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## Research article

[urn.lsid:zoobank.org/pub:966C5DFD-72A9-4567-9DB7-E4C56974DDFA](http://urn.lsid:zoobank.org/pub:966C5DFD-72A9-4567-9DB7-E4C56974DDFA)

# Taxonomy and distribution of the genus *Trichomyrmex* Mayr, 1865 (Hymenoptera: Formicidae) in the Arabian Peninsula, with the description of two new species

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**Abstract.** The ant genus *Trichomyrmex* Mayr, 1865 is revised for the Arabian Peninsula based on the worker caste. Nine species are recognized and descriptions of two new species, *T. almosayari* sp. nov. and *T. shakeri* sp. nov. from Riyadh Province, Saudi Arabia, are given. For nomenclatural stability, lectotypes for *T. abyssinicus* (Forel, 1894a), *T. lameerei* (Forel, 1902) and *T. mayri* (Forel, 1902) are designated. A key to species and diagnostic characters of the treated species are presented. New country records are presented for *T. abyssinicus* (Saudi Arabia), *T. destructor* (Jerdon, 1851) (Saudi Arabia and the United Arab Emirates) and *T. mayri* (Qatar). New distributional records for *T. destructor* and *T. mayri* for Saudi Arabia are also provided. World and regional species distributions are indicated and distributional maps for nine Arabian species are included. Ecological and biological information is given when known.

**Keywords.** Myrmicinae, Palearctic Region, Kingdom of Saudi Arabia, key, new record.

Sharaf M.R., Salman S., Al Dhafer H.M., Akbar S.A., Abdel-Dayem M.S. & Aldawood A.S. 2016. Taxonomy and distribution of the genus *Trichomyrmex* Mayr, 1865 (Hymenoptera: Formicidae) in the Arabian Peninsula, with the description of two new species. *European Journal of Taxonomy* 246: 1–36. <http://dx.doi.org/10.5852/ejt.2016.246>

## Introduction

The ant genus *Trichomyrmex* Mayr, 1865 is a small genus in the subfamily Myrmicinae Lepeletier de Saint-Fargeau, 1835 which currently includes 21 recognized species and subspecies (Bolton 2014) distributed worldwide ([www.antwiki.org](http://www.antwiki.org); [www.AntWeb.org](http://www.AntWeb.org)). The genus is known from the Palearctic (Collingwood 1985; Collingwood & Agosti 1996; Radchenko 1997), the Afrotropical (Bolton 1987), the Malagasy (Heterick 2006), the Nearctic, Neotropical, Oriental and Australian (Bolton 1987; Wetterer 2009) regions.

The genus *Trichomyrmex* was established by Mayr (1865) for the type species *T. rogeri* Mayr, 1865 by monotypy, but later the genus was treated as a junior synonym of *Monomorium* (Mayr, 1855) (Ettershank 1966; Bolton 1987). This synonymy was accepted for nearly three decades until the milestone work of Ward *et al.* (2015) on the phylogeny of the Myrmicinae. In this study, *Trichomyrmex* was again recognized as a valid genus in the tribe Crematogastrini Forel, 1893, and included the former *Monomorium scabriceps* (Mayr, 1879) and *destructor* species groups.

Workers of *Trichomyrmex* can be recognized by the following characters: usually polymorphic; antennae 12-segmented, either lacking an apical club or with a club of 3 or 4 segments (usually 3, e.g., species of the *destructor*-group); masticatory margin of mandibles armed with 3–4 teeth, when 4 the basalmost tooth is reduced to an offset denticle or blunt angle; palp formula 2,2; scrobes absent; median portion of clypeus is short and does not project anteromedially; the anterior clypeal margin is only feebly convex to concave; clypeus usually with a distinct unpaired seta located at the midpoint of the anterior margin; the antennal fossae are surrounded by fine and curved striolae; metanotal groove impressed; propodeum unarmed, with transversely sculptured dorsum; propodeal spiracle usually circular to subcircular (vertical ellipse or short slit in *T. abyssinicus* (Forel, 1894)); sting absent. Most species nest directly in the ground, or under stones, or in rotten wood, or sometimes in more specialized habitats such as termitaries. The described species are considered either granivorous (*T. abyssinicus*, *T. chobauti* (Emery, 1897) (Bingham 1903)), or are predators or scavengers (*T. destructor* (Jerdon, 1851), *T. mayri* (Forel, 1902) (Bolton 1987)).

The first survey of the ant fauna of Saudi Arabia (Collingwood 1985) recorded only *T. destructor* and *T. mayri*. A decade later Collingwood & Agosti (1996) reported on the ants of the entire Arabian Peninsula, recording *T. chobauti* from Saudi Arabia and the United Arab Emirates and *T. destructor*, *T. mayri*, and *T. robustior* (Forel, 1892) from Saudi Arabia, Oman and Yemen. A list of introduced species in the United Arab Emirates (Collingwood *et al.* 1997) included *T. destructor*. The faunal treatment of the Formicidae of the United Arab Emirates (Collingwood *et al.* 2011) added four new records for the country, *T. abyssinicus*, *T. chobauti*, *T. lameerei* (Forel, 1902), and *T. perplexus* (Radchenko, 1997). In addition, two species, *T. mayri* and *T. destructor*, are known from the Socotra Archipelago (Collingwood *et al.* 2004; Sharaf *et al.* in press).

There are limited revisionary works available for the genus *Trichomyrmex* worldwide. The Afrotropical *Trichomyrmex* fauna (Bolton 1987) comprises seven species belonging to two species groups; a single species, *T. abyssinicus* of the *scabriceps*-group, and six species, *T. destructor*, *T. emeryi* (May, 1895), *T. epinotale* (Santschi, 1923), *T. mayri*, *T. oscaris* (Forel, 1894) and *T. robustior*, of the *destructor*-group. The Malagasy *Trichomyrmex* fauna (Heterick 2006) includes two species, *T. destructor* and *T. robustior*, and lectotypes were designated for both species. The former *M. scabriceps*-group was revised and keyed by Radchenko (1997), who described a new species, *T. perplexus*, from Armenia.

In the present study ants of the genus *Trichomyrmex* of the Arabian Peninsula are revised based on the worker caste. Lectotypes are designated for *T. abyssinicus*, *T. lameerei* and *T. mayri*.

## Material and methods

### Sampling Procedures

The specimens were collected by pitfall traps, malaise traps, and handpicking during collection surveys across different regions of the Arabian Peninsula. Type material of the treated species deposited in different museums were examined and compared for any discrepancies.

### Illustrations

Specimens were photographed by April Nobile, Estella Ortega, Michele Esposito, Shannon Hartman, Will Ericson and Zach Lieberman (CAS). Digital color images of lateral and dorsal views of the entire body and full-face views of the head of each species were made using a Leica DFC450 digital camera with a Leica Z16 APO microscope and LAS (v3.8) software. These images are also available online on AntWeb ([www.AntWeb.org](http://www.AntWeb.org)) and are accessible using the unique identifying specimen code. Ecological and distributional information for the species were based on field observations together with data compiled from the literature and some ant websites, including [www.AntWeb.org](http://www.AntWeb.org) and [www.antwiki.org](http://www.antwiki.org). From these two websites, information about treated species, including taxonomic history, references, distribution, habitats and biology, were used. The species names follow the online catalogue of ants of the world (Bolton 2014) available from [www.AntCat.org](http://www.AntCat.org), and [www.antwiki.org](http://www.antwiki.org). Distribution maps were made using DIVA-GIS (version 7.5.0.0).

### Abbreviations

Throughout the text, 'w' stands for 'worker' or 'workers', 'm' for 'male' and 'q' for 'queen'.

All measurements are in millimeters and follow the standard measurements (Bolton 1987):

- EL = Eye Length; maximum diameter of eye
- HL = Head Length; maximum length of head, excluding mandibles
- HW = Head Width; maximum width of head behind eyes in full-face view
- ML = Mesosoma Length; length of mesosoma in lateral view; from a point at which pronotum meets cervical shield to posterior base of propodeal lobes or teeth
- PPL = Postpetiole Length; maximum length measured in dorsal view
- PPW = Postpetiole Width; maximum width measured in dorsal view
- PTL = Petiole Length; maximum length measured in dorsal view, from anterior margin to posterior margin
- PTW = Petiole Width; maximum width measured in dorsal view
- PW = Pronotal Width; maximum width in dorsal view
- SL = Scape Length, excluding basal neck
- TL = Total Length, outstretched length of ant from mandibular apex to gastral apex

### Indices

- CI = Cephalic Index ( $HW/HL \times 100$ )
- EI = Eye Index ( $EL/HW \times 100$ )
- SI = Scape Index ( $SL/HW \times 100$ )

### Institutional abbreviations

The collection abbreviations follow Lattke (2000).

BMNH = The Natural History Museum (British Museum, Natural History), London, U.K.

CASC = California Academy of Sciences, San Francisco, California, U.S.A.

KSMA = King Saud University Museum of Arthropods, Plant Protection Department, College of Food and Agriculture Sciences, King Saud University, Riyadh, Kingdom of Saudi Arabia

MHNG = Muséum d'Histoire Naturelle de la Ville de Genève, Geneva, Switzerland

MSNG = Museo Civico di Storia Naturale Giacomo Doria, Genoa, Italy

UASK = Institute of Zoology, Ukrainian National Academy of Sciences, Kiev, Ukraine

WMLC = World Museum Liverpool, Liverpool, U.K.

ZMPA = Instytut Zoologiczny, Polska Akademia Nauk, Warsaw, Poland

## Results

Class Hexapoda Blainville, 1816  
Order Hymenoptera Linnaeus, 1758  
Suborder Apocrita Latreille, 1810  
Family Formicidae Latreille, 1809

Genus *Trichomyrmex* Mayr, 1865

### List of Arabian *Trichomyrmex* species:

*abyssinicus* (Forel, 1894a)

*almosayari* sp. nov.

*chobauti* (Emery, 1897)

*destructor* (Jerdon, 1851)

*lameerei* (Forel, 1902)

*mayri* (Forel, 1902)

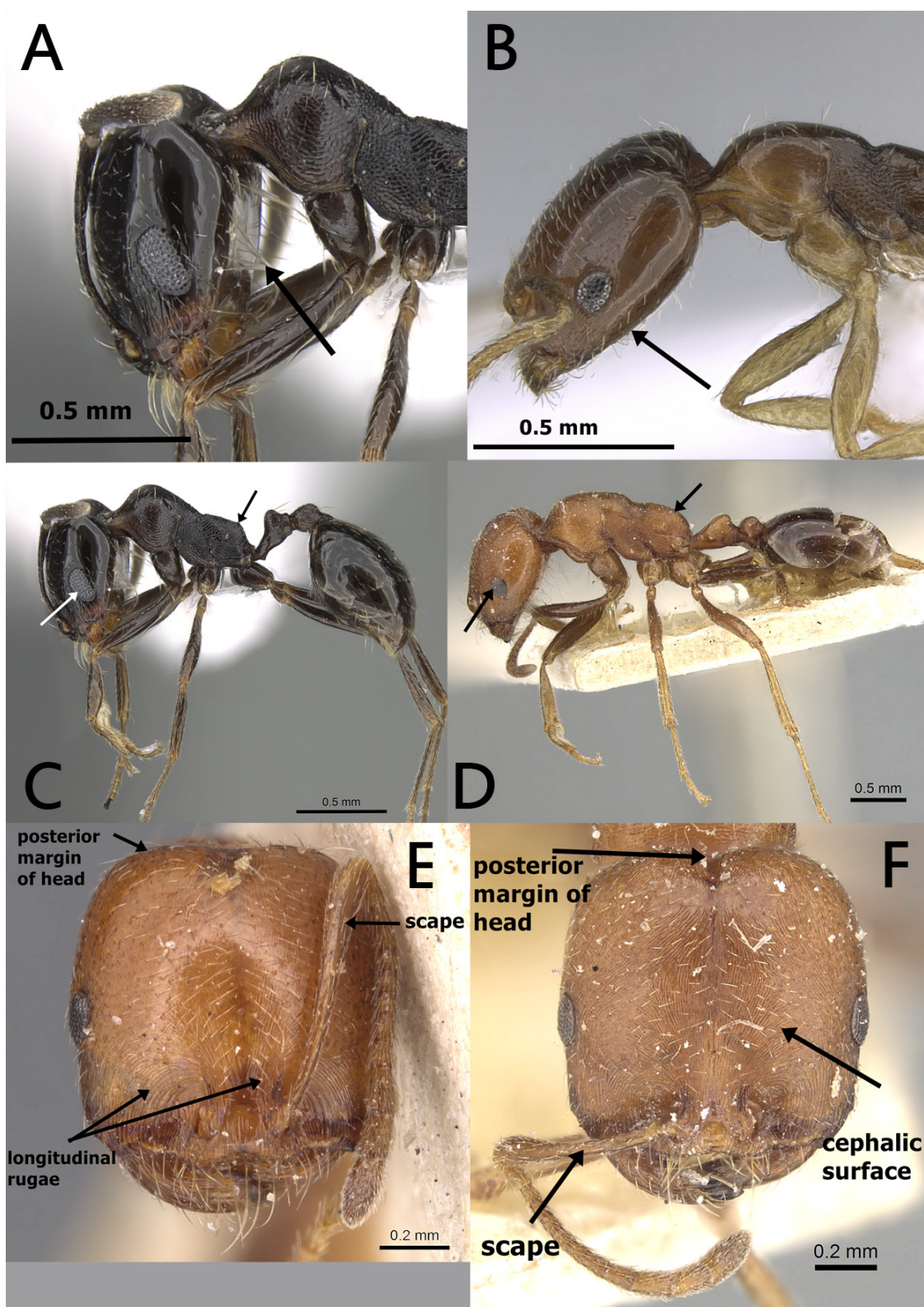
*perplexus* (Radchenko, 1997)

*robustior* (Forel, 1892)

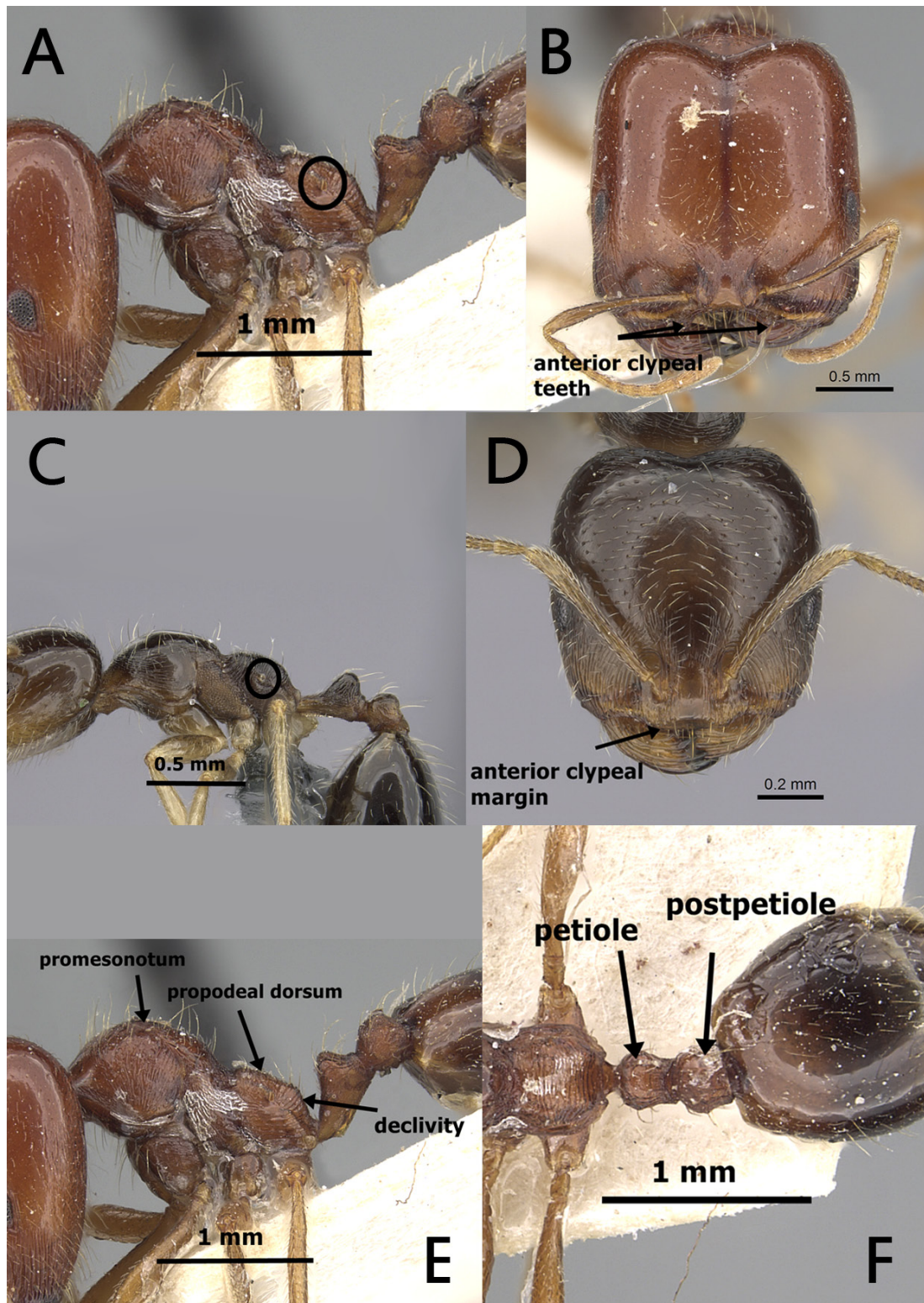
*shakeri* sp. nov.

