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Revision of the ant genus *Streblognathus* (Hymenoptera: Formicidae: Ponerinae)

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Abstract

The southern African ant genus *Streblognathus* has long been regarded as being monotypic but a morphological reappraisal of available specimens shows that there are two species: *Streblognathus aethiopicus* (F. Smith), which occurs in the southern karoo of the Eastern Cape, and *Streblognathus peetersi* **sp. nov.,** which occurs in the eastern grasslands of southern Africa. Workers and males are described and keyed. Male genitalia are illustrated and the significance of the large barbs on the penis valves is discussed.

Key words: taxonomy, Hymenoptera, Formicidae, Ponerinae, Ponerini, *Streblognathus*, South Africa, Lesotho, Swaziland, male genitalia

Introduction

Streblognathus was named by Mayr (1862) to hold a single species *Streblognathus aethiopicus*, originally described as *Ponera aethiopica* by Smith (1858). Distribution of the genus is limited to grassland and southern karoo regions of southern Africa, and it has the largest worker ants in Africa, measuring up to 2.5 cm long. Like many large southern African ponerine ants, *Streblognathus* has lost the queen caste and instead, reproduction is undertaken by a single, mated worker, termed a gamergate (Ware *et al.* 1990; Peeters 1991). Mandibular glands of workers contain three types of pyrazines which, in a study based on two colonies, were found to occur in smaller quantities and in different proportions in the gamergate compared with the mated workers (Jones *et al.* 1998). Colony size of *S. aethiopicus* is moderately small ranging from 9 to 51 workers (Ware *et al.* 1990). Workers stridulate, apparently for alarm purposes, by moving the presclerite of the second gastral segment, which has ridges on it, against the posterior edge of the first gastral segment (Lewis 1896, Ware 1994).

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Carpenter (1930) drew attention to the apparent similarity between *Streblognathus*, *Dinoponera* Roger (South American genus), and *Archiponera* Carpenter (an extinct genus known from fossils in the 35 million year old Florissant Shales in Colorado, USA). Kempf (1971) commented that *Dinoponera* was clearly related to *Pachycondyla* F. Smith and other large-sized ponerine allies. The above genera fall in the tribe Ponerini (Bolton 1995), and although there is an admitted similarity between them in the general habitus of workers and males, no-one has found dependable morphological characters that can be used to discern their evolutionary relationships. The situation is further confused by the considerable morphological variation in *Pachycondyla* and the high probability that it is paraphyletic or polyphyletic.

This revision of *Streblognathus* came about because of the discernment of a new species, specimens of which were previously included under *S. aethiopicus*. Behavioural and molecular research by V. Cuvillier-Hot, C. Peeters and co-workers (submitted) has revealed that there are two species in the genus and this is further confirmed by detailed morphological analysis, the results of which are presented here.

Materials and methods

Material was examined from the following collections: Albany Museum, Grahamstown (AMGS); Museum of Zoology, Lund University, Lund (MZLU); National Collection of Insects, Biosystematics Division, Plant Protection Research Institute, Pretoria (SANC); South African Museum, part of Iziko Museums of Cape Town (SAMC); and Transvaal Museum, part of the Northern Flagship Institution (TMSA). Specimens of *Dinoponera quadriceps* Kempf and *D. gigantea* (Perty) in the South African Museum collection were examined for comparative purposes.

Using an ocular micrometer on a Wild M5 microscope, the following measurements were taken from each worker that was measured: Head width (maximum head width in full-face view); Head length (measured in full-face view along the midline from posterior margin to a line linking the anterior-extremities of the clypeal teeth); Eye length (maximum length of compound eye) ; Scape length (length of first antennal segment, excluding the radicle); Pronotal width; Mesonotal-propodeal length (measured in lateral view from middle of promesonotal margin to posterior point of propodeal lobes); and Hind tibia length. From these measurement the following indices were calculated: Cephalic index (head width / head length X 100); Scape index (Scape length / head width X 100); Eye index (eye length / head width X 100). Measurements were compared in bivariate plots in order to discern relative differences between species.

The following measurements were taken from males: Head width (maximum head width in full face view); Head length (measured in full face view along the midline from a line linking the posterior extremities of the lateral ocelli to a line linking the anterior points of the clypeus); Eye length (maximum length of eye); Ocellus diameter (diameter of

median ocellus, measured in full face view); Forewing length (measured from distal extremity of tegula to apex of wing); and Hind tibia length. Cephalic index and Eye index were calculated in the same way as for workers. Terminology of male genitalia follows Snodgrass (1941).

Scanning electron micrographs were taken of gold-coated specimens using a JEOL JSM-5200 Scanning Microscope.

Descriptive taxonomy

Streblognathus Mayr

Streblognathus Mayr 1862: 716.
Type species: *Ponera aethiopica* F. Smith, 1858, by monotypy.

WORKER (Fig. 1). Large, black, monomorphic ants.

