ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE
Published 31.xii.2015 Volume 55(2), pp. 495–503 ISSN 0374-1036
http://zoobank.org/urn:lsid:zoobank.org:pub:879078EE-3058-46B0-A3A1-19E8945F42AC

Review of the genus *Psychomasina* (Diptera: Psychodidae: Psychodinae), with descriptions of two new species

Gunnar M. KVIFTE[1,2)]

[1)] Department of Limnology, Institute of Biology, University of Kassel, Heinrich-Plett Str. 40, DE-34132 Kassel-Oberzwehren, Germany; e-mail: Gunnar.Kvifte@uib.no
[2)] Department of Natural History, University Museum of Bergen, P.O. Box 7800, University of Bergen, NO-5020 Bergen, Norway

Abstract. The genus *Psychomasina* Ježek, 2004 is redefined and two new species are described: *Psychomasina paedagogica* sp. nov. based on a male from Kenya and *Psychomasina violina* sp. nov. based on a male from Madagascar. The chief character uniting the three included species is the basiphallus narrow, the distiphallus joints with lateral and/or medial spines and the parameres fusing medially to form a functionally single, elongate appendage. A median parameral appendage also occurs in Pericomaini, and to a lesser extent the paramormiine genus *Seoda* Enderlein, 1935. Other characters are consistent with placement in Paramormiini.

Key words. Diptera, Psychodidae, Psychodinae, Paramormiini, *Psychomasina*, taxonomy, new species, Kenya, Madagascar, Afrotropical Region

Introduction

The genus *Psychomasina* Ježek, 2004 was pointed out by Kvifte (2014) as a possible link between Paramormiini and Pericomaini based on its intermediate genitalic characters. Although the head, wing, gonopods and, to some extent, distal aedeagal elements are typical of Paramormiini, the presence of an elongate median appendage is more reminiscent of the median moveable appendage in Pericomaini (see Kvifte et al. 2013). Although some other taxa of Paramormiini (e.g. *Seoda* Enderlein, 1935, *Jungiella* Vaillant, 1972, *Parajungiella* Vaillant, 1972 and *Vaillantodes* Wagner, 2001) also have medially fused parameral appendages, *Psychomasina* is the only taxon to have them as elongate as in Pericomaini.

Placing *Psychomasina* in a phylogenetic context was, until recently, a difficult task as the genus remained very poorly known. The original description by Ježek (2004) defined the

genus based on a single species, in turn only known from the holotype male. In this paper, a species of *Psychomasina* from Madagascar and one from Kenya are described. Details of the morphology, particularly of the male genitalia, are given and phylogenetic placement of the genus is discussed.

Material and methods

Prior to examination the specimens were cleared in KOH, dissected and mounted in Canada balsam. The holotypes will be deposited in the collections of the National Museum of Bloemfontein, South Africa (BMSA) and in the German Entomological Institute, Müncheberg (Senckenberg Deutsches Entomologisches Institut, SDEI). Measurements are made with an ocular micrometer and are given in μm with an accuracy of ± 5 μm, except for wing length which is given in mm with an accuracy of ± 0.03 mm.

Morphological terminology follows Quate & Brown (2004) as modified in Kvifte (2014). Colour-coding in the illustrations is according to Kvifte (2014).

The following abbreviations are used in the illustrations:

aed j – aedeagal joint
b gcx c – base of gonocoxal condyles
b pm – base of parameral sclerites
b sst – base of surstylus
cr sst – cercal region of surstylus
dp – distal phallomeres
gcx c – gonocoxal condyles
h – hypandrium
p j – proctiger/surstylus joint
p p – porous protuberance
pm – paramere
pms – parameral sheath
vep j – ventral epandrial plate/surstylus joint

Taxonomy

Psychomasina Ježek, 2004

Psychomasina Ježek, 2004: 64. Type species: *Psychomasina armata* Ježek, 2004, by original designation.

