

**NEOTROPICAL TINEIDAE IX: A REVIEW OF THE WEST INDIAN
XYSTROLOGA AND BIOLOGY OF *XYSTROLOGA GRENADELLA*
(WLSM.), AN INVASIVE PEST OF CULTIVATED GREENHOUSE
PLANTS IN SOUTHERN FLORIDA, USA AND GERMANY
(LEPIDOPTERA: TINEOIDEA)**

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Abstract.—Only two species, *Xystrologa grenadella* (Walsingham) and *X. nigrovitta* (Walsingham), of the predominantly Neotropical genus *Xystrologa* are known to occur in the West Indies. *Xystrologa antipathetica* (Forbes), originally described from Puerto Rico but also reported from the United States (Florida), is considered a junior synonym of *X. grenadella*. The adults of both species and the larva and pupa of *X. grenadella* are described and illustrated. The larval habits of the genus are reported for the first time as a general detritivore, feeding on woody refuse, the bark of *Ficus* trees (in Florida, USA), fungi, and the roots of orchids, and pineapple (in Puerto Rico). The injury that larvae of *X. grenadella* can inflict upon cultivated orchids in Florida is summarized. The introduction of *X. grenadella* is reported for the first time in the Old World, as a pest of greenhouse plants in Germany.

Key Words: Distribution, genital morphology, invasive species, larval morphology, orchid pest, parasitoids, root-feeding

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Since their initial descriptions, members of the predominantly Neotropical genus *Xystrologa* have received little attention in the literature. The genus was proposed as a monobasic genus by Edward Meyrick (1919) for *X. invidiosa* from La Crumbre, Colombia. Davis (1984) added six previously named species to *Xystrologa* with the synonymy of *Achanodes* Meyrick (1922) and *Syrrhoauala* Meyrick (1932). Six species are currently recognized in *Xystrologa* following the synonymy of *Xystrologa antipathetica* (Forbes 1931) as proposed in this study. Several undescribed

New World species are known to the senior author, including at least four species from the United States.

No information on the biology of any member of this genus has been published previously other than the brief label data, “reared 13 Dec. 1965 from branches of *Sabel causiarun* [= *Inodes causiarum* O. F. Cook (Areaceae)]” reported for *X. antipathetica* (= *grenadella*) in the Lepidoptera of Bermuda (Ferguson 1991). No indication is provided in the foregoing record as to what association existed between the moth and the “host”.

In southern Florida *X. grenadella* is known to feed on bark mulch used as a potting media in nurseries, as well as on the roots of orchids (*Phalaenopsis* sp.) within containers at these nurseries. Adults have also been reared from larvae feeding in damaged areas on the trunks of bonsai *Ficus* trees in Florida, on the roots of pineapple in Puerto Rico, and pupae have been discovered under bark of an unknown tree in Dominica. Adults of *X. nigrovitta* have been reared from an unidentified bracket fungus in Dominica.

On August 23, 2011 specimens later identified by DRD to be *X. grenadella* were collected by Jörg Schaller in a large greenhouse, or “Biosphäre”, in Potsdam (near Berlin), Germany. Dr. Schaller sent adults to Dr. Reinhard Gaedike who then forwarded specimens of both sexes to DRD. Schaller reported the larvae were found in dead wet wood of *Robinia*, on which are arranged *Tillandsia* and other Bromeliaceae, and on palm (*Washingtonia* sp.). The Potsdam Biosphäre houses numerous tropical plants from various regions.

MATERIALS AND METHODS

Genitalic dissections were cleared by heating in hot 10% KOH for ~ 30 minutes, and subsequently cleaned and stained with either 2% chlorazol black E or mercurochrome solutions. All genitalic illustrations were drawn from dissections temporarily stored in glycerine, which were later permanently embedded in Canada balsam. Genitalic terminology follows Klots (1970).

Specimens examined in this study are deposited in the following institutions:

BMNH – The Natural History Museum, London, UK.

CU – Cornell University, Ithaca, NY, USA.

FSCA – Florida State Collection of Arthropods, FDACS/DPI, Gainesville, FL, USA.

MGCL – McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, FL, USA.

USNM – National Museum of Natural History (formerly United States National Museum), Smithsonian Institution, Washington, DC, USA.

NMW – Naturhistorisches Museum Wien, Austria.

SDEI – Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany.

RESULTS AND DISCUSSION

Xystrologa Meyrick

Xystrologa Meyrick 1919: 271 (type species: *Xystrologa invidiosa* Meyrick, *ibid.*, original designation).—Clarke, 1970: 111.—Davis, 1984: 24.—Nye and Fletcher, 1991: 323.

Achanodes Meyrick, 1922: 592 (type species: *Achanodes sympathetica* Meyrick, *ibid.*, by monotypy).—Clarke, 1970: 3.—Davis, 1984: 24 (new synonym of *Xystrologa*).—Nye and Fletcher, 1991: 3.

Syrrhoaula Meyrick, 1932:207 (type species: *Syrrhoaula lactirivis* Meyrick, *ibid.*, by monotypy).—Clarke, 1970: 88.—Davis, 1984: 24 (new synonym of *Xystrologa*).—Nye and Fletcher, 1991: 295.

Diagnosis.—Antenna with a single row of slender, appressed scales encircling each flagellomere. Galea present, ~ 2/3 length of labial palpus. Maxillary palpus 5-segmented. Forewing slender, W/L ratio ~ 0.24–0.26, apex subacute. Forewing (Fig. 18) with all radial veins present; accessory cell absent; Rs₃ and Rs₄ stalked with M₁. Hindwing W/L ratio ~ 0.20–0.32; base of Rs usually absent or poorly developed; discal cell poorly defined in both sexes; M with either 2 or 3 branches. Male genitalia with uncus consisting of a pair of widely separated, short to elongate, slender, setose lobes; valva usually broad for most of length, either tapering gradually or abruptly to complex apex; costa of

