BioOne COMPLETE

Five New Species of Scuttle Fly (Diptera: Phoridae) from Southern Africa

Author: Disney, R. H. L.

Source: African Invertebrates, 53(1) : 113-124

Published By: KwaZulu-Natal Museum

URL: https://doi.org/10.5733/afin.053.0106

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

African Invertebrates Vol. 53 (1) Pages 113–124 Pietermaritzburg June, 2012

Five new species of scuttle fly (Diptera: Phoridae) from southern Africa

R. H. L. Disney
Department of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK;
rhld2@hermes.cam.ac.uk

ABSTRACT

Diplonevra longifistula sp. n., *D. meridafricana* sp. n., *D. stuckenbergi* sp. n., *Phalacrotophora petersoni* sp. n. and *Ph. stuckenbergi* sp. are described. A revised key to Afrotropical *Diplonevra* species and a key to Afrotropical species of *Phalacrotophora* are provided.

KEY WORDS: Diptera, Phoridae, *Diplonevra*, *Phalacrotophora*, scuttle flies, Afrotropical, South Africa, Botswana, Malawi, identification keys, new species.

INTRODUCTION

The new species described below belong to genera that are poorly known for the Afrotropical Region. In this paper I describe five new species from southern Africa, that were among the specimens awaiting processing in the collections of the University of Cambridge Museum of Zoology. Two are named in honour of Brian Stuckenberg, who sent me material from Malawi for examination, and after whom I have named other species also (Disney 1988, 2003).

The descriptions and provisional keys below serve to underline our relative ignorance of the taxonomy of Afrotropical Phoridae. The larval habits of most Afrotropical species remain unknown.

MATERIAL AND METHODS

The specimens had been preserved in ethanol and were slide mounted in Berlese Fluid (Disney 2001). The terminology for the morphology employs the more traditional labels (e.g., Disney 1994), except the 'third antennal segment' is now called by the older term postpedicel in view of Stuckenberg's (1999) demonstration that it is a composite of more than one segment. The more fashionable label 'flagellomere 1' is thus clearly incorrect.

The specimens are deposited in the University of Cambridge Museum of Zoology (UCMZ) and the KwaZulu-Natal Museum, South Africa (NMSA). The figures after the institutional codes, e.g., 5–108, refer to my notebook (5) and page (108) number; and are also written on the data label.

TAXONOMY

Genus *Diplonevra* Lioy, 1864

About 70 species have been described in this cosmopolitan genus. Species recognition is currently based on the males, and descriptions based on females alone are no longer helpful. The Afrotropical species were last keyed by Disney and Kistner (1998). A revised key is given below. The larval habits range from feeders on vertebrate and invertebrate carrion to those that parasitise termites and earthworms.

http://www.africaninvertebrates.org.za

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

Diplonevra longifistula sp. n.

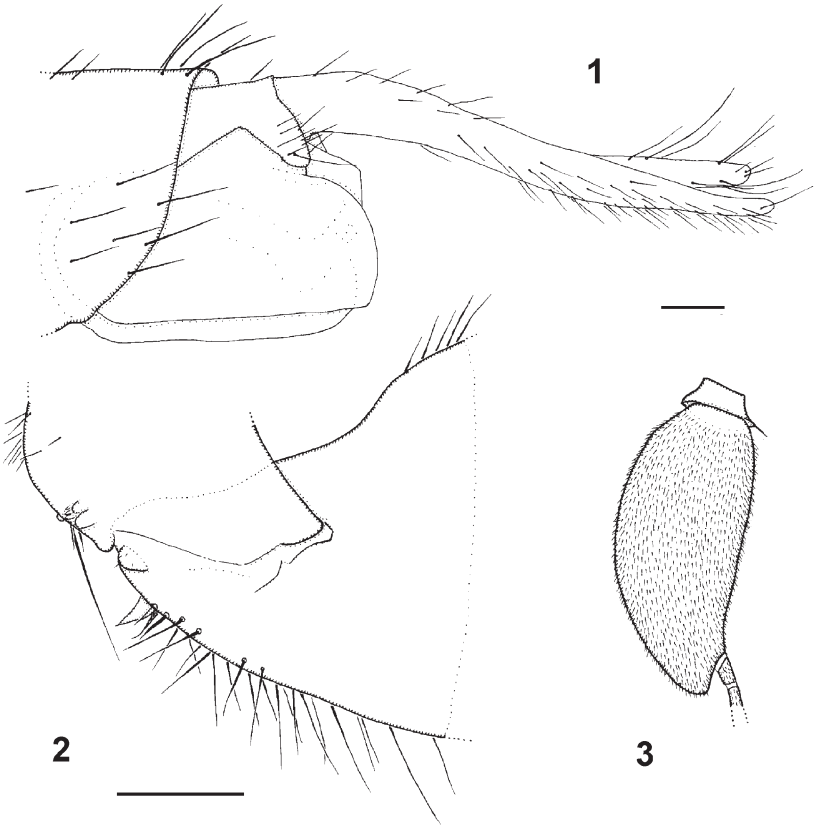
Figs 1–3

Etymology: The name refers to the long anal tube.

Description:

Male.