### Key to Arabian *Trichomyrmex* (workers)

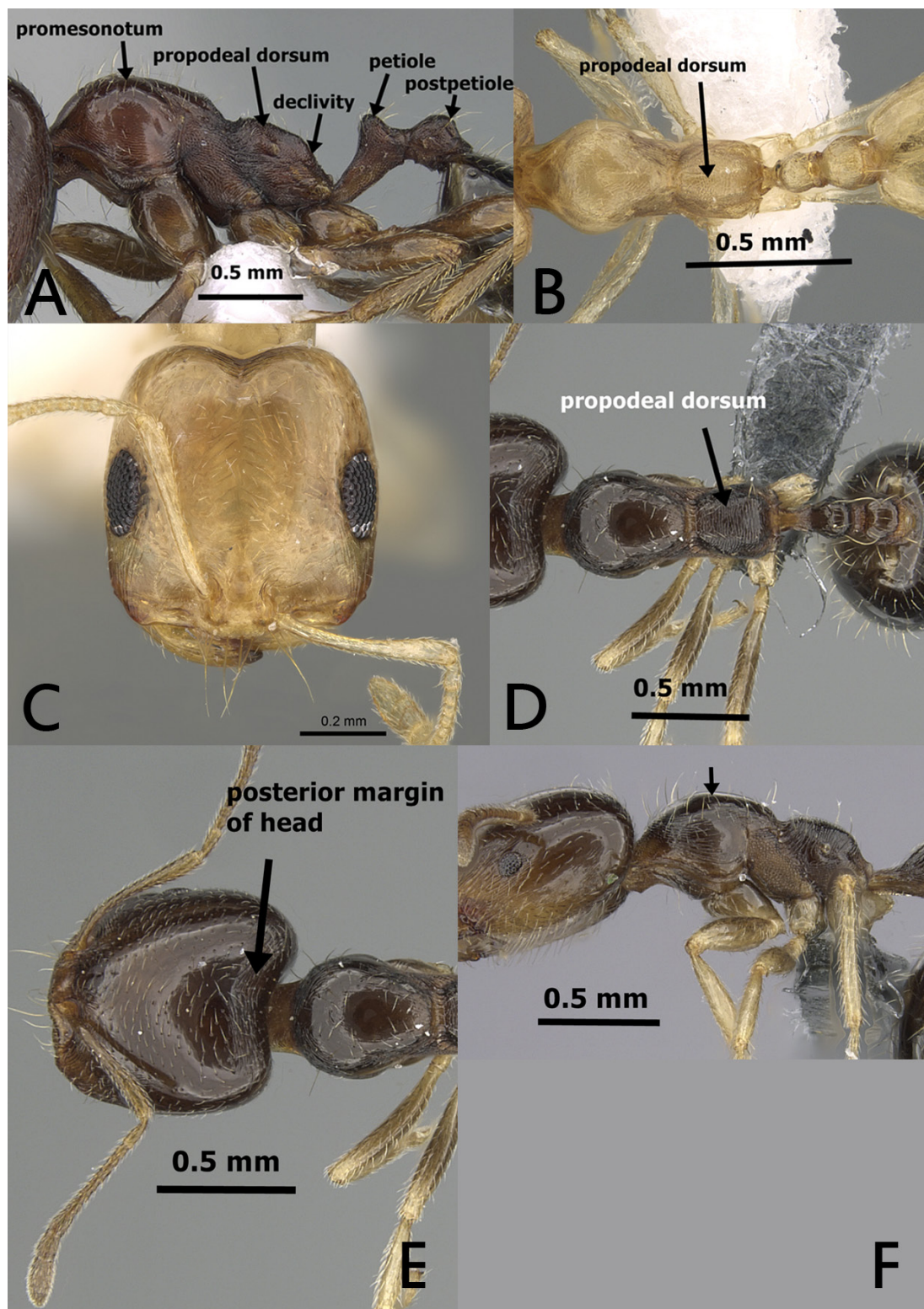
1. Underside of head with abundant long ammochaete J-shaped hairs forming a distinct psammophore (Fig. 1A) ..... 2  
– Underside of head with scattered short hairs or few long hairs but not forming a distinct psammophore (Fig. 1B) ..... 4
2. Unicolorous black species. Eyes reniform in profile, with distinctly concave ventral margin and broadly convex dorsal margin (Fig. 1C). Propodeal dorsum making an obtuse angle with propodeal declivity in profile (Fig. 1C). Posterior margin of head strongly concave in full-face view (Fig. 6C) (Saudi Arabia) ..... *almosayari* sp. nov.  
– Bicoloured species. Head, mesosoma, petiole and appendages brown or reddish brown, gaster brown or blackish brown. Eyes nearly oval in profile (Fig. 1D). Propodeal dorsum making a continuous curve with propodeal declivity in profile (Fig. 1D). Posterior margin of head nearly straight or feebly concave in full-face view (Fig. 7C) ..... 3
3. Smaller species (TL 3.27, HL 0.88, HW 0.88, PW 0.45). Scapes distinctly longer; when laid back from their insertions scapes reach the posterior margin of the head (SI 82) (Fig. 1E). Posterior margin of head nearly straight or shallowly concave (Fig. 1E). Cephalic dorsum between frontal carinae and in front of eyes longitudinally rugulose with posterior half slightly shining (Fig. 1E) (Algeria, Saudi Arabia, United Arab Emirates) ..... *chobauti* (Emery, 1897)  
– Larger species (TL 4.06–4.50, HL 0.95–1.09, HW 1.00–1.15, PW 0.60–0.61). Scapes shorter; when laid back from their insertions scapes just reach level of posterior margin of eyes (SI 53–65) (Fig. 1F). Posterior margin of head shallowly but distinctly emarginated medially in full-face view (Fig. 1F). Cephalic dorsum distinctly finely and densely longitudinally costulate and completely dull (Fig. 1F) (Algeria, United Arab Emirates) ..... *lameerei* (Forel, 1902)



**Fig. 1.** A. Head of *Trichomyrmex almosayari* sp. nov. showing psammophore. B. Head of *T. mayri* (Forel, 1902) showing absence of the psammophore. C. *T. almosayari* sp. nov., body in profile. D. *T. lameerei* (Forel, 1902), body in profile. E. *T. chobauti* (Emery, 1897), head in full-face view. F. *T. lameerei*, head in full-face view.

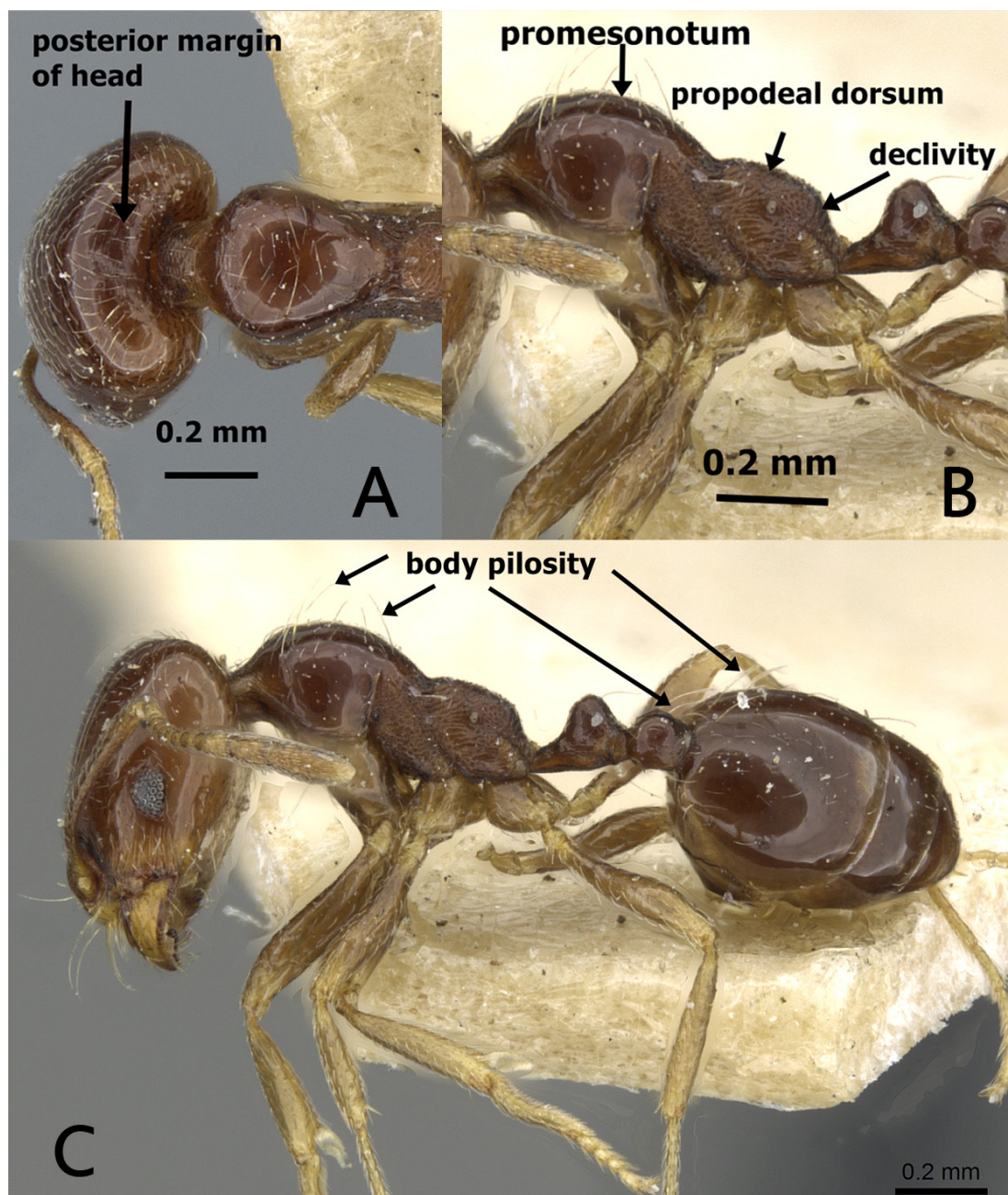


**Fig. 2.** A. Vertical propodeal spiracle of *Trichomyrmex abyssinicus* (Forel, 1894a). B. Head of *T. abyssinicus* in full-face view showing clypeus and mandibles. C. Circular propodeal spiracle of *T. mayri* (Forel, 1902). D. Head of *T. mayri* in full-face view showing clypeus. E. Mesosoma of *T. abyssinicus* in profile. F. Petiole and postpetiole of *T. abyssinicus* in dorsal view.



**Fig. 3.** A. *Trichomyrmex perplexus* (Radchenko, 1997), mesosoma, petiole and postpetiole in profile. B. *T. shakeri* sp. nov., mesosoma in dorsal view showing propodeum. C. *T. shakeri* sp. nov., head in full-face view. D. *T. mayri* (Forel, 1902), mesosoma in dorsal view showing propodeum. E. *T. mayri*, showing posterior margin of head in dorsal view. F. *T. mayri*, mesosoma in profile.

4. Propodeal spiracle vertically slit-shaped or elliptical (Fig. 2A). Anterior clypeal margin with a pair of well-developed strong teeth which overhang the mandibles, these teeth broadly separated by a distance greater than maximum width across frontal lobes (Fig. 2B) ..... 5
- Propodeal spiracle circular or subcircular (Fig. 2C). Anterior clypeal margin without teeth (Fig. 2D).6
5. Promesonotum in profile distinctly convex (Fig. 2E). Propodeal dorsum about twice as long as declivity in profile (Fig. 2E). Propodeum, petiole and postpetiole irregularly rugulose (Fig. 2F) (Benin, Burkina Faso, Eritrea, Ethiopia, Ghana, Nigeria, Sudan, Tanzania, United Arab Emirates) ..... *abyssinicus* (Forel, 1894)



**Fig. 4.** *Trichomyrmex robustior* (Forel, 1892). A. Posterior margin of head in dorsal view. B. Mesosoma in profile. C. Body in profile.



- Promesonotum in profile flat (Fig. 3A). Propodeal dorsum as long as declivity in profile (Fig. 3A). Propodeum sides, petiole and postpetiole finely punctate-reticulate (Fig. 3A) (Armenia, Cyprus, Greece, Turkey, Jordan, Syria, United Arab Emirates) ..... *perplexus* (Radchenko, 1997)
- 6. Unicolorous yellow species. Propodeal dorsum densely punctulate-reticulate (Fig. 3B). Eyes conspicuously larger (EI 31–37) (Fig. 3C) (Saudi Arabia) ..... *shakeri* sp. nov.
- Unicolorous dark brown or reddish brown; or bicoloured species with at least gaster distinctly darker than rest of body. Propodeal dorsum finely transversely striolate or transversely rugulose (Fig. 3D). Eyes conspicuously smaller (EI 15–18) ..... 7
- 7. Head and mesosoma yellow (India, Pantropical tramp species) ..... *destructor* (Jerdon, 1851)
- Head and mesosoma brown or reddish brown ..... 8
- 8. Posterior margin of head transversely striolate in dorsal view (Fig. 3E). Promesonotum in profile nearly flat or weakly convex (Fig. 3F). Propodeal dorsum in profile making a continuous curve with propodeal declivity. Transverse sculpture of propodeal dorsum fine and dense. Pilosity of mesosoma, petiole, postpetiole and gaster short, and weakly curved (India, North Africa, Middle East, Afrotropical, Indomalayan and Oriental regions) ..... *mayri* (Forel, 1902)
- Posterior margin of head transversely smooth in dorsal view (Fig. 4A). Promesonotum in profile strongly convex (Fig. 4B). Propodeal dorsum in profile making a weak but distinct obtuse angle with propodeal declivity (Fig. 4B). Transverse sculpture of propodeal dorsum coarse and broadly spaced. Pilosity of mesosoma, petiole, postpetiole and gaster longer, and strongly curved (Fig. 4C) (Somalia, Afrotropical and Malagasy regions) ..... *robustior* (Forel, 1892)

***Trichomyrmex abyssinicus*** (Forel, 1894)

Fig. 5A–C

*Holcomyrmex abyssinicus* Forel, 1894a: 83 (workers). Ethiopia: Afrotropic. Syntype workers [examined]. (Lectotype here designated: Erythrea, Ghinda, III.06 (Dr. Escherich) (MHNG) (CASENT0249906)).

*Monomorium abyssinicus* – Forel 1910: 250. — Viehmeyer 1923: 91 (q).

*Trichomyrmex abyssinicus* – Ward, Brady, Fisher & Schultz 2015: 16. — Bolton 1987: 321 (redescription).

**Material examined**

SAUDI ARABIA: 11 w, Al Bahah Province, Shada Al A’la, 19.86° N, 41.30° E, alt. 1225 m, 15 Nov. 2015, Aldhafer *et al.* leg.; 3 workers, same data, 29 Jul. 2015, Aldhafer *et al.* leg. (all in KSMA).

