Monomorium (Hymenoptera: Formicidae) of the Arabian Peninsula with description of two new species, *M. heggyi* sp. n. and *M. khalidi* sp. n. (#54174)

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Monomorium (Hymenoptera: Formicidae) of the Arabian Peninsula with description of two new species, *M. heggyi* sp. n. and *M. khalidi* sp. n.

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We present a revised and updated synoptic list of 44 Arabian *Monomorium* species, including two new species of the *M. salomonis* species-group: *M. heggyi* **sp. n.**, and *M. khalidi* **sp. n.** We propose the following new synonyms: *M. abeillei* André (= *M. wahibiense* Collingwood & Agosti **syn. n.)**; *M. areniphilum* Santschi (= *M. fezzanense* Collingwood & Agosti **syn. n.**, **=** *M. hemame* Collingwood & Agosti **syn. n. =** *M. marmule* Collingwood & Agosti **syn. n.)**; *M. bicolor* Emery (= *M. phoenicum* Santschi **syn. n.)**; *M. harithe* Collingwood & Agosti (= *M. najrane* Collingwood & Agosti **syn. n.)**; *M. niloticum* Emery (= *M. matame* Collingwood & Agosti **syn. n.)**; and *M. nitidiventre* Emery (= *M. yemene* Collingwood & Agosti **syn. n.**). An illustrated key and distribution maps are presented for the treated species. Ecological and biological notes are given when available. The majority of Arabian *Monomorium* species (25) are endemic to the peninsula. All except one of the remaining species are more broadly ranging Afrotropical and Palearctic species, supporting the view of Arabia as a biogeographical crossroads between these two regions. *Monomorium floricola* (Jerdon), the sole species of Indomalayan origin, is recorded for the first time from the Arabian Peninsula.

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Running head: Revision of Arabian *Monomorium*.

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ABSTRACT

We present a revised and updated synoptic list of 44 Arabian *Monomorium* species, including two new species of the *M. salomonis* species-group: *M. heggyi* **sp. n.**, and *M. khalidi* **sp. n.** We propose the following new synonyms: *M. abeillei* André (= *M. wahibiense* Collingwood & Agosti **syn. n.)**; *M. areniphilum* Santschi (= *M. fezzanense* Collingwood & Agosti **syn. n.**, = *M. hemame* Collingwood & Agosti **syn. n. =** *M. marmule* Collingwood & Agosti **syn. n.)**; *M. bicolor* Emery (= *M. phoenicum* Santschi **syn. n.)**; *M. harithe* Collingwood & Agosti (= *M. najrane* Collingwood & Agosti **syn. n.)**; *M. niloticum* Emery (= *M. matame* Collingwood & Agosti **syn. n.)**; and *M. nitidiventre* Emery (= *M. yemene* Collingwood & Agosti **syn. n.**). An illustrated key and distribution maps are presented for the treated species. Ecological and biological notes are given when available. The majority of Arabian *Monomorium* species (25) are endemic to the peninsula. All except one of the remaining species are more broadly ranging Afrotropical and Palearctic species, supporting the view of Arabia as a biogeographical crossroads between these two regions. *Monomorium floricola* (Jerdon), the sole species of Indomalayan origin, is recorded for the first time from the Arabian Peninsula.

Keywords. biogeography, faunal list, Middle East, taxonomic revision.

INTRODUCTION

Monomorium is one of the largest genera of ants, with 326 valid species and subspecies, as well as three fossil species (Bolton, 2020). *Monomorium* species predominantly inhabit tropical, subtropical, and warm temperate regions of the world (Bolton, 1987; Bolton, 1994; Brown, 2000). The majority of *Monomorium* species are native to the Afrotropical bioregion (Bolton, 1987; Hita Garcia et al., 2013; Bolton, 2020). In contrast, the Palaearctic and New World faunas are relatively species-poor (Kempf, 1972; Sharaf et al., 2018a; Fernández & Serna, 2019). In total, 56 species have been reported from the Arabian Peninsula (Collingwood, 1985; Collingwood & Agosti,1996; Aldawood et al., 2010; Aldawood & Sharaf, 2011; Sharaf et al., 2013a, b, c, Sharaf et al., 2014a, b, Sharaf et al., 2015, 2017a, b, 2018a, b). Most are generalized feeders or granivores, but some are lestobiotic or parasitic (Ettershank, 1966; Bolton, 1987; Brown, 2000). Notably, *Monomorium* is one of the few genera that includes several very successful cosmopolitan tramp species, such as *M. pharaonis* (L.) and *M. floricola* (Jerdon), *M. latinode* Mayr, and *M. subopacum* (Smith) (Bolton, 1987; Wetterer, 2010a, b).

The genus *Monomorium* has a long and complex taxonomic history (see Heterick 2006 for a full history of the genus). Emery (1922) offered subgeneric names for several *Monomorium* species, based on characters of the antennal club and number of antennomeres, some names were later raised to the generic level. Ettershank (1966) made a bold attempt to organize the global fauna of *Monomorium* and related genera. Bolton (1987) extensively reviewed, refined and keyed the Afrotropical species recognizing 145 species in 8 species-groups including descriptions of 46 new species and 43 new synonyms. The Malagasy *Monomorium* fauna was revised by Heterick (2006) following Bolton's Afrotropical species-groups as a basis for organizing numerous new species. Heterick (2001, 2003, 2009) comprehensively treated the Australian *Monomorium* fauna, whereas DuBois (1986) and Mackay & Mackay (2002) studied the Nearctic fauna. The comprehensive phylogenetic work of the subfamily Myrmicinae (Ward et al., 2015) has adopted substantial taxonomic changes including the resurrection of the genera *Syllophopsis* and *Trichomyrmex* from synonymy under *Monomorium*. Sparks et al. (2014) fully revised the *Monomorium rothsteini* species-complex. Numerous smaller and regional contributions are scattered in the literature including Argentine (Kusnezov, 1949), China (Wu &

Wang, 1995), Colombia (Fernández & Serna, 2019), Fiji (Sarnat & Economo, 2012), Italy (Baroni Urbani, 1964, 1968), Japan (Morisita et al., 1992), Morocco (Barech et al., 2017), New Zealand (Brown, 1958), Polynesia (Wilson & Taylor, 1967), Taiwan (Terayama, 2009), the Iberian Peninsula (Collingwood, 1978), Turkmenistan (Dlussky et al., 1990), and Western Europe (Bernard, 1968).

However, our understanding of the phylogenetic relationships among the currently accepted *Monomorium* species-groups remains far from satisfactory and the overall taxonomic foundation is in a rather moderate stage (Sparks et al., 2019). Moreover, our knowledge about the diversity of the *genus* is still fragmentary for several regions, such as the Mediterranean, the North African-Indian Desert (including what referred as the Saharo-Arabian in some literatures [Holt at al., 2013]) (Vigna Taglianti et al., 1999; Sharaf et al., 2017a), as well asthe Indomalayan and the Neotropical realms, which contain large numbers of described infraspecific taxa in need of further reevaluation (Borowiec, 2014). We note that, even the Afrotropical *Monomorium* fauna, which is the most diverse and best studied so far, is in dire need of an updated taxonomic revision with likely more than 100 undescribed species and many valid species needing reevaluation (Bolton, 1987; Hita Garcia, pers. obs.).

The oldest records of *Monomorium* species from the Arabian Peninsula were of *M. carbonarium* (Smith) and *M. niloticum* Emery (Forel). Collingwood (1985) reported 17 ant species from the Kingdom of Saudi Arabia (KSA). Collingwood & Agosti (1996) listed 49 ant species from the entire Arabian Peninsula, including 32 newspecies. Additional papers have included records from the KSA (Aldawood & Sharaf, 2011; Sharaf & Aldawood, 2013b; Sharaf et al., 2015, 2018 a, b), Oman (Sharaf et al., 2018b; Monks et al., 2019), the Socotra Archipelago (Collingwood, 2004; Sharaf et al., 2017a), the United Arab Emirates (UAE) (Collingwood et al., 2011), and Yemen (Aldawood et al., 2010).

Collingwood (1985) and Collingwood & Agosti (1996) recognized a total of 53 *Monomorium* species on the Arabian Peninsula, of which 17 were described from countries in the region. However, taxonomic status of several species has remained uncertain due to brief descriptions with insufficient differential diagnoses, apparent ambiguities in the taxonomic keys, lack of species-group assignment (Sharaf et al., 2020a, b). The present study aims to clarify the current status of the Arabian *Monomorium* by providing the following:

I. Diagnoses of Arabian *Monomorium* and *Monomorium* species-groups

II. A synoptic checklist of Arabian *Monomorium*

III. An illustrated identification key to species based on the worker caste.

IV. New taxonomic treatments proposing new synonymies and describing two new species.

V. Biogeographical analyses, including distribution maps

MATERIAL AND METHODS

The species names follow the online catalogue of ants of the world (Bolton 2020). We made digital color images of each species using a Leica DFC450 digital camera with a Leica Z16 APO microscope and LAS (v3.8) software. The images are available online on AntWeb (http://www.AntWeb.org) and are accessible through unique specimen identifiers (e.g. CASENT0922288). Distribution maps were made using DIVA-GIS (version 7.5.0.0).

Measurements and indices.

All measurements are in millimeters and follow the standard measurements of Bolton (1987) and Sharaf et al. (2018a).

CI= Cephalic Index (HW/HL × 100).

EI= Eye Index (EL/HW × 100).

EL= Eye Length; maximum diameter of eye in lateral view.

EM= Distance between anterior margin of eye and mandibular insertion in lateral view.

HL= Head Length; maximum length of head, excluding mandibles in full-face view.

HW= Head Width; maximum width of head behind eyes in full-face view.

ML= Mesosoma Length (=Weber Length); length of mesosoma in lateral view); from a point at which pronotum meets cervical shield to posterior base of propodeal lobes or teeth.

PPH= Postpetiole Height; maximum height measured in lateral view.

PPL= Postpetiole Length; maximum length measured in dorsal view.

PPW= Postpetiole Width; maximum width measured in dorsal view.

PTH= Petiole Height; maximum height measured in lateral 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.

SI= Scape Index (SL/HW × 100).
SL= Scape Length, excluding basal neck.
TL= Total Length, sum of lengths of head, mesosoma, petiole, postpetiole and gaster in profile.

Abbreviations of museums.

Abbreviations of natural history collections follow Evenhuis (2020). The material on which this study is based is located and/or was examined at the following institutions:
BMNH = The Natural History Museum, London, United Kingdom.
CASC = California Academy of Sciences, San Francisco, USA.
KSMA = King Saud University Museum of Arthropods, Riyadh, Kingdom of Saudi Arabia.
LACM = Los Angeles County Museum of Natural History, Los Angeles, CA, USA.
MNHN = Muséum National d'Histoire Naturelle, Paris, France.
NHMB = Naturhistorisches Museum, Basel, Switzerland.
OUMC = Oxford University Museum, Oxford, U.K.
WMLC = World Museum Liverpool, Liverpool, United Kingdom.

Nomenclatural acts

The electronic version of this article in Portable Document Format (PDF) will represent a published work according to the International Commission on Zoological Nomenclature (ICZN), and hence the new names contained in the electronic version are effectively published under that Code from the electronic edition alone. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed through any standard web browser by appending the LSID to the prefix http://zoobank.org/. The LSID for this publication is: urn:lsid:zoobank.org:pub:A7FFDF5C-6CD5-41CA-B106-BFF6BDFCB258; for *Monomorium heggyi* **sp. n.** is urn:lsid:zoobank.org:act:B57EC2EA-1781-4C19-ADFE-757C834E2774; and for *Monomorium khalidi* **sp. n.** is urn:lsid:zoobank.org:act:3B5BB529-D842-4146-B8F7-ACCAC9CD5BA7. The online version of this work is archived and available from the following digital repositories: PeerJ, PubMed Central and CLOCKSS.

RESULTS

I. Diagnosis of Arabian *Monomorium*

Members of the genus *Monomorium* can be recognized by combination of the following characters in the worker caste (Bolton, 1987, 1994; DuBois,1986; Fisher & Bolton, 2016; Sparks *et al.*, 2019): monomorphic to polymorphic; antennae 10–12 segmented (most frequently 12), conspicuous 3-segmented club; mandibles with 3–4 teeth; palp formula 2,2, or 1,2; median clypeal seta conspicuous; median portion of clypeus raised, the raised portion usually longitudinally bicarinate; lateral portions of the clypeus not elevated as shield-like ridges anterior to the antennal toruli; frontal carinae distinct, butabsent posterior to the medial arches of the antennal toruli; metanotal groove present, commonly impressed; propodeal dorsum usually unarmed and rounding into the declivity; propodeal spiracle usually circular, located at about the midlength of the sclerite; abdominal segment IV (metasomal III, gastral I) with posttergite overlapping postternite.

Diagnosis of Arabian *Monomorium* species-groups

The *M. monomorium* species-group can be readily recognized by the following combination of characters in the worker caste (Sharaf et al. 2018a): monomorphic, with size variation; head longer than broad; mandibles smooth and masticatory margin armed with four teeth; antennae with 10–12 segments, terminating in a three-segmented club; median clypeal portion raised anteriorly and longitudinally bicarinate; anterior clypeal margin without a pair of teeth; eyes present with variable size, located in front of the midlength of the sides in full-face view, and with four or more ommatidia in the longest row; head smooth and shining; metanotal groove well-defined, with distinct cross-ribs; propodeal spiracle circular to subcircular; propodeal dorsum meeting declivity in a rounded angle; promesonotum and propodeal dorsum smooth; body pilosity variable but usually distinct; petiole, postpetiole and gastral tergites usually smooth.

The *M. salomonis* species-group can be diagnosed by the following character states in the worker caste (Bolton, 1987): monomorphic, with minor size variation; palp formula 2,2 or 1,2 in some minute species; mandibles usually sculptured; masticatory margins of mandibles armed with four teeth which decrease in size from apex to base; median clypeal portion raised,

projecting anteriorly; cephalic dorsum usually sculptured, ranging from dense blanketing reticulate-punctuation to feeble superficial reticular patterning; eyes prominent of medium to large size, usually with six or more ommatidia in the longest row; eyes circular to oval in shape; head longer than broad; scapes usually relatively long (SI > 80); metanotal groove moderately impressed to absent; metanotal cross-ribs inconspicuous to absent; propodeal spiracle circular to subcircular; propodeum rounded to angular between dorsum and declivity; propodeal dorsum usually sculptured but never transversely striate; petiolar spiracle situated at the node or immediately in front of the anterior face of the node; body pilosity variable in distribution and density, but usually reduce on the head and mesosoma; mesosoma, petiole and postpetiole usually sculptured; first gastral tergite usually shagreenate or finely sculptured.

II. Synoptic checklist of Arabian *Monomorium*

Monomorium monomorium species-group

1. *Monomorium aeyade* Collingwood & Agosti, 1996
2. *Monomorium brunneolucidulum* Collingwood & Agosti, 1996 **(nomen dubium)**.
3. *Monomorium carbonarium* (Smith, 1858)
   = *Monomorium minutum* Mayr, 1862
4. *Monomorium clavicorne* André, 1881
   = *Monomorium clavicorne punicum* Santschi, 1915a
5. *Monomorium exiguum* Forel, 1894
   = *Monomorium exiguum bulawayensis* Forel, 1913
   = *Monomorium faurei* Santschi, 1915b
   = *Monomorium exiguum flavescens* Forel, 1916
   = *Monomorium baushare* Collingwood & Agosti, 1996
   = *Monomorium qarahe* Collingwood & Agosti, 1996
6. *Monomorium floricola* (Jerdon, 1851)
   = *Monomorium poecilum* Roger, 1863
   = *Monomorium cinnabari* Roger, 1863
   = *Monomorium specularis* Mayr, 1866
   = *Monomorium impressum* Smith, 1876
   = *Monomorium floreanum* Stitz, 1932

= *Monomorium angusticlava* Donisthorpe, 1947

7. *Monomorium holothir* Bolton, 1987
8. *Monomorium mohammedi* Sharaf & Hita Garcia, 2018
9. *Monomorium rimae* Collingwood & Agosti, 1996
10. *Monomorium sarawatense* Sharaf & Aldawood, 2013b

***Monomorium salomonis* species-group**

11. *Monomorium abeillei* André, 1881

= *Monomorium wahibiense* Collingwood & Agosti, 1996 **syn. n.**

12. *Monomorium acutinode* Collingwood & Agosti, 1996
13. *Monomorium areniphilum* Santschi, 1911

= *Monomorium fezzanense* Collingwood & Agosti, 1996 **syn. n.**

= *Monomorium hemame* Collingwood & Agosti, 1996 **syn. n.**

= *Monomorium marmule* Collingwood & Agosti, 1996 **syn. n.**

= *Monomorium salomonis lepineyi* Santschi, 1934

= *Monomorium salomonis pullula* Santschi, 1919

14. *Monomorium asiriense* Collingwood & Agosti, 1996
15. *Monomorium barbatulum* Mayr, 1877 (New record to KSA)
16. *Monomorium bicolor* Emery, 1877

= *Monomorium bicolor aequatoriale* Santschi, 1926

= *Monomorium bicolor coerulescens* Santschi, 1912

= *Monomorium bicolor rufibasis* Santschi, 1914

= *Monomorium bicolor tropicale* Santschi, 1926

= *Monomorium bicolor uelense* Santschi, 1926

= *Monomorium phoenicum* Santschi, 1927 **syn. n.**

17. *Monomorium buettikeri* Collingwood & Agosti, 1996
18. *Monomorium buxtoni* Crawley, 1920a
19. *Monomorium carbo* Forel, 1910
20. *Monomorium dammame* Collingwood & Agosti, 1996
21. *Monomorium dirie* Collingwood & Agosti, 1996
22. *Monomorium elghazalyi* Sharaf & Aldawood, 2017
23. *Monomorium fayfaense Collingwood & Agosti, 1996*

24. *Monomorium gallagheri* Collingwood & Agosti, 1996
25. *Monomorium hanaqe* Collingwood & Agosti, 1996
26. *Monomorium harithe* Collingwood & Agosti, 1996
    = *Monomorium najrane* Collingwood & Agosti, 1996 **syn. n.**
27. *Monomorium heggyi* Sharaf, **sp. n.**
28. *Monomorium jizane* Collingwood & Agosti, 1996
29. *Monomorium khalidi* Sharaf, **sp. n.**
30. *Monomorium knappi* Collingwood & Agosti, 1996
31. *Monomorium luteum* Emery, 1881
32. *Monomorium mahyoubi* Collingwood & Agosti, 1996
33. *Monomorium moathi* Sharaf & Collingwood, 2010
34. *Monomorium niloticum* Emery, 1881
    = *Monomorium matame* Collingwood & Agosti, 1996 **syn. n.**
35. Monomorium nimihil Collingwood, 2004
36. *Monomorium nitidiventre* Emery, 1893
    = *Monomorium yemene* Collingwood & Agosti, 1996 **syn. n.**
37. *Monomorium pharaonis* (Linnaeus, 1758)
    = *Monomorium antiguensis* (Fabricius, 1793)
    = *Monomorium domestica* (Shuckard, 1838)
    = *Monomorium contigua* (Smith, 1858)
    = *Monomorium fragilis* (Smith, 1858)
    = *Monomorium minuta* (Jerdon, 1851)
    = *Monomorium vastator* (Smith, 1857)
38. *Monomorium riyadhe* Collingwood & Agosti, 1996
39. *Monomorium salomonis* (Linnaeus, 1758)
    = *Monomorium debilis* (Walker, 1871)
    = *Monomorium salomonis obscuratum* Stitz, 1917
    = *Monomorium thorense* Mayr, 1862
40. *Monomorium subdenticorne* Collingwood & Agosti, 1996
41. *Monomorium subopacum* (Smith, 1858), full synonymy in Heterick (2006)
42. *Monomorium suleyile* Collingwood & Agosti, 1996

43. *Monomorium tumaire* Collingwood & Agosti, 1996

44. *Monomorium venustum* (Smith, 1858)

III. Key to Arabian *Monomorium* based on the worker caste

Note: *M. brunneolucidulum* excluded due to lack of diagnostic characters.

