

# DESCRIPTION OF A NEW SPECIES OF *EXELASTIS* (LEPIDOPTERA: PTEROPHORIDAE) FROM THE NEOTROPICS, WITH KEYS TO ADULTS OF THE FOUR SPECIES OCCURRING IN FLORIDA

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**Abstract** – A new species of *Exelastis* Meyrick, 1908 is described from Florida, Grand Bahama Island, and Belize. Images of adults and keys are provided for the four *Exelastis* species occurring in Florida. Descriptions and illustrations of the male and female genitalia of this new species and for *E. rhynchosiae* (Dyar) are included, the female of the latter published for the first time.

**Key words:** Bahamas, Belize, *Desmodium*, Exelastini, Fabaceae, *Fuscoptilia*, legume feeders, Leguminosae, *Marasmarcha*, Platyptiliinae, plume moth, Pterophorinae, Pterophoroidea, *Rhynchosia*, *Tomotilus*, U.S.A.

The genus *Exelastis* Meyrick, 1908, has previously included 17 species worldwide, with three occurring in the Neotropical Region: *E. phlyctaenias* (Meyrick, 1911) from the Virgin Islands, *E. montischristi* (Walsingham, 1897) from the Galapagos Islands, Grenada, Jamaica, and the Virgin Islands, and *E. pumilio* (Zeller, 1873) which is pantropical (Gielis 2003, 2006). The type species *E. atomosa* (Walsingham, 1885) is a well known pest of pigeon pea, *Cajanus cajan* (L.) Millsp., lablab bean, *Lablab purpureus* (L.) Sweet, and other leguminous crops in the Old World tropics, especially India and Sri Lanka; but it has not been reported from the neotropics (Fletcher 1920, Matthews & Lott 2005).

In the U.S.A., Florida includes species of both the neotropical and nearctic faunas. Images of adults and keys to the four *Exelastis* species occurring in Florida are presented below. One species, *Exelastis rhynchosiae* (Dyar), is nearctic, thus far known only from Arkansas and Florida, and originally described and reared by Dyar (1898) from Miami. Two are previously known neotropical species, and one, a new neotropical species, earlier referred to as *Exelastis* sp. by Matthews (1989) and Matthews *et al.* (1990), is described and named in this paper. The male and female genitalia of the new species and *E. rhynchosiae* are illustrated herein. We refer the reader to the earlier published genitalia illustrations (Landry & Gielis 1992, Landry 1993) to supplement the keys for identification of the other two species (*E. pumilio* and *E. montischristi*) occurring in Florida. Genitalia of the type species, *E. atomosa*, are illustrated by Gibeaux (1994). Life histories, keys, and descriptions of the larvae and pupae of Florida *Exelastis* are detailed in Matthews *et al.* (1994) and Matthews (2006). The life history of the new species is unknown but likely host candidates should be sought based on the affinities of related species.

As larvae, Pterophoridae feed on a variety of hosts with records including 70 plant families, but are most strongly associated with Asteraceae (Matthews & Lott 2005). Within the tribe Exelastini as delimited by Gielis (2000), larvae of the genera *Exelastis*, *Marasmarcha* Meyrick, 1886, and *Fuscoptilia* Arenberger, 1991 are specialized on Fabaceae (Leguminosae). The genus *Tomotilus* Yano, 1961, represented by *T. saitoi* Yano, 1961 (currently Oxyptilini), and *Platyptilia cretalis* Meyrick, 1908 of uncertain generic placement, are also legume-feeders. The possible monophyly of the legume-feeding genera was presented relative to larval characters by Matthews *et al.* (1994) and is further discussed in the present paper with regard to morphological characters found in the genitalia.

## SPECIES ACCOUNTS

### *Exelastis dowi* Matthews & B. Landry, n. sp.

(Figs. 1-3, 7-9, 12)

**Diagnosis.** This species is distinguished from *E. pumilio* and *E. rhynchosiae* by the presence of scattered dark basal scales in the fringes of the hindwing third lobe and from *E. montischristi* by the lighter color and by the absence of a median discal spot on the forewing. It is also distinguished from the other *Exelastis* species in the region by characters of the male genitalia, which are unique in having asymmetrical valvae.

**Description** (male, female). Based on holotype (male) and paratypes (3 males, 4 females). HEAD with labial palpi slender, erect, length just exceeding eye diameter, light brown scaling above and laterally, light buff below. Front and vertex with scales appressed, light buff. Occiput with few light buff, elongate, bifid scales laterally. Antenna light buff, sparsely scaled above, minutely ciliated below, base light buff, with few light brown scales medially. THORAX light buff, medially with few mixed light tan scales. Foreleg coxae light brown with narrow light buff stripe along anterolateral margin. Femur light tan laterally, brown medially. Tibia light buff with paired brown slender, distally flaired stripes, with small distal tuft of elongate brown and light buff scales. Tarsomeres light buff with single thin brown to light tan dorsal stripe. Midleg coxa light buff, femur and tibia brown and light buff striped, tibial spurs subequal, light buff above, brown below. Tarsomeres light buff above, light brown to tan below. Hindleg coxa light buff with mixed brown scales, femur brown laterally, light buff medially. Tibia light buff above, brown below, with two spur pairs, proximal pair longer with medial spur slightly longer than lateral spur. Distal spur pair subequal. Spurs light buff above, brown below. Tarsomeres mostly cream with faint tan scaling laterally. FOREWING length 6.0-9.5 mm (n = 8, Holotype = 9.0 mm), cleft origin at 0.6× wing length from base. Color mostly light buff to light ochraceous-buff mixed with light tan scales. Costa with three small diffuse spots marking terminus of veins R<sub>1</sub>, R<sub>2</sub>, and R<sub>3</sub>. Two small brown spots present near cleft base. Anterior spot larger and more distinct, round or elongate, positioned between costa and cleft base but not extending to cleft margin, with faint trail of brown scales extending basad to middle of wing. Posterior spot in shape of dash along posterior margin of cleft base, with thin trail of brown scales to middle of wing. Scattered brown scales present in first lobe along middle and cleft margin. Second lobe with scattered brown scales along veins Cu<sub>1</sub> and Cu<sub>2</sub>. Few scattered brown scales also present at wing base along costa and second anal vein. Fringes white with grayish tinge except for small brownish gray patch along anal margin near middle of second lobe. Fringe scales elongate, with dark brown-tipped spatulate basal scales present in clusters (or “teeth”) or individually scattered as described below. Scattered dark brown basal scales present along posterior margin on distal third of first lobe, followed distally by tiny subapical cluster. Scattered basal scales at distal third of second lobe anterior margin, a small cluster at second lobe apex, and scattered scales along termen. Anal margin of wing with small basal scale cluster at 0.5× and 0.7× from wing base, scattered within brownish gray fringe scale patch, and a small cluster at anal angle. A few scattered white basal scales also present. HINDWING slightly darker than forewing, uniformly ochraceous-tawny, fringes medium gray. Fringes of third lobe posterior margin interspersed with brownish black-tipped basal scales extending from base to near apex. A few white basal scales also sometimes present. ABDOMEN light buff to light ochraceous-buff with tan middorsal stripe.

