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A new species of *Xestomyza* Wiedemann, 1820 from South Africa, with a key to the genera of Xestomyzinae (Diptera: Therevidae)

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ABSTRACT

A new species, *Xestomyza stuckenbergi* sp. n., is described from the Western Cape Province, South Africa. The new species differs from the only previously described species of this genus, *Xestomyza lugubris* Wiedemann, 1820, being smaller and entirely covered in white pubescence and also having differences in the male terminalia. A third species of this genus is briefly described, but because there is only one female specimen available it is not formally named. Identification keys are provided to genera of the subfamily Xestomyzinae and to species of *Xestomyza* Wiedemann.

KEY WORDS: Diptera, Xestomyzinae, Therevidae, *Xestomyza*, Afrotropical, stiletto flies, new species.

INTRODUCTION

The family Therevidae Newman, 1834 is distributed world-wide (with the exception of Antarctica), with more than 1000 described species in about 130 genera. Lyneborg (1972) revised a monophyletic group of mainly African Therevidae and named it the *Xestomyza*-group. Later, Lyneborg (1976) elevated this informal group to a tribe, Xestomyzini Lyneborg, 1976, with the tribe Phycini Lyneborg, 1976, as higher-level groups within the subfamily Phycinae Lyneborg, 1976. Before Lyneborg (1976) recognised this subfamily and Therevinae, the family had no internal hierarchy. This classification was followed in subsequent revisions of Therevidae, including major changes in genus circumscriptions (Irwin & Lyneborg 1981), with the tribe Xestomyzini elevated to subfamily status by Irwin and Webb (1992). Winterton *et al.* (2001) erected the subfamily Agapophytinae Winterton, 2001 for genera endemic to the Australasian Region monophyletic with respect to Therevinae and the *Taenogera*-group, an informal group that included genera from Australia and South America within the current extended circumscription of Agapophytinae (Winterton *et al*. 2001; Winterton 2007).

Phylogenetic placement of Agapophytinae genera is intermediate to the Phycinae and the Therevinae clades (Yang *et al*. 1999; Winterton *et al*. 2011), based on the selection of characters and taxa representing Phycinae by Winterton *et al*. (2001). The subfamily Xestomyzinae was not mentioned and from the characters used as typical for Phycinae in Winterton *et al.* (2001), it was clear that the paper referred to the Phycinae *sensu stricto* (*i.e*., excluding Xestomyzinae). The Therevinae are distributed worldwide, while the Phycinae, are found on every continent except Australia.

The small subfamily Xestomyzinae includes 10 genera and 47 species, of which one genus (*Henicomyia* Coquillett, 1898) with seven species is found in the New World (Coquillett 1898; Kröber 1931; Lyneborg 1972, 1976; Irwin 1973), but the greatest diversity is known from southern Africa and recently from Madagascar (Hauser & Irwin 2005*a*). Two fossil species are known, one from Baltic and one from Mexican amber (Hauser & Irwin 2005*b*; Hauser 2007).

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Two additional species of the previously monotypic type genus for this subfamily, *Xestomyza*, have been identified from South American specimens, of which one is described here.

MATERIAL AND METHODS

General morphology follows McAlpine (1981) with additional terminology from Webb and Irwin (1999), Irwin and Lyneborg (1981), and Winterton *et al*. (1999*a*, 2001) for some structures of the male terminalia. Terminology for structures of the female terminalia follows Irwin (1976), as modified by Winterton *et al*. (1999*a*, *b*). Each specimen was given a unique code on a yellow label in the format THEREVIDAE/M. E. Irwin/Specimen #/999999. The code facilitates entry and manipulation of data within the architecture of MANDALA (Kampmeier & Irwin 2009) and is recorded as "MEI 999999" with the associated specimens throughout the text. All material examined is listed after the description, and the depository collection is given within parentheses after the MEI specimen number. Specimen information for type specimens is given between quotation marks as it appears on the specimen label.

Abdomens were macerated in 10% potassium hydroxide, rinsed in distilled water, and dilute glacial acetic acid, and were dissected in 80% ethanol. Terminalia preparations were placed in glycerine in a microvial pinned beneath the relevant specimen.