Head (Figs 1a-c). Mandibles elongate with broad angle (about 138º) between apical and basal margin. Apical margin with three teeth followed by three denticles and with a tooth at the basal angle. Inner margin of apical tooth sinuate. Basal margin of mandible with an obtuse angle at about one third of its length from the base. The margin proximal to this angle lies adjacent to the clypeus when mandibles are closed. Mandibles glossy smooth or slightly shagreenate with sparsely distributed punctures containing hairs. Fringe of black or golden hairs inserted on dorsal surface just behind the distal two thirds of the basal margin and the basal tooth, and the hairs extending over the margin into the triangular space between the closed mandibles and the clypeal margin. Also a line of golden hairs along the external margin, and one behind the inner side of the apical margin. Maxillary and labial palps both four segmented. Margin of labrum deeply bisected and fringed with golden hairs (Fig. 1b). Anterior clypeal margin with middle section straight or concave, projecting beyond side margins and meeting them in a right angle or in a tooth-like projection (Fig. 1a). In anterior view, the region between the clypeal teeth is crescent-shaped, shiny, and overhangs the labrum (Fig. 1b). Posterior median portion of clypeus broadly inserted between the frontal lobes and indented medially. Clypeus with sparse, fine golden pubescence and smooth to shagreenate with sparsely distributed punctures containing short, black, pointed subdecumbent hairs that point anteriorly. Frontal triangle prominent between frontal carinae and inlaid into surface of head. Frontal lobes in dorsal view half obscuring the antennal sockets. Frontal carinae short, fading out just behind the level of the anterior margins of the compound eyes. Compound eyes in dorsal view situated at, or slightly anterior to, midlength of head and do not break the lateral margins. Head, excluding mandibles, rounded rectangular, usually a little longer than broad with a flat posterior margin and sides only slightly convex (Fig. 1a). Head covered in fine punctate sculpture, overlaid by fine, sparsely distributed golden pubescence, and covered by short, black, pointed, subdecumbent, curved hairs (Fig. 1c). Punctures poorly defined and unevenly distributed. Antennal scapes bowed, covered in sparse, short, golden or black subdecumbent

or decumbent hairs and sparse, fine, golden pubescence. Neck between scape and condylar bulb (radicle) curved strongly downwards. Ventral surface of head smooth to shagreenate with variable densities of golden pubescence and with more-or-less evenly distributed anteriorly pointing, subdecumbent curved hairs.

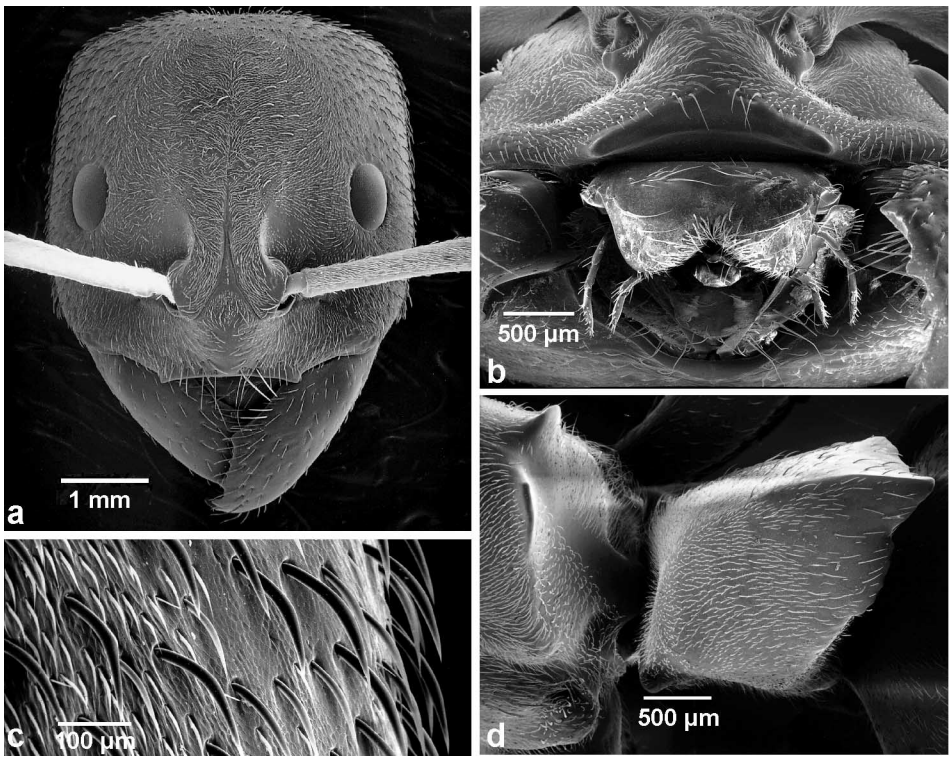

FIGURE 1. *Streblognathus peetersi* worker: (a) head, dorsal view; (b) anterior view of head between opened mandibles; (c) close-up of hairs situated dorso-laterally on head, above the eyes; and (d) dorso-lateral view of declivity of propodeum, and petiole.

Mesosoma. In dorsal view, promesonotal suture sharply defined, strongly curved backwards. Metanotal groove slightly impressed, defined in lateral view by the downwardly curving mesonotum meeting the flat propodeal dorsum, although in some specimens the propodeal dorsum curves down slightly at the metanotal groove. In lateral view, propodeum with elongate, flat dorsum and a nearly vertical declivity. Dorsum often with a slight indentation about a quarter of the way from the metanotal groove. Lateral margins of dorsum sometimes distinct posteriorly. At the junction of the dorsum and declivity is a pair of upwardly projecting teeth which are continuous with the sharply raised lateral margins of the declivity (Fig. 1d). Propodeal spiracle slit-shaped. Large metapleural gland opening, fringed with long golden hairs. In many individuals there is a hairless shallow furrow passing from the dorsal edge of the propodeal spiracle, round its posterior edge, and across to above the dorsal edge of the metapleural gland opening. This furrow is reduced to varying

degrees across individuals. Mesosoma covered in fine, ill-defined punctate sculpture, smeared to striolate in parts, or appearing shagreenate. Mesosoma covered in sparse, fine, golden pubescence and dorsum with scattered subdecumbent short, black, pointed hairs.

Legs. Middle and hind tibiae each with a pair of pectinate spurs, the posterior spur longer and more pectinate than the anterior. Tarsal claws simple. All legs covered in short subdecumbent hairs.