**MALE GENITALIA** (Figs. 7-9). Tegumen narrow and weakly sclerotized, free

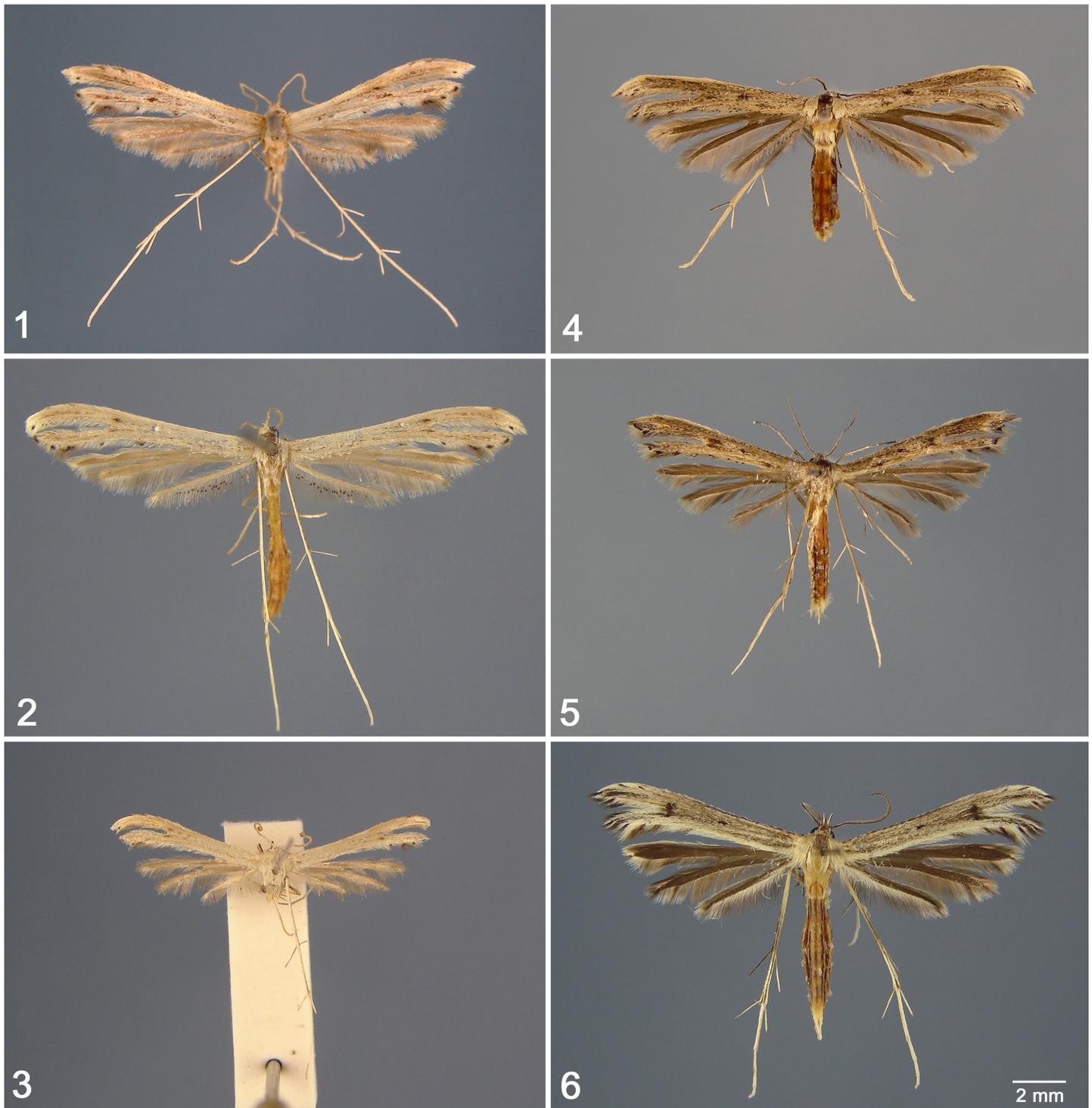


Fig. 1-6. *Exelastis* adults: 1) *E. dowi*, holotype ♂, Key Largo, Florida [MGCL]; 2) *E. dowi*, paratype ♀, Key Largo, Florida [MGCL]; 3) *E. dowi*, paratype ♂, Freeport, Grand Bahama Island [USNM] (Figs. 1-3, see text for additional data); 4) *E. montischristi* ♀, Florida: Hernando Co., Withlacoochee State Forest, Croom W.M.A. 25.viii.1991 T. Lott & D. Matthews, on *Rhynchosia minima* / em. 31.viii.1991 / [DMC]; 5) *E. pumilio* ♂, Florida: Putnam Co., 2.5 mi. SE of Hawthorne, 17.x.1996, D. Matthews / reared ex. larva on *Desmodium incanum*, p. 21.x.1996, em. 29.x.1996 [DMC]; 6) *E. rhynchosiae* ♂, Florida: Clay Co., W side of SR 21 nr. Deer Spring Rd. 21.vii.1991 T.A. Lott & D. Matthews / pupa on leaf of *Rhynchosia cinerea*, em. 24.vii.1991 [DMC]. All images to same scale.

from the uncus. Uncus with two asymmetrical, well sclerotized, laterally flattened and apically rounded lateral arms bearing small setae; right arm slightly longer than left; two arms connected at base with marginally sclerotized triangular structure with anus in middle. At its base, this triangle forming a sclerotized ring with lateral ear-like lobes, connecting with narrow juxtal arms ventrally, supporting phallus and apparently fused to it. Valvae asymmetrical, about four times as long as largest width, moderately sclerotized, basally narrower and with more sclerotized margins. Left valva apically divided into two lobes: ventral scoop-like lobe glabrous, larger than dorsal setose lobe; division between lobes extending inwardly to middle and

ending in short, well sclerotized, flat, tongue-like extension projecting laterally. Right valva also divided into two lobes; ventral lobe apically with well sclerotized scoop-like extension with pore connected to gland inside valva near middle; ventral margin of ventral lobe forming short crest with short flat rounded extension, followed by 3× longer, curved, narrow, digitiform extension pointing laterally, in middle of valva. Sternite VIII with median modification large, apically bilobed, with dorsomedian support structure weakly developed. Vinculum very narrow and well sclerotized. Phallus narrow, as long as two-thirds length of valva, well sclerotized, S-shaped, with small dorsal bulge post medially.