1. Head smooth and glossy (Fig. 1A) ... **2** (*M. monomorium* species-group)

– Head usually sculptured, ranging from dense reticulate-punctate, longitudinal striations, to faint reticular patterning (Fig. 1B) … **10** (*M. salomonis* species-group)

2. Anterior median portion of clypeus strongly concave with two laterally projecting teeth (Fig. 1C) … **3**

– Anterior median portion of clypeus straight or feebly concave without raised ridges (Fig. 1D) ... **4**

3. Uniform dark brown to black; metanotal groove broadly and deeply impressed (Fig. 1E) … ***M. carbonarium***

– Bicolored with yellow mesosoma contrasting with the black gaster; metanotal groove shallowly impressed … ***M. rimae***

4. Antenna 12-segmented … **5**

– Antenna 11-segmented … 7

5. Body pilosity clubbed; mesosoma, petiole and postpetiole distinctly sculptured (Fig. 1F) … ***M. sarawatense***

– Body pilosity simple; mesosoma, petiole and postpetiole smooth and shining (Fig. 2A) … **6**

6. Bicolored, with head and gaster dark brown to black contrasting the yellow or yellow-brown mesosoma and petiole; eyes small (EL 0.21–0.24 x HW) with six ommatidia in longest row, oval in profile (Fig. 2A) … ***M. floricola***

– Uniform yellow; eyes relatively large (EL 0.30–0.32 x HW) with 8-9 ommatidia in longest row, in profile with convex dorsal margin and straight ventral margin (Fig. 2B) … ***M. holothir***

7. Mesosoma without standing hairs (Fig. 2C) … 8
– Mesosoma with standing hairs (Fig. 2D) … **9**

8. Eyes larger, with a ring of seven to eight ommatidia encircling a single row of 2 ommatidia, and in profile closer to mandibular insertions (EM 0.05); meso- and metapleuron smooth; petiole and postpetiole smooth and each with one pair of standing hairs (Fig. 2C) … ***M. aeyade***
– Eyes smaller, with only 5–6 ommatidia total, and in profile further away from mandibular insertions (EM 0.09–0.11); meso-and metapleuron finely shagreened; petiole and postpetiole superficially shagreened and without standing hairs (Fig. 2E) … ***M. mohammedi***

9. Mesosoma with two pairs of standing hairs, one on pronotal corners and one on propodeum (Fig. 2F) … ***M. clavicorne***
– Mesosoma with several pairs of standing hairs, about 10 pairs (Fig. 2D) … ***M. exiguum***

10. Underside of head with crowded J-shaped hairs forming a distinct psammophore (Fig. 3A) … ***M. barbatulum***
– Underside of head with sparse hairs, psammophore absent … **11**

11. Mesosoma without standing hairs … **12**
– Mesosoma with standing hairs … **25**

12. Uniform yellow, brown, or yellow-brown, gaster not darker than mesosoma … **13**
– Bicolored, with gaster distinctly darker than mesosoma … **18**

13. Metanotal groove shallowly impressed or indistinct (Fig. 3B) … **14**
– Metanotal groove deeply impressed (Fig. 3C) … **15**

14. Small yellow species (TL 1.7, HL 0.45–0.48, HW 0.34–0.36, SI 92–97); cephalic surface with vestigial or superficial reticular patterning, almost entirely effaced; petiole and postpetiole

without standing hairs; (Fig. 3B); first gastral tergite completely glabrous, *i.e.*, without standing hairs (Fig. 3B) … ***M. heggyi* sp. n.**

– Large brown species (TL 2.20–2.75, HL 0.57–0.65, HW 0.51, SI 93–103); cephalic surface with fine and dense reticulate-rugulose sculpture; petiole and postpetiole each with two pairs of standing hairs (Fig. 3D); first gastral tergite always with several pairs of standing hairs (Fig. 3D) … ***M. harithe***

15. Eyes located nearly at the mid-length of head as seen in full-face view (Fig. 3E); eyes smaller, with 5 ommatidia in longest row); posterior margin of head distinctly concave in full-face view (Fig. 3E) … ***M. elghazalyi***

– Eyes located nearly behind or at head mid-length as seen in full-face view (Fig. 3F); eyes distinctly larger, with 10–14 ommatidia in longest row); posterior margin of head concave or linear in full-face view … **16**

16. Underside of head without long, standing hairs (Fig. 4A) … ***M. dirie***

– Underside of head with numerous pairs of long, standing hairs (Fig. 4B) … **17**

17. Yellow; scapes just reaching posterior margin of head when laid back; body pilosity abundant over entire body … ***M. nimihil***

– Brown; scapes surpassing posterior margin of head by about half the length of the pedicel when laid back; body pilosity distinctly reduced over entire surface, mesosoma with a single pair of hairs on propodeum, while the petiole, postpetiole, and gaster are bare … ***M. salomonis***

18. First gastral tergite without standing hairs … ***M. moathi***

– First gastral tergite with hairs either scattered on tergite surface or apically on the posterior margin … **19**

19. Scapes when laid back from their insertions reach or surpass posterior margin of head in full-face view … **20**

– Scapes when laid back from their insertions fail to reach posterior margin of head in full-face view … **21**

20. Propodeal dorsum in profile meeting declivity forming two blunt, slightly projecting angled bosses (Fig. 4C) … ***M. subdenticorne***

– Propodeal dorsum in profile meeting declivity in a continuous curve (Fig. 4D) … ***M. bicolor***

21. Petiole in the form of a high triangle in profile with anterior face appears as a continuous line sloping anteriorly (Fig. 4E) … ***M. acutinode***

– Petiole broadly rounded with anterior face sloping downward and then anteriorly to the peduncle (Fig. 4F) … **22**

22. Head faintly superficial sculptured, slightly shining … ***M. venustum***

– Head densely and finely reticulate to reticulate-shagreenate … 23

23. Small (TL 2.3–2.4, HL 0.60–0.63, HW 0.43–0.45, PW 0.30–0.31, ML 0.66–0.70); mesosoma and gaster approximately of the same color, the two not strongly contrasting … ***M. carbo***

– Larger (TL 3.1–3.4, HL 0.70–1.04, HW 0.54–0.88, PW 0.36–0.53, ML 0.88–1.24); mesosoma and gaster conspicuously differently colored, gaster usually darker … **24**

24. Eyes with 12–14 ommatidia in longest row); metanotal groove deeply impressed (Fig. 5A); postpetiole with two to three pairs of backward directed hairs … ***M. areniphilum***

– Eyes with 9–11 ommatidia in longest row); metanotal groove feebly impressed (Fig. 5B); postpetiole with a single pair of backward directed hairs … ***M. subopacum***

25. Large (TL ≥ 3.8, HW > 0.75) … **26**

– Smaller (TL 2.2–3.2, ≤ HW 0.67) … **28**

26. Entirely yellowish; mesosoma rather flat with a shallow oblique metanotal groove (Fig. 5C) … ***M. luteum***

– Gaster dark contrasting with red mesosoma; metanotal groove steeply angled (Fig. 5D) … **27**

27. Head smooth with superficial sculpture; the first of the three segments forming the club being shorter than the second (Fig. 5E); head in full-face view with feebly but distinctly convex sides; head in full-face view with eyes fail or just break head sides (Fig. 5E) … ***M. niloticum***

– Head completely finely striate (Fig. 5F); the first of the three segments forming the club nearly subequal to the second (Fig. 5F); head in full-face view with straight sides; head in full-face view with eyes break sides (Fig. 5F) … ***M. riyadhe***

28. Mesosoma red, contrasting with dark gaster … **29**

– Mesosoma pale brown to black, concolorous with gaster … **34**

29. Mesosoma hairs restricted to one pair on pronotum … **30**

– Mesosoma with several pairs of hairs scattered over whole dorsum … **31**

30. Head and mesosoma dull red, gaster brown; scapes reaching posterior head margin when laid back (Fig. 6A); cephalic surface with vestigial sculptures; posterior margin of head with a single pair of hairs (Fig. 6A); propodeum in profile with dorsum making an obtuse angle with declivity (Fig. 6B) … ***M. hanaqe***

– Head and mesosoma bright orange red, gaster black; scapes not reaching posterior head margin when laid (Fig. 6C); cephalic surface densely punctate; posterior margin of head without hairs except for appressed pubescence (Fig. 6C); propodeum in profile with dorsum making a continuous curve with declivity (Fig. 6D) … ***M. jizane***

31. Propodeal dorsum with a single pair of standing hairs … **32**

– Propodeal dorsum with at least three pairs of standing hairs … **33**

32. Scapes when laid back from their insertions reach posterior margin of head in full-face view (Fig. 6E); cephalic surface densely punctate (Fig. 6E); gaster smooth and shining (Fig. 6F) … ***M. fayfaense***

– Scapes when laid back from their insertions fail to reach posterior margin of head in full-face view (Fig. 7A); cephalic surface with vestigial sculptures (Fig. 7A); gaster finely densely shagreened and dull (Fig. 7B) … ***M. knappi***

33. Whole body with abundant fine hairs (Fig. 7C); with head in full-face view outer margins of eyes break head sides (Fig. 7D) … ***M. nitidiventre***

– Body pilosity limited and stiff (Fig. 7E); promesonotum with five to six pair of standing hairs, promesonotum and propodeum each with three pairs; petiole and postpetiole each with two-three pairs; with head in full-face view outer margins of eyes fail to break head sides (Fig. 7F) … ***M. khalidi* sp. n.**

34. Whole body including gaster densely sculptured and dull … **35**

– Gaster at least more or less shining with superficial sculpture … **37**

35. Head, mesosoma, and waist segments very light brown or yellow); hairs on mesosoma scattered (Fig. 8A) … ***M. pharaonis***

– Head, mesosoma, and waist segments conspicuously of darker brown or black; mesosoma hairs mainly or entirely to pronotum (Fig. 8B) … **36**

36. Body color brown; larger species (TL 3.1–3.3, HW 0.70); scapes long, surpassing posterior head margin by about the length of the pedicel when laid back (Fig. 8C); head in full-face view with convex sides (Fig. 8C) … ***M. suleyile***

– Body color uniformly black; smaller species (TL 2.7–2.9, HW 0.56); scapes shorter, just reaching posterior head margin when laid back of head (Fig. 8D); head in full-face view with parallel sides (Fig. 8D) … ***M. mahyoubi***

37. Whole body glossy, nodes and gaster brilliant … ***M. dammame***

– At least mesosoms with close punctate sculpture … **38**

38. Underside of head with numerous hairs (12–16), the longest exceeding the maximum eye length (Fig. 8E) … ***M. tumaire***

– Underside of head with fewer hairs, none as long as maximum eye length (Fig. 8F) … **39**

39. Head finely and densely punctate, general appearance dull … **40**

– Head feebly superficially sculptured, relatively but distinctly shining … **41**

40. Smaller species (TL 2.4–2.7); clypeal border feebly concave to straight with a very small median notch or none (Fig. 9A); mesonotum straight in profile (Fig. 9B) … ***M. gallagheri***

– Larger species (TL > 3.0); clypeus with a distinct anteromedian notch (Fig. 9C); mesonotum distinctly convex in profile (Fig. 9D) … ***M. buxtoni***

41. Scapes distinctly short, surpassing compound eye posterior margins by only about the length of the pedicel …***M. buettikeri***

– Scapes longer, reachin posterior head margin … **42**

42. Color dark brown to black; smaller species (TL 2.40–2.75, C1 78–91); metanotal groove shallowly impressed (Fig. 9E) … ***M. abeillei***

– Color light to median brown; larger species (TL 3.2, CI 69–71); metanotal groove distinctly impressed (Fig. 9F) … ***M. asiriense***

IV New taxonomic treatments

New site records include, when available, geo-coordinates (°N, °E), elevation (m), collection date, collector, and number worker (w) and queen (q) specimens.

Monomorium abeillei André, 1881

(Fig. 10 A–C)

Monomorium abeillei André, 1881: 531 (footnote) (w.) Israel. Palearctic. (MNHN, CASENT0915411). [Image of lectotype worker examined]. [Also described as new by André, 1881: 67.].

Combination in *Monomorium* (*Xeromyrmex*): Emery, 1922: 177; subspecies of *Monomorium salomonis*: Forel, 1910a: 23; Hamann & Klemm, 1967: 413; revived status as species: Collingwood, 1985: 269; Collingwood & Agosti, 1996: 340.

Monomorium wahibiense Collingwood & Agosti, 1996: 357 (w.) Oman. Palearctic. [NHMB], CASENT0913864. Syntype worker, Oman, Wahiba dunes (21.vii.1985, M. D. Gallagher) [examined] **syn. n.**

Material examined. KSA: Asir Province: Raydah (18.198, 42.410, 2443m, 22.ii.2014, M.R. Sharaf, 3w); Raydah (18.204, 42.412, 2820m, 21.ii.2014, M.R. Sharaf, 6w); **Riyadh Province:** Huraymila, Buaythiran (25.149, 45.950, 07.ii.2011, M.R. Sharaf, 2w); Rawdhat Khureim (25.383, 47.277, 618m, 02.vi.2013, S. Salman, 6w); Rawdhat Khureim (25.425, 47.235, 579m, 09.i.2015, S. Salman, 12w); Dirab, KSU research station (24.419, 46.654, 568m, 05.xii.2013, S. Salman, 1w); Wadi Hanifa (24.670, 46.654, 657m, 14.ii.2014, S. Salman, 3w); Mezahmyia (24.472, 46.239, 633m, 25.i.2014, S. Salman, 1w); Mezahmyia (24.466, 46.251, 648m, 29.xi.2014, S. Salman, 1w); Al Hayer (24.546, 46.742, 647m, S. Salman, 2w); Al Hayer (24.557, 46.744, 589m, 11.iv.2014, S. Salman, 6w); Runnah (25.571, 46.973, 615m, 12.iv.2014, S. Salman, 1w); Dawademi (24.478, 44.364, 1027m, 18.iv.2014, S. Salman, 1w); Dawademi (24.583, 44.323, 966m, 16.i.2015, S. Salman, 3w); Dawademi (24.538, 44.355, 999m, 16.i.2015, S. Salman, 1w); Afif (23.766, 42.840, 1015m, 19.iv.2014, S. Salman, 6w); Afif (24.302, 43.688, 951m, 19.iv.2014, S. Salman, 1w); Afif (23.900, 42.081, 1052m, 17.i.2015, S. Salman, 15w); Afif (23.957, 42.976, 1059m, 17.i.2015, S. Salman, 1w); Irgah (24.6710, 46.593, 625m, 19.i.2015, S. Salman, 2w); Thadiq (25.294, 45.871, 735m, 26.iv.2014, S. Salman, 1w); Quwayia (24.047, 45.244, 854m, S. Salman, 7w); Shaqra (25.326, 45.233, 710m, 30.v.2014, S. Salman, 9w); Shagra (25.230, 45.319, 703m, 24.i.2015, S. Salman, 1w); Shaqra (25.270, 45.291, 712m, 23.i.2015, 2w); Durma (24.607, 46.130, 646m, 30.i.2015, S. Salman, 1w); Majma'a (25.880, 45.365, 730m, 07.ii.2015, S. Salman, 5w); Kharrarah (24.392, 46.244, 726m, 08.iv.2015, S. Salman, 15w); Al Ghat (26.066, 44.919, 653m, 31.x.2015, S. Salman, 1w); Hawtet Sudeir (25.592, 45.612, 732m, 31.i.2015, S. Salman, 1w); KSU campus (24.737, 46.618, 662m, 29.ii.2012, K. Mahmoud, 1w); Dirab (24.419, 46.654, 804m, 18.ix.2014, S. Salman, 9w); Hareeq (23.614, 46.054, 689m, 22.ii.2015, S. Salman, 1w); Quwayia (24.058, 45.245, 846m, 29.xi.2014, S. Salman, 1w); Salboukh (25.078, 46.347, 716m, 26.xii.2014, S. Salman, 8w); **Jazan Province:** Sajid Island, Al-Sajid (16.860, 41.932, 05.iii.2017, U. Abuelgheit, 1w).

Remarks. *Monomorium wahibiense* is represented by a single worker deposited in WMLC and accompanied by a red card and handwritten label by C. Collingwood indicating that this specimen represents the syntype. The label's data are consistent with the data for the type in the original description in terms of collecting locality (Oman, Wahiba sand) and collector (M. D. Gallagher), but not the collection date, which we consider a typographical error.

Comparing the mentioned type material with the image of the type material of *M. abeillei* André, we found the two species share the same morphological characters, which can be summarized as follow: scapes relatively short, when laid back from their insertions just reaching posterior head margin; eyes of moderate size with about 10 ommatidia in longest row); cephalic surface between frontal lobes faintly striated; promesonotum and mesonotum forming continuous flat line in profile; mesosoma with single pair of standing hairs on pronotal humeral angles; metanotal groove feebly impressed; petiole with single pair of backward directed hairs; postpetiole with two pairs. Consequently, we propose treating *M. wahibiense* as a junior synonym of *M. abeillei* André.

Geographic Distribution. *Monomorium abeillei* is originally described from Israel and recorded from several countries in the Middle East, including the Arabian Peninsula (KSA, Kuwait, Oman and Yemen) (Collingwood 1985, Collingwood & Agosti 1996), Iran (Paknia et al. 2008), Israel (Vonshak & Ionescu-Hirsch 2009) and North Africa (Borowiec 2014).

Monomorium areniphilum **Santschi, 1911**

(Fig. 11 A–C)

Monomorium Salomonis var. *areniphila* Santschi, 1911: 84 (w.) Tunisia. Palearctic. [NHMB], CASENT0249829, [Syntype worker, examined].

Emery, 1915: 378 (q.); combination in *Monomorium* (*Xeromyrmex*): Emery, 1922: 177; subspecies of *Monomorium salomonis*: Santschi, 1936a: 50; raised to species: Collingwood, 1985: 269; senior synonym of *Monomorium lepineyi*, *Monomorium pullula*: Bolton, 1987: 336.

Senior synonym of *Monomorium fezzanense* Collingwood & Agosti, 1996: 346 (w.) Saudi Arabia. Afrotropic. [NHMB], Syntype worker, Saudi Arabia, 31 km NW Tabuk (24.iv.1979, CASENT0913557) [examined] **syn. n.**

Senior synonym of *Monomorium hemame* Collingwood & Agosti, 1996: 348 (w.) Kuwait. Palearctic. [WMLC], holotype worker, Kuwait, Umm Al-Hemam (9.III.1988, W. Biittiker, CASENT0922316) [examined]; paratype worker, Saudi Arabia, Uyaynah (01.IV 1976, W. Biittiker, CASENT0913800) [examined] **syn. n.**

Senior synonym of *Monomorium marmule* Collingwood & Agosti, 1996: 349, fig. 21 (w.)
OMAN. Palearctic. Paratype worker, Oman, Minririb (14.i.1986, M.D. Gallagher, CASENT0913824, NHMB) [examined] **syn. n.**

Remarks. A thorough examination of the type material of *M. fezzanense*, *M. hemame*, *M. marmule*, and *M. areniphilum* yielded no evidence for heterospecificity; they are indistinguishable. All four taxa share the following characters: median portion of anterior clypeal margin shallowly concave; eyes large with 12-15 ommatidia in longest row; promesonotum and anterior portion of mesonotum in profile feebly convex; posterior portion of mesonotum sloping steeply to broadly and deeply impressed metanotal groove; mesosoma without hairs; petiole with single pair of backward directed hairs; postpetiole with two pairs of hairs.

Herein *M. fezzanense*, *M. hemame*, and *M. marmule* are treated as junior synonyms of *M. areniphilum*. It is worth mentioning that in the original description of *M. marmule*, Collingwood & Agosti (1996) gave a brief differential diagnosis with *M. areniphilum* based on variable characters such as the presence of mesosomal pubescence, the petiole and postpetiole color and pilosity.

Geographic Distribution. A species originally described from Tunisia and recorded from most countries of the Arabian Peninsula including KSA, Kuwait, Oman, and Yemen (Collingwood, 1985; Collingwood & Agosti, 1996), and the UAE (Collingwood et al., 2011). It is also reported from North Africa and the Afrotropical Region (Bolton, 1987).

Monomorium barbatulum Mayr, 1877
(Fig. 12 A–C)

Monomorium barbatulum Mayr, 1877: 17 (w.) Kazakhstan. Palearctic.

Material examined. KSA: Riyadh Province: Zulfi (26.367, 44.986, 670m, 18.i.2014, Al Dhafer et al., 1w: CASENT0922263, KSMA).

Geographic Distribution. This species was originally described from Kazakhstan and recorded from Oman (Collingwood, 1985; Collingwood & Agosti, 1996), the UAE (Collingwood et al., 2011), and Israel (Vonshak & Ionescu-Hirsch, 2009). The present material represents a new record to the KSA.

Monomorium bicolor Emery, 1877

(Fig. 13 A–C)

Monomorium bicolor Emery, 1877: 368 (w.) Eritrea. Afrotropic.

Senior synonym of *Monomorium phoenicum* Santschi, 1927e: 242 (w.q.) Lebanon. Palearctic. Syntype worker, Lebanon, Beyroth (05.viii.1933, Santschi, CASENT0249831, NHMB) [examined] **syn. n.**

Material examined. KSA: Asir Province: Almajardah, Wadi Eltalalei (19.003, 41.732, 223m, 10.xi.2012, M.R. Sharaf, 1w); Wadi Shahadan (17.472, 42.856, 452m, 13.xi.2012, M.R. Sharaf, 13w, (1w, CASENT0906396); Allaith, Adam, Wadi Elarj (20.453, 40.816, 450m, 09.xi.2012, M.R. Sharaf, 45w, 1w: CASENT0906395, 1q: CASENT0906394); Wadi Aljora, near Abadan (17.293, 43.070, 465m, 12.xi.2012, M.R. Sharaf, 2w); Almajardah, Wadi Bagara (18.793, 42.019, 436m, 10.xi.2012, M.R. Sharaf, 2w); **Jazan Province:** Abu Arish (17.013, 42.802, 90m, 10.iv.2012, M.R. Sharaf, 11w); Sabia (17.107, 42.650, 43m, 09.iv.2012, M.R. Sharaf, 23w); Jazan (16.97627, 42.61743, 38m, 12.iv.2012, M.R. Sharaf, 12w); **Al Bahah Province:** Dhi Ayn Archeological village (19.930, 41.443, 741m, 18.v.2011, M.R. Sharaf, 3w); Wadi Gonouna (19.429, 41.605, 353m, 12.v.2011, M.R. Sharaf, 10w: KSMA).

Remarks. The type material of *M. bicolor* and *M. phoenicum* are clearly conspecific. They share the same diagnostic characters as follow: scapes relatively long, when laid back from their insertions surpassing posterior head margin by about length of pedicel; head in full-face view with eyes just breaking sides; cephalic surface dull, finely and densely punctate; median anterior clypeal margin distinctly concave; area between frontal carinae finely longitudinally striated; mesosoma without standing hairs; metanotal groove acutely impressed; propodeal dorsum in profile meeting declivity in continuous curve; petiole and postpetiole each with single pair of back directed hairs; first gastral tergite with hairs scattered over tergite surface; biocolored species, with head, mesosoma, petiole and postpetiole yellow-red or yellow-brown, gaster dark brown to black. Herein, we propose *M. phoenicum* as a junior synonym of *M. bicolor*.