Revised diagnosis. Flagellomeres nodiform symmetrical to asymmetrical (Figs 1, 6). Sc elongate, nearly reaching C, R_5 terminating below wing apex; radial fork distal to medial fork; crossveins r-m and m-cu absent. Coxa of mid legs with distal mesal anterior protuberance covered with pores (Fig. 3). Gonostylus with one to five setiform sensilla subapically on the mesal surface. Aedeagus with basiphallus narrow, distiphallus comprised of two symmetrical S- to G-shaped phallomeres with lateral and/or mesal spines; paramere sheath-like, with two parameral sclerites converging, fused medially, present as single needle-shaped protuberance.

Remarks. The median unpaired protuberance of the aedeagal complex originates from the gonocoxal condyles (Fig. 4) and is therefore ontogenetically a paramere. An unpaired median elongate paramere also occurs in Pericomaini; and a much shorter similar structure occurs in the Palaearctic genus *Seoda* Enderlein, 1935 (= *Telmatoscopus* auct., see Kvifte 2014). Observations made in the present study support the hypothesis that *Psychomasina* represents a transitional form between Paramormiini and Pericomaini.

Psychomasina armata Ježek, 2004

(Fig. 12)

Material examined. Holotype: ♂, 'MADAGASCAR: Toamasina, 2.5 km SE of Amboditafonana (17° 27'37" S 48° 45'36" E), 850 m.a.s.l., 28.–30.I.2000, P. Chvojka leg. (blacklight)'. (coll. National Museum, Prague, Czech Republic, slide cat. no. 34241).

Diagnostic characters. *Psychomasina armata* can be distinguished from all other *Psychomasina* species on the eyebridges separated by two facet diameters, wing veins R_3, M_3 and CuA_2 with subapical oval expansions, the gonostylus distinctly hooked terminally and the phallomeres of the aedeagus lack lateral spines but has a row of mesal teeth (Ježek 2004: Figs 31, 33, 35, 42; see also http://www.morphbank.net/Browse/ByImage/?tsn=999022223 from Tkoč et al. 2014).

Psychomasina paedagogica sp. nov.

(Figs 1–5, 10)

Type material. Holotype: ♂, 'KENYA: East Province, Njuki-ini forest station (0.51660° S, 37.41843° E), 1455 m.a.s.l., 19–20.IV.2011, A.H. & M.H. Kirk-Spriggs leg.' (coll. BMSA).

Diagnostic characters. *Psychomasina paedagogica* can be separated from all other *Psychomasina* species by the eyebridges separated by one facet diameter, wing veins without expanded areas, gonostylus with a row of five spiniform sensilla subapically on mesal surface and without terminal hook, and distal phallomeres of aedeagus without teeth or spines on mesal or lateral surfaces (Figs 1, 2, 4).

Description. ***Male*** (n = 1). Head (Fig. 1) about as long as wide, vertex covering about 0.3 of total head length; five pairs of postocular setae present on dorsal side, reaching fourth facet column from middle, only slightly larger than other setae on vertex; eyebridge comprised of four rows of facets, separated by one facet diameter; interocular suture present, broadly U-shaped; frontal scar patch nearly square, posteriorly with line of hairs reaching interocular suture; sides of frons area sharply delimited from rest of face by keels; clypeus with anterior margin straight; labellae bulbous with seven setae; palps with only segments 1–3 present, length of preserved palp segments 80 : 155 : 150.