**FEMALE GENITALIA** (Fig. 12). Papillae anales rather short, moderately sclerotized, with setation medium-sized and moderately abundant. Apophyses posteriores thin, well sclerotized, about 5.5× length of papillae anales, apically recurved. Sternite VII enlarged, with rather large median plate ventrally extending from middle of sternite to shortly beyond apical margin, widest at base, slightly narrowing and extended laterally into narrow arms; pair of small pockets present next to each lateral arm. Membrane posterior to sternum VII folded into dead-end pouch extending internally near middle of segment VII. Ostium at base of well sclerotized and large tergum VIII medially. Ostial plate absent. Ductus bursae strictly membranous, very narrow, connecting with corpus bursae beyond middle of segment VII. Corpus bursae large, slightly elongate, extending shortly into segment V, with pair of well-sclerotized blade-like signa. Inception of ductus seminalis at connection of ductus and corpus bursae.

**Holotype.** ♂ - with the following labels: 'KEY LARGO FL | 11 MAR 86 | [L. C.] DOW' [white printed and hand printed]; 'genitalia slide | BL 736 ♂' [green, printed and hand printed]; 'dowi nsp. | Dét. B. Landry 1994' [white printed and hand printed]; 'HOLOTYPE | *Exelastis dowi* | Matthews & B. Landry' [red printed and hand printed]; Genitalia slide labels: 'BL 736 ♂ | FL, Key Largo | 11.iii.1986, Dow | Euparal | B. Landry, 26.x.1994'; 'HOLOTYPE | *Exelastis dowi* | Matthews & B. Landry'. Deposited in the McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, Florida [MGCL].

**Paratypes.** 1 ♂, 4 ♀ - same locality as holotype (1 ♂ with genitalia slide DM 171 [MGCL], 1 ♀ intact [MGCL], 2 ♀ with genitalia slides DM 170 and DM 172 [MGCL], 1 ♀ with genitalia slide DM 168 and DM venation slide # 10, 4.ix.88 Deborah Matthews Collection [DMC]); 1 ♂ - GRAND BAHAMA ISLAND Freeport 20-27.vi.1987 W.E. Steiner, M.J. & R. Molineaux, Malaise trap in Caribbean pine & palmetto scrub (genitalia vial DM 169) [USNM]; 1 ♂ - BELIZE San Ignacio 6.iv.1989 Dow (genitalia slide DM 330) [MGCL]. Deposited in the McGuire Center for Lepidoptera and Biodiversity, National Museum of Natural History, Washington, D.C. [USNM], and the first author's collection [DMC].

**Additional Material.** 1 ♂ - USA: FLORIDA: Monroe Co.: Big Pine Key, Blue Hole 25.1-4.II.1988 M. Hennessey, malaise trap (genitalia slide DM 523) [DMC]. This specimen was retrieved from an alcohol vial and though pinned, it is in poor condition and thus excluded from the type series.

**Immature Stages.** Unknown.

**Larval Hostplant.** Unknown.

**Phenology.** The holotype and paratypes from Key Largo were collected in March. Bahamas and Belize specimens were collected in April.

**Distribution.** BAHAMAS: Grand Bahama Island; BELIZE; USA: FLORIDA: Monroe County: Key Largo and Big Pine Key.

**Etymology.** This species is named in honor of Mr. Linwood C. Dow who collected the holotype and paratypes from Key Largo, Florida and Belize.

**Comments.** Dissection of genitalia may be necessary for decisive identification in worn specimens where most if not all of the dark basal spatulate scales of the hindwing third lobe are missing, as seen in the Bahamas specimen (Fig. 3).

*Exelastis montischristi* (Walsingham, 1897)  
(Fig. 4)

This species was known as *Exelastis cervinicolor* (Barnes & McDunnough, 1913) in previous literature (Barnes & Lindsey 1921, Matthews 1989, Matthews *et al.* 1990, Landry & Gielis 1992) including our description of the larva and pupa (Matthews *et al.* 1994). Barnes & McDunnough (1913) described *Pterophorus cervinicolor* from two specimens from "Everglade, Fla. (Apr. 8-15)." The species was not included in the pterophorid section of the MONA checklist by Munroe (1983) but the synonymy of *E. cervinicolor* and *E. montischristi* was established by Gielis (1993). Landry & Gielis (1992) include a detailed description of the adult, as well as illustrations of the male and female genitalia (as *E. cervinicolor*).

**Diagnosis.** Distinguished from *E. pumilio* and *E. rhynchosiae* by the presence of scattered dark spatulate basal scales along hindwing anal margin and from *E. dowi* by the lighter forewing ground color and median discal spot present. FOREWING light grayish brown with mixed beige scales and some scattered dark brown scales; clusters of dark brown scales forming small spot in discal cell at 0.4× from wing base; smaller diffuse spot basal and posterior to discal spot and pair of diffuse dashes proximal of cleft base. Costal margin with two small spots at R<sub>2</sub> and R<sub>3</sub>; similar spots at first lobe apex at R<sub>4</sub> and subapical at R<sub>5</sub>. Anal margin with five to six small dark brown scale clusters in fringes and at second lobe apex at M<sub>3</sub>. Cleft just exceeding 0.3× FW length. Wing expanse 12.0 – 19.5 mm. HINDWING uniformly dark grayish brown with somewhat lighter fringes; third lobe with scattered dark brown and light beige spatulate basal scales mixed within linear fringe scales.

