Inclan D.J.”, “DI246CA [specimen ID number]” (CNC). Five males, as previous except ID numbers “DI01CA”; “DI08CA”; “DI09CA”; “DI04CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); and “DI272CA” (NMNH). One male, as previous except date “13–14. II. 1982” and ID number “DI03CA” (CNC). Two males, as previous except locality and date “6 km S [South] Baeza/ 13. II. 1982” and ID numbers “DI259CA” (CNC); and “DI260CA”, terminalia stored in glycerin in a microvial pinned below specimen (QCAZ). Two males, as previous except location and date “7 km s [south] Baeza/ 28. III. 1983” and ID numbers “DI10CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); and “DI13CA”, terminalia stored in glycerin in a microvial pinned below specimen (JOS).

Recognition

This species is morphologically very similar to *E. jaena* and can be distinguished from it only by differences in the male hind tibia setae and male terminalia (see above). The main distinction between *E. abdominalis* and *E. jaena* in male terminalia is that the cercus of the former ends in a narrow rounded tip (as seen in lateral view), rather than a wide truncate tip. Female unknown. Complete information on the recognition of *E. abdominalis* and its separation from the remaining *Erythromelana* species is in the above description of *E. jaena*.

Redescription

Redescribed from 8 males (including the holotype), unless otherwise noted as "N".

Length: 6.1–6.9 mm (mean = 6.47 mm, N = 7).

As described for *E. jaena* except as follows:

Head (Figs. 5, 10): Eye sparsely haired, ommatrichia about as long as 2–3 eye facets. Eye 0.84–0.90 (mean = 0.88, N = 7) head height. Vertex width 0.15–0.17 (mean = 0.16, N = 7) head width. Width of frontal vitta 0.27–0.33 (mean = 0.29, N = 7) vertex width. Length of first flagellomere 0.36–0.43 (mean = 0.40, N = 7) head height. Width of first flagellomere 0.19–0.25 (mean =0.22, N = 10) head length. Pedicel length 0.29–0.38 (mean = 0.32, N = 7) length of first flagellomere. Fronto-orbital plate with 6–9 (m = 8) medioclinate frontal setae; 2 reclinate inner orbital setae (rarely with 1 extra small seta). Ocellar setae proclinate, hardly differentiated from the adjacent setae. Parafacial bare and extremely narrow, with the narrowest point nearly equal to the palpus width at the base. Parafacial width 0.05–0.06 (mean = 0.05, N = 10) head length and 0.19–0.31 (mean = 0.25, N = 10) first flagellomere width. Height of haired portion of facial ridge 0.11–0.20 (mean = 0.14, N = 7) head height. Palpus length 0.28–0.33 (mean = 0.31, N = 7) head height.

Thorax (Figs. 19, 24): Dorsocentral length 0.33–0.38 (mean = 0.36, N = 7) total body length. Faint white pruinose stripes on presutural scutum leaving 5 black vittae; the inner 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae (Fig. 19). Scutum with 1 presutural acrostichal seta, rarely with 1 additional small seta; 2 postsutural acrostichal setae, rarely with 1 additional seta; 2 presutural and 2 postsutural dorsocentral setae, rarely with 1 or 2 additional small setae. Scutellum discal setae usually with 1 small pair of hair-like setae. Fore claw length 0.96–1.40 (mean = 1.12, N = 7) length of fore 5th tarsomere in male. Hind tibia usually with 4 well-developed anteroventral setae, but varied from 3 to 5. Dorsal section of wing vein R_{4+5} usually with 2 setae at base.

Male terminalia (Figs. 34, 47, 62): Apical lobes of st5 0.61–0.64 (mean = 0.62, N = 4) st5 length (Fig. 34). In lateral view, surstylus almost straight with anterior and posterior margins parallel-sided. Surstylus slightly longer than cercus. Cercus straight along anterior surface, ending in a narrow round tip. In posterior view, cerci narrowly constricted on apical 1/3, length of upper lobes almost equal to medial section and more than double the length of the apical cleft. Upper lobe length of cercus 0.28–0.44 (mean = 0.38, N = 5) cercus length, medial section length of cercus 0.39–0.50 (mean = 0.44, N = 5) cercus length (Figs. 47 and 62).

Female: Unknown.

Host: Unknown.

Geographic distribution and seasonal occurrence

The holotype was collected from northern Peru and all other specimens from Ecuador (Fig. 112). *Erythromelana abdominalis* seems to occur at moderate to high elevations (Charape, Peru, 1500 m; Napo, Ecuador, 2000–2600 m). This species, like *E. jaena*, may be widely distributed along the Andes Mountains, but how far north and south is unclear due to the lack of specimens collected from Colombia, Peru, Bolivia, and Chile. Specimens from Ecuador were collected in February and March, and the holotype from Peru was collected in September.

Discussion

See discussion section of *E. jaena*.

***Erythromelana leptoforceps* Inclan sp. nov.**
(Figs. 1, 3, 7, 12, 21, 26, 38, 52, 66, 75, 76, 77, 81, 113)

Type material

Holotype male, labeled: " COSTA RICA Pnts [Puntarenas province]/ Monteverde, EBM [Estacion Biologica Monteverde]/ 20–30.VIII.1997/ D.M. Wood 1500 m", "HOLOTYPE/ Erythromelana/ leptoforceps/ Inclan D.J. [red label]", "DI184MW [specimen ID]" (CNC).

Allotype female, labeled: " COSTA RICA Pnts [Puntarenas province]/ Monteverde, EBM [Estacion Biologica Monteverde]/ 20–30.VIII.1997/ D.M. Wood 1500 m", "ALLOTYPE/ Erythromelana/ leptoforceps/ Inclan D.J. [red label]", "DI186MW [specimen ID]" (CNC).

Paratypes, 30 males and 22 females. **Costa Rica**: one male, "COSTA RICA Pnts [Puntarenas province]/ Monteverde 1600 m/ 18–24.VIII.1987/ G. & M. Wood", "PARATYPE/ Erythromelana/ leptoforceps/ Inclan D.J. [yellow label]", "DI180MW [specimen ID]" (CNC). One male and female, "COSTA RICA Pnts [Puntarenas province]/ Monteverde/ 20–25.VIII.1991/ D.M. Wood 1500 m", "DI181MW [♂]", and "DI188MW [♀]" (CNC). One female, as previous except date "20–22.VIII.1993" and specimen ID "DI187MW" (CNC). One male, as previous except date " 22.VIII.1991" altitude "1842 m" and specimen ID "DI182MW" (CNC). One male, same as allotype except date "10–15.I.1998" and specimen ID "DI185MW", terminalia stored in glycerin in a microvial pinned below specimen (CNC). One male, "COSTA RICA Pnts [Puntarenas province]/ Monteverde, Cerro/ Amigos 1842 m/ 2.IX.95 D.M. Wood", "DI183MW [specimen ID]" (CNC). Three males and one female, "COSTA RICA PNTS [Puntarenas province]/ Monteverde NP [National Park] ~1600 m/ 17–viii–10 Forest Clearing/ 10°15′N 84°32′W/ P. Cerretti", one male "JOS 810.7.2 [molecular barcoding]" (PCE), and female "JOS 810.7.1 [molecular barcoding]" (PCE). Four males, as previous except "18–viii–10 Stream/ J.O. Stireman III", one male "JOS 810.6.1 [molecular barcoding]" (JOS), one male "JOS 810.4.1 [molecular barcoding]" (JOS). One male, "Quebrada Segunda Ref./ Nac. Fauna Silv. Tapanti,/ 1250 m, Prov. Cartago,/ Costa Rica, R. Vargas, abr/ 1992, L-N 194000, 560000", "COSTA RICA INBIO/ CRI000/ 459612", terminalia stored in glycerin in a microvial pinned below specimen (INBio). One male, as previous except "F.A. Quesada, Ago 1991/ L-N–194000, 559800", "CRI000/ 551708" (INBio). One female, " COSTA RICA, Prov. Cartago, R./ Grande de Orosi, desde/ Administracion hasta Sendero La/ Pava. 1150–1600 m. AGO 1996. R./ Guzman. L_N_192500_560400", "CRI002/ 459482" (INBio). **Brazil**: four males and one female, "Nova Teutonia"/ S.C.-BRAZIL/ Nov. 1970/ F. Plaumann", "DI355CA [♂]"; "DI356CA [♂]"; "DI62CA [♂]", terminalia stored in glycerin in a microvial pinned below specimen; "DI63CA [♂]", terminalia stored in glycerin in a microvial pinned below specimen; and "DI361CA [♀]" (CNC). Four males and two females, as previous except "Nov. 1971", "DI375CA [♂]"; "DI376CA [♂]"; "DI367CA [♂]"; "DI371CA [♂]", terminalia stored in glycerin in a microvial pinned below specimen; "DI370CA [♀]"; and "DI378CA [♀]" (CNC). One male and one female, same as previous except "Nov. 1969", "DI380CA [♂]" and "DI381CA [♀]" (CNC). One female, as previous except "Jan. 1970", "DI363CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC). One female, as previous except "Dec. 1970", "DI366CA" (JOS). One male, as previous except "Aug. 1970", "DI351CA" (CNC). One male and one female, as previous except "Oct. 1970", "DI358CA [♀]" (CNC); "DI352CA [♂]", terminalia stored in glycerin in a microvial pinned below specimen (QCAZ). One female, as previous except "Oct. 1961", "DI71CA" (QCAZ). One female, as previous except "XII. 1971", "DI377CA" terminalia stored in glycerin in a microvial pinned below specimen (CNC). One female, as previous except "April 1960", "DI385CA" (CNC). One female, "Sao Paulo/ S.P., BRAZIL/ 3 Jan. 1965/ R. Inoue", "DI384CA" (CNC). One female, "Brasilien/ Nova Teutonia/ 27° 11′la 52° 23′L/ Fritz Plaumann/ V 1968 [diagonal on label]/ 300–500 m [diagonal on label]", "DI387CA" (CNC). One male, as previous except "20 II 1938", "Brit. Mus./ 1939–66.", "DI111BM" (BMNH). One male "Nova Teutonia/ 27°11'S 52°23'W/ Brazil, 300–500 m/ II–1965/ Fritz Plaumann", "Minthomyia/ Det. D.M. Wood 1968", "DI383CA" (CNC). One male, "BRAZIL: Santa Catarina:/ Nova Teutonia, 27°11′S/ 52°23′W, 300–500 m, Feb/ 1969, F. Plaumann", "COLLECTION OF/ PAUL H. ARNAUD, JR.", "DI151NM" (NMNH). One male, as previous except "Mar. 1969", "DI162NM" (NHNM). One female, as previous except "14 Mar. 1966", "DI149NM" (NMNH). Three females, as previous except "Apr. 1966", "DI143NM", "DI141NM", and "DI147NM" (NMNH). One female, as previous except "Jan. 1967", "DI163NM" (NMNH). **Peru**: one male, "Quincemil/ Cuzco, PERU/ 13–31. VIII. ′62/ L.Pena. 780 m.", "DI230CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Argentina**: one female, "ARGENTINA: Tuc./ Horco Molle, c. 12 km./ W. of Tucuman. 700 m./ Malaise trap/ 18–21.iii.1974. C.R. Vardy/ B.M. 1974–204", "DI117BM" (BMNH).

Other material examined

Twenty-four males and eight females. **Brazil**: one male: "BRAZIL: Santa Catarina:/ Nova Teutonia, 27°11′S/ 52°23′W, 300–500 m/ Feb. 1966, F. Plaumann", "COLLECTION OF/ PAUL H. ARNAUD, JR.", "DI125NM" (NMNH). 17 males, "Nova Teutonia"/ S.C.–BRAZIL/ Nov. 1970/ F. Plaumann", "DI65CA", "DI64CA", "DI66CA", "DI61CA", "DI60CA", "DI360CA", "DI344CA", "DI350CA", "DI346CA", "DI345CA", "DI347CA", "DI348CA", "DI349CA", "DI357CA", "DI368CA", "DI353CA", "DI354CA" (CNC). One female, as previous except "DI365CA" (CNC). Four males, as previous except "Nov. 1971", "DI372CA", "DI373CA", "DI3374CA", "DI369CA" (CNC). One female, as previous except "DI379CA" (CNC). One male, as previous except "March 1970", "DI359CA" (CNC). One male, as previous except "April 1963", "DI67CA" (CNC). One female, as previous except "Oct. 1961", "DI72CA" (CNC). One female, as previous except "Sept. 1961", "DI70CA" (CNC). One female, as previous except "June 1970", "DI362CA" (CNC). One female, as previous except "Feb. 1970", "DI364CA" (CNC). One female, as previous except "Nov. 1969", "DI382CA" (CNC). One female, as previous except "III. 1968", "DI386CA" (CNC).

Etymology

From the Greek *leptos* and the Latin *forceps*, meaning narrow cerci, in reference to the relatively narrow cerci (viewed from the posterior) of this species compared to those of its close relative, *E. nigrithorax* (Wulp).

Recognition

This species is morphologically very similar to *E. nigrithorax* and can only be distinguished from it by differences in the male terminalia. The medial section of the cerci of *E. leptoforceps*, viewed from the posterior, is notably narrower than in the cerci of *E. nigrithorax*. In addition, the base of sternite 5 is wider in *E. leptoforceps* than in *E. nigrithorax*. Females of these two species cannot be reliably separated morphologically (see discussion section). Here, the identity of females is assumed based on geographic distribution (see geographic distribution section). Males and females of both species can be distinguished from other species in the *E. jaena* species group by the black abdominal color forming a vitta and transverse bands, in contrast to the yellow abdomen characteristic of the remaining species in the *E. jaena* group. Species in the *E. cryptica* species group share similar abdominal coloration patterns with *E. leptoforceps* and *E. nigrithorax*; however, most of them have three katepisternal setae whereas *E. leptoforceps* and *E. nigrithorax* have only two. There are only two species in the *E. cryptica* group that have two katepisternal setae, *E. distincta* and *E. woodi* (usually three, but varied from two to three), and they can be separated from *E. leptoforceps* and *E. nigrithorax* by the presence of setae on R_1 and small ocellar setae, respectively. Additionally, *E. woodi* usually has an irregular row of discal setae on tg5, where the discal setae are absent from all species of the *E. jaena* species group.

Description

Described from 31 males and 23 females, unless otherwise noted as "N".

Length: 6.3–8.0 mm (mean = 6.24 mm, N = 9) in males, 5.4–6.1 mm (mean = 5.78 mm) in females.

Head (Figs. 1, 3, 7, 12): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence (which can appear grayish from certain angles), with faint golden reflections visible only in lateral view. Arista black with brown on basal 1/4, thickened only on basal 1/6. Eye moderately densely haired, ommatrichia about as long as 4–5 eye facets. Eye 0.89–0.93 (mean = 0.91) head height in male, 0.90–0.92 (mean = 0.92) in female. Vertex width 0.12–0.15 (mean = 0.14) head width in male, 0.16–0.23 (mean = 0.18, N = 5) in female. Width of frontal vitta 0.27–0.33 (mean = 0.30) vertex width in male, 0.30–0.44 (mean = 0.39, N = 5) in female. Length of first flagellomere 0.40–0.47 (mean = 0.41, N = 9) head height in male, 0.39–0.48 (mean = 0.43) in female. Width of first flagellomere 0.17–0.25 (mean = 0.20) head length in male, 0.20–0.22 (mean = 0.21, N = 5) in female. Pedicel length 0.26–0.34 (mean = 0.30) length of first flagellomere in male, 0.26–0.31 (mean = 0.28) in female. Fronto-orbital plate with 6–10 (m = 8) medioclinate frontal setae in male, 4–5 (m = 5) in female; 2 reclinate inner orbital setae (rarely with 1 extra small setae); female with 2 proclinate outer orbital setae, male without outer orbitals. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter barely differentiated from the row of postocular setae on both sexes. Ocellar setae absent. Parafacial bare and extremely narrow, with the narrowest point narrower than the width of maxillary palpus at base in both sexes. Parafacial width 0.03–0.06 (mean = 0.04) head length in male, 0.03–0.04

(mean = 0.03, N = 5) in female, and 0.15–0.29 (mean = 0.22) first flagellomere width in male, 0.15–0.20 (mean = 0.17, N = 5) in female. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.11–0.18 (mean = 0.14) head height in male, 0.11–0.18 (mean = 0.13) in female. Palpus yellow, usually dark yellowish at base; distally sparsely haired with base usually bare; apex slightly to substantially broadened; length 0.24–0.32 (mean = 0.23, N = 9) head height in male, 0.28–0.34 (mean = 0.30) in female.

Thorax (Figs. 21, 26): Dorsocentral length 0.35–0.43 (mean = 0.38) total body length in male, 0.38–0.44 (mean = 0.41) in female. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence and scutellum revealing underlying black ground color. In dorsal view, only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well, especially in the female. Faint white pruinose stripes on presutural scutum leaving 4 or 5 black vittae; the inner 2 or 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae (Fig. 21). Postpronotum with 2 setae, rarely with 1 small additional seta. Katepisternum with 2 setae. Scutum with 1 presutural acrostichal seta, rarely with 1 additional small seta; 3 postsutural acrostichal setae, rarely with only 2; 2 presutural and 2 postsutural dorsocentral setae, occasionally with 1 and 2 additional small setae respectively; 1 presutural and 3 postsutural intra-alar setae; 1 presutural and 2 postsutural supra-alar setae, first postsutural supra-alar absent. Scutellar discal setae usually absent, but sometimes with 1 small hair-like pair of setae.

Legs black (Fig. 26), rarely with front and hind tibiae dark yellowish. Tarsal claws longer than 5th tarsomere in male and shorter than 5th tarsomere in female. Fore claw length 1.04–1.27 (mean = 1.11) length of fore 5th tarsomere in male, 0.79–0.94 (mean = 0.88) in female. Hind tibia with 2 well-developed posterodorsal setae, rarely with 1 additional shorter seta; usually 5 well-developed anteroventral setae, but varied from 3 to 7. Wing usually dark fumose at r_1 and r_{2+3} cells; and light fumose at c, sc, r_{4+5}, and dm cells. Wing vein R_{4+5} dorsally with 1–4 setae at base. Vein M smoothly curved at bend and ending at wing margin anterior to wing tip separately from vein R_{4+5}.

Abdomen (Figs. 21, 26): Ovoid in female and more elongate in male. Mostly bright yellow in dorsal view with a narrow black vitta medially on tg1+2 to tg5 merging with black transverse bands on anterior 1/4 of tg1+2, posterior 1/4 to 1/5 of tg3, posterior 2/3 of tg4, and usually 3/4 of tg5 (rarely full black or yellowish) in male. Tg5 mostly yellow in female. Transverse bands of sparse white pruinosity not sharply demarcated (appearing almost invisible to the naked eye) on anterior 1/4 of tg3 and tg4 and on anterior 1/3–1/2 of tg5. Mid-dorsal depression of tg1+2 not reaching median marginal setae (Fig. 21). Discal setae absent, 1 pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5 (usually 4 pairs of well-developed setae on tg4 and tg5), and 1 pair of lateral marginal setae on tg1+2 and tg3.

Male terminalia (N = 7) (Figs. 38, 52, 66): Sternite 5 with median cleft smoothly U-shaped, inner margin with minute setae, apical lobes rounded apically, and anterior margin of basal plate slightly concave (Fig. 38). Apical lobe of st5 0.61–0.67 (mean = 0.64) st5 length. Surstylus bare, in lateral view almost straight. Surstylus and cercus subequal in length. Cercus in lateral view straight along anterior surface and slightly concave on posterior surface, ending in a nearly truncate tip. In posterior view, cerci narrowly constricted on apical 1/3; length of the upper lobes almost equal to the medial section and longer than the apical cleft. Apices of the cerci linear, with rounded tips directed distally. Length of upper lobe of cercus 0.33–0.42 (mean = 0.38) cercus length, medial section 0.33–0.52 (mean = 0.40) cercus length (Figs. 52, 66).

Female terminalia (N = 2) (Figs. 75–77, 81): Sternite 5 rectangular-shaped, middle of anterior margin with a slightly concave curve, covered with well-developed setae on more than posterior 2/3 (Fig. 75). Width of st5 0.51–0.56 (mean = 0.54) the length. Sternite 6 with several well-developed setae on posterior corners (Fig. 76). Tergite 6 well developed, present as two lateral sclerites, uniform in width, with strong setae along posterior margin. Sternite 7 with a distinctive lobe on the medial section of the anterior margin, with several small setae on posterior sides (Fig. 77). Tergite 7 present as two lateral sclerites, with small setae along posterior margins (Fig. 81). Sternite 8 small and bare, almost round, difficult to distinguish from the surrounding membrane. Tergite 8 bare, well developed laterally, strongly narrowed dorsally, joining at the ventral end with the postgenital plate. Tergite 10 between the cerci, small and bare, rhomboid in shape. Postgenital plate with several small setae on posterior tip. Cercus slightly clavate with several setae apically (Fig. 81).

Host: Unknown.

Geographic distribution and seasonal occurrence

Widely distributed, from Costa Rica to northern Argentina (Fig. 113). There is a large geographic gap between the specimens collected in Costa Rica and those from southern Brazil that is probably due to the lack of

collecting effort between these two areas. This species occurs at both low elevations (e.g., Santa Catarina, Brazil, 300–500 m) and moderately high elevations (e.g., Monteverde, Costa Rica, 1500–1800 m). However, the tachinid fauna of the eastern Andes of Ecuador (2000–2600 m) has been sampled for several years and this species has not been collected, suggesting that it may not occur above ~2000 m. Specimens from Brazil were collected throughout the year, but 57% were collected in November. Specimens from Costa Rica were collected from August to October, the specimen from Peru was collected in August, and the single specimen from Argentina was collected in March.

Discussion

As mentioned above in the recognition section, *E. leptoforceps* and *E. nigrithorax* can be reliably separated based on differences in the shape of the cerci and st5. In addition to these characters, there are two other differences in the male terminalia, (1) the shape of the surstylus is more rounded in *E. nigrithorax* and more rectangular in *E. leptoforceps*, and (2) the shape of the distiphallus, in general, varies between these two species (Figs. 52–53). However, the shapes of these structures vary intraspecifically such that some specimens exhibit intermediate states in the shape of surstylus and phallus. In contrast to males, it is extremely difficult to separate the females of these two species. There appear to be some slight differences between *E. leptoforceps* and *E. nigrithorax* in the shapes of sternites 5–7 and the cerci. However, variation in these structures is also present within these taxa. Therefore, females cannot be reliably separated at this time based on terminalia or other characters. Here, females are associated with males based primarily on their geographic distribution. The collection locality records of *E. nigrithorax* and *E. leptoforceps* suggests that these species exhibit allopatric or parapatric distributions (see previous section). Females used in the description of the species were collected in the same place and on the same dates as males of the same species. Still, the female descriptions should be used with some caution. Additional study is needed to separate females confidently. In addition, collection of specimens from El Salvador, Honduras and Nicaragua, where these two species may coexist, would be useful in corroborating the separation of these species and assessing variation between and within them.

***Erythromelana nigrithorax* (Wulp)**

(Figs. 8, 13, 22, 27, 39, 53, 67, 113)

Anisia nigrithorax Wulp, 1890: 197; Guimarães, 1971: 41.
Erythromelana nigrithorax: Wood, 1985: 39–40.

Type material

Lectotype male, by designation of Wood (1985: 94), labeled: “LECTO–/ TYPE [purple label]”, “Teapa/ Tabasco. [Mexico]/ Feb H.H.S.”, “B.C.A.. Dipt. II./ Anisia/ nigrithorax,/ v.d.W.”, “Central America./ Pres. by/ F.D. Godman./ O. Savin./ 1903–172.”, “LECTOTYPE ♂/ of Anisia/ nigrithorax Wulp/ designated 1979/ D.M. Wood”, “ Erythromelana/ nigrithorax (Wulp)/ det. Inclan D.J.” (BMNH).

Paralectotype, one female, labeled: “PARA–/ LECTO–/ TYPE [blue label]”, “♀”, “Atoyac,/ Vera Cruz. [Mexico]/ April H.H.S.”, “B.C.A.. Dipt. II./ Anisia/ nigrithorax,/ v.d.W.”, “Central America./ Pres. by/ F.D. Godman./ O. Savin./ 1903–172.”, “PARALECTOTYPE ♀/ of Anisia/ nigrithorax Wulp/ designated 1979/ D.M. Wood”, “Erythromelana/ nigrithorax (Wulp)/ det. Inclan D.J.”, “DI110BM [specimen ID number]” (BMNH).

Other material examined

Six males and four females. One female, labeled: “MEXICO Chiapas/ 8.9 km E. Rayon/ 19. IX. 1991/ M. Wood 1500 m”, “Erythromelana/ nigrithorax (Wulp)/ det. Inclan D.J.”, “DI59CA [specimen ID number]”, terminalia stored in glycerin in a microvial pinned below specimen (CNC). Six males and three females, as previous except location and date “ MEXICO GRO.-jcn/ Chichihualco–Filo/ de Caballo roads/ 15. VII. 92 M.Wood” and ID numbers “DI58CA [♀]”; “DI226CA [♀]”; “DI49CA [♂]”; “DI224CA [♂]”; “DI225CA [♂]”,terminalia stored in glycerin in a microvial pinned below specimen; “DI48CA [♂]”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); “DI50CA [♂]”, terminalia stored in glycerin in a microvial pinned below specimen (INBio); and “DI57CA [♀]”, terminalia stored in glycerin in a microvial pinned below specimen (JOS). One male,

"3–25–78/ monte Cristo/ El Salvador, CA [Central America]/ d.r. barger", " Urodexiini ?/ [D.R. Barger/ 78–4903]", "Erythromelana/ nigrithorax (Wulp)/ det. Inclan D.J.", "DI136NM", terminalia stored in glycerin in a microvial pinned below specimen (NMNH).

Recognition

This species is morphologically very similar to *E. leptoforceps* and can only be distinguished from it by differences in the male terminalia. The medial section of the cerci of *E. nigrithorax* (Wulp), viewed from the posterior, is notably wider than in the cerci of *E. leptoforceps*. In addition, the base of sternite 5 is narrower in *E. nigrithorax* than in *E. leptoforceps*. Information on the recognition of the female of *E. nigrithorax* and the distinction of this species from the remaining *Erythromelana* species are provided in the description of *E. leptoforceps*.

Redescription

Redescribed from 5 males and 4 females (including the male lectotype and the female paralectotype), unless otherwise noted as "N".

Length: 5.2–7.8 mm (mean = 6.98 mm) in male, 5.4–6.8 mm (mean = 6.35 mm) in female.

As described for *E. leptoforceps* sp. nov. except as follows:

Head (Figs. 8, 13): Eye moderately haired, ommatrichia about as long as 4 eye facets. Eye 0.84–0.93 (mean = 0.88) head height in male, 0.86–0.92 (mean = 0.89) in female. Vertex width 0.12–0.16 (mean = 0.14) head width in male, 0.15–0.17 (mean = 0.16) in female. Width of frontal vitta 0.27–0.41 (mean = 0.33) vertex width in male, 0.33–0.45 (mean = 0.39) in female. Length of first flagellomere 0.41–0.50 (mean = 0.47) head height in male, 0.39–0.47 (mean = 0.42) in female. Width of first flagellomere 0.20–0.25 (=0.22, N = 10) head length in male, 0.21–0.24 (mean = 0.22, N = 5) in female. Pedicel length 0.27–0.31 (mean = 0.29) length of first flagellomere in male, 0.27–0.37 (mean = 0.31) in female. Fronto-orbital plate with 7–11 (m = 10) medioclinate frontal setae in male, 4–6 (m = 6) in female. Parafacial width 0.03–0.05 (mean = 0.04) head length in male (N = 10) and female (N = 5), and 0.14–0.25 (mean = 0.18, N = 10) first flagellomere width in male, 0.17–0.23 (mean = 0.19, N = 5) in female. Height of haired portion of facial ridge 0.11–0.21 (mean = 0.16) head height in male, 0.12–0.16 (mean = 0.14) in female. Palpus brown-yellowish, apex slightly broadened; length 0.27–0.29 (mean = 0.28) head height in male, 0.28–0.31 (mean = 0.29) in female.

Thorax (Figs. 22, 27): Dorso-central length 0.34–0.42 (mean = 0.37) total body length in male, 0.33–0.41 (mean = 0.39) in female. Faint white pruinose stripes on presutural scutum leaving 4 black vittae on males and females, rarely 5 black vittae on females (Fig. 22). Postpronotum with 2 setae, usually with one small additional seta in males. Scutum with 2 presutural acrostichal seta, if only 1 seta then usually accompanied by 1 additional small seta; 3 postsutural acrostichal setae. Scutellar discal setae usually comprised of 1 pair of hair-like setae, but setae sometimes absent.

Legs black (Fig. 27). Fore claw length 1.20–1.36 (mean = 1.21, N = 4) length of fore 5th tarsomere in males, 0.73–0.95 (mean = 0.85) in females. Hind tibia with only 2 well-developed posterodorsal setae; usually 4–5 well-developed anteroventral setae, but varied from 3 to 6. Wing vein R_{4+5} dorsally with 3 setae at base, but varied from 2–4 setae.

Abdomen (Figs. 22, 27): Mostly bright yellow in dorsal view with a narrow black vitta medially on tg1+2 to tg5 merging with black transverse bands on anterior 1/4 of tg1+2, posterior 1/5 to 1/4 of tg3, posterior 2/3 of tg4, and usually 3/4 of tg5 (rarely full black) in male (Fig. 22). Female similar to males, but black transverse bands on posterior 1/3 to all of tg4, and fully black or yellow on tg5. Transverse bands of sparse white pruinosity not sharply demarcated on anterior 1/4 of tg3, 1/4 to 1/3 of tg4, and usually well differentiated on anterior 1/2 to all of tg5.

Male terminalia (N = 4) (Figs. 39, 53, 67): Apical lobes of sternite 5 0.63–0.70 (mean = 0.66) st5 length (Fig. 39). Surstylus slightly widened distally with a rounded tip. Cercus in lateral view with the anterior and posterior surface of the tip almost parallel-sided. In posterior view, length of upper lobes of cerci shorter than medial section and almost equal to the apical cleft. Length of upper lobe 0.15–0.19 (mean = 0.18) cercus length, medial section 0.49–0.69 (mean = 0.60) cercus length (Figs. 53, 67).

Female terminalia (N = 2) (as in Figs. 75–77, 81): Sternite 5 rectangular-shaped, usually with the posterior section slightly wider and anterior margin almost flat. Width of st5 0.56–0.72 (mean = 0.64) the length. Sternite 6 length 0.62–0.74 (mean = 0.68) st5 length. Cerci slightly curved medially.

Host: Unknown.

Geographic distribution and seasonal occurrence

Erythromelana nigrithorax has been collected primarily from southern Mexico with one specimen from El Salvador (Fig. 113). The gap between the specimens collected from Mexico and El Salvador suggests the presence of this species in Guatemala as well. The closely related species, *E. leptoforceps*, has been collected in Costa Rica, and it is not clear if or where these species coexist. This species occurs at both low elevations (e.g., Teapa, Mexico, 100–300 m) and high elevations (e.g., Monte Cristo, El Salvador, 1800–2300 m). Specimens from Mexico were collected in February, April, July, and September, and the specimen from El Salvador was collected in March.

Discussion

See discussion section of *E. leptoforceps.*

***Erythromelana curvifrons* Inclan sp. nov.**

(Figs. 2, 4, 9, 14, 23, 28, 35, 48, 63, 85, 89, 100, 104)

Type material

Holotype male, labeled: “Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED/ January 2006/ 11280 [rearing record]”, “HOLOTYPE/ Erythromelana/ curvifrons/ Inclan D.J. [red label]” (CNC). Puparium pinned below specimen.

Allotype female, labeled: “Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED/ April 2006/ 14245 [rearing record]”, “ALLOTYPE/ Erythromelana/ curvifrons/ Inclan D.J. [red label]” (CNC). Puparium pinned below specimen.

Paratype, one male, labeled: “Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED/ January 2006/ 11279 [rearing record]”, “PARATYPE/ Erythromelana/ curvifrons/ Inclan D.J. [yellow label]” (JOS). Puparium and terminalia stored in glycerin in a microvial pinned below specimen.

Etymology

From the Latin *curvus* and *frons* meaning bent or curved forehead, in reference to the curvature of the frontal orbital plate compared to other *Erythromelana* species.

Recognition

Erythromelana curvifrons is morphologically similar to the related species with yellow abdomens in the *E. jaena* species group (*E. jaena, E. abdominalis*, *E. ecuadoriana* and *E. eois*). In general, this species can be separated from all the species in the *E. jaena* and *E. cryptica* species groups by the curvature of the fronto-orbital plate and the extremely narrow frontal vitta. Additionally, *E. curvifrons* can be distinguished from all the species in the *E. cryptica* species group by the yellow abdominal coloration.

Description

Described from 2 males and 1 female, 1 puparium and cephalopharyngeal skeletons from second and third instar larvae; unless otherwise noted as “N”.

Length: 6.4–6.8 mm (mean = 6.6 mm) in male, 6.5 mm in female.

Head (Figs. 2, 4, 9, 14): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with silver pruinescence (which could appear grayish from certain angles) restricted mostly to the fronto-orbital plate, vertex with weak golden pruinescence visible only in lateral view. Arista black with brown-yellowish on basal 1/4, thickened only on basal 1/5. Eye moderately long-haired in male, sparser and shorter in female; ommatrichia about as long as 3 eye facets in male, 2 in female. Eye 0.89 head height in male, 0.90 in female. Vertex width 0.13–0.14 (mean = 0.13) head width in male, 0.13 in female. Width of

frontal vitta 0.14–0.15 (mean = 0.15) vertex width in male, 0.21 in female. Length of first flagellomere 0.41–0.43 (mean = 0.42) head height in male, 0.42 in female. Width of first flagellomere 0.20–0.24 (mean = 0.22) head length in male, 0.21 in female. Pedicel length 0.28–0.29 (mean = 0.28) length of first flagellomere in male, 0.26 in female. Fronto-orbital plate with 9–10 medioclinate frontal setae in male, 6–7 in female; 2 reclinate inner orbital setae (sometimes with 1 extra small setae); female with 2 proclinate outer orbital setae, male without outer orbitals. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter barely differentiated from the row of postocular setae (especially in male). Ocellar setae absent. Parafacial bare and extremely narrow, the narrowest point approximately equal to the width of the thickened section of the arista in both sexes. Parafacial width 0.04–05 (mean = 0.4) head length in male, 0.03 in female and 0.15–0.23 (mean = 0.19) first flagellomere width in male, 0.13 in female. Facial ridge haired on basal 1/5 or less. Height of haired portion of facial ridge 0.13 (mean = 0.13) head height in male, 0.08 in female. Palpus yellow; sparsely haired with base usually bare; almost uniform in width; length 0.28–0.31 (mean = 0.30) head height in male.

Thorax (Figs. 23, 28): Dorsocentral length 0.38–0.40 (mean = 0.39) total body length in male, 0.39 in female. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view only the presutural scutum appears slightly grayish; where in lateral view the postsutural scutum appears slightly grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae; the inner 2 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae (Fig. 23). Postpronotum with 2 setae. Katepisternum with 2 setae. Scutum with 1 postsutural and 3 presutural acrostichal setae; 2 presutural dorsocentral setae, usually with 1 additional small setae; 2 postsutural dorsocentral setae, usually with 1 or 2 additional small setae; 1 presutural and 3 postsutural intra-alar setae; 1 presutural and 2 postsutural supra-alar setae, first postsutural supra-alar absent. Scutellum with discal setae usually absent or with 1 pair of small hair-like setae.

