

A new species of the genus *Gondwanoscurus*, and two new records of non-biting moth flies (Diptera: Psychodidae: Psychodinae) from Socotra Island

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Abstract. *Gondwanoscurus socotrensis* sp. nov. is described and figured. Specimens were collected on Socotra Island, Yemen. The genus *Gondwanoscurus* Ježek, 2002, with seven species (two from Peninsular Malaysia, two from Thailand and three from Sabah, North Borneo), was previously recorded only from the Oriental Region. In addition, two common species of moth flies are newly recorded for Socotra Island: *Tinearia acanthostyla* (Tokunaga, 1957) and *T. alternata* (Say, 1824).

Key words. Paramormiini, Psychodini, *Gondwanoscurus*, *Tinearia*, new species, taxonomy, new records, Yemen, Socotra

Introduction

In general, non-phlebotomine Psychodidae from the Afrotropical Region remain very poorly known. DUCKHOUSE & LEWIS (1980) catalogued 100 species, and within the past 25 years, 45 species were added (JEŽEK 2004). KVIFTE (2012) produced a catalogue of Afrotropical Psychodidae (exclusive of Phlebotominae) with 174 species. JEŽEK (2002) described the genus *Gondwanoscurus* from the Oriental Region including *G. malaysiensis* Ježek, 2002 and redescribed the newly combined type species of the genus, *G. mcclurei* (Quate, 1962) from Malaysia (QUATE 1962). CURLER (2009) recognized the proposed genus and included additional new species: two from Thailand – *G. cruciferus* Curler, 2009 and *G. ornithostylus* Curler, 2009. He also transferred three species from the genus *Telmatoscopus* Eaton, 1904 to *Gondwanoscurus*: *G. ejundicus* (Quate, 1962), *G. eximius* (Quate, 1962) and *G. praecipuus* (Quate, 1962) – all from northern Borneo (Malaysia, Sabah). His revision of the genus *Gondwanoscurus* includes keys to males of the seven known species and females of four species.

Here we describe *Gondwanoscurus socotrensis* sp. nov. as the first known representative of this genus from the Afrotropical Region. In addition we add two new records of Psychodidae for Socotra Island.

Material and methods

Socotra Island is treated as part of the Afrotropical Region here following the geographical delimitation of the zoogeographical regions used in the BioSystematic Database of World Diptera and the Afrotropical Diptera Catalogue (PAPE & THOMPSON 2010, DUCKHOUSE & LEWIS 1980). Adults of *Gondwanoscurus* were collected by J. Hájek and J. Bezděk during 12.–13. xi.2010 using a non-automatic light trap and preserved in 70% EtOH. Specimens of *Tinearia* Schellenberg, 1803 were obtained by individual collecting with hands and an aspirator (J. Hájek and J. Bezděk; A. van Harten). Captured moth flies were mounted on slides (Canada balsam). The material is deposited in the National Museum, Natural History Museum, Department of Entomology, Prague, Czech Republic (NMPC). Slides were numbered in the NMPC with two separate series of numbers: Inv. No. = Inventory Slide Number of the family Psychodidae and Cat. No. = Catalogue Number of the slide. The catalogue numbers are used for the type material and historical specimens deposited in the NMPC Diptera collection. Microphotographs were captured with a digital camera mounted on a Nikon TS-100F trinocular eclipse microscope and printed. Outlines of pertinent characters were integrated into calligraphic pen pictures with Indian ink. The photographs were combined from multiple layers using Helicon Focus Pro 5.2. The drawings and photographs were edited in CorelDRAW 12 and Corel PHOTO-PAINT 12 graphic software. Wing indices are based on distances between the following points: A = tip of R_5 , B = radial fork, C = medial fork, D = tip of CuA_2 ; the distances are indicated by both extreme points. Maximum wing length is approximately equal to the distance from the line connecting the bases of the basal costal node and neala to the wing apex. Ratios of the lengths of the femur, tibia and first tarsomere, and one of the fore, middle and hind legs are indicated by P_1 , P_2 and P_3 , respectively. Terminology used here follows STARK et al. (1999), JEŽEK et al. (2011) and OMELKOVÁ & JEŽEK (2012a,b).

Taxonomy

Gondwanoscurus Ježek, 2002

Telmatoscopus auct., partim. (nec Eaton, 1904); QUATE (1962: 227); DUCKHOUSE (1973: 232).

Gondwanoscurus Ježek, 2002: 6 (type species: *Telmatoscopus mcclurei* Quate, 1962); CURLER (2009: 21); CURLER & MOULTON (2012).

