Order Hymenoptera, family Figitidae
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INTRODUCTION

Figitid wasps (Hymenoptera) are a moderately speciose group of koinobiont endoparasitoids of endopterygote insect larvae. Adults typically range from 0.75 mm to 5.00 mm in body length. The primary hosts attacked by Figitidae are first- and second-instar larvae of cyclorrhaphous Diptera found in habitats ranging from leaf mines to decomposing plant and animal matter. The biology and diversity of this group on a global scale was reviewed in Ronquist (1999), Ronquist et al. (2006) and Buffington & Ronquist (2006).

The Figitidae is only lineage of the entire Cynipoidea known to occur in the United Arab Emirates (UAE). Absent are the gall inducing, phytophagous Cynipidae (though many species have been documented in southwestern Palearctic (Melika, 2006) and the middle East (Tavakoli et al., 2008; Karimpour et al., 2008), as well as the Liopteridae that occur throughout Africa (Benoit, 1955; Liu et al., 2007). The only common subfamily encountered within the UAE are the ubiquitous eucoilines; less commonly encountered are the Aspicerinae and Pycnostigminae. It is likely the hyper-parasitic Charipinae are also present in the country, but no specimens have been discovered. Among the eucoilines, most species can be determined using the comprehensive African studies by Quinlan (1986, 1988). Indeed, all the genera of Eucoilinae present in the UAE, save for one, are present in equatorial Africa. Further, the most common species are all known from equatorial Africa. The phylogeny presented in Buffington et al. (2007) suggested that the African lineages of Eucoilinae are the result of migration, followed by radiation, from southwestern Eurasia; the species reported in this work support this hypothesis. The UAE provides a sort of ‘crossroads’ for lineages, helping trace back the origins of currently distributed plant and animal groups.

To my knowledge, no thorough documentation of the figitid fauna has ever been undertaken for the Arabian Peninsula. To this end, presented here is a list of species based on fieldwork by Antonius van Harten, as well as a key and diagnoses for all genera of Figitidae in the UAE. The following new species are described from the UAE: Tobiasiana theremini and Nordlanderia phaedrae.

MATERIALS AND METHODS

The vast majority of specimens examined in this study were collected via light trap, Malaise trap or pan traps. These methods typically yield large numbers of cynipoids regardless of habitat. Unless otherwise stated, the specimens were collected by A. van Harten. Specimens were preserved in a minuscule amount of ethanol and shipped to the National Museum of Natural History, Smithsonian Institution (USNM). The specimens were dried from ethanol using a vacuum filtration system, developed by the author, then card or point mounted. Specimens from this study are deposited in the USNM, the United Arab Emirates Invertebrate Collection (UAEIC), and the University of California, Davis, Bohart Museum (UCD).

Scanning electron micrographs used herein were obtained from Morphbank (www.morphbank.net), and the images were obtained using methods summarized in Fontal-Cazalla et al. (2002) and Buffington (2009). Light microscope images were obtained using a Leica DRMB compound microscope with a GT-Vision Lw11057C-SCI digital camera, or a Leica M16 with a JVC KY-75U 3-CCD digital video camera attached. Both setups fed image
data to a desktop computer where the program Cartograph 5.6.0 merged an image series (representing typically 30 focal planes) into a single in-focus image. Lighting was achieved using techniques summarized in Kerr et al. (2009) and Buffington & Gates (2009). Morphological terminology follows that of Ronquist & Nordlander (1989) and Fontal-Cazalla et al. (2002); cuticular surface terminology follows Harris (1979). Abbreviations used: ML = Malaise trap; LT = light trap; WT = water trap; NARC = National Avian Research Centre.

**SYSTEMATIC ACCOUNT**

**Key to the figitid genera of the UAE**

Lighting is critical to the successful identification of Figitidae, especially the Eucoilinae. Care should be taken to use either light-dispersing film in conjunction with fibre optic illuminators or naturally light-dispersing fluorescent light sources. The key to genera is based females and males.