Petiole (Fig. 1d). Petiolar node with about a third of its height above the level of the propodeal dorsum. In lateral view, anterior and dorsal faces form a single steep convexity that terminates in an acute point where it meets the vertical, concave posterior margin. Dorsum laterally compressed to form an acute, sharp-edged ridge. In dorsal view, petiole node longer than wide and with the posterior point of the dorsum overhanging the posterior face. Subpetiolar process in lateral view with more-or-less horizontal ventral margin meeting posterior margin at an acute but narrowly rounded angle. Petiole unsculptured except for hair pits, covered in sparse, golden pubescence and sometimes with a few strongly curved subdecumbent black hairs.

Gaster. Constriction between first and second gastral segments hardly discernable. Gaster smooth, shiny except for hair pits, and covered in sparse to moderately dense golden pubescence, and sparse black hairs that are bent near their tip. Sting well developed.

MALE (Figs 2-4)

Head (Figs 2a-b). Dominated by the compound eyes which take up 69-75% of the length of the head and which are hemispherical in dorsal view. Ocelli large, hemispherical. Width of median ocellus about the same as the shortest distance between the lateral ocelli. Occipital carina a blade-like ridge. Antennal sockets situated at midlength on the head; diameter of sockets greater than the shortest distance between them and also greater than the distance from outer margin of socket to margin of compound eye. Torulus built up into raised rim round antennal socket. Antennae 13-segmented, elongate, about 83% of total length (from head to tip of gaster). Scape short, equal to or slightly shorter than diameter of median ocellus. Pedicel length slightly shorter than half the length of scape. Flagellum decreases in diameter and length of individual segments from base to tip. Antennae covered in fine, white pubescence. Anterior margin of clypeus built out as a narrow lamella that is broader at the sides than in the middle so that the median anterior margin is concave (Fig. 2b). Tentorial pits deeply impressed (Fig. 2b). Large frontal triangle present above the clypeus and between the antennal sockets. Head smooth with scattered hair pits except for shagreenate sculpture between the antennal sockets and on the frontal triangle and clypeus. Short, sparse golden hairs distributed over head; densest on frontal triangle and clypeus. Vertex reddish brown through to dark brown; golden brown forwards from the anterior margin of the median ocellus.

Mouthparts (Fig. 2b). Mandibles short, rounded, without teeth, not meeting when closed. Labrum bilobed and small, narrower than the distance between the closed mandi-

bles. Maxillary palpi 4-5 segmented, the apical segment being a fusion segment in 4-segmented palpi. One individual had one palp 4-segmented and the other 5-segmented. Labial palpi 3-segmented.

Mesosoma. Pronotum small, vertical, without a dorsal surface; displaced by the large mesoscutum. Median line on mesoscutum fades out at about half its length. Parapsidal lines present, notauli absent. Scutellum dome-like, dorsellum strongly convex in lateral view and slightly overlapping the top of the propodeum. . Propodeum gently convex in lateral view and with spiracle slit shaped. Wings as illustrated in Fig. 2c.

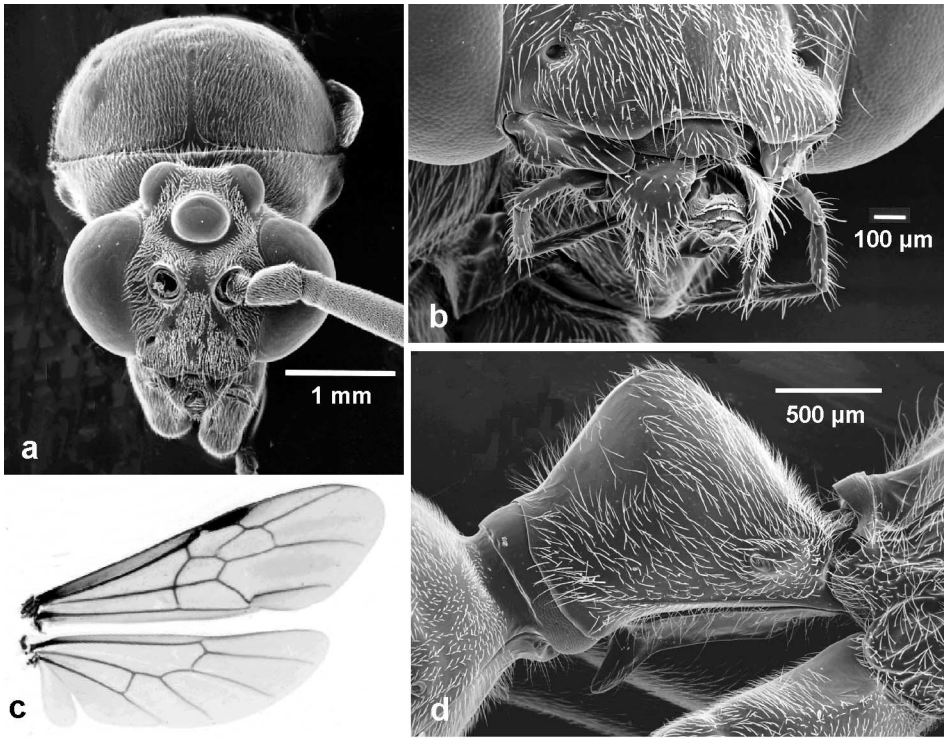

FIGURE 2. *Streblognathus peetersi* male: (a) anterior view of head; (b) antero-lateral view of clypeus and mouthparts; (c) wings; and (d) lateral view of petiole.

Petiole (Fig. 2d). In lateral view, node more-or-less an equilateral triangle with narrowly rounded dorsum. In dorsal view, petiole longer than wide; spiracles on projecting tubercles; shallow ridge along the median line of node. Subpetiolar process with an acute, backwardly projecting spine. Petiole covered in backwardly projecting, slender, pale hairs.

Gaster. Smooth with fine, sparse, golden pubescence. Fifth gastral sternite with a pair of broad lateral ridges with a concavity in between them; long, curved golden hairs along posterior margin. Backwardly projecting golden hairs present on the lateral ridges and shorter less dense hairs in the concavity in between. Subgenital plate narrowing posteriorly

and broadly rounded at the apex (Figs 3c-d). Sixth gastral tergite terminates in an acute point.

