Zootaxa 5148 (1): 001–151
https://www.mapress.com/zt/

Monograph

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

https://doi.org/10.11646/zootaxa.5148.1.1
http://zoobank.org/urn:lsid:zoobank.org:pub:20BC627E-56A1-4674-A6B2-96F9B8DB15F7

ZOOTAXA

5148

Mitochondrial genetics of Ophiderini, with a new species from the *Eudocima phalonia* species group (Lepidoptera: Noctuidae: Calpinae)

ROBERT J. BORTH[1,*] & HUGO L. KONS, JR.[2]
[1] *18951 Bianchi Street, Venice, FL, USA. bobborth@sbcglobal.net; https://orcid.org/0000-0002-5228-5699*
[2] *719 West Summer Street, Appleton, WI, USA. hkonsjr@yahoo.com; https://orcid.org/0000-0002-6041-6732*
[*] *Corresponding author*

Magnolia Press
Auckland, New Zealand

Accepted by J. De Prins: 6 Apr. 2022; published: 2 Jun. 2022

ROBERT J. BORTH & HUGO L. KONS, JR.
Mitochondrial genetics of Ophiderini, with a new species from the *Eudocima phalonia* species group (Lepidoptera: Noctuidae: Calpinae)
(*Zootaxa* 5148)

151 pp.; 30 cm.

2 Jun. 2022

ISBN 978-1-77688-534-3 (paperback)

ISBN 978-1-77688-535-0 (Online edition)

FIRST PUBLISHED IN 2022 BY

Magnolia Press

P.O. Box 41-383

Auckland 1041

New Zealand

e-mail: magnolia@mapress.com

https://www.mapress.com/zt

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

Table of Contents

Abstract

We evaluate species, species group, and generic concepts for Ophiderini and Phyllodini (Lepidoptera: Calpinae) with a cladistic analysis of COI 5' mitochondrial DNA sequences. Species recognized by current taxonomy formed monophyletic clades with three exceptions: *Eudocima phalonia* (L.), *E. cocalus* (Cramer) and *E. hypermnestra* (Cramer). *Eudocima phalonia* formed two allopatric clades, an African clade sister to *E. lequeuxi* Brou & Zilli, and another clade sister to *E. euryzona* (Hampson). Each of these four clades comprises a separate taxon diagnosable by unique combinations of discrete genitalic characters, and the African clade previously lumped under *E. phalonia* is described herein as *E. afrikana* **sp. n**. *Eudocima cocalus* and *E. hypermnestra* phenotypes overlap in COI 5' haplotypes. Eleven *Eudocima* species groups delimited from morphology are independently supported as monophyletic with the molecular analysis. Unique combinations of COI 5' characters diagnosing species and species groups are provided. *Eudocima* is largely supported as monophyletic, except *E. formosa* is excluded from the *Eudocima* clade, and *Graphigona regina, Tetrisia florigera,* and *Ferenta stolliana* are embedded within it. Structural morphology of *E. formosa* also suggests it does not belong in *Eudocima.* Adult images are shown for most species of Ophiderini, including many DNA sequence vouchers, and their diagnoses and general distributions are provided.

Key words: Lepidoptera, Calpinae, Ophiderini, Phyllodini, *Eudocima*, fruit-piercing moths

Introduction

The economic impact of fruit-piercing moths (Noctuidae: Calpinae: Ophiderini and Phyllodini) has prompted efforts to study their behavior (Bänziger 1982; Hargreaves 1936; Zaspel 2008) as well as their systematics (Zilli & Hogenes 2002; Zahiri *et al*. 2012; Zaspel *et al*. 2012; Zilli *et al*. 2017). Most molecular studies of Ophiderini and Phyllodini have focused on phylogenetic inference with limited representations of the species in these tribes (Zahiri *et al*. 2011; Zaspel *et al*. 2012; Kawahara *et al*. 2019). Marsberg *et al*. (2015) compared COI sequences for three species of *Eudocima* for identification purposes, including: *E. divitiosa, E, materna,* and a nominotypical *E. phalonia* from GenBank. However, to date no rigorous analysis of the species concepts has been published with molecular data. A purpose of this paper is to independently evaluate the morphology-based species concepts in the Ophiderini and Phyllodini with an analysis of mitochondrial DNA from the 5' region of the gene Cytochrome Oxidase Subunit I (COI).

Eudocima phalonia causes extensive damage to commercial fruit crops (Baptist 1944; Bänziger , 1982; Roland *et al*. 2012; Leroy *et al*. 2021), and much has been written on efforts to control it (Davis *et al*. 2005; Sands & Liebregts 2005; Chikkalaki *et al*. 2018). This species is morphologically similar to *E. lequeuxi* Brou & Zilli*, E. euryzona* (Hampson)*, E. oliveri* Zilli & Brou*,* and *E. steppingstonia* Brou *et al*. (Zilli *et al*. 2017). These taxa are herein referred to as the *Eudocima phalonia* species group. Here we analyze three dimensional genitalic structure to evaluate a contradiction between the current classification and the mtDNA results for the *E. phalonia* species group.

Materials and methods

The following collection acronyms are used herein:

ANIC	Australian National Insect Collection, Canberra, Australia
CAS	Chinese Academy of Sciences, Institute of Zoology, Beijing, China
CBG	Centre for Biodiversity Genomics, Guelph, Canada
CC	Area de Conservacion Guanacaste, Costa Rica
CNC	Canadian National Collection, Ottowa, Ontario, Canada,
DJ	Private collection of D. Janzen & W. Hallwachs, Pennsylvania, USA
FMC	Florida Museum of Natural History, McGuire Center, Gainesville, Florida, USA
FMNH	Field Museum of Natural History, Chicago, Illinois, USA
GC	Private collection of Graeme Cocks, Townsville, Australia
HLK	Private collection of Hugo Kons, Appleton, Wisconsin, USA
MJWC	Private collection of Mathew J.W. Cock, Trinidad & Tobago
MNHN	National Museum of Natural History, Paris, France
NBC	Naturalis Biodiversity Center, Leiden, Netherlands
NHMUK	National History Museum, London, England
NIBGE	National Institute for Biotechnology and Genetic Engineering, Faisalabad, Pakistan
NRC	Nature Research Centre, Vilnius, Lithuania
RJB	Private collection of Robert Borth, Mequon, Wisconsin, USA
SB	Private collection of Steve Bransky, Chicago, Illinois, USA
SMC	State Museum of Carinthia, Klagenfurt, Austria
UM	University of Maryland, College Park, Maryland, USA
UP	University of Pennsylvania, Philadelphia, Pennsylvania, USA
UR	University of Rouen, Mont-Saint Aignan, France
USNM	National Museum of Natural History, Washington D.C., USA
UW	University of Wisconsin, Madison, Wisconsin, USA
YPM	Yale Peabody Museum of Natural History, New Haven, USA
ZSM	Bavarian State Collection of Zoology, Munich, Germany

We submitted legs to BOLD (Barcode of Life Data Systems) to obtain sequences for 42 *Eudocima* species (Ophiderini), and 14 Phyllodini species. Up to 658 base pairs from the 5' region of COI were sequenced by Paul Hebert's lab at the University of Guelph as described in Hebert et al. (2003). Christian Wieser and Carlos Lopez Vaamonde added sequences of *Miniodes phaeosoma* and a second sequence of *Huebnerius dux*. J. B. Sullivan provided a sequence for *Eudocima anguina*. The six *Eudocima* species not sequenced include *toddi* Zayas, *treadawayi* Zilli & Hogenes, *talboti* Prout, *behouneki* Zilli & Hogenes, *oliveri* Zilli and Brou and *smaragdipicta* Walker. Data for sequence vouchers is presented in Tables 3 and 5.

We obtained additional sequences from BOLD public projects including exemplars representing approximately 43% of the remaining Calpinae species. Many of these public sequences come from Costa Rican material submitted by Daniel Janzen, Winifred Hallwachs, and collaborators. All included taxa have at least one complete 658 base pair COI 5' sequence with the following three exceptions: *Phyllodes conspicillator* Cramer (600), *Calyptra hokkaida* (Wileman) (612) and *Gonodonta syrna* Guenée (630).

Sequences were manually aligned in Mesquite version 2.75 (Madison & Madison 2011). Characters were mapped on the strict consensus of most parsimonious trees (MPTs) for the included taxa, and diagnostic combinations of COI 5' characters were identified with the "map characters (show hash marks)" function of Winclada (Nixon 2002). Haplotypes for characters that vary within species were identified with the "character diagnoser" function of Winclada or by comparing the full sequences in Mesquite. MPTs were calculated in TNT (Goloboff *et al.* 2008) with all four search algorithms selected at the default settings and the best score hit 1000 times. Bootstrap supports were obtained from 1000 replications of a TNT new technology search with 100 random addition sequences per replication and all four search algorithms selected at the default settings.

No taxonomic changes or phylogenetic hypotheses are proposed solely based on COI 5' mitochondrial DNA.

Some of the molecular results are independently corroborated with morphological data presented herein and/or cited in the literature. Other molecular results that contradict the current classification are noted, but we consider it premature to take formal action until these results can be further evaluated with additional morphological study or nuclear DNA. The taxonomic changes proposed herein would be traditionally justifiable by the mophological data alone, and the COI 5' data provides additional corroboration.

Specimen photos were taken by RJB with a Canon EOS 60D camera and 100 mm macro lens without flash at the daylight wavelength using Ott lights. Live images of fruit-piercing moths were obtained from many individuals including 80 images supplied by iNaturalist photographers. The photographers' name or login attribution information follows their observation data in Table 4. Adult photos of *Eudocima talboti* and *E. oliveri* from Alberto Zilli are licensed by CC BY 4.0 https://creativecommons.org/licenses/by/4.0/.

Genitalia were dissected and imaged by HLK with the Automontage system at the University of Wisconsin-Madison Department of Entomology. Multiple images were taken at different focal lengths for each structure and combined into a single sharp image with Syncroscopy or Helicon Focus software, except for single frame images of the abdominal cuticle and juxta flattened out between two slides. Photos were taken with either white or black backgrounds, depending on which showed the characters best on a case by case basis. Generally black backgrounds were used for vesica images, characters of the colleterial gland complex, and to highlight setae on the papillae anales and uncus. Some images had photographic artifacts with Syncroscopy software, particularly images derived from overlapping three dimensional structures. In these cases the stacks of images were saved and combined with Helicon Focus, which generally eliminates or greatly reduces such artifacts.

Abdomens were removed and soaked in 10% KOH for 2–4 days. For males the phallus was removed from the capsule in 70% IsOH, and the external portion of the ductus ejaculatorius was removed from the coecum with a micro scissors. The phallus was photographed from multiple angles prior to everting the vesica. To evert the vesica the phallus was placed in distilled water, and distilled water was blown into the coecum opening with a syringe. Then the phallus and vesica were transferred to 99% IsOH, and 99% IsOH was pumped into the vesica with a syringe until it held its shape. The vesica was photographed from at least four angles, with the phallus hood orientated above, below, lateral and above, and lateral and below. Then the phallus/vesica was transferred to a vial of 99% IsOH for permanent storage (placing the vesica in water or weaker alcohol would cause permanent deflation). The ductus ejaculatorius was cleaned with fine forceps and stained with chlorazol black, then photographed in a petri dish with a thin layer of 70% IsOH. The inside of the capsule was cleaned out with fine forceps and by blowing in 70% IsOH with a syringe. Then the capsule was photographed before and after the long hairs covering the valvae were removed with fine forceps. The capsule was then dissected apart and separated into the two valvae, the uncus+tegumen, juxta, and saccus. The three-dimensional structure of these components was photographed in 99% IsOH from multiple angles, and then the juxta and saccus were flattened out between two slides, dried out with 99% IsOH, and photographed again. No other component of the male genitalia was ever slide mounted.

For females the abdomen was placed in 70% IsOH, and the cuticle anterior of segment seven was separated from the genitalia. Scales and hairs were carefully removed with blunt and fine forceps. The vagina and rectum were clipped below the papillae anales with a micro scissors. The colleterial gland complex was meticulously dissected out in a well-lit petri dish over a black background. The colleterial gland complex was photographed in a petri dish with a thin layer of 70% IsOH. The corpus bursae was blown out with a syringe of 99% IsOH. Remaining female structures were photographed while submerged in 99% IsOH. No portion of the female genitalia was ever slide mounted.

Abdominal cuticles were prepared in 70% IsOH. Scales were removed with blunt and fine forceps. The tergites were separated from the sternites with a micro scissors, and the segments pulled apart with fine forceps to show the structure of individual segments. The clean cuticle was soaked in 99% IsOH, flattened between two slides, and photographed after it was dry. The eighth and seventh segments were photographed separately in males and females, respectively.

Sets of legs were removed with fine forceps and soaked in 10% KOH for 2–4 days. Scales and hairs were removed with fine forceps. Legs were submerged in 99% IsOH and photographed in a petri dish.

Proboscides were soaked in 10% KOH for 2–4 days. They were cleaned with fine forceps and then photographed in a petri dish with 99% IsOH.

Results

The strict consensus of most parsimonious trees (MPTs) from the cladistic analysis of COI 5' sequences is presented in Figures 78–86. The *Phyllodes* clade (Fig. 81) and *Calyptra* clade (Fig. 79) were recovered on some but not all MPTs, and are shown with those nodes unresolved in the strict consensus tree indicated by a Bremer support of zero. All included species of Ophiderini and Phyllodini recognized by current taxonomy are diagnosable by unique combinations of COI 5' characters and supported as apomorphic with three exceptions: *Eudocima cocalus, E. hypermnestra,* and *E. phalonia.* These exceptions are discussed in the following section. Results above the species level are discussed in the section on Calpinae Phylogeny (below).

Images of Ophiderini and Phyllodini, including all known *Eudocima* species (except for Cuban endemic *E. toddi* Zayas) are provided in Figures 1–28. Because *Eudocima* are often sexually dimorphic both males and females are shown where available. Numbers in parentheses under specimen images include the first part of the BOLD sample ID number (for DNA sequence vouchers) on the left, and the HLK: dissection number on the right. These specimen sample ID numbers correspond to the numbers on the strict consensus tree in Figures 78–85, while the dissection numbers correspond to the numbers with the structural images in Figures 33–77. Sequence vouchers that were not dissected have a "-" in place of the dissection number. Comparative palpi close-up images of 64 specimens of Calpinae are provided in Figures 29–32. Images of live individuals are provided in Figures 87–96.

Conflicts with species level classification

Eudocima cocalus and *E. hypermnestra*: These two phenotypes form a single clade and overlap in COI 5' haplotypes. We did not compare their structural morphology, but Zilli *et al.* (2017) reported finding no meaningful genitalic differences between them, and raised the possibility of sinking *E. hypermnestra* into *E. cocalus*. Zilli *et al*. (2017) reported wing pattern differences: *E. hypermnestra* has paired black hindwing spots, and a more neatly scalloped marginal band which encloses pale marginal spots. The specimen shown in Fig. 11:F, labeled from Papua New Guinea, appears to be intermediate between the two phenotypes. Zilli *et al*. (2017) observed faded hindwing spots in *E. hypermnestra* specimens from the Andaman and Nicobar Islands, and no spots for New Guinea specimens which he includes under *E. cocalus*.

Eudocima phalonia: The current paraphyletic concept of *Eudocima phalonia* is comprised of two morphospecies corresponding to two genetic clades: an unnamed African clade sister to sympatric *E. lequeuxi,* and the nominate clade sister to allopatric *E. euryzona.* Structurally the African *phalonia* clade is most similar to *E. lequeuxi* whereas the nominate *phalonia* clade is most similar to *E. euryzona,* as explained in detail in the diagnoses (below). The *E. phalonia* species group contains five morphospecies forming genetic clades (a sixth morphospecies, *E. oliveri*, has not been sequenced), each diagnosable by unique combinations of discrete genitalic structural differences. In the current classification three of the clades are recognized as single species: *Eudocima lequeuxi, E. euryzona,* and *E. steppingstonia,* while two clades are currently lumped together under *E. phalonia*. This creates a very inconsistent classification by any species concept. Because all five entities are diagnosable by unique combinations of both mtDNA and structural characters, they should have equal rank. Since the African clade currently lumped under *E. phalonia* is sympatric with *E. lequeuxi* and *E. euryzona,* the five clades could not be considered subspecies of a single species level taxon, even under a broad lumping concept that doesn't recognize discrete genitalic differences as a basis for species separation. The African clade lacks an available name and we describe it herein as *Eudocima afrikana* **sp. n**.

The possibility of a second taxon included under *E. phalonia* had previously been raised by Zilli & Hogenes (2002) who recommended "Further research should be done to establish whether or not two different allopatric taxa are involved within this nominal species." They reported differences in the more elongate-lanceolate shape of the forewings and narrower juxta processi in the West African compared to Indoaustralian *phalonia* samples. Our study found that these juxta differences, along with additional genitalic characters, correspond to mtDNA differences.
Images of genitalic structural morphology for *Eudocima phalonia, E. afrikana, E. lequeuxi,* and *E. euryzona* are presented in Figures 33–68, with differences between taxa specified in the diagnosis of *E. afrikana* (below). Male genitalic characters are shown for all four taxa while female genitalia are included only for *E. phalonia* and *E. afrikana.* We had no specimens of the rare *E. oliveri* and *E. steppingstonia* available for dissection; however, species specific differences in male genitalia for both are illustrated in Zilli *et al*. (2017).

Eudocima afrikana sp. n.

Type material. The type series is restricted to specimens with DNA sequences and/or genitalic dissections.

Holotype male (Figure 15:G): Togo, Forest of Missahoe, Kpalime-Kloto, 1–25.ix.2018, (DNA Sample ID No. 24834-150918-TO, Dissection No. HLK: 2633), leg. Chmielowiec (YPM).

Paratypes: TANZANIA: 1 male (Figure 27:H) Tanga, Nguu mtns., Kilindi village, Tamota Forest, 10.ii.2007, (DNA No. 9346-100207-TA, Dissection No. HLK: 2501), (RJB).

TOGO: 1 female (Figure 27:K) Forest of Missahoe, Kpalime-Kloto, 1–25.ix.2018, (DNA No. 24816-130918-TO, Dissection No. HLK: 2645), leg. Chmielowiec (RJB).

MADAGASCAR: Fianarantsoa, Ranomafana, N -21.26 ˚ E47.42˚, 850m**:** 1 male (Figs 1:C, 15:I): 15.xi.2018, (DNA No. 24833-151118-MA, Dissection No. HLK: 2632), leg. Golovizin (RJB). 1 female (Figures 1:B, 15:J), 15.xi.2018, (DNA No. 24831-131118-MA), leg. Golovizin, (RJB); 1 male (Figure 27:F), 2.iii.2019, (DNA No. 24832-171118-MA, Dissection No. HLK: 2503), leg. Golovizin, (RJB); 1 male (Fig. 27:G, 21:I), 2.iii.2019, (DNA No. 24889-090319-MA), leg. Golovizin, (RJB);

UGANDA: 1 male (Fig. 27:E), Karbole Fort Portal, Lake Nkuruba Nature Reserve, N0.518˚ E30.302˚, 1519m (DNA No. 25027-211119-UG), leg. Golovizin, (RJB).

Diagnosis. The Sub-Saharan African distribution separates *E. afrikana* from its more eastern relatives including *E. phalonia* (found from India eastward to Hawaii), *E. oliveri* (found over 11,000 km to the east in the Vanuatu Archipeligo), and *E. steppingstonia* (found in the Marquesas Islands another 4,600 km further east). However, *E. afrikana* could be confused with the sympatric *E. lequeuxi* and *E. euryzona*. At least five species in the *Eudocima phalonia* group are diagnosable both by unique combinations of male genitalic and COI 5' mitochondrial DNA characters (*E. oliveri* has not been sequenced), and all six species are diagnosable by discrete differences in male genitalia. Male genitalic and abdominal structures are compared for *E. afrikana, E. phalonia, E. euryzona,* and *E. lequeuxi* in Figures 33–58, and female genitalic and abdominal characters are compared for *E. afrikana* and *E. phalonia* in Figures 59–69. The male genitalia of *E. afrikana* is most similar to *E. lequeuxi* whereas *E. phalonia* is most similar to *E. euryzona.*

Versus *Eudocima phalonia*. Wings: *Eudocima afrikana* cannot be reliably separated from *E. phalonia* by wing pattern or external characteristics.

Male genitalia. We found multiple consistent differences in the male genitalia. The posterior terminal process of the valvae are relatively broader in *E. afrikana* (Figs 39: A–D) than in *E. phalonia* (Figs 39: E–G, black arrows). The distance from the anterior median of the juxta to the point where the posterior processes diverge is 0.47–0.58 mm in *E. phalonia* versus 0.8–1.02 mm in *E. afrikana* (Fig. 38). The paired posterior processes of the juxta are wider in *E. phalonia*; the widest point measured 0.68 to 0.70 mm in *E. phalonia* versus 0.44–0.52 in *E. afrikana* (Fig. 38). The point where the posterior juxta processes diverge is broader and U-shaped in *E. phalonia* (Figs 38: E–G) versus V-shaped with a sharp point in *E. afrikana* (Figs 38: A–D). In dorsal or ventral aspects there are a pair of conspicuous dark pigmented bands near the inner margin of the anterior portion of the juxta processes in *E. afrikana* (Figs 34: A–C, red arrows) but not in *E. phalonia* (Figs 34: D–F). In lateral aspect the paired juxta processes bend posteriorly farther distally in *E. afrikana* (Figs 36: A–C) than in *E. phalonia* (Figs 36: D–F) (red lines in these figures cross the inflection point). In ventral aspect, with the natural three dimensional structure intact, the apices of the paired juxta processes cross in *E. phalonia* (Figs 34: D–F, 37: B), whereas they are widely separated in *E. afrikana* (Figs 34: A–C, 37: A). In ventral aspect the paired dark pigmented bands on the uncus converge distinctly proximal of the apical spine in *E. phalonia* (Figs 44: E–G), whereas in *E. afrikana* these bands remain separated where they meet the spine (Figs 44: A–D). The apex of the scoop-shaped region of the ductus ejaculatorius has a large terminal fold that completely covers the tip in *E. phalonia* (Figs 46: E–G)*,* whereas *E. afrikana* has only a small fold that does not overlap with the tip (Figs 46: A–D). With the ventral phallus hood orientated behind the vesica opening and tilted to the left (Figs 48–49), there is a deep U–shape on the posterior side of the vesica between the base and diverticulum 1 in *E. afrikana* (Figs 48: A–C, 49: A, red arrows)*,* whereas this U–shape is not visible in the same orientation in *E. phalonia* (Figs 48: D–E, 49: B, red arrows). With the ventral phallus hood orientated behind the vesica opening (Figs 48–49), the sclerotized plate of cornuti on diverticulum 1 is partially on top in *E. phalonia* (Figs 48: D–E, 49: B, yellow arrows), whereas it is entirely underneath in *E. afrikana* (Figures 48: A–C, 49: A, yellow arrows). With the ventral phallus hood orientated above (Figs 50–51), vesica diverticulum 1 projects to the right in *E. phalonia* (Figs 50: D–E, 51: B), whereas it projects to the left in *E. afrikana* (Figs 50: A–C, 51: A). In this same orientation, the sclerotized curved cornuti plate on diverticulum 1 is entirely underneath in *E. phalonia,* whereas it occupies lateral and ventral planes in *E. afrikana* (same figures as preceding character, red arrows). With the ventral phallus hood orientated lateral and down (Figs 52–53) the plate with deciduous spines is nearly perpendicular to the phallus in *E. phalonia* (Figs 52: D–E, 53: B, red lines), whereas it is roughly parallel to the phallus in *E. afrikana* (Figs 52: A–C, 53: A, red lines).

Female genitalia. In comparing female genitalic structures between two specimens each of *E. afrikana* and *E. phalonia,* only one consistent difference was found. The ventral anterior edge of the ovipositor lobe is convex and smoothly curved in *E. phalonia* (Figs 61: C–D, red arrows), whereas it is more triangular and protracted anteriorly in *E. afrikana* (Figs 61: A–B, red arrows).

Versus Eudocima lequeuxi. Wings: Brou & Zilli (2016) compared *E. lequeuxi* and *E. afrikana* (called *E. phalonia*) and noted differences in wing shape, genitalia, and the abdominal coremata. Some of the following characters were previously noted in Brou & Zilli (2016), whereas others are newly reported. In *E. lequeuxi* there is a concave indentation in the forewing outer margin between veins M3 and R5 (Fig. 15: E–F, Brou & Zilli (2016)), whereas this area is fairly straight in *E. afrikana* (Figs 1: A, 15: G). The female forewing has less contrast between lighter and darker areas in *E. afrikana* (Figs 1: B, 15: H, J) than in *E. lequeuxi* (Fig. 15: F). The distance between the dorsal hindwing black marginal band and medial patch is wider in *E. lequeuxi* (Figs 15: E–F, Brou & Zilli (2016)) than *E. afrikana* (Figs 15: G–J). The basal side of the dorsal hindwing medial patch is convex in *E. afrikana* whereas there is a concave indentation in *E. lequeuxi* (same figures as preceding character, Brou & Zilli (2016)). The ventral hindwing black marginal band of *E. lequeuxi* is more tapered posterior of vein Cu2, whereas the posterior apex of this band is abruptly squared off in *E. afrikana* (same figures as two preceding characters).

Male genitalia. Eudocima lequeuxi is the only one of these four species with a serrate inner margin of the posterior processes of the juxta (Figs 38: J–L, Brou & Zilli (2016, Figs 9–12)). When the saccus and arms of the vinculum are flattened out on a slide, the arms of the vinculum are distinctly less strongly curved posteriorly in *E. lequeuxi* (Figs 45: H–I) than in the other three species (Figs 45: D–G). The paired dark bands on the ventral side of the uncus are strongly concave on the outer sides subapically in *E. lequeuxi* (Figs 44: H, 45: A, distal to the red arrows) whereas they are straighter in the other three species (Figs 44: A–G, 45: B–C). The apex of the scoop-shaped region of the ductus ejaculatorius is strongly folded over (Fig. 46: I), similar to *E. phalonia* and *E. euryzona* (Figs 46: E–H), but unlike the smaller fold of *E. afrikana* (Figs 46: A–D, red arrows). With the phallus hood orientated lateral and down (Figs 52–53) diverticulum 2 appears narrower and more elongate in *E. lequeuxi* (Figs 53: D–E) than in *E. afrikana* (Figs 52: A–C, 53: A). The same is true with the phallus hood orientated lateral and up (Figs 54–55).

Male abdomen. The coremata on sternite 8 is more elongate in *E. lequeuxi* (Figs 57: C–E, Brou & Zilli (2016, Fig. 19)) than in the other three species (Figs 56, 57: A–B).

Versus *Eudocima euryzona.* Wings: The forewing of *E. euryzona* has a more pronounced falcate apical tip (Figs 16: A–B). The abdomen of *E. euryzona* is dorsally covered by orange hairs and scales throughout (Figs 16: A–B), whereas the anterior half of the abdomen in *E. afrikana* has extensive brown hairs and scales along the dorsal midline (Figs 15: H–J). The space between the medial patch and marginal hindwing band is narrower in *E. afrikana* (Figs 15: G–J) than in *E. euryzona* (Figs 16: A–B). Females of both species are variable but the background color of the forewings of *E. euryzona* is generally lighter (Fig. 16: B). The ventral hindwing black marginal band of *E. euryzona* tapers to a triangular point posterior of vein Cu2 (Fig. 21: J), whereas the posterior apex of this band is abruptly squared off in *E. afrikana* (Fig. 21: I). The ventral hindwing apical area of *E. euryzona* is a pale cream color (Fig. 21: J) versus the orange-yellow coloration of *E. afrikana* (Fig. 21: I).

Male genitalia. In ventral aspect, with the natural three dimensional structure intact, the apices of the paired juxta processes cross in *E. euryzona* (Figs 34: G–H) whereas they are widely separated in *E. afrikana* (Figs 34: A–C, 37: A). In dorsal or ventral aspects there are a pair of conspicuous dark pigmented bands near the inner margin of the anterior portion of the juxta processes in *E. afrikana* (Figs 34: A–C, red arrows) but not in *E. euryzona* (Figs 34: G–H). With the ventral phallus hood in lateral aspect, the top of the hood is more strongly convex in *E. euryzona* (Figs 47: I (bottom image), 53: C, F, 55: C, F) than in *E. afrikana* (Figs: 47: C–D (bottom images), 52: A–C, 53: A, 54: A–C, 55: A). With the ventral phallus hood orientated behind the vesica opening and tilted to the left (Figs 48–49), there is a deep U–shape on the posterior side of the vesica between the base and diverticulum 1 in *E. afrikana* (Figs 48: A–C, 49: A, red arrows)*,* whereas this U-shape is much shallower in the same orientation in *E. euryzona* (Figs 49: C, F, red arrows). With the ventral phallus hood orientated behind the vesica opening (Figs 48–49), the sclerotized plate of cornuti on diverticulum 1 is partially on top in *E. euryzona* (Figs 49: C, F yellow arrows), whereas it is entirely underneath in *E. afrikana* (Figs 48: A–C, 49: A yellow arrows).

Versus *Eudocima oliveri.* This species is known from only two males and one female from the Vanuatu Archipelago (Zilli *et al*. 2017), and no specimens were examined by us; however, a diagnosis is provided by Zilli *et al.* (2017). *E. oliveri* has shorter, broader forewings with a noticeably darker and more evenly convex PM line, and a narrower medial patch on the hindwing (Figs 16: G–H). Zilli *et al*. (2017) also noted *E. oliveri* has an outwardly projecting apex of the valvae. This character is unique among all species in the *E. phalonia* group.

Versus *Eudocima steppingstonia.* This species is known from only one male and two females from the Marquesas Islands (Zilli *et al*. 2017), and no dissections were examined by us. *Eudocima steppingstonia* has paler, yellowish hindwings with an indistinct outer margin and medial patch (Figs 15: C–D). Zilli *et al*. (2017) show this species has an elongated narrow uncus, which differs from the much wider uncus of *E. afrikana, E. phalonia, E. euryzona,* and *E. lequeuxi* (Figs: 42: D–F, 43).

COI 5’: This species is diagnosable by the following unique combination of COI 5’ character states: 46(C), 154(T), 313(C or T). There are 13 consistent character state differences between *E. afrikana* and *E. lequeuxi,* 21 between *E. afrikana* and *E. phalonia*, and 24 between *E. afrikana* and *E. euryzona* (Fig. 86).

Description. **Head (Male).** Vertex and frons with predominately pale purple hairs and scales, except ventral margin of frons with light tan hairs and scales. Labial palp basal segment predominately brown but mottled with lighter tan scales and hairs, narrow bands of iridescent pale purple scales along apical margin and dorso-lateral sides; middle segment with predominately dark purple scales and hairs on dorso-lateral side, predominately bluish grey scales and hairs on ventro-lateral side except proximally where dark brown scales dominate; terminal segment with tan and dark brown scales for roughly proximal 2/3 of length, distal 1/3 appearing wider with a lateral patch of blue rimmed with black, extreme apex light tan. Terminal segment appearing much narrower than proximal two segments (Fig. 32: K).

Proboscis (Figs 71: A, 72: A, H). Approximately basal 2/3 simple (Fig. 71: A). Subapical portion with lightly sclerotized rasping spines. Apex with glossy dark, smooth sclerotization, contrasting with the ribbing of the more lightly sclerotized remainder of the proboscis (Figs 72: A, H). Unsclerotized ovoid areas present around heavily sclerotized tearing hooks (Figs 72: A, H). Extreme apex with heavily sclerotized hooks lacking the unsclerotized ovoid areas (Fig. 72: H). Dorsal galeal ligulae extend for most of length (Fig. 71: A), except for extreme apex (Fig. 72: H).

Thorax (Male) (Fig. 1: A). Patagia mottled with purple, brown, and lighter tan scales. Tegulae pattern similar to patagia except at apex and along distal outer margin, where pattern sharply changes to mottled blue, black, and sparser white scales. Elsewhere dorsally a mix of brown, lighter tan, and purple scales and hairs. Ventrally with dense brown and tan hairs and scales.

Wings (Figs 1, 15: G–J, 21: I, 27: E–L). Length of anterior forewing base to apex: 37–45 mm, mean=42 mm males (n=8); 40–46 mm, mean=43.4 mm females (n=7); ratio of (anterior forewing base to apex)/ (anterior forewing base to tornal angle): 1.8–2.1, mean=1.9 (males); 1.8–2.1, mean=1.9 (females). Anal flap prominent, sharply pointed with convex sides. Tornal hook prominent, outer side convex, inner side concave, apex bluntly pointed to narrowly rounded. Shape of wings similar in both genders, but forewing fringe scalloped in female.

Forewing upperside (Figs 1: A–B, 15: G–J, 27: E–L). Sexually dimorphic.

Males. Background color predominantly brown with most pattern elements diffused, some individuals with distinctly lighter brown distal to the postmedial line. Veins accented by black scaling, often broken, creating the appearance of dashed-lines along the veins, especially distal to the postmedial line. Basal dash and basal line absent. Antemedial line diffuse, fairly straight and slanted proximally anterior to posterior, bent slightly basally at costa, terminating basal of anal flap along inner margin. Paired terminal lines present but often faint, barely discernible in some individuals, slightly paler than background color, distal terminal line extending from costa to postmedial line, basal terminal line extending from costa to posterior margin of discal cell. Medial line diffuse, convex, slightly darker brown than background color when discernible. Postmedian line diffuse, convex, curving strongly basally posterior of vein M3 and straightening between vein Cu1 and inner margin, darker brown than background color, tending to be more conspicuous than aforementioned lines, thinner and sharper than medial line. When discernible, reniform spot a simple band of lighter tan scaling spanning the width of the distal edge of the discal cell. Small, inconspicuous darker brown dot in discal cell basal to reniform. When discernible, subterminal line broad and diffuse with indistinct margins, darker brown than background color, convex, primarily spanning between veins Cu2 and M1. Apical line conspicuous, contrasting light tan to pale greenish tan, extends basally from subapical area at costa to vein M1 as a slightly convex arc, then bent distally between veins M1 and M2, sometimes weakly chevron-shaped between veins M1 and M2. Small white apical patch sometimes present distal of apical line and anterior of vein R4, with diffuse white scaling between veins R4 and R5. Margin with a thin band slightly darker brown than background color, fringe concolorous with margin. Forewing covered with a glossy sheen.

Females. Background color variable, mottled with grey, brown, olive-grey, and violet-grey. Pattern elements generally better defined than in males. Veins accented by black scaling, often broken, creating the appearance of dashed-lines along the veins, especially distal to the postmedial line. Basal dash and basal line absent. Antemedial line sharp, edged with white on distal side, fairly straight, bent slightly basally at costa, terminating basal of anal flap along inner margin. Paired terminal lines absent. Medial line a variable, wide, diagonal black band posterior of veinlet between veins Cu2 and Cu1, broken between this veinlet and vein M3, a much thinner, more diffused arc distal to the reniform between veins M3 and the costa. Postmedian line similar to male except contrasting more strongly against background color and variably edged with white on the distal side posterior of vein Cu1. Postmedian line transversed by a chevron-shaped whitish mark between veins Cu1 and M3. Reniform spot strongly contrasting against background, partially edged with black and white and filled with dark brown to blackish scales, shape an inverted chevron, sometimes surrounding area with extensive whitish diffusion. Small, sharply contrasting black dot in discal cell basal to reniform. When discernible, subterminal line narrow and diffuse with indistinct margins, lighter tan than background color, bulging distally between veins Cu1 and M1. Margin with extensive whitish suffusion, especially posterior to vein Cu1. Fringe distinctly scalloped, dark brown-grey anterior of veinlet between veins Cu1 and Cu2, lighter tan to whitish posterior of this veinlet.

Hindwing upperside (Figs 1: A–B, 15: G–J, 27: E–L). Not sexually dimorphic except in males the medial patch averages larger. Background color orange, variable amount of brown suffusion in basal area. Medial patch large and black, basal side simple and convex, distal side convex on each end and strongly concave in the middle. Marginal black band wide, widest anterior of vein M1, abruptly narrows across vein M1, then gradually narrows until abruptly squared off slightly posterior of vein Cu2, in some individuals extending slightly farther along wing margin with a small disjunct tornal spot sometimes present at vein 2A. Fringe chequered black and creamish-white, black patches at vein apices from veins Cu2 to Rs, creamish-white patches between the veins from Cu2 to Sc+R1, orange at anal angle proximal of vein Cu2 except for a small black patch contiguous with the tornal spot (when present).

Forewing underside (Figs 1: C, 21: I). Background color yellow-orange. Marginal band thick and black, basal margin sharp, distal margin less distinct. Apical area between marginal band and outer margin with lighter grayish-black, diffused with pale orange scaling. Postmedial band yellow-orange and completely surrounded with black, extends from vein parallel to costa to cell between veins Cu2 and 2A. Medial band sharp and black, fused with marginal band posterior of vein Cu2. Anterior of discal cell, antemedial band darker orange than postmedial band; posterior of discal cell largely concolorous with postmedial band. Basal band comprised of two small black patches separated by orange along vein Cu2. Basal area dull orange with a small black patch parallel to the costa. Area between costa and parallel vein mottled with black and yellow-orange. Fringe sexually dimorphic, solid dark brownish black in male, chequered with black patches at ends of veins and pale tan between in female.

Hindwing underside (Figs 1: C, 21: I). Background color varies from orange basally to yellow-orange distally. Medial patch like upperside. Marginal band similar to upperside posterior of vein M1, but partially replaced by pale cream suffused with black between veins M1 and R2 (on the distal side), and nearly completely replaced with pale cream suffused with black anterior of vein Rs. Tornal spot (when present) like upperside. Fringe similar to upperside.

Legs (Male) (Fig. 70).

Legs covered with tan scales and hairs, male metatibia with more elongate ventral hairs than female.

Foreleg (Figs 70: A–C): Protibia (Fig. 70: C) and profemur (Figs 70: A–B) unspined. Protibia with small convex sulcus with radiating spines near basal extremity on the inner side (Fig. 70: C). Protibial flange in shallow ovoid pit, margins of flange smooth (Fig. 70: C). Foreleg sclerotized throughout except for inner side of protibia distal of the flange (Fig. 70: A–C).

Midleg (Figs 70: A–B, D). Mesotibia and femur unspined with no hair pencil groove on mesotibia (Figs 70: A–B). Midleg sclerotized throughout except for a narrow translucent area at apex of mesotibia (Figs 70: A–B).

Hindleg (Figs 70: A–B, E–F). Metafemur and metatibia unspined (Figs 70: A–B). Sclerotization pattern as observed for *Catocala* and other Erebinae, with femur sclerotized throughout, metatibia translucent white except for proximal edge (Figs 70: A–B), metatarsomere 1 translucent white except at distal apex (Fig. 70: E), remaining tarsomeres sclerotized throughout (Figs 70: E–F).

Tarsi (Figs 70: D–F). Spination similar on all legs. Tarsomeres 1–4 with three ventral rows of large triangular spines, with one to three extra spines between the middle and right outer rows of spines at tarsomere apices (ventral aspect with claw on left) (Fig. 70: E). Tarsomere 5 with the same two outer rows of triangular spines but spines reduced in size, dense smaller spines between them not arranged in rows (Fig. 70: F). Minute translucent hair-like spines present on lateral sides of tarsomeres (Fig. 70: F) and along dorsal midline. Tarsomere 5 with two pairs of elongate, narrow, tubular spines dorsally at apex (Figs 70: D, F). Tarsal claws strongly bifid (Fig. 70: D, F), arolium translucent on edges, with two dark lateral bands and a somewhat opaque whitish center, distal margin strongly emarginate (Fig. 70: F).

Abdominal Scale Pattern (Fig. 1). Dorsally predominately orange scales and hairs except for anterior two segments and apex where brownish-tan hairs dominate. Male with apical brown hairs protruding from the genital capsule. Brownish-tan hairs decrease anterior to posterior except at apex. Ventrally with brownish-tan hairs throughout.

Abdominal cuticle (Figs 56: A–D, G, 58: A, E, 69: A–C). Male as shown in Figures 56 & 57, segment 8 highly modified, corema on sternite 8 comprised of deep pocket densely filled with hair pencils, tergite 8 sclerotization deltoid with deeply concave sides (Figs 56: A–D, G). Female as shown in Fig. 69: A–C.

Male genitalia (Figs 33–55).

Capsule (Figs 33: A–B, I–J, 34: A–C, 35: A–C, 36: A–C). Juxta and vinculum weakly fused with valvae, vinculum weakly fused with tegumen, vinculum arms expanded midventrally to a contiguous saccus without separation at the midpoint (Figs 34, 35, 45: D–E). Diaphragma membranous except for juxta (Fig. 34).

Valvae (Figs 33: A–B, I–J, 39: A–D). Outer surfaces densely covered with elongate brown and tan hairs and scales except for anterior and dorsal portions of sacculus (Figs 33: A–B, I–J); we could not get these hairs and scales to reflect iridescent green, although we observed this in two preparations of *E. phalonia* (Fig. 33: C). Dorsal edge of sacculus strongly concave (Figs 39: A–D). Posterior margin with broad convex process extending around to both dorsal and ventral sides; dorsal margin with blunt triangular subapical process. Sclerotized throughout except for a translucent subapical band arching over the dorsal triangular process. Ventral fold with fang-shaped medial gap. No claspers (Figs 39: A–D).

Juxta (Figs 34: A–C, 36: A–C, 37: A, 38: A–D). No distinct separation into a juxta and anellus, thus we refer to the entire structure as the juxta. Anterior margin U-shaped with a triangular median notch (Fig. 38: A–D). Diverges into two elongate processes with sharply pointed apices, anterior point of divergence triangular and sharply pointed (Figs 37: A, 38: A–D); distance from the anterior median to the point where the processes diverge 0.80–1.02 mm, processes 0.44–0.52 mm at widest point. Shape as shown in Figs 37: A (three dimensional) and 38: A–D (flattened out between two slides). In lateral aspect fairly straight in roughly anterior 2/3 but sinusoidal in posterior 1/3 (Figs 36: A–C). In dorsoventral aspect paired dark pigmented bands along inner margin anterior in roughly anterior fourth (Figs 34: A–C, 37: A).

Uncus (Figs 43: A–D, 44: A–D). Broad in lateral aspect, widest medially, posterior side strongly convex, anterior side strongly concave (Figs 43: A–D). Narrower in posterior aspect, shape variable but always distinctly flared and dorsoventrally flattened subapically (Figs 44: A–D). Apical spine heavily sclerotized, dorsoventrally flattened with a blunt tip (Figs 44: A–D), appearing fang shaped in lateral aspect (Fig. 43: A–D), in lateral aspect transition from uncus to apical spine nearly entire on posterior side, with a strongly convex bulge on anterior side (Figs 43: A–D). Setae dense on sides throughout length (Figs 44: A–D), projecting posteriorly to laterally (Figs 44: A–D), longest medially, longest setae of comparable length to maximum width of uncus in lateral aspect (Figs 43: A–D), row of short setae projecting anteriorly along medial to subapical anterior edge (Figs 43: B, D).

Tuba analis (Figs 41: A–D). Membranous except for scaphium and posterior–lateral corners. Scaphium an invaginated, concave plate tapering to a point slightly dorsal of the apical spine.

Phallus (Figs 47: A–D). Translucent throughout, coecum distinctly less sclerotized than remainder. Width and shape variable, fairly straight, apical triangular process present on ventral phallus hood highly variable in size, shape, and length. Coecum opening and posterior opening both on dorsal side.

Ductus ejaculatorius (Figs 46: A–D). Slender region much longer than scoop-shaped region. Scoop slender with small fold at distal end of inner side. Portion inside the phallus readily everts with the vesica (labeled “DE” in Figs 48–55), adjacent to and posterior of diverticulum 2 (Figs 48: A–C, 49: A).

Vesica (Figs 48: A–C, 49: A, 50: A–C, 51: A, 52: A–C, 53: A, 54: A–C, 55: A). Two simple unilobal diverticula present and a basal bulge. Diverticulum 1 with a sclerotized ovoid plate with dense deciduous heavily sclerotized spine-like cornuti. Orientation of diverticula as described in the diagnosis.

Female genitalia (Figs 59–68).

Papillae anales (Figs 61: A–B, 62: A–B, 63: A–B). Sclerotized throughout, shape as shown in Figs 61: A–B, setae project primarily posteriorly, dense short setae along posterior edge, more widely separated and elongate setae elsewhere.

Apophyses (Figs 60, 66: A–B). Posterior apophyses conspicuous, sclerotized, elongated rods (Fig. 60). Anterior apophyses short and unpigmented distally (Figs 66: A–B).

Intersegmental membrane between papillae and segment 8 (Figs 59: A–B, 60: A). Gradually widening posteriorly to anteriorly. Ratio of length to width at anterior end about 0.8.

Segment A8 (Figs 64: A–B, 66: A–B). Shape as shown in Figs 64: A (ventral) and 66: A–B (lateral). Elongate, posteriorly projecting setae arranged irregularly along posterior edge (Figs 64: A–B, 66: A–B).

Intersegmental membrane between lamella and segment 8 on ventral side (Fig. 64: A). Heavily sclerotized sinus vaginalis with two tones of sclerotization, including a more darkly sclerotized interior ovoid pattern; only two narrow bands of unscleriotized tissue (not present in Fig. 64: B, where this area appears to be deformed). Sclerotization pattern posterior of antrum ornate with radiating bands of darker sclerotization as shown in Figs 64: A–B.

Lamella antevaginalis (LAV)/Antrum (Figs 64: A–B (ventral), 66: A–B (lateral)). A large amount of variation is present between our two preparations as one specimen (HLK: 2645) appears to have a deformed antrum and lamella antevaginalis. Specimen HLK: 2505 is typical of other dissections we have prepared or examined in the literature from the *E. phalonia* species group. Both preparations have two asymmetrical pockets with a long, tapering triangular medial spine extending posterior of the sinus vaginalis, with the left pocket larger than the right (ventral aspect). The spine is fairly straight in HLK: 2505 (Fig. 64: A) whereas it is strongly curved to the right and much longer in HLK: 2645 (Fig. 64: B).

Ductus bursae (Fig. 59: A). Membranous, dorsoventrally flattened with broad vertical striations, forks posteriorly into asymmetrical diverging, pointed extensions where fused with antrum (Fig. 65: A).

Corpus bursae (Figs 59: A–B, 60). Longitudinal raised striations throughout. Shape irregular, posteriorly bulging, anteriorly gradually tapering and curving ventrally. Note the degree of inflation varies among preparations in Fig. 59. While we fully inflated the corpus bursae with 99% IsOH, it quickly retracted and lost its shape before it could be photographed.

Ductus seminalis (Fig. 67: B). Total length approximately 3.8 mm. Simple, uncoiled, bulla begins about 0.9 mm distal of base. Note the bulla is not inflated in Fig. 67: B, but is inflated in Fig. 67: C of *E. phalonia.*

Colleterial gland complex (Figs 67: D–E, 68: A, C, E). Terminology follows Mitter (1988). Adjoining differentiated canals of spermathecal duct with 1.5 coils basal to the vesicle; abrupt transition to undifferentiated section at base of vesicle; vesicle unsclerotized, elongate and weakly curved (Fig. 68: C). Utriculus elongate, terminus somewhat crescent-shaped, heavily ribbed (Fig. 68: E). Lagena globular with short triangular stalk (Fig. 68: E). Colleterial gland (separated from the vagina in Fig. 67: E) tubular for most of length, narrowest at base, widening medially, then constricting basal to a distal asymmetric expansion from which the paired glands arise at its apex (Fig. 67: E). Note the colleterial gland is not inflated in Fig. 67: E of *E. afrikana* but is inflated in Fig. 67: F of *E. phalonia.* Oviductus communalis narrow with the paired branches much longer than basal stalk (Fig. 67: D). Vagina ovoid (Fig. 67: B).

Rectum/Intestine (Fig. 69: D). Rectum sculptured throughout with small ovuloid shapes with slightly raised walls. Intestine robust, as shown in Fig. 69: D.

COI 5' Mitochondrial DNA. The holotype with a DNA Sample ID Number of 24834-150918-TO has a complete 658 base pair COI 5' sequence as follows:

AACATTATATTTTATTTTTGGTATTTGAGCAGGTATAGTAGGAACCTCACTCAGTTTATTAATTCGAGCTGAATTAGGAAACCCAGGATCACTAATTGGAGATGATCAAATTTATAATACTATTGTCACAGCTCATGCTTTTATTATAATTTTTTTCATAGTAATACCTATTATAATTGGAGGATTTGGAAATTGATTAGTACCCCTTATATTAGGAGCCCCTGATATAGCTTTCCCCCGAATAAATAATATAAGTTTCTGACTTCTTCCCCCTTCTTTAACTCTTCTTATTTCAAGAAGAATTGTAGAAAATGGAGCAGGAACTGGATGAACAGTTTATCCCCCACTTTCATCTAATATTGCCCATAGAGGTAGTTCGGTAGATTTAGCTATTTTTTCCCTTCATTTAGCTGGAATTTCATCAATTTTAGGAGCTATTAACTTTATTACAACAATTATTAATATACGACTAAATAATTTATCATTTGATCAAATACCATTATTTATTTGAGCTGTTGGAATTACTGCATTTTTATTACTTCTTTCTTTACCTGTCTTAGCAGGTGCTATTACAATACTTTTAACAGATCGAAATTTAAATACATCTTTCTTTGACCCCGCTGGTGGTGGAGATCCTATTCTATATCAACATTTATTT

Infraspecific variation is shown in Table 1.

Taxonomic notes. *Eudocima phalonia* (Linnaeus, 1763) (=*fullonia* Clerck, 1764) includes the following synonyms, along with their type countries in parentheses:

Phalaena (=Noctua) phalonia Linnaeus, 1763 (India),
Othreis fullonia Clerck, 1764 (India),
Ophideres fullonica Linnaeus 1767 (incorrect spelling of *fullonia*),
Noctua dioscoreae Fabricius, 1775 (Oriental India),
Phalaena pomona Cramer, 1776 (India),
Ophideres obliterans Walker [1858] (Samoa).

A thorough nomenclatural review of *E. phalonia* was undertaken by Brou & Zilli (2016), who concluded that no names were based on material of African origin. Terrell (2020) found no overall genitalic variance in dissections of 14 female and 16 male specimens of *E. phalonia* from Indomalya and Australasia, but did not include any African material. Thus, all material included in that study constitutes nominate *E. phalonia*.

Etymology. The new species is named after the Swahili spelling of Africa.

Eudocima (Ophiderini) species groups

The cladistic analysis of COI 5' sequences recovered a number of species groups that are known to correspond well with morphological characters. These groups are discussed below:

Eudocima collusoria species group (Figs 7: I–L, 18: D–E, 23: J–K, 30: H). *E. collusoria* (Cramer) and *E. memorans* (Walker). These small Neotropical species are sexually dimorphic with strongly concave apical forewing lines. The hindwing medial patch reaches the wing margin. They are weakly supported as sister taxa in the molecular analysis (Fig. 82).

Eudocima kinabaluensis species group (Figs 8: A–D, 18: I–J, 23: N–O, 30: I–J). *E. kinabaluensis* (Feige) and *E. splendida* (Yoshimoto). This group is not sexually dimorphic, has similar transverse green forewing markings, and similar palpi with a long, slender third segment and the second segment broadening medially. These two species come out as sister taxa in the molecular analysis (Fig. 83), and Yoshimoto (1999) illustrates that the genitalia of these two species are similar.

Eudocima homaena species group of Zilli *et al*. (2017) (Figs 8: E–J, 18: K–N, 23: R–X, 24: A–D, 30: K–N). *E. homaena* (Hübner), *E. iridescens* (Lucus) and *E. caesar* (Felder). The females have transverse green forewing bands and the males have well defined contrasting am and pm lines. The forewing apex is not pointed outward and there is a contrasting pale area distal to the subterminal line. *Eudocima iridescens* comes out basal to a clade with *E. caesar* + *E. homaena* in the molecular analysis (Fig. 83).

Eudocima materna species group (Figs 9: A–D, 19: A–B, 24: E–I, 30: O–P). *E. materna* (L.) and *E. apta* (Walker). These allopatric taxa form sister clades (Figure 83). They are similar in wing pattern and genitalia (Zilli & Hogenes 2002) and are the only *Eudocima* with a marginal band that have the median patch in the form of a round spot. The hindwing fringe is checkered black and white, with eight white and nine black sections; only dissimilar *E. hypermnestra* has as many as eight white sections. The female dorsal forewing has a contrasting pale streak extending from the base through the reniform toward the subterminal area. The female dorsal forewing also contains a contrasting curved white stripe, extending distally/anteriorly from the base, then curving distally/posteriorly beneath the reniform, and extending into the subterminal area. Also, females are the only *Eudocima* taxa with the reniform in the form of three dots representing the vertices of a right triangle. *Eudocima apta* is the only New World species in the clade including all of the sequenced Old World *Eudocima* species (Figs 83–86).

Eudocima salaminia species group of Zilli *et al*. (2017) (Figs 10: A–F, 19: F–H, 25: A–F, 31: D–F). *E. salaminia* (Cramer)*, E. dividens* (Walker) and *E. nigricilia* (Prout). All three share a very similar forewing with two pattern characters unique in the *Eudocima*: (1) an extensive olive brown to green triangular patch covering much of the forewing except for the costal area, basal area, and subterminal area; (2) an arching line on the anterior side of this patch, extending from the inner margin (at the anal flap or basal to it) to the apex, with a contrasting pale edge on the anterior side. *Eudocima dividens* comes out basal to a clade with *E. nigricilla* + *E. salaminia* in the molecular analysis (Fig. 84).

Eudocima discrepans species group of Zilli *et al*. (2017) (Figs 10: G–J, 19: I–K, 25: G–J, 31: G–I): *E. discrepans* (Walker) and *E. muscigera* (Butler). These taxa have similar wing pattern and palpi (Figs 30: G–I). *Eudocima discrepans* may include two species that differ in wing pattern, wing shape, and COI sequences (Fig. 84), but only one specimen of the possible second species was available for study, and it has no collection data. These two morphotypes come out sister to *E. muscigera* in the molecular analysis (Fig. 84).

Eudocima cocalus species group of Zilli & Hogenes (2002) (Figs 11: C–J, 20: B–D, 25: K–L, 31: K–L). *E. cocalus* (Cramer), *E. hypermnestra* (Cramer) and *E. treadawayi* Zilli & Hogenes. *Eudocima cocalus* and *E. hypermnestra* form a clade and overlap in COI haplotypes (Fig. 84) as discussed above. The Philippine endemic, *E. treadawayi*, is similarly patterned but the yellowish-green forewings are duller (Zilli & Hogenes 2002); however, no sequence was available.

Eudocima cajeta species group of Zilli *et al*. (2017) (Figs 12: C–J, 20: F–G, 25:O–T, 31:N–O): *E. cajeta* (Cramer), *E. srivijayana* (Bänziger), and *E. talboti* (Prout). Zilli *et al*. (2017) reported that external differences between these species are minor and not always constant such that identification is best done with genitalic differences. All three are strongly sexually dimorphic. Males have strongly contrasting am and pm lines edged with a band of light scaling on the distal side. The pm line is strongly concave whereas the am line can be concave or straighter. Females are more mottled with the am and pm lines more irregular, diffused, and less distinct. The molecular analysis includes two sister clades tentatively identified as *E. cajeta* and *E. srivijayana* based on geographic distribution, although single representatives of each clade occur at the same locality in Vietnam (Bach Ma Mountain) (Fig. 85). COI analysis places *E. jordani* (Holland), which is also sexually dimorphic with scalloped forewing margins (Figs 12: A–B), as the probable sister taxon to this group (Fig. 85).

Eudocima sikhimensis species group of Zilli *et al*. (2017) (Figs 13: E–J, 20: K, 21: A–B, 26: F–K, 32: C–D). *E. sikhimensis* (Butler), *E. mazzeii* Zilli & Hogenes and *E. behouneki* Zilli & Hogenes. *Eudocima sikhimensis* and *E. mazzeii* were recovered as a clade (Fig. 85) but no sequence was available for *E. behouneki*. All three species have a similar wing pattern, and Zilli *et al*. (2017) reported that all three species have fairly short labial palpi and a small compact vesica.

Eudocima tyrannus species group (Figs 14: C–F, 21: C, E, 26: L–O, 32: E–F). *E. tyrannus* (Guenée) and *E. okurai* (Okano). This group has a similar wing pattern and has slightly larger palpi with squarer tips compared to the previous group. These species come out as sister taxa in the molecular analysis (Fig. 85).

Eudocima phalonia species group (Figs 15: C–J, 16: A–H, 21: H–L, 27, 28: A–L, 32: J–M, 33–70, 71: A–B, 72: A–B). *E. phalonia*, *E. euryzona*, *E. afrikana*, *E. lequeuxi, E. steppingstonia, & E. oliveri*. These species have similar wing pattern, genitalia and palpi as discussed in the description of *E. afrikana*. No sequence was obtained for *E. oliveri*. The tree topology for the remaining five species is shown in Fig. 86.

Ophiderini species accounts with diagnoses and distribution data

Note. For some species only small series were available for comparison, thus in these cases diagnoses based on wing pattern must be considered preliminary. In such cases we selected characters that tend not to vary greatly within those species where we have examined longer series.

Eudocima procus (Cramer, 1777)

(Figs 6: A–B, 18: A, 23: A–D, 30: B, 91: I)
This species has a unique hindwing character: the medial patch is expanded into a median band extending across the entire wing from the costa to the inner margin. The band is comprised of four comma-shaped patches fused together. Other *Eudocima* species have at most two comma-shaped patches fused together. The hindwing marginal band is disjunct from the wing margin except between veins Cu2 and M3. Females without hindwings exposed could be confused with *E serpentifera* or *E. colubra,* but *E. procus* has a contrasting pale triangle on the proximal side of the PM line between veins Cu2 and Cu1, which is absent in the other two species. This species feeds on *Odontocarya tamoides* (Menispermaceae) in Honduras (Caballero *et al.* 1994). *Eudocima procus* is relatively common and widespread from Bolivia and Peru up to Mexico.

***Eudocima toddi* (Zayas, 1965)**

This sexually dimorphic species is illustrated in Brou & Águila (2013). It is unique among the *Eudocima* by having the hindwing medial patch separated into two disjunct sections. The marginal band is reduced to a thin, irregular band widely separated from the hindwing margin. The only known specimens are a single male and female from La Gran Piedra, Oriente Province, in Cuba (Brou & Águila 2013).

***Eudocima serpentifera* (Walker, [1858])**

(Figs 6: C–D, 18: B, 23: E, 30: C, 71: C, 72: C, 91: C–D, H)

In this large (44–56 mm) species the dorsal hindwing medial patch does not reach the wing margin. It is separated from *E. procus* as described above. The dorsal forewing of *E. serpentifera* females has a light orange-brown patch extending from the anal angle to vein Cu1. The homologous patch in females of *E. colubra* only extends to the veinlet between Cu2 and Cu1, and is a distinctly darker orange-brown. Furthermore, the female of *E. colubra* has subterminal greyish-white shadings between the pm and subterminal lines posterior of vein M3, which are absent in *E. serpentifera. Eudocima serpentifera* ranges from Brazil and Peru to Mexico and the West Indies. A single U.S. record from Louisiana is illustrated in Brou (2006). In Costa Rica it feeds on *Disciphania calocarpa* (Menispermaceae) (Janzen & Hallwachs 2009).

***Eudocima colubra* (Schaus, 1911)**

(Figs 6: E–F, 18: C, 23: F–G, 30: D)

The separation of this species from *E. procus* and *E. serpentifera* is described above. It has been collected from Peru through Columbia, Panama and Costa Rica. We doubt the accuracy of a Zimbabwe label for one specimen (Fig. 6: E) which was obtained from a third party. Like *E. serpentifera* it feeds on *Disciphania calocarpa* (Menispermaceae) in Costa Rica (Janzen & Hallwachs 2009).

***Eudocima anguina* (Schaus, 1911)**

(Figs 7: A–B, 23: H)

Schaus (1911b) raised the possibility that this species was conspecific with *E. collusoria,* but these two species differ in wing shape, pattern, and COI 5' characters. This is one of the three smallest Neotropical *Eudocima* species (32 mm, n=2), along with *E. memorans* (33 mm, n=1) and *E. collusoria* (34–35 mm, n=2). Of the three only *E anguina* has a fairly straight rather than strongly concave apical line. The forewing of *E. anguina* has a more pointed apex and tornal hook, and more angular outer margin relative to the other two species. Also, only *E. anguina* lacks dark hairs and scales in the dorsal hindwing basal area. The hindwing medial patch may be absent (Fig. 23: H). When present the patch does not extend anterior of vein Cu1, whereas in the other two species it extends to vein M2 or beyond. The female dorsal forewing has a white spot on the basal side of the PM line between veins Cu2 and Cu1, lacking in the other two species. This species is rarely recorded from Columbia (Vargas-Fonseca *et al*. 2020) north to Costa Rica.

***Eudocima memorans* (Walker, [1858])**

(Figs 7: I–J, 18: D, 23: J, 30: H, 90: A, D)

This species is separated from similar *E. anguina* as described above. Eudocima *collusoria* shares a more similar forewing pattern but lacks the small, elongate dark patch on the distal side of the pm line between veins Cu2 and Cu1. The apical line is strongly concave in both species, but in *E. collusoria* it is distinct between vein R5 and the apex whereas in *E. memorans* it is barely discernible between vein R5 and its more rounded apex. *Eudocima collusoria* has a distinct hindwing apical patch whereas there is no trace of one in *E. memorans. Eudocima memorans* has been recorded as far south as Bolivia and ranges from Ecuador east to French Guiana and north to Costa Rica.

***Eudocima collusoria* (Cramer, 1777)**

(Figs 7: K–L, 18: E, 23: K, 90: B–C)

This species is separated from similar *E. memorans* and *E. anguina* as described above. *Eudocima collusoria* is an uncommon species reported from Columbia east to Trinidad and Suriname.

***Eudocima splendida* (Yoshimoto, 1999)**

(Figs 8: A–B, 18: I, 30: I)

This species is most similar to *E. kinabaluensis* but the forewing differs by a smooth outer margin and the shape of the green patch from base to subterminal area (Yoshimoto 1999). The distal side of the dark discal stigma extends anteriorly as a short projection. This species is only recorded from northern Myanmar (Yoshimoto 1999) and northern Thailand.

***Eudocima kinabaluensis* (Feige, 1976)**

(Figs 8: C–D, 18: J, 30: J, 94: A–C)

The forewing differs from *E. splendida* in that the green patch bulges distally at vein Cu2, the reniform is less distinct, and the outer wing margin is crenulate. All specimens are from Borneo.

***Eudocima smaragdipicta* (Walker, [1858])**

(Figs 8: K, 23: P–Q, 94: D–F)

The longitudinal green forewing mark is more irregular than in *E. kinabaluensis* or *E. homaena*. Both *E. smaragdipicta* and *E. homaena* have a medial patch which is lacking in the *E. kinabaluensis* group. The life cycle is illustrated by Leong (2009) who found the larvae in Singapore feeding on *Fibraurea tinctoria* (Menispermaceae). That larvae attained a length of 75 mm, and while resting adopted a typical *Eudocima* defensive posture presenting a striking pair of ocelli on the third abdominal segment. It is found in peninsular Malaysia, Sumatra, and Borneo (Holloway 2005).

***Eudocima iridescens* (Lucus, 1894)**

(Figs 8: E–F, 18: K, 23: R–S, 30: K, 94: J–L)

Eudocima iridescens is strongly sexually dimorphic with females having a dorsal forewing green transverse band coming to a point at the distal end. It has no hindwing medial patch, separating it from *E. homaena* but not from all specimens of *E. caesar*. It can be separated from *E. caesar* by the hindwing marginal band extending to the inner margin, versus extending slightly beyond vein Cu2 in *E. caesar*. Also, *E. iridescens* has a black tipped orange dorsal abdomen, whereas the dorsal abdomen is orange throughout in *E. caesar* and *E. homaena* (Zilli *et al*. 2017). It is known from New Guinea and Queensland, Australia, along with a number of surrounding islands.

***Eudocima caesar* (Felder, 1861)**

(Figs 8: G–H, 18: L, 23: T–X, 30: L)

This species could be confused with *E iridescens* or *E. homaena,* and the diagnosis is described under those species. The few known specimens are from the Moluccans including Halmhera, Buru, Ambon, Seram (Zilli *et al*. 2017) and Bacon Island.

***Eudocima homaena* (Hübner, [1823])**

(Figs 8: I–J, L, 18: M–N, 24: A–D, 30: M–N, 93: B, 94: G–I)

This species could be confused with *E. iridescens* as discussed under that species (above). It can be separated from *E. caesar* and *E. iridescens* by the hindwing fringe, which is checkered black and orange in *E. homaena* and black in *E. caesar* and *E. iridescens* (Zilli *et al*. 2017). *Eudocima homaena* always has a comma shaped medial patch but this is rounder when present in *E. caesar*. It is allopatric with *E. caesar* and widespread from India and Sri Lanka eastward to Sulawesi, Lombok, Flores and Timor (Zilli *et al*. 2017).

Specimens from Sumba Island (Fig. 8: L) and Malaysia (Fig. 24: D) have the typical *homaena* hindwings and abdomen, but the forewings are more similar to *E. iridescens* than material we have examined from elsewhere. The transverse green forewing band is narrower than typical *homaena,* and similar to the band of *iridescens. E. homaena* usually has a small finger-like extension on the anterior side of the green band, extending anteriorly to touch the posterior side of the reniform, whereas in *E. iridescens* the transverse green band touches the posterior side of the reniform without this extension. The specimen from Sumba Island is like *E. iridescens* for this character, whereas in the specimen from Malaysia the finger-like extension is also absent, but the green band barely touches the reniform–only at the posterior corner on the basal side. The specimen from Malaysia comes out at the base of the *E. homaena* clade with the COI 5' analysis, followed by the Sumba Island specimen in the second basal position (Fig. 83).

Eudocima apta (Walker, [1858])

(Figs 9: A–B, 19: A, 24: E–F, 30: O, 91: B, F)

This species and *E. materna* are supported as allopatric, apomorphic phylogenetic species diagnosable by unique combinations of mtDNA and genitalic characters. *Eudocima apta* occurs in the New World whereas nominotypical *E. materna* occurs in the Old World. While a single specimen in BOLD, (Sample ID: BC ZSM Lep 40393) dubiously reported to be from Brazil, comes out in the Old World mtDNA Clade, the remaining thirty specimens split into Old World and New World clades with eight consistent mtDNA character state differences between them.

These two sexually dimorphic taxa are extremely similar in wing pattern, but there is a tendency for the dorsal hindwing marginal band to be thinner in *E. materna* and for the medial patch to be smaller. The aforementioned specimen BC ZSM Lep 40393 has a narrow marginal band and small medial patch, consistent with the Old World phenotype, casting further doubt on the reported Brazilian locality. Zilli & Hogenes (2002) specify differences in the size and shape of the corpus bursae, which they report is distinctly longer in *E. materna* than *E. apta.*

Eudocima apta has been recorded from Argentina through Mexico and feeds on *Disciphania heterophylla* (Menispermaceae) and *Cissampelos pareira* (Menispermaceae) in Costa Rica (Janzen & Hallwachs 2009). It also occurs sporadically in the southern United States (Kimball 1965; Kons & Borth 2006; Brou *et al*. 2013; Reeves *et al*. 2017). It has been recorded as far north as Upper Michigan (Kyle Johnson, pers. com. 2018), Vermont (Gilligan & Passoa 2014), Quebec (Handfield 1999), and Ontario (Reeves *et al*. (2017). It has recently been found in numbers in southern Florida and Texas; we collected six specimens of *E. apta* in the Davis Mountains of Texas over two nights in 2018, and Reeves *et al*. (2017) recorded 41 adult observations on a single *Ficus aurea* tree in the Florida Everglades in 2016.

Eudocima materna (Linnaeus, 1767)

(Figs 9: C–D, 19: B, 24: G–I, 30: P, 95: H–I)

This species with the thinner hindwing marginal band can be diagnosed from the very similar *E. apata* as discussed under that species above. The vast range of *E. materna* includes Africa, India, the Indoaustralian region up to the Central Pacific and the Philippines (Zilli *et al*. 2017).

Eudocima boseae (Saalmüller, 1880)

(Figs 9: E–F, 19: C, 24: J–L, 31: A, 92: D)

This is a sexually dimorphic species with a banded black, red and yellow abdomen unique to the genus. It is one of only two *Eudocima* where the dorsal hindwing medial patch is fused with the marginal band; the other species, *E. imperator,* has an orange dorsal abdomen and a checkered hindwing fringe like other African *Eudocima*. *Eudocima boseae* is the only Old World *Eudocima* species with a double medial patch, although this condition occurs in several New World species including *E. memorans, E. collusoria, E. colubra,* and *E. sepentifera.* The female has a narrow green transverse band which is not found in any New World taxa. It is endemic to Madagascar.