Frons brown, midline length about equal to maximum breadth, microtrichia absent, with only 7 hairs toward each side, 2 below antial bristles and none in middle. Bristle sockets surrounded by pale spots. Supra-antennal bristles well below antials, which are a little lower on frons than anterolaterals. Likewise mediolaterals are a little lower than pre-ocellars. No bristles on cheeks and a pair on each jowl. Antenna dusky yellow to increasingly brown towards base of arista, which is brown, and with pedicel and post-pedicel as in Fig. 3. Palps with brown basal segments and yellow second segments, and each of latter bears 5 apical bristles and numerous fine hairs along its lower edge. Labrum brown basally, but pale yellow distally and only about 0.8× as broad as a postpedicel. Labella pale. Thorax brown, being darkest on top. Notopleuron with 3 bristles, front one being clearly longer and more robust than two behind. Scutellum with single pair of



Figs 1–3. *Diplonevra longifistula* sp. n., ♂: (1) left face of hypopygium; (2) posterior face of base of hind femur and tip of trochanter; (3) pedicel and postpedicel of antenna. Scale bars = 0.1 mm.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

strong bristles. Abdominal tergites brown, with fine hairs which are a little longer on T6 (Fig. 1). Venter brownish grey on sides, but more greyish yellow below, and with only a few hairs on segment 5, but several longer hairs on segment 6. Hypopygium very pale to pale yellow in parts and as in Fig. 1. Legs yellow apart from brown patch on mid coxa, tip of hind femur and most of hind tibia. Front tibia with near-dorsal spine in basal third followed by row of weakly differentiated hairs. All tarsal segments with posterodorsal hair palisade and segment 5 a little longer than 4. Mid tibia with 2 longitudinal hair palisades, anterodorsal one being sharply deflected onto anterior face just beyond anterodorsal bristle of basal pair of bristles. Base of hind femur as in Fig. 2. Hind tibia with anterior bristle in basal quarter and a series of transverse dorsal combs between two hair palisades. Wing 4.2–4.3 mm long. Costal index 0.45. Costal ratios 5.5:1.0:1.0. Costal cilia 0.16–0.17 mm long. Vein *Sc* weak and fading well before reaching vein 1. Strong hair at base of vein 3. With 5 axillary bristles, all but most basal being clearly longer than costal cilia. All veins brown. Membrane brownish grey (clearly evident to naked eye when viewed against a white background). Haltere whitish yellow.

Holotype: ♂ MALAWI: Ntschisi [=Ntchisi] Forest Reserve [13.32°S 34.05°E], 1500 m, montane forest and woodland, 3–4.xii.1980, J. Londt & B. Stuckenberg (NMSA, 5–108).

Diplonevra meridafricana sp. n.

Figs 4–7

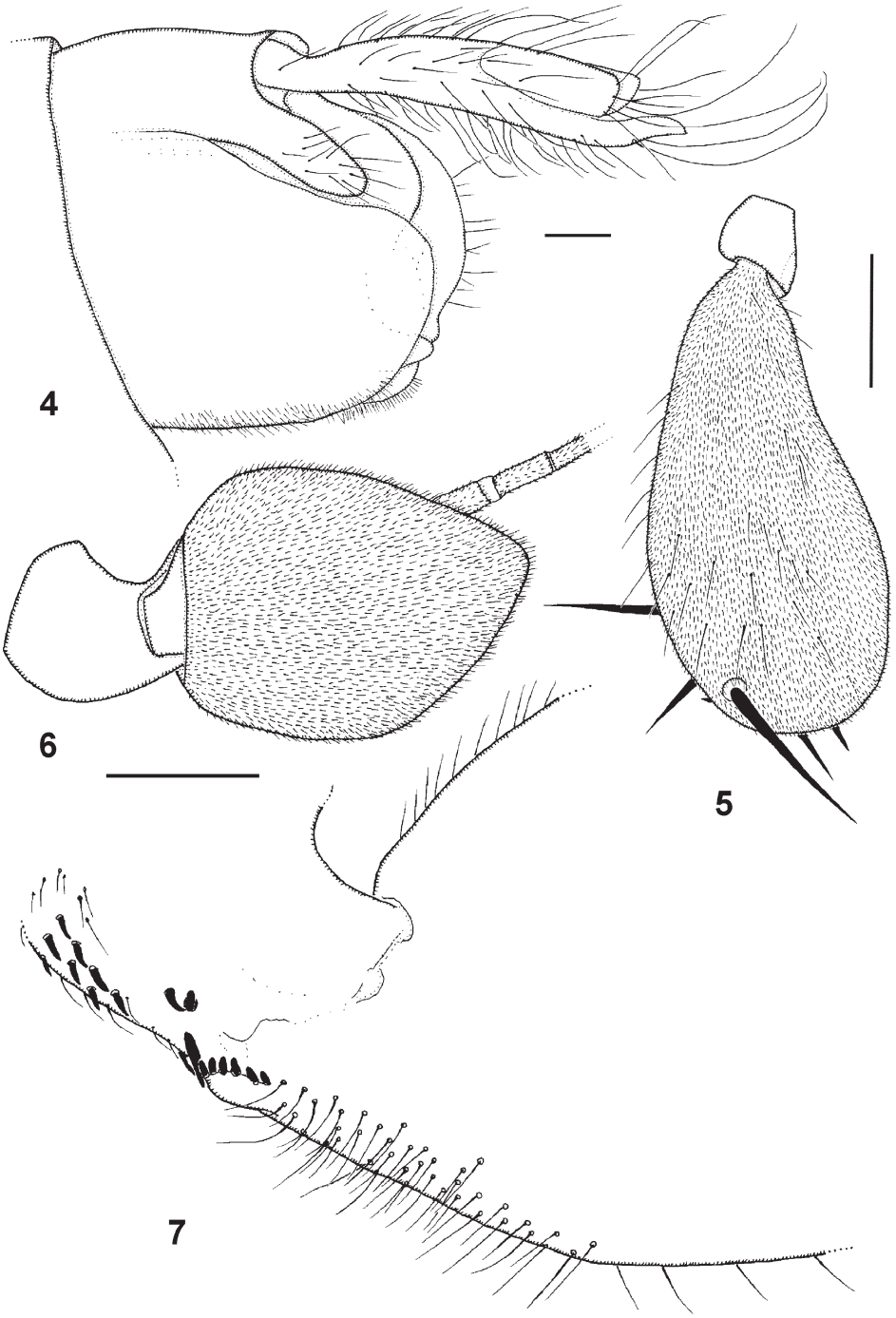
Etymology: The name refers to its occurrence in southern Africa.