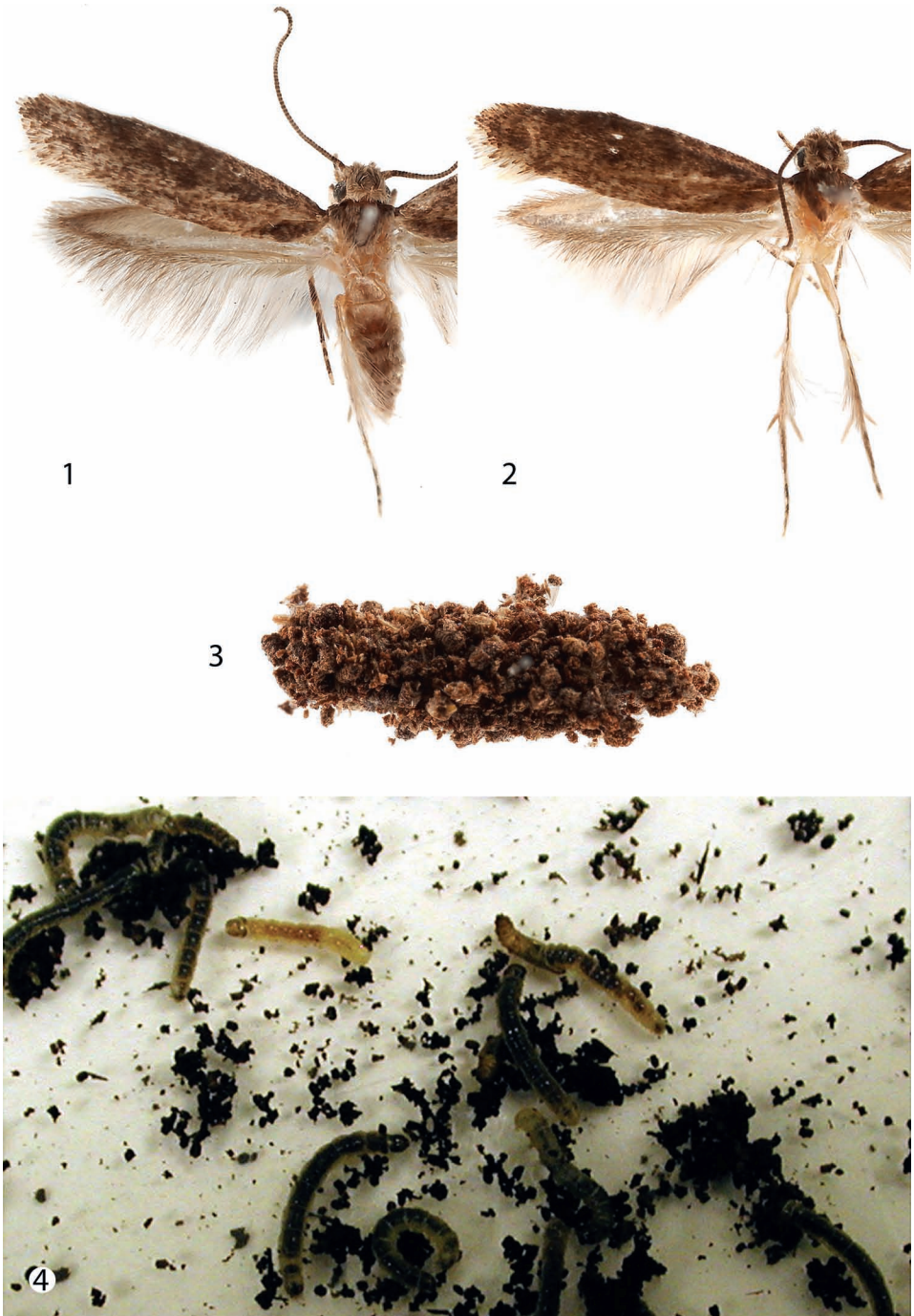
valva usually extended mesally to connect via membrane to opposite member to form a partial arch (transtilla) between bases of valvae. Female genitalia with ductus bursae 0.4 to 1.2x length of anterior apophysis, with partially to almost entirely sclerotized, cylindrical walls; corpus bursae relatively large, often circular in form, membranous, with a pair of often prominent, highly variably spined signa.

Description.—Adult: Small moths with forewing length \sim 4–9 mm.

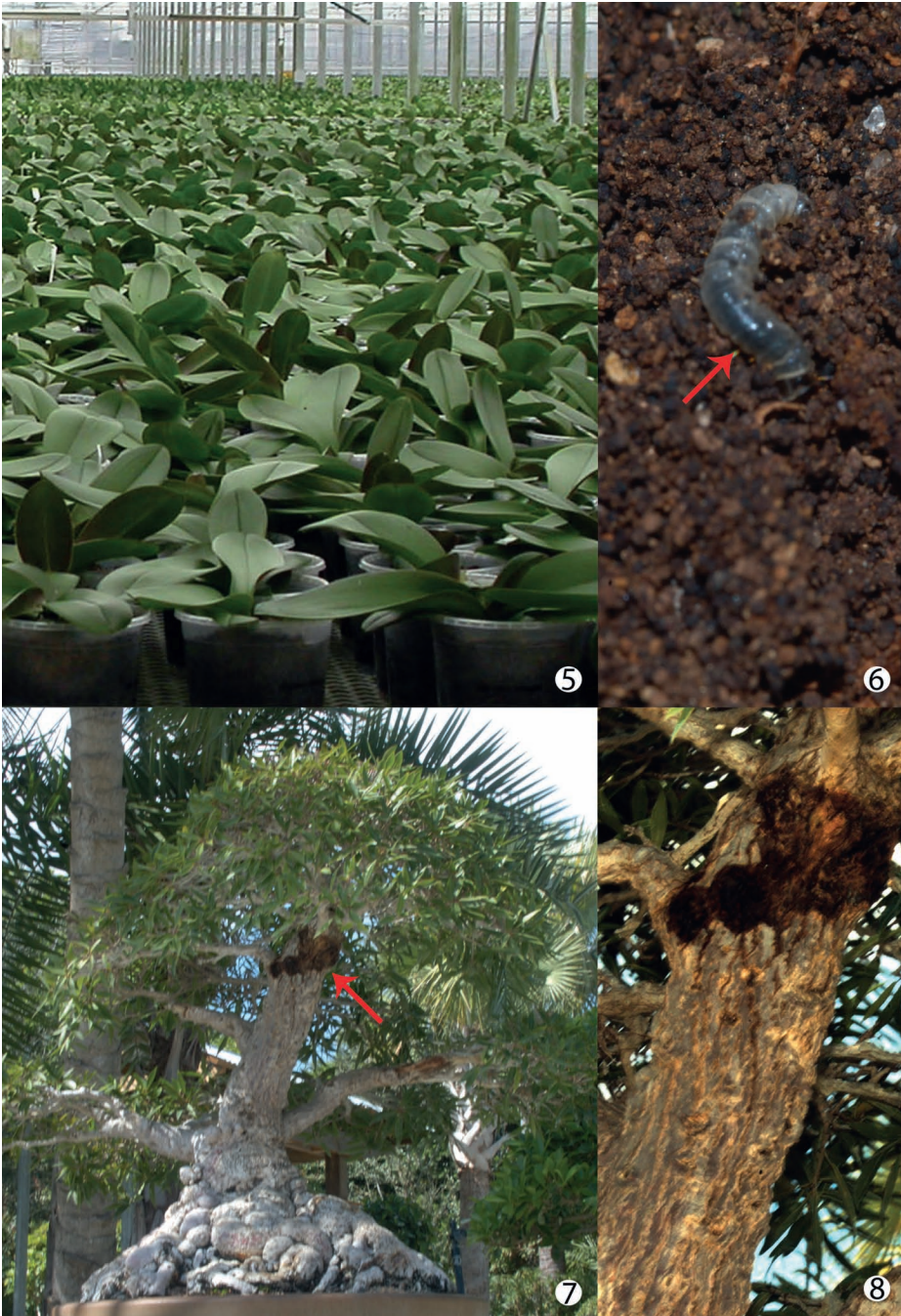
Head: Vestiture rough; vertex and frons densely covered with erect, piliform scales with acute apices. Antenna simple, \sim 0.6–0.65x length of forewing; scape slightly flattened, pectin present, with up to 6–7 erect bristles; flagellum with a single row of slender, appressed scales encircling each segment. Eye moderately reduced; vertical diameter \sim 1.2x length of scape; frons broad, interocular index \sim 0.75. Pilifer moderately developed, with a prominent tuft of elongate bristles. Mandible rudimentary, a slender elongate lobe \sim equal in length to basal segment of labial palpus. Galea present, \sim 2/3 length of labial palpus. Maxillary palpus 5-segmented, elongate, exceeding length of labial palpus; length ratio of segments from base: \sim 1.0:1.0:1.8:5.4: 3.0. Labial palpus well developed, 3-segmented; length ratio of segments from base: \sim 1.0:2.3:1.2; vestiture smooth laterally, except with segment 2 rough ventrally with numerous (\sim 8–10), elongate bristles arising laterally and apically. **Thorax:** Forewing slender, W/L ratio \sim 0.24–0.26, apex subacute. Venation (Figs. 18–19) moderately well preserved with most veins distinct. Forewing with all radial veins present; accessory cell absent; Rs₃ and Rs₄ stalked with M₁; M₂ and M₃ either separate or fused; base of M usually absent within cell; CuA₁₋₂ well preserved, separate; CuP partially preserved; A₁ and A₂ completely fused, without basal fork; male retinaculum strongly

curved; female retinaculum consisting of a scattered row of relatively short curved hairs from ventral base of Sc. Hindwing W/L ratio \sim 0.20–0.32; base of Rs usually absent or poorly developed; discal cell poorly defined in both sexes; M with either 2 or 3 branches; M₂ either separate or fused to M₃; CuA₁ and CuA₂ well developed; 1A + 2A usually well preserved; 3A faint; an elongate, dorsal, androconial fold (Fig. 18) often present in either discal or cubital area; fold containing a dense concentration of small, oval androconial scales; associated with but external to androconial fold is an elongate hair pencil which arises from a small circular area at extreme base of anal area and extends \sim 2/3 the length of hindwing along dorsal margin (Fig. 18); frenula a single stout bristle in male, 2 bristles in female. Legs with tibial spur pattern of 0-2-4; epiphysis well developed, \sim 3/5x length of foretibia. **Abdomen:** Without specialized structures; S2 apodemes slender, nearly straight, elongate, \sim 0.5x length of S2. Male coremata and female corethrogyne absent.