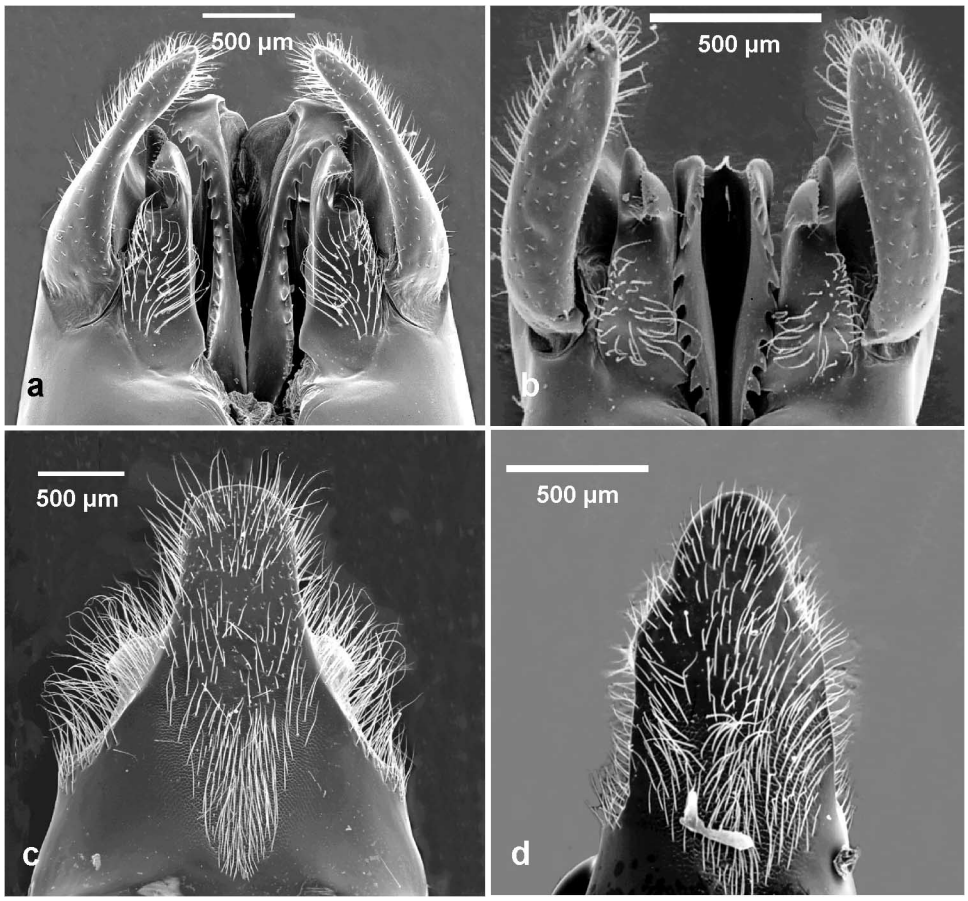

FIGURE 3. Male genitalia (a, b) and subgenital plates (c, d) of *S. aethiopicus* (left column: a, c) and *S. peetersi* (right column: b, d).

Genitalia (Figs 3-4). Parameres in cross-section with a sharp-edged dorsal margin and a broadly convex ventral margin. In lateral view, ventral margin of paramere is convex and dorsal margin more-or-less straight. In dorsal view, dorsal margin of paramere is bowed outwards. Exterior and apex of parameres with golden hairs. Volsellae pincer-like: digitus curved outwards and inner margin of cuspidus convex, with a narrow gap between them at their closest point. In lateral view, digitus arches downwards whereas cuspidus is more-or-less straight with a broadly rounded apex. Inner surfaces of both digitus and cuspidus covered with small tubercles (Fig. 4). Golden, curved hairs on ventral surface of volsella and inner surface of digitus and cuspidus. Ventral margins of penis valves with large, acute, sharp, backwardly projecting barbs, oriented vertically or outwards, depending on species. Apex of valves splayed outwards or inwards (depending on species) and broadly rounded

with backwardly projecting barbs on ventral margin. Dorsal outer edges of penis valves joined by a large trough-like lamella that is V-shaped in cross-section, the whole complex forming the aedeagus.

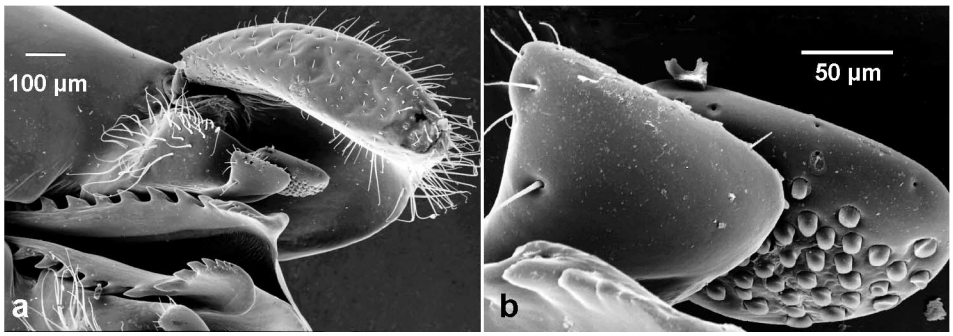

Figure 4. Male genitalia of *S. peetersi*: (a) postero-lateral view of ventral side of genitalia, showing paramere (top), volsella (middle) and barbed penis valve (bottom); (b) close-up of pincer-like apex of volsella made up of the digitus (LHS) and cuspidus (RHS) and showing the tubercles on the inner surface of the cuspidus.