Geographic Distribution. *Monomorium bicolor* was originally described from Eritrea and is a widespread species commonly encountered in open, sandy areas through the Afrotropical Region (Bolton ,1987). In the Arabian Peninsula, it is known from the KSA and the UAE (Collingwood, 1985; Collingwood & Agosti, 1996; Collingwood et al., 2011).

Monomorium brunneolucidulum **Collingwood & Agosti, 1996**

Monomorium brunneolucidulum Collingwood & Agosti, 1996: 343. Oman. Palearctic.

Remarks. In their brief original description of the enigmatic species *M. brunneolucidulum* from Oman, Collingwood & Agosti (1996) neither gave successful diagnostic characters nor illustrations for species recognition. In addition, the type-material is apparently lost. Due to a lack of type material and species diagnostic characters, it is impossible to confirm the identity of the species and it remains as a nomen dubium.

Monomorium floricola (Jerdon, 1851)

(Fig. 14 A–C)

Atta floricola Jerdon, 1851: 107 (w.) India. Indomalaya.

Forel, 1893: 388 (q.m.); Wheeler, 1905: 88 (q.m.); Donisthorpe, 1914: 136 (gynandromorph); Crawley, 1920: 217 (gynandromorph); Wheeler & Wheeler, 1955c: 121 (l.). Combination in *Monomorium*: Mayr, 1879: 671.

Senior synonym of *Monomorium poecilum*: Emery, 1894d: 151.

Senior synonym of *Monomorium specularis*: Mayr, 1879: 671.

Senior synonym of *Monomorium cinnabari*: Wheeler, 1913: 486.

Senior synonym of *Monomorium floreanum*: Brown, in Linsley & Usinger, 1966: 175.

Senior synonym of *Monomorium angusticlava*: Bolton, 1987: 390.

Senior synonym of *Monomorium impressum*: Bolton, 1987: 390.

Senior synonym of *Monomorium floricola furina*: Heterick, 2006: 122.

Senior synonym of *Monomorium floricola philippinensis*: Heterick, 2006: 122.

Material examined. Oman: Dhofar Province: Ayn Dirbat (17.106, 54.453, 207m, 17.xi.2017, M.R. Sharaf, 4w: KSMA, 1w: CASENT0922876, CASC).

Geographic Distribution. This species was originally described from India. It is a successful tramp species of putative Southeast Asian origin that is widely distributed throughout tropical and subtropical regions worldwide (Deyrup et al., 2000; Wetterer, 2010a). The present material represents a new record for Oman and the Arabian Peninsula.

Monomorium harithe Collingwood & Agosti, 1996

(Fig. 15 A–C)

Monomorium harithe Collingwood & Agosti, 1996: 347 (w.) Saudi Arabia. Afrotropic. Holotype worker: Saudi Arabia, desert near Najran (17.533, 44.000, 10.iv.1983, C.A. Collingwood, CASENT0922335, WMLC) [examined] **Syn. n.**

Monomorium najrane Collingwood & Agosti, 1996: 352 (w.) Saudi Arabia. Afrotropic.

Previous records. KSA: Riyadh (24.714, 46.675, 21.i.1980, A.H. Talhouk, 2w); **Yemen:** Taiz (13.578, 44.018, 20.iii.1993, C.A. Collingwood, 2w).

Remarks. *Monomorium harithe* was described from the KSA and Yemen, while *M. najrane* was described from Najran (KSA) near the Saudi-Yemeni borders (Collingwood & Agosti 1996). The comparison of the type material of the two species reveals a straightforward synonymy. The two species share the following characters: anterior median clypeal margin distinctly concave; scapes distinctly short, when laid back from their insertions failing to reach posterior head margin; mesosoma without standing hairs; metanotal groove feebly impressed but distinct; propodeal dorsum with distinct furrow); mesosoma, petiole and postpetiole finely and densely punctate; petiole and postpetiole each with single pair of back directed hairs; gaster smooth and shining. In addition, the two species share common body measurements (e.g. HW 0.51; SL 0.53).

Geographic Distribution. This Arabian endemic species is only known from the KSA and Yemen (Collingwood & Agosti, 1996).

Monomorium heggyi Sharaf, sp. n.

(Fig. 16 A–C)

Holotype pinned worker. KSA: Al Bahah Province: Shada Al A'la Mountain (19.877, 41.311, 897m, Al Dhafer et al., MRS0261, CASENT0746641, KSMA).

Paratype pinned workers. KSA: Al Baha Province: Shada Al A'la Mountain (19.877, 41.311, 897m, 04.vi.2014, M. R Sharaf, 4w, 1w: CASENT0746641); Shada Al A'la Mountain (19.863, 41.301, 1225m, 08.xii.2014, Al Dhafer et al., 6w, 1w: CASENT0922301); Shada Al A'la Mountain (19.843, 41.312, 1666m, 23.viii.2014, Al Dhafer et al., 1w: CASENT0906391); Shada Al A'la Mountain (19.877, 41.311, 897m, 04.vi.2014, M.R. Sharaf, MRS0261, 2w); Shada Al A'la Mountain (19.877, 41.311, 897m, 23.viii.2014, M.R. Sharaf, MRS0261, 1w: CASENT0746641); Shada Al A'la Mountain (19.863, 41.301, 1225m, 08.xii.2014, Al Dhafer et al., 1w); Shada Al A'la Mountain (19.851, 41.301, 1325m, 15.ii.2014, Al Dhafer et al., 1w); Shada Al A'la Mountain (19.839, 41.310, 15.xi.2015, Al Dhafer et al., 3w: KSMA).

Other Material. Jazan Province: Zabia (17.107, 42.650, 43m, 09.iv.2012, M. R Sharaf, MRS0070, 2w); Abu Arish (17.013, 42.802, 90m, 10.iv.2012, M. R Sharaf, MRS0073, 10w); Jazan (16.97627, 42.61743, 38m, 12.iv.2012, M. R Sharaf, MRS0077, 25w: KSMA, 1w: CASC, 1w: BMNH, 1w: WMLC, 1w: OUMC, 1w: LACM).

Measurements. Holotype: TL 2.01; HL 0.49; HW 0.39; SL 0.42; EL 0.12; EM 0.07; ML 0.59; PW 0.25; PTL 0.11; PTW 0.11; PPL 0.09; PPW 0.09; CI 80; EI 31; SI 108.

Paratype workers: TL 1.50–2.55; HL 0.42–0.49; HW 0.32–0.39; SL 0.28–0.42; EL 0.07–0.12; EM 0.07–0.09; ML 0.45–0.59; PW 0.21–0.31; PTL 0.09–0.14; PTW 0.07–0.11; PPL 0.07–0.09; PPW 0.07–0.09; CI 69–86; EI 21–31; SI 80–108 (n=13).

Diagnosis. *Monomorium heggyi* is diagnosed by the following character combination: scapes when laid back from their insertions just reaching posterior margin of head; head in full-face view with eyes located nearly at midlength; promesonotal outline feebly convex or flat, sloping posteriorly to narrow and shallowly impressed metanotal groove.

Worker. Head. Head in full-face view distinctly longer than broad, with concave posterior margin and shallowly convex sides and feebly concave posterior margin; median portion of clypeus with anterior free margin slightly indented; eyes of moderate size, in profile with convex dorsal sides and straight ventral side, maximum diameter 0.21 x– 0.30 x HW, with 7 ommatidia in longest row); head in full-face view eyes located nearly at midlength of head and just breaking sides; scapes when laid back from their insertions just reaching posterior head margin. **Mesosoma.** Promesonotal outline feebly convex or flat, slopping posteriorly to narrow and shallowly impressed metanotal groove; propodeal dorsum in profile convex making a continuous curve with propodeal declivity and with defined lateral margins. **Petiole.** Petiole with high rounded node in profile; subpetiolar process broad and blunt. **Postpetiole.** Postpetiolar node lower than petiolar node in profile and nearly as broad as petiole in dorsal view. **Sculpture.** Mandibles feebly longitudinally sculptured; cephalic surface with faint vestiges of superficial reticular patterning, almost entirely effaced, area between frontal carinae finely longitudinally striate; clypeus smooth; entire mesosoma, petiole and postpetiole sharply and densely reticulate-punctate; gastral tergites smooth and shining. **Pilosity.** Dorsum of head without standing hairs behind the level of the frontal lobes; several pairs of long hairs on the anterior clypeal margin and on mandibles; antennae with dense appressed pubescence; mesosoma, petiole and postpetiole without standing hairs of any description; first gastral tergite without standing hairs

except for sparse appressed pubescence; pilosity of remaining gastral tergites restricted to the posterior margins. **Color.** Uniformly yellow.

Remarks. *Monomorium heggyi* belongs to the *M. salomonis* species-group (Bolton 1987). It is most similar to *M. rabirium* Bolton, 1987 from Botswana from which it is readily distinguished by the longer scapes (SI 80–108) that reach the posterior head margin in full-face view, the posteriorly shifted eyes located nearly at the midlength of head in full-face view. *Monomorium rabirium* has shorter scapes (SI 92–97) that fail reaching the posterior head margin in full-face view, and eyes conspicuously located in front of midlength of head in full-face view. Among the Arabian species of the *M. salomonis* species-group, *M. heggyi* is superficially similar to *M. elghazalyi* from the Socotra Archipelago from which is can be easily separated by the larger eyes (EI 21–31), the shallowly impressed metanotal groove, and the densely sculptured mesosoma, petiole and postpetiole. *Monomorium elghazalyi* has smaller eyes (EI 19–20), broadly and deeply impressed metanotal groove, and a smooth body surface.

Etymology. The patronymic name honors Essam Heggy, the Egyptian space scientist at NASA.

Habitat. The type locality, Shada Al A'la, is a Nature Reserve **(Fig. 17)** located in the Al Bahah Province in the southwestern KSA at an elevational range of 470–2,222 m. The locality is characterized by relatively high rainfall, diverse habitats, and high biodiversity, as well as by the presence of large areas of terraced fields used for cultivating banana, coffee, figs, and lemon. The region has a diverse range of wild vegetation cover including plants of the Leguminosae (Fabaceae), composites (Asteraceae), and graminoides (Poaceae). Acacia (Fabaceae) and Juniper (Cupressaceae) are the most dominant plants (SWA, 2018, El-Hawagry et al., 2016). Shada Al-A'Ala harbors a high number of endemic animals including birds, mammals (SWA, 2018) and insects (El-Hawagry et al., 2016).

Geographic Distribution. KSA.

Monomorium khalidi Sharaf, sp. n.

(Fig. 18 A–C)

Holotype pinned worker. KSA: Al Bahah Province: Shada Al A'la (19.839, 41.310, 1563m, 18.x.2014, Al Dhafer et al., CASENT0922288, KSMA).

Three paratype, pinned workers, **KSA: Jazan Province:** Wadi Shahdan (17.452, 42.715, 200m, 13.xi.2012, M.R. Sharaf, MRS0131, CASENT0919810, KSMA); Fayfa, Wadi Al Jora (17.279, 43.062, 419m, 06.iv.2013, M.R. Sharaf, KSMA).

Measurements. Holotype: TL 3.16; HL 0.75; HW 0.67; SL 0.62; EL 0.14; EM 0.25; ML 0.95; PW 0.44; PTL 0.27; PTW 0.21; PPL 0.17; PPW 0.21; CI 89; EI 21; SI 93.

Paratype workers: TL 2.31–2.98; HL 0.59–0.72; HW 0.49–0.59; SL 0.45–0.59; EL 0.14–0.15; EM 0.11–0.18; ML 0.71–0.85; PW 0.32–0.41; PTL 0.28–0.32; PTW 0.11–0.15; PPL 0.11–0.17; PPW 0.08–0.15; CI 81–83; EI 24–29; SI 92–102 (n=3).

Diagnosis. *Monomorium khalidi* can be distinguished by the combination of the following characters: short scape failing to reach posterior head margin in full-face view; abundant mesosomal pilosity; straight outline of promesonotum; densely reticulate-punctate surfaces of head, mesosoma, petiole, and postpetiole; promesonotum dorsally with at least five to six pair of hairs, promesonotum and propodeum each with three pairs.

Worker. Head. Head nearly as long as broad, or little longer than broad with concave posterior margin and feebly convex sides; median portion of clypeus with anterior free margin distinctly concave; eyes of moderate size, in profile view with convex dorsal sides and straight ventral side, maximum diameter 0.20 x HW, with 9-10 ommatidia in longest row); head in full-face view with eyes failing to break head sides; scapes when laid back from their insertions failing to reach posterior margin. **Mesosoma.** Promesonotal outline flat, slopping posteriorly to narrow and feebly impressed metanotal groove; propodeal dorsum flat and short, longitudinally concave, with sharply defined lateral margins. **Petiole.** Petiole with high rounded node in profile. **Postpetiole.** Postpetiole as broad as petiole in dorsal view. **Sculpture.** Cephalic surface between and immediately behind frontal lobes finely longitudinally striate; cephalic surface and sides, entire mesosoma, petiole and postpetiole sharply and densely reticulate-punctate; first gastral tergite shagreened and relatively shining. **Pilosity.** Cephalic surface with several pairs of standing hairs behind level of frontal lobes; posterior margin of head with three pairs of standing hairs; underside of head with about five pairs of short hairs; promesonotum dorsally with at least five to six pair of hairs, promesonotum and propodeum each with three pairs; petiole and postpetiole each with two-three pairs of backward directed hairs; first gastral tergite with numerous standing hairs which are evenly distributed over the sclerite in front of the apical

transverse row. **Color.** Bicolored species, head, mesosoma, petiole, postpetiole and appendage light red brown, gaster black.

Remarks. This new species is a member of the *M. salomonis* species-group (Bolton, 1987). *Monomorium khalidi* is closest to *M. junodi* Forel, 1910 from South Africa in terms of the relatively small eyes, the short scapes that fail to reach posterior margin of head, the acute metanotal groove, and densely punctate body surface. The two species have short scapes that fail to reach posterior margin of head in full-face view, metanotal groove feebly impressed; body surface densely punctate; and propodeal longitudinally concave, with sharply defined lateral margins. However, *M. khalidi* can be easily distinguished from *M. junodi* by the following characters: body bicolored with head, mesosoma, petiole, postpetiole and appendages light red-brown contrasting with the black gaster; head in full-face view with eyes failing to break sides; promesonotum dorsally with at least five to six pair of hairs, promesonotum and propodeum each with three pairs; promesonotal outline flat. *Monomorium junodi* is uniformly brown to dark brown, head in full-face view with eyes breaking sides; promesonotum dorsally with two pair of hairs, propodeum without hairs; promesonotal outline feebly but distinctly convex. Among the Arabian *Monomorium* species, *M. khalidi* is superficially similar to *M. nitidiventre* in terms of body size, surface sculpture, eye shape but the former can be readily recognized by the reduced stiff pilosity.

Etymology. The patronymic name honors Khalid Amr (born at 04/11/2012) the son of the second author.

Habitat. The type locality of *M. khalidi* is Shada Al A'la **(Fig. 19),** the same locality where *M. heggyi* was collected.

Geographic Distribution. KSA.

Monomorium niloticum **Emery, 1881**

(Fig. 20 A–C)

Monomorium niloticum Emery, 1881: 533 (w.) Egypt. Palearctic. [MSNG], [Syntype worker, CASENT0905755, image examined].

Combination in *Monomorium* (*Xeromyrmex*): Emery, 1922: 179; subspecies of *Monomorium venustum*: Forel, 1910: 6; Wheeler & Mann, 1916: 170; Stitz, 1917: 346; Finzi, 1936:

175; revived status as species: Santschi, 1936: 37; see also: Collingwood & Agosti, 1996: 352; current subspecies: nominal plus *M. n. gracilicorne*, *M. n. niloticoides*.

Senior synonym of *Monomorium matame* Collingwood & Agosti, 1996: 350, fig. 22 (w.) OMAN. Palearctic, Holotype worker, Oman, Wadi Matam (0l.II.1986, M.D. Gallagher, CASENT0922325, WMLC) [examined] **Syn. n.**

Material examined. KSA: Asir Province: Jebel Al Habala (18.038, 42.873, W. Buttiker, 1w); Alkhola (13.600, 44.283, 4w, WMLC). **Al Baha Province:** Al Atawla, Al Baha-Taif RD, Wadi Bawa (20.750, 41.247, 1310m, 08.xi.2012, M.R. Sharaf, MRS0099, 7w, 1w: CASENT0906397); Wadi Elzaraeb (20.073, 41.387, 2086m, 09.v.2011, M.R. Sharaf, 3w); Al Mandaq, Wadi Turabah (20.242, 41.263, 1715m, 19.ix.2011, M.R. Sharaf, 6w); Hawtat Bani Tamimc (23.525, 46.845, 19.iv.2008, M.R. Sharaf, 6w); Riyadh city (06.viii.2008, 1w); Wadi Hanifa (24.671, 46.595, 641m, 11.iv.2013, M.R. Sharaf, 11w); Al Mandaq, Wadi Turabah (20.211, 41.288, 1793m, 10.v.2011, M.R. Sharaf, 4w). **Riyadh Province:** Al Hayer (24.280, 46.766, 647m, 10.iii.2011, A.S. Aldawood, 24w); Al Hayer (24.557, 46.744, 589m, 11.iv.2014, S. Salman, 5w); Dawademi (24.557, 44.377, 983m, 18.iv.2014, S. Salman, 6w); Dawademi (24.478, 44.364, 1027m, 18.iv.2014, S. Salman, 4w); Dawademi (24.583, 44.323, 966m, 16.i.2015, S. Salman, 9w); Dawademi (24.538, 44.355, 999m, 16.i.2015, S. Salman, 1w); Afif (23.900, 42.881, 1052m, 17.i.2015, 1w); Afif (23.957, 42.976, 1059m, 17.i.2015, S. Salman, 6w); Dhurma (24.607, 46.130, 646m, 30.i.2015, S. Salman, 8w); Hawtat Bani Tamim (23.454, 46.819, 582m, 19.ii.2015, M.R. Sharaf, 3w); Hawtat Bani Tamim (23.500, 46.850, 612m, 19.ii.2015, M.R. Sharaf, 2w); Hareeq (23.614, 46.054, 689m, 22.ii.2015, S. Salman, 29w); Quwayia (24.070, 45.280, 823m, 03.v.2014, S. Salman, 3w); Majma'a (26.005, 45.019, 730m, 13.ix.2014, S. Salman, 6w, KSMA); Riyadh (23.953, 43.636, x.1979, W. Buttiker, 2w); Wadi Eflah, x.1983, W. Buttiker, 2w); wadi Mawran (22.050833, 46.671944, 10.ii.1985, W. Buttiker, 6w); Riyadh (24.7136, 46.6753, 07.vii.1975, W. Buttiker, 1w); Shoiba (Shuaibah) (20.6295, 39.5624, 06.xii.1983, W. Buttiker, 2w); Wadi Nimar (24.5705, 46.68, v.1983, W. Buttiker, 2w); Harithi (21.28, 40.28, 11.v.1984, W. Buttiker, 1w); Wadi Ellah (09.ix.1986, W. Buttiker, 3w, WMLC); Malham (25.154, 46.282, 711m, 15.ix.2014, S. Salman, 4w); Malham (25.161, 46.229, 742m, 15.ix.2014, S. Salman, 1w); Quwayia (24.058, 45.245, 846m, 29.x.2014, S. Salman, 4w); Quwayia (24.05043, 45.25795, 839m, 29.x.2014, S. Salman, 12w); Quwayia (24.053, 45.262, 836m, 29.xi.2014, S. Salman, 2w); Na'jan (24.026, 47.138, 467m, 13.xii.2014, S. Salman, 9w);

Wadi Al Dawaser (22.778, 44.786, 686m, 20.ii.2015, S. Salman, 3w); Wadi Al Dawaser (20.778, 44.786, 686m, 20.ii.2015, S. Salman, 3w); Qassim, Buraydah (26.216, 44.0414, 633m, 17.ix.2011, Steyaningrum, 9w); Qassim, Buraydah (26.330, 43.979, 623m, 19.x.2013, M.R. Sharaf, 9w); Huraymila (25.1487, 45.950, 815m, 07.ii.2011, M.R. Sharaf, 9w); Dirab Research Station (24.419, 46.654, 570m, 28.ix.2011, B.L. Fisher, 1w, CASENT0260164; Dirab Research Station (24.737, 46.618, 662m, 29.ii.2012, K. Mahmoud, 27w); Naam Dam (23.628, 46.631, 646m, 22.ii.2015, S. Salman, 30w); Dirab (24.409, 46.662, 588m, 30.xii.2009, M.R. Sharaf, 6w); Salboukh (25.079, 46.347, 689m, 05.xi.2009, M.R. Sharaf, 15w); Salboukh (25.074, 46.377, 728m, 26.xi.2014, S. Salman, 12w); Ghiyanah (25.074, 46.226, 728m, 26.xii.2014, S. Salman, 3w); Al Hayer (24.280, 46.766, 10.iii.2011, A.S. Aldawood, 10w); Qassim, Buraydah (26.338, 44.024, 643m, 19.x.2013, S. Salman, 2w); Wadi Al Dawaser (20.487, 44.764, 690m, 22.i.2014, S. Salman, 1w, All previous material in KSMA); Wadi Khumra (17.viii.1979, W. Buttiker, CASENT0249836, 1w, NHMB). **Mekkah Province:** Ras Hatibah (21.978, 38.937, 11.i.1983, 2w, WMLC). **OMAN:** Nakhl (23.44696, 57.88062, 364m, 02.iv.2016, M.R. Sharaf, 8w, CASENT0922306); Dhofar, Dhalkout (16.727, 53.249, 623m, 18.xi.2017, M.R. Sharaf, 6w, CASENT0922859, KSMA); no locality (2005, 1w); no locality (xi.1984, 1w); Jebel Akhdar (23.073, 54.662, 1w); Wattayah (23.591, 58.363, 1983, 3w, WMLC). **UNITED ARAB EMIRATES:** Wadi Maidaq (25.300, 56.117, 22.xi-02.xii.2010, M. Hauser et al., UAE12977, 1w, CASENT0264568, KSMA); Hatta (24.806, 56.125, iii.1998, A.V. Harten, 2w); Hatta (24.806, 56.125, iii.1995, A.V. Harten, 2w, WMLC). **YEMEN: Ta'iz** (13.578, 44.018, A.V. Harten, 1w); Al Kawd (13.089, 45.365, 1991, A.V. Harten, 2w, WMLC).