**Description**

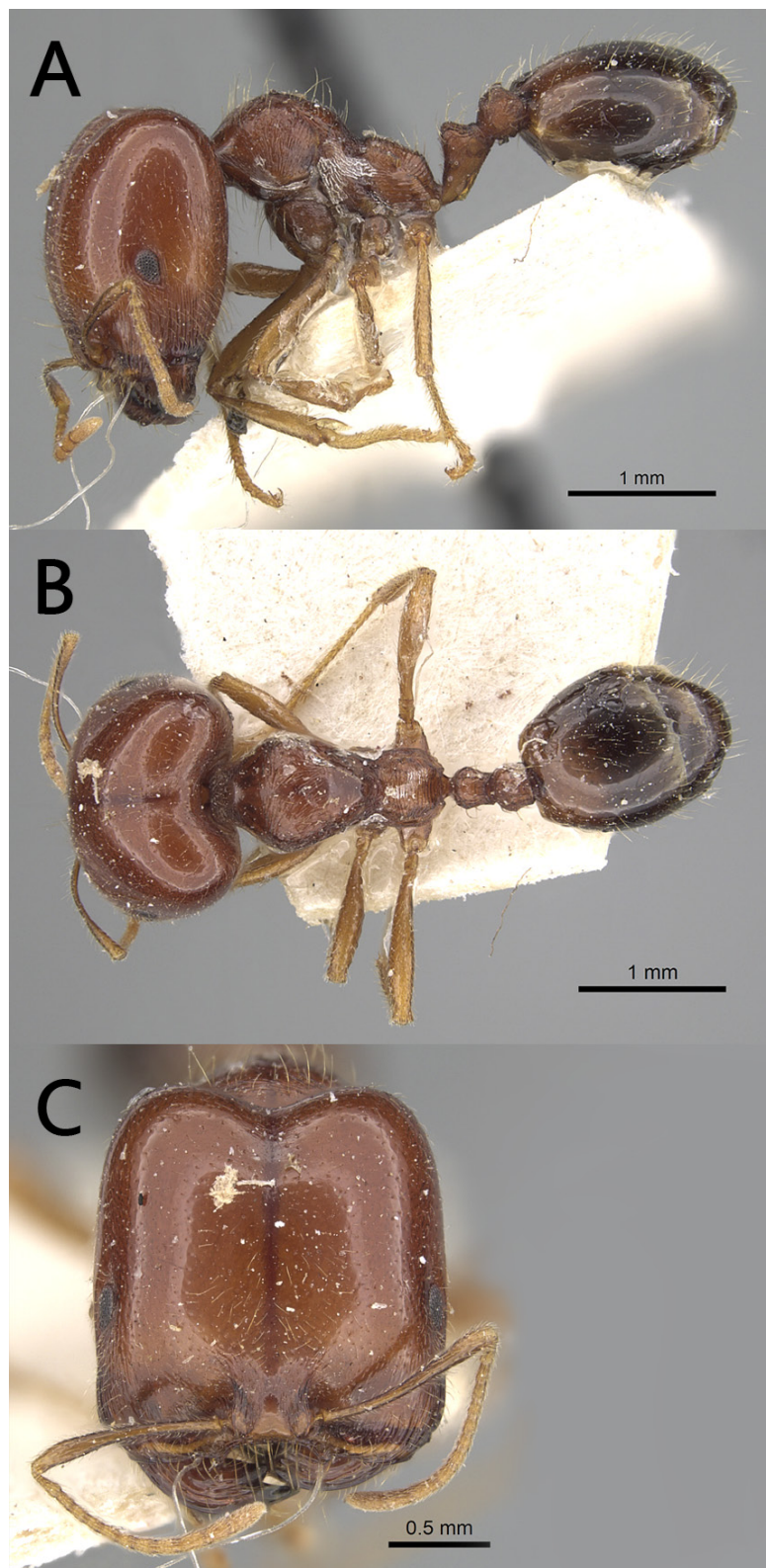
Workers of this species exhibit marked size variation in any nest series.

**Large workers**

With a broad size variation (TL 2.60–6.70; HW 0.60–1.94).

MEASUREMENTS. TL 3.55–5.35; HL 1.06–1.53; HW 1.05–1.56; SL 0.78–0.92; EL 0.14–0.20; ML 1.05–1.56; PW 0.52–0.70; PTL 0.28–0.40; PTW 0.17–0.24; PPL 0.23–0.30; PPW 0.21–0.31; CI 98–105; EI 12–14; SI 59–74 (n = 6). Worker TL 2.60–6.70; HL 0.68–2.04; HW 0.60–1.94; SL 0.50–1.06; PW 0.38–0.90; ML 0.72–1.74; CI 86–100; SI 55–110 (Bolton 1987).

HEAD. In full-face view with emarginated posterior margin and nearly parallel sides; posterior corners strongly rounded; mandibles blunted; scapes when laid back from their insertions fail to reach posterior margin of head.



**Fig. 5.** *Trichomyrmex abyssinicus* (Forel, 1894a), lectotype, worker (CASENT0249906). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Shannon Hartman).

**MESOSOMA.** Metanotal groove broad and distinctly impressed in profile; promesonotum strongly convex in profile; propodeal spiracle a vertical ellipse or slit; propodeal dorsum about twice as long as propodeal declivity in profile.

**PETIOLE.** Petiolar peduncle with a distinct anteroventral process that consists of a triangular lamella followed by a broad flange; petiolar spiracle situated at midline of petiolar peduncle.

**PILOSITY.** Underside of head with short straight hairs not forming a distinct psammophore; cephalic pilosity sparse; mesosoma with abundant standing hairs, the longest on pronotum and mesonotum, propodeal pilosity shorter; petiole, postpetiole and gaster with abundant, sparse suberect hairs.

**SCULPTURE.** Cephalic surface smooth and shining except area in front of eyes, which is finely rugulose in profile; mandibles strongly longitudinally rugulose; promesonotal dorsum strongly longitudinally rugulose or with disorganized rugulae, to smooth; propodeal dorsum distinctly transversely rugulose; mesosomal sides strongly rugulose; petiole and postpetiole irregularly rugulose, gaster smooth and shining.

**COLOUR.** Head, mesosoma, petiole and postpetiole reddish brown or dark brown, gaster darker than head and mesosoma, blackish brown or black; head with a dark median longitudinal line in full-face view.

#### **Small workers**

**MEASUREMENTS.** TL 2.43–3.37; HL 0.65–0.89; HW 0.60–0.88; SL 0.57–0.70; EL 0.14–0.16; ML 0.70–0.99; PW 0.33–0.45; PTL 0.21–0.28; PTW 0.11–0.14; PPL 0.14–0.21; PPW 0.16–0.18; CI 90–98; EI 18–24; SI 80–95 (n = 8). With a broad size variation.

**HEAD.** In full-face view with emarginated posterior margin and sides diverging anteriorly; anterior clypeal margin distinctly concave medially between two well developed teeth that are situated anteriorly in front of the antennal insertions; mandibles armed with three teeth; eyes small, situated in front of midline of head sides (EL 0.14–0.24 × HW), with eight ommatidia in longest row; antennal scapes distinctly short, when laid back from their insertions they fail to reach posterior margin of head.

**MESOSOMA.** Promesonotum nearly flat in profile; propodeal spiracle a vertical ellipse or slit; propodeal dorsum about twice as long as propodeal declivity in profile.

**PETIOLE.** Petiolar peduncle with a distinct anteroventral process that consists of a triangular lamella followed by a broad flange; petiolar spiracle situated at midline of petiolar peduncle.

**PILOSITY.** Subcephalic pilosity short and sparse; cephalic pilosity sparse, short, decumbent to appressed pubescence, and directed inward to midline of head.

**SCULPTURE.** Cephalic surface smooth and shining except for area in front of eyes, which is finely rugulose in profile; mandibles strongly longitudinally rugulose; propodeal dorsum weakly, irregularly, transversely rugulose; mesosomal sides faintly rugulose; gaster smooth and shining.

**COLOUR.** Lighter than large workers, pale brown or yellowish brown, gaster dark brown.

#### **Differential diagnosis**

*Trichomyrmex abyssinicus* can be distinguished from other Arabian species except *T. perplexus* by the vertical ellipse or slit propodeal spiracle. This species is similar to *T. perplexus* but can be separated from it by the convex promesonotum outline, the distinctly longer propodeal dorsum, and the irregularly rugulose propodeum, petiole and postpetiole.

### Ecological and biological notes

Shada Al A'la Mountain peak is an extension of the Hijaz Mountains to the west and is a natural protectorate in Al Bahah Province. The region has a substantial plant biodiversity and the most abundant plants are *Olea europaea* ssp. *africana* (Mill.) P. Green. (Oleaceae), *Coffea arabica* L. (Rubiaceae), *Juniperus procera* Hochst. ex Endlicher (Cupressaceae), and *Acacia* spp. (Fabaceae).

### Distribution

This species was originally described from Ethiopia and has a broad distribution in the Afrotropical region, especially the Sahelian Zone. It has been recorded from Benin, Burkina Faso, Ghana, Nigeria, Sudan, Tanzania (Bolton 1987), Egypt (Gebel Elba) (Sharaf 2006), and United Arab Emirates (Collingwood *et al.* 2011).

The distribution of *T. abyssinicus* appears to be restricted to the southwestern mountains of Saudi Arabia, since several years of collecting efforts by the senior author did not retrieve material from any region in the country except the present record, the first record from Saudi Arabia.

*Trichomyrmex almosayari* Sharaf & Aldawood sp. nov.

[urn:lsid:zoobank.org:act:A1AA36BD-D206-46FB-A21D-FF26D7EB4609](https://zoobank.org/urn:lsid:zoobank.org:act:A1AA36BD-D206-46FB-A21D-FF26D7EB4609)

Fig. 6A–C

### Etymology

The patronym *almosayari* has been selected to honor the late Egyptian Islamic writer Dr. Mohammed Sayed Almosayari (1948-2008).

### Material examined

#### Holotype

SAUDI ARABIA: w, Riyadh Province, Rawdhat Khorim, 25.38° N, 47.27° E, alt. 574 m, 9 Jan. 2015, S. Salman leg. (KSMA).

#### Paratypes

SAUDI ARABIA: 4 w, same data as holotype (KSMA); 1 w, same data as holotype (CASC); 3 w, same data as holotype (KSMA, 1 without gaster); 5 workers, Riyadh Province, Rawdhat Khorim, 25.38° N, 47.27° E, alt. 618 m, 2 Jun. 2013, S. Salman leg. (KSMA); 1 w, Riyadh Province, Al Zulfi, Rawdhat Al Sabalah, 26.36° N, 44.98° E, alt. 670 m, 25 Oct. 2015, Aldhafer *et al.* leg. (WMLC).

### Description

MEASUREMENTS. Holotype. TL 2.60; HL 0.75; HW 0.67; SL 0.55; EL 0.20; ML 0.77; PW 0.40; PTL 0.22; PTW 0.12; PPL 0.15; PPW 0.17; CI 89; SI 82. Paratypes. TL 2.62–2.92; HL 0.70–0.75; HW 0.67–0.72; SL 0.52–0.60; EL 0.17–0.20; ML 0.75–0.80; PW 0.37–0.42; PTL 0.15–0.22; PTW 0.12; PPL 0.12–0.15; PPW 0.15–0.17; CI 93–96; EI 25–28; SI 74–90 (n = 5).

HEAD. Head short, only slightly longer than broad (CI 93–96), with feebly convex sides and emarginated posterior margin; anterior clypeal margin lacking teeth of any description; masticatory margin of mandibles armed with three teeth; eyes relatively large, with 12 ommatidia in the longest row (EL 0.25–0.27 × HW), reniform with ventral margin weakly but distinctly concave, dorsal margin distinctly broadly convex; scapes short, when laid back from their insertions failing to reach posterior margin of head (SI 74–90).

MESOSOMA. Promesonotum strongly convex, descending evenly to a much lower, shallowly but distinctly impressed metanotal groove; propodeal spiracles circular.

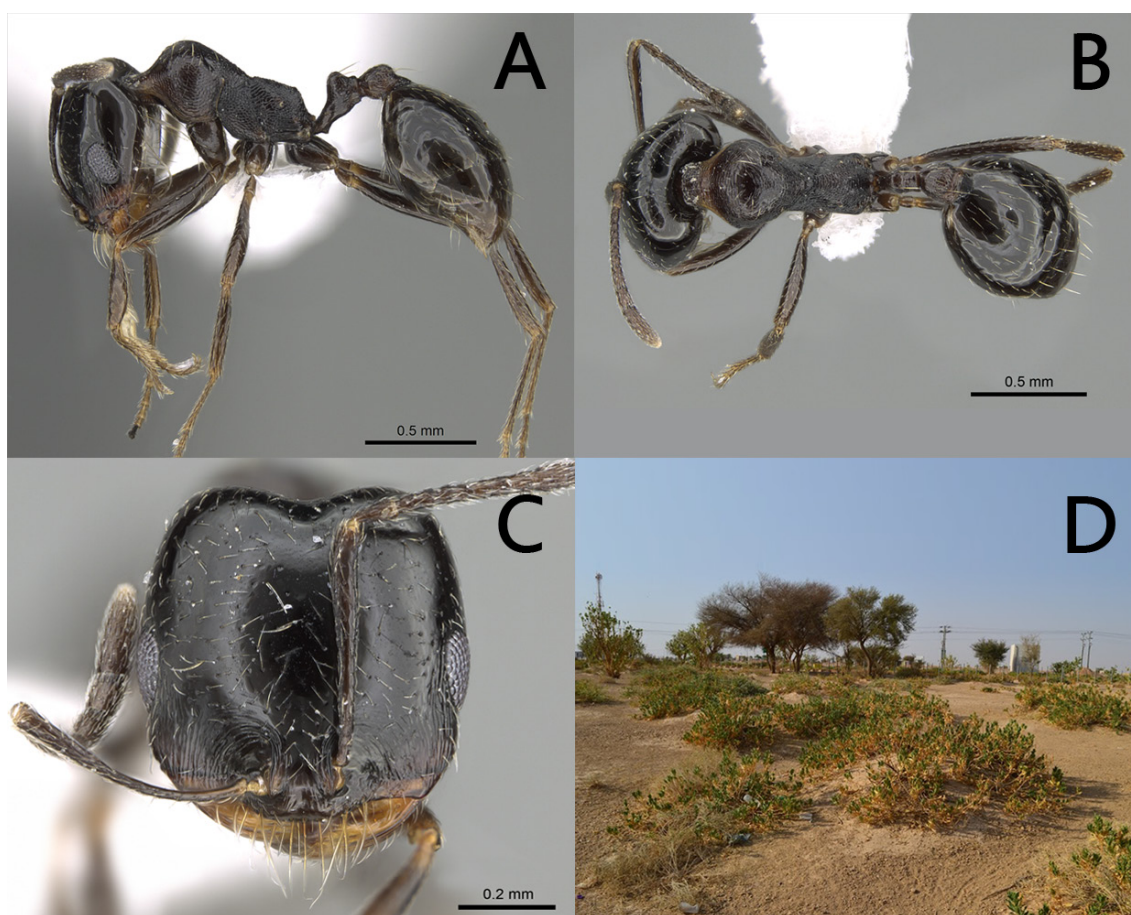
PILOSITY. Underside of head with crowded, long J-shaped ammochaete hairs forming a psammophore; two pairs of hairs on pronotum and mesonotum, propodeum bare, petiole and postpetiole each with one pair of long hairs, gaster with decumbent pubescence; cephalic pilosity shorter than body pilosity.

SCULPTURE. Mandibles longitudinally striolate; cephalic dorsum smooth and shining, except for scattered hair pits; area in front of eyes and behind posterior clypeal margin finely striolate; pronotal dorsum faintly shagreenate; mesosomal dorsum, sides, petiole and postpetiole finely and densely punctulate or shagreenate, general appearance dull; gaster smooth and polished.

COLOR. Dark brown to blackish brown; mandibles, antennae, and legs brownish.

### Differential diagnosis

*Trichomyrmex almosayari* sp. nov. can be immediately separated from all known African and Arabian species of the genus by the reniform eyes, the ventral eye margin feebly concave and the dorsal eye margin distinctly broadly convex.



**Fig. 6.** *Trichomyrmex almosayari* sp. nov., paratype, worker (CASENT0914921). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Michele Esposito). **D.** Type locality (photo: Shehzad Salman).

### Ecological and biological notes

The new species was foraging on dry sandy soil (Fig. 6D) surrounding shrubs of *Rhazya stricta* Decnet (Apocynaceae) and coexisting with several other ant species, including *Camponotus sericeus* (Fabricius, 1798), *Cataglyphis semitonsa* (Santschi, 1929), *Messor ebeninus* (Santschi, 1927), *M. minor* (André, 1883), *Monomorium venustum* (Smith, 1858), *M. abeillei* (Emery, 1881), and *T. mayri*. Several additional attempts to collect more material at the type locality were not successful, indicating that the new species may be an uncommon taxon. The type locality, Rawdhat Khorim, is one of the most important natural protectorates in Saudi Arabia due to its diverse flora (Al-Farraj *et al.* 1997, Alfarhan 2001). The region occupies an area of 24 km<sup>2</sup>, located about 95 km northeast of Riyadh (25.38° N, 47.28° E, alt. 560 m) (Vesey-Fizberald 1957). The diversity of the flora in Rawdhat Khorim is relatively high, with about 153 plant species in 32 families recognized (Alfarhan 2001).

### *Trichomyrmex chobauti* (Emery, 1897)

Fig. 7A–C

*Holcomyrmex chobauti* Emery, 1897: 418, Fig. (worker). Algeria: Palearctic. Syntype worker (MSNG) (CASENT0904606) [examined].

*Trichomyrmex faf* Emery, 1922: 176.

*Holcomyrmex chobauti* – Délye 1961: 69 (q., m.).

*Monomorium chobauti* – Emery 1908: 672.