**Immature Stages.** Final instar larva reaching 9 mm in length, 1.7 mm in maximum width. Head translucent grayish yellow, body light green with dark

green middorsal line and raised ivory longitudinal ridges bearing the primary dorsal setae. With quite remarkable dense covering of conspicuously bifurcate-tipped primary and secondary setae. Secondary setae both scattered and arranged with primary setae on tubercles. Primary setae mostly light brown, secondary setae usually translucent. Longest setae reaching 1.2 mm (0.7× maximum body width).

Pupa reaching 8.5 mm in length, maximum width 1.7 mm. Coloration similar to larva. Light green with long white primary setae arising from pale dorsal ridge. Body densely covered with short spinule-like setae arising from transverse striations. More detailed larval and pupal descriptions are given by Matthews *et al.* (1994) and Matthews (2006).

**Larval Hostplant.** Larvae feed on leaves and shoots of *Rhynchosia minima* (L.) DC [Fabaceae], and are more easily found on small seedling plants than mats of older vines. The hostplant grows throughout the year in South Florida but dies back through the winter in more northern parts of the state.

**Phenology.** Adults have been collected from July to September in northern Florida with additional South Florida records for April, June to August, November, and December. Other adult records include October for the Bahamas, and August and November for the neotropics. Larvae have been collected in July and August in northern Florida as well as April and November to January in South Florida where they are probably present throughout the year.

**Distribution.** BAHAMAS; BARBADOS; CAYMAN ISLANDS; ECUADOR: Galapagos Islands; GRENADA; HAITI; VIRGIN ISLANDS; USA: FLORIDA and TEXAS. Florida specimens are from the following counties: Alachua, Citrus, Collier, Dade, Hernando, Manatee, and Monroe.

*Exelastis pumilio* (Zeller, 1873)  
(Fig. 5)

This is a very common species, formerly listed in the genus *Marasmarcha* in earlier nearctic literature (Barnes & Lindsey 1921, McDunnough 1939, Kimball 1965) but apparently inadvertently excluded from Munroe (1983).

**Diagnosis.** Similar to *E. montischristi* but FOREWING lobes with more noticeable termen and with more prominent dark apical scale clusters; base color caramel to grayish brown; spots at cleft base distinct, together forming larger spot than median discal spot. Anal margin with four small dark brown scale clusters. Wing expanse 10.5-17.5 mm. HINDWING uniform dark caramel to dark grayish brown, first and second lobes usually with a few dark scales at apex; third lobe without spatulate scales in fringes. Male and female genitalia distinguishable as noted in the keys below.

**Immature Stages.** Final instar larva reaching 8.5 mm in length, 1.8 mm in maximum width. Head yellowish, body green with diffuse white longitudinal stripes or entirely reddish purple when feeding on flowers. Body covered with long translucent setae on verruca-like tubercles. Primary setae central on tubercles, simple with smooth shafts and pointed tips, secondary setae on tubercles minutely barbed. Longest setae reaching 1.44 mm (0.8× maximum body width). Some scattered short to minute setae with slightly expanded tips present, most on prothorax and along posterior margin of segments.

Pupa reaching 8 mm in length, maximum width 1.5 mm; light green with contrasting white setae. Primary D and SD setae long, reaching 1.2 mm; secondary setae or setiform protuberances confined to dorsal ridge and lateral margins. Dorsal ridge and anterior half of forewing with fringe of short to minute secondary setae. With conspicuous purple middorsal stripe flanked by pale lines on A1-A9. Two pale subdorsal lines and broken lines present along L and SV setae. Larvae and pupae are described in further detail by Matthews *et al.* (1994) and Matthews (2006).

**Larval Hostplants.** Larvae feed on the flowers, shoots and young leaves of *Desmodium* species (beggar weeds) and certain other legumes (Fabaceae) (Matthews & Lott 2005). In Florida, *Desmodium incanum* DC., and *D. tortuosum* (Sw.) DC. are the usual hosts (Matthews *et al.* 1990, 1994). The former is a very common weed of lawns; both are common in disturbed areas.

**Phenology.** Florida adults have been collected throughout the year. Larvae are present from June to November with most larval specimen records for September.

**Distribution.** BARBADOS; CUBA; ECUADOR: GALAPAGOS ISLANDS; GRENADA; JAMAICA; PUERTO RICO; USA: ALABAMA, ARKANSAS, FLORIDA, LOUISIANA, MARYLAND, MISSISSIPPI, MISSOURI, NEW JERSEY, SOUTH CAROLINA, TEXAS. This species is also known from the Old World tropics and subtropics. Florida records include the following counties: Alachua, Broward, Collier, Dade, Dixie, Escambia, Flagler, Hendry, Hernando, Highlands, Hillsborough, Liberty, Indian River, Manatee, Marion, Monroe, Okaloosa, Orange, Palm Beach, Pasco, Pinellas, Putnam, Sarasota, St. Johns, and Volusia.

**Comments.** Worn males can be easily determined by brushing the scales from the tip of the abdomen to reveal the distinct terminal curvature of the valvae.

*Exelastis rhynchosiae* (Dyar, 1898)  
(Figs. 6, 10, 11, 13)

This species is uncommon and very difficult to rear. It is restricted to specific habitats with dry or well drained sandy soils such as pine flatwoods, pine-turkey oak sandhills, sandy open areas of high live oak hammocks, or sand pine-evergreen scrub on ancient dunes where the hostplants grow. The original species description by Dyar (1898) is based on the reared holotype from Miami and includes a brief larval description. Recent material is from northern Florida. Although the host grows in some of the few remaining tracts of Miami pinelands, this plume moth has not been collected from South Florida since the era of Dyar's description and another undated USNM specimen from Miami from the William Schaus collection.

**Diagnosis.** Distinguished from the previous species by the yellowish coloration of the body and forewings (less apparent in older specimens) and the bicolorous fringes of the hindwing third lobe.

**Redescription** (male, female). Based on the male holotype (USNM type # 4116, examined) and reared adults from North Florida (11 males, 7 females, see data below). Ground color of thorax and abdomen pale yellow; abdomen with brown longitudinal stripes (middorsal, two sublateral, and one lateral). FOREWING gray with yellowish tinge (grayish yellow with scattered pale yellow scales); basal half of costal margin medium gray and distal half whitish with two dark spots marking R<sub>2</sub> and R<sub>3</sub>; a very small dark brown discal spot midway between cleft and wing base; a dark brown double spot basad of cleft. Fringes at apex and termen of lobes with alternating dark and white tufts; anal margin with three additional dark linear scale patches between pale linear fringes. Wing expanse 12.0-18.0 mm. HINDWING uniformly dark gray brown with medium gray brown fringes, terminus of first and second lobes with light and dark tufts; third lobe with fringes of hindwing posterior lobe anal margin bicolorous, shorter, robust pale basal scales interspersed with longer, gray brown, linear fringe scales.