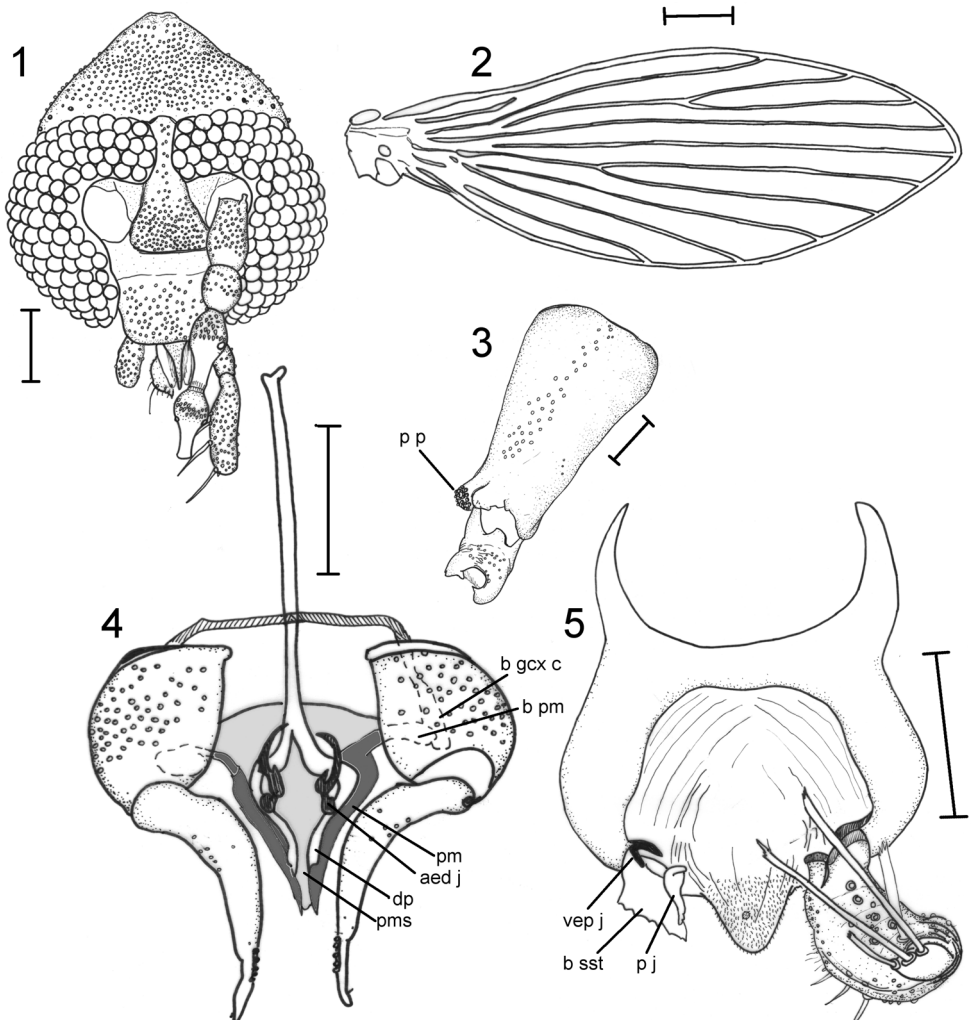
Antennae not completely preserved; scapus cylindrical, pedicel round; flagellomeres subsymmetrically nodiform with node onion-shaped; slightly projected on mesal side; length of preserved antennal segments 100 : 65 : 115 : 100 : 95; ascoids not preserved.

Thorax with dorsum, anepisternum and scutellum densely setose; laterotergite sparsely haired; other thoracic sclerites bare; coxae with dorsal stripe of setae; mid coxae with strong mesal protuberance covered in pores (Fig. 3); legs otherwise not present.

Wing (Fig. 2) 2.22 mm long, 0.78 mm wide; costa with single break, thickened basally over S_c; S_c elongate, weakly curved, almost reaching C, distally narrowed; R_5 terminating nearly in wing apex; radial fork distal to medial fork, apex of CuA_2 between medial and radial fork; jugum broadly rounded triangular; section of R_1 that runs parallel to Sc reduced; crossveins reduced.

Genitalia (Fig. 4) with hypandrium narrow, connected laterally to gonocoxal condyles; gonocoxite about two thirds of gonostylus length; dorsally without mesal seta or projections;

gonocoxal condyles broadly fused with paramere, forming a broad ventral bridge; gonostylus bent towards the lateral side; basally bulb-shaped with long tube-shaped main shaft, apical fifth narrowed, blade-like; row of five sensillae present subapically on mesal surface; aedeagus with basiphallus narrow in dorsal and ventral views, distally Y-shaped; distiphallus consisting of two symmetrical phallomeres shaped like the number 3 or the calligraphic letter G, jointed to basiphallus; with distal mesal joint to ventral epandrial plate and basal lateral joint to basiphallus; parameral sclerite elongate V-shaped, weakly sclerotized distally; more than twice as long as distiphallus.