*Monomorium (Equestrimessor) chobauti* – Santschi 1919: 92.

*Trichomyrmex chobauti* – Ward, Brady, Fisher & Schultz 2015: 16.

*Trichomyrmex faf* – Bolton 1987: 297.

### Material examined

UNITED ARAB EMIRATES: 2 w, Nr. Mahafiz, 25.15° N, 55.8° E, 24 Mar. – 2 Apr. 2011, M. Hauser *et al.* leg. (United Arab Emirates 13055) (KSMA).

### Previous records

UNITED ARAB EMIRATES: 1 w, Baynounah, 23.64° N, 53.62° E, Mar. 1995; 1 w, Medinat Zayed, 23.65° N, 53.65° E, Mar. 1995, Collingwood *et al.* leg. (WMLC).

### Description

MEASUREMENTS. TL 3.27; HL 0.88; HW 0.88; SL 0.72; EL 0.16; ML 1.22; PW 0.45; PTL 0.28; PTW 0.30; PPL 0.25; CI 100; EI 18; SI 82.

HEAD. As long as broad, with feebly concave posterior margin and weakly convex sides; anterior clypeal margin distinctly concave; eyes of moderate size (EL 0.18 × HW) with 11 ommatidia in longest row; scapes when laid back from their insertions reach posterior margin of head.

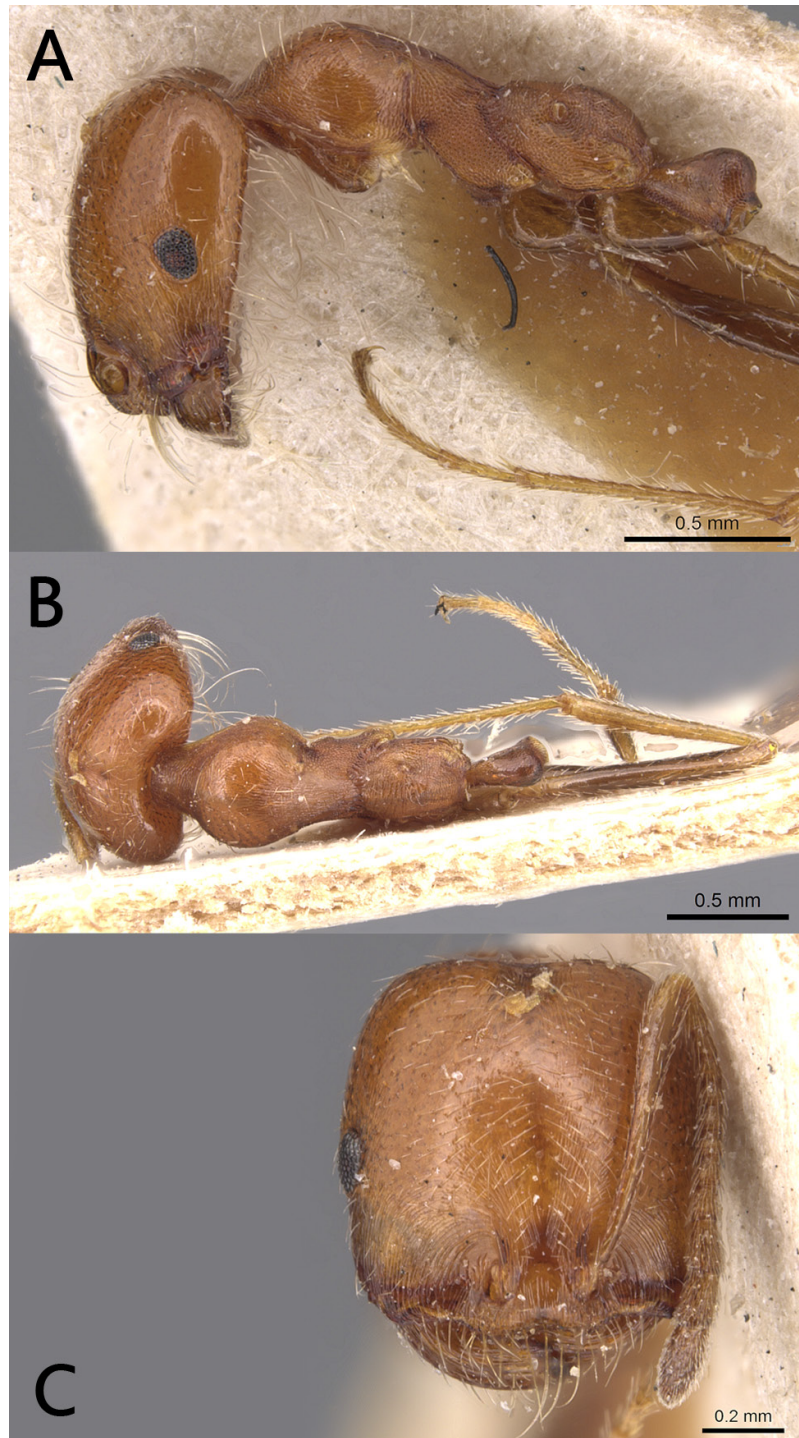
MESOSOMA. Promesonotum convex in profile, running back to straight mesonotum; metanotal groove impressed; propodeal dorsum nearly twice as long as declivity in profile; propodeal spiracle circular, situated above midline of propodeum in profile.

PETIOLE. Petiolar node rounded in profile.

POSTPETIOLE. Node low and broad in profile.

PILOSITY. Underside of head with long ammochaete J-shaped hairs forming a distinct psammophore; cephalic dorsum with sparse suberect hairs directed inward to midline of head; antennae with dense

appressed pubescence; anterior clypeal margin with abundant long curved hairs; pilosity on mesosoma restricted to two or three pairs of hairs on pronotum and promesonotum; sparse decumbent pubescence on mesonotal and propodeal dorsum; petiole and postpetiole bare; gastral tergites with sparse appressed pubescence, few longer pairs of hairs present at gastral apex.



**Fig. 7.** *Trichomyrmex chobauti* (Emery, 1897), syntype, worker (CASENT0904606). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Will Ericson).

SCULPTURE. Clypeus, mandibles, and cephalic surface between frontal carinae and in front of eyes longitudinally rugulose; promesonotum and mesonotum faintly longitudinally rugulose; propodeum and sides of mesonotum, petiole and postpetiole densely punctulate-reticulate, gaster smooth and shining.

COLOUR. Head, mesosoma, petiole and postpetiole reddish brown, gaster dark brown.

### Differential diagnosis

*Trichomyrmex chobauti* is closest to *almosayari* sp. nov. and *lameerei*. All three species share the abundant long ammochaete J-shaped hairs that form a distinct psammophore on the underside of the head. *Trichomyrmex chobauti* can be readily separated from *T. almosayari* sp. nov. by the bicoloured body, the oval eyes, and the straight or feebly concave posterior margin of the head. From *T. lameerei* it can be distinguished by the smaller size, the longer antennal scapes that reach the posterior margin of the head, and the unsculptured posterior half of the head.

### Distribution

*Trichomyrmex chobauti* was originally described from Algeria and recorded from the Middle East and from two countries of the Arabian Peninsula, Saudi Arabia and United Arab Emirates (Collingwood & Agosti 1996; Collingwood *et al.* 2011).

### *Trichomyrmex destructor* (Jerdon, 1851)

Fig. 8A–C

*Atta destructor* Jerdon, 1851: 105 (workers). India. Indomalaya. Lectotype worker (BMNH) (CASENT0008623) [examined].

*Atta destructor* – Bingham 1903: 209 (q.m.).

*Monomorium destructor* – Dalla Torre 1893: 66.

*Trichomyrmex destructor* – Ward, Brady, Fisher & Schultz 2015: 16. — Smith 1979: 1382. — Bolton 1987: 324. — Heterick 2006: 96.

### Material examined

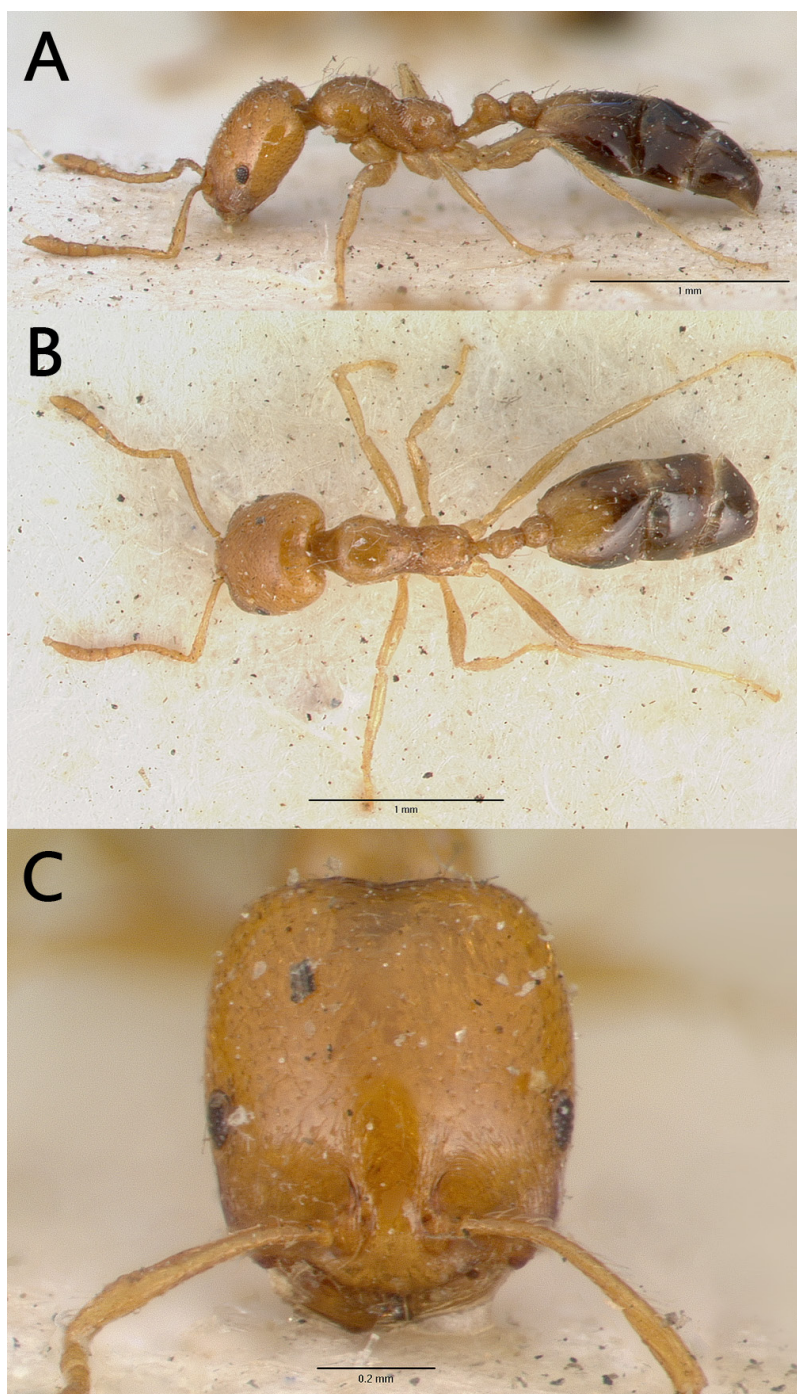
SAUDI ARABIA: 21 w, Al Bahah Province, Almekhwah, Dhi Ayn Archeological Village, 19.92° N, 41.44° E, alt. 741 m, 18 May 2010, M.R. Sharaf leg.; 3 w, Almekhwah, Dhi Ayn Arch. Vill., 19.92° N, 41.44° E, alt. 741 m, 11 May, M.R. Sharaf leg.; 1 w, Almekhwah, Dhi Ayn Arch. Vill., 19.92° N, 41.44° E, alt. 741 m, 23 Sep. 2011, M.R. Sharaf leg.; 1 w, Al Bahah, 19.81° N, 41.36° E, alt. 490 m, 22 Sep. 2011, F.A. Esteve leg. (CASENT0264350); 2 w, Shada Al A'la, 19.85° N, 41.30° E, alt. 1325 m, 15 Feb. 2014, Aldhafer *et al.* leg.; 6 w, Shada Al A'la, 19.86° N, 41.30° E, alt. 1225 m, 26 Jan. 2015, Aldhafer *et al.* leg. — Asir Province: 4 w, Almajardah, Wadi El talaei, 19.00° N, 41.73° E, alt. 223 m, 10 Nov. 2012, M.R. Sharaf leg.; 8 w, Wadi Aljora near Abadan, 17.29° N, 43.07° E, alt. 456 m, 12 Nov. 2012, M.R. Sharaf leg.; 1 w, Almajardah, Wadi Bagara, 18.79° N, 42.01° E, alt. 436 m, 10 Nov. 2012, R. Sharaf leg. — Jazan Province: 2 w, Jazan, 16.97° N, 42.61° E, alt. 38 m, 12 Apr. 2012, M.R. Sharaf leg.. — Makkah Province: 9 w, Allaith gov., Wadi Elarj, 20.52° N, 40.78° E, alt. 529 m, 9 Nov. 2012, M.R. Sharaf leg.; 2 w, Wadi Gonouna, 19.42° N, 41.60° E, alt. 353 m, 12 May 2011, M.R. Sharaf leg. — Riyadh Province: 2 w, Wadi Al Dawasir, 20.48° N, 44.76° E, alt. 690 m, 22 Jan. 2014, S. Salman leg.; 3 w, Wadi Al Dawasir, 20.77° N, 44.78° E, alt. 686 m, 22 Jan. 2014, S. Salman leg.; 3 w, Wadi Al Dawasir, 20.47° N, 44.78° E, alt. 694 m, 22 Jan. 2014, S. Salman leg.; 6 w, Wadi Al Dawasir, 20.48° N, 44.79° E, alt. 709 m, 22 Jan. 2014, S. Salman leg.; 6 w, Wadi Al Dawasir, 20.49° N, 44.79° E, alt. 721 m, 22 Feb. 2015, S. Salman leg.; 12 w, Wadi Al Dawasir, 20.45° N, 44.86° E, alt. 680 m, 22 Feb. 2015, S. Salman leg.; 3 w, Dhurma, 24.60° N, 46.12° E, alt. 649 m, 30 Jan. 2015, S. Salman leg. (all material in KSMA).



UNITED ARAB EMIRATES: 1 w, Ain Al Waal, Jebel Hafit, 24.06° N, 55.74° E, 27 Feb. 2014, H. Roberts leg.; 3 w, Ain Al Waal, Jebel Hafit, 24.06° N, 55.74° E, 19 Dec. 2014, H. Roberts leg.; 2 w, Jebel Hafit, 24.05° N, 55.76° E, 27 Feb.–3 Mar. 2011, M. Hauser *et al.* leg. (CASENT0264882, CASENT0264883) (all material in KSMA).

**Previous records**

QATAR: 1 w, Doha, no locality, 17 Mar. 2005, M.S. Abdel-Dayem leg. (KSMA).



**Fig. 8.** *Trichomyrmex destructor* (Jerdon, 1851), lectotype, worker (CASENT0008623). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: April Nobile).

SAUDI ARABIA: w, Sug al Ahahd riverside, Jazan, 16.70° N, 42.95° E, 26 Mar. 1983, M.R. Sharaf leg.; w, Makkah, 21.41° N, 39.81° E, 8 Dec. 1979, W. Buttiker leg. (Collingwood 1985).

UNITED ARAB EMIRATES: w, Wadi Safad, 25.13° N, 56.19° E, 20 Dec. 2005–2 Jan. 2006, A.V. Harten leg.; w, Sharjah, 25.32° N, 55.51° E, alt. 24 m, 11–17 Oct. 2004, light trap, A.V. Harten leg.; w, Al-Wathba Wetland Reserve, 24.26° N, 54.61° E, 23 Aug. 2004, A.V. Harten leg.; Al-Ajban, 24.61° N 54.84° E, 9 Nov.–7 Dec. 2005, A.V. Harten leg. (Collingwood *et al.* 2011).

## Description

### Small workers

Measurements. TL 1.79–2.33; HL 0.47–0.64; HW 0.38–0.45; SL 0.38–0.45; EL 0.07; ML 0.50–0.64; PW 0.23–0.28; PTL 0.14–0.20; PTW 0.07–0.11; PPL 0.10–0.16; PPW 0.08–0.13; CI 71–85; EI 15–18; SI 88–111 (n = 10). Worker. TL 1.80–3.50; HL 0.50–0.88; HW 0.40–0.79; SL 0.41–0.56; PW 0.23–0.45; ML 0.54–0.92; CI 76–92; SI 70–104 (Bolton 1987).

Workers of this species exhibit size variation in any nest series.