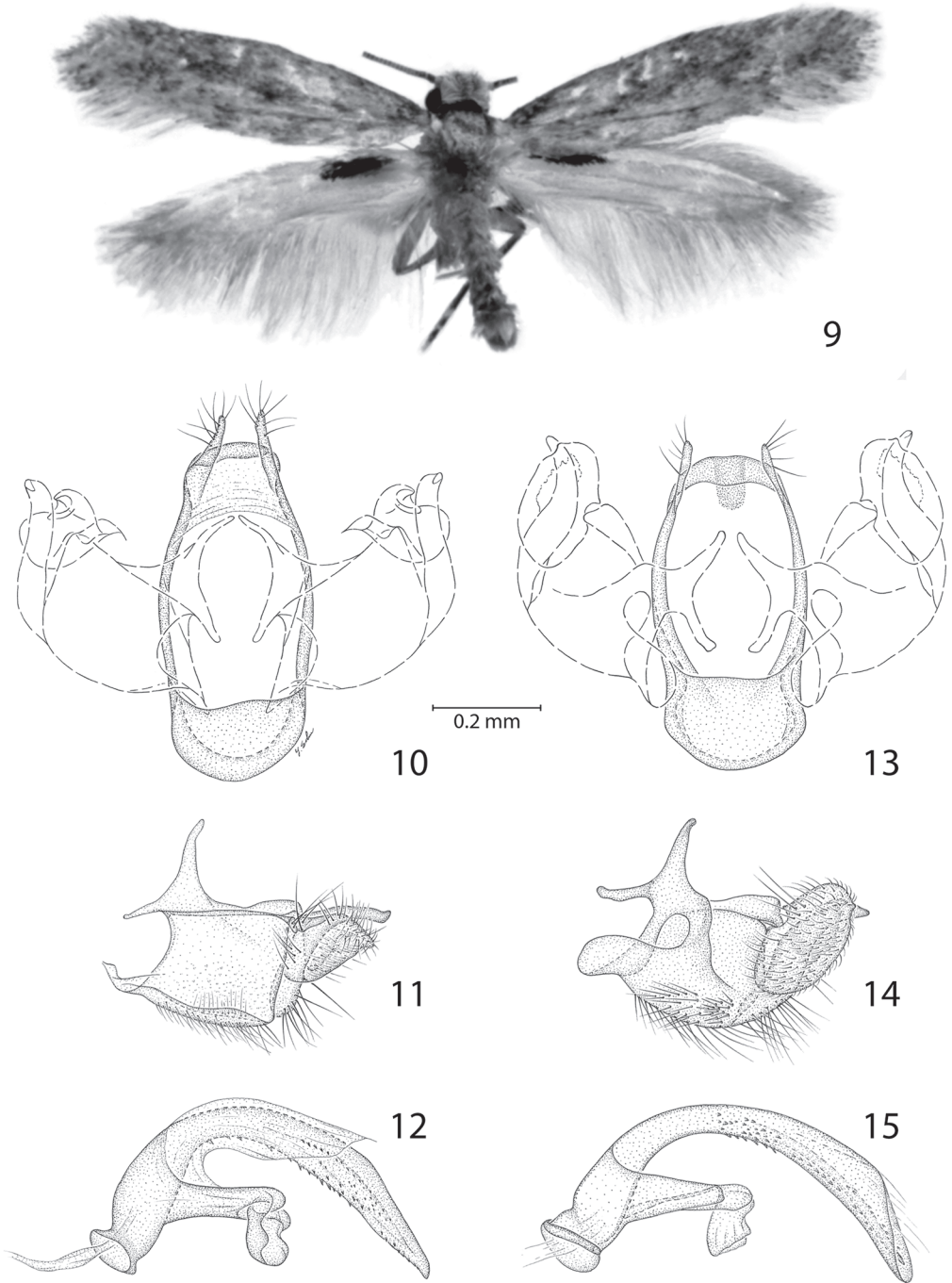
Male genitalia: Uncus a pair of widely separated, short to elongate, slender, setose lobes. Tegumen a narrow dorsal ring. Vinculum well developed as a broad, U-shaped sclerite. Gnathos absent. Valva usually broad for most of length, either tapering gradually or abruptly to complex apex; costa of valva usually extended mesally to connect via membrane to opposite member to form a partial arch (transtilla) between bases of valvae; cucullus often highly modified as a broadly rounded apical lobe; sacculus usually produced as a stout to slender process which frequently curves toward costal margin of apex where it may be partially enclosed by cucullar lobe (Fig. 11). Juxta a short to elongate, stout, strongly curved, armlike connection firmly attached to aedeagus. Aedeagus a relatively straight



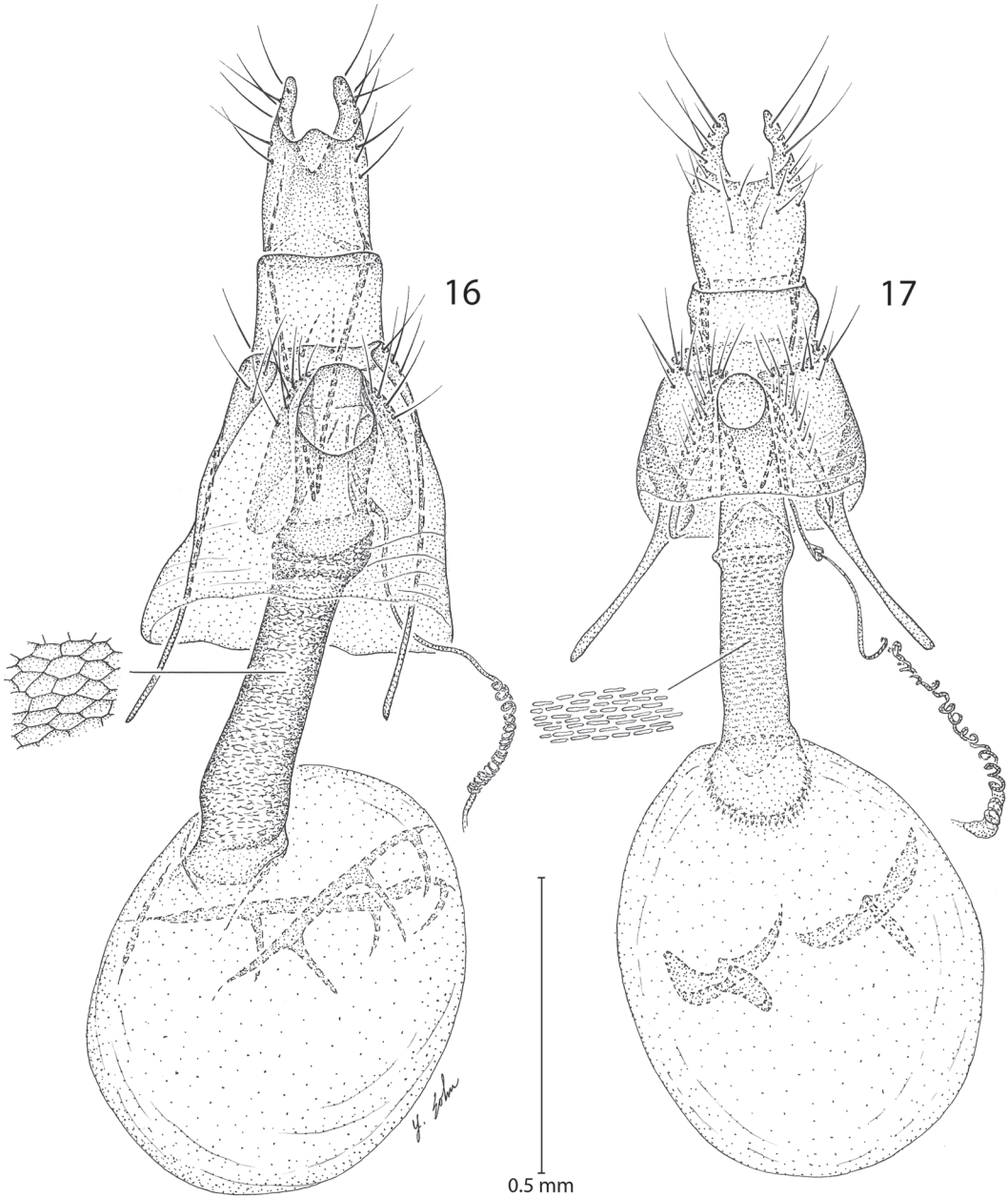
Figs. 1–4. *Xystrologa* adults and immature stages. 1. *X. grenadella*, forewing 4.3 mm (Jean, Dominica); 2. *X. nigrovitta*, forewing 4.6 mm (Clarke Hall, Dominica); 3. *X. grenadella*, larval case, length 9 mm; 4. *X. grenadella*, larvae from bottom of orchid container (see Fig. 5).



