

Taxonomic review of the ant genus *Paratrechina*, with a description of a new species from Africa

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Abstract

With the recent finding of *Paratrechina* (broad sense) paraphyly, only *Paratrechina longicornis* remained in a redefined genus. As one of the most widely distributed ant species due to human transfer around the world, there is much interest in the biology of *P. longicornis*. One issue concerning *P. longicornis* has been as to where exactly the species is native, with both African and Asian native ranges being invoked in the literature. Here we report the discovery of a second species within *Paratrechina*. This species, *P. zanjensis*, is native to Africa (known from Angola, Mozambique and Tanzania), where it appears to be a dry miombo woodland species. Given the discovery of this new species, a reevaluation of the morphological definition of *Paratrechina* is provided; also provided is an updated generic level identification key. Given the available distribution information on *P. longicornis*, we conclude that *P. longicornis* remains most likely native to southeastern Asia, and that the discovery of a new species native to Africa makes *Paratrechina* yet another example of an ant genus that possesses an Afro-Asian distribution.

Keywords

Invasive species, miombo woodland, new species, *Nylanderia*, *Prenolepis*, *Zatania*

Introduction

Recently the ant genus *Paratrechina* (broad sense) was found to be paraphyletic, with all but one species being transferred to the revived genera *Nylanderia* and *Paraparatrechina* (LaPolla et al. 2010a; LaPolla et al. 2010c; LaPolla et al. 2011a). The sole remaining species within *Paratrechina* was *P. longicornis* (see LaPolla et al. 2010b). The discovery of *Paratrechina* (broad sense) paraphyly was not particularly surprising, because *P. longicornis* possesses a morphology that had long been noted as being different from other members of the genus with especially elongated scapes, head and tibiae, coupled with a distinctly shaped mesosoma and unusual mesosomal setal pattern (Trager 1984; LaPolla et al. 2010a).

One particularly interesting and important aspect of *Paratrechina longicornis* biology is that it is perhaps the most widespread ant species in the world (Wetterer 2008), owing to the ease with which it is spread by human activities and the ability to survive even in extremely anthropogenically changed environments. This species has literally been spread around the planet, being found in almost every urban center in the tropics; it can also widely be found in greenhouses and other manmade structures in cool temperate climates (Wetterer 2008). Where exactly the species is native has been a source of debate and uncertainty, although the evidence seems to suggest it is native to Southeast Asia (Wetterer 2008; LaPolla et al. 2010a).

The unusual morphology of *P. longicornis*, coupled with its widespread tramp status, makes the discovery of a new species within the genus particularly important. Here we report on such a discovery from Africa (records from Angola, Mozambique and Tanzania). The discovery of this new species of *Paratrechina* now requires a reevaluation of the previous morphological definition of the genus (LaPolla et al. 2010a) and may contribute to our understanding of the native range of *P. longicornis*.

Materials and methods

Specimens examined for this study are deposited in the following institutions:

- AFRC** AfriBugs, Pretoria, South Africa
- ANIC** Australian National Insect Collection, Canberra, Australia
- CASC** California Academy of Sciences, San Francisco, CA, USA
- MCZC** Museum of Comparative Zoology, Cambridge, MA, USA
- NMKE** National Museum of Kenya, Nairobi, Kenya
- SAMC** Iziko South African Museum, Cape Town, South Africa
- USNM** National Museum of Natural History, Washington, DC, USA

Measurements were taken using an eyepiece graticule with a Leica MZ16 microscope mounted on an axial shift carrier to avoid parallax errors, recorded to the nearest 1/10 graticule unit and lengths calculated using calibration data from a stage

micrometer for each magnification. All measurements are given in millimeters. Digital color images of a *P. longicornis* male were created using a JVC KY-F75 digital camera and Syncrosopy Auto-Montage (v 5.0) software; color images of *P. zanjensis* and *P. longicornis* workers were created using a Leica DFC425 digital camera and Leica LAS Montage (v3.8) software. Morphological terminology for measurements and indices employed throughout are defined (following LaPolla et al. 2011b) as:

- EL** (Eye Length): maximum length of compound eye in full-face view
GL (Gaster Length): the length of the gaster in lateral view from the anteriormost point of the first gastral segment (third abdominal segment) to the posteriormost point
HL (Head Length): the length of the head proper, excluding the mandibles; measured in full-face view from the midpoint of the anterior clypeal margin (a line is drawn between the projecting lateral portions of the clypeus to accommodate the anterior margin which is medially indented in *Paratrechina*) to a line drawn across the posterior margin from its highest points
HW (Head Width): the maximum width of the head in full-face view, excluding eyes
MSC (Mesonotal Setal Count): the number of erect macrosetae on mesonotum to one side of the sagittal plane
PW (Pronotal Width): the maximum width of the pronotum in dorsal view
PrFL (Profemur Length): the length of the profemur from its margin with the trochanter to its margin with the tibia
PSC (Pronotal Setal Count): the number of erect macrosetae on pronotum to one side of the sagittal plane
SSC (Scape Setal Count): the number of erect macrosetae on one antennal scape, excluding the terminal setal cluster
SL (Scape Length): the maximum length of the antennal scape excluding the condylar bulb
TL (Total Length): $HL+WL+GL$
WL (Weber's Length): in lateral view, the distance from the posteriormost border of the metapleural lobe to the anteriormost border of the pronotum, excluding the neck.
CI (Cephalic Index): $(HW/HL) \cdot 100$
REL2 (sensu Ward 2006): $(EL/HW) \cdot 100$
SI (Scape Index): $(SL/HW) \cdot 100$

Results

Diagnosis of the genus

Since the new species described here is only known from the worker, we provide only a worker-based definition for the genus pending the discovery of males and queens for *Paratrechina zanjensis*.

Monomorphic, medium sized (2.1–3.2 mm in total length) formicine ants; brown to dark brown in color, with lighter mandibles, antennae (especially funicular segments towards tips) and legs (especially distal portion of tibiae and tarsi). Head with medially erect macrosetae roughly paired, extending through the medial portion of clypeus. Cuticle on the head smooth and shining, with faint shagreenate sculpture, especially towards the posterior margin. Antennae 12 segmented; scapes very long, with scape index above 180, usually above 200 (SI 183–220). Scapes with a dense layer of pubescence. Head is distinctly longer than wide, with cephalic index below 100 (CI 71–94); posterolateral corners rounded, with straight posterior margin. Eyes large relative to head width (REL2 greater than 35); eyes distinctly convex, extending beyond head margin in full frontal view; three small but distinct ocelli present. Mandibles typical for *Prenolepis* genus-group (Fig. 9), with 5 teeth; mandalus large and anteriorly placed; palps very long (0.70–0.75 mm); palp formula 6:4; segments 3–6 are longest (numbered from basal segment (1) to apical segment (6)). Mesosoma distinctly elongated; in profile pronotum and mesonotum long; propodeal dorsal face either nearly flat or moderately convex (Figs 2, 5); propodeum without macrosetae, anteriorly occasionally with a sparse layer of pubescence; pronotal setal count 5–10 (both sides of notum); mesonotal setal count 4–8 (both sides of notum). Petiole cuneate, broadly rounded dorsally, with much longer posterior face and not surpassing the height of the propodeum. Legs distinctly long (profemur length 0.6–1.0 mm). Gaster robust, covered in abundant erect macrosetae.

Synopsis of *Paratrechina* species

- Paratrechina longicornis* (Latreille, 1802) Pantropical tramp, origin uncertain
 = *Paratrechina currens* Motschoulsky, 1863. Junior synonym of *longicornis* by Emery, 1892: 166. Neotype designated by LaPolla et al. 2010b: 1.
 = *Paratrechina gracilescens* (Nylander, 1856). Synonymy with *longicornis* by Roger 1863: 10.
 = *Paratrechina longicornis hagemanni* (Forel, 1901). Junior synonym of *longicornis* by Wheeler 1922: 942. Revived from synonymy by Emery, 1925: 217. Junior synonym of *longicornis* by LaPolla et al. 2010a: 128.
 = *Paratrechina vagans* (Jerdon, 1851). Junior synonym of *longicornis* by Dalla Torre 1893: 179; Forel 1894: 408.

