5-29-2020

Arcola malloi (Pastrana), the alligatorweed stemborer, a new synonym of *Macrorrhinia endonephele* (Hampson) (Lepidoptera: Pyralidae: Phycitinae)

James E. Hayden

Jean-François Landry

INSECTA MUNDI

A Journal of World Insect Systematics

0768

Arcola malloi (Pastrana), the alligatorweed stemborer, a new synonym of *Macrorrhinia endonephele* (Hampson) (Lepidoptera: Pyralidae: Phycitinae)

James E. Hayden
Florida Department of Agriculture and Consumer Services,
Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608 USA

Jean-François Landry
Canadian National Collection of Insects, Arachnids, and Nematodes, Agriculture & Agri-Food Canada,
Ottawa Research and Development Centre, 960 Carling Ave, Ottawa, ON K1A 0C6, Canada

Date of issue: May 29, 2020

CENTER FOR SYSTEMATIC ENTOMOLOGY, INC., Gainesville, FL

James E. Hayden and Jean-François Landry
Arcola malloi (Pastrana), the alligatorweed stemborer, a new synonym of *Macrorrhinia endonephele* (Hampson) (Lepidoptera: Pyralidae: Phycitinae)
Insecta Mundi 0768: 1–25
ZooBank Registered: urn:lsid:zoobank.org:pub:FA113144-2E1D-4492-963F-FB766029834F

Published in 2020 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
http://centerforsystematicentomology.org/

Printed copies (ISSN 0749-6737) annually deposited in libraries
CSIRO, Canberra, ACT, Australia
Museu de Zoologia, São Paulo, Brazil
Agriculture and Agri-Food Canada, Ottawa, ON, Canada
The Natural History Museum, London, UK
Muzeum i Instytut Zoologii PAN, Warsaw, Poland
National Taiwan University, Taipei, Taiwan
California Academy of Sciences, San Francisco, CA, USA
Florida Department of Agriculture and Consumer Services, Gainesville, FL, USA
Field Museum of Natural History, Chicago, IL, USA
National Museum of Natural History, Smithsonian Institution, Washington, DC, USA
Zoological Institute of Russian Academy of Sciences, Saint-Petersburg, Russia

Electronic copies (Online ISSN 1942-1354, CDROM ISSN 1942-1362) in PDF format
Printed CD or DVD mailed to all members at end of year. Archived digitally by Portico.
Florida Virtual Campus: http://purl.fcla.edu/fcla/insectamundi
University of Nebraska-Lincoln, Digital Commons: http://digitalcommons.unl.edu/insectamundi/
Goethe-Universität, Frankfurt am Main: http://nbn-resolving.de/urn/resolver.pl?urn:nbn:de:hebis:30:3-135240

Layout Editor for this article: Robert G. Forsyth

INSECTA MUNDI 0768: 1–25 2020

Arcola malloi (Pastrana), the alligatorweed stemborer, a new synonym of *Macrorrhinia endonephele* (Hampson) (Lepidoptera: Pyralidae: Phycitinae)

James E. Hayden (JEH)
Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608 USA; james.hayden@fdacs.gov

Jean-François Landry (JFL)
Canadian National Collection of Insects, Arachnids, and Nematodes, Agriculture & Agri-Food Canada, Ottawa Research and Development Centre, 960 Carling Ave, Ottawa, ON K1A 0C6, Canada; jean-francois.landry@canada.ca

Abstract. *Arcola malloi* (Pastrana, 1961) is a junior subjective synonym of *Macrorrhinia endonephele* (Hampson, 1918) **syn. nov.** (Lepidoptera: Pyralidae). The species is a biological control agent introduced in United States and Australia to control alligatorweed, *Alternanthera philoxeroides* (Mart.) Griseb. (Amaranthaceae). The synonymy is recognized by comparison of type specimens, genitalic dissections, and DNA COI barcoding. *Vogtia* Pastrana, 1961 **syn. nov.** and *Arcola* Shaffer, 1995 **syn. nov.** are synonymized with *Macrorrhinia* Ragonot, 1887. *Macrorrhinia megajuxta* (Neunzig and Goodson, 1992) **comb. nov.** is transferred from *Ocala* Hulst, 1892. Lectotypes are designated for *Divitiaca ochrella* Barnes and McDunnough, 1913, and *Divitiaca simulella* Barnes and McDunnough, 1913.

Key words. Biological control, DNA barcoding, *Divitiaca*, lectotype, Nearctic, Neotropics, *Ocala*, *Rhinaphe*, *Vogtia*.

Introduction

Hampson (1918) described *Rhinaphe endonephele* Hampson and *R. ignetincta* Hampson in Hypsotropinae (a taxon that is now synonymous with Pyralidae: Phycitinae: Anerastiini) (Horak 2003), with type localities respectively in Rio de Janeiro, Brazil and northern Argentina. Shaffer (1991) transferred the two species to *Divitiaca* Barnes and McDunnough, 1913, a phycitine genus outside of Anerastiini Ragonot, and illustrated the lectotypes. Neunzig (2003) synonymized these two species (Hampson's lectotypes representing the male and the female respectively), and Neunzig also synonymized *Macrorrhinia signifera* Blanchard, 1976, described from Texas. Neunzig (2003) synonymized *Divitiaca* and *Ocala* Hulst, 1892 with *Macrorrhinia* Ragonot, 1887, thereby placing five Nearctic species in that genus, including *M. endonephele*. Shaffer (1995) listed all the then-known species among these genera, and one was subsequently described (Landry and Neunzig 1998). The on-line database GlobIZ (Nuss et al. 2003–2019) currently lists eight valid species of *Macrorrhinia*.

Pastrana (1961) established the monotypic genus *Vogtia* Pastrana and described *V. malloi* Pastrana from Buenos Aires, Argentina. Shaffer (1995) proposed *Arcola* as a replacement name for *Vogtia* (preoccupied by *Vogtia* Kölliker, 1853, Cnidaria). *Arcola malloi* is listed as such in the most recent North American pyraloid checklist (Scholtens and Solis 2015).

Arcola malloi was discovered, tested, and released to control alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb., Amaranthaceae) (Maddox 1970; Buckingham 1996) in the southeastern United States. Moths were introduced in 1971 in Gainesville, Florida and other sites in the Southeast (Brown and Spencer 1973), and it was hailed as a success for helping to control the weed, alongside two other insect biological control agents (Buckingham 1996). The species was also introduced in Australia in 1977 for the same purpose using South American source specimens, but despite becoming established, it did not significantly contribute to control alligatorweed (Julien et al. 2012).

In 2012, JFL and Paul Hebert (Centre for Biodiversity Genomics, University of Guelph), who were engaged in developing DNA barcode libraries, noticed that voucher specimens of *A. malloi* from Australia and specimens of *Macrorrhinia endonephele* from Florida shared DNA barcodes. This raised the possibility that the two taxa were synonymous.

Independently in 2014, JEH noted that specimens of *A. malloi* were absent from the Florida State Collection of Arthropods in Gainesville, Florida (FSCA). This was curious because of the long tradition of aquatic weed control research at the University of Florida and the supposed success of *A. malloi* (Buckingham 1996). A few voucher specimens from the original release were eventually found in the FSCA Biological Control Collection, separate from the main Lepidoptera collection housed in the McGuire Center for Lepidoptera and Biodiversity (MGCL; Florida Museum of Natural History). On the other hand, numerous specimens identified as *Macrorrhinia endonephele* and *M. signifera* exist in the collection, starting from the early 1970s.

The purpose of this paper is to revise the status of the aforementioned taxa based on evidence provided by genitalia morphology supplemented by DNA barcode (COI) sequences. We also provide a synopsis and illustrations of other North American species of *Macrorrhinia* and designate lectotypes for two of them. We found published genitalia illustrations, which are all line drawings, inadequate for the smallest comparative details. In view of the close morphological similarity of the species, we provide comparable genitalia photos of all the species except *M. megajuxta* (Neunzig and Goodson, 1992), as well as a key to the species.

Materials and Methods

Collection acronyms are as follows:

ANIC Australian National Insect Collection, Canberra, Australia
CBG Centre for Biodiversity Genomics, University of Guelph, Guelph, ON, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, ON, Canada
FSCA Florida State Collection of Arthropods, Florida Dept. of Agriculture and Consumer Services, Gainesville, FL, USA
MACN Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina
MEM Mississippi Entomological Museum, Mississippi State University, Starkville, MS, USA
MGCL McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, FL, USA
USNM National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA

Specimens of *Macrorrhinia endonephele* from Florida and Louisiana, *M. signifera* from Texas, and *A. malloi* vouchers in the FSCA Biological Control Collection were examined by JEH. Specimens from the type series of *A. malloi* were borrowed by JFL from MACN, including two males and one female paratypes with the abdomen intact, and two genitalia slides (one male, one female) of paratypes prepared by Pastrana. Plans were made to obtain DNA barcodes (see below) from these paratypes in addition to examining their genitalia but this could not be realized. JFL also examined and dissected *M. endonephele* specimens from Florida, Massachusetts, South Carolina, and Texas (CBG, CNC, USNM), specimens from Argentina found among the unidentified USNM Phycitinae, as well as the holotype of *M. signifera*, and syntypes of *M. ochrella* (Barnes and McDunnough, 1913) and *M. simulella* (Barnes and McDunnough, 1913), both dissected and undissected. Specimens of other species of *Macrorrhinia* from the CNC, FSCA and USNM were also examined and dissected by both authors.

Morphological analysis. Genitalia were dissected by maceration in 10 or 20% aqueous KOH, stained with Chlorazol black or Orange G, and slide-mounted in Euparal by standard methods (Robinson 1976, with variations presented in Landry 2007). The dissections were compared to Pastrana's slides and illustrations in his 1961 original description of *Vogtia malloi*, and to the figures of *M. endonephele* and *M. signifera* in Blanchard (1976), Shaffer (1991), and Neunzig (2003), and to the diagnosis of *M. endonephele* in the latter work. Specimens were dissected of congeneric North American species, and of *M. pinta* Landry and Neunzig, 1998 from the Galapagos Islands (holotype and many paratypes in the CNC), and for some exotic species, the original descriptions and subsequent treatments were consulted (Zeller 1848; Heinrich 1956; Neunzig and Goodson 1992; Landry and Neunzig 1998). Specimens of the FSCA and MGCL are curated together in the MGCL, except the Biological Control Collection in the Doyle Conner Building, 1911 SW 34th Street, Gainesville, Florida. Morphological terms follow Klots

(1970) and Neunzig (2003), except for "phallus" instead of aedeagus.

Genitalia slides were photographed by JFL using a Nikon DS-Fi1 digital camera mounted on a Nikon Eclipse 800 microscope at magnifications of 100×. Nikon's NIS 2.3 Elements was used to assemble multiple photos of different focal planes into single deep-focus images, which were further edited in Adobe Photoshop CS6. Photographs of additional slides by JEH were taken with a Leica DM6 B compound microscope, a DMC6200 camera, and Leica Application Suite X to process the stacked images. Habitus photographs by JEH were taken with an Auto-montage Pro 5.01 system (Synoptics Ltd.) using a JVC camera and Leica Z16APO lens; those by JFL were taken with a Canon EOS 60 D camera and MP-E 65 mm lens, and Zerene Stacker application to process stacked images.