Remarks. *Monomorium matame* was described from Oman and KSA based on the worker caste. In the original description Collingwood & Agosti (1996) pointed out the similarity between *M. matame* and *M. niloticum* and used variable characters that were not useful in species recognition. Our examination of the type material of both shows that *M. matame* is not separable from *M. niloticum*. The two species share the following characters: scapes when laid back from their insertions failing to reach posterior head margin; eyes relatively large about 0.30–0.33 x HW); metanotal groove deeply impressed; mesosoma with several pairs of scattered standing hairs; promesonotum with three pairs, mesonotum with two to three, propodeum with a single pair of hairs; bicolored species with head, mesosoma, petiole, postpetiole red-brown contrasting with dark brown to black gaster. Based on the examination of the type images of both species,

we propose to synonymize *M. matame* as a junior synonym of *M. niloticum*, on the basis of morphological similarity.

Geographic Distribution. *Monomorium niloticum* is originally described from Egypt and widely spread in the Arabian Peninsula (Collingwood, 1985; Collingwood & Agosti, 1996; Collingwood et al., 2011, Sharaf et al., 2018b). It is also collected from Israel (Vonshak & Ionescu-Hirsch, 2009), and North Africa (Sharaf, 2006; Borowiec, 2014). *Monomorium niloticum* is one of the most broadly spread myrmicine species throughout several countries of the Arabian Peninsula including the KSA, Oman, UAE, and Yemen (Collingwood, 1985; Collingwood & Agosti, 1996).

Ecological and Biological notes. The broad geographic distribution of the species can be interpreted in the light of the species diverse habitat preferences, including the deserts, mountainous, and cultivated sites. Several worker series were found nesting in either dry or humid soil beneath rocks in an undisturbed site in the KSA where a broad diverse of plant species exists including *Acacia* (Fabaceae), *Citrus limon* (L.) Osbeck (Rutaceae), *Prunus dulcis* (Mill.) D. A. Webb (Rosaceae), *Juniperus* L. (Cupressaceae), *Mangifera indica* L. (Anacardiaceae), *Ficus* sp. (Moraceae), *Hibiscus* L. (Malvaceae) and *Azadirachta indica* A. Juss. (Meliaceae).

***Monomorium nitidiventre* Emery, 1893**

(Fig. 21 A–C)

Monomorium bicolor subsp. *nitidiventris* Emery, 1893: 256 (w.) Egypt. Palearctic. [MSNG], [Syntype worker, CASENT0904602, image examined].

Mayr, 1901: 7 (q.); Karavaiev, 1911: 5 (m.); combination in *Monomorium* (*Xeromyrmex*): Wheeler, 1922: 869; subspecies of *Monomorium bicolor*: Santschi, 1938: 39; of *Monomorium subopacum*: Santschi, 1927: 245; Menozzi, 1932: 94; Bernard, 1953: 159; Hamann & Klemm, 1967: 413; raised to species: Collingwood, 1985: 272; see also: Wheeler & Mann, 1916: 171; Collingwood & Agosti, 1996: 352.

Monomorium yemene Collingwood & Agosti, 1996: 357, fig. 32 (w.) Yemen. Afrotropic. Holotype worker, Yemen, Taiz (20.x.1991, A. van Harten, NHMB) [Presumed lost]; Paratype worker, Yemen, Zingibar- Shuqrah (13.356, 45.700, 21.iii.1993, C.A. Collingwood, CASENT0913865, NHMB) [examined] **syn. n.**

Material examined. YEMEN, W. Adem Port, Wadi Tiban, N. W. of Jebel Jihaf (13.198, 44.787, ~3800 ft, 22.x.1937, C.A. Collingwood, from flower of *Adenium* sp., B. M. Exp. To S. W. Arabia, H. Scott & E. B. Britton, B. M. 1938-246, BMNH (E) 1017382, 1w, CASENT0914158, BMNH).

Remarks. The synonymy of *M. yemene* with *M. nitidiventre* is straightforward since both are morphologically similar and indistinguishable. Both share the following key characters: posterior margin emarginated in full-face view); median portion of anterior clypeal margin distinctly concave; metanotal groove deeply impressed; head, mesosoma, petiole, and postpetiole densely reticulate-punctate and covered with abundant pale standing hairs.

Note: However, the locality label of the paratype specimen (CASENT0913865) (Madinat Al shiraq) is not matching the locality data mentioned in the original description but the collecting data and collector are congruous with the description, therefore, this specimen is treated as one of the type material of *M. yemene*.

Geographic Distribution. *Monomorium nitidiventre* is originally described from Egypt and recorded from the KSA, Kuwait and Yemen (Collingwood, 1985; Collingwood & Agosti, 1996).

Monomorium subdenticorne Collingwood & Agosti, 1996

(Fig. 22 A–C)

*Monomorium subdenticorn*e Collingwood & Agosti, 1996: 354, fig. 27 (w.) Yemen. Afrotropic.

Material examined. KSA: Asir Province: Ahad Refedah (18.134, 43.001, 2179m, 23.ii.2015, M. Alharbi, 2w); (KSMA); **Yemen**: Ghaiman, about 9 miles S. E. of San'a (13.933, 44.833, ~8400 ft, 18.ii.1938, B. M. Exp. To S. W. Arabia, H. Scott & E. B. Britton, B. M. 1938-246, BMNH1017456, 1w, CASENT0914318, BMNH).

Geographic Distribution. A species originally known from Yemen and herein collected for the first time from the KSA.

Monomorium venustum (Smith, 1858)

(Fig. 23 A–C)

Myrmica venusta Smith, 1858a: 126 (w.) Syria. Palearctic.

Material examined. KSA: Asir Province: Wadi Asidah (20.417, 41.200, 10.ix.1983, 1480m, W. Buttiker, 1w, WMLC). **Riyadh Province:** Zulfi (26.272, 44.771, 635m, 18.i.2014, S.

Salman, 15w); Mezahmyia (24.466, 46.251, 648m, 29.xi.2014, S. Salman, 10w); Dawademi (24.552, 43.932, 873m, 16.i.2015, S. Salman, 1w); Bijadriyah (24.310, 43.731, 439m, S. Salman, 2w); Afif (23.900, 42.081, 1052m, 17.i.2015, S. Salman, 18w); Shaqra (25.270, 45.291, 712m, 23.i.2015, 63w); Sajir (25.165, 44.601, 750m, 23.i.2015, S. Salman, 6w); Shaqra (25.274, 45.300, 707m, 24.i.2015, S. Salman, 2w, KSMA). **Kuwait:** Kuwait (no date, 2w, WMLC). **Oman:** Wahiba sands (21.438, 58.554, 23.iii.1986, W. Buttiker, 1w, WMLC). **United Arab Emirates:** Jebel Hafit (24.050, 55.767, 27.ii-03.iii.2011, M. Hauser et al., UAE13010, 1w, CASENT0264463); Um Al-Quwain (12. iv-07.vi.2009, M. Hauser et al., UAE12920, 1w, CASENT0264584); Ar-Rafah (25.717, 55.867, 15-30. x.2010, M. Hauser et al., UAE12866, CASENT0264475, KSMA); Wadi Asidah (20.417, 41.200, 10.ix.1983, W. Buttiker, 1w); Riyadh (24.714, 46.675, 18.ii.1975, W. Buttiker, 1w); Sharjah (25.346, 55.421, vii.2003, A.V. Harten, 2w, WMLC). **Yemen:** Sana'a (15.369, 44.191, iii.1990, 1w, WMLC).

Geographic Distribution. *Monomorium venustum* is originally described from Syria and recorded from the KSA, Kuwait, Oman (Collingwood, 1985; Collingwood & Agosti, 1996; Sharaf et al., 2018b), Israel (Vonshak & Ionescu-Hirsch, 2009), and North Africa (Borowiec, 2014).

V. Biogeographical analyses

Species distribution.

(Figs. 24–28)

***Monomorium abeillei* André.** This is a successfully distributed species in the central deserts of the KSA and no material is recorded from any other country in the Arabian Peninsula. The species appears to have a habitat preference confined to the desert areas. Only two records from the southwestern mountains of the KSA **(Fig. 24)**.

***Monomorium niloticum* Emery, and *M. venustum* (Smith) (Figs. 25, 26).** These two species are widely spread through most countries of the Arabian Peninsula except Bahrain, Kuwait and Qatar. The former species has a broader distribution especially in the KSA and seems to be well adapted to inhabit both the desert and mountainous ecosystems of the country. We refer the lack of any record from the mentioned three countries to a deficiency in the sampling efforts, therefore it is likely that one of these two species at least, especially *M. niloticum* will be recorded from these countries.

951 ***Monomorium barbatulum* Mayr, *M. floricola* (Jerdon).** These two species are one of the rarest
952 species of the genus with a single record for each from the Riyadh Province (KSA) and the
953 Dhofar Governorate (Oman) respectively **(Fig. 27)**.
954 ***Monomorium bicolor* Emery.** A mountainous species widely spread in the southwestern
955 mountains of the KSA **(Fig. 27)**.
956 ***Monomorium harithe* Collingwood & Agosti.** This species is only known from KSA and
957 Yemen **(Fig. 28)**.
958 ***Monomorium khalidi* sp. n.** This new species has a distribution restricted to the southwestern
959 mountains of the KSA **(Fig. 28)**.
960 ***Monomorium nitidiventre* Emery.** A species only recorded from Yemen. It is likely the species
961 will be collected from the southwestern mountains of the KSA because of the occurrence of the
962 preferred habitats **(Fig. 28)**.
963 ***Monomorium heggyi* sp. n.** This new species is only recorded from the southwestern mountains
964 of the KSA **(Fig. 28)**.
965 ***Monomorium subdenticorne* Collingwood & Agosti (Fig. 29).** A rare species endemic to the
966 Arabian Peninsula and only recorded from Yemen and the KSA.
967
968
969
970 **Table 1. Bioogeography of the Arabian *Monomorium*.**

Species	Type locality	Bioregion	Reference
Monomorium abeillei	ISRAEL	Palearctic	1; 2; 3
Monomorium acutinode	OMAN	Palearctic	3
Monomorium aeyade	OMAN	Endemic	3; Sharaf et al. 2018a
Monomorium areniphilum	TUNISIA	Palearctic	1; 3
Monomorium asiriense	KSA	Endemic	3
Monomorium barbatulum	KAZAKHSTAN	Palearctic	1; 3
Monomorium bicolor	ERITREA	Afrotropic	1; 2; 3
Monomorium brunneolucidulum	OMAN	Endemic	3
Monomorium buettikeri	KUWAIT	Endemic	3
Monomorium buxtoni	IRAQ	Palearctic	1; 3

Monomorium carbo	ETHIOPIA	Afrotropic	1; 3
Monomorium carbonarium	MADEIRA	Palearctic	3
Monomorium clavicorne	ISRAEL	Palearctic	3; Sharaf et al. 2018a
Monomorium dammame	KSA	Endemic	3
Monomorium dirie	OMAN	Endemic	3
Monomorium elghazalyi	YEMEN	Endemic	Sharaf et al., 2017a
Monomorium exiguum	ETHIOPIA	Afrotropic	3; Sharaf et al. 2018a
Monomorium fayfaense	KSA	Endemic	3
Monomorium floricola	INDIA	Tramp	Heterick, 2006
Monomorium gallagheri	OMAN	Endemic	3
Monomorium hanaqe	KSA	Endemic	3
Monomorium harithe	KSA	Endemic	3
Monomorium heggyi	KSA	Endemic	
Monomorium holothir	KENYA	Afrotropic	2
Monomorium jizane	KSA	Endemic	3
Monomorium khalidi	KSA	Endemic	
Monomorium knappi	YEMEN	Endemic	3
Monomorium luteum	YEMEN	Afrotropic	1; 3
Monomorium mahyoubi	YEMEN	Endemic	3
Monomorium moathi	YEMEN	Endemic	Sharaf & Collingwood, 2010
Monomorium mohammedi	KSA	Endemic	3; Sharaf et al. 2018a
Monomorium niloticum	EGYPT	Palearctic	1; 3
Monomorium nimihil	YEMEN	Endemic	Collingwood, 2004
Monomorium nitidiventre	EGYPT	Palearctic	1; 3
Monomorium pharaonis	EGYPT	Tramp	1; 3
Monomorium rimae	YEMEN	Endemic	3
Monomorium riyadhe	KSA	Endemic	3
Monomorium salomonis	EGYPT	Palearctic	1; 3
Monomorium sarawatense	KSA	Endemic	3; Sharaf et al. 2018a
Monomorium subdenticorne	YEMEN	Endemic	3

Monomorium subopacum	PORTUGAL	Palearctic	1; 2; 3
Monomorium suleyile	KSA	Endemic	3
Monomorium tumaire	KSA	Endemic	3
Monomorium venustum	SYRIA	Palearctic	1; 3

971 References: 1 = Collingwood 1985, 2 = Bolton, 1987, 3 = Collingwood & Agosti, 1996

972

973 **DISCUSSION**

974 *Monomorium* is one of the most diverse ant genera in the world, but it is rarely the most
975 speciose genus on a regional scale. However, the Arabian *Monomorium* fauna, based on review
976 of previous literature data and on our current work, includes 44 species, making it the most
977 diverse known ant genus of the Arabian Peninsula (Collingwood, 1985; Collingwood & Agosti,
978 1996; Collingwood et al., 2011; Aldawood & Sharaf, 2011; Sharaf & Aldawood, 2013b; Sharaf
979 et al., 2015, 2017a, 2018 a, b). Currently, the genus represents ~14% of the total number of
980 species reported from the region (312 spp.) (e.g. Collingwood, 1985; Collingwood & Agosti,
981 1996; Collingwood et al., 2011; Aldawood & Sharaf, 2011; Sharaf et al., 2011, 2013c, 2015,
982 2017a, b, Sharaf et al., 2018a, b; Sharaf & Aldawood, 2019; Sharaf et al. 2019; 2020). This value
983 is lower than the 20% mentioned by Collingwood & Agosti (1996). This reduction is the result
984 of numerous taxa in previous studies now treated as junior synonyms of other species (Sharaf et
985 al., 2015, 2017a, 2018a; this study).

986 We found that ~58% of the *Monomorium* species (25/44) appear to be endemic to the
987 Arabian Peninsula. High degrees of endemism have been reported for many of Arabian
988 arthropod groups, including ants in general (Collingwood, 1985; Collingwood & Agosti, 1996;
989 Sharaf et al. 2014a &b; 2017a, 2018b), staphylinid beetles (Assing et al., 2013; Hlaváč et al.
990 2013), carabid beetles (Abdel-Dayem et al. 2018), termites (Cowie 1989), lepidopterans (Larsen
991 1984), and pseudoscorpions (Mahnert et al. 2014).

992 Biogeographically, the biota of the Arabian Peninsula does not constitute a cohesive unit
993 (Larsen, 1984; Sharaf et al., 2020a). Instead, the Arabian Peninsula is often considered to be at
994 the nexus of two terrestrial biogeographic realms, the Palearctic and the Afrotropic. In fact,
995 Olson et al. (2001) places the northern and central Arabian Peninsula in the Palearctic bioregion
996 (along with Europe, northern Africa, Asia north of the Himalayas, and neighboring islands) and
997 the southern and eastern coasts of the Arabian Peninsula in the Afrotropic bioregion (along with

sub-Saharan Africa, southern Iran, southwestern Pakistan, and neighboring islands). Our biogeographic analysis of Arabian *Monomorium* supports this basic division, with 12 Palearctic species more common in the north and central deserts and the five Afrotropic species more common in the southern region and along the coasts.

The majority of the endemic Arabian ant species has faunal similarities with taxa from the Afrotropic bioregion that has been earlier documented by several studies (e.g. Larsen, 1984; Collingwood, 1985; Collingwood & Agosti, 1996; Sharaf & Aldawood, 2011, 2012, 2019; Sharaf et al., 2012a, b, c & 2020 a, b; El-Hawagry et al., 2013, 2017; Hájek & Reiter, 2014). Therefore, it is not surprising that a large proportion of the endemic Arabian *Monomorium* species (13/25) have been found in the mountainous ranges of southwestern KSA that extend to Yemen.

Both new *Monomorium* species reported here, *M. heggyi* and *M. khalidi*, were collected in the Shada Al-A'Ala Nature Reserve (SANR), a protected area consisting of an isolated granite mountain massif in southwestern Saudi Arabia. Its location, elevational range (470–2,222 m) and high rainfall resulting in diverse microclimates and a high biodiversity (SWA 2020). As a unique biodiversity hotspot, the SANR contains ~495 plant species (~22% of the total reported Saudi Arabian flora), including 43% of the threatened plant species and 19 endemic plants (Thomas et al., 2017). The SANR also protects a diverse fauna, including rare and endemic vertebrates, including the griffon vulture (*Gyps fulvus* (Hablitz)), the Arabian leopard (*Panthera pardus nimr* (Hemprich and Ehrenberg)), and the Arabian wolf (*Canis lupus arabs* Pocock) (SWA, 2020). The SANR invertebrate fauna has attracted relatively little attention, but recent insect biodiversity inventories and monitoring research projects conducted by King Saud University Museum of Arthropods resulted in two important faunistic studies that recorded 119 Diptera species (El-Hawagry et al., 2016) and 62 carabid beetle species (Abdel-Dayem et al., 2019). Further studies are planned to be carried out at SANR to explore additional levels of biodiversity.

In addition to the native *Monomorium* species, there are two *Monomorium* known from the Arabian Peninsula that are cosmopolitan tramp species, spread around the world through human commerce: *M. pharaonis* and *M. floricola*. The pharaoh ant, *M. pharoanis*, is a common domestic pest. Although it was first described from Egypt, its original native range is uncertain (Wetterer 2010b). We report the first known Arabian record of *M. floricola*, an Indomalayan species, from a single site in Oman. Although widespread around the world, *M. floricola* is rarely

considered a serious pest. However, because this species is very small, slow moving, cryptically colored, and primarily arboreal, its abundance and ecological importance may be underappreciated (Wetterer, 2010a).

Considering the high degree of endemism encountered, it is likely that the known Arabian *Monomorium* fauna will increase in the future with further exploration of poorly surveyed areas of the Arabian Peninsula, especially the southwestern mountains of the KSA, Yemen, and the mountainous regions of Oman and the UAE. We hope that the present study will serve as a cornerstone of future taxonomic treatments of *Monomorium* in the Arabian Peninsula.

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REFERENCES

Abdel-Dayem MS, Elgharbawy AA, Rasool I., Nagel P, Aldhafer HM. 2019. The Carabidae (Coleoptera) of Shada Al-A'Ala Nature Reserve, Southwestern Saudi Arabia, with description of a new species of Paussinae. *Zookeys* **812**: 93–131. doi: 10.3897/zookeys.812.30937

Aldawood AS, Sharaf MR. 2011. *Monomorium dryhimi* sp. n., a new ant species (Hymenoptera, Formicidae) of the *M. monomorium* group from Saudi Arabia, with a key to the Arabian *Monomorium monomorium*-group. *ZooKeys* **106**: 47–54. doi:10.3897/zookeys.106.1390

Aldawood AS, Sharaf MR, Collingwood CA. 2010. *Monomorium moathi* sp. n., a new ant species from Yemen (Hymenoptera: Formicidae) related to the *salomonis*-group. *Egyptian Academic Journal of Biological Sciences* **3** (2): 37–42.

André E. 1881. Catalogue raisonné des Formicides provenant du voyage en Orient de M. Abeille de Perrin et description des espèces nouvelles. *Annales de la Société Entomologique de France* (**6**)1: 53–78.

Assing V, Schülke M, Sharaf, MR, Aldawood AS. 2013. On the Staphylinidae of Saudi Arabia, with descriptions of two new species (Insecta: Coleoptera). *Linzer Biologische Beitraege* **45**(1):141–154.

Barech G, Khaldi M, Espadaler X, Cagniant H. 2017. Le genre *Monomorium* (Hymenoptera, Formicidae) au Maghreb (Afrique du Nord): Clé d'identification, avec la redescription de la fourmi *Monomorium major* Bernard, 1953 et nouvelles citations pour l'Algérie. *Boletín de la Sociedad Entomológica Aragonesa* **61**: 151–157.

Baroni Urbani C. 1964. Studi sulla mirmecofauna d'Italia. II. Formiche di Sicilia. *Atti della Accademia gioenia di scienze naturali in Catania* (**6**) 16: 25–66.

Baroni Urbani, C. 1968. Studi sulla mirmecofauna d'Italia. V. *Aspetti Ecologici della Riviera del M. Cònero, Bolletino di zoologia* **35**: 39-76.

Bernard F. 1953. Les fourmis du Tassili des Ajjer. Pp. 121-250 in: Bernard, F. (ed.) 1953. Mission scientifique au Tassili des Ajjer (1949). Volume I. Recherches zoologiques et médicales. Paris: P. Lechevalier, 302 pp.

Bernard F. 1968. Faune de l'Europe et du Bassin Méditerranéen. 3. Les fourmis (Hymenoptera Formicidae) d'Europe occidentale et septentrionale. Paris: Masson, 411 pp.