### Worker

HEAD. Mandibles with three strong teeth, the fourth (basal) reduced to a minute offset denticle; eyes relatively small (EL 0.14–0.20 × HW), with 4–6 ommatidia in longest row; in small workers scapes relatively long (SI 88–111), when laid back from their insertions reaching posterior margin of head; in large workers scapes relatively shorter (SI 70–104), failing to reach posterior margin of head.

MESOSOMA. Promesonotum convex in profile; metanotal groove impressed.

PETIOLE. Petiolar node rounded in profile.

POSTPETIOLE. Postpetiolar node lower than petiolar node in profile.

PILOSITY. Posterior margin of head with 2–4 pairs of hairs; cephalic surface behind frontal lobes with 1–4 pairs of hairs straddling midline; cephalic pubescence scattered and directed inward to midline; promesonotal dorsum and propodeum with many pairs of long hairs; petiole, postpetiole and gaster with backward directed long hairs.

SCULPTURE. Cephalic surface smooth and shining, except areas in front of eyes and posterior margin of head (in dorsal view) finely striolate; mandibles longitudinally striolate; promesonotum and mesonotum smooth and shining; mesopleura densely punctulate-reticulate; propodeal dorsum finely transversely striolate to rugose, fainter in smaller than in larger workers; gastral tergite smooth and shining.

COLOUR. Head, mesosoma, petiole and postpetiole ranging from pale yellow to dull brownish yellow; gaster dark brown to blackish brown, with a distinct yellowish area mediobasally.

## Differential diagnosis

The most similar species to *T. destructor* is *T. mayri*, from which it can be distinguished only by the bicoloured body. Head, mesosoma, petiole and postpetiole yellow to brown yellow, gaster dark brown, whereas *T. mayri* is unicolorous dark brown or black brown.

## Ecological and biological notes

Workers of this species were foraging close to the trunk base of an *Acacia* sp. tree where the surrounding area was impacted by trash and human waste. Another nest series was found in moist soil under a stone

next to a date palm, *Phoenix dactylifera* L. (Arecaceae). A nest series was also found under rooster tree, *Calotropis procera* (Aiton) W.T. Aiton (Asclepiadaceae) and associated with the ant species, *T. mayri*, *Carebara arabica* (Collingwood & Van Harten, 2001), *Tapinoma melanocephalum* (Fabricius, 1793), *Nylanderia jaegerskioeldi* (Mayr, 1904), *Monomorium* sp. and *Cardiocondyla* sp.

### Distribution

Originally described from India, this species is now widely distributed in tropical and subtropical regions (Wetterer 2009). It has supposedly been dispersed by commerce from central Asia west to North Africa (Forel 1909; Sharaf 2006), southern Europe (Ruzsky 1907), the Arabian Peninsula (Collingwood 1985; Collingwood & Agosti 1996), and the Socotra Archipelago (Collingwood *et al.* 2004, Sharaf *et al.* in press).

### *Trichomyrmex lameerei* (Forel, 1902)

Fig. 9A–C

*Holcomyrmex lameerei* Forel, 1902a: 150 (workers). Algeria. Palearctic, syntype worker [examined], (Lectotype here designated; Hamada between Houderat, Sahara Algeria, A. Forel (CASENT0249871) (MHNG); paralectotype worker with same data as the lectotype (CASENT0249870) [examined].

*Holcomyrmex lameerei* – Santschi 1907: 327 (q.m.).

*Monomorium lameerei* – Emery 1908: 673.

*Monomorium (Equestrimessor) lameerei* – Santschi 1919: 92.

*Monomorium (Xeromyrmex) lameerei* – Emery 1922: 177.

*Trichomyrmex lameerei* – Ward, Brady, Fisher & Schultz, 2015: 16. – Bolton 1987: 297.

### Material examined

#### Previous records

UNITED ARAB EMIRATES: w, Dibba, 25.62° N, 56.27° E, alt. 19 m, Mar. 1995, Collingwood leg.; w, Lahbab-al-Madam, 24.97° N, 55.77° E, alt. 173 m, 12 Mar. 2005, A.V. Harten leg.; w, Sharjah, 25.32° N, 55.51° E, alt. 24 m, 11–17 Oct. 2004, A.V. Harten leg. (all material in KSMA).

### Description of worker

MEASUREMENTS. TL 4.06–4.50; HL 0.95–1.09; HW 1.00–1.15; SL 0.53–0.75; EL 0.16–0.18; ML 1.25–1.40; PW 0.60–0.61; PTL 0.30–0.31; PTW 0.21–0.25; PPL 0.17–0.23; PPW 0.27–0.30; CI 105–106; EI 16; SI 53–65 (CASENT0249870, CASENT0249871).

HEAD. Broader than long, with emarginated posterior margin, rounded corners and feebly convex sides; anterior clypeal margin feebly concave; eyes of moderate size (EL 0.15–0.16 × HW) with 12 ommatidia in longest row; scapes when laid back from their insertions fail to reach posterior margin of head.

MESOSOMA. Metanotal groove impressed; propodeal dorsum 1.5 × longer than propodeal declivity in profile.

PETIOLE. Peduncle long; two small lateral projections at junction between node and peduncle seen in dorsal view; petiolar node high and rounded in profile.

PILOSITY. Underside of head with abundant long J-shaped hairs forming a distinct psammophore; cephalic surface with sparse short hairs directed inward to midline of head; anterior clypeal margin with abundant long hairs; scapes with sparse appressed pubescence; funiculus with dense appressed pubescence; mesosoma with abundant short hairs, few longer pairs on pronotum and mesonotum;

petiole with abundant short hairs; postpetiole with about seven pairs of long hairs directed backward; gaster with few sparse long hairs and abundant appressed pubescence.

**SCULPTURE.** Cephalic surface finely and densely longitudinally costulate; mandibles longitudinally rugulose; mesosomal dorsum finely transversely costulate; petiolar node nearly smooth and slightly shining; postpetiolar dorsum irregularly longitudinally rugulose; gaster smooth and shining.

**COLOUR.** Head, mesosoma, petiole, postpetiole and appendages reddish brown, gaster dark brown or blackish brown.

### Differential diagnosis

Separation is given under *T. chobauti*.

### Ecological and biological notes

One paralectotype specimen is mounted with a seed between mandibles which indicates a granivorous feeding habitat of this species.

### Distribution

This species was described from Algeria and recently recorded from United Arab Emirates (Collingwood *et al.* 2011).

### *Trichomyrmex mayri* (Forel, 1902)

Fig. 10A–C

*Monomorium* (*Parholcomyrmex*) *gracillimum* var. *mayri* Forel, 1902b: 209 (workers). India, Indomalaya. Syntype worker [examined] (lectotype here designated (CASENT0249904) (MHNG)).

*Trichomyrmex karawajewi* Bolton, 1987: 326.

*Trichomyrmex destructor* – Forel 1911: 24.

*Monomorium mayri* – Wheeler 1923: 3 (male).

*Monomorium* (*Parholcomyrmex*) *mayri* – Emery 1922: 180.

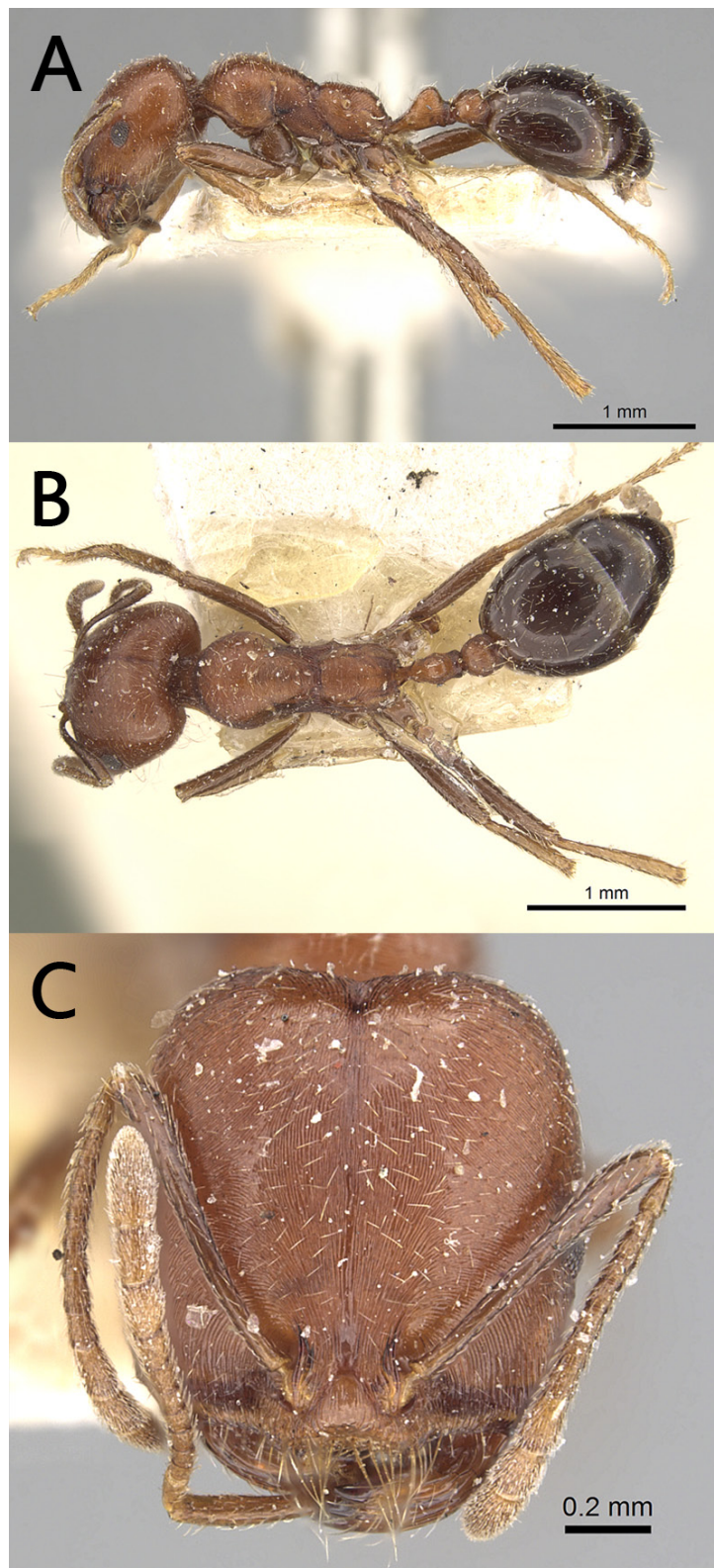
*Trichomyrmex mayri* – Ward, Brady, Fisher & Schultz 2015: 16.

*Trichomyrmex destructor* – Viehmeyer 1916: 132.

### Material examined

QATAR: 1 w, Doha, Ben Mahmoud, 25.28° N, 51.52° E, 14 Mar. 2005, M.S. Abdel-Dayem leg. (KSMA).

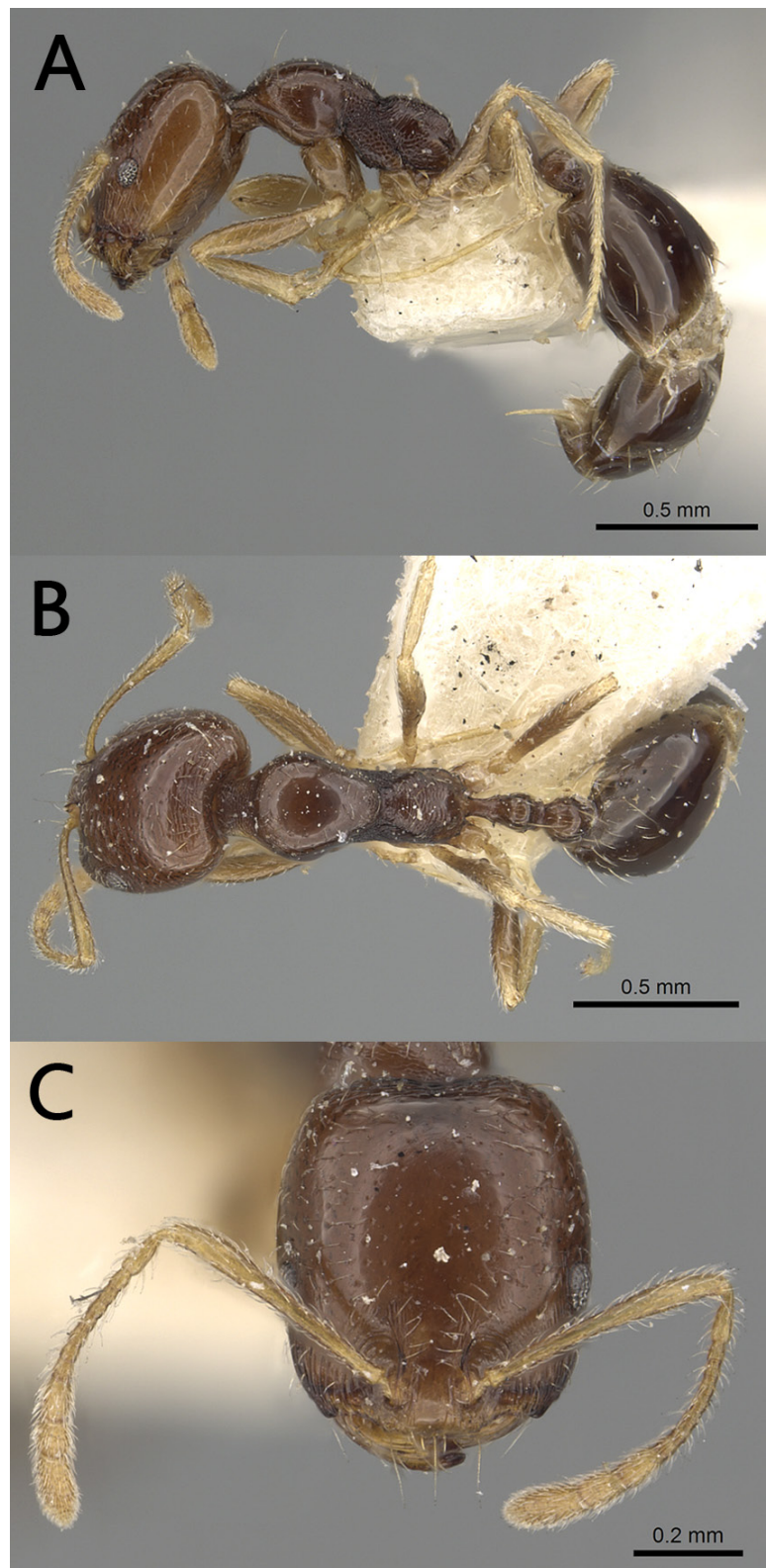
SAUDI ARABIA: 8 w, Al Bahah Province, Raghadan forest, 20.00° N, 41.44° E, alt. 2222 m, 13 May 2010, M.R. Sharaf leg.; 17 w, Park, Beljurashi, 19.80° N, 41.71° E, alt. 2222 m, 17 May 2010, M.R. Sharaf leg.; 12 w, Elqam'a Park, Beljurashi, 19.80° N, 41.71° E, alt. 1950 m, 21 Sep. 2011, M.R. Sharaf leg.; 10 w, Amadan forest, Al Mandaq, 20.20° N, 41.23° E, alt. 1881 m, 19 May 2010, M.R. Sharaf leg.; 2 w, Wadi Elzaraeb (w. Kheir), 20.06° N, 41.38° E, alt. 2123 m, 15 May 2010, M.R. Sharaf leg.; 5 w, Wadi Elzaraeb (w. Kheir), 20.07° N, 41.38° E, alt. 2086 m, 9 May 2011, M.R. Sharaf leg.; 20 w, Shohba forest, 20.04° N, 41.47° E, alt. 2324 m, 14 May 2010, M.R. Sharaf leg.; 2 w, Wadi Turabah, 20.24° N, 41.26° E, alt. 1751 m, 19 Sep. 2011, M.R. Sharaf leg. — 2 w, Asir Province, Raydah, 18.19° N, 42.39° E, alt. 1897 m, 21 Feb. 2014, Aldhafer *et al.* leg.; 2 w, Raydah, 18.19° N, 42.39° E, alt. 1772 m, 29 Jan. 2015, Aldhafer *et al.* leg.; 4 w, Raydah, 18.19° N, 42.40° E, alt. 2285 m, 29 Jan. 2015, Aldhafer *et al.* leg.; 2 w, Raydah, 18.19° N, 42.39° E, alt. 1897 m, 29 Jan. 2015, Aldhafer *et al.* leg.; 1 w, Almajardah, wadi Bagara, 18.79° N,



**Fig. 9.** *Trichomyrmex lameerei* (Forel, 1902), lectotype, worker (CASENT0249871). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Shannon Hartman).