Eudocima imperator (Boisduval, 1833)

(Figs 9: G–H, 19: D, 24: M–Q, 31: B, 92: F)

This large sexually dimorphic species is separated from *E. boseae* and all other *Eudocima* species as described under *E. boseae* (above). It is a Madagascar endemic sympatric with *E. boseae.*

Eudocima divitiosa (Walker, 1869)

(Figs 9: I–J, 19: E, 24: R–T, 31: C, 92: E)

This is the only African *Eudocima* with no hindwing medial patch. The hindwing has a broad continuous marginal band similar to the one found in *E. iridescens* of the Australian region; however, the female of *E. iridescens* has a green forewing transverse band. The male of *E. divitiosa* has a unique pale greenish band bordering the distal side of the PM line. It has been recorded from numerous localities throughout subsaharan Africa (De Prins & De Prins 2022).

Eudocima dividens (Walker, [1858])

(Figs 10: A–B, 19: F, 25: A–B, 31: D, 93: D)

This species can be separated from similar *E. salaminia* by the following characters: the forewings have a darker, less greenish background color; the light tan band along the outer edge of the forewing is wider, and the hindwing marginal band is wider. Females have a strongly contrasting stigma which is lacking in *E. salaminia.* It is found in southwest Asia from the Philippines and peninsular Malaysia to Java and Sulawesi (Zilli *et al*. 2017).

***Eudocima salaminia* (Cramer, 1777)**

(Figs 10: C–D, 19: G, 25: C–F, 31: E, 93: A, C)

This species is separated from similar *E. dividens* as described above. It can also be confused with similar *E. nigricilia* and can be separated as follows: the dorsal forewing background color is lighter and more greenish, the medial patch is more deeply notched the distal side, and the hindwing fringe is checkered cream and black rather than contiguous black. It is a widespread species from India to Fiji in the central Pacific, north to Korea and Japan and south to New Guinea and Australia (Zilli *et al*. 2017).

***Eudocima nigricilia* (Prout, 1924)**

(Figs 10: E–F, 19: H, 31: F)

This species is separated from similar *E. salaminia* as described above. It is endemic to New Guinea where it is found in the Central Highlands. In New Guinea it is sympatric with *E. salaminia* which is less common there (Papua Insects Foundation 2020).

***Eudocima discrepans* (Walker, [1858]) complex**

(Figs 10: G–I, 19: I–J, 25: G, 31: G–H, 95: N)

This is a relatively large species (46–51 mm) with a conspicuous tornal hook and plain brownish-grey forewings, except for a few small green patches distal to the pm line. It is sexually dimorphic with two white triangular marks basal to the PM line in females. It may be confused with the smaller *E. muscigera* (36–38 mm) but has more elongate forewings with a more slanted outer margin. It ranges from the northeast Himalayas, W. China, Thailand, and Vietnam south to Sundaland (Holloway 2005).

One unlabelled specimen (Fig. 10: I) differs in mtDNA, wing shape, and wing pattern. It comes out sister to the nominotypical *discrepans* clade with 19 COI 5' differences between the clades (Fig. 84). The forewing apex is more rounded than typical *discrepans,* and the tornus is rounded without a hook. It has a much narrower hindwing medial patch than typical *discrepans*. On the ventral forewing surfaces, the basal band and postmedial band are nearly concolorous pale yellow, whereas in typical *discrepans* the basal band is orange and postmedial band is creamish-white. On the ventral hindwing anterior of vein R5 the color is pale yellow, whereas in typical *discrepans* the color is creamish-white.

***Eudocima muscigera* (Butler, 1882)**

(Figs 10: J, 19: K, 31: I, 25: H–J)

The pattern and sexual dimorphism is similar to *E. discrepans* but it can be separated as described above. It is found only on the large island of New Guinea and surrounding smaller islands (Zilli *et al*. 2017).

***Eudocima kuehni* (Pagenstecher, 1886)**

(Figs 11: A–B, 20: A, 31: J, 95: C)

This large sexually dimorphic species has no medial patch. The outer margin of the hindwing is the least convex of all *Eudocima* species. The male is unique among *Eudocima* by having two conspicuous white patches in the discal cell on the otherwise blackish forewing. The female dorsal forewing has a lighter grey background color with prominent contrasting dark patches and banding. Both forewing and hindwing outer margins are more crenulate in the more variegated female. Zilli *et al*. (2017) record it from Seram, Kei islands, New Guinea, Supiori Island, Rook Island, New Britain, Goodenough Island and Ferusson Island.

***Eudocima cocalus* (Cramer, 1777)**

(Figs 11: C–E, 20: B–C, 25: K, 31: K)

Eudocima cocalus and *E. hypermnestra* doubtfully represent separate species as discussed above. *Eudocima cocalus* lacks paired black medial spots on the hindwing which are present in *E. hypermnestra*. *Eudocima cocalus* has a less dentate inner margin of the dorsal hindwing marginal band relative to *E. hypermnestra. Eudocima cocalus* is widely distributed from the Sunda Islands and the Philippines east to New Guinea, Australia and the Solomon Islands (Zilli *et al*. 2017).

Eudocima hypermnestra **(Cramer, 1780)**
(Figs 11: F–H, J, 20: D, 25: L, 31: L, 95: A–B)
The diagnosis is provided under *E. cocalus* above. It is essentially a continental species (or phenotype) allopatric with nominate *E. cocalus,* occurring from India to southern China and all of Indochina south to the Andaman and Nicobar Islands (Zilli *et al*. 2017).

Eudocima treadawayi **Zilli & Hogenes, 2002**
(Fig. 11: I)
It is sympatric with similar *E. cocalus* in the Philippines but can be separated by the duller more olive forewing color, and reduced white maculation in the female (Zilli *et al*. 2017). The pm line of *E. treadawayi* is distinctly sinusoidal posterior of vein R5, whereas it is fairly straight in *E. cocalus.* In *E. cocalus* the pm line is sharply bent at vein R5, whereas in *E. treadaway* it is straight across this vein. It has been recorded from the Philippine islands of Leyte and Negros (Zilli *et al*. 2017).

Eudocima jordani **(Holland, 1900)**
(Figs 12: A–B, 20: E, 25: M–N, 31: M, 95: K)
The male is unique among the *Eudocima* in having the forewing dark throughout due to a close sprinkling of brownish-black scales on a purplish brown background (Holland 1900). The female looks similar to those in the *E. cajeta* group but the dorsal hindwing medial patch on the hindwing is less elongate. This species' range includes Sulawesi, the Moluccas, New Guinea, Australia (Queensland), the Bismark Archipelago, Nissan Island and New Caledonia (Zilli *et al*. 2017).

Eudocima cajeta **Cramer 1775**
(Figs 12: C–D, 20: F, 25: O–S, 31: N, 95: G)
Zilli *et al*. (2017, Figs 9–12, 14–17) provide clear male genitalic differences that separate the three similar species *E. cajeta, E. srivijayana,* and *E. talboti*. *Eudocima cajeta* has a short triangular subapical process on the costal margin of the valvae, absent in the other two species, and the longest juxta processes of the three species. *Eudocima talboti* has a minute apical spine on the valvae. Zilli *et al*. (2017) reported *E. cajeta* from India, Sri Lanka, Bhutan, Southern China, Myanmar, Thailand, Vietnam, and Andamans. It was reported in South Africa (Vári 2002) prior to the description of *E. lequeuxi* (Brou & Zilli 2016) http://www.afromoths.net/species/show/31573.

Eudocima srivijayana **Bänziger 1885**
(Figs 12: E–H, 20: G, 25: T, 31: O, 95: E–F)
Eudocima srivijayana has longer spines projecting from the apex of the valvae and shorter juxta projections relative to *E. cajeta* and *E. talboti* (Zilli *et al*. 2017). Zilli *et al*. (2017) reported *E. srivijayana* from peninsular Malaysia, Singapore, Nias, Sumatra, Borneo, Java, Bali, Lombok, Sumbawa, Sumba, Flores, Timor, Sulawesi, and the Philippines. They reported no known zone of sympatry between the three species in the *E. cajeta* group.

As we have not dissected any of our material, all of our determinations are tentative and hypothesized based upon geographic distribution. Among five sequenced specimens there are two haplotype clades separated by 14 consistent differences (Fig. 85). Both haplotypes occur sympatrically on Bach Ma Mountain at the biogeographical border between northern and southern Vietnam. Unfortunately, there is only one specimen of each haplotype where they are sympatric, and they belong to different genders.

Eudocima talboti **(Prout, 1922)**
(Figs 12: I–J)
Zilli *et al*. (2017) examined old specimens allopatric from either *E. cajeta* or *E. srivijayana* collected in the eastern Indonesian islands of Seram, Halmahera, Waigeo and Numfoor. They found the forewings were broader than in those two related sexually dimorphic species, the hindwing medial patch was smaller and the inner edge of the black marginal band on vein M1 was blunter. Genitalic differences that separate this species from *E. cajeta* and *E. srivijayana* are noted above.

Eudocima prolai Zilli & Hogenes, 2002

(Figs 13: A–B, 20: H, 26: A–B, 31: P, 95: M)

This species could be mistaken for sympatric *E. aurantia*, but can be separated by the much broader marginal band reaching the outer margin of the hindwing, the larger medial patch, and the smaller size (38–40 mm, n=2) vs (48–54 mm, n=7). Relative to allopatric *E. okurai* the forewing shape is less elongate, there is no green spot inside the reniform, and the distal side of the medial patch has a less distinct concave indentation. This species is endemic to the island of New Guinea.

Eudocima bathyglypta (Prout, 1928)

(Figs 13: C–D, 20: I, 26: C–D, 32: A, 95: J)

The forewings are reddish brown with green flecks like *E. mionopastea* but the inner margin is more deeply concave proximal to the tornal hook. The hindwing marginal band is closer to the outer margin and is more dentate at the veins than in *E. sikhimensis*. The forewing has a conspicuous greenish patch above the inner margin at the base and proximal to the PM line that is absent in *E. tyrannus* and *E. aurantia*. It is found in Indonesia.

Eudocima behouneki Zilli & Hogenes 2002

(Figs 13: E–F, 21: B)

This species is similar to *E. mazzeii* but the black marginal hindwing band is more dentate at the veins (Zilli & Hogenes 2002). This band is also dentate but extends closer to the wing margin in *E. bathyglypta,* and the forewing of that species has greenish flecks, especially proximal to the PM line just above the inner margin. Unlike in *E. bathyglypta* the forewing apex of *E. behouneki* is produced as in *E. sikhimensis* and *E. mazzeii*. This species is endemic to the central southern Philippines where it replaces *E. mazzeii* which is found to the North (Zilli & Hogenes 2002).

Eudocima sikhimensis (Butler, 1895)

(Figs 13: G–H, 20: K, 26: F–H, 32: C, 95: D)

It is distinguished from *E. mionopasta* as described above. The forewings vary from pale yellowish green to deep green. The hindwing marginal band is disjunct from the outer margin but is broader than in similar and allopatric *E. mazzeii* and *E. behouneki*. The range includes the Indian Subregion, Thailand, and Sundaland (Holloway 2005).

Eudocima mazzeii Zilli & Hogenes, 2002

(Figs 13: I–J, 21: A, 26: I–K , 32:D)

This species looks very similar to *E. sikhimensis* but it has broader wings and differs further as described above. It is found in the northeastern Philippines in Luzon and on the island of Mindoro (Zilli & Hogenes 2002), especially around the higher elevations of Banaue.

Eudocima mionopastea (Hampson, 1926)

(Figs 14: A–B, 20: J, 26: E, 32: B)

The hindwings are very similar to *E. sikhimensis*; however the forewing apex is not falcate, the forewing color is predominately bright rufous rather than olive, and the third segment of the palpi is shorter and less spatulate. The greenish forewing mottling is similar to *E. bathyglypta* but the tornal hook and anal flap are much less pronounced. This rare species is found in peninsular Malaysia, Sumatra and Borneo (Zilli & Hogenes 2002).

Eudocima okurai (Okano, 1964)

(Figs 14: C–D, 21: E, 26: L–N, 32: E, 93: E)

The PM and apical lines are fused across from the reniform creating the appearance of a single oblique line abruptly bending towards the inner margin. In *E. tyrannus, E. aurantia* and *E. sikhimensis* there is no distinct bend in this line across from the reniform. The forewing has a distinctly less pronounced tornal hook and has more green flecks versus *E. tyrannus.* The forewings have a less prominent anal flap, and the hindwings have a more distally set hindwing marginal band than either *E. tyrannus* or *E. aurantia* (Bänziger & Honey 1984). The ventral marginal hindwing band is clearly separated at the veins compared to the continuous band in *E. tyrannus*. *Eudocima okurai* is found in the southeastern Himalayas, northeast India, Bhutan, Myanmar, Thailand, northwest Malaysia at elevations of 1200–1700 m (Bänziger & Honey 1984) and Vietnam.

Eudocima tyrannus (Guenée, 1852)

(Figs 14: E–F, 21: C, 26: O, 32: F, 93: F)
The marginal band on the hindwing is larger than in *E. aurantia* but barely reaches the wing margin if at all. The background color of the sharply pointed forewing is brownish rather than the variable green shading of *E. sikhimensis*. It can be separated from *E. okurai* by the shape of the oblique line as discussed under that species. Individuals from the northern portion of the range in Amur and Japan show a larger comma-shaped medial patch on the hindwing than in its southern range from Nepal, Sichuan, Vietnam and Taiwan where it has a smaller patch similar to *E. okurai* (Zilli *et al*. 2017).

Eudocima aurantia (Moore, 1877)

(Figs 14: G–H, 21: D, 26: P, 32: G, 95:L)
The forewing apex is unique with a protracted obliquely rounded lobe (Hampson 1894). The large size is comparable to *E. tyrannus* and *E. sikhimensis,* but the hindwing marginal band is greatly reduced and well separated from the wing margin by the orange background color. There is very little black on the underside especially in the marginal areas. The range of this relatively common species includes India, China, Indonesia, New Guinea and the Solomons (Holloway 2005).

Eudocima martini Zilli & Brou, 2017

(Figs 14: I–J, 21: F, 26: Q–T, 32 :H)
This small species (34–35 mm, n=6) is similar in size to another island endemic, *E. paulii*, but in *E. martini* the hindwings have no medial patch. Members of the *C. homaena* group also have no medial patch but lack a green dot inside the reniform, and the females have a green transverse bar across the forewing. This species also has unique genitalia including a thin aedeagus and uncus and small juxta (Zilli *et al*. 2017). This species is rare in collections and is apparently endemic to the Solomon Islands (Zilli *et al*. 2017).

Eudocima paulii (Robinson, 1968)

(Figs 15: A–B, 21: G, 32: I)
This relatively small, variable species is sexually dimorphic. The female is reminiscent of the larger *E. jordani* but has a wider hindwing marginal black band across from the medial patch, and a less strongly crenulate outer forewing margin. The male is similar to *E. martini* but its hindwing has a medial patch which that species lacks. It is endemic to the Fiji Islands of Vanua Levu and Viti Levu (Zilli *et al*. 2017).

Eudocima afrikana Borth & Kons, 2021

(Figs 1: A–C, 15: G–J, 21: I, 27: E–L, 32: K, 33: A–B, I–J, 34: A–C, 35: A–C, 36: A–C, 37: A, 38: A–D, 39: A–D, 41: A–D, 43: A–D, 44: A–D, 45: D–E, 46: A–D, 47: A–D, 48: A–C, 49: A, 50: A–C, 51: A, 52: A–C, 53: A, 54: A–C, 55: A, 56: A–D, G, 58: A, E, 59: A–B, 60, 61: A–B, 62: A–B, 63: A–B, 64: A–B, 65: A–B, 66: A–B, 67: B, D–E, 68: A, C, E, 69: A–D, 70, 71: A, 72:A, H, 87:A, 92:H)
The diagnosis is covered in the description (above).

Life History and Bionomics. Hargreaves (1936) studied the species now named *E. afrikana* over an eleven-year period in an orchard in Njala, Sierra Leone. He recorded a life cycle there of up to 37 days beginning with pale green spherical eggs which darkened before hatching in about 3 days. The larvae fed only on Menispermaceae and went through 5 instars. Most larvae were found during October and November on *Tiliacora* sp. nr. *dinklagei* Engl., but were also found at various times on *Dioscoreophyllum volkensii* Engl.*, Stephania dinklagei* (Engl.)*, Albertisia ferruginea* (Diels) and *Triclisia patens* Oliv. During May and June larvae were generally pale yellow-green and reached 7 cm. At other times of the year larvae typically reached 6 cm. During July and August larvae were all pale yellow to green, and September through November they were primarily brown to black. Larvae have two similar large dark ocelli on the second and third abdominal segments, each with a pale lilac or blue center and a peripheral margin white to pale yellow above and reddish-orange to yellow below. The pupal stage can last up to two weeks in a loose silk cocoon (Hargreaves 1936).

As in other *Eudocima, E. afrikana* is able to pierce hard skinned fruits as well as thick-skinned, soft-skinned or ripening fruits. Zaspel (2008) provided scanning electron microscope images for exemplar *Eudocima* species illustrating serrated ridges, rasping spines, erectile barbs and socketed tearing hooks, and credited the ventrally serrated cuticular ridge and robust proboscis for the ability to pierce hard skinned fruit. We illustrate these features on the proboscis of *E. afrikana* in Figs 71: A, 72: A and H.

Populations of *E. afrikana* in Sierra Leone (reported as *Othreis fullonica*) appeared to be correlated to rainfall with adult activity peaking when fruit availability was highest during the drier months of April and May with an outbreak occurring in 1934 (Hargreaves 1936). Hargreaves noted that in Sierra Leone adults focus on cashews and mangoes in February through April until citrus becomes attractive 4–5 weeks before maturity. Then, in order of preference, sweet lime, mandarin, orange, and grapefruit were attacked with breadfruit and jackfruit also affected. Mangoes and tangerines were pierced in Nigeria (Golding 1945).

Unlike most Lepidoptera pests, with *Eudocima* it is the adult rather than the larva that causes economic damage. Calpinae larvae are not agricultural pests as they feed primarily on Menispermaceae (Zaspel 2008) but the adult moths are piercers of fruits (Bänziger 1982). Fay (2002) noted that *E. phalonia* inserts its proboscis in a direct straight line penetrating 15 mm into the fruit and may feed at that site for over 30 minutes. Fruit-rotting molds such as *Odium* species (Muller 1939), *Fusarium* species (Bänziger 1982) and bacteria (Hargreaves 1936) invade the penetration site leading to fermentation, dark lesions, and premature fruit fall. The piercing hole causes susceptibility to secondary fruit-sucking species (Bänziger 1982). Leaf mimics such as *E. afrikana* and *E. phalonia* are difficult to see during the daytime but can often be detected feeding on fruit at the periphery of a crop at night with their eyes glowing in the flashlight beam.

Eudocima afrikana is difficult to control with insecticide because the larvae don't feed on the adult host but are widely dispersed in surrounding disturbed areas (Hargreaves 1936). Furthermore, adults spend only a short time on fruits and spraying pesticides on fruit at harvest time is dangerous for human consumption. Bats are the main predators (Hargreaves 1936) prompting experimentation with solar powered acoustic frequencies to repel the moths (Chikkalaki *et al*. 2018).

Distribution and dispersal: *Eudocima afrikana* is distributed throughout much of sub-Saharan Africa including Madagascar. Adults are strong fliers (Hargreaves 1936) and may not be restricted to one area, but we are unaware of evidence that they migrate outside their permanent range like congeners *E. phalonia* and *E. apta.*

We have examined specimens or photos from Benin, Botswana, Cameroon, the Democratic Republic of the Congo, Kenya, Madagascar, Malta, Réunion, South Africa, Tanzania, Toga, Uganda and South Africa. Waterhouse & Norris (1987) also recorded *E. afrikana* (reported as *E. phalonia*) in Angola, Republic of the Congo, Côte d'Ivoire, Ghana, Liberia, Malawi, Mozambique, Namibia, Nigeria, Sierra Leone, and Zimbabwe. Additional distribution records (reported as *E. phalonia*) are Eritrea (Berio 1941), Gabon and Guinea (Zilli & Hogenes 2002), Malawi and Rwanda (Brou & Zilli 2016), Comoros (Guillermet 2005), Seychelles (Pagenstecher 1907), Somalia (Poulton 1916) Principe and São Tomé (Aurivillius 1910) (see De Prins & De Prins 2022 http://www.afromoths.net/species/show/31586). *Eudocima afrikana* was not recorded in a study of fruit-sucking and fruit-piercing moths in citrus orchards in South Africa (Goddard 2019).

***Eudocima phalonia* (Linnaeus, 1763)**

(Figs 16:C–F, 21:K–L, 27:M–T, 28:A–B, 32:L, 33:C–D, K–L, 34:D–F, 35:D–F, 36:D–F, 37:B, G, 38:E–G, 39:E–G, 41:E, 43:E–F, 44:E–G, 45:F, 46:E–G, 47: E–G, 48:D–E, 49:B, 50:D–E, 51:B, 52:D–E, 53:B, 54:D–E, 55:B, 56:E–F, 57:A, 58:B, F, 59:C–D, 61:C–D, 62:C–D, 63:C-D, 64:C–D, 65:C–D, 66:C–D, 67:A, C, F, 68:D, 69:E–H, 71:B, 72: B, 87:B–E)

Diagnosis. Separation of this species from the allopatric *E. afrikana, E. euryzona,* and *E. lequexui,* and sympatric *E. oliveri*, is covered in the *E. afrikana* description.

Eudocima phalonia has also been confused with co-occurring *E. homaena* and *E. cajeta.* For example, Gilligan & Passoa (2014) is an often-cited reference for screening for *E. phalonia*; however, their figure 2 of a photo of a live *E. homaena* from India is misidentified as *E. phalonia.* This same *E. homaena* photo is used again to represent *E. phalonia* on Wikipedia (2021). The third specimen in Gilligan & Passoa (2014) figure 4 is identified as a female *E. phalonia,* but it is actually a male. For *E. homaena,* only the males are likely to be confused as the females have a transverse green forewing band not present in *E. phalonia.* The males of *E. phalonia* have a fairly uniformly patterned forewing, whereas males of *E. homaena* have contrasting paler areas distal to the subterminal line and between the postmedial and antemedial lines. Also, *E. phalonia* has a contrasting lighter band on the posterior edge of the apical line, which may be greenish in fresh specimens. The male of *E. homaena* also has an apical line, but there is no contrasting lighter band or greenish coloration.

Males of *E. phalonia* and *E. cajeta* are somewhat similar in pattern, but in *E. cajeta* the apical line is faint if discernible, without the contrasting lighter band on the posterior side that occurs in *E. phalonia.* Also, *E. cajeta* has a more pronounced and pointed tornal hook relative to *E. phalonia.* For females, *E. phalonia* consistently has a larger whitish mark on the forewing than *E. cajeta.* Also, in *E. phalonia* the forewing has a glossier appearance with more contrasts relative to *E. cajeta,* which has a plainer, more granulated forewing.

Pattern of dimorphism in Fiji. In Fiji there are two male phenotypes of *E. phalonia,* the typical phenotype and a phenotype which is darker ventrally, particularly in the apical areas, with a reduced medial patch ventrally (Fig. 21: K). Zilli *et al*. (2017) provided additional differences between these phenotypes, but reported an intermediate phenotype from Guadalcanal, and no meaningful differences in genitalia between the two phenotypes. We sequenced two of the darker phenotypes from Fiji (DNA sequence vouchers 24816 and 24817) and both have the most common COI 5' haplotype found in typical *E. phalonia* (Fig. 86). We also dissected a male of one of these specimens (HLK: 2647) and found the genitalia to be the typical *E. phalonia* morphotype. Given the lack of differentiation in both male genitalia and COI 5' plus the Zilli *et al*. (2017) report of an intermediate phenotype, we favor the hypothesis that the second Fiji phenotype represents infraspecific variation in *E. phalonia.*

Life history and bionomics. Most recent *Eudocima* life history studies have focused on *E. phalonia.* This species is associated with temperate broadleaf and mixed forests, tropical and subtropical grasslands, savannas and shrubs, and tropical and subtropical moist broadleaf forests (Davis 2005). This species often exposes its bright hindwings while feeding, revealing the medial patch which is useful for separating it from other *Eudocima* species (Fig. 87: B, E).

In a Sarawak orchard it had a 40-day life cycle from oviposition to adult emergence (Kueh 2012). The larvae of *E. phalonia* use Menispermaceae, but in the eastern part of their range they feed on *Erythrina* (Fabaceae) (Cochereau 1977). The cocoon may stay on the host plant or drop with the leaves (Waterhouse & Norris 1987). Bänziger (1982) noted that the three *Tinospora* (Menispermaceae) foodplants preferred in Thailand are most common in more open areas where these tenacious vines can endure drought and generate aerial roots. Foodplants thrive in close proximity to humans where they even survive on telephone posts and wires. In Palawan (Philippines) *E. phalonia* occurred in disturbed forest but did not come to bait traps in primary forest openings (observation by RJB). RJB also didn't find it in old growth forest in Papua New Guinea (PNG) where it is widely distributed and not considered a pest. In PNG much of the forest remains intact and *E. phalonia* is believed to be regulated by native parasitoids such as *Ooencyrtus* sp. (Hymenoptera: Encyrtidae) and *Telenomus lucullus* Nixon (Hymenoptera: Platygastridae) which contributed up to 95% mortality of the eggs (Sands & Liebregts 2005). Bänziger (1982) urged the establishment and protection of forest reserves for control of *E. phalonia.* He attributed the increase in *E. phalonia* to replacement of *Tinaspora*-poor primary forests with secondary forest habitat conducive to their larval foodplants, and to increased cultivation of fruit hosts for the adults.

Outbreaks of *E. phalonia* were reported by Cochereau (1977) in New Caledonia during February and March following a rainfall deficit of over 50% during September to December in the previous year. That outbreak caused an increase in damage to citrus production from 4% in a normal year to 90% after the drought period (Cochereau 1973, 1977). Vargas-Fonseca *et al*. (2020) observe that the 1968–1969 drought in New Caledonia was prompted by the El Niño-Southern Oscillation (Benoir & Delcroix 2000) and that these El Niño related droughts likely also triggered other outbreaks of fruit-piercing moths. Intense rainfalls after drought periods can enhance vigorous new larval food production (Ngampongsai *et al*. 2005). This young plant tissue with greater nitrogen and reduced defensive compounds (Shure *et al*. 1998) can be linked to the improved survival rate of young larvae (Leroy *et al*. 2021; Srygley *et al*. 2010, 2014).

Distribution and dispersal. This widespread species is found from India to Australia and east to Hawaii. It has become established on many isolated island chains in the southern Pacific. In Australia *E. phalonia* can move great distances between breeding sites and fruit orchards (Sands & Schotz 1988). In New Caledonia *E. phalonia* temporarily leaves the wild figs in the mountains to use larger orchard fruit on the plains but returns to mountain biotopes after fruits are harvested (Leroy *et al*. 2021). The ability to migrate allows it to leave the tropics during hotter weather to temporarily colonize temperate regions in eastern Australia (Sands *et al*. 1991). It was first recorded from Hawaii (Oahu) in 1985, and by 1986 it had spread to four other Hawaiian Islands (Kessing & Mau 1993). True *E. phalonia* **does not** occur in mainland Africa or Madagascar.

Eudocima euryzona (Hampson, 1926)

(Figs 16: A–B, 21: J, 28: C–L, 32: M, 33: E–F, M–N, 34: G–H, 35: G–H, 36: G, 37: C–D, H–I, 38: H–I, 40: A–B, 41: F, 42: A, D, 45: B–C, G 46: H, 47: H–I, 49: C, F, 53: C, F, 55: C, F, 57: B, 58: C, G, 92: A, G)

A diagnosis of this Madagascar endemic species is covered in the *E. afrikana* description. Other Madagascar *Eudocima* include *E. imperator* and *E. boseae,* but in each of those species the hindwing medial patch is fused with the marginal band. *Eudocima boseae* is much smaller and lacks the orange dorsal abdomen. It could also be confused with *E. lequeuxi* but that species is only found on mainland Africa.

Eudocima lequeuxi Brou & Zilli, 2016

(Figs 15: E–F, 21: H, 27: A–D, 32: J, 33: G–H, N–O, 34: I–J, 35: I–J, 36: H, 37: E–F, J–K, 38: J–L, 40: C–D, 42: B–C, E–F, 44: H, 45: A, 46: I, 47: J–K, 48: D–E, 51: D–E, 53: D–E, 55: D–E, 57: C–E, 58: D, H, 92: B)

The diagnosis is covered in the *E. afrikana* description. It is found from east central Africa to South Africa. The only other mainland African *Eudocima* besides *E. afrikana* are *E. divitiosa* and *E. materna. Eudocima divitiosa* has no hindwing medial patch, and in *E. materna* the medial patch is reduced to a round dot.

Eudocima steppingstonia Brou, Klem, Zaspel & Zilli, 2017

(Figs 15: C–D)

The diagnosis is covered in the *E. afrikana* description. The only specimens are from Fatu Hiva in the Marquesas. It can be distinguished from its southeast Pacific relative, *E. oliveri*, by its paler hindwings and more elongate medial patch.

Eudocima oliveri Zilli & Brou, 2017

(Figs 16: G–H, 28: M)

The diagnosis is covered in the *E. afrikana* description and under *E. steppingstonia* (above). All three known specimens were collected on the Vanuatu Archipelago (Zilli *et al*. 2017).

Eudocima formosa (Griveaud & Viette, 1960)

(Figs 3: G–H, 17: J, 22: P–T, 29: I, 71: F, 72: F, 73–77, 88: C)

This Madagascar endemic is the only species classified as *Eudocima* that completely lacks a hindwing marginal band. The medial patch is reduced to a somewhat round dot, a condition otherwise found only in *E. apta* and *E. materna* within the *Eudocima.* The erroneous generic placement is discussed in the Calpinae Phylogeny section below.

[_Phalaena [Noctua] felicia_] (Stoll, 1790)

(Fig. 28: Q)

This unrecognized phenotype from Suriname was listed as a *Eudocima* by Poole (1989) and Zaspel & Branham (2008). Zilli & Hogenes (2002) noted the pattern was totally unlike any *Eudocima* species and concluded it does not belong in this group. We agree with the latter interpretation and believe this species should be excluded from the genus *Eudocima*.

Ferenta incaya Hampson, 1926

(Figs 7: G–H)

This species is rare in collections and confused with more common species, although there are good wing characters for diagnosing it. The oblique dorsal hindwing orange band extends to the wing margin in cell CuA2, unlike *F. cacica* and *F. stolliana* where the black marginal band spans the entire outer margin. This species lacks a contrasting light band between the dorsal forewing reniform spot and the postmedial line which is present in the other two species. It was described from Peru by a single male, and has also been recorded from Columbia (Fig. 7: G). No recent material or COI 5' sequences were available.

Ferenta cacica (Guenée, 1852b)

(Figs 7: C–D, 90: G)

This species is separated from other Ferenta species by its wider, more ovuloid orange hindwing band. It has a more southern distribution than other Ferenta. The type locality is Brazil and all specimens and images we have seen are from southeastern Brazil, with records extending as far south as Rio Grande do Sul. There are recent photographs, but we are not aware of recent specimens and no COI 5' sequences were available.

Ferenta stolliana **(Stoll, 1782)**

(Figs 7: E–F, 18: F, 23: I, 28: P, 30: G, 90: E–F, H)

This species differs from *F. incaya* by the dorsal hindwing orange band not reaching the wing margin, and this band is narrower than in *F. cacica. Ferenta stolliana* was described as having violet tints in the forewings and ebony blue hues on the hindwings and was illustrated in Cramer (1782) Fig. 28: P)). It was described from Suriname and ranges from Costa Rica south to Ecuador, Peru and Bolivia and east to Suriname near the French Guiana border.

The description of *Darceta (Ferenta) castula* Dognin was based on one female specimen from Venezuela in the heart of the *F. stolliana* distribution range. The description refers to a large orange hindwing spot as in *cacica*, but thinner and less oval (Dognin 1912). This agrees with *F. stolliana.* The fact that Dognin (1912) compared *F. castula* to *F. cacica* but not *F. stolliana* (which also has a thinner, less ovuloid hindwing band), suggests that Dognin was unaware of the latter species. He also described *castula* as having bluish tinted forewings and ebony blue hues on the hindwings, which also agrees with *F. stolliana*. We are unaware of any difference between *F. stolliana* and *F. castula,* and thus consider *F. castula* a **syn. nov.** of *F. stolliana.*

Tetrisia florigera **Walker, 1867**

(Figs 6: G–H, 18: G, 30: E, 71: E, 72: E, 91: E)

This species is unique within the Ophiderini as the only species with an oblique reddish pink hindwing patch conspicuous against a black background. We include specimen records from Venezuela and French Guiana, and a live image from Peru. It has also been recorded from Costa Rica (Schaus 1911b) and Brazil (Felder & Rogenhofer 1874) in addition to the type locality, Colombia (Walker 1867b).

In 1867 Walker described the genus *Tetrisia* in two separate publications, one for Hemiptera (Walker 1867a) and one for Lepidoptera (Walker 1867b). The Hemiptera genus name was published nearly four months before the Lepidoptera genus. Therefore, a replacement genus name is required for *Tetrisia florigera* (Waldkircher *et al*. 2004).

Graphigona regina **(Guenée, 1852b)**

(Figs 6: I, 18: H, 23: L–M, 30: F, 71: D, 72: D, 91: A)

This is the only Neotropical Ophiderini with orange-yellow hindwings lacking a medial patch. As in *Tetrisia* the forewings do not have a tornal hook. Specimens or photos have been examined from Mexico, Belize, Costa Rica, Panama, Columbia, Bolivia, French Guiana, and Brazil (Santa Catarina State).

Genetic diagnosis and variation for Ophiderini Species (mtDNA COI 5' characters)

These species accounts are in the order species appear in the strict consensus tree in Figures 78–86.

Eudocima procus**:** This species is diagnosable by the following unique combination of COI 5' character states: 4(C), 70(C), 82(C), 85(T), 91(A), 92(C), 127(C), 193(C), 220(T), 241(T), 247(C), 382(T), 385(C), 412(T), 457(C), 470(C), 477(G), 478(A), 484(T), 499(C), 574(A), 607(C), 616(C), 637(A), and 646(C). A single haplotype was obtained from a sample size of six specimens from Peru, Brazil, and Columbia.

Eudocima serpentifera**:** This species is diagnosable by the following unique combination of COI 5' character states: 31(C), 100(T), 124(C), 139(C), 379(T), 412(T), 508(A), and 580(C). Two haplotypes which differ by five base pairs were obtained with a sample size of 12 specimens:

211(A), 220(C), 235(T), 301(T), 506(A) (one specimen from Ecuador);

211(G), 220(T), 235(C), 301(A), 506(G) (10 specimens from Costa Rica and Mexico).

***Tetrisia florigera*:** This species is diagnosable by the following unique combination of COI 5' character states: 91(A), 92(C), 112(C), 118(C), 142(C), 214(G), 238(C), 284(T), 286(A), 289(C), 304(C), 343(G), 346(T), 373(A), 379(G), 386(T), 463(C), 506(G), 547(C), 548(C), 553(A). A single haplotype was obtained from two specimens from French Guiana and Venezuela.

***Eudocima colubra*:** This species is diagnosable by the following unique combination of COI 5' character states: 4(C), 37(G), 52(C), 55(C), 64(C), 206(T), 208(A), 223(C), 226(C), 263(T), 265(A), 266(T), 274(C), 349(C), 361(C), 376(T), 424(C), 457(C), 478(C), 479(C), 536(C), 571(C), 574(C). Two haplotypes were obtained with a sample size of eight specimens due to one variable character: 211(G & A). Seven specimens from Costa Rica have 211(G). The remaining specimen, almost certainly erroneously attributed to Zimbabwe, has 211(A).

***Eudocima anguina*:** One sequenced specimen from Costa Rica has the following unique combination of COI 5' character states: 52(C), 91(A), 124(C), 127(T), 142(C), 205(C), 232(C), 235(T), 346(C), 547(A), 548(C), 595(C), 596(C), 601(C), 616(C), 619(C), 643(A), 646(C).

***Ferenta stolliana*:** This species is diagnosable by the following unique combination of COI 5' character states among taxa sequenced thus far: 40(A), 46(C), 70(C), 220(T), 247(C), 376(C), 386(T), 542(T), 544(A); however, as only one of three species in this genus has been sequenced, some of these characters may be shared by related species. Five haplotypes that differ by one to seven characters were obtained with a sample size of 10 specimens from Costa Rica due to nine variable characters:
1(T), 5(T), 6(G), 79(A), 200(A), 208(T), 367(T), 401(T), 475(T) (1 specimen);
1(T), 5(T), 6(T), 79(G), 200(G), 208(C), 367(C), 401(C), 475(C) (1 specimen);
1(T), 5(C), 6(T), 79(G), 200(G), 208(C), 367(C), 401(C), 475(C) (1 specimen);
1(T), 5(C), 6(T), 79(G), 200(G), 208(C), 367(T), 401(C), 475(C) (2 specimens);
1(C), 5(C), 6(T), 79(G), 200(G), 208(C), 367(C), 401(C), 475(C) (5 specimens).

***Eudocima collusoria*:** One sequenced specimen from Trinidad has the following unique combination of COI 5' character states: 1(T), 5(C), 13(C), 34(A), 46(C), 55(A), 67(T), 100(T), 157(C), 223(C), 499(A), 544(A), 547(A), 556(G), 634(C).

***Eudocima memorans*:** This species is diagnosable by the following unique combination of COI 5' character states: 82(T), 103(C), 263(T), 265(A), 271(A), 287(T), 289(A), 325(C), 470(C), 472(T), 484(C), 490(C), 506(G). Three haplotypes that differ by three to five base pairs were obtained from a sample size of five specimens due to five variable characters:
157(T), 181(A), 223(T), 400(C), 622(A) (2 specimens from Ecuador and Costa Rica);
157(C), 181(G), 223(C), 400(C), 622(A) (2 specimens from Costa Rica);
157(C), 181(G), 223(C), 400(T), 622(G) (1 specimen from French Guiana).

***Graphigona regina* species complex:** This species or species complex is diagnosable by the following unique combination of COI 5' character states: 49(A), 130(T), 163(A), 208(A), 373(A), 526(A). Two divergent haplotype groups were obtained within this clade that differ by 30 COI 5' base pairs. One haplotype group is represented by eleven specimens from Costa Rica, and is diagnosable by the following unique combination of character states: 10(C), 202(C), 206(T), 220(T), 278(C), 295(C), 340(T), 400(T), 406(C), 442(C), 547(C). Within this group there are two haplotypes due to one variable base pair: 40(A & T). Only one of the specimens has 40(A). The other haplotype group is represented by 13 specimens from Costa Rica, Mexico, and French Guiana. It is diagnosable by the following unique combination of character states: 85(C), 112(C), 136(C), 250(C), 271(T), 274(T), 287(T), 289(A), 346(T), 367(T), 386(T), 388(G), 397(C), 401(C), 487(C), 500(C), 532(C), 544(C), 628(G). Within this haplotype group there are five haplotypes that differ by one to eight base pairs due to nine variable characters:
82(C), 85(C), 202(T), 205(T), 250(T), 304(T), 421(A), 463(T), 550(A) (1 specimen from Costa Rica);
82(C), 85(C), 202(T), 205(T), 250(C), 304(T), 421(A), 463(T), 550(A) (2 specimens from Costa Rica and 2 from French Guiana);
82(C), 85(T), 202(C), 205(T), 250(C), 304(C), 421(C), 463(C), 550(A) (1 specimen from Costa Rica);

82(C), 85(C), 202(C), 205(T), 250(C), 304(T), 421(A), 463(T), 550(G) (1 specimen from Costa Rica);
82(T), 85(C), 202(C), 205(C), 250(C), 304(T), 421(A), 463(T), 550(A) (6 specimens from Costa Rica and 1 from Mexico).

While only one *Graphigona* species is currently recognized (Zaspel 2008) the extent of variation in COI haplotypes exceeds that recorded within any other species in the Ophiderini, particularly the 30 base pair difference between the two most divergent groups of haplotypes. While divergent haplotypes can exist within a single population with mtDNA due to maternal inheritance and historical allopatry, another possibility is that two separate taxa are present. Detailed morphological investigation is needed, comparing representatives of at least the two divergent haplotype groups to determine if there are morphological differences corresponding to these 30 COI base pair differences.

***Eudocima kinabaluensis*:** One sequenced specimen from Malaysia has the following unique combination of COI 5' character states: 49(C), 121(C), 157(C), 220(T), 238(C), 259(C), 266(T), 286(A), 325(T), 385(C), 407(C), 424(T), 538(G), 542(T), 544(A), 574(C), 613(C), 631(G).

***Eudocima splendida*:** This species is diagnosable by the following unique combination of COI 5' character states: 55(C), 56(C), 58(T), 85(C), 115(C), 178(C), 205(C), 206(T), 208(A), 283(C), 289(A), 292(C), 364(T), 379(T), 382(T), 391(A), 401(C), 403(C), 412(C), 415(A), 526(C), 547(A), 568(A). Two haplotypes were obtained with a sample size of two specimens from Vietnam due to one variable character: 572 (A & T).

***Eudocima materna*:** This species is diagnosable by the following unique combination of COI 5' character states: 82(C), 616(C), and 646(C). Three haplotypes that differ by one or two base pairs were obtained with a sample size of 14 specimens due to two variable characters:
25(T), 487(T) (two specimens from Australia);
25(T), 487(C) (seven specimens from Australia, one from Tanzania, one from Pakistan, and one almost certainly mislabeled "Brazil");
25(C), 487(C) (two specimens from India).

***Eudocima apta*:** This species is diagnosable by the following unique combination of COI 5' character states: 220(T) and 337(A). Seven haplotypes that differ by one or two base pairs were obtained with a sample size of 17 specimens due to four variable characters:
142(C), 208(T), 557(C), 637(C) (eight specimens from Costa Rica, 1 from FL (USA), 1 from AZ (USA));
142(T), 208(T), 557(C), 637(C) (one specimen from Costa Rica and one from Brazil);
142(C), 208(T), 557(T), 637(C) (one specimen from Costa Rica);
142(T), 208(T), 557(T), 637(C) (one specimen from Costa Rica);
142(C), 208(T), 557(C), 637(T) (one specimen from Costa Rica);
142(C), 208(C), 557(C), 637(C) (one specimen from Costa Rica);
142(C), 208(T), 557(C), 637(A) (one specimen from Ecuador).

***Eudocima iridescens*:** This species is diagnosable by the following unique combination of COI 5' character states: 52(C), 56(C), 133(C), 139(C), 178(C), 265(C), 428(C), 616(C), 634(C), and 646(C). Four haplotypes that vary by one to three base pairs were recorded with a sample size of six specimens due to four variable characters:
79(A), 88(A), 364(A), 628(A) (one specimen from Indonesia);
79(G), 88(G), 364(G), 628(A) (one specimen from Australia);
79(A), 88(G), 364(A), 628(G) (one specimen from Australia);
79(A), 88(G), 364(A), 628(A) (three specimens from Australia).

***Eudocima caesar*:** This species is diagnosable by the following unique combination of COI 5' character states: 181(G), 268(C), 628(T). Two haplotypes were obtained from a sample size of three specimens due to one variable character: 190 (A & G).

***Eudocima homaena*:** A single homoplastic character supports the species clade node: 200(G). However, this species is diagnosable by a unique combination of COI 5' character states if this character is combined with the fixed

character states supporting the *caesar* + *homaena* clade: 49(A), 202(C), 427(C), 502(G), 643(A). All seven sequenced specimens have a difference haplotype, and these haplotypes differ by one to seven base pairs due to ten variable characters:
40(T), 235(C), 340(T), 412(T), 490(C), 500(T), 589(T), 601(T), 616(T), 628(A) (Malaysia);
40(T), 235(C), 340(T), 412(T), 490(C), 500(T), 589(T), 601(T), 616(T), 628(G) (Sumba Island);
40(T), 235(T), 340(C), 412(C), 490(C), 500(T), 589(C), 601(T), 616(T), 628(G) (Philippines);
40(T), 235(T), 340(C), 412(C), 490(T), 500(C), 589(C), 601(T), 616(C), 628(G) (Vietnam);
40(T), 235(T), 340(C), 412(C), 490(C), 500(C), 589(C), 601(T), 616(C), 628(G) (India);
40(C), 235(T), 340(C), 412(C), 490(C), 500(T), 589(C), 601(T), 616(C), 628(G) (Vietnam);
40(C), 235(T), 340(C), 412(C), 490(C), 500(T), 589(C), 601(C), 616(C), 628(G) (Malaysia).

Eudocima boseae**:** This species is diagnosable by the following unique combination of COI 5' character states: 55(A), 92(C), 100(C), 208(A), 287(T), 289(A), 355(C), 397(C), 421(T), 529(T), 547(A), 616(C). One haplotype was obtained with a sample size of three specimens from Madagascar.

Eudocima imperator**:** This species is diagnosable by the following unique combination of COI 5' character states: 59(C), 127(C), 205(C), 475(C), 574(C), 586(C), 634(C). Three specimens sequenced from Madagascar each have different haplotypes that differ by one to three base pairs due to three variable characters:
28(A), 607(T), 628(A);
28(G), 607(C), 628(G);
28(A), 607(T), 628(G).

Eudocima divitiosa**:** This species is diagnosable by the following unique combination of COI 5' character states: 202(C), 259(C), 274(C), 328(G), 340(T), 386(C), 401(C), 418(C), 469(G), 505(C), 536(C), 607(C), 637(C), 646(C). All three sequenced specimens have different haplotypes that differ by five or six base pairs due to eight variable characters:
46(T), 97(T), 235(C), 238(T), 376(T), 478(C), 577(A), 625(A) (Togo);
46(C), 97(T), 235(T), 238(T), 376(T), 478(T), 577(G), 625(G) (Cameroon);
46(T), 97(C), 235(T), 238(C), 376(C), 478(T), 577(A), 625(A) (Gabon).

Eudocima dividens**:** This species is diagnosable by the following unique combination of COI 5' character states: 127(C), 136(C), 220(T), 268(C), 349(C), 400(T), 500(C), 508(C), 526(C), 547(C), 613(C), 625(A). Two specimens sequenced from the Philippines have different haplotypes that vary by three base pairs:
73(G), 238(T), 382(A);
73(A), 238(C), 382(G).

Eudocima nigricilia**:** One sequenced specimen from Papua New Guinea has the following unique combination of COI 5' character states: 92(C), 142(C), 205(C), 220(A), 289(C), 328(T), 355(A), 385(C), 403(T), 541(A).

Eudocima salaminia**:** This species is diagnosable by the following unique combination of COI 5' character states: 82(C), 208(A), 259(T), 265(C), 406(C), 533(C), 544(A), 634(C). Nine sequenced specimens from Australia, Indonesia, China, Japan, and Myanmar have five haplotypes which vary by one to five base pairs due to six variable characters. A tenth sequence from GenBank (MK934830) contains four character states otherwise not recorded in the Calpinae: 9(T), 13(A), 14(T), and 125(A). We suspect there are errors in this sequence. The other five haplotypes are:
1(G), 235(T), 401(C), 542(C), 619(A), 640(T) (one specimen from Australia);
1(A), 235(T), 401(C), 542(C), 619(A), 640(T) (5 specimens: Australia (3), Indonesia (1), Japan (1));
1(A), 235(T), 401(C), 542(C), 619(A), 640(C) (one specimen from China);
1(A), 235(T), 401(T), 542(C), 619(A), 640(T) (one specimen from Australia);
1(A), 235(C), 401(C), 542(T), 619(G), 640(C) (one specimen from Myanmar).

***Eudocima discrepans* complex:** This species complex is diagnosable by the following unique combination of COI 5’ character states: 52(C), 205(A), 301(T), 370(T). The two morphotypes discussed above differ by 19 base pairs. Typical *E. discrepans* is diagnosable by the following unique combination of COI 5’ character states: 76(G), 154(C), 238(C), 277(C), 289(A), 292(C), 302(G), 367(C), 368(G), 403(C), 470(C), 487(C), 544(C), 619(T), 625(A). Single sequenced specimens from Vietnam and China have the same haplotype. The second morphotype with no locality data has the following unique combination of COI 5’ character states: 133(C), 202(C), 220(T), 364(C).

***Eudocima muscigera*:** This species is diagnosable by the following unique combination of COI 5’ character states: 46(C), 49(A), 85(G), 115(C), 187(C), 200(A), 376(C), 382(G), 500(C), 547(C). Two haplotypes were obtained from three sequenced specimens that differ by three base pairs:
268(C), 386(C), 628(A) (one specimen from Waigeo Island);
268(A), 386(T), 628(G) (one specimen from Papua New Guinea and one from Waigeo Island).

***Eudocima kuehni*:** This species is diagnosable by the following unique combination of COI 5’ character states: 32(A), 34(A), 46(C), 49(A), 52(C), 100(C), 169(C), 197(C), 200(A), 232(C), 259(T), 373(C), 445(C), 547(C), 548(C), 550(C), 577(G), 586(T), 604(T), 652(C). Two sequenced specimens from Indonesia have two haplotypes that differ by five base pairs:
19(T), 268(C), 427(C), 463(T), 553(T);
19(C), 268(T), 427(T), 463(C), 553(C).

***Eudocima cocalus, Eudocima hypermnestra*:** These two phenotypes overlap in COI 5’ haplotypes. The combination of both can be diagnosed by the following unique combination of COI 5’ character states: 127(C), 187(C), 217(A), 265(C), 368(G), 376(C), 382(T), 400(A), 406(C), 641(T), 643(A), 646(C). Two sequenced specimens of the *hypermnestra* phenotype from Tibet and Vietnam have the same haplotype, and share this haplotype with three specimens of the *cocalus* phenotype from Australia. The *cocalus* phenotype has two additional haplotypes that vary by one base pair. An Australian specimen has 460 (C instead of T). Two Indonesian specimens have 85 (G instead of A).

***Eudocima jordani*:** This species is diagnosable by the following unique combination of COI 5’ character states: 313(C), 337(C), 401(C), 436(C), 487(C), 500(C), 556(C), 616(C). Two haplotypes that differ by one base pair were recorded among five sequenced specimens from Australia and Papua New Guinea. One of the Australia specimens has 390(T), the other specimens have 390(C).

***Eudocima srivijayana, Eudocima cajeta*:** Since related *E. talboti* has not been sequenced, the genetic assessment for this group is incomplete and some of the characters will likely be shared by this taxon. Furthermore, since no specimens have been dissected, identifications are tentative and hypothesized based on geographic distribution. However, the two divergent haplotypes obtained (separated by 14 base pairs) are sympatric at Bach Ma Mountain in Vietnam. Thus far, the species group is diagnosable by the following unique combination of COI 5’ character states: 197(C), 205(C), 212(C), 232(C), 397(C), 400(T), 589(C), 628(T). The haplotype attributed to *srivijayana* has the following unique combination of character states: 85(G), 91(G), 157(C), 247(C), 265(C), 427(C), 463(C). Two sequenced specimens from Vietnam and Indonesia have the same haplotype. The haplotype attributed to *cajeta* has the following unique combination of character states: 70(C), 235(T), 355(C), 364(C), 368(G), 457(C), 544(C). Three sequenced specimens have two haplotypes that differ by three base pairs:
595(C), 631(G), 643(C) (Vietnam);
595(T), 631(A), 643(T) (Tibet & China).

***Eudocima prolai*:** This species is diagnosable by the following unique combination of COI 5’ character states: 31(T), 40(G), 82(C), 127(A), 145(C), 208(A), 220(T), 226(C), 265(C), 304(C), 313(C), 550(G), 574(G), 628(G), 634(C). Two sequenced specimens from Papua New Guinea have the same haplotype.

***Eudocima bathyglypta*:** This species is diagnosable by the following unique combination of COI 5’ character states: 46(C), 268(C), 274(C), 301(T), 325(C), 500(C), 505(C), 562(G), 604(T), 616(C), 619(A). Three sequenced specimens from Sumatra and West Java have the same haplotype.

***Eudocima mionopastea*:** One sequenced specimen from Malaysia has the following unique combination of COI 5' character states: 157(C), 238(A), 421(T), 592(T).

***Eudocima sikhimensis*:** One sequenced specimen from Myanmar has the following unique combination of COI 5' character states: 52(T), 205(C), 364(C), 401(C), 477(G), 637(C).

***Eudocima mazzeii*:** This species is diagnosable by the following unique combination of COI 5' character states: 28(G), 31(G), 70(C), 163(G), 397(C), 445(C), 479(A), 616(C), 646(C). Three sequenced specimens from the Philippines have the same haplotype.

***Eudocima okurai*:** This species is diagnosable by the following unique combination of COI 5' character states: 208(A), 220(T), 268(A), 391(C), 397(C), 553(C), 574(C), 658(C). Two sequenced specimens from Myanmar and Malaysia have the same haplotype.

***Eudocima tyrannus*:** This species is diagnosable by the following unique combination of COI 5' character states: 46(C), 70(C), 193(C), 223(C), 340(T), 424(T), 505(C), 562(G), 613(C). All eight sequenced specimens have the same haplotype.

***Eudocima aurantia*:** This species is diagnosable by the following unique combination of COI 5' character states: 106(C), 142(C), 197(C), 284(T), 287(T), 289(A), 302(G), 364(A), 373(A), 539(T), 541(A), 542(T), 544(A), 553(A), 574(C), 634(C). Three specimens sequenced from Australia and Sumatra each have different haplotypes that differ by one to four base pairs due to four variable characters:
130(A), 238(T), 463(C), 553(A) (Australia);
130(G), 238(C), 463(T), 553(A) (Australia);
130(G), 238(C), 463(T), 553(G) (Sumatra).

***Eudocima martini*:** This species is diagnosable by the following unique combination of COI 5' character states: 50(T), 52(A), 82(C), 97(C), 121(C), 124(C), 163(T), 232(C), 235(T), 250(C), 271(A), 274(C), 337(G), 427(C), 550(G), 625(A), 643(C). Three sequenced specimens from the Solomon Islands have two haplotypes due to one variable base pair: 202 (A & G).

***Eudocima paulii*:** One sequenced specimen from Fiji has the following unique combination of COI 5' character states: 46(A), 49(T), 142(C), 169(C), 212(C), 268(A), 283(C), 508(C), 589(C), 625(A), 641(T).

***Eudocima steppingstonia*:** The possible sister taxon, *E. oliveri,* has not been sequenced so some of the characters on the *E. steppingstonia* node may be shared with this taxon. One sequenced specimen from French Polynesia has the following unique combination of COI 5' character states: 10(C), 25(A), 37(G), 52(T), 115(C), 121(C), 205(C), 265(C), 364(C), 397(C), 427(C), 436(C), 500(C), 514(C), 568(C), 571(C), 625(C).

***Eudocima lequeuxi*:** This species is diagnosable by the following unique combination of COI 5' character states: 52(T), 127(T), 289(C), 346(C), 355(C), 475(C), 532(C), 544(C), 613(C), 634(C), 646(C). Three sequenced specimens have two haplotypes due to one variable base pair. One specimen from South Africa has 313(C), and single specimens from South Africa and Tanzania have 313(T).

***Eudocima afrikana*:** This species is diagnosable by the following unique combination of COI 5' character states: 46(C), 154(T), 313(C or T). While only three COI 5' character states support the node of the *E. afrikana* clade, there are 13 fixed COI 5' character state differences between *E. afrikana* and its sister taxon *E. lequeuxi,* 21 between *E. afrikana* and *E. phalonia*, and 24 between *E. afrikana* and *E. euryzona* (Fig. 86).
Nine sequenced specimens have seven haplotypes that vary from one to ten base pairs due to twelve variable characters. These haplotypes are shown in Table 1. Four haplotypes are in a subclade unique to Madagascar (Fig. 86).
While material from Madagascar and mainland Africa represents the same morphospecies (two males from Madagascar have no consistent morphological differences from two males from continental Africa), we found no overlap

in COI 5' haplotypes between Madagascar and Continental Africa. This suggests the population(s) in Madagascar may be isolated from population(s) in mainland Africa, although no morphological divergence has occurred.

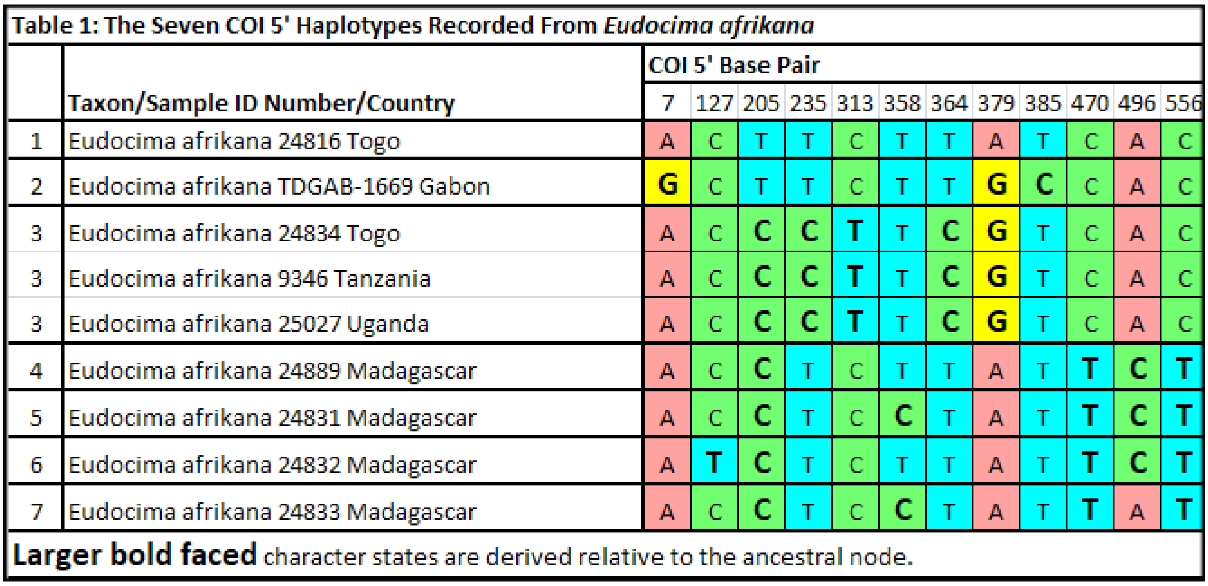


Table 1: The Seven COI 5' Haplotypes Recorded From *Eudocima afrikana*

		COI 5' Base Pair											
	Taxon/Sample ID Number/Country	7	127	205	235	313	358	364	379	385	470	496	556
1	Eudocima afrikana 24816 Togo	A	C	T	T	C	T	T	A	T	C	A	C
2	Eudocima afrikana TDGAB-1669 Gabon	**G**	C	T	T	C	T	T	**G**	**C**	C	A	C
3	Eudocima afrikana 24834 Togo	A	C	**C**	**C**	**T**	T	**C**	**G**	T	C	A	C
3	Eudocima afrikana 9346 Tanzania	A	C	**C**	**C**	**T**	T	**C**	**G**	T	C	A	C
3	Eudocima afrikana 25027 Uganda	A	C	**C**	**C**	**T**	T	**C**	**G**	T	C	A	C
4	Eudocima afrikana 24889 Madagascar	A	C	**C**	T	C	T	T	A	T	**T**	**C**	**T**
5	Eudocima afrikana 24831 Madagascar	A	C	**C**	T	C	**C**	T	A	T	**T**	**C**	**T**
6	Eudocima afrikana 24832 Madagascar	A	**T**	**C**	T	C	T	T	A	T	**T**	**C**	**T**
7	Eudocima afrikana 24833 Madagascar	A	C	**C**	T	C	**C**	T	A	T	**T**	A	**T**

Larger bold faced character states are derived relative to the ancestral node.

***Eudocima euryzona*:** This species is diagnosable by the following unique combination of COI 5' character states: 127(A), 148(G), 206(T), 208(A), 364(C), 373(A), 400(T), 439(C), 517(A), 613(C), 625(G), 634(C), 641(T). All four sequenced specimens have different haplotypes that differ by two to six base pairs due to six variable characters:
40(G), 148(G), 364(T), 400(C), 433(A), 625(G);
40(G), 148(G), 364(C), 400(T), 433(A), 625(G);
40(A), 148(A), 364(C), 400(T), 433(G), 625(A);
40(A), 148(G), 364(C), 400(T), 433(A), 625(G).

***Eudocima phalonia*:** This species is diagnosable by the following unique combination of COI 5' character states: 265(C), 376(A), 391(C), 479(C), 500(C), 532(C), 574(T), 607(C), 610(T), 652(C). Nine haplotypes were recorded among 26 sequenced specimens that differ from one to six base pairs due to ten variable characters. These haplotypes are shown in Table 2. Despite the widespread distribution on many different isolated land masses, no geographic subclades were obtained from COI 5' data.

Overview of Calpinae phylogeny

Previous studies. Zaspel (2008) analyzed 66 morphological characters for 59 species in the Calpinae genera *Hemiceratoides, Graphigona, Eudocima, Plusiodonta, Gonodonta, Oraesia,* and *Calyptra.* The strict consensus of most parsimonious trees recovered all genera as monophyletic. The generic arrangement from most basal to most derived, was *Hemiceratoides, Graphigona+Eudocima, Plusiodonta, Gonodonta,* and *Oraesia + Calyptra.* Zaspel (2008) also analyzed a subset of 34 of the species for the same morphological characters in addition to segments of the COI and 28S genes. This changed the generic results substantially, as *Gonodonta, Oraesia,* and *Calyptra* were not recovered as monophyletic with either parsimony or Bayesian analyses, and no genera were recovered as monophyletic with Bayesian analysis.

Zahiri *et al*. (2011) analyzed 152 Lepidoptera species (primarily Noctuoidea) with one mitochondrial and seven nuclear genes. This analysis yielded a Calpinae clade with single representatives of seven genera in the following arrangement: (*Eudocima,* (*Minioides + Phyllodes*)) sister to (((*Plusiodonta + Oraesia*), *Calyptra*), *Gonodonta*). *Anomis* and *Scoliopteryx* were included in the analysis but not supported as members of the Calpinae clade.

Zahiri *et al*. (2012) analyzed the same genes for 237 taxa. In this analysis two *Eudocima* species came out sister to *Hemiceratoides sittaca,* and this clade came out sister to the *Gonodonta* clade with the same four genera and topology as the first study. These two clades came out sister to a clade with *Phyllodes* and *Minioides.*

Zaspel *et al*. (2012) analyzed one mitochondrial, one ribosomal, and seven nuclear genes for 28 species of Calpinae. The arrangement of genera in the *Gonodonta* clade matched Zahiri *et al*. (2011); however, the *Eudocima* + *Hemiceratoides* clade came out sister to the *Minioides* + *Phyllodes* clade.

Kawahara *et al*. (2019) analyzed 186 Lepidoptera species with 2098 protein coding genes. Their analysis recovered a clade for the two representatives of Calpinae included in their analysis (*Eudocima salaminia* and *Phyllodes eyndhovii*) sister to an Arctiinae clade (five representatives). The Calpinae + Arctiinae clade came out sister to a Lymantriinae clade (two representatives). One representative of Calpinae has the complete mitochondrial genome available, a specimen of *Eudocima phalonia* from India (Sivasankaran *et al*. 2017).

Calpinae currently consists of the tribes Calpini (including *Gonodonta, Calyptra, Plusiodonta,* and *Oraesia*), Ophiderini (including *Eudocima, Graphigona,* and possibly *Hemiceratoides*) and Phyllodini (including *Minioides* and *Phyllodes*) (Zaspel *et al*. 2012). *Miniophyllodes, Lobophyllodes, Tetrisia,* and *Ferenta* have not been included in previous phylogenetic studies. In her study of calpine moths Zaspel (2008) stated there was little structural variation of proboscides within a genus and reported that the proboscides of species in the genera *Ferenta, Graphigona,* and *Tetrisia* are identical to *Eudocima*. The genus *Wolframmeyia* Behounek, Hacker, & Speidel has been synonymized with *Calyptra* (Snyder *et al*. 2020).

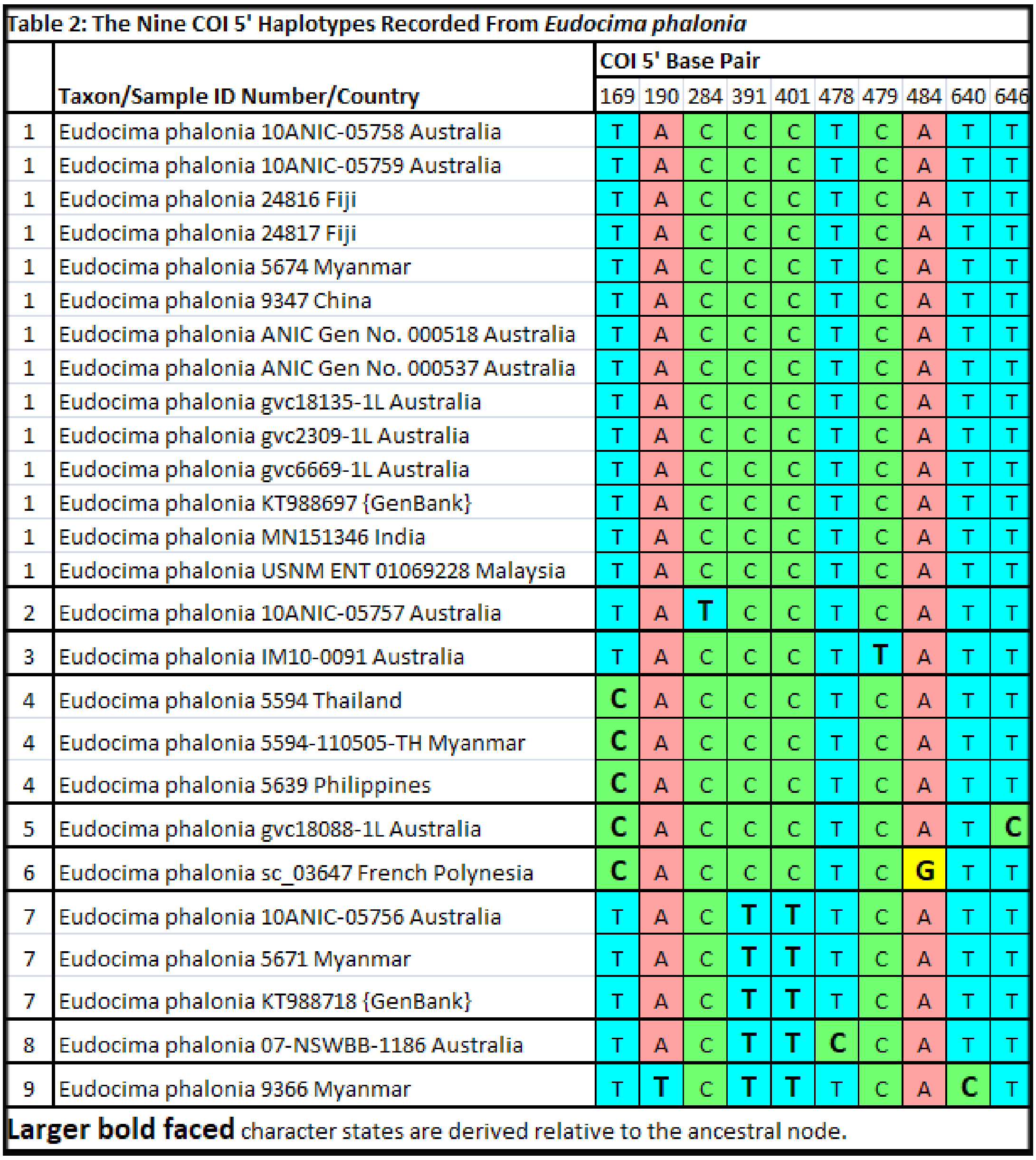


Table 2: The Nine COI 5' Haplotypes Recorded From *Eudocima phalonia*

	Taxon/Sample ID Number/Country	COI 5' Base Pair									
		169	190	284	391	401	478	479	484	640	646
1	Eudocima phalonia 10ANIC-05758 Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia 10ANIC-05759 Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia 24816 Fiji	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia 24817 Fiji	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia 5674 Myanmar	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia 9347 China	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia ANIC Gen No. 000518 Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia ANIC Gen No. 000537 Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia gvc18135-1L Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia gvc2309-1L Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia gvc6669-1L Australia	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia KT988697 {GenBank}	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia MN151346 India	T	A	C	C	C	T	C	A	T	T
1	Eudocima phalonia USNM ENT 01069228 Malaysia	T	A	C	C	C	T	C	A	T	T
2	Eudocima phalonia 10ANIC-05757 Australia	T	A	**T**	C	C	T	C	A	T	T
3	Eudocima phalonia IM10-0091 Australia	T	A	C	C	C	T	**T**	A	T	T
4	Eudocima phalonia 5594 Thailand	**C**	A	C	C	C	T	C	A	T	T
4	Eudocima phalonia 5594-110505-TH Myanmar	**C**	A	C	C	C	T	C	A	T	T
4	Eudocima phalonia 5639 Philippines	**C**	A	C	C	C	T	C	A	T	T
5	Eudocima phalonia gvc18088-1L Australia	**C**	A	C	C	C	T	C	A	T	**C**
6	Eudocima phalonia sc_03647 French Polynesia	**C**	A	C	C	C	T	C	**G**	T	T
7	Eudocima phalonia 10ANIC-05756 Australia	T	A	C	**T**	**T**	T	C	A	T	T
7	Eudocima phalonia 5671 Myanmar	T	A	C	**T**	**T**	T	C	A	T	T
7	Eudocima phalonia KT988718 {GenBank}	T	A	C	**T**	**T**	T	C	A	T	T
8	Eudocima phalonia 07-NSWBB-1186 Australia	T	A	C	**T**	**T**	**C**	C	A	T	T
9	Eudocima phalonia 9366 Myanmar	T	**T**	C	**T**	**T**	T	C	A	**C**	T

Larger bold faced character states are derived relative to the ancestral node.