The genus *Gondwanoscurus* was diagnosed by JEŽEK (2002) and consequently extended by CURLER (2009). The phylogenetic relationships in the tribe Paramormiini are far from resolved, even the new molecular studies do not provide any final resolution (see Discussion). Consequently, current generic relationships are also rather artificial and far from reality. The sister genus of *Gondwanoscurus* is thus unknown, however we provide comparison of important diagnostic characters with four other of many potentially related genera (Tab. 1).

Table 1. Intergeneric comparison of five selected genera of subtribe Paramormiina with pertinent diagnostic characters (males).

	<i>Perakomyia</i> Ježek, 2010	<i>Gondwanoscopus</i> Ježek, 2002	<i>Neotelmatoscopus</i> Tomoir, 1933	<i>Nototelmatoscopus</i> Satchell, 1953	<i>Eutelmatoscopus</i> Satchell, 1953
Type species	<i>Perakomyia sijneri</i> Ježek, 2010	<i>Telmatoscopus meclurei</i> Quate, 1962	<i>Telmatoscopus horai</i> Tomoir, 1933	<i>Telmatoscopus obscurus</i> Satchell, 1953	<i>Telmatoscopus spiratifer</i> Tomoir, 1953
number of rows of setae alveoli above dorsal margins of eyes	two	one	one	one	one or two very closely touched
eye bridge	not contiguous	contiguous	contiguous	not contiguous	not contiguous
neck of the second flagellomere	short (as long as neck diameter)	long (as long as two neck diameters)	short (as long as neck diameter or one half diameter)	short (as long as neck diameter)	long (as long as two neck diameters) or very short, inconspicuous
ascoids of flagellomeres	needle-shaped	threadlike, multi-branched	two to five branched	needle-shaped	branch simple, sinuate
insertions of ascoids	paired	multiple, arranged in a ring	multiple, arranged in a ring	multiple, arranged in a ring	paired
flagellar nodes	slightly asymmetrical	conspicuously eccentrically bulbous (a great width of one side)	symmetrical	slightly asymmetrical	eccentrically bulbous
subcostal and cubital area of wing	enlarged with a costal cleft behind; not broad	enlarged without a costal cleft behind; very broad	only sometimes broad and enlarged; without a costal cleft behind	enlarged without a costal cleft behind; broad or very broad	not enlarged; costal cleft missing
placement of radial fork in relation to the apex of CuA_1	CuA_2 basal to radial fork	radial fork basal to CuA_2	CuA_2 basal to radial fork or in the same level	radial fork basal to CuA_2	CuA_2 basal to radial fork
relative position of medial fork to the apex of CuA_1	behind a level of the apex of CuA_2	in a level of half of CuA_2	behind or before a level of the apex of CuA_2	in a level of a half or one third of CuA_2	slightly behind or before a level of the apex of CuA_1
gonostylus	simple, gradually tapered from base to apex	modified from simple gonostylus (with swollen parts or basal, medial- or apical bifurcation from main stalk)	simple or bifurcate, shape variable among species	simple, gradually tapered, sometimes with two or three projections on the end	simple, gradually tapered, conspicuously long and thin
surstylus (ratio means proportions of basal width to length)	short (1.3); cone-shaped, straight	short or long (1.4–10), cylindrical, mostly arcuate	short or long (1.2–2–6), sometimes subequal in length to gonopods, conical, straight or arcuate	short (1.1–8–4); arcuate	short or long (1.3–5–6), arcuate
number of retinacula	11–12	7–23	4–18	8–30	3–9

List of the Word species of the genus *Gondwanoscurus*

- G. cruciferus* Curler, 2009 – Thailand
G. ejundicus (Quate, 1962) (*Telmatoscopus*) – Malaysia: Sabah
G. eximius (Quate, 1962) (*Telmatoscopus*) – Malaysia: Sabah
G. malaysiensis Ježek, 2002 – Malaysia & Thailand
G. mcclurei (Quate, 1962) (*Telmatoscopus*) – Malaysia
G. ornithostylus Curler, 2009 – Thailand
G. praecipuus (Quate, 1962) (*Telmatoscopus*) – Malaysia: Sabah
G. socotrensis sp. nov. – Socotra Island, Yemen

Gondwanoscurus socotrensis sp. nov.