Figs 1–5. *Psychomasina paedagogica* sp. nov., holotype, male. 1 – head; 2 – wing; 3 – mid coxa; 4 – aedeagus and gonopods; 5 – epandrium and proctiger. For abbreviations see Material and methods. Length of scale bars in µm: 100 (1, 4, 5), 250 (2), 50 (3)

Epandrium (Fig. 5) about as wide as long, with long curved anterior projections half the length of basal epandrial body; aperture not evident; ventral epandrial plate large, U-shaped, well-developed; surstyli tapering, strongly curved in the dorsoventral plane, with tenacula along entire dorsal surface; tenacula of varying length, distalmost one almost as long as surstylus; with feathery apices; proctiger with hypoproct diamond-shaped, epiproct densely setose, small and circular; areas of surstylus flanking proctiger with dense microsetae.

Biology. The only known specimen was collected in a Malaise trap in a montane forest.

Etymology. The specific epithet is an adjective, derived from Greek *παιδαγωγός* (= *paidagogos*), pedagogue; referring to the possible morphological insights the species reveals into the ontogenesis of parameral appendages and surstyli.

Remarks. In *Psychomasina paedagogica* sp. nov., the surstylus is jointed by one sclerite to the ventral epandrial plate and by another to the lateral sides of the proctiger. This may be interpreted as evidence of a dual ontogenetic origin of the surstyli in Psychodinae, or at least in some Psychodinae – rather than being an appendage derived only from the epandrium (surstylus, see Curler & Moulton 2012) or an appendage derived only from the proctiger (cercus, e.g. Quate & Vockeroth 1981), it may be a fusion of both. A dual origin could also explain the difference in sclerotization, pigmentation and setation of the basal mesal areas of the surstyli in some Pericomaini (e.g. Kvifte et al. 2013, Fig. 2D) and Paramormiini (Fig. 9, cr sst). The occurence of the latter kind of surstylus texture heterogeneity, however, is a variable character in Psychodinae and must be examined for a greater taxon sample in order to determine whether it has any phylogenetic implications.

Psychomasina violina sp. nov.

(Figs 6–9, 11)

Type material. Holotype: ♂, 'MADAGASCAR: 10 km SW of Ranomafana (21°16'03'' S 47°25'30'' E), 980 m.a.s.l., 4.XI.2003, F. Menzel leg.' (coll. SDEI).

Diagnosis. *Psychomasina violina* can be separated from all other *Psychomasina* species by the eyebridges separated by 0.25 facet diameters; wing veins without expanded areas, gonostylus with a single subapical sensillum and with indistinct terminal hook, and distal phallomeres of aedeagus without mesal teeth but with a single lateral spine (Figs 6–8).

Description. ***Male*** (n = 1). *Head* (Fig. 6) slightly wider than long, vertex covering about 0.3 of total head length; six pairs of postocular setae present on dorsal side, reaching third facet column from middle; eyebridge comprised of four rows of facets, separated by 0.25 facet diameters; interocular suture present, U-shaped with pronounced edges; frontal scar patch trapezoid, posteriorly with line of hairs reaching interocular suture; sides of frons area sharply delimited from rest of face by keels; clypeus with weak anterior U-shaped notch; labellae bulbous with around eight setae; only first palp segments preserved, length of first palpomere 94.5.