Cladistic Analysis. Cladistic analysis of COI 5' sequences recovered the following genera as monophyletic and separate from all other genera: *Hemiceratoides* (up to three species) (Fig. 78), *Plusiodonta* (12 species) (Fig. 79), *Gonodonta* (up to 24 species) (Fig. 80), *Xylophylla* (one species) (Fig. 80), *Huebnerius* (one species) (Fig. 80), *Gloriana* (one species) (Fig. 80), and *Miniophyllodes* (two species) (Fig. 81). *Calyptra* (up to nine species) (Fig. 79) and *Phyllodes* (six or seven species) (Fig. 81) were recovered as monophyletic on some but not all most parsimonious trees. *Lobophyllodes* (one species) is embedded within an otherwise monophyletic *Miniodes* (three species) (Fig. 81). *Oraesia* (ten species) forms five stable clades in a polytomy on the strict consensus tree (Fig. 78).

Eudocima is largely supported as monophyletic group (Figs 82–86), with the exception of *E. formosa,* which weakly groups with *Huebnerius, Gloriana,* and *Xylophylla* (Fig. 80). Otherwise, the *Eudocima* form a clade with three subclades: (1) *Eudocima procus* (Fig. 82); (2) all other sequenced Neotropical *Eudocima* species (four species) except for *E. apta* with the Neotropical genera *Ferenta* (one species), *Tetrisia* (one species), and *Graphigona* (up to two species) embedded within this clade (Fig. 82), and (3) all sequenced Old World *Eudocima* species (35 species) plus *Eudocima apta* (supported as the sister taxon to Old World *E. materna* with both morphology and COI) (Figs 83–86). While we have not investigated if structural morphology could provide synapomorphies in support of these clades, it seems unlikely to be a coincidence that all the sequenced Old World species are in one clade, and another clade contains exclusively New World species. As previously discussed, many *Eudocima* species groups proposed on the basis of morphology are independently supported as monophyletic with the cladistic analysis of COI 5' sequences (Figs 82–86).

As is typical of COI 5', many relationships above the genus level are unsupported. Relationships among the following clades were unresolved (Fig. 78): *Plusiodonta, Calyptra, Gonodonta,* (*Xylophylla*+*E. formosa*+*Huebnerius*+*Gloriana*)*,* (*Miniophyllodes*+*Minioides* (including *Lobophyllodes*)), *Phyllodes, Eudocima* (including *Ferenta, Tetrisia,* and *Graphigona*), and all five clades of *Oraesia* (Figure 78)*.* Even with extensive taxon sampling COI 5' is inadequate to resolve these relationships.

We would not propose any generic level changes solely based on analysis of COI 5' sequences. However, there is substantial congruence between the COI 5' MPTs and morphology-based classification at and below the generic level. Thus, the inconsistencies highlight possible errors in the existing classification that merit further investigation with other sources of data.

Generic Placement of Eudocima Formosa. Cladistic analysis of COI 5' sequences places *E. formosa* outside the clade with all other *Eudocima* (Figs 82–86)*,* and weakly places it embedded within a clade of *Xylophylla, Huebnerius,* and *Gloriana* (Fig. 80: C). Zilli & Hogenes (2002) had previously suggested this species was probably misplaced in the genus *Eudocima.* We dissected/imaged the male and female genitalia (Figs 73–76) and compared the structures with images of other *Eudocima* genitalia in the literature. In addition to the five *Eudocima* species we dissected, we examined images in the literature for males of an additional 26 species, including: *E. mazzeii, E. sikhimensis, E. behouneki, E. bathyglypta, E. prolai, E. okurai, E. tyrannus, E. treadawayi, E. cocalus, E apta and E. materna* from Zilli & Hogenes (2002); *E. oliveri, E. steppingstonia, E. talboti, E. paulii, E. cajeta and E. srivijayana* from Zilli *et al.* (2017); *E. salaminia, E. dividens, E. discrepans, E. aurantia, E. homaena, E. smaragdipicta, E. kinabaluensis, and E. miniopastea* from Holloway (2005); and *E. splendida* from Yoshimoto (1999).

In all *Eudocima* genitalic images where we were able to discern the juxta , it is distinctly bifid with paired posterior processes. However, *E. formosa* has a simple juxta, with the posterior side convex with no processes (Figs 73: C, H).

The *Eudocima* images with everted vesicas vary greatly in quality, but all show a simple vesica. The better images show a base and two diverticula with few if any subdiverticula, recognizable as homologous to the diverticula labeled in Figs 48–55 for the *E. afrikana* group. Diverticulum 1 contains the sclerotized plate with deciduous spines, and diverticulum 2 is distal to it. *Eudocima formosa* appears to have the two homologous diverticulita present in *Eudocima,* but diverticulum 2 is complexly expanded into many subdiverticula (Figs 75: A–D).

Holloway (2005) reported that the anterior apophyses were often small, and may be vestigial or lost in *Eudocima.* These apophyses are often undetectable in literature images, perhaps because they can be largely unpigmented, as is the case for *E. afrikana* and *E. phalonia* (Fig. 66). In those figures where we can see the anterior apophyses they are always short, comparable in proportionate length to *E. afrikana* and *E. phalonia. E. formosa* has long, pigmented anterior apophyses (Figs 76: B–C), unlike anything we have seen in *Eudocima.*

Holloway (2005) reported that males of *Eudocima* have the eighth segment as the framed corematous type. We show examples of this for *E. afrikana, E. phalonia, E. euryzona,* and *E. lequeuxi* (Figs 56–57). However, *E. formosa* has no trace of a coremata on the eighth segment (Fig. 75: H).

We compared Automontage images of the proboscis for *E. formosa* (Fig. 72: F) with *E. afrikana* (Figs 72: A, H), *E. phalonia* (Fig. 72: B), and *E. serpentifera* (Fig. 72: C), as well as *Graphigona* (Fig. 72: D) and *Tetrisia* (Fig. 72: E) which cladistic analysis of COI 5' sequences place within the *Eudocima.* Like the other *Eudocima* examined, *E. formosa* has tearing hooks and rasping spines (Fig. 72:F). Zaspel (2008) reported that the proboscis of *Eudocima* has ventral serrations; however, with our images we were unable to reliably distinguish between ventral serrations and tearing hooks, as the shape and degree of sclerotization around these structures appears to vary continuously among our images; in any event, *E. formosa* is comparable to other *Eudocima* for these hooks and serrations. However, it lacks glossy sclerotization present at the apex of the proboscis in *E. afrikana, E. phalonia, E. serpentifera,* and *Graphigona regina*. It also has sclerotized scales subapically, somewhat similar to those observed in *Oporophylla* (Fig. 72: G), although the exact shape differs. However, in *Oporophylla* the tearing hooks are absent and the scales extend to the apex. Nothing comparable to these scales is present in the other aforementioned taxa we examined.

The shape of the inner forewing margin includes a broad, barely protruding anal flap and no trace of a tornal hook. This condition is comparable to *Xylophylla, Huebnerius, Gloriana, Phyllodes, Minioides,* and *Miniophyllodes* rather than *Eudocima.*

In summary, results of our morphological investigation are consistent with the COI 5' hypothesis that *E. formosa* is incorrectly classified within the *Eudocima.* While it seems clear *formosa* is not really a *Eudocima,* its phylogenetic placement within the Calpinae is unknown; the placement of *E. formosa* sister to *Huebnerius* + *Gloriana* on the MPTs has only minimal support (Fig. 80: C). A comparative morphological study is needed between *E. formosa, Huebnerius, Gloriana, Xylophylla,* and other genera of Calpinae, including the other aforementioned Phyllodini genera with similar wing shapes.

Ferenta, Graphigona, and *Tetrisia.* Cladistic analysis of COI 5' sequences places *Ferenta, Graphigona,* and *Tetrisia* embedded within a clade of four Neotropical *Eudocima*. *Ferenta* and *Tetrisia* were not included in previous phylogenetic analyses. However, the placement of *Graphigona* differs between Zaspel's (2008) morphological analysis and the present COI 5' analysis. In the former it is sister taxon to a monophyletic *Eudocima* (12 species represented), rather than embedded within *Eudocima*. When we reanalyzed the Zaspel (2008) matrix in TNT, we found support for the *Eudocima* clade exclusive of *Graphigona* is minimal (Bremer support=1, bootstrap=unsupported). Zaspel's (2008) *Eudocima* clade was supported by one character state that was coded to occur in all included *Eudocima* but not coded to occur in *Graphigona*: tearing hooks with basiconic sensilla present on the proboscis. However, Zaspel (2008) also reported that the proboscis of species in *Tetrisia, Graphigona,* and *Ferenta* are virtually identical to species of *Eudocima.*

We compared Automontage images of the proboscis for *E. afrikana, E. phalonia, E. serpentifera, Graphigona regina,* and *Tetrisia florigera* (Figs 71–72). We were unable to detect the basiconic sensilla for any of these taxa on either our Automontage images or under a dissecting microscope. However, tearing hooks/ventral serrations and rasping spines are present on all of these taxa. Zaspel (2008) did not provide a SEM image for *Graphigona,* but reported it was examined under a light microscope.

Our Automontage images reveal a character that was not clear on Zaspel's (2008) SEM images, smooth, glossy sclerotization at the apex in *E. afrikana, E. phalonia, E. serpentifera,* and *G. regina* (Figs 72: A–D, H). This smooth sclerotization is not present in *T. florigera,* however the homologous part of the proboscis is more darkly pigmented (Fig. 72: E), and as in the other taxa the apex lacks the ribbing present on the remainder of the proboscis. *Eudocima seprentifera* has a unique feature among these taxa: the absence of an unsclerotized ovoid pit around some of the tearing hooks. *Eudocima serpentifera* does have pits around some of the tearing hooks, but the glossy sclerotization extends into these pits and is contiguous with the tearing hooks (Fig. 72: C).

Our comparison of the proboscides among these taxa revealed nothing that would exclude *Graphigona* from the *Eudocima,* and all the character states we can see are the same for *G. regina, E. afrikana,* and *E. phalonia.* The hypothesis that *Graphigona* lacks basiconic sensilla present in *Eudocima* should be evaluated with a SEM, as we are unclear whether it is possible to do so accurately without one.

A comparative study of the genitalia between *Graphigona, Ferenta, Tetrisia,* and *Eudocima* could provide valuable insight into whether these other three genera actually belong within *Eudocima.* Questions of particular interest include: does the juxta have paired posterior processes? Is the vesica simple with a base and two diverticula? Are the anterior apophyses short and partially translucent? and Does male abdominal segment 8 have coremata? (see the above discussion of *E. formosa* on the potential significance of these characters to *Eudocima*). A detailed study of the morphology of the Neotropical *Eudocima* may also reveal species group characters that could be checked for in the other genera.

***Phyllodes imperialis* complex:** Sands (2012) recognized four taxa within the *Phyllodes imperialis* complex (ranked as subspecies of *imperialis*): *imperialis* Druce*, meyricki* Olliff*, smithersi* Sands*,* and *dealbata* Holloway. He considered *papuana* Hampson to be synonymous with *meyricki.* The type localities associated with these names are:

imperialis, TL=Solomon Islands, "Guadalcanar" [misspelling of Guadalcanal?] Island, Aola (Poole 1989);
meyricki, TL=Australia, Queensland, Mt Bellenden (Sands 2012);
papuana, TL=Papua New Guinea, Aroa R. (Poole 1989);
smithersi, Australia, Queensland, Mary Cairncross Park (Sands 2012);
dealbata, TL=New Caledonia (Poole 1989).

Some characters proposed to separate these taxa are characters we found not to be helpful in *Eudocima*. For example, for *smithersi* and *meyricki* (both with type localities on the eastern Australian coast) *smithersi* was reported to have denser and proportionally smaller apical cornuti than *meyricki* (Sands 2012). In *E. phalonia* and *E. afrikana* these cornuti are deciduous, and thus the density of apical cornuti and size of those present is extremely variable within species and of no diagnostic value.

We analyzed six sequences for the *P. imperialis* complex and recovered two clades separated by 12 COI 5' base pairs (Fig. 81). One clade is represented by one specimen from the highlands of Papua New Guinea, and has the following combination of character states: 166(G), 202(C), 265(C), 433(G), 634(C), and 641(C). The other clade includes two specimens from Misool Island (Indonesia) two from the northeastern coast of Queensland (Australia), and one of an unknown locality. This clade has the following combination of character states: 76(G), 178(C), 286(C), 484(C), 637(C) and 640(1). Two haplotypes separated by one base pair occur within this clade due to one variable position: 542 (C & T).

The distribution of sequenced specimens relative to the type localities for the available names is mapped in Fig. 97, created with Google Earth Pro in July 2021. No material was sequenced from the Solomon Islands, New Caledonia, or the southeastern coast of Queensland, so the type localities associated with three of the available names (*imperialis, dealbata,* and *smithersi*) have not been sampled. Since *imperialis* is the oldest name in the complex, and the type locality of the Solomon Islands has not been sampled, we provisionally identify the sequenced material as *Phyllodes imperialis* complex. Also, since one of the COI 5' clades is represented by a single specimen, there is insufficient material to evaluate if the two clades correspond to separate morphologically diagnosable entities.

The sequenced specimens from the northeastern coast of Queensland are close to the type locality of *meyricki* (Fig. 97). Sands (2012) considered the distribution of *meyricki* to include the Island of New Guinea, yet our sequenced specimen from Papua New Guinea represents a divergent haplotype from sequenced specimens near the type locality of *meyricki.* The type locality of *papuana* is a coastal lowland site, whereas the divergent haplotype is from a mountainous area. The Misool Island material that matches northeastern coastal Queensland is also from coastal lowlands. Therefore, if the divergent haplotype turns out to be a separate taxon, it might represent an unnamed taxon rather than *papuana.* Additional research is needed to resolve relationships and taxa within the *P. imperialis* complex. Sequences are needed for the type localities, and a larger series of the second divergent haplotype recorded thus far is needed for morphological evaluation.

***Hemiceratoides* divergent haplotypes**: The COI 5' MPTs include three divergent haplotypes for the genus *Hemiceratoides*. One sequence is from a specimen we did not examine, mined from GenBank and identified as *H. sittaca*. According to the BOLD taxonomy browser it is from West-Central Africa as is the type of *H. sittaca.* Our sequenced specimen from Madagascar (Fig. 16: I) represents the second haplotype. Madagascar is the type locality for *H. hieroglyphica* and *H. vadoni*; the latter is considered a synonym of *hieroglyphica* on Afromoths (De Prins & De Prins 2022). Our sequenced *Hemiceratoides* specimens from Uganda (Figs 16: J–K) represent the third haplotype.

TABLE 3: Data for specimens shown in Figures 1–32 (Page 1 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 1.		
***Eudocima afrikana* sp. n.**		
A. Madagascar, Fianarantsoa, Ranomafana, 17.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24832	2503
B. Madagascar, Fianarantsoa, Ranomafana, 13.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24831	
C. Madagascar, Fianarantsoa, Ranomafana, 9.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24889	
Figure 2.		
***Lobophyllodes miniatus* Grünberg, 1907**		
A & 17:A. Togo, Kpalimé, ii.2021, N6.9° E0.6°, 240m, local coll, [RJB]		
B. Togo, Kpalimé, ii.2021, N6.9° E0.6°, 240m, local coll, [RJB]		
***Miniodes maculifera* Hampson, 1913**		
C. Cameroon, Bengbis, xi.2016, N3.45° E12.45°, 670m, [RJB]	22023	
D & 17:B. Uganda, Kabarole Fort Portal Nkuruba Lake Nature Reserve, 6.ii.2021, leg. Golovizin, [RJB]		
***Miniodes discolor* Guenée, 1852**		
E & 17:C. Togo, North Mirolina, Kpalimé, 10.i.2017, N6.9° E.63°, 231m, local coll, [RJB]	24876	
***Miniodes phaeosama* Hampson, 1913**		
F & 17:D. Togo, Kpalimé, ii.2021, N6.9° E0.6°, 240m, local coll, [RJB]		
***Miniophyllodes sikorai* Viette, 1974**		
G. Madagascar, Hell-Ville, pre-2015, N-13.367° E48.2667°, 106m, leg. Wieser, [SMC]	1359	
H. Madagascar, Hell-Ville, pre-2015, N-13.367° E48.2667°, 106m, leg. Wieser, [SMC]	1824	
17:E. Allotype, Madagascar,25 km west of Andapa to Ambalapaiso, 24-28.xi.1968, leg Griveaud et al., [MNHN]		
***Miniophyllodes aurora* de Joannis, 1912**		
I. Madagascar, Fianarantsoa, Ranomafana, 13.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24873	
J & 17:F. Madagascar, Fianarantsoa, Ranomafana, 7.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24874	
Figure 3.		
***Xylophylla punctifascia* Leech 1900**		
A & 17:G. Taiwan, Nantou County, Sungkang, 9.vi.2012, N24.0715° E121.169°, 1979m, leg. local coll., [RJB]	26092	
B. China, Shinkai Si, Mt Emei, Sichuan, 1.vii.1921, 1320m, leg. Graham, [USNM]		
***Gloriana dentilinea* (Leech, 1900)**		
C. China, Ishang, Central China, leg. Neumogen, [USNM]		
***Gloriana ornata* (Moore, 1882)**		
D & 17:H. Myanmar, Kachin State, Chudu Razi Hills, 7.viii.2008, N25.851° E97.438°, 601m, local coll., [RJB]	5712	
***Huebnerius dux* (Saalmüller, 1881)**		
E. Madagascar, Antananarivo N -18.935° E47.52° [MNHN]		
F & 17:I. Madagascar, Fianarantsoa, Ranomafana, 7.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	25054	
***Eudocima formosa* (Griveaud and Viette, 1960)**		
G &17:J. Madagascar, Ankarafantsika NP env., 21.i.2020, N-16.325° E46.825°, 150m, leg. Krutov., [RJB]	25024	
H. Madagascar, Mahajanga, Mandritsarahely., 24.i.2020, N-16.37° E46.91°, 200m, leg. Krutov., [RJB]	25025	
Figure 4.		
***Oporophylla ustulata* Westwood, 1848a**		
A. Vietnam, Ngoc Linh Mtn., Kon Tum, 15.xi.2016, N15.05° E108.02°, 1700m, leg. Lunog Le, [RJB]	22092	
B. Vietnam, Ngoc Linh Mtn., Kon Tum, 15.xi.2016, N15.05° E108.02°, 1700m, leg. Lunog Le, [RJB]		
***Phyllodes staudingeri* Semper, 1901**		
C. Vietnam, Quang Nam, Tay Giang District, 15.viii.2017, N15° E107°, 1300m, leg. Lunog Le, [RJB]	22149	
***Phyllodes endhovii* Vollenhoven, 1858**		
D. Vietnam, Fansipan, 22.vi.2009, N-22.3° E103.7°, 2451m, leg. local coll., [RJB]	9153	
***Phyllodes consobrina* Westwood, 1848**		
E .Vietnam, Ngoc Linh Mtn., Kon Tum, 15.vi.2016, N15.05° E108.02°, 1700m, leg. Lunog Le, [RJB]	22094	
***Phyllodes verhuelli* Vollenhoven, 1858b**		
F. Solomon Islands, Guadalcanal, 15.ix.2016, N-9.6° E160°, 285m, leg. local coll., [RJB]	22147	
Figure 5.		
***Phyllodes conspicillator* Cramer, [1777]**		
A. Indonesia, West Papua, Misool Island, 15.xi.2018, N-1.89° E130.08°, 212m, leg. local coll., [RJB]	22146	
***Phyllodes imperialis smithersi* Sands, 2012**		
B. Australia, Queensland, Lamington NP, 6.iii.2019, N-28.2173° E153.1522°, 675m, "Questagame", [ANIC]		
***Phyllodes imperialis* Druce, 1888**		
C. Papua New Guinea, Kerowagi District, Simbu Province, 01.xi.1991, 1636m, leg. local coll., [RJB]	9270	
D. Indonesia, Mimka Regency, W. Central Highlands, 15.x.2018, N-4.13° E137°, 500m, leg. local coll., [RJB]	25057	
E. Indonesia, Misool Island, 15.xi.2018, N-1.8° E130.2°, 182m, leg. local coll., [RJB]	24887	
F. Australia, Queensland, Garradunga, 9.ix.1998, -17.455° 146.007° leg. Hasenpusch, [ANIC]	07346	

TABLE 3: Data for specimens shown in Figures 1–32 (Page 2 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 6.		
***Eudocima procus* (Cramer, 1777)**		
A & 18:A. Columbia, Ventanas, 27.v.2016, N7.07˚ E-75.449˚, 2020m, Sinyaev & Pinilla, [RJB]	22055	
B. Venezuala, 5.viii.1967, [USNM]		
***Eudocima serpentifera* (Walker, [1858] 1857b)**		
C. Ecuador, Napo Yasuni Nat Pk, 20.ix - 4.x.2003, leg. Bordelon & Knudsen, [FMC]	7061	2668
D & 18:B. Ecuador, Chuchubi Prov, Esmeraldas, vi.2016, [RJB]		
***Eudocima colubra* (Schaus, 1911b)**		
E. & 18:C. Costa Rica, San Vito City, v.2012, N8.82˚ E-82.97˚, 1015m, [RJB]	24822	
F. [USNM]		
***Tetrisia florigera* Walker, 1867**		
G & 18:G. French Guiana, St. Laurent du Maroni, 17.vi.2017, N5.5˚ E-54.03˚, 1m, leg. local coll., [RJB]	24841	2649
H. Venezuela, Palmichal Edo Carabobo, ii.2016, N10.06˚ E-68.63˚, 1033m, [RJB]	22093	
***Graphigona regina* (Guenée, 1852b)**		
I & 18:H. French Guiana, St. Laurent du Maroni, 15.v.2018, [RJB]	24848	2669
Figure 7.		
***Eudocima anguina* (Schaus 1911b)**		
A.Costa Rica, leg. Sullivan, [JBS]	20630	
B. Peru, Vista Allegre, v.2000, 800-1400m, [MNHN]		
***Ferenta cacica* (Guenée, 1852b)**		
C. Brazil, Morro Reuter, Faz.Padre Eterno, 14.04.2006, 450m, leg. Moser, [ZSM]		
D. Brazil, Petropolis, [NMNH]		
***Ferenta stolliana* (Stoll, 1782)**		
E & 18:F. Ecuador, Alto Tambo, 5.iv.2021, N0.89454˚ E-78.52558˚, 820m, leg. Gortovannyi & Zaritzkiy, [RJB]		
F. Costa Rica, Alajuela, Guanacaste, 20.vi.2004, N10.881˚ E-85.389˚, 570m, le. Araya, [UP]	2444	
***Ferenta incaya* Hampson, 1926**		
G. Columbia, [USNM]		
H. [MNHN]		
***Eudocima memorans* (Walker, [1858] 1857b)**		
I. Columbia, [USNM]		
J &18:D. French Guiana, St. Laurent du Maroni, i.2013, [RJB]	24823	
***Eudocima collusoria* (Cramer, 1777)**		
K & 18:E. Trinidad & Tobago, Brigand Hill Lighthouse, 28.ii.2003, N10.495˚ E-61.068˚, 177m, leg. Cock, [MJWC]	26052	
L. Surinam, [USNM]		
Figure 8.		
***Eudocima splendida* (Yoshimoto, 1999)**		
A. & 18:I. Vietnam, Quang Nam, Tay Giang District, Axan Mountain, iv.2018, leg Luong Le, [RJB]	22164	
B. Vietnam, Quang Nam, Tay Giang District, Axan Mountain, 20.iii.2018, leg Luong Le, [RJB]	22155	
***Eudocima kinabaluensis* (Feige, 1976)**		
C. Malaysia, Sabah, Mount Trusmadi, N5.55˚ E116.52˚, 1200m, iv. 1997, leg. Martini, [ZSM]		
D & 18:J. Malaysia, Sabah, Mount Trusmadi, N5.55˚ E116.52˚, 1200m, iv. 2008, leg. Martini	22050	
***Eudocima iridescens* (Lucus, 1894)**		
E & 18:K. Australia, Qld, Kuranda, 19 Butler Dr., 15.vii.2005, N-16.8˚ E145.633˚, 335m, leg. Rentz, [ANIC]		
F. Indonesia, West Papua, Manokwari Regency, Arfak Mountains, Mybri, vi.2017, 1500m, [RJB]		
***Eudocima caesar* (Felder, 1861)**		
G & 18:L. Indonesia, Moluccas, Bacan Is., Mt. Sibela, 13.ii.1996, N.63˚ E127.5˚, 400m, leg. Siniaev/Afonin, [RJB]	26042	
H. Indonesia, Seram, Kankeh Manusele NP, vi.1998, N3.1˚ E129.48˚, leg. Steinke & Lehmann, [ZSM]		
***Eudocima homaena* (Hübner, [1823] 1816)**		
I. Vietnam, Thue Thien Hue, Bach Ma Mountain, Hue, i.2016, N16.2˚ E107.8˚, 1400m, leg. Luong Le, [RJB]		
J. Vietnam, Kon Tum Prov, Ngoc Linh Mtn, 2017, N15.05˚ E103.02˚, 1700m, [RJB]		
L. Indonesia, Sumba Island, Mt. Langgaliru, 15.x.2016, N-10.1˚ E120.3˚, 890m, [RJB]	22056	
18:M. Malaysia, Sabah, 15.i.2020, 285m, leg. local coll, [RJB]	25069	
18:N. Vietnam, Kon Tum Prov, Ngoc Linh Mtn,, ix.2017, N15.05˚ E103.02˚, 1700m, [RJB]	24843	
***Eudocima smaragdipicta* (Walker, [1858] 1857b)**		
K. N. Sumatra, 5.xi.1973, [USNM]		

TABLE 3: Data for specimens shown in Figures 1–32 (Page 3 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 9.		
***Eudocima apta* (Walker, [1858] 1857b)**		
A. Columbia, Antioquia, Ventanas, 23-30.v.2016, N7.07° E75.44°, 2020m, leg. Sinyaev & Pinilla, [RJB]		
B. & 19:A. Columbia, Antioquia, Ventanas, 23-30.v.2016, N7.07° E75.44°, 2020m, leg. Sinyaev & Pinilla, [RJB]	25071	
***Eudocima materna* (Linnaeus, 1767)**		
C. Togo, Kpalimé, vi.2021, N6.9° E0.6°, 240m, local coll, [RJB]		
D. Tanzania, Iringa, Ruaha Mountains, 27.i.2004, N-7° E35.69°, [RJB]		
***Eudocima boseae* (Saalmüller, 1880)**		
E. Madagascar, Fianarantsoa, Ranomafana, 2.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24828	
F. & 19:C. Madagascar, Fianarantsoa, Ranomafana, 5.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	28429	
***Eudocima imperator* (Boisduval, 1833)**		
G. Madagascar, Fianarantsoa, Ranomafana, 5.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
H. Madagascar, Fianarantsoa, Ranomafana, 5.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
***Eudocima divitiosa* (Walker, 1869b)**		
I. Holotype, Congo, [FMNH]		
J & 19:E. Togo, 6.vii.2009, [RJB]	28842	
Figure 10.		
***Eudocima dividens* (Walker, [1858] 1857b)**		
A & 19:F. Philippines, Luzon, Mindoro Oriental Baco, ix.2017, N13.26° E121.06°, 743m, [RJB]	24821	
B. Indonesia, N Sumatra, Prapat, 21.x.1983, 1050m, leg. Diehl, [ZSM]		
***Eudocima salaminia* (Cramer, 1777)**		
C. Myanmar, Kachi State, Chudu Razi Hills, 21.vii.2008, 1500m, [RJB]	5673	
D & 19:G. China, Yunwushan, Femgling, Hebei, 1.x.2003, leg. Ying, [RJB]		
***Eudocima nigricilia* (Prout, 1924)**		
E &19:H. Papua New Guinea, [RJB]	26039	
F. Papua New Guinea, Fane, Zentral-Provinz, 21.i.1987, 1400m, leg. Willner, [ZSM]		
***Eudocima discrepans* (Walker, [1858] 1857b)**		
G & 19:J. Vietnam, 2007, N14° E108.2°, 40m, leg. local, [RJB]	9152	
H. Vietnam, Kon Tum Prov, Ngoc Linh, viii.2016, N15.05° E108.02°, 1700m, [RJB]		
I & 19:I. no data label, [RJB]	26045	
***Eudocima muscigera* (Butler, 1882)**		
J & 19:K. Indonesia, Waigeo Island, 15.ii.2019, 400m, N-.2° W130.83°, 400m, [RJB]	24839	
Figure 11.		
***Eudocima kuehni* (Pagenatecher, 1886)**		
A. Indonesia, West Papua, Arfak Mountains, Mybri, 15.vii.2015,1500m, [RJB]	22051	
B & 20:A. Indonesia, West Papua, Minka Regency, western central highlands, x.2018, 3500m, [RJB]	24837	
***Eudocima cocalus* (Cramer, 1777)**		
C & 20:B. Indonesia, Sumba Island, Mt. Langgaliru, x.2016, N-10.1° E120.3°, 890m, [RJB]	22048	
D. Indonesia, Sumatra, 1890, leg. Pasteur, [MNHN]		
E. Indonesia, West Timor, N-9.6° E124°, 800m, leg. local collector, [RJB]	25076	
***Eudocima hypermnestra* (Cramer,1780)**		
F & 20:C. Papua New Guinea (questionable label), [RJB]		
G & 20:D. Vietnam, Quang Nam, Axan Mountain, v.2017, leg Luong Le, [RJB]	24846	
H. no label [USNM]		
J. Vietnam, Thue Thien Hue, Bach Ma Mountain, Hue, xii.2015, N16.2° E107.8°, 1400m, leg. Luong Le, [RJB]		
***Eudocima treadawayi* Zilli & Hogenes, 2002**		
I. Philippines, S. Leyte, St. Bernard, Ca-oloy Mts., 27.vi.1996, 426m, leg. Medicielo, [ZSM]		
Figure 12.		
***Eudocima jordani* (Holland, 1900)**		
A. Indonesia, West Papua, Arfak Mountains, Mybri, vii.2015, N-1° E134°, 1500m, [RJB]		
B. Indonesia, Papua, Mimika, W. Central Highlands, 15.x.2018, N4.13° W137.11°, 3500m, [RJB]		
***Eudocima cajeta* (Cramer, 1775)**		
C. Vietnam, Quang Nam, Axan Mountain, 15.viii.2017, leg Luong Le, [RJB]		
D & 20:F. Tibet, Motuo Co, Hanmi, 15.viii.2016, N29.36° E95.13°, 2200m, leg. Yunkang, [RJB]	22046	
***Eudocima srvijayana* (Bänziger, 1985)**		
E. Vietnam, Thue Thien Hue, Bach Ma Mtn, Hue, 15.i.2016, N16.2° E107.8°, 1400m, leg. Luong Le, [RJB]	22057	
F & 20:G. Indonesia, 5.xi.2005, [RJB]	5595	
G. Borneo, Sabah, Deningan distr, Trus Madi Mt., 1.v.2008, N5.55° E116.52°, 1300m, leg. Gorodinski, [RJB]		
H. Borneo, Sabah, Deningan distr, Trus Madi Mt., 1.v.2008, N5.55° E116.52°, 1300m, leg. Gorodinski, [RJB]		
***Eudocima talboti* (Prout, 1922)**		
I. Syntype, Central Ceram, Manusela, x-xii.1919, 6000 ft, leg. C.F. & J. Pratt, (modified) [NHMUK-1378713]		
J. Syntype, Indonesia, Halmaheira of the Maluku Islands, viii.1892, leg. Doherty, (modified) [NHMUK-1378716]		

TABLE 3: Data for specimens shown in Figures 1–32 (Page 4 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 13		
Eudocima prolai **Zilli and Hogenes, 2002**		
A & 20:H. Papua New Guinea, [RJB]	26038	
B. Papua New Guinea, [RJB]	26037	
Eudocima bathyglypta **(Prout, 1928)**		
C. Indonesia, North Sumatra, Mount Sibayak, 18.x.2018, N3.239˚ E98.506˚, 2100m, leg. local [RJB]	24836	
D. Indonesia, N. Sumatra, Dairi, 16.ii.1980, leg. Diehl, [ZSM]		
Eudocima behouneki **Zilli and Hogenes, 2002**		
E & 21:B. Philippines, Palawan, Mt. Gantung, 20.1.1988, N9.02˚ E117.12˚, 200m, leg. Cerny/Schintlmeister, [ZSM]		
F. Philippines, Palawan, Mt. Gantung, 20.1.1988, N9.02˚ E117.12˚, 200m, leg. Cerny/Schintlmeister, [ZSM]		
Eudocima sikhimensis **(Butler, 1895)**		
G. [RJB]		
H. Vietnam, Lâm Đông Prov., Di Linh, iv.2017, N11.5˚ W108.12˚, 1040m, local coll., [RJB]		
Eudocima mazzeii **Zilli and Hogenes, 2002**		
I. Paratype, Philippines, N Luzon, Chatol, Banaue, 24.ix - 14.x.1988, leg. Cerny/Schintlmeister, [RJB]		
J & 21:A. Philippines, Ifugao Prov., Banaue, 15.ii.2017, N16.919˚ E121.059˚, 1144m, [RJB]	24845	
Figure 14.		
Eudocima miniopastera **(Hampson, 1926)**		
A & 20:J. Malaysia, Sabah, Mount Trusmadi, N5.55˚ E116.52˚, 1200m, iv. 1997, leg. Martini	22053	
B. Borneo, 1996, [RJB]		
Eudocima okurai **(Okano, 1964)**		
C & 21:E. Vietnam, Kon Tum Prov, Ngoc Linh Mountain, viii.2016, leg. Luong Le, [RJB]		
D. Vietnam, Kon Tum Prov, Ngoc Linh Mountain, viii.2016, leg. Luong Le, [RJB]		
Eudocima tyrannus **(Guenée, 1852a)**		
E & 21:C. Myanmar, Chudu Razi Hills, Kachin State, 8.iv.2008, [RJB]	5672	
F. China, Yunwushan, Femgling, Hebei, 1.x.2003, leg. Ying, [RJB]	9348	
Eudocima aurantia **(Moore, 1877)**		
G. Indonesia, W. Papua, Arfak, Mybri, 2 hrs. SW of Manokwai, vii.2015, 1500m, leg. local, [RJB]		
H & 21:D. Key Islands, leg. Dominic, [NMNH]		
Eudocima martini **(Zilli & Brou, 2017)**		
I & 21:F. Solomon Islands, Gaudalcanal, 17km SSE of Honiara, 23.ix-18.xii.2016, leg. Jákl & Gurko, [RJB]		
J. Solomon Islands, Gaudalcanal, Koso, 17km SSE of Honiara, 23.ix-18.xii.2016, leg. Jákl & Gurko, [RJB]	22162	
Figure 15.		
Eudocima paulii **(Robinson, 1968)**		
A . Fiji, Vanua Levu Island, Labasa, 10-16.01.2015, [RJB]		
B & 21:G. Fiji, Vanua Levu Island, Labasa, 10-16.01.2015, [RJB]	22054	
Eudocima steppingstonia **(Zilli et al., 2017)**		
C. French Polynesia, Marquesas Islands, Fatu Hiva, Mt. Teoaula, 22.iii.1968, 610m, leg. Clarke, [NMNH]	1069399	
D. French Polynesia, Marquesas Islands, Fatu Hiva, Mt. Upe, 22.iii.1968, 617m, leg. Clarke, [NMNH]	1069400	
Eudocima lequeuxi **(Brou & Zilli, 2016)**		
E & 21:H. South Africa, KwaZulu-Natal, 02.iii.2019, N30.273˚ E30.549˚, 493m, leg. Knyazevv, [RJB]	24817	
F. South Africa, KwaZulu-Natal, Vernon Crooks, 02.iii.2019, N30.273˚ E30.549˚, 493m, leg. Knyazevv,[RJB]	24890	
Eudocima afrikana **sp. n.**		
G. Togo, Forest of Missahoe, Kpalime-Kloto, 1-25.ix.2018, leg. Chmielowiec, [RJB]	24834	2633
H. Madagascar, Fianarantsoa, Ranomafana, 17.xi.2018, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [YPM]		
I. Madagascar, Fianarantsoa, Ranomafana, 15.xi.2018, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [YPM]	24833	2632
J. Madagascar, Fianarantsoa, Ranomafana, 13.xi.2018, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [RJB]	24831	
21:I. Madagascar, Fianarantsoa, Ranomafana, 9.iii.2019, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [RJB]	24889	
Figure 16		
Eudocima euryzona **(Hampson, 1926)**		
A & 21:J. Madagascar, Fianarantsoa, Ranomafana, 15.xi.2018, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [RJB]		
B. Madagascar, Fianarantsoa, Ranomafana, 4.iii.2019, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [RJB]	24827	
Eudocima phalonia **(Linneaus, 1763)**		
C. Tibet, Linzhi area, Bomi county, viii-ix.2020, 2000m, [RJB]		
D. Indonesia, Waigeo Island, 15.ii.2019, N-.2˚ E130.83˚, 400m, [RJB]		
E. Japan, [RJB]		
F & 21:K. Fiji, Vanua Levu Isl., Natew pen.-Nakobo, 15.xii.2018, N-16.73˚ E 179.69˚, 11m, leg. Gurko, [RJB]	24820	
Eudocima oliveri **(Zilli & Brou, 2017)**		
G. HT, Vanuatu, Aneityum I., Agathis Camp-1150' [feet], 19-21.vii.1971, modif., leg. Robinson [NHMUK-1378103]		
H. Paratype, Vanuatu, Espiritu Santo, Apouna River, Camp 2, 450'[feet], modif., leg. Robinson [NHMUK-1378102]		
Hemiceratoides hieroglyphica		
I. Madagascar, Mahajanga, 24.i.2020, N-16.368˚ N46.908˚, 200m, leg. Krutov, [RJB]	25029	
Hemiceratoides **sp.**		
J. Uganda, Kabarole Fort Portal Nkuruba Lake Nature Reserve, 20.xi.2019, leg. Golovizin, [RJB]	25030	
K. Uganda, Kabarole Fort Portal Nkuruba Lake Nature Reserve, 6.ii.2021, leg. Golovizin, [RJB]		

TABLE 3: Data for specimens shown in Figures 1–32 (Page 5 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK
Figure 22.		
***Lobophyllodes miniatus* Grünberg, 1907**		
A. Uganda, Kalinzu forest, Ankole-southwest Uganda, vi.1961, leg Carcasson, [USNM]	29456	
B. [MNHN]		
C. Togo, Kpalimé, ii.2021, N6.9˚ E0.6˚, 240m, local coll, [RJB]		
***Miniodes maculifera* Hampson, 1913**		
D. Uganda, v.1966, [NMNH]		
E. Cameroon, Benbis, 15.xi.2016, N3.45˚ E12.45˚, 670m, leg. local coll, [RJB]	22023	
F. [MNHN]		
***Miniodes phaeosama* Hampson, 1913**		
G. Uganda, Toro, Pt. Portal, 16-21.vii.1960, leg. Twomey, [CMNH]		
H. [MNHN]		
***Miniodes discolor* Guenée, 1852**		
I. Togo, North Mirolina, Kpalimé N6.9˚ E0.63˚, 231m., leg. local coll, [RJB]	24875	
J. Togo, North Mirolina, Kpalimé N6.9˚ E0.63˚, 231m., leg. local coll, [RJB]		
***Miniophyllodes sikorai* Viette, 1974**		
K. Allotype, E. Madagascar, 25 km West of Andapa, 24-28.xi.1968, Griveaud, Peyrieras & Viette, [MNHN]		
***Miniophyllodes aurora* de Joannis, 1912**		
L. Madagascar, Fianarantsoa, Ranomafana, 14.xi.2018, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [RJB]		
M. Madagascar, Fianarantsoa, Ranomafana, 8.iii.2019, N-21.26˚ E47.42˚, 850m, leg. Golovizin, [RJB]		
N. Madagascar, Moramanga District, 10.xi.2018, N-18.95˚ E48.42˚, 943m, leg. local coll, [RJB]		
***Huebnerius dux* (Saalmüller, 1881)**		
O. Madagascar, Northern massif from Tsaratanana to Maromokotra, xi.1966, 2831 m, Viette et al., [ZSM]		
***Eudocima formosa* (Griveaud and Viette, 1960)**		
P. Madagascar, Fianarantsoa, Ankarafantsika NP, 23.i.2020, N-16.325° E46.825°, 150m, leg Krutov, [RJB]		2665
Q. Madagascar, Fianarantsoa, Ankarafantsika NP, 23.i.2020, N-16.325° E46.825°, 150m, leg Krutov, [RJB]		
R. Madagascar, Fianarantsoa, Ankarafantsika NP, 23.i.2020, N-16.325° E46.825°, 150m, leg Krutov, [RJB]		2648
S. Madagascar, Fianarantsoa, Ankarafantsika NP, 23.i.2020, N-16.325° E46.825°, 150m, leg Krutov, [RJB]	25083	
T. Madagascar, Fianarantsoa, Ankarafantsika NP, 23.i.2020, N-16.325° E46.825°, 150m, leg Krutov, [RJB]	25026	
Figure 23.		
***Eudocima procus* (Cramer, 1777)**		
A. Ecuador, Tinalandia, S. Domingo De Los Colorados, 29.vi.1986, N-0.2° E-79.2°, 400m , leg. Borth, [RJB]		
B. Ecuador, Tinalandia, Santo Dom. De Los Colorados, 29.vi.1986, N-0.2° E-79.2°, 400m , leg. Borth, [RJB]		
C. Ecuador, Napo Yasuni Nat Pk, 20.ix-4.x.2003, leg. Bordelon & Knudsen, [FMC]	7062	
D. Peru, Tingo Maria, 18.xii.2018, [RJB]		
***Eudocima serpentifera* (Walker, [1858] 1857b)**		
E. Peru, Tingo Maria, 18.xii.2018, [RJB]		
***Eudocima colubra* (Schaus, 1911b)**		
F. Zimbabwe, Manicaland, Selinda Mt., 7.i.2011, N-20.4˚ E32.7˚, 1150m, leg. Sochivko, [RJB] (dubious label)	24824	
G. Mexique, 1913, leg. Génin, [MNHN]		
***Eudocima anguina* (Schaus, 1911b)**		
H. Peru, Amazonas, Muyo-Oliva, iv-v.1999, [MNHN]		
***Ferenta stolliana* (Stoll, 1782)**		
I. Ecuador, Napo Yasuni Nat Pk, 20.ix-4.x.2003, leg. Bordelon & Knudsen, [FMC]	7064	
***Eudocima memorans* (Walker, [1858] 1857b)**		
J. Ecuador, Napo Yasuni Nat Pk, 20.ix-4.x.2003, leg. Bordelon & Knudsen, [FMC]	7063	
***Eudocima collusoria* (Cramer, 1777)**		
K. Guyana, [MNHN]		
***Graphigona regina* (Guenée, 1852b)**		
L. Brazil, Gamagna, [FMNH]		
M. French Guiana, Village Espérance, Saint Laurent du Maroni, v.2018, 22m, leg. local, [RJB]	22161	
***Eudocima kinabaluensis* (Feige, 1976)**		
N. Malaysia, Sabah, Mt. Trus Madi, 4-24.iv.2002, 1100m, leg. Martini, [ZSM]		
O. Malaysia, Sabah, Mt. Trus Madi, iv.1997, 1200m, leg. Martini, [ZSM]		
***Eudocima smaragdipicta* (Walker, [1858] 1857b)**		
P. N. Sumatra, Parapat, 25.xi.1989, N3˚ E99˚ 1050m, leg. Diehl, [ZSM]		
Q. Malaysia, Bukit Larut, N4.9 E100.8, 880m, [MNHN]		
***Eudocima iridescens* (Lucus, 1894)**		
R Indonesia, West Papua, Manokwari regency, Arfak Mountains, Mybri, vi.2017, 1500m, [RJB]		
S. Indonesia, West Papua, Manokwari regency, Arfak Mountains, Mybri, vi.2017, 1500m, [RJB]		
***Eudocima caesar* (Felder, 1861)**		
T. Indonesia, Seram, Kankeh Manusele NP, vi.1998, N3.1˚ E129.48˚, leg. Steinke & Lehmann, [ZSM]		
U. Indonesia, Seram, Kankeh Manusele NP, vi.1998, N3.1˚ E129.48˚, leg. Steinke & Lehmann, [ZSM]	24810	
V. Himalaya, Mt. Anapura, 4.vii.95, 4000m, leg. Afonin (dubious label, probably same as No. 43 below)	26041	
W. Indonesia, Moluccas, Bacan Isl., Mt. Sibela, 13.ii.1996, N.63˚ E127.53˚, 400m, leg. Siniaev /Afonin, [RJB]	26040	
***Eudocima homaena* (Hübner, [1823] 1816)**		
X. Philippines, Palawan, Irawan, 1.x.1997, 50m, [RJB]	26043	

TABLE 3: Data for specimens shown in Figures 1–32 (Page 6 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 24.		
Eudocima homaena **(Hübner, [1823] 1816)**		
A. Vietnam, Quang Nam, Axan Mountain, ix.2017, leg Luong Le, [RJB]		
B. Vietnam, Quang Nam, Axan Mountain, ix.2017, leg Luong Le, [RJB]	24844	
C. Vietnam, Kon Tum Prov, Ngoc Linh Mtn,, ix.2017, N15.05° E103.02°, 1700m, [RJB]	24843	
D. Malaysia, Sabah, 15.i.2020, 285m, leg. local coll, [RJB]	25069	
Eudocima apta **(Walker, [1858] 1857b)**		
E. USA, AZ, Cochise Co., Copper Cyn, 31.vii.2003, N31.3627° E-110.301°, 1501m, leg. Borth, [RJB]	891	
F. Costa Rica, Guanacaste Lab, 11.vii.2010, N10.9269° E-85.4682°, 1150m, leg. Franco & Rios, [ACG]	110720	
Eudocima materna **(Linnaeus, 1767)**		
G. Australia, Pilbara Ngurrawaana Aboriginal Commu. 1.vi.2013, N-21.425° E116.981°, leg. Heath, [CBG]	20289	
H. Australia, Pilbara, Marillana Station, 1.v.2010, N-22.667° E119.387°, leg. Heath, [CBG]	4511GO5	
I & 19:B. Togo, Bala Village Kloto, Kpalimé area (plateau), 5-15.05.2019, leg. Chmielowiec, [RJB]		
Eudocima boseae **(Saalmüller, 1880)**		
J. Madagascar, Fianarantsoa, Ranomafana, 7.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
K. Madagascar, Fianarantsoa, Ranomafana, 6.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
L. Madagascar, E. of Lk Mantasoa, Frt. Ambohiboatavo, iii.1973, 1340m, leg. Griveaud & Peyrieras, [NMHN]		
M & 19:D. Madagascar, Fianarantsoa, Ranomafana, 16.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24813	
Eudocima imperator **(Boisduval, 1833)**		
N. Madagascar, Fianarantsoa, Ranomafana, 07.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
O. Madagascar, Fianarantsoa, Ranomafana, 03.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
P. Madagascar, Fianarantsoa, Ranomafana, 13.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24814	
Q. Madagascar, Fianarantsoa, Ranomafana, 17.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24815	
Eudocima divitiosa **(Walker, 1869b)**		
R. Uganda, Kabarole Fort Portal Nkuruba Lake Nature Reserve, 27.xi.2019, leg. Golovizin, [RJB]		
S. Cameroon, Yaounde area, viii.2013, N3.84° E11.50°, 596m, [RJB]	24818	
T. Cameroon, Obout, 1.xi.2004, [RJB]		
Figure 25.		
Eudocima dividens **(Walker, [1858] 1857b)**		
A. Malaysia, Sabah, Mt. Trus Madi, 19.iv.2002,, 285m, leg. Martini, [ZSM]		
B. Philippines, Palawan, Buena Vista Falls, 29.xi.2008, N10.073° E118.822°, 35m, leg. Borth, [RJB]	5638	
Eudocima salaminia **(Cramer, 1777)**		
C. China, Yunwushan, Fengling, Hebei, 1.x.2003, leg. Ying, [RJB]	9350	
D. Indonesia, Seram, Elpaputih, ii.2019, N-3.4° E128.2°, 50m, [RJB]	24847	
E. Indonesia, West Java Cimanggu, x.2017, N7.2° E107.4°, 1780m, leg. local, [RJB]		
F. Indonesia, Sumba Island, Mt. Langgaliru, x.2016, [RJB]		
Eudocima discrepans **(Walker, [1858] 1857b)**		
G. Vietnam, Thua Thein Prov, Bach Ma Mtn, i.2016, N16.2° E107.8°, 1400m, leg Lunog Le, [RJB]		
Eudocima muscigera **(Butler, 1882)**		
H. Indonesia, Waigeo Island, 15.ii.2019, 400m, N-.2° W130.83°, 400m, [RJB]	24840	
I. Papua New Guinea, 1925, [USNM]		
J. Indonesia, West Papua, Mimika, West Central Highlands, x.2018, N4.13° W137.11°, 3500m, [RJB]	24838	
Eudocima cocalus **(Cramer, 1777)**		
K. Indonesia, Sumba Island, Mt. Langgaliru, x.2016, [RJB]		
Eudocima hypermnestra **(Cramer, 1780)**		
L. Vietnam, Lâm Đồng Province, Lạc Dương, v.2015, N12° E108°, leg. local, [RJB]		
Eudocima jordani **(Holland, 1900)**		
M. Indonesia, West Papua, Arfak Mountains, Mybri, vii.2015, N-1° E134°, 1500m, [RJB]		
N & 20:E. Indonesia, West Papua, Arfak Mountains, Mybri, vii.2015, N-1° E134°, 1500m, [RJB]		
Eudocima cajeta **(Cramer, 1775)**		
O. Vietnam, Mù Cang Chải, Yên Bái Province, vii.2016, N21.7° E104.3°, 1700m, leg. Lunog Le, [RJB]	22159	
P. Vietnam, Mù Cang Chải, Yên Bái Province, vii.2016, N21.7° E104.3°, 1700m, leg. Lunog Le, [RJB]		
Q. Vietnam, Quang Nam Prov., Axan Mtn., Tay Giang, viii.2017, leg. Luong Le, [RJB]	22160	
R. Vietnam, Quang Nam, Axan Mountain, iv.2017, leg Luong Le, [RJB]		
S. Vietnam, Thue Thien Hue, Bach Ma Mtn., Hue, xii.2015, N16.2° E107.8°, 1400m, leg. Luong Le, [RJB]		
Eudocima srvijayana **(Bänziger, 1985)**		
T. Vietnam, Lâm Đồng Province, Di Linh, iv.2017, N11.5° E108.12°, leg. local, [RJB]	25028	

TABLE 3: Data for specimens shown in Figures 1–32 (Page 7 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 26.		
***Eudocima prolai* Zilli and Hogenes, 2002**		
A. Papua New Guinea [SB]		
B. Papua New Guinea [SB]		
***Eudocima bathyglypta* (Prout, 1928)**		
C. Indonesia, North Sumatra, Mount Sibayak, 15.xii.2018, N3.239° E98.506°, 2100m, [RJB]	24835	
D & 19:I. Indonesia, W. Java, Cimanggu, x.2017, N7.09° E107.23°, 1780m, [RJB]	22156	
***Eudocima miniopastera* (Hampson, 1926)**		
E. Malaysia, Sabah, Sipulut Hills, 14.iv.2010, 1200m, leg. Martini, [ZSM]		
***Eudocima sikhimensis* (Butler, 1895)**		
F. Vietnam, Ngoc Linh Mtn., Kon Tum, vii.2016, N15.05° E108.02°, 1700m, leg. Lunog Le, [RJB]		
G. Myanmar, Kachin State, Chudu Razi Hills, 25.ix.2008, N25.851° E37.438°, 601m, leg. local, [RJB]	9367	
H & 20:K. Vietnam, Ngoc Linh Mtn., Kon Tum, xi.2015, N15.05° E108.02°, 1700m, leg. Lunog Le, [RJB]		
***Eudocima mazzeii* Zilli and Hogenes, 2002**		
I. Philippines, Ifugao Prov., Banaue, iii.2017, N16.95° E121.10°, 1474m, leg. local, [RJB]		
J. Philippines, Ifugao Prov., Banaue, 15.ii.2017, N16.919° E121.059°, 1144m, [RJB]	22158	
K. Philippines, Ifugao Prov., Banaue, 15.ii.2017, N16.919° E121.059°, 1144m, [RJB]	22157	
***Eudocima okurai* (Okanao, 1964)**		
L. Malaysia, Okano, [NMNH]		
M. Vietnam, Quang Nam, Tay Giang District, Axan Mountain, xi.2021, 1300m, leg Luong Le, [RJB]		
N. Myanmar, Chudu Razi Hills, Kachin State, 8.iv.2008, [RJB]	5711	
***Eudocima tyrannus* (Guenée, 1852a)**		
O. Vietnam, Quang Nam, Tay Giang District, Axan Mountain, iii.2021, 1300m, leg Luong Le, [RJB]		
***Eudocima aurantia* (Moore, 1877)**		
P. Indonesia, North Sumatra, South Kalang, 10.01.2007, [RJB]	9151	
***Eudocima martini* (Zilli and Brou, 2017)**		
Q. Solomon Islands, Gaudalcanal, Koso, 17km SSE of Honiara, 23.ix-18.xii.2016, leg. Jákl & Gurko, [RJB]	22163	
R. Solomon Islands, Gaudalcanal, Koso, 17km SSE of Honiara, 23.ix-18.xii.2016, leg. Jákl & Gurko, [RJB]		
S. Solomon Islands, Gaudalcanal, Koso, 17km SSE of Honiara, 23.ix-18.xii.2016, leg. Jákl & Gurko, [RJB]		
T. Solomon Islands, Gaudalcanal, Koso, 17km SSE of Honiara, 23.ix-18.xii.2016, leg. Jákl & Gurko, [RJB]	25073	
Figure 27		
***Eudocima lequeuxi* (Brou and Zilli, 2016)**		
A. South Africa, Vernon Crooks Nature Reserve, 2.iii.2019, N-30.273° E30.549°, 493m, leg. Knyazevv, [RJB]	24817	2642
B. Uganda, Karbole Ft. Portal, Lake Nikuruba NR, 20.xi.2019, N-0.518° E30.302°, 1519m, leg. Golovizin, [RJB]		2643
C. Uganda, Rubanda District, near Bwindi NP, 12.ii.2021, N-1.0° E29.7°, 1700m, leg. Golovizin, [RJB]		
D. Uganda, Rubanda District, near Bwindi NP, 11.ii.2021, N-1.0° E29.7°, 1700m, leg. Golovizin, [RJB]		
***Eudocima afrikana* sp. n.**		
E. Uganda, Kabarole Fort Portal Nkuruba Lake Nature Reserve, 1.xii.2019, leg. Golovizin, [RJB]	25027	
F Madagascar, Fianarantsoa, Ranomafana, 17.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24832	2503
G & 21:I. Madagascar, Fianarantsoa, Ranomafana, 8.iii.2019, N-21.26° E47.42°, 850m, Golovizin, [RJB]	24889	
H. Tanzania, Tanga Region, Kilindi, Nguu Mtns, 15.viii.2006, [RJB]	9346	2501
I. Madagascar, Fianarantsoa, Ranomafana, 15.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
J. Togo, Bala Village Kloto, Kpalimé area (plateau), 5-15.05.2019, leg. Chmielowiec, [RJB]		
K. Togo, Bala Village Kloto, Kpalimé area (plateau), 13.ix.2018, leg. Chmielowiec, [RJB]	24816	2645
L. Madagascar, Antananarivo Province, xi, 1998, N-18.7°5 E46.75°, 1000m, leg. Local, [RJB]		2505
***Eudocima phalonia* (Linneaus, 1763)**		
M. China, Yunwushan, Femgling Hebei, x.2003, leg. Ying, [RJB]	9347	2502
N. Fiji, Vanua Levu Island, Natew pen.-Nakobo, 15.xii.2018, N-16.73° E 179.69°, 11m, leg. Gurko, [RJB]	24819	2647
O. Myanmar, Chudu Razi Hills, Kachin State, 5.xi.2005, [RJB]	5594	2500
P. Philippines, Palawan, Buena Vista Falls, 29.xi.2008, N10.073° E118.822°, 35m, leg. Borth, [RJB]	5639	
Q. Myanmar, Chudu Razi Hills, Kachin State, 5.xi.2005, [RJB]	5671	
R. Myanmar, Chudu Razi Hills, Kachin State, 5.xi.2005, [RJB]	5674	
S. Philippines, Mindoro oriental, S. Luzon, Baco, ix.2017, N13.26° E21.06°, 743m, [RJB]		2504
T. Japan, Tokyo, Mt. Takao, 25.viii.1960, [RJB]		

TABLE 3: Data for specimens shown in Figures 1–32 (Page 8 of 8).

Collection data	COI 5' Sample ID	Dissection No. HLK:
Figure 28		
***Eudocima phalonia* (Linneaus, 1763)**		
A. Indonesia, West Papua, Minka Regency, western central highlands, x.2018, 3500m, [RJB]		
B & 21:L. Myanmar, Kachin State, Chudu Razi Hills, 7.viii.2008, N25.851° E97.438°, 601m, leg. local coll., [RJB]	9366	
***Eudocima euryzona* (Hampson, 1926)**		
C. Madagascar, Fianarantsoa, Ranomafana, 5.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	25082	2641
D. Madagascar, Fianarantsoa, Ranomafana, 5.i.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		2644
E. Madagascar, Fianarantsoa, Ranomafana, 7.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
F. Madagascar, Fianarantsoa, Ranomafana, 7.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24825	
G. Madagascar, Fianarantsoa, Ranomafana, 7.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
H. Madagascar, Fianarantsoa, Ranomafana, 2.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
I. Madagascar, Fianarantsoa, Ranomafana, 17.xi.2018, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]	24826	
J. Madagascar, Fianarantsoa, Ranomafana, 17.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
K. Madagascar, Fianarantsoa, Ranomafana, 9.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
L. Madagascar, Fianarantsoa, Ranomafana, 6.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
***Calyptra imperialis* (Grünberg, 1910)**		
M. PT, Vanuatu, Aneityum I., Agathis Camp-1150' [feet], 19-21.vii.1971, modif., leg. Robinson [NHMUK-1378101]		
***Oraesia cerne* (Fawcett, 1916)**		
N. Uganda, Kabarole Fort Portal Nkuruba Lake Nature Reserve, 21.xi.2019, leg. Golovizin, [RJB]		
***Plusiodonta malagasy* (Viette, 1968)**		
O. Madagascar, Fianarantsoa, Ranomafana, 12.iii.2019, N-21.26° E47.42°, 850m, leg. Golovizin, [RJB]		
***Ferenta stolliana* (Stoll, 1782)**		
P. Cramer & Stoll, Uitlandsche Kapellen, Vol 4, Pl 310-001 Surinam		
***"Eudocima" felicia* (Stoll, 1790)**		
Q. Aanhangsel Werk, Uitl. Kapellen (2-5): 58, pl. 12, f. 11		

Fruit-Feeding Behavior

Much effort has been devoted to assessing fruit-piercing capability and its development within the Calpinae. Examples of fruit-feeding behavior are provided in Figures (87–96), with details provided in Table 4.

The ability to pierce fruit can be viewed on a continuum from secondary piercers to primary piercers. Secondary piercers opportunistically access pulp through openings made available by primary piercers, other animals or insects, weather, or disease. Primary piercers penetrate soft, thick and even hard-skinned fruits (Bänziger 1982). He lists three species of *Plusiodonta*, three *Oraesia*, three *Eudocima* and two *Phyllodes* as fruit-piercers in Thailand, and stated that the four *Calyptra* species there were at least in part fruit-piercing.

Speidel *et al*. (1996) reported deep morphological differences between piercers and non-piercers, based on SEM studies of the proboscis. They found the fruit sucking genera *Catocala* and *Erebus* are basically similar in proboscis ultrastructure, with no special structures for piercing, whereas Calpini fruit piercers have the distal part of the proboscis covered with sclerotized cuticular hooks. These sclerotized cuticular hooks are clearly present for all Calpini taxa shown on Figure 72 with the exception of *Oporophylla.*

Zaspel *et al*. (2012) postulated that the ancestral feeding behavior for the leaf-mimicking clade Phyllodini + Ophiderini is the primary piercing of soft-skinned fruit and secondary piercing of other fruits, and the derived condition present in the Ophiderini (exclusive of *Hemiceratoides*) is piercing of hard- skinned fruits. Species in the Phyllodini clade exhibit the postulated ancestral condition (Zaspel *et al*. 2012). Calpini includes *Gonodonta, Plusiodonta* and *Oraesia* which are primary thick-skinned fruit piercers*,* and *Calyptra* which can feed on the blood of mammals as well as pierce thick-skinned fruit (Zaspel *et al*. 2012).

We have regularly observed *Plusiodonta compressipalpis* and *Calyptra canadensis* feeding on mashed rotten bananas and sugar applied to tree trunks and leaves (Figs 96: B and D, respectively), but we have not observed them piercing fruit (including soft-skinned wild grapes that occur in their habitats). Likewise, thousands of observations of these species on iNaturalist did not include possible examples of fruit-piercing behavior. These observations raise the possibility that particular types of feeding behavior may vary among species within some of the Calpinae genera.

TABLE 4: Data for live photos in Figures 87-96 (page 1 of 2).
Figure 87.
A. *E. afrikana,* Madagascar, Analanjirofo, 21.ix.2018, N-15.721° E49.96°, by laplace-t, Creative Commons license (CC-BY-NC)
B. *E. phalonia,* Australia, Queensland, 16.iv.2020, N-21.223° E149.146°, by Steve Dew, Creative Commons license (CC-BY-NC)
C. *E. phalonia,* New Caledonia, 3.vi.2020, N-22.308° E166.452°, by Pierre-Louis Stenger, Creative Commons license (CC-BY-NC)
D. *E. phalonia* on *Legnephora moorei,* Australia, 14.ii.2020, N-27.37° E152.87°, by Marie Tarrant, Creative Commons license (CC-BY-NC)
E. *E. phalonia,* Australia, Queensland, 20.iv.2020, N-26.825° E152.924°, by Ian McMaster, Creative Commons license (CC-BY-NC)
Figure 88.
A. *Xylophylla punctifascia,* Eastern China, N30° E119°, permission from MaZehao
B. *Xylophylla punctifascia,* Eastern China, 13.vii.2020, N30.3° E119.4°, permission from MaZehao
C. *Eudocima formosa,* Madagascar, Antsiranana, N-12.9687° E49.1368°, by Damon Tighe, Creative Commons license (CC-BY-NC)
D. *Gloriana ornata,* India, Arunachal Pradesh, N27.0134° E92.4142°, by Purnendu Roy, Creative Commons license (CC-BY)
E. *Phyllodes conspicillator,* Indonesia, W. Papua, 25.xii.2017, N-0.49753° E130.66752°, by Pasha Kirillov, Creative Commons license (CC BY-SA)
F. *Miniodes discolor,* Mozambique, Sofala, N-18.32754° E35.35766°, by Bart Wursten, Creative Commons license (CC-BY-NC)
G. *Phyllodes imperialis,* Australia, Queensland, Cairns, 16.i.2019, N-16.96203° E145.679137°, permission from John Lenagan
H. *Phyllodes sp.,* Malaysia, Sabah, Kinabalu, 27.v.2019, N6.0125° E116.5392°, permission from Frank Deschandol (aka Frank Canon)
Figure 89.
A. *Phyllodes imperialis,* Australia, Wonga, Queensland, 17.vi.2019, permission from David White
B. *Phyllodes consobrina,* Thailand, Phanom District, 25.xi.2018, N8.915° E98.528°, by lungchris, Creative Commons license (CC-BY-NC)
C. *P. staudingeri,* Borneo, Trusmadi hill, 1100m, 31.iii.2011, by Alexey Yakovlev, Creative Commons Attribution-Share Alike 4.0, Wikimedia Commons
D. *Phyllodes endhovii,* Malaysia, Sabah, Poring, 5.vii.2017, by Pavel Kirillov, Creative Commons license (CC BY-SA 2.0), Flickr
E. *Phyllodes imperialis* on *Myrciaria cauliflora,* Australia, Queensland, permission from David White
F. *Phyllodes verhuelli,* Malaysia, 14.iv.2019, N3.32° E101.75°, Cyren Asteraceya, by QuestaGame, Creative Commons license (CC-BY-NC-ND)
Figure 90.
A. *E. memorans,* Bolivia, Vaca Diez, El Beni, 15.ii.2020, N-11.029° E-66.088°, by Ruben, Creative Commons license (CC-BY-NC)
B. *E. collusoria,* Trinidad and Tobago, Mayaro, 8.xi.2020, N10.3827° E-61.0317°, permission from Rainer Deo
C. *E. collusoria,* Trinidad and Tobago, Mayaro, 8.xi.2020, N10.3865° E-61.0318°, permission from Rainer Deo
D. *E. memorans,* Panama, Cerro Azul, 8.i.2019, N9.264° E-79.415°, by Thorsten Usée, Creative Commons license (CC-BY-NC)
E. *Ferenta stolliana,* Peru, Maynas, Loreto, N. of Iquitos, N-3.5278° E-73.1794° by John Sullivan, Creative Commons license (CC-BY-NC)
F. *F. stolliana,* Bolivia, Caranavi, Yungas, 10.ii.2019, permission from Peter Moellmann
G. *F. cacica,* Brazil, Concórdia, 11.xi.2020, N-27.2442° E-52.0249°, by Frederico Acaz Sonntag, Creative Commons license (CC-BY-NC)
H. *F. stolliana,* Costa Rica, La Selva OTS, 22.viii.2018, N10.4314° E-84.0060°, permission from Gernot Kunz
Figure 91.
A. *Graphigona complex,* Costa Rica, Alajuela, N10.7313° E-850584°, by dannyvasquez, Creative Commons license (CC-BY-NC)
B. *E. apta,* Colombia, Nocaima, 17.vii.2020, N5.070° E-74.380°, by Oscar Enciso, Creative Commons license (CC-BY-NC)
C. *E. serpentifera,* Mexico, Jalisco, La Huerta, 12.viii.2016, N19.42° E-104.98°, by Barry Sullender, Creative Commons license (CC-BY-NC)
D. *E. serpentifera,* Mexico, Querétaro, 10.xi.2019, N20.522° E-100.388°, by Coronado Govaerts, Creative Commons license (CC-BY-NC)
E. *Tetrisia florigera,* Peru, Maynas, 18.vii.2019, N-3.967° E-73.4198°, permission from Projeto Mantis
F. *E. apta* larva, Colombia, Atlántico, Paluato, 8.vi.2020, N10.877° E-74.930°, by Jeir Ortega Galvan, Creative Commons license (CC-BY-NC)
G. *F. cacica,* Brazil, Concórdia, 11.xi.2020, N-27.2442° E-52.0249°, by Frederico Acaz Sonntag, Creative Commons license (CC-BY-NC)
H. *E. serpentifera,* Ecuador, Mindo Valley, 20.ix.2019, N-0.051° E-78.771°, by Josh Vandermeulen, Creative Commons license (CC-BY-NC-ND)
I. *E. procus,* Bolivia, Vaca Diez, el Beni, 15.ii.2020, N-11.029° E-66.088°, by Ruben, Creative Commons license (CC-BY-NC)
Figure 92.
A. *E. euryzona,* Madagascar, Ranomafana, Fianarantsoa, 5.i.2019, N-21.282° E47.425°, permission from Chien Lee
B. *E. lequeuxi,* Eswatini, Mbuluzi Game Reserve, 2.ii.2021, N-26.156° E31.982°, by Phil White, Creative Commons license (CC-BY-NC)
C. *Eudocima* larva, Madagascar, Anjiamangirana Forest, 12.xii.2014, N-15.156° E47.735°, permission from Martin Mandák
D. *E. boseae,* Madagascar, Masoala NP, 29.xi.2018, N-15.675° E49.956°, by Kristof Zyskowski, Creative Commons license (CC-BY-NC-ND)
E. *E. divitiosa,* Zambia, Mwinilunga, 9.v.2019, N-13.1028° E24.6932°, by Clare Mateke, Creative Commons license (CC-BY-NC)
F. *E. imperator,* Madagascar, Antrema Protected Area, 23.xi.2015, N-15.713° E46.715°, permission from Martin Mandák
G. *E. euryzona,* Madagascar, Lakato Forest (Mouramanga), x.2002, permission from Patrick Basquin
H. *E. afrikana,* Madagascar, Alaotra-Mangoro, 15.v.2019, N-18.9377° E48.5157°, permission from Éric Mathieu

TABLE 4: Data for live photos in Figures 87-96 (page 2 of 2).
Figure 93. A. *E. salaminia,* Philippines, Mindoro, Udalo, Abra de Ilog, 18.viii.2012, permission from Michaela S. Webb B. *E. homaena* piercing *Solanum*, Taiwan, Siianjiyan, Taipei City, 23.xi.2008, by Shipher Wu, Creative Commons license (CC BY-NC-SA 2.0), Flickr C. *E. salaminia,* Australia, Queensland, 9.xi.2014, N-16.805˚ E145.637˚, by Ashley M Bradford, Creative Commons license (CC-BY-NC) D. *E. dividens,* Malaysia, Sarawak, 22.iii.2012, N1.6128˚ E110.1969˚, by dhfischer, Creative Commons license (CC-BY-NC) E. *E. okurai,* Malaysia, Fraser's Hill, Pahang, 3.x.2020, N3.756˚ E101.7501˚, permission from Paul Davis F. *E. tyrannus,* Taiwan, Taipei, 7.ix.2019, N25.015˚, E121.557˚, by jamesmifan, Creative Commons license (CC-BY-NC)
Figure 94. A. *E. kinabaluensis,* Malaysia, Kinabalu National Park, Sabah, xii.2016, permission from Ron Eldie B. *E. kinabaluensis,* Malaysia, Sarawak, Bahagian Miri, 4.v.2009, N4.043˚ E114.816˚, permission from Chien Lee C. *E. kinabaluensis,* Malaysia, Kinabalu National Park, Sabah, xii.2016, permission from Ron Eldie D. *E. smaragdipicta,* Malaysia, Jalan, Tamparuli, Sabah, 27.i.2018, N6.101˚ E116.264˚, permission from Ron Eldie E. *E. smaragdipicta,* Singapore, 8.8.2020, N1.3521˚ E103.8198˚, permission from Jerome Lee F. *E. smaragdipicta,* Malaysia, Jalan, Tamparuli, Sabah, 27.i.2018, N6.101˚ E116.264˚, permission from Ron Eldie G. *E. homaena,* Taiwan, Siianjiyan, Jingmei, Taipei City, 12.xii.2008, by Shipher Wu, Creative Commons license (CC BY-NC 4.0) H. *E. homaena,* Taiwan, Pingtug N22.641˚ E120.616˚, 30.viii.2020, 577m, by abujudy, Creative Commons license (CC-BY-NC) I. *E. homaena,* Taiwan, Taichung N24.194˚ E120.797˚, 1.viii.2019, 577m, by 羅忠良, Creative Commons license (CC-BY-NC) J. *E. iridescens,* Indonesia, Papua Barat, Teluk Wondama, nr. Aisandami village, 26.xi.2017, permission from Martin Mandák K. *E. iridescens,* Australia, Queensland, Crater Lakes Naional Park, 17.i.2016, by Shae Nechwatal, Creative Commons license (CC-BY-NC) L. *E. iridescens,* Australia, Wonga, Queensland, permission from David White
Figure 95. A. *E. hypermnestra,* India, Arunachal Pradesh, Papum Reserved Forest, 23.xi.2018, permission from Martin Mandák B. *E. hypermnestra,* Sri Lanka, 1.i.2017, N6.89˚ E79.91˚, by kamanisujee gunasena, Creative Commons license (CC-BY-NC) C. *E. kuehni,* Papua New Guinea, West New Britain, 9.vii.2021, N-5.30888˚ E151.05162˚, by nerrida, Creative Commons license (CC-BY-NC) D. *E. sikhimensis*, Malaysia, Kinabalu Park, N6.009 ˚ E116.5416 ˚, 1560m, by louie2013, Creative Commons license (CC-BY-NC) E. *E. srivijayana*, Malaysia, Sabah, Mount Kinabalu Park, 10.x.2018, N6.0118˚ E116.5347˚, by dhfischer, Creative Commons license (CC-BY-NC) F. *E. srivijayana,* Indonesia, Bali, Gianyar, 3.x.2019, N-8.4047˚ E115.2849˚, by Bruno Durand, Creative Commons license (CC BY-NC) G. *E. cajeta,* Vietnam, Nho Quan, 3.vii.2019, N20.26036˚ E105.70383˚, permission from Gernot Kunz H. *E. materna,* Kenya, 3.24.2021, N-1.14825˚ E36.960453˚, permission from Robin James I. *E. materna,* Madagascar, Menabe, 7.iii.2020, N-20.167˚ E44.668˚, by Lennart Hudel, Creative Commons license (CC-BY-NC) J. *E. bathyglypta,* Malaysia, Frasers Hill, 25.ii.2020, N3.7169˚ E101.7528˚, by dhfischer, Creative Commons license (CC-BY-NC) K. *E. jordani,* Australia, Queensland, 7.i.2021, N-17.28525˚ E145.5752˚, permission from John Lenagan L. *E. aurantia,* Australia, Queensland, 7.i.2021, N-17.28525˚ E145.5752˚, permission from John Lenagan M. *E. prolai,* W. Papua, Arfak Mtns., Manokwari, 27.x.2019, N-1.0746˚ E133.9046˚, by Gerrit Alink, Creative Commons license (CC-BY-NC) N. *E. discrepans,* Singapore, Tanjong Pagar Market, 16.vii.2019, N1.277˚ E103.843˚, by CheongWeei Gan, Creative Commons license (CC-BY-NC)
Figure 96. A. *Oraesia excavata*,Taiwan, Taipei City, 16.xi.2008, by Wu (吳), Creative Commons license (CC BY-NC-SA) B. *Plusiodonta compressipalpis,* USA, WI, Outagamie Co., Fallen Timbers Environ. Ctr., 1.viii.2020, H Kons Jr. C. *Gonodonta sinaldus,* Mexico, Nuevo León, 26.xi.2015, N24.829˚ E-99.583˚, by Juan Cruzado Cortés, Creative Commons license (CC-BY-SA) D. *Calyptra canadensis,* USA, Wisconsin, Outagamie Co., H Kons Jr. E. *Ischyja manlia,* Cambodia, Ou Reang, 30.ix.2014, N12.321˚ E107.081˚, by benbarca, Creative Commons license (CC-BY-NC) F. *Catocala maestosa,* USA, Illinois, Cook Co., Northern Chicago, 16.ix.2020, by Jeff Skrentny, Creative Commons license (CC-BY-NC) G. *Artena dotata,* Hong Kong, Tai Po Kau, 15.vii.2016, N22.4236˚ E114.1856˚, by Jacky Lau, Creative Commons license (CC-BY-NC) H. *Platyja exequialis* on guava, Australia, Wonga, Queensland, permission from David White I. *Thyas honesta,* Cambodia, Tuek Chhou, 29.vii.2015, N10.66˚ E104.15˚, by Jonathan Hakim, Creative Commons license (CC-BY-NC)

TABLE 5: Collection data for DNA (COI 5') sequence vouchers from BOLD public projects not shown on figures (page 1 of 3).