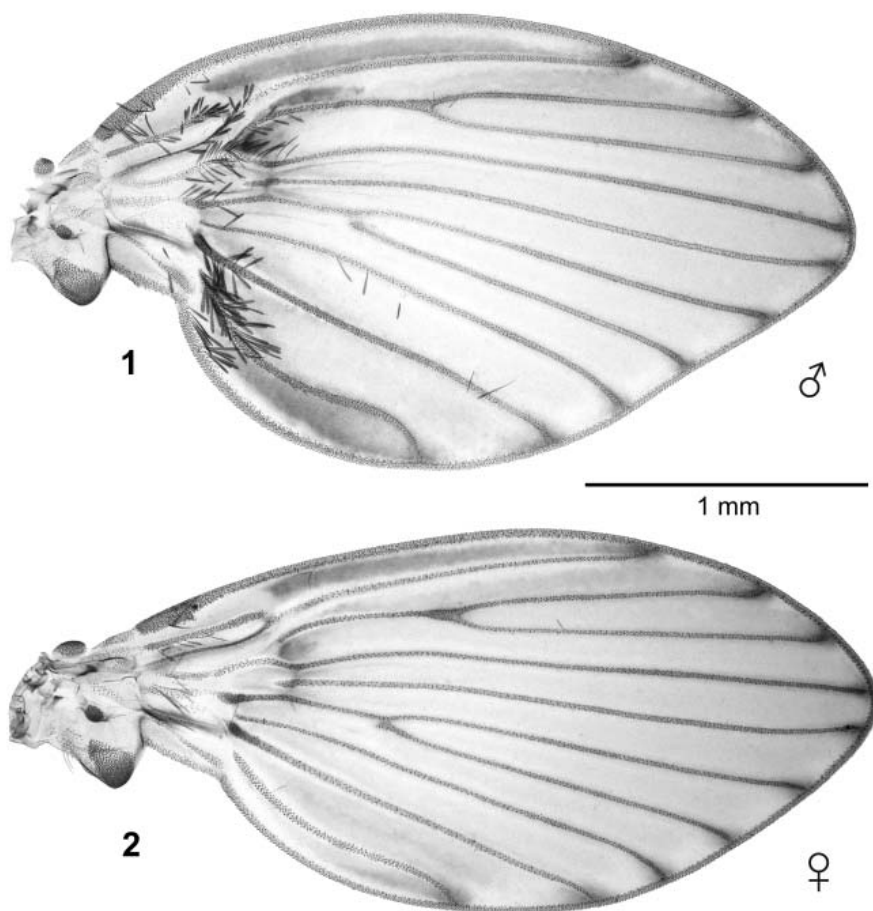
(Figs. 1–33)

Type locality. Yemen, Socotra Island, Al Haghier Mts., Scant Mt., 1450 m a.s.l., 12°34.6'N 54°01.5'E (Fig. 34).

Type material. HOLOTYPE: ♂, Yemen, Socotra Island, Al Haghier Mts., Scant Mt., 1450 m a.s.l., 12°34.6'N 54°01.5'E. 12.–13.xi.2010, at light, J. Hájek and J. Bezděk leg. (NMPC, slide Cat. No. 34568, Inv. No. 19769). PARATYPES: 14 ♂♂ and 13 ♀♀, same data as holotype (NMPC), slides Cat. No. 34569–34595, Inv. No. 19770–19796 (allotype 34583/19784); Al Haghier Mts., wadi Madar, 1180–1230 m a.s.l., 12°33.2'N 54°00.4'E, 12.–14.xi.2010, at light, 3 ♂♂ and 23 ♀♀, J. Hájek and J. Bezděk leg. (NMPC, slides Cat. No. 34596–34621, Inv. No. 19797–19822).

Description. *Male.* Eyes contiguous (Figs. 3, 4), touching for more than three facet diameters, facets hardly hexagonal or inconspicuously globular, eye-bridge of four facet rows, ratio of facet diameter to the width of basis of scape 1 : 3, vertex pyramidal, rounded, vertex ratio (width versus high) 2.4 : 1. Only one row of sockets of side setae above dorsal apices of eyes. Frontoclypeus with oval area of insertions of setulae, setula patch has dorso-ventral cleft. Antenna with 16 antennomeres. Scape cylindrical, 2.4 times as long as pedicel, pedicel almost globular (Fig. 24); flagellomeres 2–13 with long necks, flagellomere 1 amphora-shaped (Fig. 24), flagellar nodes (2–12) conspicuously excentrically bulbous with great width of one side (Figs. 16, 24, 25), last two flagellomeres with conical nodes, apical flagellomere with asymmetrical side protuberance and terminal long digit (Fig. 16). Sensory filaments (ascoids) of flagellomeres multiple, arranged in ring (Fig. 25), threadlike, multibranched (3–6 arms). Length ratios of maxillary palpomeres 1.0 : 2.0 : 1.8 : 2.4, palpomere 4 thinnest, cylindrical, annulate (Fig. 17), scales of maxillary palpomeres maculated (compare as well the scales of wing on Fig. 1, P_1 on Fig. 12, haltere on Fig. 19, surstylus on Fig. 31). Terminal lobes of labium bulbous (Fig. 5), with many sensory setae. Cibarium, labrum and epipharynx as in Fig. 18. Thoracic sclerites and spiraculum as in Figs. 10 and 11.