Description:

Male.

Frons brown, about 1.3× as broad as midline length, with minute microtrichia and two dozen small hairs. Antials closer to anterolaterals than to supra-antennals and very slightly higher on frons than anterolaterals. Mediolaterals slightly lower on frons than pre-ocellar bristles. Cheeks with single bristle and jowls with 2 stronger and longer bristles. Pedicel and postpedicel of antenna as in Fig. 6, pedicel being brown and postpedicel mainly orange, but brown around base of arista, which is also brown. Palps yellow, but basal segment in part brown, and as in Fig. 5. Labrum brown and at most only 0.75× as wide as palps. Labella pale apart from narrow yellowish brown band towards each side dorsally. Thorax brown, being darkest on top. Notopleuron with 3 bristles. Scutellum with two pairs of strong bristles, posterior pair being longer than anterior pair. Abdominal tergites brown, T6 being longest, and with short fine hairs. Venter brownish grey and almost devoid of hairs. Hypopygium brown, including greyish brown anal tube, and as in Fig. 4. Legs with coxae, femora (except tips of front femora), mid tibiae, front and mid tarsal segments 5 and all of hind legs brown. Rest of legs dusky yellow to yellow. Front tibia lacking near-dorsal spine or differentiated hairs. Front tarsus with posterodorsal hair palisade on all five segments and segment 5 longer than 4. Mid tibia with single, very small, anterodorsal bristle in basal quarter and single dorsal hair palisade, but a vestige of anterodorsal palisade evident just below bristle. Tip of hind trochanter and base of femur as in Fig. 7. Hind tibia with anterodorsal bristle near end of first quarter and another near halfway point. Wing 3.5–3.6 mm long. Costal index 0.55–0.56. Costal ratios 5.3:2.7:1.0. Costal cilia 0.09–0.10 mm long. *Sc* obscure and only evident near base. No hair at base of vein 3. With 6 axillary bristles, all clearly longer

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use



Figs 4–7. *Diplonevra meridafricana* sp. n., ♂: (4) left face of hypopygium; (5) inner face of left palp; (6) left antenna; (7) posterior face of tip of hind trochanter and base of femur. Scale bars = 0.1 mm.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

than costal cilia. All veins brown, except 7 more pale grey. Membrane grey (evident to naked eye when viewed against a white background). Haltere brown.

Holotype: ♂ SOUTH AFRICA: *Western Cape*: Saasveld [33.95°S 22.53°E], near George, indigenous forest, 17.xii.1986–17.i.1987, V. Nicolai, pitfall trap (UCMZ, 20–39).

Diplonevra stuckenbergi sp. n.