Paratrechina zanjensis, sp. n. Angola, Mozambique and Tanzania

Key to *Paratrechina* workers

For a genus-level key see LaPolla et al. (2012). The only modification for that key would be that the last statement in the second lug of couplet 4 would need to be removed.

It currently states: “....scapes always lacking erect setae” which is true for all *Paraparatrechina* (except the morphologically unusual *Paraparatrechina bufona*) and *P. longicornis*. The discovery of *P. zanjensis* demonstrates that there is at least one species of *Paratrechina* that does possess erect macrosetae on the scapes.

- 1 Scapes without erect macrosetae (Fig. 7); in lateral view propodeal dorsal face almost flat (Fig. 2) *longicornis*
 – Scapes with erect macrosetae (Fig. 8); in lateral view propodeal dorsal face convex (Fig. 5)..... *zanjensis* sp. n.

Species accounts

Paratrechina longicornis (Latreille, 1802)

http://species-id.net/wiki/Paratrechina_longicornis

Figs 1–3, 7 (worker); Figs 12–17 (male)

Formica longicornis Latreille, 1802: 113 (worker described). Neotype worker, THAILAND: Bangkok, 18 November 1970 (P. Jolivet) (ANIC32-053687) (ANIC) [examined]. For complete taxonomic history see Bolton (2013).

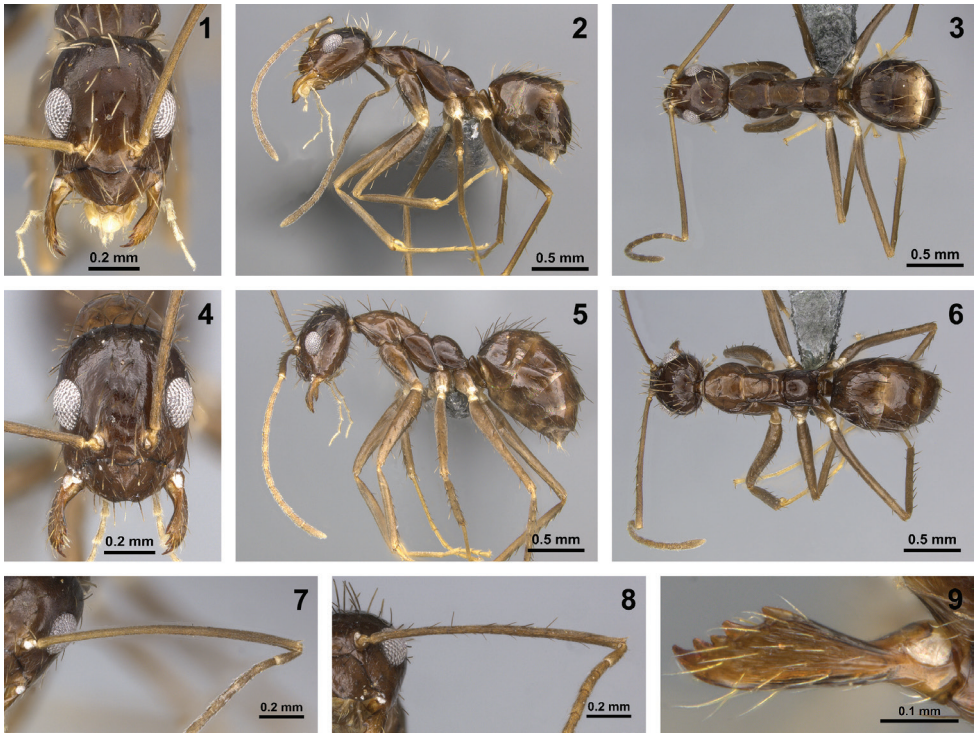
Worker diagnosis. Scapes without erect macrosetae.