Legs black with front and hind tibiae yellowish (Fig. 28). Tarsal claws longer than 5th tarsomere in male and shorter than 5th tarsomere in female. Fore claw length 1.04–1.08 (mean = 1.06) length of fore 5th tarsomere in male, 0.67 in female. Hind tibia with 2 well-developed posterodorsal setae, sometimes with 1 additional small seta; usually with 4 or 5 well-developed anteroventral setae. Wing vein R_{4+5} dorsally with 3 setae at base. Vein M smoothly curved at bend, ending at wing margin, almost at wing tip, separately from vein R_{4+5}.

Abdomen (Figs. 23, 28): Bright yellow with black on the anterodorsal margin and the mid-dorsal depression of tg1+2. Transverse white pruinose bands absent (Fig. 23). Discal setae absent, 1 pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, and 1 pair of lateral marginal setae on tg1+2 and tg3.

Male terminalia (N = 1) (Figs. 35, 48, 63): Sternite 5 with narrow median cleft nearly V-shaped, inner margin with minute setae, apical lobes rounded apically, and anterior margin of basal plate slightly concave (Fig. 35). Apical lobes of st5 0.64 st5 length. Surstylus in lateral view slightly concave on posterior margin. Surstylus and cercus subequal in length. In lateral view, cercus straight along anterior surface, with anterior corner forming a nearly right angle; slightly concave on posterior surface forming a rounded posterior corner. In posterior view, cerci narrowly constricted on nearly apical 1/2; length of upper lobes longer than medial section and almost double the length of the apical cleft; apical cleft well defined; and apices of the cerci linear, with rounded tips directed medially. Length of upper lobe of cercus 0.39 cercus length, medial section 0.35 cercus length (Figs. 48, 63).

Female terminalia: Not examined.

Puparium (N = 1) (Figs. 85, 89): Similar to the puparium of *E. jaena*. The major difference is that the posterior spiracles are more ovoid in *E. curvifrons* and more rounded in *E. jaena*. The three slits of the posterior spiracular discs are very similar between these species, but are longer and straighter in *E. curvifrons* than in *E. jaena*.

Cephalopharyngeal skeleton (N = 1) (Figs. 100, 104): Cephalopharyngeal skeletons from the second and last instars were found in the remains of the larva of the caterpillar and inside the puparium, respectively. The second instar skeleton is similar to that of the last instar, but the mouth hooks are more pronounced, the dorsal cornu is smaller and the ventral cornu lacks an anterior projection. Mouth hooks of the third instar are rounded in shape relative to the more angulate mouth hooks of *E. jaena*.

Host: Three specimens were reared from unknown geometrid caterpillars (probably *Eois* sp). Specifically, two males were reared from caterpillars that were collected from YBS on an unidentified species of *Piper*. The first and second instar caterpillars were collected on 6th January 2006 and the tachinid pupae were noticed 16 days later. Adult flies were observed 29 and 31 days after puparium were first observed, respectively. The single female was reared from a caterpillar that was collected from YBS on the host plant *Siparuna pyricarpa* (Monimiaceae). The

second instar caterpillar was collected on 18th April 2006 and the fly puparium was noticed 19 days later, with the adult emerging 26 days later.

Geographic distribution and seasonal occurrence

All the specimens were collected in the province of Napo, Ecuador at 2000–2600 m. The presence of the specimens collected in high elevations, suggest that this species could be distributed more widely along the Andes Mountains in South America. The males were reared in January, and the female was reared in April (see host section).

Discussion

Ideally, the description of a species should be based on a long series of specimens. Here, this species is described based on two males and a single female because of the unique non-terminalic and terminalic features. As described in the recognition section, *E. curvifrons* is easily separated from other *Erythromelana* species based on the curvature of their fronto-orbital plate and their narrow frontal vitta. In addition, the male terminalia has a distinctive shape in which the cercus, in lateral view, is straight along the anterior surface forming a nearly right angle at the end of the cercus; and the cerci, in posterior view, have long upper lobes, longer than the medial section and almost double the length of the apical cleft. Therefore, there is no doubt that these specimens are distinct from the other *Erythromelana* species. However, given the few specimens examined in this description, it remains unknown how much variation exists among individuals of this species. Because of these circumstances, this description should be used with some caution. Additional study of a larger sample of specimens is needed to evaluate variation in each character presented in this description.

***Erythromelana ecuadoriana* Inclan sp. nov.**

(Figs. 36, 49, 64, 86, 90, 93, 105)

Type material

Holotype male, labeled: “Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED/ Feb [February] 2009/ 37297 [rearing record]”, “HOLOTYPE/ Erythromelana/ ecuadoriana/ Inclan D.J. [red label]” (CNC). Puparium stored in glycerin in a microvial pinned below specimen.

Allotype female, labeled: “Ecuador: Napo [Province]/ 7 km. S [south] Baeza/ 20–25. II. 79/ G. & M. Wood 2000 m”, “ALLOTYPE/ Erythromelana/ ecuadoriana/ Inclan D.J. [red label]” “DI06CA” (CNC).

Paratype, one male, labeled: “Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ Pan Traps/ 4–11 Feb 2008”, “PARATYPE/ Erythromelana/ ecuadoriana/ Inclan D.J. [yellow label]”, “DI03PT” (JOS). Terminalia stored in glycerin in a microvial pinned below specimen.

Etymology

Named after the country, Ecuador, where all known specimens have been collected.

Recognition

Erythromelana ecuadoriana is morphologically similar to other species with yellow abdomens in the *E. jaena* species group (*E. jaena*, *E. abdominalis*, *E. curvifrons*, and *E. eois*). In general, this species can be separated from most other *Erythromelana* species by the presence of a row of setae on the apical half of the vein R_1. *Erythromelana distincta* is the only species that also has the R_1 vein setose, but this species is easily distinguished by the yellow and black abdominal coloration characteristic of the *E. cryptica* species group. Additionally, this is the only *Erythromelana* species where tarsal claws are shorter than the 5th tarsomere in both males and females.

Description

Described from 2 males and 1 female, 1 puparium and a cephalopharyngeal skeleton from the third instar larvae; unless otherwise noted as “N”.

Length: 5.6–6.1 mm (mean = 5.9 mm) in male, 5.8 mm in female.

Head (as in Figs. 6, 11): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate black in ground color covered with silver pruinescence, which appears grayish from certain angles. Vertex

black with faint golden reflections visible only in lateral view. Arista black with dark brown on basal 1/4, thickened only on basal 1/5. Eye sparsely haired, ommatrichia about as long as 4 eye facets in male and female. Eye 0.83–0.84 (mean = 0.83) head height in male, 0.84 in female. Vertex width 0.20–0.21 (mean = 0.21) head width in male, 0.19 in female. Width of frontal vitta 0.44–0.50 (mean = 0.47) vertex width in male, 0.47 in female. Length of first flagellomere 0.56–0.59 (mean = 0.58) head height in male, 0.47 in female. Width of first flagellomere 0.27 head length in male and female. Pedicel length 0.19–0.22 (mean = 0.21) length of first flagellomere in male, 0.3 in female. Fronto-orbital plate with 5–6 medioclinate frontal setae in male, 4–5 in female; 2 reclinate inner orbital setae in male, 1 in female; female with 2 proclinate outer orbital setae, male without outer orbitals. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta; the latter smaller than the inner setae, but well differentiated from the row of postocular setae in both sexes. Ocellar setae well developed, proclinate. Parafacial bare and extremely narrow, with the narrowest point narrower than the width of maxillary palpus at base in both sexes. Parafacial width 0.05 head length in male, 0.06 in female, and 0.20 first flagellomere width in male, 0.28 in female. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.14–0.16 (mean = 0.15) head height in male, 0.19 in female. Palpus yellow, usually dark yellowish at base; distally sparsely haired in female, dorsally almost bare in male; apex slightly broadened; length 0.35–0.36 (mean = 0.35) head height in male, 0.35 in female.

Thorax (as in Figs. 20, 25): Dorsocentral length 0.35–0.38 (mean = 0.37) total body length in male, 0.37 in female. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view, only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae in male, 5 in female; the inner 2 or 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Postpronotum with 2 setae. Katepisternum with 2–3 setae; the lower hair-like in male, absent in female. Scutum with 1 presutural acrostichal seta, with 1 additional small seta; 2 postsutural acrostichal setae in male, 1 in female; 2 presutural dorsocentral setae, with 1 additional small seta; 2 postsutural dorsocentral setae, with 1 or 2 additional small setae; 1 presutural and 3 postsutural intra-alar setae; 1 presutural and 2 postsutural supra-alar setae, first postsutural supra-alar absent. Scutellum with discal setae absent or with 1 pair of small hair-like setae.

Legs black, usually with the mid section of the tibiae dark yellowish. Tarsal claws shorter than the 5th tarsomere in male and female. Fore claw length 0.74–0.79 (mean = 0.77) length of fore 5th tarsomere in male, 0.77 in female. Hind tibia with 2 well-developed posterodorsal setae, 5–7 well-developed anteroventral setae. Wing usually dark fumose at sc, r_1 and r_{2+3} cells; and light fumose at c and r_{4+5} cells. Wing vein R_1 dorsally setose on apical half and vein R_{4+5} dorsally with 2–3 setae at base. Vein M smoothly curved at bend and ending at wing margin close to wing tip separately from vein R_{4+5}.

Abdomen (as in Figs. 20, 25): Completely bright yellow, white pruinose transverse bands absent. Mid-dorsal depression of tg1+2 not reaching median marginal setae. Discal setae absent, 1 pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, and 1 pair of lateral marginal setae on tg1+2 and tg3.

Male terminalia (N = 1) (Figs. 36, 49, 64): Sternite 5 with median cleft smoothly U-shaped, inner margin with minute setae, apical lobes narrowly rounded apically and directed laterally, and anterior margin of basal plate slightly concave (Fig. 36). Apical lobes of st5 0.64 st5 length. Surstylus bare, in lateral view, slightly concave on anterior and posterior margins, broadened distally and spatulate in shape. Surstylus and cercus subequal in length. Cercus, in lateral view, slightly concave on anterior and moderately concave on posterior margin, ending in a rounded tip. In posterior view, cerci slightly constricted on apical 1/3; upper lobes shorter than length of medial section and almost equal in length to the apical cleft; apical cleft well defined; and apices of the cerci linear, with rounded tips directed medially. Length of upper lobe 0.32 cercus length, medial section 0.43 cercus length (Figs. 49, 64).

Female terminalia: Not examined.

Puparium (N = 1) (Figs. 86, 90, 93): Posterior spiracles slightly raised from the surface of the puparium. The slits of each posterior spiracular disc are located in the upper part of the disc and are almost straight. The entire puparium is covered by bands of long hair-like spinules.

Cephalopharyngeal skeleton (N = 1) (Fig. 105): A cephalopharyngeal skeleton from the final instar was found inside one puparium. The morphology is similar to *E. jaena*, but with differences in the shape of the mouth hooks (ventral process more distinct), the intermediate region (ventral spur weakly developed), the thicker dorsal cornu and the ventral cornu with a more weakly developed dorsal process.

Host: A single male was reared from an *Eois* sp. caterpillar collected from YBS on an unidentified *Piper* species. The second instar caterpillar was collected on 28th February 2009; the puparium was noticed 19 days later, and the adult fly was found 27 days later.

Geographic distribution and seasonal occurrence

All specimens were collected in the vicinity of YBS in the province of Napo, Ecuador at 2000–2600 m. All specimens were collected in February. One male was reared (see host section), the other male was collected with a yellow pan trap, and the female was hand collected.

Discussion

As described in the recognition section, *E. ecuadoriana* can be easily separated from other *Erythromelana* species based on the presence of setae on the R_1 vein and the yellow abdominal coloration. In addition, the male terminalia has a distinctive shape: sternite 5 has the apical lobe narrowly rounded and pointing laterally; the surstyli, in lateral view, are spatulate in shape; and the cerci, in posterior view, has upper lobes that are shorter than the medial section and subequal to the apical cleft in length. Given these unique characteristics, this species is described as new even though only two males and a single female were available for study.

***Erythromelana eois* Inclan sp. nov.**

(Figs. 37, 50, 65)

Type material

Holotype male, labeled: "Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′/ 2163 M [meters], 27–May–2 Jun 2005/ J.O. Stireman III", "HOLOTYPE/ Erythromelana/ eois/ Inclan D.J. [red label]", "DI5+6+2a [specimen ID number]" (CNC). Terminalia stored in glycerin in a microvial pinned below specimen.

Allotype female, labeled: "Ecuador: Napo prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′ 2163 m/ REARED 26–viii–06/ J.O. Stireman III 16608[rearing record number]", "Allotype/ Erythromelana/ eois/ Inclan D.J. [red label]" (CNC). Puparium stored in glycerin in a microvial pinned below specimen.

Paratype, one female, labeled: "Ecuador: Napo Prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED/ November 2005/ 9772 [rearing record number]", "PARATYPE/ Erythromelana/ eois/ Inclan D.J. [yellow label]" (CNC). Puparium pinned below specimen.

Etymology

Named after the genus of its lepidopteran host, *Eois* Hübner (Lepidoptera: Geometridae).

Recognition

Erythromelana eois is morphologically similar to the related species with yellow abdomens in the *E. jaena* species group (*E. jaena*, *E. abdominalis*, *E. ecuadoriana* and *E. curvifrons*). In general, this species can be separated from the species in the *E. jaena* group by the presence of 3 katepisternal setae and the long palpus that is bare anteroventrally. *Erythromelana ecuadoriana* is the only other species in the *E. jaena* group that sometimes possesses 3 katepisternal setae, but this species can be separated from *E. eois* by the presence of setae on the vein R_1. *Erythromelana eois* can be distinguished from all species in the *E. cryptica* species group by the completely yellow abdomen.

Description

Described from 1 male and 2 females, unless otherwise noted as "N".

Length: 7.08 mm in male, 6.2–6.8 mm (mean = 6.50 mm) in female.

Head (as in Figs. 6, 11): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence (appearing grayish from certain angles), with faint golden reflections visible only in lateral view. Arista black with dark brown on basal 1/5,

thickened only on basal 1/6. Eye densely haired in male, sparsely in female; ommatrichia about as long as 4 eye facets in male, 3 in female. Eye 0.88 head height in male, 0.82–0.89 (= 0.86) in female. Vertex width 0.18 head width in male, 0.20 (mean = 0.20) in female. Width of frontal vitta 0.48 vertex width in male, 0.33–0.45 (mean = 0.39) in female. Length of first flagellomere 0.50 head height in male, 0.51–0.60 (mean = 0.55) in female. Width of first flagellomere 0.25 head length in male, 0.28–0.29 (mean = 0.28) in female. Pedicel length 0.23 length of first flagellomere in male, 0.22–0.26 (mean = 0.24) in female. Fronto-orbital plate with 8 medioclinate frontal setae in male, 4–5 in female; 2 reclinate inner orbital setae; female with 1 or 2 proclinate outer orbital setae, male without outer orbitals. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter barely differentiated from the row of postocular setae (especially in male). Ocellar setae proclinate, reduced and hair-like. Parafacial bare and extremely narrow with the narrowest point narrower than the width of maxillary palpus at base in both sexes. Parafacial width 0.05 head length in male, 0.04–0.05 (mean = 0.04) in female, and 0.19 first flagellomere width in male, 0.15–0.17 (mean = 0.16) in female. Facial ridge, in lateral view, nearly straight (especially in female). Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.15 head height in male, 0.13–0.21 (mean = 0.17) in female. Palpus yellow; sparsely covered with hair-like setae distally with dorsal section usually bare in males, and setae restricted to the lateral basal section in females; apex substantially broadened (especially in females); length 0.32 head height in male, 0.33–0.34 (mean = 0.34) in female.

Thorax (as in Figs. 20, 25): Dorsocentral length 0.33 total body length in male, 0.35–0.37 (mean = 0.36) in female. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view, only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae; the inner 2 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Middle of prosternum often with several hair-like setae. Postpronotum with 2 setae, sometimes with 1 small additional seta. Katepisternum with 3 setae, the lower hair-like. Scutum with 2 presutural acrostichal seta, sometimes with 1 additional small seta; 3 or 2 postsutural acrostichal setae; 2 presutural dorsocentral setae, sometimes with 1 additional small seta; 3 postsutural dorsocentral setae; 1 presutural and 3 postsutural intra-alar setae; 1 presutural supra-alar setae, sometimes with 1 additional small setae; 2 postsutural supra-alar setae, first postsutural supra-alar absent. Scutellum with 1 pair of small hair-like discal setae.

Legs black in male, sometimes with front and hind tibiae dark yellowish in female. Tarsal claws longer than 5th tarsomere in male and shorter than 5th tarsomere in female. Fore claw length 1.14 length of fore 5th tarsomere in male, 0.68–0.81 (mean = 0.75) in female. Hind tibia with 2 well-developed posterodorsal setae; anteroventral surface with 6 to 9 well-developed setae. Wing usually dark fumose at r_1 and r_{2+3} cells; and light fumose at c, sc, r_{4+5}, and dm cells. Wing vein R_{4+5} dorsally with 1–4 setae at base. Vein M smoothly curved at bend and ending at wing margin close to wing tip separately from vein R_{4+5}.

Abdomen (as in Figs. 20, 25): Fully bright yellow in male and female. Transverse pruinose bands absent. Mid-dorsal depression of tg1+2 not reaching median marginal setae. Discal setae absent, 1 pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, and 1 pair of lateral marginal setae on tg1+2 and tg3.

Male terminalia (Figs. 37, 50, 65): Sternite 5 with median cleft smoothly U-shaped, inner margin with minute setae, apical lobes broadly rounded apically, and anterior margin of basal plate concave (Fig. 37). Length of apical lobes of st5 0.60 st5 length. Surstylus bare, in lateral view, almost parallel-sided, and ending in a rounded tip. Surstylus and cercus similar in length, the cercus slightly longer. Cercus in lateral view slightly concave on anterior and posterior margins, ending in a broad rounded tip. In posterior view, length of upper lobe slightly shorter than medial section and slightly longer than the length of the apical cleft; apices of the cerci curved, with tips directed medially. Length of upper lobe of cercus 0.32 cercus length, medial section 0.41 cercus length (Figs. 50, 65).

Female terminalia (N = 1) (as in Figs. 75–77, 81): Sternite 5 rectangular-shaped, anterior margin slightly concave, covered with well-developed setae on more than posterior 2/3. Width of st5 0.57 the length. Sternite 6 with several well-developed setae on posterior corners. Tergite 6 well developed, present as two lateral sclerites with strong setae along posterior margin. Sternite 7 with a distinctive lobe on the medial section of the anterior margin, with several small setae on posterior corners. Tergite 7 present as two lateral sclerites, with small setae along posterior margins. Sternite 8 absent. Tg8 bare, well developed laterally, strongly narrowed dorsally, joining ventrally with the postgenital plate. Tergite 10 between the cerci, small and bare, rhomboid in shape. Postgenital plate with several small setae on posterior tip. Cerci slightly narrowed at bases, with several setae apically.

Host: Two females were reared, one from an unknown geometrid (probably *Eois* sp.) and one from an *Eois* sp. caterpillar. The first female was reared from a caterpillar collected from YBS on the host plant *Piper schuppii* Gentry (Piperaceae). The third instar caterpillar was collected on 20 November 2005, the puparium was observed 14 days later, and the adult fly was observed 30 days later. The second female was reared from a caterpillar that was collected from the Arenillas cloud forest (Napo, Ecuador, 00°33.721′S, 077°51.940′W) on another unidentified *Piper* species. The fourth instar caterpillar was collected on 19 June 2006 and the adult fly was found 68 days later.

Geographic distribution and seasonal occurrence

All specimens are from the province of Napo, Ecuador at 2000–2600 m. The male was collected in May, and the two females were reared in August and November.

Discussion

As described in the recognition section, *E. eois* can be separated from other *Erythromelana* species based on the presence of 3 katepisternal setae, palpus uniquely-shaped and with reduced setae, and fully yellow abdomen. In addition, several structures of the male terminalia have a distinctive shape: the cercus is not narrowly constricted on the apex as in other species in the *E. jaena* species group, and the length of the medial section is longer than that of the upper lobes.

ERYTHROMELANA CRYPTICA SPECIES GROUP

Erythromelana cryptica Inclan sp. nov.

(Figs. 15, 16, 29, 30, 43, 57, 71, 83, 91, 96, 97–99, 101, 106, 114)

Type material

Holotype male, labeled: “VENEZUELA Aragua/ Rancho Grande/ 18–27.II.1971/ G.&M. Wood 1100 m”, “HOLOTYPE/ Erythromelana/ cryptica/ Inclan D.J. [red label]”, “DI477CA [specimen ID number]” (CNC). Terminalia stored in glycerin in a microvial pinned below specimen.

Paratypes, 16 males. **Venezuela**: Four males, same data as the holotype except “PARATYPE/ Erythromelana/ cryptica/ Inclan D.J. [yellow label]”, and ID numbers “DI37CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); “DI472CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); and “DI476CA” terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Ecuador**: two males, “ECUADOR, Napo [Province]/ 7 km. s. [South] Baeza/ 22. II. 79 2000 m/ G. & M. Wood”, “DI488CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); and “DI27CA”, terminalia stored in glycerin in a microvial pinned below specimen (QCAZ). Two males, as previous except date “20–25.II.79”, and ID numbers “DI16CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); and “DI20CA”, terminalia stored in glycerin in a microvial pinned below specimen (JOS). One male, “Ecuador: Napo prov. [Province]/ Yanayacu Biological Station,/ S 00°35.9′ W 77°53.4′ 2163 m/ REARED/ Sep [September] 2007/ 26213 [rearing record number]”, puparium and terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Peru**: one male, “Oxipampa Peru/ 2–VIII 19”, “CHTTow’d/ coll”, “DI88NM” terminalia stored in glycerin in a microvial pinned below specimen (NMNH). **Bolivia**: one male, “BOLIVIA Cbba [Cochabamba] Chapare/ Villa Tunari-Cochabamba/ road-km 365–1800 m/ G. & M. Wood 3–10.XII.96”, “DI173MW”, terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Mexico**: two males, “MEXICO Chiapas/ Lagunas de Monte-/ bello 21.IX.1991/ D.M. Wood 1580 m”, “DI52CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC); and “DI51CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Costa Rica**: one male “Estacion Pitilla, 9km S. Santa Cecillia, P./ N. Guanacaste, Prov. Guanacaste, COSTA/ RICA, 700 m. 9–14 Jul 1993, Gredy,/ Diego, Carlos, Estudiantes, L N/ 330200_380200 #2319”, “COSTA RICA INBIO/ CRI001/ 955711” terminalia stored in glycerin in a microvial pinned below specimen (INBio). One male, “COSTA RICA, Cartago, Send. [Sendero]/ Rancho Negro. Puente Dos Amigos/ hasta la Represa. 1400–1800 m/ FEB 1997. R. Guzman./ L_N_186600_562000 #45462”, “COSTA RICA INBIO/ CRI002/ 536979”, terminalia stored in glycerin in a microvial pinned below specimen (INBio). One male, “17 III”, “COSTA RICA/ La Suiza’ 24/ P. Schild”, “ALMelander/ Collection/ 1961”, “DI85NM”, terminalia stored in glycerin in a microvial pinned below specimen (NMNH).

Etymology

Derived from the Greek *kryptos*, meaning hidden, in reference to the morphological similarity of this species with others in the *E. cryptica* species group.

Recognition

This species is morphologically very similar to *E. catarina*, *E. convexiforceps*, *E. arciforceps*, and *E. napensis*, and can only be distinguished from them by differences in the male terminalia. Therefore, females presently cannot be assigned to any of these species. This species, as well as *E. catarina* and *E. convexiforceps*, can be separated from *E. arciforceps* and *E. napensis* by the presence, in lateral view, of a raised carina on the medial section of the posterior margin of the cercus. *Erythromelana cryptica* can be separated from *E. convexiforceps* by the more gradually ending of the carina on the posterior margin of the cercus, which forms an obtuse angle; and by the apex that, in posterior view, points medially (although see Discussion). Additionally, *E. cryptica* can be distinguished from *E. catarina* and *E. convexiforceps* by the nearly truncate apical tip of the cercus (in lateral view). The other species in the *E. cryptica* species group, *E. distincta* and *E. woodi*, can be separated from this species, in addition to *E. catarina*, *E. convexiforceps*, *E. arciforceps*, and *E. napensis*, by the presence of setae on wing vein R_1 and narrow, dorsally bare palpus, respectively.

Erythromelana cryptica, and all the species in *E. cryptica* species group, can be separated from *E. jaena*, *E. abdominalis*, *E. curvifrons*, *E. ecuadoriana*, and *E. eois* by the mostly black abdominal color (although see discussion of *E. woodi*), in contrast to the bright yellow abdomen of species in the *E. jaena* group. In addition, *E. cryptica*, *E. catarina*, *E. convexiforceps*, *E. arciforceps*, and *E. napensis*, can be separated from the *E. jaena* species group (except *E. eois*) by the presence of three katepisternal setae. Finally, all species in the *E. cryptica* species group can be separated from all the species in the *E. jaena* species group by the presence of a dorsal depression or twist in the cercus and by the presence of long setae on the apical lobes of the 5th sternite (although see discussion of *E. woodi*).

Description

Described from 17 males, 1 puparium and cephalopharyngeal skeletons from second and third instar larvae; unless otherwise noted as “N”.

Length: 6.0–8.3 mm (mean = 7.09 mm).

Head (Figs. 15, 16): Parafacial brown in ground color covered with silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence (appearing grayish from certain angles), with faint golden reflections visible only in lateral view. Arista black with dark brown on basal 1/4, thickened only on basal 1/4–1/5. Eye densely haired with long ommatrichia, about as long as 5–7 eye facets. Eye 0.84–0.91 (mean = 0.89) head height. Vertex width 0.13–0.16 (mean = 0.14) head width. Width of frontal vitta 0.19–0.33 (mean = 0.25) vertex width. Length of first flagellomere 0.39–0.44 (mean = 0.42) head height. Width of first flagellomere 0.18–0.25 (mean = 0.20, N = 10) head length. Pedicel length 0.24–0.31 (mean = 0.28) length of first flagellomere. Fronto-orbital plate with 5–11 (m = 8) medioclinate frontal setae, 2 reclinate inner orbital setae, outer orbital setae absent. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter barely differentiated from the row of postocular setae. Ocellar setae proclinate. Parafacial bare and extremely narrow with the narrowest point equal to or narrower than the basal width of the palpus. Parafacial width 0.04–0.06 (mean = 0.05, N = 10) head length, and 0.18–0.31 (mean = 0.24, N = 10) first flagellomere width. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.11–0.25 (mean = 0.16) head height. Palpus dark yellowish, usually black at base; distally sparsely haired with dorsal base usually bare; almost uniform in width; length 0.26–0.36 (mean = 0.31) head height.

Thorax (Figs. 29, 30): Dorsocentral length 0.32–0.41 (mean = 0.36) total body length. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae, rarely 5; the inner 2 or 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae (Fig. 29). Postpronotum with 2 setae. Katepisternum with 3 setae. Scutum with 1 presutural and 1 postsutural acrostichal seta; 2 well-developed presutural dorsocentral setae, rarely with 1 additional small seta; 2 well-developed postsutural dorsocentral setae, usually with 2 additional small setae; 1 presutural and 3 postsutural

intra-alar setae; 1 presutural supra-alar setae; 3 postsutural supra-alar setae, rarely with the first postsutural supra-alar absent. First postsutural supra-alar seta similar in length and stoutness to the first postsutural dorsocentral seta. Scutellar discal setae absent.

Legs black (Fig. 30). Tarsal claws longer than 5th tarsomere. Fore claw length 1.04–1.36 (mean = 1.23) length of fore 5th tarsomere. Hind tibia with 2 well-developed posterodorsal setae, rarely with 1 or 2 additional shorter setae; usually 3 or 4 well-developed anteroventral setae. Wing usually light fumose at c, sc, r_1, r_{2+3}, r_{4+5}, and dm cells; rarely dark fumose at sc, and r_1 cells. Wing vein R_{4+5} dorsally with 2–4 setae at base. Vein M smoothly curved at bend and ending at wing margin anterior to wing tip separately from vein R_{4+5}.

Abdomen (Figs. 29, 30): Coloration varied, in dorsal view from fully black to mostly black with yellow. In dorsal view, tg1+2 completely black, rarely with yellow on 1/3 of anterolateral sides; tg3 with yellow on 3/4 of anterolateral sides, rarely fully black; tg4 with yellow on 1/3–1/2 of anterolateral sides, rarely fully black; tg5 fully black. Transverse bands of sparse white pruinosity present on anterior 1/3–1/4 of tg3 and tg4 and on anterior 2/3 of tg5. Mid-dorsal depression of tg1+2 not reaching median marginal setae (Fig. 29). One pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, 1 pair of lateral marginal setae on tg1+2 and tg3, and an irregular row of small discal setae on tg5.

Male terminalia (Figs. 43, 57, 71): Sternite 5 with median cleft V-shaped, inner margin with minute setae, apical lobes pointed apically, each with a single long well-developed seta, and anterior margin of basal plate slightly concave (Fig. 43). Apical lobe of st5 0.61–0.68 (mean = 0.65) st5 length. Surstylus with small hairs on inner and outer surfaces, in lateral view slightly concave along anterior and posterior margins resulting in a spatulate shape. Surstylus and cercus subequal in length. Cercus in lateral view concave on anterior margin; the medial section of the posterior margin weakly carinate, with the carina ending gradually before the nearly truncate apex, forming an obtuse angle. In posterior view, dorsal inner medial margins of the cerci with small pointed processes; cerci narrowed on apical 1/3; length of upper lobes almost equal to medial sections and to the length of the apical cleft; apical cleft well defined and internally twisted, and apices of the cerci curved, with tips directed medially. Length of upper lobe of cercus 0.33–0.48 (mean = 0.39) cercus length, length of medial section 0.28–0.40 (mean = 0.32) cercus length (Figs. 57, 71).

Female terminalia: Unknown.

Puparium (N = 1) (Figs. 83, 91, 97–99): Similar to the puparium of *E. jaena*. The major differences are in the shape of the slits of the posterior spiracles and its vestiture. In general, the slits of the posterior spiracles are nearly straight (Fig. 83), and the minute spinules that cover the puparium are arranged in lines (Figs. 98, 99) instead of bands of irregular cells (as in *E. jaena*).

Cephalopharyngeal skeleton (N = 1) (Figs. 101, 106): Second and third instar cephalopharyngeal skeletons were obtained from the remains of the host caterpillar and inside of the puparium, respectively. The mouth hooks of the second instar are well developed and hook-like, whereas in the last instar the mouth hooks are smaller and straighter. These mouth hooks are less distinct than in *E. jaena* group species and they lack a well-defined ventral process. The dorsal and ventral cornu are straighter in the second instar and broader in the last instar, similar to *E. curvifrons*. The ventral cornu is considerably longer than the dorsal cornu.

Host: A single male was reared from an *Eois* sp. nr. *nigricosta* caterpillar. The host caterpillar was collected from YBS on the host plant *Piper hispidum* Sw. (Piperaceae). The third instar caterpillar was collected on 13th September 2007, the puparium was noticed 17 days later and the adult fly was recorded 38 days later.

Geographic distribution and seasonal occurrence

Erythromelana cryptica exhibits one of the widest geographic distributions of all *Erythromelana* species. It has been collected from Mexico to Bolivia (fig. 113). There are large geographic gaps among the specimens collected. No specimens have been collected between Mexico and Costa Rica, and Venezuela and Ecuador probably due to the lack of collecting efforts in these areas. This species seems to occur at both low elevations (e.g., Guanacaste, Costa Rica, 700 m) and high elevations (e.g., Napo, Ecuador, 2000–2600 m). Specimens have been collected throughout the year: 2 specimens from Mexico were collected in September; 3 specimens from Costa Rica were collected in February, March, and July; 5 specimens from Venezuela were collected in February; 4 specimens from Ecuador were collected in February, and one specimen was reared in September; 1 specimen from Peru was collected in August; and 1 specimen from Bolivia was collected in December.

Discussion

As mentioned in the recognition section, male terminalia provide the only reliable characters to identify this species. There are no apparent differences in female terminalia that allow the matching of females with their respective male for most of the species in the *E. cryptica* species group. Additionally, males of these species exhibit overlapping geographic distributions prohibiting the separation of females based on locality information. *Erythromelana cryptica* is one of the most difficult species of the genus to identify. This is due to the confusing variation evident among the several specimens examined. The shape of the cercus was found to be the most important character defining species in this species group. However, there is considerable variation in the shape of the cercus and the surstylus among specimens. Specifically, the carina on the medial section of the posterior margin of the cercus (in lateral view) varies in shape and in the angle that it forms with the apical tip. This variation could represent the extremes of intraspecific variation or possibly different species that vary slightly in cercus shape. A few specimens of *Erythromelana* that seem to present extreme intraspecific variation, but insufficient variation to be effectively described as a distinct species, were excluded from the type series of this species. Therefore, future study of *E. cryptica*, including a larger collection of specimens, is needed in order to determine whether it consists of multiple cryptic species or is just a single, phenotypically variable species.

***Erythromelana catarina* Inclan sp. nov.**

(Figs. 41, 55, 69, 113)

Type material

Holotype male, labeled: “Nova Teutonia/ S. C. [Santa Catarina Province]-BRAZIL/ June 1970/ F. Plaumann”, “HOLOTYPE/ Erythromelana/ catarina/ Inclan D.J. [red label]”, “DI392CA [specimen ID number]” (CNC). Terminalia stored in glycerin in a microvial pinned below specimen.

Paratypes, four males, same data as the holotype except “PARATYPE/ Erythromelana/ catarina/ Inclan D.J. [yellow label]”, “DI410CA”, terminalia stored in glycerin in a microvial pinned below specimen (QCAZ); “II 1968”, “DI460CA”, terminalia stored in glycerin in a microvial pinned below specimen (NMNH); “Oct. 1970”, “DI408CA” (CNC); and “Feb. 1971”, “DI452CA” (CNC).

Etymology

Named after the Brazilian province, Santa Catarina, where all the specimens used in this description were collected.

Recognition

This species is morphologically very similar to *E. cryptica*, *E. convexiforceps*, *E. arciforceps*, and *E. napensis*, and can only be distinguished from them by differences in the male terminalia. *Erythromelana catarina* can be separated from *E. convexiforceps* by the more gradually curved ending of the carina on the medial section of the posterior margin of the cercus (in lateral view) that forms an obtuse angle; the cercal apex that (in posterior view) is directed medially, and by the narrower and less truncate surstylus. Additionally, *E. catarina* can be distinguished from *E. cryptica* by the narrower and more rounded apical tip of the cercus (in lateral view). Female unknown (see Discussion of *E. cryptica*). See the recognition section of *E. cryptica* for the distinction between *E. catarina* and the other species in the *E. cryptica* and *E. jaena* species group.

Description

Described from 5 males, unless otherwise noted as “N”.

Length: 5.8–6.1 mm (mean = 5.9 mm).

As described for *E. cryptica* except as follows:

Head (as in Figs. 15, 16): Parafacial brown in ground color covered with dull silver pruinescence. Arista black with dark brown on basal 1/4, thickened only on basal 1/5. Eye densely haired with ommatrichia about as long as 4–5 eye facets. Eye 0.87–0.91 (mean = 0.89) head height. Vertex width 0.16–0.17 (mean = 0.17) head width. Width

of frontal vitta 0.24–0.31 (mean = 0.27) vertex width. Length of first flagellomere 0.42–0.46 (mean = 0.44) head height. Width of first flagellomere 0.19–0.21 (mean = 0.20) head length. Pedicel length 0.27–0.30 (mean = 0.28) length of first flagellomere. Fronto-orbital plate with 5–7 (m = 7) medioclinate frontal setae. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter varied from well to barely differentiated from the row of postocular setae. Ocellar setae proclinate. Parafacial width 0.03–0.07 (mean = 0.05) head length, and 0.17–0.36 (mean = 0.25) first flagellomere width. Height of haired portion of facial ridge 0.12–0.19 (mean = 0.16) head height. Palpus dark yellowish with black at base, length 0.29–0.36 (mean = 0.32) head height.