Bolton B. 1987. A review of the *Solenopsis* genus-group and revision of Afrotropical *Monomorium* Mayr (Hymenoptera: Formicidae). *Bulletin of the British Museum (Natural History). Entomology* **54**:263–452.

Bolton B. 1994. *Identification Guide to the Ant Genera of the World*: Cambridge, Mass, 222 pp.

Bolton B. 2020. *An online catalog of the ants of the world*. http://antcat.org. [accessed 13 July 2020].

Bolton B, Fisher BL. 2014. The Madagascan endemic myrmicine ants related to *Eutetramorium* (Hymenoptera: Formicidae): taxonomy of the genera *Eutetramorium* Emery, *Malagidris* nom. n., *Myrmisaraka* gen. n., *Royidris* gen. n., and *Vitsika* gen. n. *Zootaxa* **3791**:1–99.

Borowiec L. 2014. Catalogue of ants of Europe, the Mediterranean Basin and adjacent regions (Hymenoptera: Formicidae). *Genus* (Wroclaw) **25** (1–2): 1–340

Brown WL Jr. 1958. A review of the ants of New Zealand. *Acta Hymenopterologica* **1**:1–50.

1089 Brown Jr WL. 2000. Diversity of ants. In: Agosti D, Majer J, Alonso E, Schultz TR, eds. *Ants. Standard methods for measuring and monitoring biodiversity*. Biological diversity handbook series, Washington, D.C.: Smithsonian Institution Press, 45–79, 280 pp.
1092 Collingwood CA. 1978. A provisional list of Iberian Formicidae with a key to the worker caste (Hym. Aculeata). EOS. *Revista Española de Entomología* **52**:65–95.
1094 Collingwood CA. 1985. Hymenoptera: Fam. Formicidae of Saudi Arabia. *Fauna of Saudi Arabia* **7**:230–301.
1096 Collingwood CA., Agosti D. 1996. Formicidae (Insecta: Hymenoptera) of Saudi Arabia (part 2). *Fauna Saudi Arabia* **15**:300–385.
1098 Collingwood C, Prince A. 1998. A guide to ants of continental Portugal (Hymenoptera: Formicidae). *Boletim da Sociedade Portuguesa de Entomologia* Suplemento **5**:1–49.
1100 Collingwood C.A, Pohl H, Guesten R, Wranik W, Van Harten A. 2004. The ants (Insecta: Hymenoptera: Formicidae) of the Socotra Archipelago. *Fauna of Arabia* **20**:473–495.
1102 Collingwood CA, Agosti D, Sharaf MR, Van Harten A. 2011. Order Hymenoptera, family Formicidae. *Arthropod Fauna of the UAE* **4**:405–474.
1104 Crawley WC. 1920. A gynandromorph of *Monomorium floricola*, Jerd. *Entomologist's Record and Journal of Variation* **32**:217–218.
1106 Deyrup M, Davis L, Cover S. 2000. Exotic ants in Florida. Transactions of the American Entomological Society **126**:293–325.
1108 Dlussky GM, Soyunov OS, Zabelin SI. 1990. *Ants of Turkmenistan*. [In Russian.]. Ashkabad: Ylym Press, 273 pp.
1110 Donisthorpe H. 1914. Myrmecophilous notes for 1913. *Entomologist's Record and Journal of Variation* **26**:37–45.
1112 Donisthorpe H. 1947. Some new ants from New Guinea. *Annals and Magazine of Natural History* (**11**)14:183–197.
1114 DuBois MB. 1986. A revision of the native New World species of the ant genus *Monomorium* (*minimum* group) (Hymenoptera: Formicidae). *University of Kansas Science Bulletin* 53:65–119.
1117 El-Hawagry MS, Abdel-Dayem MS, Elgharbawy AA, Al Dhafer HM. 2016. A preliminary account of the fly fauna in Jabal Shada Al-A'la Nature Reserve, Saudi Arabia, with new

records and biogeographical remarks (Diptera, Insecta). *ZooKeys* **636**: 107–139. https://doi.org/10.3897/zookeys.636.9905

Emery C. 1877. Catalogo delle formiche esistenti nelle collezioni del Museo Civico di Genova. Parte prima. Formiche provenienti dal Viaggio dei signori Antinori, Beccari e Issel nel Mar Rosso e nel paese dei Bogos. [part]. *Annali del Museo Civico di Storia Naturale* **9**:363–368.

Emery C. 1881. Viaggio ad Assab nel Mar Rosso dei Signori G. Doria ed O. Beccari con il R. Avviso "Esploratore" dal 16 novembre 1879 al 26 febbraio 1880. I. Formiche. *Annali del Museo Civico di Storia Naturale* **16**:525–535.

Emery C. 1893. Voyage de M. E. Simon à l'île de Ceylan (janvier-février 1892). Formicides. *Annales de la Société Entomologique de France* **62**:239–258.

Emery C. 1894. Studi sulle formiche della fauna neotropica. VI-XVI. *Bullettino della Società Entomologica Italiana* **26**:137–241.

Emery C. 1915. Su due formiche della Tripolitania. Bollettino del Laboratorio di Zoologia Generale e Agraria della Reale Scuola Superiore d'Agricoltura. *Portici* **9**:378.

Emery C. 1922. Hymenoptera. Fam. Formicidae. Subfam. Myrmicinae. [part]. *Genera Insectorum* **174B**:95–206.

Ettershank G. 1966. A generic revision of the world Myrmicinae related to *Solenopsis* and *Pheidologeton*. *Australian Journal of Zoology* **14**: 73–171.

Evenhuis N. 2020. *The insect and spider collections of the world website*. http://hbs.bishopmuseum.org/codens/ [accessed 10 Augst 2020].

Fabricius JC. 1793. Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species, adjectis synonimis, locis observationibus, descriptionibus. Tome 2. Hafniae [= Copenhagen]: C. G. Proft, 519 pp.

Fernández F, Serna FJ. 2019. Subfamilia Myrmicinae. Fernández, F.; Guerrero, R. J.; Delsinne, T. (eds.) 2019d. *Hormigas de Colombia. Bogotá*: Universidad Nacional de Colombia, 1198 pp.

Finzi B. 1936. Risultati scientifici della spedizione di S. A.S. il Principe Alessandro della Torre e Tasso nell'Egitto e peninsola del Sinai. XI. Formiche. *Bulletin. Société Entomologique d'Egypte* **20**:155–210.

1149 Fisher BL, Bolton B. 2016. *Ants of Africa and Madagascar: A Guide to the Genera*. Berkeley:
1150 University of California Press, i–ix, 1–503 pp.
1151 Forel A. 1893. Formicides de l'Antille St. Vincent, récoltées par Mons. H. H.
1152 Smith. Transactions of the Entomological Society of London 1893:333-418.
1153 Forel A. 1907. Formicides du Musie nationale Hongroise. *Annales historico-naturales Musei*
1154 *nationalis hungarici* **5**: 1–42.
1155 Forel A. 1910. Glanures myrmécologiques. *Annales de la Société Entomologique de Belgique*
1156 **54**:6–32.
1157 Forel A. 1913. Ameisen aus Rhodesia, Kapland usw. (Hym.) gesammelt von Herrn G. Arnold,
1158 Dr. H. Brauns und Anderen. *Deutsche Entomologische Zeitschrift* 1913(Suppl.):203–
1159 225.
1160 Forel A. 1916. Fourmis du Congo et d'autres provenances récoltées par MM. Hermann Kohl,
1161 Luja, Mayné, etc. *Revue Suisse de Zoologie* **24**:397–460.
1162 Hamann HHF, Klemm W. 1967. Ergebnisse der zoologischen Nubien-Expedition 1962. Teil
1163 XXXIV. Hymenoptera - Formicidae. *Annalen des Naturhistorischen Museums in Wien*
1164 **70**:411–421.
1165 Heterick BE. 2001. Revision of the Australian ants of the genus *Monomorium* (Hymenoptera:
1166 Formicidae). *Invertebrate Taxonomy* **15**:353–459.
1167 Heterick BE. 2003. Two new Australian *Monomorium* Mayr (Hymenoptera: Formicidae),
1168 including a highly distinctive species. *Australian Journal of Entomology* **42**:249–253.
1169 Heterick BE. 2006. A revision of the Malagasy ants belonging to genus *Monomorium* Mayr,
1170 1855. *Proceedings of the California Academy of Sciences* **57**:69–202.
1171 Heterick BE. 2009. A guide to the ants of south-western Australia. *Records of the Western*
1172 *Australian Museum Supplement* **76**:1–206.
1173 Hita Garcia F, Wiesel E, Fischer G. 2013. The ants of Kenya (Hymenoptera: Formicidae)—
1174 faunal overview, first species checklist, bibliography, accounts for all genera, and
1175 discussion on taxonomy and zoogeography. *Journal of East African Natural History*
1176 **101**:127–222
1177 Hlaváč P., Sharaf, MR, Aldawood AS. 2013. New species and record of of Pselaphinae
1178 (Coleoptera: Staphylinidae) from Saudi Arabia. *Zootaxa* **3666** (3): 331–336,
1179 http://dx.doi.org/10.11646/zootaxa.3666.3.3

Holt BG, Lessard JP, Borregaard MK, Fritz SA, Araújo MB, Dimitrov D, et al. 2013. An update of Wallace's zoogeographic regions of the world. *Science* **339**: 74–78. pmid:23258408

Jerdon TC. 1851. A catalogue of the species of ants found in Southern India. *Madras Journal of Literature and Science* **17**:103–127.

Karavaiev V. 1911. Ameisen aus Aegypten und dem Sudan. *Russkoe Entomologicheskoe Obozrenie* **11**:1–12.

Kempf WW. 1972. Catálogo abreviado das formigas da região Neotropical. *Studia Entomologica* **15**:3–344.

Kusnezov, N. 1949. El género Monomorium (Hymenoptera, Formicidae) en la Argentina. Acta Zoologica Lilloana 7:423-448.

Linnaeus C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Tomus I. Editio decima, reformata. Holmiae [= Stockholm]: L. Salvii, 824 pp.

Linsley EG, Usinger RL. 1966. Insects of the Galápagos Islands. *Proceedings of the California Academy of Sciences* (**4**)33:113–196.

Mackay W, Mackay E. 2002. *The ants of New Mexico (Hymenoptera: Formicidae)*. Lewiston, New York: Edwin Mellen Press, 400 pp.

Mahnert V, Sharaf MR, Aldawood AS. 2014. Further records of Pseudoscorpions (Arachnida, Pseudoscorpions) from Saudi Arabia. *Zootaxa* **3764** (3): 387–393, https://doi.org/10.11646/zootaxa.3764.3.8

Mayr G. 1862. Myrmecologische Studien. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien* **12**:649–776.

Mayr G. 1866. Myrmecologische Beiträge. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften in Wien. Mathematisch-Naturwissenschaftliche Classe*. Abteilung I **53**:484–517.

Mayr G. 1877. Formicidae. [In Russian.]. In: Fedchenko, A. P. 1877. Travels in Turkestan. Vol. 2, Div. 5, No. 7. [In Russian.]. Izvestiya Imperatorskago Obshchestva Lyubitelei Estestvoznaniya Antropologii i Etnografii pri Imperatorskom Moskovskom Universitete **26**:i-iii, 1-20 (+1).

Mayr G. 1879. Beiträge zur Ameisen-Fauna Asiens. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien* **28**:645–686.

Mayr G. 1901. Südafrikanische Formiciden, gesammelt von Dr. Hans Brauns. *Annalen des Kaiserlich-Königlichen Naturhistorischen Museums in Wien* **16**:1–30.

Menozzi C. 1932. Missione scientifica del Prof. E. Zavattari nel Fezzan (1931). Hymenoptera-Formicidae. *Bollettino della Società Entomologica Italiana* **64**:93–95.

Monks J, Ross S, Geiser M, De Prins J, Sharaf MR, Wyatt N, Al Rijeibi S & Polaszek A. 2019. A preliminary survey of the insect fauna of the Hajar Mountain Range, Oman. *Journal of Natural History* **53**: 939–963, https://doi.org/10.1080/00222933.2019.1611969

Morisita M, Kubota M, Onoyama K, Ogata K, Terayama M, Yamauchi K, Sonobe R, Yamane S, Kondoh M, Imai HT. 1992. *A guide for the identification of Japanese ants. III. Myrmicinae and supplement to Leptanillinae. (Hymenoptera: Formicidae)*. [In Japanese.]. Tokyo: Myrmecological Society of Japan, 94 pp.

Paknia O, Radchenko A, Alipanah H, Pfeiffer M.. 2008. A preliminary checklist of the ants (Hymenoptera: Formicidae) of Iran. *Myrmecological News* **11**: 151-159.

Roger J. 1863a. Die neu aufgeführten Gattungen und Arten meines Formiciden-Verzeichnisses nebst Ergänzung einiger früher gegebenen Beschreibungen. *Berliner Entomologische Zeitschrift* **7**:131–214.

Roger J. 1863b. Verzeichniss der Formiciden-Gattungen und Arten. *Berliner Entomologische Zeitschrift* **7**(Beilage):1–65.

Santschi F. 1911. Formicides nouveaux de l'Afrique Mineure (4e note suite). *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord* **2**:78–85.

Santschi F. 1912. Quelques nouvelles variétés de fourmis africaines. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord* **3**:147–149.

Santschi F. 1914. Formicides de l'Afrique occidentale et australe du voyage de Mr. le Professeur F. Silvestri. *Bollettino del Laboratorio di Zoologia Generale e Agraria della Reale Scuola Superiore d'Agricoltura* Portici **8**:309–385.

Santschi F. 1915a. Nouvelles fourmis d'Algérie, Tunisie et Syrie. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord* **6**:54–63.

Santschi F. 1915b. Nouvelles fourmis d'Afrique. *Annales de la Société Entomologique de France* **84**:244–282.

Santschi F. 1919. Fourmis nouvelles éthiopiennes. *Revue Zoologique Africaine* (Brussels) **6**:229–240.

1242 Santschi F. 1926. Description de nouveaux Formicides éthiopiens (IIIme partie). *Revue*
1243 *Zoologique Africaine* (Brussels) **13**:207–267.
1244 Santschi F. 1927. Révision myrmécologique. *Bulletin et Annales de la Société Entomologique de*
1245 *Belgique* **67**:240–248.
1246 Santschi F. 1934. Mission J. de Lépiney au Soudan Français 1933–1934. (Huitième note.)
1247 Fourmis. *Bulletin de la Société des Sciences Naturelles du Maroc* **14**:33–34.
1248 Santschi F. 1936. Étude sur les fourmis du genre *Monomorium* Mayr. *Bulletin de la Société des*
1249 *Sciences Naturelles du Maroc* **16**:32–64.
1250 Santschi F. 1938. Quelques nouvelles fourmis d'Egypte. *Bulletin Société Entomologique*
1251 *d'Egypte* **21**:28–44.
1252 Sarnat EM, Economo EP. 2012. *The ants of Fiji*. University of California Publications in
1253 Entomology, Volume 132. Berkeley: University of California Press, xiii + 384 pp.
1254 Sharaf MR. 2006. *Taxonomic and ecological studies on family Formicidae (Order:*
1255 *Hymenoptera) in Egypt including some protectorates with a study of some insect fauna*
1256 *associated with ant species* [unpublished thesis]. Cairo: Ain Shams University, Faculty of
1257 Science, Entomology Department; 340 pp.
1258 Sharaf MR, Aldawood AS. 2013a. First occurrence of the *Monomorium hildebrandti*-group
1259 (Hymenoptera: Formicidae), in the Arabian Peninsula, with description of a new
1260 species *M. kondratieffi* n. sp. *Proceedings of the Entomological Society of Washington*
1261 **115** (1):75–84.
1262 Sharaf MR, Aldawood AS. 2013b. *Monomorium sarawatensis* Sharaf & Aldawood, sp. n. Pp.
1263 70-73 in: El-Hawagry, M. S.; Khalil, M. W.; Sharaf, M.R.; Fadl, H. H.; Aldawood,
1264 A.S. 2013. A preliminary study on the insect fauna of Al-Baha Province, Saudi Arabia,
1265 with descriptions of two new species. *ZooKeys* **274**:1–88.
1266 Sharaf MR, Aldawood AS. 2013c. The ant genus *Carebara* Westwood in the Arabian Peninsula
1267 (Hymenoptera, Formicidae). *ZooKeys* **357**:67–83. doi:10.3897/zookeys.357.5946
1268 Sharaf MR, Al Dhafer HM, Aldawood AS. 2014a. First record of the myrmicine ant genus
1269 *Meranoplus* Smith, 1853 (Hymenoptera: Formicidae) from the Arabian Peninsula with
1270 description of a new species and notes on the zoogeography of southwestern Kingdom
1271 Saudi Arabia. *PLoS ONE* **9**(11):e111298. doi:10. 1371/journal.pone.0111298

Sharaf MR, Fisher BL, Aldawood AS. 2014b. Notes on ants of the genus *Strumigenys* F. Smith, 1860 (Hymenoptera: Formicidae) in the Arabian Peninsula, with a key to species. *Sociobiology* **61**(3):293–299. doi:10.13102/sociobiology.v61i3.293-299.

Sharaf MR, Collingwood CA, Al Dhafer HM, Al mutairi MS, Aldawood AS.2015. New synonyms of two Arabian ants of the genus *Monomorium* Mayr, 1855 (Hymenoptera, Formicidae). *ZooKeys* **505**: 51–58. doi: 10.3897/ zookeys.505.9441

Sharaf MR, Fisher BL, Collingwood CA, Aldawood, A.S. 2017a. Ant fauna (Hymenoptera: Formicidae) of the Socotra Archipelago (Yemen): zoogeography, distribution and description of a new species. *Journal of Natural History* **51** (5-6):317–378. 10.1080/00222933.2016.1271157

Sharaf MR, Akbar, SA, Al Dhafer HM, El-Gharbawy A, Aldawood AS. 2017b. Taxonomy of the Myrmicine ant genus *Temnothorax* Mayr, 1861 (Formicidae: Myrmicinae) in the Arabian Peninsula. *European Journal of Taxonomy***280**:1–17. doi:10.5852/ejt.2017.280

Sharaf MR, Al Dhafer HM, Aldawood AS, Hita Garcia F. 2018a. Ants of the *Monomorium monomorium* species-group (Hymenoptera: Formicidae) in the Arabian Peninsula with description of a new species from southwestern Saudi Arabia. *PeerJ* **6**:e4277. 10.7717/peerj.4277

Sharaf MR, Fisher BL, Al Dhafer HM, Polaszek A, Aldawood AS. 2018b. Additions to the ant fauna (Hymenoptera: Formicidae) of Oman: an updated list, new records and a description of two new species. *Asian Myrmecology* **10**:e010004. 1–38. doi:10.20362/am.010004

Sharaf MR Aldawood AS.2019. Review of the ant genus *Meranoplus* Smith, 1853 (Hymenoptera: Formicidae) in the Arabian Peninsula with description of a new species *M. mosalahi* sp. n. from Oman. *PeerJ* **7**:e6287. doi:10.7717/peerj.6287

Sharaf MR, Aldawood AS, Hita Garcia F. 2019. Review of the Arabian *Crematogaster* Lund (Hymenoptera, Formicidae), synoptic list, distribution, and description of two new species from Oman and Saudi Arabia. *ZooKeys* **898**:27–81, doi:10.3897/zookeys.898.37531

Sharaf MR, Aldawood AS, Mohamed, AA, Hita Garcia F. 2020a. The genus *Lepisiota* Santschi, 1926 of the Arabian Peninsula with the description of a new species, *Lepisiota elbazi* sp.

nov. from Oman, an updated species identification key, and assessment of zoogeographic affinities. *Journal of Hymenoptera Research* **76**: 127–152, doi:10.3897/jhr.76.50193

Sharaf MR, Mohamed AA, Al Dhafer HM, Aldawood AS. 2020b. *Nesomyrmex micheleae*, a new ant species (Hymenoptera: Formicidae) from the Dhofar Governorate, Oman, with a synoptic list, distribution, and a key to the Arabian *Nesomyrmex*. *Journal of Natural History* **54**: 351–365. https://doi.org/10.1080/00222933.2020.1762013

Shuckard WE. 1838. Description of a new species of *Myrmica* which has been found in houses both in the Metropolis and Provinces. *Magazine of Natural History* (**2**)2:626–627.

Smith F. 1857. Catalogue of the hymenopterous insects collected at Sarawak, Borneo; Mount Ophir, Malacca; and at Singapore, by A. R. Wallace. [part]. *Journal and Proceedings of the Linnean Society of London. Zoology* **2**:42–88.

Smith F. 1858. *Catalogue of hymenopterous insects in the collection of the British Museum*. Part VI. Formicidae. London: British Museum, 216 pp.

Smith F. 1876. Preliminary notice of new species of Hymenoptera, Diptera, and Forficulidae collected in the island of Rodriguez by the naturalists accompanying the Transit-of-Venus expedition. *Annals and Magazine of Natural History* (**4**)17:447–451.

Sparks KS, Andersen AN, Austin AD. 2014. Systematics of the *Monomorium rothsteini* Forel species complex (Hymenoptera: Formicidae), a problematic ant group in Australia. *Zootaxa* **3893** (4):489–529.

Sparks KS., Andersen AN, Austin AD. 2019. A multi-gene phylogeny of Australian *Monomorium* Mayr (Hymenoptera: Formicidae) results in reinterpretation of the genus and resurrection of *Chelaner* Emery. *Invertebrate Systematics* **33**: 225–236.

Stitz H. 1917. Ameisen aus dem westlichen Mittelmeergebiet und von den Kanarischen Inseln. *Mitteilungen aus dem Zoologischen Museum in Berlin* **8**:333–353.

Stitz H. 1932. Formicidae [of the Wollebaek Galapagos Expedition]. *Nyt Magazin for Naturvidenskaberne* **71**:367-372.