The studied material is kept in the following institutions:

CSCA – California State Collection of Arthropods, Sacramento, California, USA;
NHMW – Naturhistorisches Museum Wien, Vienna, Austria;
NMSA – KwaZulu-Natal Museum, Pietermaritzburg, South Africa;
TAU – Tel Aviv University, Tel Aviv, Israel;
WBC – Personal collection of Werner Barkemeyer, Flensburg, Germany;
ZMUC – Zoological Museum, University of Copenhagen, Copenhagen, Denmark.

TAXONOMY

Subfamily Xestomyzini Lyneborg, 1976

The subfamily Xestomyzinae is morphologically very well supported (Lyneborg 1972). One of the most obvious external characters in females is the set of thick macrosetae on sternite 8, that are utilized for digging during oviposition, just as acanthophorite spines are utilized by Agapophytinae and Therevinae. Other characters include: spermathecal duct possessing a sclerotised ring basally; presence of lateral sclerites of the distiphallus (Hauser & Irwin 2005*a*); dorsal aedeagal apodeme reduced; spermathecal ducts entering the dorsal wall of the bursa copulatrix independently; and sternite 10 being rounded posteriorly with a long anterior extension.

There is a clear taxonomic distinction between the New World genus *Henicomyia* Coquillett and the Old World genera of Xestomyzinae. *Henicomyia* has setulae on vein R_1, while all other Xestomyzinae lack these setulae. Lyneborg (1972) stated that the genera *Xestomyza* Wiedemann, *Braunsophila* Kröber and *Ceratosathe* Lyneborg form a monophyletic group, these being characterised by: proboscis longer than head; broad gena; frons possessing numerous setae; and more than three pairs of dorsocentral macrosetae. The relationship between this informal group and the other genera of Xestomyzinae remains unclear.

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Key to the genera of Xestomyzinae

1 Face and gena with numerous conspicuous setae....2
– Face and gena without conspicuous setae....5

2 Scape enlarged, much thicker than pedicel; males dichoptic....**Xestomyza** Wiedemann, 1820
– Scape subequal to pedicel; males holoptic or dichoptic....3

3 Proboscis as long as head or shorter; males holoptic....**Hemigephyra** Lyneborg, 1972 (part: *H. atra*)
– Proboscis much longer than head; males holoptic or dichoptic....4

4 Wing maculate; scutellum without velvety black patch; male dichoptic....**Braunsophila** Kröber, 1931
– Wing with three brown bands; scutellum with velvety black patch; male holoptic....**Ceratosathe** Lyneborg, 1972



Fig. 1. *Xestomyza lugubris* Wiedemann, male, habitus, lateral, overall length 11 mm.

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5 Vein R_1 with setulae (New World) ..... **Henicomyia** Coquillett, 1898
– Vein R_1 without setulae (Old World) 6

6 Antenna ventrally directed; wing with two dark bands, apical band much broader than basal (*Cochlodactyla* has the apical wing band broader, but the antenna is parallel to body axis) ..... **Pentheria** Kröber, 1914
– Antenna horizontal, parallel to body axis; wing without bands or if with two dark bands, then bands subequal (except in *Cochlodactyla* which has a broader apical wing band) 7

7 One notopleural macroseta; wing of female vestigial ..... **Lyneborgia** Irwin, 1973
– Two notopleural macrosetae; wing of female normal 8

8 Medial surface of scape with setae; female postocular area enlarged, cushion-shaped ..... **Hemigephyra** Lyneborg, 1972 (part: *H. braunsi*)
– Medial surface of scape without setae; female postocular area not enlarged 9

9 Antennal socket not protruding; dorsal surface of costal vein with scattered setulae ..... **Cochlodactyla** Lyneborg, 1972
– Antennal socket protruding; dorsal surface of costal vein with two rows of setulae ..... **Microgephyra** Lyneborg, 1972

Genus *Xestomyza* Wiedemann, 1820

Xestomyza: Wiedemann 1820: 10. Type species: *Xestomyza lugubris* Wiedemann, by monotypy.
Pseudoxestomyza Kröber, 1912: 2. Type species: *Pseudoxestomyza longirostris* Kröber, by monotypy. (Synonymy by Lyneborg 1972: 355.)