Thorax (as in Figs. 29, 30): Dorsocentral length 0.34–0.39 (mean = 0.36) total body length. Faint white pruinose stripes on presutural scutum leaving usually 5 black vittae; the inner 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Scutum with 2 well-developed presutural dorsocentral setae; 2 well-developed postsutural dorsocentral setae, usually with 1 or 2 additional small setae; 1 presutural and 3 postsutural supra-alar setae, first postsutural supra-alar seta small. Fore claw length 1.05–1.25 (mean = 1.10) length of fore 5th tarsomere. Hind tibia with 3 well-developed anteroventral setae. Wing usually light fumose at c, sc, r_1, r_{2+3}, r_{4+5}, and dm cells.

Abdomen (as in Figs. 29, 30): Mostly black with yellow laterally. In dorsal view, tg1+2 complete black, tg3 with yellow on 3/4 of anterolateral sides, tg4 with yellow on 1/3 or less of anterolateral sides, tg5 fully black. Transverse bands of sparse white pruinosity present on anterior 1/3 or less of tg3 and tg4 and on anterior 2/3 of tg5. An irregular row of small discal setae on tg5 (rarely with only 1–2 pairs of setae).

Male terminalia (Figs. 41, 55, 69): Apical lobes of st5 0.64–0.67 (mean = 0.66) st5 length (Fig. 41). Surstylus, in lateral view, slightly concave along anterior margin and almost straight along posterior margin. Cercus in lateral view slightly concave on anterior margin; medial section of the posterior margin weakly carinate, with the carina ending gradually before short rounded apical tips, forming an obtuse angle. In posterior view, dorsal inner margin of the medial section of cerci with small processes pointing laterally. Length of upper lobe of cercus 0.30–0.45 (mean = 0.36) cercus length, length of medial section 0.41–0.45 (mean = 0.43) cercus length (Figs. 55, 69).

Female terminalia: Unknown.

Host: Unknown.

Geographic distribution and seasonal occurrence

All the specimens were collected from Nova Teutonia, Santa Catarina province, Brazil (Fig.114). The elevation of this region (300–500 m) suggests that *E. catarina* may occur only in low elevations. A long series of specimens that were collected in different regions of South America above 1000 m were examined and *E. catarina* was not present. However, in order to confirm that this species is restricted to low elevations more samples from a broader geographic range are needed. Two specimens were collected in February; and one specimen each in June, October and November.

Discussion

E. catarina specimens have only been collected from Santa Catarina (Brazil), where *E. arciforceps* was collected as well. These two species are morphologically very similar, but *E catarina* can initially be separated from *E. arciforceps* based on body size, where *E. catarina* is usually smaller than *E. arciforceps*. However, body size could vary beyond the limits of the specimens examined, making male terminalia the only reliable way to identify these species. See discussion section of *E. cryptica* for notes on females.

Erythromelana convexiforceps **Inclan sp. nov.**

(Figs. 42, 56, 70, 114)

Type material

Holotype male, labeled: “Mexico, Oax [Oaxaca] 4.6 km/ S [South] Suchistepec/ 23.VII.1992/ D.M. Wood 2150 m”, “HOLOTYPE/ Erythromelana/ convexiforceps/ Inclan D.J. [red label]”, “DI54CA [specimen ID number]” (CNC). Terminalia stored in glycerin in a microvial pinned below specimen.

Paratypes, two males, labeled: “Omilteme,/ Guerrero,/ 8000 ft./ July. H.H. Smith.”, “CENT. AMERICA./ Press by/ F.D. Godman./ & O. Salvin./ B.M. 1903–172.”, “PARATYPE/ Erythromelana/ convexiforceps/ Inclan D.J.

[yellow label]", "DI119BM"; "DI118BM" terminalia stored in glycerin in a microvial pinned below specimen (BMNH).

Etymology

From the Latin *convexus* and *forceps*, meaning convex cerci, in reference to the strongly convex posterior margin of the cercus (in lateral view) of this species.

Recognition

This species is morphologically very similar to *E. cryptica*, *E. catarina*, *E. arciforceps*, and *E. napensis*, and can only be distinguished from them by differences in the male terminalia. *E. convexiforceps* can be separated from *E. cryptica* and *E. catarina* by the abrupt ending of the carina on the medial section of the posterior margin of the cercus (in lateral view) that forms a nearly right angle; and by the rounded apical tips that (in posterior view) are directed distally. Additionally, this species can be distinguished from *E. cryptica* and *E. catarina* by the almost straight anterior margin of the surstyli (in lateral view) and their truncate apices and the relatively broad lobes of st5. Females are unknown (see discussion of *E. cryptica*). See the recognition section of *E. cryptica* for the distinction of *E. convexiforceps* from other species in the *E. cryptica* and *E. jaena* species groups.

Description

Described from 3 males, unless otherwise noted as "N".

Length: 7.0–7.3 mm (mean = 7.2 mm).

As described for *E. cryptica* except as follows:

Head (as in Figs. 15, 16): Arista black, thickened only on basal 1/4. Eye densely haired with long ommatrichia, each one about as long as 6–7 eye facets. Eye 0.90–0.92 (mean = 0.91) head height. Vertex width 0.12–0.14 (mean = 0.13) head width. Width of frontal vitta 0.20–0.23 (mean = 0.22) vertex width. Length of first flagellomere 0.39–0.41 (mean = 0.40) head height. Width of first flagellomere 0.20–0.21 (mean = 0.20) head length. Pedicel length 0.27–0.28 (mean = 0.27) length of first flagellomere. Fronto-orbital plate with 6–9 (m = 9) medioclinate frontal setae. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter usually well differentiated from the row of postocular setae. Parafacial bare and extremely narrow with the narrowest point almost equal to the basal width of the palpus. Parafacial width 0.06–0.08 (mean = 0.07) head length, and 0.32–0.38 (mean = 0.34) first flagellomere width. Height of haired portion of facial ridge 0.16–0.19 (mean = 0.17) head height. Palpus length 0.30–0.33 (mean = 0.31) head height.

Thorax (as in Figs. 29, 30): Dorsocentral length 0.37–0.38 (mean = 0.37) total body length. Faint white pruinose stripes on presutural scutum leaving 4 black vittae; the inner 2 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Scutum with 1 presutural acrostichal seta, usually with 1 additional seta; 1 postsutural acrostichal seta; 2 well-developed presutural dorsocentral setae; 1 presutural intra-alar seta, usually with 1 additional small seta; 1 presutural supra-alar seta, usually with 1 additional small seta; 2 postsutural supra-alar setae, first postsutural supra-alar seta absent. Length of fore claw 1.18–1.41 (mean = 1.30) length of fore 5th tarsomere. Wing almost completely hyaline, with light fumosity at c, sc, r_1, and r_{2+3} cells. Wing vein R_{4+5} dorsally with 3 setae at base.

Abdomen (as in Figs. 29, 30): Mostly black with yellow laterally. In dorsal view, tg1+2 with yellow on 3/4 of posterolateral sides; tg3 with yellow on 3/4 to nearly all anterolateral sides; tg4 with yellow on 1/3 or less of anterolateral sides, sometimes fully black; tg5 fully black. Transverse bands of sparse white pruinosity on anterior 1/3 or less of tg3 and tg4 and on anterior 2/3 or less of tg5.

Male terminalia (Figs. 42, 56, 70): Apical lobes of st5 0.62–0.63 (mean = 0.62) st5 length (Fig. 42); apical lobe margins broadly rounded, not extended into narrow points. Surstylus, in lateral view, almost straight along anterior margin and slightly concave along posterior margin ending in a nearly truncate apex. Cercus in lateral view slightly concave on anterior margin; the medial section of the posterior margin strongly carinate, with the carina ending abruptly before the rounded tips, forming a nearly right angle. In posterior view, dorsal inner margin of the cerci at the medial region with small pointed processes; upper lobes longer than the medial section and the apical cleft. Apex of the cercus linear, with rounded tip directed distally. Length of upper lobe of cercus 0.42–0.52 (mean = 0.47) cercus length, medial section 0.31–0.32 (mean = 0.31) cercus length. (Figs. 56, 70).

Female terminalia: Unknown.
Host: Unknown.

Geographic distribution and seasonal occurrence
All specimens were collected in the states of Oaxaca (2150 m) and Guerrero (2450 m), Mexico (Fig.114). The elevation of the collecting locations (2150–2450 m) suggests that this species may occur only at higher elevations. *Erythromelana cryptica* group specimens that were collected in the same region of Mexico at lower elevations (1500 m) were examined, but *E. convexiforceps* was not present. However, to confirm if this species is restricted to high elevations more samples are needed, particularly given the undersampled tachinid fauna of Mexico. All specimens were collected in July.

Discussion
Erythromelana convexiforceps exhibits a unique distinction in the shape of the surstylus and cercus. This species is distinguished by the abrupt end of the carina on the medial section of the posterior margin (in lateral view) of the cercus, which forms a nearly right angle with the apex of the cercus. Because of this unique characteristic, this species is described despite having only three males available for examination. See the discussion section of *E. cryptica* for female notes.

***Erythromelana arciforceps* Inclan sp. nov.**
(Figs. 40, 54, 68, 115)

Type material
Holotype male, labeled: “Nova Teutonia/ S. C. [Santa Catarina Province]–BRAZIL/ Nov. 1970/ F. Plaumann”, “HOLOTYPE/ Erythromelana/ arciforceps/ Inclan D.J. [red label]”, “DI412CA [specimen ID number]” (CNC). Terminalia stored in glycerin in a microvial pinned below specimen.

Paratypes, five males. **Costa Rica**: one male, “San Luis, Monteverde, Prov. [Province] Punta, [Puntarenas]/ COSTA RICA. 1040 m. nov [November] 1993, Z./ Fuentes, L N 250850_449250 #2443”, “ COSTA RICA INBIO/ CRI001/ 938508”, “PARATYPE/ Erythromelana/ arciforceps/ Inclan D.J. [yellow label]”, terminalia stored in glycerin in a microvial pinned below specimen (INBio). **Brazil**: two males, same as holotype except ID numbers “DI397CA”, terminalia stored in glycerin in a microvial pinned below specimen (NMNH); and “DI414CA”, terminalia stored in glycerin in a microvial pinned below specimen (QCAZ). One male, “Brasilien/ Nova Teutonia/ 2711′B. 52°23′L/ Fritz Plaumann/ 20.3.1937”, “DI120BM”, terminalia stored in glycerin in a microvial pinned below specimen (BMNH). One male, as previous except date “II 1968” and ID number “DI455CA”, terminalia stored in glycerin in a microvial pinned below specimen (CNC).

Etymology
From the Latin *arcus* and *forceps*, meaning arced cerci, in reference to the arched shape of the cercus (in lateral view) of this species compared to relatively linear cercus of its close relative, *E. napensis.*

Recognition
This species is morphologically very similar to *E. cryptica*, *E. catarina*, *E. convexiforceps* and *E. napensis* and can only be distinguished from them by differences in the male terminalia. The posterior margin of the cercus of *E. arciforceps*, in lateral view, is relatively rectilinear compared with the carinate cercus of *E. cryptica*, *E. catarina*, and *E. convexiforceps*. *Erythromelana napensis* is the only species with a similar cercus that lacks a strong carina, but *E. arciforceps* is distinguished by its more spatulate surstylus (in lateral and posterior views) and curved cercus (in lateral view). Additionally, *E. arciforceps* can be distinguished from *E. napensis* by the cerci, in posterior view, having the length of the upper lobes subequal to the medial section (much longer in *napensis*), and by a relatively short apical cercal cleft (shorter than or equal to the midsection length). Female unknown (see discussion of *E. cryptica*). See recognition section of *E. cryptica* for the distinction between *E. arciforceps* and the other species in the *E. cryptica* and *E. jaena* species groups.

Description

Described from 6 males, unless otherwise noted as "N".

Length: 7.2–7.9 mm (mean = 7.67 mm, N = 5).

Head (as in Figs. 15, 16): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence mostly on fronto-orbital plate (appearing grayish from certain angles), with faint golden reflections visible only in lateral view, mostly on the vertex. Arista black with dark brown on basal 1/4, thickened only on basal 1/4 or less. Eye densely haired with large ommatrichia about as long as 5–6 eye facets. Eye 0.88–0.89 (mean = 0.89, N = 4) head height. Vertex width 0.13–0.16 (mean = 0.15, N = 4) head width. Width of frontal vitta 0.20–0.27 (mean = 0.24, N = 4) vertex width. Length of first flagellomere 0.39–0.42 (mean = 0.40, N = 4) head height. Width of first flagellomere 0.16–0.19 (mean = 0.17) head length. Pedicel length 0.28–0.33 (mean = 0.29, N = 4) length of first flagellomere. Fronto-orbital plate with 8–10 (m = 8) medioclinate frontal setae, 2 reclinate inner orbital setae, outer orbital setae absent. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter slightly to barely differentiated from the row of postocular setae. Ocellar setae proclinate. Parafacial bare and extremely narrow with the narrowest point equal to or narrower than the basal width of the palpus. Parafacial width 0.05–0.07 (mean = 0.06) head length, and 0.31–0.42 (mean = 0.37) first flagellomere width. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.14–0.18 (mean = 0.16, N = 4) head height. Palpus dark yellowish, usually black at base; distally sparsely haired with dorsal base usually bare; almost uniform in width; length 0.27–0.33 (mean = 0.30, N = 3) head height.

Thorax (as in Figs. 29, 30): Dorsocentral length 0.39–0.41 (mean = 0.40, N = 4) total body length. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae, rarely 5; the inner 2 or 3 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Postpronotum with 2 setae. Katepisternum with 3 setae. Scutum with 1 presutural acrostichal seta; 1 or 2 postsutural acrostichal setae; 2 presutural dorsocentral setae, usually with 1 additional small seta; 2 postsutural dorsocentral setae, with 2 additional small setae; 1 presutural and 3 postsutural intra-alar setae; 1 presutural and 3 postsutural supra-alar setae, first postsutural supra-alar seta small. Scutellar discal setae absent.

Legs black. Tarsal claws longer than 5th tarsomere. Fore claw length 1.07–1.32 (mean = 1.21, N = 4) length of fore 5th tarsomere. Hind tibia with 2 well-developed posterodorsal setae, rarely with 1 or 2 additional shorter seta; usually 3 or 4 well-developed anteroventral setae. Wing usually light fumose at c, sc, r_1, r_{2+3}, r_{4+5}, and dm cells. Wing vein R_{4+5} dorsally with 3–4 setae at base. Vein M smoothly curved at bend and ending at wing margin anterior to wing tip separately from vein R_{4+5}.

Abdomen (as in Figs. 29, 30): Mostly black with yellow laterally. In dorsal view, tg1+2 completely black, tg3 with yellow on 4/5 of anterolateral sides, tg4 with yellow on 1/3–1/2 of anterolateral sides, and tg5 fully black. Transverse bands of sparse white pruinosity present on anterior 1/3–1/4 of tg3 and tg4 and on anterior 2/3 of tg5. Mid-dorsal depression of tg1+2 not reaching median marginal setae. One pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, 1 pair of lateral marginal setae on tg1+2 and tg3, and an irregular row of small discal setae on tg5.

Male terminalia (Figs. 40, 54, 68): Sternite 5 with median cleft V-shaped, inner margin with minute setae, apical lobes broadly pointed apically, each with a single, long, well-developed seta. Anterior margin of basal plate slightly concave (Fig. 40). Apical lobes of st5 0.57–0.62 (mean = 0.59) st5 length. Surstylus with small hairs on inner and outer surfaces Surstylus, in lateral view, almost straight on basal 1/2 and convex on apical 1/2 of anterior margin, and very slightly concave along posterior margin. Surstylus and cercus subequal in length. Cercus, in lateral view, bent, strongly concave on anterior surface, slightly concave on posterior-apical margin, and ending in a rounded tip. In posterior view, cerci narrowed on apical 1/3, length of upper lobes almost equal to medial section and longer than the apical cleft; apical cleft well defined with rounded tips directed slightly medially. Cerci, in posterior view, with a depression on the medial section. Length of upper lobe of cercus 0.37–0.47 (mean = 0.41) cercus length, medial section 0.33–0.44 (mean = 0.39) cercus length (Figs. 54, 68).

Female terminalia: Unknown.

Host: Unknown.

Geographic distribution and seasonal occurrence

Erythromelana arciforceps is widely distributed, from Costa Rica to southern Brazil (Fig. 115). It is likely to be present throughout the intervening region, and the absence of this species between these countries likely represents a lack of collecting effort. *Erythromelana arciforceps* occurs at low elevations (e.g., Santa Catarina, Brazil, 300–500 m) and mid elevations (e.g., San Luis de Monteverde, Costa Rica, 1100 m). Specimens from Brazil were collected throughout the year, 1 in February, 1 in March, 1 in October, and 2 in November. The single specimen from Costa Rica was collected in November.

Discussion

The terminalia of *E. arciforceps* are very distinct from the terminalia of *E. cryptica*, *E. catarina*, and *E. convexiforceps*, but similar to that of *E. napensis*. This species is well differentiated from *E. napensis* by the spatulate surstylus, strongly curved cercus, and (in posterior view) by the wider and shorter apical cleft. These differences in the shape of the surstylus and cercus appear relatively constant; providing confidence that *E. arciforceps* is distinct from these other *Erythromelana* species. See the discussion of *E. cryptica* for female notes.

***Erythromelana napensis* Inclan sp. nov.**

(Figs. 45, 58, 73, 84, 92, 95, 102, 107, 115)

Type material

Holotype male, labeled: "ECUADOR: Napo Prov. [Province]/ Yanayacu Biological Station/ S 00°35.9′ W 77°53.4′, 2163 m/ REARED [in red]/ October 2005/ 8135 [rearing record]", "HOLOTYPE/ Erythromelana/ napensis/ Inclan D.J. [red label]" (CNC). Puparium and terminalia stored in glycerin in a microvial pinned below specimen.

Paratype, one male, labeled: "COSTA RICA, Cartago, Sect. [Sector] la/ Represa, al inicio del Send. [Sendero] Rancho/ Negro al Cruce del Rio Villegas./ 1780 m. ABR [April] 1997. R. Guzman./ L_N_187750_560000 #46243", " COSTA RICA INBIO/ CRI002/ 550825", "PARATYPE/ Erythromelana/ napensis/ Inclan D.J. [yellow label]" (INBio). Terminalia stored in glycerin in a microvial pinned below specimen.

Etymology

Named after the Ecuadorian province, Napo, where the holotype was reared.

Recognition

This species is very similar to *E. arciforceps* and can only be distinguished from it by differences in the male terminalia. *Erythromelana napensis* can be separated from *E. arciforceps* by the shape, in lateral view, of their less spatulate surstylus, their relatively straight cercus, and the rounded cercal apices. Additionally, *E. napensis* can be distinguished from *E. arciforceps* by the cerci, in posterior view, with the upper lobes longer than the medial section and almost equal to the length of the apical cleft; and by the apical cleft being much narrower and longer than in *E. arciforceps*. See the recognition sections of *E. arciforceps* and *E. cryptica* for the distinction of *E. napensis* from the remaining *Erythromelana* species.

Description

Described from 2 males, 1 puparium and cephalopharyngeal skeletons from second and third instar larvae; unless otherwise noted as "N".

Length: 7.0 mm (mean = 7.0 mm).

As described for *E. arciforceps* except as follows:

Head (as in Figs. 15, 16): Parafacial brown in ground color covered with silver pruinescence. Eye 0.87–0.88 (mean = 0.87) head height. Vertex width 0.15–0.17 (mean = 0.16) head width. Width of frontal vitta 0.25–0.33 (mean = 0.29) vertex width. Length of first flagellomere 0.39–0.43 (mean = 0.41) head height. Width of first flagellomere 0.18–0.22 (mean = 0.20) head length. Pedicel length 0.28–0.31 (mean = 0.29) length of first flagellomere. Fronto-

orbital plate with 7–9 medioclinate frontal setae. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter barely differentiated from the row of postocular setae. Ocellar setae proclinate, small and hair-like. Parafacial width 0.03–0.04 (mean = 0.04) head length and 0.18 first flagellomere width. Height of haired portion of facial ridge 0.16–0.17 (mean = 0.16) head height. Palpus apically densely haired with dorsal base usually bare, length 0.28–0.36 (mean = 0.32) head height.

Thorax (as in Figs. 29, 30): Dorsocentral length 0.40 (mean = 0.40) total body length. Faint white pruinose stripes on presutural scutum leaving 4 black vittae; the inner 2 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Scutum with 1 postsutural acrostichal seta; 2 presutural dorsocentral setae; 2 postsutural dorsocentral setae, usually with 1 or 2 additional small setae. Scutellar discal setae absent, one specimen with only one apical seta. Fore claw length 1.11–1.21 (mean = 1.16) length of fore 5th tarsomere. Hind tibia with 2 well-developed posterodorsal setae, sometimes with 1 additional shorter seta; 3 well-developed anteroventral setae. Wing completely hyaline. Wing vein R_{4+5} dorsally with 3 setae at base.

Abdomen (as in Figs. 29, 30): Mostly black with yellow laterally. In dorsal view, tg1+2 completely black; tg3 with yellow on 2/3 or less of anterolateral sides; tg4 with yellow on 1/3 of anterolateral sides, or almost fully black; and tg5 fully black.

Male terminalia (Figs. 45, 58, 73): Apical lobes of st5 0.65–0.66 (mean = 0.65) st5 length (Fig. 45). Surstylus, in lateral view, slightly concave along anterior and posterior margin. Cercus, in lateral view, slightly concave on anterior and posterior-apical margins, ending in a rounded apex. In posterior view, length of upper lobes almost double the medial section and almost equal to the length of the apical cleft; apical cleft narrow and elongate, and apices of the cerci curved, with tips directed medially. Length of upper lobe of cercus 0.33–0.36 (mean = 0.35) cercus length, medial section 0.25–0.30 (mean = 0.28) cercus length (Figs. 58, 73).

Female terminalia: Unknown.

Puparium (N = 1) (Figs. 84, 92, 95): Similar to the puparium of *E. cryptica*. The slits of the posterior spiracles are more curved in *E. napensis* than in *E. cryptica*, and melanized areas around spiracular slits appear to be thicker and more strongly developed.

Cephalopharyngeal skeleton (N = 1) (Figs. 102, 107): Second and final instar cephalopharyngeal skeletons were found among the host remains, and inside the puparium, respectively. The mouth hooks of the second instar and the last instar are similar in form, in contrast to *E. curvifrons* and *E. cryptica* where the last instar mouth hooks are smaller. The intermediate region in the second instar is almost half of the size of that of the last instar. The dorsal and ventral cornu are also larger in the last instar. In comparison with *E. cryptica* the second instar dorsal cornu is more robust, the ventral process of the mouth hooks is absent, and the intermediate process is taller and thinner, and bears a ventral spur. The final instar cephalopharyngeal skeleton is more similar to *E. cryptica*, but retains a somewhat taller, thinner intermediate region.

Host: A single male was reared from an *Eois pallidicosta* (Warren) group caterpillar (Lepidoptera: Geometridae) collected from YBS on an unidentified species of *Piper*. The third instar caterpillar was collected on 4th October 2005 and the puparium was observed 13 days later. The adult was observed 31 days later.

Geographic distribution and seasonal occurrence

Erythromelana napensis is distributed from Costa Rica to Ecuador (Fig. 115). Similar to *E. arciforceps*, no specimens have been collected between Costa Rica and Ecuador. This species appears to occur at high elevations (e.g., Cartago, Costa Rica, 1800 m; and Napo, Ecuador, 2000–2600 m); however, there are only two locality records. More specimens are needed to evaluate the geographic and altitudinal distribution of this species. The single specimen from Costa Rica was collected in April, and the specimen from Ecuador was reared in October (see Host section).

Discussion

The male terminalia of *E. napensis* are similar to the male terminalia of *E. arciforceps*. This species is well differentiated from *E. arciforceps* by the shape (in lateral view) of the surstylus, the straight cercus with rounded apices, and (in posterior view) by a longer and narrower apical cleft. Because of these unique characteristics, this species is described despite the availability of only two males. See the discussion section of *E. cryptica* for female notes.

***Erythromelana distincta* Inclan sp. nov.**
(Figs. 44, 59, 72, 78–80, 84, 116)

Type material

Holotype male, labeled: "VENEZUELA Aragua/ 11 km Rancho/ Grande 25.II.1971/ G.&M. Wood", "HOLOTYPE/ Erythromelana/ distincta/ Inclan D.J. [red label]", "DI280CA [specimen ID number]" (CNC). Terminalia stored in glycerin in a microvial pinned below specimen.

Allotype female, labeled: "VENEZUELA Aragua/ 11 km Rancho/ Grande 25.II.1971/ G.&M. Wood", "ALLOTYPE/ Erythromelana/ distincta/ Inclan D.J. [red label]", "DI46CA [specimen ID number]" (CNC).

Paratypes, 17 males and 19 females. **Costa Rica**: one female, "COSTA RICA, Prov. [Province] Puntarenas, Send. [Sendero]/ a Trocha Acuaductos Tablas a 700 m/ NO. de Cerro Chivo. 1680 m./ 11DIC 1997. A. Picado./ L_S_322200_597800 #48784", "COSTA RICA INBIO/ CRI002/ 593459", "PARATYPE/ Erythromelana/ distincta/ Inclan D.J. [yellow label]", terminalia stored in glycerin in a microvial pinned below specimen (INBio). **Venezuela**: one male and one female, same as holotype data except date "18–27.II.1971" and ID numbers "DI38CA [♂]", terminalia stored in glycerin in a microvial pinned below specimen (CNC); and "DI47CA [♀]", terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Ecuador**: one male, "Coca, Napo R. [River?]/ Napo [Province], ECUADOR/ .V1965/ 250 m., L. Pena", "DI343CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC). **Peru**: three males, "Avispas, Madre/ de Dios, PERU/ 10–20.IX.1962/ L.Pena. 400 m.", "DI342CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC); "DI341CA" (CNC); and "340CA" (CNC). **Brazil**: five males, "Nova Teutonia/ S.C. [Santa Catarina Province]-BRAZIL/ Nov. 1970/ F. Plaumann", "DI296CA", terminalia stored in glycerin in a microvial pinned below specimen (JOS); "DI290CA" (CNC); "DI289CA" (CNC); "DI288CA" (CNC); "DI324CA" (CNC). Seven females, same data as previous except ID numbers "DI313CA" (CNC); "DI309CA" (CNC); "DI311CA" (CNC); "DI312CA" (CNC); "DI308CA" (CNC); "DI303CA" (CNC); "DI315CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC). Three males, as previous except date "Dec. 1970" and ID numbers "DI383CA" (CNC); "DI282CA" (QCAZ); and "DI281CA" (INBio). One male, same as previous except date "XII 71" and ID number "DI328CA" (CNC). One female, as previous except date "Aug. 1969" and ID number "DI335CA" (QCAZ). Two females, as previous except date "Oct. 1970" and ID numbers "DI319CA" (CNC); and "DI306CA" (CNC). One female, as previous except date "Dec. 1961" and ID number "DI334CA" (CNC). One female, as previous except date "Sept. 1961" and ID number "DI333CA" (CNC). One female, as previous except date "Jan. 1971" and ID number "DI330CA" (CNC). One female, "Brasilien/ Nova Teutonia/ 27°11′B 52°23′L/ Fritz Plaumann/ III 1960/ 300 500 m", "DI388CA" (JOS). One male, "Nova Teutonia/ 27°11′S 52°23′W/ Brazil, 300–500 m/ XII. 1964/ Fritz Plaumann", "DI339CA" (CNC). One female, as previous except date "II 1965" and ID number "DI338CA" (CNC). Two males, "BRAZIL: Santa Catarina/ Nova Teutonia, 27°11′S/ 52°23′W, 300–500 m, 20/ Apr. 1966. F. Plaumann", "COLLECTION OF/ PAUL H. ARNAUD, JR.", "DI156NM" (NMNH); "DI158NM" (NMNH). One female, as previous except date "Feb 1969" and ID number "DI142NM" (NMNH). One female, as previous except date "11/ Apr. 1966" and ID number "DI160NM" (NMNH).

Other material examined

Nineteen males and twenty females. One male, "BRAZIL: Santa Catarina/ Nova Teutonia, 27°11′S/ 52°23′W, 300–500 m/ Feb. 1966. F. Plaumann", "COLLECTION OF/ PAUL H. ARNAUD, JR.", "DI156NM" (NMNH); "Erythromelana/ distincta/ Inclan D.I.", "DI164NM" (NMNH). Two females, as previous except date "21 Apr. 1966" and ID numbers "DI161NM" (NMNH); and "DI165NM" (NMNH). One female, as previous except date "20/ Apr. 1966" and ID number "DI157NM" (NMNH). Five males, "Nova Teutonia/ S.C. [Santa Catarina Province]–BRAZIL/ Nov. 1970/ F. Plaumann", "DI287CA" (CNC); "DI286CA" (CNC); "DI299CA" (CNC); "DI302CA" (CNC); and "DI295CA" (CNC). Three females, as previous except ID numbers "DI304CA" (CNC); "DI305CA" (CNC); and "DI317CA" (CNC). Two males, as previous except date "Dec. 1970" and ID numbers "DI284CA" (CNC); and "DI285CA" (CNC). Two females, as previous except ID numbers "DI322CA" (CNC); and "DI314CA" (CNC). Two males, as previous except date "Aug. 1970" and ID numbers "DI291CA" (CNC); and "DI298CA" (CNC). Two females, as previous except ID numbers "DI328CA" (CNC); and "DI321CA" (CNC). Five males, as previous except date "Oct. 1970" and ID numbers "DI300CA" (CNC); "DI297CA" (CNC); "DI294CA" (CNC); "DI293CA" (CNC); and "DI292CA" (CNC). Three females, as previous except ID

numbers “DI307CA” (CNC); “DI310CA” (CNC); and “DI316CA” (CNC). One male, as previous except date “June 1970” and ID number “DI301CA” (CNC). Two females, as previous except date “May 1970” and ID numbers “DI320CA” (CNC); and “DI318CA” (CNC). One female, as previous except date “Sept. 1969” and ID number “DI336CA” (CNC). One female, as previous except date “Dec. 1969” and ID number “DI337CA” (CNC). Two males, as previous except date “XII 71” and ID numbers “DI326CA” (CNC); and “DI327CA” (CNC). One female, as previous except ID number “DI332CA” (CNC). One male, as previous except date “ Nov. 1971” and ID number “DI325CA” (CNC). Two females, as previous except ID numbers “DI331CA” (CNC); and “DI329CA” (CNC).

Etymology

Derived from the Latin *distinctus*, meaning apart or different, in reference to the surstyli and cerci of the male terminalia that are uniquely shaped and well-differentiated from all other *Erythromelana* species.

Recognition

This species is easily distinguished from all other *Erythromelana* species by its black and yellow abdominal coloration and the presence of setae on the dorsum of vein R_1. *E. ecuadoriana* is the only other species that has setae on the vein R_1, but this species possesses bright yellow abdominal coloration. Additionally, the surstylus of *E. distincta* is the broadest of all observed *Erythromelana* species and it is the only one bearing large internal setae.

Description

Described from 18 males and 20 females, unless otherwise noted as “N”.

Length: 5.4–6.0 mm (mean = 5.60 mm) in male, 5.3–6.4 mm (mean = 5.82 mm) in female.

Head (as in Figs. 15, 16): Parafacial brown in ground color covered with silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence (appearing grayish from certain angles), with faint golden reflections visible only in lateral view (mostly on vertex). Arista black with dark brown on basal 1/3–1/4, thickened only on basal 1/4. Eye sparsely haired with short ommatrichia about as long as 2–3 eye facets in male and female. Eye 0.86–0.92 (mean = 0.89) head height in male, 0.86–0.91 (mean = 0.89) in female. Vertex width 0.19–0.24 (mean = 0.22) head width in male, 0.20–0.23 (mean = 0.22) in female. Frontal vitta width 0.30–0.50 (mean = 0.40) vertex width in male, 0.32–0.42 (mean = 0.38) in female. Length of first flagellomere 0.48–0.59 (mean = 0.54) head height in male, 0.48–0.53 (mean = 0.51) in female. Width of first flagellomere 0.23–0.30 (mean = 0.26) head length in male, 0.20–0.25 (mean = 0.23, N = 10) in female. Pedicel length 0.21–0.29 (mean = 0.24) length of first flagellomere in male, 0.23–0.29 (mean = 0.25) in female. Fronto-orbital plate with 5–7 (m = 6) medioclinate frontal setae in male, 4–5 (m = 5) in female; 2 reclinate inner orbital setae, usually the first pair large and well developed and the second pair small or reduced to a hair-like seta (especially in female); 2 proclinate outer orbital setae in female, absent in male. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta, the latter well differentiated from the row of postocular setae. Ocellar setae proclinate. Parafacial bare and extremely narrow, with the narrowest point equal to or narrower than the basal width of the palpus. Parafacial width 0.03–0.06 (mean = 0.03) head length in male, 0.03–0.05 (mean = 0.04, N = 10) in female, and 0.13–0.23 (mean = 0.16) first flagellomere width in male, 0.14–0.23 (mean = 0.18, N = 10) in female. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.14–0.24 (mean = 0.19) head height in male, 0.14–0.18 (mean = 0.15) in female. Palpus yellowish, usually with dark brown-yellow base; distally sparsely haired with external lateral edges usually bare; almost uniform in width; length 0.28–0.38 (mean = 0.31) head height in male, 0.31–0.36 (mean = 0.33) in female.

Thorax (as in Figs. 29, 30): Dorsocentral length 0.33–0.39 (mean = 0.37) total body length in male, 0.36–0.41 (mean = 0.38) in female. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view, only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae, the inner 2 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae. Postpronotum with 2 setae, usually with one additional small seta. Katepisternum with 2 setae. Scutum with 1 presutural acrostichal seta; 1 postsutural acrostichal seta, rarely with one additional small seta; 2 well-developed presutural dorsocentral setae, rarely with 1 additional small seta; 2 well-developed postsutural dorsocentral setae, usually with 1 additional small seta; 1 presutural intra-alar seta,

usually with 1 additional small seta; 3 postsutural intra-alar setae; 1 presutural supra-alar seta, usually with one additional small seta; 2 postsutural supra-alar setae, the first postsutural supra-alar absent. Scutellar discal setae usually present but hair-like.

Legs black. Tarsal claws longer than 5th tarsomere in male and shorter than 5th tarsomere in female. Fore claw length 1.00–1.15 (mean = 1.09, N = 7) length of fore 5th tarsomere in male, 0.73–0.92 (mean = 0.83) in female. Hind tibia with 2 well-developed posterodorsal setae, usually with 1 or 2 additional shorter setae; usually 3 or 4 well-developed anteroventral setae. Wing usually light fumose on c, sc, r_1, r_{2+3}, and r_{4+5} cells; or dark fumose on sc, and r_1 cells. Wing vein R_1 dorsally setose on about apical half and vein R_{4+5} dorsally with 3–6 (m = 3) setae at base. Vein M smoothly curved at bend and ending at wing margin anterior to wing tip separately from vein R_{4+5}.

Abdomen (as in Figs. 29, 30): Mostly black with yellow laterally. In dorsal view, tg1+2 usually with yellow on 1/3 to all of posterolateral sides, rarely fully black; tg3 with yellow on 3/4 to all of anterolateral sides; tg4 with yellow on 1/3–1/2 of anterolateral sides, rarely fully black; tg5 fully black. Transverse bands of sparse white pruinosity present on anterior 1/3–1/4 of tg3 and tg4 and on anterior 2/3 of tg5. Mid-dorsal depression of tg1+2 not reaching median marginal setae. One pair of median marginal setae on tg1+2 and tg3, a row of median marginals on tg4 and tg5, 1 pair of lateral marginal setae on tg1+2 and tg3, and an irregular row of small discal setae sometimes present, but usually absent on tg5.