SWA 2018. *Protected Areas. Saudi Wildlife Commission*. https://www.swa.gov.sa/en [accessed 13 July 2020].

SWA 2020. *Protected Areas. Saudi Wildlife Commission*. https://www.swa.gov.sa/en [26-8-2020].

1332 Terayama M. 2009. A synopsis of the family Formicidae of Taiwan (Insecta:
1333 Hymenoptera). *Research Bulletin of Kanto Gakuen University*. Liberal Arts **17**:81–266.
1334 Thomas J, El-Sheikh MA, Alatar AA. 2017. Endemics and endangered species in the
1335 biodiversity hotspot of the Shada Mountains, Saudi Arabia. *Journal of Arid Land* **9**(1):
1336 109–21. doi: 10.1007/s40333-016-0025-8
1337 Vigna Taglianti A, Audisio PA, Biondim, Bologna MA, Carpaneto GM, De Biase A, Fattorini S,
1338 Piattella E, Sindaco R, Venchi A, Zapparolim, 1999. A proposal for a chorotype
1339 classification of the Near East fauna, in the framework of the Western Palaearctic region.
1340 *Biogeographia* **20**: 31–59.
1341 Vonshak M, Ionescu-Hirsch A. 2009. A checklist of the ants of Israel (Hymenoptera: Formici-
1342 dae). *Israel Journal of Entomology* 39: 33–55.
1343 Walker F. 1871. *A list of Hymenoptera collected by J. K. Lord, Esq. in Egypt, in the*
1344 *neighbourhood of the Red Sea, and in Arabia, with descriptions of the new species*.
1345 London: E. W. Janson, vi + 59 pp.
1346 Ward PS, Brady SG, Fisher BL, Schultz TR. 2015. The evolution of myrmicine ants: phylogeny
1347 and biogeography of a hyperdiverse ant clade (Hymenoptera: Formicidae). *Systematic*
1348 *Entomology* **40**:61–81.
1349 Wetterer JK. 2010a. Worldwide spread of the flower ant, *Monomorium floricola* (Hymenoptera:
1350 Formicidae). *Myrmecological News* **13**:19–27.
1351 Wetterer JK. 2010b. Worldwide spread of the pharaoh ant, *Monomorium pharaonis*
1352 (Hymenoptera: Formicidae). *Myrmecological News* **13**:115–129
1353 Wheeler WM. 1905. The ants of the Bahamas, with a list of the known West Indian
1354 species. *Bulletin of the American Museum of Natural History* **21**:79–135.
1355 Wheeler WM. 1913. The ants of Cuba. *Bulletin of the Museum of Comparative Zoology* **54**:477–
1356 505.
1357 Wheeler WM. 1922. Ants of the American Museum Congo expedition. New York: *Bulletin of*
1358 *the American Museum of Natural History* 1139.
1359 Wheeler GC, Wheeler J. 1955. The ant larvae of the myrmicine tribe Solenopsidini. *American*
1360 *Midland Naturalist* **54**:119–141.
1361 Wheeler WM, Mann WM. 1916. The ants of the Phillips Expedition to Palestine during 1914.
1362 *Bulletin of the Museum of Comparative Zoology* **60**:167–174.

Wilson EO, Taylor RW. 1967b. The ants of Polynesia (Hymenoptera: Formicidae). *Pacific Insects Monograph* **14**: 1–109.

Wu J, Wang C. 1995. *The ants of China*. [In Chinese.]. Beijing: China Forestry Publishing House, x + 214 pp.

Figure Legends.

Figure 1. A: head of *M. exiguum* in full-face view, CASENT0217367 (Erin Prado); B: head of *M. khalidi,* **sp. n.** in full-face view, CASENT0922288 (Michele Esposito); C: head of *M. carbonarium* in full-face view, CASENT0902279 (Ryan Perry); D: head of *M. floricola* in full-face view, CASENT0922876 (Michele Esposito); E: body of *M. carbonarium* in profile, CASENT0902279 (Ryan Perry); F: body of *M. sarawatense* in profile, CASENT0280971 (Estella Ortega), www.AntWeb.org.

Figure 2. A: body of *M. floricola* in profile, CASENT0922876 (Michele Esposito); B: body of *M. holothir* in profile, CASENT0902243 (Will Ericson); C: body of *M. aeyade* in profile, CASENT0922329 (Michele Esposito); D: body of *M. exiguum* in profile, CASENT0217367 (Erin Prado); E: body of *M. mohammedi* in profile, CASENT0922351 (Michele Esposito); www.AntWeb.org, F: body of *M. clavicorne* in profile, (Francisco Hita Garcia).

Figure 3. A: head of *M. barbatulum* in profile, CASENT0922263 (Michele Esposito); B: mesosoma of *M. rabirium* in profile, CASENT0746641 (Zach Lieberman); C: mesosoma of *M. elghazalyi* in profile, CASENT0746626 (Michele Esposito); D: petiole and postpetiole of *M. harithe* in profile, CASENT0913802 (Will Ericson); E: head of *M. elghazalyi* in full-face view, CASENT0746626 (Michele Esposito); F head of *M. dirie* in full-face view, CASENT0913571 (Alexandra Westrich), www.AntWeb.org.

Figure 4. A: head of *M. dirie* in profile, CASENT0913571 (Alexandra Westrich); B: head of *M. salomonis* in profile, CASENT0913835 (Will Ericson); C: mesosoma of *M. subdenticorne* in profile, CASENT0914318 (Zach Lieberman); D: mesosoma of *M. bicolor* in profile, CASENT0073615 (Michele Esposito); E: petiole of *M. acutinode* in profile, CASENT0913547 (Will Ericson); F petiole of *M. carbo* in profile, CASENT0249908 (Shannon Hartman), www.AntWeb.org.

Figure 5. A: mesosoma of *M. areniphilum* in profile, CASENT0048600 (Michele Esposito); B: mesosoma of *M. subopacum* in profile, CASENT0064820 (April Nobile); C: mesosoma of *M. luteum* in profile, CASENT0904599 (Will Ericson); D: mesosoma of *M. niloticum* in profile,

CASENT0260164 (Estella Ortega); E: head of *M. niloticum* in full-face view, CASENT0919811 (Michele Esposito); F head of *M. riyadhe* in full-face view, CASENT0922342 (Michele Esposito), www.AntWeb.org.

Figure 6. A: head of *M. hanaqe* in full-face view, CASENT0249834 (Ryan Perry); B: mesosoma of *M. hanaqe* in profile, CASENT0249834 (Ryan Perry); C: head of *M. jizane* in full-face view, CASENT0913806 (Will Ericson); D: propodeum of *M. jizane* in profile, CASENT0913806 (Will Ericson); E: head of *M. fayfaense* in full-face view, CASENT0249833 (Ryan Perry); F gaster of *M. fayfaense* in profile, CASENT0249833 (Ryan Perry), www.AntWeb.org.

Figure 7. A: head of *M. knappi* in full-face view, CASENT0913812 (Will Ericson); B: body of *M. knappi* in profile, CASENT0913812 (Will Ericson); C: body of *M. nitidiventre* in profile, CASENT0904602 (Will Ericson); D: head of *M. nitidiventre* in full-face view, CASENT0904602 (Will Ericson); E: body of *M. khalidi* **sp. n.** in profile, CASENT0922288 (Michele Esposito); F head of *M. khalidi* **sp. n.** in profile, CASENT0922288 (Michele Esposito), www.AntWeb.org.

Figure 8. A: mesosoma of *M. pharaonis* in profile, CASENT0246072 (Andrea Walker); B: mesosoma of *M. buxtoni* in profile, CASENT0902220 (Will Ericson); C: head of *M. suleyile* in full-face view, CASENT0913854 (Zach Lieberman); D: head of *M. mahyoubi* in full-face view, CASENT0913823 (Alexandra Westrich); E: head of *M. tumaire* in profile, CASENT0249858 (Ryan Perry); F head of *M. buettikeri* in profile, CASENT0913565 (Zach Lieberman), www.AntWeb.org.

Figure 9. A: head of *M. gallagheri* in full-face view, CASENT0913582 (Zach Lieberman); B: head of *M. buxtoni* in full-face view, CASENT0902220 (Zach Lieberman); C: body of *M. abeillei* in profile, CASENT0915411 (Will Ericson); D: body of *M. asiriense* in profile, CASENT0913560 (Zach Lieberman), www.AntWeb.org.

Figure 10. *M. abeillei*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0915411 (Will Ericson), www.AntWeb.org.

Figure 11. *M. areniphilum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0048600 (Michele Esposito), www.AntWeb.org.

Figure 12. *M. barbatulum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922263 (Michele Esposito), www.AntWeb.org.

Figure 13. *M. bicolor*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0904601 (Will Ericson), www.AntWeb.org.

Figure 14. *M. floricola*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922876 (Michele Esposito), www.AntWeb.org.

Figure 15. *M. harithe*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0913802 (Will Ericson), www.AntWeb.org.

Figure 16. *M. heggyi* sp. n., A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0746641 (Zach Lieberman), www.AntWeb.org.

Figure 17. Shada Al A'la, the type locality of *M. heggyi* **sp. n.** (A. Shams Al Ola).

Figure 18. *M. khalidi* **sp. n.**, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922288 (Michele Esposito), www.AntWeb.org.

Figure 19. Shada Al A'la, the type locality of *M. khalidi* **sp. n.** (A. Shams Al Ola).

Figure 20. *M. niloticum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0905755 (Will Ericson), www.AntWeb.org.

Figure 21. *M. nitidiventre*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0904602 (Will Ericson), www.AntWeb.org.

Figure 22. *M. subdenticorne,* A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0914318 (Zach Lieberman), www.AntWeb.org.

Figure 23. A: *M. venustum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0902221 (Will Ericson), www.AntWeb.org.

Figure 24. Distribution map of *M. abeillei*.

Figure 25. Distribution map of *M. niloticum*.

Figure 26. Distribution map of *M. venustum*.

Figure 27. Distribution map of *M. barbatulum*, *M. bicolor*, *M. floricola*.

Figure 28. Distribution map of *M. harithe*, *M. khalidi* **sp. n.**, *M. nitidiventre*, *M. heggyi* **sp. n.**

Figure 29. Distribution map of *M. subdenticorne*.

Figure 1

Figure 1

Figure 1. A: head of *M. exiguum* in full-face view, CASENT0217367 (Erin Prado); B: head of *M. khalidi,* **sp. n.** in full-face view, CASENT0922288 (Michele Esposito); C: head of *M. carbonarium* in full-face view, CASENT0902279 (Ryan Perry); D: head of *M. floricola* in full-face view, CASENT0922876 (Michele Esposito); E: body of *M. carbonarium* in profile, CASENT0902279 (Ryan Perry); F: body of *M. sarawatense* in profile, CASENT0280971 (Estella Ortega), www.AntWeb.org.

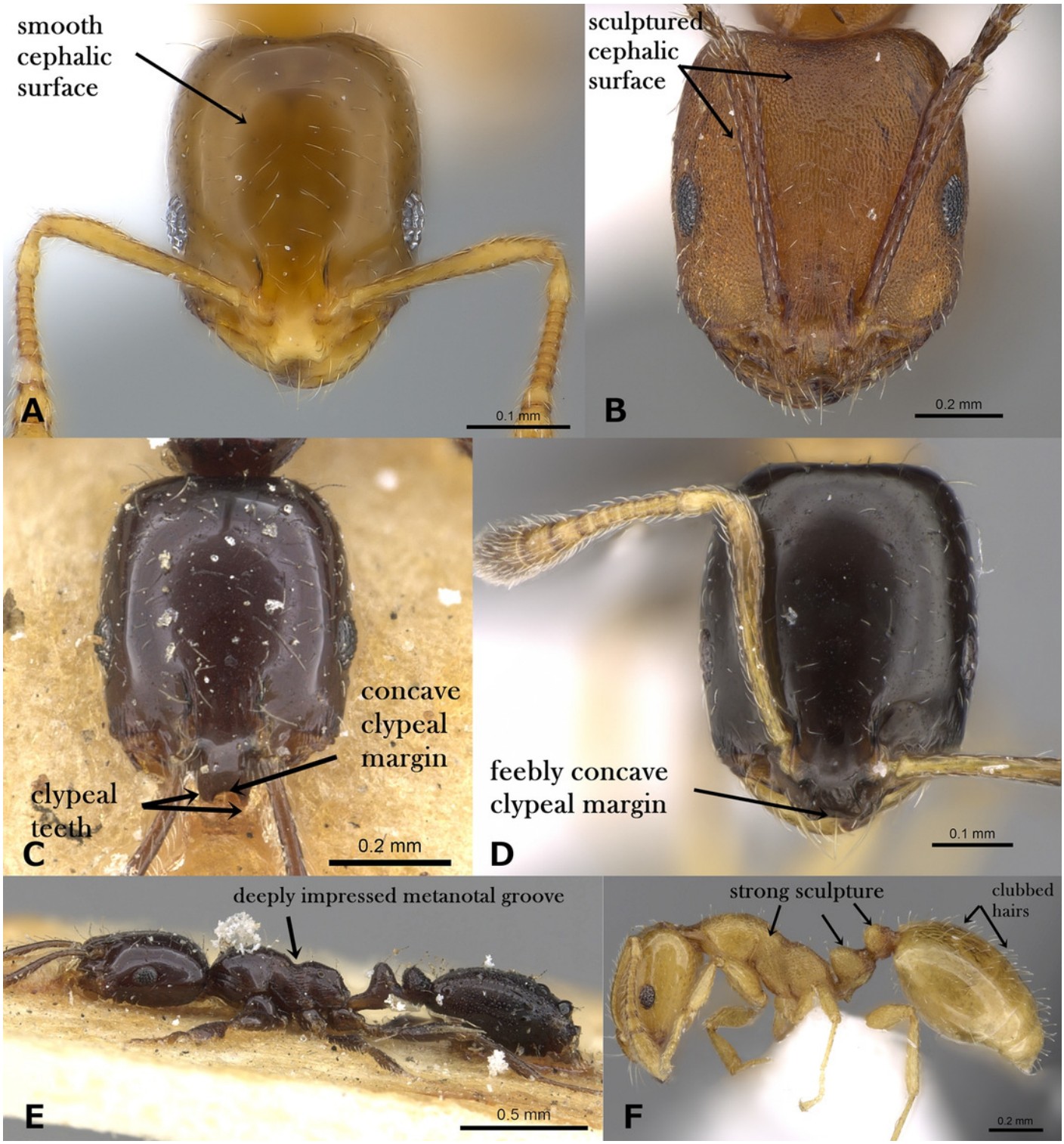
smooth
cephalic
surface
A
0.1 mm
sculptured
cephalic
surface
B
0.2 mm
concave
clypeal
margin
clypeal
teeth
C
0.2 mm
feebly concave
clypeal margin
D
0.1 mm
deeply impressed metanotal groove
E
0.5 mm
strong sculpture
clubbed
hairs
F
0.2 mm

Figure 2

A: body of *M. floricola* in profile, CASENT0922876 (Michele Esposito); B: body of *M. holothir* in profile, CASENT0902243 (Will Ericson); C: body of *M. aeyade* in profile, CASENT0922329 (Michele Esposito); D: body of *M. exiguum* i

Key illustrations

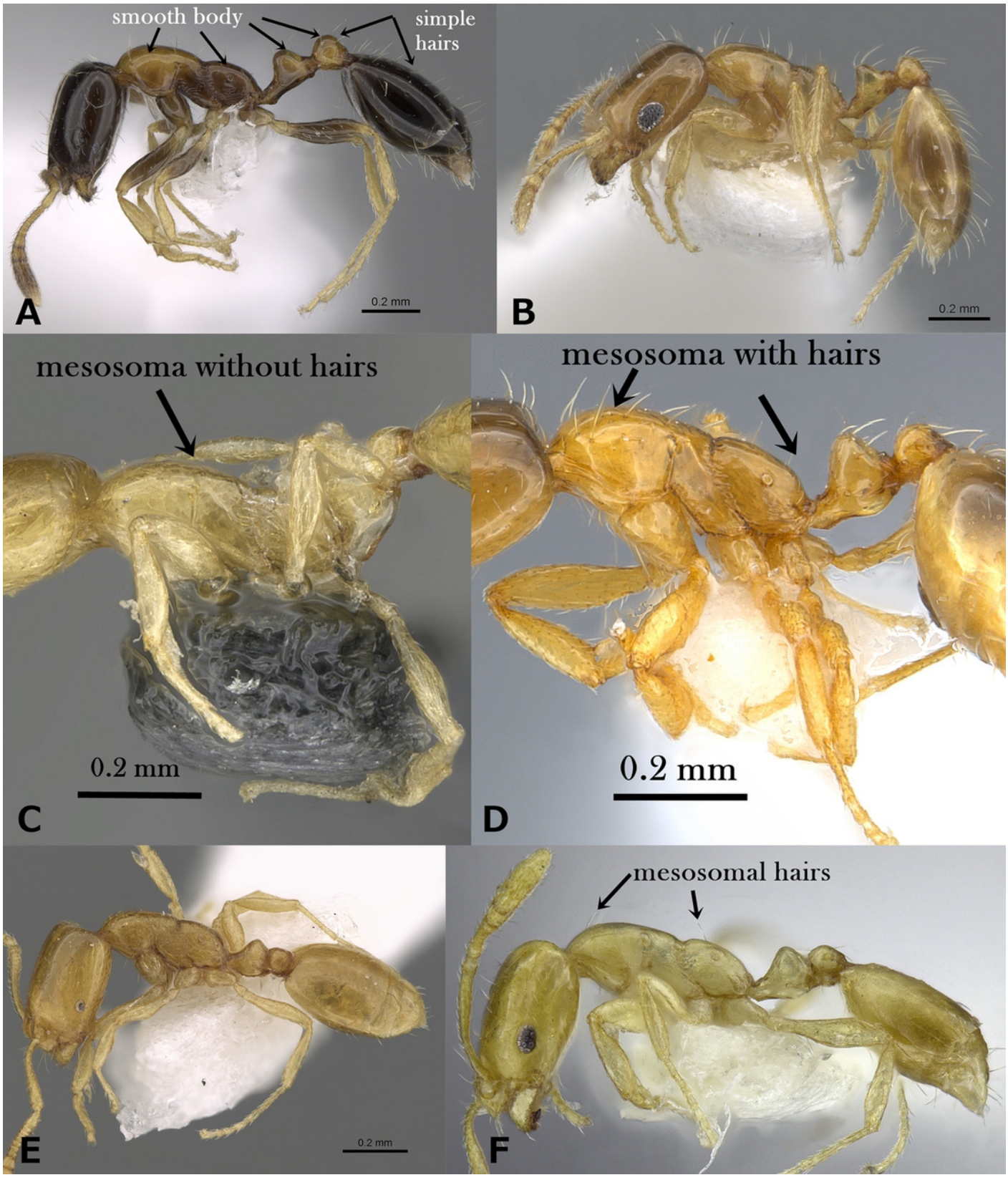
smooth body
simple hairs
0.2 mm
A
B
0.2 mm
mesosoma without hairs
0.2 mm
C
mesosoma with hairs
0.2 mm
D
0.2 mm
E
mesosomal hairs
F

Figure 3

A: head of *M. barbatulum* in profile, CASENT0922263 (Michele Esposito); B: mesosoma of *M. rabirium* in profile, CASENT0746641 (Zach Lieberman); C: mesosoma of *M. elghazalyi* in profile, CASENT0746626 (Michele Esposito); D: petiole and postp

Key illustrations

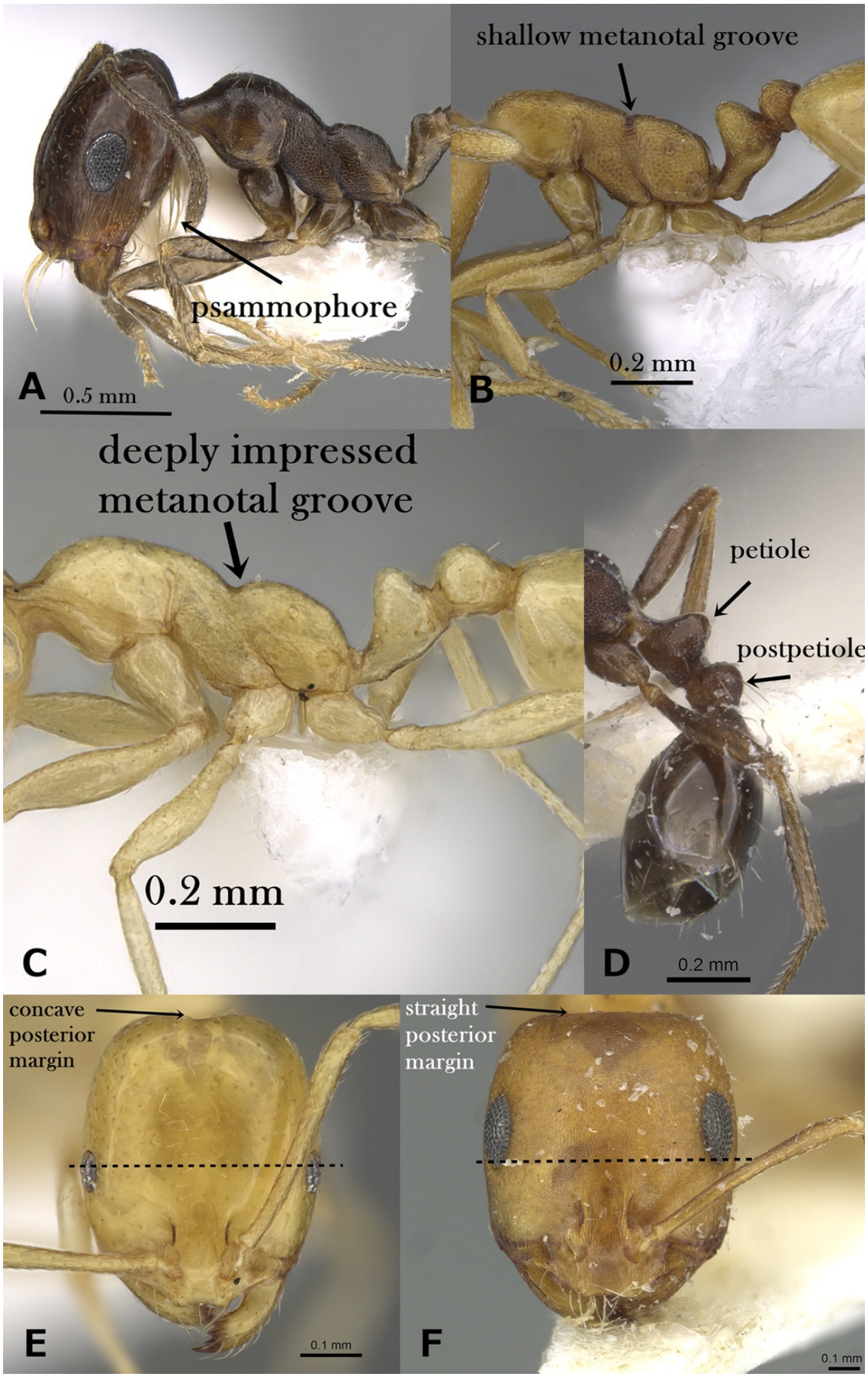
psammophore
A
0.5 mm
shallow metanotal groove
B
0.2 mm
deeply impressed
metanotal groove
0.2 mm
C
petiole
postpetiole
D
0.2 mm
concave
posterior
margin
E
0.1 mm
straight
posterior
margin
F
0.1 mm