Collection data	BOLD Sample ID
Calyptra bicolor, Nepal, 13.x.1995, 2560m, leg. Fibiger	JMZA4-004
Calyptra canadensis, Canada, Ontario, 11.vii.2006, N44.53° E-77°, leg. deWaard, [CBG]	2006-ONT-0831
Calyptra canadensis, Canada, Ontario, 15.vii.2008, N43.609° E-80.36°, leg. Gregory, [CBG]	BL1028
Calyptra canadensis, Canada, Ontario, 9.vii.2005, N44.53° E-77°, leg. deWaard, [CBG]	2005-ONT-555
Calyptra fasciata, Myanmar, Kachin, 24.vi.2008, N25.851° E97.438°, 601m, leg. local, [RJB]	5706-240608-MY
Calyptra fasciata, Myanmar, Kachin, 31.vii.2008, N25.851° E97.438°, 601m, leg. local, [RJB]	5751-010808-MY
Calyptra hokkaida, GenBank	JX392801
Calyptra lata, GenBank	JN674884
Calyptra lata, Russia, 18.vii.2006, N43.699° E132.152°, 87m, leg. Zaspel, [FMNH]	JMZA3-003
Calyptra minuticornis, Australia, Queensland, 17.xii.2010, N-31.063° E153.052°, 37m, leg. Hebert, [CBG]	BIOUG00952-B06
Calyptra minuticornis, Australia, Queensland, 5.i.2001, N-14.667° E145.467°, leg. Hebert, [CBG]	Moth 211.01LZ
Calyptra minutiornis, Australia, New South Wales, 28.xii.2008, N-31.063° E153.052°, 37m, leg. Hebert, [CBG]	08-NSWHH-0133
Calyptra species, China, Yunnan, 11.viii.2011, N24.287° E101.25°, 2600m, leg. Kitching, Ashton, [CAS]	ARB00027495
Calyptra species, Japan, 24.vii.1984, N36.872° E139.572°, leg. Pellmyr, [USNM]	CCDB-22953-H09
Calyptra species, Pakistan, Kashmir, 1.vii.2012, N34.38° E73.54°, 2660m, leg. Akhtar, [NIBGE]	NIBGE MOT-01824
Calyptra species, Pakistan, Kashmir, 10.vii.2012, N34.82° E74.35°, 2145m, leg. Akhtar, [NIBGE]	NIBGE MOT-01825
Calyptra species, Pakistan, Kashmir, 11.vii.2012, N34.81° E74.26°, 1950m, leg. Akhtar, [NIBGE]	NIBGE MOT-01823
Calyptra thalictri, Macedonia, 17.vii.2005, N42° E22°, 1534m, leg. Stavic, [RJB]	9143-170705-MA
Calyptra thalictri, Macedonia, 17.vii.2005, N42° E22°, 1534m, leg. Stavic, [RJB]	9144-170705-MA
Eudocima cocalus, Australia, Queensland, 16.vii.1998, N-12.43° E143.18°, leg. Edwards, [ANIC]	10ANIC-05761
Eudocima cocalus, Australia, Queensland, 21.iii.1994, N-11.42° E142.3°, leg. Zborowski, [ANIC]	10ANIC-05760
Eudocima cocalus, Australia, Queensland, 25.vii.1989, N-19.281° E146.776°, leg. Sancis, Broe, [ANIC]	10ANIC-05762
Eudocima cocalus, Australia, Queensland, 5.i.2001, N-14.667° E145.467°, leg. Hebert, [CBG]	Moth 280.01LZ
Eudocima jordani, Australia, Queensland, 31.v.1989, N-18.954° E146.293°, leg. Ring, [ANIC]	10ANIC-05753
Eudocima jordani, Australia, Queensland, 31.v.1989, N-18.954° E146.293°, leg. Ring, [ANIC]	10ANIC-05754
Eudocima apta, Brazil, 17.ii.2010, N-25.3508° E-48.8858°, 579m, leg. Zenker, [Universidade Federal do Parana]	MMZ0001
Eudocima apta, Brazil, Rio Grande do Sul, 20.i.2010, N-29.483° E-50.16°, 900m, leg. Moser, [ZSM]	BC ZSM Lep 40393
Eudocima apta, Costa Rica, Alajuela, 18.v.2017, N10.9305° E-85.3722°, 527m, [UP]	17-SRNP-905
Eudocima apta, Costa Rica, Guanacaste, 11.vii.1998, N10.802° E-85.654°, 10m, leg Pereira, [UP]	98-SRNP-8348
Eudocima apta, Costa Rica, Guanacaste, 11.vii.2010, N10.9269° E-85.4682°, 1150m, leg. Franco, Rios, [CC]	10-SRNP-110718
Eudocima apta, Costa Rica, Guanacaste, 11.vii.2010, N10.9269° E-85.4682°, 1150m, leg. Franco, Rios, [CC]	10-SRNP-110719
Eudocima apta, Costa Rica, Guanacaste, 11.vii.2010, N10.9269° E-85.4682°, 1150m, leg. Franco, Rios, [CC]	10-SRNP-110720
Eudocima apta, Costa Rica, Guanacaste, 28.ii.2006, N10.989° E-85.426°, 675m, leg. Rios, Cambronero, [CC]	06-SRNP-101349
Eudocima apta, Ecuador, 16.x.2008, N-0.022° E-78.688°, 2310m, leg. Beck, Dietl, [ZSM]	BC ZSM Lep 32396
Eudocima aurantia, Australia, Queensland, 15.ii.1998, N-17.45° E145.32°, 800m, leg. Edwards, [ANIC]	10ANIC-05765
Eudocima aurantia, Australia, Queensland, 23.xi.1998, N-17.2° E145.4°, 760m, leg. Edwards, Sutrisno, [ANIC]	10ANIC-05764
Eudocima discrepans, China, Yunnan, 6.vii.2012. N21.613° E101.576°, 800m, leg. Kitching, Ashton, [CAS]	ARB00024168
Eudocima homaena, GenBank	MN151347
Eudocima homaena, Malaysia, Pahang, 30.v.2014, N3.357° E101.795°, 668m, leg. Barlow, [CBG]	BIOUG14394-E09
Eudocima iridescens, Australia, Queensland, 15.vii.2005, N-16.8° E145.633°, 335m, leg. Rentz, [ANIC]	10ANIC-05749
Eudocima iridescens, Australia, Queensland, 16.iii.1998, N-17.45° E145.32°, 800m, leg. Horak, [ANIC]	10ANIC-05751
Eudocima iridescens, Australia, Queensland, 30.iv.2005, N-16.8° E145.633°, 335m, leg. Rentz, [ANIC]	10ANIC-05750
Eudocima jordani, Papua New Guinea, 14.xii.1976, N-7.34° E146.715°, 1200m, leg. Hevel, Dietz IV, [USNM]	USNM ENT 01069397
Eudocima lequeuxi, South Africa, Limpopo, 27.ix.2018, N-23.649° E31.147°, 301m, leg. Mathebula, [CBG]	BIOUG45440-H10
Eudocima materna, Australia, Queensland, 15.v.2001, N-14.667° E145.467°, leg. Hebert, [CBG]	2002-QLD-1
Eudocima materna, Australia, W. Australia, 22.iv.2003, N-22.34° E118.06°, leg. Edwards, FitzGibbon, [ANIC]	10ANIC-05746
Eudocima materna, Australia, Western Australia, 1.v.2010, N-22.667° E119.387°, leg. Heath, [CBG]	BIOUG04511-G02
Eudocima materna, GenBank	KP898255
Eudocima materna, GenBank	MN151348
Eudocima materna, Pakistan, Sindh, 15.ix.2010, N26.033° E68.9333°, 22m, leg. Heath, [CBG]	NIBGE MOT-01060
Eudocima memorans, Costa Rica, Alajuela, 6.ii.2008, E10.973° E-85.315°, 288m, leg. Rios, Franco, [DJ]	08-SRNP-100738
Eudocima memorans, Costa Rica, Guanacaste, 18.ii.2007 N11.027° E-85.41°, 400m, leg Quesada, Rios, [CG]	07-SRNP-101407

TABLE 5: Collection data for DNA (COI 5') sequence vouchers from BOLD public projects not shown on figures (page 2 of 3).

Collection data	BOLD Sample ID
Eudocima okurai, Malaysia, 1.iv.1989, 1700m, leg. Butti, [USNM]	USNM ENT 01069398
Eudocima phalonia, Australia, New South Wales, 30.xii.2007, N-28.658° E153.622°, 13m, leg. Hebert, [CBG]	07-NSWBB-1186
Eudocima phalonia, Australia, Queensland, 1.i.2006, N-6.48° E145.38°, 335m, leg. Rentz, [ANIC]	ANIC Gen No. 000537
Eudocima phalonia, Australia, Queensland, 10.xii.2011, N-19.283° E146.801°, 10m, leg. Cocks, [CBG]	gvc18088-1L
Eudocima phalonia, Australia, Queensland, 14.i.2007, N-19.291° E146.786°, 10m, leg. Cocks, [CBG]	gvc6669-1L
Eudocima phalonia, Australia, Queensland, 14.ii.2009, N-21.037° E149.158°, leg. Sandery, [ANIC]	10ANIC-05759
Eudocima phalonia, Australia, Queensland, 14.xii.2009, N-21.037° E149.158°, leg. Sandery, [ANIC]	10ANIC-05756
Eudocima phalonia, Australia, Queensland, 16.xii.2005, N-6.48° E145.38°, 335m, leg. Rentz, [ANIC]	ANIC Gen No. 000518
Eudocima phalonia, Australia, Queensland, 24.iii.2010, N-26.444° E152.668°, 90m, leg. McMillan, [CBG]	IM10-0091
Eudocima phalonia, Australia, Queensland, 25.xii.2007, N-21.037° E149.158°, leg. Sandery, [ANIC]	10ANIC-05758
Eudocima phalonia, Australia, Queensland, 29.xii.2011, N-19.283° E146.801°, 10m, leg. Cocks, [CBG]	gvc18135-1L
Eudocima phalonia, Australia, Queensland, 6.xii.2003, N-19.291° E146.786°, 10m, leg. Cocks, [GC]	gvc2309-1L
Eudocima phalonia, Australia, Queensland, 7.ii.2002, N-21.037° E149.158°, leg. Sandery, [ANIC]	10ANIC-05757
Eudocima phalonia, French Polynesia, Moorea, 4.i.2007, N-17.491° E149.83°, leg. McIlroy, [U. Claude Bernard]	sc_03647
Eudocima phalonia, GenBank	KT988718
Eudocima phalonia, GenBank	KT988697
Eudocima phalonia, GenBank, India, 1.vii.2018	MN151346
Eudocima phalonia, Malaysia, Sabah, 9.ix.1983, N6° E116.54°, 1560m, leg. Hevel, Steiner, [USNM]	USNM ENT 01069228
Eudocima procus, Brazil, Santa Catarina, N-28.015° E-51.081°, 1300m, leg. Moser, [ZSM]	BC ZSM Lep 06015
Eudocima procus, Peru, Huanuco, 31.xii.2017, N-9.6136° E-74.9353°, 225m, leg. Flore, [ZSM]	BC ZSM Lep 101912
Eudocima procus, Peru, Huanuco, 31.xii.2017, N-9.6136° E-74.9353°, 225m, leg. Flore, [ZSM]	BC ZSM Lep 101925
Eudocima procus, Peru, Huanuco, 31.xii.2017, N-9.6136° E-74.9353°, 225m, leg. Flore, [ZSM]	BC ZSM Lep 101926
Eudocima salaminia, Australia, Queensland, 23.xi.2006, N-19.291° E146.786°, 10m, leg. Cocks, [CBG]°	gvc6410-1L
Eudocima salaminia, Australia, Queensland, 31.iii.2007, N-21.037° E149.158°, leg. Sandery, [ANIC]	10ANIC-05744
Eudocima salaminia, Australia, Queensland, 8.i.2007, N-21.037° E149.158°, leg. Sandery, [ANIC]	10ANIC-05745
Eudocima salaminia, GenBank	MK934830
Eudocima salaminia, Japan, 1.viii.2007, N35.2167° E138.617°, 200m, leg. Kawahara, [UM]	AYK-07-7601
Eudocima serpentifera, Costa Rica, Alajuela, 5.x.2005, N10.93° E-85.37°, 500m, leg. Sihezar, [UP]	05-SRNP-5205
Ferenta stolliana, Costa Rica, Alajuela, 18.ix.2005, N10.93° E-85.372°, 500m, leg. Sihezar, [UP]	05-SRNP-4900
Ferenta stolliana, Costa Rica, Alajuela, 20.vi.2004, N10.881° E-85.389°, 570m, leg. Araya, [UP]	04-SRNP-2444
Ferenta stolliana, Costa Rica, Alajuela, 26.vi.2005, N10.93° E-85.372°, 500m, leg. Araya, [UP]	05-SRNP-2373
Ferenta stolliana, Costa Rica, Alajuela, 7.xi.2008, N10.8777° E-85.3934°, 645m, [DH]	08-SRNP-5623
Ferenta stolliana, Costa Rica, Guanacaste, 9.vi.2018, N11.002° E-85.4617°, 590m, [UP]	18-SRNP-20201
Gloriana ornata, Myanmar, Kachin, 7.viii.2008, N25.851° E97.438°, 601m, leg. local, [RJB]	5666-080708-MY
Gonodonta bidens, Costa Rica, Guanacaste, 30.vii.2001, N11.03° E-85.527°, 280m, leg. Rios, [UP]	01-SRNP-9873
Gonodonta bidens, Ecuador, Napo, 4.x.2003, N-1.001° E-76.001°, 230m, leg. Knudson, Bordelon, [FMNH]	7160-COI-09
Gonodonta clotilda, Costa Rica, Alajuela, 7.x.2001, N10.904° E-85.287°, 410m, leg. Vargas, [UP]	01-SRNP-5755
Gonodonta clotilda, Ecuador, Napo, 4.x.2003, N-1.001° E-76.001°, 230m, leg. Knudson, Bordelon, [FMNH]	7327-COI-09
Gonodonta correcta, Costa Rica, Alejuela, 29.iii.2008, N10.973° E-85.315°, 288m, leg Quesada, Franco, [DJ]	08-SRNP-101099
Gonodonta fernandezi, Costa Rica, Alajuela, 3.xi.2003, N10.89° E-85.388°, 52m, leg Sihezar, [UP]	03-SRNP-9014
Gonodonta fulvangula, Ecuador, Napo, 4.x.2003, N-1.001° E-76.001°, 230m, leg. Knudson, Bordelon, [FMNH]	7329-COI-09
Gonodonta fulvangula, USA, Texas, 13.xi.2001, leg. Knudson, Bordelon, [FMNH]	7161-COI-09
Gonodonta holosericea, Costa Rica, Guanacaste, 20.vii.2005, N10.993° E-85.429°, 660m, leg. Moraga, [UP]	05-SRNP-32374
Gonodonta identata, Costa Rica, Guanacaste, 30.xi.2003, N10.915° E-85.463°, 1060m, leg. Ramirez, [UP]	03-SRNP-23798
Gonodonta immacula, Costa Rica, Guanacaste, 25.vi.2002, N11.032° E-85.528°, 290m, leg. Rios, [UP]	02-SRNP-15138
Gonodonta incurva, Costa Rica, Alajuela, 21.vi.2004, N10.871° E-85.387°, 700m, leg. Araya, [UP]	04-SRNP-2493
Gonodonta latimacula, C. Rica, Alajuela, 30.viii.2008, N10.973° E-85.315°, 288m, leg. Franco, Quesada, [CG]	08-SRNP-105534
Gonodonta latimacula, Costa Rica, Alajuela, 9.x.2014, N10.93° E-85.25°, 135m, [UP]	14-SRNP-76936
Gonodonta lincus, Costa Rica, Guanacaste, 29.vii.2009, N10.927° E-85.468°, 1150m, leg. Ramirez, [UP]	09-SRNP-36344
Gonodonta lincus, Costa Rica, Guanacaste, 29.vii.2009, N10.927° E-85.468°, 1150m, leg. Ramirez, [UP]	09-SRNP-36347
Gonodonta mexicana, Costa Rica, Guanacaste, 16.viii.2005, N11.019° E-85.41°, 440m, leg. Moraga, [UP]	05-SRNP-32576
Gonodonta milla, GenBank	JN674873
Gonodonta nitidimacula, Costa Rica, Guanacaste, 31.i.2005, N10.891° E-85.472°, 640m, leg. Garcia, [UP]	05-SRNP-45084

TABLE 5: Collection data for DNA (COI 5') sequence vouchers from BOLD public projects not shown on figures (page 3 of 3).

Collection data	BOLD Sample ID
Gonodonta nutrix, Costa Rica, Alajuela, 8.vii.2009, N10.933° E-85.253°, 135m, leg. Umana, [UP]	09-SRNP-44520
Gonodonta paraequalis, Costa Rica, Guanacaste, 25.x.2001, N10.748° E-85.586°, 90m, leg. Gusaneros, [UP]	01-SRNP-17190
Gonodonta pyrgo, USA, Texas, 20.x.2005, N26.2° E-98.3°, 42m, leg. Knudson, Bordelon, [FMNH]	7164-COI-09
Gonodonta pyrgo, USA, Texas, 20.x.2005, N26.2° E-98.3°, 42m, leg. Knudson, Bordelon, [FMNH]	7165-COI-09
Gonodonta sicheas, USA, Texas, 30.x.2005, N26.2° E-98.3°, 42m, leg. Knudson, Bordelon, [FMNH]	7163-COI-09
Gonodonta sinaldus, USA, Texas, 10.v.2008, N25.996° E-97.569°, 11m, leg. Kons, Borth, [HK]	3515-COI-08
Gonodonta sitia, Costa Rica, Alajuela, 26.xi.2004, N10.914° E-85.382°, 460m, leg. Araya, [UP]	04-SRNP-60521
Gonodonta syrna, Ecuador, Napo, 4.x.2003, N-1.001° E-76.001°, 230m, leg. Knudson, Bordelon, [FMNH]	7328-COI-09
Gonodonta unica, USA, Florida, 20.iii.1997, N25.792° E-81.1°, leg. Pogue, [USNM]	CCDB-20810-D10
Gonodonta uxor, Costa Rica, Alajuela, 20.iv.2017, N10.93° E-85.25°, 135m, [UP]	17-SRNP-75347
Graphigona regina complex, C. Rica, Guanacaste, 26.xii.2003, N10.915° E-85.463°, 1060m, leg. Ramirez, [UP]	03-SRNP-23580
Graphigona regina complex, C. Rica, Guanacaste, 28.x.2003, N11.011° E-85.421°, 520m, leg. Moraga, [UP]	03-SRNP-21473
Graphigona regina complex, Costa Rica, Alajuela, 12.iv.2002, M10.893° E-85.379°, 520m, leg. Espinoza, [UP]	02-SRNP-2372
Graphigona regina complex, Costa Rica, Alajuela, 17.viii.2005, M10.893° E-85.379°, 520m, leg. Espinoza, [UP]	05-SRNP-3791
Graphigona regina complex, Costa Rica, Alajuela, 27.xii.2008, N10.8777° E-85.3934°, 645m, [DJ]	08-SRNP-5961
Graphigona regina complex, Costa Rica, Alajuela, 4.i.2006, M10.893° E-85.379°, 520m, leg. Cano, [UP]	05-SRNP-7059
Graphigona regina complex, Costa. Rica, Guanacaste, N11.019° E-85.41°, 440m, leg. Rios, [UP]	05-SRNP-33480
Graphigona regina complex, Mexico, 7.xii.2006, N18.56° E-89.92°, leg. May, [El Colegio de la Frontera Sur]	MAL-00316
Oraesia aenofusa, Costa Rica, Guanacaste, 9.xi.2001, N10.996° E-85.456°, 560m, leg. Moraga, [UP]	01-SRNP-11724
Oraesia argyrosigna, PS1 Australia, Queensland, 9.i.2004, N-14.667° E145.467°, leg. Hebert, [CBG]	04HBL004421
Oraesia emarginata, Australia Queensland, 16.x.2005, N-16.48° E145.38°, 335m, leg. Rentz, [ANIC]	ANIC Gen No. 000557
Oraesia excavata, GenBank	JN401293
Oraesia excitans, Costa Rica, Guanacaste, 14.vi.2005, N10.89° E-85.48°, 550m, leg. Garcia, [UP]	05-SRNP-45369
Oraesia nobilis, Costa Rica, Guanacaste, 21.ix.2001, N11.03° E-85.527°, 280m, leg. Rios, [UP]	01-SRNP-11018
Oraesia rectristria, GenBank	JN674883
Oraesia serpens, Costa Rica, Guanacaste, 26.ix.2005, N10.927° E-85.468°, 1150m, leg. Garcia, [UP]	05-SRNP-35161
Oraesia striolata, Costa Rica, Guanacaste, 27.x.2013, N10.927° E-85.468°, 1150m, [UP]	13-SRNP-35618
Phyllodes eyndhovii, China, Yunnan, 11.vii.2012, N21.621° E101.574°, 1000m, leg. Kitching, Ashton, [CAS]	ARB00024180
Phyllodes eyndhovii, GenBank	HQ006228
Phyllodes eyndhovii, Malaysia, Pahang, 18.v.2014, N3.357° E101.795°, 668m, leg. Barlow, [CBG]	BIOUG14394-H11
Phyllodes eyndhovii, Malaysia, Pahang, 18.viii.2013, N3.357° E101.795°, 668m, leg. Barlow, [CBG]	BIOUG09048-H04
Phyllodes imperialis complex, GenBank	JN674869
Phyllodes imperialis, Australia, Queensland, 22.ii.1998, N-16.04° E145.28°, leg. Edwards, [ANIC]	10ANIC-07347
Phyllodes imperialis, Australia, Queensland, 9.ix.1998, N-17.455° E146.007°, leg. Hasenpusch, [ANIC]	10ANIC-07346
Phyllodes imperialis complex, Indonesia, Misool Island, 15.xi.2018, N-1.2° E130.2°, 205m, leg. local, [RJB]	25078-150118-IN
Phyllodes staudingeri, Vietnam, Quang Nam, 15.viii.2017, N15° E107°, 1300m, leg. Luong Le, [RJB]	22150-150817-VI
Phyllodes staudingeri, Vietnam, Quang Nam, 27.vi.2017, N15° E107°, 1300m, leg. Luong Le, [RJB]	25079-270117-VI
Phyllodes verhuelli, Indonesia, Kalimantan Timur, 14.xi.2005, N-1.61° E115.979°, 150m, leg., De Jong, [NBC]	RMNH.INS.14821
Plusiodonta amado, USA, Arizona, 2.viii.2008, N31.77° E-111.55°, 1707m, leg. Schmidt, Crabo, [CNC]	CNCLEP00062903
Plusiodonta arctipennis, Australia, New S. Wales, 17.xii. 2005, N-31.59° E152.476°, 118m, leg. Hebert, [CBG]	06-NSWE-01353
Plusiodonta casta, GenBank	JN674879
Plusiodonta clavifera, C. Rica, Guanacaste, 12.viii.2007, N10.894° E-85.436°, 835m, leg. Franco, Quesada, [CC]	07-SRNP-108030
Plusiodonta coelonota, Australia, Queensland, 7.vii.1998, N-12.43° E143.18°, leg. Cardale, [ANIC]	10ANIC-05585
Plusiodonta compressipalpis, USA, Florida, 29.ix.2007, N29.599° E-82.365°, 20m, leg. Kons, [HLK]	1857-COI-07
Plusiodonta compressipalpis, USA, Kentucky, 7.ii.2008, N36.995° E-82.985°, 2500m, leg. Borth, [RJB]	5925-030708-KY
Plusiodonta compressipalpis, USA, Texas, 9.vi.2008, N29.35° E-99.055°, 242m, leg. Kons, Borth, [HLK]	3787-COI-08
Plusiodonta effulgens, Costa Rica, Guanacaste, 6.i.2005, N11.019° E-85.41°, 440m, leg. Moraga, [UP]	04-SRNP-56442
Plusiodonta gueneei, Madagscar, Toamasina, 6.xi.2018, N-18.94° E48.41°, 938m, leg. Golovizin, [RJB]	25061-061118-MA
Plusiodonta incitans, Costa Rica, Guanacaste, 9.vii.2010, N10.9269° E-85.4682°, 1150m, leg. Rios, Franco, [CC]	10-SRNP-110248
Plusiodonta megista, Malaysia, Sabah, 18.iii.2014, N5.612° E116.447°, 1189m, leg. Maslov, [CBG]	BIOUG12317-A08
Plusiodonta nigissima, C. Rica, Guanacaste, 19.iii.2018, N10.97° E-85.32°, 385m, leg. Franco, Cambron, [UP]	18-SRNP-101321
Plusiodonta wahlbergi, Uganda, 23.xi.2019, N0.518° E30.302°, 1519m, leg. Golovizin, [RJB]	25062-231119-UG

Not all fruit-piercers are within the Calpinae and examples of other fruit-piercers are included for comparison. In Zilli *et al*. (2021) Bänziger observes that the genus *Platyja* (Fig. 96: H) uses its scleratized proboscis with blade-like bristles to slash fruit pulp to release its sap rather than piercing a hole through the skin. A possible fruit-feeding relative of *Platyja* is *Ischyja* (Homziak *et al*. 2019) which RJB has found exploiting wounded (Fig. 96: E) and especially fallen fruit. Bänziger (1982) also mentions the common *Artena dotata* (Fig. 96: G) and *Thyas honesta*

(Fig. 96: I) as fruit-piercers on mandarin and longan. The fruit-sucking genus *Catocala* is shown here feeding on soft Asian pear (Fig. 96: F).

Of over 4,000 images of Phyllodini and Ophiderini on iNaturalist reviewed by RJB, the most commonly observed species was the pest *Eudocima phalonia*. This species accounted for about a quarter of all *Eudocima* observations while *E. materna* and *E. homaena* together added another 25%. The great majority of leaf-mimic fruit-piercing moths are not considered of economic significance. Preserving their natural habitat can help protect these species while helping to control damage caused by population increases in the pest species which thrive in disturbed habitats.

Acknowledgements

We thank the following individuals for providing specimens, literature, images, access to equipment or collections under their care, and/or hospitality during trips: Gottfried Behounek, Merla Borth, Steve Bransky, Vernon Brou, John Brown and Scott Miller (USNM), Mathew Cock, Adam Cotton, Larry Gall (YPM, USA), Benny De Groof, Vadim Golovinski, Jerry Goth, Vladimir Gurko, Alex Hausmann and Wolfgang Speidel (ZSM, Germany), Kyle Johnson, Hugo and Sharon Kons Sr, Aidas Saldaitis (NRC, Lithuania), J. Bo Sullivan, Jöel Minet (NMHN, France), Cathy Wakefield, Christian Wieser and Carlos Lopez Vaamonde (SMC, Austria), Dan Young (UW, USA) and Alberto Zilli with Trustees of the Natural History Museum (NHMUK, UK). Paul Hebert's BOLD (Barcode of Life Data Systems) lab at the University of Guelph (Canada) sequenced COI 5' for our Lepidoptera samples and Evgeny Zakharov and his staff managed the data. We thank the many iNaturalist observers attributed in Table 4 for sharing live photos of these species. We are grateful to Juarte De Prins, Willy De Prins and Wolfgang Speidel for review of this manuscript.

References

Aurivillius, C. (1910) Schmetterlinge gesammelt in Westafrika von Leonardo Fea in den Jahren 1897–1902. *Annali del Museo Civico di Storia Naturale di Genova*, 3 (4), 494–530.

Bänziger, H. (1982) Fruit-piercing moths (Lepidoptera: Noctuidae) in Thailand: a general survey and some new perspectives. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft,* 55, 213–240.

Bänziger, H. (1985) Description of *Othreis srivijayana* n. sp., and notes on related fruit-piercing moths of the Indomalayan region (Lep., Noctuidae). *Heterocera Sumatrana*, 2, 41–48.

Bänziger, H. & Honey, M.R. (1984) Description of *Adris suthepensis* n. sp., a suspected fruit-piercing (Lepidoptera: Noctuidae) from N. Thailand and contiguous mountain regions. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft, Bulletin de la Société Entomologique Suisse*, 57, 173–177.

Baptist, B.A. (1944) The fruit-piercing moth (*Othreis fullonica* L.) with special reference to its economic importance. *Indian Journal Entomology*, 6, 1–13.

Berio, E. (1941) Contributo alla studio dei lepidotteri eteroceri dell'Eritrea VII. Euchromiidae, Arctiidae, Agaristidae, Lymantriidae, Lasiocampidae, Noctuidae raccolte dal sig. G. Vaccaro nel. *Annali del Museo Civico di Storia Naturale di Genova*, 61, 176–190.

BOLD Systems (2021) Taxonomy Browser. Available from: http://www.barcodinglife.org/index.php/TaxBrowser_Home (accessed 15 May 2022)

Boisduval, J.B.A.D. de (1832) *Voyage de découvertes de l'Astrolabe exécuté par ordre du Roi, pendant les années 1826–1827–1828–1829, sous le commandément de M. J. Dumont d'Urville. Faune entomologique de l'Océan Pacifique, avec l'illustration des insectes nouveaux recueillis pendant le voyage, premiere partie.* J. Tastu, Paris, 267 pp.

Boisduval, J.B.A.D. de (1833) *Faune Entomologique de Madagascar, Bourbon et Maurice. Lépidoptères.* Jules Didot L'aine, Paris, 122 pp.

Boisduval, J.B.A.D. de & Guenée, A. (1852) *Histoire naturelle de insectes, species général des Lépidoptères*. *Noctuélites. Tome 2*. Roret, Paris, 443 pp.

Boisduval, J.B.A.D. de & Guenée, A. (1852a) *Histoire naturelle de insectes, species général des Lépidoptères*. *Noctuélites. Tome 3.* Roret, Paris, 441 pp.

Brou, V.A. (1994) New records of two fruit-piercing moths encountered in Louisiana and other southern states. *Southern Lepidopterists' News*, 16, 39–40.

Brou, V.A. (2006) A new US record for the tropical fruit-piercing moth *Eudocima serpentifera* (Walker, [1858]). *Southern Lepidopterists' News*, 28, 105–108.

Brou, V.A. & Núñez Águila, R. (2013) *Eudocima toddi* (Zayas, 1965) (Lepidoptera: Erebidae) a rare and endemic species of Cuba. *Southern Lepidopterists' News*, 35, 92–93.

Brou, V.A. & Zilli, A. (2016) An overlooked sibling of the fruit-piercing moth *Eudocima phalonia* (Linnaeus, 1763) from Africa (Lepidoptera, Erebidae, Calpinae). *Zootaxa*, 4109 (3), 391–399.
https://doi.org/10.11646/zootaxa.4109.3.9

Butler, A.G. (1882) Descriptions of new species of Lepidoptera, chiefly from Duke-of-York Island and New Britain. *Annals and Magazine of Natural History*, Series 5, 10 (57), 226–238.
https://doi.org/10.1080/00222938209459698

Butler, A.G. (1895) *Adris sikhimensis*, a new form of the Ophideroid group of noctuid moths. *Annals and Magazine of Natural History*, Series 6, 15 (85), 126.
https://doi.org/10.1080/00222939508677853

Cheraghian, A.C. (2015) *A guide for diagnosis and detection of quarantine pests-Fruit sucking moth, Eudocima fullonia (Clerck, 1764), Lepidoptera: Noctuidae*. Bureau of Plant pest surveillance and pest risk analysis, Ministry of Jihad-e-Agriculture, Tehran, 15 pp.

Chikkalaki, P., Shivanappagol, D., Metigud, V., Balavalad, K.B. & Sankangoudar, K. (2018) Repellent for *Eudocima materna*: a Fruit Piercer/Sucking moth. *International Journal of Engineering Research & Technology*, 7 (5), 621–625.

Caballero, R., Habeck, D. & Andrews, K. (1994) Clave ilustrada para larvas de noctúidos de importancia económica de El Salvador, Honduras y Nicaragua. *CEIBA*, 35 (2), 225–237.

Clerck, C.A. (1764) *Icones insectorum rariorum cum nominibus eorum trivialibus, locisque e C. Linnaei. Sectio Secunda*. s.n., Stockholm, pls. 17–55.

Cochereau, P. (1973) Natural biological control of fruit-piercing moths. *Fruits*, 28 (5), 367–375.

Cochereau, P. (1977) Biology and ecology of populations in New Caledonia of a fruit-piercing moth: *Othreis fullonia* Clerck (Lepidoptera, Noctuidae, Catocalinae). *Travaux et Documents de l'O.R.S.T.O.M.*, 71, 1–322.

Comstock, J.A. (1963) A fruit-piercing moth of Samoa and the South Pacific Islands. *The Canadian Entomologist*, 95 (2), 218–222.
https://doi.org/10.4039/Ent95218-2

Cramer, P. (1775–1776) *De uitlandsche kapellen voorkomende in de drie waereld-deelen Asia, Africa en America, by een verzameld en beschreeven 1.* S.J. Baalde, Amsterdam and Barthelmemy Wild, Utrecht, 156 pp., 96 pls.

Cramer, P. (1777) *De uitlandsche kapellen voorkomende in drie waereld-deelen Asia, Africa, en America by een verzameld en beschreeven 2.* S.J. Baalde & Barthelmemy Wild, Amsterdam & Utrecht, 152 pp., pls. 97–192.

Cramer, P. & Stoll, C. (1780–1782) *De uitlandsche kapellen voorkomende in drie waereld-deelen Asia, Africa, en America by een verzameld en beschreeven 4.* S.J. Baalde & Barthelemy Wild, Amsterdam & Utrecht, 252 pp., pls. 289–400.
https://doi.org/10.5962/bhl.title.65748

Davis, E.E., French, S. & Venette, R.C. (2005) *Mini Risk Assessment Fruit piercing Moth: Eudocima fullonia Green [Lepidoptera: Noctuidae].* CAPS PRA, US Department of Agriculture Animal and Plant Health Inspection Service, St. Paul, Minnesota, 43 pp.

De Prins, J. & De Prins, W. (2011–2021) Afromoths, online database of Afrotropical moth species (Lepidoptera). World Wide Web electronic publication. Available from: http://www.afromoths.net/ (accessed 29 September 2021)

De Vos, R. & Zilli, A. (2021) The Phyllodini (Lepidoptera: Erebidae, Calpinae) of Papua Indonesia. *In*: *The insects of Papua Indonesia*. Papua Insects Foundation. Available from: https://www.papua-insects.nl/insect%20orders/Lepidoptera/Erebidae/Calpinae/Phyllodini/Phyllodes%20imperialis.htm (accessed 1 August 2021)

Dognin, P. (1912) *Hétérocères nouveaux de l'Amérique du Sud. Fascicule VI*. Oberthür, Rennes, 51 pp.

Druce, H. (1888) Descriptions of new species of Lepidoptera. *Annals and Magazine of Natural History*, Series 6, 2 (9), 234–242.
https://doi.org/10.1080/00222938809460917

Fabricius, J.C. (1775) *Systema Entomologiae sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus.* Kort, Flensburg and Leipzig, 832 pp.
https://doi.org/10.5962/bhl.title.36510

Fay, H.A.C. (2002) Fruitpiercing moths and fruitspotting bugs: Intractable pests of tree fruits in a reduced-insecticide environment. *Acta Horticulturae*, 575, 485–493.
https://doi.org/10.17660/ActaHortic.2002.575.56

Feige, R. (1976) Eine übersehene Noctuidae aus Malaysia: *Othreis kinabaluensis* n. sp. (Lep.). *Entomologische Zeitschrift*, 86, 188–190.

Felder, C. (1861) Lepidopterorum Amboienesium a Dre. L. Doleschall annis 1856–58 collectorum species novae diagnosibus collustratae a Dre. C. Felder. II. Heterocera. *Sitzungsberichte der kaiserlichen Akademie de Wissenschaften. Mathematisch-Naturwissenschaftliche Classe*, 43, 26–44.

Felder, C., Felder, R. & Rogenhofer, A.F. (1874) Atlas der Heterocera Sphingida-Noctuida. Heft 4. *In*: Felder, C., Felder, R. & Rogenhofer, A.F. (Eds.), *(["1864"] 1865–1875), Reise der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. Von Wüllerstorf-Urbair Zoologischer Theil. Zweiter Band. Zweite Abtheilung. Lepidoptera*. Hof-und Staatsdruckerei, Vienna, pls. 108–120.

Gilligan, T.M. & Passoa, S.C. (2014) *Screening aid: Fruit piercing moth, Eudocima phalonia (Linnaeus). Identification Tech-*

nology Program (ITP). USDA-APHIS-PPQ-S&T, Fort Collins, Colorado, 4 pp.

Goddard, M., Hill, M.P. & Moore, S.D. (2019) An Analysis of the Fruit-Sucking and Fruit-piercing Moth Complex in Citrus Orchards in South Africa. *African Entomology*, 27 (1), 1–9.
https://doi.org/10.4001/003.027.0001

Golding, F.D. (1946) Fruit-piercing Lepidoptera in Nigeria. *Bulletin of Entomological Research*, 36 (2), 181–184.
https://doi.org/10.1017/S0007485300024019

Goloboff, P.A., Farris J.S. & Nixon K.C. (2008) TNT, a free program for phylogenetic analysis. *Cladistics*, 24, 1–13.
https://doi.org/10.1111/j.1096-0031.2008.00217.x

Griveaud, P. & Viette, P.E.L. (1960) Nouvelles espéces malgaches de noctuelles quadrifides (Lepidopteres). *Bulletin de l'Academie Malgache*, New Series, 38, 53–62.

Grünberg, K. (1907) Einige neue afrikanische Heteroceren (Lep.). *Deutsche Entomologische Zeitschrift*, 1907, 431–437, pl. 4.

Guenée, A.M. (1852) *Histoire naturelle des Insectes. VII. Species général des Lépidoptères. Noctuélites. Tome III.* Librairie Encyclopédique de Roret, Paris, 442 pp.

Guillermet, C. (2005) *Les Hétérocères ou papillons de nuit, de l'île de La Réunion. Vol. 1. Famille des Noctuidae Quadrifides*. Association Nature Découverte et Partage, Réunion, Saint-Gilles-les-Hauts, 532 pp., pls. 1–13.

Hampson, G.F. (1902) The moths of South Africa (Part II) Noctuidae. *Annals of the South African Museum*, 2, 255–446.

Hampson, G.F. (1913) *Catalogue of the Lepidoptera Phalaenae in the collection of the British Museum (Natural History). Vol. 12. Noctuidae 2.* Taylor and Francis, London, 626 pp.

Hampson, G.F. (1916) On a collection of moths made in Somaliland by Mr. W. Feather. *Proceedings of the Zoological Society of London 1916*, 86 (1), 91–182, pls. 1–2.
https://doi.org/10.1111/j.1096-3642.1916.tb02011.x

Hampson, G.F. (1926) *Descriptions of new genera and species of Lepidoptera Phalaenae of the subfamily Noctuinae (Noctuidae) in the British Museum (Natural History)*. Taylor and Francis, London, 641pp.

Handfield, L. (1999) *Le guide des Papillons du Québec*. Broquet Inc., Saint-Constant, Quebec, 536 pp.

Hargreaves, E. (1936) Fruit-piercing Lepidoptera in Sierra Leone. *Bulletin of Entomological Research*, 27 (4), 589–605.
https://doi.org/10.1017/S0007485300058685

Hernández-Ruiz, A., Illescas-Riquelme, C.P., Bautista-Martínez, N., Vargas-Abasolo, R., Valdez-Carrasco, J.M. & Figueroa-Castro, P. (2017) Identification of Fruit-piercing Moths (Lepidoptera: Erebidae) and Damage Caused to Papaya Fruit in Mexico. *Entomological News*, 126 (5), 415–420.
https://doi.org/10.3157/021.126.0511

Holland, W.J. (1900) The Lepidoptera of Buru. Part II. Heterocera. *Novitates Zoologicae*, 7 (3), 555–591.
https://doi.org/10.5962/bhl.part.17458

Holloway, J.D. (2005) The moths of Borneo (parts 15 and 16): family Noctuidae, subfamily Catocalinae. *Malayan Nature Journal*, 59 (1–4), 1–529.

Homziak, N.T., Breinholt, J.W., Branham, M.A., Storer, C.G. & Kawahara, A.Y. (2019) Anchored hybrid enrichment phylogenomics resolves the backbone of erebine moths. *Molecular Phylogenetics and Evolution*, 131, 99–105.
https://doi.org/10.1016/j.ympev.2018.10.038

Hübner, J. ([1823] 1816) *Verzeichniss bekannter Schmetterlinge*. J. Hübner, Augsburg, 431 pp.
https://doi.org/10.5962/bhl.title.48607

Janzen, D.H. & Hallwachs, W. (2009) Dynamic database for an inventory of the macrocaterpillar fauna, and its food plants and parasitoides, of Area de Conservacion Guanacaste (ACG), northwestern Costa Rica (nn-SRNP-nnnnn voucher codes). Available from: http://janzen.sas.upenn.edu (accessed 3 August 2021)

Joannis, J. de (1912) Description de trois espèces nouvelles de Catocalinae (Lep. Noctuidae). *Bulletin de la Société entomologique de France*, 17 (15), 331–336.

Kawahara, A.Y., Plotkin, D., Espeland, M., Meusemann, K., Toussaint, E.F.A., Donath, A., Gimnich, F., Frandsen, P.B., Zwick, A., Reis, M.D., Barber, J.R., Peters, R.S., Liu, S., Zhou, X., Mayer, C., Podsiadlowski, L., Storer, C., Yack, J.E., Misof, B. & Breinholt, J.W. (2019) Phylogenomics reveals the evolutionary timing and pattern of butterflies and moths. *Quadrifina*, 5, 153–207.
https://doi.org/10.5061/dryad.j477b40.

Klem, C.C. & Zaspel, J.M. (2019) Pest Injury Guilds, Lepidoptera, and Placing Fruit-piercing Moths in Context: A Review. *Annals of the Entomological Society of America*, 112 (5), 421–432.
https://doi.org/10.1093/aesa/saz031

Kimball, C.P. (1965) *Arthropods of Florida and neighboring land areas. Vol. 1. Lepidoptera of Florida.* Florida Department of Agriculture, Gainesville, Florida, 363 pp.

Kons, H.L. Jr. & Borth, R.J. (2006) Contributions to a study of the diversity, distribution, habitat association and phenology of the Lepidoptera of Northern Florida. *North American Journal of Lepidoptera Biodiversity*, 1, 1–213.

Leech, J.H. (1900) Lepidoptera Heterocera from Northern China, Japan and Corea. Part IV. *Transactions of the Entomological Society of London*, 48 (4), 511–664.
https://doi.org/10.1111/j.1365-2311.1900.tb02720.x

Leong, T.M. (2009) Final Instar Caterpillar and Metamorphosis of *Eudocima smaragdipicta* (Walker) (Lepidoptera: Noctuidae: Calpinae). *Nature in Singapore*, 2, 177–182.

Leroy, L., Mille, C. & Fogliani, B. (2021) The Common Fruit-Piercing Moth in the Pacific Region: A Survey of the Current State of a Significant Worldwide Economic Pest, *Eudocima phalonia* (Lepidoptera: Erebidae), with a Focus on New Caledonia. *Insects*, 12 (2), 117.
https://doi.org/10.3390/insects 12020117

Linnaeus, C. (1763) *Centuria In sectorum Rariorum*. s.n., Upsalia, 32 pp.

Linnaeus, C. (1767) *Systema naturae. Editio duodecima reformata. Tome 1. Part 2.* L. Salvius, Stockholm, 533–1327.

Lucas, T.P. (1894) Australian Lepidoptera: Thirty new species. *Transactions of the Natural History Society of Queensland*, 1, 103–116.

Maddison, W.P. & Maddison D.R. (2011) Mesquite: A Modular System for Evolutionary Analysis. Version 2.75. Available from https://mesquiteproject.org (accessed 15 May 2022)

Marsberg, T., Hill, M.P., Moore, S.D. & Timm, A.E. (2015) DNA-based identification of Lepidoptera associated with citrus in South Africa. *African Entomology*, 23 (1), 165–171.

Mitter, C. (1988) Taxonomic Potential of Some Internal Reproductive Structures in *Catocala* (Lepidoptera: Noctuidae) and Related Genera. *Annals of the Entomological Society of America*, 81 (1), 10–18.
https://doi.org/10.1093/aesa/81.1.10

Moore, F. (1877) The lepidopterous fauna of the Andaman and Nicobar Islands. *Proceedings of the scientific Meetings of the Zoological Society of London*, 1877 (3), 580–632, pls. 58–60.

Moore, F. (1882) s.n. *In*: *Descriptions of new Indian lepidopterous insects from the collection of the Late Mr. W.S. Atkinson. Heterocera (continued) (Cymatophoridae–Herminiidae). Part II.* Taylor and Francis, London, pp. 89–198, pls. 4–6.

Muller, H.R.A. (1939) Overzicht van de belangrijkste citrus–ziekten in Nederlands Indië. *Landbouw*, 15, 249–290.

Ngampongsai, A., Barrett, B., Permkam, S., Suthapradit, N. & Nilla-or, R. (2005) A preliminary study on some ecological aspects of the fruit piercing moths in Songkhla Province of Southern Thailand. *Songklanakarin Journal of Science and Technology*, 27, 1135–1145.

Nixon, K. (2002) WinClada Software. Version 1.00.08. Published by the author, Ithaca, New York. Available from: https://www.claudistics.com/aboutWinc.htm (accessed 15 May 2022)

Okano, M. (1964) New or little known moths from Formosa (5). *Tohoku Konchu, Morioka*, 1, 41–44.

Olliff, A.S. (1889) Description of a new moth of the genus Phyllodes. *Proceedings of the Linnean Society of New South Wales*, 4, 113–116.
https://doi.org/10.5962/bhl.part.15038

Pagenstecher, A. (1886) Beiträge zur Lepidopteren-Fauna des malayischen Archipels, 3. Heteroceren der Aru-Insein, Kei-Insein und von Südwest-Neu-Guinea. *Jahrbücher des nassauischen Vereins für Naturkunde*, 39, 104–194, pl. 10.

Pagenstecher, A. (1907) Wissenschaftliche Ergebnisse 2. Systematische Arbeiten, Bd 2, Hft 2 (Lepidoptera Heterocera von Madagaskar, den Comoren und Ostafrika: Uraniidae, Geometridae, Noctuidae, Pyralidae, Thyrididae *In*: Voeltzkow, A. (Ed.), *Reise in Ostafrika in den Jahren 1903–05.* Schweizerbartsche Verlagsbuchhandlung, Stuttgart, pp. 93–146, pl. 6.

Prout, A.E. (1922) On some apparently new species and forms of Noctuidae. Collected by C., F., and J. Pratt, in the mountains of central Ceram, October, 1919 to February, 1920. *Bulletin of the Hill Museum*, 1 (2), 193–251.

Prout, A.E. (1924) Some apparently new Noctuidae from Sumatra, New Guinea, Mefor, and Buru. *Bulletin of the Hill Museum*, 1 (3), 427–450, pls. 13–15.

Prout, A.E. (1928) Descriptions of some Indo-Australian Noctuidae. *Bulletin of the Hill Museum*, 2, 256–270.

Robinson, G.S. (1968) Some new species of Lepidoptera from the Fiji Islands. *The Entomologist's Record and Journal of Variation*, 80, 249–255, pl. 14.

Roland, K.J.H., Leong, C.T.S. & Kundat, F.R. (2012) Biology and ecology of fruit piercing moth *Eudocima phalonia* (L.) in a citrus orchard in Sarawak, Malaysia. *Journal of Tropical Biology & Conservation*, 9 (2), 176–182.

Richards, A.G. Jr. (1933) Comparative skeletal morphology of the noctuid tympanum. *Entomologica Americana*, New Series, 13, 1–84.

Saalmüller, M. (1880) Neue Lepidopteren aus Madagascar, die sich in Museum der Senckenberg'schen naturforschenden Gesellschaft befinden. *Bericht über die Senckenbergische Naturforschende Gesellschaft in Frankfurt a.M.*, 1879–1880, 258–310.

Saalmüller, M. (1892) *Lepidoptoren von Madagaskar*. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt, 405 pp., fig. 208.

Sands, D.P.A., Schotz, M. & Bourne, A.S. (1991) Effects of temperature on development and seasonality of *Eudocima salaminia* (Cramer) (Lepidoptera: Noctuidae) in eastern Australia. *Bulletin of Entomological Research*, 81 (3), 291–296.
https://doi.org/10.1017/S0007485300033563

Sands, D.P.A. & Liebregts, W. (2005) Biological control of Fruit Piercing moth (Eudocima fullonia [Clerk]) (Lepidoptera: Noctuidae) in the Pacific: Exploration, specificity, and evaluation of parasitoids. *Proceedings of the Second International Symposium on Biological Control of Arthropods, Davos, Switzerland*, 12–16 September 2005, 267–276.

Sands, D.P.A. (2012) Review of Australian *Phyllodes imperialis* Druce (Lepidoptera: Erebidae) with description of a new subspecies from subtropical Australia. *Australian Entomologist*, 39 (4), 281–282.

Schaus, W. (1911a) New species of Heterocera from Costa Rica - IV. *Annals and Magazine of Natural History*, Series 8, 7 (37), 33–84.
https://doi.org/10.1080/00222931108692905

Schaus, W. (1911b) New species of Heterocera from Costa Rica - IV. *Annals and Magazine of Natural History*, Series 8, 7 (38), 173–193.
https://doi.org/10.1080/00222931108692920

Semper, G. (1901) *Die Schmetterlinge der Philippinischen Inseln 2: Die Nachtfalter, Heterocera*.C.W. Kreidel, Wiesbaden, 576 pp., pl. 61, fig. 5.

Shure, D.J., Mooreside, P.D. & Ogle, S.M. (1998) Rainfall effects on plant-herbivore processes in an upland oak forest. *Ecology*, 79 (2), 604–617.
https://doi.org/10.2307/176957

Snyder, J.L., Zilli, A. & Zaspel, J.M. (2020) Evidence for the dissolution of the *Calyptra minuticornis novaepomeraniae* (Strand) and *C. minuticornis minuticornis* (Guenée) sub–species distinction (Insecta: Lepidoptera: Erebidae). *Insect Systematics & Evolution*, 51 (4), 784–809.
https://doi.org/10.1163/1876312X-00001010

Speidel, W., Fänger, H. & Naumann, C.M. (1996) The surface microstructure of the noctuid proboscis (Lepidoptera: Noctuidae). *Zoologischer Anzeiger*, 234, 307–315.

Srygley, R.B., Dudley, R., Oliveira, E.G., Aizprúa, R., Pelaez, N.Z. & Riveros, A.J. (2010) El Niño and dryseason rainfall influence hostplant phenology and an annual butterfly migration from Neo-tropical wet to dry forests. *Global Change Biology*, 16 (3), 936–945.
https://doi.org/10.1111/j.1365-2486.2009.01986.x

Srygley, R.B., Dudley, R., Oliveira, E.G., Aizprúa, R., Pelaez, N.Z. & Riveros, A.J. (2014) El Niño, hostplant growth, and migratory butterfly abundance in a changing climate. *Biotropica*, 46 (1), 90–97.
https://doi.org/10.1111/btp.12081

Stoll, C. (1787) *Aanhangsel van het Werk, de Uitlandsche Kapellen, Voorkomende in Drie Waereld-Deelen Asia, Africa, en America*. Chez Nic. Th. Gravius, Amsterdam, 42 pp.

Stoll, C. (1790) s.n. *In*: *Aahangsel van het Werk, de Uitlandsche Kapellen, Voorkomende in Drie Waereld-Deelen Asia, Africa, en America.* Chez Nic. Th. Gravius, Amsterdam, pp. 43–184.

Terrell, C. (2021) (PDF file) Morphological genitalia variation in *Eudocima phalonia.* Available from: from: https://ag.purdue.edu/entm/ENTM493Capstone Summaries/CatherineTerrell.pdf (accessed 15 May 2021)

Van Vollenhoven, S.C.S. (1857) *Phyllodes verhuellii*. Nieuwe vlindersoort uit Java. *Tijdschrift voor entomologie*, 1, 159–162, pl. 8.

Van Vollenhoven, S.C.S. (1858) *Phyllodes eyndhovii*. Nieuwe vlindersoort uit Java. *Tijdschrift voor entomologie*, 2, 86–89, pl. 6., fig. 1.

Vári, L., Kroon, D.M. & Krüger, M. (2002) *Classification and checklist of the species of Lepidoptera recorded in Southern Africa.* Published by the authors, Sasolburg, 385 pp.

Viette, P.E.L. (1968) Noctuelles quadrifies de Madagascar nouvelles ou peu connus, III. [Lep. Noctuidae]. *Lambillionea*, 67, 9–20.

Viette, P. (1974) Sur quelques Catocalinae de Madagascar (Lep. Noctuidae). *Bulletin de la Société entomologique de France*, 79 (7–8), 212–213.
https://doi.org/10.3406/bsef.1974.21406

Waldkircher, G., Webb, M.D. & Maschwitz, U. (2004) Description of a new shieldbug (Heteroptera: Plataspidae) and its close association with a species of ant (Hymenoptera: Formicidae) in Southeast Asia. *Tijdschrift voor Entomologie*, *147* (1), 21–28.
https://doi.org/10.1163/22119434-900000133

Walker, F. (1858) s.n. *In*: *List of the specimens of lepidopterous insects in the collection of the British Museum. Vol. 13.* Trustees of the British Museum, London, pp. 983–1236.

Walker, F. (1867a) *Catalogue of the specimens of heteropterous-Hemiptera in the collection of the British Museum*. *Vol. 1.* Trustees of the British Museum, London, 240 pp.
https://doi.org/10.5962/bhl.title.118688

Walker, F. (1867b) Characters of undescribed heterocerous Lepidoptera. *Journal of the Proceedings of the Linnean Society*, 9, 181–199.
https://doi.org/10.1111/j.1096-3642.1867.tb00191.x

Walker, F. (1869) On some lepidopterous insects from Congo. *Proceedings of the Natural History Society of Glasgow*, Series 2, 1, 325–378.

Waterhouse, D.F. & Norris K.R. (1987) *Biological Control: Pacific Prospects*. Inkata Press, Melbourne, 454 pp.

Westwood, J.O. (1848) *The cabinet of oriental entomology: being a selection of some of the rarer and more beautiful species of insects, natives of India and the adjacent islands, the greater portion of which are now for the first time described and figured.* William Smith, London, 88 pp.
https://doi.org/10.5962/bhl.title.34273

Yoshimoto, H. (1999) A new species of the genus *Othreis* Hübner (Noctuidae, Ophiderinae) from Myanmar. *Transactions of the Lepidopterological Society of Japan*, 50 (1), 60–62.

Younghusband, J.E. (1979) The life-history and description of the fruit-piercing moth, *Elygea-materna* (*Othreis*) Billberg, with brief notes on the related species *Othreis fullonia*(Clerck) and *Othreis divitiosa* Wlk. *Rhodesia Agricultural Journal*, 76

(3), 119–121.

Zahiri, R., Kitching, I.J., Lafontaine, J.D., Mutanen, M., Kaila, L., Holloway, J.D. & Wahlberg, N. (2011) A new molecular phylogeny offers hope for a stable family level classification of the Noctuoidea (Lepidoptera). *Zoologica Scripta*, 40, 158–173.

Zahiri, R., Holloway, J.D., Kitching, I.J., Lafontaine, J.D., Mutanen, M. & Wahlberg, N. (2012) Molecular phylogentics of Erebidae (Lepidoptera, Noctuoidea). *Systematic Entomology*, 37 (1), 102–124.
https://doi.org/10.1111/j.1365-3113.2011.00607.x

Zaspel, J.M. & Branham M.A. (2008) World Checklist of Tribe Calpini (Lepidoptera: Noctuidae: Calpinae). *Insecta Mundi*, 47, 1–15.

Zaspel, J.M. (2008) *Systematics, Biology, and Behavior of Fruit-piercing and Blood-Feeding Moths in the Subfamily Calpinae (Lepidoptera: Noctuidae)*. Ph.D. Thesis, University of Florida, Gainsville, Florida, 239 pp.

Zaspel, J.M., Weller, S.J. & Branham, M.A. (2011) A comparative survey of proboscis morphology and associated structures in fruit-piercing, tear-feeding, and blood-feeding moths in Calpinae (Lepidoptera: Erebidae). *Zoomorphology*, 130, 203–225.
https://doi.org/10.1007/s00435-011-0132-1

Zaspel, J.M., Zahiri, R., Hoy, M.A., Janzen, D., Weller, S.J. & Wahlberg, N. (2012) A molecular phylogenetic analysis of the vampire moths and their fruit-piercing relatives (Lepidoptera: Erebidae: Calpinae). *Molecular Phylogenetics and Evolution*, 65 (2), 786–791.
https://doi.org/10.1016/j.ympev.2012.06.029

Zayas, F. (1965) Dos nuevas especies de insectos cubanos de los ordres Lepidoptera (Noctuidae) y Orthoptera (Tettigoniidae). *Poeyana*, Series A, 5, figs 1–8.

Zilli, A. & Hogenes, W. (2002) An annotated list of the fruit-piercing moth genus *Eudocima*Billberg, 1820 (sensu Poole) with descriptions of four new species (Lepidoptera: Noctuidae, Catocalinae). *Quadrifina*, 5, 153–207.

Zilli, A., Brou, V.A., Klem, C. & Zaspel, J. (2017) The *Eudocima* Billberg, 1820 of the Australian Region (Lepidoptera: Erebidae). *In*: Telnov, D. (Ed.), *Biodiversity, Biogeography and Nature Conservation in Wallacea and New Guinea. Vol. 3*. The Entomological Society of Latvia, Riga, pp. 631–655, pls. 152–166.

Zilli, A., Vos, R. de & Edwards, E.D. (2021) The torsilinea species group (subgenus Mocrendes Nye, 1975) of the genus *Platyja* Hübner, [1823] (Lepidoptera: Erebidae), with descriptions of four new species. *In*: Telnov D., Barclay, M.V.L. & Pauwels, O.S.G. (Eds.), *Biodiversity, Biogeography and Nature Conservation in Wallacea and New Guinea. Vol. 4*. The Entomological Society of Latvia, Riga, pp. 413–430.

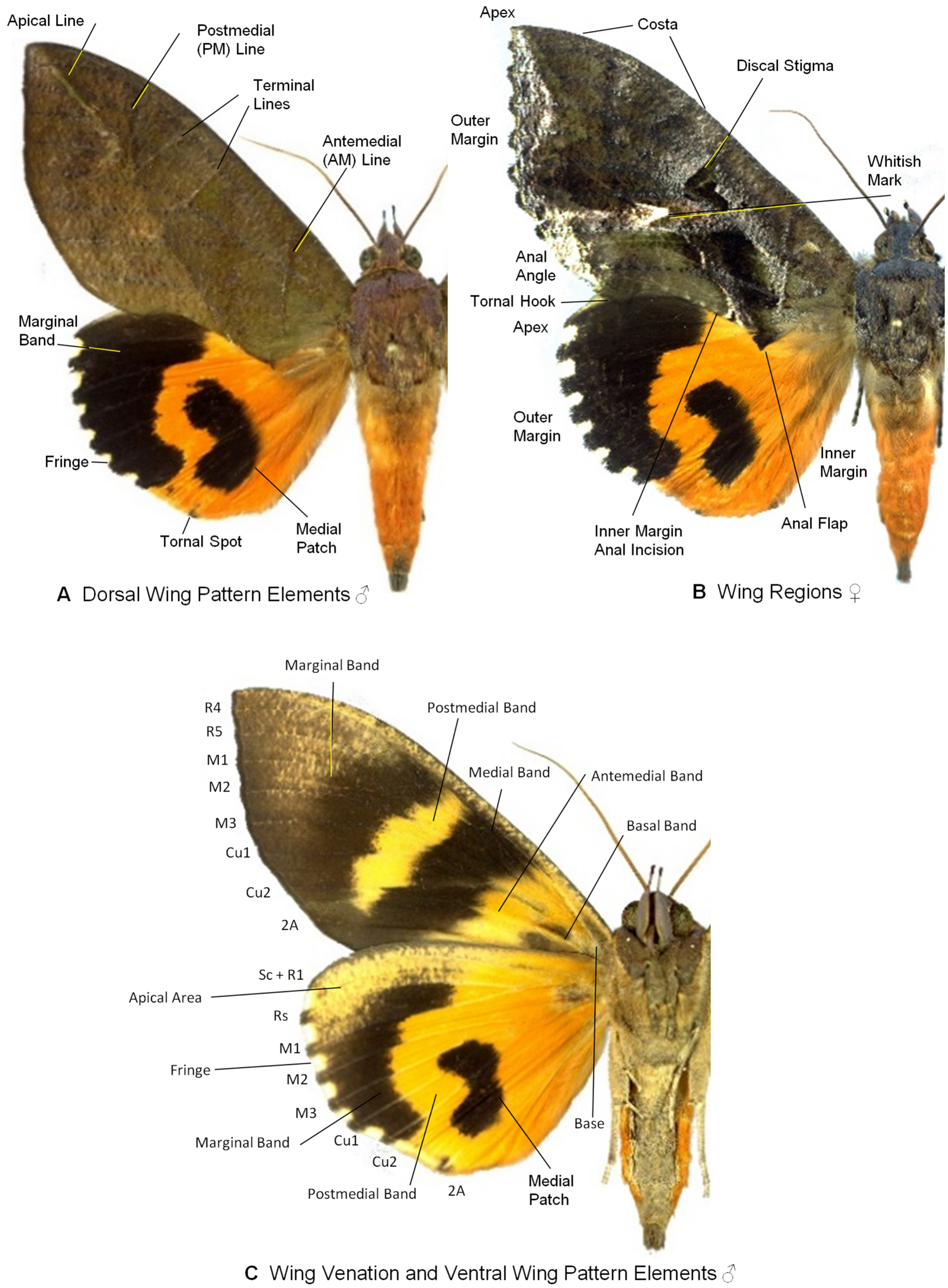
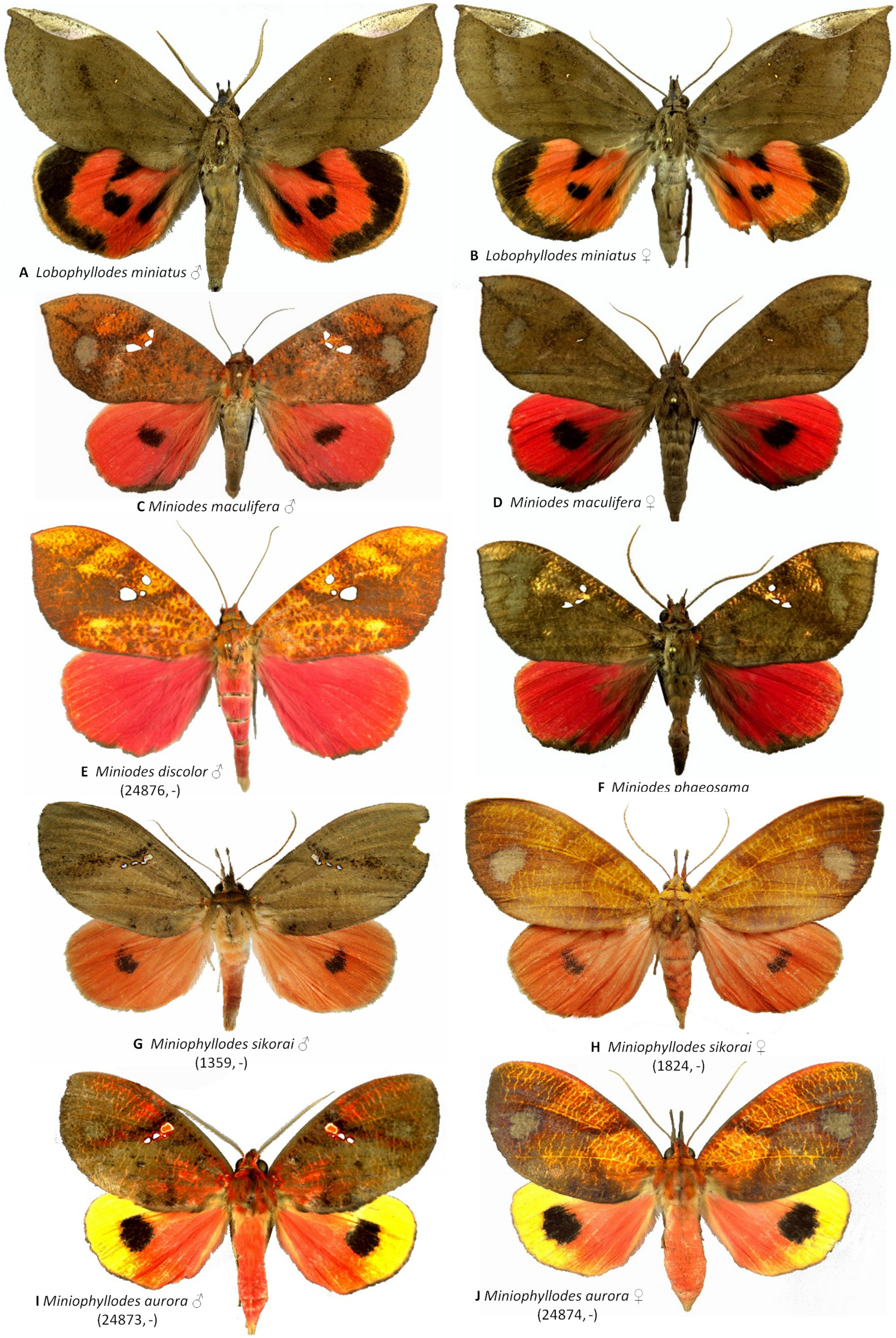


FIGURE 1. *Eudocima afrikana* wing pattern terminology.