Male terminalia (N = 5) (Figs. 44, 59, 72): Sternite 5 with median cleft roughly V-shaped, inner margin with minute setae, apical lobes not strongly pointed apically, each with a single long well-developed seta, and anterior margin of basal plate slightly concave (Fig. 44). Apical lobes of st5 0.58–0.67 (mean = 0.62) st5 length. Postgonite slightly spatulate with a broad rounded tip. Surstylus on outer surface with several small setae and on inner surface with several large setae, in lateral view slightly concave along anterior and posterior margins resulting in a very broad spatulate apex. Cercus length slightly shorter than the surstylus length. Cercus in lateral view slightly concave on anterior surface, the medial section of the posterior margin strongly carinate, with the carina ending before the rounded apex, forming an obtuse angle. In posterior view, cerci narrowed on apical 1/3, upper lobes longer than the medial section and almost equal to the combined lengths of the medial section and the apical cleft; apical cleft well defined and internally twisted; and apices of the cerci linear, with rounded tips directed distally. Length of upper lobe of cercus 0.45–0.55 (mean = 0.50) cercus length, medial section 0.24–0.32 (mean = 0.27) cercus length (Figs. 59, 72).

Female terminalia (N = 3) (Figs. 78–80, 82): Sternite 5 rectangular-shaped, anterior margin slightly concave, with 2 pairs of well-developed setae close to posterior margin (Fig. 78). Width of st5 0.67–0.86 (mean = 0.67) the length. Sternite 6 with several well-developed setae on posterior corners (Fig. 79). Tergite 6 well developed, present as two lateral sclerites with well-developed setae along posterior margin. Sternite 7 with a distinctive lobe on the medial section of the anterior margin, with several small setae on posterior corners (Fig. 80). Tergite 7 present as two lateral sclerites, with small setae along posterior margins. Sternite 8 small, difficult to distinguish from the surrounding membrane. Tergite 8 bare, dorsally with a distinctive narrow lobe on the medial section of the anterior margin, strongly narrowed dorsally, joining ventrally with the postgenital plate (Fig. 82). Tergite 10 between the cerci, small and bare, rhomboid in shape. Postgenital plate with several small setae on posterior tip. Cerci slightly narrow at bases, with several setae apically (Fig. 82).

Host: Unknown.

Geographic distribution and seasonal occurrence

Erythromelana distincta is widely distributed, from Costa Rica to southern Brazil (Fig. 116). Aside from the specimens from Venezuela, Ecuador, and Peru, there is a large geographic gap between the specimens collected in Costa Rica and those collected in Brazil. There is a large collection of specimens from Nova Teutonia (Brazil) contrasting with the records for Costa Rica, Venezuela, Ecuador, and Peru that correspond to singletons or no more than four specimens. This species occurs at low to mid elevations (Puntarenas, Costa Rica, 1600 m; Araguas, Venezuela, 1100 m; Napo, Ecuador, 250 m; Avispas, Peru, 400 m; and Santa Catarina, Brazil, 300–500 m). Specimens from Brazil were collected throughout the year, but most were collected late in the year (1 in January, February, and March; 2 in May; 1 in June; 5 in August; 2 in September; 10 in October; 24 in November; and 14 in December). The single specimen from Costa Rica was collected in December, the four specimens from Venezuela were collected in February, the single specimen from Ecuador was collected in May, and the three specimens from Peru were collected in September.

Discussion

Erythromelana distincta is the only species in the *E. cryptica* species group that has only two katepisternal setae and the discal setae on tg5 are usually absent (although see discussion of *E. woodi*). This species is the only one that has a character of the female terminalia distinguishing it from all other *Erythromelana* species: the distinctive narrow lobe on the dorsal anterior margin of tg8.

***Erythromelana woodi* Inclan sp. nov.**

(Figs. 17, 18, 31, 32, 46, 60, 74, 117)

Type material

Holotype male, labeled: "COSTA RICA Pnts [Puntarenas Province]/ Monteverde/ 28.VIII. 1993/ D.M. Wood 1842 m", "HOLOTYPE/ Erythromelana/ woodi/ Inclan D.J. [red label]", "DI208MW [specimen ID number]" (CNC).

Allotype female, labeled: "COSTA RICA Pnts [Puntarenas Province]/ Monteverde 1600 m/ 18–24.VIII. 1987/ G. & M. Wood", "ALLOTYPE/ Erythromelana/ woodi/ Inclan D.J. [red label]", "DI210MW [specimen ID number]" (CNC).

Paratypes, five males and seven females. **Mexico**: one male, "MEXICO Oax [Oaxaca] 100/ km s [South] Tuxtepec/ 20.VIII.1984/ D.M. Wood", "PARATYPE/ Erythromelana/ woodi/ Inclan D.J. [yellow label]", "DI228CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC). Two females, as previous except ID numbers "DI55CA", terminalia stored in glycerin in a microvial pinned below specimen (CNC); and "DI227CA" (NMNH). One female, "MEXICO Oax [Oaxaca] 4.6 km/ S Suchistepec/ 23.VII.1992/ D.M. Wood 2150 m", "DI56CA" (CNC). **Costa Rica**: one male, same data as the Holotype except date "22.IX.1994" and ID number "DI207MW" (INBio). One female, "COSTA RICA Pnts/ Monteverde, Cerro/ Chomogo 1800 m/ 1.IX.95 Blutler&Wood", "DI209MW" (CNC). **Ecuador**: one male, "Ecuador: Cosanga, Napo./ 8 km NW from Yanayacu B.S. [Biological Station]/ 05–XII–09 00°35.955′S/ ~6904ft 77°53.377′W/ Diego J. Inclan", "DI84EC–09", terminalia stored in glycerin in a microvial pinned below specimen (CNC). One female, "Ecuador: Mindo, Pichincha/ road to tarabita/ 24–XI–09 00°04.062′S/ ~4800ft 78°45.246′W/ Diego J. Inclan", "DI507ECU" (CNC). One female, "ECUADOR: Napo prov/ Yanayacu Biological Station/ S 00°35.9′ W77°53.4′ 2163m/ 5–vi–06 J.O. Stireman III", "sp jaena ab?"(JOS). **Bolivia**: two males, "BOLIVIA Cbba Chapare/ Villa Tunari-Cochabamba/ road-km 388–2200 m/ G&M.Wood 3.XII.96", "DI205MW" (CNC); and "DI203MW" (QCAZ). One female, "BOLIVIA Cbba Chapare/ Villa Tunari-Cochabamba/ road-km 365–1800 m/ G.&M.Wood 3–10.XII.96", "DI204MW" (CNC).

Etymology

This species is named in honor of Dr. D. Monty Wood, who has contributed greatly to the systematics of the New World Tachinidae. In particular, his revision of the North and Central American Blondeliini (Wood 1985) was a key resource in the development of this revision. Dr. Wood has extensively collected tachinids in Central and South America including the holotype and nine paratypes of this species as well as several other *Erythromelana* species.

Recognition

This species is easily recognized by the shape and the setal arrangement of the palpus (Fig. 17), and by having three postpronotal setae. The palpus of *E. woodi* is distinguished from all other *Erythromelana* species by being narrower and slightly curved inward medially, with two distinctive setae on the external lateral side, usually with one or two small setae at tip, and dorsally bare. See recognition section of *E. leptoforceps* for differences between this species and *E. woodi*, and see recognition section of *E. cryptica* for the distinction between *E. woodi* and other species in the *E. cryptica* and *E. jaena* species groups.

Description

Described from 6 males and 8 females, unless otherwise noted as "N".

Length: 5.9–6.8 mm (mean = 5.28 mm) in male, 5.2–6.6 mm (mean = 5.75 mm) in female.

Head (Figs. 17, 18): Parafacial brown in ground color covered with dull silver pruinescence. Fronto-orbital plate and vertex black in ground color covered with dull silver pruinescence (appearing grayish from certain angles), with faint golden reflections visible only in lateral view (mostly on vertex). Arista fully black or with dark brown on basal 1/4, thickened only on basal 1/4. Eye sparsely haired, with short ommatrichia about as long as 2–3 eye facets in both sexes. Eye 0.88–0.89 (mean = 0.89) head height in male, 0.89–0.90 (mean = 0.90) in female. Vertex width 0.18–0.23 (mean = 0.20) head width in male, 0.20–0.24 (mean = 0.22) in female. Width of frontal vitta 0.30–0.45 (mean = 0.35) vertex width in male, 0.36–0.57 (mean = 0.45) in female. Length of first flagellomere 0.40–0.54 (mean = 0.49) head height in male, 0.48–0.54 (mean = 0.52) in female. Width of first flagellomere 0.26–0.29 (mean =0.27, N = 6) head length in male, 0.23–0.27 (mean =0.25, N = 7) in female. Pedicel length 0.24–0.35 (mean = 0.27) length of first flagellomere in male, 0.23–0.30 (mean = 0.26) in female. Fronto-orbital plate with 6–8 (m = 6) medioclinate frontal setae in male, 4–5 (m = 4) in female; 2 reclinate inner orbital setae, rarely with 1 additional small seta in male; 2 proclinate outer orbital setae in female, absent in male. Vertex with 1 reclinate inner and 1 lateroclinate outer vertical seta; the latter barely differentiated from the row of postocular setae in male, well differentiated in female. Ocellar setae proclinate. Parafacial bare and extremely narrow, with the narrowest point narrower than the basal width of the palpus. Parafacial width 0.02–0.03 (mean = 0.03) head length in male (N = 6) and female (N = 7), and 0.08–0.12 (mean = 0.10, N = 6) first flagellomere width in male, 0.09–0.13 (mean = 0.11, N = 7) in female. Facial ridge with hairs on basal 1/4 or less. Height of haired portion of facial ridge 0.12–0.20 (mean = 0.16) head height in male, 0.12–0.19 (mean = 0.16) in female. Palpus yellowish, usually with brown-yellow at base; narrow and medially slightly curved inward; almost uniform in width; setae mostly on internal lateral surface, dorsally bare, with two distinctive larger setae on external lateral surface, and usually with 1 or 2 small setae at tip; length 0.29–0.37 (mean = 0.33) head height in male, 0.28–0.40 (mean = 0.34) in female.

Thorax (Figs. 31, 32): Dorsocentral length 0.37–0.38 (mean = 0.37) total body length in male, 0.34–0.37 (mean = 0.39) in female. Shiny black in ground color; presutural scutum with thin white pruinescence, postsutural scutum with much sparser pruinescence revealing underlying black ground color. In dorsal view, only the presutural scutum appears grayish; whereas in lateral view the postsutural scutum appears grayish as well. Faint white pruinose stripes on presutural scutum leaving 4 black vittae, the inner 2 vittae longer and thinner, almost 1/2 the width of each of the outer 2 vittae (Fig. 31). Postpronotum with 3 setae, usually the middle basal seta displaced anterolaterally forming a nearly right-angled triangle with outer and inner basal setae. Katepisternum usually with 3 setae, the lower seta hair-like or sometimes absent. Scutum with 2 presutural and 2 postsutural acrostichal setae; 2 well-developed presutural dorsocentral setae; 2 well-developed postsutural dorsocentral setae, usually with 1 additional small seta; 1 presutural intra-alar seta, with 1 additional small seta; 3 postsutural intra-alar setae; 1 presutural supra-alar setae, usually with one additional small seta; 2 postsutural supra-alar setae, the first postsutural supra-alar absent. Scutellar discal setae absent.

Legs black (Fig. 32). Tarsal claws longer than 5th tarsomere in male and shorter than 5th tarsomere in female. Fore claw length 1.14–1.36 (mean = 1.22, N = 4) length of fore 5th tarsomere in male, 0.81–0.94 (mean = 0.88, N = 5) in female. Hind tibia with 2 well-developed posterodorsal setae, rarely with 1 additional shorter seta; usually 4 or 5 well-developed anteroventral setae. Wing usually dark fumose on sc, and r_1 cells; and light fumose on c, r_{2+3}, and r_{4+5} cells. Wing vein R_{4+5} dorsally with 2–5 (m = 3) setae at base. Vein M smoothly curved at bend and ending at wing margin anterior to wing tip separately from vein R_{4+5}.

Abdomen (Figs. 31, 32): Coloration varied from mostly yellow to mostly black. In dorsal view, tg1+2 usually with yellow on 1/3 to all of posterolateral sides or black only on mid-dorsal depression, rarely fully yellow; tg3 with yellow on 3/4 to all of anterolateral sides, rarely fully yellow; tg4 with yellow on 1/3–2/3 of anterolateral sides, rarely with black only on posterior margin; tg5 varied from fully black to fully yellow or mostly yellow with black only at the center of posterior margin. Black color usually forming a triangular shape on dorsum of tg3, tg4, and tg5. Transverse bands of sparse white pruinosity present on anterior 1/3–1/4 of tg3 and tg4 and on anterior 2/3 of tg5 on mostly black abdomens, and absent on mostly yellow abdomens. Mid-dorsal depression of tg1+2 not reaching median marginal setae (Fig. 31). One pair of median marginal setae on tg1+2 and tg3; a row of median marginals on tg4 and tg5; 1 pair of lateral marginal setae on tg1+2 and tg3; and usually with an irregular row of small discal setae present on tg5, rarely absent.

Male terminalia (N = 3) (Figs. 46, 60, 74): Sternite 5 with median cleft almost U-shaped; inner margin with minute setae; apical lobes truncate, not strongly pointed apically; each usually with a single long well-developed seta, but varied from absent to 2 medium-sized setae. Anterior margin of basal plate slightly concave (Fig. 46). Apical lobes of st5 0.62–0.68 (mean = 0.65) st5 length. Surstylus with small hairs on inner and outer surfaces, in lateral view slightly concave along anterior and posterior margins. Surstylus and cercus subequal in length. Pregonite relatively large and broad and postgonite reduced in size. Cercus narrow, in lateral view, slightly concave on anterior and posterior margins ending in a narrow rounded apex. In posterior view, cerci with slight depressions on the medial section extending towards the apical cleft, length of upper lobes almost half the length of medial section and almost equal to the length of the apical cleft, apical cleft weakly defined with rounded tips directed distally. Length of upper lobe of cercus 0.24–0.27 (mean = 0.25) cercus length, medial section 0.50–0.56 (mean = 0.53) cercus length (Figs. 60, 74).

Female terminalia (N = 3) (as in Figs. 75–77, 81): Sternite 5 rectangular-shaped, anterior margin slightly concave, covered with well-developed setae on more than posterior 1/2. Width of st5 0.66–0.76 (mean = 0.71) the length. Sternite 6 with several well-developed setae on posterior corners. Tergite 6 well developed, present as two lateral sclerites with well-developed setae along posterior margin. Sternite 7 with a distinctive lobe on the medial section of the anterior margin, with several small setae on posterior corners. Tergite 7 present as two lateral sclerites, with small setae along posterior margins. Sternite 8 small and bare, difficult to distinguish from the surrounding membrane. Tergite 8 bare, well developed laterally, strongly narrowed dorsally, joining ventrally with the postgenital plate. Tergite 10 between the cerci, small and bare, almost rhomboid in shape. Postgenital plate with several small setae on posterior tip. Cerci slightly narrow at bases, with several setae apically.

Host: Unknown.

Geographic distribution and seasonal occurrence

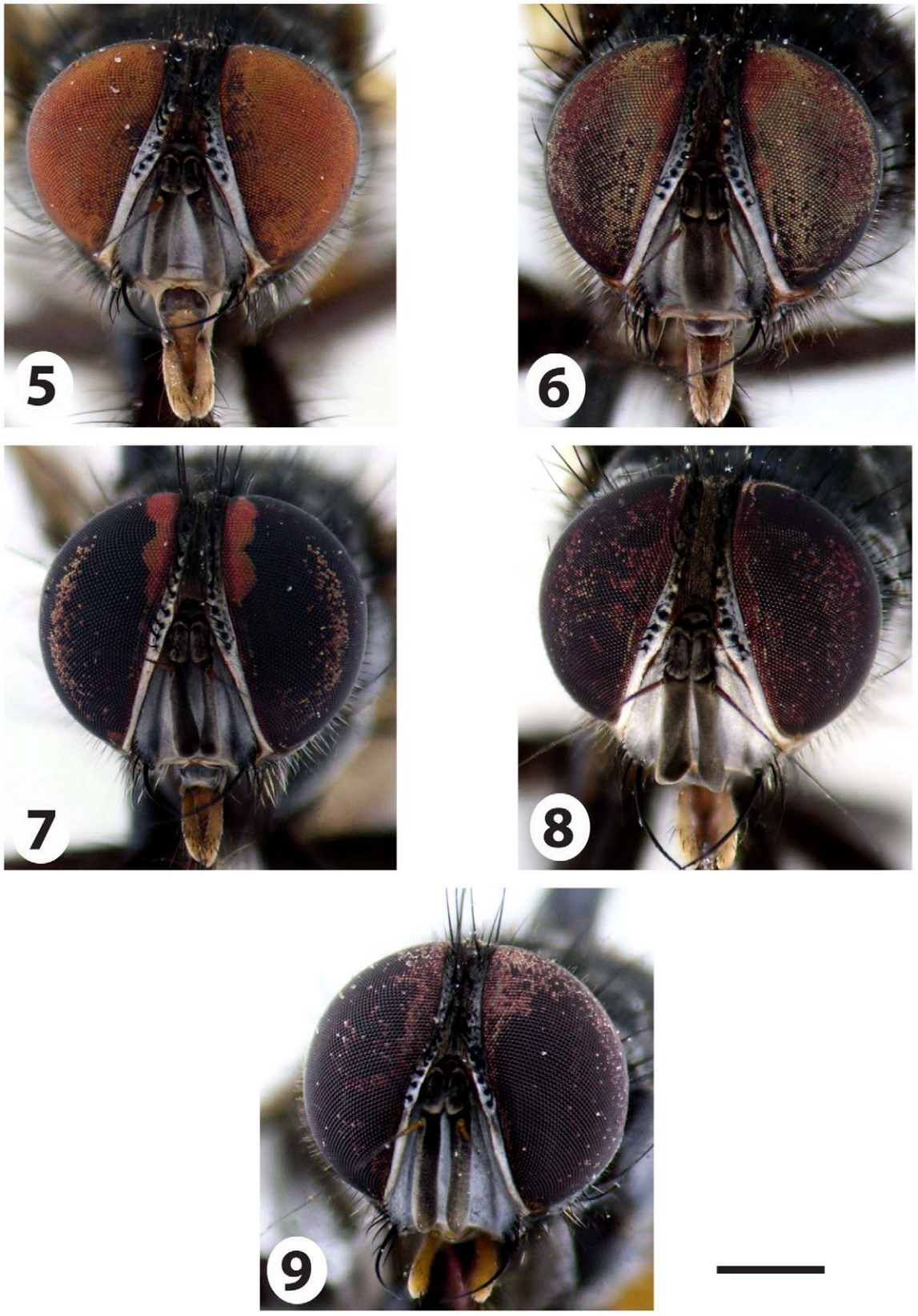
Erythromelana woodi exhibits one of the wider geographic distributions among *Erythromelana* species. It has been collected from Mexico to Bolivia (Fig. 117). As with other *Erythromelana* species, the actual distribution of this species remains unknown due to the lack of specimens collected between Mexico and Costa Rica, Costa Rica and Ecuador, and Ecuador and Bolivia. It occurs at higher elevations, above 1500 m (e.g., Oaxaca, Mexico, 2000–2500 m; Monteverde, Costa Rica, 1600 m; Napo, Ecuador, 2000–2600 m; Mindo, Ecuador, 1500 m; Cochabamba, Bolivia, 1800–2200 m). Specimens have been collected from June throughout December. In Mexico, one specimen was collected in July and three in August; in Costa Rica, two specimens were collected in August and two in September; in Ecuador, three specimens were collected in June, November and December; and in Bolivia, three specimens were collected in December.

Discussion

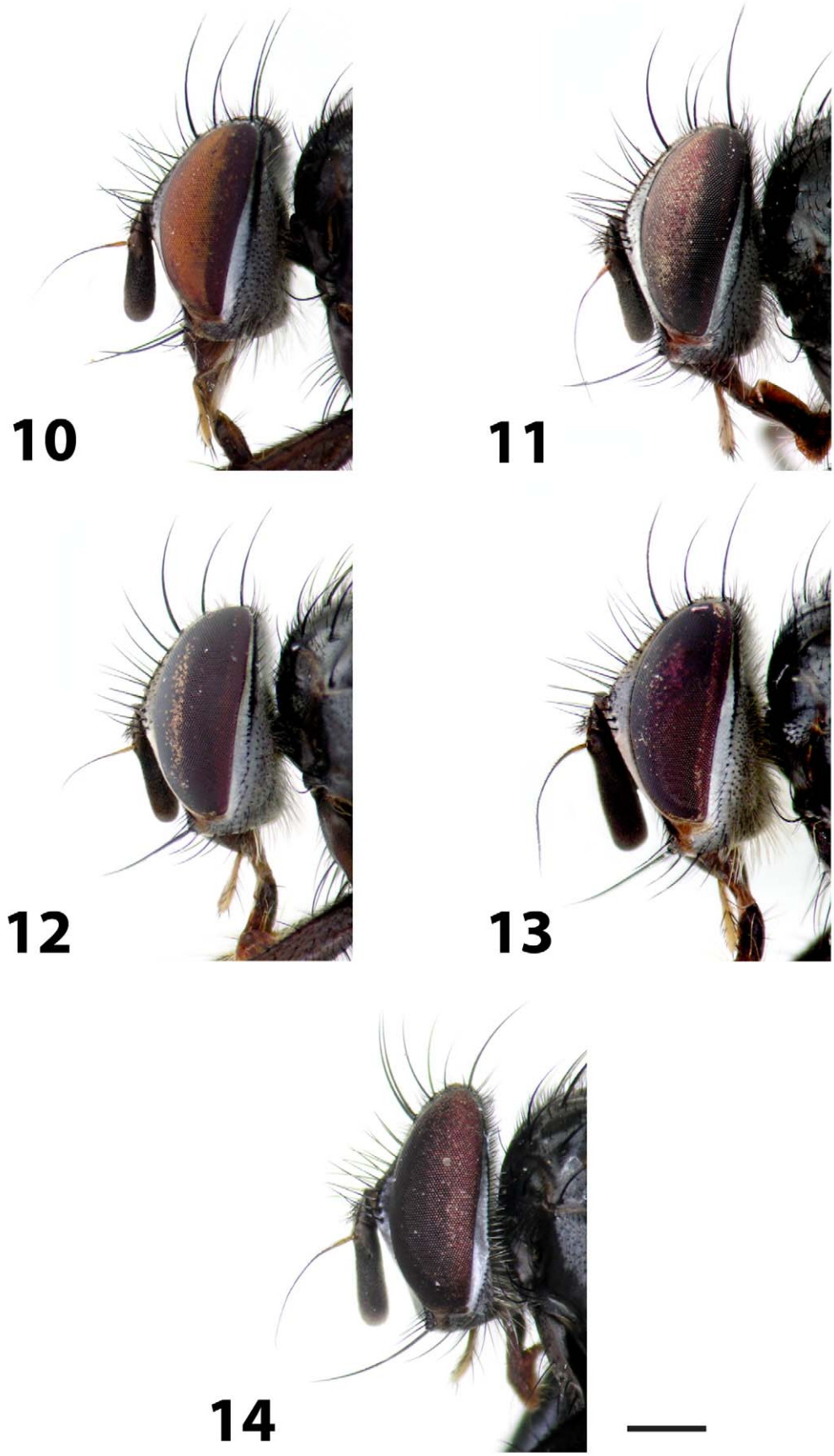
The abdominal coloration varies from specimens with the abdomen mostly black to mostly bright yellow. In general, specimens from higher elevations seem to have more yellow abdomens, but these specimens retain small black posterodorsal markings usually on tg3 and always on tg4. Another character that varies is the number of katepisternal setae, usually there are three setae, but some specimens seem to have lost the lower seta and possess only two well-developed setae. Of all the *Erythromelana* species, this is the only species in which the number of katepisternal setae varies. Aside from this species, this character is useful as an indicator to separate species (e.g., *E. leptoforceps* and *E. nigrithorax*) in the *E. cryptica* species group. A final character that varies in this species is the setae on the apical lobes of st5. A characteristic of species in the *E. cryptica* species group is the presence of long, well-developed setae on the apical lobes of st5. Males of *E. woodi* usually have one long seta or two medium-sized setae, but rarely this seta is absent. However, the shape of the surstylus and cercus are identical in all specimens examined. Given that these differences may represent intraspecific variation and there is no clear way to subdivide the species further without additional evidence, *E. woodi* is described as a single species.

As explained above, *E. woodi* presents the most variation from the characters defining the *E. cryptica* species group in terms of abdominal color and chaetotaxy of the katepisternum and st5. In addition, the female st5 in the *E. cryptica* species group is characterized by the presence of two pairs of well-developed setae close to the apical margin, but the st5 of females of *E. woodi* is similar to that of species in the *E. jaena* group, which usually have

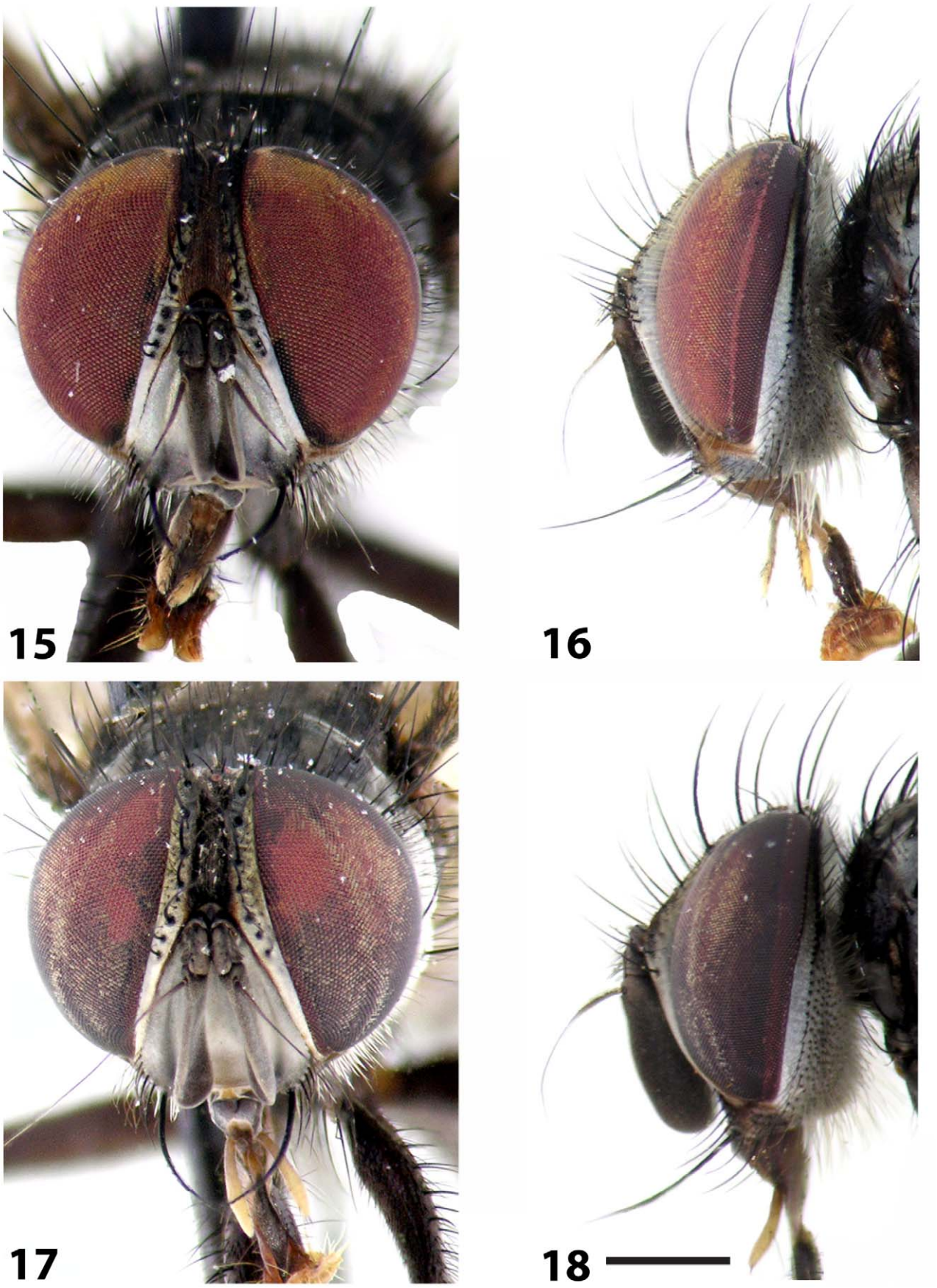
several well-developed setae on more than the posterior 1/2. However, *E. woodi* has a slight dorsal depression on the medial sections of the cerci that is characteristic of all species in the *E. cryptica* species group (although in other species this depression makes a twist toward the apical cleft). Due to this character, *E. woodi* may be more closely allied to the *E. cryptica* species group.



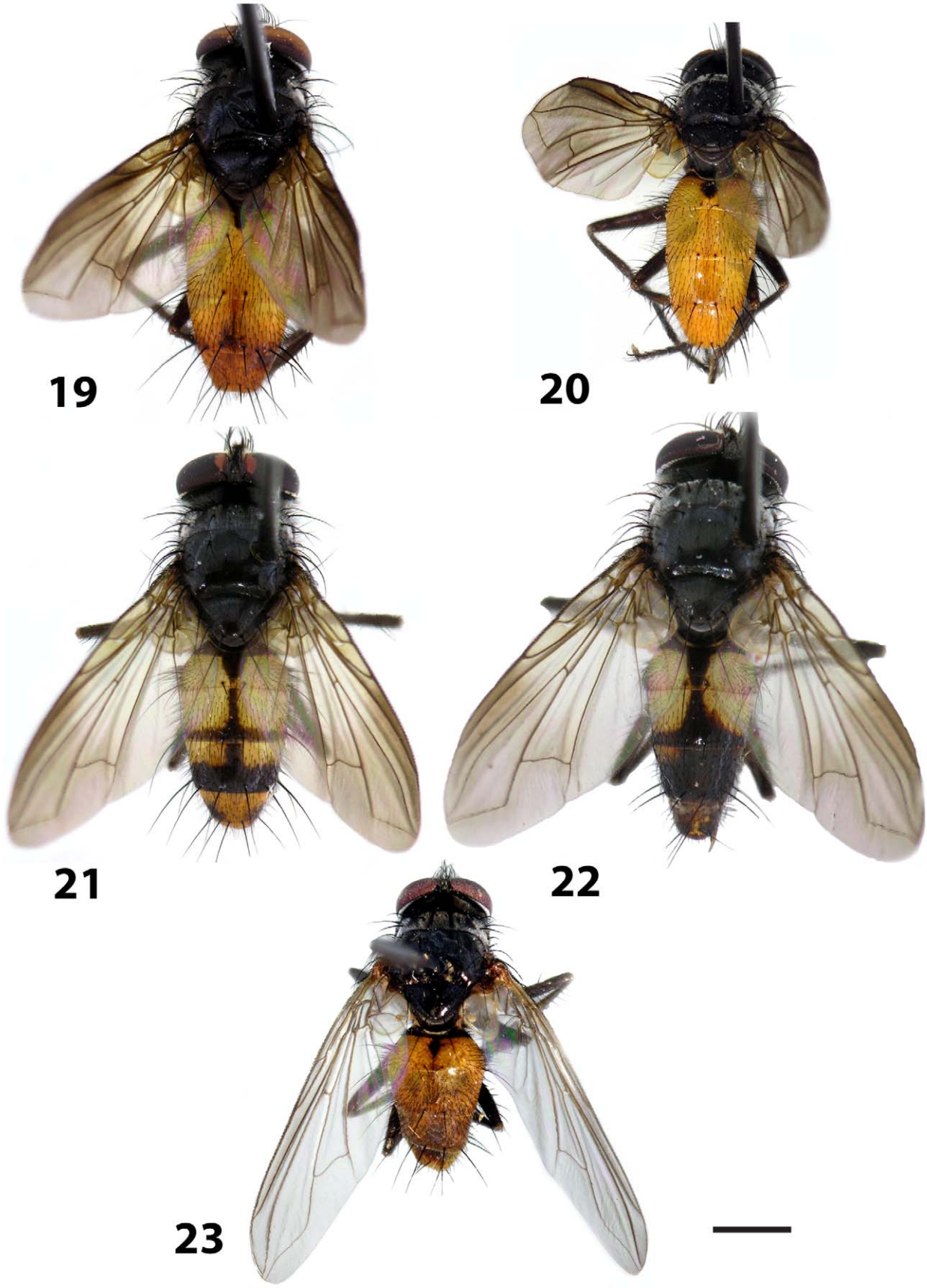
FIGURES 5–9. Frontal view of the head of males of *E. jaena* species group. **5.** *E. abdominalis* (Townsend). **6.** *E. jaena* Townsend. **7.** *E. leptoforceps* sp. nov. **8.** *E. nigrithorax* (Wulp). **9.** *E. curvifrons* sp. nov. Scale bar = 1.0 mm.



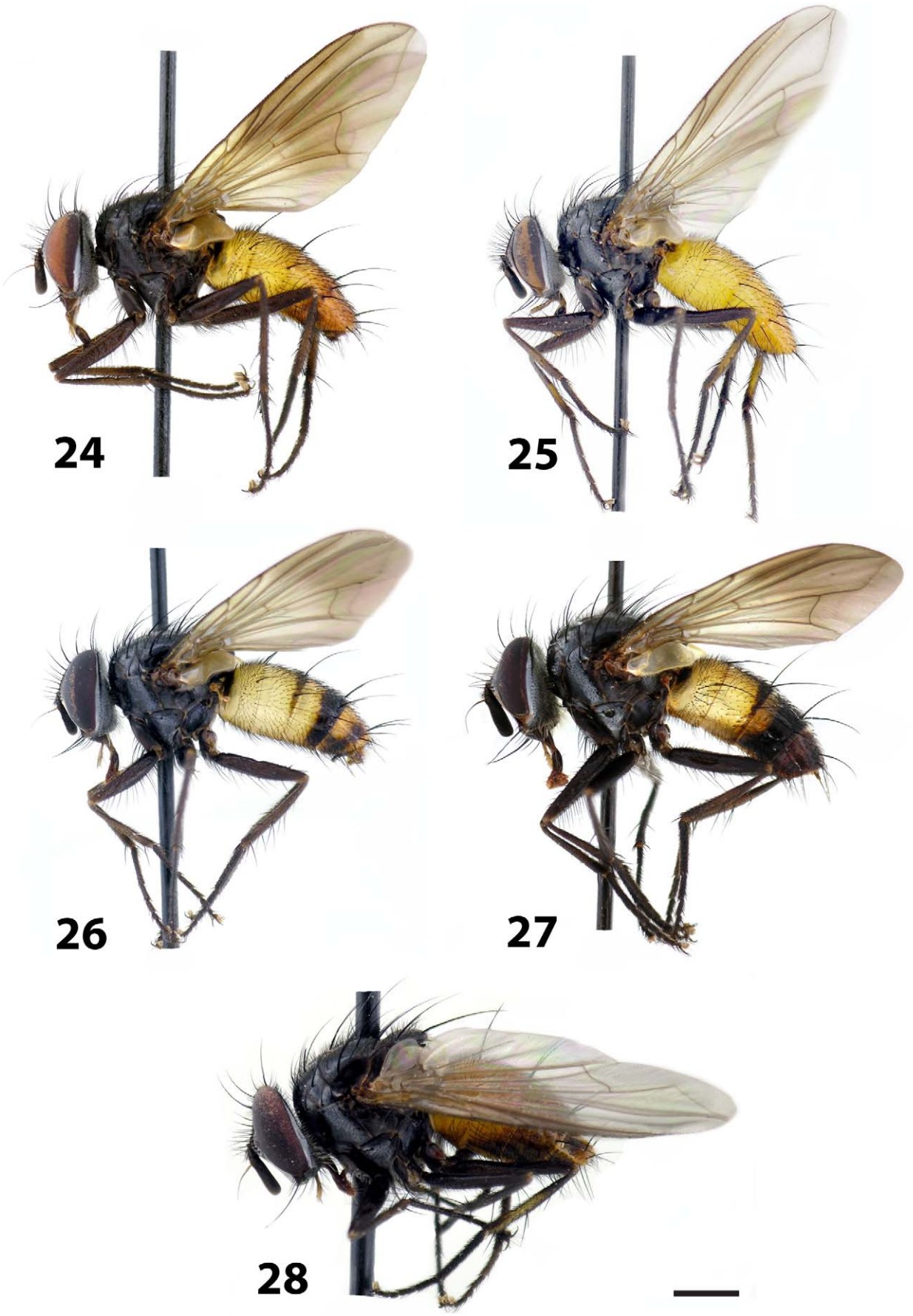
FIGURES 10–14. Lateral view of the head of males of the *E. jaena* species group. **10.** *E. abdominalis* (Townsend). **11.** *E. jaena* Townsend. **12.** *E. leptoforceps* sp. nov. **13.** *E. nigrithorax* (Wulp). **14.** *E. curvifrons* sp. nov. Scale bar = 1.0 mm.