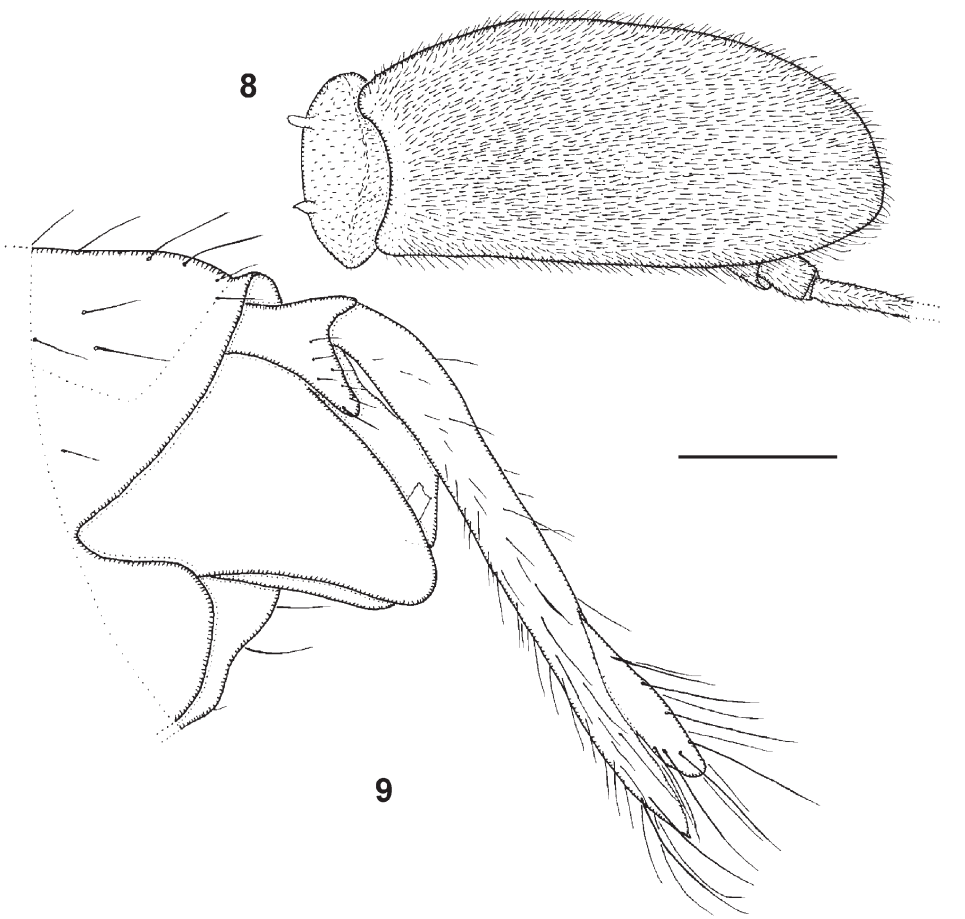
Figs 8, 9

Etymology: The species is named after Brian Stuckenberg.

Description:

Male.

Frons brown, midline length slightly longer than maximum breadth, microtrichia absent, with only 20 hairs which are situated mainly towards each side. Bristle sockets surrounded by pale spots. Supra-antennal bristles are well below antials, which are lower



Figs 8, 9. *Diplonevra stuckenbergi* sp. n., ♂: (8) right pedicel and postpedicel of antenna (with ventral side uppermost); (9) left face of hypopygium. Scale bar = 0.1 mm.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

on frons than anterolaterals. Likewise, mediolaterals clearly lower than pre-ocellars. No bristles on cheeks, but strong pair on each jowl. Pedicel and postpedicel of antenna as in Fig. 8, postpedicel being orange-brown with brown arista. Palps at most 0.6× as broad as postpedicel and with brown basal segment and yellow second segment, which bears 5 bristles and many fine hairs. Brown labrum about 1.2× as broad as postpedicel. Labella pale. Thorax brown and with 3 bristles on notopleuron. Scutellum with 3 bristles on one side and 2 on the other. Abdominal tergites brown, T6 being longest, with fine hairs, which are longer at rear of T6 (Fig. 9). Venter brownish grey with fine hairs below segments 3–6. Hypopygium yellowish brown to yellow with pale yellow anal tube, and as in Fig. 9. Legs with brown coxae and femora (except for tips), and mid and hind tibiae; otherwise rest of legs yellow. Front tibia with near-dorsal spine near end of first quarter followed by half a dozen differentiated hairs. Front tarsus with posterodorsal hair palisade on segments 1–5, and 1–4 somewhat thickened. Mid tibia with 2 longitudinal hair palisades, anterodorsal one being sharply deflected onto anterior face just beyond anterodorsal bristle of basal pair of bristles. Base of hind femur with crowded fine hairs only. Hind tibia with anterior bristle in basal quarter, with a series of transverse dorsal combs between two hair palisades, and row of long but fine posterodorsal hairs. Wing 4.3 mm long. Costal index 0.46. Costal ratios 4.7–4.8:1.20:1.0. Costal cilia 0.18 mm long. *Sc* very pale and fading away long before approaching vein 1. Long bristly hair at base of vein 3. With 4 axillary bristles all longer than costal cilia, but shorter than vein 3 hair. All veins brown. Membrane grey in basal third and more brownish grey beyond (clearly evident to the naked eye when viewed against a white background). Haltere very pale.

Holotype: ♂ MALAWI: Ntschisi [=Ntchisi] Forest Reserve [13.32°S 34.05°E], 1500 m, montane forest and woodland, 3–4.xii.1980, J. Londt & B. Stuckenberg (NMSA, 5–108).

Key to the Afrotropical species of *Diplonevra*

Note: Species recognition in this genus is based on the male sex in the first instance. The description of *D. hercules* and *D. concava* from the female sex only was unfortunate. When their males become known an improved key can be constructed.