DNA barcode analysis. DNA extracts were prepared from one leg removed from each specimen. DNA extraction, PCR amplification of the barcode region of COI, and subsequent sequencing followed standard protocols at the Canadian Centre for DNA Barcoding in Guelph (deWaard et al. 2008). Laboratory protocols at this facility have been heavily optimized, and the current iteration can be accessed at http://www.ccdb.ca. Sequences, along with the specimen data, images, and trace files, are deposited in the Barcode of Life Data Systems (BOLD) (Ratnasingham and Hebert 2007; www.barcodinglife.org). Sequences of *M. endonephele* were compared with DNA barcodes for four other species of *Macrorrhinia* for which barcodes were available: *M. aureofasciella* Ragonot, 1887, *M. dryadella* (Hulst, 1892), *M. ochrella*, and *M. parvulella* (Barnes and McDunnough, 1913). All data are available through the following dataset: https://doi.org/10.5883/ds-mrrhinia (see also Appendix 1). Sequence analysis was conducted using MEGA 7 (Kumar et al. 2016), using the Kalign option for sequence alignment and the Kimura-2-parameter distance model for calculating genetic divergence estimates and generating a neighbor-joining distance tree.

Results

DNA barcodes of *M. endonephele* showed modest intra-specific variation (mean 0.38%, standard error 0.15) whereas inter-specific distances to four other species of *Macrorrhinia* were an order of magnitude greater (4.07–5.44%) (Table 1). The barcodes of two specimens of *A. malloi* from Australia were a close match (0.0–0.05%) to specimens of *M. endonephele* from the United States (Fig. 1). They shared the same Barcode Index Number (BIN = BOLD:AAE0182) and were nested within sequences from the United States. These two specimens, deposited in ANIC, are reared vouchers from the laboratory colony developed from source specimens from Argentina and used in the release of that species as a biological control agent of alligatorweed in Australia. Haplotype variation within United States specimens,

Table 1. Estimates of evolutionary divergence over sequence pairs in species of *Macrorrhinia*. The number of base substitutions per site from averaging over all sequence pairs between groups are shown. The analysis involved 26 nucleotide sequences. Codon positions included were 1st+2nd+3rd+Noncoding. All ambiguous positions were removed for each sequence pair. There was a total of 658 positions in the final dataset.

Species 1	Species 2	Distance	Std. Error
M. aureofasciella	*M. dryadella*	5.45%	0.95%
M. aureofasciella	*M. ochrella*	5.12%	0.88%
M. aureofasciella	*M. parvulella*	5.46%	0.90%
M. dryadella	*M. ochrella*	5.54%	0.89%
M. dryadella	*M. parvulella*	5.55%	0.96%
M. endonephele	*M. aureofasciella*	4.97%	0.93%
M. endonephele	*M. dryadella*	5.44%	0.92%
M. endonephele	*M. ochrella*	4.32%	0.76%
M. endonephele	*M. parvulella*	4.07%	0.78%
M. ochrella	*M. parvulella*	4.88%	0.83%

although an order of magnitude lower than interspecific differences, showed some heterogeneity despite being presumably all derived from lab colonies initially released in 1971.

The male and female genitalia of *M. endonephele* specimens from the United States, including the holotype of *M. signifera* from Texas, are very similar to those of *A. malloi* paratypes from Argentina. The shape of the male valvae, the shape of the gnathos, and the shape and spines of the female corpus bursae are diagnostic for *M. endonephele*. In particular, the gnathos is dorsally deeply concave and evenly curved (being straighter in other species), the distal margin of the valva is evenly rounded, and the spines in the corpus bursae are numerous and set on a linear sclerotized inner ridge that runs most of the length, plus several to many more spines along the broad anterior section of the ductus bursae (whereas other species have few or no spines). Differences in male genitalia are slight among *Macrorrhinia* species. Female genitalia afford more pronounced differences.

Slides or specimens of *A. malloi* could not be located in the USNM. The holotype and paratypes of *M. signifera* collected in 1975 are conspecific with *M. endonephele*. Blanchard's female paratype of *M. signifera* collected in 1966 (slide A.B. 3531, numbered USNM 109,490) is not conspecific, and indeed not a *Macrorrhinia* species nor *Maricopa lativittella* (Ragonot), a related species (Heinrich 1956). The damaged female moth is gray with some orange scales, not fully orange. The corpus bursae is missing from the dissection, but the antrum does not have the V-shape characteristic of *Macrorrhinia* and *Maricopa lativittella*; furthermore, the puteoli of the tympanal organs are angled differently.

From both the morphological and genetic evidence, we conclude that *Arcola malloi* (Pastrana, 1961) **syn. nov.** is a junior subjective synonym of *Macrorrhinia endonephele* (Hampson, 1918). *Vogtia* Pastrana, 1961 **syn. nov.** and its replacement name *Arcola* Shaffer, 1995 **syn. nov.** are junior subjective synonyms of *Macrorrhinia* Ragonot, 1887. In addition, the South American species *Macrorrhinia megajuxta* (Neunzig and Goodson, 1992) **comb. nov.** is hereby transferred to formalize the combination online (Nuss et al. 2003–2019).

Maricopa Hulst is probably the sister-genus of *Macrorrhinia*, as suggested by Heinrich (1956) and reiterated by Neunzig (2003). (Both authors refer to it as *Valdivia* Ragonot, 1888, which Shaffer [1995] noted to be a junior homonym of *Valdivia* White, 1847 [Crustacea]). *Maricopa* includes three species distributed in Chile and the southern United States. The two genera share elongate, porrect labial palpi in both sexes, and forewing veins M_2 and M_3 are short-stalked. In both genera, males have broad valvae that are expanded distad of the sacculus, a broad tegumen and uncus (Fig. 12–19), and a narrow, aciculate phallus (Fig. 20–27). In females, the armature of the corpus bursae (if present) consists of numerous small spines (Fig. 50–55, 59–61) (absent in *M. aureofasciella* and *M. parvulella*), the posteriormost portion of the ductus bursae ends in a short, wide, V-shaped antrum, and the sinus vaginalis posteriad of the ostium bursae is covered with a zone of dense microtrichia (Fig. 68–73). The ductus seminalis is inserted variously on the anterior or posterior third of the ductus bursae (Fig. 50–52, 56–61).

In view of this relationship, the diagnostic characters and putative synapomorphies of *Macrorrhinia* are mainly of the female genitalia (Fig. 50–73). The corpus bursae is bean-shaped, with the inception of the ductus bursae situated on the right side of the corpus at about the mid-point or one-third. The posterior portion of the ductus bursae is narrow and slender (as long or longer than segments 8–10); its anterior portion just prior to joining the corpus bursae is dilated, not coiled, and more thickly walled (*M. ochrella*, *M. parvulella*) or slightly sclerotized (*M. endonephele*). The spines, if present, extend along the wall of the corpus bursae adjacent to the dilated ductus bursae. In *Maricopa*, the corpus bursae is ovoid and symmetrical, without a posterior lobe, and the anterior section of the ductus bursae has several large coils. This coiled section may be homologous with the dilated section in *Macrorrhinia*. Males of *Macrorrhinia* have a sinus at the base of the antennal flagellum that is flanked by erect scale tufts (a feature present in many Phycitinae) whereas this structure is absent in *Maricopa*. The male genitalia of *Macrorrhinia* are simple and similar to those of *Maricopa*. In particular, the eighth sternite has eversible lateral coremata (Fig. 46–49) that *Maricopa* species lack.

Anerastiini and some genera removed from that taxon by Shaffer (1968) are also likely to be confused with *Macrorrhinia* because they share long, porrect labial palpi and indistinct maculation with *Macrorrhinia*. None have a scale-knot at the base of the male antenna as in *Macrorrhinia*, many have a reduced haustellum, and some have a conically projected frons. The valvae are not distally expanded. The ductus bursae is short and wide, not dilated anteriad; the corpus bursae is unarmed or has signa that are not spines.

Synopsis of North American species of *Macrorrhinia*

Macrorrhinia Ragonot, 1887

Macrorrhinia Ragonot 1887: 13. Type species: *Macrorrhinia aureofasciella* Ragonot, 1887, by monotypy.
Dolichorrhinia Ragonot 1888: 28. Unnecessary replacement name for *Macrorrhinia*.
Ocala Hulst 1892: 61. Type species: *Ocala dryadella* Hulst, 1892, by monotypy. Synonymized by Neunzig (2003: 261).
Divitiaca Barnes and McDunnough 1913: 183. Type species: *Divitiaca ochrella* Barnes and McDunnough, 1913, by original designation. Synonymized by Neunzig (2003: 261).
Vogtia Pastrana 1961: 265. Type species: *Vogtia malloi* Pastrana, 1961, by original designation. Preoccupied by *Vogtia* Kölliker, 1853: 31 (Cnidaria). **New synonymy**.
Arcola Shaffer 1995: 98. Replacement name for *Vogtia* Pastrana. **New synonymy**.

Macrorrhinia endonephele (Hampson, 1918)

Fig. 2–5, 12–13, 20–21, 28–30, 37–38, 46–47, 50–55, 68

Rinaphe endonephele Hampson 1918: 87.
Rinaphe ignetincta Hampson 1918: 87; synonymized by Neunzig 2003: 266.
Vogtia malloi Pastrana 1961: 268; **new synonymy.**
Macrorrhinia signifera Blanchard 1976: 285; synonymized by Neunzig 2003: 266.

Diagnosis. The forewing length is 7.5–10.5 mm. The maculation is dull orange with scattered black scales, with faint antemedial and postmedial lines; males (Fig. 2–4) have a faint gray-black antemedial spot that is not developed in females (Fig. 5). The gnathos of the male genitalia (Fig. 28–30) curves evenly into a narrow, dorsally directed hook; the narrow distal part of the hook is as long as the base of the gnathos. The end of the sacculus (Fig. 12–13) is not strongly projected, so the distal margin of the valva is evenly rounded, not truncate. The corpus bursae (Fig. 50–55) is rather elongate, without constriction between the anterior and posterior lobes; the ductus bursae is dilated more than half of its length, nearly to the posterior end of the corpus bursae, which it parallels closely. There is a long row of spines on the wall of the corpus bursae nearest to the ductus bursae, another row in the ductus bursae facing the corpus bursae, and a few in the anterior angle of the corpus and ductus bursae. The posterior margin of the antrum (Fig. 68) is thickened and transversely straight, with slender lateral angles that are wider than the ductus bursae.

Material examined. Years of collection follow the specimen count. Specimens are in the FSCA and MGCL unless noted.

Macrorrhinia endonephele: **USA, ALABAMA,** Baldwin Co.: 1 (1992); Covington Co.: 1 (1976). **FLORIDA,** Alachua Co.: 58 (1972, 1978, 1982–1984, 2005, 2007, 2008, 2014), slide MGCL 5200; Collier Co.: 2 (1990); Highlands Co.: 2 (2006), slides MIC 5833 and MIC 5510 (CNC); Hillsborough Co.: 2 (1990); Jackson Co.: 1 (1984); Lake Co.: 2 (1998); Leon Co.: 4 (1986, 1989); Levy Co.: 11 (2008, 2009, 2010, 2012, 2013), MGCL slides 1804 & 1805; Liberty Co.: 6 (1983, 1986, 1990); Marion Co.: 7 (2000, 2001, 2003, 2004, 2006, 2014); Martin Co.: 1 (1999); Miami-Dade Co.: 2 (1990); Okaloosa Co.: 1 (1974), MGCL slide 5184; Orange Co.: 3 (1981, 1983, 1986); Pinellas Co.: 3 (1986); Polk Co.: 1 (1975); Putnam Co.: 2 (1986); Santa Rosa Co.: 1 (1986); Volusia Co.: 1 (1986); Wakulla Co.: 1 (1975). **LOUSIANA,** Ascension Parish: 2 (1974), MGCL slide 4356; Lafourche Parish: 59 (1974, 1975, 1979); Morehouse Parish: 1 (1979); Orleans Parish: 13 (1974, 1975), MGCL slide 4357; St. John Parish: 31 (1975, 1978–1982). **MASSACHUSETTS,** Barnstable Co.: 1 (2010) (CBG); **MISSISSIPPI,** Hancock Co.: 5 (1977–1979) (MEM); Oktibbeha Co.: 1 (1980) (MEM); Warren Co.: 2 (1983, 1988) (MEM). **NORTH CAROLINA**, Craven Co: 2 (2005, 2006) (CBG). **SOUTH CAROLINA,** Colleton Co.: 1 (1981). **TEXAS,** Anderson Co.: 1 (1982); Cameron Co.: 1 (1999); Harris Co.: 10 (1979, 1980, 1983, 1986, 1991–1993) (FSCA and USNM); Jasper Co.: 4 (1983, 1986, 1993), MGCL slide 5199; Jefferson Co.: 1 (1994); Montgomery Co.: 2 (1977), MGCL slide 5198 (FSCA and USNM); Newton Co.: 4 (1979); San Jacinto Co.: 2 (1985, 1989) (MEM and MGCL); San Patricio Co.:

1 (1985); Tyler Co.: 1 (1996) (MGCL).