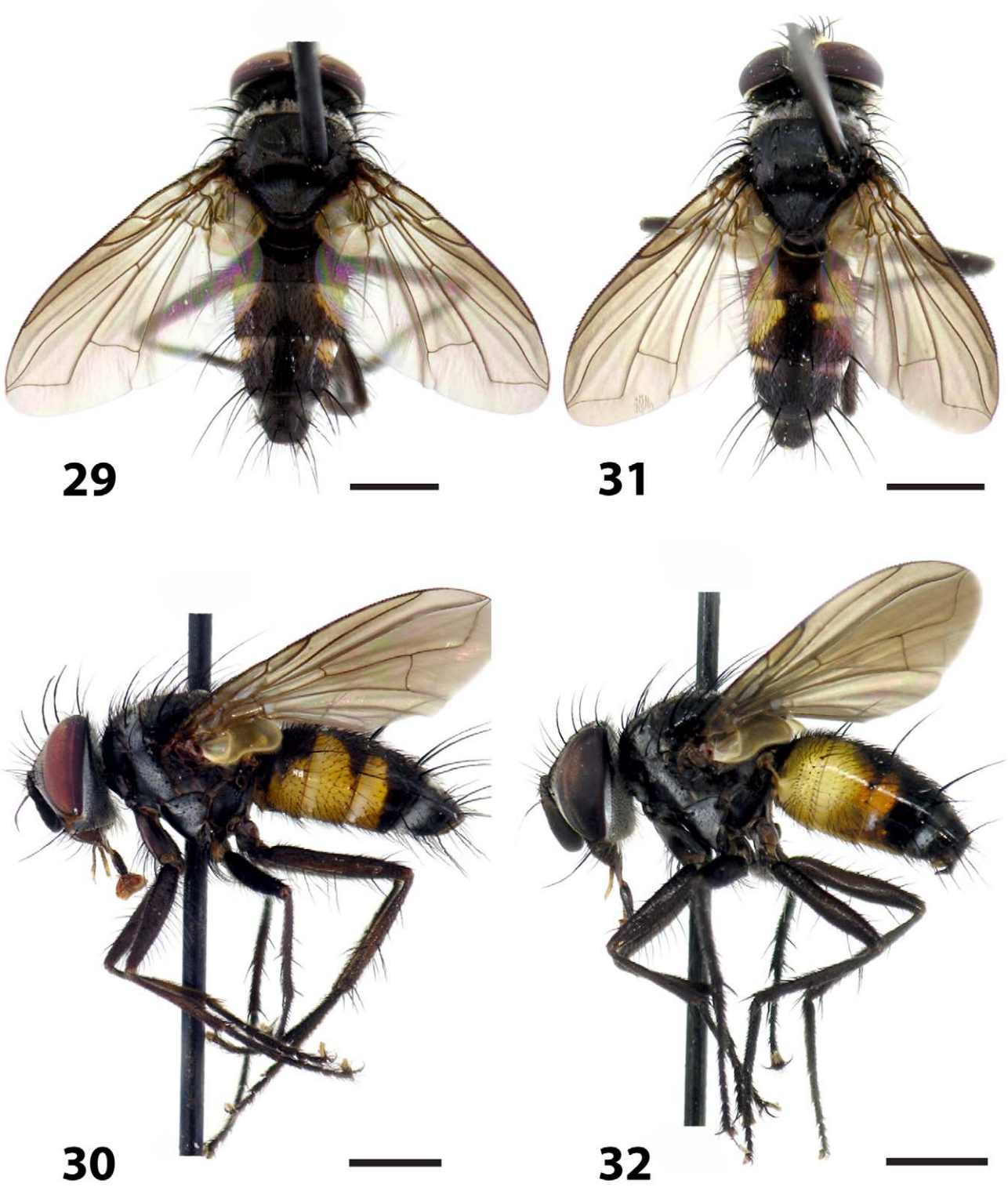
FIGURES 15–18. Frontal and lateral view of the head of males of the *E. cryptica* species group. **15–16.** *E. cryptica* sp. nov. **17–18.** *E. woodi* sp. nov. Scale bar = 1.0 mm.



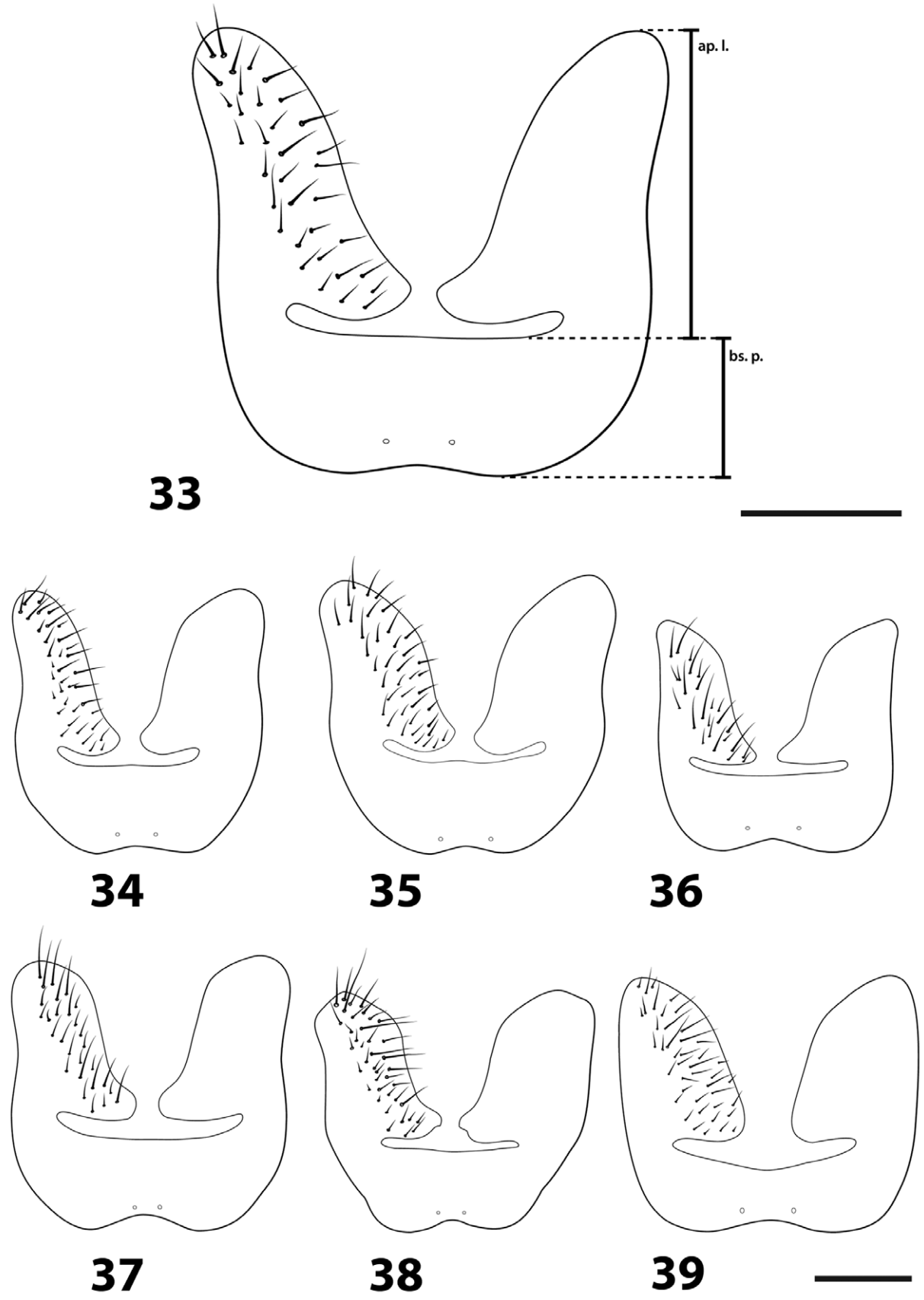
FIGURES 19–23. Dorsal view of males of *E. jaena* species group. **19.** *E. abdominalis* (Townsend). **20.** *E. jaena* Townsend. **21.** *E. leptoforceps* sp. nov. **22.** *E. nigrithorax* (Wulp). **23.** *E. curvifrons* sp. nov. Scale bar = 1.0 mm.



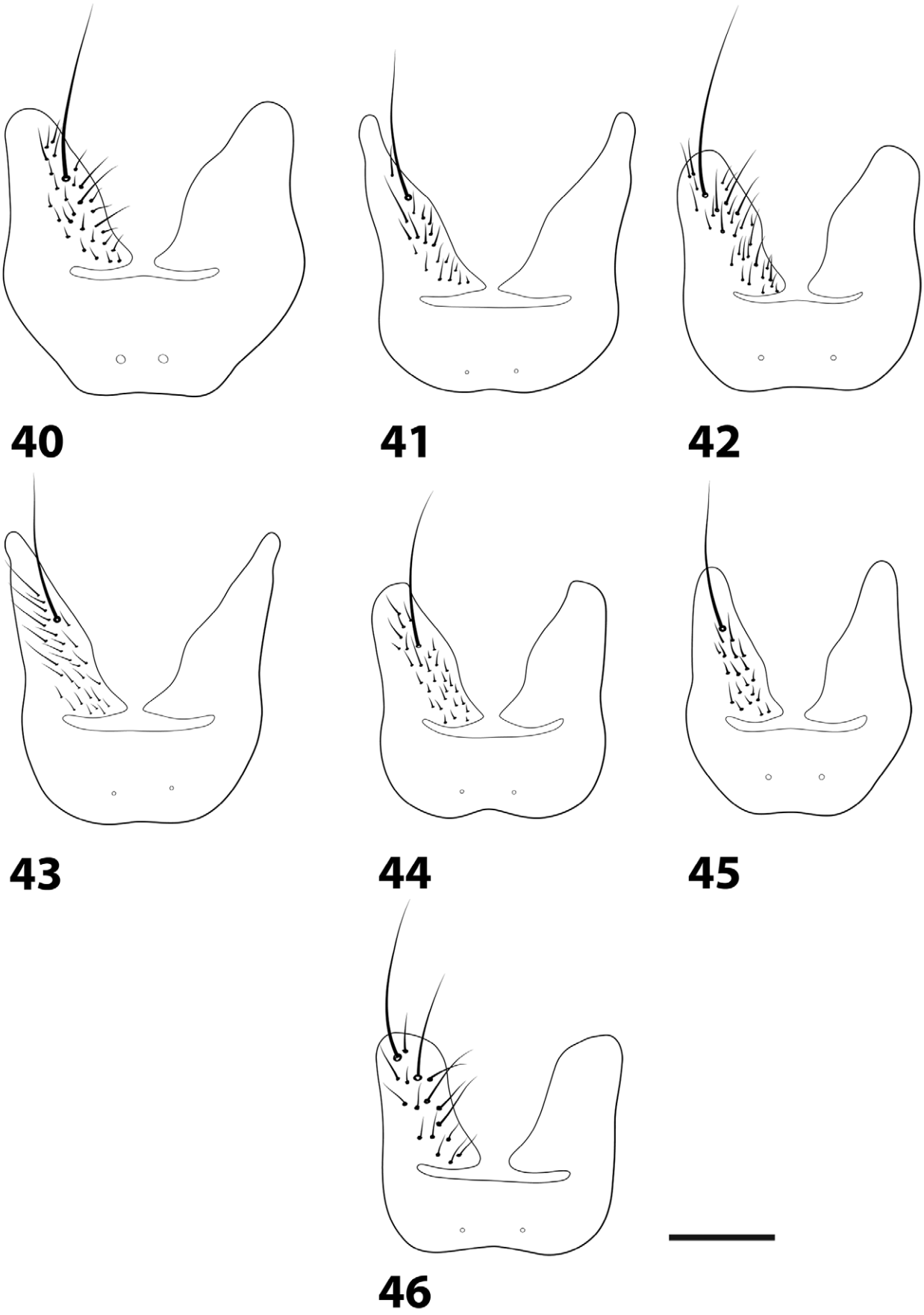
FIGURES 24–28. Lateral view of males of the *E. jaena* species group. **24.** *E. abdominalis* (Townsend). **25.** *E. jaena* Townsend. **26.** *E. leptoforceps* sp. nov. **27.** *E. nigrithorax* (Wulp). **28.** *E. curvifrons* sp. nov. Scale bar = 2.0 mm.



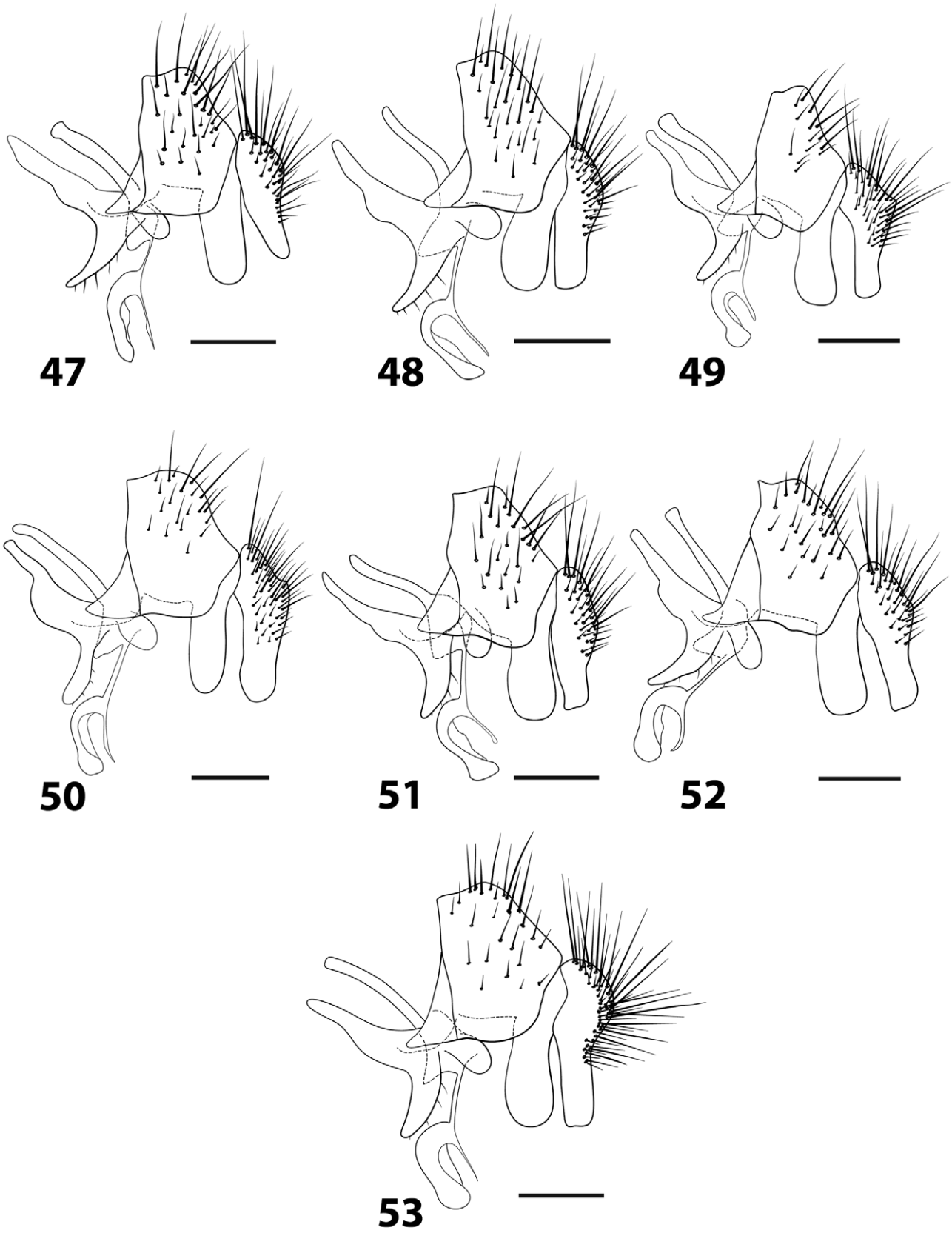
FIGURES 29–32. Dorsal and lateral view of males of the *E. cryptica* species group. **29** and **30.** *E. cryptica* sp. nov. **31–32.** *E. woodi* sp. nov. Scale bars = 2.0 mm.



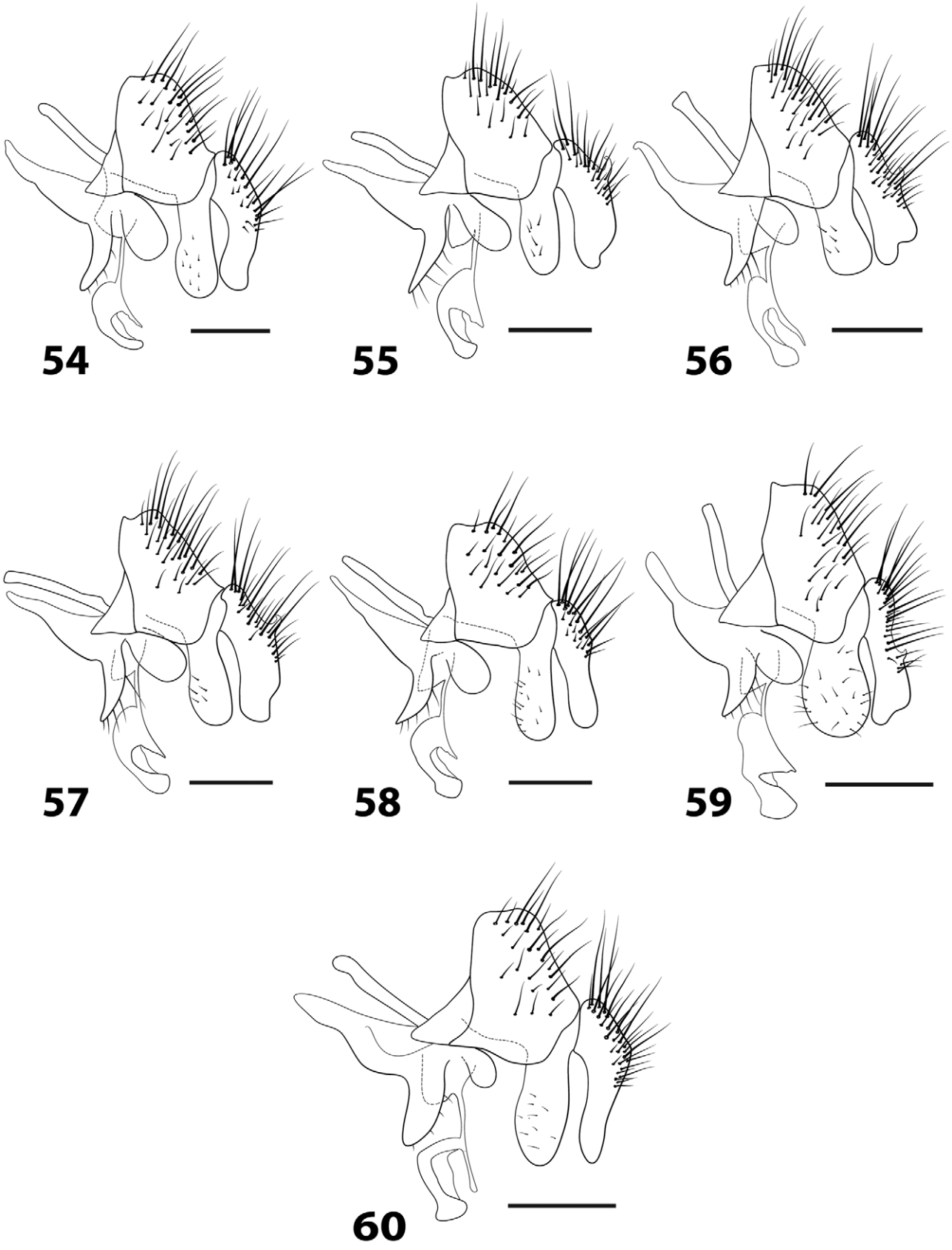
FIGURES 33–39. Sternite 5 of males of the *E. jaena* species group. **33.** *E. jaena* Townsend, showing sternite 5 measurements taken for descriptive purposes: ap.l. = apical lobe length, bs.p. = basal plate length. **34.** *E. abdominalis* (Townsend). **35.** *E. curvifrons* sp. nov. **36.** *E. ecuadoriana* sp. nov. **37.** *E. eois* sp. nov. **38.** *E. leptoforceps* sp. nov. **39.** *E. nigrithorax* (Wulp). Scale bars = 0.2 mm.



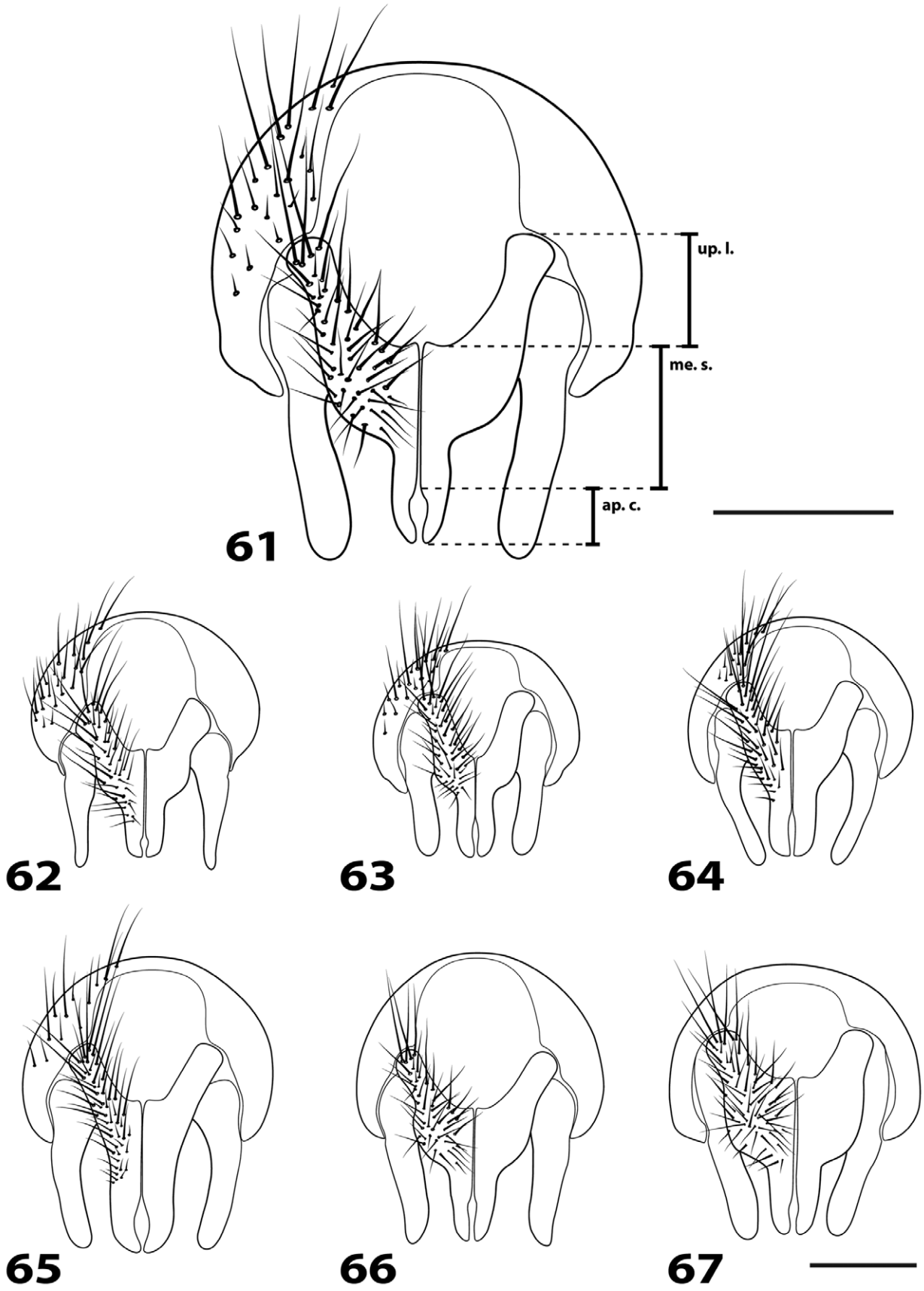
FIGURES 40–46. Sternite 5 of males of *E. cryptica* species group. **40.** *E. arciforceps* sp. nov. **41.** *E. catarina* sp. nov. **42.** *E. convexiforceps* sp. nov. **43.** *E. cryptica* sp. nov. **44.** *E. distincta* sp. nov. **45.** *E. napensis* sp. nov. **46.** *E. woodi* sp. nov. Scale bar = 0.2 mm.



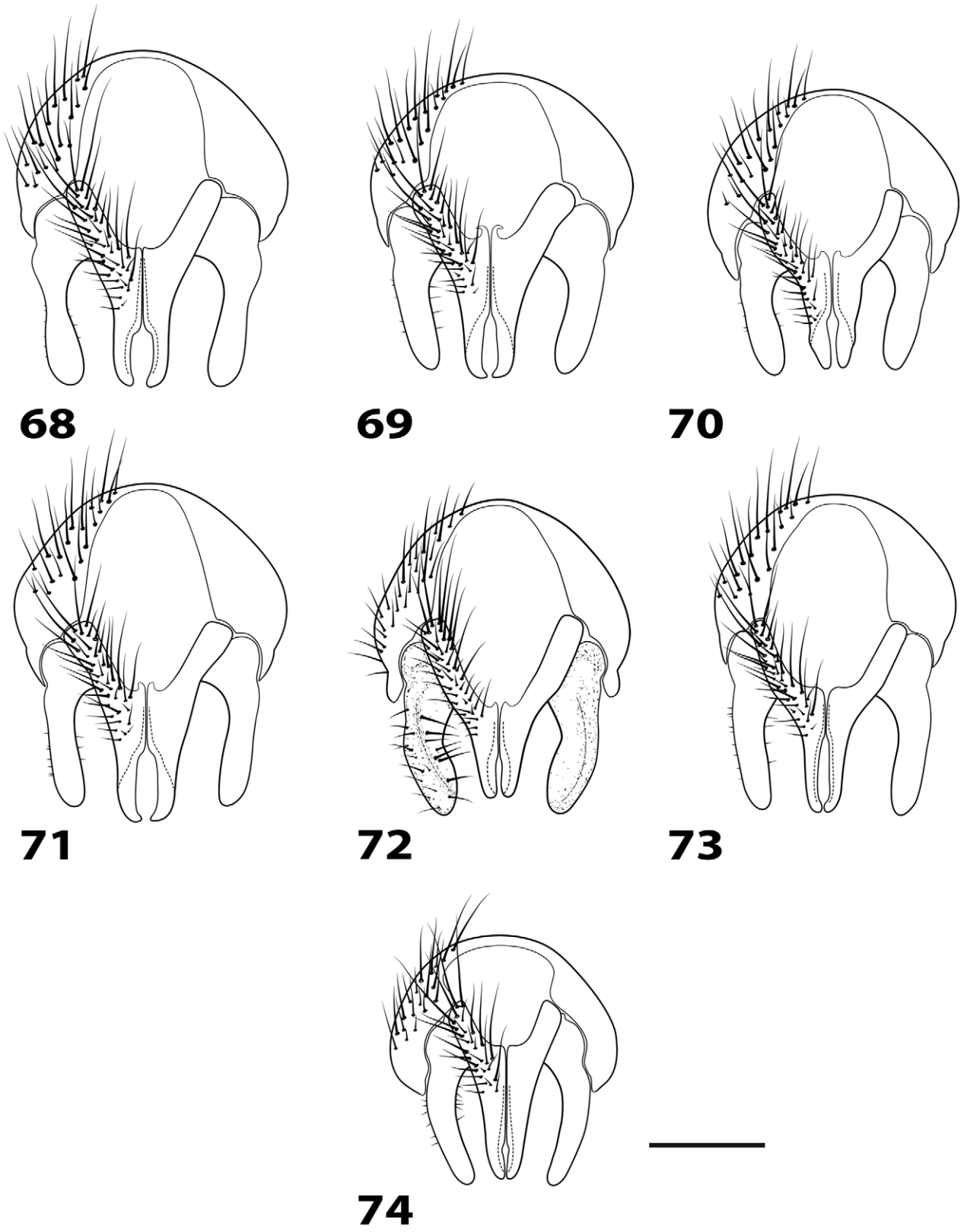
FIGURES 47–53. Lateral view of *E. jaena* species group male terminalia. **47.** *E. abdominalis* (Townsend). **48.** *E. curvifrons* sp. nov. **49.** *E. ecuadoriana* sp. nov. **50.** *E. eois* sp. nov. **51.** *E. jaena* Townsend. **52.** *E. leptoforceps* sp. nov. **53.** *E. nigrithorax* (Wulp). Scale bars = 0.2 mm.



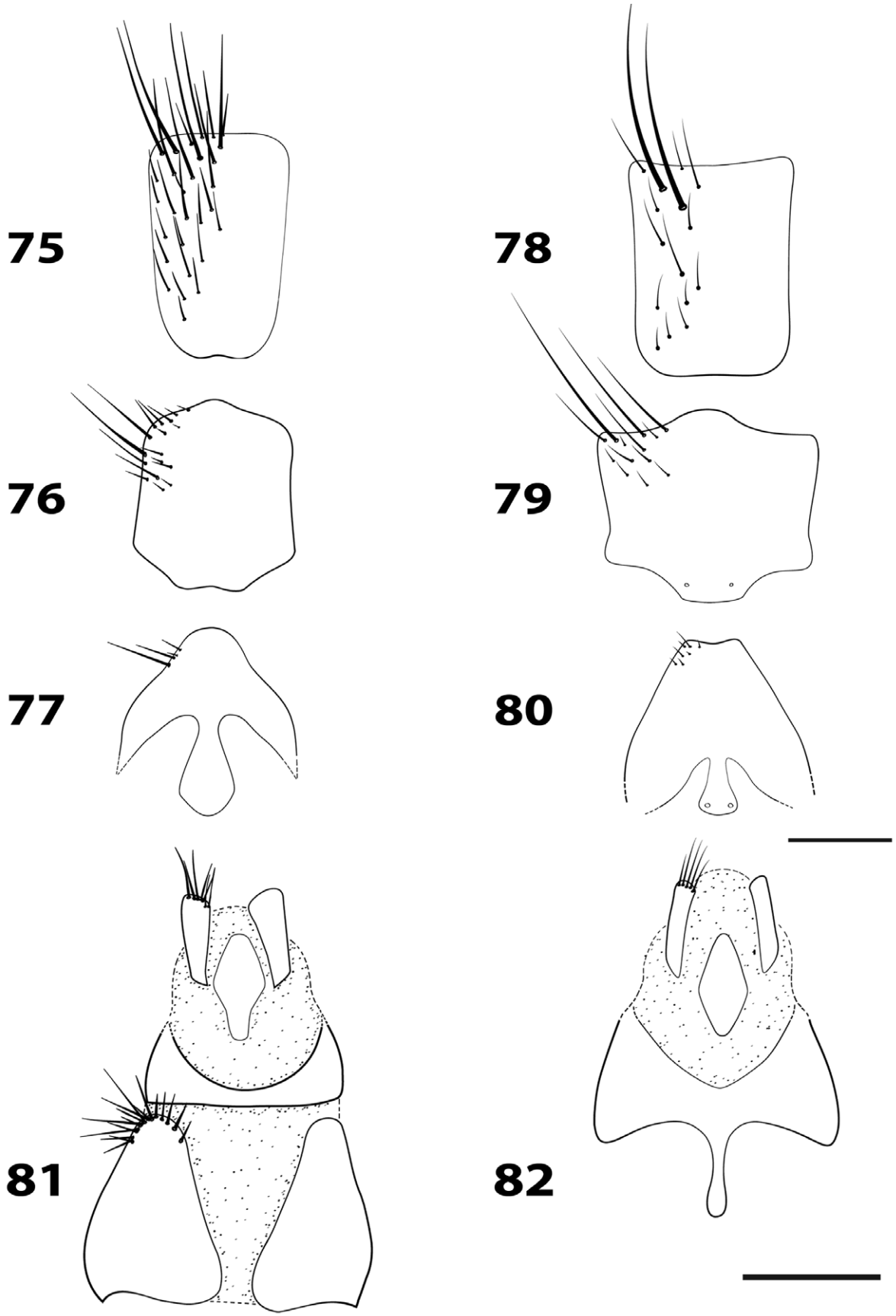
FIGURES 54–60. Lateral view of *E. cryptica* species group male terminalia. **54.** *E. arciforceps* sp. nov. **55.** *E. catarina* sp. nov. **56.** *E. convexiforceps* sp. nov. **57.** *E. cryptica* sp. nov. **58.** *E. napensis* sp. nov. **59.** *E. distincta* sp. nov. **60.** *E. woodi* sp. nov. Scale bars = 0.2 mm.