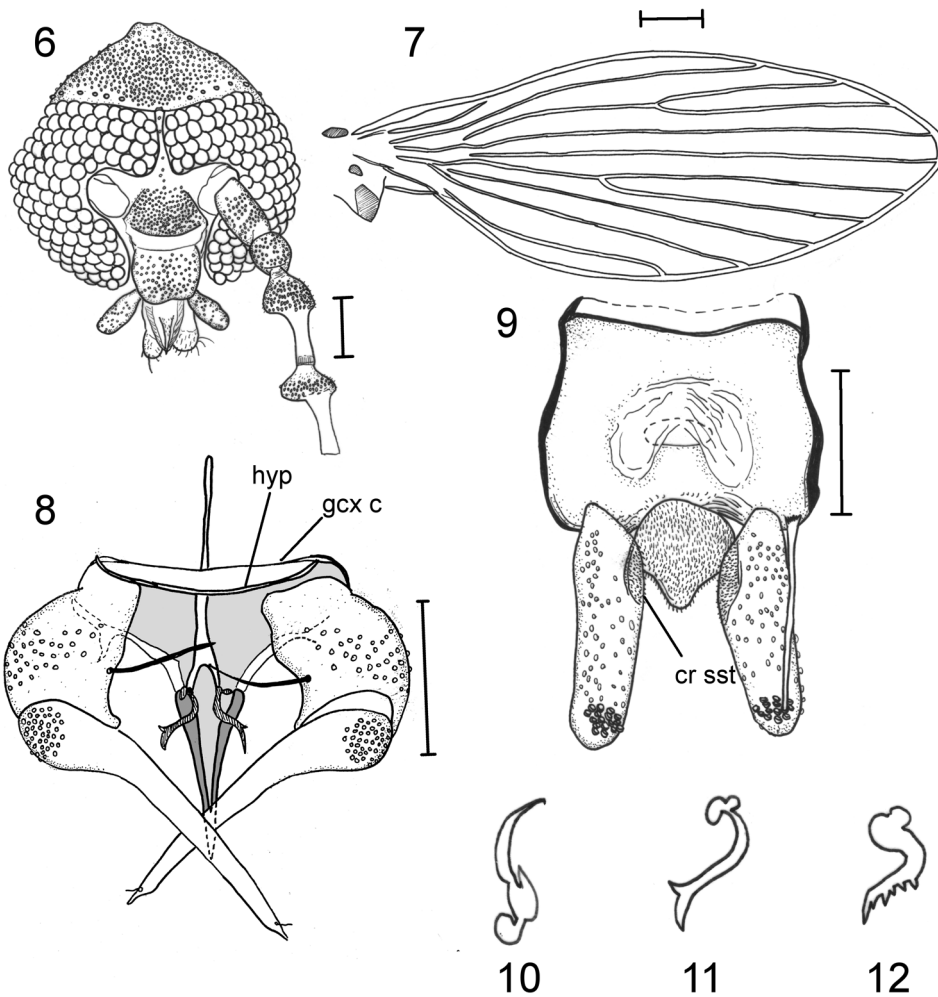
Antennae not completely preserved; scapus cylindrical, pedicel round; flagellomeres asymmetrically nodiform with node rounded conical; length of preserved antennal segments 105 : 70 : 160 : 150; ascoids not preserved.

Thorax poorly preserved; dorsum, anepisternum and scutellum densely setose; laterotergite and anepimeron sparsely haired; postpronotum, katepimeron, proepimeron, katepisternum and

meron bare; coxae each with dorsal stripe of setae, mid coxae with strong mesal protuberance covered in pores (as in Fig. 3); legs otherwise not present.

Wing (Fig. 7) 2.38 mm long, 0.92 mm wide; costa with single break, thickened basally over S_c; S_c elongate, weakly curved, almost reaching C; R_5 terminating below wing apex; radial fork distal to medial fork, apex of CuA_2 distal to radial fork; jugum broadly triangular.

Genitalia (Fig. 8) with hypandrium narrow, connected at sides to narrow gonocoxal condyle bridge, together appearing like a membranous structure with anterior and pos-



Figs 6–12. 6–9 – *Psychomasina violina* sp. nov., holotype, male. 6 – head; 7 – wing; 8 – aedeagus and gonopods; 9 – epandrium and proctiger. 10–12 – aedeagal joint shape in *Psychomasina* spp.: 10 – *P. paedagogica* sp. nov., 11 – *P. violina* sp. nov., 12 – *P. armata* Ježek, 2004 (Fig. 12 redrawn from Ježek 2004). For abbreviations see Material and methods. Length of scale bars in μm: 100 (6, 8, 9) 250 (7)