ARGENTINA, Buenos Aires, Ensenada: 3 (1989, 1990), slides USNM 144161, USNM 144168, USNM 144169 (USNM).

Release voucher specimens: **USA, FLORIDA,** Alachua Co.: 9 (1971), MGCL slides 2515 and 2516.

Macrorrhinia signifera holotype male (USNM): **USA, TEXAS**, Tyler Co., Town Bluff (Dam B), 7 Aug 1975, USNM slide 130224.

Vogtia malloi paratypes (MACN): **ARGENTINA, BUENOS AIRES Province**, Ramallo, 1 male, 31 March 1960, slide JFL 1725; José C. Paz, 1 male, 23 March 1961, slide JAP 407; Tigre, 1 male, Jan 1940, slide JAP 405; **ENTRE RIOS PROVINCE**, Conception del Uruguay, 4 March 1957, slide JFL 1724 ; **MISIONES PROVINCE**, Iguazu Cataratas, Nov 1951, slide JFL 1723.

Macrorrhinia aureofasciella Ragonot, 1887

Fig. 6, 16, 26, 31, 39, 49, 56, 70

Macrorrhinia aureofasciella Ragonot 1887: 13.

Diagnosis. The forewing length is 6.5–11.0 mm. The maculation (Fig. 6) is mostly gray with a transverse orange band in the basal third from the costa to the posterior margin, proximally margined with black. The phallus (Fig. 26) has a series of small teeth in the distal portion. The lateral lobes of the juxta are short (Fig. 38). The corpus bursae (Fig. 56) lacks signa and constrictions, and the ductus bursae is dilated as far as the posterior end of the corpus bursae. The posterior margin of the antrum (Fig. 70) is convex with stout lateral projections that are almost as wide as the ductus bursae.

Material examined. USA, TEXAS, Brewster Co.: 1 (1984); Briscoe Co.: 1 (1996); Cameron Co.: 1 (1999); Hardin Co.: 2 (1996, 1997); Donley Co.: 1 (1978); Jeff Davis Co.: 2 (1978, 1980); Kerr Co.: 2 (1980, 1985), MGCL slide 1912; Val Verde Co.: 1 (1994). **ARIZONA**, Cochise Co., Chiricahua Mts: 4 males, 3 females, (1959–1962) (CNC), slides PYR 1537, PYR 2204, PYR 2205.

Macrorrhinia dryadella (Hulst, 1892)

Fig. 7, 18, 22, 35, 44, 57, 73

Ocala dryadella Hulst 1892: 61.
Dolichorrhinia platanella Grossbeck 1917: 131.

Diagnosis. The forewing length is 5.5–7.0 mm. The maculation (Fig. 7) is mostly gray with an orange antemedial spot in the posterior half of the forewing (not a completely transverse band), lined with black proximally. The male maxillary palpi have elongate hair-pencils. The gnathos (Fig. 35) is y-shaped, with a short dorsal subapical process. The corpus bursae (Fig. 57) is weakly constricted between the anterior and posterior lobes, and the ductus bursae is dilated half its length, as far as the posterior end of the corpus bursae. A small signum is present at the juncture of the dilated section of the ductus bursae. The posterior margin of the antrum (Fig. 73) is narrow with short, recurved lateral projections.

Material examined. USA, FLORIDA, Monroe Co.: 11 (1973, 1990, 1992, 1996, 2014), MGCL slides 2034, 5744, 5746.

Macrorrhinia ochrella (Barnes and McDunnough, 1913)

Fig. 8–10, 14–15, 23–24, 32–33, 40–42, 48, 59–60, 62–67, 69

Divitiaca ochrella Barnes and McDunnough 1913: 183.
Divitiaca simulella Barnes and McDunnough 1913: 183; synonymized by Neunzig 2003: 266.

Diagnosis. The forewing length is 4.5–6.5 mm. The maculation (Fig. 8–10) is cream with scattered black scales; good specimens have faint pink streaks on the anal fold in the basal area and along the radial veins. The gnathos (Fig. 32–33) has a wide base in sagittal view. The dilated section of the ductus bursae (Fig. 59–60) is reduced and looks like a boot, and it has one major row of spines on the posterior side and, in some specimens, a row of smaller spines on the anterior side (Fig. 62–67). The posterior margin of the antrum (Fig. 69) is transverse and slightly convex or sinuate with slender lateral projections that are considerably wider than the ductus bursae.

Material examined. USA, FLORIDA, Broward Co.: 1 male (2013), MGCL slide 1289; Monroe Co.: 18 (1987, 1988, 1990, 1992, 1994–1996, 2019), MGCL slides 5326, 5742, 5743, 5753–5756; Everglades: 1 female (1961), slide PYR 2197 (CNC).

Divitiaca ochrella syntypes (USNM): There are two syntypes in the USNM, one male and one female, with red-bordered labels inscribed "Divitiaca ochrella B. & McD Type [sex symbol]" in McDunnough's handwriting, with collecting data matching the description. The male was illustrated in Barnes and McDunnough (1913, plate I, figure 3), and the genitalia later dissected by Heinrich (genitalia and wings on separate slides). The female was undissected. Because the male and the female are similarly inscribed as "Type" and the female genitalia of *Macrorrhinia* afford better specific differences, we selected the female for the lectotype and dissected it.

***Divitiaca ochrella* lectotype female, here designated**, labelled: "Everglade [sic], Florida"; "Apr 8-15"; "Divitiaca ochrella B. & McD Type ♀"; "Barnes Collection" [red-bordered and lined]; "Genitalia slide by JF Landry ♀ USNM 130,222" [green]; "LECTOTYPE ♀ Divitiaca ochrella Barnes & McD. by J.-F. Landry 2019" [orange]; specimen # USNMENT00657700 (USNM).

One paralectotype ♂, labelled as lectotype, additional label "Photograph Pl. 1 No. 3" [pale blue], slide USNM 101842, specimen # USNMENT00657701.

One male from Everglade [sic] from the Barnes Collection dated "Apr 16-23" is not a syntype (slide USNM 144171, specimen # USNMENT00657702).

Divitiaca simulella syntypes (USNM): as for *D. ochrella*, there is a pair of USNM syntypes bearing the inscription "Type", as well as a third male specimen labelled as "cotype", all on red-bordered labels in McDunnough's hand. The male "type" was illustrated in Barnes and McDunnough (1913, plate I, figure 6) and its genitalia later dissected by Heinrich. The female "type" and the cotype were undissected. For the same reason as *D. ochrella*, we selected the female for lectotype and dissected it.

***Divitiaca simulella* lectotype female, here designated**, labelled: "Everglade [sic], Florida"; "Apr 8-15"; "Divitiaca simulella B. & McD Type ♀"; "Barnes Collection" [red-bordered and lined]; "Genitalia slide by JF Landry ♀ USNM 130,223" [green]; "LECTOTYPE ♀ Divitiaca simulella Barnes & McD. by J.-F. Landry 2019" [orange], specimen # USNMENT00657704 (USNM).

One paralectotype male, labelled as lectotype, additional label "Photograph Pl. 1 No. 6" [pale blue]; slide USNM 101844, specimen # USNMENT00657703. One paralectotype male, labelled as lectotype except for the word "Cotype", slide USNM 144162, specimen # USNMENT00657705.

Additional ♂ specimen: Everglade [sic], Apr. 10, '12; slide USNM 144172, specimen # USNMENT00657706; a white label "Divitiaca simulella B & McD" is by a different hand.

Comments. The slight difference in size and coloration between *M. ochrella* and *M. simulella* led Heinrich (1956) to doubt that they were different species, nevertheless he maintained them separate. He did not illustrate the genitalia of *M. simulella* citing their close similarity to those of *M. ochrella*. Neunzig (2003) judged them to be conspecific on account of finding no significant difference and synonymized them. We observed that the female genitalia of the two lectotypes, undissected prior to the present study, differed slightly in the shape of the corpus bursae (a possible artefact of stretching), the spination at the anterior end of the ductus bursae near its inception into the corpus bursae (this area is crumpled in the *M. ochrella* lectotype slide so difficult to compare), the size of the ostium bursae (proportionally wider in *M. ochrella*) and the extent of the zone of microtrichia of the sinus vaginalis (more extensive in *M. ochrella*). Recently observed specimens from Monroe Co., Florida showed variation in female genitalia similar in extent to intraspecific variation exhibited by *M. endonephele*. We conclude that this supports maintaining their synonymic status.

***Macrorrhinia parvulella* (Barnes and McDunnough, 1913)**

Fig. 11, 17, 25, 34, 43, 58, 71

Divitiaca parvulella Barnes and McDunnough 1913: 183.
Divitiaca parvulella consociata Heinrich 1956: 190 ("race").

Diagnosis. The forewing length is 4.5–6.0 mm. The maculation (Fig. 11) resembles that of *M. ochrella* but is darker, rather cream-orange with dark scales and complete transverse lines, and the hind wings are darker gray than those of the other species. The gnathos (Fig. 34) is not tapered, having a broadly rounded apex and recurved point. The ductus bursae (Fig. 58) is not dilated near the corpus bursae; this section instead is represented by an appendicular lobe attached to the corpus bursae adjacent to the ductus bursae. Spines and signa are absent. The antrum (Fig. 71) is proportionally small and narrower than the zone of microtrichiae with a convex posterior margin and short lateral projections.

Material examined. USA, FLORIDA, Miami-Dade Co.: 2 (2014, 2015), MGCL slide 1984, 1 male (1940), slide USNM 144164; Monroe Co.: 75 (1955, 1964, 1990, 1992, 1994–1996, 2015), MGCL slide 5202 (FSCA), Key Largo: 1 male, 1 female (1967), CNC slides PYR 2199, PYR 2200 (CNC); 50 males and females, Broward Co., Collier Co., Indian River Co., Monroe Co. (CNC, USNM).

Comments. We examined the holotype but not the dissection slide of *M. parvulella consociata* (Heinrich), described from Colombia. Shaffer (1995) listed it at the subspecies rank, and we have no reason to change its status.

The following two species are included for comparative purposes.

Macrorrhinia pinta Landry and Neunzig, 1998

Fig. 19, 27, 36, 45, 61, 72

Macrorrhinia pinta Landry and Neunzig 1998: 499.