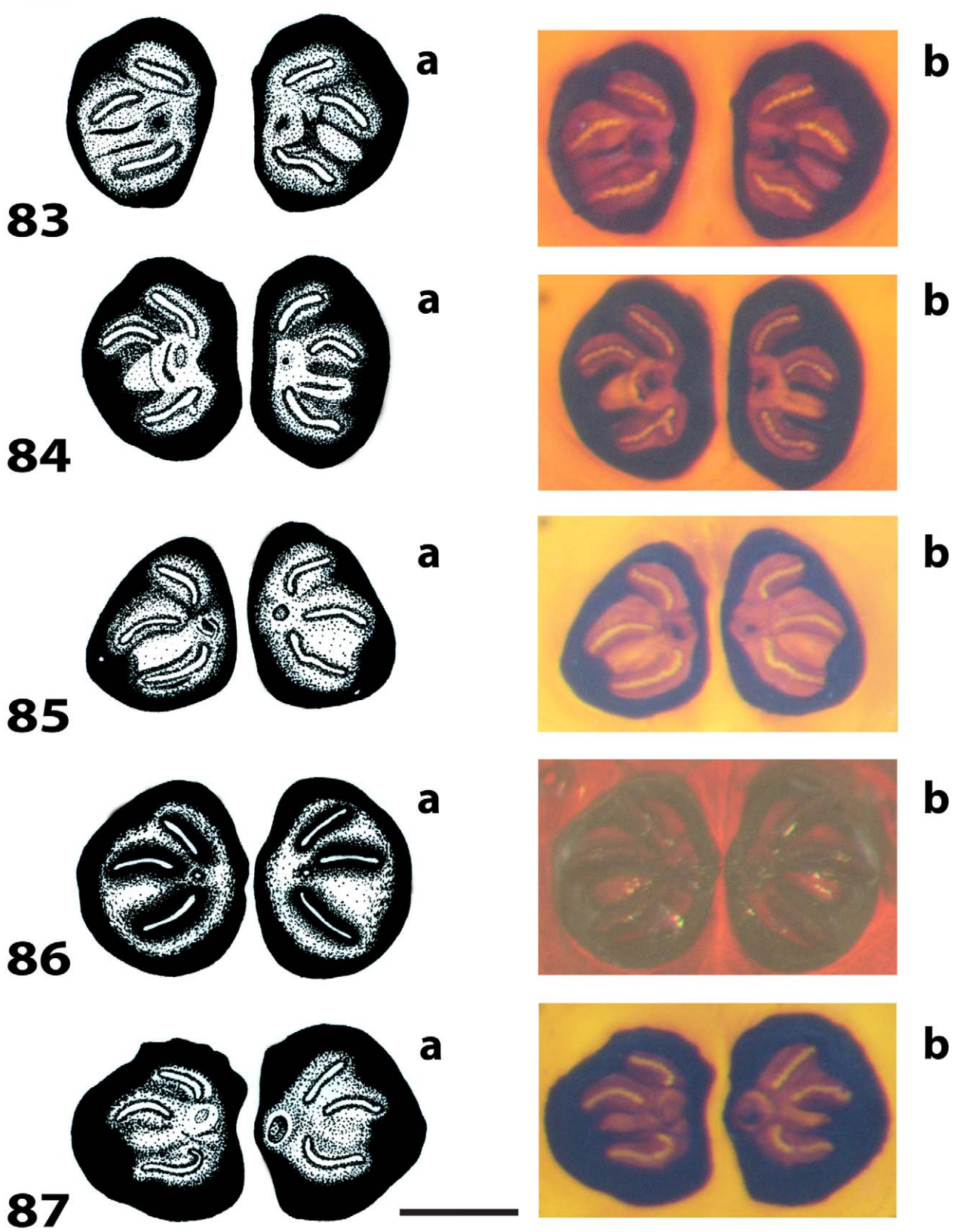
FIGURES 61–67. Posterior view of the epandrial complex in males of the *E. jaena* species group. **61.** *E. jaena* Townsend, showing cercus measurements taken for descriptive purposes: up.l. = upper lobe length, me.s. = medial section length, ap.c. = apical cleft length. **62.** *E. abdominalis* (Townsend). **63.** *E. curvifrons* sp. nov. **64.** *E. ecuadoriana* sp. nov. **65.** *E. eois* sp. nov. **66.** *E. leptoforceps* sp. nov. **67.** *E. nigrithorax* (Wulp). Scale bars = 0.2 mm.



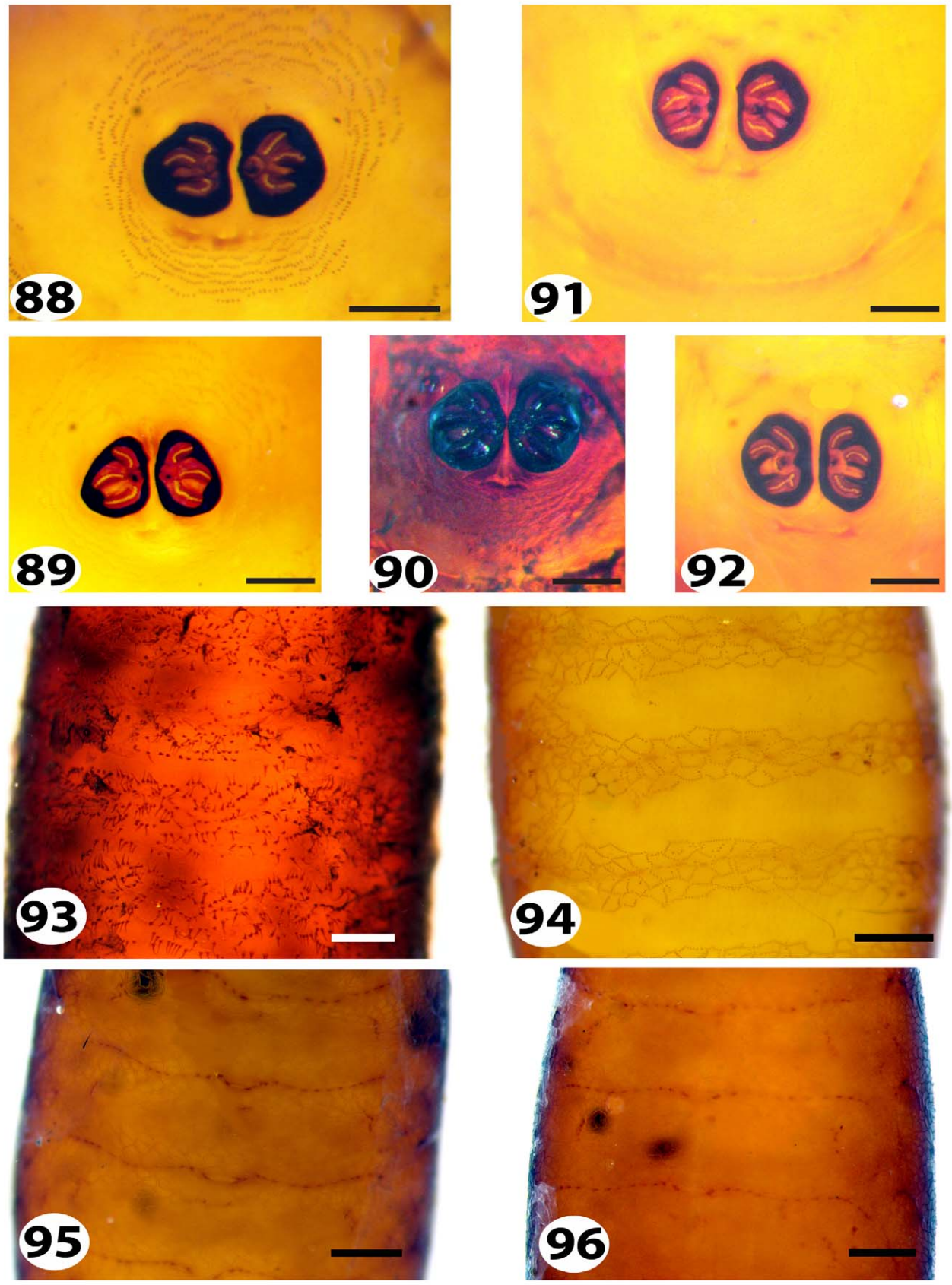
FIGURES 68–74. Posterior view of the epandrial complex in males of the *E. cryptica* species group. **68.** *E. arciforceps* sp. nov. **69.** *E. catarina* sp. nov. **70.** *E. convexiforceps* sp. nov. **71.** *E. cryptica* sp. nov. **72.** *E. distincta* sp. nov. **73.** *E. napensis* sp. nov. **74.** *E. woodi* sp. nov. Scale bar = 0.2 mm.



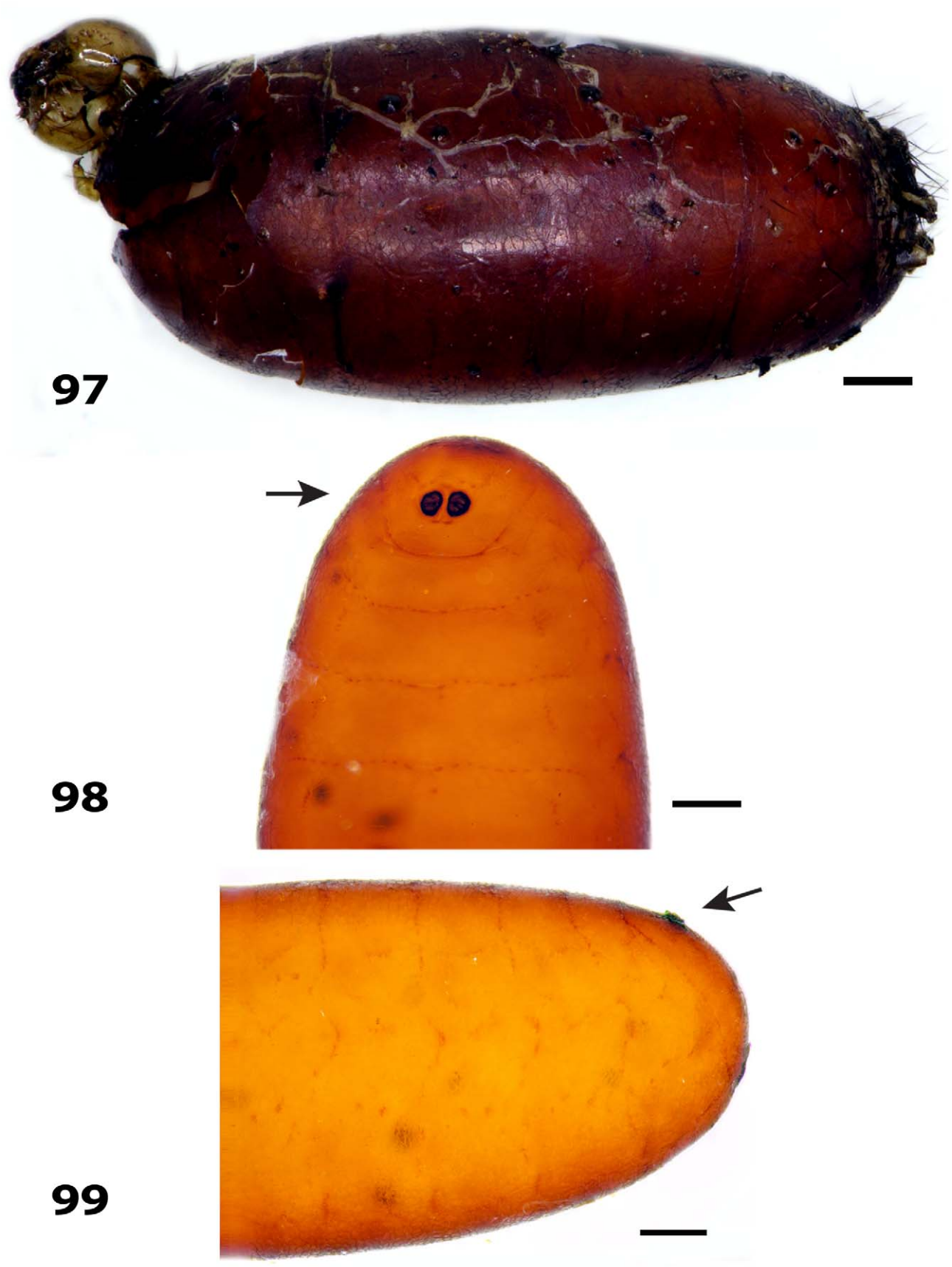
FIGURES 75–82. Female terminalia of *Erythromelana* species. **75.** Sternite 5 of *E. leptoforceps* sp. nov. **76.** Sternite 6 of *E. leptoforceps* sp. nov. **77.** Sternite 7 of *E. leptoforceps* sp. nov. **78.** Sternite 5 of *E. distincta* sp. nov. **79.** Sternite 6 of *E. distincta* sp. nov. **80.** Sternite 7 of *E. distincta* sp. nov. **81.** Tergites 7–10 and cerci of *E. leptoforceps* sp. nov. **82.** Tergites 8–10 and cerci of *E. distincta* sp. nov. Scale bars = 0.2 mm.



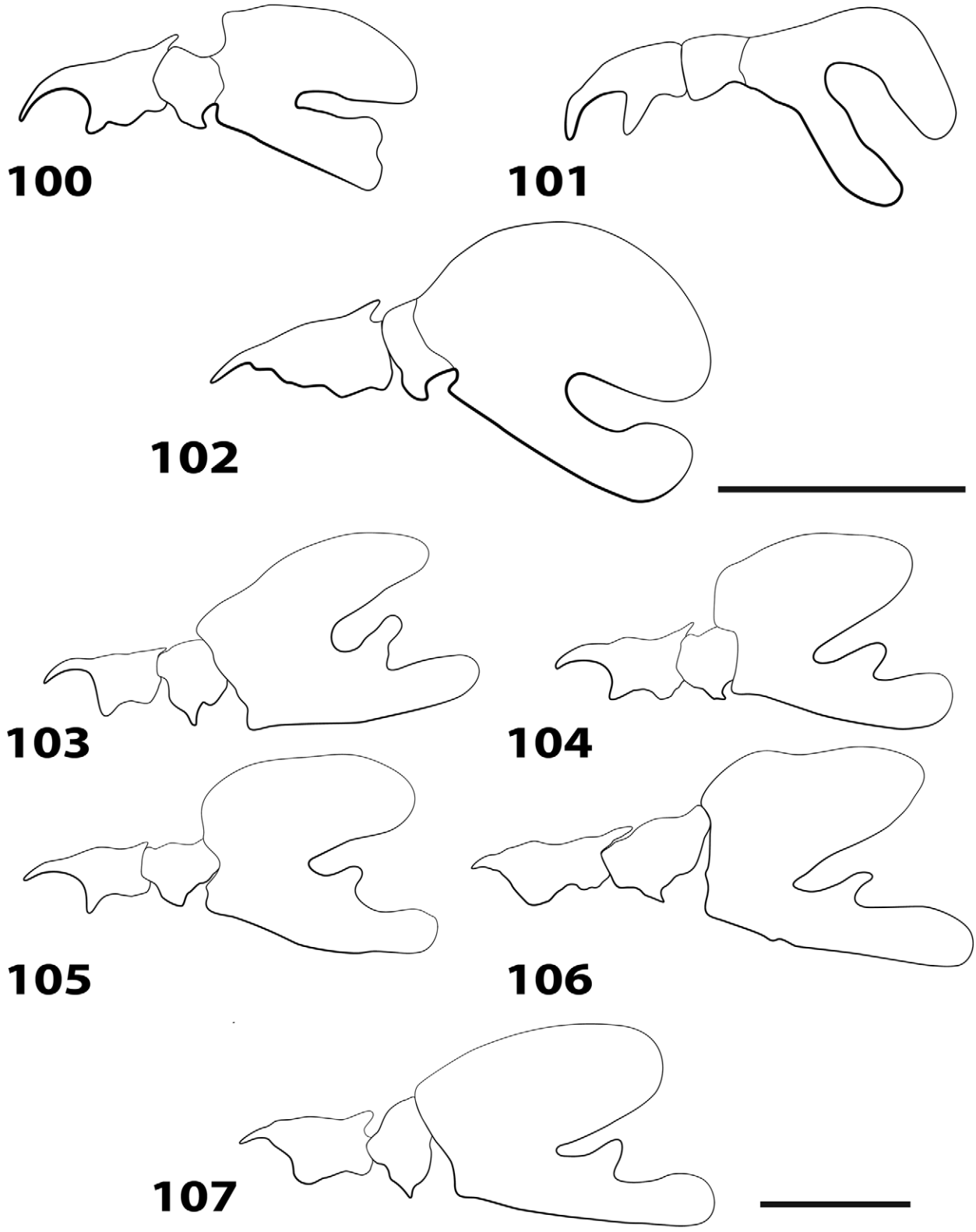
FIGURES 83–87. Posterior spiracles of *Erythromelana* species showing (a) drawings and (b) photos. **83.** *E. cryptica* sp. nov. **84.** *E. napensis* sp. nov. **85.** *E. curvifrons* sp. nov. **86.** *E. ecuadoriana* sp. nov. **87.** *E. jaena* Townsend. Scale bar = 0.1 mm.



FIGURES 88–96. Posterior spiracles and surrounding region of *Erythromelana* species. **88.** *E. jaena* Townsend. **89.** *E. curvifrons* sp. nov. **90.** *E. ecuadoriana* sp. nov. **91.** *E. cryptica* sp. nov. **92.** *E. napensis* sp. nov. Scale bars = 0.2 mm. Dorsal mid section of the puparium of *Erythromelana* species. **93.** *E. ecuadoriana* sp. nov. **94.** *E. jaena* Townsend. **95.** *E. napensis* sp. nov. **96.** *E. cryptica* sp. nov. Scale bars = 0.4 mm.



FIGURES 97–99. Puparium of *E. cryptica* sp. nov. **97**. Lateral view, showing the remains of its caterpillar host. **98**. Posterior-dorsal section. **99**. Posterior-lateral section. Arrows point to the posterior spiracles. Scale bars = 0.6 mm.



FIGURES 100–107. Lateral view of cephalopharyngeal skeletons of second instar larvae. **100.** *E. curvifrons* sp. nov. **101.** *E. cryptica* sp. nov. **102.** *E. napensis* sp. nov. Scale bar = 0.2 mm. Last instar larvae. **103.** *E. jaena* Townsend. **104.** *E curvifrons* sp. nov. **105.** *E. ecuadoriana* sp. nov. **106.** *E cryptica* sp. nov. **107.** *E. napensis* sp. nov. Scale bar = 0.2 mm.

PRINCIPAL COMPONENTS ANALYSIS (PCA)

PCA by genus

Projections of 227 specimens of *Erythromelana* and related genera onto the first three PCA axes, based on 62 external morphological characters, accounted for 12.6, 11.9 and 10.8% of the variance respectively. Despite these low eigenvalues, the first two axes are sufficient to reveal a clear division of the four major taxa examined (*Erythromelana s.s.*, *Euptilodegeeria*, *Myiodoriops*, and *Phyllophilopsis*; Fig. 108). Separation of specimens along the first axis (PC1) was due to contrasts in the number of setae on various body sclerites, particularly the presence or absence of abdominal discal setae, the number of katepisternal setae, the number of supra-alar setae on postsutural scutum, the number of posterodorsal setae on the mid tibia, and the number of setae at the base of the R_{4+5} wing vein (Table 1). Separation of specimens along the second axis (PC2) is primarily due to the number of acrostichal setae on postsutural scutum, the number of anterodorsal and posterodorsal setae on the mid tibia, color of the sc and r_1 wing cells, and the number of inner orbital setae (Table 1).

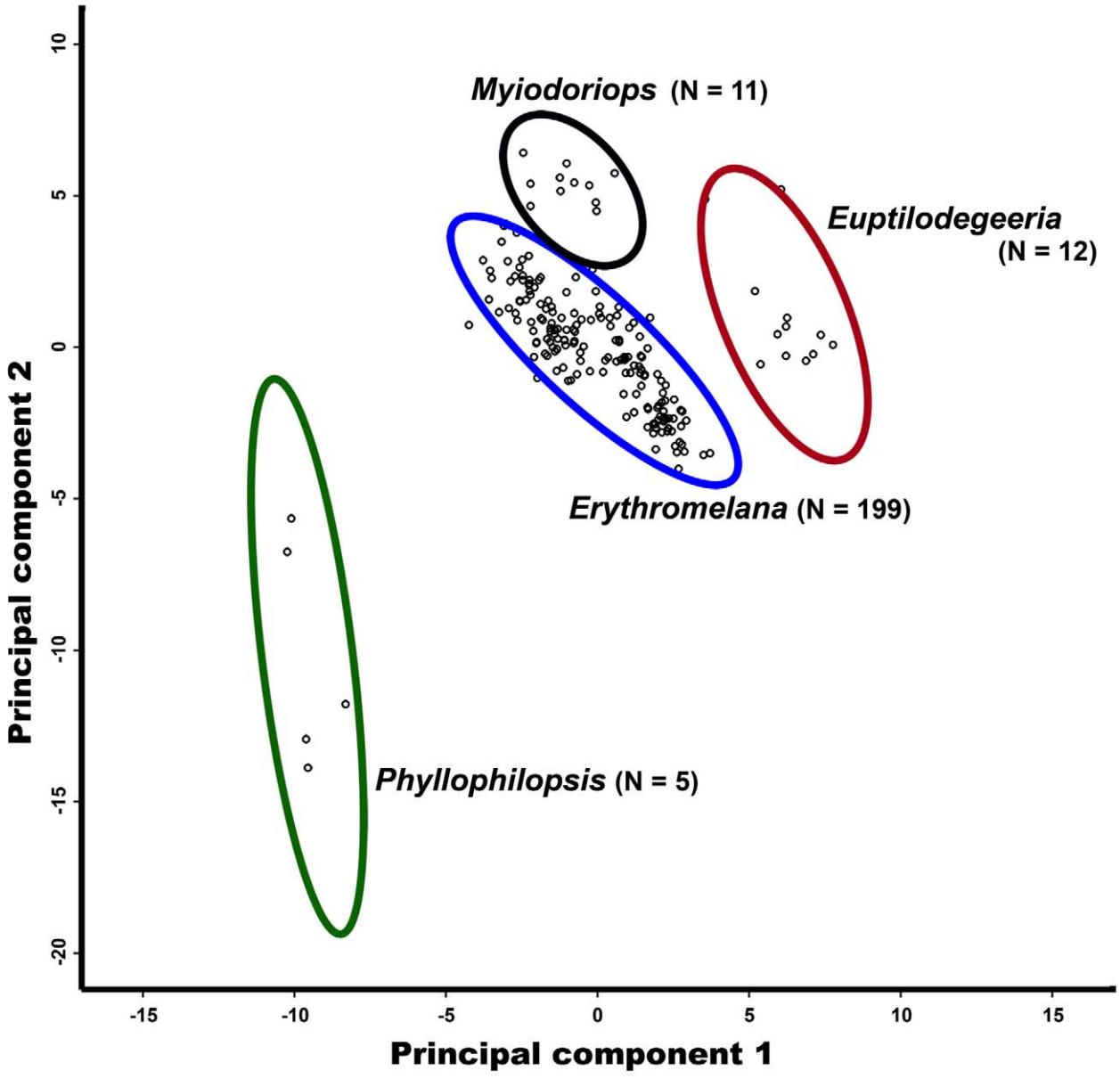


FIGURE 108. Principal components ordination of 227specimens of *Erythromelana* and related blondeliine genera based on the analysis of 62 morphological characters. Ovals indicate 95% confidence limits.

The PCA ordination clearly shows separation of the four genera (Fig. 108). Specimens of *Phyllophilopsis* are distantly separated and grouped at the lower-left quadrant of the ordination plot. Similarly, specimens of the former genera *Euptilodegeeria* and *Myiodoriops* are clustered in the upper-right quadrant. This supports the distinctness of these groups previously assigned to *Erythromelana* (Wood 1985). However, given their multivariate proximity to *Erythromelana* relative to *Phyllophilopsis*, the PCA suggests that these genera may be closely related to *Erythromelana*. *Phyllophilopsis* differs from *Erythromelana* in the presence of 14–17 frontal setae and no inner orbitals in males, no acrostichal seta on postsutural scutum, scutellum with apical seta, setae on the arista longer than the width of the arista, no anterodorsal seta on mid tibia, and four setae on posterodorsal mid tibia. Specimens of *Euptilodegeeria* differ from *Erythromelana* principally in the presence of small first supra-alar seta on postsutural scutum, R_{4+5} dorsally haired to cross vein r-m, discal setae on tg3 and tg4, and the presence of sex patches on the ventral tg4 and tg5 of males. Finally, *Myiodoriops* differs from *Erythromelana* in their relatively wider parafacial, three inner orbital setae, scutum with three presutural and postsutural acrostichal setae, postsutural scutum with a small first supra-alar seta, and M vein ending in vein R_{4+5}.

TABLE 1. Factor loadings of the five most important characters on the first two axes of the PCA of 227 specimens based on the analysis of 62 morphological characters of *Erythromelana* and related genera.

Variable	PCA loading Axis 1	Variable	PCA loading Axis 2
abdominal discal setae	0.24	number of acrostichal setae on postsutural scutum	0.22
number of katepisternal setae	0.22	number of anterodorsal setae on the mid tibia	0.21
number of supra-alar setae on postsutural scutum	0.21	number of posterodorsal setae on the mid tibia	- 0.21
number of posterodorsal setae on the mid tibia	- 0.2	r1 coloration	- 0.2
number of setae at the base of the R_{4+5} wing vein	0.2	number of inner orbital setae	0.2

PCA of *Erythromelana*

Mapping *Erythromelana s.s.* specimens onto the first two PCA axes, based on 45 morphological characters, accounted for the 18.5 and 11.6% of the variance respectively. However, these first two axes allow us to illustrate a relatively clear division of two main groups (Fig. 109), although there is slight overlap in the 95% confidence intervals. Separation of specimens along the first axis (PC1) is due primarily to the number of setae on various sclerites, particularly the number of supra-alar setae on the postsutural scutum, the presence of abdominal discal setae, the number of katepisternal setae, the number of discal scutellar setae, and the number of acrostichal setae on the postsutural scutum (Table 2). Separation of specimens along the second axis (PC2) was mainly the result of contributions from the number of frontal setae, the ratio of the flagellum length to the head height, abdominal coloration, tibia coloration, and the presence of ocellar setae (Table 2).

TABLE 2. Factor loadings for the five most important characters on the first two axes of the PCA of 169 specimens based on the analysis of 45 morphological characters of *Erythromelana* species.

Variable	PCA loading Axis 1	Variable	PCA loading Axis 2
number of supra-alar setae on the postsutural scutum	0.3	number of frontal setae	0.28
presence of abdominal discal setae	0.28	flagellum length to the head height	0.27
number of katepisternal setae	0.26	abdominal coloration	- 0.26
number of discal scutellar setae	0.23	tibia coloration	- 0.22
number of acrostichal setae on the postsutural scutum	- 0.23	presence of ocellar setae	- 0.22

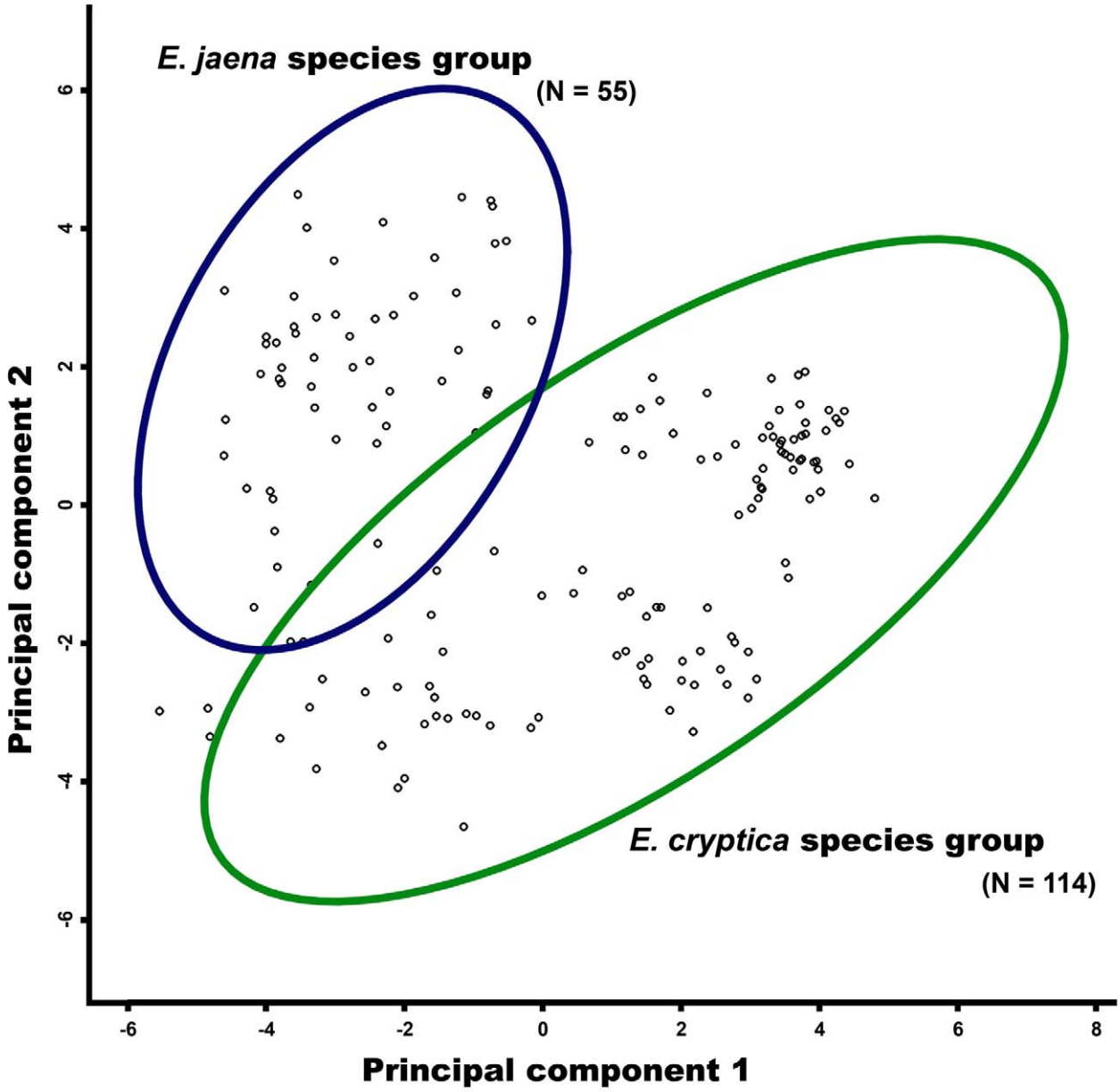


FIGURE 109. Principal components ordination of 169 *Erythromelana* specimens based on the analysis of 45 morphological characters. Ovals indicate 95% confidence limits.

Specimens morphologically similar to *E. jaena* are grouped towards the upper-left quadrant of the ordination plot, and specimens similar to *E. cryptica* are clustered along a diagonal from lower-left to upper-right portions of the ordination space. This suggests that *Erythromelana* species can be separated into two main species groups, which are referred here as the *E. jaena* and *E. cryptica* species groups (see species description section). In general, most of the species in the *E. jaena* group have a bright yellow abdomen (except *E. leptoforceps* and *E. nigrithorax*), 2–3 katepisternal setae (usually 2), and the first postsutural supra-alar absent. In contrast, most of the species in the *E. cryptica* group have the abdomen mostly black with yellow laterally, usually 3 katepisternal setae, and first postsutural supra-alar usually present. Individual species do not form clear, identifiable clusters in the PCA ordination. One reason for this overlap is that this PCA only includes non-terminalic structures and within the species groups most *Erythromelana* can only be separated by differences in male terminalia. Similar results have been found in other Diptera, such as *Pseudexechia* Tuomikoski (Mycetophilidae) flies, where a PCA of 59 non-terminalic characters showed broad overlap between species in the ordination plot and only species groups were identified (Kjærandsen 2009). Morphologically cryptic species have been commonly found across Tachinidae (e.g.,

Belvosia Robineau-Desvoidy, Smith *et al.* 2006; *Winthemia* Robineau-Desvoidy, *Anoxynops*, *Lespesia* Robineau-Desvoidy, Smith *et al*. 2007) and many other insect groups (e.g., butterflies, Burns *et al*. 2008; beetles, Monaghan *et al*. 2005; Wasps, Molbo *et al*. 2003), where separation of species has required molecular techniques and/or terminalic characters. The difficulty in separating species of *Erythromelana* based on external morphology reinforces the usefulness of incorporating terminalic characters and genetic data.

PHYLOGENETIC RELATIONSHIPS OF *ERYTHROMELANA* SPECIES

Phylogenetic analysis of morphological characters

Phylogenetic analysis of the morphological data set using parsimony resulted in a single most parsimonious cladogram (L = 253); however, most internal nodes are supported by low bootstrap values (<70%) (Fig. 110). The MPT supports the monophyly of *Erythromelana s.s.* relatively strongly, as the branch that separates this genus from *Myiodoriops* and *Euptilodegeeria* has a bootstrap value of 74 (Fig. 110). The genus *Myiodoriops* is separated from *Erythromelana* and *Euptilodegeeria* by six characters: 3 inner orbital setae; 2 subvibrissal setae; M vein ending in R_{4+5} vein at wing margin; cercus length more than 0.75 st5 length; length of medial section of cercus less or equal to 0.25 cercus length; and surstylus with a few small setae like spines on the anterior side of the apex. The genus *Euptilodegeeria* is separated from *Erythromelana* and *Myiodoriops* by four synapomorphies: R_{4+5} vein setose on more than half way to crossvein r-m; abdominal discal setae on tg3 and tg4; sex patches present ventrally on tg4 and tg5; and st5 basal plate shorter than or equal to 0.42 st5 total length. Finally, together, the genera *Euptilodegeeria* and *Myiodoriops* are separated from *Erythromelana* by two characters: pregonite strongly curved and surstylus triangular-shaped, narrowed toward the apex.

In this morphology-based phylogenetic reconstruction, the two clusters of species within *Erythromelana* (*E. cryptica* and *E. jaena* groups) are clearly separated (see PCA section above), but these groups are supported by low bootstrap values (Fig. 110). Two characters of the male terminalia divide these groups: males in the *E. jaena* species group have the apical lobes of st5 rounded, with several small setae; and the cercus is dorsally flat on the medial section (likely plesiomorphic traits, see above). In contrast, males in the *E. cryptica* species group have the apical lobe of st5 usually pointed, with a pair of long, well-developed setae (rarely absent on *E. woodi*); and a slight dorsal depression on the medial section of the cercus. *Erythromelana woodi* appears intermediate in some ways, as some specimens lack the long setae on st5 and the abdominal coloration sometimes resembles the *E. jaena* species group. Thus, its placement in the *E. cryptica* species group is somewhat tenuous. Species relationships within these species groups remain unclear due to weak branch support.

The species *E. cryptica* was separated into four groups based on geographic location, (ME) Mexico, (CR) Costa Rica, (VE) Venezuela, and (EC) Ecuador, in order to analyze the morphological variation of these subgroups. In this analysis, *E. cryptica* was recovered as a paraphyletic group, but all branches are weakly supported. All specimens are united by a single synapomorphy in the male terminalia, where the cerci, in posterior view, are slightly carinate on the medial section of the posterior margin, and end in nearly truncate tips. The most apparent variation among these specimens is the wing coloration, the number of scutal setae; and the ratios of head height and width to the body length and pedicel length to flagellum length. Based on the terminalic synapomorphy of this species, the ME, CR, VE, and EC populations are considered as members of one species, *E. cryptica*, but it remains unclear whether the variation within this group is truly interspecific or intraspecific.

Phylogenetic analysis of molecular characters

Of the initial 70 specimens from which DNA was extracted, mtDNA COI sequences of about 700 bp were recovered for only 17 *Erythromelana* specimens, corresponding to nine males and eight females (Appendix 3). This low percentage of sequences recovered is mostly due to the age of the samples used for DNA extraction because 86% and 60% of the sampled specimens were four and ten or more years old, respectively.

The consensus maximum likelihood (ML) tree of those taxa supports the monophyly of *Erythromelana s.s.* (Fig. 111), although bootstrap support is weak. *Erythromelana woodi* is reconstructed as the most basal lineage of the genus, but this relationship is weakly supported. Three clusters of taxa within the genus are apparent: *E. woodi*, the *E. cryptica* group, and the *E. jaena* group, although the latter group is supported in <40% of bootstrap replicates. The main difference between these relationships and those indicated by the morphological analysis is that the *E. cryptica*

species group is monophyletic based on parsimony analysis of morphology and is paraphyletic in ML analyses of sequence data. Given low bootstrap support and the lack of morphological characters that clearly separate *E. woodi* from the *E. cryptica* species group, *E. woodi* will continue to be considered a member of this informal group.