terior margins sclerotized; gonocoxite about half length of gonostylus; dorsally without sclerotized projections but with mesal elongate seta; gonostylus curved laterally; bulbous at base, with long tube-shaped main shaft with pointed apex; setiform sensillum present subapically; aedeagus with basiphallus narrow in dorsal and ventral views, distally Y-shaped; distiphallus consisting of two symmetrical S-shaped phallomeres jointed to basiphallus; aedeagus with basolateral joint with ventral epandrial plate and mediodistal lateral spine; parameral sclerite elongate V-shaped, more than twice as long as distiphallus; epandrium (Fig. 9) about as wide as long; with single median oval aperture; ventral epandrial plate membranous, U-shaped; surstyli of even width throughout length, slightly curved in the dorsoventral plane, with 15 tenacula in single group inserted distally; tenacula nearly as long as surstylus, with apices appearing frayed; proctiger consisting of membranous oval epiproct (not illustrated) and trilobate micropilose hypoproct with median lobe of rounded V-shape and lateral lobes angulate; area of surstylus flanking proctiger with mesal darkened notch.

Biology. The type specimen was collected near a small brook in a primary alpine rainforest in Southern Madagascar. The holotype of *Psychomasina armata* was collected in similar habitats, but four degrees further north.

Etymology. Named after Latin *violina,* violin, because the distal phallomeres resemble the F-holes of a violin. The name is to be treated as a noun in apposition.

Remarks. With the description of *Psychomasina violina* sp. nov., 27 species of Psychodidae are known from Madagascar; including 13 species of Psychodinae, 13 of Phlebotominae and one species of Trichomyiinae (Quate 1957, Ježek 2004, Depaquit et al. 2008, Randrianambintsoa & Depaquit 2013, Randrianambintsoa et al. 2014).

Key to world species of *Psychomasina* Ježek, 2004

1 Basiphallus not bilobate (Fig. 8). Gonostylus with single subapical sensillum. 2
– Basiphallus bilobate at base (Fig. 4). Gonostylus with subapical row of five sensilla. Aedeagal joint shaped as in Fig. 10. ..... ***Psychomasina paedagogica* sp. nov.**
2 Gonostylus distinctly hooked apically. Eyes separated by width of two facet diameters. Shape of aedeagal joint as in Fig. 12. ..... ***Psychomasina armata*** Ježek, 2004
– Gonostylus indistinctly hooked (Fig. 8). Eyes separated by width of 0.25 facet diameters (Fig. 6). Shape of aedeagal joint as in Fig. 11. ..... ***Psychomasina violina* sp. nov.**

Discussion

The aedeagal complex of *Psychomasina* is similar to *Telmatoscopus* Eaton, 1904, in having a narrowly Y-shaped basiphallus and a symmetrical, sclerotized distiphallus with connections to the ventral epandrial plate and/or parameres. It differs from *Telmatoscopus* in posessing distally sclerotized developed parameres, which meet at the median and form an elongate protuberance. The shape of the basiphallus is likely to be a plesiomorphic character – it can also be found in taxa such as *Philosepedon* Eaton, 1904, *Psychoda* Latreille, 1796 and *Brunettia* Annandale, 1910, which are unlikely to be very close to the Paramormiini/Pericomaini lineage (Duckhouse 1985, Curler & Moulton 2012, Espindola et al. 2012).

A single median protuberance of parameral origin is otherwise present in *Seoda* Enderlein, 1935 and some Pericomaini (Kvifte 2014). In addition, the parameral sclerites have fused to form a V- to U-shaped furca in a number of genera including *Vaillantodes* Wagner, 2001, *Elsahowia* Duckhouse, 1978, *Jungiella* Vaillant, 1972, *Parajungiella* Vaillant, 1972 and *Satoba* Ježek, 1984. Kvifte (2014) argued that the direction of parameral evolution moved from separate parameral sclerites via a furca to a median fused appendage. The present reexamination of *Psychomasina* is consistent with this argument, but does not provide significant new evidence for or against it.

The expansion of C dorsal to S_c, combined with S_c approaching C, is a shared character with the Afrotropical Paramormiine genus *Elsahowia*, which has furcate parameral sclerites. The aedeagal base in *Elsahowia*, however, is broad and flat like in *Seoda* and some Pericomaini.