1 At least top of thorax brown to dark brown 2
– Thorax reddish yellow..... **hercules** Beyer

2 Hind tibia with ventral spines as well as anterodorsals (e.g., Fig. 10)..... 3
– Hind tibia without ventral spines 5

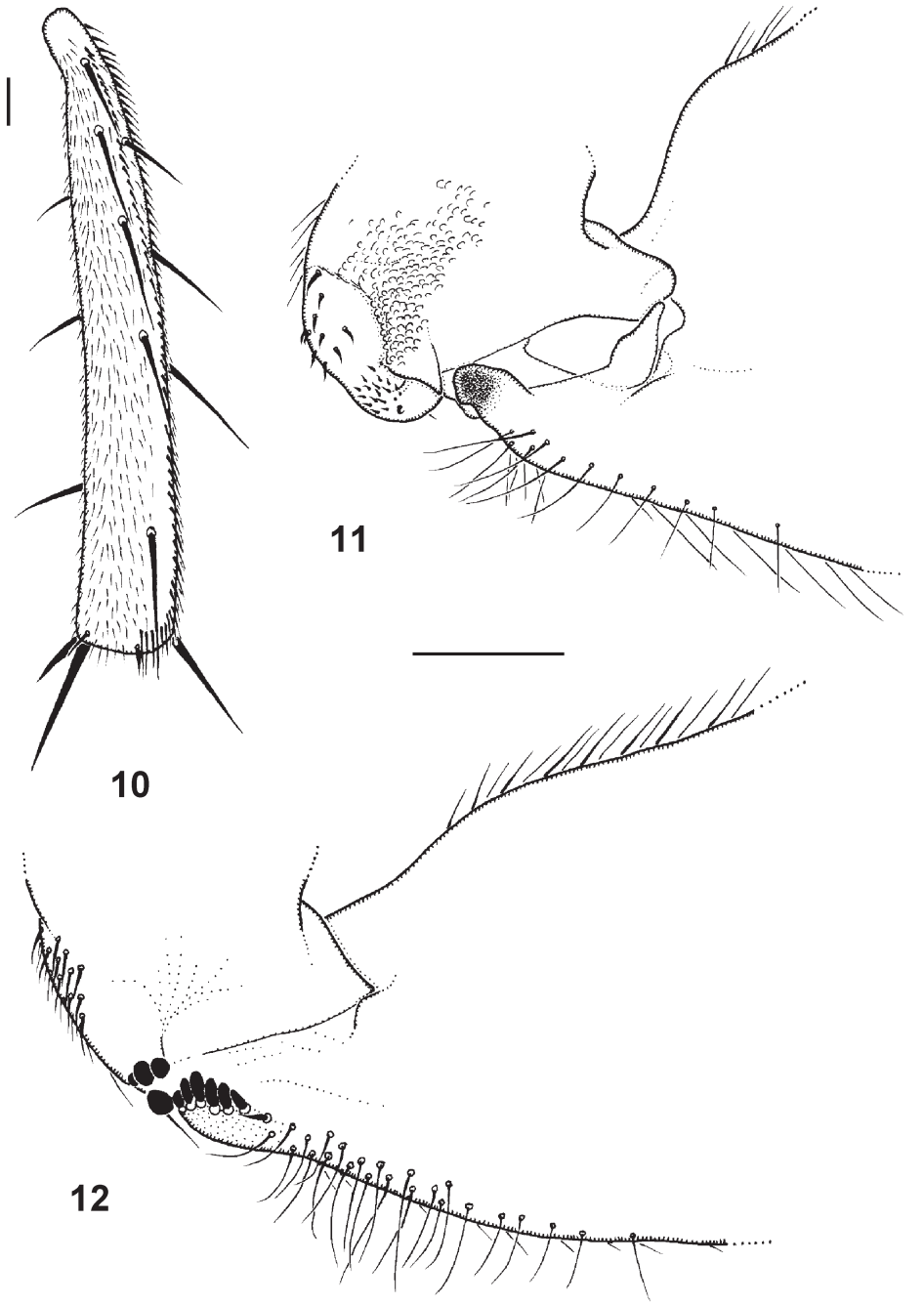
3 Hind femora brown to dark brown..... 4
– Hind femora largely yellow (tip of hind trochanter and base of hind femur as in Fig. 11; hind tibia as in Fig. 10; postpedicels short in both sexes) .... **armipes** (Brues)

4 Wing at most 3 mm long. Hind femora brown, but not very dark... **concava** Beyer
– Wing clearly more than 3 mm long. Hind femora dark brown (♂ postpedicel about 2.75× as long as basal width and tapered to a point..... **epinephele** Beyer

5 Hind femora brown to dark brown..... 6
– Hind femora with basal halves at least yellowish brown to yellow..... 8

6 Haltere knob brown..... 7

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use



Figs 10–12. *Diplonevra* spp., ♂: (10) *D. armipes* (Brues), anterior face of hind tibia; (11) *D. armipes* (Brues), posterior face of base of hind femur and trochanter; (12) *D. brincki* Beyer, posterior face of base of hind femur and trochanter. Scale bars = 0.1 mm.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

– Haltere knob yellow or paler (♂ anal tube more than 3× as long as dorsal face of epandrium (Fig. 9); ♂ postpedicel as in Fig. 8) ..... **stuckenbergi** sp. n.

7 Mid tibia with a single greatly reduced anterodorsal bristle in its basal third. Wing length clearly more than 3 mm. Base of hind femur and trochanter as Fig. 7 (♂ postpedicel as in Fig. 6; hypopygium as in Fig. 4; palps as in Fig. 5)..... ..... **meridafricana** sp. n.

– Mid tibia with the typical dorsal and anterodorsal bristles in the basal third. Wing length clearly less than 3 mm. Base of hind femur and trochanter as in Fig. 12 .... **brincki** Beyer

8 Male anal tube exceptionally long (Fig. 1). Postpedicel as in Fig. 3 (base of hind femur as in Fig. 2) ..... **longifistula** sp. n.

– Male anal tube less than twice as long as dorsal face of epandrium. Postpedicel shorter and rather lemon-shaped ..... **basilewskyi** Beyer

Genus *Phalacrotophora* Enderlein, 1912

About fifty species are known in this cosmopolitan genus. The subgenus *Phalacrotophora* includes the species with hairy mesopleura. However, this genus is almost certainly polyphyletic as presently understood. The subgenus *Omapanta* Schmitz, 1932, whose mesopleura are bare, should probably be treated as a genus or perhaps two genera. The Afrotropical species are poorly known, with most species being only known in one sex. The key by Beyer (1965) was supplemented by Schmitz (1932) and Disney (2006, 2009). A new key for the *Omapanta* species is given below. The larvae of many species parasitise the pupae of ladybird beetles (Coccinellidae).

Phalacrotophora (Omapanta) petersoni sp. n.