Species description. WORKER. Measurements in millimeters (n=4): TL: 2.1–2.5; HW: 0.46–0.56; HL: 0.49–0.7; EL: 0.17–0.23; SL: 0.98–1.16; PW: 0.34–0.43; WL: 0.82–0.98; PrFL: 0.6–0.9; GL: 0.83–0.9.

Indices: CI: 73–94; REL2: 38–42 ; SI: 182–226.

Overall coloration pale to very dark brown, often with a distinct blueish iridescent sheen, especially on the mesosoma and gaster. Mandibles, antennae and legs (especially the trochanters of all legs, which are a strongly contrasting very pale yellow-brown) much lighter in color; cuticle smooth and moderately shining with faint shagreenate sculpture, which is most obvious on head and gaster. Head narrow, distinctly longer than broad, with abundant pale (yellow-brown to almost white), erect macrosetae; anterior clypeal margin with a shallow medial indentation; scapes with a dense layer of very fine pubescence but lacking erect macrosetae; eyes large and convex, extending beyond head lateral margin in full frontal view; posterior head margin with rounded posterolateral corners; three distinct ocelli present. Mesosoma with scattered pale erect macrosetae (PSC = 3; MSC = 3–4); in profile pronotum and mesonotum almost flat dorsally, with a broadly angled junction; metanotal area relatively indistinct, medially about 1/5 the length of the mesonotum but longer laterally than medially; dorsum of propodeum almost flat to very shallowly domed, rounding evenly into the short declivitous face; anterolateral portion of dorsal face with some scattered pubescence. Gaster with abundant erect pale macrosetae.

Material examined. The authors have examined hundreds of specimens of *P. longicornis* from around the world for this and other related studies. These are not



Figures 1–9. *Paratrechina* workers in various views (left to right: full frontal, lateral and dorsal views for figs 1–6): 1–3 *P. longicornis* (CASENT0250003) 4–6 *P. zanjensis* holotype (SAM-HYM-C020685) 7 *P. longicornis* scape (CASENT0250003) 8 *P. zanjensis* holotype scape (SAM-HYM-C020685) 9 *P. zanjensis* paratype mandible (CASENT0250002).

listed here. The four specimens measured for this study were from: **MADAGASCAR:** Prov. Mahajanga; Mahavavy River; 6.2 km 145 SE Mitsinjo (CASENT0490165); 16°03.1'S, 45°54.5'E (BLF6931); **MAURITIUS:** Pte d'Esny; 20°25.52'S, 57°43.44'E (CASENT0055961).

***Paratrechina zanjensis* sp. n.**

<http://zoobank.org/B8FE1331-6242-44AB-8E31-BBE08175E83E>

http://species-id.net/wiki/Paratrechina_zanjensis

Figs 4–6, 8, 9 (worker)

Holotype worker, TANZANIA: Ruvuma Region, Namtumbo District, Mkuju River, 855m, 10.07400S, 36.57959E ± 100m, 27–29.xi.2011, MKU2011-3.1 (P Hawkes, J Fisher) (SAMC: SAM-HYM-C020685). 13 paratypes with same data as holotype, 7 paratypes, TANZANIA: Ruvuma Region, Namtumbo District, Mkuju River, 831m, 10.08380 S, 36.57267 E ± 100m, 2–4.xii.2011, MKU2011-5.1 (P Hawkes, J Fisher) (AFRC, CASC, MCZC, NMKE, SAMC, USNM).

Worker diagnosis. Scapes with abundant erect macrosetae.

Species description. WORKER. Measurements in millimeters (n=18): TL: 2.6-3.2; HW: 0.50-0.59; HL: 0.68-0.77; EL: 0.19-0.23; SL: 1.07-1.24; PW: 0.41-0.5; WL: 0.94-1.20; PrFL: 0.78-0.91; GL: 0.92-1.30.

Indices: CI: 71-79; REL2: 37-44; SI: 198-220.