1 Forewing with a distinct pseudopterostigma, appearing as an extremely dark spot where the marginal cell of the forewing is located (Plate 1) ........................................................................
   – Forewing lacking a pseudopterostigma, instead possessing a typical hyaline marginal cell (Plate 2) ........................................................................................................... 2

2 Dorsal surface of scutellum lacking a plate, instead, surface rugulose (Plate 4); posterior margin of scutellum with a distinct spine (Plate 4) ........ Aspicerinae: *Aspiceria* Dahlbom
   – Dorsal surface of scutellum with a distinct plate with the central pit (Plate 3); posterior margin of scutellum rounded (Plate 3) ...................................................................... Eucoilinae, 3

3 Anterior margin of clypeus and malar space with three distinct projections (Plates 5-6)
   – Anterior margin of clypeus and malar space smooth and rounded, no projections present (Plate 7) ................................................................................................. 4

4 Projection off anterior margin of clypeus distinctly quadrate anteriorly, spade shaped (CP – Plate 5) ................................................................................................. *Tobiasiana* Kovalev
   – Projection off anterior margin of clypeus conical, not spade shaped (CP - Plate 6)........ 

5 Notauli present (Plate 3) .................................................................................... *Gronotoma* Förster
   – Notauli absent (Plates 9-10) .................................................................................. 6

6 Lateral fovea of pronotal plate closed (Plate 9) .................................................... *Rhoptromeris* Förster
   – Lateral fovea of pronotal plate open (Plate 10) ......................................................... 7

7 Distal margin of forewing distinctly bilobed (Plate 8) .................................. *Kleidotoma* Westwood
   – Distal margin of forewing rounded, not bilobed (Plate 2) ........................................ 8

8 Anterior margin of metasoma completely lacking setae (Plate 11) ... *Cothonaspis* Hartig
   – Anterior margin of metasoma with a ring of setae (Plate 12) .................................... 9

9 Ring of setae at base of metasoma incomplete, broken dorsally ........... *Leptopilina* Förster
   – Ring of setae at base of metasoma complete around the entire base (Plate 12) ........ 10

10 Dorsal surface of scutellum distinctly striate anteriorly (Plate 13) ........... *Hexacola* Förster
   – Dorsal surface of scutellum rugulose over entire surface (Plate 14) ....... *Ganaspis* Förster

Subfamily *Aspicerinae* Dalla Torre & Kieffer, 1910

Genus *Aspicera* Dahlbom, 1842
Species of *Aspicera* are the largest of cynipoids recorded from the UAE, frequently reaching over 3mm in length. One species is recorded from the UAE; the genus is presently being revised (Ros-Farre & Pujade Villar, pers. comm.), so no species determination is made at the present. Species of Aspicerinae are purported to be koinobiont endoparasitoids of Syrphidae (Ronquist, 1999; Buffington et al., 2007). The only other aspicerine recorded from the Arabian Peninsula is *Anacharoides striaticeps* Cameron, which has been recorded from Yemen (Buffington & van Noort, in press).
Aspicera spec. Plates 4, 15–16

Distribution (of the genus): Holarctic region.

Subfamily Eucoilinae Thompson, 1862

Genus Cothonaspis Hartig, 1840
Nordlander (1976) clarified the taxonomic history and morphology of this genus. The only hints to the biology of Cothonaspis species is a loose association with Sepsidae and cow manure reported by Nordlander (1976). I have swept and pan-trapped species of Cothonaspis in cow pastures in California. Two species of Sepsidae have been reported from the UAE (Stuke, 2008).

Quinlan’s (1986) treatment of this genus in Africa is sound; the only species I was able to determine from the UAE was Cothonaspis ealis Quinlan.

Cothonaspis ealis Quinlan, 1986. Plate 17

Distribution: Sub-Saharan Africa. New to the UAE.

Genus Ganaspis Förster, 1869
Ganaspis is one of the more problematic genera of Eucoilinae and is in desperate need of revision. As a consequence, I have hesitated to name the species from the UAE. Two distinct morphospecies were recorded, one of which looks much like Ganaspis mundata (Hartig). Neither species keys when using Quinlan (1986). Additionally problematic is how easily species of this genus are moved around the world by human activity. It is very likely that the two species I have examined are not endemic to the Arabian Peninsula. Species of Ganaspis have been reared from Drosophilidae (Nordlander, 1980, 1982; Vet & Bakker, 1985; Carton et al., 1986).

Ganaspis cf. mundata Förster, 1868 Plates 10, 18
Specimens examined: Fujairah, 3♂, 5♀, 28.ii–1.iv.2006, LT.
Distribution (of G. mundata): Cosmopolitan. New to the UAE.

Ganaspis spec. Plates 2, 14, 19

Distribution (of the genus): Cosmopolitan.