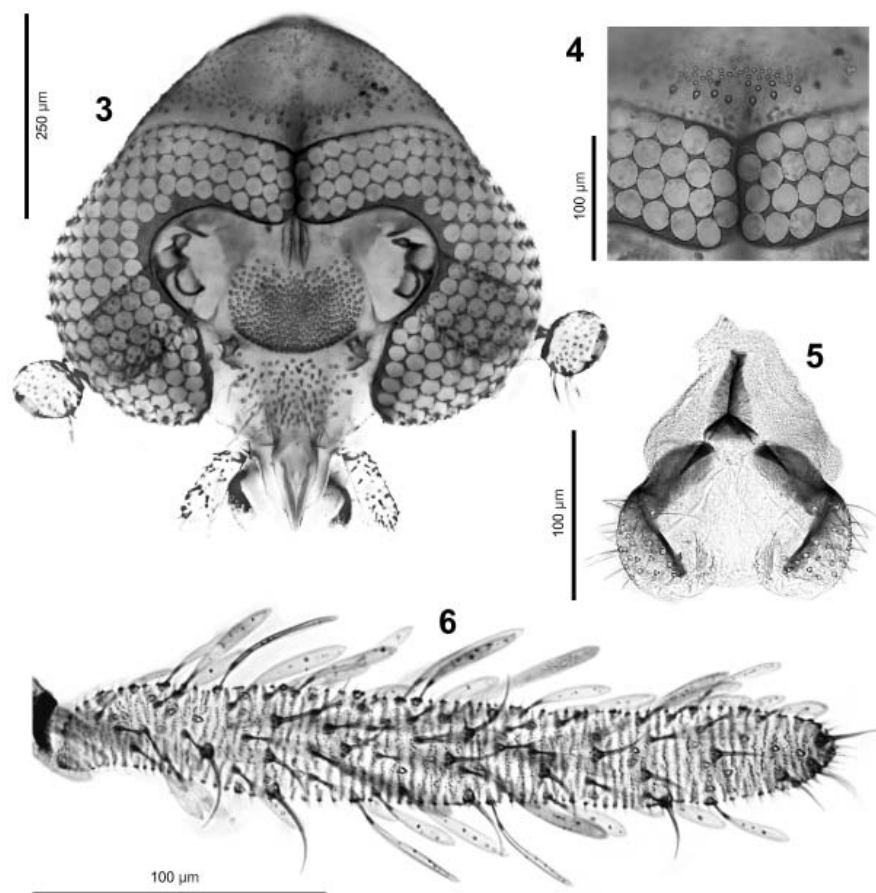
Wings broadly lancet-shaped, 2.9 mm long (holotype), paratypes 2.4–3.0 mm, slightly clouded, rounded at apex, with well developed and enlarged cubital area (Fig. 1), membrane bare, with conspicuous infuscation patches at apices of longitudinal veins, in area between R_1 and C, at basis of R_{2+3} , and between CuA_2 and hind margin of the wing. Radial fork complete, medial one incomplete (very faint connection of M_1 to M_2). Following veins or their parts strengthened: R_{2+3} and R_2 , CuA_1 and CuA_2 , A_1 distad. Some parts of basal cell



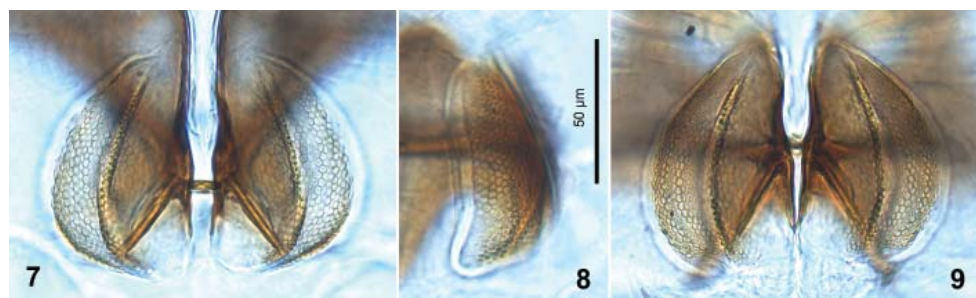
Figs. 1–2. *Gondwanoscurus socotrensis* sp. nov., wing (1 – male; 2 – female).