Overall coloration dark brown with lighter mandibles, antennae (especially funicular segments towards tips) and legs (especially trochanters of mid and hind legs, and distal portions of tibiae and tarsi); cuticle smooth, shining, and with very faint shagreenate sculpture, which is more obvious on head and gaster. Head narrow, distinctly longer than broad, with abundant dark, erect macrosetae; anterior clypeal margin with a shallow medial indentation; scapes with a dense layer of pubescence and scattered erect macrosetae (SSC = 17-29); eyes large and convex, extending beyond head lateral margin in full frontal view; posterior head margin with rounded posterolateral corners; three distinct ocelli present. Mesosoma with scattered dark erect macrosetae (PSC = 2-5; MSC = 2-3); in profile pronotum and mesonotum shallowly convex dorsally, presenting a uniform overall curvature through their junction; metanotal area distinct, about 1/3 the length of the mesonotum; dorsal face of propodeum rounded, with short declivitous face; anterior portion of dorsal face with thin layer of pubescence. Gaster with abundant erect dark macrosetae.

Etymology. The specific epithet is derived from the ancient Arabic name for the stretch of East African coast that encompasses parts of modern day Kenya, Mozambique, and Tanzania.

Non-type specimens examined. **ANGOLA:** Huambo, Mont. Moko, 1725 m, 12°27.20'S, 15°07.45'E, 7.vi.2007, miombo woodland (BL Fisher) (CASENT0128086); **MOZAMBIQUE:** Sofala Prov., Gorongosa N.P., Ravine (18.63407S, 34.80689E), 172 m, 12.vi.2012 (P Naskrecki); Sofala Prov., Gorongosa N.P., Gorongosa Mountain, road to waterfall (18.49764S, 34.04975E), 800 m, 19.vi.2012 (GD Alpert).

Natural history and distribution. Very little is known about the natural history of *P. zanjensis*; the 23 specimens collected in the Mkuju River region of the Selous Game Reserve in Tanzania were all found in 48-hour pitfall trap samples (present in 8 of a total of 60 samples from two sites separated by about 1.3 km) while none were found in the 40 Winkler-extracted leaf litter samples collected during daytime along the same transects. The two Tanzanian sites in which *P. zanjensis* were found were representative of mature dry miombo woodland, while they appeared to be absent from both dry and moist closed canopy forest sites nearby. The Angola and Mozambique specimens were also collected in miombo woodlands; this, in combination with the absence of *P. zanjensis* from 15 forest sites surveyed by one of us (PH) in the Eastern Arc Mountains and Coastal Forests of Tanzania, suggests that the species prefers open woodland rather than forest habitats.

Discussion

The worker of *P. zanjensis* can easily be separated from *P. longicornis* based on the presence of erect macrosetae on the scapes. There are several other notable differences

between the two species (see Figs 1–6). The propodeal dorsal face of *P. zanjensis* is more convex than is observed in *P. longicornis*. Similarly, the pronotum and to a lesser degree the mesonotum are more convex in *P. zanjensis*, being almost flat in *P. longicornis*. The metanotal area is also longer and more distinct in *P. zanjensis*, being more strongly separated from the mesonotum and propodeum. *Paratrechina zanjensis* has erect macrosetae that are dark rather than pale as in *P. longicornis*, the body is glossier, and largely lacks the opalescent sheen / iridescence that is characteristic of *P. longicornis*. Unfortunately, the male and queen for *P. zanjensis* remain unknown. *Paratrechina zanjensis* is superficially similar to *Nylanderia silvula* (see images in LaPolla et al. 2011b), but can readily be distinguished from this species by its mandibular dentition (5 teeth in *Paratrechina*, 6 in *Nylanderia*), larger eyes, longer limbs and less strongly domed propodeum.