Diagnosis. The forewing length is 4.6–7.0 mm. (The range given in Landry and Neunzig (1997) who listed 82 specimens is 5.0–8.0 mm. No specimen measured more than 7.0 mm among the 69 specimens examined.) The maculation is similar to *M. aureofasciella* but the transverse bands are more subdued or indistinct and do not reach the costa (not illustrated). The gnathos (Fig. 36) is similar to that of *M. endonephele*. The phallus (Fig. 27) is laterally curved, whereas it is straight or nearly so in the other species. The corpus bursae (Fig. 61) is barely constricted in the middle as in *M. aureofasciella*, but the appendicular lobe is larger with the posterior portion broadly dilated and extended to the posterior end of the corpus bursae. The ductus bursae is barely dilated at the level of the corpus bursae and its inception is situated near the base of the appendicular lobe near the juncture of the corpus bursae. There are no signum nor spines except for a small sclerotization at the juncture of the appendicular lobe. The posterior margin of the antrum has a “winged” appearance with a mesial indentation and curved lateral projections wider than the ductus bursae (Fig. 72).

Material examined. Holotype male (CNC), slide PYR 358; 50 males and females including 18 paratypes: **ECUADOR, GALAPAGOS**, Pinta, Isabela, Santa Cruz, Espanola, San Cristobal, Seymour Norte, Floreana (1989, 1992), slides PYR 399, PYR 400, PYR 435, PYR 2206, PYR 2207 (CNC).

Maricopa lativittella (Ragonot, 1887) (Not figured)

Ciris lativittella Ragonot 1887: 18.

Diagnosis. The male genitalia are rather similar to those of *Macrorrhinia* species except for a differently shaped sternum 8. The female ductus bursae has 4–5 large coils, and the corpus bursae is ovoid and small relative to the wide ductus bursae, without signa. Illustrations of the genitalia are in Heinrich (1956).

Material examined. USA, TEXAS: Brewster Co.: 2 (1995, 1999); Cameron Co.: 1 (1988), MGCL slide 5764; Hidalgo Co.: 2 (1980), MGCL slide 1911; Jeff Davis Co.: 8 (1979, 1980, 1981, 1983, 1984, 1994), MGCL slides 1911, 5203, 5763; San Patricio Co.: 1 (1985); Terrell Co.: 1 (1982); North Padre Is. (county uncertain): 1 (1977).

Discussion

Shaffer (1991) and Neunzig (2003) apparently overlooked Pastrana (1961). The purpose of Shaffer (1991) was not to revise the genus but simply to remove the species from Peoriinae Hulst, a taxon that

Horak (2003) subsequently synonymized with Anerastiini. Heinrich did not treat *M. endonephele* and *M. ignetincta* because they were still in Anerastiinae, so Pastrana (1961) would have had the same issue if he had consulted Heinrich (1956). We agree with the validity of Neunzig's (2003) other specific and generic synonymies in *Macrorrhinia*. His focus in that publication on the Nearctic fauna necessitates the transfer of *M. megajuxta*.

The collection dates of *M. endonephele* circumstantially support the fact that it was introduced in the early 1970s (cf. Brown and Spencer 1973) and rapidly dispersed. The oldest specimens of *M. endonephele* in the FSCA that were collected in the environment were caught at light in Gainesville in 1972. Gainesville was one of the ten original release sites of the alligatorweed stemborer in 1971 (Brown and Spencer 1973). Preserved specimens of immature stages could not be located. The species quickly dispersed across the Southeast, reaching Louisiana by 1974 (FSCA, leg. V.A. Brou). The species reached Texas by 1975, represented by Blanchard's types of *M. signifera* from eastern Texas; the one paratype from 1966 that antedates the release is not conspecific. A specimen from Massachusetts trap-collected on 27 September 2010 could indicate a recent range expansion or represent a vagrant.

The original laboratory colonies that provided the specimens released in 1971 may have been collected from multiple Argentine populations, which would explain the observed haplotype heterogeneity. The moths were collected from the vicinity of Buenos Aires (Belle Vista area), Argentina (Brown and Spencer 1973).

Key to *Macrorrhinia* Ragonot

The following key is global, including Neotropical species. It does not include *M. placidella* (Zeller, 1848), which is of dubious association and is known only from the unique, damaged lectotype (Heinrich 1956).

1. Forewing color mostly gray, with distinctly contrasted black and orange scales in antemedial area **2**
— Forewing color mostly orange, pale ochre, or cream, with black scales in antemedial area absent or diffuse **4**

2. Maxillary palpus of male without elongate scales; lobes of juxta rounded and not longer than wide; dilated part of ductus bursae tapered and narrower in posterior half. . . . . ***M. aureofasciella* Ragonot**
— Maxillary palpus of male with elongate scales; lobes of juxta acute or longer than wide; dilated part of ductus bursae of even width or with posterior half wider than anterior **3**

3. Gnathos with subapical process; lobes of juxta short and acute; signum present at juncture of ductus bursae and corpus bursae; distribution: Florida, USA . . . . . . ***M. dryadella* (Hulst)**
— Gnathos without subapical process; lobes of juxta round-ended and much longer than wide; signum absent; distribution: Argentina . . . . ***M. megajuxta* (Neunzig and Goodson)**

4. Forewing length ≥7.5 mm; valva with distal margin evenly curved; corpus bursae with long row of spines extended nearly to posterior end . . . . ***M. endonephele* (Hampson)**
— Forewing length ≤7.0 mm; valva with distal margin straight in ventral half because of extended sacculus; corpus bursae without spines or only a few spines inside ductus bursae **5**

5. Forewing postmedial line absent; phallus curved; appendix bursae present, almost as large and long as posterior half of corpus bursae; distribution: Galapagos Islands ***M. pinta* Landry and Neunzig**
— Forewing postmedial line present; phallus straight or nearly so; appendix bursae absent or present and small; distribution: Florida, USA **6**

6. Forewing postmedial line interrupted; hind wing whitish and semihyaline; gnathos evenly tapered and curved; expanded part of ductus bursae small, containing a few small spines; corpus bursae without appendix . . . . ***M. ochrella* (Barnes and McDunnough)**
— Forewing postmedial line continuous; hind wing smoky gray; gnathos not tapered, having parallel dorsal and ventral edges; ductus bursae not expanded near corpus bursae, without

spines; corpus bursae with small appendix, about half the length of posterior half of corpus bursae . . . . ***M. parvulella* (Barnes and McDunnough)**

Acknowledgments

We thank Louis Somma (FDACS-DPI) for recording specimen data and Richard Brown for access to the MEM. Terhune Dickel and Vernon Brou collected, dissected, and donated long series of *Macrorrhinia* specimens from southern Florida and Louisiana, which proved invaluable for assessing variation and phenology. JFL is grateful to Dr. Pablo Luis Tubaro, Director of MACN, for arranging the loan of Pastrana types and granting permission to prepare dissections and extract DNA for barcoding; to M. Alma Solis (USNM) for access to the USNM and the loan of various identified and unidentified *Macrorrhinia* specimens, including types; to Paul Hebert, Centre for Biodiversity Genomics, University of Guelph, for shared field work with JFL, for facilitating the loan of Pastrana types, and for unfailing support of barcoding; and to Lisa Bartels for technical assistance, specimen photography, image editing, and plate preparation. Brian Scholtens, Alma Solis, and Paul Skelley (FDACS-DPI) carefully reviewed the manuscript and suggested several improvements. This publication was supported by the Florida Department of Agriculture and Consumer Services – Division of Plant Industry, and Agriculture & Agri-Food Canada – Research and Development Branch.

Literature Cited

Barnes, W. M., and J. H. McDunnough. 1913. Some apparently new Lepidoptera from southern Florida. Contributions to the Natural History of the Lepidoptera of North America 2(4): 166–195, pls. 1–4.

Blanchard, A. 1976. Two new species of phycitine moths with description of a new genus (Pyralidae). Journal of the Lepidopterists' Society 30: 284–288.

Brown, J. L., and N. R. Spencer. 1973. *Vogtia malloi*, a newly introduced phycitine moth (Lepidoptera: Pyralidae) to control alligatorweed. Environmental Entomology 2(4): 519–523.

Buckingham, G. R. 1996. Biological control of alligatorweed, *Alternanthera philoxeroides*, the world's first aquatic weed success story. Castanea 61(3): 232–243.

deWaard, J. R., N. V. Ivanova, M. Hajibabaei, and P. D. N. Hebert. 2008. Assembling DNA barcodes. p. 275–294. *In*: C. C. Martin (ed.). Environmental Genomics. Methods in Molecular Biology vol. 410. Humana Press; Totowa, NJ. xi+364 p. Available at https://doi.org/10.1007/978-1-59745-548-0_15. (Last accessed 26 March 2020.)

Grossbeck, J. A. 1917. Insects of Florida. IV. Lepidoptera. Bulletin of the American Museum of Natural History 37: 1–147.

Hampson, G. F. 1918. A classification of the Pyralidae, subfamily Hypsotropinae. Proceedings of the Zoological Society of London 1918: 55–131.

Heinrich, C. 1956. American moths of the subfamily Phycitinae. Bulletin of the United States National Museum, Washington, D.C. 207: i–viii, 1–581, Fig. 1–1138.

Horak, M. 2003. Reassessment of the Anerastiini and their status in the Phycitinae (Pyralidae): a century-long controversy. Invertebrate Systematics 79: 89–98.

Hulst, G. D. 1892. New species of Pyralidae. The Canadian Entomologist 24(3): 59–64.

Julien, M., A. Sosa, R. Chan, S. Schooler, and G. Traversa. 2012. *Alternanthera philoxeroides* (Martius) Grisebach – alligator weed. p. 43–51. *In*: M. Julien, R. McFadyen, and J. Cullen (eds.). Biological control of weeds in Australia. CSIRO Publishing; Collingwood, Victoria, Australia. 620 p.

Klots, A. B. 1970. Lepidoptera. p. 115–130. *In*: S. L. Tuxen (ed.). Taxonomist's glossary of genitalia in insects. Munksgaard; Copenhagen, Denmark. 283 p.

Kölliker, A. 1853. Die Schwimmpolypen oder Siphonophoren von Messina. Wilhelm Engelmann; Leipzig. 96 p. + 12 pls.

Kumar, S., G. Stecher, and K. Tamura. 2016. MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. Molecular Biology and Evolution 33(7): 1870–1874.

Landry, B., and H. H. Neunzig. 1998. A review of the Phycitinae of the Galápagos Islands (Lepidoptera: Pyralidae). Entomologica Scandinavica 28(4): 493–508.
Landry, J. F. 2007. Taxonomic review of the leek moth genus *Acrolepiopsis* (Lepidoptera: Acrolepiidae) in North America. The Canadian Entomologist 139: 319–353.
Maddox, D. M. 1970. The bionomics of a stem borer, *Vogtia malloi* (Lepidoptera: Phycitidae) on alligatorweed in Argentina. Annals of the Entomological Society of America 63(5): 1267–1273.
Neunzig, H. H. 2003. Pyraloidea, Pyralidae (part), Phycitinae (part). p. 1–338. *In*: R. B. Dominick et al. (eds.). The Moths of America North of Mexico, fascicle 15.5. The Wedge Entomological Research Foundation; Washington, D.C. 338 p.
Neunzig, H. H., and R. L. Goodson. 1992. New genera and species of southern South American Phycitinae (Lepidoptera: Pyralidae). Proceedings of the Entomological Society of Washington 94(2): 189–222.
Nuss, M., B. Landry, R. Mally, F. Vegliante, A. Tränkner, F. Bauer, J. Hayden, A. Segerer, R. Schouten, H. Li, T. Trofimova, M. A. Solis, J. De Prins, and W. Speidel. 2003–2019. Global Information System on Pyraloidea. Hosted by the Senckenberg Collection of Natural History, Museum of Zoology, Dresden, Germany. Available at http://www.pyraloidea.org/. (Last accessed 20 April 2019.)
Pastrana, J. A. 1961. Una nueva Phycitidae (Lep.) parasito de la "lagunilla". Revista de Investigaciones Agricolas (Buenos Aires) 15(2): 265–272.
Ragonot, E. L. 1887. Diagnoses of North American Phycitidae and Galleriidae. Published by the author; Paris. 20 p.
Ragonot, E. L. 1888. Nouveaux genres et espèces de Phycitidae & Galleriidae. Published by the author; Paris. 52 p.
Ratnasingham, S., and P. D. N. Hebert. 2007. BOLD: The Barcode of Life Data System (http://www.barcodinglife.org). Molecular Ecology Notes 7: 355–364.
Robinson, G. S. 1976. The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera. Entomologist's Gazette 27: 127–132.
Scholtens, B. G., and M. A. Solis. 2015. Annotated check list of the Pyraloidea (Lepidoptera) of America North of Mexico. ZooKeys 535: 1–136.
Shaffer, J. C. 1968. A revision of the Peoriinae and Anerastiinae (Auctorum) of America North of Mexico (Lepidoptera: Pyralidae). United States National Museum Bulletin 280. Smithsonian Institution Press; Washington, D.C. v+124 p.
Shaffer, J. C. 1991. *Rhinaphe endonephele* and *R. ignetincta* redescribed and assigned to *Divitiaca* Barnes & McDunnough (Pyralidae: Phycitinae). Journal of the Lepidopterists' Society 45(2): 130–134.
Shaffer, J. C. 1995. Phycitinae. p. 93–105, 174. *In:* J. B. Heppner (ed.). Atlas of Neotropical Lepidoptera. Checklist: Part 2. Hyblaeoidea – Pyraloidea – Tortricoidea 3. Association for Tropical Lepidoptera and Scientific Publishers; Gainesville, FL. 243 p.
Zeller, P. C. 1848. Exotische Phyciden. Isis von Oken 1848: 857–890.