Fig. 13

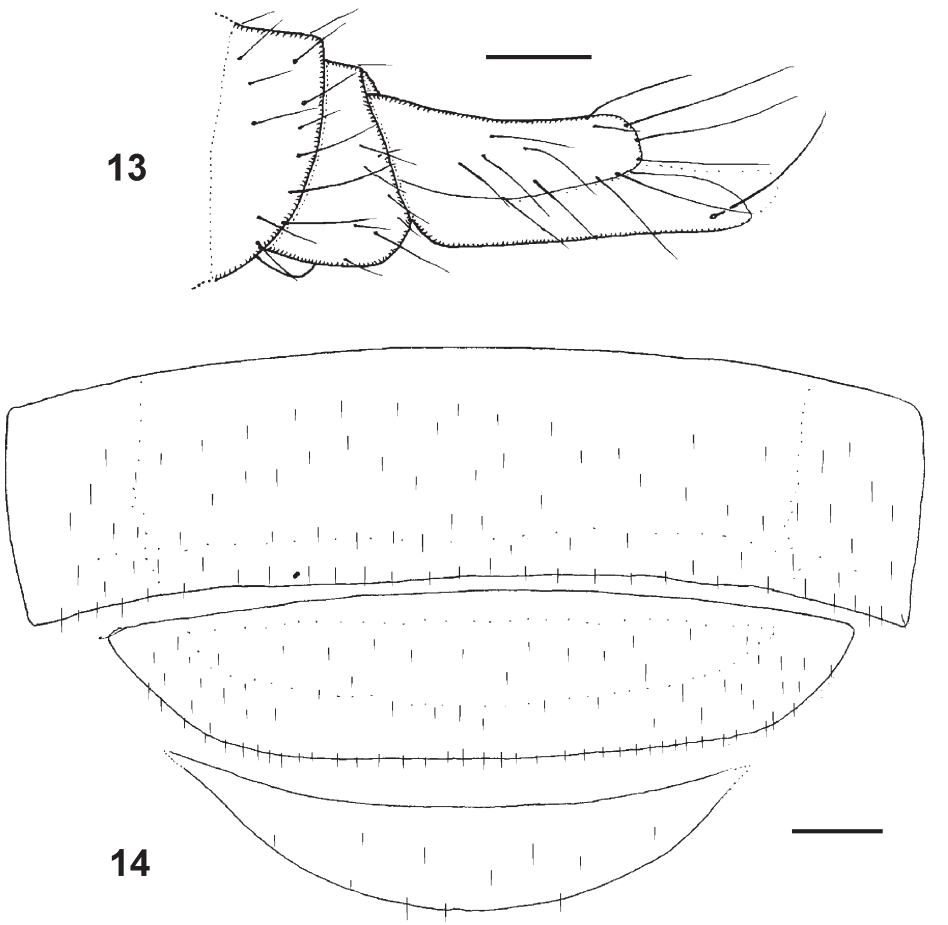
Etymology: It is named after B.V. Peterson, who donated the specimen.

Description:

Male.

Frons brown, midline length about 1.5× greater than maximum breadth, without microtrichia, with about 30 hairs largely restricted to sides and the vicinity of supra-antennal bristles, which are only a little lower on frons than antials. Anterolaterals closer to eye margins than antials and almost as distant from the latter as from mediolaterals, which are clearly lower on frons than pre-ocellars. One or two small bristles on cheek plus 2 or 3 extending onto back of head, and with 2 longer more robust bristles on jowl. Pedicels brown but postpedicels yellow and slightly longer than greatest breadth, and with about 10 SPS vesicles. Palps yellow, with greatest breadth about 0.8× that of postpedicels, with 4 or 5 bristles, of which only apical long (0.08–0.09 mm) and with as many hairs. Labrum very pale and only about 0.6× as broad as postpedicel. Width of two labella combined almost twice that of postpedicel and both faces densely covered in microtrichia, which are more scale-like on lower faces. Thorax brown and dark brown on top. Anterior spiracles clearly longer than high. No humeral bristles and, associated with the rearward extension of the mesothorax, most posterior of 3 bristles on each notopleuron well behind other two bristles. Mesopleuron bare. Scutellum with 4 bristles,

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use



Figs 13, 14. *Phalacrotophora* species: (13) *P. petersoni* sp. n., ♂, left face of hypopygium; (14) *P. stuckenbergi* sp. n., ♀, abdominal tergites 4–6. Scale bars = 0.1 mm.

with anterior pair at most only three quarters as long as those behind. Abdominal tergites brown with hairs that a little longer at rear of T6 (Fig. 13). Venter brownish grey and lacking hairs. Hypopygium mainly brown, but with pale yellow anal tube and as in Fig. 13. Legs yellow apart from brown on outer third of hind femur and patch on mid coxa. Front tibia with 10–13 near-dorsal spines and half as many at tip. Front tarsus with posterodorsal hair palisade on all five segments and segment 5 longer than 4. Mid tibia with dorsal hair palisade and with 5 posterodorsal spine-like bristles, with 4 in basal half and one pre-apical, and 3 anterodorsals in basal half. Hairs below basal half of hind femur about as long as those of anteroventral row of outer half. Hind tibia with strong anterodorsal and posterodorsal spine-like bristles. Wing 2.1–2.2 mm long. Costal index 0.46. Costal ratios 4.6:1.8:1.0. Costal cilia 0.07–0.08 mm long. Space between two arms of vein 3 fork narrow. Vein *Sc* pale and fading before reaching vein 1. Minute hair at base of vein 3. Seven bristles on axillary ridge, all clearly longer than costal cilia. Costa yellowish brown and rest of thick veins brown and thin veins yellowish brown.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

Membrane almost colourless with microtrichia absent from much of middle of wing. Haltere with whitish yellow knob.