Diagnosis: The genus can be distinguished from other genera in the subfamily by the long setae on the frons and parafacial, a characteristic shared with *Braunsophila*, *Cera-*



Fig. 2. *Xestomyza lugubris* Wiedemann, female, habitus, lateral, overall length 9 mm.

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tosathe and *Hemigephyra*. *Xestomyza* differs from *Ceratosathe* by the holoptic eyes in males. From *Hemigephyra* it differs by the much longer proboscis. They also differ in wing coloration, with bands in *Ceratosathe* and *Hemigephyra* versus brown-maculated coloration in *Xestomyza*. *Braunsophila* is the most similar to *Xestomyza*, but can be separated by the following characters: scape much thicker than pedicel in *Xestomyza* (same thickness in *Braunsophila*), pair of finger-like extensions on gonocoxite with strong apical setae and apical cap on aedeagus (both features absent in *Braunsophila*).

Notes. Flies of the genus *Xestomyza*, as well as the related genus *Braunsophila*, are rarely collected, even with Malaise traps and few specimens are known in collections. The majority of studied *Xestomyza* specimens were collected in September, but there are collecting dates ranging from July to December. More intense collecting efforts will very likely discover additional undescribed species.

Xestomyza lugubris Wiedemann, 1820

Figs 1–4, 9, 11, 18, 19

Xestomyza lugubris: Wiedemann 1820: 10; Lyneborg 1972: 357. Type locality: Cape of Good Hope; holotype in ZMUC.

Pseudoxestomyza longirostris Kröber, 1912: 12; Lyneborg 1972: 357. Type locality: Algoa Bay; holotype in NHMW.



Figs 3, 4. *Xestomyza lugubris* Wiedemann, habitus, dorsal: (3) male, overall length 11 mm; (4) female, overall length 9 mm.

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Lyneborg (1972) gave a detailed redescription of this species, with illustrations of the male terminalia and head. One illustration he provides (Lyneborg 1972: 356, fig. 187) supposedly illustrates a male head in lateral view, but it is clearly a female specimen and not identical with the male specimen in fig. 186. The setae on the frons and the dorsal part of the scape are much longer and erect in males, whereas they are short and virtually appressed in females (Figs 9, 11).

Material examined: SOUTH AFRICA: *Northern Cape*: 1♀ 8 km E of Kamieskroon [30°10'52"S 18°00'20"E], [SE]3018AA, 5.ix.1983, Londt & Stuckenberg, montane old land with rocks & bushes nearby (MEI 116079, NMSA). *Western Cape*: 1♂ Stellenbosch, #34, 33°57'S 18°54'E, 1494 m, 15.ix.1994, P.E. Reavell (MEI 164793, NMSA); 1♂ Paarl Dist., Du Toits Kloof [33°45'S 19°11'E], 1000–2300 ft, 27–28.ix.1959, B. & P. Stuckenberg (MEI 116078, NMSA); 1♂ Stellenbosch [33°56'05"S 18°52'00"S], 2.ix.1926, Dr H. Brauns, "/*Pseudoxestomyza longirostris* Kröb. Det Kröber 1927/Therevidae Lyneborg specimen no. 1002/ *Xestomyza lugubris* det. Lyneborg 1970" (NMSA); 1♂ Cape Peninsula, Silvermine Nature Reserve [34°06'27"S 18°26'08"E] nr road, 12.ix.2002, Barkemeyer (MEI 146480, WBC).

Xestomyza stuckenbergi sp. n.