Received April 7, 2020; accepted May 1, 2020.
Review editor Andrei Sourakov.

Appendix 1. Summary of records in BOLD dataset DS-MRRHINIA used in the barcode analysis.

Name	Origin	Depository	BOLD Sample ID	BOLD Process ID
A. malloi release voucher	Australia, Qld	ANIC	10ANIC-12269	ANICP273-10
A. malloi release voucher	Australia, Qld	ANIC	10ANIC-12270	ANICP274-10
M. aureofasciella	USA, AZ	CNC	CNCLEP00107410	CNCLA6712-13
M. aureofasciella	USA, AZ	CNC	CNCLEP00107412	CNCLA6714-13
M. dryadella	USA, FL	FSCA	JEH20151104E	MNAQ996-16
M. endonephele	USA, FL	CBG	BIOUG01419-F12	BBLOB1497-11
M. endonephele	USA, FL	CBG	BIOUG01425-C01	BBLOB1830-11
M. endonephele	USA, FL	CBG	BIOUG01396-E07	BBLOB435-11
M. endonephele	USA, FL	CBG	06-FLOR-0259	LOFLA259-06
M. endonephele	USA, FL	CBG	06-FLOR-1610	LOFLB670-06
M. endonephele	USA, FL	CNC	CNCLEP00025722	MNAB131-07
M. endonephele	USA, FL	CNC	CNCLEP00025749	MNAB158-07
M. endonephele	USA, MA	CBG	TDWG-0093	MJMSL176-10
M. endonephele	USA, MS	CBG	09BBLEP-04450	BBLSU081-09
M. endonephele	USA, NC	CBG	06-NCCC-1206	LNCB250-06
M. endonephele	USA, NC	CBG	06-NCCC-1207	LNCB251-06
M. endonephele	USA, OK	CBG	MDOK-0741	LPOKA741-09
M. endonephele	USA, TX	CBG	BIOUG01545-A11	BBLOC1459-11
M. endonephele	USA, TX	CBG	BIOUG01545-H06	BBLOC1538-11
M. endonephele	USA, TX	CBG	BIOUG01551-F09	BBLOD087-11
M. endonephele	USA, TX	CBG	BIOUG01551-F11	BBLOD089-11
M. endonephele	USA, TX	CBG	BIOUG01828-E05	BBLOD1496-11
M. endonephele	USA, TX	CBG	BIOUG01568-C10	BBLOD812-11
M. endonephele	USA, TX	Texas A&M U.	TAMUICEGR-0588	TAMIC588-10
M. ochrella	USA, FL	FSCA	JEH20151104C	MNAQ995-16
M. parvulella	USA, FL	FSCA	JEH20151104D	MNAQ999-16

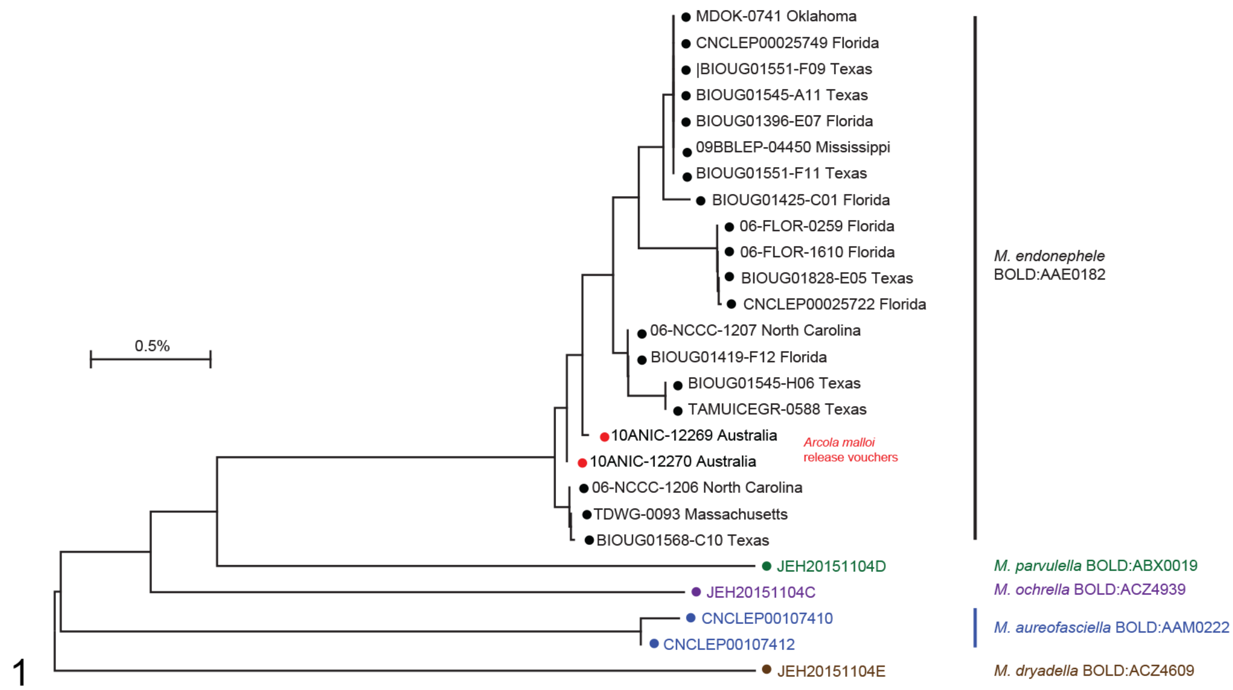
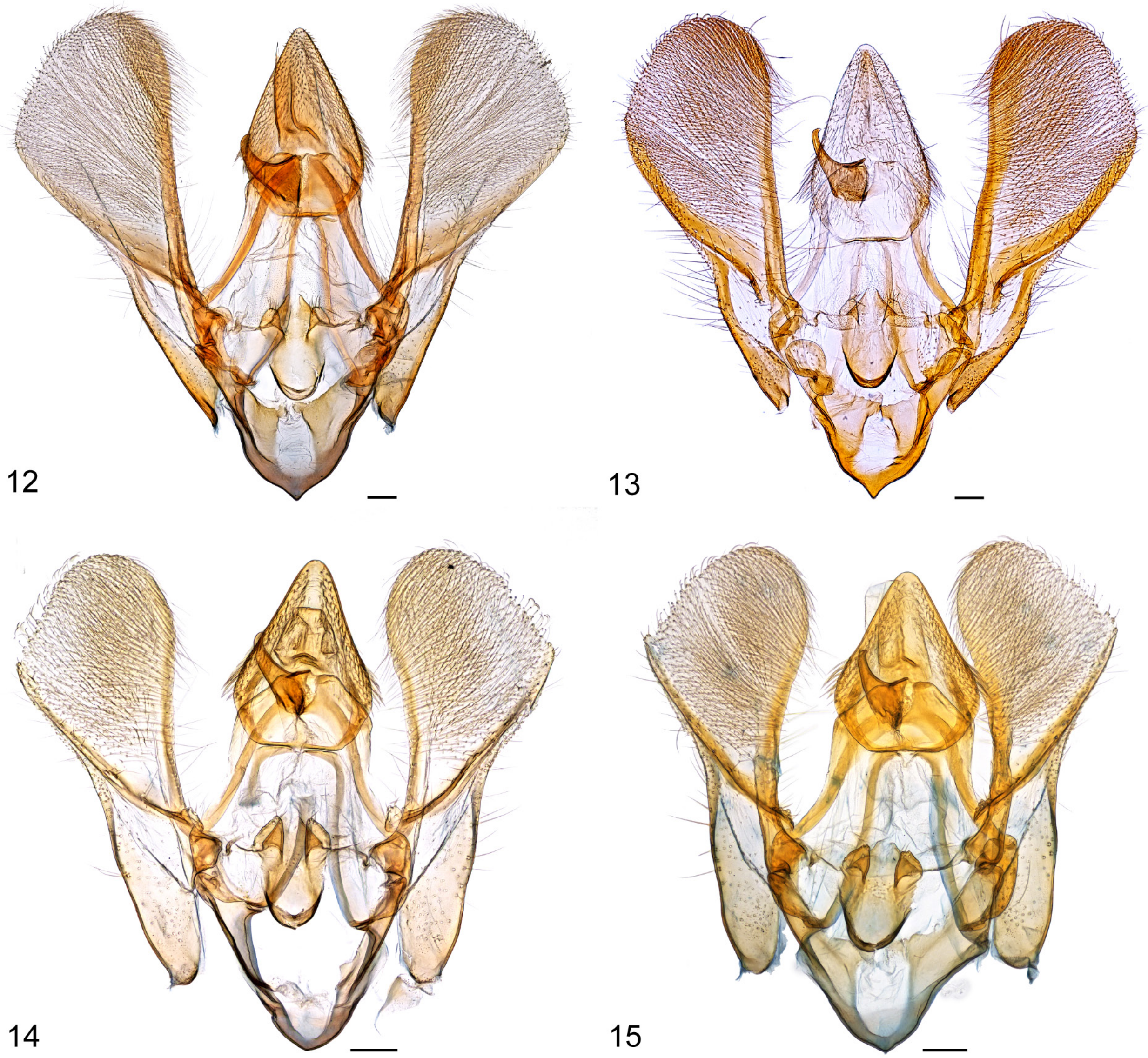
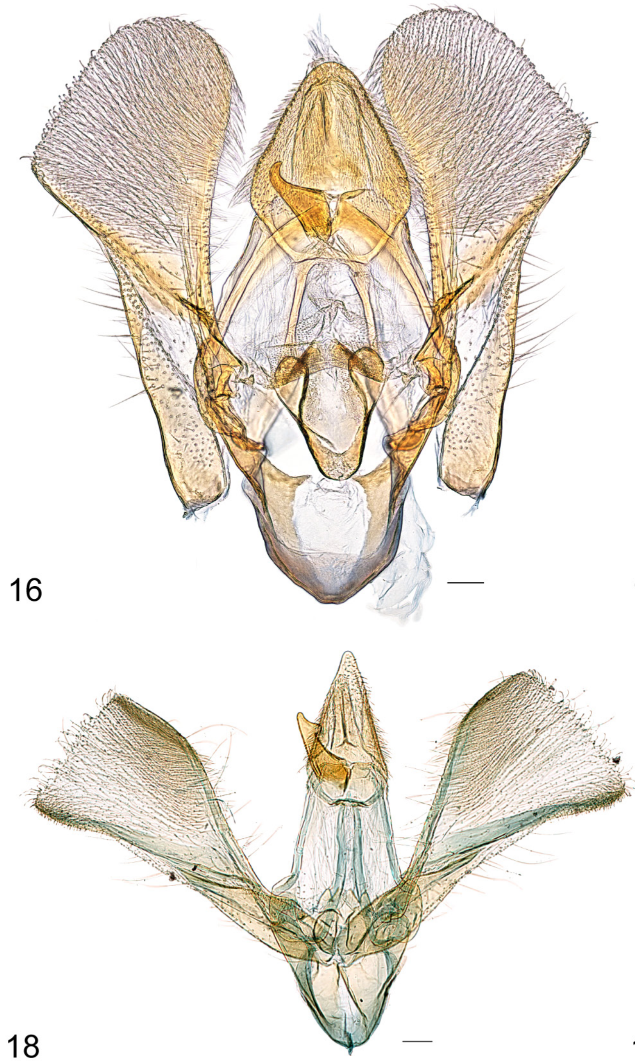


Figure 1. DNA barcode neighbor-joining tree for *Macrorrhinia endonephele* and four congeneric species. Scale bar = divergence of 0.5% using Kimura-2-parameter distances. Solid dots denote individual specimens followed by their unique identifiers (Specimen IDs). Red dots indicate voucher specimens of *Arcola malloi* released in Australia for the biological control of alligatorweed.