42.01° E, alt. 641 m, 10 Nov. 2012, M.R. Sharaf leg.; Dalaghan, 18.10° N, 42.70° E, alt. 2100 m, 17 Apr. 2008, M.R. Sharaf leg. — 2 w, Eastern Province, Al Qatif, 26.50° N, 50.01° E, alt. 3 m, 21 Dec. 2013, M.R. Sharaf leg. — 5 w, Jazan Province, Abu Arish, 17.01° N, 42.80° E, alt. 90 m, 10 Apr. 2012, M.R. Sharaf leg.; 3 w, Jazan, 16.97° N, 42.61° E, alt. 38 m, 12 Apr. 2012, M.R. Sharaf leg.; 1 w, Jazan, Sabia, 17.10° N, 42.65° E, alt. 43 m, 9 Apr. 2012, M.R. Sharaf leg. — 20 w, Makkah Province, Wadi Gonouna, 19.42° N, 41.60° E, alt. 353 m, 14 May 2010, M.R. Sharaf leg.; 11 w, Allaiith gov., Adam, wadi Elarj, 20.45° N, 40.81° E, alt. 450 m, 9 Nov. 2012, M.R. Sharaf leg. — 4 w, Riyadh Province, Al Dawadmi, 24.46° N, 44.34° E, alt. 1038 m, 18 Apr. 2014, S. Salman leg.; 12 w, Al Ammariyah, 24.81° N, 46.44° E, alt. 696 m, 12 Oct. 2013, S. Salman leg.; 7 w, Al Ghat, 26.06660° N, 44.91957° E, alt. 675 m, 7 Feb. 2015, S. Salman leg.; 1 w, Al Kharaj, 24.15° N, 47.23° E, alt. 463 m, 19 Jan. 2014, S. Salman leg.; 2 w, Kharaj, 24.29° N, 47.15° E, alt. 453 m, 8 Sep. 2014, S. Salman leg.; 5 w, Dhurma, 24.69° N, 46.12° E, alt. 649 m, 30 Jan. 2015, S. Salman leg.; 17 w, Al Majma'ah, 26.00° N, 45.01° E, alt. 594 m, 13 Sep. 2014, S. Salman leg.; 1 w, Al Majma'ah, 25.93° N, 45.29° E, alt. 736 m, 5 Jun. 2014, S. Salman leg.; 13 w, Rawdhat Khorim, 25.38° N, 47.27° E, alt. 551 m, 16 Jan. 2015, S. Salman leg.; 1 w, Rawdhat Khorim, 25.38° N, 47.28° E, alt. 618 m, 2 Jun. 2013, S. Salman leg.; 26 w, Rawdhat Khorim, 25.38° N, 47.27° E, alt. 618 m, 2 Jun. 2013, S. Salman leg.; 6 w, Layla, 20.49° N, 44.79° E, alt. 721 m, 19 Feb. 2015, S. Salman leg.; 3 w, Layla, 22.28° N, 46.74° E, alt. 558 m, 19 Feb. 2015, S. Salman leg.; 7 w, Ergah, 24.67° N, 46.59° E, 625 m, 19 Jan. 2015, S. Salman leg.; 6 w, Ergah, 24.67° N, 46.59° E, 625 m, 1 Apr. 2015, S. Salman leg.; 1 w, Diriyah, 24.76° N, 47.55° E, alt. 673 m, 9 Oct. 2013, S. Salman leg.; 1 w, Dirab, 24.41° N, 46.65° E, alt. 604 m, 18 Sep. 2014, S. Salman leg.; 2 w, Hawtet Bani Tamim, 23.45° N, 46.81° E, alt. 582 m, 13 Dec. 2014, S. Salman leg.; 2 w, Huraymila, 25.13° N, 46.13° E, alt. 783 m, 15 Sep. 2014, S. Salman leg.; 8 w, Kharrarah, 24.39° N, 46.24° E, alt. 726 m, 8 Apr. 2014, S. Salman leg.; 9 w, Mezahmiyah, 24.47° N, 46.23° E, alt. 633 m, 25 Jan. 2014, S. Salman leg.; 1 w, Mezahmiyah, 24.46° N, 46.22° E, alt. 641 m, 25 Jan. 2014, S. Salman leg.; 6 w, Mezahmiyah, 24.48° N, 46.26° E, alt. 648 m, 25 Jan. 2014, S. Salman leg.; 1 w, Na'ajan, 24.06° N, 47.17° E, alt. 513 m, 13 Dec. 2014, S. Salman leg.; 3 w, Na'ajan, 24.02° N, 47.13° E, alt. 467 m, 13 Dec. 2014, S. Salman leg.; 5 w, Sajir, 25.06° N, 44.69° E, alt. 751 m, 23 Jan. 2015, S. Salman leg.; 1 w, Salboukh, 25.07° N, 46.34° E, alt. 716 m, 26 Dec. 2014, S. Salman leg.; 12 w, Shagra, 25.26° N, 45.26° E, alt. 728 m, 30 May 2014, S. Salman leg.; 5 w, Shagra, Al Qarain, 25.23° N, 45.31° E, alt. 703 m, 24 Jan. 2015, S. Salman leg.; 5 w, Buraydah, 26.32° N, 44.02° E, alt. 643 m, 19 Oct. 2013, S. Salman leg.; 15 w, Thadiq, 25.29° N, 45.87° E, alt. 735 m, 26 Apr. 2014, S. Salman leg.; 5 w, Wadi Al Dawasir, 20.49° N, 44.76° E, alt. 706 m, 22 Jan. 2014, S. Salman leg.; 3 w, Wadi Al Dawasir, 20.45° N, 44.86° E, alt. 680 m, 20 Feb. 2015, S. Salman leg.; 3 w, Wadi Al Dawasir, 20.49° N, 44.79° E, alt. 721 m, 22 Feb. 2015, S. Salman leg.; 11 w, Wadi Hanifa, 25.77° N, 47.52° E, alt. 690 m, 9 Jan. 2013, S. Salman leg.; 1 w, Wadi Hanifa, 24.74° N, 46.56° E, alt. 673 m, 18 Sep. 2014, S. Salman leg.; 2 w, Wadi Hanifa, 24.67° N, 46.58° E, alt. 654 m, 14 Feb. 2014, S. Salman leg.; 2 w, Wadi Hanifa, 24.86° N, 46.45° E, alt. 695 m, 21 Jan. 2015, S. Salman leg.; 6 w, Wadi Hanifa, 24.54° N, 46.74° E, alt. 647 m, 11 Apr. 2014, S. Salman leg.; 1 w, Deryia, 24.76° N, 46.55° E, alt. 673 m, 9 Oct. 2013, S. Salman leg.; 1 w, Dirab, 24.41° N, 46.65° E, alt. 604 m, 18 Sep. 2014, S. Salman leg.; 18 w, Oyaina, 24.90° N, 46.38° E, alt. 749 m, 28 Apr. 2010, M.R. Sharaf leg.; 11 w, Wadi Hanifa, 24.67° N, 46.59° E, alt. 641 m, 11 Apr. 2013, M.R. Sharaf leg.; 9 w, Al Ammariyah, 24.81° N, 46.44° E, alt. 630 m, 21 Jan. 2010, M.R. Sharaf leg.; 6 w, Al Ammariyah, 24.81° N, 46.44° E, alt. 696 m, 12 Oct. 2013, M.R. Sharaf leg.; 10 w, Salboukh, 25.07° N, 46.34° E, alt. 689 m, 5 Nov. 2009, M.R. Sharaf leg.; 4 w, Kharaj, 24.19° N, 47.23° E, alt. 465 m, 19 Jan. 2014, M.R. Sharaf leg.; 1 w, King Saud University Campus, 24.71° N, 46.62° E, alt. 660 m, 9 Jul. 2009, M.R. Sharaf leg. (all material in KSMA).

UNITED ARAB EMIRATES: 1 w, Wadi Wurayah farm, 25.23° N, 56.19° E, 2 Jun.–16 Jul. 2009, M. Hauser *et al.* leg. (CASENT0265232); 1 w, Jebel Hafit, 24.03° N, 55.46° E, 27 Feb.–3 Mar. 2011, M. Hauser *et al.* leg. (CASENT0261837); 1 w, Wadi Safad, 25.13° N, 56.19° E, 4 May–15 Jul. 2006, M. Hauser *et al.* leg. (CASENT0264937).



**Fig. 10.** *Trichomyrmex mayri* (Forel, 1902), lectotype, worker (CASENT0249904). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Shannon Hartman).

YEMEN: 1 w, Taizz, 13.57° N, 44.02° E, 26–28 Jul. 1999, A.V. Harten leg.

#### Previous records

SAUDI ARABIA: 1 w, Wadi Khumra, 21.15° N, 41.35° E, 10 Feb. 1978, C.A. Collingwood leg.; 1 w, Al Mandaq, 20.20° N, 41.23° E, 8 Apr. 1980, C.A. Collingwood leg.; 1 w, Al Tawala, 25.5° N, 37.28° E, 7 Apr. 1983, C.A. Collingwood leg.; 1 w, Bisha, 20° N, 42.6° E, 7 Apr. 1983, C.A. Collingwood leg.; 1 w, Al Qatif, 26.51° N, 49.96° E, alt. 30 m, 14 Apr. 1983, C.A. Collingwood leg. (Collingwood 1985).

UNITED ARAB EMIRATES: 1 w Al-Jazira Al-Hamra, 25.70° N, 55.79° E, 9 Sep. 2004, A.V. Harten leg.; 1 w, Ruwais, 24.15° N, 52.73° E, Mar. 1995, A.V. Harten leg. (Collingwood *et al.* 2011).

YEMEN: 1 w, Sana' a, 15.34° N, 44.20° E, Jan. 1991–Nov. 1991; w, Aden, 12.78° N, 44.95° E, Dec. 1991, A.V. Harten leg. (Collingwood & Agosti 1996).

#### Differential diagnosis

Separation is given under *T. destructor*.

#### Ecological and biological notes

A nest series was found under a *Calotropis procera* (Aiton) W.T.Aiton 1811 tree and coexisting with several ant species including: *Carebara arabica* (Collingwood & Van Harten, 2001), *T. melanocephalum* (Fabricius, 1793), *N. jaegerskioeldi* (Mayr, 1904), *Monomorium* sp. and *Cardiocondyla* sp. Another nest series was found under a stone next to a *Citrus limon* (L.) Burm. F. (Rutaceae) tree and a nest of *Brachyponera sennaarensis* (Mayr, 1862). Many workers were foraging on moist clay soil under a mango tree, *Mangifera indica* L. (Anacardiaceae). Some other workers were collected from dry leaf litter under a *Myoporum insulare* R.Br. (Scrophulariaceae) tree. A nest was found under a stone in moist soil and next to a *Juniperus procera* Hochst. ex. Endlicher (Cupressaceae) in the Asir Mountains. Some workers were foraging in leaf litter under a *Psidium guajava* L. (Myrtaceae) tree. Another nest was found in moist soil, rich in decayed organic matter and the surrounding area of dense grasses. Many workers were collected by sifting the leaf litter under date palms. In Shada Al A'la, a nest was found under a discarded bag filled with soil rich in decaying organic matter under a coffee tree, *Coffea arabica* L. (Rubiaceae). Several workers were found under the bark of *Acacia* sp. trees. A nest series was foraging under a pomegranate tree, *Punica granatum* L. (Lythraceae). Some workers were collected under a ficus tree (Moraceae) where soil was moist and rich in decaying organic matter.

#### Distribution

This species has successfully invaded many regions of the tropics, with a speculated origin in the Indian subcontinent (Bolton 1987). Geographically, this species has spread westward to the Middle East, the Arabian Peninsula (Collingwood 1985; Collingwood & Agosti 1996; Sharaf *et al.* 2013), North Africa (Egypt) (Sharaf 2006) and along the coastal zones of Sub-Saharan Africa (Bolton 1987). *Trichomyrmex mayri* is the most successful and widely distributed species of the genus in the Arabian Peninsula and one of the most abundant ants of the Socotra Archipelago (Collingwood 2004; Sharaf *et al.* in press).

#### *Trichomyrmex perplexus* (Radchenko, 1997)

Fig. 11A–C

*Monomorium perplexus* Radchenko, 1997: 213, figs 1–11. (w, q, m.) Armenia. Palearctic. [not examined].

*Trichomyrmex perplexus* – Ward, Brady, Fisher & Schultz, 2015: 16.



### Material examined

GREECE: 3 w, Dodecanese, Rhodes Kolymbia, 36.23° N, 28.15° E, alt. 157 m, 3 May 2015, L. Borowiec leg. (ROD-220); 4 w, Aegean Is., Lesbos Anaxos Skoutarou, 39.31° N, 26.14° E, alt. 28 m, 7 Jun. 2015, L. Borowiec leg. (LES-239) (all material in KSMA).

### Previous records

UNITED ARAB EMIRATES: w, Hatta-Khor Kalba, 25.07° N, 56.35° E, 12 Feb. 2005, C.A. Collingwood leg.

### Description

MEASUREMENTS. Worker: HL 0.69–1.37; HW 0.62–1.38; EL 0.15; SL 0.52–0.87; ML 0.83–1.37 (Radchenko 1997). Large worker: TL 3.50–4.89; HL 1.03–1.31; HW 1.01–1.43; SL 0.70–0.91; EL 0.15–0.16; ML 1.05–1.40; PW 0.55–0.66; PTL 0.22–0.33; PTW 0.15–0.21; PPL 0.18–0.23; PPW 0.20–0.23; CI 107–109; EI 11–14; SI 64 (CASENT0281551, CASENT0914153). Small worker: TL 2.15; HL 0.55; HW 0.54; SL 0.42; EL 0.11; ML 0.68; PW 0.31; PTL 0.13; PTW 0.10; PPL 0.13; PPW 0.13; CI 98; EI 20; SI 78 (CASENT0281552).

HEAD. Slightly longer than broad (CI 98–109) with concave posterior margin and convex sides; anterior clypeal margin shallowly concave; scapes short, when laid back from their insertions failing to reach posterior margin of head.

MESOSOMA. Convex in profile; promesonotal outline flat; metanotal groove impressed; propodeum angular in profile or with short blunt rounded denticle; propodeal dorsum as long as declivity in profile; propodeal declivity with feeble longitudinal impression.

PETIOLE. Peduncle long; petiolar node low, triangular and rounded in profile.

POSTPETIOLE. Node low and rounded in profile.

PILOSITY. Underside of head with numerous straight short hairs not forming a psammophore; cephalic surface with abundant subdecumbent pubescence; posterior margin of head with numerous long curved hairs; mesosoma, petiole and postpetiole with many projecting hairs, varying in length; gastral pilosity numerous and sparse.

SCULPTURE. Head smooth and shining, with sparse fine punctures; mandibles longitudinally rugulose; promesonotum and mesonotum smooth and shining, rest of mesosoma densely punctulate-reticulate.

COLOUR. Head, mesosoma, petiole and postpetiole orange red to reddish brown, gaster dark brown, legs brownish or reddish yellow.

### Differential diagnosis

Separation is given under *T. abyssinicus*. In addition, *T. perplexus* seems similar to a species described under *Monomorium*, *M. dentigerum* (Roger, 1862), from Syria, but more material of both species is required in order to verify the synonymy.

### Ecological and biological notes

Granivorous species. It prefers open and dry habitats including pastures, shores of artificial lakes, seashore with *phrygana*, abandoned gardens, but also found in limestone gorges with *Platanus* trees, open pine forests and open oak woodlands. Nests are built directly in the ground and under stones.

Lowland species, the highest locality in Greece was recorded at about 570 m a.s.l. (L. Borowiec pers. comm.).

### Distribution

*Trichomyrmex perplexus* was described from Armenia and recorded from United Arab Emirates (Collingwood *et al.* 2011), the Middle East including Jordan, and Syria (Borowiec 2014), Eastern Europe and from the Mediterranean Basin including Greece, Turkey, and Cyprus (Borowiec 2014). It is common in the Aegean Islands, Crete, Macedonia, Dodecanese Islands, Ionian Islands, and Thessaly (Borowiec & Salata 2012, 2013; L. Borowiec pers. comm.).

### *Trichomyrmex robustior* (Forel, 1892)

Fig. 12A–C

*Monomorium (Parholcomyrmex) gracillimum robustior* Forel, 1892: 352 (workers). Somalia. Afrotropic. Lectotype, worker (CASENT0101849) (MHNG) [examined].

*Monomorium (Parholcomyrmex) robustior* – Emery 1893: 256. — Forel 1894b: 228.

*Trichomyrmex robustior* – Ward, Brady, Fisher & Schultz 2015: 16. — Heterick 2006: 99 (lectotype designation).

### Material examined

#### Previous records

OMAN: AI-Khuwayr, 23.59° N, 58.41° E, Sep. 1989, M.D. Gallagher leg.

SAUDI ARABIA: Wadi Al-Ammariyah, 24.81° N, 46.44° E, alt. 696 m, Dec. 1977, W. Buttiker leg.