Genus Gronotoma Förster, 1869
Species of Gronotoma are very distinctive, with all possessing well-developed notaulices, relatively large scutellar plates (Plate 3), and lacking any setation around the anterior end of the metasoma. Species of Gronotoma are strictly parasitoids of Agromyzidae (Buffington 2002). Quinlan (1986) described several new species of Gronotoma, reflecting what appears
to be a recent radiation of the group in Africa. One of these species, *G. nitida* Quinlan, is common throughout Africa, the Middle East, and Southeast Asia (Buffington, pers. obsv.). Two species are recorded from the UAE.

**Gronotoma lana** Quinlan, 1986  
Distribution: Sub-Saharan Africa. New to the UAE.

**Gronotoma marcellus** Quinlan, 1986  
Specimens examined: Sharjah Desert Park, 1♀, 29.iii–6.iv.2005, LT.  
Distribution: Sub-Saharan Africa and Madagascar. New to the UAE.

Genus *Hexacola* Förster, 1869  
As with *Ganaspis*, *Hexacola* is in need of revision. Species are also easily moved with human activity (Beardsley, 1989), and one species, *H. neoscatellae* Beardsley, 1989, can be an extremely beneficial natural enemy of shore flies (Ephydridae) in greenhouses (Beardsley, 1989; Buffington, pers. obs.). The two species recorded from the UAE, *H. quisnana* Quinlan and *H. septemius* Quinlan, were both diagnosed entirely on antennal morphology. Nordlander (1976) demonstrated that antennal morphology can be quite misleading in eucoiline taxonomy, and hence, these species may ultimately be synonymized when the genus is revised.
**Hexacola quismana** Quinlan, 1986
Specimens examined: Sharjah Desert Park, 3♀, 29.iii–6.iv.2005, LT.
Distribution: Sub-Saharan Africa. New to the UAE.

**Hexacola septemius** Quinlan, 1986
Distribution: Sub-Saharan Africa. New to the UAE.

Genus *Kleidotoma* Westwood, 1833
Species of *Kleidotoma* are united by several derived features, most notably, a bilobed distal margin of the forewing (Plate 8). The only other cynipoid taxa that share this feature are the emarginine figitids. Two species are recorded from the UAE, and both are species that have been described from Africa. As in the case of *Hexacola*, these species belong to a large genus that is in need of revision. Further, these species are based entirely on antennal morphology. They may prove to be synonyms following a generic revision of *Kleidotoma*. Species of *Kleidotoma* have been associated with cow dung and carrion (Buffington, pers. obs.) and algal mats (Beardsley, 1993).

**Kleidotoma favus** Quinlan, 1986.
Distribution: Sub-Saharan Africa. New to the UAE.

**Kleidotoma cf. erebus** Quinlan, 1986
Distribution: Sub-Saharan Africa. New to the UAE.

Genus *Leptopilina* Förster, 1869
Nordlander (1980) revised the European species of *Leptopilina* and Quinlan (1988) revised the Afrotropical species and described nine new species. This genus is distinct in that the setose ring at the base of the metasoma is dorsally interrupted, such that there are only setae on the lateral aspects of the metasoma. Two species are recorded from the UAE. Species of *Leptopilina* are parasitoids of Drosophilidae (Nordlander, 1980).

**Leptopilina boulardi** (Barbotin, Carton & Kelner-Pillault, 1979)
Distribution: Holarctic, probably worldwide. New to the UAE.
Leptopilina victoriae Nordlander, 1980.


Genus Nordlanderia Quinlan, 1986

Species in this genus are closely related to Gronotoma and are known to parasitize Agromyzidae (Buffington & LaSalle, unpublished data). As in the case of Gronotoma nitida, Nordlanderia plowa Quinlan can be found throughout India and Southeast Asia (Buffington, pers. obsv.). There are undoubtedly several undescribed species in this genus. Three species are recorded from the UAE, one described as new to science. Based on the specimens sent for the present research, Nordlanderia plowa is one of the most frequently encountered species of Figitidae in the UAE.