are more sclerotized. Basal costal wing node distinct, Sc uninterrupted, straight. CuA_1 basally without connection to M_3 and to CuA_2 . R_5 extending distally and reaching wing margin slightly below wing apex. Veins r-r, r-m and m-m not developed. Wing 1.8 times as long as wide. Haltere 2.7 times as long as wide (Fig. 19). Length ratios of femora, tibiae and first tarsomeres: $P_1 = 1.7 : 2.0 : 1.0$; $P_2 = 1.9 : 2.5 : 1.2$; $P_3 = 2.0 : 2.9 : 1.2$. Fore claws as in Fig. 27.

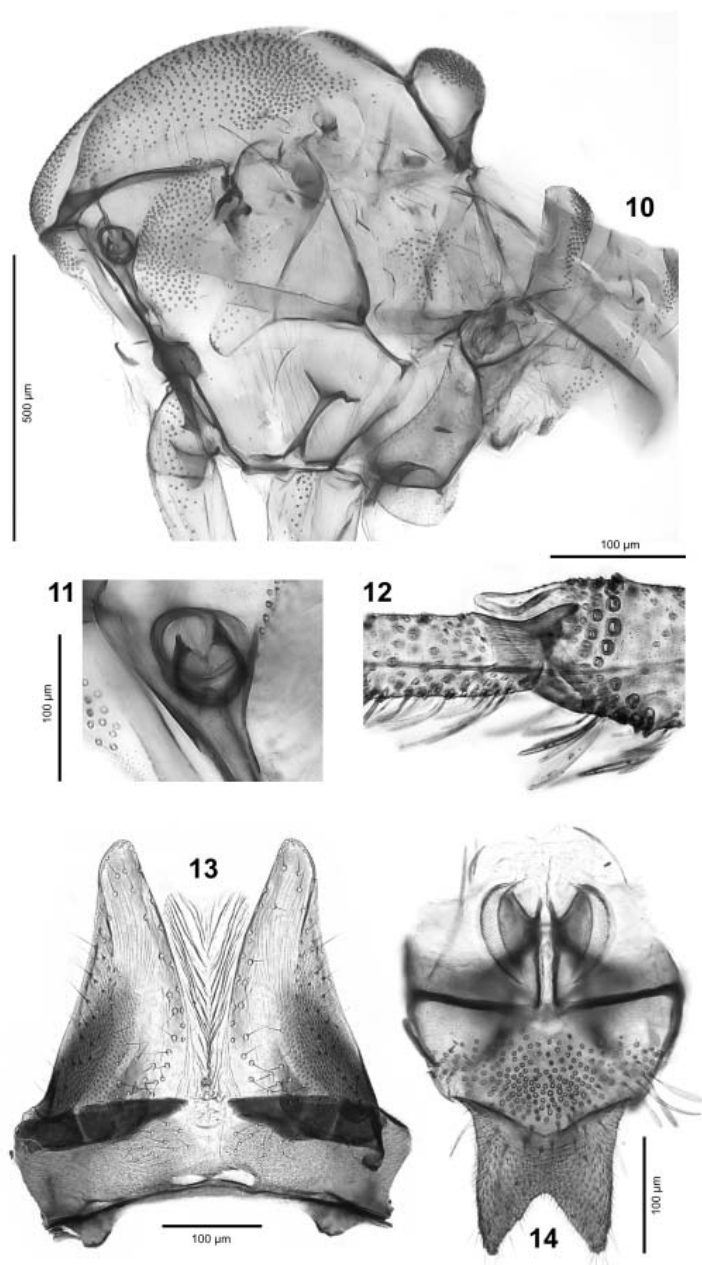
Basal apodeme of male genitalia straight and narrow in dorsal view (Fig. 28), bent in lateral and diagonal view (proximal end rounded – Figs. 20, 29). Aedeagus simple with internal structures of characteristic shape (Figs. 20, 28, 29). Gonocoxites long and thin,