Figs 5–8, 12–17, 20

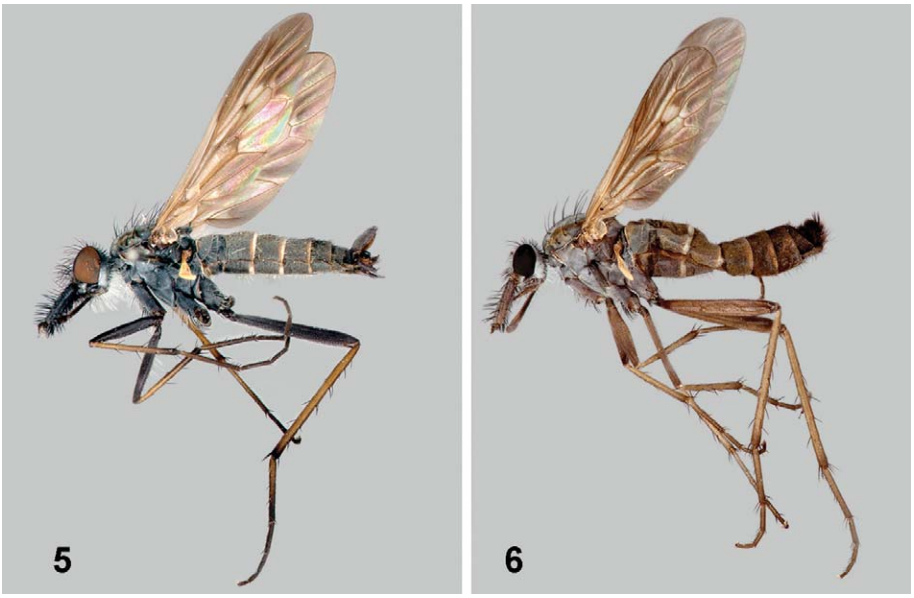
Etymology: The species is named after Brian Stuckenberg, in honour of his leading role in African Dipterology for many decades.

Diagnosis: This species is significantly smaller than *X. lugubris* and is characterized by the grey pubescence covering the entire body and the differences in the male terminalia.

Description:

Male.

Body length: 5.5–6.2 mm; wing length: 5.5–6.9 mm.

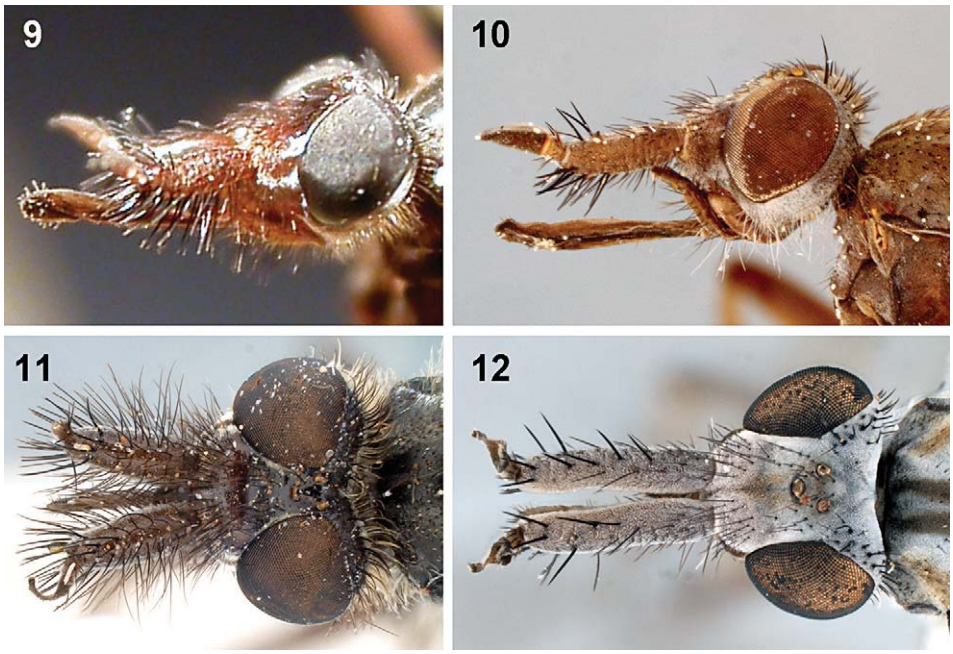


Figs 5, 6. *Xestomyza stuckenbergi* sp. n., habitus, lateral: (5) male, overall length 6.2 mm; (6) female, overall length 6.4 mm.