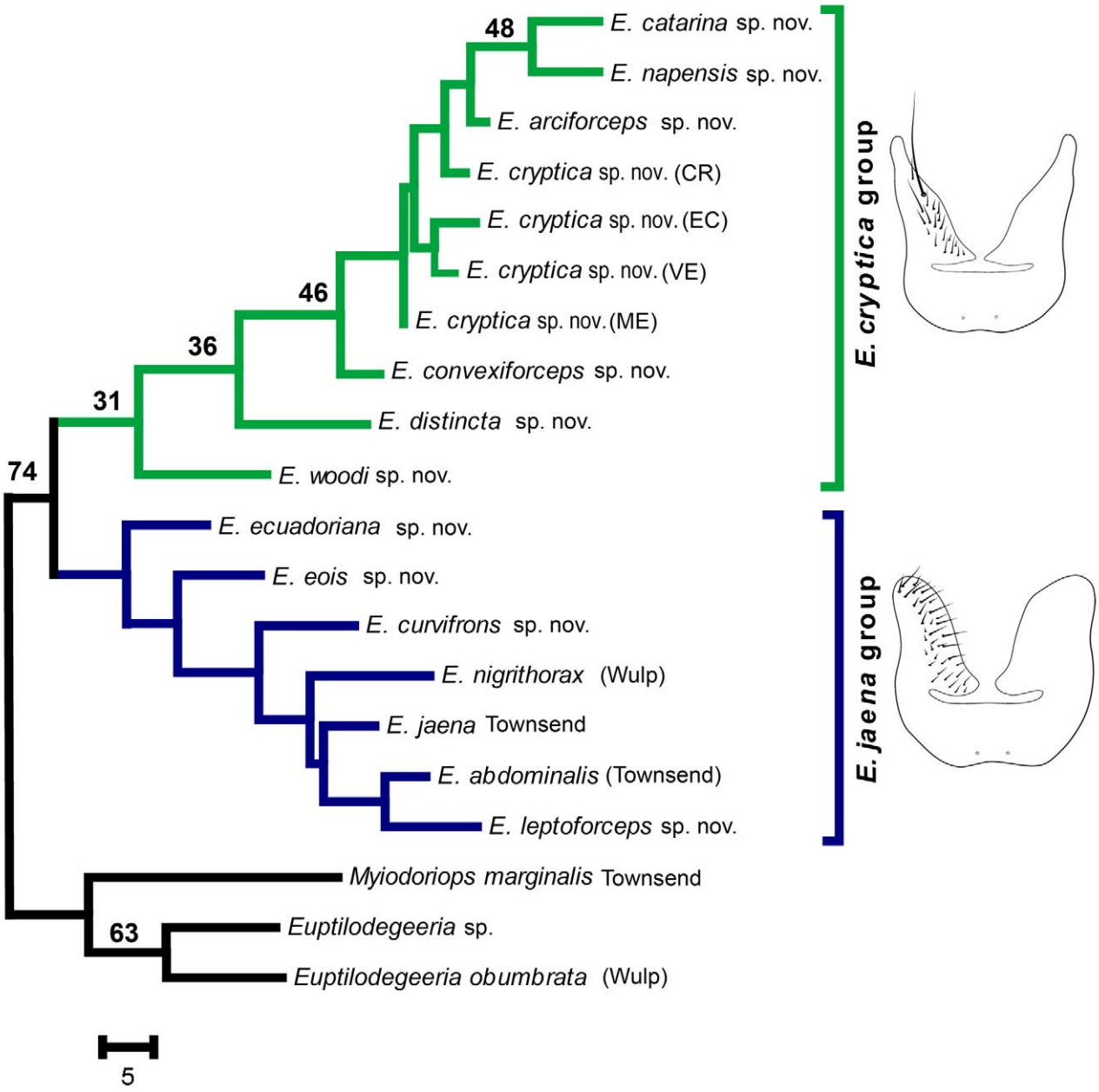


FIGURE 110. The most parsimonious tree of *Erythromelana* based on the analysis of 56 morphological characters. Numbers above branches indicate bootstrap percentages greater than 30.

The recognition of *Erythromelana* species based on COI mtDNA sequences depends on the percent divergence between lineages. Proponents of DNA barcoding have suggested 3% COI divergence as the threshold for separation of Lepidoptera species (Hebert *et al*. 2003), but this threshold has been highly debated due to the greater intraspecific and lower interspecific variation observed in many taxa (e.g., Whinnett *et al*. 2005, Meier *et al*. 2006). If a 3% raw pairwise divergence threshold is adopted to separate the 17 *Erythromelana* specimens sequenced in this study (using uncorrected "p" distances), roughly eight species can be identified from our sequenced samples, four from the *E. cryptica* and four from the *E. jaena* species groups. For the *E. cryptica* species group, (1) *E. woodi* DI84EC09 is 3.4% divergent from (2) *E. woodi* DI507ECU; (3) *E.* sp. YY7599, YY8640, and *E. napensis* YY8135 exhibit less than 1.5% sequence divergence from one another, but are 2.8–3.1% divergent from (4) *E. cryptica* YY26213 and *E.* sp. YY8740 (1.6% divergent). For the *E. jaena* species group, (5) *E. ecuadoriana* YY37297 is

identical to DI03PT; (6) *E.* sp. YY13862 is 2.0% divergent from *E.* sp. YY11445, but together they are 2.7–3.4% divergent from (7) *E.* sp. YY8844 and *E.* sp. YY8485 (0.006% divergent), and (8) the *E. leptoforceps* specimens are identical and >3.2% divergent from any other samples. These "DNA species" are delimited by an arbitrary 3% COI divergence threshold and there may be fewer or more distinct species actually present in these samples.

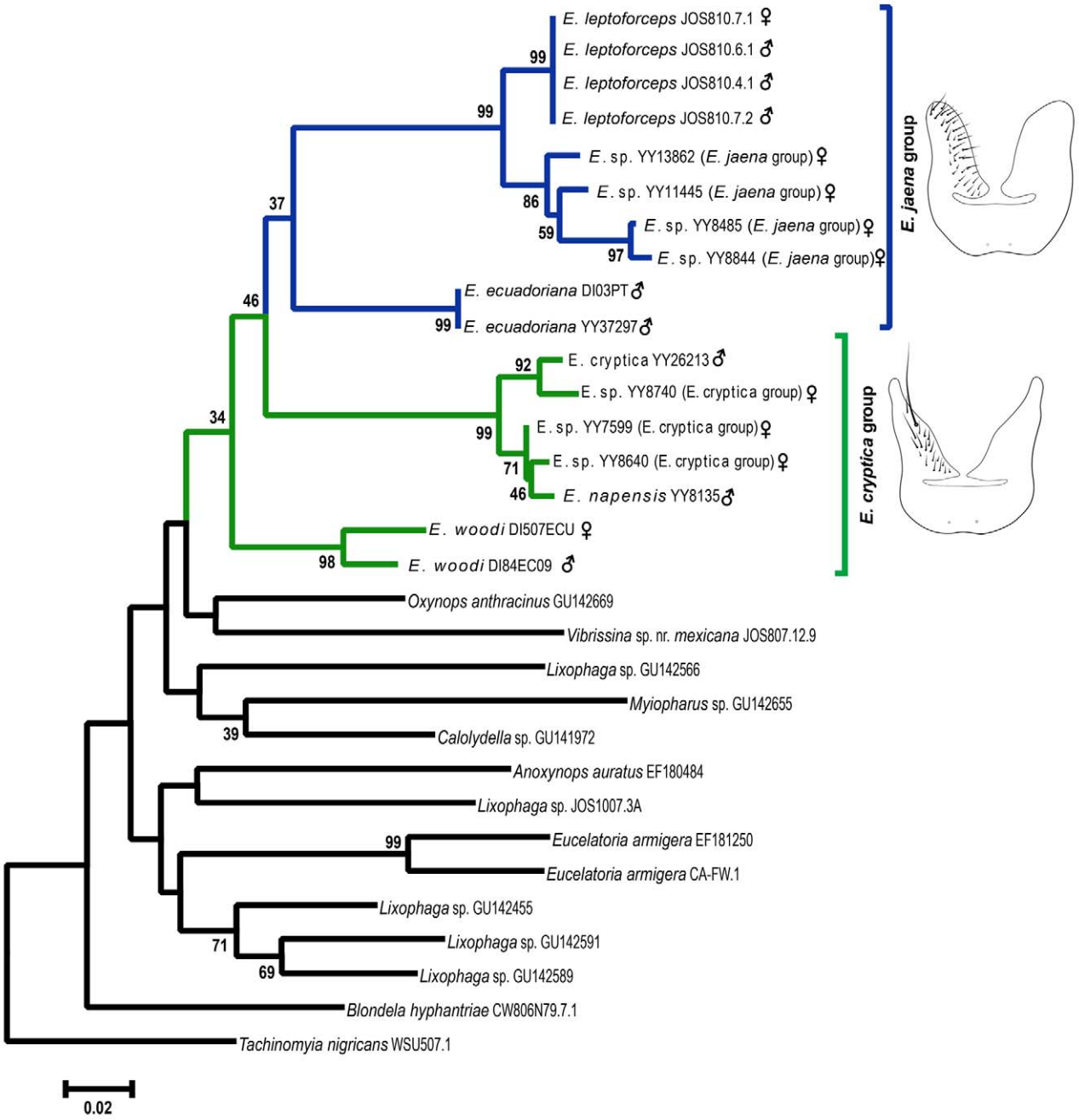


FIGURE 111. Maximum Likelihood tree for 12 representatives of Blondeliini and 13 *Erythromelana* COI sequences. Numbers above branches indicate bootstrap percentages greater than 30.

The only clear difference between these seven "DNA species" and those that are morphologically well defined involves the male and female of *E. woodi*, which were classified as a single species, but are clearly divergent in COI sequences. Interestingly, both of these specimens were collected in the Ecuadorian Andes, but the female is from the western slope and the male is from the eastern slope (both at above 1500 m). More sequence data from males and females is necessary to confirm this divergence, evaluate molecular differences, and examine their correlation with morphological variation (see discussion section of *E. woodi* species description). In contrast to *E. woodi*, the DNA divergence of the species *E. ecuadoriana*, *E. leptoforceps*, *E. napensis*, and *E. cryptica*

corresponds to their classification based on morphological characters. This analysis indicates that *E.* sp. YY7599 and YY8640 are probably females of *E. napensis*, and *E.* sp. YY8740 is likely a female of *E. cryptica*. However, as mentioned previously, females of the *E. cryptica* group (except *E. distincta* and *E. woodi*) remain undescribed due to the lack of morphological characters to separate them and associate them with their respective species. Similarly, the two sets of females in the *E. jaena* species group are morphologically similar to *E. jaena* and *E. abdominalis*, but there are differences in the shape of the palpus, where the specimens YY13862 and YY11445 have a small and sparsely haired palpus and YY8844 and YY8485 have a larger and apically almost bare palpus. However, the determination of which group of females corresponds to *E. jaena* and *E. abdominalis* remains unclear because of the absence of sequence data from males of these species. Given the moderate levels of sequence divergence within some species recognized here (1–2%), it is possible that additional, morphologically cryptic species exist, but more data is needed to properly evaluate this possibility.

The relative position of *Erythromelana* within the Blondeliini is unclear from this analysis. The closest group in this analysis is a weakly supported cluster of *Oxynops* and *Vibrissina* sp. nr. *mexicana* (Fig. 111). However, these latter taxa are probably not closely related because branches are very weakly supported. It appears that COI data are poor at resolving supra-generic relationships in this group as has been reported in other taxa (e.g., Winterton *et al*. 2007). There are only two studies that have analyzed phylogenetic relationships of the Blondeliini, both including only a small number of taxa (Stireman 2002, Tachi & Shima 2010). These studies have suggested that the tribe is generally monophyletic, but relationships among genera remain largely unknown. To understand relationships and the position of *Erythromelana* within the Blondeliini more taxa and data are needed.

TAXONOMIC CHANGES

In the original description of *Erythromelana*, Townsend (1919a) described the genus from two specimens of a single species, *E. jaena*. Therefore, his definition of the genus was limited to the variation between these specimens. For example, Townsend noted the absence of ocellar setae and abdominal discal setae. In this broader treatment of the genus, these two characters vary; ocellar setae may be absent to well-developed and abdominal discal setae may be present or absent on tg5. Additionally, in Wood's (1985) revision, he stated that the pospronotum has only 2 setae and the wing vein R_{4+5} may be setose more than half way to crossvein r-m. In this revision, based on additional specimens these two characters vary, with the postpronotum bearing 2 or 3 setae and the vein R_{4+5} setose only at base.

The nominal species *E. obscurifrons* (Wulp) is treated as a *nomen dubium* within *Erythromelana*. Specifically, *E. obscurifrons* was described from a single female, which in this study corresponds to one of the cryptic females in the *E. cryptica* species group. Females in this species group lack obvious morphological characters for their identification and separation and cannot be associated with their respective males. Given the difficulty of determining to which male this female belongs, this species is designated here as a *nomen dubium*.

The species *Myiodoriops marginalis* Townsend and *Euptilodegeeria obumbrata* (Wulp) previously assigned to *Erythromelana* appear to represent distinct genera with unclear relationships to this genus and are reinstated as monotypic genera. *Myiodoriops marginalis* is separated externally from *Erythromelana* mainly by having 3 inner orbital setae, 2 subvibrissal setae, and M vein ending in R_{4+5} vein at wing margin. The genus *Euptilodegeeria* is separated from *Erythromelana* mainly by having the R_{4+5} vein setose on more than half way to crossvein r-m, abdominal discal setae present on tg3 and tg4, and sex patches present ventrally on tg4 and tg5. However, the clearest differences of *E. obumbrata* and *M. marginalis* from *Erythromelana* are found in the male terminalia in which the pregonite is strongly curved and the surstylus is triangular-shaped, becoming narrower toward its apex. In addition, *M. marginalis* possesses a unique surstylus with spine-like setae on the anterior side of its apex (see PCA and phylogenetic sections).

The relationships between *Euptilodegeeria*, *Myiodoriops* and *Erythromelana* are unclear. They bear a resemblance in size, head shape, thoracic chaetotaxy, and other traits, but the many unique features of the former two taxa, particularly with regard to terminalia, suggest that they are distinct from *Erythromelana* and it is unclear if either represents its sister taxon or where they may lie among the Blondeliini. More phylogenetic study, particularly using terminalia and molecular data, is needed to understand inter-generic relationships of the Blondeliini. Given their many distinct morphological features and the uncertainty in their relationships, it seems most conservative to regard *Euptilodegeeria* and *Myiodoriops* as distinct genera at this time.

ERYTHROMELANA HOST ASSOCIATIONS, SPECIES RICHNESS AND DIVERSIFICATION

Despite the importance and diversity of tachinids, the ecology of most species in the family is poorly known or unknown (Stireman *et al*. 2006), and the genus *Erythromelana* is no exception. Prior to this work, the only knowledge of the genus was the external morphology of three species. Geographic distributions, host associations, and immature stages have not been previously recorded in the literature. As mentioned previously, the Neotropical Region harbors a rich tachinid fauna, particularly Blondeliini, and the species described here probably represent just a fraction of the total species richness of *Erythromelana*. The great diversity of morphologically similar species of Neotropical Blondeliini begs the question of how all these taxa diversified and what ecological factors were involved. Here, information on geographic distributions and host records of *Erythromelana* are examined to evaluate potential modes of diversification.

ERYTHROMELANA HOST ASSOCIATIONS

After seven years of inventorying caterpillars, the *Caterpillars and Parasitoids of the Eastern Andes in Ecuador* project has reared over 1000 tachinids from 16 families of Lepidoptera, and preliminary identifications of these specimens suggest the existence of over 230 tachinid species (Miller & Dyer 2009, Stireman *et al*. 2009, Stireman unpub. data). Of these records, 28 *Erythromelana* specimens were reared from *Eois* spp. (Lepidoptera: Geometridae), and one specimen from an unknown pyralid larva (Lepidoptera: Pyralidae). Given the nearly perfect association of *Erythromelana* with *Eois* hosts and that most of the caterpillars sampled at the site and day of collection of the pyralid-reared specimen were geometrids, this latter record is suspected to be erroneous. The 28 *Erythromelana* specimens were reared from 24 caterpillars collected from host plants in the genus *Piper*, two from *Peperomia*, one on *Sarcorachis* (Piperaceae), and a single specimen from the genus *Siparuna* (Monimiaceae) (Table 3).

One problem in understanding insect diversity and host relationships of herbivores and parasitoids is the presence of large numbers of rare species (Novotny & Basset 2000). In the Ecuadorian lepidopteran and parasitoid inventory project mentioned above, with a total parasitism by tachinids of about 9% , more than 50% of 150 morphospecies were represented by a single individual (Stireman *et al*. 2009). In particular, *Erythromelana* appear to be extremely rare. From 5810 successful *Eois* spp. rearing events with a total percent of parasitism of 8.2% (including Braconidae and Ichneumonidae), the percent of tachinid parasitism (e.g., by *Eribella* Mesnil, *Calolydella* Townsend, *Siphona* Meigen, *Eucelatoria* Townsend, and *Phytomyptera* Rondani) is less than 2%, and the percent parasitism by *Erythromelana* is less than 0.5%. Additionally, two years of monthly samples from Malaise and pan traps from the area where these caterpillars were collected recovered only a single *Erythromelana* specimen from a collection of over 2000 individual tachinids. Although the rarity of these species makes it difficult to analyze host associations, a brief examination is provided below.

Host specialization appears to be a key factor in species diversification (Schluter 2000). Specifically, specialization can increase genetic differentiation of populations by linking resource use and mate choice (e.g., Bush 1975, Feder *et al*. 1988, Hawthorne & Via 2001). At least five *Erythromelana* species appear to be specialized on the geometrid genus *Eois* (Table 3). Of these records, *E. curvifrons* is the only species where the host genus is unknown, although it is likely *Eois* as it was identified as a geometrid and was collected on a host plant on which *Eois* feeds. The specificity of *Erythromelana* species on particular *Eois* species is difficult to evaluate because most of the caterpillar hosts were identified only to genus. Still, several *Erythromelana* species appear to parasitize the same host species and it is likely that some parasitize several *Eois* species. For example, *E. napensis* and the two morphospecies, *E.* sp. (*E. cryptica* group) and *E. jaena*-group specimens with small palpus, all appear to parasitize the same host in the *Eois encina* group; and *E.* sp. (*E. cryptica* group) parasitizes *Eois* on at least five host-plants, which likely represents multiple *Eois* species (Table 3). This suggests that *Erythromelana* are largely specialized on the genus *Eois*, but individual species may use more than one *Eois* host. From these records it appears unlikely that host-associated ecological speciation by itself can explain the diversification of *Erythromelana*. However, a recent analysis of *Eois* diversification has revealed widespread cryptic speciation in this group, as well as the use of multiple hosts by some lineages (Wilson *et al*. 2012), suggesting that host-related diversification of *Erythromelana* remains a possibility.

TABLE 3. *Erythromelana* species and morphospecies reared from areas surrounding YBS (Napo, Ecuador) with their respective caterpillar host-plants. (Specimen IDs represent unique numbers assigned to each rearing event).

***Erythromelana* parasitoids**		**Lepidoptera host**		**Host plant**	
Species	**Specimen ID**	**Family**	**Species**	**Family**	**Species**
E. curvifrons	14245	Geometridae	unknown	Monimiaceae	*Siparuna pyricarpa* (Ruiz & Pav.) Perkins
	11279		unknown	Piperaceae	*Piper* sp2
	11280		unknown		*Piper* sp2
E. jaena	14830		*Eois* sp.nr. *olivacea* Felder		*Piper baezanum* (Sodd. MS.S.) C.DC.
E. eois	16608		*Eois* spp.		*Piper* sp1
	9772		unknown		*Piper* cf. *schuppii* A.H. Gentry
E. ecuadoriana	10737		*Eois* spp.		*Sarcorachis sydowii* Trel.
	37297		*Eois* spp.		*Piper* sp1
E. cryptica	26213		*Eois* sp.nr. *nigricosta* Prout		*Piper hispidum* Sw.
	8740		*Eois* spp.		*Piper* sp3
E. napensis	8135		*Eois pallidicosta* Warren		*Piper* sp1
	7599		*Eois pallidicosta* Warren		*Piper* sp1
	8640		*Eois* spp.		*Piper baezanum* (Sodd. MS.S.) C.DC.
E. sp. (*E. cryptica* group)	9763		*Eois* spp.		*Piper* sp4
	9764		*Eois* spp.		*Piper* sp4
	8512		*Eois pallidicosta* Warren		*Piper* sp1
	8532		*Eois* spp.		*Piper baezanum* (Sodd. MS.S.) C.DC.
	1813		*Eois* spp.		*Piper baezanum* (Sodd. MS.S.) C.DC.
	7655		*Eois pallidicosta* Warren		*Piper* cf. *schuppii* A.H. Gentry
	12215		*Eois* spp.		*Piper baezanum* (Sodd. MS.S.) C.DC.
	16758		*Eois* spp.		*Piper* sp4
	24562		*Eois* spp.		*Piper* sp3
E. sp. big palpi (*E. jaena* group)	10384		*Eois* spp.		*Peperomia* sp.
	8485		*Eois* spp.		*Peperomia* sp.
	8844		*Eois* spp.		*Piper* sp3
E. sp. small palpi (*E. jaena* group)	13861		*Eois pallidicosta* Warren		*Piper* sp1
	13862		*Eois pallidicosta* Warren		*Piper* sp1
	11445	Pyralidae	unknown		*Piper* cf. *schuppii* A.H. Gentry

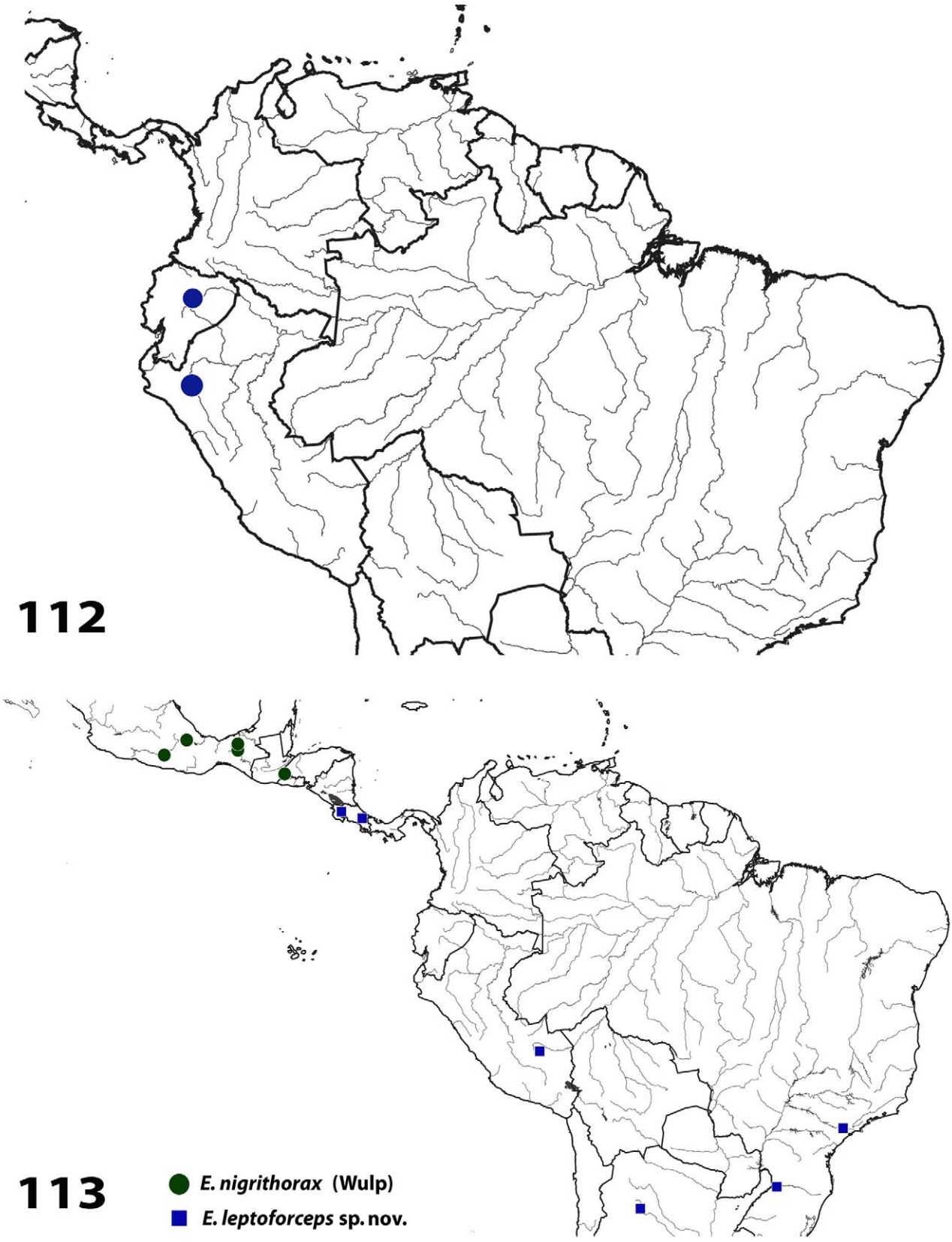
GEOGRAPHIC PATTERNS IN *ERYTHROMELANA* RICHNESS

Species in the genus *Erythromelana* are broadly distributed across the Neotropical Region (Figs. 112–117). In general, the genus is poorly sampled, as the fauna between Mexico and Costa Rica and between southern Brazil and the Andes Mountains remains unknown. *Erythromelana* species occur in a variety of habitats ranging from lowland to montane tropical forest across a range of elevations (e.g., Santa Catarina, Brazil, 300–500 m to Napo, Ecuador 2000–2600 m).

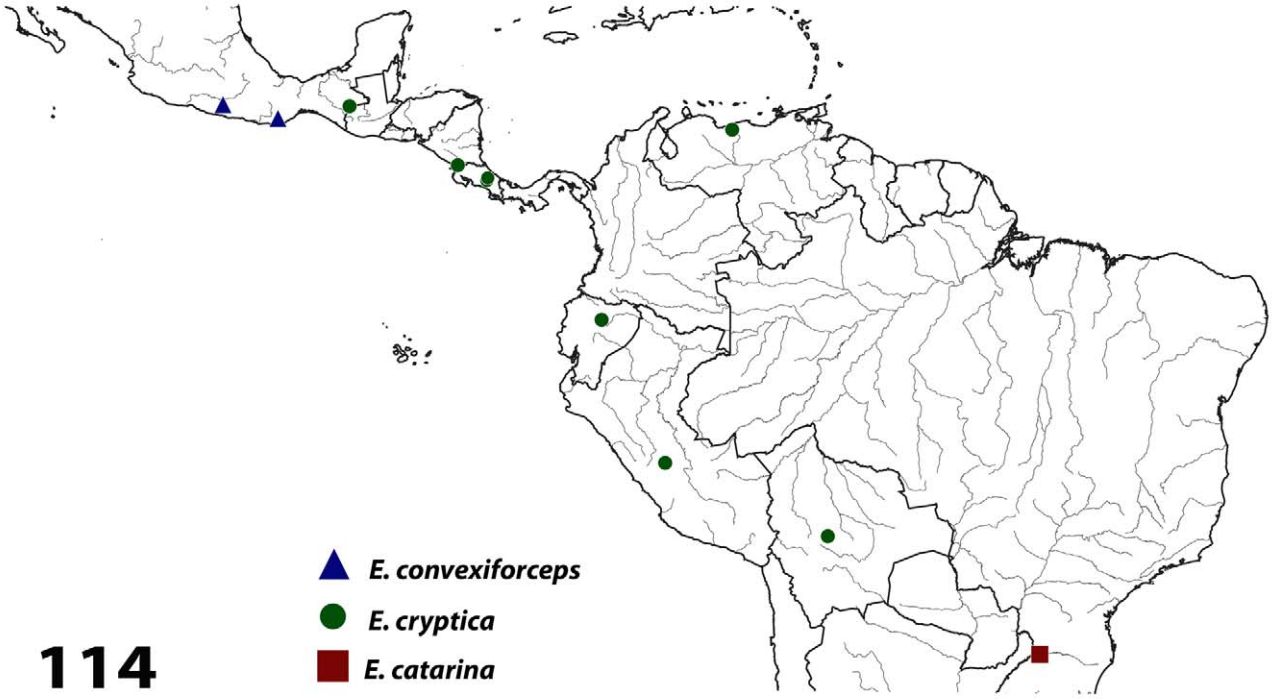
Given the parasitoid lifestyle of *Erythromelana* species, their distribution must correspond to the distribution and diversity of their lepidopteran hosts and their host plants. The primary caterpillar host of *Erythromelana*, *Eois*, is widely distributed in the Neotropics, from Mexico to Argentina, where it comprises an important part of the geometrid fauna (Strutzenberger *et al*. 2009). *Eois* includes 239 Neotropical species, but estimates of the diversity of this genus suggest the existence of perhaps 2000 species in this region (Strutzenberger *et al*. 2009, Rodriguez-Castañeda *et al*. 2010, Brehm *et al*. 2011). The bulk of *Eois* species diversity appears to occur in Neotropical montane regions (1600–1800 m), where more than 500 species are estimated to occur (Rodriguez-Castañeda *et al*. 2010, Brehm *et al*. 2011). Plants in the genus *Piper*, the predominant hosts of *Eois* caterpillars, exhibit similar distributions and diversity patterns. *Piper* is widely distributed in the Neotropics, including about 700 described species (Jaramillo & Manos 2001). Similar to *Eois*, pipers are diverse at mid elevations (1600–1800 m), particularly in the Andes where there are at least 300 described species (Jaramillo & Manos 2001, Rodriguez-Castañeda *et al*. 2010). In summary, *Erythromelana*, *Eois*, and *Piper* are similarly distributed across the Neotropical Region, and the Andes Mountains appear to be a hotspot of diversity for each of these genera.

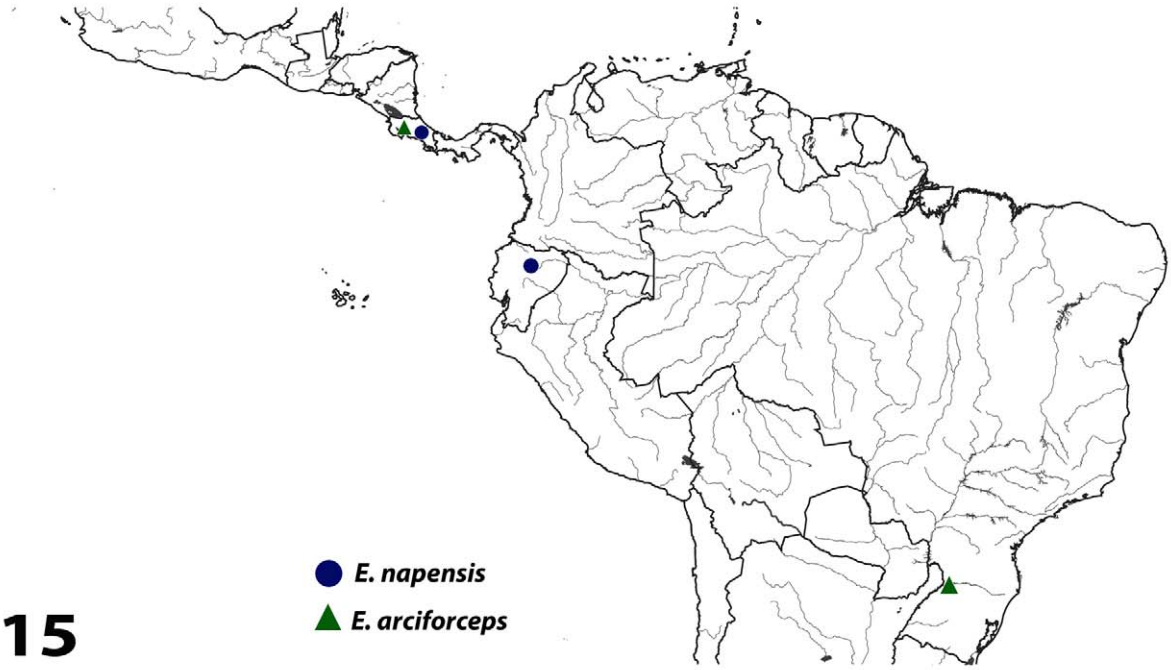
Altitude appears to be a major factor in determining the distribution and diversification of *Erythromelana* species. *Erythromelana* species can be divided into species occurring only at low elevations (<1000 m), mid elevations (1000–1800 m), and high elevations (>1800 m). For example, *E. catarina* appears to be restricted to low elevations, whereas *E. convexiforceps*, *E. napensis*, *E. jaena*, *E. curvifrons*, *E. ecuadoriana*, and *E. eois* appear to be restricted to high elevations. The species *E. arciforceps*, *E. distincta*, *E. leptoforceps*, and *E. nigrithorax* occur at both low and mid elevations, and *E. abdominalis* and *E. woodi* occur at mid and high elevations. *Erythromelana cryptica* is the only species that has been collected across a wide range of elevations, from relatively low elevations in Costa Rica (700 m) to high elevations in Ecuador (2000–2600 m). Interestingly, it is this species, along with *E. woodi*, that is most likely to contain additional cryptic species. Overall, *Erythromelana* exhibits a lower species diversity in low elevations and higher diversity in mid and high elevations. This distribution of diversity across different altitudes correlates well with the distribution of their caterpillar hosts. The number of low elevation *Eois* species is estimated to be 260 species, whereas 570 species are estimated to inhabit higher elevations (Rodriguez-Castañeda *et al*. 2010, also see Brehm *et al*. 2011).

Most *Erythromelana* species are found in South America with a few species restricted to Central America. For example, *E. convexiforceps* and *E. nigrithorax* have been collected only from southern Mexico and El Salvador. There are only two species, *E. woodi* and *E. cryptica*, that are widely distributed from Mexico to the Andes in South America (but see the note about these two taxa above). All the other species occur in South America, with *E. leptoforceps*, *E. napensis*, *E. arciforceps*, and *E. distincta* also occurring in Costa Rica. From a phylogenetic perspective, this distribution suggests that *Erythromelana* may have originated in the Andes Mountains and expanded to Central America and the Amazon lowlands. The distribution and phylogenetic position of *E. woodi* (see Figs. 110, 111 and 117) suggests that it may represent the most basal lineage, perhaps dispersing from the Andes and radiating into the species found in Central America and Mexico. The radiation of *Erythromelana* could be related to the rapid uplift of the Andes Mountains in South America and the Talamanca highlands in Central America. The current elevation of the Andes is the result of a rapid uplift that occurred during the last ten million years, whereas the Talamanca highlands rose within the last five million years (Hooghiemstra & Van der Hammen 1998, Gregory-Wodzicki 2000, Grafe *et al*. 2002). The Andes Mountains, with their great topographic heterogeneity, represent one of the most biologically diverse regions on Earth (Lomolino 2001, Molau 2004, Beck *et al*. 2008). Of the 14 *Erythromelana* species described in this revision, five (*E. jaena*, *E. abdominalis*, *E. curvifrons*, *E. ecuadoriana*, and *E. eois*) appear to be restricted to the Andes. This Andean fauna includes all species with yellow abdomens. *Erythromelana woodi* is the only species that contains individuals with abdomens ranging from mostly yellow to mostly black, but specimens with mostly yellow abdomens are from the Andes and specimens with black abdomens occur in Central America. The varied topography and habitat heterogeneity of the



FIGURES 112–113. Known distributions. **112.** *E. jaena* Townsend and *E. abdominalis* (Townsend). **113.** *E. nigrithorax* (Wulp) and *E. leptoforceps* sp. nov.





FIGURES 114–115. Known distributions. **114.** *E. cryptica* sp. nov., *E. catarina* sp. nov. and *E. convexiforceps* sp. nov. **115.** *E. arciforceps* sp. nov. and *E. napensis* sp. nov.

Andes could promote isolation of populations and increase the likelihood of differentiation among them. For example, single female and male *E. woodi* specimens were collected at approximately the same latitude in Ecuador, but the female is from Mindo on the western slope and the male from is from YBS on the eastern slope of the Andes. These specimens appear morphologically to be a single species, but the molecular analysis suggests that they may represent distinct species (see phylogeny section and Fig. 111). The lack of morphological differences between these specimens may reflect recent geography-associated divergence of this species, in which eastern and western populations are isolated by the high Andean paramo.

Further systematic, biogeographic and ecological studies on this group will undoubtedly allow more rigorous evaluation of the evolutionary origins, patterns of diversification, and host-relationships of this fascinating genus.