YEMEN: Wadi Surdud, 15.26° N, 43.71° E, 29 Dec. 1991, A.V. Harten leg.

### Description of large worker

MEASUREMENTS. TL 2.5–3.4; HL 0.68–0.84; HW 0.62–0.78; SL 0.52–0.66; PW 0.36–0.46; ML 0.70–0.92; CI 90–97; SI 82–88 (Bolton 1987).

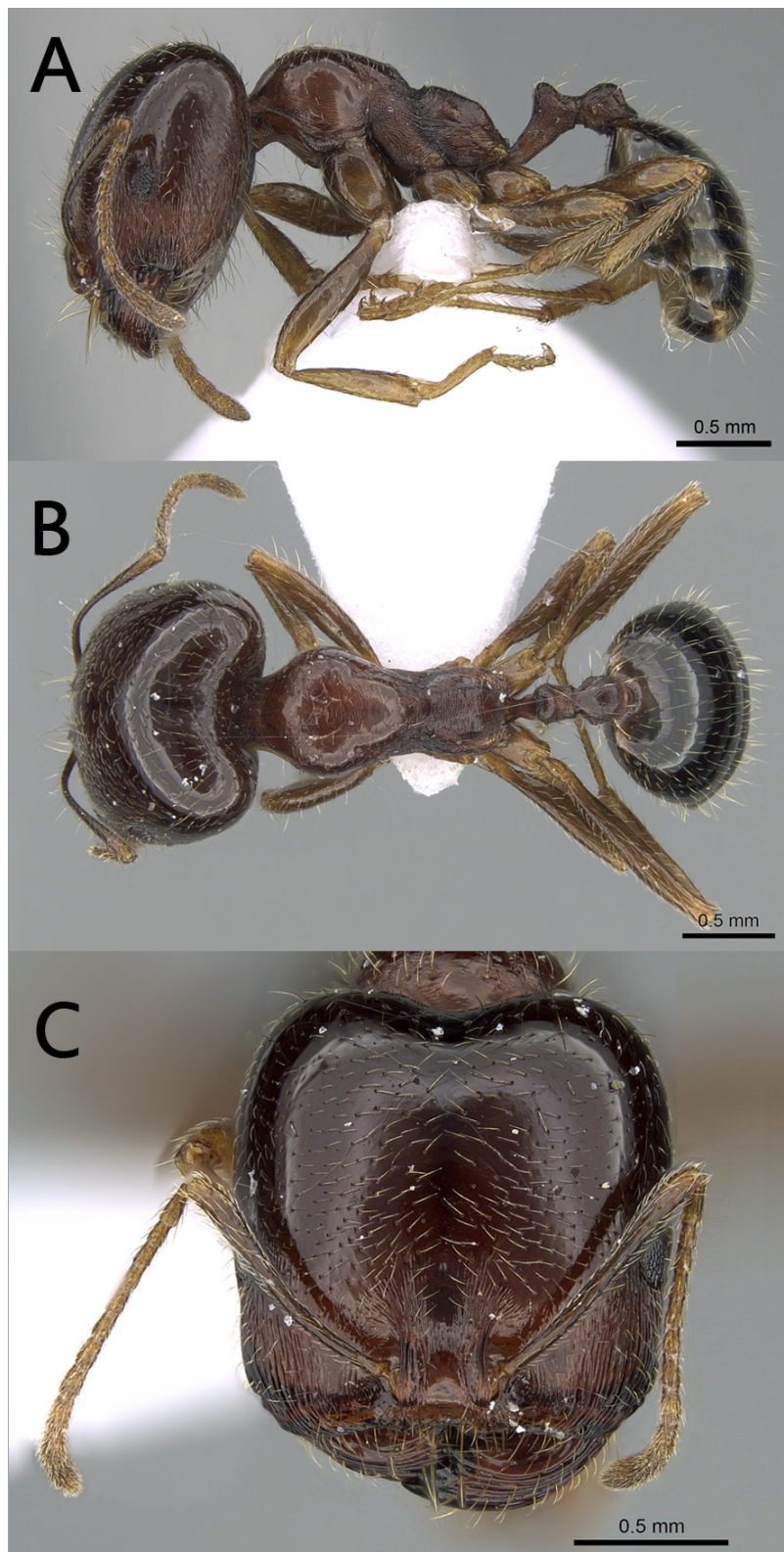
HEAD. With feebly convex sides and slightly concave or emarginated posterior margin in full-face view; in some individuals head broader anteriorly than posteriorly; anterior clypeal margin nearly straight or shallowly concave; basal mandibular tooth reduced to minute denticle; eyes of moderate size (EL 0.18–0.20 × HW), situated just in front of midline of head and with 6–8 ommatidia in longest row; scapes when laid back from their insertions just reach posterior margin of head.

MESOSOMA. Promesonotum domed in profile; metanotal groove impressed; propodeal dorsum on a lower level than that of promesonotum in profile.

PETIOLE. Peduncle elongate, petiolar node strongly rounded in profile.

POSTPETIOLE. Node at a much lower level than that of petiole in profile.

PILOSITY. Underside of head with few short straight hairs, not forming a psammophore; cephalic surface with long fine decumbent to appressed pubescence directed toward midline of head; mesosomal dorsum with long erect to suberect hairs and abundant appressed pubescence; petiole, postpetiole, first gastral tergite and sternite with numerous long curved backward directed hairs and with sparse appressed pubescence.



**Fig. 11.** *Trichomyrmex perplexus* (Radchenko, 1997), worker, Cyprus (CASENT0281551). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view. (photos: Estella Ortega).

SCULPTURE. Mandibles longitudinally rugulose, cephalic dorsum and sides of promesonotum smooth and shining; metapleuron and propodeal sides regularly punctulate-reticulate; propodeal dorsum finely transversely rugulose; petiole, postpetiole and gastral tergites entirely smooth and shining.

COLOUR. Dark brown or blackish brown; gaster usually darker than head and mesosoma.

### Differential diagnosis

The most similar species to *T. robustior* is *T. mayri* from which it can be separated by the smooth posterior margin of the head, the strongly convex promesonotal outline, the coarse and broadly spaced propodeal sculpture, and the longer and strongly curved body pilosity.

### Distribution

This species was described from Somalia and recorded from Kenya and Madagascar (Bolton 1987). *Trichomyrmex robustior* has been recorded from Saudi Arabia, Oman and Yemen (Collingwood & Agosti 1996).

*Trichomyrmex shakeri* Sharaf & Al Dhafer sp. nov.

[urn:lsid:zoobank.org:act:CBBBD8CB-46EF-4D9E-9BBC-4252822A9206](https://zoobank.org/urn:lsid:zoobank.org:act:CBBBD8CB-46EF-4D9E-9BBC-4252822A9206)

Fig. 13A–C

### Etymology

The new species has been named in honor of the late Egyptian writer Mahmoud M. Shaker (1909–1997).

### Material examined

#### Holotype

SAUDI ARABIA: worker, Riyadh, Wadi Hanifa, 24.90° N, 46.18° E, alt. 814 m, 12 Oct. 2015, Aldhafer *et al.* leg. (KSMA).

#### Paratypes

SAUDI ARABIA: 1 w, same data as the holotype (KSMA); 4 w, Riyadh, Wadi Hanifa, 24.90° N, 46.18° E, alt. 806 m, 29 Apr. 2015, Aldhafer *et al.* leg. (1 in CASC: CASENT0922068; 3 in KSMA). Type material is collected by pitfall traps.

### Description

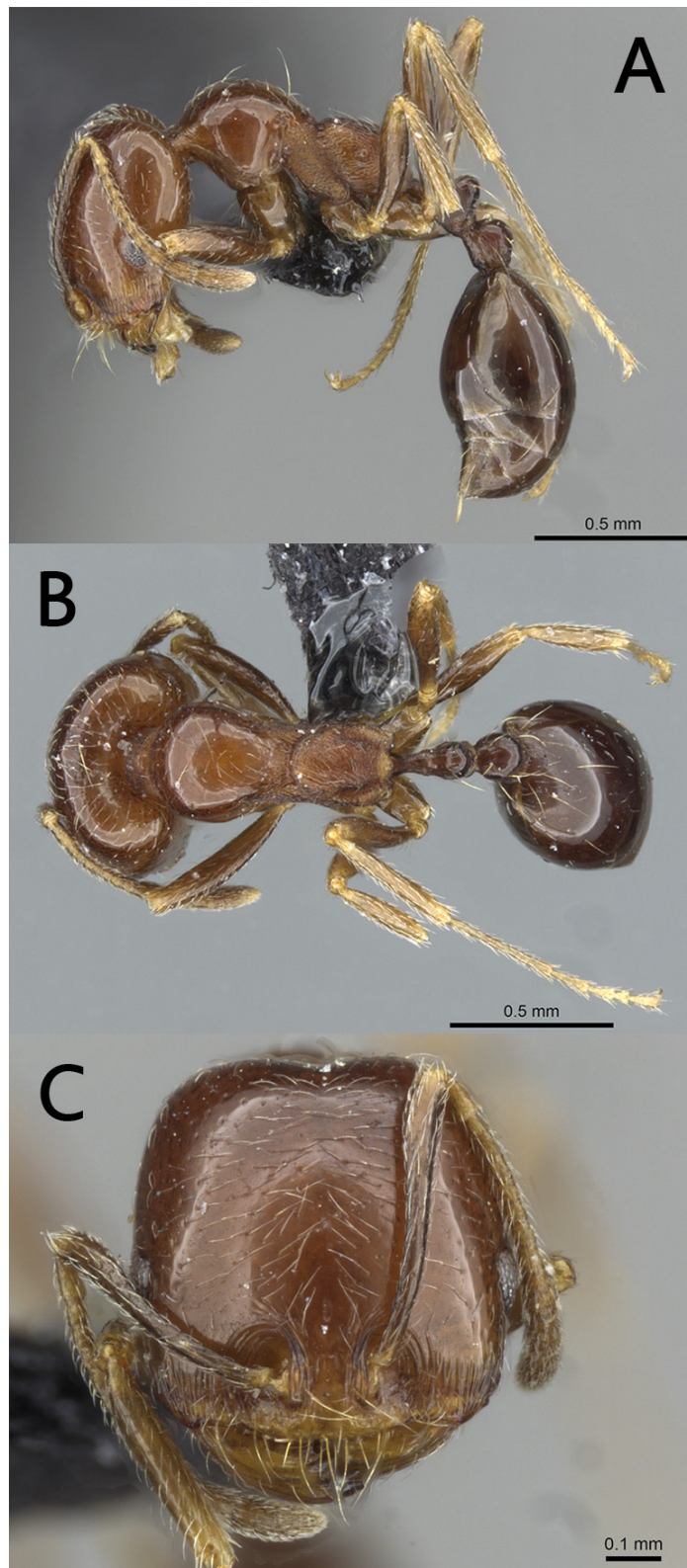
MEASUREMENTS. Holotype, worker. TL 2.07; HL 0.62; HW 0.56; SL 0.48; EL 0.19; ML 0.56; PW 0.31; PTL 0.14; PTW 0.09; PPL 0.08; PPW 0.15; CI 90; EI 34; SI 86.

WORKER. TL 1.94–2.33; HL 0.58–0.67; HW 0.52–0.64; SL 0.36–0.48; EL 0.18–0.21; ML 0.53–0.66; PW 0.29–0.34; PTL 0.14–0.18; PTW 0.09–0.13; PPL 0.08–0.15; PPW 0.14–0.18; CI 85–96; EI 31–37; SI 68–86 (n = 5).

HEAD. Slightly longer than broad and broader anteriorly than posteriorly, with emarginated posterior margin and feebly convex sides; anterior clypeal margin nearly straight or feebly convex; eyes large (EL 0.31–0.36 × HW), with 11 ommatidia in longest row; scapes when laid back from their insertions surpassing posterior margin of head by about one third of eye length.

MESOSOMA. Promesonotum distinctly convex in profile; metanotal groove impressed.

PILOSITY. Underside of head with few short straight hairs, not forming a psammophore; cephalic surface and mandibles with sparse short hairs, anterior clypeal margin with a median long hair and two pairs of



**Fig. 12.** *Trichomyrmex robustior* (Forel, 1892), lectotype, worker (CASENT0101849). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Zach Lieberman).

long hairs on each side; antennae with dense appressed pubescence; mesosoma without hairs except for few sparse appressed pubescence on promesonotum.

PETIOLE. With one pair of long, backward directed hairs.

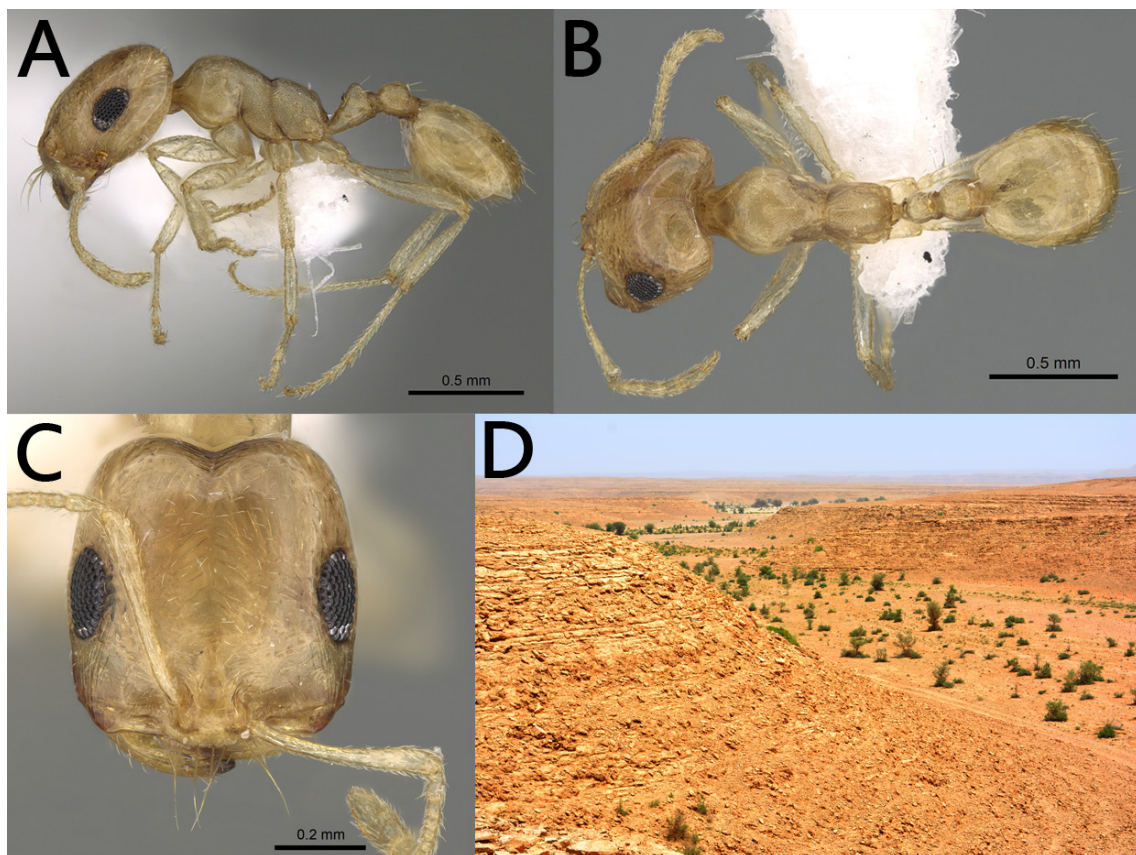
POSTPETIOLE. With two pairs; first gastral tergite bare except for few sparse appressed pubescence, the remaining gastral tergites with some long hairs.

SCULPTURE. Cephalic surface smooth and shining except posterior margin of head, area in front of eyes and mandibles longitudinally rugulose; promesonotal dorsum faintly irregularly sculptured; mesopleura, propodeum, petiole and postpetiole densely punctulate-reticulate; gaster smooth and shining.

COLOUR. Uniform yellow, eyes black, mandibular teeth dark brown.

### Differential diagnosis

Among the Arabian *Trichomyrmex* species, *T. shakeri* sp. nov. is a conspicuous species, quickly identified by the uniform yellow colour and the exceptionally larger eyes (EL 0.31–0.36 × HW) compared to other sympatric species. *Trichomyrmex shakeri* sp. nov. is superficially similar to *T. santschii* (Forel, 1907) from North Africa (Tunisia) in colour and measurements, but it can be readily separated by the absence of the psammophore, which is well-developed in *T. santschii*.



**Fig. 13.** *Trichomyrmex shakeri* sp. nov., paratype, worker (CASENT0922068). **A.** Body in profile. **B.** Body in dorsal view. **C.** Head in full-face view (photos: Michele Esposito). **D.** Type locality (photo: A. Shams Alola).