In summary, most characters of *Psychomasina* are consistent with a placement in Paramormiini, but the likely apomorphic fusion and elongation of the parameral sclerites is more reminiscent of Pericomaini. Ultimately, molecular evidence may be neccessary to accurately resolve the placement of *Psychomasina*.

Acknowledgements

This paper is dedicated to Jan Ježek on his 70th birthday, in recognition of his many contributions to the taxonomy, faunistics and systematics of Psychodidae. I am grateful to him and Michal Tkoč for their guidance and hospitality on my 2012 visit to the entomological collections at the National Museum in Prague, Czech Republic. I am indebted to Ashley Kirk-Spriggs and Frank Menzel for providing material of Psychodidae from Kenya and Madagascar, and to Rüdiger Wagner who kindly slide-mounted the specimens and put them in my care. Rüdiger Wagner, Greg Curler and an anonymous reviewer further provided useful comments on an earlier version of the manuscript.

References

CURLER G. R. & MOULTON J. K. 2012: Phylogeny of psychodid subfamilies (Diptera: Psychodidae) inferred from nuclear DNA sequences with a review of morphological evidence for relationships. *Systematic Entomology* **37**: 603–616.

DEPAQUIT J., LÉGER N. & ROBERT V. 2008: Les Phlébotomes de Madagascar (Diptera: Psychodidae). VI – Un sous-genre nouveau (Vattieromyia) avec trois espèces nouvelles: Sergentomyia (V.) sclerosiphon, S. (V.) namo et S. (V.) anka. *Parasite* **15**: 15–26.

DUCKHOUSE D. A. 1985: A re-examination of Neomaruina (Diptera, Psychodidae), with observations on its life-history and affinities and redefinition of the tribe Psychodini. *Annals of the Natal Museum* **26**: 601–620.

ESPINDOLA A., BUERKI S., JACQUIER A., JEŽEK J. & ALVAREZ N. 2012: Phylogenetic relationships in the subfamily Psychodinae (Diptera, Psychodidae). *Zoologica Scripta* **41**: 489–498.

JEŽEK J. 2004: New taxa of non-biting moth flies (Diptera, Psychodidae, Psychodinae, Paramormiini) from Madagascar. *Acta Facultatis Ecologiae* **12(suppl. 1)**: 57–68.

KVIFTE G. M. 2014: Nomenclature and taxonomy of Telmatoscopus Eaton and Seoda Enderlein; with a discussion of parameral evolution in Paramormiini and Pericomaini (Diptera: Psychodidae, Psychodinae). *Zootaxa* **3878**: 390–400.

KVIFTE G. M., IVKOVIĆ M. & KLARIĆ A. 2013: New records of moth flies (Diptera: Psychodidae) from Croatia, with the description of Berdeniella keroveci sp. nov. *Zootaxa* **3737**: 57–67.

QUATE L. W. 1957: Premier etude des Psychodidae des Madagascar. *Le Naturaliste Malgache* **9**: 251–261.

QUATE L. W. & BROWN B. V. 2004: Revision of Neotropical Setomimini (Diptera: Psychodidae: Psychodinae). *Contributions in Science* **500**: 1–117.

QUATE L. W. & VOCKEROTH J. R. 1981: Psychodidae. Pp. 293–300. 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*. Biosystematics Research Institute, Ottawa, 647 pp.

RANDRIANAMBININTSOA F. J. & DEPAQUIT J. 2013: Phlebotomine sand flies from Madagascar (Diptera: Psychodidae). VIII - Phlebotomus (Anaphlebotomus) vincenti n. sp. *Bulletin de la Société de Pathologie Exotique* **106**: 206–211.

RANDRIANAMBININTSOA F. J., LÉGER N., ROBERT V. & DEPAQUIT J. 2014: Paraphyly of the subgenus Sintonius (Diptera, Psychodidae, Sergentomyia): Status of the Malagasy species, creation of a new subgenus and description of a new species. *PLOS One* **9(e98065)**: 1–15.

TKOČ M., PECHAROVÁ M. & JEŽEK M. 2014: Catalogue of the type specimens of Diptera deposited in the Department of Entomology, National Museum, Prague, Czech Republic. *Acta Entomologica Musei Nationalis Pragae* **54**: 789–837.