Diagnosis of *Streblognathus*

The shape of the petiolar node in the worker, with its sharp-edged dorsal margin and concave posterior face (Fig. 1d) is unique among ants. The shape of the anterior margin of the clypeus is similar to that of *Dinoponera* in that in both genera there are lateral projections with a concave margin inbetween. However, the projections are acute and spine-like in *Dinoponera* whereas in *Streblognathus* they are merely obtuse points or short and tuberculate.

Males in the tribe Ponerini have been insufficiently studied to make a reliable diagnosis for *Streblognathus*. The large barbs along the ventral margin of the penis valves in *Streblognathus* are matched by only small serrations in *Dinoponera*. *Dinoponera* parameres are elongate linear whereas those in *Streblognathus* are short and broad. *Streblognathus* males have a large, acutely angled, subpetiolar process (Fig. 2d) which is absent in *Dinoponera*.

Key to workers of *Streblognathus*

1 Scape both absolutely and relatively longer (Scape length 4.32-5.11 mm; Scape index 102-113) (Fig. 5b). Eye length 0.86-1.03 mm; Mesonotal-propodeal length 5.56-6.32 mm; Hind tibia length 4.80-5.54 mm (Figs 5c, e, f) .....*S. aethiopicus*

\- Scape both absolutely and relatively shorter (Scape length 3.28-4.12 mm; Scape index

87-98) (Fig. 5b). Eye length 0.62-0.85 mm; Mesonotal-propodeal length 4.34-5.47 mm; Hind tibia length 3.80-4.80 mm (Figs 5c, e, f) ..... *S. peetersi*

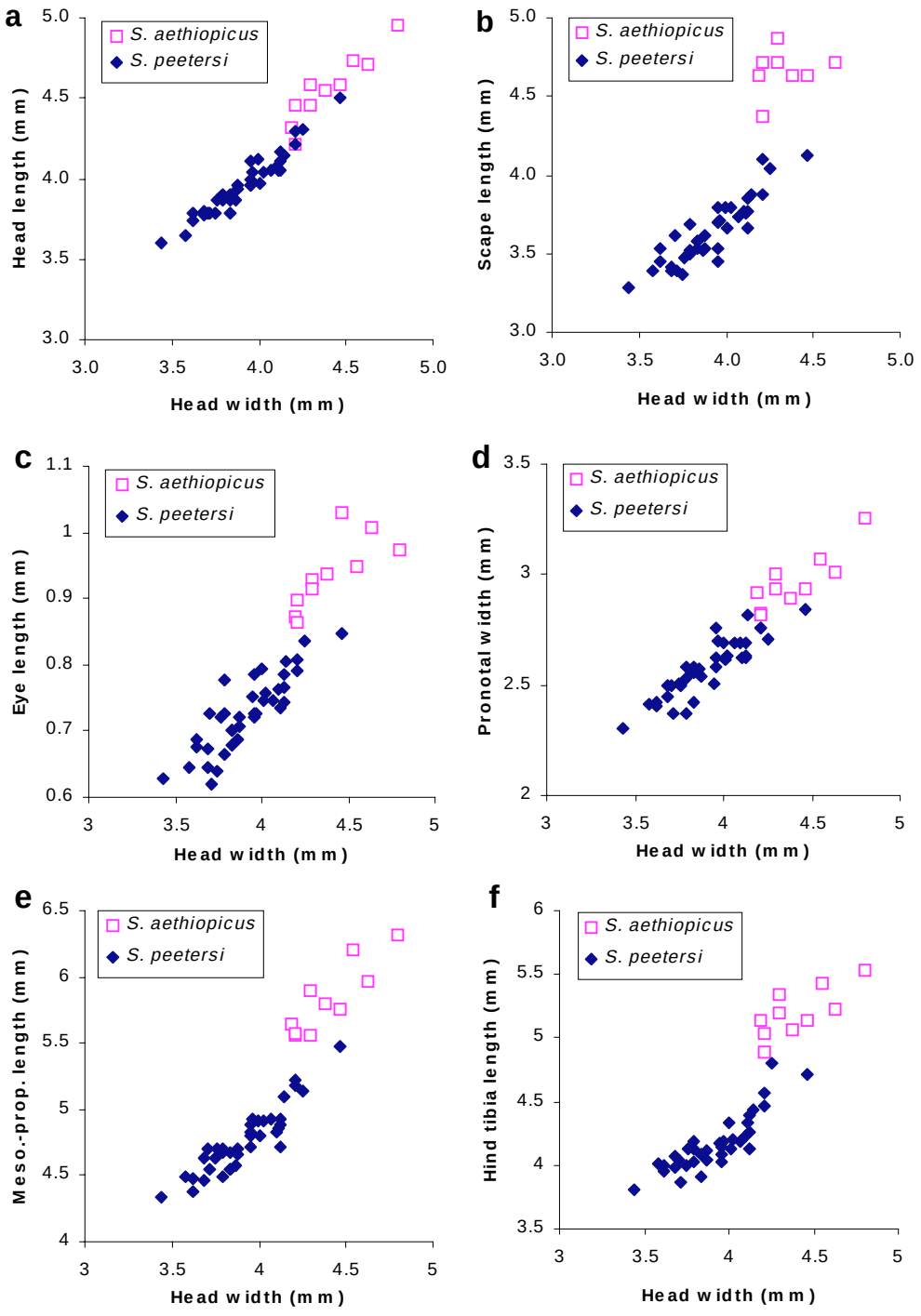

FIGURE 5. Bivariate plots of measurements taken from workers of *S. aethiopicus* (open squares) and *S. peetersi* (closed diamonds).

Key to males of *Streblognathus*

1 Sides of subgenital plate concave and apex flat (Fig. 3c). Barbed apex of penis valve splayed outwards, whereas barbs along ventral margin oriented vertically (Figs 3a) ... .*S. aethiopicus*

- Sides of subgenital plate convex and apex broadly rounded (Fig. 3d). Barbed apex of penis valve vertical whereas barbs along ventral margin are splayed outwards (Fig. 3b) ..... *S. peetersi*

Streblognathus aethiopicus (F. Smith)

Ponera aethiopica F. Smith, 1858: 91, plate VI figs 19, 20. Worker and male described by Arnold (1915: 41-43).
Streblognathus aethiopicus (F. Smith): Mayr 1862: 716.