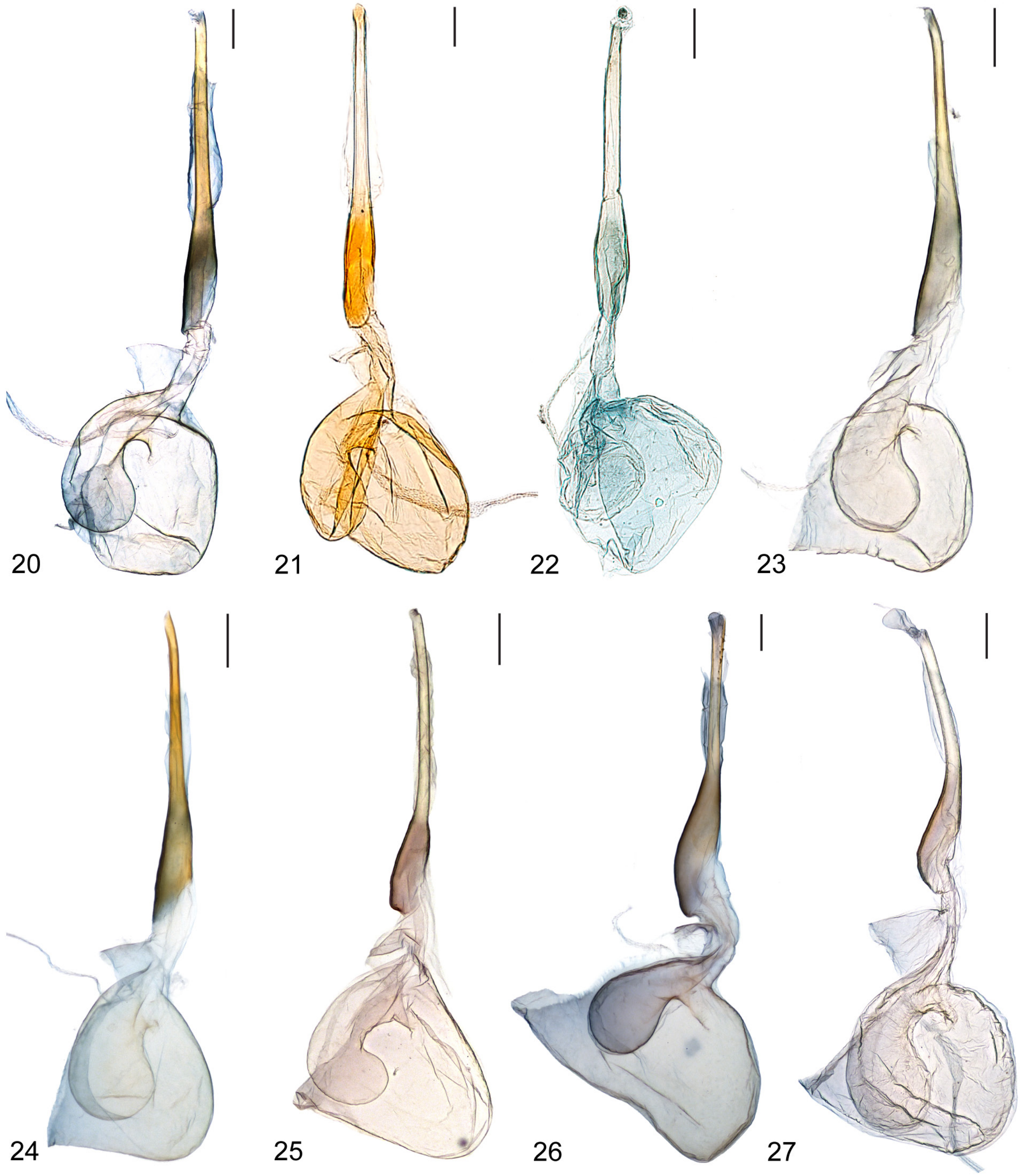
Figures 2–11. Adults of *Macrorrhinia*. Specimen numbers in parentheses. **2)** *M. endonephele* ♂, South Carolina (USNMENT00657713). **3)** *M. endonephele* ♂, holotype of *M. signifera*, Texas (USNMENT00657707). **4)** *M. endonephele* ♂, Argentina (USNMENT00657659). **5)** *M. endonephele* ♀, Florida (MGCL). **6)** *M. aureofasciella* ♂, Texas (MGCL). **7)** *M. dryadella* ♂, Florida (FSCA). **8)** *M. ochrella* ♀, lectotype (USNMENT00657700), Florida. **9)** *M. simulella* ♀, lectotype (USNMENT00657704), Florida. **10)** *M. simulella* ♂, paralectotype (USNMENT00657703), Florida. **11)** *M. parvulella* ♂, Florida (FSCA). Scale lines = 5 mm.



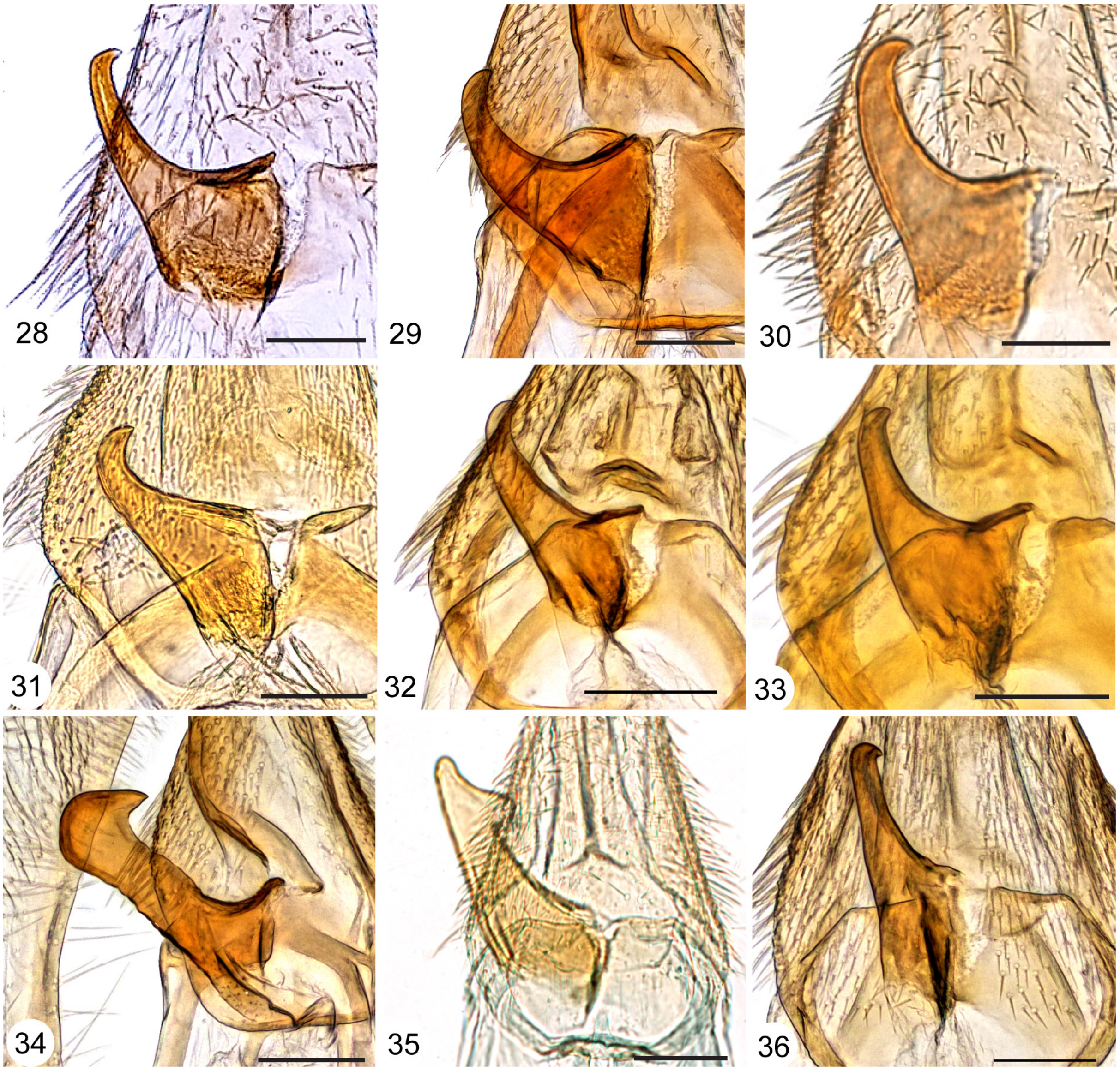
Figures 12–15. Male genitalia of *Macrorrhinia*. Slide numbers in parentheses. **12)** *M. endonephele*, Florida (PYR 2190). **13)** *M. endonephele*, holotype of *M. signifera* Texas (USNM 130224). **14)** *M. ochrella*, Florida (USNM 144171). **15)** *M. ochrella*, paralectotype of *M. simulella* Florida (USNM 144162). Scale lines = 100 µm.



Figures 16–19. Male genitalia of *Macrorrhinia*. Slide numbers in parentheses. **16)** *M. aureofasciella*, Arizona (PYR 2205). **17)** *M. parvulella*, Florida (PYR 2199). **18)** *M. dryadella*, Florida (MGCL 2034). **19)** *M. pinta*, Galapagos (PYR 2207). Scale lines = 100 µm.