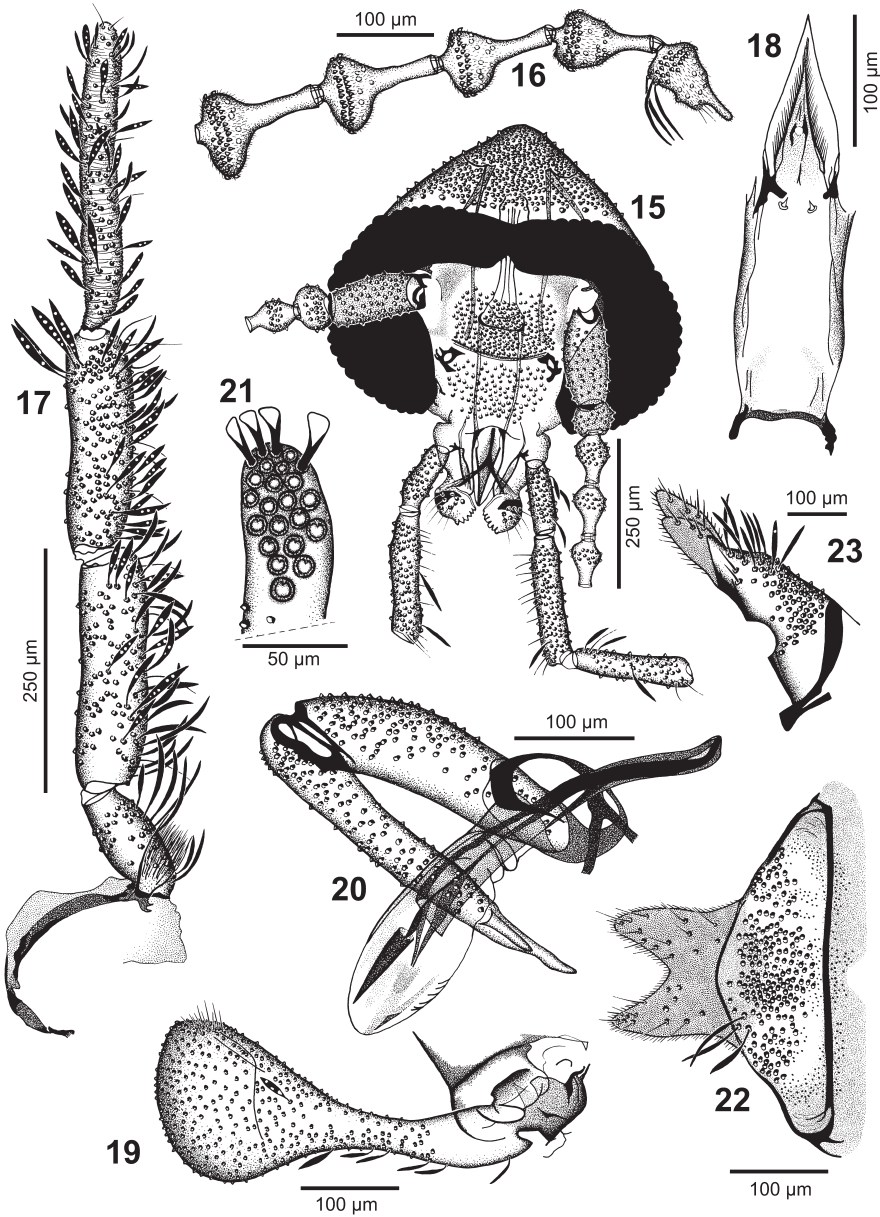
Figs. 3–6. *Gondwanoscurus socotrensis* sp. nov. 3 – head, male; 4 – frontal suture and facets, male; 5 – terminal lobes of labium, male; 6 – terminal (fourth) palpomere, female.