WORKER. Description of worker matches that for the genus but with the following additional species-specific characters. Mandibles castaneous with black border.

Size. Head width 4.14-4.80 mm (*n* = 11); Head length 4.21-4.95 mm; Eye length 0.86-1.03 mm; Scape length 4.32-5.11 mm (*n* = 11); Pronotal width 2.82-3.26 mm; Mesonotal-propodeal length 5.56-6.32 mm; Hind tibia length 4.80-5.54 mm; Cephalic index 94-100; Scape index 102-113; Eye index 20-23 (*n* = 10 except for Head width and Scape length which include the measurements of the holotype).

MALE. Description of male matches that of the genus, but with the following species-specific characters.

Size. Head width 2.55-2.99 mm; Head length 2.00-2.33 mm; Eye length 1.49-1.65 mm; Ocellus diameter 0.55-0.69 mm; Forewing length 14.42-17.20 mm; Hind tibia length 4.61-5.22 mm; Cephalic index 124-132; Eye index 54-58 (*n* = 5).

Diagnosis. See under *S. peetersi*.

Distribution and habitat. All records are from between 33 and 34 degrees latitude S, within which it has been collected from Willowmore in the west to Grahamstown and near Port Alfred in the east (Fig. 6). Found in open habitats, such as Nama Karoo. It seems to occur in small isolated populations, thus following a metapopulation structure.

Type material examined. *Ponera aethiopica.* Label details and measurement of scape and head width supplied to me by B. Bolton from holotype in The Natural History Museum, London. SOUTH AFRICA: 'S. Africa. 40.6.26.613'. The accessions register gives the following information for these numbers: 'Cape Colony, bought of Dr Krauss'.

Additional material examined. Grahamstown, 33º42'S 26º32'E, iii.1997, A. Weaving (SAMC); same locality but 26.i.1958, J.H. Grobler (SAMC); same locality but v.1957, Nat. Mus. S. Rhodesia (SAMC); Hilton [farm near Grahamstown], 33º45'S 26º21'E, 11-16.xii.1979, F.W. Gess (AMGS); Kowie [= Port Alfred], 33º25'S 26º53'E, 1891, (SAMC);

Thursford Farm, 33º48'S 26º22'E, 30.vii.1983, H.G. Robertson (SAMC); Middelburg Division, 31'S 25'E, no date, SAM Museum Expedition (SAMC); Willowmore, 33º42'S 23º29'E, ii.1915, H. Brauns (SAMC); same data but.xii.1912 (SAMC); same data but 1911 (TMSA).

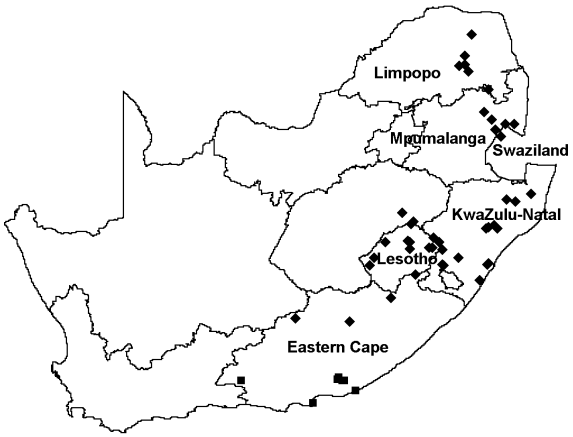

Figure 6. Map of South Africa, showing distribution of *S. aethiopicus* (squares) and *S. peetersi* (diamonds).

***Streblognathus peetersi* sp. nov.**

Males from Natal described under *S. aethiopicus* by Emery (1899: 468).
Larvae from Natal described under *S. aethiopicus* by Wheeler and Wheeler (1989).

HOLOTYPE WORKER. Matching description of genus but with the following specimen-specific characters.

Size. Head width 3.87 mm; Head length 3.93 mm; Eye length 0.71 mm; Scape length 3.54 mm; Pronotal width 2.54 mm; Mesonotal-propodeal length 4.66 mm; Hind tibia length 4.04 mm; Cephalic index 99; Scape index 91; Eye index 18.

Head (Fig. 1a, b). Mandibles glossy smooth with sparsely distributed punctures containing hairs. Fringe of black hairs on anterior surface, behind basal margin and basal tooth. Anterior clypeal margin with middle section broadly concave, projecting beyond the outer margins and meeting them in a right angle. Compound eyes situated slightly anterior to mid-length of head. Fine puncturing on head poorly defined and smeared in appearance. Golden pubescence on head sparse to absent, limited mainly to the posterior, the central region and anterior to eyes. Antennal scapes with sparse golden pubescence overlaid by sparse decumbent black hairs. Venter of head smooth to shagreenate with sparse golden pubescence and uniformly distributed short, black hairs.

Mesosoma. Propodeal dorsum in profile mainly flat but curving down slightly to the metanotal groove and terminating posteriorly in dorsally projecting short spines (Fig. 1d).

Slight indentation present about one quarter of the way from the metanotal groove. No distinct lateral margins to propodeal dorsum. A hairless shallow furrow passes from the dorsal edge of the propodeal spiracle, round its posterior edge, and across to above the dorsal edge of the metapleural gland opening. Mesosoma dorsum covered in fine, ill-defined punctate sculpture, some of the punctures flowing into one another. Sides with shagreenate sculpture. Mesosoma covered in sparse, fine, golden pubescence and dorsum with scattered subdecumbent short, black, pointed hairs.