A *Lobophyllodes miniatus* ♂

B *Lobophyllodes miniatus* ♀

C *Miniodes maculifera* ♂

D *Miniodes maculifera* ♀

E *Miniodes discolor* ♂
(24876, -)

F *Miniodes phaeosoma*

G *Miniophyllodes sikorai* ♂
(1359, -)

H *Miniophyllodes sikorai* ♀
(1824, -)

I *Miniophyllodes aurora* ♂
(24873, -)

J *Miniophyllodes aurora* ♀
(24874, -)

FIGURE 2. *Miniodes*, *Miniophyllodes*, *and Lobophyllodes* adults (dorsal aspect).

A *Xylophylla punctifascia* ♂
(26092, -)

B *Xylophylla punctifascia* ♀

C *Gloriana dentine* ♀

D *Gloriana ornata* ♂
(5712, -)

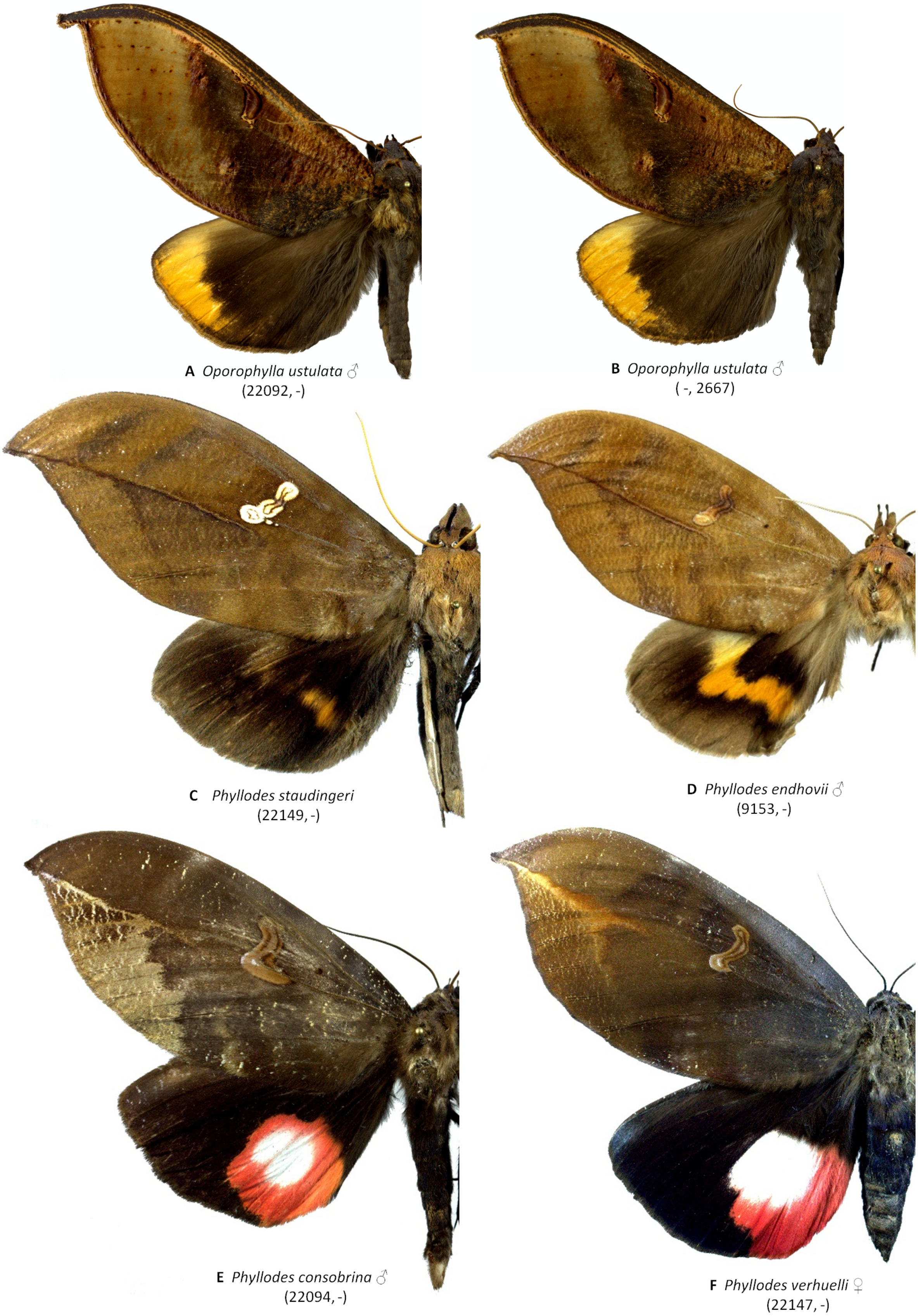
E *Huebnerius dux* ♂

F *Huebnerius dux* ♂
(25054, -)

G *Eudocima formosa*
(25024, -)

H *Eudocima formosa*
(25025, -)

FIGURE 3. *Xylophylla*, *Gloriana*, *Huebnerius* and *Eudocima formosa* adults (dorsal aspect).



A *Oporophylla ustulata* ♂
(22092, -)

B *Oporophylla ustulata* ♂
(-, 2667)

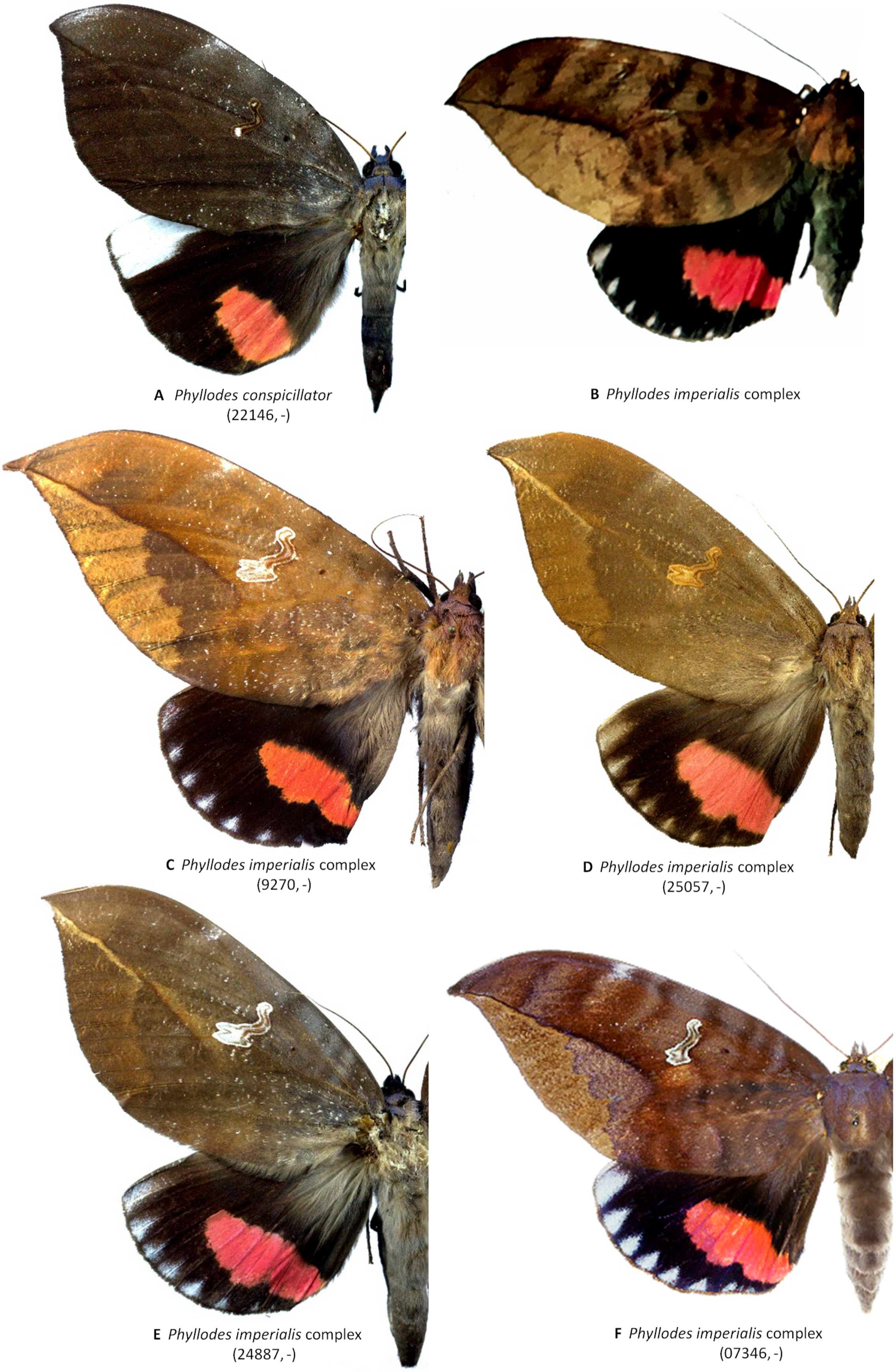
C *Phyllodes staudingeri*
(22149, -)

D *Phyllodes endhovii* ♂
(9153, -)

E *Phyllodes consobrina* ♂
(22094, -)

F *Phyllodes verhuelli* ♀
(22147, -)

FIGURE 4. *Oporophylla* and *Phyllodes* adults (dorsal aspect).



A *Phyllodes conspicillator*
(22146, -)

B *Phyllodes imperialis* complex

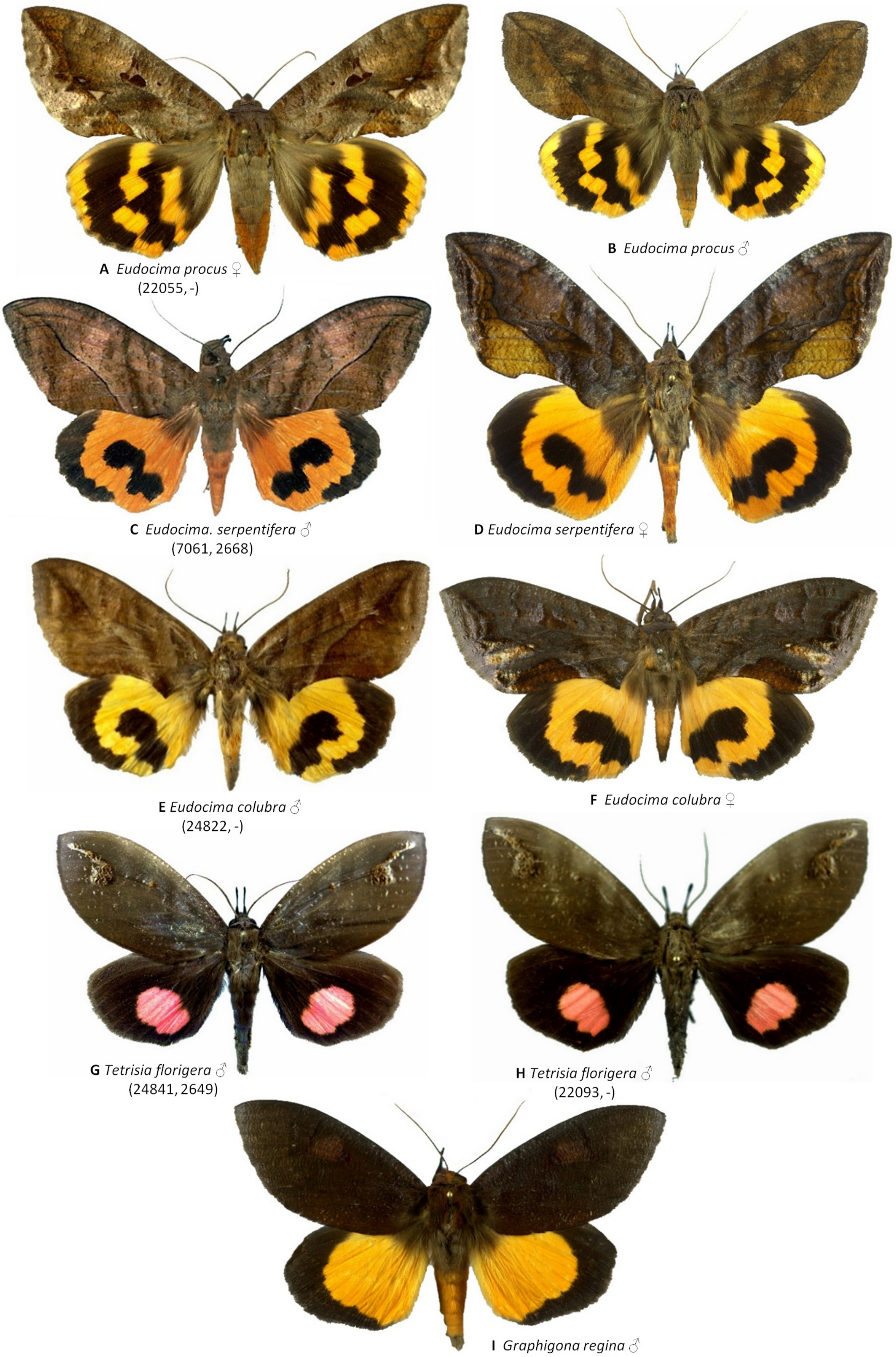
C *Phyllodes imperialis* complex
(9270, -)

D *Phyllodes imperialis* complex
(25057, -)

E *Phyllodes imperialis* complex
(24887, -)

F *Phyllodes imperialis* complex
(07346, -)

FIGURE 5. *Phyllodes* adults (dorsal aspect).



A *Eudocima procus* ♀
(22055, -)

B *Eudocima procus* ♂

C *Eudocima. serpentifera* ♂
(7061, 2668)

D *Eudocima serpentifera* ♀

E *Eudocima colubra* ♂
(24822, -)

F *Eudocima colubra* ♀

G *Tetrisia florigera* ♂
(24841, 2649)

H *Tetrisia florigera* ♂
(22093, -)

I *Graphigona regina* ♂
(24848, 2669)

FIGURE 6. Neotropical *Eudocima*, *Tetrisia*, and *Graphigona* adults (dorsal aspect).

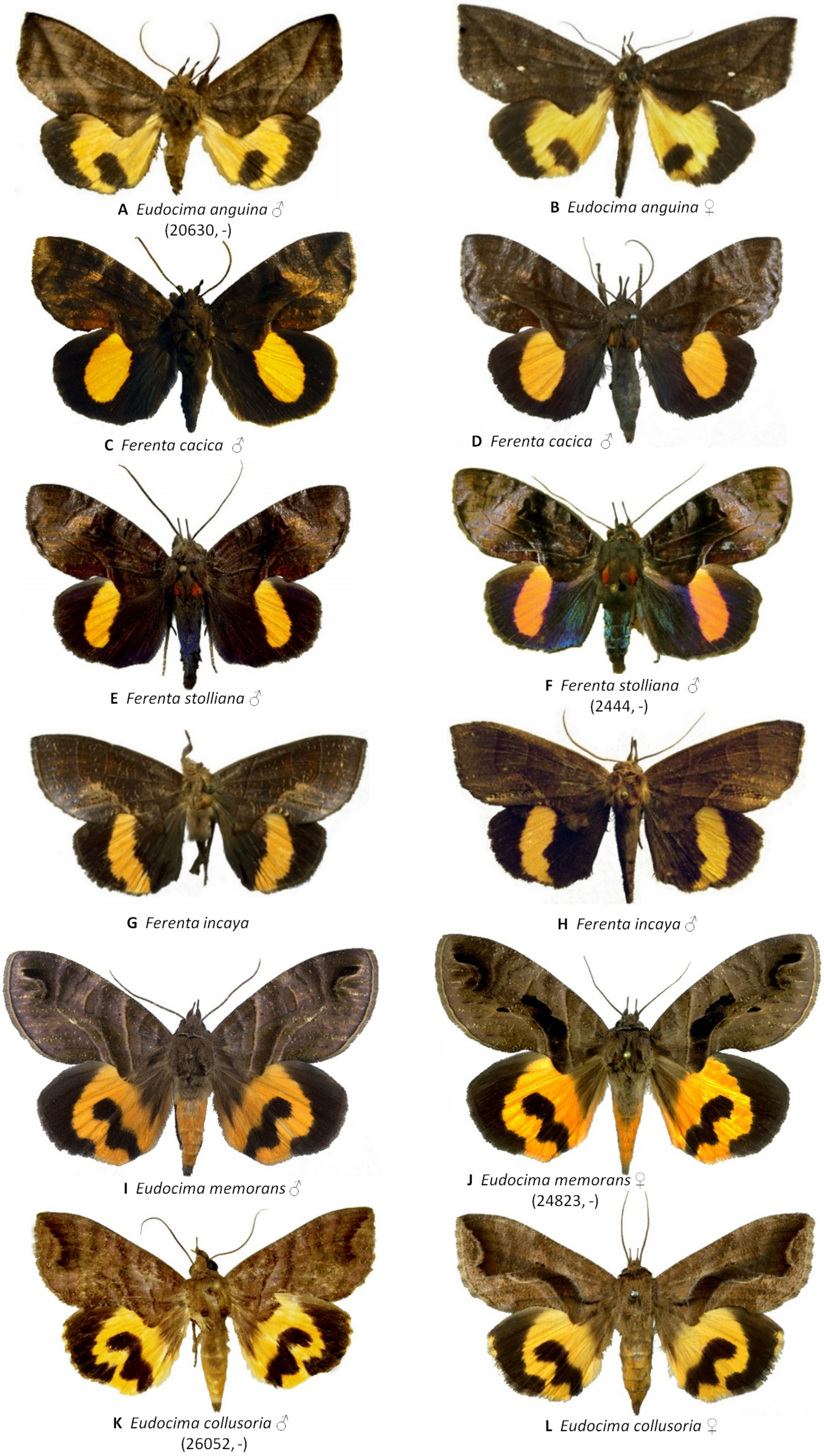
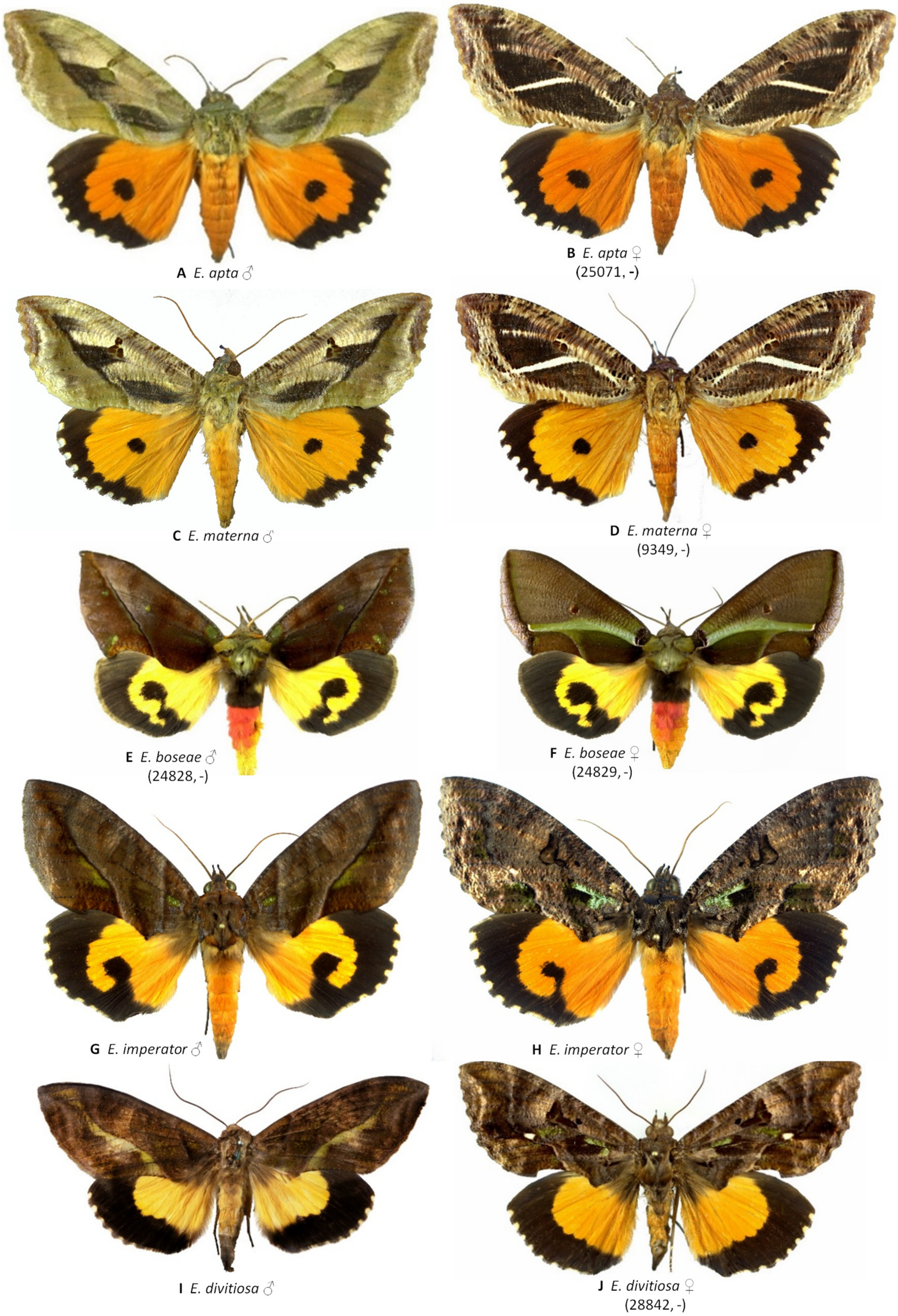


FIGURE 7. Neotropical *Eudocima* and *Ferenta* adults (dorsal aspect).

FIGURE 8. *Eudocima kinabaluenis* and *Eudocima homaena* group adults (dorsal aspect).



A *E. apta* ♂

B *E. apta* ♀
(25071, -)

C *E. materna* ♂

D *E. materna* ♀
(9349, -)

E *E. boseae* ♂
(24828, -)

F *E. boseae* ♀
(24829, -)

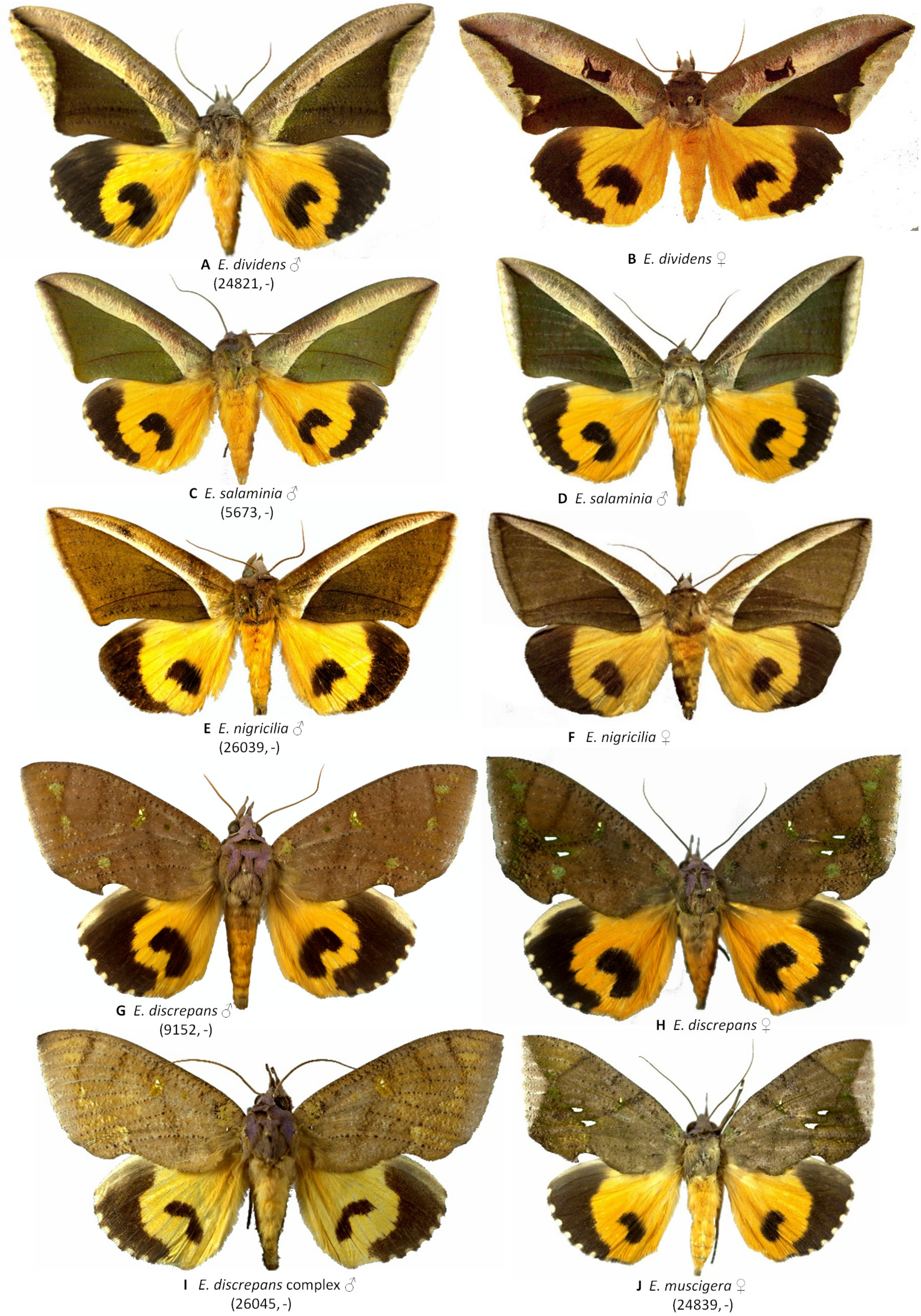
G *E. imperator* ♂

H *E. imperator* ♀

I *E. divitiosa* ♂

J *E. divitiosa* ♀
(28842, -)

FIGURE 9. *Eudocima materna* group and African *Eudocima* adults (dorsal aspect).



A *E. dividens* ♂ (24821, -)

B *E. dividens* ♀

C *E. salaminia* ♂ (5673, -)

D *E. salaminia* ♂

E *E. nigricilia* ♂ (26039, -)

F *E. nigricilia* ♀

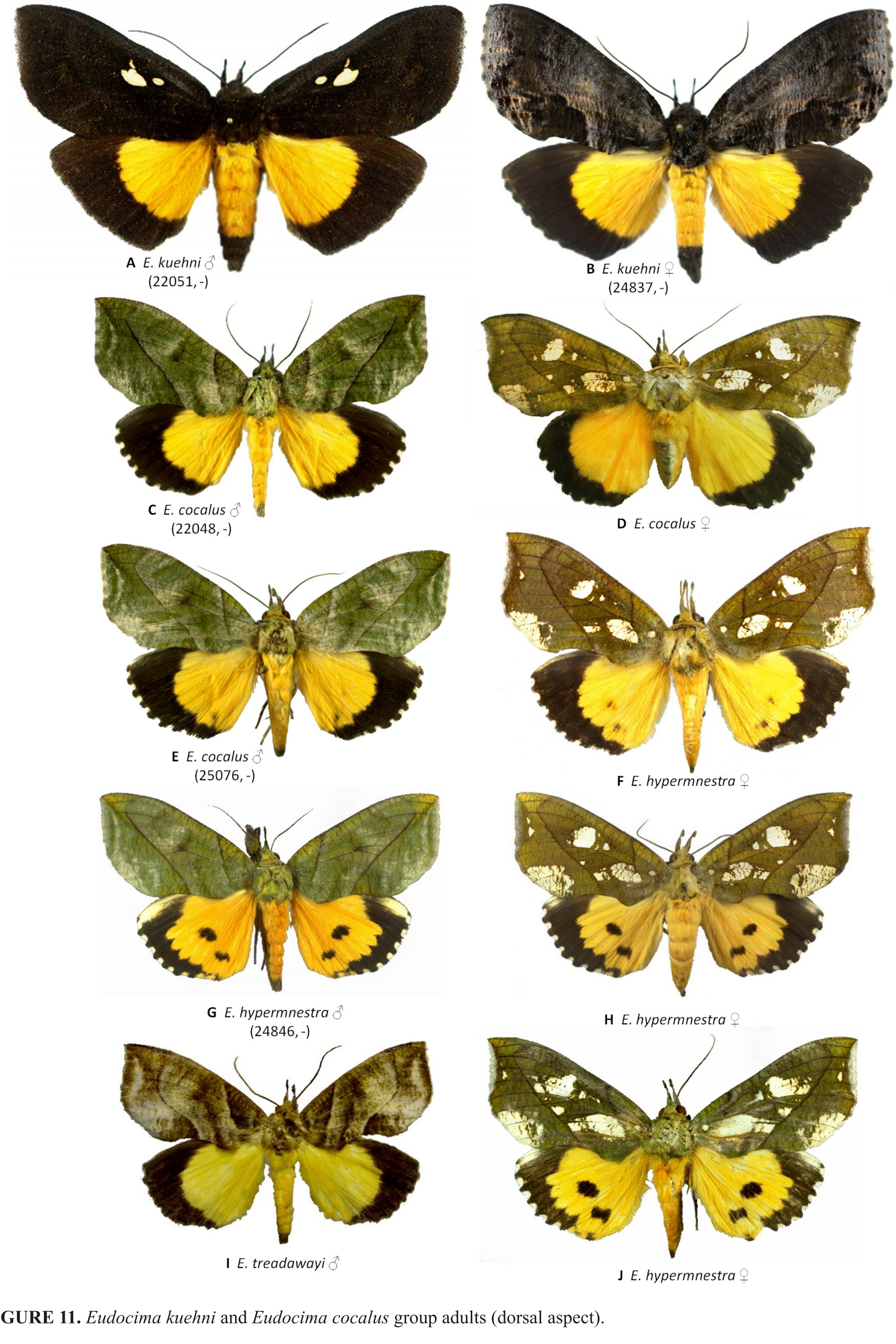
G *E. discrepans* ♂ (9152, -)

H *E. discrepans* ♀

I *E. discrepans* complex ♂ (26045, -)

J *E. muscigera* ♀ (24839, -)

FIGURE 10. *Eudocima salaminia* and *Eudocima discrepans* group adults (dorsal aspect).



A *E. kuehni* ♂
(22051, -)

B *E. kuehni* ♀
(24837, -)

C *E. cocalus* ♂
(22048, -)

D *E. cocalus* ♀

E *E. cocalus* ♂
(25076, -)

F *E. hypermnestra* ♀

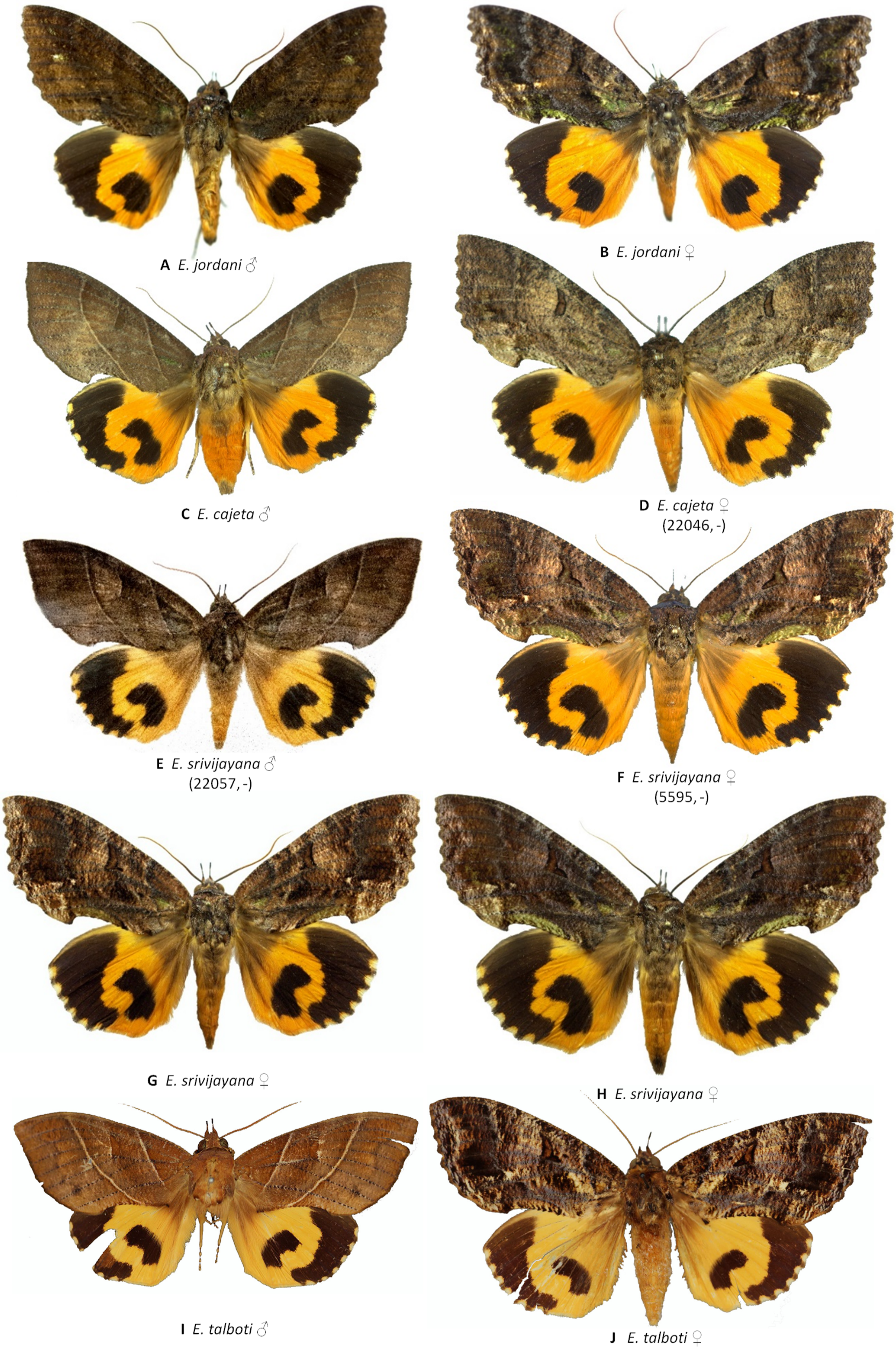
G *E. hypermnestra* ♂
(24846, -)

H *E. hypermnestra* ♀

I *E. treadawayi* ♂

J *E. hypermnestra* ♀

FIGURE 11. *Eudocima kuehni* and *Eudocima cocalus* group adults (dorsal aspect).



A *E. jordani* ♂

B *E. jordani* ♀

C *E. cajeta* ♂

D *E. cajeta* ♀
(22046, -)

E *E. srivijayana* ♂
(22057, -)

F *E. srivijayana* ♀
(5595, -)

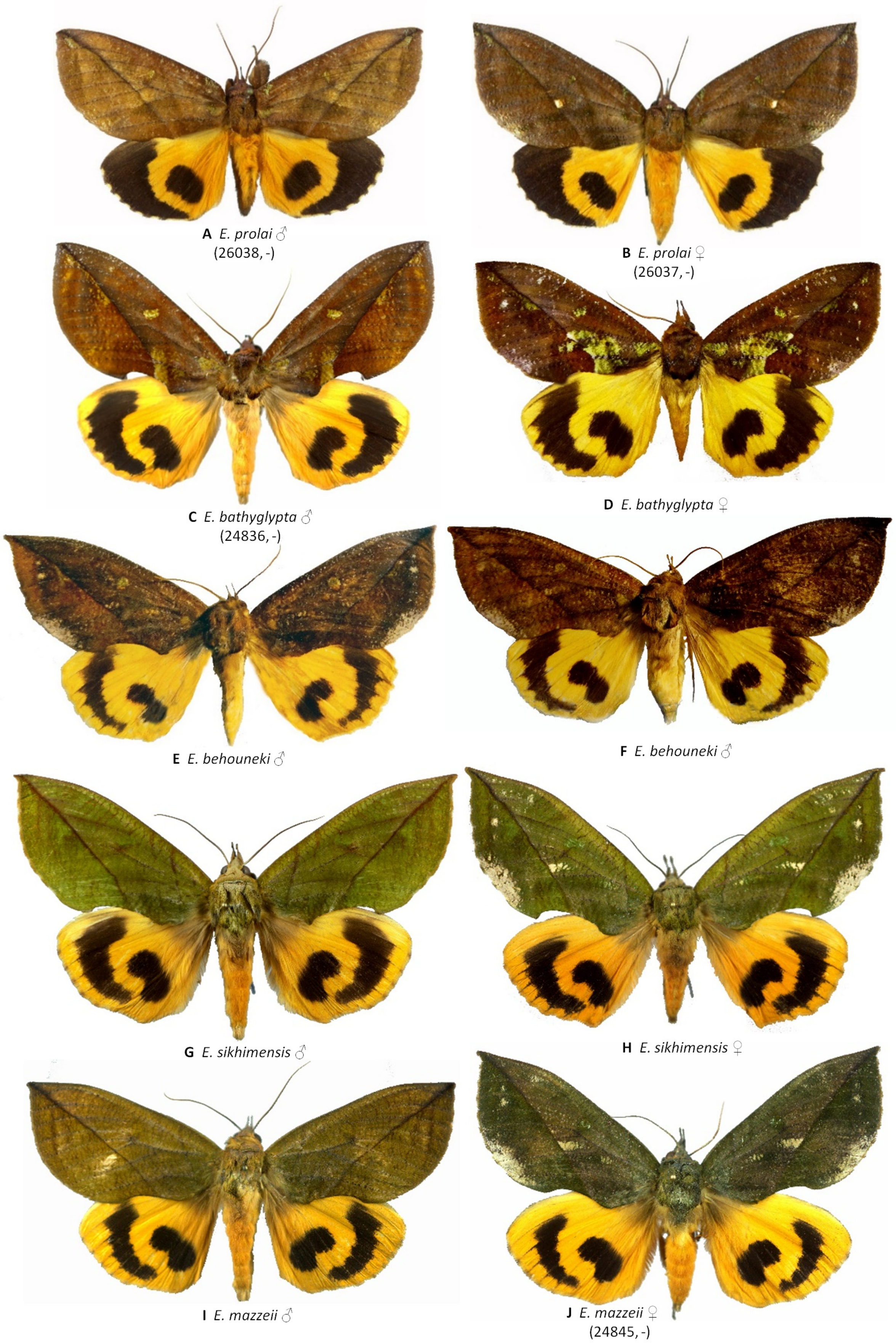
G *E. srivijayana* ♀

H *E. srivijayana* ♀

I *E. talboti* ♂

J *E. talboti* ♀

FIGURE 12. *Eudocima cajeta* group adults (dorsal aspect).



A *E. prolai* ♂
(26038, -)

B *E. prolai* ♀
(26037, -)

C *E. bathyglypta* ♂
(24836, -)

D *E. bathyglypta* ♀

E *E. behouneki* ♂

F *E. behouneki* ♂

G *E. sikhimensis* ♂

H *E. sikhimensis* ♀

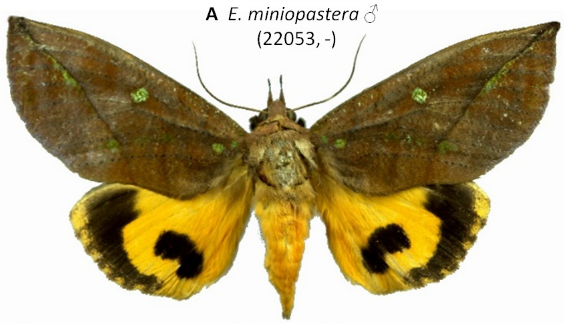
I *E. mazzeii* ♂

J *E. mazzeii* ♀
(24845, -)

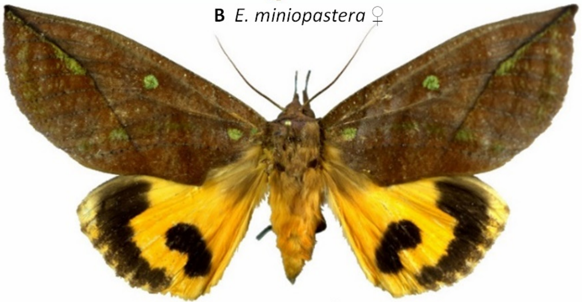
FIGURE 13. Southeast Asian *Eudocima* and *Eudocima sikhimensis* group adults (dorsal aspect).

A *E. miniopastera* ♂
(22053, -)

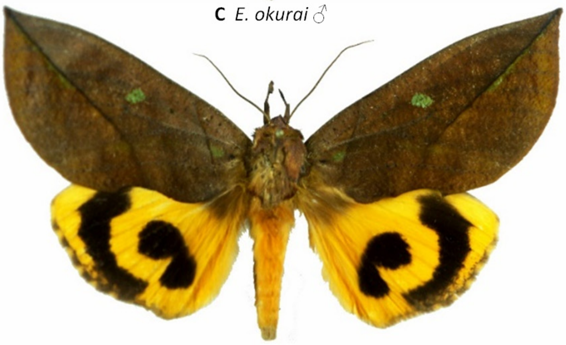
B *E. miniopastera* ♀



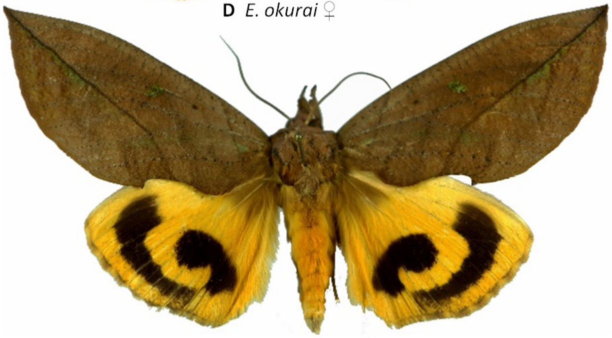
C *E. okurai* ♂



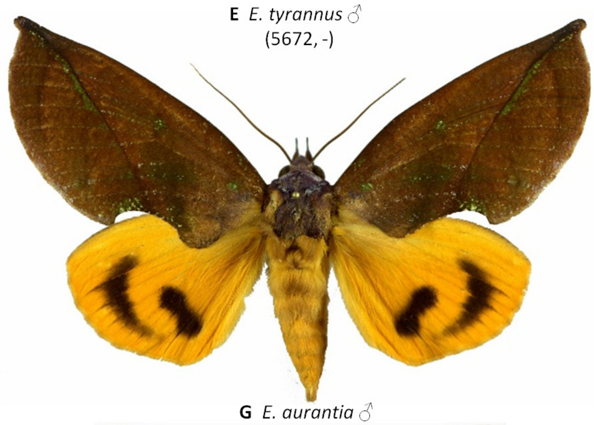
D *E. okurai* ♀



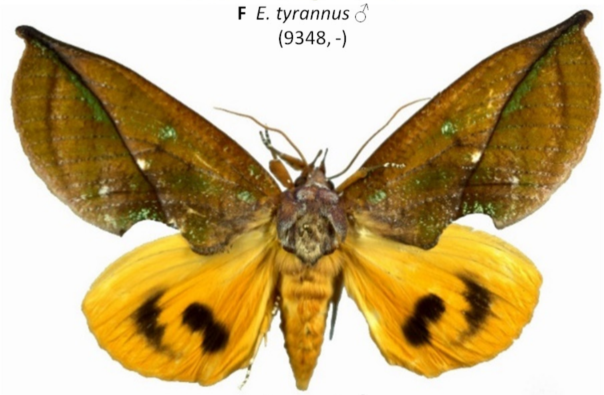
E *E. tyrannus* ♂
(5672, -)



F *E. tyrannus* ♂
(9348, -)

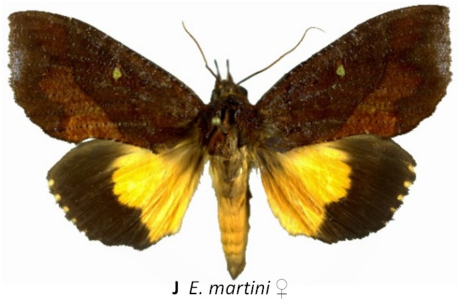


G *E. aurantia* ♂



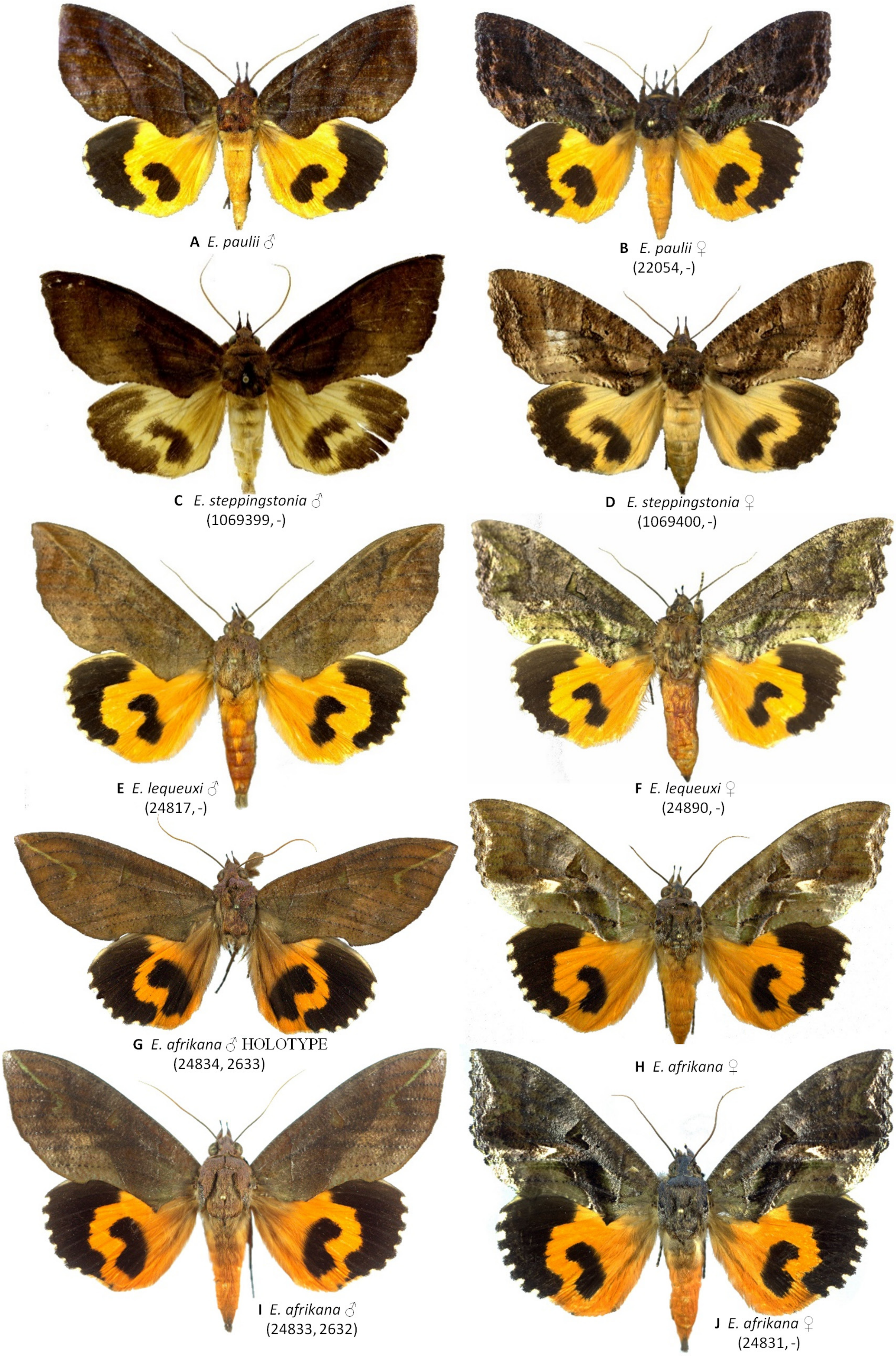
H *E. aurantia* ♀

I *E. martini* ♂



J *E. martini* ♀
(22162, -)

FIGURE 14. Southeast Asian *Eudocima* and *Eudocima tyrannus* group adults (dorsal aspect).



A *E. paulii* ♂

B *E. paulii* ♀
(22054, -)

C *E. steppingstonia* ♂
(1069399, -)

D *E. steppingstonia* ♀
(1069400, -)

E *E. lequeuxi* ♂
(24817, -)

F *E. lequeuxi* ♀
(24890, -)

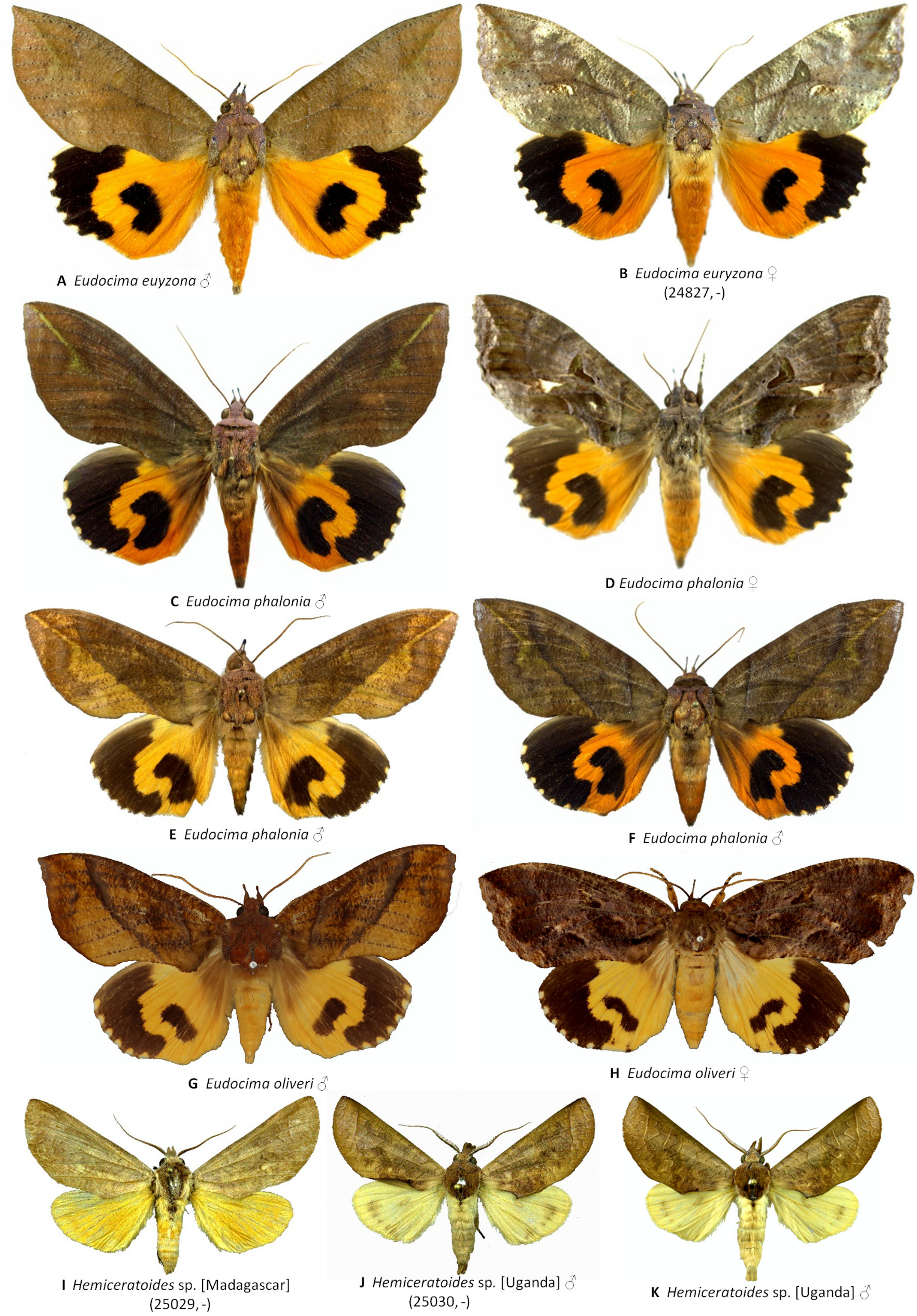
G *E. afrikana* ♂ HOLOTYPE
(24834, 2633)

H *E. afrikana* ♀

I *E. afrikana* ♂
(24833, 2632)

J *E. afrikana* ♀
(24831, -)

FIGURE 15. *Eudocima paulii* and *Eudocima phalonia* group adults (dorsal aspect).


A *Eudocima euyzona* ♂

B *Eudocima euryzona* ♀
(24827, -)

C *Eudocima phalonia* ♂

D *Eudocima phalonia* ♀

E *Eudocima phalonia* ♂

F *Eudocima phalonia* ♂

G *Eudocima oliveri* ♂

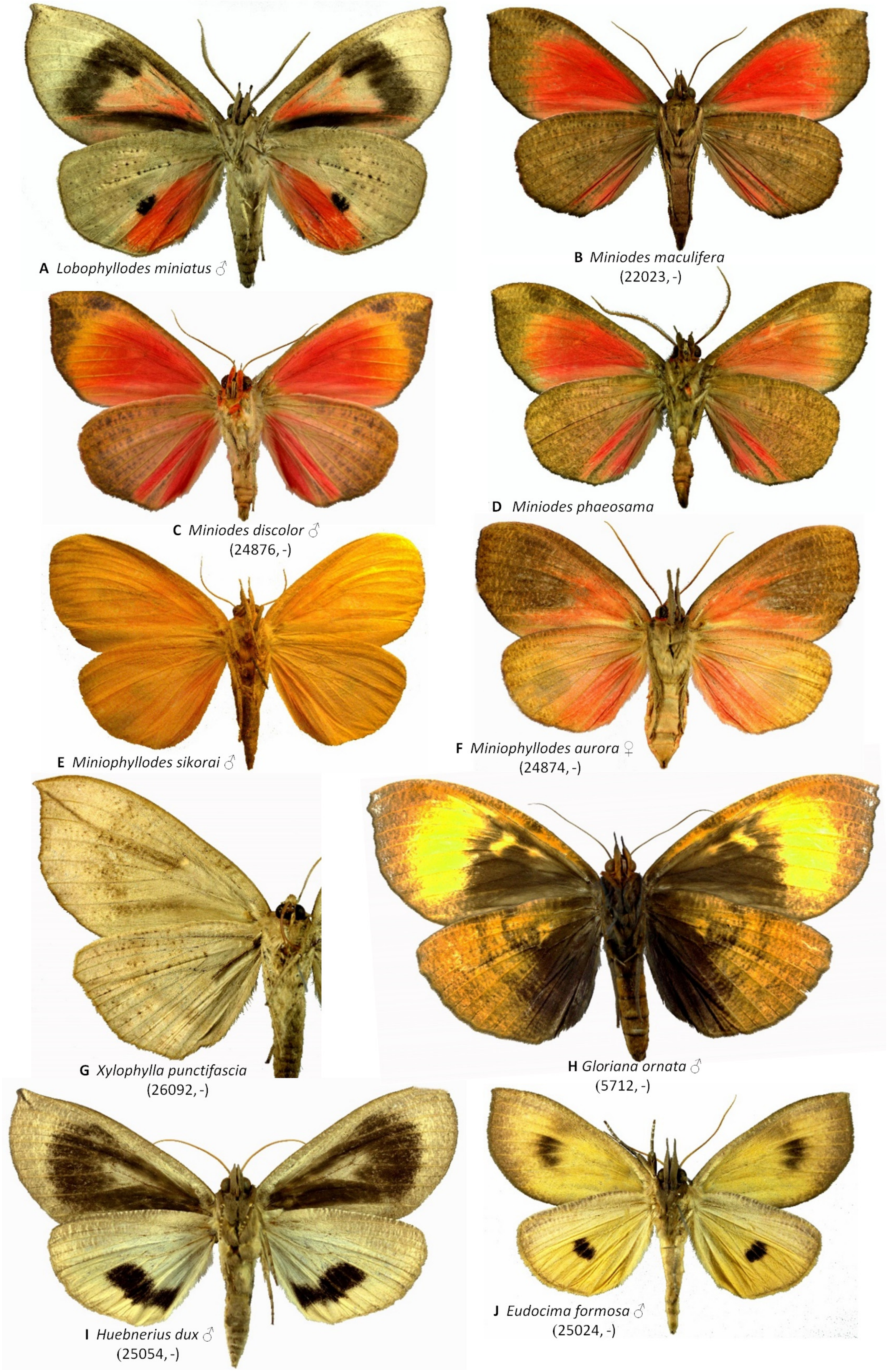
H *Eudocima oliveri* ♀

I *Hemiceratoides* sp. [Madagascar]
(25029, -)

J *Hemiceratoides* sp. [Uganda] ♂
(25030, -)

K *Hemiceratoides* sp. [Uganda] ♂

FIGURE 16. *Eudocima phalonia* group and *Hemiceratoides* adults (dorsal aspect).



A *Lobophyllodes miniatus* ♂

B *Miniodes maculifera* (22023, -)

C *Miniodes discolor* ♂ (24876, -)

D *Miniodes phaeosama*

E *Miniophyllodes sikorai* ♂

F *Miniophyllodes aurora* ♀ (24874, -)

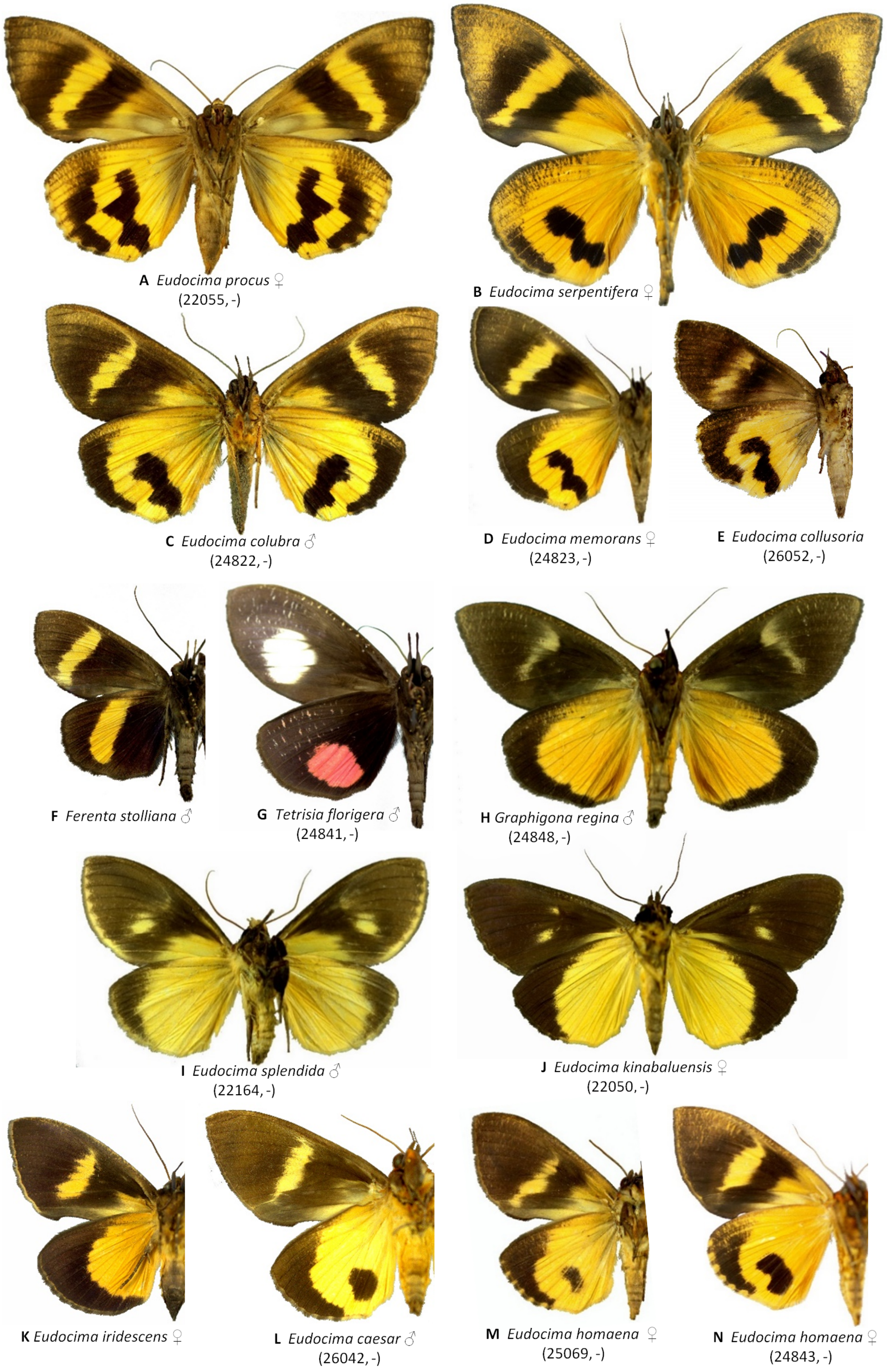
G *Xylophylla punctifascia* (26092, -)

H *Gloriana ornata* ♂ (5712, -)

I *Huebnerius dux* ♂ (25054, -)

J *Eudocima formosa* ♂ (25024, -)

FIGURE 17. Phyllodini adults (ventral aspect).



A *Eudocima procus* ♀
(22055, -)

B *Eudocima serpentifera* ♀

C *Eudocima colubra* ♂
(24822, -)

D *Eudocima memorans* ♀
(24823, -)

E *Eudocima collusoria*
(26052, -)

F *Ferenta stolliana* ♂

G *Tetrisia florigera* ♂
(24841, -)

H *Graphigona regina* ♂
(24848, -)

I *Eudocima splendida* ♂
(22164, -)

J *Eudocima kinabaluensis* ♀
(22050, -)

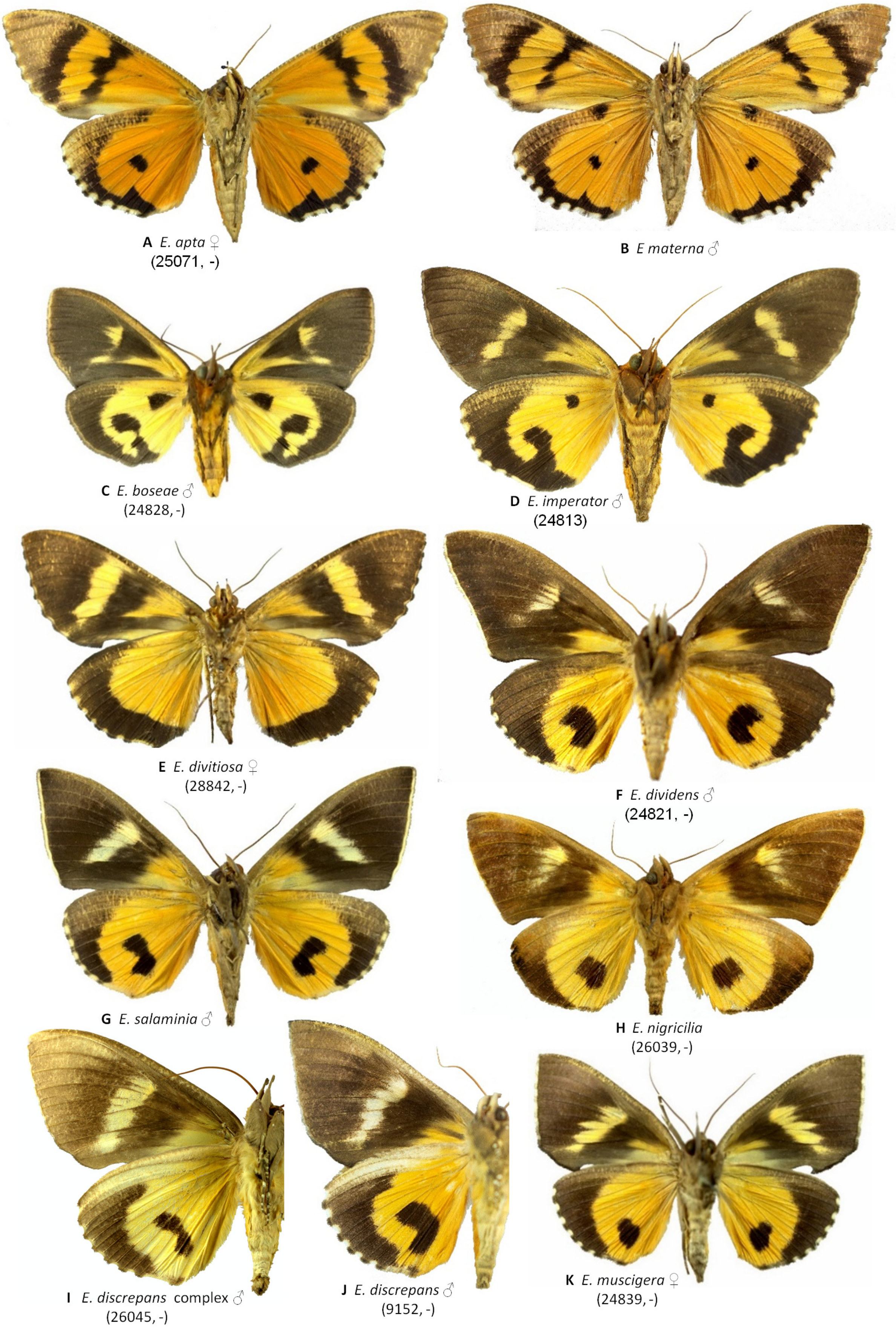
K *Eudocima iridescens* ♀

L *Eudocima caesar* ♂
(26042, -)

M *Eudocima homaena* ♀
(25069, -)

N *Eudocima homaena* ♀
(24843, -)

FIGURE 18. Neotropical *Eudocima*, *Ferenta*, *Tetrisia*, *Graphigona*; *Eudocima kinabaluensis* group, and *E. homaena* group adults (ventral aspect).