Paratrechina has been shown to be a distinct lineage within the *Prenolepis* genus-group (LaPolla et al. 2010a), but with the discovery of *P. zanjensis*, some modifications need to be made to the genus diagnosis. The biggest change comes from the fact that *P. zanjensis* possesses erect macrosetae on their scapes, so the lack of erect macrosetae is no longer diagnostic for the genus. This is not particularly surprising; for instance, even though most *Nylanderia* species possess erect macrosetae on the scapes, a few species do not (Kallal and LaPolla 2012). This trait is also variable within *Zatania* as well, although the erect macrosetae when present in this genus are short (LaPolla et al. 2012), and despite the fact that nearly every species of *Paraparatrechina* lacks erect macrosetae on the scape, at least one species (*Paraparatrechina bufona*) possesses them (LaPolla et al. 2010c). With a scape index above 180, and with most specimens registering above 200, *Paratrechina* possess among the longest scapes relative to head width within the genus-group (Fig. 10). The same can be said for their eye length relative to their head width (Fig. 11). Only species within the genera *Prenolepis* and *Zatania* seem to have such long scapes and eyes relative to their head width (Figs 10, 11).

The similarity of the scapes of *Paratrechina*, *Prenolepis* and *Zatania* extends to other aspects of overall worker morphology within these genera, and these three genera are the most likely members of the *Prenolepis* genus-group to be confused with each other. This is because workers from these genera generally possess elongated heads, scapes, mesosomata, and legs. Whether or not the elongated state of these morphological features represents the plesiomorphic state (as might be suggested by the basally diverging position of *Prenolepis* within the clade, see LaPolla et al. 2010a and LaPolla et al. 2012) within the genus-group or has been independently derived several times is unclear. There are diagnostic features, however, that separate workers in these genera. *Paratrechina* can be separated from *Prenolepis* by the fact that *Paratrechina* lack a constriction immediately behind the pronotum. From *Zatania*, where a constriction behind the pronotum is variable, the number of mandibular teeth is an important diagnostic character. When a constriction is not present in a *Zatania* species those species also possess 6 teeth versus the 5 teeth found in *Paratrechina*.

As was found in *Zatania* (LaPolla et al. 2012), the male morphology of *Paratrechina* does provide some important features that show it to be a distinct lineage based on morphological characters. In both *Prenolepis* and *Zatania* the parameres

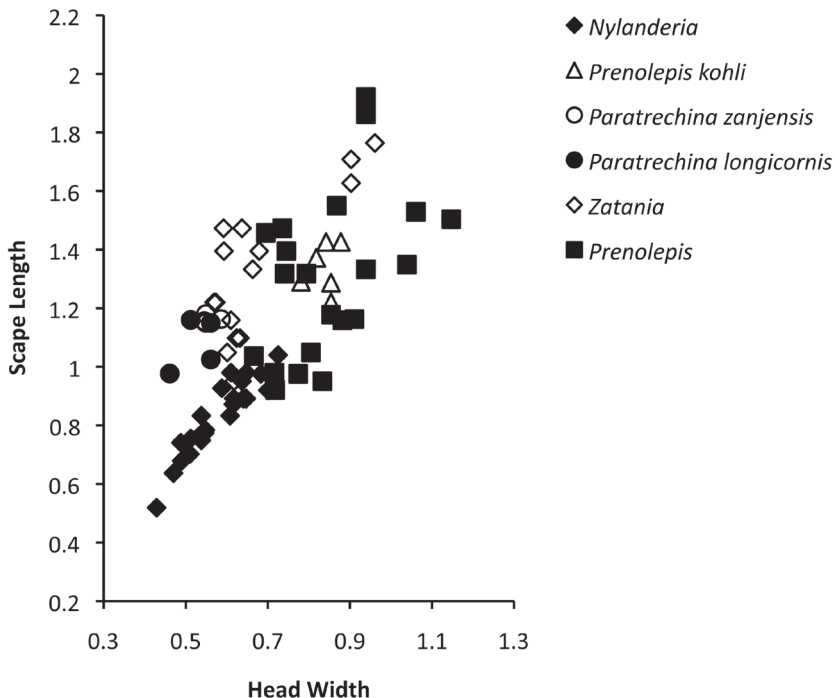


Figure 10. Scape length versus head width of various *Prenolepis* genus-group taxa. Measurements are based on results from this study and LaPolla 2009; LaPolla et al. 2011a; Kallal and LaPolla 2012; LaPolla et al. 2012.