Kovalev & Runeva (2004) considered Nordlanderia a junior synonym of Tobiasiana, recognizing Nordlanderia as a subgenus of Tobiasiana. The justification for this move is unclear, and until further phylogenetic data can be obtained, I prefer Nordlanderia to remain a valid genus. Species of these two genera can be recognized based on the clypear and metapleural morphology. The following species of Nordlanderia are hereby removed from synonymy with Tobiasiana: Nordlanderia acis Quinlan, 1986, revised status; N. pallida Quinlan, 1986, revised status; N. plowa Quinlan, 1986, revised status. Two additional species, Tobiasiana merickeli (Miller, 1989) and T. navajoe (Miller, 1989), were considered nomina dubia by Buffington (2004) since the holotypes for both species have been lost; hence, both species are removed from synonymy with Tobiasiana and returned to Nordlanderia: N. merickeli Miller, 1989, revised status; N. navajoe Miller, 1989, revised status.

Nordlanderia plowa Quinlan, 1986


Distribution: Sub-Saharan Africa. New to the UAE.

Nordlanderia pallida Quinlan, 1986


Distribution: Sub-Saharan Africa (Quinlan, 1986) and Oriental Region (Buffington, pers. obs.). New to the UAE.
**Nordlanderia phaedrae** Buffington nov. spec. Plates 6, 30–31


Diagnosis: Differs from all other species of *Nordlanderia* by the distinctly enlarged scutellar plate. In dorsal view, nearly the entire (90%) dorsal surface of the scutellum is obscured by the rim of the scutellar plate in *N. phaedrae*; in other species of *Nordlanderia*, a smaller percentage (<50%) of the dorsal surface of the scutellum is obscured.

Description: Adult length: 0.88–1.22 mm (n=8). Head and mesosoma black; metasoma dark brownish–black; legs pale brown medially, blending to yellow distally.

Head. Nearly glabrous with scattered setae along lower face, inner orbits of compound eyes, clypeus and gena; ocellar hair patch absent. Ventral 1/4 of lower face with admedial clypeal furrows converging towards the clypeus; convergence point extending to distinct conical protuberance. Orbital furrows absent. Malar sulcus simple. Malar space weakly strigose, glabrous; ventral margin with distinct conical protuberance. Genal carina absent. Antennae. Female: 13 segments, moniliform, semi-clavate; flagellomeres 1–10 sub-equal in length; subapical flagellomere equal to 1.4× the length of apical flagellomere; rhinaria present on flagellomeres 3–11. Male: 15 segments, moniliform; rhinaria present on flagellomeres 1–13; flagellomeres 2–13 sub-equal in length. Flagellomere 1 modified, 1.5× longer than flagellomere 2, curved outwardly, excavated laterally.

Pronotum. Pronotal plate narrow; dorsal margin with a few scattered setae; dorsal margin rounded; pronotal lateral fovea open. Lateral pronotal carina present. Lateral portion of pronotum (posterior to lateral carina) smooth and glabrous. Pronotal impression absent. Mesoscutum. Smooth and nearly glabrous, with only a few scattered setae. Notaulus reduced, marked with setae, converging weakly towards each other near the posterior margin of mesoscutum. Parascutal impression complete. Medial mesoscutal keel, parapsidal ridges absent. Mesopleuron. Upper and lower part of mesopleuron smooth and glabrous. Dorsal and ventral margins of mesopleural triangle distinct (at least posteriorly). Mesopleural carina simple. Lower part of mesopleuron bordered by a prominent precoxal carina; surcoxa depression prominent, rugose. Scutellum. Scutellar plate small; midpit placed towards posterior of plate; rim of plate translucent; tubercles absent along dorsal surface of plate. Dorsal surface of scutellum not obscured by rim of scutellar plate; scutellum smooth, glabrous; rounded laterally and posteriorly; margined laterally and posteriorly; laterodorsal and posterior projections of the scutellum absent. Lateral bars as long as wide; ventral lobe absent. Scutellar fovea semi-circular, smooth and deep. Metapleural-propodeal complex. Entire metapectus glabrous, posterior 1/3 with some scattered setae. Spiracular groove with a well-defined dorsal margin, ventral margin reduced. Posterior margin of metapectus ridged. Metapleural ridge reduced to absent; submetapleural ridge absent. Anterior impressions of metaplemeron and metapisternum reduced. Propodeum with few, scattered, slender setae, revealing all propodeal sculpture. Lateral propodeal carinae parallel, slightly bowed at fusion point with auxiliary propodeal carinae; auxiliary propodeal carinae reduced; area between lateral propodeal carinae bare. Nucha glabrous, rugose. Wings. Hyaline; setose. R1 complete, pigmented along anterior margin; marginal cell slightly longer than deep. Apical fringe present, short. Legs. Fore and mid coxa sub-equal in size, hind coxa about twice the size of either fore or mid coxa. Fore coxa variously setose; mid and hind coxa with lateral and posterior dorsoventral setal band. Femora and tibia variously setose, sometimes rather sparsely; tarsomeres with dense appressed setae. Length of hind tarsomere 1 equal to 0.50× to 0.75× the combined length of remaining tarsomeres.
Metasoma. Female: Sub equal in size to mesosoma. Crenulate ring present, usually obscured by syntergum; when visible, with prominent lateral carinae and glabrous. Base of syntergum nearly glabrous, with a few scattered hairs ventrally; remainder of metasoma glabrous. Micropunctures present on posterior 1/3 of syntergum and on remaining terga. Terga posterior to syntergum directed ventrally, resulting in a 90 degree angle between syntergum and remaining terga. Male: As in the female.