A *E. apta* ♀ (25071, -)

B *E materna* ♂

C *E. boseae* ♂ (24828, -)

D *E. imperator* ♂ (24813)

E *E. divitiosa* ♀ (28842, -)

F *E. dividens* ♂ (24821, -)

G *E. salaminia* ♂

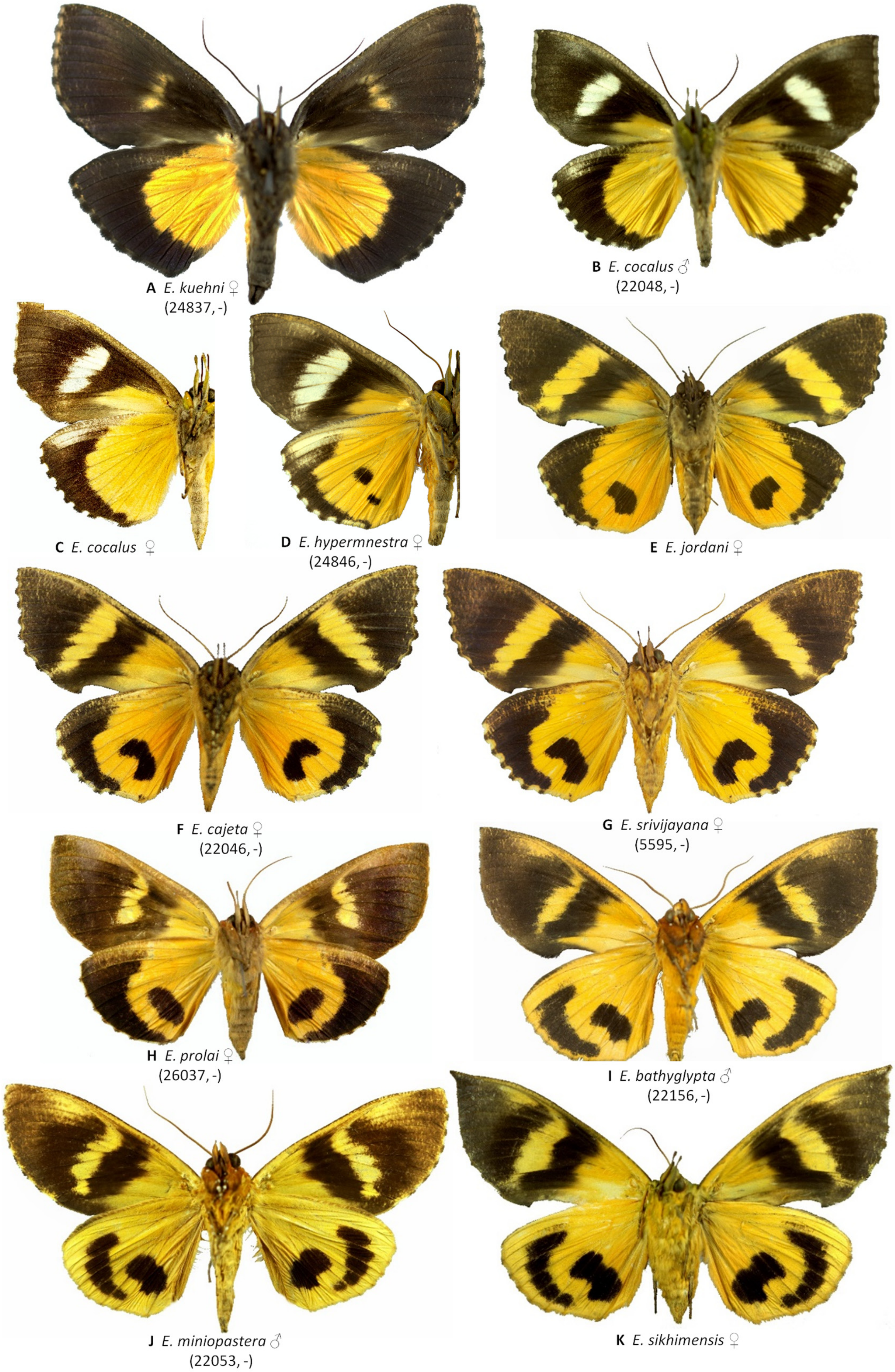
H *E. nigricilia* (26039, -)

I *E. discrepans* complex ♂ (26045, -)

J *E. discrepans* ♂ (9152, -)

K *E. muscigera* ♀ (24839, -)

FIGURE 19. *Eudocima materna*, *E. salaminia*, *E. discrepans* groups and African *Eudocima* adults (ventral aspect).



A *E. kuehni* ♀ (24837, -)

B *E. cocalus* ♂ (22048, -)

C *E. cocalus* ♀

D *E. hypermnestra* ♀ (24846, -)

E *E. jordani* ♀

F *E. cajeta* ♀ (22046, -)

G *E. srivijayana* ♀ (5595, -)

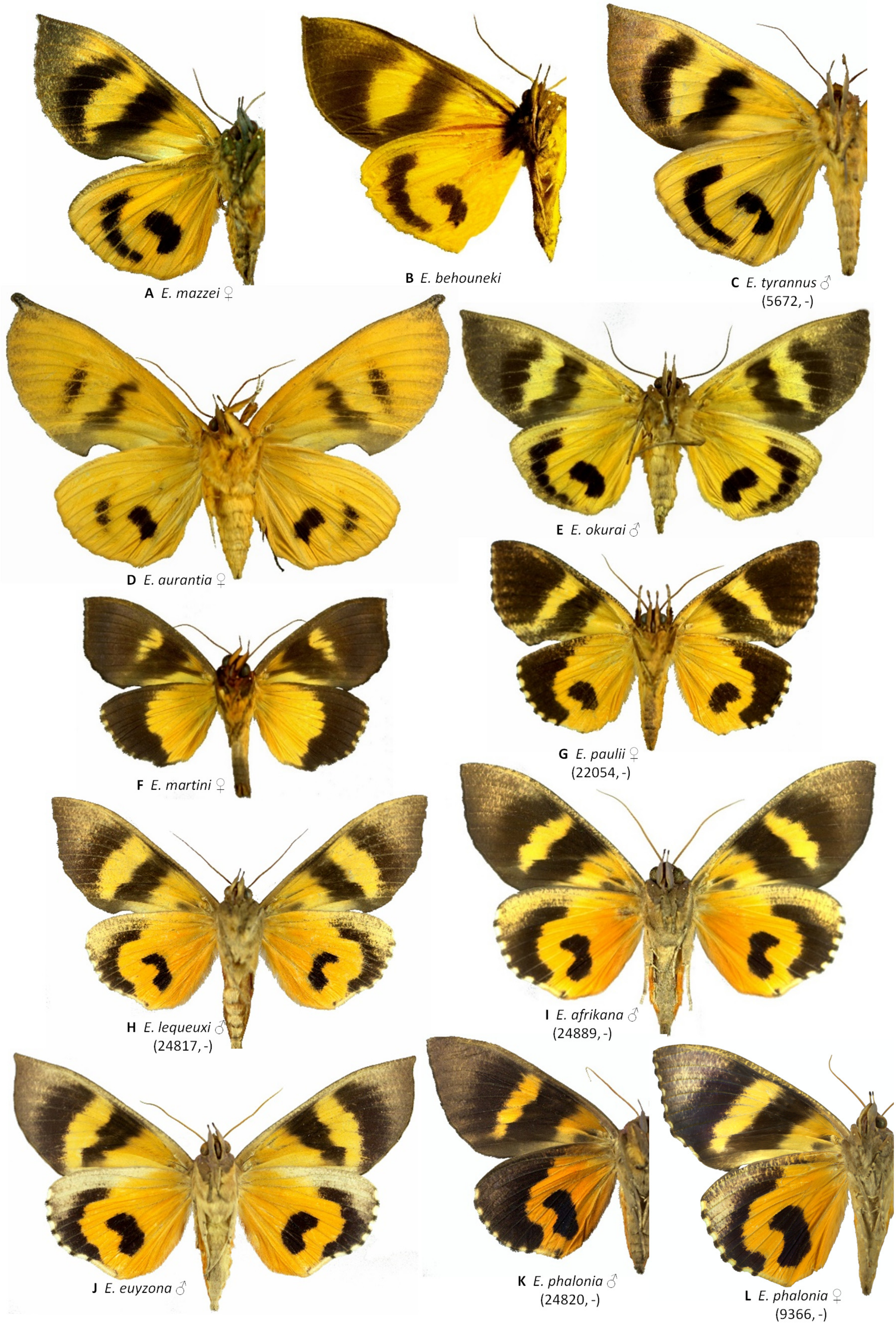
H *E. prolai* ♀ (26037, -)

I *E. bathyglypta* ♂ (22156, -)

J *E. miniopastera* ♂ (22053, -)

K *E. sikhimensis* ♀

FIGURE 20. *Eudocima cocalus*, *E. cajeta*, *E. sikhimensis* groups and Southeast Asian *Eudocima* adults (ventral aspect).



A *E. mazzei* ♀

B *E. behouneki*

C *E. tyrannus* ♂ (5672, -)

D *E. aurantia* ♀

E *E. okurai* ♂

F *E. martini* ♀

G *E. paulii* ♀ (22054, -)

H *E. lequeuxi* ♂ (24817, -)

I *E. afrikana* ♂ (24889, -)

J *E. euyzona* ♂

K *E. phalonia* ♂ (24820, -)

L *E. phalonia* ♀ (9366, -)

FIGURE 21. *Eudocima tyrannus*, *E. phalonia* groups and Southeast Asian *Eudocima* (ventral aspect).

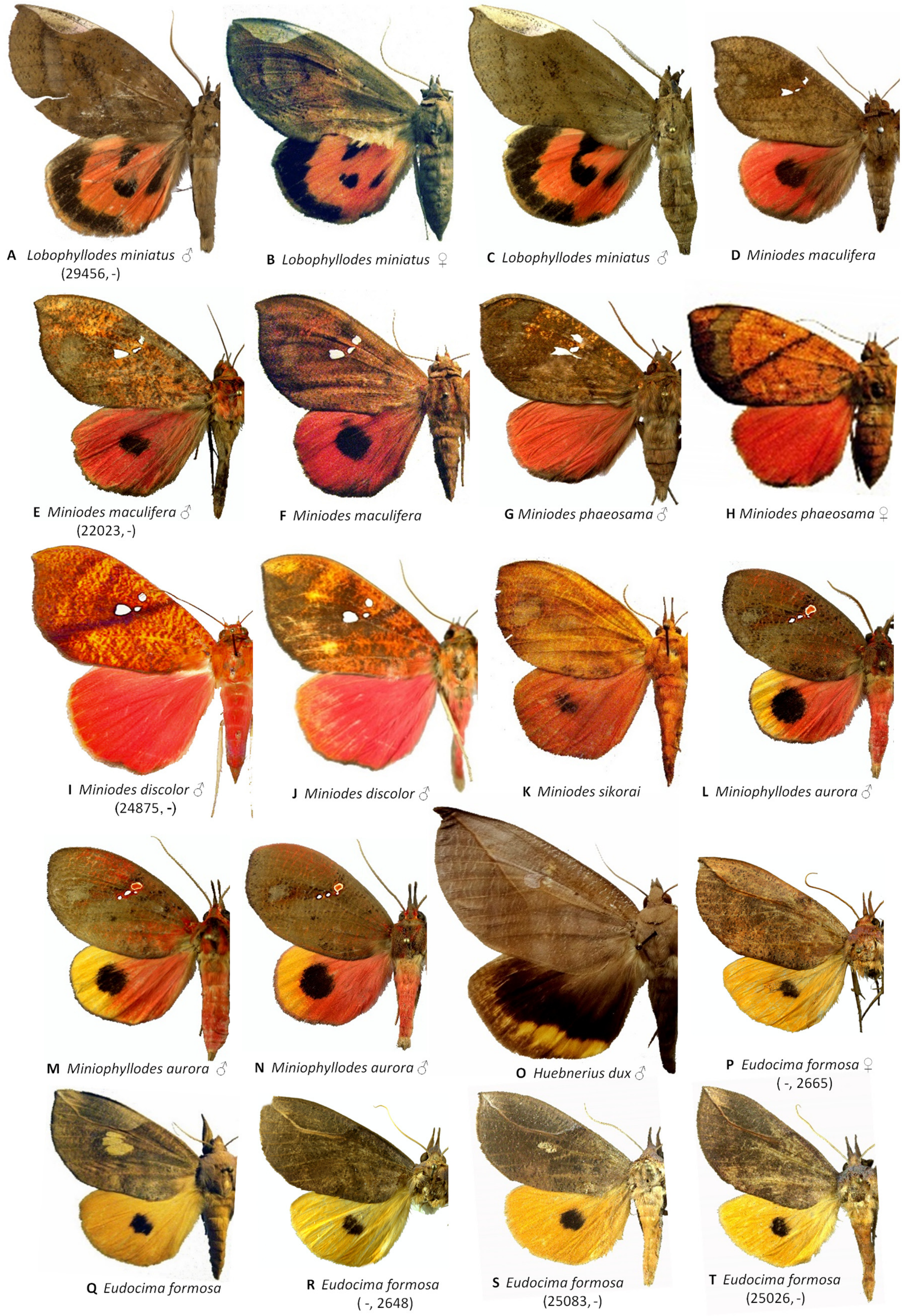


FIGURE 22. Phyllodini and *Eudocima formosa* adults (dorsal aspect).

FIGURE 23. *Eudocima*, *Ferenta* and *Graphigona* adults (dorsal aspect).

A *E. homaena* ♀

B *E. homaena* ♀ (24844, -)

C *E. homaena* ♀ (24843, -)

D *E. homaena* ♀ (25069, -)

E *E. apta* ♂ (891, -)

F *E. apta* ♀ (110720, -)

G *E. materna* ♀ (20289, -)

H *E. materna* ♀ (4511GO5, -)

I *E. materna* ♀

J *E. boseae* ♂

K *E. boseae* ♂

L *E. boseae* ♀

M *E. imperator* ♂ (24813, -)

N *E. imperator* ♀

O *E. imperator* ♀

P *E. imperator* ♀ (24814, -)

Q *E. imperator* ♀ (24815, -)

R *E. divitosa* ♂

S *E. divitosa* ♂ (24818, -)

T *E. divitosa* ♀

FIGURE 24. *Eudocima* adults (dorsal aspect).

A *E. dividens* ♂

B *E. dividens* ♀ (5638, -)

C *E. salaminia* ♂ (9350, -)

D *E. salaminia* ♂ (24847, -)

E *E. salaminia* ♀

F *E. salaminia* ♂

G *E. discrepans* ♂

H *E. muscigera* ♂ (24840, -)

I *E. muscigera* ♂

J *E. muscigera* ♀ (24838, -)

K *E. cocalus* ♂

L *E. hypermnestra* ♂

M *E. jordani* ♂

N *E. jordani* ♀

O *E. cajeta* ♂ (22159, -)

P *E. cajeta* ♂

Q *E. cajeta* ♀ (22160, -)

R *E. cajeta* ♀

S *E. cajeta* ♀

T *E. srivijayana* ♀ (25028, -)

FIGURE 25. *Eudocima* adults (dorsal aspect).

A *E. prolai* ♂

B *E. prolai* ♀

C *E. bathyglypta* ♂ (24835, -)

D *E. bathyglypta* ♂ (22156, -)

E *E. miniopastera* ♂

F *E. sikhimensis* ♂

G *E. sikhimensis* ♂ (9367, -)

H *E. sikhimensis* ♀

I *E. mazzeii* ♂

J *E. mazzeii* ♂ (22158, -)

K *E. mazzeii* ♂ (22157, -)

L *E. okurai* ♂

M *E. okurai* ♂

N *E. okurai* ♂ (5711, -)

O *E. tyrannus* ♂

P *E. aurantia* ♂ (9151, -)

Q *E. martini* ♂ (22163, -)

R *E. martini* ♂

S *E. martini* ♂

T *E. martini* ♀ (25073, -)

FIGURE 26. *Eudocima* adults (dorsal aspect).

FIGURE 27. *Eudocima phalonia* group adults (dorsal aspect).


A *Eudocima phalonia* ♀

B *Eudocima phalonia* ♀ (9366, -)

C *Eudocima euyzona* ♂ (25082, 2641)

D *Eudocima euyzona* ♂ (25082, 2644)

E *Eudocima euyzona* ♂

F *Eudocima euyzona* ♂ (24825, -)

G *Eudocima euyzona* ♂

H *Eudocima euyzona* ♀

I *Eudocima euyzona* ♀ (24826, -)

J *Eudocima euyzona* ♀

K *Eudocima euyzona* ♀

L *Eudocima euyzona* ♀

M *Eudocima oliveri* ♂

N *Oraesia cerne* ♀

O *Plusiodonta malagasy* ♂

P *Ferenta stolliana*

Q *"Eudocima" felicia*

FIGURE 28. A–O: *Eudocima phalonia* group and Calpini adults (dorsal aspect); **P:** Page 41, Plate 310, Figure A from Cramer (1782); **Q:** Page 58, Plate 12, Figure 11 from Stoll (1790).


A *Lobophyllodes miniatus*
B *Miniodes maculifera* (22023, -)
C *Miniodes phaeosama*
D *Miniodes discolor*
E *Miniophyllodes aurora* (24874, -)
F *Hemiceratoides* species (Madagascar)
G *Gloriana ornata* (5666, -)
H *Huebernerius dux*
I *Eudocima formosa*
J *Oporophylla ustulata*
K *Phyllodes staudingeri* (22149, -)
L *Phyllodes endhovii* (9153, -)
M *Phyllodes imperialis* complex
N *Phyllodes imperialis* complex
O *Phyllodes imperialis* complex
P *Phyllodes consobrina* (22094, -)

FIGURE 29. Phyllodini palpi.

A *Phyllodes verhuelli* (22147, -)

B *Eudocima procus*

C *Eudocima serpentifera*

D *Eudocima colubra* (24822, -)

E *Tetrisia florigera,* (24841, -)

F *Graphigona regina* (22161, -)

G *Ferenta stollingana*

H *Eudocima memorans,* (24823, -)

I *Eudocima splendida* (22164, -)

J *Eudocima kinabaluensis* (22050, -)

K *Eudocima iridescens* (22049, -)

L *Eudocima caesar* (24811, -)

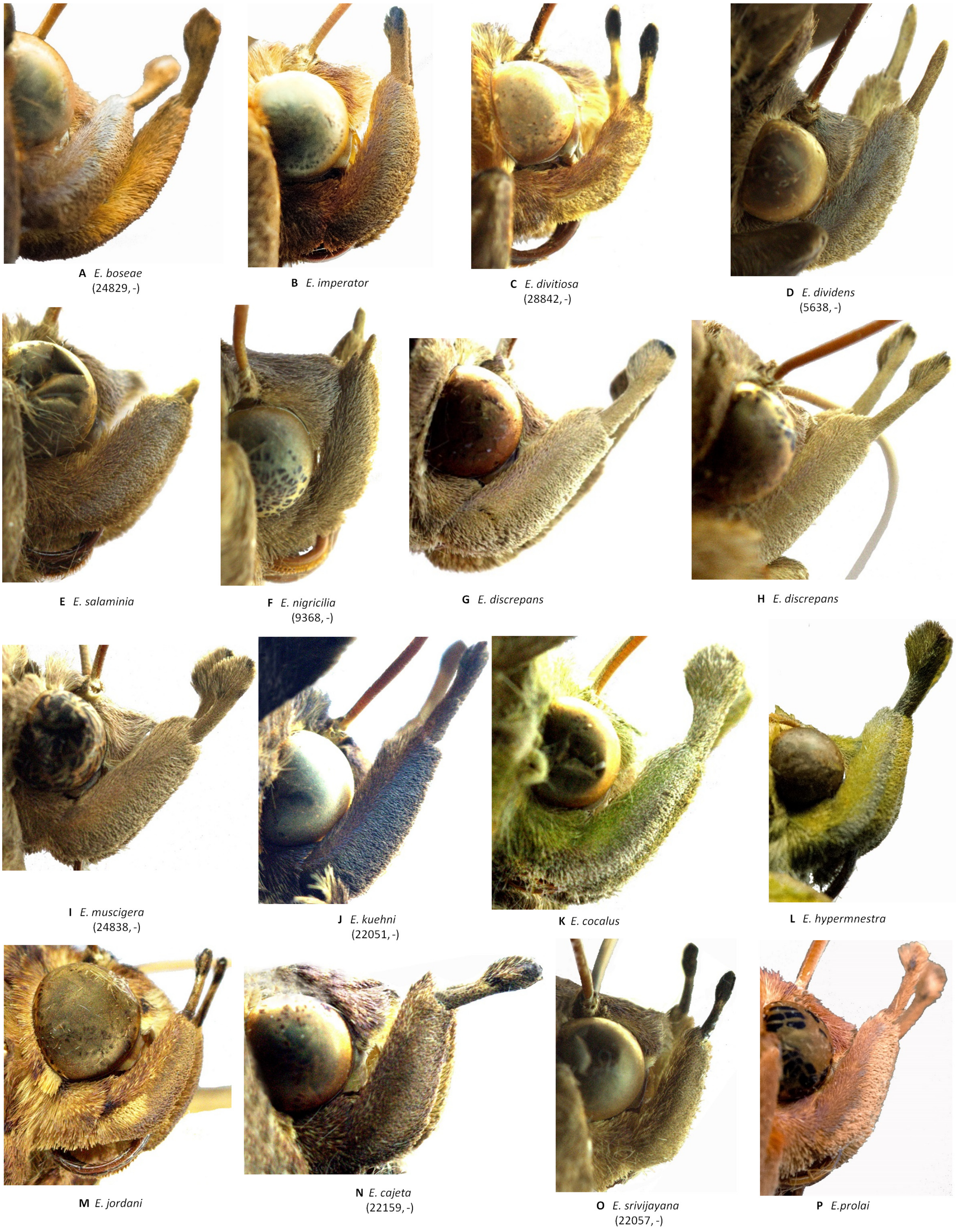
M *Eudocima homaena* (22056, -)

N *Eudocima homaena* (24843, -)

O *Eudocima apta*

P *Eudocima materna*

FIGURE 30. Phyllodini and Ophiderini palpi.



A *E. boseae* (24829, -)

B *E. imperator*

C *E. divitiosa* (28842, -)

D *E. dividens* (5638, -)

E *E. salaminia*

F *E. nigricilia* (9368, -)

G *E. discrepans*

H *E. discrepans*

I *E. muscigera* (24838, -)

J *E. kuehni* (22051, -)

K *E. cocalus*

L *E. hypermnestra*

M *E. jordani*

N *E. cajeta* (22159, -)

O *E. srivijayana* (22057, -)

P *E.prolai*

FIGURE 31. *Eudocima* palpi.

A *Eudocima bathyglypta* (24836, -)

B *Eudocima miniopastera* (22053, -)

C *Eudocima sikhimensis*

D *Eudocima mazzeii*

E *Eudocima okurai*

F *Eudocima tyrannus* (5672, -)

G *Eudocima aurantia*

H *Eudocima martini*

I *Eudocima paulii* (22054, -)

J *Eudocima lequeuxi*

K *Eudocima. afrikana* (24833, 2632)

L *E.udocima phalonia* (9366, -)

M *Eudocima euryzona*

N *Calyptra imperialis*

O *Plusiodonta malagasy*

P *Oraesia cerne*

FIGURE 32. *Eudocima* and Calpini palpi.

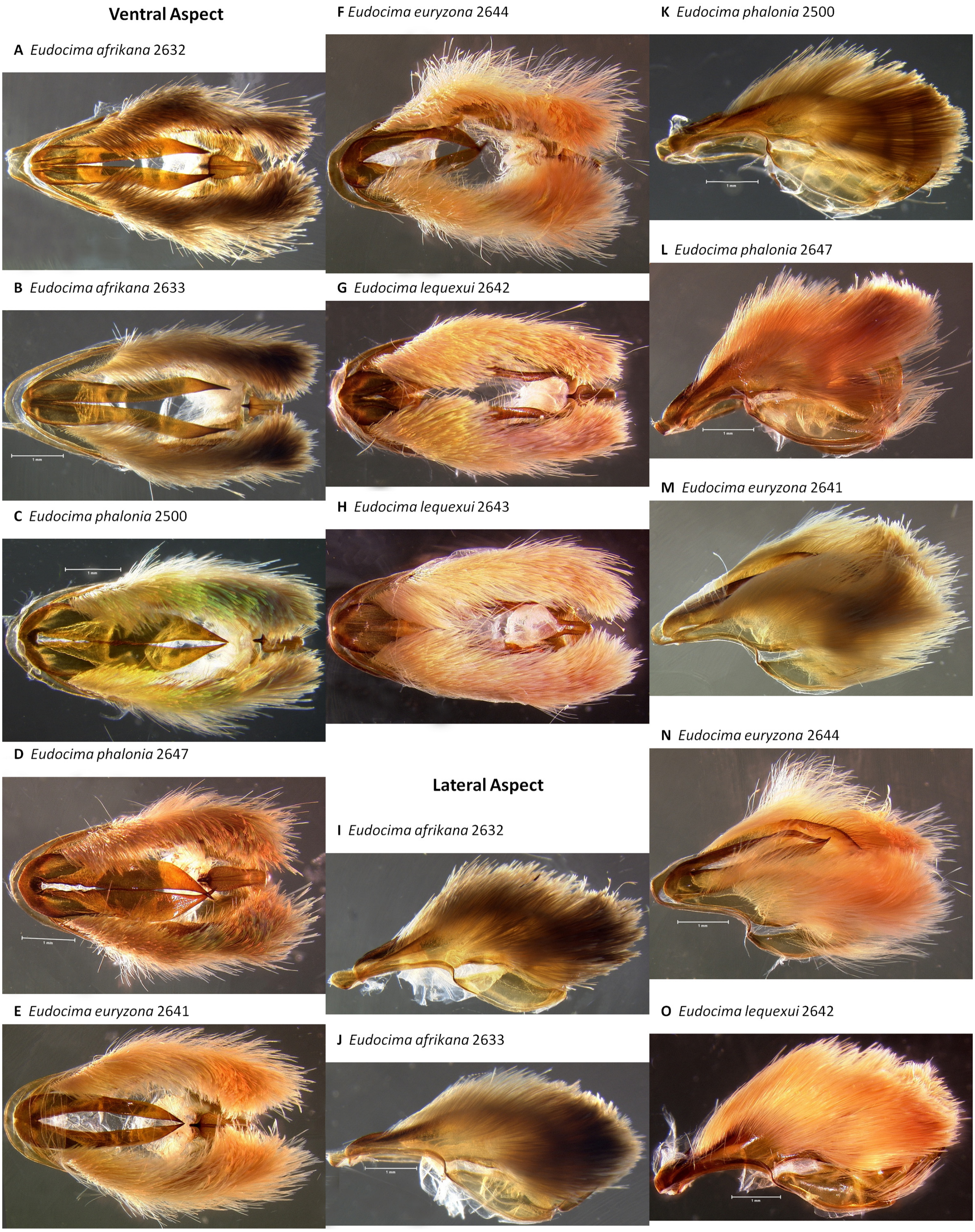
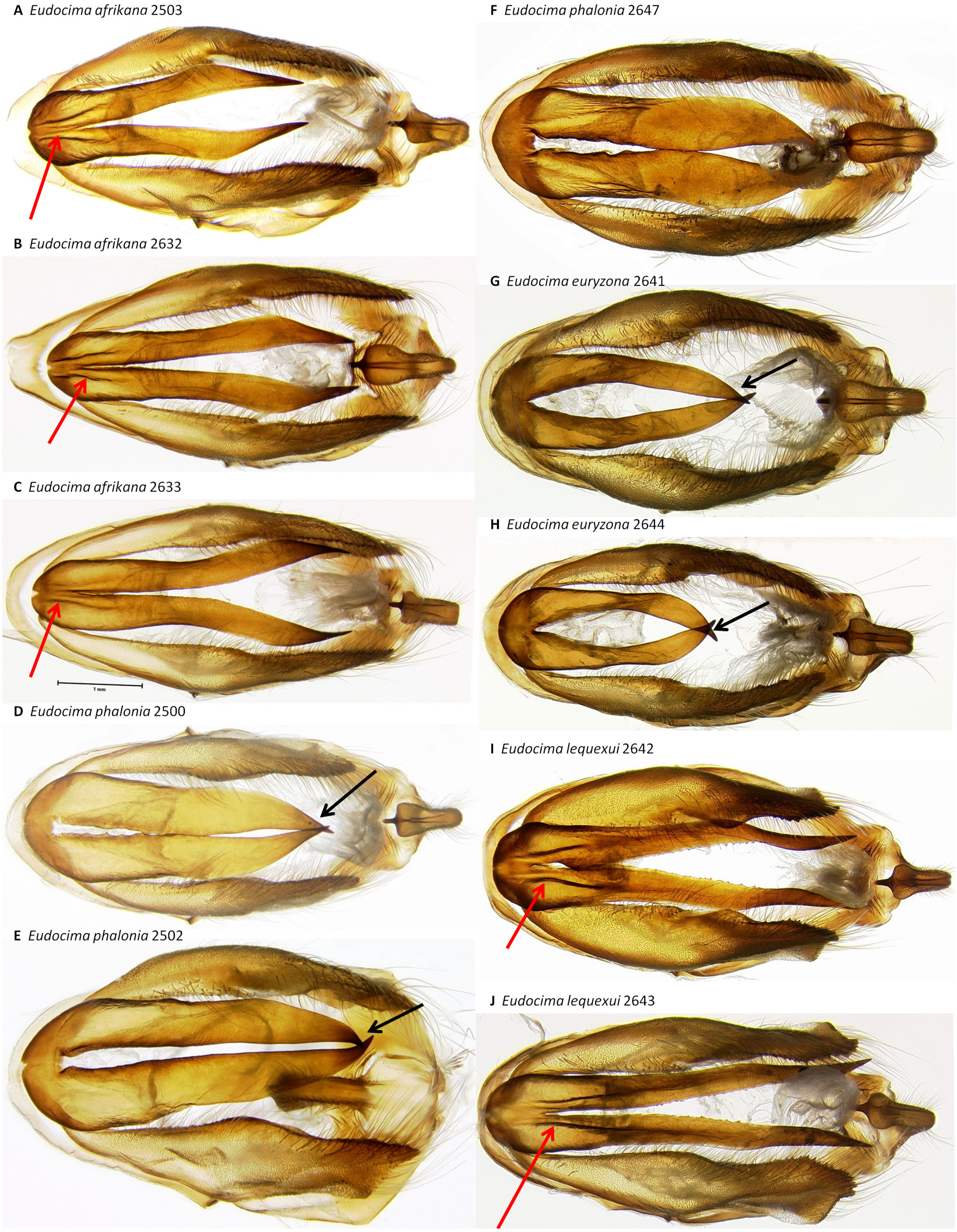


FIGURE 33. *Eudocima* male genitalic capsules with hairs intact. Apparent differences in coloration are due to differences in lighting.



A *Eudocima afrikana* 2503

B *Eudocima afrikana* 2632

C *Eudocima afrikana* 2633

D *Eudocima phalonia* 2500

E *Eudocima phalonia* 2502

F *Eudocima phalonia* 2647

G *Eudocima euryzona* 2641

H *Eudocima euryzona* 2644

I *Eudocima lequexui* 2642

J *Eudocima lequexui* 2643

FIGURE 34. *Eudocima* male genitalic capsules (ventral aspect) with hairs removed.

A *Eudocima afrikana* 2503

B *Eudocima afrikana* 2632

C *Eudocima afrikana* 2633

D *Eudocima phalonia* 2500

E *Eudocima phalonia* 2502

F *Eudocima phalonia* 2647

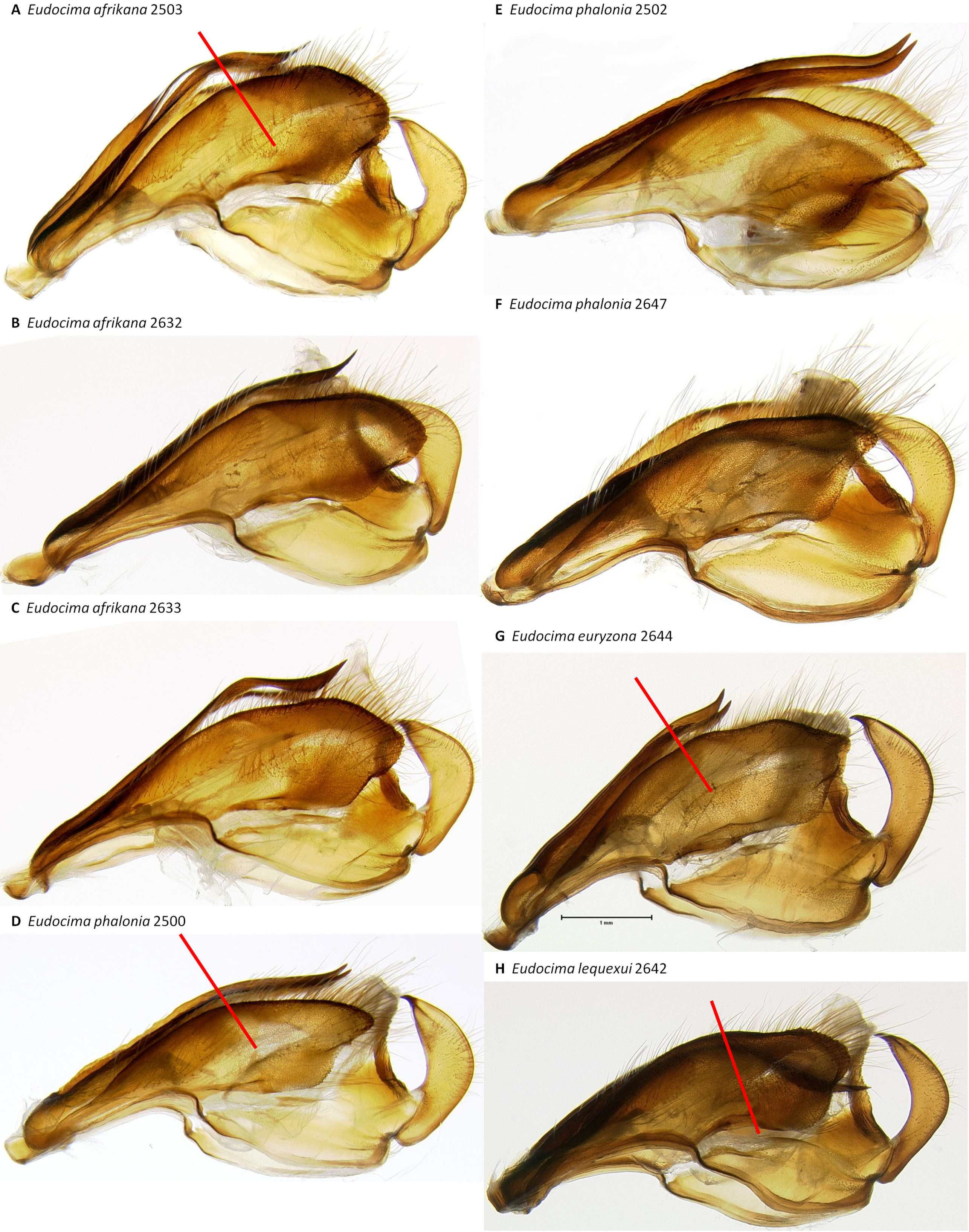
G *Eudocima euryzona* 2641

H *Eudocima euryzona* 2644

I *Eudocima lequexui* 2642

J *Eudocima lequexui* 2643

FIGURE 35. *Eudocima* male genitalic capsules (dorsal aspect) with hairs removed.



A *Eudocima afrikana* 2503

B *Eudocima afrikana* 2632

C *Eudocima afrikana* 2633

D *Eudocima phalonia* 2500

E *Eudocima phalonia* 2502

F *Eudocima phalonia* 2647

G *Eudocima euryzona* 2644

H *Eudocima lequexui* 2642

FIGURE 36. *Eudocima* male genitalic capsules (lateral aspect) with hairs removed. Red lines cross the first inflexion point on the juxta.

FIGURE 37. *Eudocima* juxtas with natural three dimensional structure.

FIGURE 38. *Eudocima* juxtas (ventral aspect). These preparations are flattened out and mounted on slides.

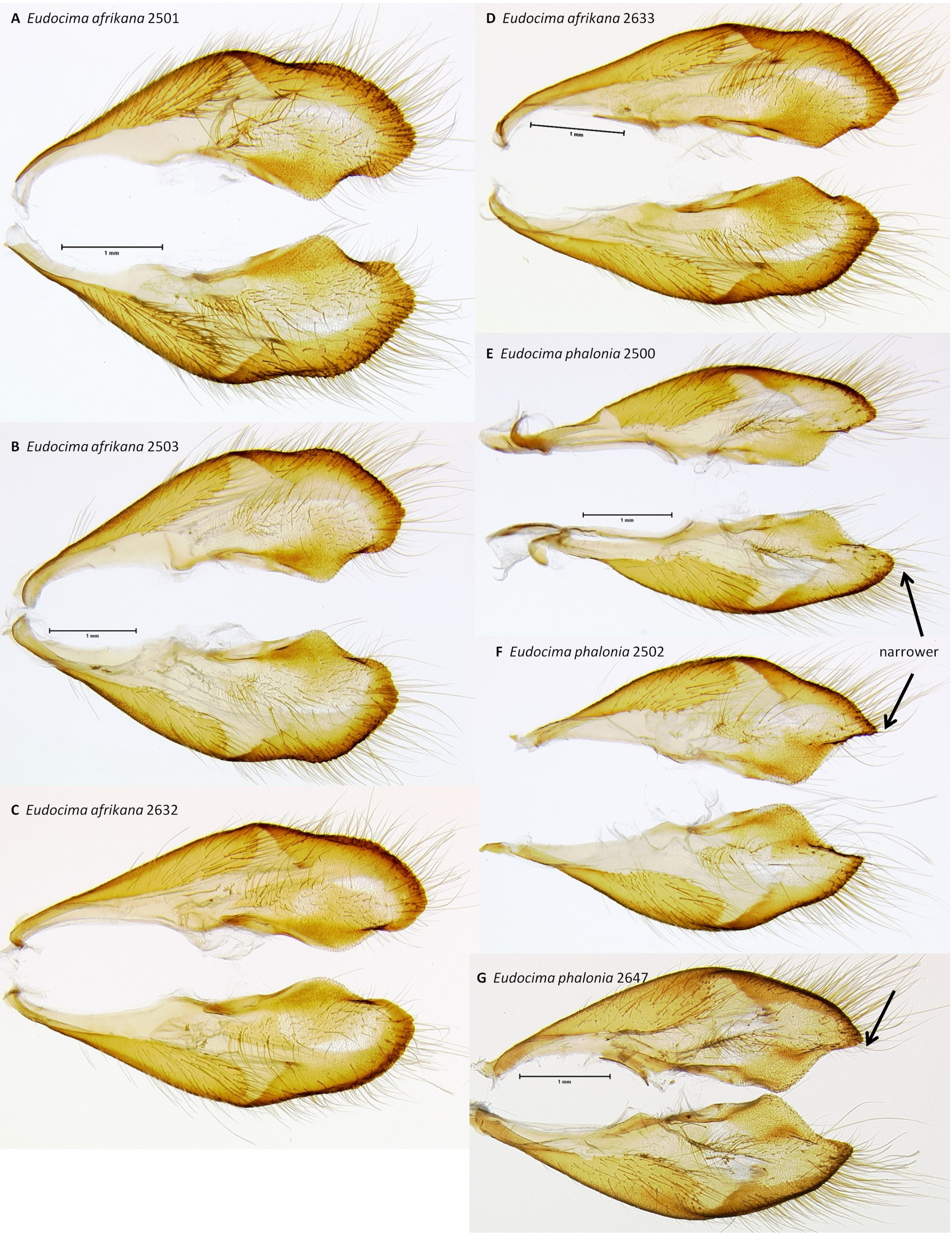


FIGURE 39. *Eudocima* valvae (inner aspect). These preparations are lying flat on the bottom of a petri dish.

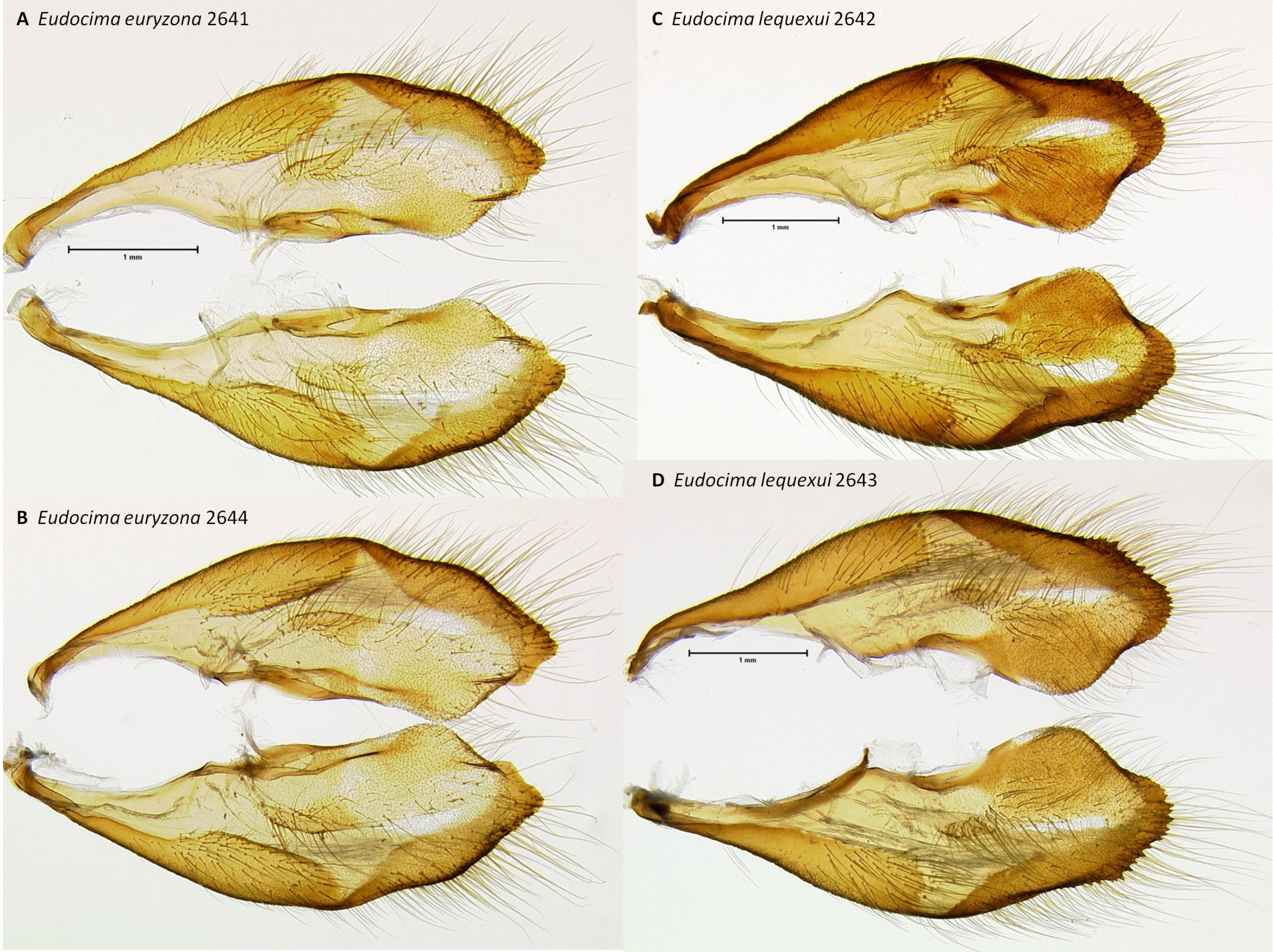


FIGURE 40. *Eudocima* valvae (inner aspect). These preparations are lying flat on the bottom of a petri dish.

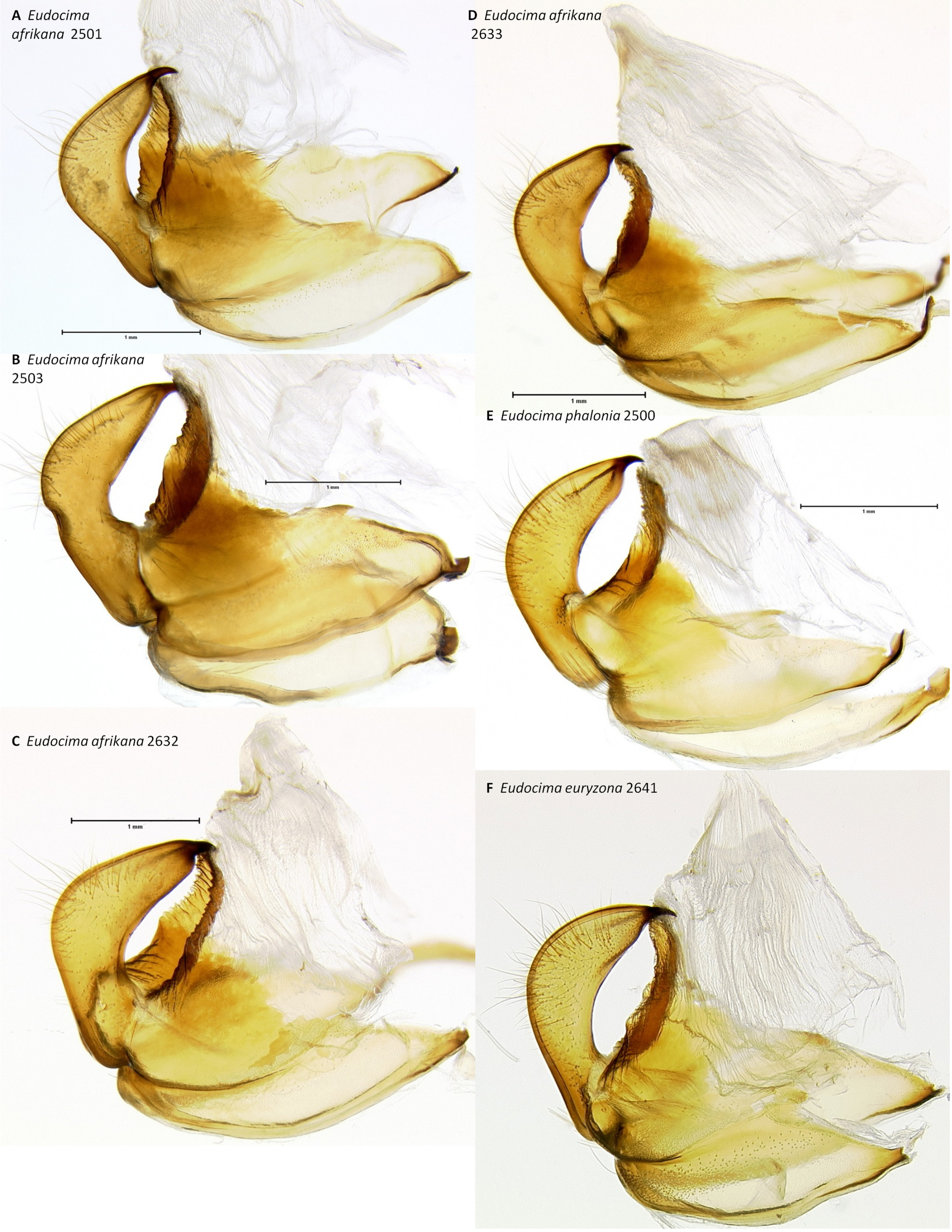


FIGURE 41. *Eudocima* uncus, tuba analis, and tegumen (lateral aspect). These preparations are on the bottom of a petri dish and the arms of the tegumen are slightly compressed due to being held in place by a piece of concave glass.

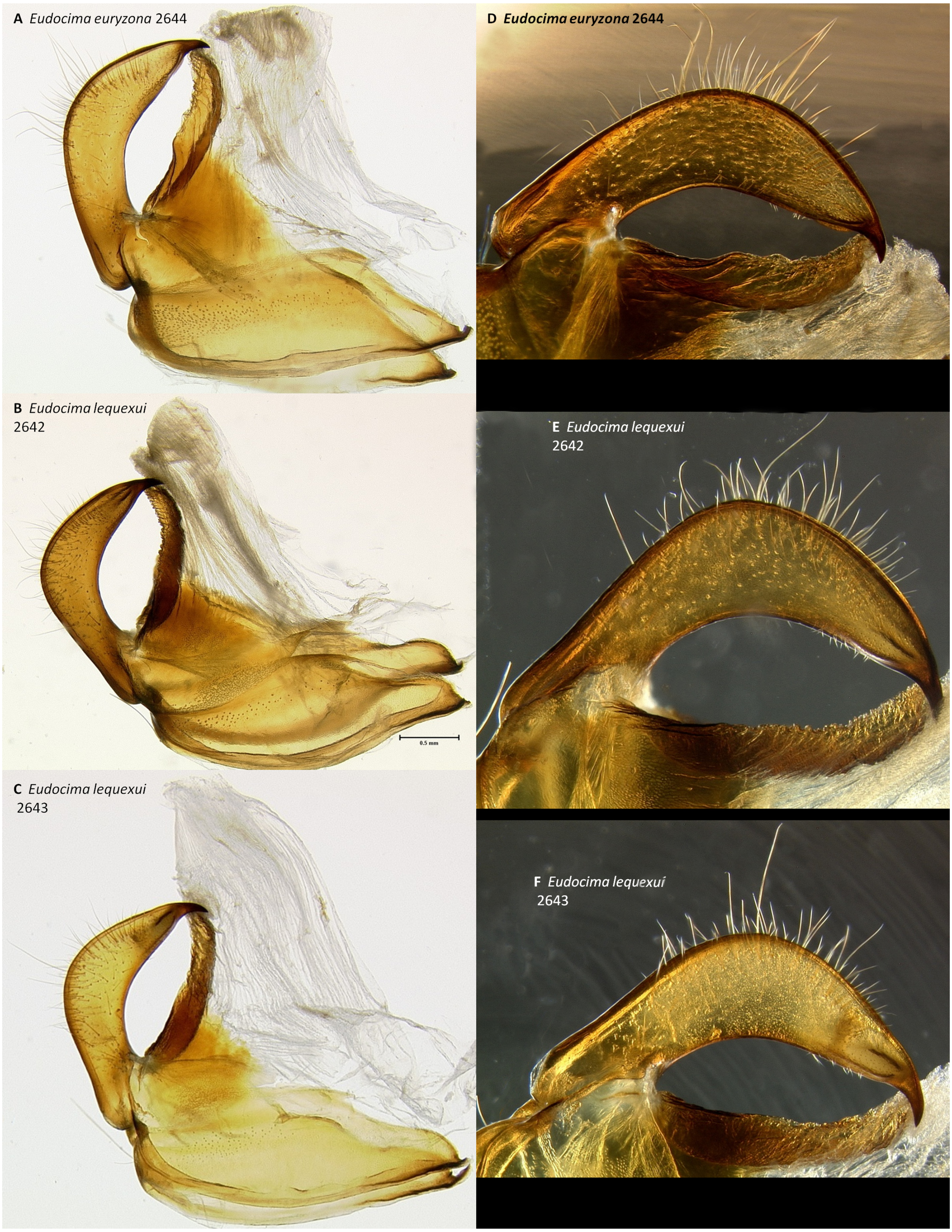


FIGURE 42. A–C: *Eudocima* uncus, tuba analis, and tegumen (lateral aspect). These preparations are on the bottom of a petri dish and the arms of the tegumen are slightly compressed due to being held in place by a piece of concave glass; **D–F:** *Eudocima* uncus and scaphium (lateral aspect).

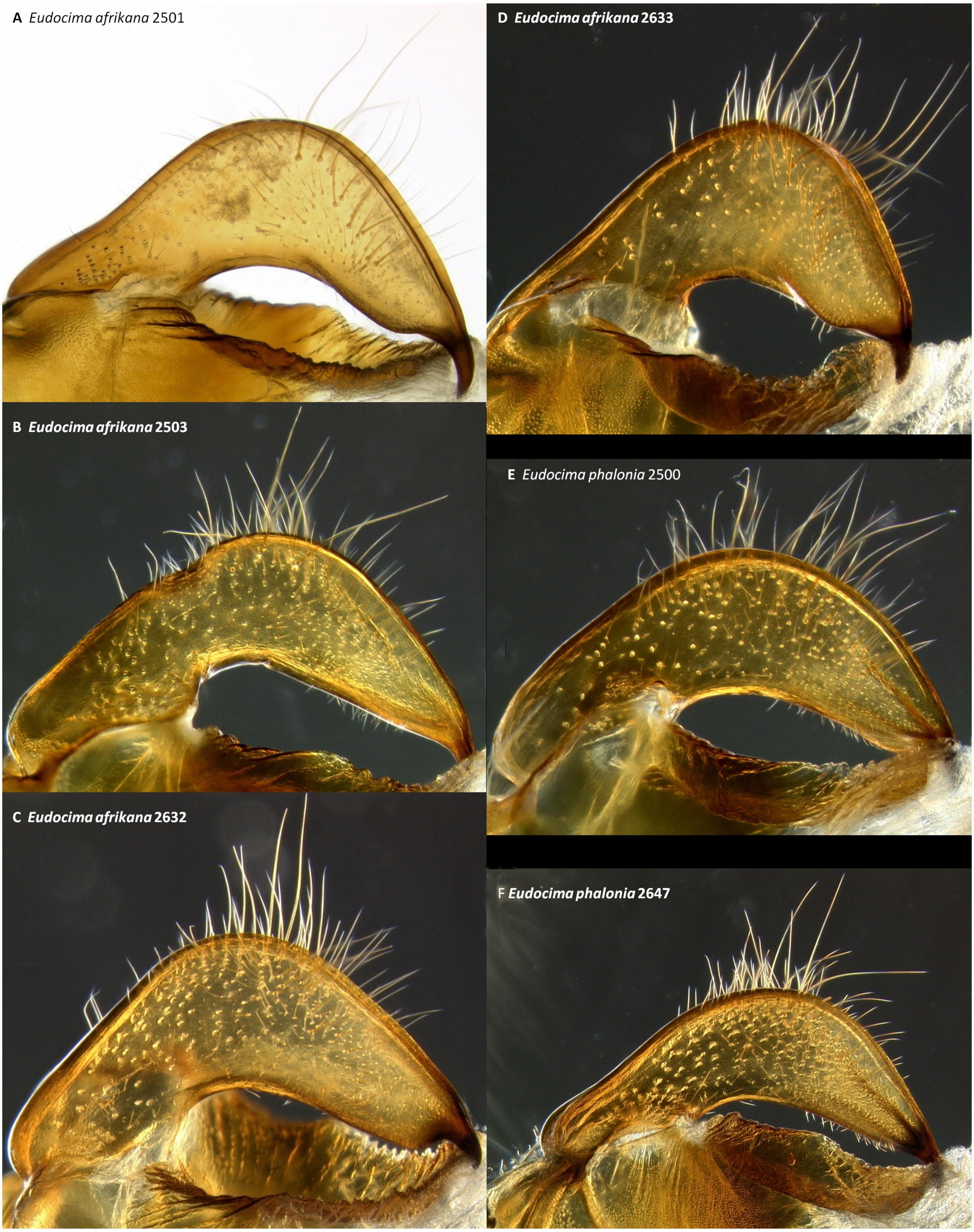


FIGURE 43. *Eudocima* uncus (lateral aspect).

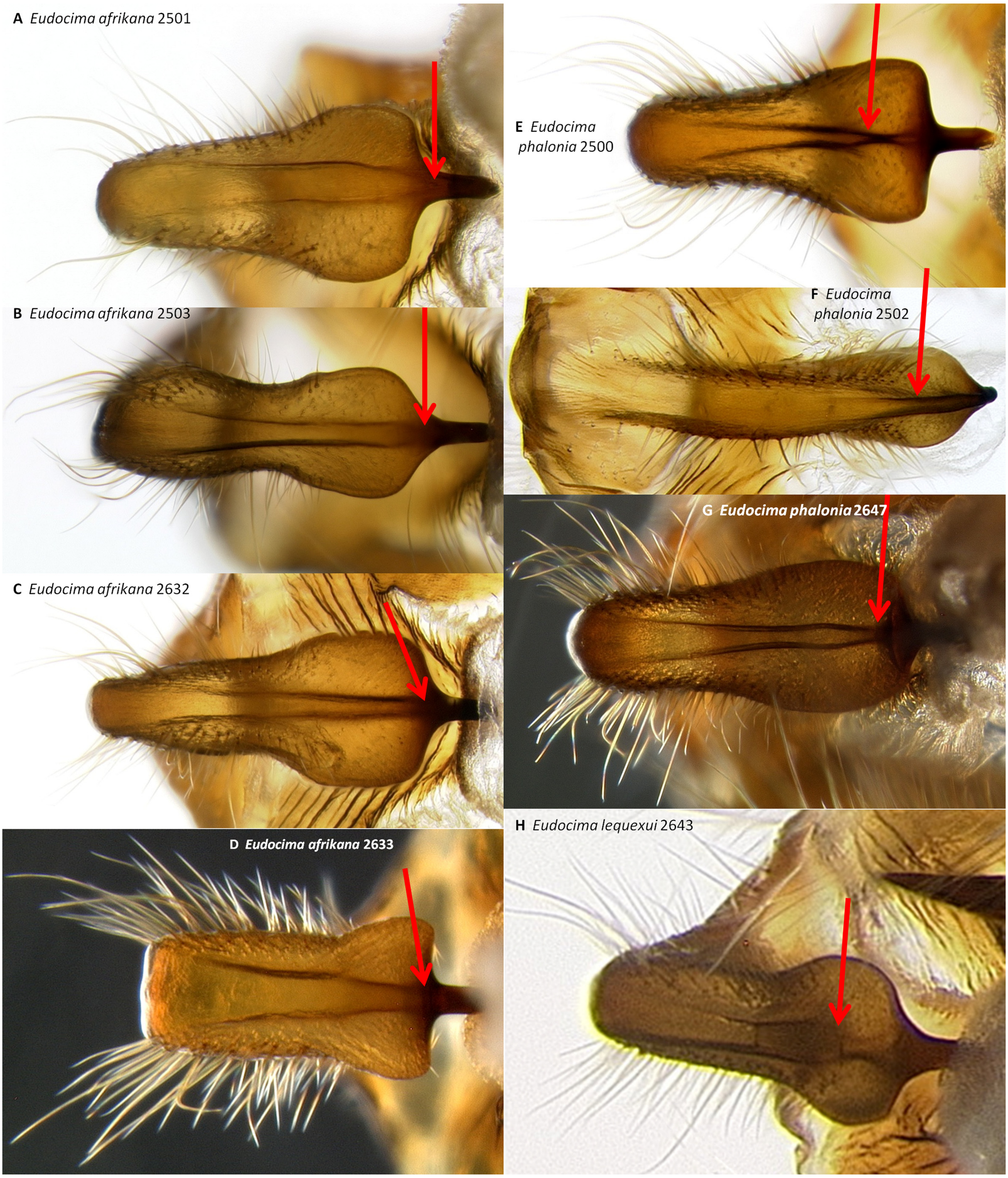


FIGURE 44. *Eudocima* uncus apex (ventral aspect).

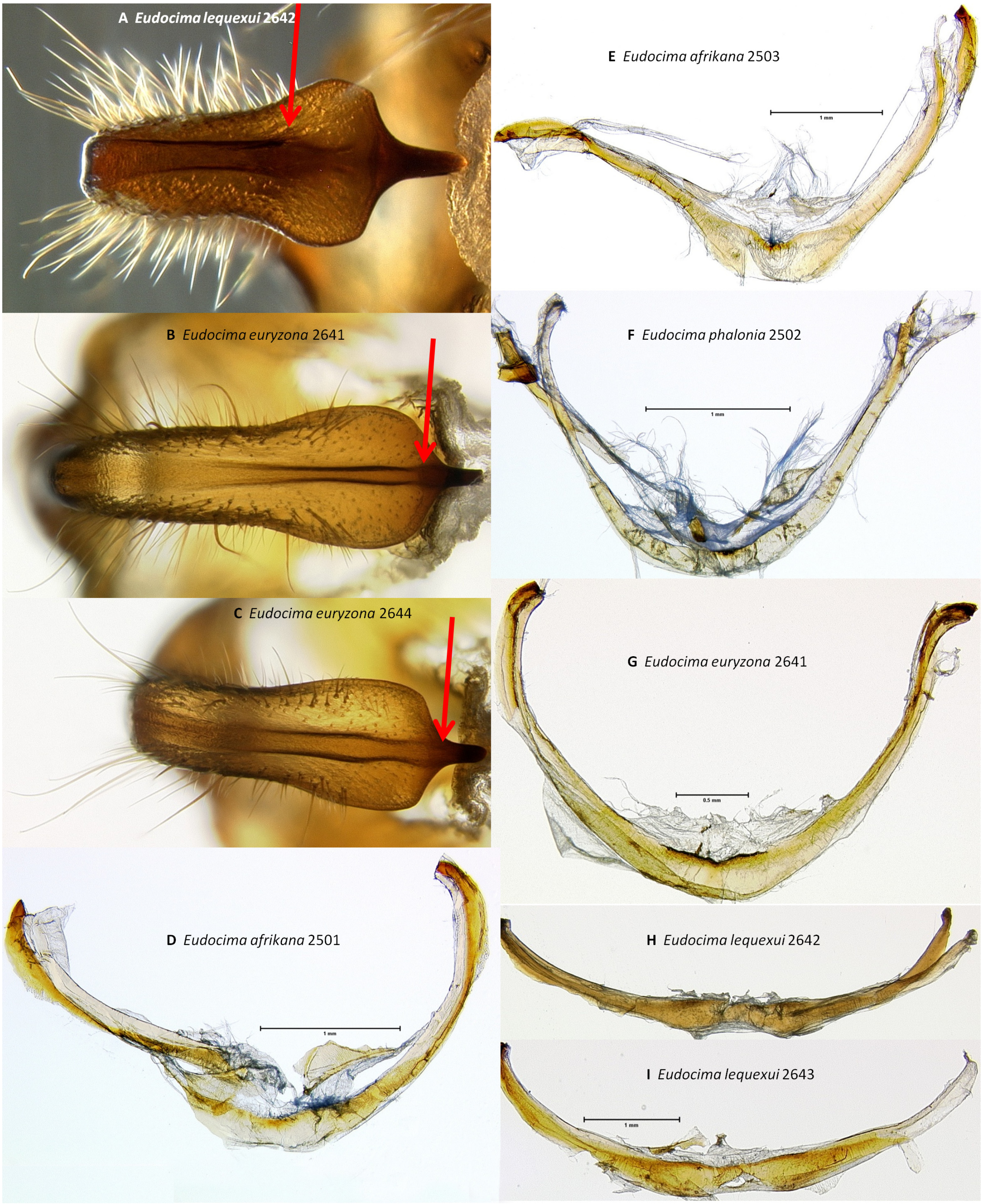


FIGURE 45. A–C: *Eudocima* uncus apex (ventral aspect); **D–I:** Eudocima saccus (ventral aspect). These preparations are flattened out and mounted on slides.

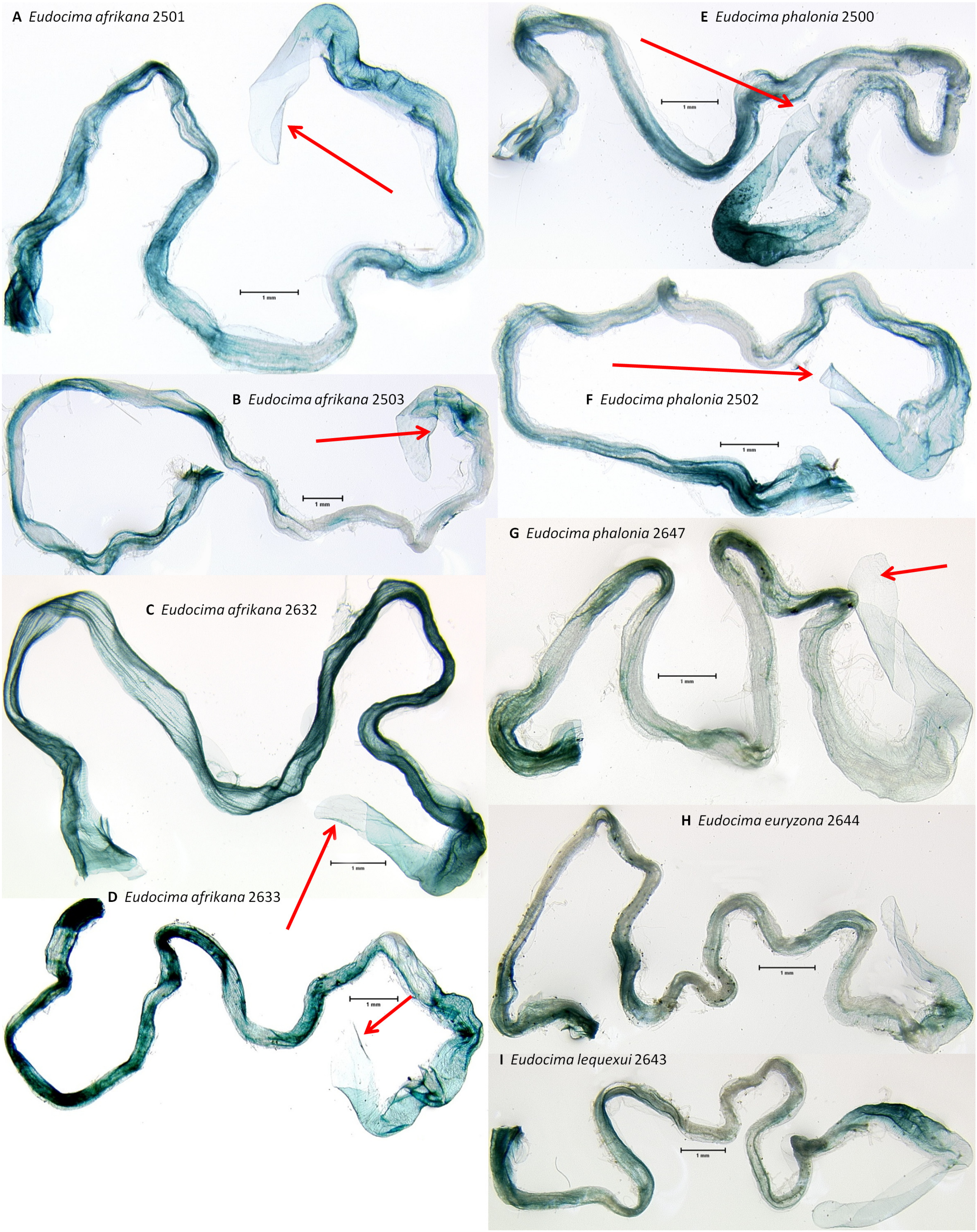
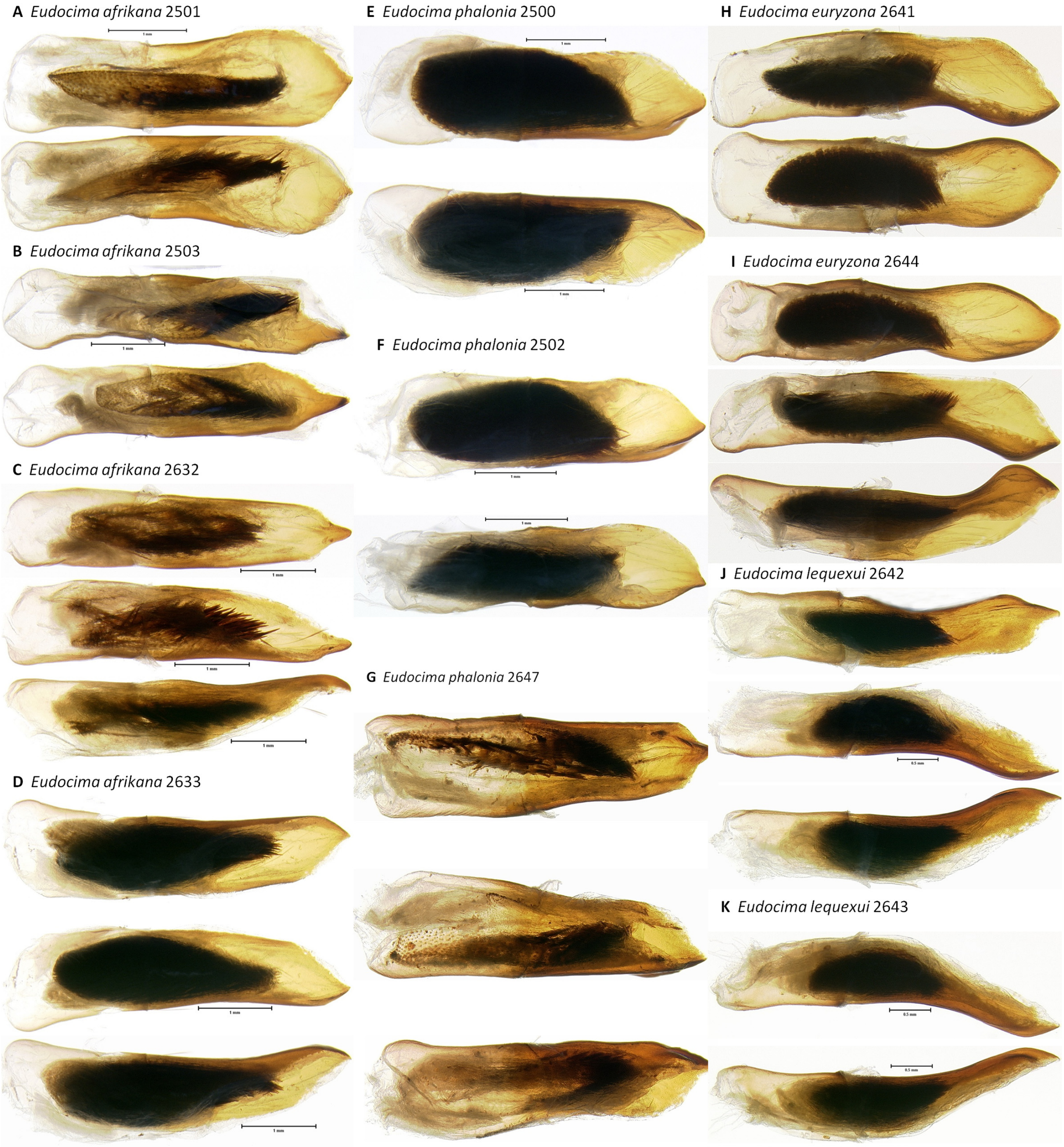


FIGURE 46. *Eudocima* ductus ejaculatorius simplex (posterior section, external of the phallus) stained with chlorozol black. Terminology follows Mitter (1988). The homologous structures for a variety of *Catocala* species appear in Mitter's (1988) Figures 22–24 & 26–34.