Figs. 5–8. Larval habitats of *Xystrologa grenadella* in southern Florida, USA. 5. Orchid greenhouse, Homestead, FL; 6. Larva (arrow) in wood fragments and larval frass from damaged trunk area in Fig. 8; 7. Bonsai willow leaf *Ficus* showing damaged area on trunk (arrow) from feeding of larva; 8. Detail of damaged trunk in Fig. 7. (Figs. 6–8 from D. Hall).



Figs. 9–15. Adult and male genitalia of *Xystrologa*. 9. *X. nigrovitta*, holotype male, showing black scaling exposed at base of hindwing costa, forewing length 4.5 mm; 10. *X. grenadella*, male genitalia, ventral view; 11. *X. grenadella*, valva, meso-lateral view; 12. *X. grenadella*, aedeagus, lateral view; 13. *X. nigrovitta*, male genitalia, ventral view; 14. *X. nigrovitta*, valva, meso-lateral view; 15. *X. nigrovitta*, aedeagus, lateral view.

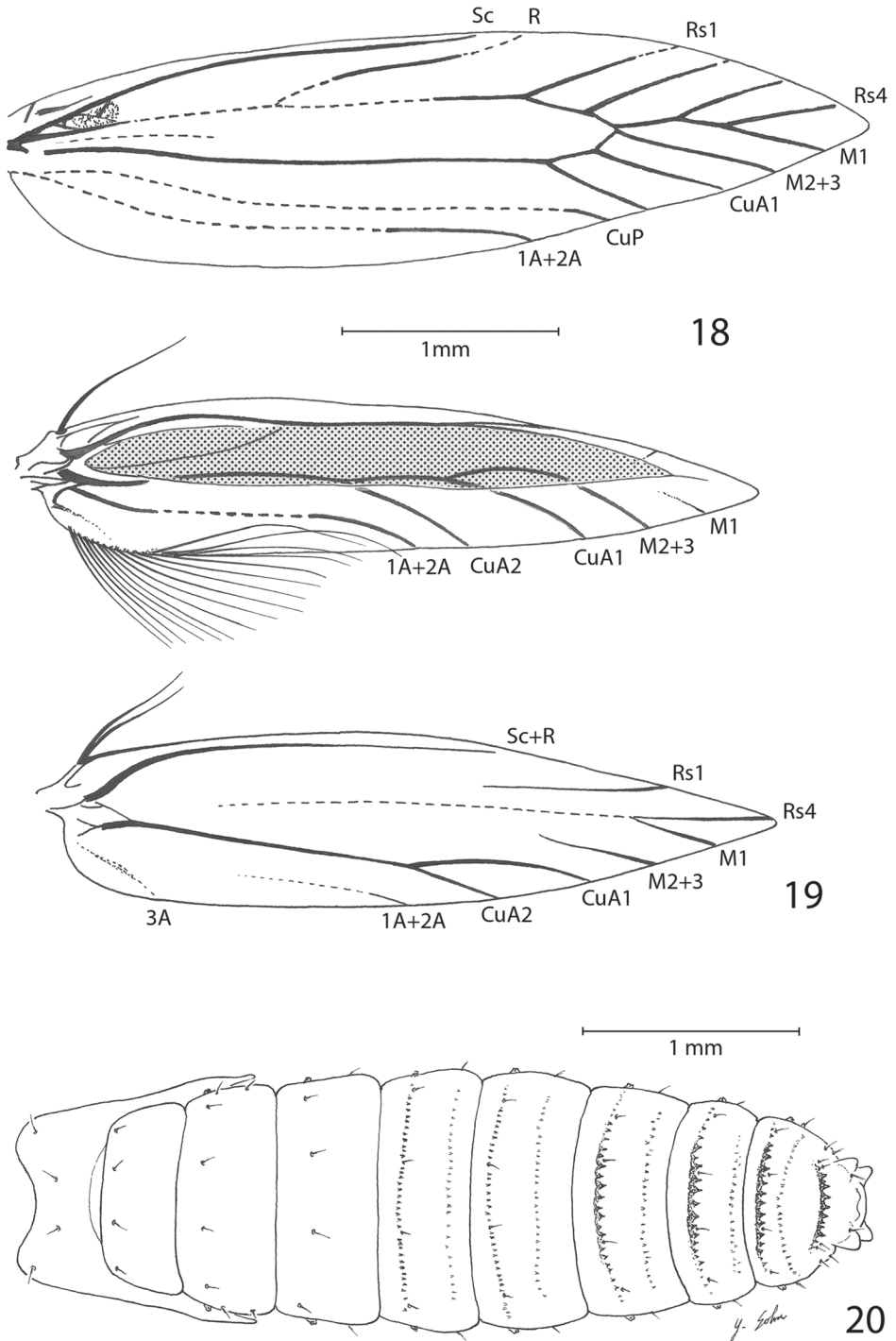


Figs. 16–17. Female genitalia of *Xystrologa*, ventral views. 16. *X. grenadella*; 17. *X. nigrovitta*.