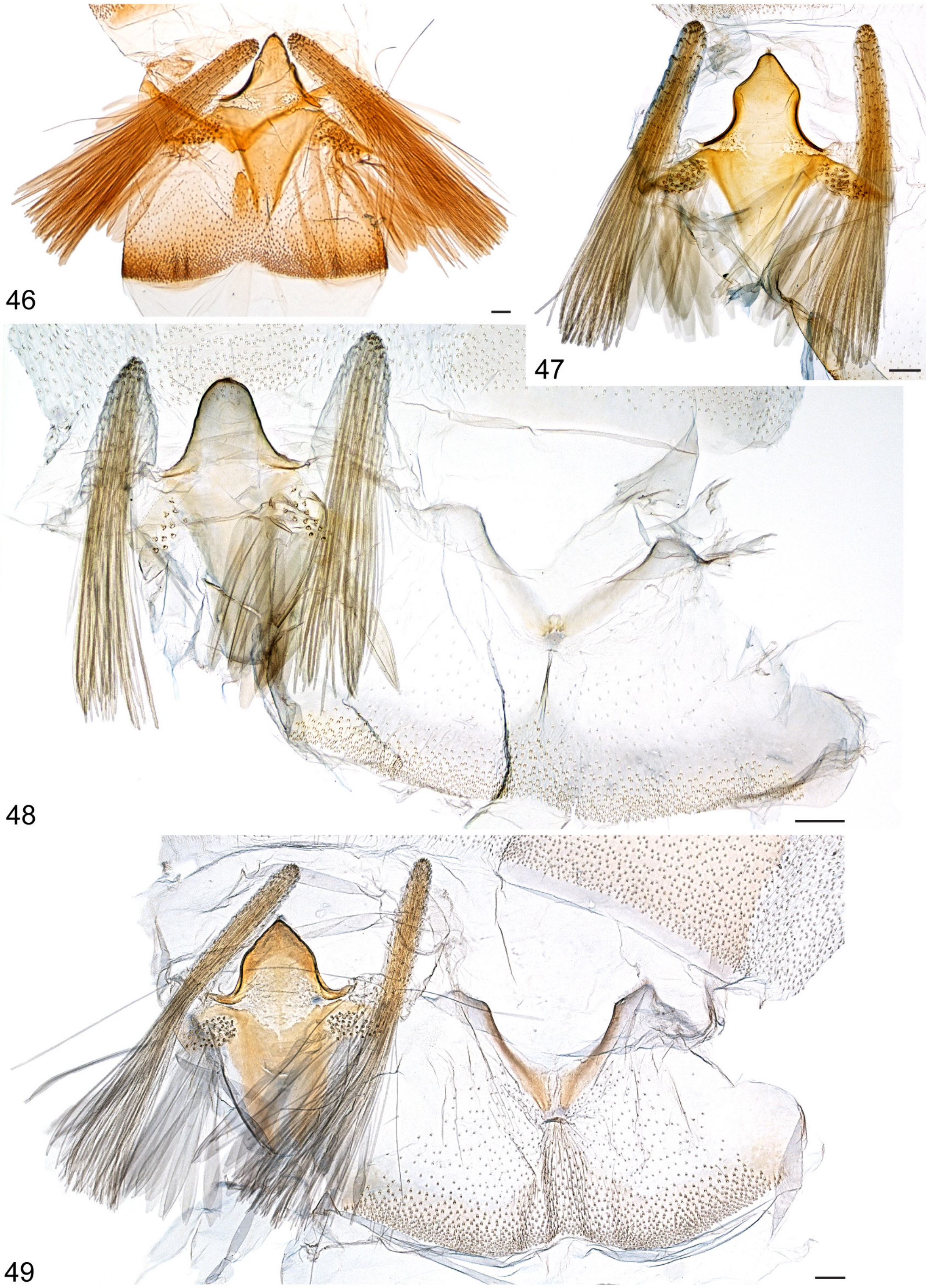


Figures 20–27. Male phalli of *Macrorrhinia*, dorsal aspect. Slide numbers in parentheses. **20)** *M. endonephele*, South Carolina (USNM 144170). **21)** *M. endonephele*, paratype of *Arcola malloi* Argentina (JFL 1724). **22)** *M. dryadella*, Florida (MGCL 2034). **23)** *M. ochrella*, Florida (USNM 144171). **24)** *M. ochrella*, paralectotype of *M. simulella* Florida (USNM 144162). **25)** *M. parvulella*, Florida (PYR 2199). **26)** *M. aureofasciella*, Arizona (PYR 2205). **27)** *M. pinta*, Galapagos (PYR 2207). Scale lines = 100 µm.

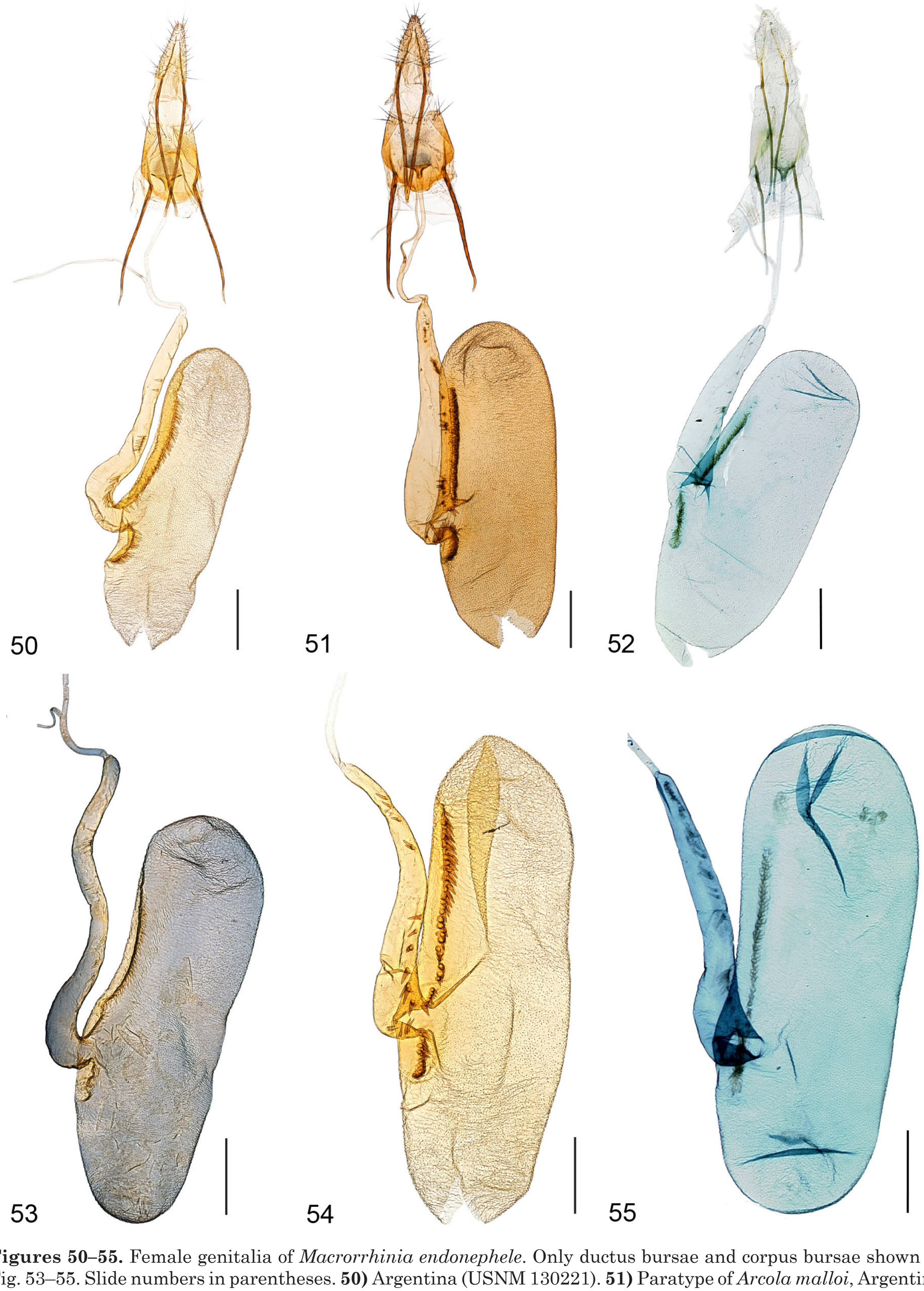


Figures 28–36. Male gnathos of *Macrorrhinia*. Slide numbers in parentheses. **28)** *M. endonephele*, holotype of *M. signifera* Texas (USNM 130224). **29)** *M. endonephele*, Florida (PYR 2190). **30)** *M. endonephele*, paratype of *Arcola malloi* Argentina (JFL 1725). **31)** *M. aureofasciella*, Arizona (PYR 2205). **32)** *M. ochrella*, Florida (USNM 144171). **33)** *M. ochrella*, paralectotype of *M. simulella* Florida (USNM 144162). **34)** *M. parvulella*, Florida (PYR 2199). **35)** *M. dryadella*, Florida (MGCL 2034). **36)** *M. pinta*, Galapagos (PYR 2207). Scale lines = 100 µm.

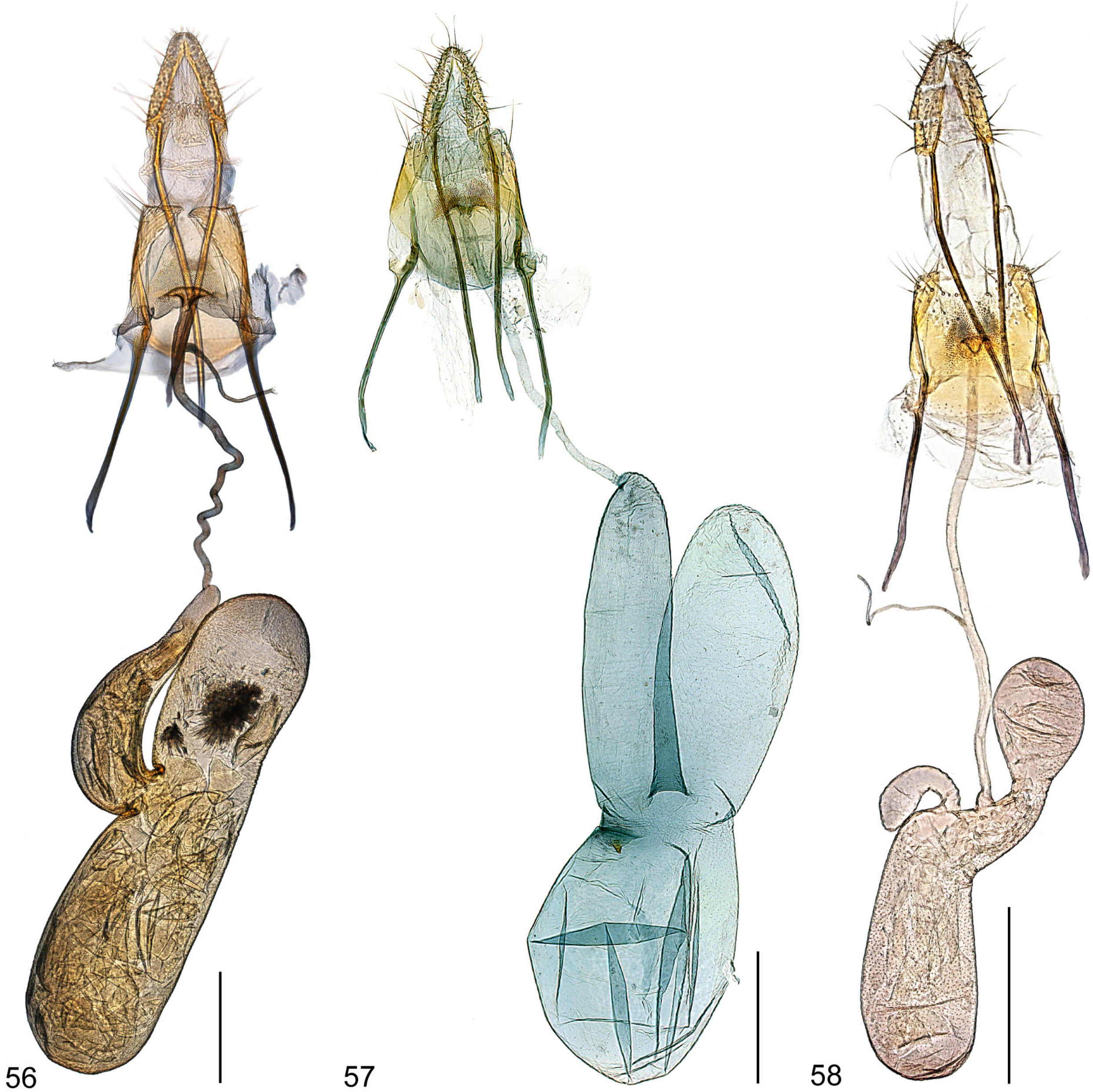
Figures 37–45. Male juxta of *Macrorrhinia*. Slide numbers in parentheses. **37)** *M. endonephele*, Florida (PYR 2190). **38)** *M. endonephele*, holotype of *M. signifera* Texas (USNM 130224). **39)** *M. aureofasciella*, Arizona (PYR 2205). **40)** *M. ochrella*, Florida (USNM 144171). **41)** *M. ochrella*, paralectotype of *M. simulella* Florida (USNM 144162). **42)** *M. ochrella*, Florida (USNM 144172). **43)** *M. parvulella*, Florida (PYR 2199). **44)** *M. dryadella*, Florida (MGCL 2034). **45)** *M. pinta*, Galapagos (PYR 2207). Scale lines = 100 µm.