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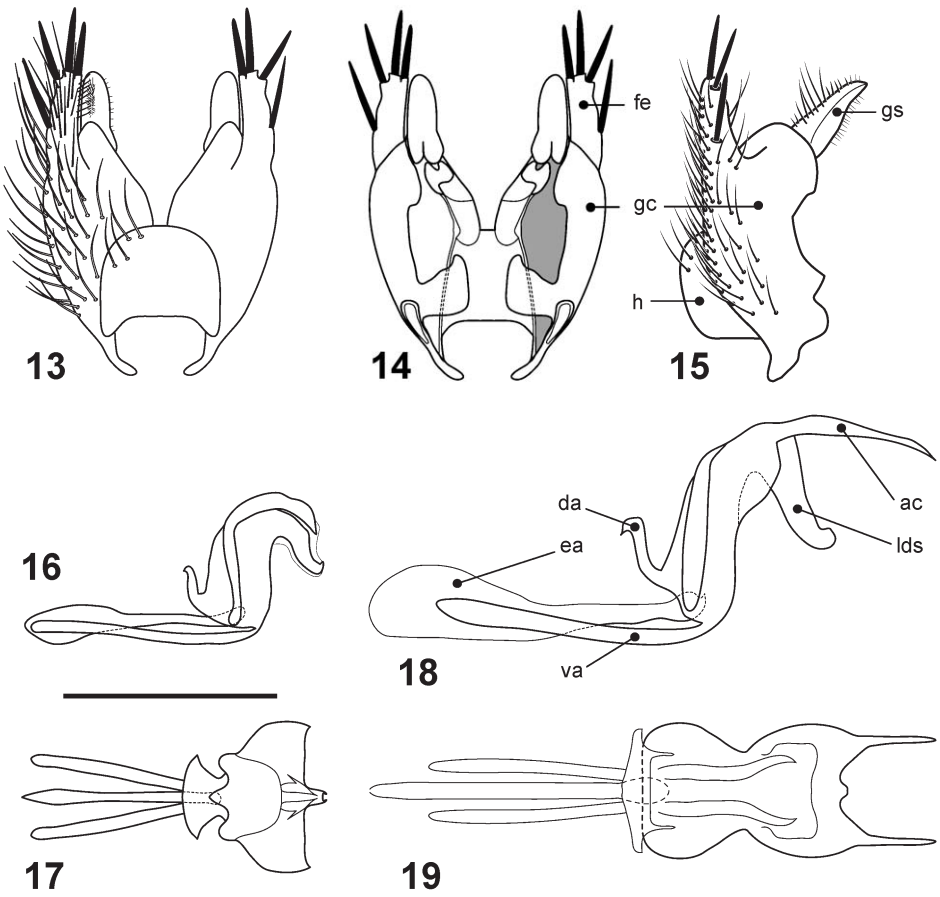
Figs 7, 8. *Xestomyza stuckenbergi* sp. n., habitus, dorsal: (7) male, overall length 6.2 mm; (8) female, overall length 6.4 mm.



Figs 9–12. *Xestomyza* spp., heads: (9) *X. lugubris*, ♀ holotype, lateral; (10) *Xestomyza* sp. A, ♀, lateral; (11) *X. lugubris*, ♂, dorsal; (12) *X. stuckenbergi* sp. n., ♀ paratype, dorsal. Not to scale.