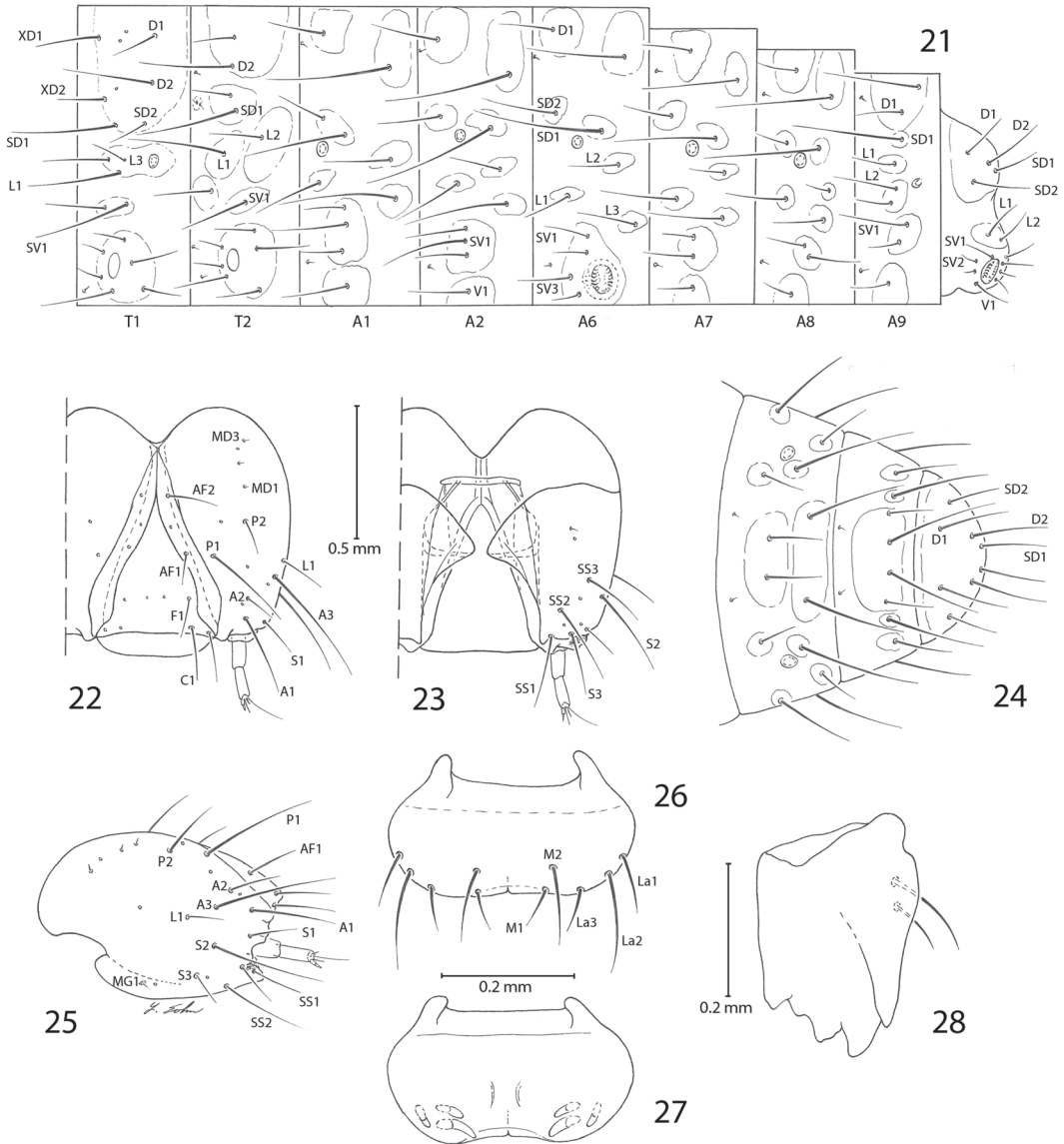
blade-like median projection extending into the corpus bursae (Fig. 17). The foregoing genitalic characters also distinguish *grenadella* from the four undescribed North American species mentioned previously in the introduction.

Description.—Adult (Fig. 1): Length of forewing 4.0–5.5 mm.

Head: Vestiture usually very light brown to dark brownish fuscous. Antenna dark brown dorsally, light brown ventrally; scape mostly light brown, pedicel dark brown.



Figs. 18–20. *Xystrologa grenadella*, wing venation and pupa. 18. Male fore- and hindwing venation, shaded area represents hindwing androconial pocket; 19. Female hindwing; 20. Pupa, dorsal view of abdomen.



Figs. 21–28. *Xystrologa grenadella*, larval chaetotaxy. 21. Lateral schematic of prothorax, mesothorax, and abdominal segments 1, 2, 5–7, 9–10; 22. Head, dorsal view; 23. Head, ventral view; 24. Dorsal view of abdominal segments 8–10; 25. Head, lateral view; 26. Labrum, dorsal view; 27. Labrum, ventral view; 28. Mandible. (Scale lengths indicated).

Maxillary palpus whitish cream. Labial palpus whitish cream over segments 1–2 and mesal surface of 3, dark brown dorsolaterally on 3; 8–12 erect dark bristles arising laterally and apically from segment 2. *Thorax*: Dark brown dorsally, irrorated with light brown, with caudal

margins of tegula and mesonotum light brown, thorax mostly dark brown irrorated with light brownish scales; thorax whitish cream ventrally. Forewing light brown, variably irrorated with dark brown scales until sometimes appearing generally dark brown; partially denuded specimens

may appear predominantly light brown; fringe light brown, variably irrorated with dark brown. Hindwing uniformly light brown to light grayish brown; fringe slightly darker brown; male with an elongate fold extending along discal area almost entire length of hindwing, containing a dense concentration of minute, oval, androconial scales; male with an elongate, light brown hair pencil arising from extreme base of anal area and extending along dorsal margin $\sim 2/3$ the length of hindwing. Fore and midleg light brown ventrally, dark brown dorsally with apices of tibiae and tarsomeres ringed with light brown; hindleg almost uniformly pale brown to cream, with reduced brownish banding dorsally on tarsomeres. *Abdomen*: Dark brown dorsally, whitish cream ventrally.

Male genitalia (Figs. 10–12): Lobes of uncus slender, elongate, length \sim equal to midventral length of vinculum. Vinculum moderately short, broadly U-shaped, length of basal portion $\sim 1/3$ the length of genital capsule. Valva with base of costa divided into a smaller mesal digitate lobe and a more caudal, larger digitate lobe that joins opposite member to form a partial arch; apex of valva complex, with a large, ventrally folded, cucullar lobe, with mesal fold triangular and larger than lateral fold; inner margin across base of valva thin, weakly sclerotized; sacculus with an elongate, curved, blunt-tipped apical process extending between dual lobes of cucullus (Fig. 11). Vinculum U-shaped. Aedeagus long, \sim equal to length of genital capsule, strongly curved dorso-ventrally; ventral surface densely covered with minute spines.

Female genitalia (Fig. 16): Posterior apophysis $\sim 1.1x$ length of anterior pair. Ostium bursae elliptical in outline, with a sclerotized, semicircular anterior rim narrowing caudally. Antrum sclerotized, short, \sim equal in length to diameter of

ostium, with a narrow membranous break before junction with heavily sclerotized wall of ductus bursae. Ductus bursae an elongate cylinder, \sim equaling anterior apophysis in length; walls of ductus thickened, completely lined with plate-like spicules forming a minutely reticulate pattern (Fig. 16). Corpus bursae spherical; walls membranous, either smooth or mostly finely wrinkled, with a pair of symmetrical, spinose signa, each consisting of a faint, elongate, mostly transverse bar with 3 widely separated slender spines arising from anterior side of bar; length of spines nearly equal to diameter of ductus bursae. Spermatophore spherical, nearly same diameter of corpus bursae.

Larva (Figs. 4, 6, 21–28): Length of largest larva 15.5mm; maximum diameter 1.2 mm. Body generally pale cream; pinacula indistinct (in alcohol). *Head*: Maximum width 1.2 mm. Color light reddish brown, with a minute, elongate, dark brown spot immediately lateral to antenna. Chaetotaxy as illustrated (Figs. 22–23, 25–28). Labrum with 5 pairs of setae; M3 absent. Stemmata absent. Mandible with 4–5 cusps of variable size. *Thorax*: Pronotum and pinacula indistinct (in alcohol). Lateral setae trisetose and together on same pinaculum. Meso- and metathorax with L1–3 all arising from separate pinacula. Legs well developed; coxae nearly contiguous on T1, more widely separated on T2 and 3. *Abdomen*: D1 and 2 on separate pinacula on A1–8; together on same pinaculum on A9. SD 1 and 2 on same pinaculum on A1, arising from separate pinacula on A2–8; SD 2 absent on A9. L1–3 on separate pinacula on A1–8; L2–3 together on same pinacula separate from L1 on A9. Subventral setae trisetose on A1–6, bisetose on A7–9. Tergal plate of A10 with 4 pairs (D1, D2, SD1, SD2) of elongate setae. Prolegs present on A3–6, 10; crochets A3–6 uniordinal,

uniserial, and arranged in a complete ellipse of ~ 31–33 hooks; prolegs densely covered with minute, scattered spines similar to those over body; crochets on A10 consisting of a single row of ~ 14–15 hooks along anterior edge of planta.