A *Eudocima afrikana* 2501

B *Eudocima afrikana* 2503

C *Eudocima afrikana* 2632

D *Eudocima afrikana* 2633

E *Eudocima phalonia* 2500

F *Eudocima phalonia* 2502

G *Eudocima phalonia* 2647

H *Eudocima euryzona* 2641

I *Eudocima euryzona* 2644

J *Eudocima lequexui* 2642

K *Eudocima lequexui* 2643

FIGURE 47. *Eudocima* phallus (multiple aspects). The position of the triangular ventral phallus hood indicates the orientation of the phallus.

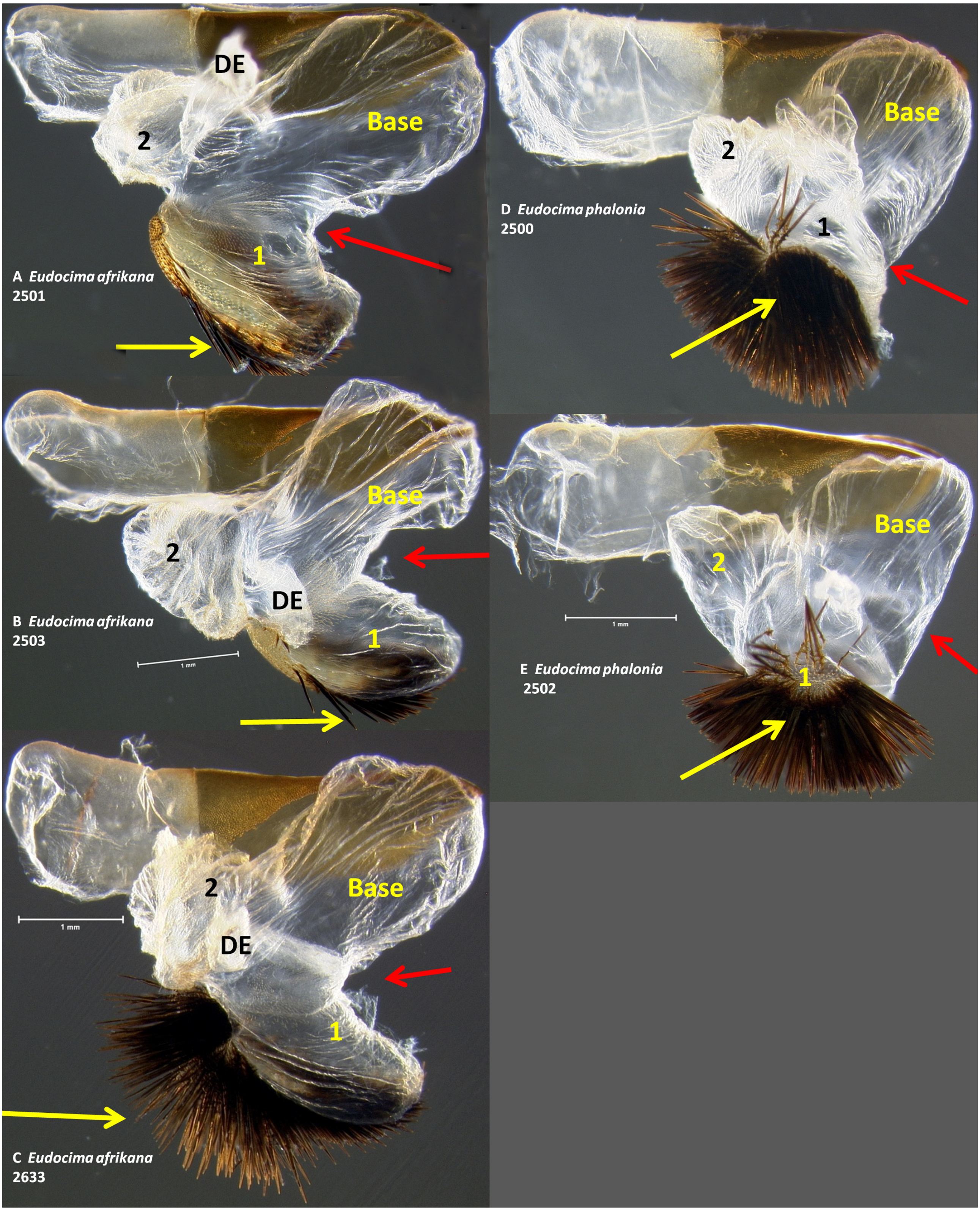


FIGURE 48. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood behind the image and tilted to the left.

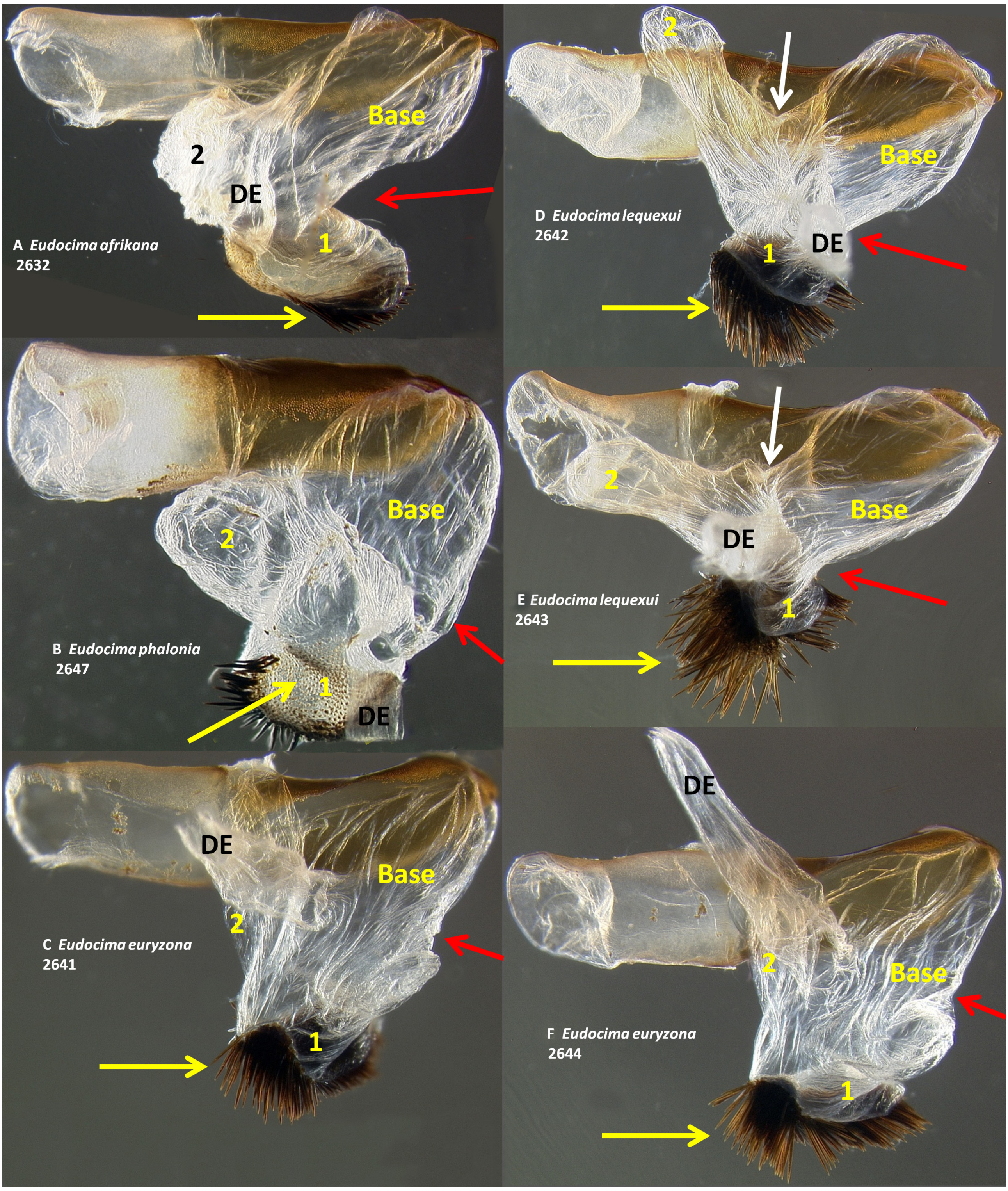


FIGURE 49. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood behind the image and tilted to the left.

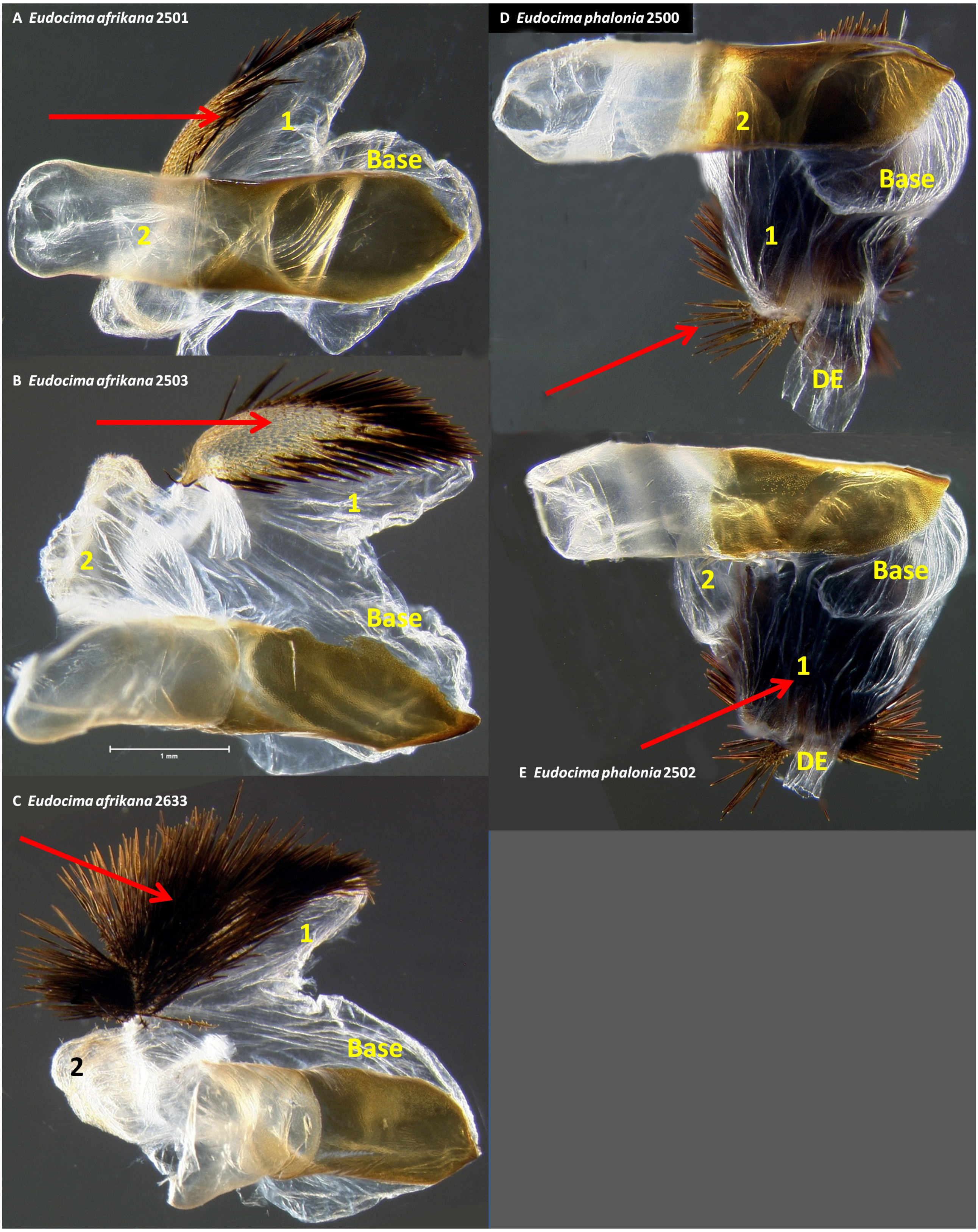


FIGURE 50. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood in front of the image. Note this is the most difficult orientation to photograph, resulting in relatively greater variation in tilt among the images.

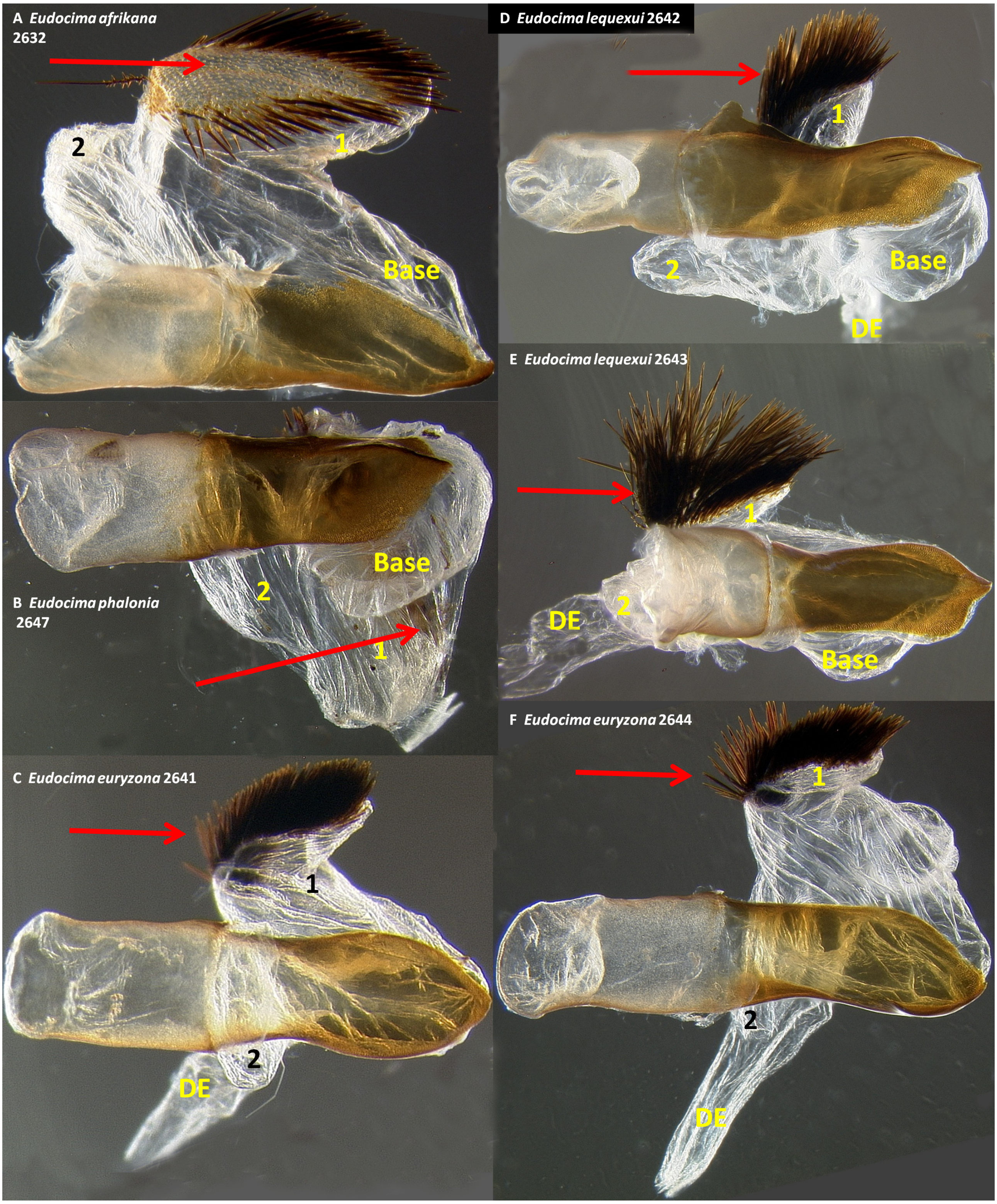


FIGURE 51. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood in front of the image. Note this is the most difficult orientation to photograph, resulting in relatively greater variation in tilt among the images.

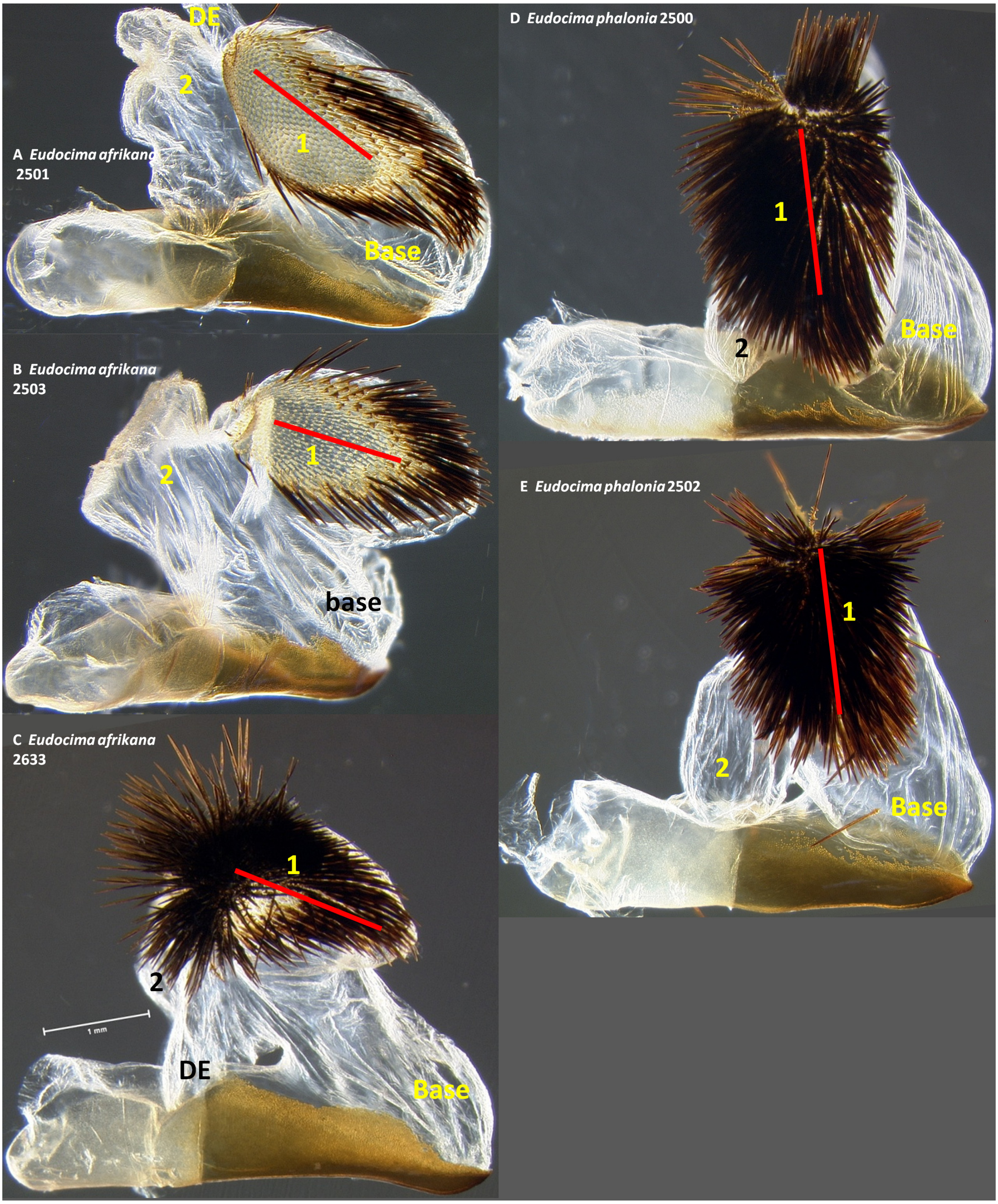


FIGURE 52. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood orientated laterally and down.

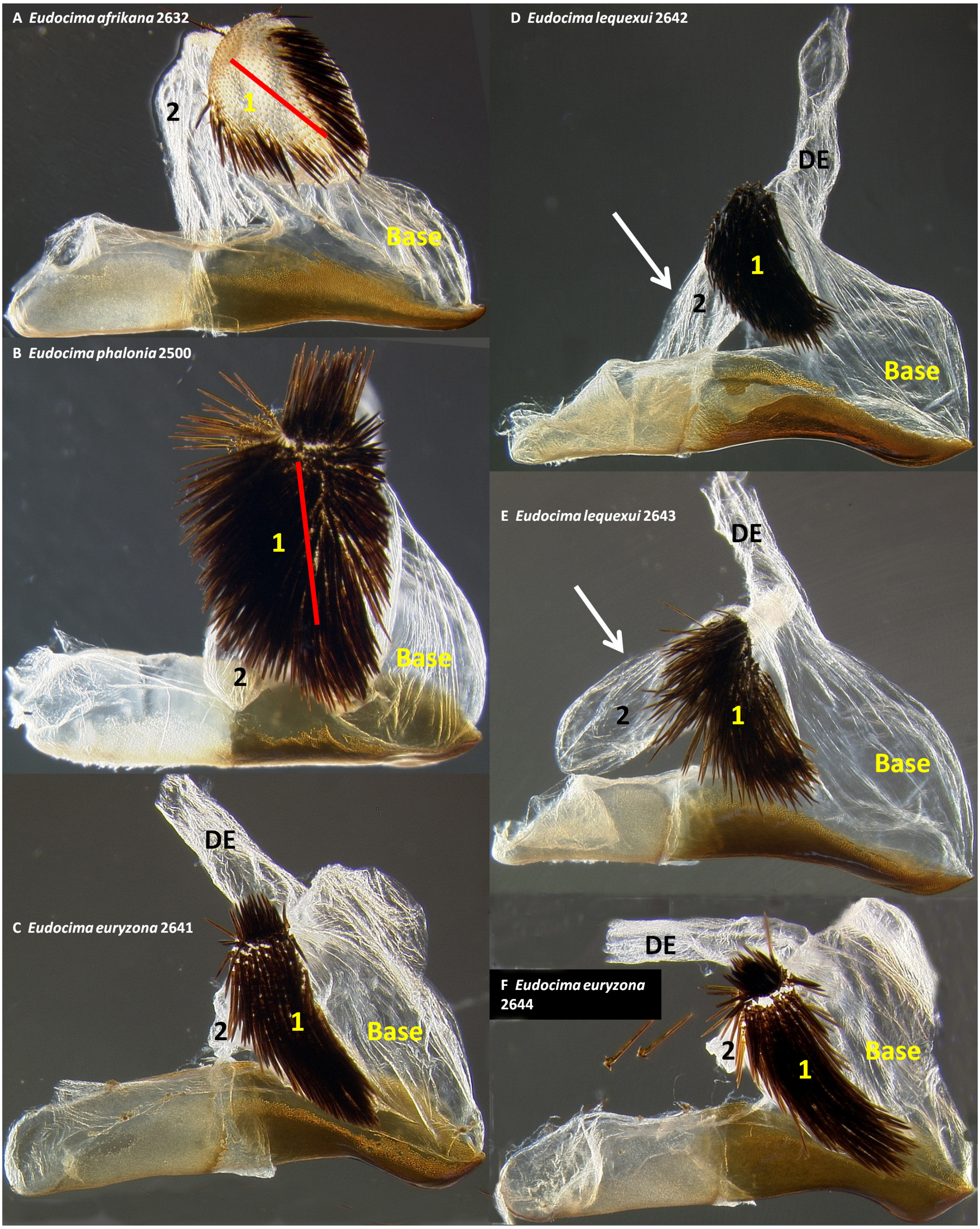


FIGURE 53. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood orientated laterally and down.

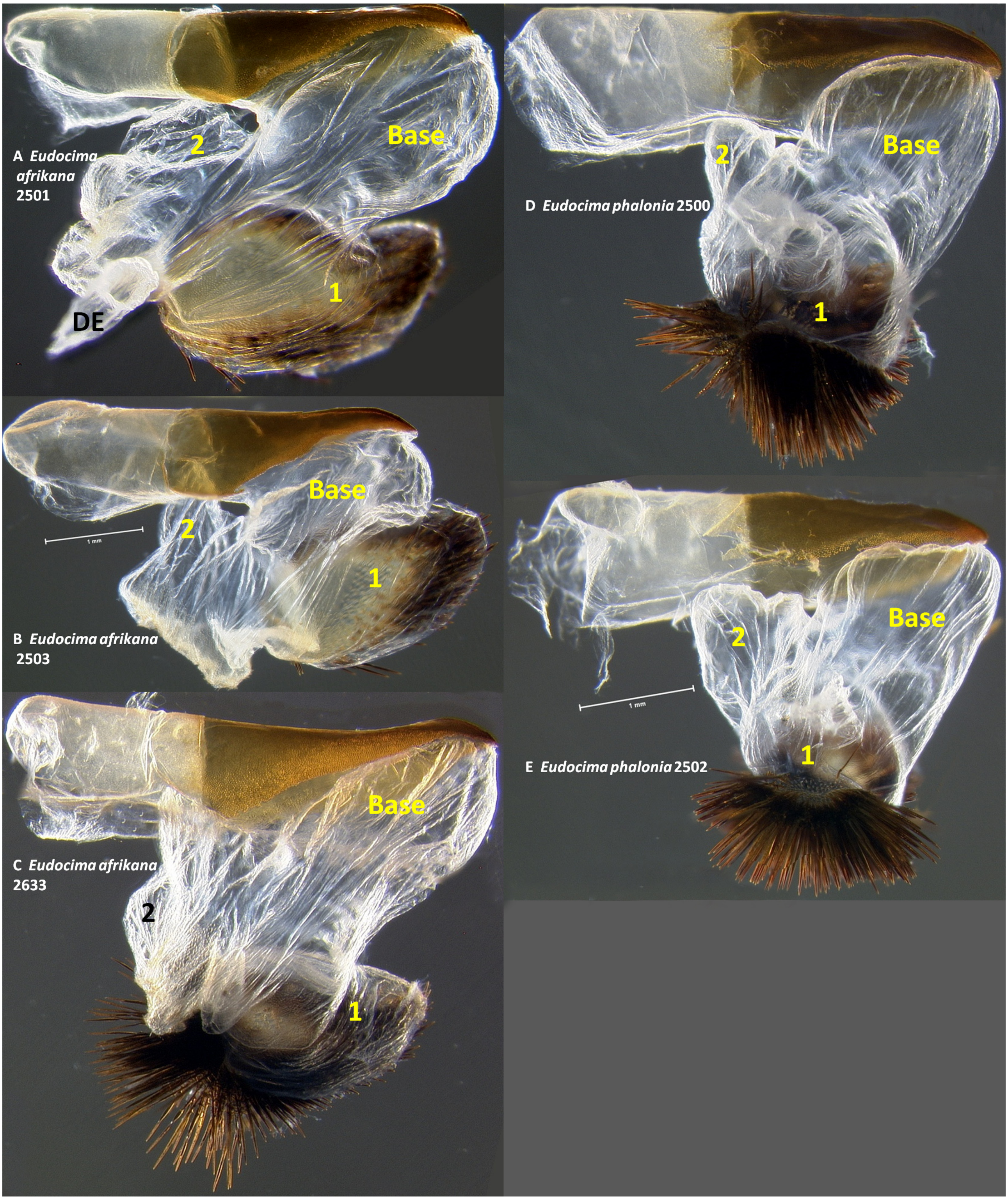


FIGURE 54. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood orientated laterally and up.

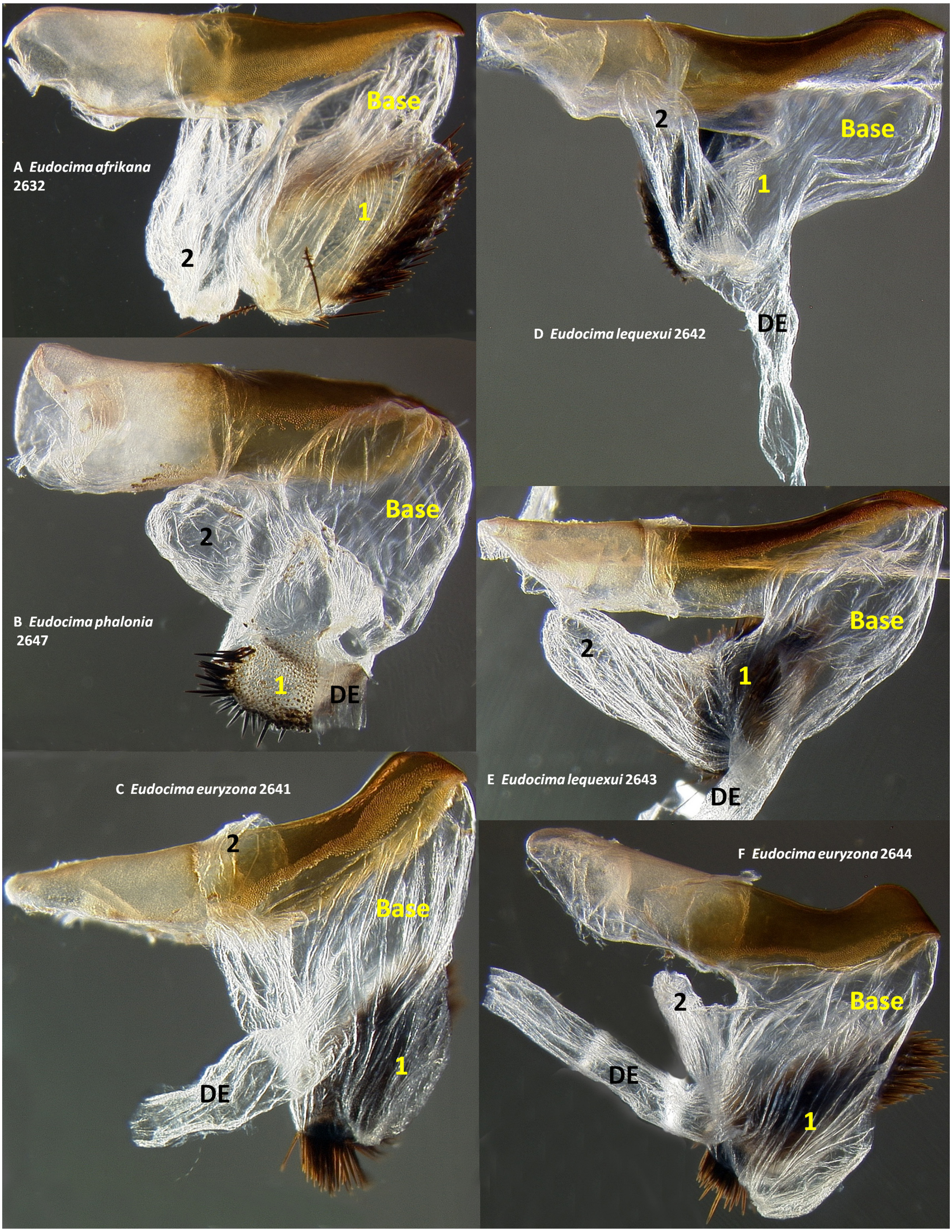


FIGURE 55. Three dimensional phallus and everted *Eudocima* vesica with the ventral phallus hood orientated laterally and up.

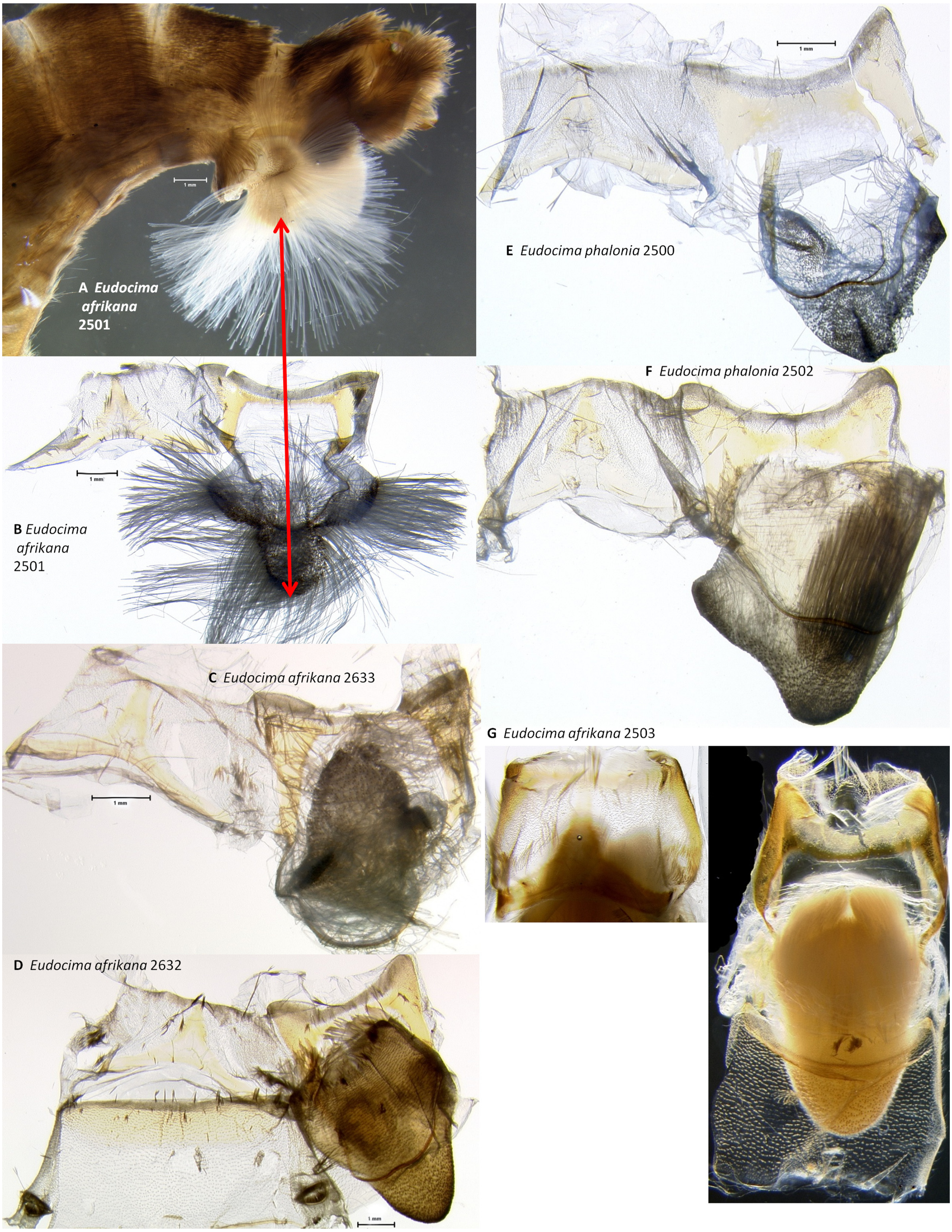


FIGURE 56. *Eudocima* coremata: **A:** KOH treated abdomen with no hairs or scales removed (lateral aspect); **B–F:** slide mounted eighth segment of abdominal cuticle with many or all hairs and scales removed; **G:** Eighth sternite in alcohol and still attached to tergite, with hairs and scales removed (left); sternites 7–8 in alcohol with hairs of coremata cut off but not removed, other hairs and scales removed (right).

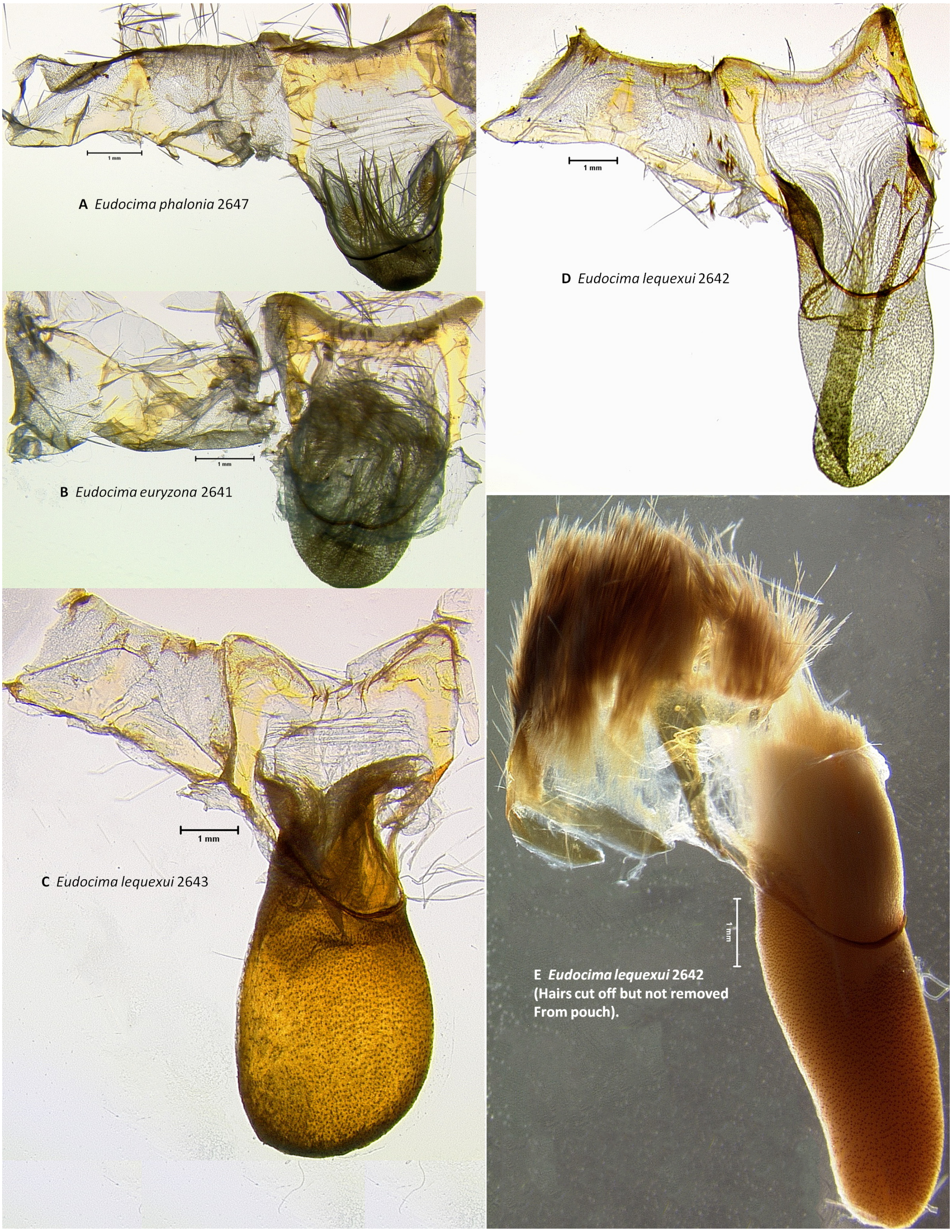
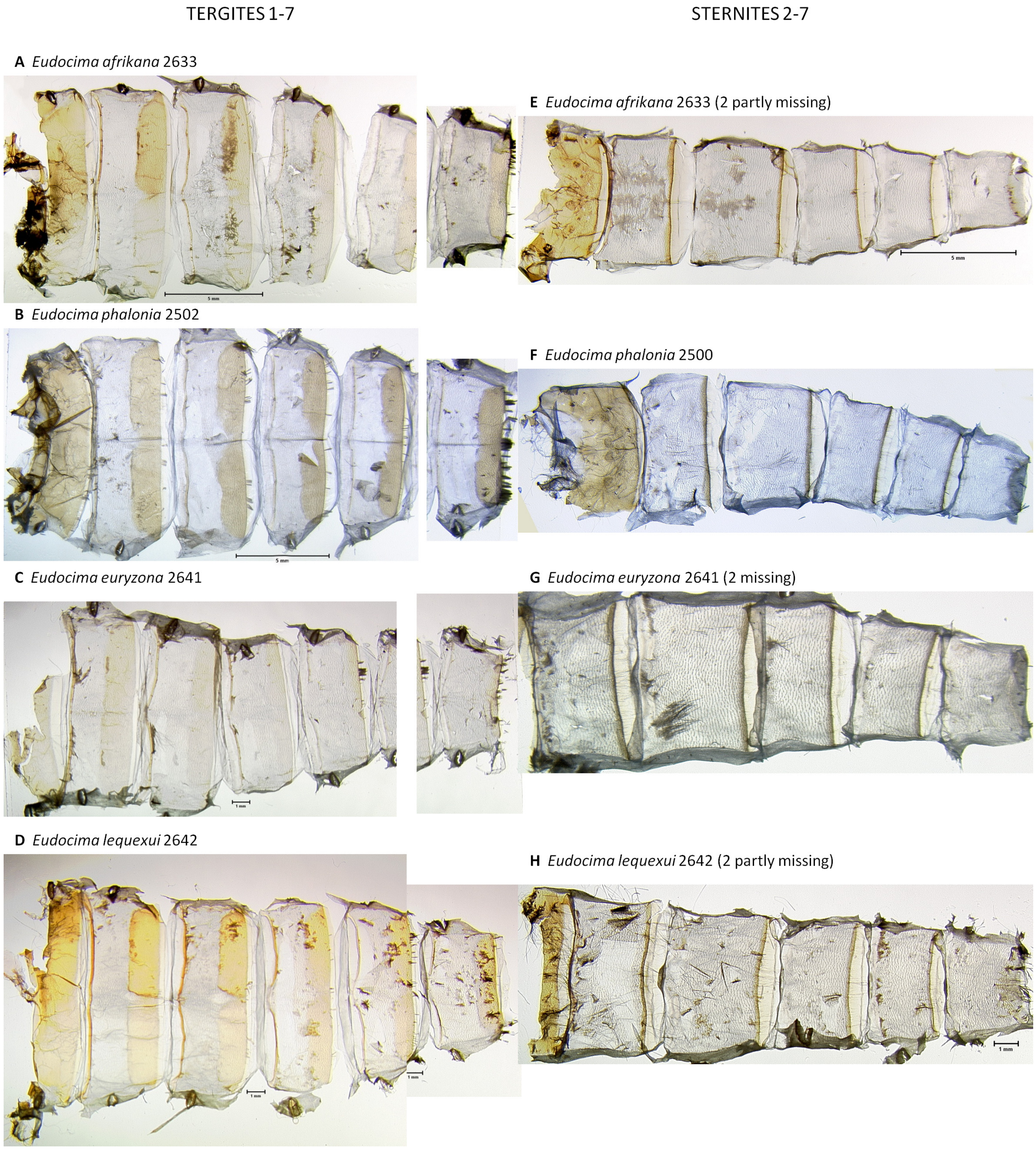


FIGURE 57. *Eudocima* coremata: **A–D:** slide mounted eighth segment of abdominal cuticle with most hairs and scales removed; **E:** Eighth abdominal segment in alcohol with hairs of coremata cut off but not removed.



TERGITES 1-7

STERNITES 2-7

A *Eudocima afrikana* 2633

B *Eudocima phalonia* 2502

C *Eudocima euryzona* 2641

D *Eudocima lequexui* 2642

E *Eudocima afrikana* 2633 (2 partly missing)

F *Eudocima phalonia* 2500

G *Eudocima euryzona* 2641 (2 missing)

H *Eudocima lequexui* 2642 (2 partly missing)

FIGURE 58. *Eudocima* tergites and sternites with hairs and scales removed (excluding eighth segment).

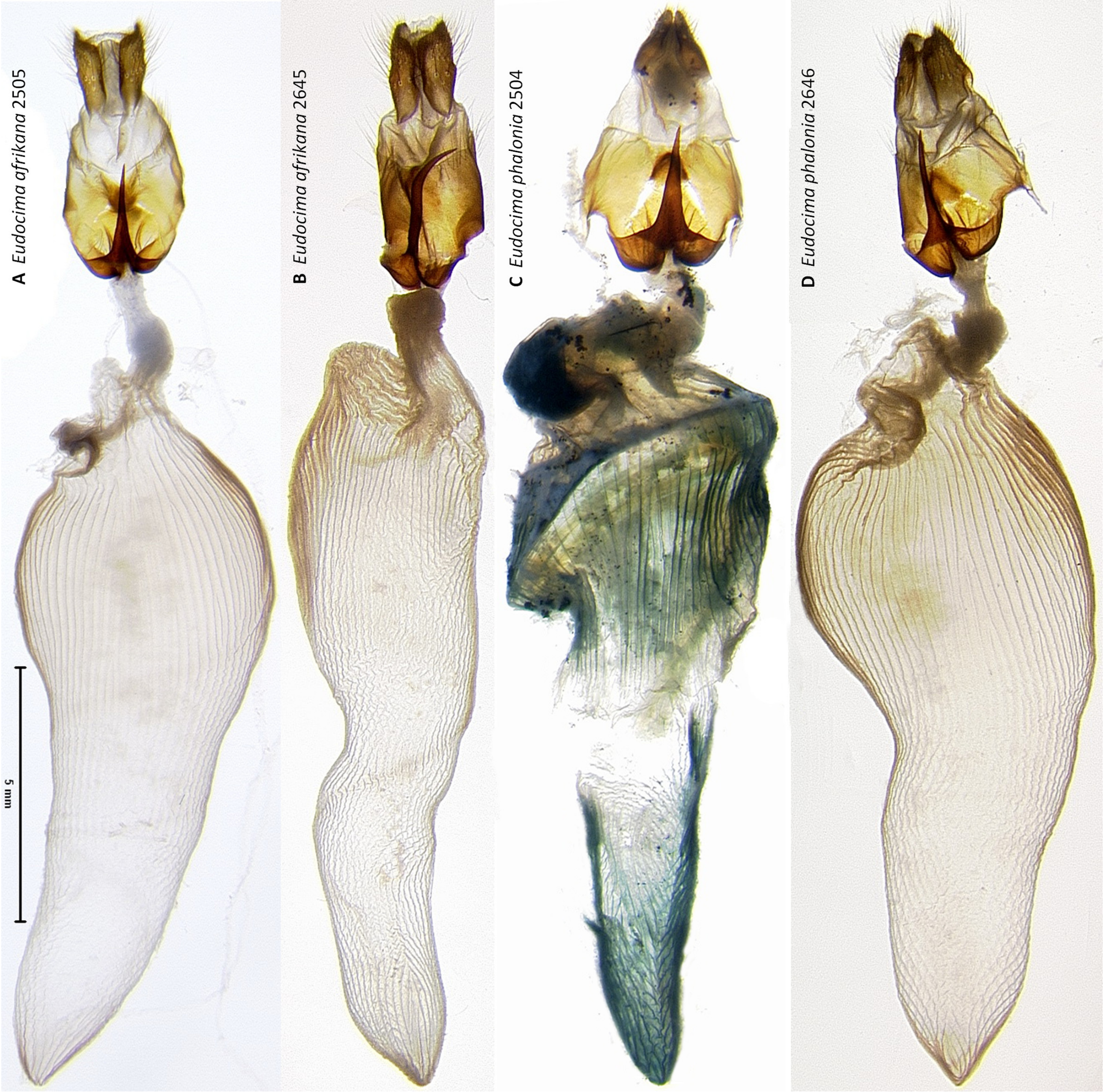


FIGURE 59. *Eudocima* female genitalia habitus (ventral aspect). Note Figure 3 is dermestid damaged and dyed with chlorozol black.

FIGURE 60. *Eudocima afrikana* female genitalia habitus in three orientations.

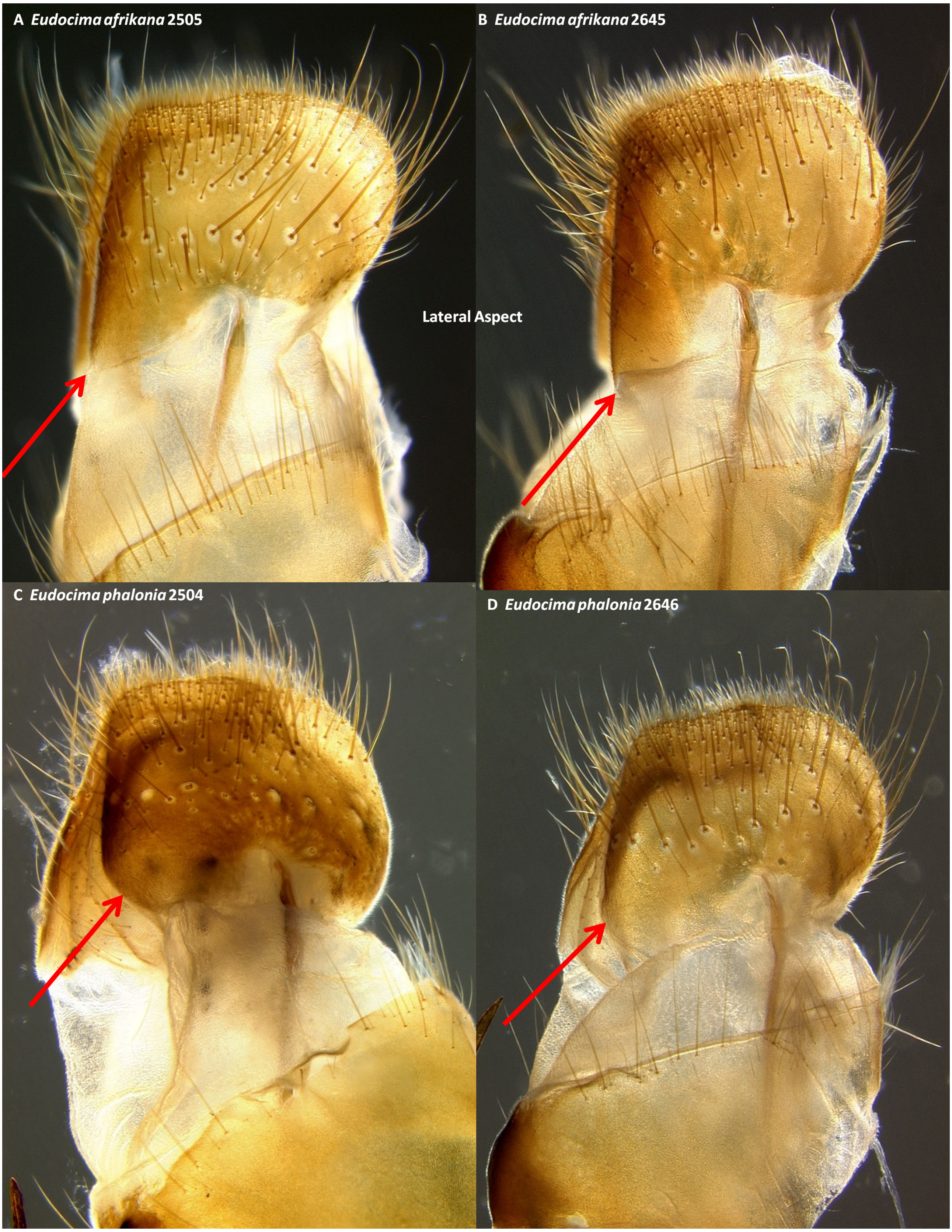


FIGURE 61. *Eudocima* papillae analis (lateral aspect).

FIGURE 62. *Eudocima* papillae analis (ventral aspect).

FIGURE 63. *Eudocima* papillae analis (dorsal aspect).

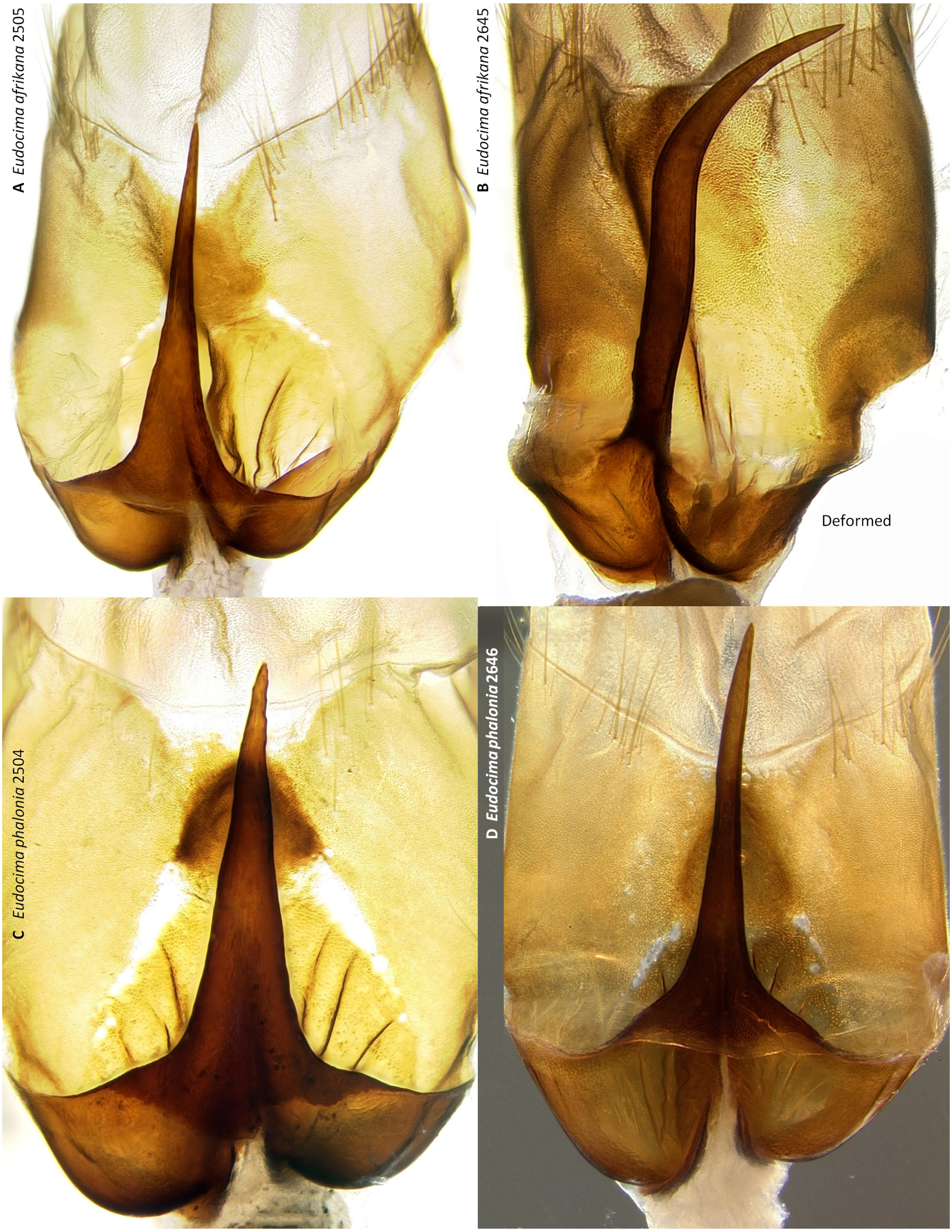


FIGURE 64. *Eudocima* lamella antevaginalis and antrum (ventral aspect).

FIGURE 65. *Eudocima* lamella antevaginalis and antrum (dorsal aspect).

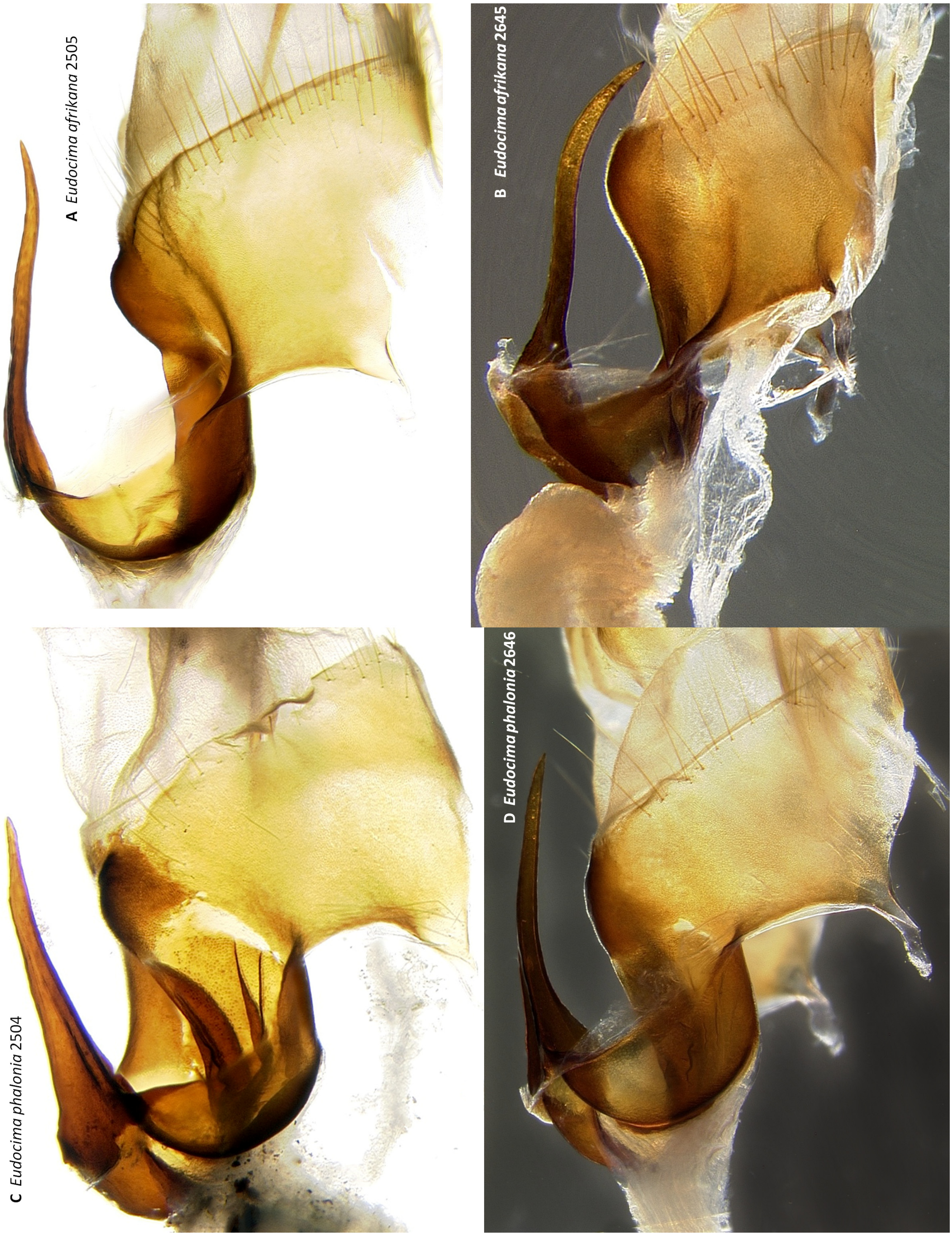


FIGURE 66. *Eudocima* lamella antevaginalis and antrum (lateral aspect).

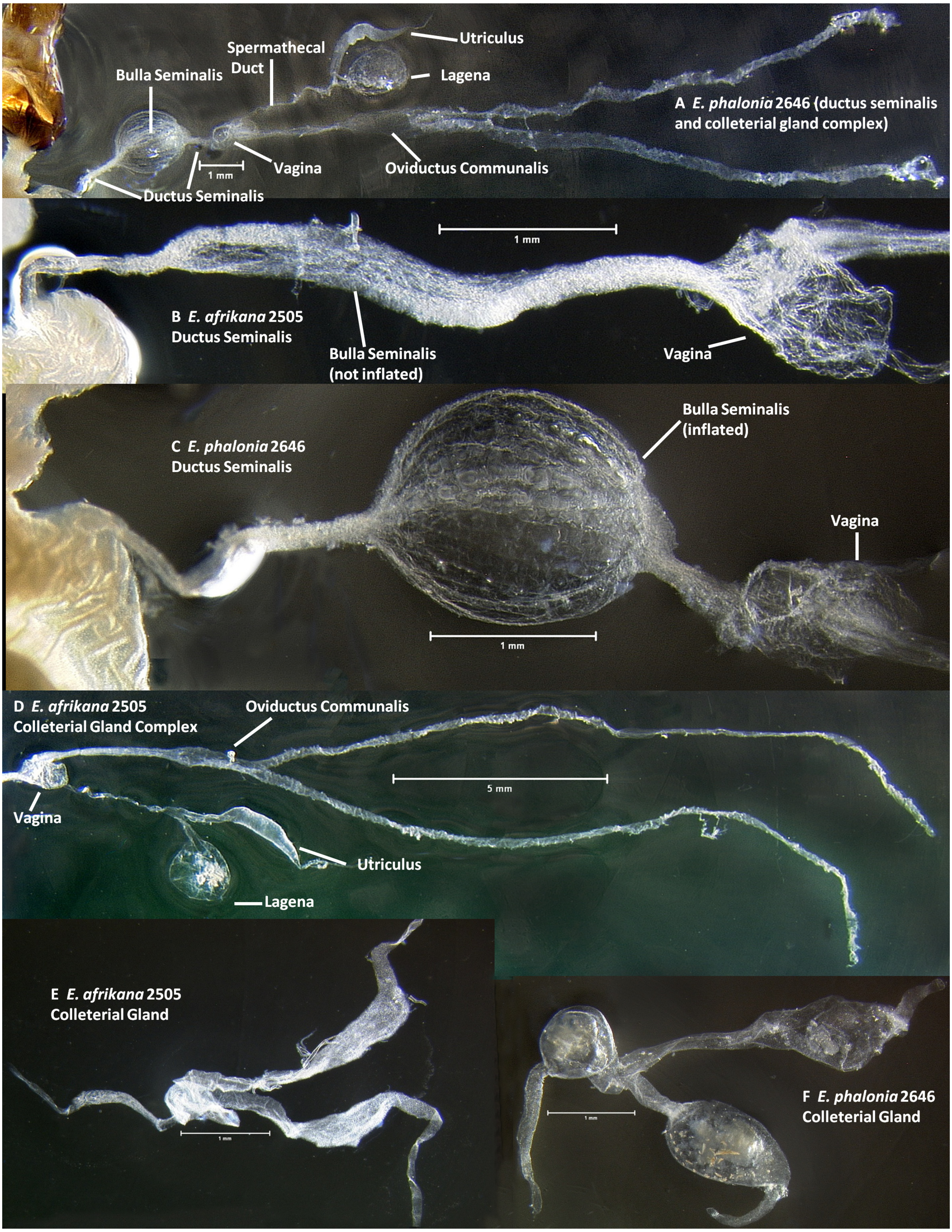


FIGURE 67. *Eudocima* ductus seminalis and colleterial gland complex.

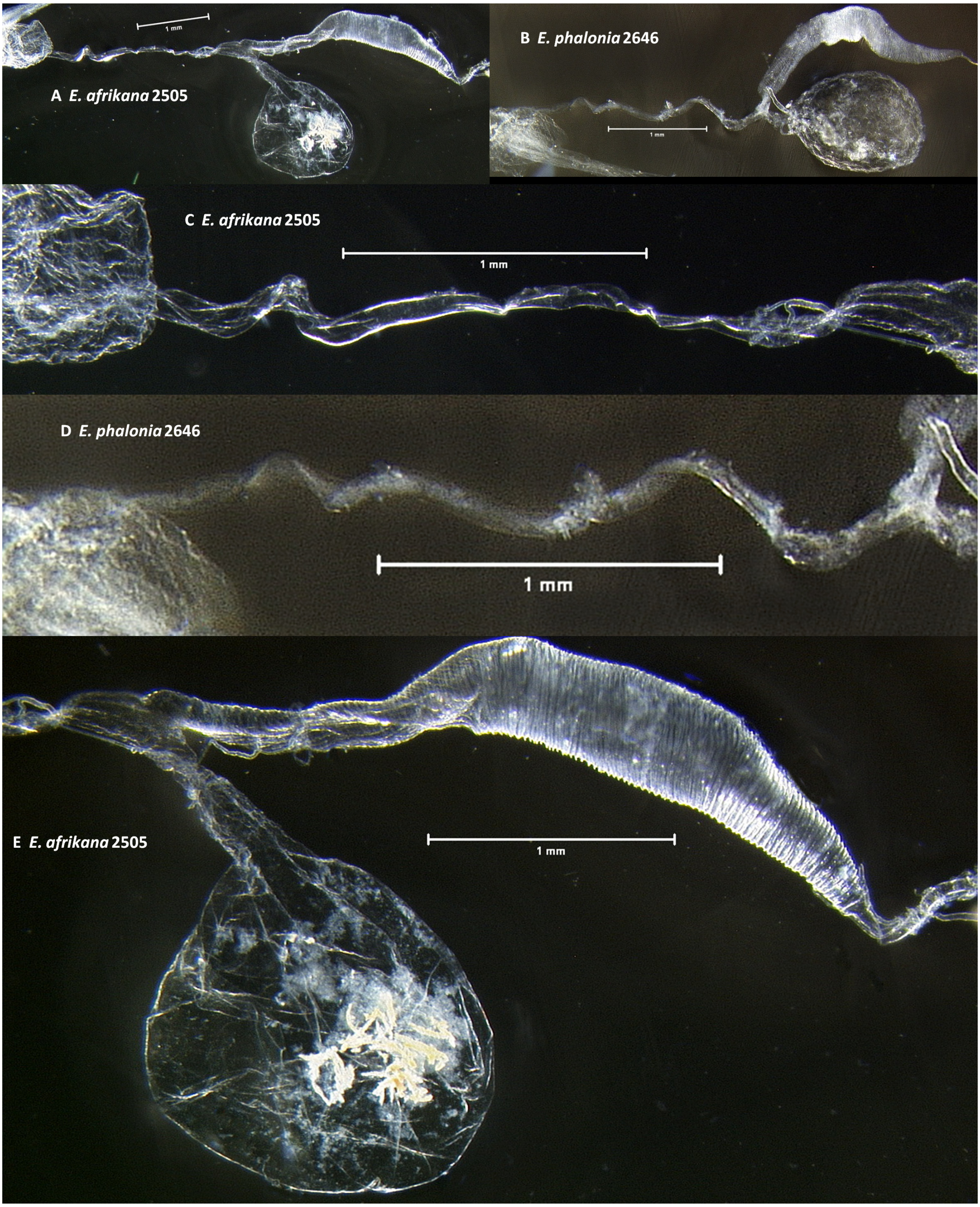


FIGURE 68. *Eudocima* spermathecal duct and associated glands.

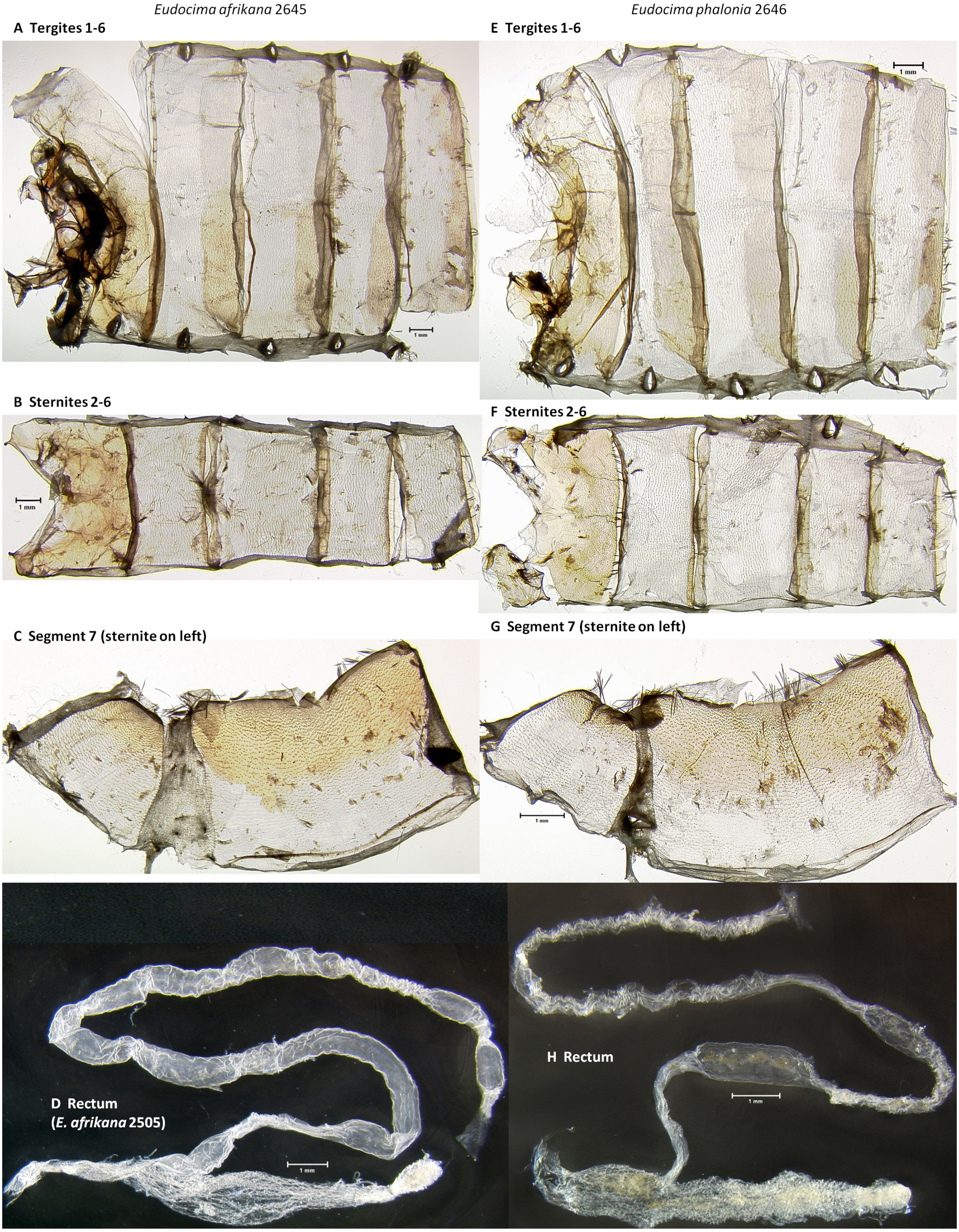


FIGURE 69. A & E: *Eudocima* tergites 1–6; **B & F:** *Eudocima sternites* 2–6; **C & G:** *Eudocima* abdominal cuticle segment 7; **D & H:** *Eudocima* female rectum. Note Figure D is a different specimen of *E. afrikana* from Figures A–C.