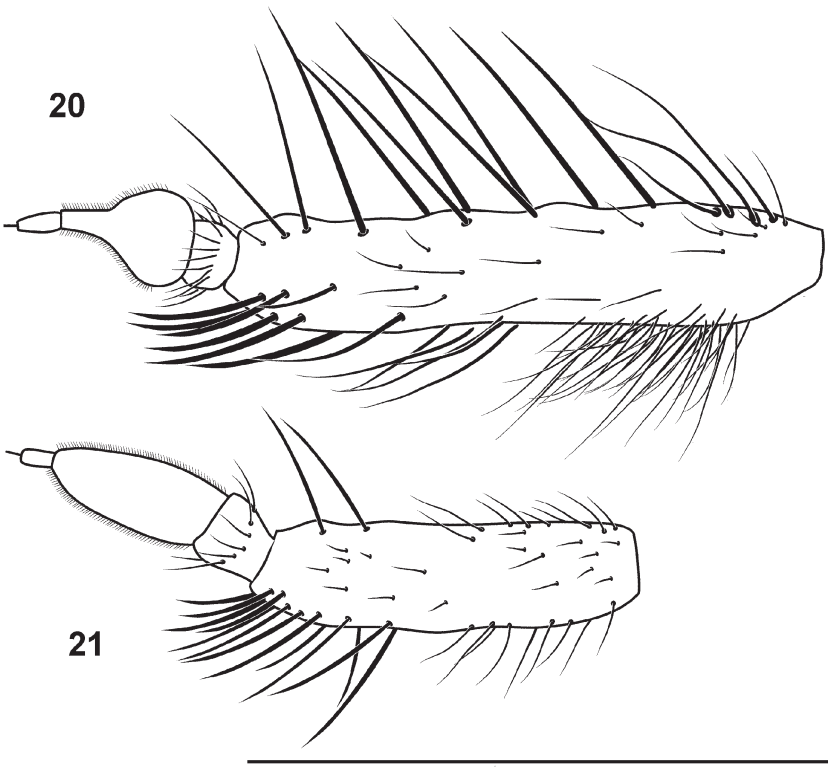
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Head: Entirely covered in silver pubescence; dichoptic with eyes separated by 2× the distance between hind ocelli (Fig. 7); eye bare, ommatidia homogeneous in size; setae on head strong, black, except finer and white on gena, palpus and proboscis. Antenna inserted on central facial protrusion, which is silver pubescent dorsally and ventrally as on remainder of head, but dark brown pubescent laterally (Fig. 5). Scape 4.5× as thick as long; clothed in silver pubescence; dorsoapical three-quarters and ventroapical third with strong, black, bristle-like setae (Fig. 20); setae on dorsobasal quarter and ventrobasal two-thirds of virtually same length; pedicel ovoid, with ring of stiff black setae longer than length of pedicel; flagellomere 1 pear-shaped, covered in short erect setae; second flagellomere cylindrical, with apical arista. Proboscis straight, long, virtually as long as scape; palpus long, two-segmented, both covered with numerous long, black setae admixed with some white setae. Macrosetae: 2 notopleural, 1 supra-alar, 1 postalar, 6 dorsocentral, 1 scutellar (all black).



Figs 13–19. *Xestomyza* spp., male terminalia: (13–15) *Xestomyza stuckenbergi* sp. n., paratype: (13) ventral, (14) dorsal, (15) lateral; (16–19) aedeagus: (16) *X. stuckenbergi* sp. n., paratype, lateral; (17) same, ventral; (18) *X. lugubris*, lateral; (19) same, ventral. Abbreviations: *ac* – apical cap, *da* – dorsal apodeme, *ea* – ejaculatory apodeme, *fe* – finger-like extension, *gc* – gonocoxite, *gs* – gonostylus, *h* – hypandrium, *lds* – lateral distiphallus sclerite, *va* – ventral apodeme. Scale bar = 0.5 mm.

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Figs 20, 21. *Xestomyza* spp., antenna, lateral: (20) *X. stuckenbergi* sp. n., ♂; (21) *Xestomyza* sp. A, ♀. Scale bar = 1 mm.

Thorax and pleuron: Entirely covered in silvery-grey pubescence, except for a medial brown fascia along length of scutum, bifurcated in anterior quarter by a silver line, and brown pubescent lateral part of scutum. Scutum with sparse black erect setae; pleuron with sparse fine white setae (Fig. 7). Prosternal depression with numerous long white setae. Wing dark brown, except lighter area in discal area, comprising basal part of cell r_5, apical part of cell *d* and basal part of cell m_1 (Figs 5, 6); apical half of wing with veins surrounded by lighter coloration; visible coloration chiefly caused by colour of microtrichia that are either black or yellow; all veins brown, except subcostal vein yellow. Haltere yellow-brown, lighter towards apex. All coxae black with silver pubescence. All femora dark brown with short appressed black setae and some longer erect white setae in ventral parts. All tibiae light brown with appressed short black setae and erect bristle-like setae. Tarsi brown, darker towards apex.