Biology: Unknown


Genus *Rhoptromeris* Förster, 1869

This genus was revised by Nordlander (1978); Quinlan (1986) described 30 new species from the Afrotropical region. *Rhoptromeris* superficially resembles *Leptopilina*, but it is readily distinguished from that genus by the uniquely ‘closed’ lateral fovea of the pronotal plate (Plate 9). Only one species is recorded from the UAE. Species of *Rhoptromeris* have been reported to be parasitoids of Chloropidae (Nordlander, 1978).

*Rhoptromeris persius* Quinlan, 1986


Distribution: Sub-Saharan Africa. New to the UAE.

Genus *Tobiasiana* Kovalev, 1979

This rather unusual genus was described to accommodate *Tobiasiana arida* Kovalev, 1979, described from the southwestern regions of the former Soviet Union. This genus is putatively closely related to *Nordlanderia* and *Microstilba* Förster, 1869. in that the notauli are present but greatly reduced, and the anterior margins of both the clypeus and malar space are armed with distinct protuberances. *Tobiasiana* is distinguished from these genera by the clypeal protuberance being spade shaped, as in a shovel. Further, the genus can be further separated from *Nordlanderia* by the reduced spiracular groove on the metapleuron (distinct in *Nordlanderia*). One species, new to science, is here recorded from the UAE and Israel.

*Tobiasiana theremini* Buffington nov. spec.


Diagnosis: Readily distinguished from *Tobiasiana arida* by having a distinctly smooth dorsal surface of the scutellum (*T. arida* has a rugulose dorsal surface of the scutellum).

Description: Adult length 1.25 mm (n=2). Head and mesosoma dark brown; metasoma reddish-brown; legs pale brown medially, blending to yellow distally. Head. Nearly glabrous with scattered setae along lower face, inner orbits of compound eyes, clypeus, and gena; ocellar hair patch absent. Ventral 1/4 of lower face with admedial clypeal furrows converging towards the clypeus; convergence point extending to distinct spade-shaped protuberance. Orbital furrows absent. Malar sulcus simple. Malar space smooth, glabrous; ventral margin with distinct conical protuberance. Genal carina absent. Antennae. Female: 13 segments, moniliform, semi clavate; flagellomeres 1–10 sub equal in length;
subapical flagellomere equal to $1.4 \times$ the length of apical flagellomere; rhinaria present on flagellomeres 3–11. Male: 15 segments, moniliform; rhinaria present on flagellomeres 1–13; flagellomeres 2–13 sub equal in length. Flagellomere 1 modified, slightly longer than flagellomere 2, curved outwardly, excavated laterally.