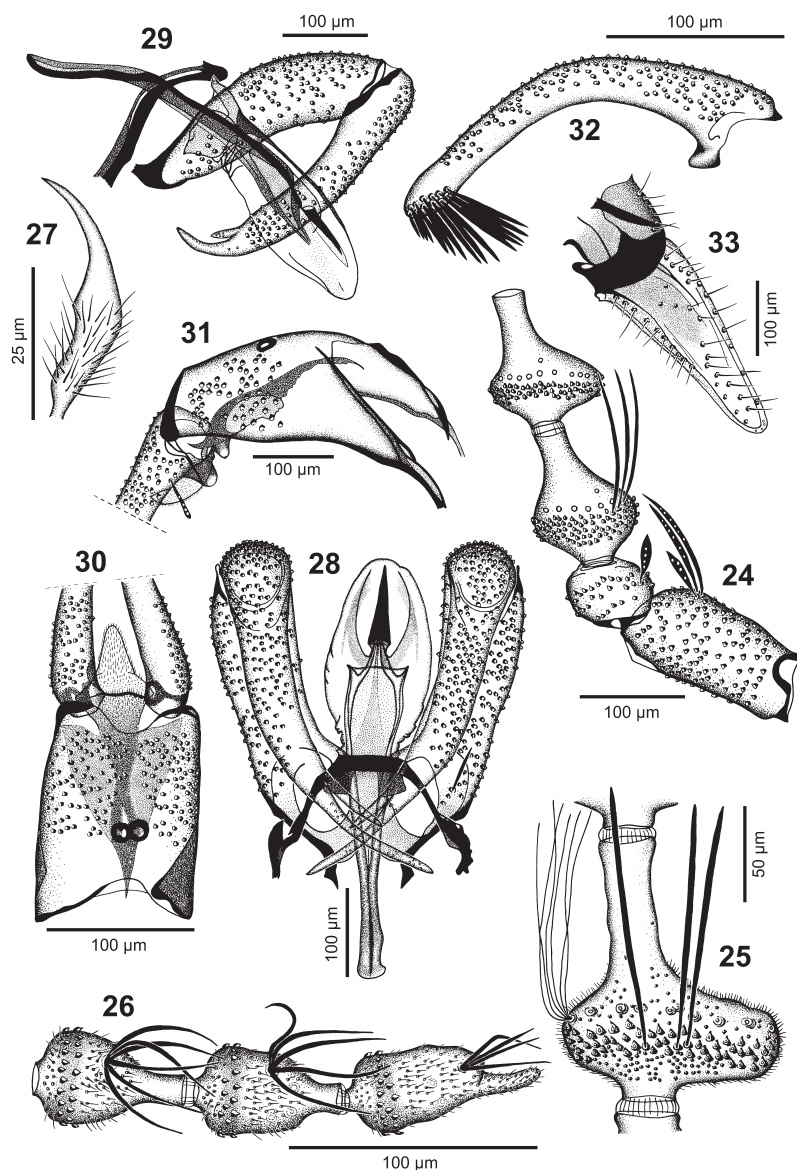
Figs. 7–9. *Gondwanoscurus socotrensis* sp. nov., female. 7 – genital chamber ventrally; 8 – same, laterally; 9 – same, anteriorly.



Figs. 10–14. *Gondwanoscurus socotrensis* sp. nov. 10 – lateral view of thoracic sclerites, male; 11 – thoracic spiracle, male; 12 – connection of tibia and first tarsomere of P_1 with a botka laterally, male; 13 – ovipositor ventrally (from a slide), female; 14 – subgenital plate and genital chamber ventrally, female.



Figs. 15–23. *Gondwanoscurus socotrensis* sp. nov. 15 – head, female; 16 – apical antennomeres, male; 17 – maxilla and palpus maxillaris, male; 18 – cibarium, labrum and epipharynx, male; 19 – haltere, male; 20 – aedeagus and gonopod diagonally, male; 21 – end of surstylus ventrally (some retinaculi omitted), male; 22 – subgenital plate (from a slide, pressed), female; 23 – same laterally, female.



Figs. 24–33. *Gondwanoscurus socotrensis* sp. nov. 24 – basal antennomeres, male; 25 – sensory area of a middle antennomere in detail, male; 26 – apical antennomeres (some ascoids on the empty sockets intentionally not figured), female; 27 – claw of P₁, male; 28 – aedeagus and gonopods dorsally, male; 29 – aedeagus and gonopod laterally, male; 30 – epandrium and surstyli (ends with retinacula omitted), male; 31 – same laterally, male; 32 – surstylus laterally, male; 33 – cercus laterally, female.

almost straight, gonostyli elongate, 1.2 times as long as gonocoxites, gradually tapering to apex, little bent, bifurcate, slightly tapered, digitiform, subequal in length (Figs. 20, 28, 29). Epandrium with two irregularly formed fields of caudal insertions of setulae on both sides, hardly connected caudally, and two central circular openings (apertures) (Figs. 30, 31). Caudal epandrial notch deep. Sclerotized remainders of 10th segment inside of epandrium developed and safely indicated, triangular from dorsal view (Fig. 30). Hypandrium little widened medially (Figs. 20, 28, 29). Epiproct linear, fold-shaped, hardly visible, hypoproct longly triangular, rounded, both parts with microtrichia (Fig. 30). Surstylus cylindrical, 3.7 times as long as its basal diameter (with a small protuberance), bent from lateral view, straight from dorsal one (Figs. 30, 32), 23 retinacula subapically, not frazzled (Figs. 21, 32).

Female. Eyes contiguous (Fig. 15), vertex pyramidal, vertex ratio (width and high) 2.6 : 1, frontoclypeal area of insertions of setulae as in male, however, near tentorial pits expanding to small obtuse corners. Sensory filaments (ascoids) of flagellomeres multiple (Fig. 26). Palpomere 4 annulate, scales maculate (Fig. 6).