Abdomen: Blackish brown, clothed in grey pubescence. Intersegmental membranes of segments 2–5 white. Medially, setae short, black, semi-erect; laterally and ventrally, setae white. *Terminalia*: Dark brown, with a finger-like extensions on each gonocoxite; each one of these two extensions with four apical macrosetae; apical part of gonocoxite (gonocoxal ring) open (Fig. 14); hypandrium free, large, with 4 or 5 pairs of long setae (Fig. 13); aedeagus with ventral apodeme long and forked, dorsal apodeme reduced and apical cap extended and wing-like (Figs 16, 17).

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Female.

Body length: 5.2–6.4 mm; wing length: 4.5–5.3 mm.

Similar to male (Figs 6, 8), except setae on frons and scape distinctly weaker (Fig. 9). Frons width equal in both sexes (but narrower in males *vs* females of *X. lugubris*).

Holotype: ♂ "R.S.A.: W Cape #110 / 10km S Lamberts Bay / 32°11'S: 18°19'E 150m / Date: 1.ix.1995 / coll: J. & A. Londt / Costal dunes" (MEI 164792, NMSA).

Paratypes: same label information as holotype (5♂ MEI 164780 (NMSA), 164783 (CSCA), 164784 (NMSA), 164786 (NMSA), 164789 (NMSA); 4♀ MEI 163370 (NMSA), 164779 (NMSA), 164787 (NMSA), 164791 (NMSA)).

Xestomyza sp. A

Figs 10, 21

One female specimen seen probably represents a new species of *Xestomyza*. As this specimen is in relatively poor condition and the male remains unknown, I do not describe it here, pending discovery of additional material. The small size, sparse setae and pubescence of the frons and most of the body, place it closer to *X. stuckenbergi* sp. n., while the flagellomere shape is more similar to *X. lugubris*. It differs from *X. stuckenbergi* sp. n. in several characters, including weakly developed *dc* setae, a short scape, a shiny spot on the anepisternum and anepimeron, and clear wings. As the male remains unknown, several important characters of the male terminalia cannot be determined. There is the possibility that this species may belong to the genus *Braunsophila*, or is intermediate between the concepts of these two genera.

Material examined: SOUTH AFRICA: *Northern Cape*: 1♀ 30 km W Calvinia [31°29'S 19°29'E], 7.ix.1983, A. Freidberg (MEI 123301, TAU).

Key to the species of *Xestomyza* Wiedemann

1 Frons (Figs 3, 4, 9, 10) (and rest of body, Figs 1–4) entirely or predominantly shiny black; male body appears bi-coloured: thorax with predominantly black long erect setae and some white setae intermixed, abdomen mainly with reddish golden long erect setae; larger species ≥8 mm (8–11.2 mm) ..... **lugubris** Wiedemann

– Frons (Figs 7, 8, 12) (and all or most of body, Figs 5–8) entirely covered in grey pubescence; abdomen with short semi-appressed setae; male body appears concolourous, grey with sparse black setae; smaller species <7 mm (5.2–6.4 mm) 2

2 Scape >3× as long as flagellomeres combined (Figs 12, 20); flagellomere 1 roundish, nearly as broad as long; *dc* setae subequal to other thoracic macrosetae; anepisternum and anepimeron entirely covered in silver pubescence (Figs 5, 6); wing dark brown with irregularly mottled pattern ..... **stuckenbergi** sp. n.

– Scape 1.8× as long as flagellomeres combined (Figs 10, 21); flagellomere 1 subovoid, >2× as long as thick; *dc* setae shorter and finer than other thoracic macrosetae; parts of anepisternum and anepimeron shiny black; wing mostly hyaline ..... **sp. A**

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REFERENCES

Coquillett, D.W. 1898. A new dipterous genus belonging to the Therevidae. *Journal of the New York Entomological Society* **6**: 187–188.

Hauser, M. 2007. Baltic amber Therevidae and Apsilocephalidae (Diptera). *Studia dipterologica* **14**: 37–59.