**MALE GENITALIA** (Figs. 10, 11). Tegumen large, weakly sclerotized, sack-like, apically rounded, with narrow lateral arms. Uncus weakly sclerotized, basally fused to tegumen, formed by two more or less quadrangular plates connected dorsally and apically, with long setae on distal half, apically with shallow groove. Juxta long and narrow, with arms fused at mid-length. Valvae symmetrical, poorly sclerotized, divided at base into two parts of same length; dorsal part blade-like, apically rounded; ventral part rod-like, pointed, apically with pore connected to gland. Vinculum medium-sized, about as long as abdominal segment VIII. Sternite VIII with median modification rather small, plate-like, almost circular, with well developed dorsomedian support structure. Phallus narrow, as long as two-thirds length of valva, well sclerotized, smoothly S-shaped.

**FEMALE GENITALIA** (Fig. 13). Papillae anales short, moderately sclerotized; with setae medium-sized and moderately abundant. Apophyses posteriores thin, well sclerotized, about 2.5× length of papillae anales. Sternite VII with pair of median lobes extending slightly beyond anterior margin of segment VIII; lobes with small hollow pocket anterad. Ostium located medially near posterior margin of segment VII. Ostial plate an elongate triangle directed anteriorly, about half length of segment VIII. Ductus bursae strictly membranous, posteriorly very narrow, enlarging near anterior margin of segment VII to about 6× its width to form even-sized elongate tube ending anteriorly into short round corpus bursae with wrinkled cuticle. Subtle constriction between ductus and corpus with small cuticular spicules of various sizes. Altogether, ductus and corpus bursae extend to about middle of segment V. Location of ductus seminalis connection unknown.

**Specimens examined.** See Matthews (2006) for more complete data including associated exuviae (pp. = prepupa, p. = pupated, em. = emerged). All reared specimens are from larvae or pupae collected on *Rhynchosia cinerea*. 1 ♂ - USA: FLORIDA: Clay Co.: W side of SR 21, nr. Deer Spring Rd. 21.vii.1991, em. 24.vii.1991 T.A. Lott & D. Matthews [DMC]; 2 ♂, 3 ♀ - Clay Co.: SR 21 & Deer Spring Rd., 2.4 mi. NE of SR 100, 29°48'46"N 82°00'18"W 27.iv.2003 D. Matthews, T.A. Lott, A.K. Lott (includes 1 ♂, p. 3.v, em. 10.v [DMC], 1 ♀ p. 13.v, em. 19.v [DMC], 1 ♂, p. 17.v, em. 23.v [USNM], 1 ♀, p. 19.v, em. 26.v [DMC], 1 ♀, p. 23.v, em. 29.v [DMC], 1 ♀, p. 25.v, em. 31.v [USNM]); 6 ♂, 3 ♀ - Marion Co.: East Silver Springs Shores (includes 1 ♂, 10.viii.1991, p. 13.viii, em. 18.viii D. Matthews & T.A. Lott [DMC], 1 ♂, 24.vi.1992 D. Matthews & J. Gillmore, p. 27.vi, em. 3.vii [DMC], 1 ♀, same data, em. 26.vi, genitalia slide BM 379 [Candian National Collection, Ottawa, CNC], 1 ♀, 1.viii.1993 D. Matthews & T.A. Lott, em. 7.viii [DMC], 1 ♂, em. 12.viii [DMC], 1 ♂, em. 13.viii [DMC], 1 ♂, p. 5.viii, em. 11.viii [DMC], 1 ♀, pp. 1.viii, p. < 3.viii, em. 7.viii [DMC], 1 ♂, pp. 9.viii, em. 16.viii [DMC]); 1 ♂ - Marion Co.: Ocala National Forest 5.7 mi. N of CR 314A on CR 314 11.v.1991 D. Matthews & T.A. Lott (genitalia slide BL 378) [CNC]; 1 ♂, 1 ♀ - Putnam Co.: near Hollister 22.viii.1984 D.H. Habeck & E. Milstrey, DHH rearing A-3554a (1 ♂, em. 27.viii genitalia slide DM 126, 1 ♀, em. 24.viii genitalia slide DM 254) [Dale H. Habeck collection, DHH].

**Immature Stages.** Final instar larva reaching 10 mm in length, 1.9 mm maximum width. Head light yellow, body light green to yellowish green with

primary and secondary setae arranged on lighter colored verruca-like tubercles. Numerous scattered secondary setae present. Setae simple or with minutely tined tips. Short to moderate length secondary setae on tubercles simple or with minutely bifid tips. Minute setae on tubercles and scattered setae spatulate to cone-tipped. Primary setae reaching 1.25 mm in length.

Pupa reaching 9 mm in length, maximum width 1.9 mm. Light greenish yellow, covered with cream colored short to minute spinule-like setae as in *E. montischristi* but with primary D and SD setae shorter, not exceeding 0.5× body width. Dorsal ridge on T2-T3 and A1-A3 bearing D setae and thick fringe of short to minute setae. Ridge slightly paler than basal body color but not forming conspicuous pale dorsal stripe as in *E. montischristi*. Also distinguished from *E. montischristi* by having setae L1 and L2 slightly longer, irregularly bent or curved at tips (*E. montischristi* with L1 and L2 consistently bent anterior and posterior ad middle). Larvae and pupae are described in more detail and illustrated by Matthews *et al.* (1994) and Matthews (2006).

**Larval Hostplants.** In Florida, larvae feed on *Rhynchosia cinerea* Nash. Leaf shoots, buds, flowers, and immature seedpods are preferred but mature leaves are occasionally skeletonized when tender growth is not available. In Arkansas, the host is most likely *R. latifolia* Nutt. ex. Torr. & Gray, the only *Rhynchosia* species present in the area where an adult (USNM) was collected (Johnnie Gentry, University of Arkansas Herbarium, Fayetteville, pers. comm. to DM).