Holotype: ♂ BOTSWANA: Serowe [22.42°S 26.73°E], Farmer's Brigade, iii.1986, coll. Forchhammer, leg. B.V. Peterson, Malaise trap (UCMZ, 7–24).

Phalacrotophora (Omapanta) stuckenbergi sp. n.

Figs 14, 15

Etymology: The species is named after Brian Stuckenberg.

Description:

Female.

Frons brown, but with pale haloes surrounding sockets of antial bristles, midline length about 1.3× as long as greatest breadth, with minute microtrichia and 18–24 minute hairs largely restricted to sides and vicinity of supra-antennal bristles. Antials only slightly higher on frons than supra-antennals. Anterolaterals and mediolaterals close to eye margins, former being almost half the distance from antials as from MLs, which are clearly lower on frons than pre-ocellars. Sockets of all but supra-antennals surrounded by circular reticulate socket plates. Four or five bristles below eye and longer one on jowl. Pedicels yellow and postpedicels orange-brown, only just longer than greatest breadth and with a single SPS vesicle. Palps very slightly broader than postpedicels, with 4 or 5 short bristles (longest being only 0.08 mm) and twice as many hairs. Pale labrum at most two-thirds width of postpedicel. Pale labella together at least twice as

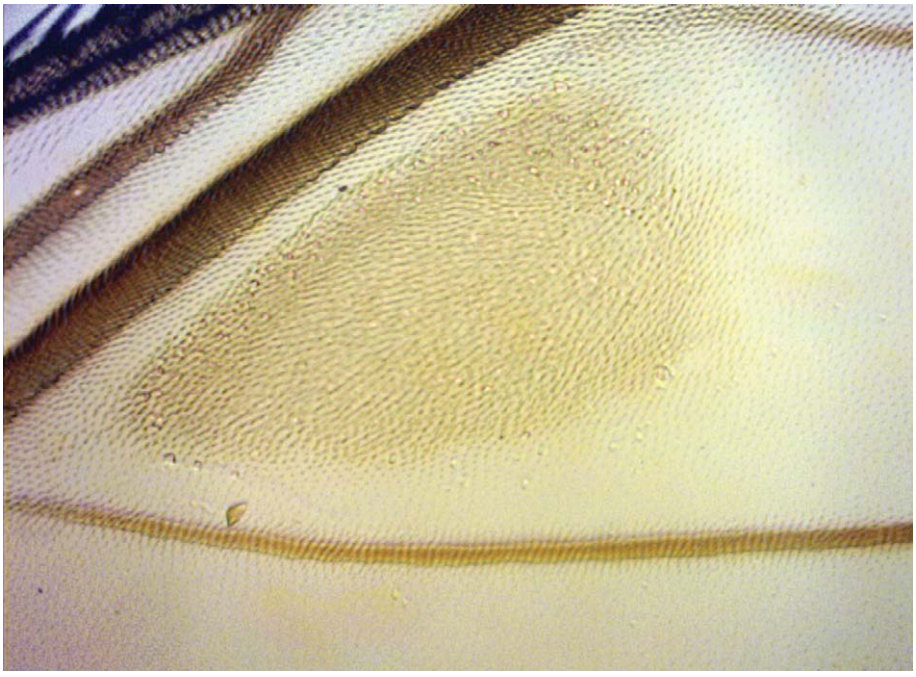


Fig. 15. *Phalacrotophora stuckenbergi* sp. n., ♀, patch of enlarged microtrichia between bases of wing veins 4 and 5.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

wide as postpedicel and appear a little greyish because of dense microtrichia on both faces. Thorax brown, being darkest on top, and front spiracles and mesothorax as in *Ph. petersoni*. Four bristles on notopleuron. Scutellum with 4 bristles, the anterior pair being only a little shorter than those behind. Abdominal tergites 1–3 brown and extending laterally onto ventral face, but 3 partially unpigmented in narrow bands in anterior halves towards sides of dorsal face. Hairs minute. T4–T6 as in Fig.14 with hind margins of T4 and T5 yellow. Venter dark brown with minute hairs on segments 2–6. Terminal segments form retractile ovipositor sheath; pair of long bristles on epiproct and pair of short pale bristles on hypoproct. Cerci cylindrical and about 3× as long as broad. Legs yellow apart from brown on outer third of hind femur and patch on mid coxa. Front tibia with 16 near-dorsal spines and a third as many at tip. Front tarsus with posterodorsal hair palisade on all five segments and segment 5 is longer than 4. Mid tibia with dorsal hair palisade and with 5 posterodorsal spine-like bristles, with 4 in basal two thirds and one pre-apical, and 5 anterodorsals. Hairs below basal half of hind femur longer than those of anteroventral row of outer half. Hind tibia with strong anterodorsal and posterodorsal spine-like bristles. Wing 2.6 mm long. Costal index 0.48. Costal ratios 6.0–6.1:3.1:1.0. Costal cilia 0.08 mm long. *Sc* reduced to a pale shadow. Vein 3 with minute hair at base and space between two arms of fork narrow. Axillary ridge with 9 bristles, all clearly longer than costal cilia. All veins brown, but costa more yellowish brown. Membrane lightly tinged brownish grey, but a little darker towards edges and beyond costa. Darker patch, formed from slightly larger microtrichia than on rest of membrane, between bases of veins 4 and 5 (Fig. 15). Haltere with whitish yellow knob.