### Ecological and biological notes

This species is considered uncommon. Only six workers were collected in 150 pitfall traps run for one year at the type locality, a relatively pristine section of Wadi Hanifa (Fig. 13D). Other sampling methods (soil sifting, light traps, beating sheets) were not successful in adding more material.

### *Distribution of Arabian Trichomyrmex species.*

Geographic distributions of the *Trichomyrmex* species in the Arabian Peninsula are shown in Figs 14–17.

### Discussion

Among the nine species of the genus *Trichomyrmex* reported from the Arabian Peninsula, *T. mayri* and *T. destructor* are the most abundant ones. However, *T. mayri* is the most successfully distributed species, since it has the ability to establish itself in a broad range of habitats, including desert and agricultural, wild and urban, pristine and disturbed sites (Collingwood 1985; Collingwood & Agosti 1996; Collingwood *et al.* 1997, 2011). These observations agree with Collingwood *et al.* (2004) and Sharaf *et al.* (in press) on Socotra, where *T. mayri* has a broad distributional range on the Archipelago, occurring in different habitats. The species is also recorded from different localities in Egypt, including the Sinai and Nile Delta (Sharaf 2006). The two species are recorded here for the first time from Qatar, which is not surprising, especially under the intensive urbanization that has occurred recently (UNCSD 2004).

*Trichomyrmex mayri* is most similar to *T. destructor* in all morphological characters except the colour, which is uniform dark brown in the former and yellow to brown yellow with a dark brown gaster in the latter. Although the separation of species based on colour is a feeble character, especially for genera that having distinct colour variation, like *Trichomyrmex* and *Monomorium*, it is observed that the colour is consistent for the studied material of both species in the Arabian Peninsula; therefore, we treat both as valid species. However, it is likely that a future probability for synonymizing *mayri* and *destructor* exists especially when using molecular techniques. *Trichomyrmex abyssinicus* is reported here for the first time from Saudi Arabia. The newly described species *T. almosayari* sp. nov. and *T. shakeri* sp. nov. appear to be restricted to Riyadh Province (Central region). Relatively few specimens of the three species have been collected despite intensive efforts using a variety of sampling methods. All specimens were collected using pitfall traps.

### Acknowledgments

We are grateful to Barry Bolton and Boris Kondratieff (Colorado State University) for their critical review of the manuscript and valuable comments. Barry Bolton provided useful information on African and Malagasy species. We thank Francisco Hita Garcia, Brendon Boudinot, and Lech Borowiec for useful suggestions and providing material. The authors would like to extend their sincere appreciation to the Deanship of Scientific Research at King Saud University for its funding of this Research group (no. RGP-1436-029). We are indebted to A. Van Harten and Huw Roberts for providing material. Our gratitude to the following museum personnel for the kind loan of type material; without their help the work would have been impossible: Wojciech Czechowski (ZMPA); Alexander Radchenko (UASK, SIZK), Bernard Landry, Giulio Cuccodoro (MHNG), Tony Hunter, Steve Judd (WMLC), and Lech Borowiec, Sebastian Salata (University of Wrocław, Poland). Special thanks to Brian Fisher (CASC) for useful comments and his team for appreciated help in photographing new species and their kind permission to use type images on [AntWeb.org](http://AntWeb.org); April Nobile, Estella Ortega, Michele Esposito, Shannon Hartman, Will Ericson, and Zach Lieberman. We thank Ahmed Shams Alola for technical assistance. Mostafa Sharaf thanks his wife, Amal Elsaadany, and his son Mohammed and daughter Fayrouz Sharaf for their continuous encouragement and support.

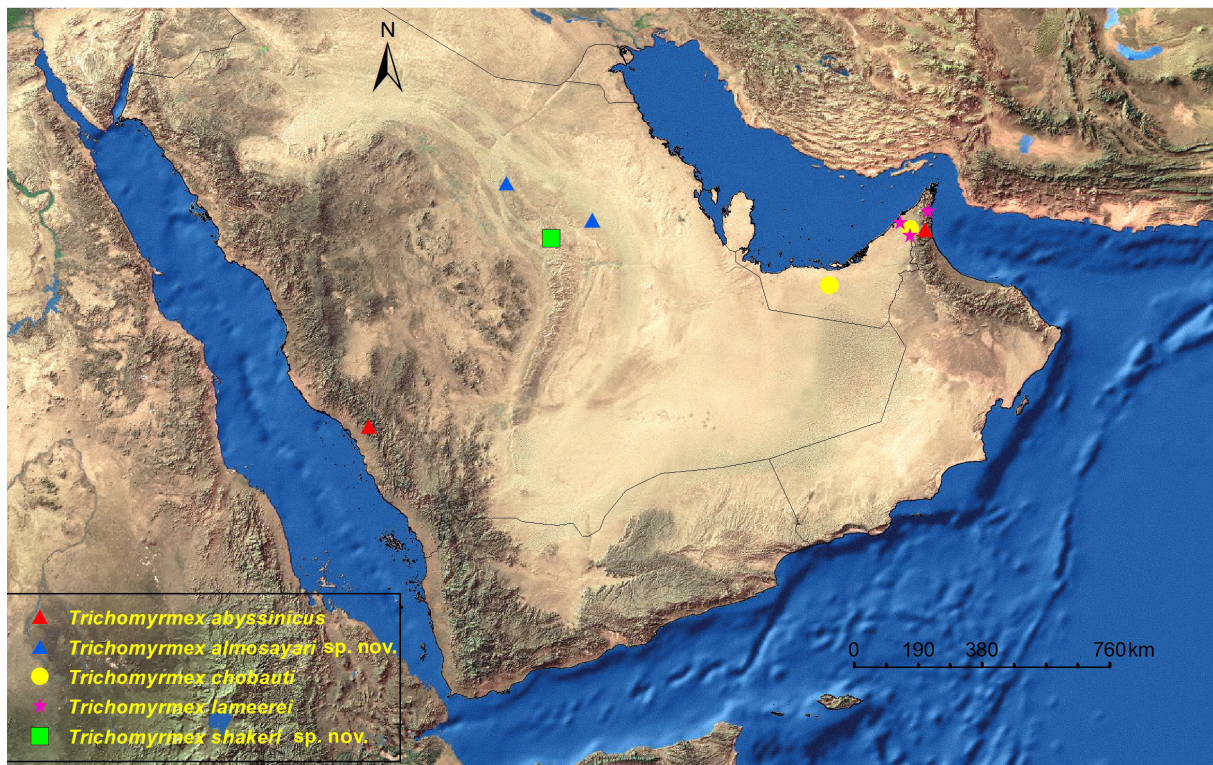


Fig. 14. Distribution map of *Trichomyrmex abyssinicus* (Forel, 1894a), *T. almosayari* sp. nov., *T. chobauti* (Emery, 1897), *T. lameerei* (Forel, 1902) and *T. shakeri* sp. nov.

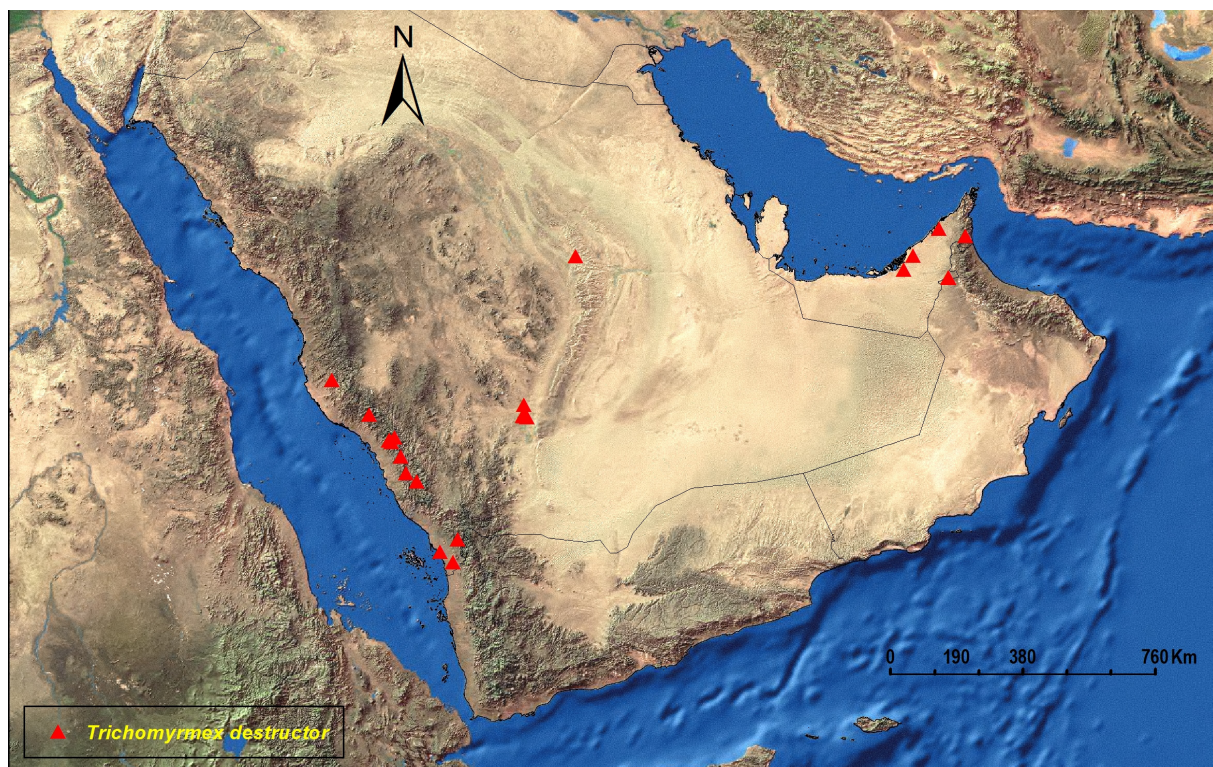


Fig. 15. Distribution map of *Trichomyrmex destructor* (Jerdon, 1851).



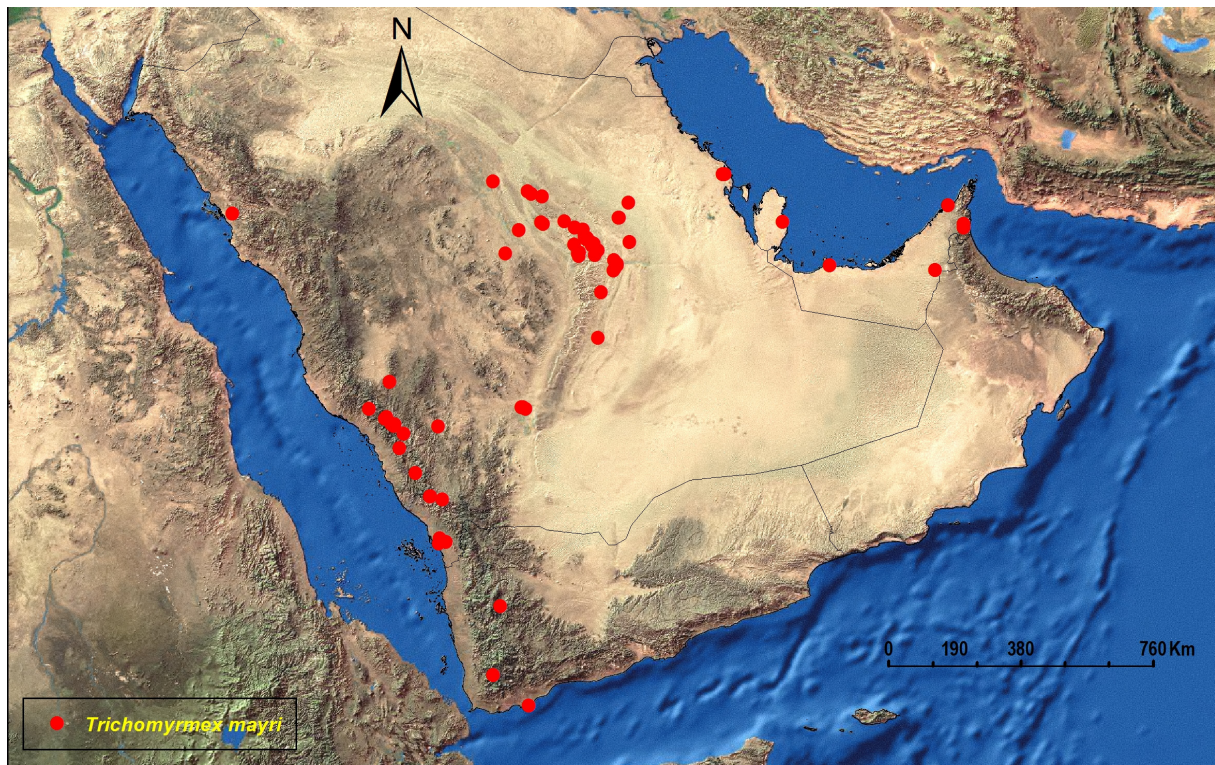


Fig. 16. Distribution map of *Trichomyrmex mayri* (Forel, 1902).

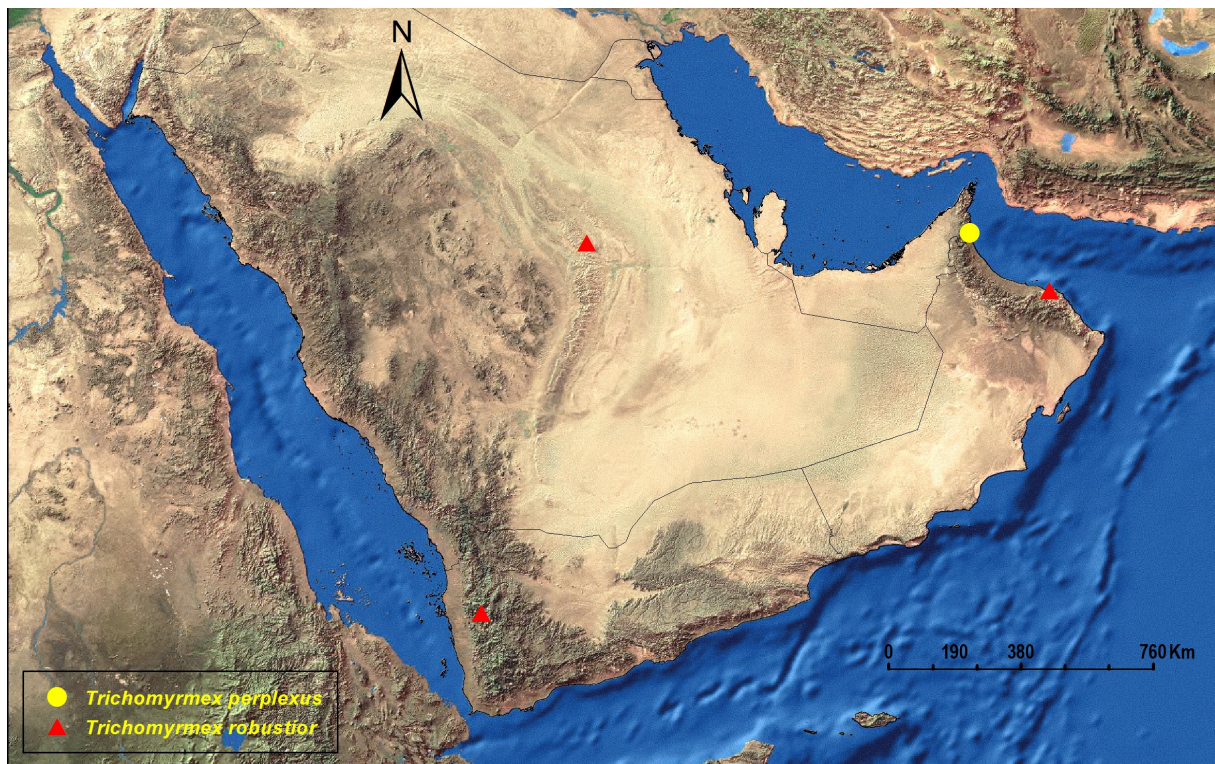


Fig. 17. Distribution map of *Trichomyrmex perplexus* (Radchenko, 1997) and *T. robustior* (Forel, 1892).

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*Manuscript received: 9 March 2016*

*Manuscript accepted: 10 May 2016*

*Published on: 24 November 2016*

*Topic editor: Gavin Broad*

*Desk editors: Charlotte Gérard, Niko Korenhof and Kristiaan Hoedemakers*

Printed versions of all papers are also deposited in the libraries of the institutes that are members of the *EJT* consortium: Museum national d'Histoire naturelle, Paris, France; Botanic Garden Meise, Belgium; Royal Museum for Central Africa, Tervuren, Belgium; Natural History Museum, London, United Kingdom; Royal Belgian Institute of Natural Sciences, Brussels, Belgium; Natural History Museum of Denmark, Copenhagen, Denmark; Naturalis Biodiversity Center, Leiden, the Netherlands.