**Phenology.** Dyar's (1898) description indicates the type from Miami was apparently reared from a larva collected in December. Two adult USNM specimens from Hillsborough County (Stemper) were collected in 1-7 June and July. More recently reared adults from Clay, Marion, and Putnam counties have emergence dates ranging from 10 May to 27 August with emergence dates between in each month. The most northerly specimens from Washington County, Arkansas (USNM) were collected 10 July 1966. Larvae in northern Florida have been collected from mid-April to mid-November.

**Distribution.** USA: ARKANSAS: Washington Co.; FLORIDA: Clay, Dade, Hillsborough, Marion, Putnam, and Santa Rosa Counties.

KEYS TO FLORIDA *EXELASTIS* SPECIES

Key to adults based on wing maculation.

1. Anal margin of hindwing third lobe with scattered dark spatulate basal scales in fringes .....2
- Anal margin of hindwing third lobe without scattered dark spatulate basal scales ..... 3
2. Forewing with distinct dark median discal spot; ground color grayish brown.....*E. montischristi*
- Forewing without distinct discal spot; ground color light buff. ....*E. dowi*
3. Forewing costal margin with two dark spots between apex and cleft base; fringes of hindwing posterior lobe anal margin bicolorous with light basal scaling; forewing ground color gray with yellowish tinge.....*E. rhynchosiae*
- Forewing costal margin without dark spots between apex and cleft base; fringes of hindwing posterior lobe anal margin unicolorous; forewing ground color brown to gray, without yellowish tinge.....*E. pumilio*

Key to males based on genitalia.

1. Valvae asymmetrical; uncus strongly bilobed, with lobes asymmetrical .....*E. dowi*
- Valvae symmetrical; uncus weakly bilobed, with lobes symmetrical .....2
2. Ventral margin of valvae with median rounded bulge and apically bilobed with row of long stiff setae on external margin of ventral lobe.....*E. pumilio*

- Valvae ventrally with free prominent narrow projection, without stiff setae .....3
- 3. Ventral projection of each valva poorly sclerotized, mostly straight, as long as dorsal part of valva .....*E. rhynchosiae*
- Ventral projection of each valva strongly sclerotized apically, recurved inwardly, about half length of dorsal part of valva.....*E. montischristi*

#### Key to females based on genitalia.

- 1. Bursa without signa.....2
- Bursa with pair of large signa.....3
- 2. Bursa large and circular, well segregated from narrow ductus..... *E. pumilio*
- Bursa small, not well segregated from enlarged anterior part of ductus.....*E. rhynchosiae*
- 3. Sternite VII with large median plate; ostium on right side.....*E. dowi*
- Sternite VII simple (without median plate); ostium median..... *E. montischristi*

#### DISCUSSION

We feel relatively confident that most, if not all, legume-feeding Pterophoridae belong to a monophyletic group. This unique host-plant association in the Pterophoridae, along with the shape of the setae on the abdomen of the caterpillars (see Matthews *et al.* 1994 for a more thorough discussion), unite the species of *Exelastis* Meyrick, *Marasmarcha* Meyrick, *Tomotilus* Yano, *Fuscoptilia* Arenberger and *Platyptilia cretalis* (Meyrick), a Japanese species misplaced in *Platyptilia*. Gielis (1993) recognizes the sister-group relationship between *Exelastis* and *Marasmarcha* based on the presence of one "scale-tooth" on the dorsal margin of the third hindwing lobe. This condition is more aptly described as the presence of scattered large-tip scales along that wing margin; but it is absent in *pumilio* and *rhynchosiae* and represents a reversal in Gielis' cladogram. The sister-group to the *Exelastis-Marasmarcha* pair is stated by Gielis to be *Arcoptilia* Arenberger, a monobasic taxon occurring in Saudi Arabia and Ethiopia, which seemingly has a real scale-tooth distally on the third hindwing lobe, but for which the natural history and immature stages are unknown (Arenberger 1985). The apomorphy used to support this hypothesis is the asymmetrical male genitalia. This situation is convergent in the family (as it is present for example in *Adaina* and *Oidaematophorus*) and is not shown in *E. pumilio* and *E. rhynchosiae* for example.

*Tomotilus*, a monobasic taxon from Japan, is placed in Gielis' cladogram as the sister-group to 31 other taxa of Pterophoridae *sensu* Gielis, thus showing no particular relationship to the *Exelastis* group. *Fuscoptilia* Arenberger was not treated by Gielis in his cladistic analysis.

Thus, to resolve the phylogenetic relationships among the legume-feeding Pterophoridae will require another, more complete analysis; but this is beyond the scope of this paper.

*Marasmarcha* seems to represent a well defined taxon based on the presence of long "thread-like processes" in the middle ventrally

on the valvae, an apomorphy mentioned by Gielis.

According to Gielis, the monophyly of *Exelastis* is based on the apomorphy: paired signa shaped as "horns". Whatever that means is erroneous based on the species placed in the genus by Gielis, because, for example, *pumilio* and *rhynchosiae* lack signa. There is at present no known apomorphy uniting all species of *Exelastis sensu* Gielis (1993). Following is a discussion supporting the placement of *dowi* and *rhynchosiae* in *Exelastis* pending better knowledge and a more inclusive analysis.