Figure 4

A: head of *M. dirie* in profile, CASENT0913571 (Alexandra Westrich); B: head of *M. salomonis* in profile, CASENT0913835 (Will Ericson); C: mesosoma of *M. subdenticorne* in profile, CASENT0914318 (Zach Lieberman); D: mesosoma of [i]M. bicolo

Key illustrations

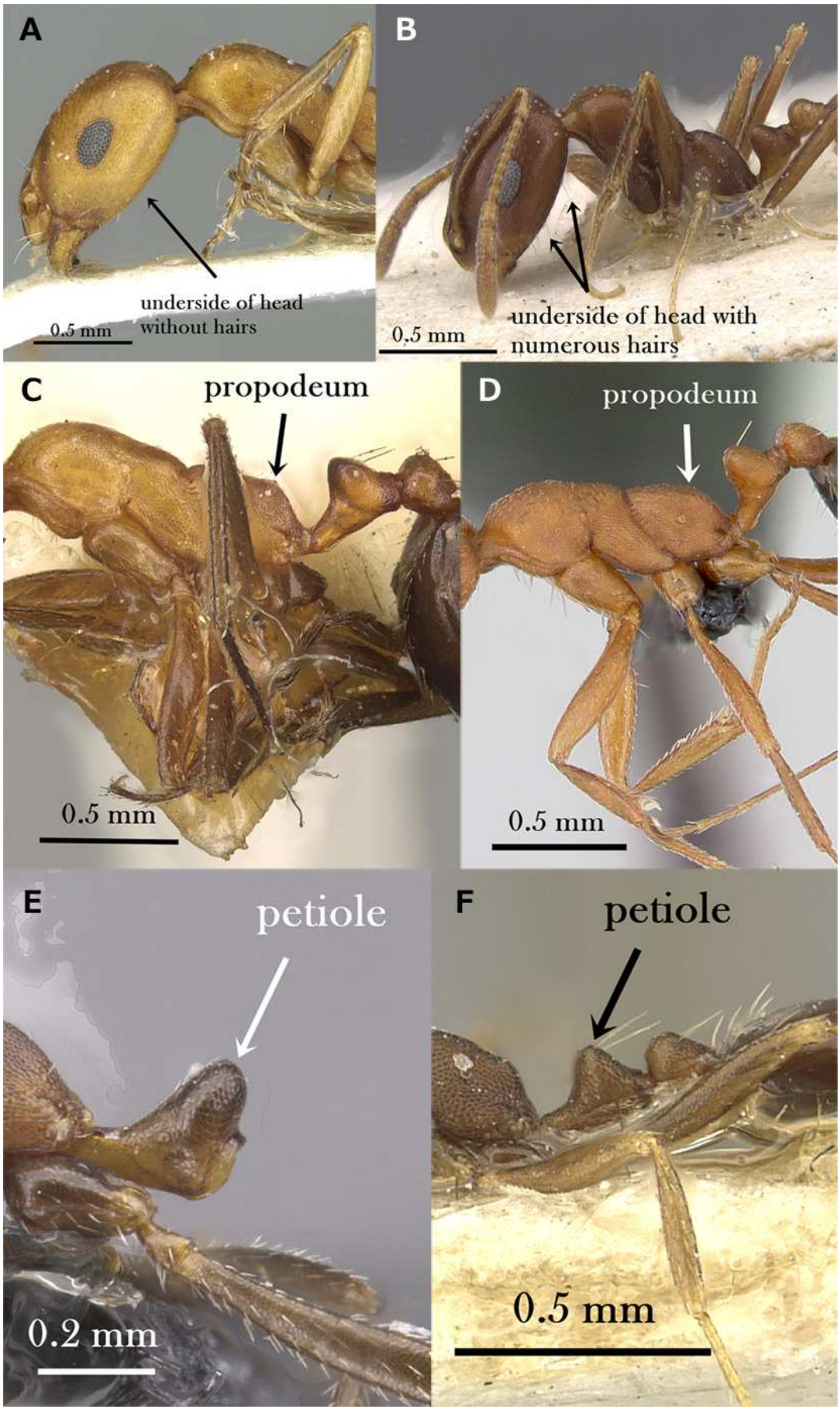
A
underside of head
without hairs
0.5 mm
B
underside of head with
numerous hairs
0.5 mm
C
propodeum
0.5 mm
D
propodeum
0.5 mm
E
petiole
0.2 mm
F
petiole
0.5 mm

Figure 5

A: mesosoma of *M. areniphilum* in profile, CASENT0048600 (Michele Esposito); B: mesosoma of *M. subopacum* in profile, CASENT0064820 (April Nobile); C: mesosoma of *M. luteum* in profile, CASENT0904599 (Will Ericson); D: mesosoma of [i]M. nil

Key illustrations

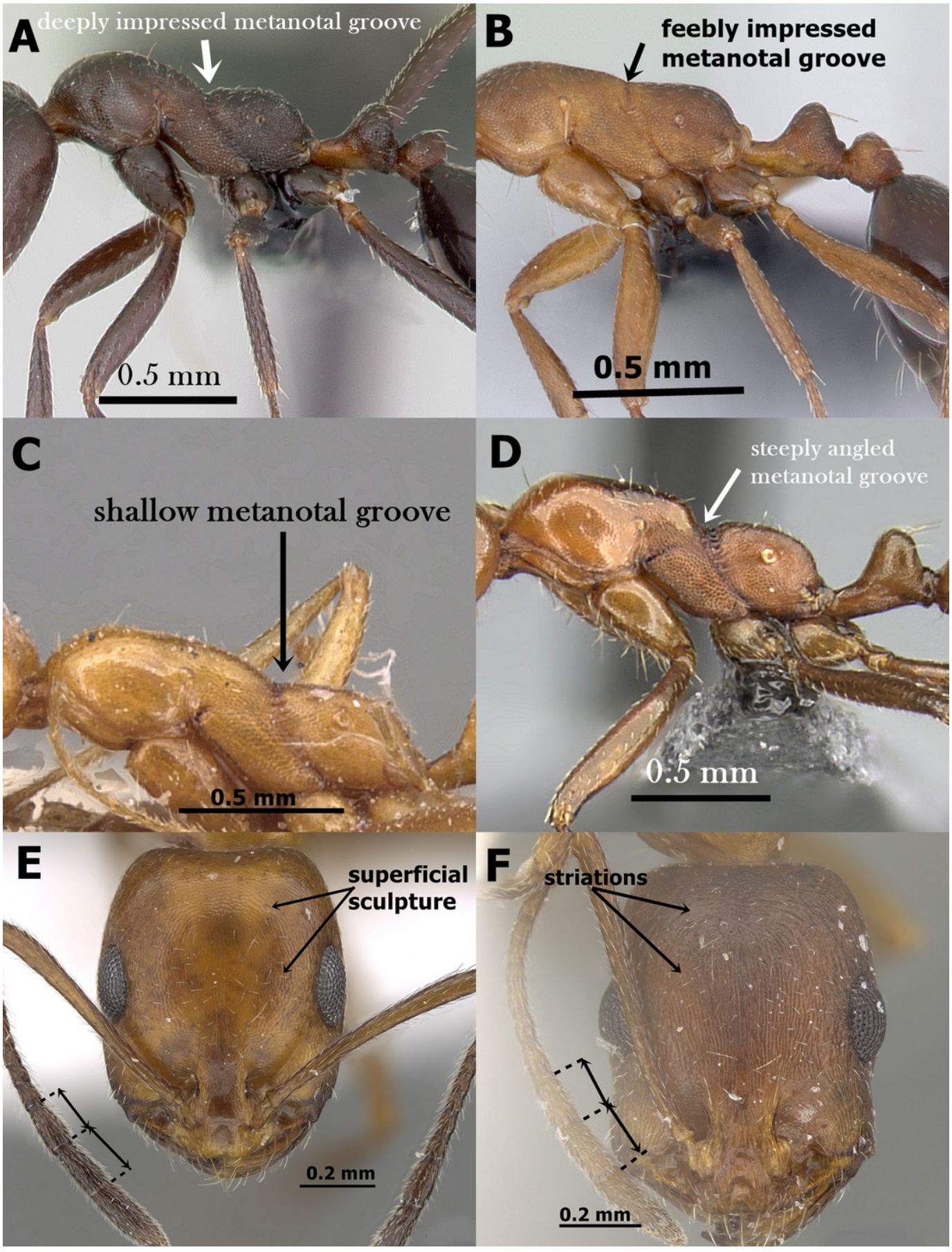
A
deeply impressed metanotal groove
0.5 mm
B
feebly impressed
metanotal groove
0.5 mm
C
shallow metanotal groove
0.5 mm
D
steeply angled
metanotal groove
0.5 mm
E
superficial
sculpture
0.2 mm
F
striations
0.2 mm

Figure 6

A: head of *M. hanaqe* in full-face view, CASENT0249834 (Ryan Perry); B: mesosoma of *M. hanaqe* in profile, CASENT0249834 (Ryan Perry); C: head of *M. jizane* in full-face view, CASENT0913806 (Will Ericson); D: propodeum of *M. jizane* in

Key illustrations

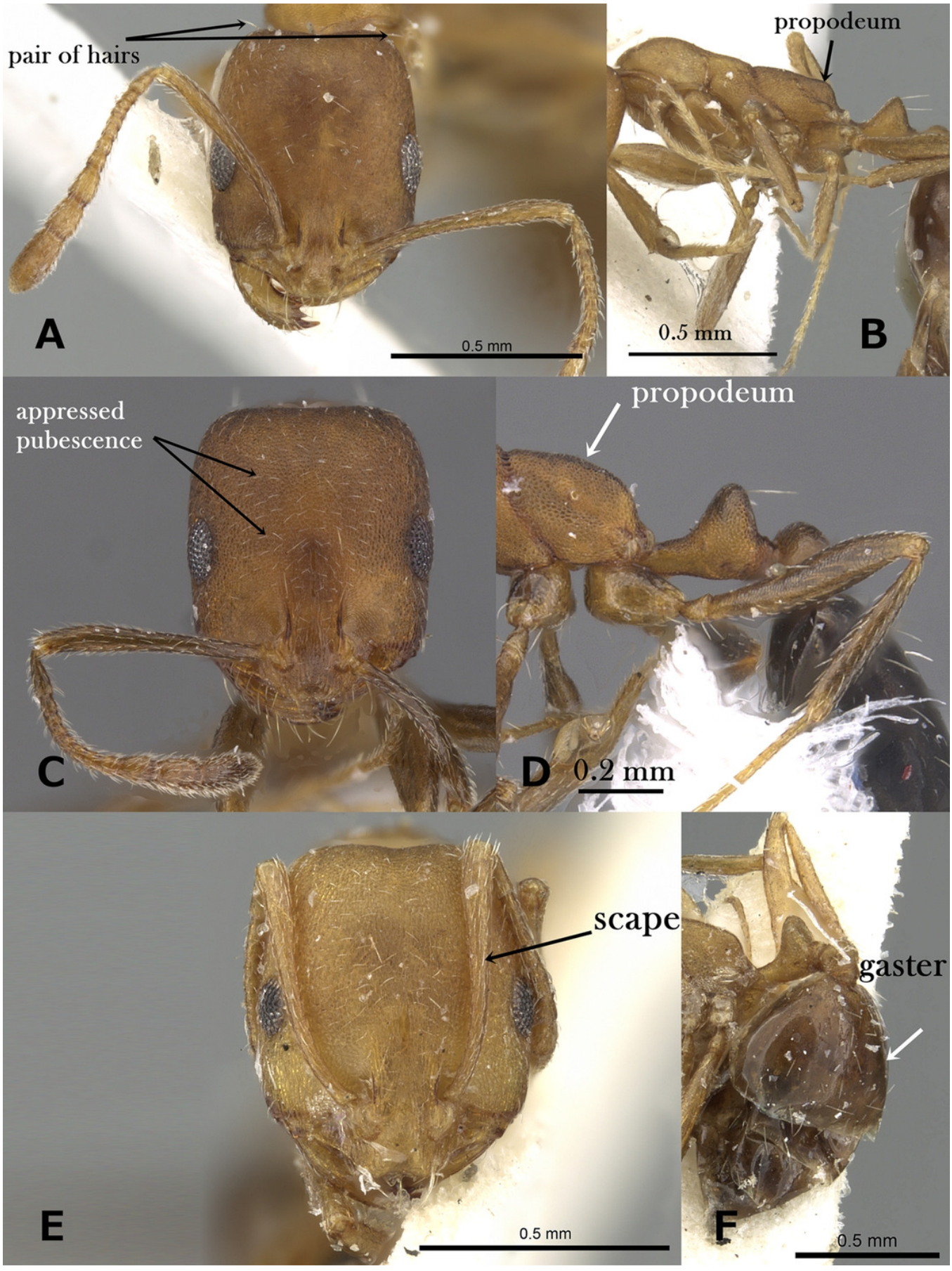
pair of hairs
A
0.5 mm
propodeum
0.5 mm
B
appressed
pubescence
C
propodeum
D
0.2 mm
scape
E
0.5 mm
gaster
F
0.5 mm

Figure 7

A: head of *M. knappi* in full-face view, CASENT0913812 (Will Ericson); B: body of *M. knappi* in profile, CASENT0913812 (Will Ericson); C: body of *M. nitidiventre* in profile, CASENT0904602 (Will Ericson); D: head of *M. nitidiventre* in

Key illustrations

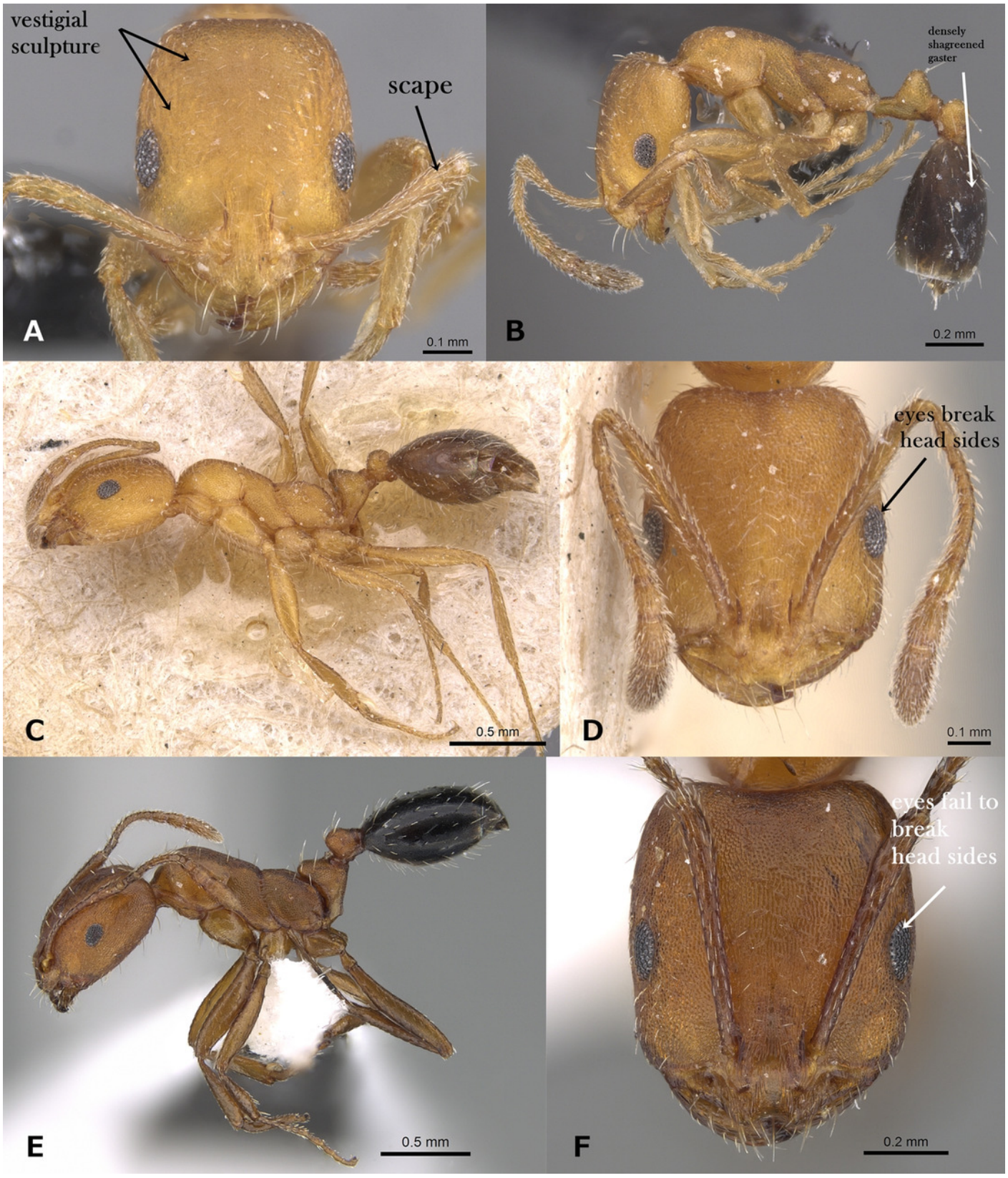
vestigial sculpture
scape
A
0.1 mm
densely shagreened gaster
B
0.2 mm
C
0.5 mm
eyes break head sides
D
0.1 mm
E
0.5 mm
eyes fail to break head sides
F
0.2 mm

Figure 8

A: mesosoma of *M. pharaonis* in profile, CASENT0246072 (Andrea Walker); B: mesosoma of *M. buxtoni* in profile, CASENT0902220 (Will Ericson); C: head of *M. suleyile* in full-face view, CASENT0913854 (Zach Lieberman); D: head of [i]M. mahyoub

Key illustrations

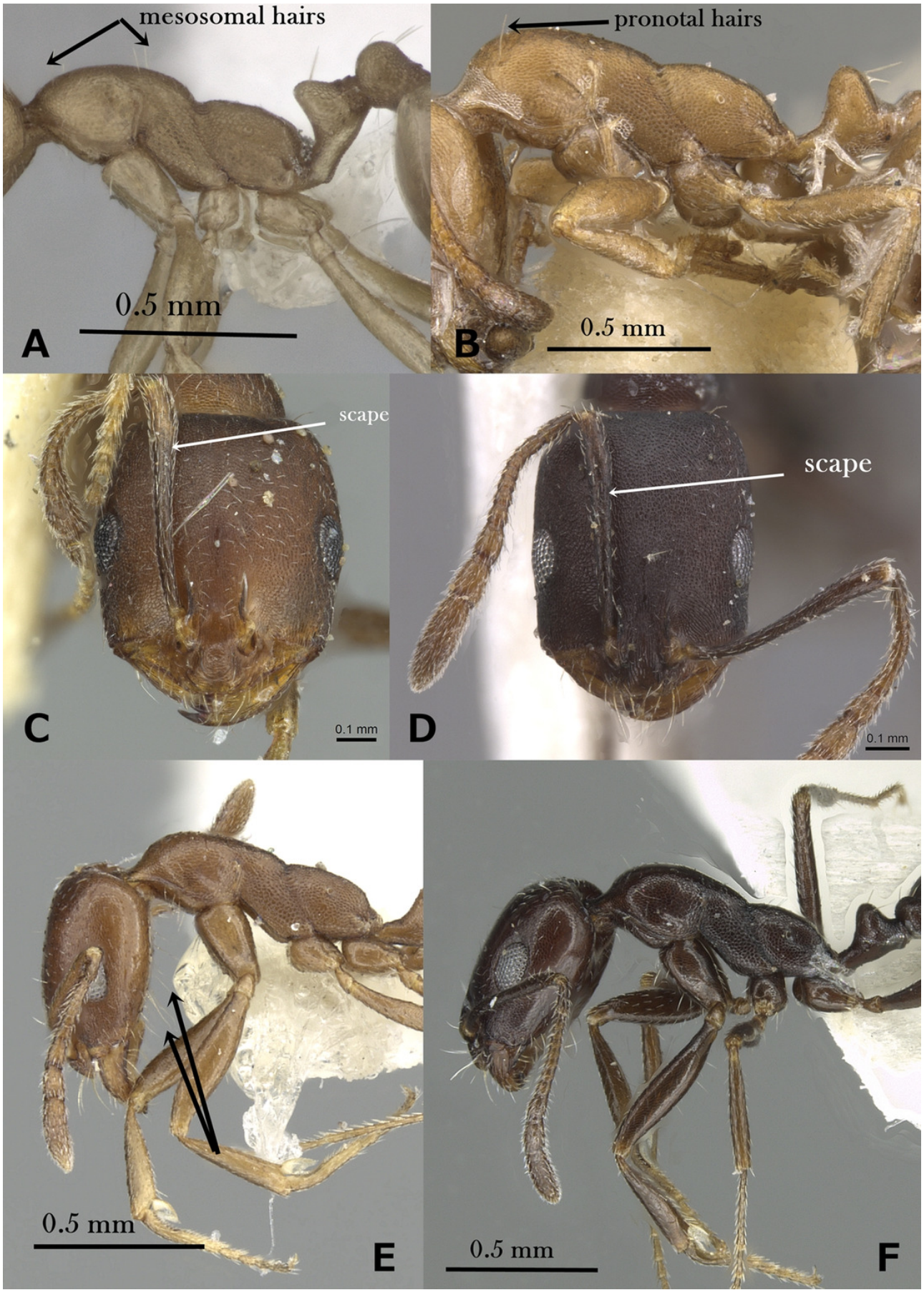
mesosomal hairs
0.5 mm
A
pronotal hairs
0.5 mm
B
scape
0.1 mm
C
scape
0.1 mm
D
0.5 mm
E
0.5 mm
F