Because the larval morphology of relatively few genera of Tineidae has been studied (Hinton 1956, Davis 1987, Robinson and Nielsen 1993), morphological comparisons of the larva of *Xystrologa* with other genera in this family are limited. Of those genera known, the larva of *Xystrologa* appears most similar to *Tinea* and *Tineola*, but differs from those genera in the loss of one labral seta (M 3) and in having the prothoracic spiracle together with the lateral setae on the same pinaculum (Fig. 21). The labrum of both *Tinea* and *Tineola* possesses a full complement of six labral setae, and the prothoracic spiracle is separate from the lateral pinaculum. The larval labrum of the North American genus *Eccritothrix* also possesses only five labral setae, but it is the inner lateral seta (La 3) that is missing in this genus. Both the spiracle and lateral pinaculum are fused with the prothoracic plate in *Eccritothrix*, an unusual condition also typical of the family Psychidae.

Larval case (Fig. 3): Length 9 mm, maximum width 2.5 mm; approximately cylindrical. Light to medium brown in color; texture coarse, densely covered with minute to small fragments of tree bark and brownish, elliptical larval frass pellets (~ 0.7–1.0 mm in length).

Pupa. (Fig. 20): Length ~ 5.0 mm; maximum width 1.1 mm (n = 1 pupal shell). Vertex of head smoothly rounded. Wing sheaths extending to anterior margin of A5. Two elongate, transverse rows of short tergal spines present on segments A4 – 9; anterior row close to anterior margin of each segment and consisting of larger, more stout spines usually increasing in size toward mid-dorsum;

general size of spines in anterior row also increasing in size to A9; posterior row located near caudal 1/3 – 1/4 of segment and consisting of much smaller spines; posterior row across A4 barely visible, segment 9+10 with only a single large, anterior row of spines. Approximate number of tergal spines per segment (anterior, posterior rows respectively): A4 = 43, 19; A5 = 49, 39; A6 = 34, 40; A7 = 28, 53; A8 = 22, 46; A9 = 8, 0. Tenth segment fused to A9, bearing two pairs of prominent, stout, cremastral spines at dorso-lateral and ventrolateral margins.

Type material.—Holotype ♂, *Setomorpha grenadella* Wlsm., GRENADA: Balthazar, 250 ft, windward side, 5-10 IV, H. H. Smith, Walsingham Collection 1910-427, BMNH slide 15278, (BMNH). Holotype ♂, *Achanodes antipathetica* Forbes, PUERTO RICO: Santurce, March 25, Hoffman, (CU).

Other material examined.—WEST INDIES: ANGUILLA BWI: Fist. Top Point: 1 ♂, 4 ♀, 13 Apr 1958, J. F. G. Clarke, DRD slide 33695 (USNM). ANTIGUA BWI: English Harbor: 1 ♀, 13 Apr 1958, J. F. G. Clarke. BERMUDA: Hamilton Parish, Walsingham Caves: 1 ♂, 20 Mar 1988, photo file (USNM); Paget, Botan. Gardens: 1 ♂, 13 Oct 1987, 2 ♂, 20 Oct 1987, 2 ♂, 1 ♀, 21 Oct 1987, photo file (USNM); Pembroke Park, Admiralty House: 2 ♂, 21 Oct 1987, USNM slide 29823 (USNM); Smith's Parish, Spittal Pond Nature Reserve: 1 ♂, 13 Oct 1988, 1 ♀, 14 Oct 1987, D. C. Ferguson, USNM slide 29824 (USNM), 2 ♂, 4 ♀, 19 Oct, 1987; South Hampton Parish: Chapltn Bay: 2 ♂, 9 ♀, D. C. Ferguson (USNM). DOMINICA BWI: Antrim 1000 ft: 1 ♂, 26 Mar 1956; Clarke Hall, 1 ♂, 24 Jun 1965, J. & T. Clarke, USNM slide 19304 (USNM); Grande Savane: 1 ♂, 30 Jan 1965; Jean, 2000 ft: 1 ♀, larval case, pupal skin (USNM slide

34350), em. 9 Mar 1965, under bark, USNM slide 33182 (USNM); Mouth of Loyou River: 1 ♀, 20 Jan 1965, USNM slide 33188; Macaucher: 2 ♂, 1 ♀, 12 Feb 1965; 5 mi W Pt. Lolo: 1 ♀, USNM slide 18068, J. F. G. Clarke, Thelma M. Clarke, Bredin-Archbold Smithsonian Bio.Surv. (USNM); 4 mi E of Pont Casse: 1 ♂, 15 Jun 1965, 1 ♀, 21 Apr 1965, USNM slides 33192, 33191 (USNM); 1.3 mi E of Pont Casse: 1 ♂, 12 May 1964, photo file, file 1 ♀, 11 Jun 1964; 1.6 mi W of Pont Casse: 1 ♀, 24 Apr 1965, 2 ♂, 9 May 1964, photo file, USNM slide 19952, 1 ♀, 16 Jun 1964, USNM slide 33187, 1 ♂, 27 Jun 1964, O. S. Flint, Jr. (USNM). GRENADA: Balthazar, 250 ft, windward side: 1 ♂ (paratype, *Setomorpha grenadella* Wlsm.), 5–10 Apr, H. H. Smith, Walsingham Collection 1910-427 (BMNH). JAMAICA: Moneague: 1 ♂, 25 Dec 1904, Wlsm. 77612, 1 ♂, 4 Jan 1905, 77668, 1 ♂, 6 Jan 1905, 77670, 1 ♂, 6 Jan 1905, 77672, 1 ♂, 6 Jan 1905, 77677, 1 ♂, 7 Jan 1905, Wlsm. 77679; 1 ♂, 9 Jan 1905, 77682, 1 ♀, Wlsm. 77683, BMNH slide 30838, 1 ♂, 11 Jan 1905, 77684, 1 ♂, 14 Jan 1905, 77686, 1 ♂, 18 Jan 1905, 77687, 1 ♂, 4 Feb 1905, 77689, 1 ♀, 4 Jan 1905, Wlsm. 77669, 1 ♀, 9 Jan 1905, 77683, BM slide 30838, (BMNH), 1 ♀, 26 Feb 1905, 77726; Constant Springs: 1 ♂, 31 Dec 1904, Wlsm.77613, (BMNH). PUERTO RICO: Coamo Springs: 1 ♀, paratype, 4 Apr, USNM slide 30367 (USNM); 1 ♂, 9 Apr 1930, Cornell Univ., Lot 795. Dorado, La Sardinera: 1 ♀, paratype, 15 Jun 1930, W. A. Hoffman (USNM). El Yunque, La Mina Recr. Area800m: 1 ♂, 16 Jan 1971, C. P. Kimball (USNM). Isabela, Hotel Palmerians, 60m: 1 ♂, 10–14 Mar 1971, C. P. Kimball (USNM). Isla Magueyes, off Parguera, 15m: 4 ♂, 1 ♀, 1–4 Feb 1971, C. P. Kimball; La Parguera, 3m: 69 ♂, 18 ♀, 5–11 Feb 1971, USNM slides 18065, 18066, 33051, 33052, C. P. Kimball (USNM). Monte del Estado, near Maricao, Centro Vocational, 650m: 1 ♂, 1–9 Mar 1971, C. P. Kimball (USNM). Mameys: 2 ♂, 27 June 1969, O. S. Flint Jr. (USNM). Pta. Jacinto, SW coast near Guanica, 3m: 21 ♂, 4 ♀, 27–28 Jan 1971, C. P. Kimball (USNM). 12.2 km S Rincon, Rte. 115, 3m: 27 ♂, 8 ♀, 22–28 Feb 1971, C. P. Kimball (FSCA, MGCL, USNM). Rio Piedras: 1 ♂, 1 May 1952, reared from Rt. pineapple roots, Mario Pérez (USNM). San German: 2 ♂, 12–22 Feb 1971, C. P. Kimball (USNM). UNITED STATES: FLORIDA: Miami-Dade Co: Homestead: 1 ♂, 2 ♀, 30 Dec 2003, Larvae in bark potting media of orchids at nursery, A Nathan, USNM slide 32878 (MGCL, USNM); Homestead: 26001 SW 217 Ave: 1 ♂, 1 ♀, 6 larvae, 6 Dec 2002, in *Phalaenopsis* pot, A. Nathan, USNM slides 33057, 33058, 33123 (USNM); Homestead: 1 ♂, 31 Mar 1959, USNM slide 19379, 1 ♀, 8 May 1958, USNM slide 33055, 1 ♂, 1 ♀, 29 Oct 1959, USNM slide 33131, 1 ♂, 4 Nov 1958, D. O. Wolfenbarger (MGCL, USNM). North Miami: 1 ♂, 8 May 1962, H. M. Heidl (USNM). Monroe Co: Bahia Honda Key: 1 ♀, 2 May 1986, W. Steiner & D. Bogar, USNM slide 33130 (USNM). Sarasota Co: Siesta Key: 1 ♂, DRD 2661, 15 Apr 1960, C. P. Kimball, USNM slide 34342; 1 ♂, 4 Mar 1967, C. P. Kimball (USNM). St. Lucie Co: Fort Pierce: 1 ♂, 1 ♀, 17 Feb 2012, ex larva on willow leaf *Ficus*, D. Hall USNM slide 34391 (USNM). GERMANY: Potsdam: 1 ♂, 12 Dec 2011, 2 ♂, J. Schalles, (SDEI), 1 ♀, 12 Dec 2011, J. Schalles USNM slide 34370 (USNM).