Adult characters supporting the placement of *dowi* and *rhynchosiae* in *Exelastis* can be found in the male genitalia although these look quite different from those of *E. atomosa* (Walsingham), the type-species of the genus. This may be explained if one accepts the hypothesis that *rhynchosiae* is the most primitive species in relation to *pumilio*, *montischristi*, *dowi*, and *atomosa*, the latter species being, presumably, the most derived of the group. Tergite VIII in all five species is similar. The tegumen is glabrous and almost fused with the uncus in all species except *dowi* and *rhynchosiae*, for which it is scaled and better separated from the uncus (presumably the primitive condition). Except for *dowi*, which has a strongly bilobed uncus, this structure is similar for all other four species, i.e., it is more or less sac-shaped, setose and apically bilobed; it is however poorly sclerotized, less setose and less bilobed in *rhynchosiae* (presumably the primitive condition). As shown by the revolver shape of the phallus, and by similarities in all characters of the male genitalia, *E. montischristi* and *E. atomosa* are close relatives; the phallus in *dowi* and *rhynchosiae* is more or less sigmoid and that of *pumilio* is straight. The complex method of attachment of the phallus in this group was not studied carefully, but it varies from the elongate narrow juxta of *rhynchosiae*, to the complex ankylosed situation in *dowi*, to an apparent lack of supporting sclerotized structures in the other three species. The valva in all four species is quite narrow and complex at the base and is enlarged apically; that of *pumilio*, *atomosa*, and *montischristi* bear stiff setae on the ventral margin of the more strongly enlarged cucullus, and that of *montischristi* and *atomosa* additionally bear a heavily sclerotized pointed process on the sacculus. The sacculus of *rhynchosiae*'s valva is also strongly produced but it is not heavily sclerotized and shows a gland opening into a pore apically. We believe that this projection is not homologous to the process of *atomosa* and *montischristi*. The valva of *dowi* is the most complex and asymmetrical in those five species and also displays a gland opening apically. The vinculum in all five species is narrow and is connected to a structure which seems to represent a modification of sternite VIII and possibly also its intersegmental membrane with sternite IX. This modified sternite VIII is sac-shaped, bilobed, setose and directed apically in all species but *rhynchosiae* for which it is represented by a more simple modification of the sternite medially (presumably the primitive condition). It is more strongly developed in *atomosa*.

In summary, similarities in the structure of the tegumen, uncus, valva, vinculum and associated modified sternite VIII suggest that *rhynchosiae* can be placed within *Exelastis* as the most primitive species of the genus; that *montischristi* and *atomosa* are the closest relatives in that group; and that *rhynchosiae* and *dowi* may be more closely related to each other than to the other species of the group by the shape of the phallus and the presence of a gland in the valva.

In the female genitalia, the situation is also quite confusing due

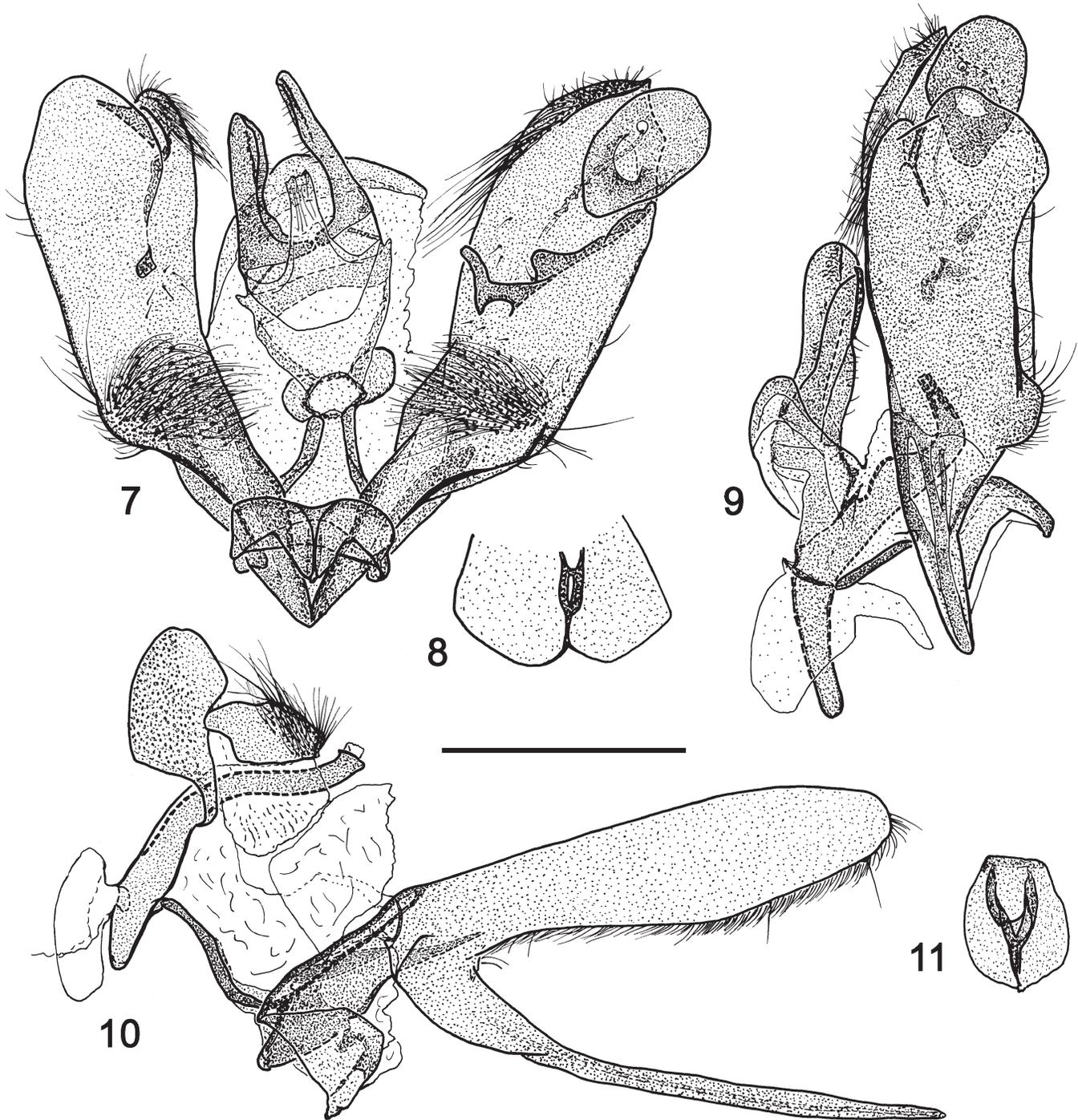


Fig. 7-11. Male genitalia: 7) *Exelastis dowi*, holotype, spread ventral view without phallus; 8) same specimen, sternite VIII; 9) same specimen, lateral view with phallus (genitalia now mounted on slide BL 736); 10) *Exelastis rhynchosiae*, lateral view with phallus; 11) same specimen, sternite VIII (genitalia now mounted on slide BL 378). Scale line = 0.5 mm.