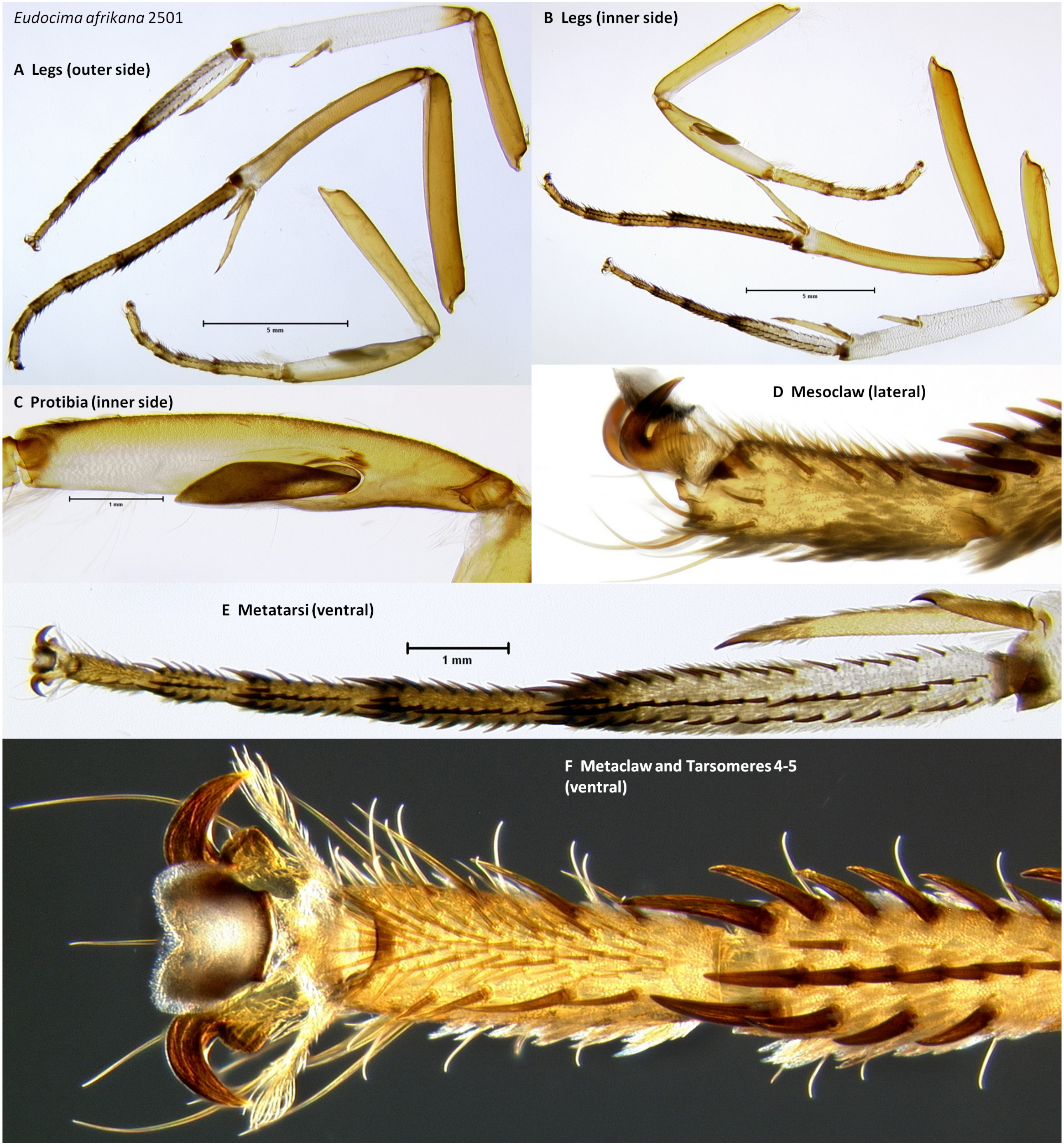


FIGURE 70. *Eudocima afrikana* male legs. These preparations are KOH treated with many hairs and scales removed.

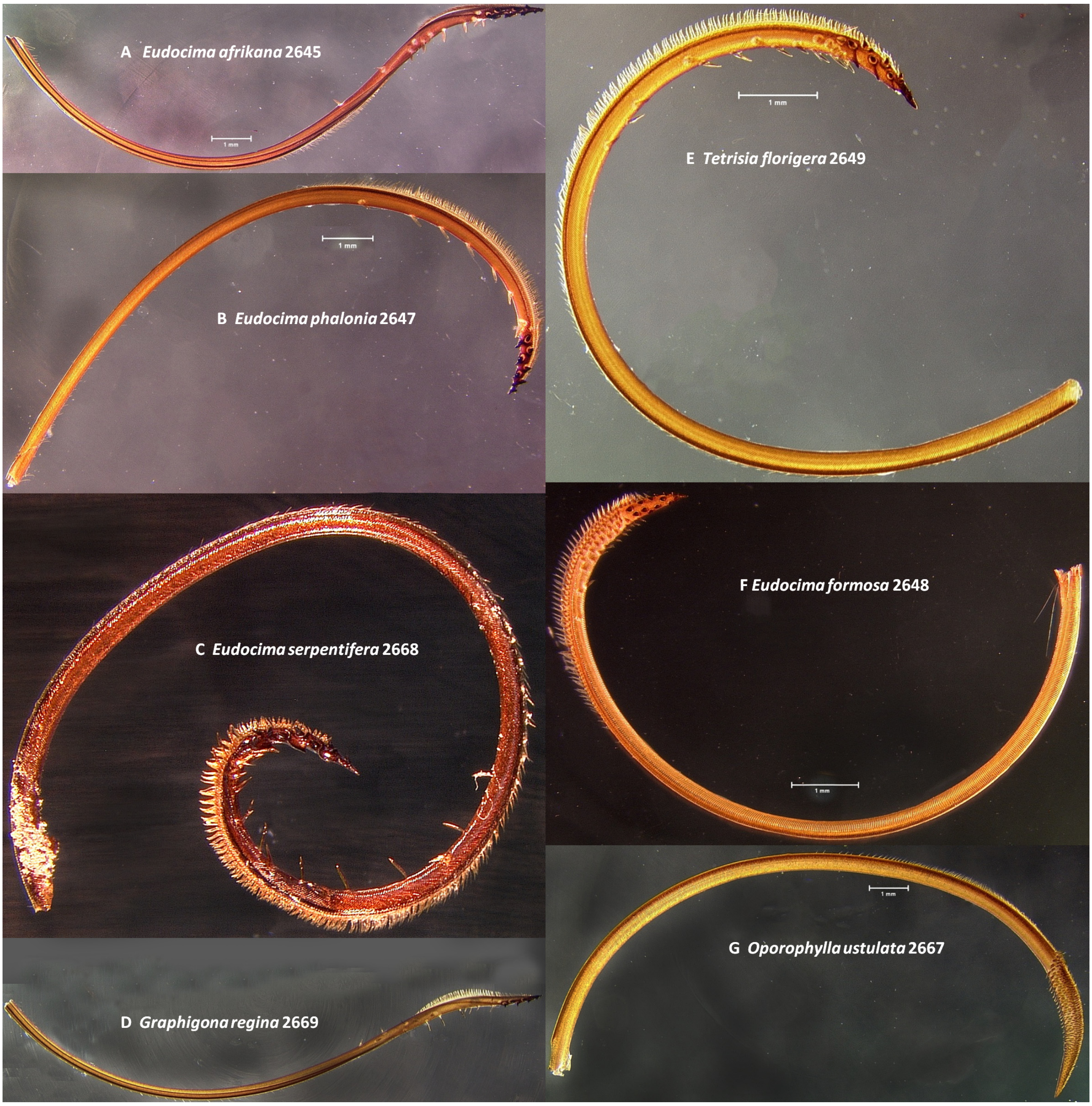


FIGURE 71. Calpinae proboscides.

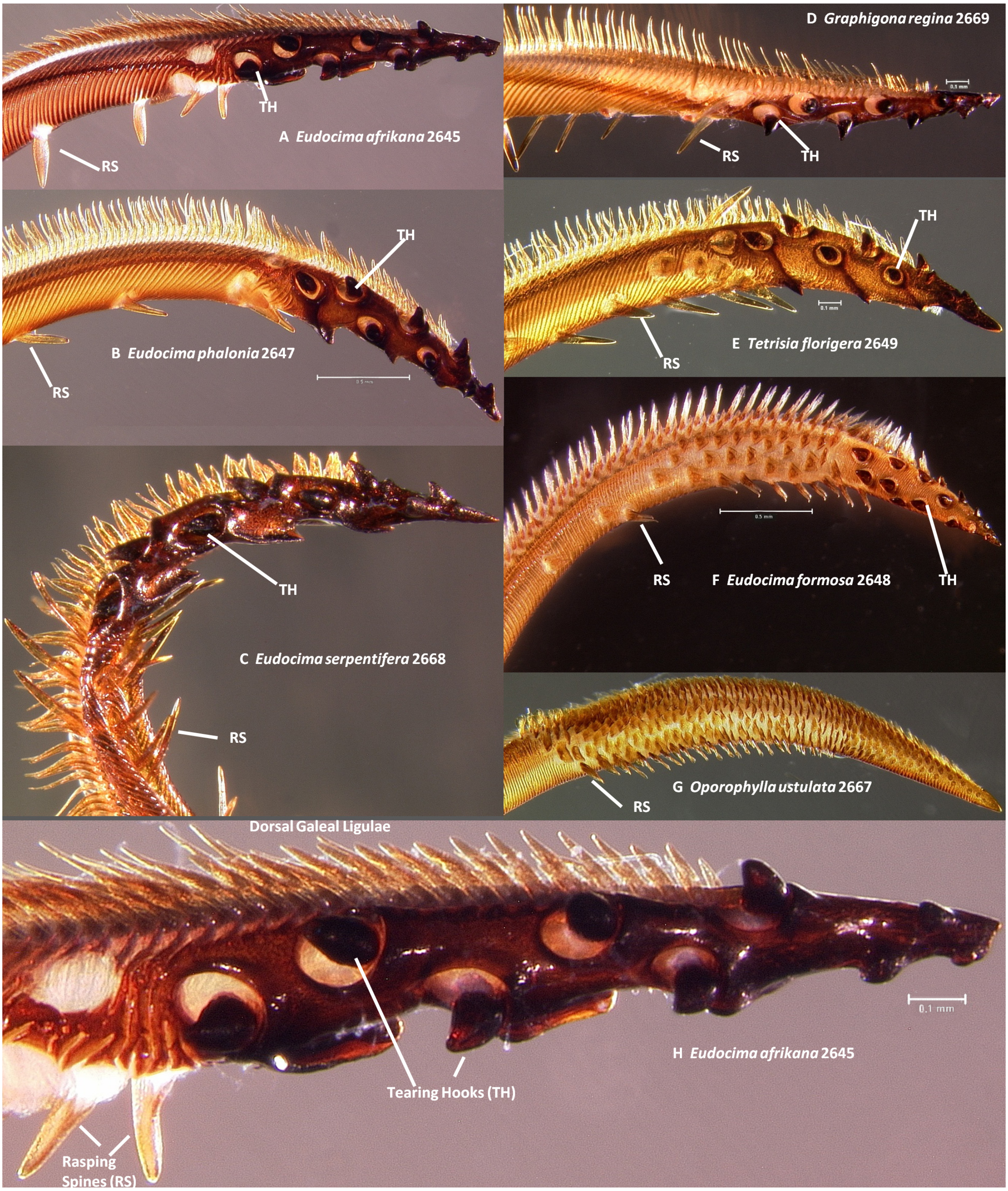


FIGURE 72. Calpinae proboscides apex. Terminology follows Zaspel (2008).

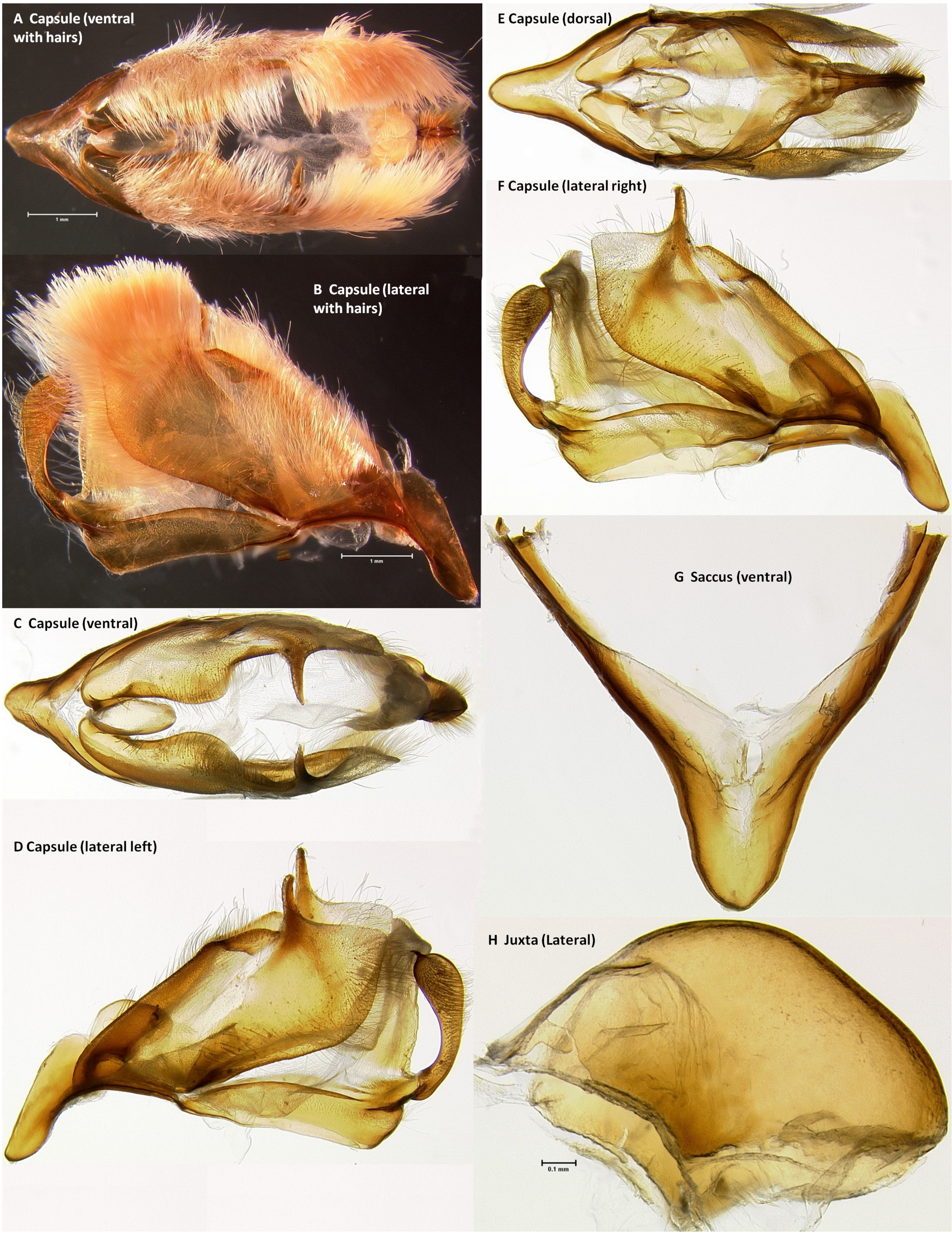


FIGURE 73. Male genitalia of *Eudocima formosa.*

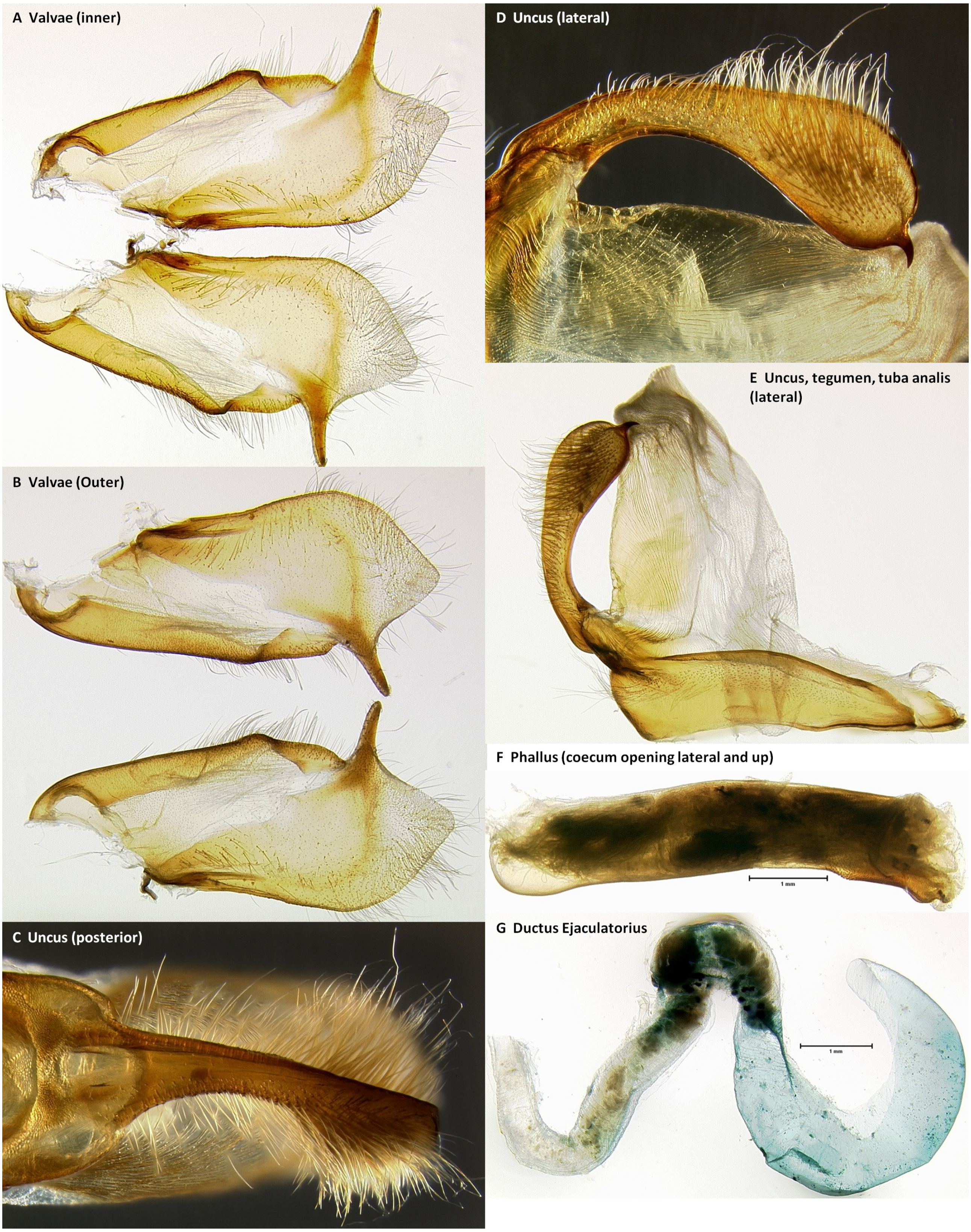


FIGURE 74. Male genitalia of *Eudocima formosa.*

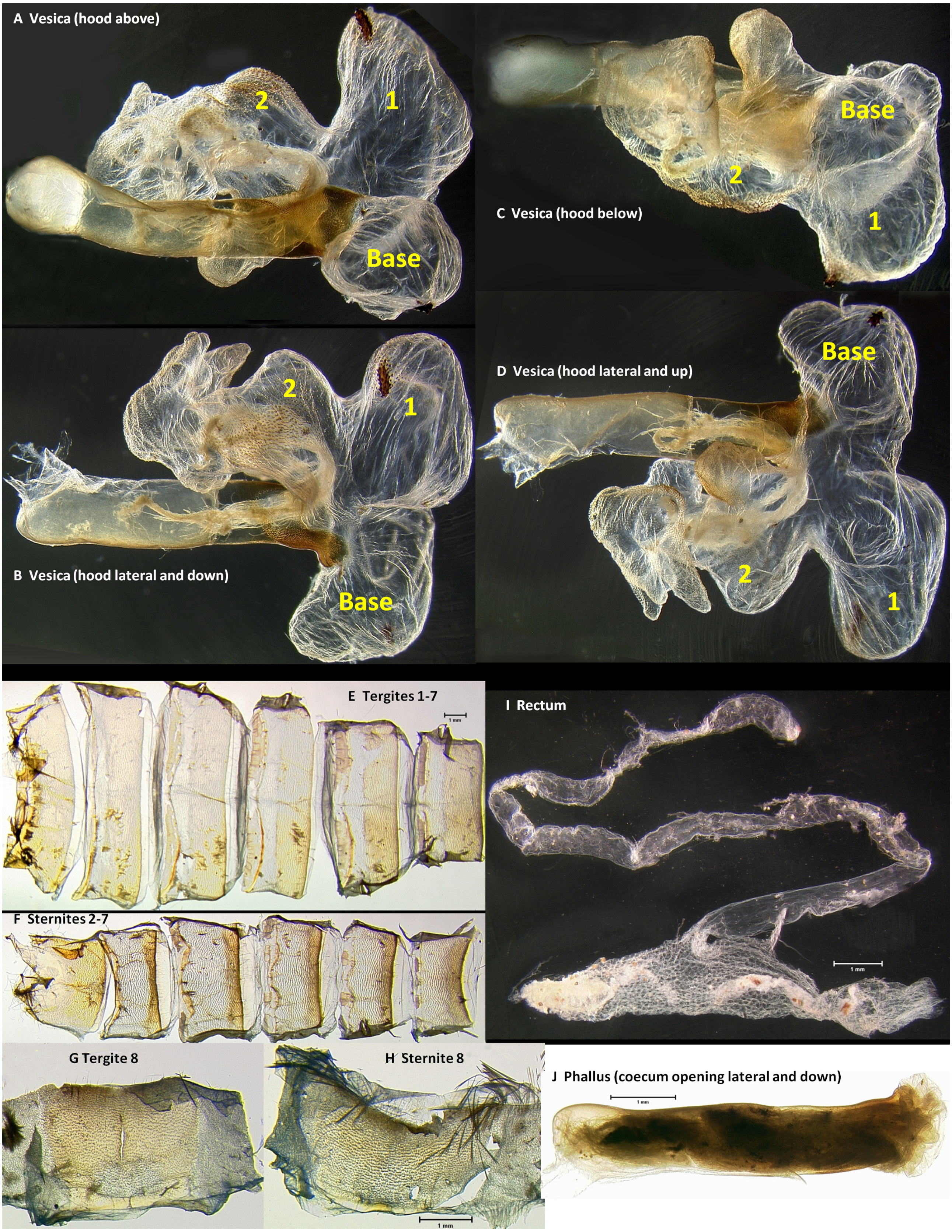


FIGURE 75. Male structures of *Eudocima formosa*.

FIGURE 76. Female genitalia of *Eudocima formosa.*

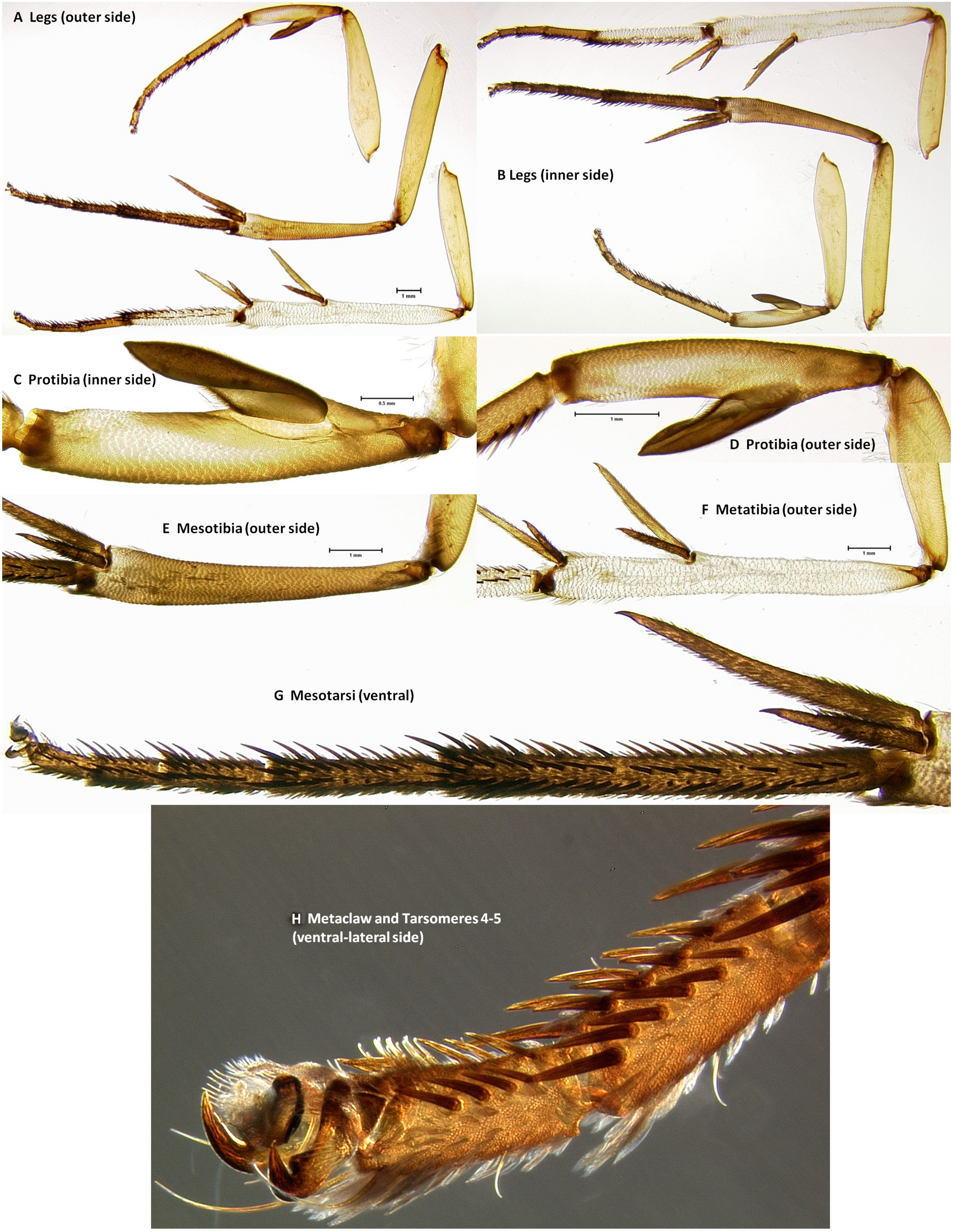
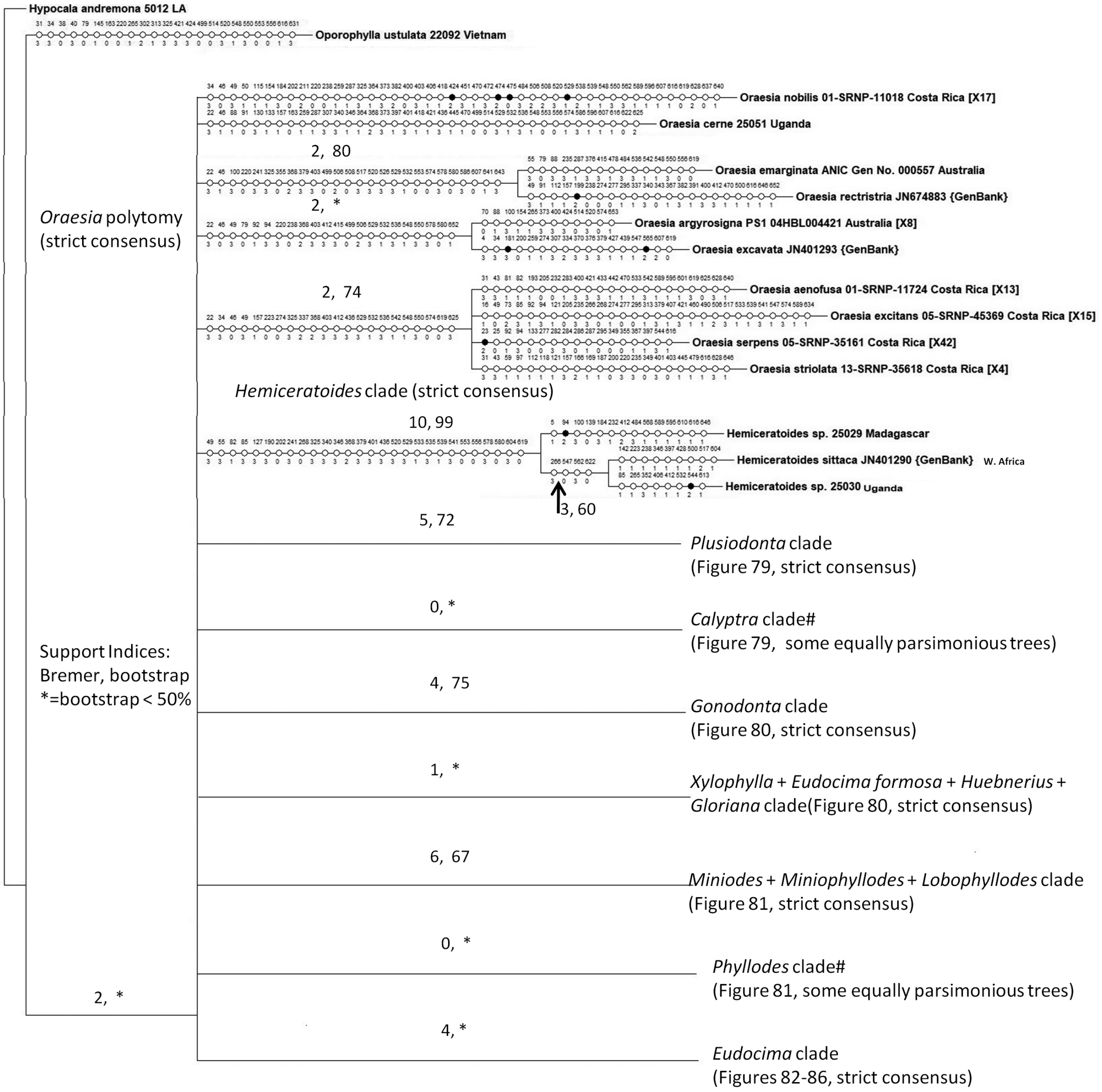


FIGURE 77. *Eudocima formosa* male legs. These preparations are KOH treated with many hairs and scales removed.



#=Recovered on some but not all of the most parsimonious trees.

Numbers above circles are character positions in the 1-658 base pair sequence of COI 5'. Numbers below circles are character states (base pairs): 0=A, 1=C, 2=G, 3=T

FIGURE 78. Summary of the strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences. Details for genera other than *Oraesia* and *Hemiceratoides* are provided in Figures 79–86.

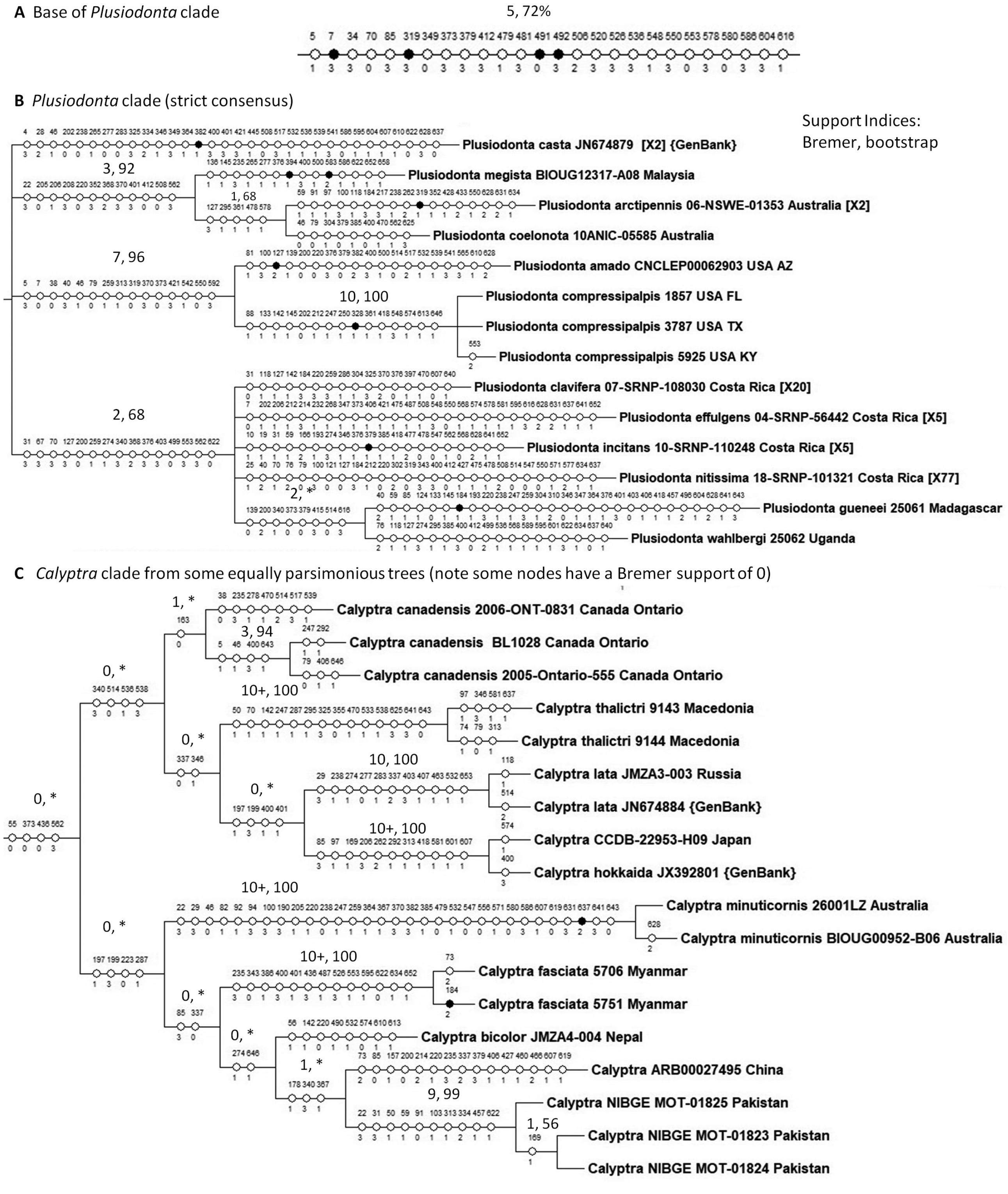


FIGURE 79. A–B: Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Plusiodonta* clade; **C:** *Calyptra* clade recovered on some but not all equally parsimonious trees.

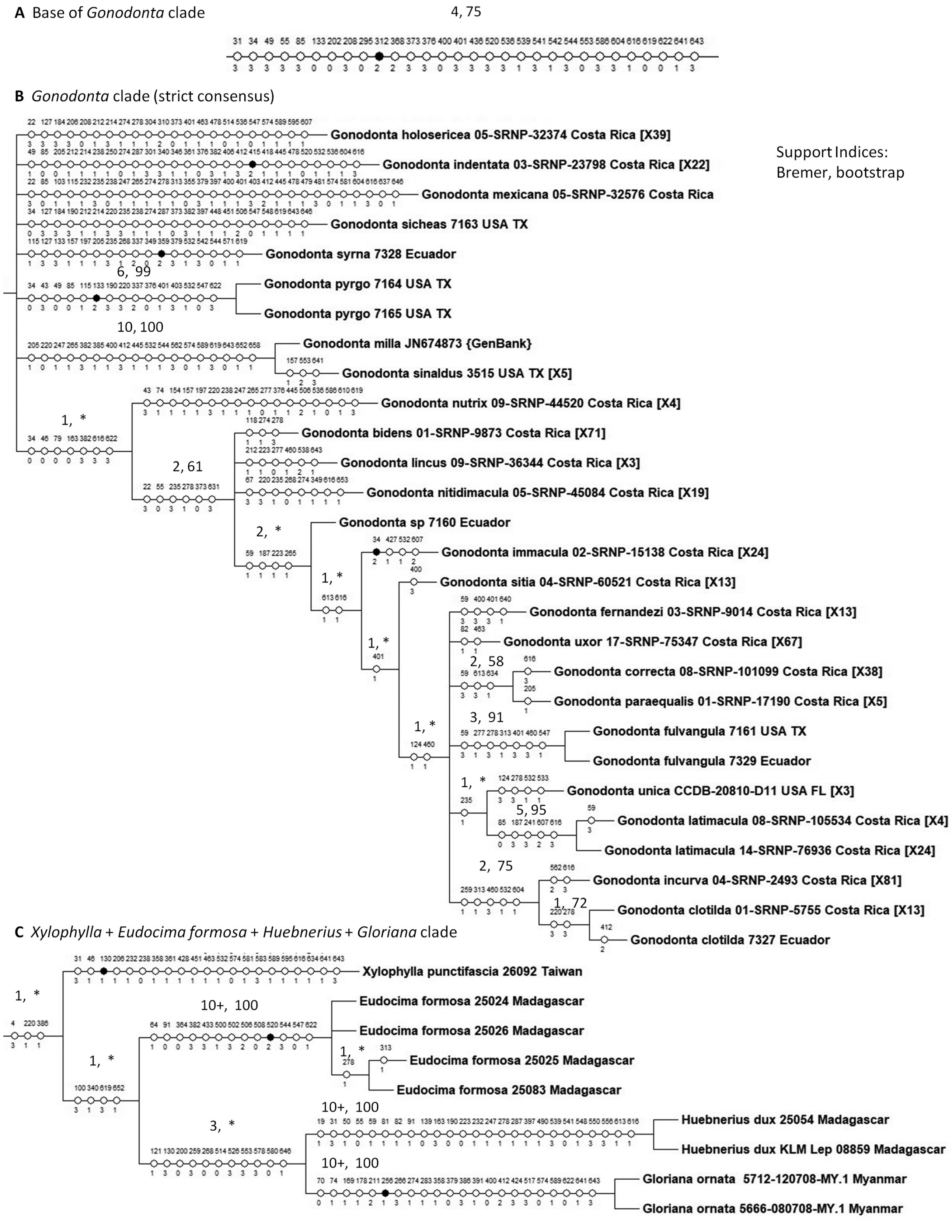
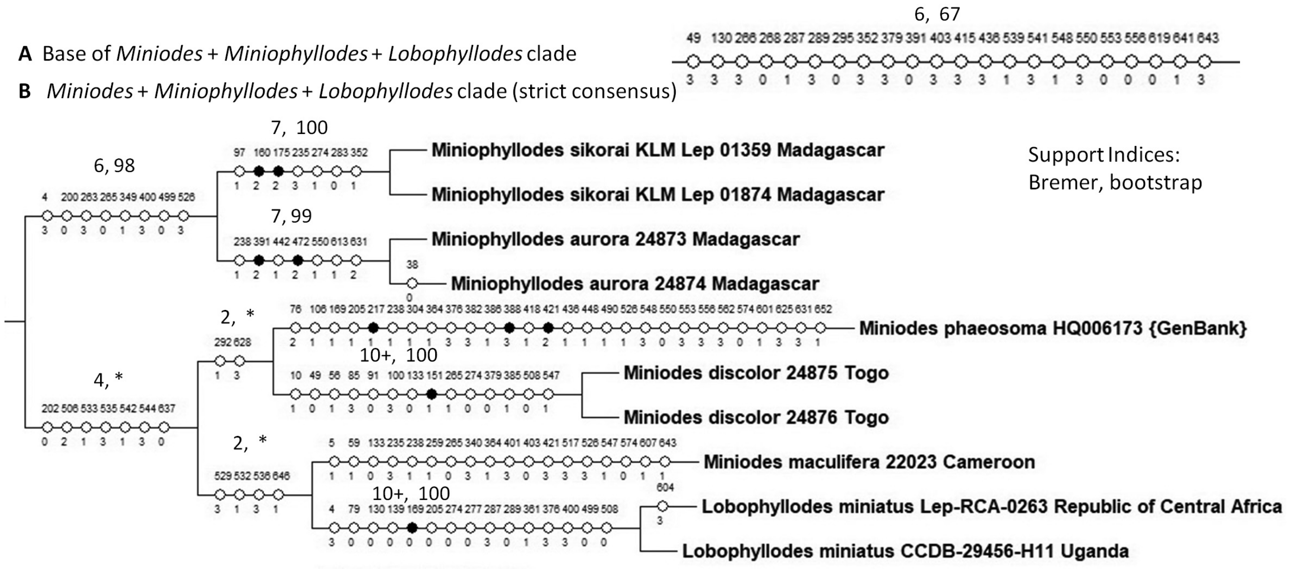


FIGURE 80. Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Gonodonta* and *Xylophylla*+*Eudocima formosa*+*Huebnerius*+*Gloriana* clades.



A Base of *Miniodes* + *Miniophyllodes* + *Lobophyllodes* clade

B *Miniodes* + *Miniophyllodes* + *Lobophyllodes* clade (strict consensus)

C *Phyllodes* clade from some of the equally parsimonious trees (note some nodes have a Bremer support of 0)

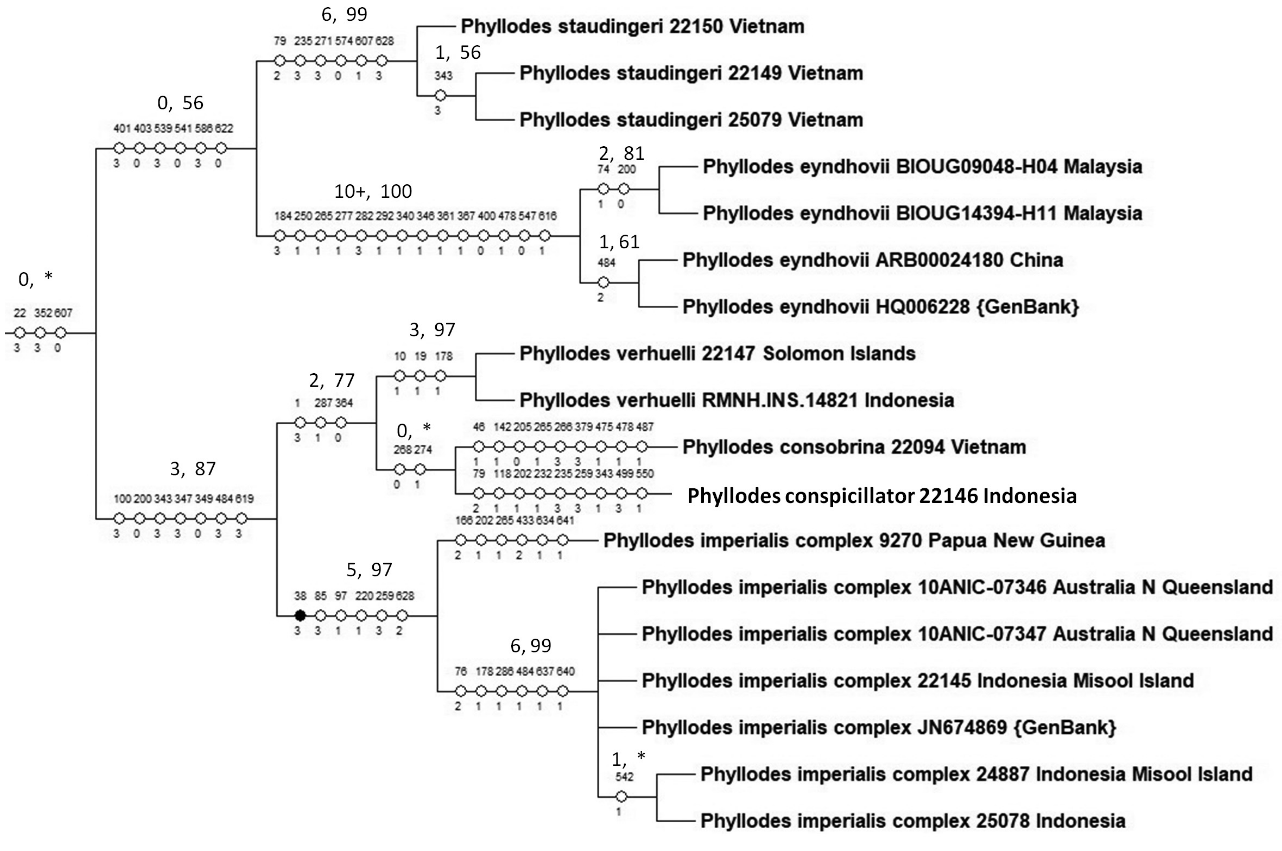


FIGURE 81. A–B: Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Miniophyllodes* +*Minioides*+*Lobophyllodes* clade; **C:** *Phyllodes* clade recovered on some but not all equally parsimonious trees.

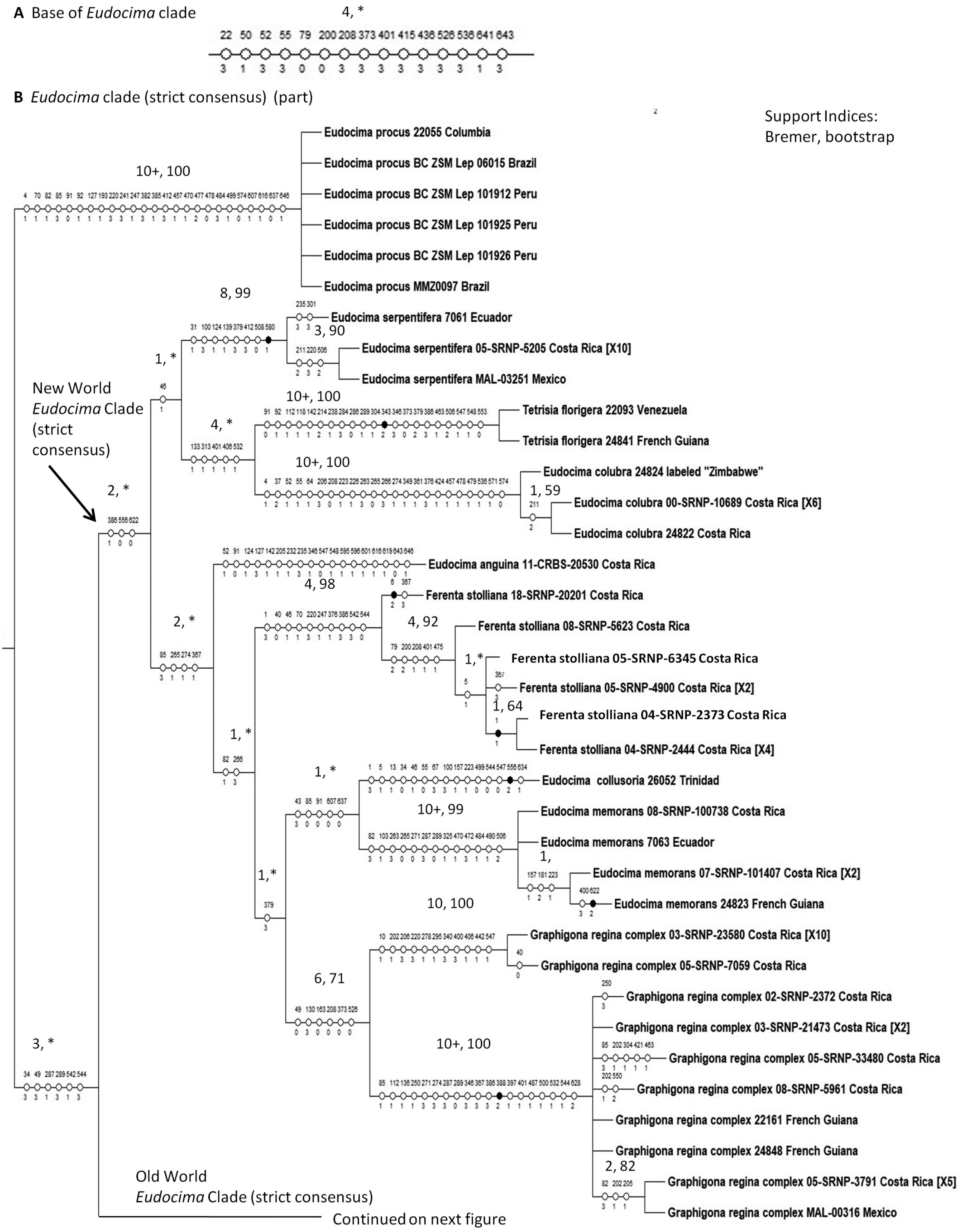


FIGURE 82. Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Eudocima* clade (part).

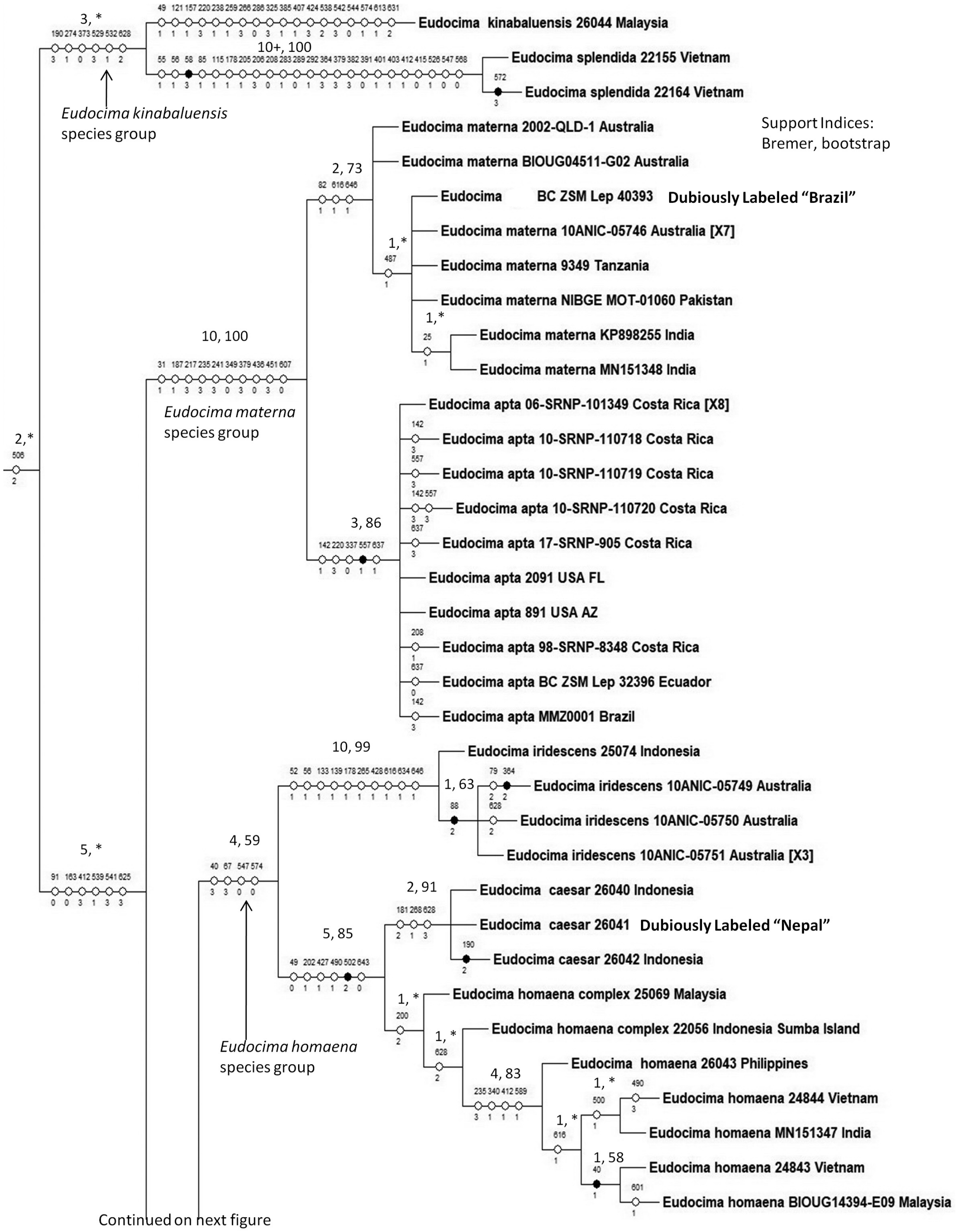
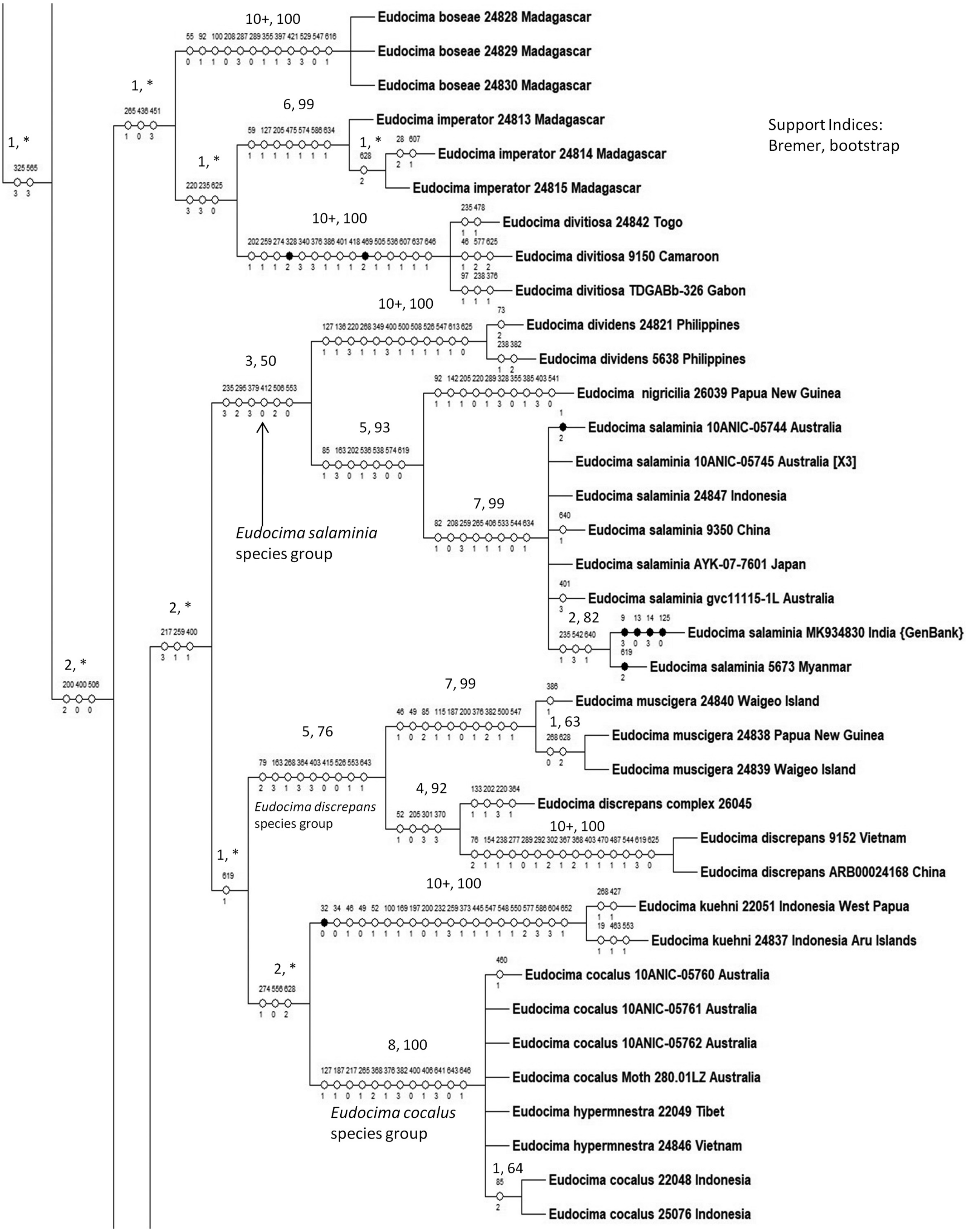


FIGURE 83. Strict consensus tree from a parsimony analysis of Calpinae COI 5’ mtDNA sequences (part): *Eudocima* clade (part).



Continued on next figure

FIGURE 84. Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Eudocima* clade (part).

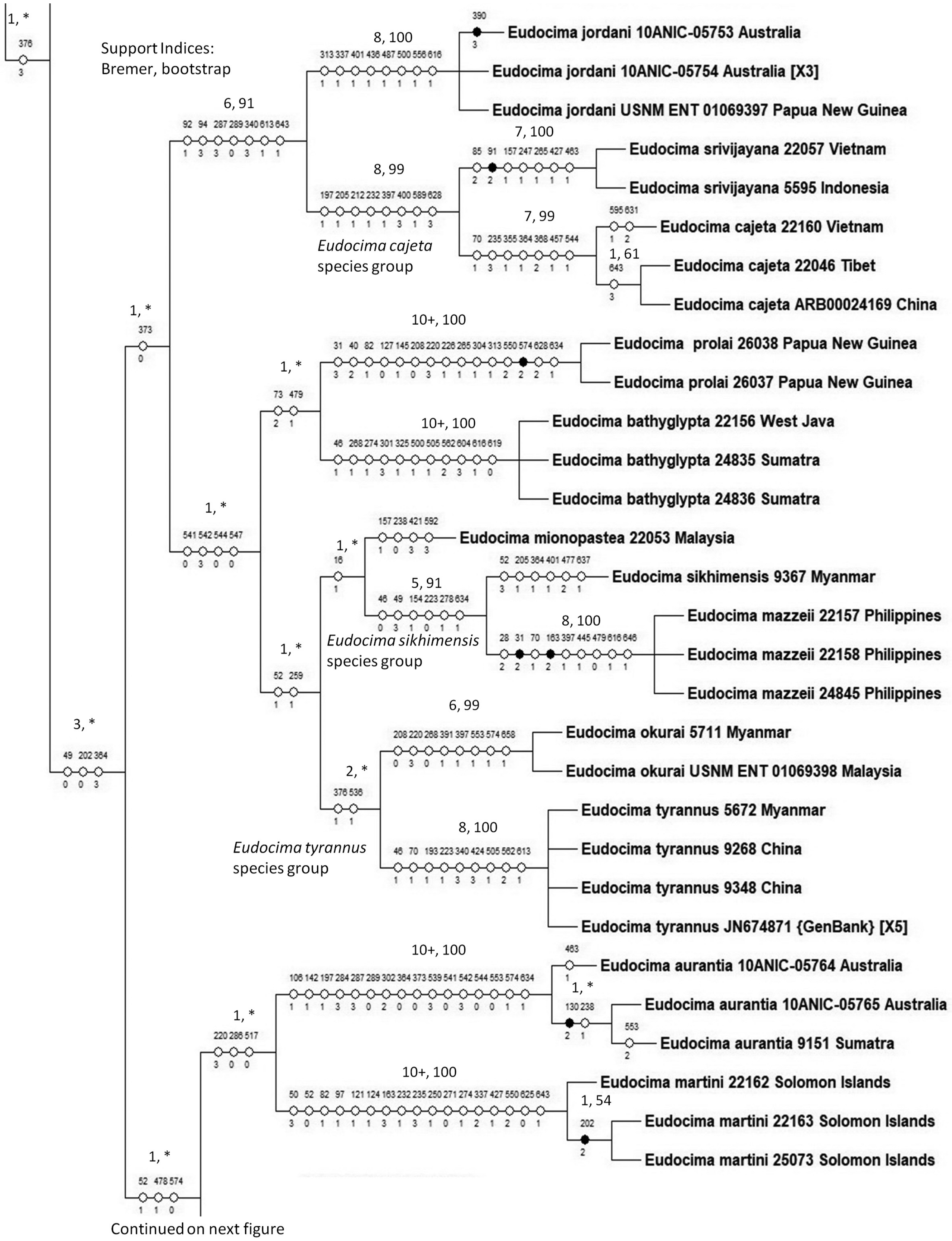


FIGURE 85. Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Eudocima* clade (part).

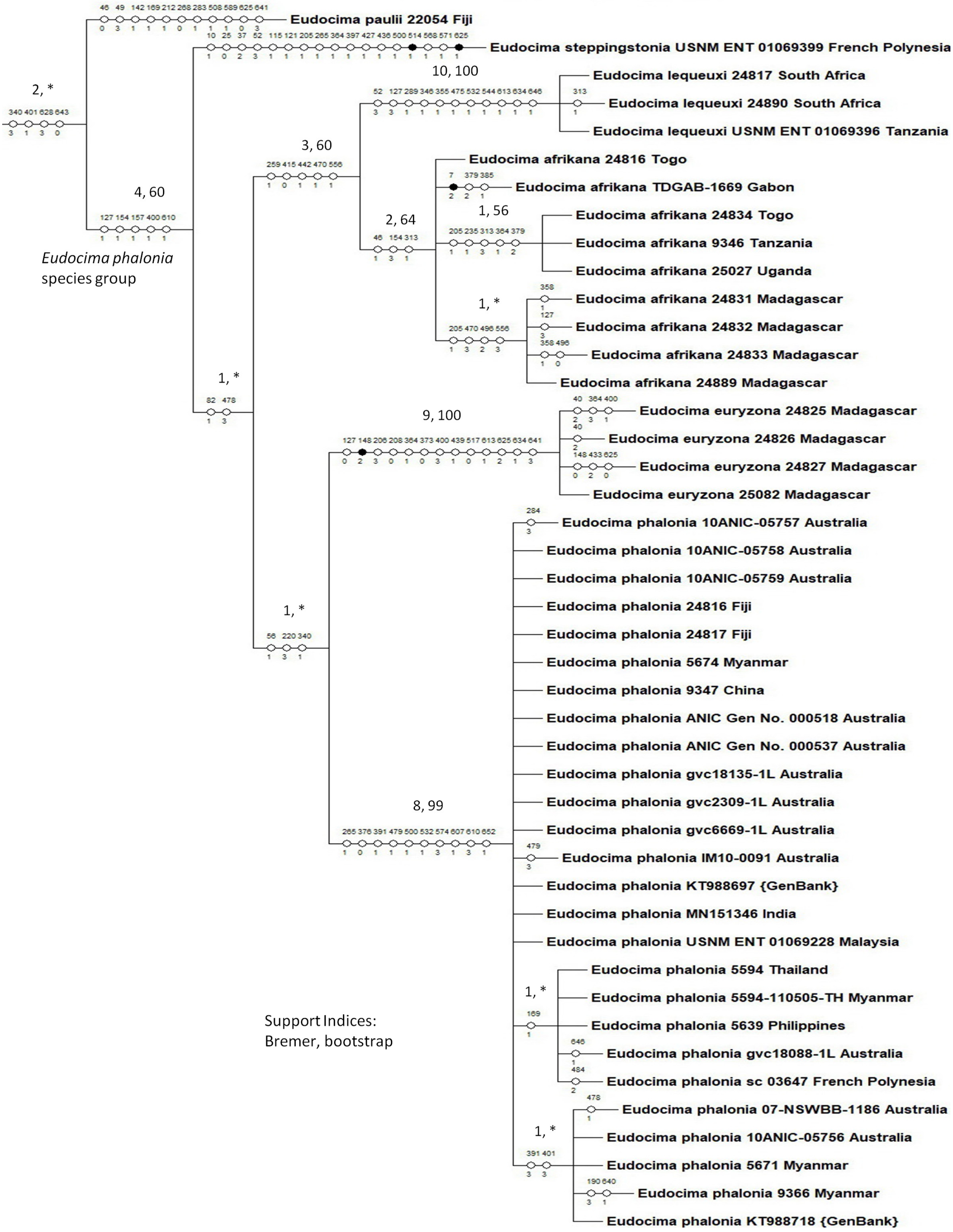


FIGURE 86. Strict consensus tree from a parsimony analysis of Calpinae COI 5' mtDNA sequences (part): *Eudocima* clade (part).

FIGURE 87. Live adults and larva of *Eudocima afrikana* and *E. phalonia.*

FIGURE 88. Live adults and larvae of Phyllodini species.

FIGURE 89. Live adults of *Phyllodes* species.

FIGURE 90. Live adults of Neotropical *Eudocima* and *Ferenta* species.

FIGURE 91. Live adults of Neotropical Ophiderini species.

FIGURE 92. Live adults and larva of African *Eudocima* species.

FIGURE 93. Live adults of *Eudocima* species.

FIGURE 94. Live adults of *Eudocima* species.

FIGURE 95. Live adults of *Eudocima* species.

FIGURE 96. Fruit-feeding moths.

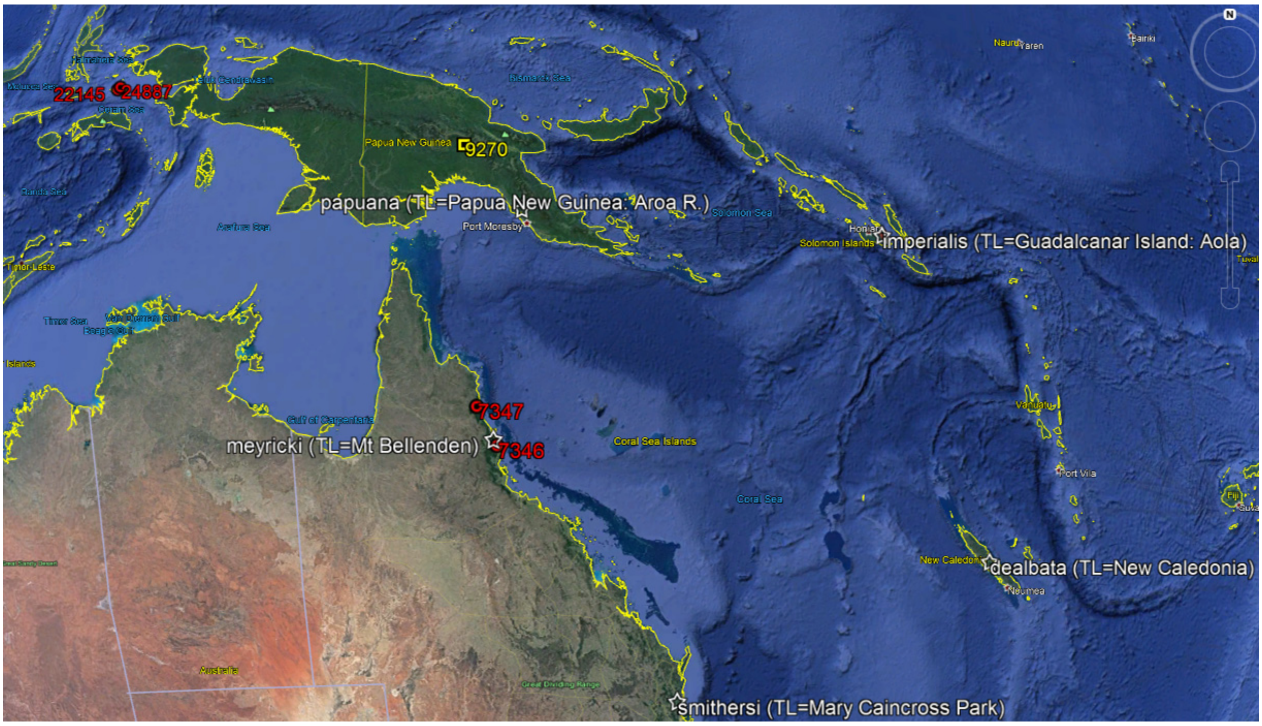


FIGURE 97. Type localities and localities for DNA sequence vouchers in the *Phyllodes imperialis* complex (white stars=type localities; red circles=first haplotype; yellow square=second haplotype).