FIGURES 116–117. Known distributions. **116.** *E. distincta* sp. nov. **117.** *E. woodi* sp. nov.

ACKNOWLEDGMENTS

We thank all those who, in various ways, made this work possible. Jim O'Hara, Monty Wood (Invertebrate Biodiversity, Agriculture and Agri-Food Canada, CNC), Norm Woodley (Systematic Entomology Laboratory, NMNH), Nigel Wyatt (Natural History Museum, Department of Entomology, BMNH), Manuel Zumbado (National Biodiversity Institute of Costa Rica, INBio) and Pierfilippo Cerretti (U. of Rome La Sapienza) provided specimen loans and expertise and training in tachinid identification. We also thank Tom Rooney (Wright State U.) and Greg Dahlem (Northern Kentucky U.) for their guidance, advice, and training while serving on D.J.I.'s graduate committee. Special thanks to Jeremy Heath and Hilary Devlin for their support and advice provided to D.J.I. Thanks to Jim O'Hara and two anonymous reviewers for carefully reviewing and editing this manuscript. This study was made possible through support by National Science Foundation grant DEB 0717092 (to J.O.S.), a Biology Award for Research Excellence from the Department of Biological Sciences at Wright State University, and a Dipterology Fund award from the North American Dipterists Society (to D.J.I.).

REFERENCES

Amorim, D. de S., Silva, V.C. & Balbi, M.I.P.A. (2002) Estado do conhecimento dos Diptera Neotropicais. *In*: Costa, C., Vanin, S.A., Lobo, J.M. & Melic, A. (eds.), *PrIBES 2002 [Proyecto de Red Iberoamericana de Biogeografía y Entomología Sistemática]*. Sociedad Entomológica Aragonesa, Zaragoza. Vol. 2, pp. 29–36.

Beck, E., Makeschin, F., Haubrich, F., Richter, M., Bendix, J. & Valarezo, C. (2008) The ecosystem (Reserva Biológica San Francisco). *In*: Beck, E., Bendix, J., Kottke, I., Makeschin, F. & Mosandl, R. (eds.), *Gradients in a tropical mountain ecosystem of Ecuador*. Ecological Studies, no.198. Springer, Berlin Heidelberg New York, pp. 1–14.
http://dx.doi.org/10.1007/978-3-540-73526-7_1

Benson, D.A., Karsch-Mizrachi, I., Lipman, D.J., Ostell, J., Rapp, B.A. & Wheeler, D.L. (2000) GenBank. *Nucleic Acids Research*, 28, 15–18.
http://dx.doi.org/10.1093/nar/28.1.15

Belshaw, R. (1993) Tachinid flies. Diptera: Tachinidae. *Handbooks for the identification of British Insects*, 10, Part 4a(i). Royal Entomological Society of London, London. 169 pp.

Brehm, G., Bodner, F., Strutzenberger, P., Hünefled, F. & Fiedler, K. (2011) Neotropical *Eois* (Lepidoptera: Geometridae): checklist, biogeography, diversity, and description patterns. *Annals of the Entomological Society of America*, 104, 1091–1107.
http://dx.doi.org/10.1603/AN10050

Brown, B.V. (2001) Flies, gnats, and mosquitoes. *In*: Levin S.A. (ed.), *Encyclopedia of Biodiversity*, Vol. 2. Academic Press, London, pp. 815–826.
http://dx.doi.org/10.1016/B0-12-226865-2/00123-1

Brown, B.V. (2005) Malaise trap catches and the crisis in Neotropical dipterology. *American Entomologist*, 51, 180–183.

Burns, J.M., Janzen, D.H., Hajibabaei, M., Hallwachs, W. & Hebert, P.D. (2008) DNA barcodes and cryptic species of skipper butterflies in the genus *Perichares* in Area de Conservacion Guanacaste, Costa Rica. *Proceedings of the National Academy of Sciences*, 105, 6350–6355.
http://dx.doi.org/10.1073/pnas.0712181105

Bush, G.L. (1975) Sympatric speciation in phytophagous parasitic insects. *In*: Price, P.W. (ed.), *Evolutionary strategies of parasitic insects and mites*. Plenum Press, New York, pp. 187–206.
http://dx.doi.org/10.1007/978-1-4615-8732-3_9

Connahs, H., Rodriguez-Castañeda, G., Walters, T., Walla, T. & Dyer, L.A. (2009) Geographical variation in host specificity and parasitism rates of an herbivore (Geometridae) associated with the tropical genus *Piper*. *Journal of Insect Science*, 9 (Article 28), 11 pp.
http://dx.doi.org/10.1673/031.009.2801

Cumming, J.M. & Wood, D.M. (2009) Adult morphology and terminology. *In*: Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M. (eds.), *Manual of Central American Diptera*, Vol. 1. NRC Research Press, Ottawa, pp. 9–50.

Dyer, L.A., Miller, J.S., Rab Green, S.B., Gentry, G.L., Greeney, H.F. & Walla, T.W. (2012). Caterpillars and parasitoids of the Eastern Andes in Ecuador. Available from: http://caterpillars.unr.edu/lsacat/ecuador/index.htm (accessed 3 June 2012).

Feder, J.L., Chilcote, C.A. & Bush, G.L. (1988) Genetic differentiation between sympatric host races of the apple maggot fly *Rhagoletis pomonella*. *Nature*, 336, 61–64.
http://dx.doi.org/10.1038/336061a0

Felsenstein, J. (2005) *PHYLIP* [*Phylogeny Inference Package*] *version 3.69*. Distributed by the author. Department of Genetics, University of Washington, Seattle.

Grafe, K., Frisch, W., Villa, I.M. & Meschede, M. (2002) Geo-dynamic evolution of southern Costa Rica related to low-angle subduction of the Cocos Ridge: constraints from thermochronology. *Tectonophysics*, 348, 187–204. http://dx.doi.org/10.1016/S0040-1951(02)00113-0

Gregory-Wodzicki, K.M. (2000) Uplift history of the Central and Northern Andes: a review. *Geological Society of America Bulletin*, 112, 1091–1105. http://dx.doi.org/10.1130/0016-7606(2000)112%3C1091:UHOTCA%3E2.0.CO;2

Guimarães, J.H. (1971) *Family Tachinidae (Larvaevoridae). A catalogue of the Diptera of the Americas south of the United States*, Vol. 104. São Paulo, 333 pp.

Hawthorne, D.J. & Via, S. (2001) Genetic linkage of ecological specialization and reproductive isolation in pea aphids. *Nature*, 412, 904–907. http://dx.doi.org/10.1038/35091062

Hebert, P.D., Cywinska, A., Ball, S.L. & deWaard, J.R. (2003) Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London*, 270, 313–321. http://dx.doi.org/10.1098/rspb.2002.2218

Hooghiemstra, H. & Van der Hammen, T. (1998) Neogene and Quaternary development of the Neotropical rain forest: the forest refugia hypothesis, and a literature overview. *Earth-Science Reviews*, 44, 147–183. http://dx.doi.org/10.1016/S0012-8252(98)00027-0

Irwin, M.E., Schlinger, E.I. & Thompson, F.C. (2003) Diptera, true flies. *In*: Goodman, S.M. & Benstead, J.P. (eds.), *The natural history of Madagascar.* University of Chicago Press, Chicago, pp. 692–702.

Jaramillo, M.A. & Manos, P.S. (2001) Phylogeny and the patterns of floral diversity in the genus *Piper* (Piperaceae). *American Journal of Botany*, 88, 706–716. http://dx.doi.org/10.2307/2657072

Kjærandsen, J. (2009) The genus *Pseudexechia* Tuomikoski re-characterized, with a review of European species (Diptera: Mycetophilidae). *Zootaxa*, 2056, 1–45.

Lomolino, M.V. (2001) Elevation gradients of species-density: historical and prospective views. *Global Ecology and Biogeography*, 10, 3–13. http://dx.doi.org/10.1046/j.1466-822x.2001.00229.x

Meier, R., Shiyang, K., Vaidya, G. & Ng, P.K.L. (2006) DNA barcoding and taxonomy in Diptera: A tale of high intraspecific variability and low identification success. *Systematic Biology*, 55, 715–728. http://dx.doi.org/10.1080/10635150600969864

Miller, J.S. & Dyer, L.A. (2009) Special feature: diversity of insect-plant interactions in the eastern Andes of Ecuador. *Journal of Insect Science*, 9 (Article 26), 3 pp. http://dx.doi.org/10.1673/031.009.2601

Molau, U. (2004) Mountain biodiversity patterns at low and high latitudes. *Ambio Special Report*, 13, 24–28.

Molbo, D., Machado, C.A., Sevenster, J.G., Keller, L. & Herre, E.A. (2003) Cryptic species of fig-pollinating wasps: implications for the evolution of the fig-wasp mutualism, sex allocation, and precision of adaptation. *Proceedings of the National Academy of Sciences*, 100, 5867–5872. http://dx.doi.org/10.1073/pnas.0930903100

Monaghan, M.T., Balke, M., Gregory, T.R. & Vogler, A.P. (2005) DNA-based species delineation in tropical beetles using mitochondrial and nuclear markers. *Philosophical Transactions of the Royal Society*, 360, 1925–1933. http://dx.doi.org/10.1098/rstb.2005.1724

Novotny, V. & Basset, Y. (2000) Rare species in communities of tropical insect herbivores: pondering the mystery of singletons. *Oikos*, 89, 564–572. http://dx.doi.org/10.1034/j.1600-0706.2000.890316.x

O'Hara, J.E. (1989) Systematics of the genus group taxa of the Siphonini (Diptera: Tachinidae). *Quaestiones Entomologicae*, 25, 1–229.

O'Hara, J.E. (2002) Revision of the Polideini (Tachinidae) of America north of Mexico. *Studia dipterologica*, 10, 1–170.

O'Hara, J.E. (2011) World genera of the Tachinidae (Diptera) and their regional occurrence. Version 6.0. PDF document, 75 pp. Available from: http://www.nadsdiptera.org/Tach/Genera/Gentach_ver6.pdf (accessed 3 June 2012).

O'Hara, J.E. & Wood, D.M. (2004) Catalogue of the Tachinidae (Diptera) of America north of Mexico. *Memoirs on Entomology, International*, 18, 410 pp.

Oksanen, J., Kindt, R., Legendre, P., O'Hara, B. & Stevens M. (2007) *vegan: Community Ecology Package.* R package version 1.15–4. Available from: http://r–forge.r–project.org/projects/vegan (accessed 3 June 2010).

R Development Core Team (2010) *R: a language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna. Available from: http://www.R–project.org (accessed 18 May 2010).

Rodriguez-Castañeda, G., Dyer, L.A., Brehm, G., Connahs, H., Forkner, R.E. & Walla, T.R. (2010) Tropical forests are not flat: how mountains affect herbivore diversity. *Ecology Letters*, 13, 1348–1357. http://dx.doi.org/10.1111/j.1461-0248.2010.01525.x

Schluter, D. (2000) *The Ecology of Adaptive Radiation*. Oxford University Press., Oxford, 288 pp.

Shorthouse, D.P. (2010) SimpleMappr, an online tool to produce publication-quality point maps. Available from: http://www.simplemappr.net (accessed 9 May 2010).

Smith, M.A., Woodley, N.E., Janzen, D.H., Hallwachs, W. & Hebert, P.D. (2006) DNA barcodes reveal cryptic host-specificity

within the presumed polyphagous members of a genus of parasitoid flies (Diptera: Tachinidae). *Proceedings of the National Academy of Sciences*, 103, 3657–3662.
http://dx.doi.org/10.1073/pnas.0511318103

Smith, M.A, Wood, D.M., Janzen, D.H., Hallwachs, W. & Hebert, P.D. (2007) DNA barcodes affirm that 16 species of apparently generalist tropical parasitoid flies (Diptera, Tachinidae) are not all generalists. *Proceedings of the National Academy of Sciences*, 104, 4967–4972.
http://dx.doi.org/10.1073/pnas.0700050104

Stireman, J.O., III (2002) Phylogenetic relationships of tachinid flies in subfamily Exoristinae (Tachinidae: Diptera) based on a 28S rDNA and elongation factor-1-alpha. *Systematic Entomology*, 27, 409–435.
http://dx.doi.org/10.1046/j.1365-3113.2002.00187.x

Stireman, J.O., III, O'Hara, J.E. & Wood, D.M. (2006) Tachinidae: evolution, behavior, and ecology. *Annual Review of Entomology*, 51, 525–555.
http://dx.doi.org/10.1146/annurev.ento.51.110104.151133

Stireman, J.O., III, Greeney, H.F., & Dyer, L.A. (2009) Species richness and host associations of Lepidoptera-attacking Tachinidae in the northeast Ecuadorian Andes. *Journal of Insect Science*, 9 (Article 39), 19 pp.
http://dx.doi.org/10.1673/031.009.3901

Strutzenberger, P., Brehm, G., Bodner, F. & Fiedler, K. (2009) Molecular phylogeny of *Eois* (Lepidoptera, Geometridae): evolution of wing patterns and host plant use in a species-rich group of Neotropical moths. *Zoologica Scripta*, 39, 603–620.
http://dx.doi.org/10.1111/j.1463-6409.2010.00440.x

Tachi, T. & Shima, H. (2010) Molecular phylogeny of the subfamily Exoristinae (Diptera, Tachinidae), with discussions on the evolutionary history of female oviposition strategy. *Systematic Entomology*, 35, 148–163.
http://dx.doi.org/10.1111/j.1365-3113.2009.00497.x

Tamura, K., Peterson, D., Peterson, N., Stecher, G., Nei, M. & Kumar, S. (2011) MEGA5.05: molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. *Molecular Biology and Evolution*, 28, 2731–2739.
http://dx.doi.org/10.1093/molbev/msr121

Townsend, C.H.T. (1919a) New muscoid genera, species and synonymy (Diptera). *Insecutor Inscitiae Menstruus*, 6, 157–182.

Townsend, C.H.T. (1919b) New genera and species of muscoid flies. *The Proceedings of the United States National Museum*, 56, 541–592.
http://dx.doi.org/10.5479/si.00963801.2301.541

Townsend, C. H. T. 1934–1942. Manual of myiology in twelve parts. Charles Townsend & Filhos, Itaquaquecetuba, São Paulo, Brazil.

Whinnett, A., Zimmermann, M., Willmott, K.R., Herrera, N., Mallarino, R., Simpson, F., Joron, M., Lamas, G. & Mallet, J. (2005) Strikingly variable divergence times inferred across an Amazonian butterfly "suture zone". *Proceedings of the Royal Society of London*, 272, 2525–2533.
http://dx.doi.org/10.1098/rspb.2005.3247

Wilson, J.S., Forister, M.L., Dyer, L.A., O'Connor, J.M., Burks, K., Feldman, C.R., Jaramillo, M.A., Miller, J.S., Rodríguez-Castañeda, G., Tepe, E.J., Whitfield, J.B., & Young, B. (2012) Host conservatism, host shifts and diversification across three trophic levels in two Neotropical forests. *Journal of Evolutionary Biology*, 25, 532–546.
http://dx.doi.org/10.1111/j.1420-9101.2011.02446.x

Winterton, S.L., Wiegmann, B.M., & Schlinger, E.I. (2007) Phylogeny and Bayesian divergence time estimations of small-headed flies (Diptera: Acroceridae) using multiple molecular markers. *Molecular Phylogenetics and Evolution*, 43, 808–832.
http://dx.doi.org/10.1016/j.ympev.2006.08.015

Wood, D.M. (1985) A taxonomic conspectus of the Blondeliini of North and Central America and the West Indies (Diptera: Tachinidae). *Memoirs of the Entomological Society of Canada*, 132, 1–130.
http://dx.doi.org/10.4039/entm117132fv

Wood, D.M. (1987) Chapter 110. Tachinidae. *In*: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (eds.), Manual of Nearctic Diptera, Vol. 2. *Agriculture Canada Monograph*, 28, 1193–1269.

Wood, D.M. & Zumbado, M. (2011) Tachinidae (tachinid flies, parasitic flies). *In*: Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M. (eds.), *Manual of Central American Diptera*, Vol. 2. NRC Research Press, Ottawa, pp. 1343–1417.

Wulp, F.M. van der (1890) Family Muscidae. *In*: Godman, E.D. & Salvin, O. (eds.), *Biologia Centrali-Americana, Insecta, Diptera*, Vol. 2. Taylor & Francis, London, pp. 41–208.

APPENDIX 1

Variables used in morphological ordinations and species descriptions. The numbers in brackets "[]" and parentheses "()" represent the sequential number of the variable and numbers assigned to a particular state of the character, respectively.

Continuous variables:

[1] *Total body length* – measured in profile from the pedicel to tip of the abdomen excluding abdominal setae.

Head

[2] *Ommatrichia length*; measured from the back of the head using a white background to improve contrast of the setae. For each individual, the measurement was the average of two to three setae taken from the center region of the right eye.

[3] *Head height*, [4] *eye height*; [5] *pedicel length*, and [6] *flagellum length* were measured in profile as shown in Fig. 5.

[7] *Maximum head length*: measured in profile from the point of antennal insertion to the back of the head as shown in Fig. 6.

[8] *Flagellum width*: measured in profile at their maximum width, typically near the end as shown in Fig. 6.

[9] *Parafacial width*: measured from a viewpoint perpendicular to it at the minimum width of the parafacial.

[10] *Facial ridge setae height*: measured in profile from the vibrissal seta until the uppermost seta on the facial ridge as shown in Fig. 5.

[11] *Palpus length*: measured in profile as shown in Fig 5. For specimens in which measurement was not possible because the palpus was not visible, NA was reported.

[12] *Head width*: measured in frontal view as shown in Fig. 3.

[13] *Frontal vitta* (FV) and [14] *vertex width* were measured in frontal view at their narrowest point as shown in Fig 3.

Thorax

[15] *Total thorax length*: measured in dorsal view, at the center of the thorax from the anterior edge of the prescutum to the posterior edge of the scutum.

[16] *Ultimate fore-tarsomere length*: measured in profile at the center of the right fore-tarsomere.

[17] *Fore-claw length*: measured in profile from the right fore-claw.

[18] *Wing length*: measured in profile at the right wing from the end of the basicosta to the wing apex.

[19] *Percentage of setae on wing vein* R_{4+5}: calculated as the setose portion of R_{4+5} as a proportion of the distance between base of R_{4+5} and cross vein r-m on the right wing.

Male terminalia:

[20] *St5 basal plate length*, [21] *apical lobe length*, and [22] *st5 total length* were measured as shown in Fig. 35.

[23] *Cercus* and [24] *surstylus length* were measured in profile.

The cerci were divided in three sections: [25] *upper lobe length*, [26] *medial section length*, and [27] *apical cleft length*, which were measured in posterior view as shown in Fig. 63.

Female terminalia:

[28] *St5 width* and [29] *length:* measured at the center of each sternite.

[30] *Sternite 6* and [31] *sternite 7 length*: measured at the center of each sternite.

[32] *Tergite 10* and [33] *cercus length*.

Discrete variables:

The following discrete characters were recorded:

Head:

[34] *Fronto-orbital plate (FOP) color*: (1) dull silver, (2) dull silver and black, and (3) black.

[35] *FOP pruinescence*: (0) absent and (1) golden pruinosity present.

[36] *Vertex color*: (1) dull silver, (2) dull silver and black, and (3) black.

[37] *Vertex pruinescence*: (0) absent and (1) golden pruinosity present.

[38] *Palpus color*: (1) brown, (2) yellow, (3) black, (4) brown with black at bases, and (5) brown-yellowish.

[39] *Ommatrichia*: (0) almost bare, (1) well developed, and (2) poorly developed.

[40] *Ommatrichia density*: (0) sparse, (1) dense.

[41] *Fronto-orbital seta*: Number of setae on right and left sides
[42] *Inner-orbital seta*: Number of setae on right and left sides
[43] *Outer-orbital seta*: Number of setae on right and left sides
[44] *Subvibrissal seta*: Number of setae
[45] *Ocellar seta*: (0) absent, (1) medioclinate, (2) lateroclinate, (3) proclinate, and (4) reclinate.
[46] *Arista microtrichia*: (1) pubescent, microtrichia length no more than the widest point of the arista, (2) plumose, microtrichia longer than width of arista.

Thorax:

[47] *Postpronotum setae*: Number of setae
[48] *Postpronotum setae alignment*: (1) forming a triangle, (2) in a line.
Setae on *presutural scutum*: [49] number of *acrostichal*, [50] *dorsocentral*, [51] *intra-alar*, and [52] *supra-alar setae*.
Setae on *postsutural scutum*: [53] number of *acrostichal*, [54] *dorsocentral*, [55] *intra-alar*, and [56] *supra-alar setae*.
[57] *1st supra-alar seta on postsutural scutum*: (0) absent, (1) smaller than 2nd supra-alar setae.
[58] *Katepisternum*: Number of setae
Scutellar setae: (0) absent, (1) present for [59] *basal*, [60] *discal*, [61] *lateral*, [62] *subapical*, and [63] *apical setae*.
[64] *Tibia color*: (1) yellow, (2) yellowish with black, (3) black.
Setae on *mid tibia*: Number of well-developed setae on [65] *anterodorsal*, [66] *dorsal*, [67] *posterodorsal*, [68] *posterior*, [69] *posteroventral*, and [70] *ventral sections*.
Setae on *hind tibia*: Number of well-developed setae on [71] *posterodorsal* and [72] *anteroventral* sections.
Wing cell color: (1) hyaline, (2) light fumose, and (3) dark fumose for: [73] c, [74] sc, [75] r_1, [76] r_{2+3}, [77] r_{4+5}, and [78] dm cells.
[79] R_{4+5} *dorsally with setae* on (1) only at the base, (2) more that half way between the base and the cross with the vein r-m.
[80] *Number of setae at the base of* R_{4+5} the right wing
[81] *M1 vein ending at wing apex*: (1) separately or (2) with R_{4+5}.

Abdomen:

[82] *Abdomen color* in dorsal view: (1) entirely yellow, (2) mostly yellow, (3) mostly black, (4) fully black, and (5) equally yellow and black.
[83] If *abdomen mostly yellow, dorsally with black on*: (1) tg1+2; (2) tg3; (3) tg4; (4) tg5; (5) tg1+2, tg3, and tg4; (6) tg3 and tg4; (7) tg1+2 to tg5; and (8) tg1+2, tg4, and tg5.
[84] If *abdomen mostly black; dorsally with yellow* on: (1) tg1+2; (2) tg3; (3) tg4; (4) tg5; (5) tg1+2, tg3, and tg4; (6) tg3 and tg4; (7) tg1+2 to tg5; and (8) tg1+2, tg4, and tg5.
[85] *White pruinescence forming apical bands on*: (0) absent, (1) 1/3 tg3, tg4, & ½ tg5; (2) 1/3 tg3, tg4 & 2/3 tg5; (3) 1/4 tg3, tg4 & 1/3 tg5; (4) 1/2 tg3, tg4, & 4/5 tg5; and (5) 1/4 tg3 & tg5.
[86] *Discal setae on*: (0) absent, (1) tg3 to tg5, (2) tg5, (3) tg3 & tg4, and (4) tg3.
[87] *Median marginal setae on*: (1) tg1+2 to tg5, and (2) tg3 to tg5.
[88] *Sex patches*: (0) absent, (1) on ventral tg4 and tg5.

Male terminalia:

[89] *Setae on apical lobes of st5*: (1) one long bristle on each lobe, (0) absent.
[90] *Shape of apical lobes of st5*: (1) pointed lobes, (2) rounded lobes.
[91] *Surstyli internally with setae*: (0) absent, (1) small, (2) medium, (3) large.
[92] *Surstyli with a few small setae-like spines at anterior side of the tip*: (1) present, (0) absent.
[93] *Surstylus shape*: (0) rectangular, (1) triangular shape
[94] *Cerci with a dorsal depression or twist* (1) present (0) dorsally flat.
[95] *Cercus shape in profile*: (1) slightly carinate, (2) moderately carinate, (3) strongly carinate, or (0) almost straight.
[96] *Pregonite shape*: (0) straight, (1) curved

Female terminalia:

[97] *St5 setae*: (1) with two pairs of well-developed setae on posterior edge, (2) several well developed setae covering at least distal ¼ of the sternite, and (3) only one pair of well developed setae in the center of the sternite.
[98] *Sternite 8*: (0) absent, (1) present.
[99] *Tergite 8*: (1) dorsally with a distinctive narrow lobe, (0) dorsally without a lobe

Ratios:

The list of each ratio is present followed in brackets "[]" by the number of the continuous variable involved in the calculation of the ratio and in parentheses "()"by the number of the states and their inclusive ranges.

Head:

Head height to body length [3 to 1]: (1) X≤0.25 and (2) X>0.25
Head width to body length [12 to 1]: (1) X≤0.27, (2) 0.27<X≤0.3, and (3) X>0.3
Eye height to head height [4 to 3]: (1) X≤0.84, (2) 0.84<X≤0.88, and (3) X>0.88
Frontal vitta to vertex [13 to 14]: (1) X≤0.15, (2) 0.15<X≤0.32, and (3) X>0.32
Vertex to head width [14 to 12]: (1) X≤0.16 and (2) X>0.16
Parafacial width to head length [9 to 12]: (1) X≤0.03, (2) 0.03<X≤0.06, and (3) X>0.06
Parafacial width to flagellum width [9 to 8]: (1) X≤0.15, (2) 0.12<X≤0.30, and (3) X>0.30
Flagellum width to head length [8 to 7]: (1) X≤0.18, (2) 0.18<X≤0.24, and (3) X>0.24
Facial ridge length to head height [10 to 3]: (1) X≤0.14, (2) 0.14<X≤0.18, and (3) X>0.18
Palpus length to head height [11 to 3]: (1) X≤0.29, (2) 0.29<X≤0.33, and (3) X>0.33
Pedicel length to flagellum length [5 to 6]: (1) X≤0.26, (2) 0.26<X≤0.32, and (3) X>0.33
Flagellum length to head height [6 to 3]: (1) X≤0.45, (2) 0.45<X≤0.5, and (3) X>0.5

Thorax:

Thorax length to body length [15 to 1]: (1) X≤0.34, (2) 0.34<X≤0.38, and (3) X>0.38
Fore-claw length to last fore-tarsomere length [17 to 16]: (1) X≤1 and (2) X>1
Wing length to body length [18 to 1]: (1) X≤0.85, (2) 0.85<X≤0.95, and (3) X>0.95

Male terminalia:

St5 basal plate length to st5 apical lobe length [20 to 21]: (1) X≤0.8 and (2) X>0.8
St5 basal plate length to st5 length [20 to 22]: (1) X≤0.42 and (2) X>0.42
Cercus length to st5 length [23 to 22]: (1) X≤0.55, (2) 0.55<X≤0.75, and (3) X>0.75
Surstylus length to cercus length [24 to 23]: (1) X≤0.60, (2) 0.60<X≤0.66, and (3) X>0.66
Cercus upper lobe length to cercus length [25 to 23]: (1) X≤0.30, (2) 0.30<X≤0.40, and (3) X>0.40
Cercus medial section length to cercus length [26 to 23]: (1) X≤0.25, (2) 0.25<X≤0.45, and (3) X>0.45

Female terminalia:

St5 width to st5 length [28 to 29]
Sternite 6 length to st5 length [30 to 29]
Sternite 7 length to st5 length [31 to 29]
Tergite 10 length to st5 length [32 to 29]

APPENDIX 2

Character matrix of 14 *Erythromelana* species including one species, *E. cryptica*, that was divided into four groups based on their locality records (CR Costa Rica, VE Venezuela, EC Ecuador, ME Mexico), and three different species belonging to two genera: *Euptilodegeeria obumbrata*, *Euptilodegeeria* sp. and *Myiodoriops marginalis*. The number of each variable corresponds to the sequential number of each character as stated on the Appendix 1.

Species	3 to 1	12 to 1	4 to 3	13 to 14	14 to 12	9 to 12	10 to 3	11 to 3	5 to 6	6 to 3	15 to 1	17 to 16	18 to 1	20 to 22	23 to 22	24 to 23	25 to 23	26 to 23	39	41	42	43	44	45	49	53	50	54	51	52	57	58	60	47	64	72	74	75	76	77	78	79	80	81	82	85	86	88	89	90	91	94	92	95	96	93
E. cryptica CR	2	3	1	2	1	2	2	2	2	1	3	2	3	1	1	2	3	2	1	2	2	2	1	3	1	1	2	3	1	1	1	3	0	2	3	3	3	2	2	2	2	1	0	1	3	2	2	0	1	1	1	1	0	1	0	0
E. cryptica VE	2	3	1	2	1	1	2	2	1	1	2	2	2	1	1	1	2	2	1	2	2	2	1	3	1	1	2	3	1	1	1	3	0	2	3	3	3	3	2	2	2	1	0	1	3	2	2	0	1	1	1	1	0	1	0	0
E. cryptica EC	1	2	2	2	1	2	2	2	2	1	2	2	2	1	1	1	2	2	1	2	2	2	1	3	1	1	2	3	1	1	1	3	0	2	3	3	3	3	3	2	2	1	0	1	3	2	2	0	1	1	1	1	0	1	0	0
E. cryptica ME	2	3	1	2	1	2	2	2	2	1	2	2	2	1	1	1	3	2	1	2	2	2	1	3	1	1	2	3	1	1	1	3	0	2	3	3	3	3	2	2	1	1	0	1	3	2	2	0	1	1	1	1	0	1	0	0
E. catarina	2	3	1	2	2	1	2	2	2	1	2	2	2	1	1	2	2	2	1	1	2	2	1	2	1	1	2	2	1	1	1	3	0	2	3	3	3	3	3	2	2	1	0	1	3	2	2	0	1	1	2	1	0	2	0	0
E. arciforceps	2	3	1	2	1	2	2	2	2	1	3	2	2	1	1	2	3	2	1	2	2	2	1	3	1	2	2	2	1	1	1	3	0	2	3	3	3	3	2	2	2	1	0	1	3	2	2	0	1	1	1	1	0	0	0	0
E. napensis	2	3	2	2	1	1	2	2	2	1	3	2	3	1	1	2	2	2	1	2	2	2	1	2	1	1	2	3	1	1	1	3	0	2	3	3	2	2	2	1	1	1	0	1	3	2	2	0	1	1	2	1	0	0	0	0
E. convexiforceps	2	3	1	2	1	2	2	2	2	1	2	2	2	1	1	1	3	2	1	2	2	3	1	3	1	1	2	2	1	1	0	3	0	2	3	3	2	2	2	1	1	1	0	1	3	2	2	0	1	2	1	1	0	3	0	0
E. distincta	2	3	3	3	2	1	3	2	1	3	2	1	1	1	1	1	3	2	2	1	2	3	1	3	2	2	2	2	1	1	0	2	1	2	3	4	3	3	2	2	1	1	2	1	3	1	0	0	1	2	3	1	0	3	0	0
Eu. obumbrata	1	2	2	2	2	2	3	3	3	1	2	2	2	2	2	2	2	2	2	3	2	0	1	3	3	1	3	2	2	1	1	3	1	3	3	2	3	3	2	2	1	2	0	1	3	4	3	1	0	2	0	0	0	0	1	1
M. marginalis	2	3	2	2	2	2	1	1	3	1	2	2	2	1	3	3	3	1	0	1	3	0	2	0	3	3	2	3	2	1	1	2	1	3	3	2	1	1	1	1	1	1	0	2	3	2	0	0	0	2	2	0	1	0	1	1
E. leptoforceps	2	3	3	2	1	1	2	1	2	1	3	2	3	1	1	2	2	2	2	2	2	2	1	3	1	3	2	2	1	1	0	2	1	2	2	4	2	3	3	2	2	1	0	1	2	3	0	0	0	2	0	0	0	0	0	0
E. woodi	2	3	3	3	2	1	2	3	2	2	2	2	1	1	2	2	1	3	0	1	2	2	1	3	2	2	2	3	2	2	0	3	0	3	3	5	3	3	3	2	2	1	0	1	2	2	2	0	1	2	1	1	0	0	0	0
Eu. sp	1	1	2	3	2	1	3	3	2	1	1	2	2	2	2	1	1	2	0	1	2	0	1	3	1	2	2	4	2	2	1	3	0	3	3	2	3	3	2	2	2	2	0	1	2	2	0	1	0	2	0	0	0	0	1	1
E. nigrithorax	2	3	2	3	1	1	2	1	2	2	2	2	2	1	2	2	1	3	1	3	2	2	1	0	2	3	3	3	1	1	0	2	1	3	3	4	2	2	2	2	1	1	0	1	2	2	0	0	0	2	0	0	0	0	0	0
E. jaena	2	3	2	2	1	2	2	2	2	1	2	2	3	1	2	2	2	2	2	2	2	2	1	0	2	2	3	4	2	1	0	2	1	3	2	6	2	2	2	2	1	1	0	1	1	0	0	0	0	2	0	0	0	0	0	0
E. ecuadoriana	2	3	1	3	2	2	2	3	1	3	2	1	3	1	2	1	2	2	2	2	1	2	3	1	3	2	2	3	3	2	1	0	3	0	2	2	5	3	3	2	1	1	1	2	1	1	0	0	0	0	2	0	0	0	0	0
E. eois	1	2	3	3	2	1	2	2	1	2	1	1	1	1	2	1	2	2	2	2	2	2	1	2	2	3	3	3	2	2	0	3	1	3	3	6	3	3	2	2	1	1	0	1	1	0	0	0	0	2	0	0	0	0	0	0
E. abdominalis	2	2	2	2	1	1	2	2	3	1	2	2	2	1	1	2	2	2	2	2	2	2	1	0	2	3	2	3	1	1	0	2	1	2	2	4	3	3	2	2	2	1	0	1	1	0	0	0	0	2	0	0	0	0	0	0
E. curvifrons	2	3	3	1	1	1	1	2	2	1	3	1	3	1	2	3	2	2	2	2	2	2	1	0	1	3	3	3	1	1	0	2	1	2	2	5	1	2	1	1	1	1	0	1	1	0	0	0	0	2	0	0	0	0	0	0

APPENDIX 3

GenBank accession numbers for 17 *Erythromelana* and 5 Tachinidae species COI sequences.

Genus	Species	Specimen ID	GenBank Accession No.
Erythromelana	*cryptica* Inclan	YY26213male	HQ634211
Erythromelana	*napensis* Inclan	YY8135male	HQ634214
Erythromelana	*ecuadoriana* Inclan	DI03PTmale	HQ634215
Erythromelana	*ecuadoriana* Inclan	YY37297male	HQ634217
Erythromelana	*woodi* Inclan	DI507ECUfemale	HQ634219
Erythromelana	*woodi* Inclan	DI84EC09male	HQ634221
Erythromelana	sp. / *cryptica* species group	YY8740female	HQ634212
Erythromelana	sp. / *cryptica* species group	YY8640female	HQ634213
Erythromelana	sp. / *cryptica* species group	YY7599female	HQ634218
Erythromelana	sp. / *jaena* species group	YY8844female	HQ634216
Erythromelana	sp. / *jaena* species group	YY11445female	HQ634220
Erythromelana	sp. / *jaena* species group	YY8485female	HQ634210
Erythromelana	sp. / *jaena* species group	YY13862female	HQ634222
Erythromelana	*leptoforceps* Inclan	JOS810.4.1male	JQ520139
Erythromelana	*leptoforceps* Inclan	JOS810.7.2male	JQ520140
Erythromelana	*leptoforceps* Inclan	JOS810.6.1male	JQ520146
Erythromelana	*leptoforceps* Inclan	JOS810.7.1female	JQ520145
Vibrissina	nr. m*exicana* Aldrich	JOS807.12.9	JQ520142
Lixophaga	sp.	JOS1007.3A	JQ520143
Eucelatoria	*armigera* Coquillet	CA-FW.1	JQ520141
Blondelia	*hyphantriae* Tothill	CW806N79.7.1	JQ520144
Tachinomyia	*nigricans* Webber	WSU507.1	JQ520147