to variation in the various structures among the species concerned. The anal papillae and posterior apophyses in all four of the Florida species are similar but unspecialized, except for the curved anterior tips of the apophyses in *dowi*. Tergum VIII is large in all four species except for *montischristi*, in which it is reduced. The ostium opens basally, subbasally or subapically in relation to sternum VIII. It is median and ventral except for *dowi* on which it opens dorsally. A sclerotized sterigma can be present or absent and, if present, it varies in shape and position. The ductus bursae is usually long, narrow, thinly membranous and unsclerotized;

it is, however, believed to be enlarged for the second half of its length in *rhynchosiae*. The corpus bursae is more or less circular in all five species. It has two eye-shaped, well-sclerotized signa in *montischristi* and *atomosa*, two elongate crests in *dowi*, but only scobinations in the other two species. In addition to these features, *rhynchosiae* has its sternum VII strongly modified into two large oval plates on each side with each a small "pocket" antero-medially; *atomosa* has a short knob basally on each side of "sternum VIII" (homology unknown); and *dowi* shows a large ventral process extending beyond segment VIII. In summary, it

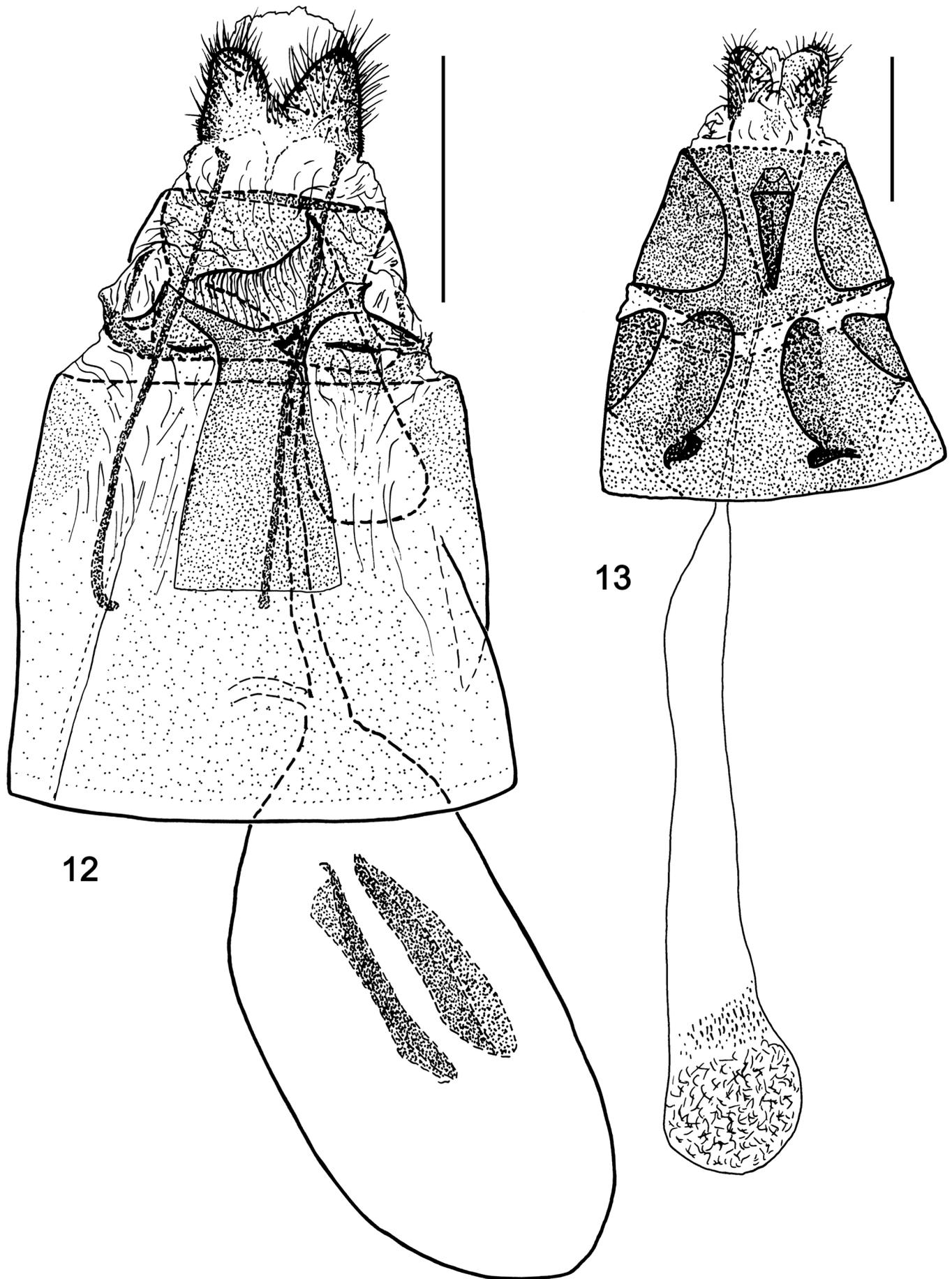


Fig. 12-13. Female genitalia, ventral views: 12) *Exelastis dowi*, composite drawing from slides DM 170 and 172; 13) *E. rhynchosiae*, slide BL 379. Scale line = 0.5 mm.

seems impossible to find a feature of phylogenetic significance that connects all five species with regards to the morphology of the female genitalia. Again, as with male genitalia features, it can be demonstrated that *atomosa* and *montischristi* are more closely related on the basis of similar signs of the corpus bursae.

Wing venation (*atomosa* not studied): in the forewing,  $R_1$  is present only in *rhynchosiae* and *dowi* which may have larger forewing lobes, otherwise with  $Sc$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $M_3$ ,  $Cu_1$ ,  $Cu_2$ ,  $1A$ , and  $2A$  in all four species not significantly variable; in the hindwing, with  $Sc + R1$ ,  $Rs$ ,  $M_3$ ,  $Cu_1$ ,  $Cu_2$ , and  $1A$  in all five species not significantly variable. The third hindwing lobe fringe is without scales in *pumilio* only. These are present but narrow in *rhynchosiae*, and spatulate in *atomosa*, *montischristi*, and *dowi*. These wing features again show the relative primitiveness of *rhynchosiae*, but also that *dowi* shares an apomorphic character-state with *atomosa* and *montischristi* and that *pumilio* has retained the primitive condition of a character.

In conclusion, using a combination of characters of wing features, male and female genitalia, ecology, setation and morphology of the immatures, it seems reasonable to unite *pumilio*, *dowi*, and *rhynchosiae* under *Exelastis*, until more knowledge is gained. We believe that the careful study of genitalia features and the discovery of the hostplant and immatures of described and yet undiscovered taxa are essential in the understanding of the evolution of this group (and all) of Pterophoridae.

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