Host.—In southern Florida *X. grenadella* is known to feed on bark mulch used as a potting media in nurseries, as well as on the roots of orchids (*Phalaenopsis* sp.) within containers at these nurseries. Adults have also been reared from the trunks of

willow leaf *Ficus* in southern Florida and the roots of pineapple in Puerto Rico. Pupae have been discovered under bark of an unknown tree in Dominica by J. F. Gates Clarke. A similar larval habit of feeding on moist dead wood is reported herein from greenhouses in Potsdam, Germany.

Biology and Pest Status.—In 2002, moth larvae identified as *Xystrologa antipathetica* were found feeding on the roots and within the containers of orchids (*Phalaenopsis* sp.) in a commercial nursery in Miami-Dade County. Other insects or diseases were ruled out as the causative agent. There were numerous larvae (usually more than 20, Fig. 4) in each container examined and they appeared to be feeding on the plant media, which was primarily bark, as well as on the roots at the base of the plants. The plants were showing symptoms of decline once there was damage to the roots. The plant media that contained the larvae was completely devoured by these insects. There were no longer any distinct pieces of bark within the plant media and all that remained was larval frass. It appears that the larvae started feeding on the roots mostly at the base of the plant once the bark pieces in the media had been eaten. Most of the roots in these containers were drastically reduced compared to non-infested plants of equal age.

Although this insect has been collected as early as May 1958 in Florida, there had not been a report of a severe infestation. At this particular nursery, the grower estimated that thousands of plants were potentially infested which could cost the grower millions of dollars in pest control and plant loss. The impact of this pest on this particular grower was significant, but there was even greater concern for the impact this pest would be if it should continue to spread to other nurseries or sales outlets through the movement of

infested plants. It is unknown if this pest is attracted to plant media, which consists primarily of bark, or for orchids, particularly *Phalaenopsis* sp. The value of all potted orchid sales at wholesale in 2011 within the United States totaled \$190 million from 15 states, with Florida the second largest in sales with a value of \$44 million (Anonymous 2012).

Most recently in February 2012 larvae of *X. grenadella* were also discovered in Fort Pierce, Florida feeding within large damaged areas (Figs. 7–8) on the trunk of bonsai willow leaf *Ficus* (*F. salicaria* Berg, 2004) by David Hall. The larvae appeared to be feeding on the bark of the *Ficus* and were burrowing in a dense mixture of wood fragments and larval frass (Fig. 6). Hall (*in litt.*) also found larvae, pupae and adults of *X. grenadella* under bromeliads growing on the trunks of the bonsai *Ficus*. Damage caused by the larvae to the trunk was noted after removal of the epiphytic Bromeliaceae.

Specimens of *X. grenadella* were discovered in August 2011 for the first time in the Old World in a large greenhouse, or “Biosphäre” in Potsdam, Germany. The larvae were found in dead wet wood of *Robinia*, on which are arranged *Tillandsia* and other Bromeliaceae, and on palm (*Washingtonia* sp.), similar to the situation discovered in Florida mentioned previously. The warm, moist greenhouse environment and large plantings contained therein provide an ideal habitat for this tropical species. Consequently, effective control measures, particularly the removal of dead or rotting wood and possibly some epiphytes, become necessary procedures to prevent possible damage to the roots or trunks of healthy plants.

Distribution.—*Xystrologa grenadella* occurs commonly over a broad range from St Lucie and Sarasota Counties in southern Florida, USA, through much of the West Indies from Jamaica and

Bermuda south to Grenada. It is likely that this widespread West Indian species later expanded its range into the south-eastern United States, but how recent this occurred is unknown. The earliest reported collection in Florida (Homestead) is May 8, 1958. This insect has recently been introduced into Europe where it has become established in greenhouses in Potsdam, Germany.

Xystrologa nigrovitta (Walsingham)
(Figs. 2, 9, 13–15, 17)

Tinea nigrovitta Walsingham, 1897: 163.

Xystrologa nigrovittata (sic) Davis, 1984: 24.

Diagnosis.—Adults of *Xystrologa nigrovitta* are superficially very similar to *X. grenadella* in being predominantly brown with varying shades of dark brown scaling over the forewings. The male genitalia of *X. nigrovitta* are distinct in having the inner margin bordering the base of the valva thickened (Fig. 14) and not thinly sclerotized as occurs in *X. grenadella*. The female genitalia are characterized by a pair of signa, each consisting of a crescent shaped sclerite with a single blade-like median projection extending into the corpus bursae (Fig. 17).

Description.—Adult (Figs. 2, 9): Length of forewing 4.4–5.0 mm. General body color very similar to *X. grenadella*. **Head:** Vestiture light to medium brown. Antenna dark brown dorsally, light brown ventrally, with scape mostly light brown, pedicel dark brown. Maxillary and labial palpi as described for *X. grenadella*. **Thorax:** Mostly light brown dorsally and variously irrorated with dark brown particularly over tegulae; thorax whitish cream ventrally. Forewing light brown, variably irrorated with dark brown scales, with greatest concentration of dark brown typically in more recently emerged specimens;

fringe light brown, variably irrorated with dark brown. Hindwing similar to *X.*

grenadella; male with an elongate fold extending along discal area almost entire length of hindwing, and with light brown hair pencil arising from extreme base of anal area and extending $\sim 2/3$ the length of hindwing; dorsal scales of basal subcostal area variable in color, possibly deciduous, usually light to medium brown, rarely black (as in holotype, Fig. 9). Legs and abdomen as described for *X. grenadella*.