Wings narrowly lancet-shaped, 3.0 mm long (allotype 2.5 mm, paratypes 2.2–3.0 mm), slightly clouded, rounded at apex, cubital area not enlarged (Fig. 2), membrane bare, with conspicuous infuscation patches at apices of longitudinal veins, in area between R_1 and C, at basis of R_{2+3} . Radial fork complete, longly triangular, medial one with almost very imperceptible wide connection of M_1 to M_2 . Following veins or their parts strengthened: Sc, CuA_1 and CuA_2 , A_1 distad. Some parts of basal cell are more sclerotized. Basal costal wing node distinct, Sc uninterrupted, straight. CuA_1 basally without connection to M_3 and to CuA_2 . R_5 extending distally and reaching wing margin slightly below wing apex. Wing 2.1 times as long as wide.

Genitalia as figured (Figs. 7–9, 13–14, 22–23, 33). Subgenital plate bilobed (Figs. 14, 22–23), with deep caudal concavity, with microtrichia, many scales and setae; complicated sclerotized forms of genital chamber with wartlike structures (Figs. 7–9, 14). Cerci short, triangular, rounded caudally, setose (Figs. 13, 33), connected by wrinkled membrane (Fig. 13).

Differential diagnosis. *Gondwanoscurus socotrensis* sp. nov. (♂) has vertex ratio 2.4 : 1 (width and high); the end of R_4 is above rounded wing apex; scales of palp segments, wings, legs, halteres and surstyli are maculated; hypandrium widened medially; gonostyli elongate, gradually tapering to apex, bifurcate apically, rami digitiform, subequal in length; aedeagus simple, with one short pointed part inside of a sheath. *G. malaysiensis* differs by vertex ratio 1.8 : 1; the end of R_4 is in pointed apex of wing; scales of palpomeres, wings, legs and surstyli are without maculation; hypandrium narrow; gonostyli with broad semiglobular basal portion, cylindrical medial portion, and abruptly narrowed at the beginning very narrow terminal portion; aedeagal complex composed from three free long pointed parts, trowel-shaped in lateral view.

Etymology. The new species name (adjective) is based on the name of the island where it was collected.

Biology and collecting circumstances. Unknown. The individuals were caught at light.

Distribution. Socotra Island.



Figs. 34–35. Socotran localities. 34 – Yemen, Socotra Island, Al Haghier Mts., Scant Mt., 1450 m a.s.l., 12°34.6'N 54°01.5'E, type locality of *Gondwanoscurus socotrensis* sp. nov. 35 – Yemen, Socotra Island, Al Haghier Mts., wadi Madar, 1180–1230 m a.s.l., 12°33.2'N 54°00.4'E, a detail of the habitat, a typical dry shrubby slopes, biotopes suitable for light trapping. Photos by J. Suchomel (November 2010).

New records

Tinearia acanthostyla (Tokunaga, 1957)

Material examined. YEMEN: SOCOTRA ISLAND: Hadibo, 1 ♀, 3.–6.x.1998, A. van Harten leg., slide Inv. No. 8826 (NMPC).

Distribution. Cape Verde Islands, India, Sri Lanka, Taiwan, Ryukyu Islands, Malaysia, 'Borneo', Philippines, New Guinea, New Ireland, Micronesian Islands. **First record from Socotra Island.**

Tinearia alternata (Say, 1824)

Material examined. YEMEN: SOCOTRA ISLAND: Hadibo, 1 ♀, 3.–6.x.1998, A. van Harten leg., slide Inv. No. 8825 (NMPC); same, Hadibo, Taj Socotra Hotel (WC), 13 ♂♂ 5 ♀♀, 8.–17.xi.2010, J. Bezděk leg., slides Inv. No. 19823–19840 (NMPC).

Distribution. Cosmopolitan species. **First record from Socotra Island.**

Discussion

The Psychodidae fauna of Socotra Island is currently represented by three species. Further new records are still possible, because the records mentioned here are rather occasional. *Tinearia acanthostyla* and *T. alternata* are facultative synantrophic species, while *Gondwanoscurus socotrensis* sp. nov. was found in the presumably obligatory natural habitat.

Gondwanoscurus was included with select other psychodine genera in a phylogenetic analysis of psychodid subfamilies by CURLER & MOULTON (2012). Relationships of *Gondwanoscurus* to other Paramormiine genera were discussed, and it was suggested that *Gondwanoscurus* is a sister group of other Paramormiini included in the analysis.

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