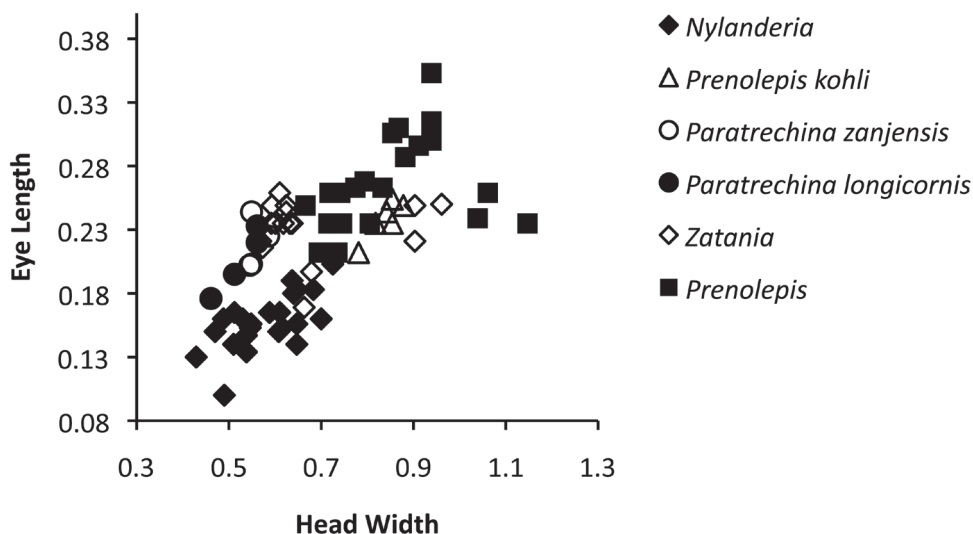
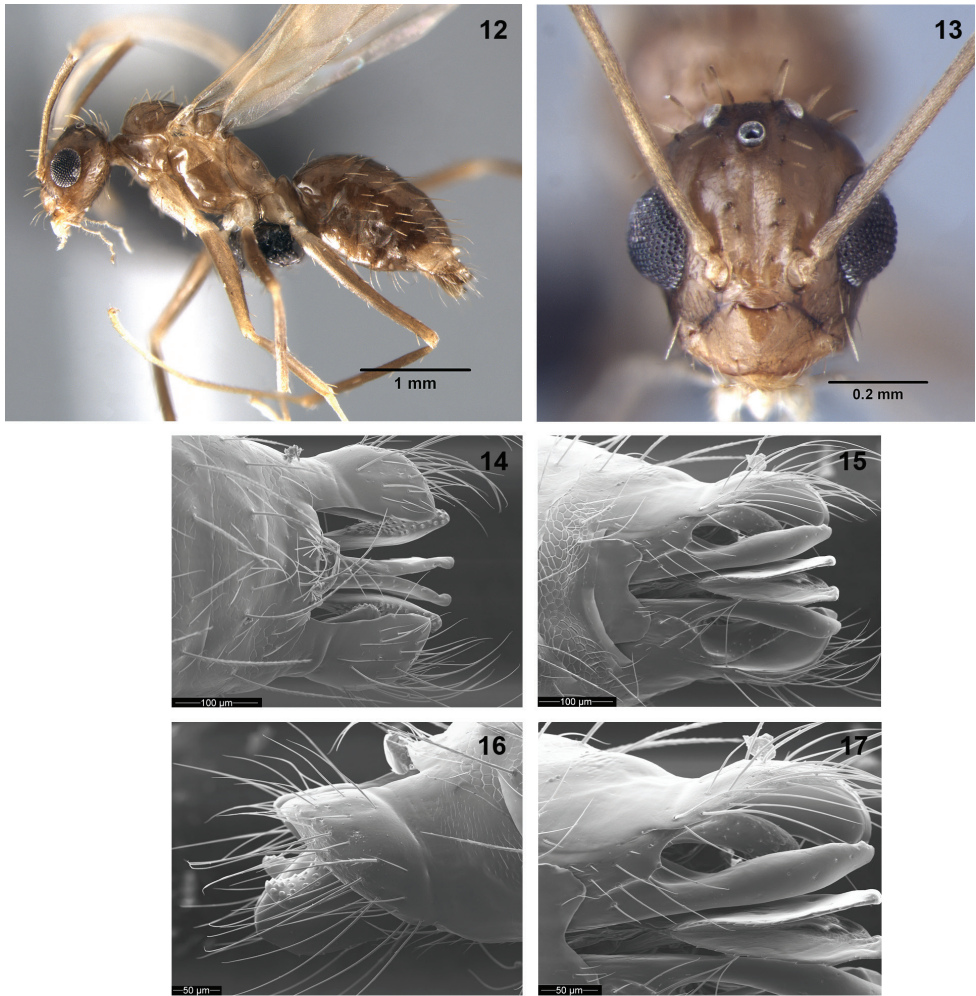