Petiole (Fig. 1d). Appearing as in description of genus. Covered in sparse golden pubescence and uniformly distributed subdecumbent short black hairs.

Gaster. As described for genus.

PARATYPE WORKERS. Matching the description of the genus and the holotype but with the following additional variation.

Size. Head width 3.83-4.12 mm; Head length 3.79-4.11 mm; Eye length 0.70-0.77 mm; Scape length 3.54-3.77 mm; Pronotal width 2.82-2.70 mm; Mesonotal-propodeal length 4.55-4.93 mm; Hind tibia length 3.91-4.26 mm; Cephalic index 98-102; Scape index 89-94; Eye index 18-19 (n=6).

ALL WORKERS.

Size. Head width 3.43-4.46 mm; Head length 3.60-4.50 mm; Eye length 0.62-0.85 mm; Scape length 3.28-4.12 mm; Pronotal width 2.30-2.84 mm; Mesonotal-propodeal length 4.34-5.47 mm; Hind tibia length 3.80-4.80 mm; Cephalic index 95-102; Scape index 87-98; Eye index 17-21 (n=38).

PARATYPE MALES.

Size. Head width 2.26-2.42 mm; Head length 1.83-1.90 mm; Eye length 1.25-1.32 mm; Ocellus diameter 0.55-0.69 mm; Forewing length 13.46-13.81 mm; Hind tibia length 4.02-4.12 mm; Cephalic index 122-128; Eye index 53-57 (n = 6).

ALL MALES.

Size. Head width 2.02-2.51 mm; Head length 1.62-1.97 mm; Eye length 1.12-1.41 mm; Ocellus diameter 0.42-0.69 mm; Forewing length 13.46-14.83 mm; Hind tibia length 3.83-4.38 mm; Cephalic index 121-130; Eye index 53-57 (n = 12).

Diagnosis. In the worker, scape, mesosoma and legs are shorter relative to width measurements in *S. peetersi* than in *S. aethiopicus* (Figs 5b, e, f), with scape index being the easiest measurement to separate the two species. The relatively longer body and appendages of *S. aethiopicus*, combined with its larger size results in Scape length, Meso-propodeal length and tibia length being longer in this species than in *S. peetersi*. There is also only a slight degree of overlap in Eye length (Fig. 5c). Mandibles in *S. aethiopicus* are castaneous with a black border whereas in *S. peetersi* they are generally black although there is a small proportion of specimens with some castaneous colouration.

In the male, the subgenital plate in *S. peetersi* has convex lateral margins and the apex is broadly rounded, whereas in *S. aethiopicus* the lateral margins are concave and the apex is flat (Figs 3c, d). The barbed apices of the penis valves are oriented vertically in *S.*

peetersi whereas in *S. aethiopicus*, they splay outwards. In contrast, the barbs along the outer margins of the penis valves, behind the apices, are splayed outwards in *S. peetersi* whereas in *S. aethiopicus* they are oriented vertically.

Distribution and habitat. *Streblognathus peetersi* has a wide distribution in the grassland regions of eastern South Africa, Lesotho and Swaziland (Fig. 6).

Etymology. Named after Christian Peeters who drew my attention to this new species and collected the type material. It is also named after him in recognition of the substantial contribution he has made to our understanding of ponerine reproductive biology.

Type material examined. HOLOTYPE: worker, SOUTH AFRICA, *Limpopo Province*: next to Magoebaskloof Hotel, 23º53'S 29º59E, 8.iv.2001, C. Peeters, SAM-HYM-C017887a (SAMC). PARATYPE: workers (unless otherwise indicated): same locality as holotype, and collector is C. Peeters unless otherwise indicated: 24.i.2000, 'MAGOE #A', SAM-HYM-C015165; 24.i.2000, 'MAGOE#B', SAM-HYM-C015166; 24.i.2000, 'ZH-2', SAM-HYM-C015168; 24.i.2000, 'ZH-3', SAM-HYM-C015169 (males); 24.i.2000, SAM-HYM-C017879; 24.i.2000, 'ZH-1', SAM-HYM-C017880; v.2000, 'ZH-5', SAM-HYM-C017882; v.2000, 'ZH-6a', SAM-HYM-C017883; v.2000, 'ZH-7', SAM-HYM-C017884; J de Oliveira, 9.ii.2001, 'ZH-9', SAM-HYM-C017885; J de Oliveira, 10.ii.2001, 'ZH-10', SAM-HYM-C017886; 8.iv.2001, SAM-HYM-C017887 (workers and males) (SAMC). Some duplicate specimens of above paratype material have been deposited in The Natural History Museum, London and at the California Academy of Sciences, San Francisco.