Pronotum. Pronotal plate narrow; dorsal margin with a few scattered setae; dorsal margin rounded; pronotal fovea open. Lateral pronotal carina present, at least ventrally. Lateral portion of pronotum (posterior to lateral carina) smooth and glabrous. Pronotal impression absent. Mesoscutum. Smooth and glabrous, with a few scattered setae. Notaulus reduced, marked with setae, converging sharply towards each other near the posterior margin of mesoscutum. Parascutal impression complete. Mesoscutal keel, parapsidal signum absent. Mesopectus. Upper and lower part of mesopleuron smooth and glabrous. Dorsal and ventral margins of mesopleural triangle distinct (at least posteriorly). Mesopleural carina simple. Lower part of mesopleuron bordered by a prominent precoxal carina; surcoxal depression prominent, rugose. Scutellum. Scutellar plate large; midpit placed in center of plate; rim of plate translucent; tubercles present along dorsal surface of plate. Dorsal surface of scutellum obscured by rim of scutellar plate; scutellum rugose; rounded laterally and posteriorly; margined laterally and posteriorly; laterodorsal and posterior projections of the scutellum absent. Lateral bars as long as wide; ventral lobe absent. Scutellar fovea semi circular, smooth and deep. Metapectal-propodeal complex. Anterior 2/3 of metapectus glabrous, posterior 1/3 glabrous to setose; setae, when present, long but not dense. Spiracular groove with a well-defined dorsal margin, ventral margin reduced. Posterior margin of metapectus ridged.
Plates 33-34. *Tobiasiana theremini* Buffington nov. spec. 33: Habitus, laterally; 34: Lateral view of head and mesosoma.
Metapleural ridge reduced to absent, often lined with setae; submetapleural ridge absent. Anterior impressions of metepimeron and metepisternum reduced. Propodeum covered with thin, long setae revealing much of the propodeal sculpturing. Lateral propodeal carinae semi parallel, bowed at fusion point with auxiliary propodeal carinae; auxiliary propodeal carinae distinct; area between lateral propodeal carinae bare. Nucha glabrous, rugose. Wings. Hyaline; setose. R1 complete, pigmented along anterior margin; marginal cell slightly longer than deep. Apical fringe present, short. Legs. Fore and mid coxa sub equal in size, hind coxa about twice the size of either fore or mid coxa. Fore coxa variously setose; mid and hind coxa with lateral and posterior dorsoventral setal band. Femora and tibia variously setose, sometimes rather sparsely; tarsomeres with dense appressed setae. Length of hind tarsomere 1 equal to 0.50 × to 0.75 × the combined length of remaining tarsomeres.

Metasoma. Female: Sub equal in size to mesosoma. Crenulate ring present, usually obscured by syntergum; when visible, glabrous with prominent lateral carinae. Base of syntergum nearly glabrous, with only a few scattered hairs ventrally; remainder of metasoma glabrous. Micropunctures present on posterior 1/3 of syntergum and on remaining terga. Terga posterior to syntergum directed ventrally, resulting in a 90 degree angle between syntergum and remaining terga. Male: as in the female.

Biology: Unknown.

Etymology: Named in honour of the Russian physicist and audio engineer Leon Theremin. His research in the 1920s led to the first truly electronic musical instrument known as the theremin. The instrument was played by interrupting electromagnetic fields produced between two antennas (Glinksy, 2000).

Subfamily Pycnostigminae Cameron, 1905

Genus Trjapitziniola Kovalev, 1995

All species of pycnostigmines are united by the possession of a pseudopterostigma in the forewing (Ronquist, 1999; Buffington & van Noort, 2007) (Plate 1). This striking group of wasps has their centre of species diversity in the Western Cape Region of South Africa, though three species can be found north of the Saharan Desert: Tylosema nigerrimum Kieffer, 1905 (from Algeria: Buffington & van Noort, 2007, and Jordan: M. Forshage, pers. comm.), and two species of Trjapitziniola: T. popovi (Belezin, 1951) from Armenia and T. vanharteni from the UAE (Buffington & van Noort, 2007). The biology of pycnostigmines is unknown.

Trjapitziniola vanharteni Buffington & van Noort, 2007 Plates 35–36

Specimens examined: Wadi Maidaq, 1♀ (holotype), 29.iii–10.iv.2006, WT.

Distribution: Currently only known from the UAE. Likely occurs near the coast of the Arabian Peninsula, and into southeastern Turkey.

ACKNOWLEDGEMENTS

I thank Terry Nuhn (Systematic Entomology Lab (SEL), USDA/ARS, Washington DC) for assistance in mounting and labelling the specimens used in this research, and Simon van Noort (IZIKO South African Museum, Cape Town) for allowing the use of the images of Trjapitziniola vanharteni. Oleg Kovalev (Russian Academy of Science, Moskow) and Steven Heydon (Bohart Entomology Museum, UC Davis, California) generously loaned specimens for my examination. Ronald Ochoa and Thomas Henry (Systematic Entomology Lab (SEL), USDA, ARS, Washington DC) and George Melika (Pest Diagnostic Laboratory, Plant
Protection & Soil Conservation Directorate of County Vas, Hungary) reviewed and helped to improve this manuscript. Finally, I thank Antonius van Harten for help preparing this manuscript and for collecting and sorting the wonderful specimens used herein.

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