Hauser, M. & Irwin, M.E. 2005*a*. The subfamily Xestomyzinae (Diptera: Therevidae) new to Madagascar, with the description of four new species. *African Invertebrates* **46**: 181–202.

———2005*b*. A new remarkable Xestomyzinae (Insecta, Diptera, Therevidae) genus from Mexican Amber. *Zootaxa* **1008**: 39–45.

Irwin, M.E. 1973. A new genus of the *Xestomyza*-group from the western coast of South Africa, based on two new species with flightless females (Diptera: Therevidae). *Annals of the Natal Museum* **21**: 533–556.

———1976. Morphology of the terminalia and known ovipositing behaviour of female Therevidae (Diptera: Asiloidae), with an account of correlated adaptations and comments on phylogenetic relationships. *Annals of the Natal Museum* **22**: 913–935.

Irwin, M.E. & Lyneborg, L. 1981. The genera of Nearctic Therevidae. *Illinois Natural History Survey Bulletin* **32**: 193–277.

Irwin, M.E. & Webb, D.W. 1992. Brasilian [*sic*] Therevidae (Diptera): a checklist and description of species. *Acta Amazonica* **21**: 85–121.

Kampmeier, G.E. & Irwin, M.E. 2009. Meeting the interrelated challenges of tracking specimen, nomenclature, and literature data in Mandala. *In*: Pape, T., Meier, R. & Bickel, D., eds, *Diptera diversity: status, challenges and tools*. Leiden: Brill Academic Publishers, pp. 407–438.

Kröber, O. 1912. Monographie der palälarktischen und afrikanischen Thereviden. *Deutsche Entomologische Zeitschrift* **1**: 1–32, **2**: 109–140, **3**: 251–266.

———1931. The Therevidae (Diptera) of South Africa. *Annals of the Transvaal Museum* **14**: 103–134.

Lyneborg, L. 1972. A revision of the *Xestomyza*-group of Therevidae (Diptera). *Annals of the Natal Museum* **21**: 297–376.

———1976. Seven new species of the *Xestomyza*-group of Therevidae (Diptera) from South Africa. *Annals of the Natal Museum* **22**: 937–949.

———1981. Morphology and terminology—Adults. *In*: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M., eds, *Manual of Nearctic Diptera.* Vol. 1. Monograph 27. Ottawa: Research Branch, Agriculture Canada, pp. 9–63.

Webb, D.W. & Irwin, M.E. 1999. A revision of *Tabuda* Walker and *Tabudamima* Irwin and Lyneborg with the description of a new genus *Incoxoverpa* Webb and Irwin (Diptera: Therevidae: Therevinae). *Annals of the Entomological Society of America* **92**: 644–674.

Wiedemann, C.R.W. 1820. *Nova dipterorum genera*. Kiel: C.F. Mohr.

Winterton, S.L. 2007. New species of *Nanexila* Winterton & Irwin and *Taenogera* Kröber from Australia (Diptera: Therevidae). *Zootaxa* **1413**: 55–64.

Winterton, S.L., Irwin, M.E. & Yeates, D.K. 1999*a*. Systematics of *Nanexila* Winterton & Irwin, gen. nov. (Diptera: Therevidae) from Australia. *Invertebrate Taxonomy* **13**: 237–308.

Winterton, S.L., Merritt, D.J., O'Toole, A., Yeates, D.K. & Irwin, M.E. 1999*b*. Morphology and histology of the spermathecal sac, a novel structure in the female reproductive system of Therevidae (Diptera: Asiloidea). *International Journal of Insect Morphology and Embryology* **28**: 273–279.

Winterton, S.L., Yang, L., Wiegmann, B.M. & Yeates, D.K. 2001. Phylogenetic revision of Agapophytinae subf. n. (Diptera: Therevidae) based on molecular and morphological evidence. *Systematic Entomology* **26**: 173–211.

Yang, L., Wiegmann, B.M., Yeates, D.K. & Irwin, M.E. 2000. Higher-level phylogeny of the Therevidae (Diptera Insecta) based on 28S ribosomal and Elongation Factor-1α gene sequences. *Molecular Phylogenetics and Evolution* **15** (3): 440–451.

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