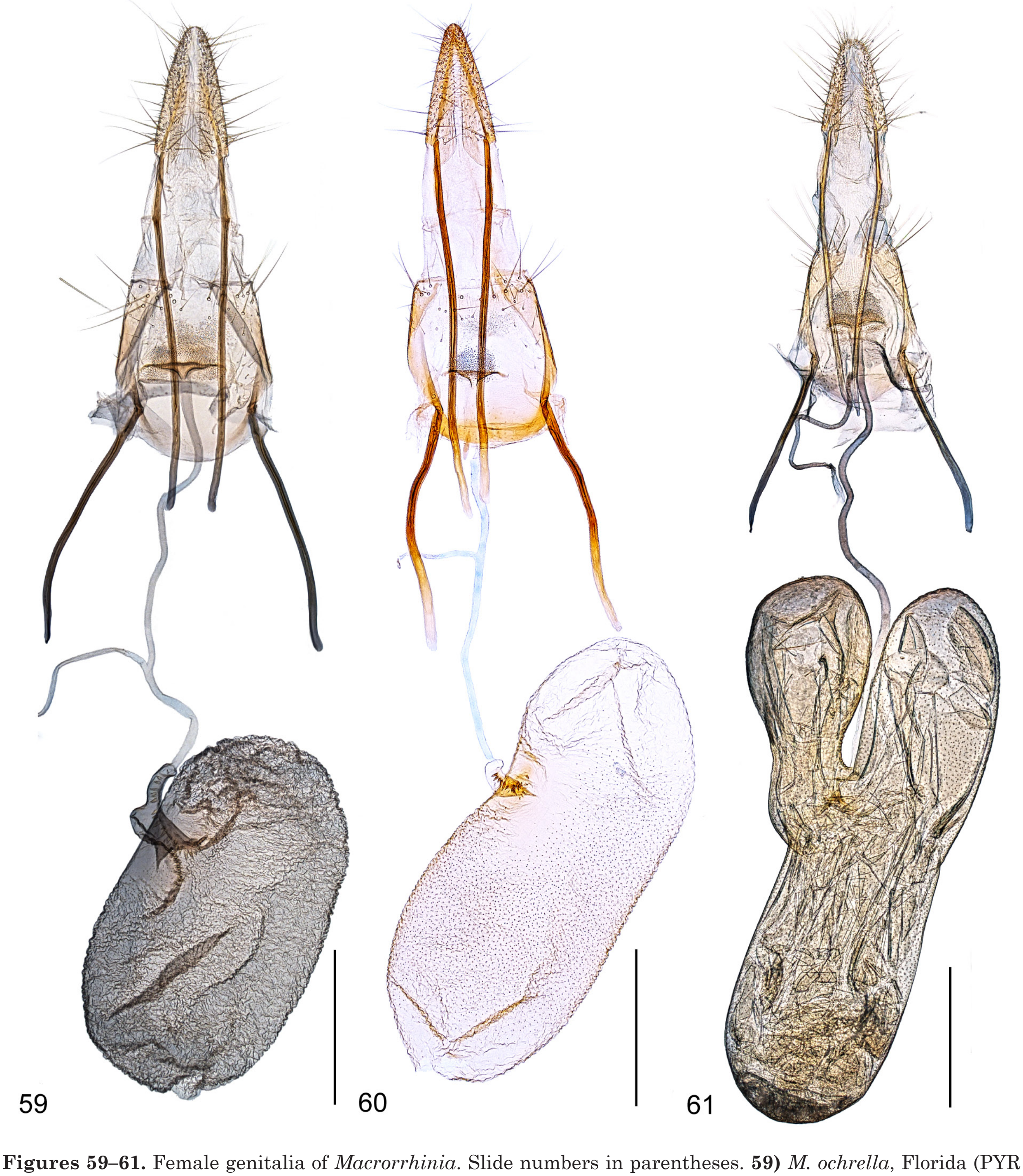
Figures 46–49. Male abdominal segment 8 of *Macrorrhinia*. Slide numbers in parentheses. **46)** *M. endonephele*, paratype of *Arcola malloi* Argentina (JFL 1725). **47)** *M. endonephele*, South Carolina, only sternum 8 shown (USNM 144170). **48)** *M. ochrella*, Florida (USNM 144171). **49)** *M. aureofasciella*, Arizona (PYR 2205). Scale lines = 100 µm.



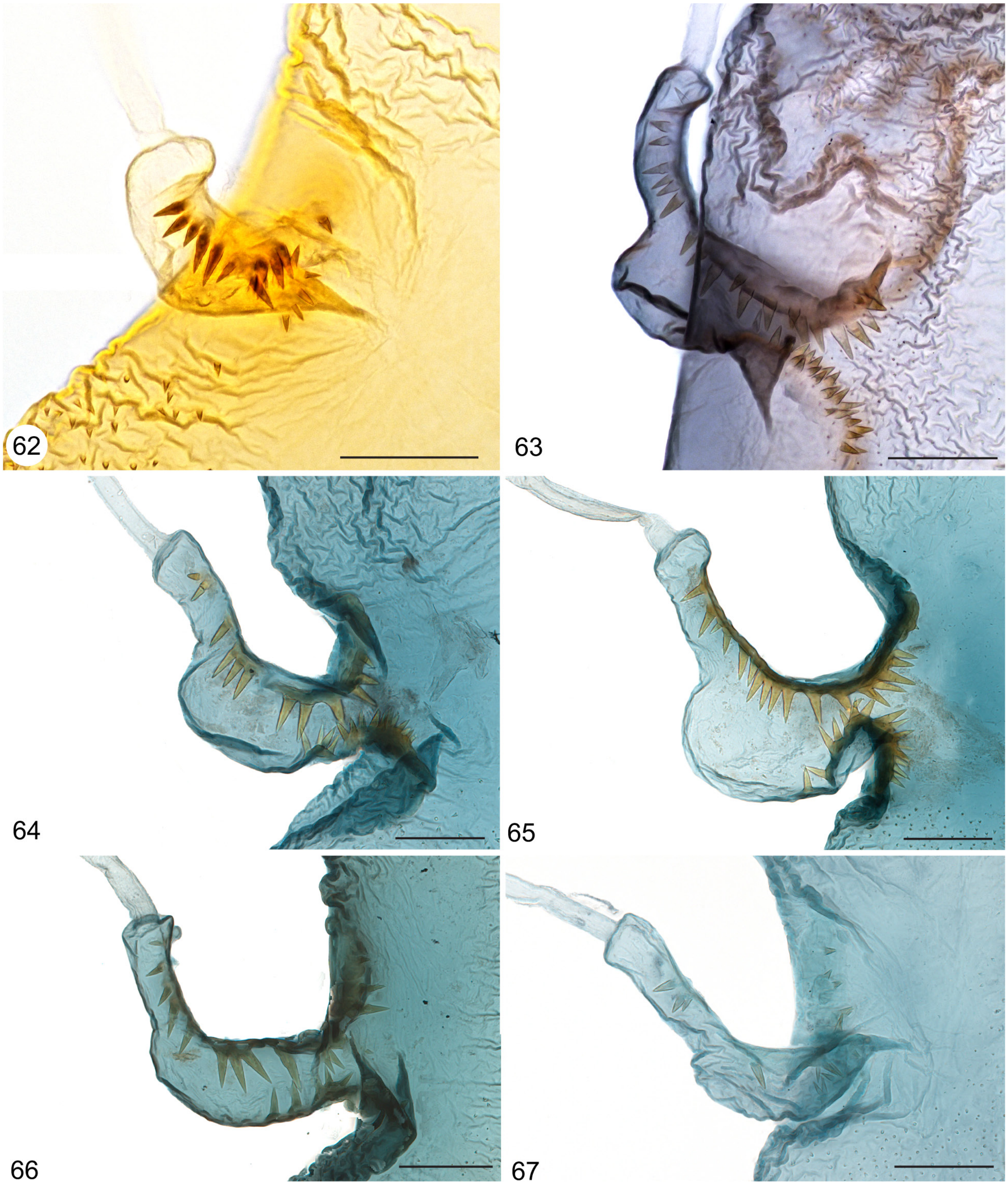
Figures 50–55. Female genitalia of *Macrorrhinia endonephele*. Only ductus bursae and corpus bursae shown in Fig. 53–55. Slide numbers in parentheses. **50)** Argentina (USNM 130221). **51)** Paratype of *Arcola malloi*, Argentina (JFL 1723). **52)** Florida (MGCL 2516). **53)** South Carolina (PYR 2195). **54)** Argentina (USNM 130220). **55)** Florida (MGCL 4357). Scale lines = 500 µm.



Figures 56–58. Female genitalia of *Macrorrhinia*. Slide numbers in parentheses. **56)** *M. aureofasciella*, Arizona (PYR 2204). **57)** *M. dryadella*, Florida (MGCL 5744). **58)** *M. parvulella*, Florida (PYR 2200). Scale lines = 500 µm.



Figures 59–61. Female genitalia of *Macrorrhinia*. Slide numbers in parentheses. **59)** *M. ochrella*, Florida (PYR 2197). **60)** *M. ochrella*, lectotype of *M. simulella* Florida (USNM 130223). **61)** *M. pinta*, Galapagos (PYR 2206). Scale lines = 500 µm.



Figures 62–67. Female genitalia of *Macrorrhinia ochrella*, close-up of connection of ductus bursae to corpus bursae. Slide numbers in parentheses. **62)** *M. ochrella*, lectotype of *M. simulella* Florida (USNM 130223). **63)** *M. ochrella*, Florida (PYR 2197). **64)** *M. ochrella*, Florida (MGCL 5756). **65)** *M. ochrella*, Florida (MGCL 5755). **66)** *M. ochrella*, Florida (MGCL 5753). **67)** *M. ochrella*, Florida (MGCL 5742). Scale lines = 100 µm.

Figures 68–73. Female genitalia of *Macrorrhinia*, close-up of ostium bursae. Slide numbers in parentheses. **68)** *M. endonephele* South Carolina (PYR 2195). **69)** *M. ochrella*, Florida (PYR 2197). **70)** *M. aureofasciella*, Arizona (PYR 2204). **71)** *M. parvulella*, Florida (PYR 2200). **72)** *M. pinta*, Galapagos (PYR 2206). **73)** *M. dryadella*, Florida (MGCL 5744). Scale lines = 100 µm.