Additional material examined. LESOTHO: Bokong N.R., 29º56'S 28º27'E, 29-30.ix.1991, H. Geertsema (SAMC); Haha-la-Sekhonyana, undetermined coordinates, 27.xii.1946, A. Jacot-Guillarmod (AMGS); Katse (3 km SW of), 29º42'S 28º30'E, 21.i.1991, H. Geertsema (SAMC); Likhoele, 29º11'S 27º19'E, no date, Dieterlin (SAMC); Makheke Mnts 10 miles ENE Mokhotlong, No. 270, 29º44'S 29º11'E, 9.iv.1951, P. Brinck & G. Rudebeck (MZLU); Mamathes, 29º53'S 27º48'E, x.1957, Nat. Mus. S. Rhodesia (SAMC); same locality but 29.ix.1957, C. Jacot-Guillarmod (AMGS); same locality and collector but 28.xi.1953 (AMGS); Mamohau, 29º53'S 28º30'E, 25-30.iii.1991, H. Geertsema (SAMC); Masite, 29º24'S 27º27'E, 31.i.1930, J. Hewitt (AMGS); Mokhotlong, 7200 ft, 29º43'S 29º05'E, 6.iv.1951, P. Brinck & G. Rudebeck (MZLU); Qachas Nek, 30º54'S 28º41'E, 13.i.1969, C. Jacot-Guillarmod (AMGS). SOUTH AFRICA, *Eastern Cape*: Queenstown to Jamestown, 31º30'S 26º42'E, 14.iv.1988, A.J. Prins, A. Prins (SAMC); Rhodes, 30º12'S 27º58'E, 10.iii.1951, P. Brinck & G. Rudebeck (MZLU). *Free State*: Bethlehem, 28º46'S 28º18'E, iii.1918, C.P. van der Merwe (SAMC); Clarens, Langkrans, 28º26'S 28º34'E, 25.xii.1976, C. Peeters (SAMC); Golden Gate, 28º30'S 28º37'E, 13-16.xii.1982, H.J. Greyling (SAMC). *KwaZulu-Natal*: Cathedral Peak area, Catchment XIV, 1920-1930m alt., 28º00'S 29º12'E, 4.xii.1989, I Pajor (SAMC); Cathedral Peak area, catchment XV, 1950m, 28º00'S 29º12'E, 13.x.1989, I. Pajor (SAMC); Champagne Castle, 29º53'S 29º23'E, iv.1965, B.V.W. (SAMC); Clovelly Farm, c6 km from Underberg, Camp V6, 29º11'S 29º32'E, 3.ii.2000, H.G. Robertson (SAMC); Giant's Castle, 29º40'S 29º29'E,

i.1983, C. Peeters (SAMC); Impendle, 29º34'45"S 29º57'57"E, 12.x.1993, J. Kotze (SAMC); Kloof, 29º13'S 30º50'E, 8.v.1915, H.W. Bell Marley (SAMC); Krantz Kloof, 29º14'S 30º51'E, 1.x.1916, H.W. Bell Marley (SAMC); Maqwaza [= Maquasa], 27º19'S 32º08'E, xi.1915, H.W. Bell Marley (SAMC); Mfongosi, Zululand, 28º18'S 30º48'E, xii.1911, W.E. Jones (SAMC); 6 miles from Nkandla to Qudeni, 28º24'S 31º02'E, 26.i.1957, J.H. Grobler (SAMC); Nongoma, Zululand, 27º06'S 31º39'E, 1923, C. Fuller (SAMC); Nongomi, 27º06'S 31º39'E, 29.xi.1957, J.J. Nel (SAMC); Ntendeka Forest Reserve, 27km E of Vryheid, 27º09'S 31º24'E, 7.x.1991, M.H. Villet (SAMC); Qudeni, 28º20'S 30º52'E, 27.i.1957, J.H. Grobler (SAMC); Underberg, 29º12'S 29º29'E, 6.i.1988, N.P. Hill (SAMC); Vernon Crookes Nature Reserve, ZI3, 30º16'S 30º35'E, 2.ii.2000, C. Peeters. *Limpopo Province*: Entabeni Forest Reserve, 22º04'S 30º21'E, xi.1978, G.L. Prinsloo (SANC); Koedoes-Riv., 23º26'S 30º09'E, xii.1902, H.G. Breyer (TMSA); Shiluvane, 24º58'S 30º16'E, iii.1906, Junod (TMSA); Tzaneen, 23º10'S 30º09'E, 26.xii.1991, A. Turner (SAMC). *Mpumalanga*: Barberton, 25º13'S 31º03'E, no date, H. Edwards (SAMC); same locality but 23.xii.1927, J.S. Taylor (AMGS); same locality but 11.iv.1927, J.S. Taylor (AMGS); Marieps Mountain, 24º26'S 30º52'E, 15.iv.1948, G. van Son (TMSA); Nelspruit, 2528DB, xii.1979, E. de Wet (SAMC); Nelspruit, 2531DA, 11.iv.1982, M. Jansson (SAMC); Nelspruit 2530BD, iv.1982, E. Anastassiades (SAMC); Stentor Estate, Dist. Kaapmuiden, 25º23'S 31º23'E, 4.iv.1983, A. Nel (SAMC); Uitsuk Forest Station, 25º45'S 30º44'E, 28.ix.1986, S. Endrödy-Younga (SAMC). SWAZILAND: Piggspeak, Swaziland, 25º02'S 31º14'E, 18.vi.1987, J.A. Warrens (SAMC).

Discussion

There is quite extensive size variation in *S. peetersi* with the head width of the smallest measured worker only 77% of that in the largest worker whereas for *S. aethiopicus* it is 86%. Most of the size variation has a geographical basis, with workers in southern KwaZulu-Natal, Lesotho and Free State being smaller than those further north in northern KwaZulu-Natal, Swaziland, Mpumalanga and Limpopo Province.

The large, recurved barbs on the penis valves are possibly an adaptation for preventing easy removal of the genitalia after insemination. Monnin and Peeters (1998) showed in *Dinoponera quadriceps*, that a male did not withdraw his genitalia after insemination of a receptive worker, and instead the worker used her mandibles to cut off the genitalia from the male and then spent about 30 minutes removing the genitalia from inside herself. Once removed, she was no longer receptive to further mating by other males. The male genitalia in *D. quadriceps* therefore act as a mating plug, preventing further insemination by other males. As there is only one receptive 'alpha' worker per nest, who prevents mating by other workers, the reproductive interests of the male are best served by committing himself suicidally to a single mating, rather than withdrawing, exposing the receptive worker to mating by other males, and running the high risk of not locating another receptive worker at

another nest. As *Streblognathus* is also monogynous, the recurved barbs on the male penis valves are probably also to secure the male genitalia in the worker's bursa copulatrix so that the genitalia act as a mating plug. The fact that the barbs in *Streblognathus* are so much larger than those in *Dinoponera* (personal observations), suggests that perhaps an even more persistent mating plug occurs in this genus.

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