Holotype: ♀ SOUTH AFRICA: *Limpopo*: Savanna [24.68°S 28.42°E], near Nylstroom, on bark of *Eucalyptus* tree, 6.ii.1987, V. Nicolai (UCMZ, 20–39).

Key to the Afrotropical species of *Phalacrotophora* (subgenus *Omapanta*)

Note: *Ph. nigrita, Ph. stuckenbergi, Ph. subnigrita* and *Ph. triguttata* are only known in the female sex and *Ph. petersoni* is only known in the male sex. Reared series or pairs caught mating are required in order to provide a better key to the species that treats the two sexes separately.

1 Between the bases of wing veins 4 and 5 an oval to pear-shaped patch (formed from slightly larger microtrichia than on the rest of the membrane) (e.g., Fig. 15) 2
– No such patch on wing.....3

2 Frons yellow.....**triguttata** Beyer
– Frons brown (abdominal tergites 4–6 as in Fig. 14; wing patch as in Fig. 15) .... **stuckenbergi** sp. n.

3 Wing tip with a darker grey cloud and costa extending about half wing length....4
– Wing more uniformly grey and costa not reaching halfway point.....5

4 Abdomen entirely dark. Hind femora yellowish brown with darker tips .... **nigrita** Schmitz
– Abdomen in part yellowish. Hind femora largely yellow.....**braunsi** (Brues)

5 Wing membrane moderately tinged grey.....6
– Wing membrane (and thin veins) pale (haltere knob pale yellow; hypopygium as in Fig. 13)..... **petersoni** sp. n.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

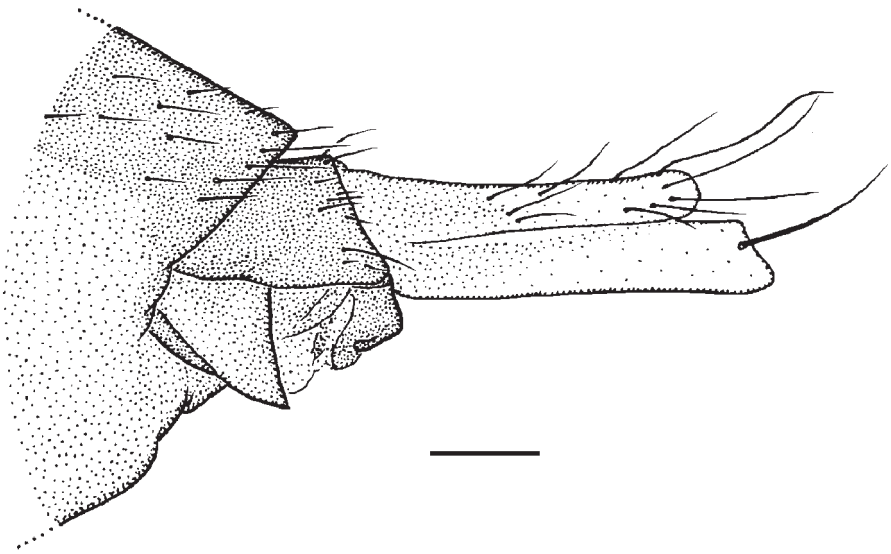


Fig. 16. *Phalacrotophora occidentata* Disney, ♂, left face of hypopygium. Scale bar = 0.1 mm.

6 Haltere knob pale yellow. Postpedicel light brown (hypopygium as in Fig. 16)..... ..... **occidentata** Disney

– Haltere knob light brown. Postpedicel dusky yellow ..... **subnigrita** Beyer

ACKNOWLEDGEMENTS

I am grateful to Dr E. De Coninck (Musee Royal de l'Afrique Centrale, Tervuren, Belgium) and the late Brian Stuckenberg (NMSA) for the loan of specimens. My studies of Phoridae are currently supported by a grant from the Balfour-Browne Trust Fund (University of Cambridge) and the Systematics Research Fund of the Linnean Society and the Systematics Association (UK).

REFERENCES

Beyer, E.M. 1965. Phoridae (Diptera Brachycera). *Exploration du Parc National Albert, Mission G.F. De Witte (1933–1935)* **99**: 1–211.

Disney, R.H.L. 1988. Biology and taxonomy of Old World *Puliciphora* (Diptera: Phoridae) with descriptions of nine new species. *Oriental Insects* **22**: 267–286.

———1994. *Scuttle flies: the Phoridae*. London: Chapman & Hall.

———2001. The preservation of small Diptera. *Entomologist's Monthly Magazine* **137**: 155–159.

———2003. Revision of the Afrotropical species of *Dohrniphora* Dahl (Diptera: Phoridae). *Zootaxa* **196**: 1–24.

———2006. Insects of Arabia scuttle flies (Diptera: Phoridae) Part I: all genera except *Megaselia*. *Fauna of Arabia* **22**: 473–521.

———2009. Insects of Arabia scuttle flies (Diptera: Phoridae) Part II: the genus *Megaselia*. *Fauna of Arabia* **24**: 249–357.

Disney, R.H.L. & Kistner, D.H. 1998. New species and new records of myrmecophilous Phoridae (Diptera). *Sociobiology* **31**: 291–349.

Schmitz, H. 1932. Neue *Stichillus*- und *Phalacrotophora*-Arten, mit einer Aufteilung von *Phalacrotophora* in drei Untergattungen. *Tijdschrift voor Entomologie* **75** (Supplement): 115–127.

Stuckenberg, B.R. 1999. Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum. *Studia Dipterologica* **6**: 33–48.

Downloaded From: https://bioone.org/journals/African-Invertebrates on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use