Figure 11. Eye length versus head width of various *Prenolepis* genus-group taxa. Measurements are based on results from this study and LaPolla 2009; LaPolla et al. 2011a; Kallal and LaPolla 2012; LaPolla et al. 2012.



Figures 12–17. *Paratrechina longicornis* male (14–17 are scanning electron microscope images): 12 lateral view 13 full frontal view 14 genitalia dorsal view 15 genitalia ventral view 16 genitalia lateral view 17 close-up view of digitus and cuspis.

for instance are thin and elongated. While the male is only known for *Paratrechina longicornis*, in that species the parameres are unique and quite different from either *Prenolepis* or *Zatania*. In *P. longicornis* the male parameres are shorter and more robust (Figs 14, 16), with a more overall dorsal orientation, and the parameres are curved. This is a unique conformation observed among *Prenolepis* genus-group species to date, but exploration of male genitalic diversity among *Pseudolasius*, a close relative of *Paratrechina*, would be warranted. Among *Euprenolepis*, the putative sister group of *Paratrechina* (LaPolla et al. 2010a), the parameres of some species such as *E. procera* and *E. wittei* also curve entad (LaPolla 2009), but they are not as extended dorsally as in *P. longicornis* (Fig. 14).

Paratrechina zanzensis is certainly native to Africa, to date only being found in natural or minimally disturbed habitats. The presence of a new species of *Paratrechina* in Africa is interesting because *P. longicornis* is thought to be native to Asia (although some authors have considered it native to Africa, see Wetterer 2008 for review). Wetterer (2008) argued that *P. longicornis* is native to Southeast Asia, because it is only in this region, despite the extremely wide distribution of the species globally, that *P. longicornis* is found in native, undisturbed habitats. LaPolla et al. (2010a) also argued for a Southeast Asian origin of the genus (then thought to be monotypic) based on the fact that *Paratrechina* was found within a clade of largely Southeast Asian species (*Euprenolepis* and *Pseudolasius*; a few species of *Pseudolasius* are known outside of SE Asia extending into Australia). Regardless, the presence of another *Paratrechina* species in Africa is potentially important to interpreting the biogeography of *P. longicornis*. Certainly it is not unusual to have ant genera that span Africa and Asia, and this appears to be another example of an Afro-Asian genus. Since we know that *Paratrechina* is not monotypic the question becomes, are there additional new species awaiting discovery within the genus? There have been two monographic revisions of *Prenolepis* genus-group genera within Africa: *Nylanderia* (LaPolla et al. 2011b) and *Paraparatrechina* (LaPolla et al. 2010c). These studies did not find evidence of additional *Paratrechina* species, despite the fact these two studies examined thousands of *Prenolepis* genus-group specimens from the across the continent. Southeast Asia may very well be the place to look for new *Paratrechina* species because, other than *Euprenolepis* (LaPolla 2009), the other genera within the *Prenolepis* genus-group remain unrevised within the region.

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