Male genitalia (Figs. 13–15): Lobes of uncus slender, moderately long, length $\sim 2/3$ midventral length of vinculum. Vinculum moderately short, broadly U-shaped; broad basal portion nearly $1/3$ the length of genital capsule. Valva with base of costa divided into a smaller mesal, digitate lobe and a more caudal, larger, digitate lobe that joins opposite member to form a partial arch; inner margin at base of valva thickened; apex of valva complex, with a large, ventrally folded, cucullar lobe, with mesal fold oval and larger than lateral fold; sacculus with an elongate, curved, acute, apical process extending between dual lobes of cucullus (Fig. 14). Aedeagus long, \sim equal to length of genital capsule, strongly curved dorso-ventrally; apical-ventral surface sparsely covered with minute spines.

Female genitalia (Fig. 17): Posterior apophysis $\sim 1.1\times$ length of anterior pair. Ostium bursae elliptical in outline, with a sclerotized, semicircular anterior rim narrowing caudally. Antrum sclerotized, moderately long, length $\sim 2\times$ diameter of ostium, with a narrow membranous break before junction with heavily sclerotized wall of ductus bursae. Ductus bursae an elongate cylinder, \sim equaling anterior apophysis in length; walls of ductus thickened, completely lined with minute, slender, transversely oriented spicules (Fig. 17). Corpus bursae spherical; walls membranous, smooth, with a pair of symmetrical, crescent shaped signa with

a single blade-like median projection extending into the corpus bursae.

Larva unknown.

Pupa unknown.

Type material.—Holotype ♂, UNITED STATES VIRGIN ISLANDS: St. Thomas, West Indies, Gudmann, 5090, slide DRD 2953, (NMW).

Other material examined.—WEST INDIES: ANGUILLA BWI: 1 ♂, 15 May 1980, A. G. Parker, 1 ♀, 27 Apr 1980, BMNH slide 31890 (BMNH). DOMINICA: Springfield Estate: 1 ♀, 20–26 Jul 1963, O. S. Flint, Jr., USNM slide 33190, (USNM). Clarke Hall: 1 ♀, 10 Jan 1965, USNM slide 33189, 1 ♂, 11 Jan, 1 ♀, 13 Jan, USNM slide 33186, 2 ♂, 14 Jan, 1 ♀ USNM slide 33187, 1 ♀, 16 Jan, USNM slide 19344, 1 ♂, 22 Jan, 1 ♂, 23 Jan, USNM slide 18067, 2 ♂, 24 Jan, 2 ♂ USNM slides 19304, 33199, 1 ♂, 26 Jan, 2 ♂, 29 Jan, 1 ♂, 14 Mar 1965, reared from bracket fungus, J. F. G. Clarke & Thelma M. Clarke; 2 ♂, 8–10 Jan 1965, USNM slide 33196, wing 33753, 1 ♂, 11–20 Jan, 1 ♂, 21–31 Jan 1965, light trap, W. W. Wirth, Bredin-Archbold-Smithsonian Bio. Surv. Dominica (USNM). ST. VINCENT: Kingstown: 1 ♂, Sep 1975, E. & K. Laidler, BMNH slide 29710, (BMNH), 1 ♀, 12371, (BMNH). TRINIDAD: St. George: St. Augustine: 1 ♂, 17 Jun – 15 Aug 1976, BMNH slide 1509, (BMNH), Curepe: 1 ♀, 21 Sep 1979, MV trap, M. J. W. Cock, (BMNH).

Host.—Adults of *X. nigrovitta* have been reared from an unidentified bracket fungus in Dominica.

Distribution.—Although currently known from only the type locality, St. Thomas, in the Virgin Islands and Dominica of the Lesser Antilles, this species probably occurs widely through the West Indies.

Remarks.—The hindwings of *nigrovitta* are now missing from the holotype, apparently lost in transit to the Naturhistorisches Museum Wien, Austria. Fortunately, the

male genitalia slide had been prepared previously, and this agrees with the genitalia illustrated in Figs. 13–15.

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LITERATURE CITED

- Anonymous. 2012. USDA National Agriculture Statistic Service Floriculture Crops Summary for 2011, p. 41. <http://usda01.library.cornell.edu/usda/current/FlorCrop-05-31-2012.pdf>.
- Berg, C. C. 2004. A new species of *Ficus* (Moraceae) of uncertain provenance. *Brittonia* 56(1): 54–57. doi:10.1663/0007-196X(2004)056[0054:ANSOFM]2.0.CO;2
- Clarke, J. F. Gates. 1970. Catalogue of the Type Specimens of Microlepidoptera in the British Museum (Natural History) Described by Edward Meyrick. 8:1–261, plates 1–60.
- Davis, D. R. 1984. Neopseustidae, Nepticulidae, Opostegidae, Tischeriidae, Incurvariidae, Cecidosidae, Adelidae, Prodoxidae, Tineidae, Psychidae, and Arrhenophanidae, pp. XX, 3–6, 16, 18–25. *In* J. B. Heppner, ed. Atlas of Neotropical Lepidoptera, Checklist: Part 1, Micropterigoidea - Immoidea. Dr. W. Junk Publ., The Hague, Boston, Lancaster.
- Davis, D. R. 1987. Tineidae, pp. 362–365. *In* F. W. Stehr, ed. Immature insects, Vol. 1. Kendall/Hunt Publ. Co., Dubuque, Iowa.
- Ferguson, D. C., D. J. Hilburn, and B. Wright. 1991. The Lepidoptera of Bermuda: Their Food Plants, Biogeography, and Means of Dispersal. *Memoirs of the Entomological Society of Canada* (158):1–105.
- Forbes, W. T. M. 1931. Supplementary Report on the Heterocera or Moths of Porto Rico. *The Journal of the Department of Agriculture of Porto Rico* 4(4): 339–394.
- Heppner, J. B. 2003. Lepidoptera of Florida, Part 1, Introduction and Catalogue. *Arthropods of Florida and Neighboring Land Areas*, 17: x + 670. Florida Department of Agriculture & Consumer Services, Division of Plant Industry, Gainesville.
- Hinton, H. E. 1956. The larvae of the species of Tineidae of economic importance. *Bulletin of Entomological Research* 47(2): 251–346. doi:10.1017/S0007485300046708
- Klots AB (1970) Lepidoptera. *In* Tuxen SL (Ed) Taxonomist's Glossary of Genitalia in Insects. Munksgaard, Copenhagen p. 115–130.
- Meyrick, E. 1919. Exotic Microlepidoptera. 2: 257–288 [Nov.].
- Meyrick, E. 1922. Exotic Microlepidoptera. 2: 577–608 [Dec.].
- Meyrick, E. 1932. Exotic Microlepidoptera. 4: 193–224 (Mar.).
- Nye, I. W. B. and D. S. Fletcher. 1991. The Generic Names of Moths of the World. Vol. 6 Microlepidoptera, xxix + 368 pages. Natural History Publications, London. *Entomological Society* 4(3):531–536, plate 9.
- Robinson, G. S. and E. S. Nielsen. 1993. Tineid genera of Australia (Lepidoptera). *Monographs on Australian Lepidoptera*. 2. xvi + 343 pp. CSIRO, Melbourne.
- Robinson, G. S. 2009. Biology, distribution and diversity of tineid moths. Southdene Sdn Bhd, Kuala Lumpur, Malaysia, and the Natural History Museum, London. 143 pp.
- Walsingham, L. (Thomas de Grey). 1897. Revision of the West-Indian Micro- Lepidoptera, with descriptions of new species. *Proceedings of the Zoological Society of London* 1:54–183.