Figure 9

A: head of *M. gallagheri* in full-face view, CASENT0913582 (Zach Lieberman); B: head of *M. buxtoni* in full-face view, CASENT0902220 (Zach Lieberman); C: body of *M. abeillei* in profile, CASENT0915411 (Will Ericson); D: body of [i]M. asirie

Key illustrations

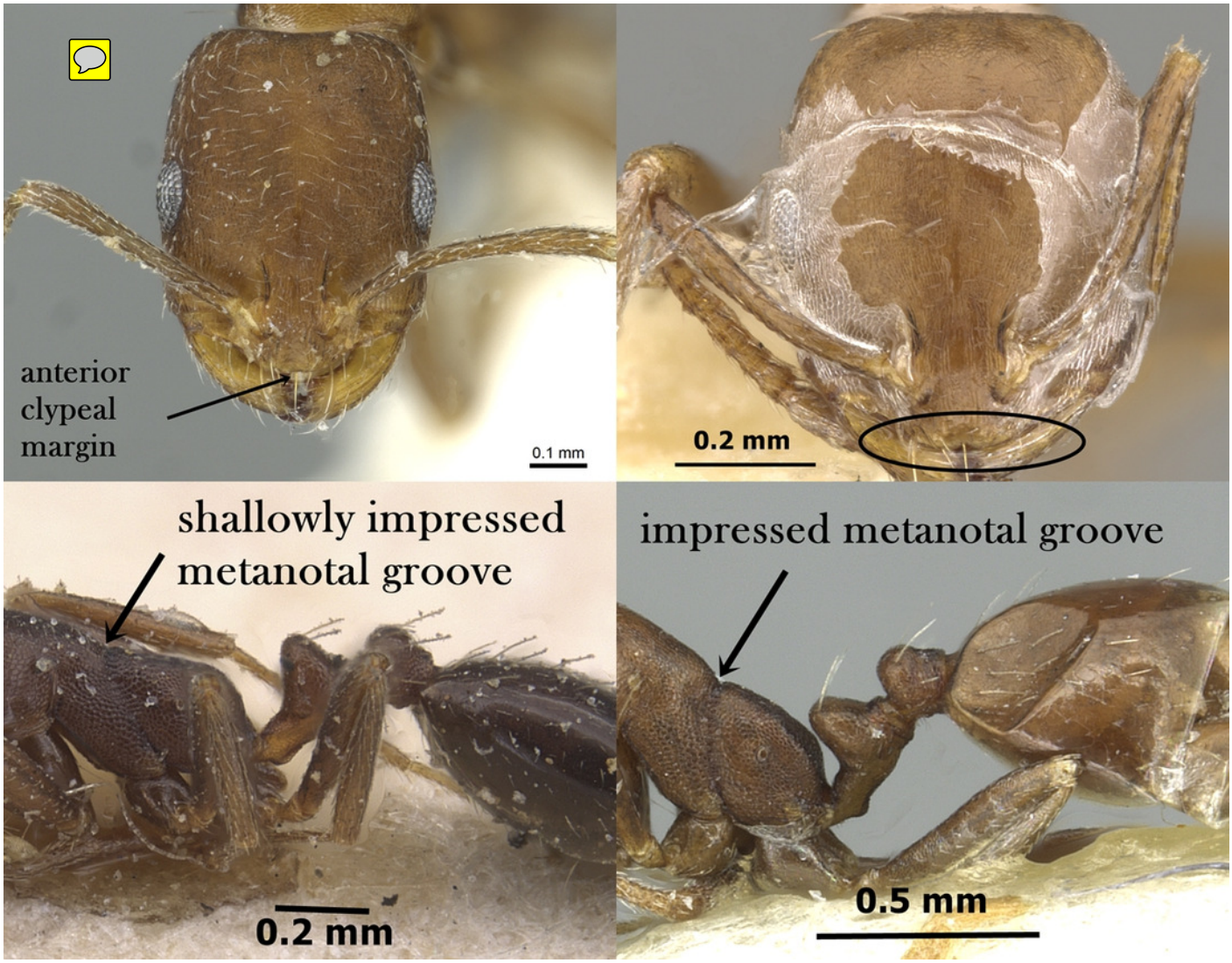

Figure 10

M. abeillei, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0915411 (Will Ericson), www.AntWeb.org . Figure 11. *M. areniphilum*, A: body in profile; B: body in dorsal view); C: head in full-face view,

Monomorium abeillei

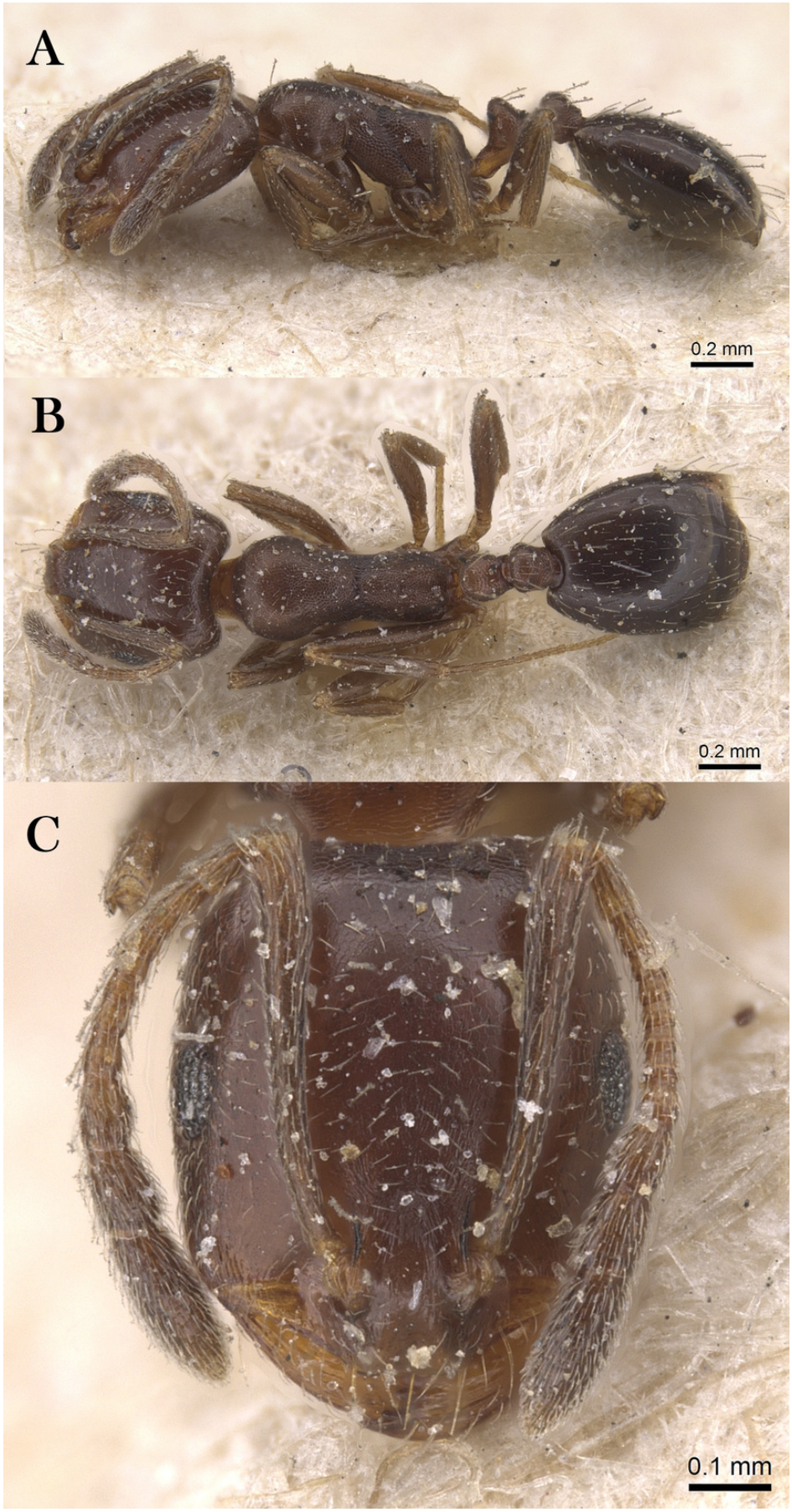
A
0.2 mm
B
0.2 mm
C
0.1 mm

Figure 11

Figure 11. *M. areniphilum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0048600 (Michele Esposito), www.AntWeb.org .

Figure 11. *M. areniphilum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0048600 (Michele Esposito), www.AntWeb.org .

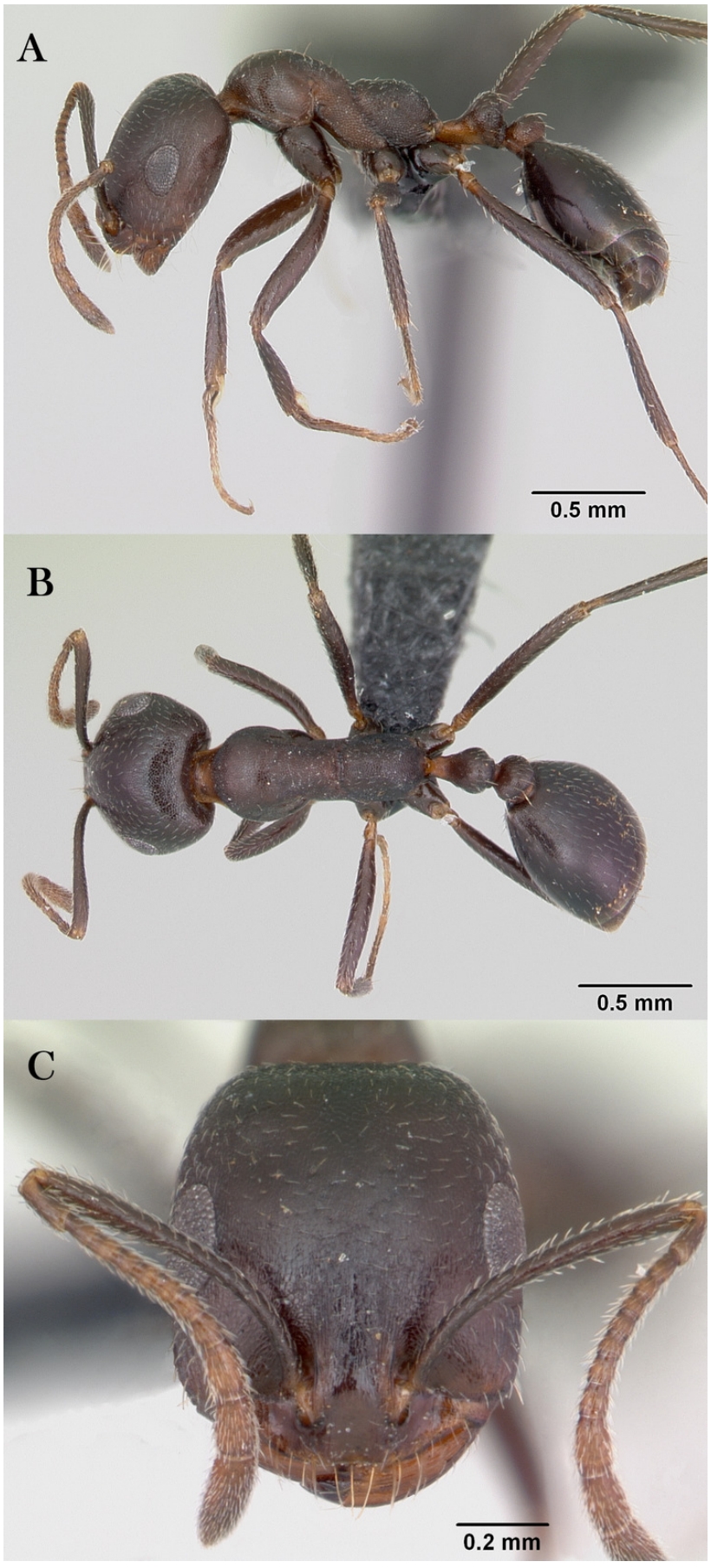
A
0.5 mm
B
0.5 mm
C
0.2 mm

Figure 12

Figure 12. *M. barbatulum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922263 (Michele Esposito), www.AntWeb.org .

Figure 12. *M. barbatulum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922263 (Michele Esposito), www.AntWeb.org .

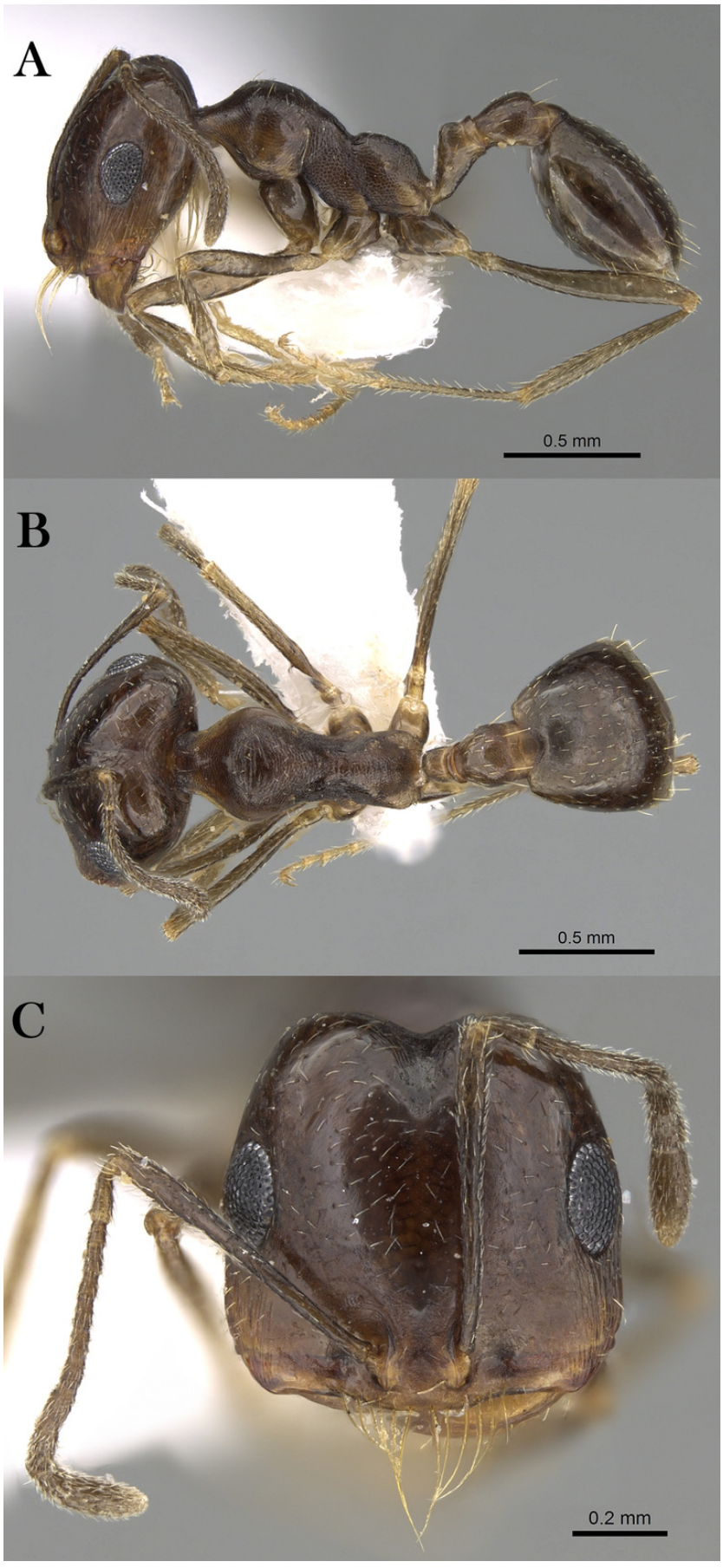
A
0.5 mm
B
0.5 mm
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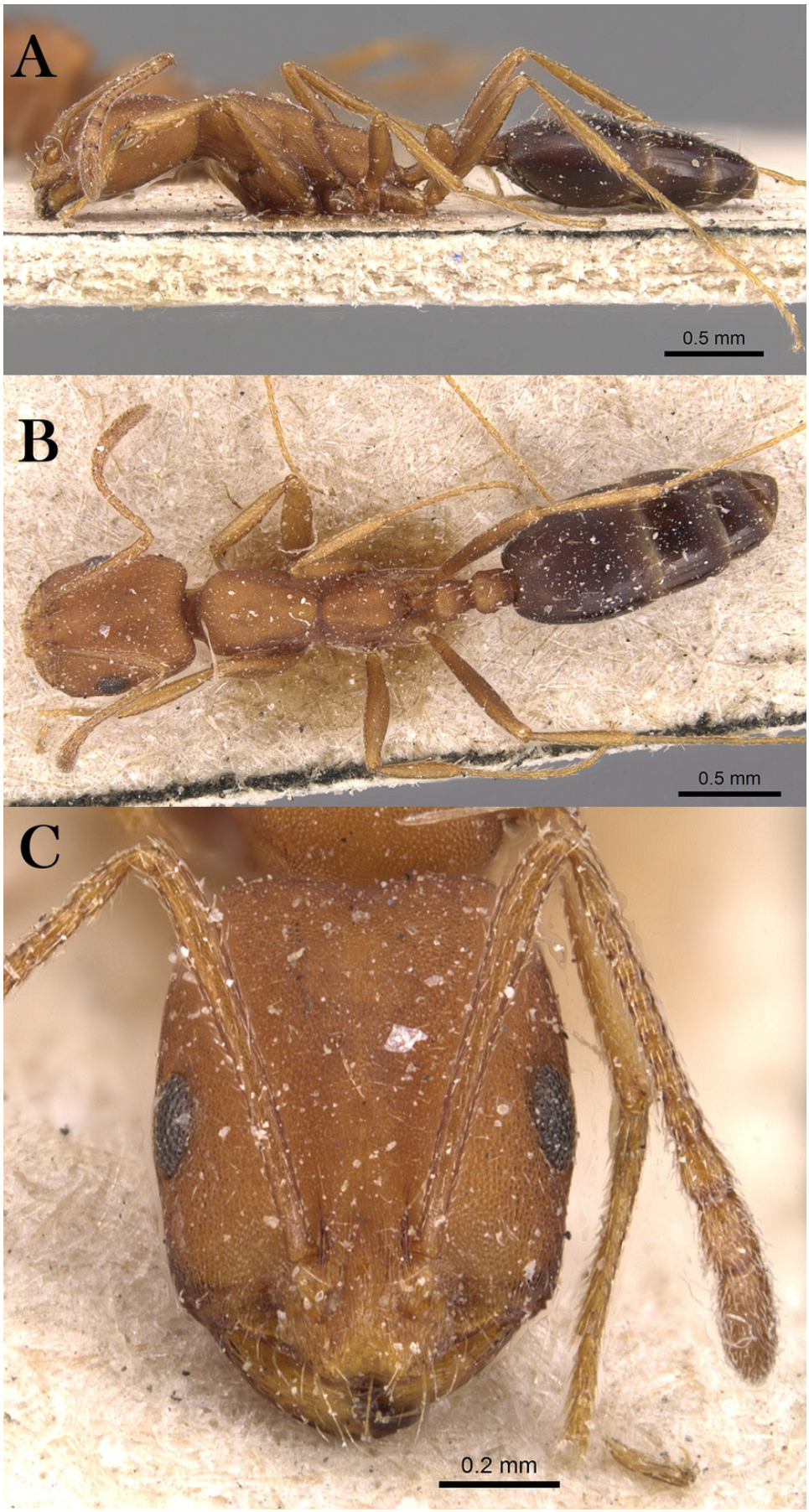
Figure 13

Figure 13. *M. bicolor*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0904601 (Will Ericson), www.AntWeb.org .

Figure 13. *M. bicolor*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0904601 (Will Ericson), www.AntWeb.org .


A
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B
0.5 mm
C
0.2 mm

Figure 14

Figure 14. *M. floricola*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922876 (Michele Esposito), www.AntWeb.org .

Figure 14. *M. floricola*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922876 (Michele Esposito), www.AntWeb.org .

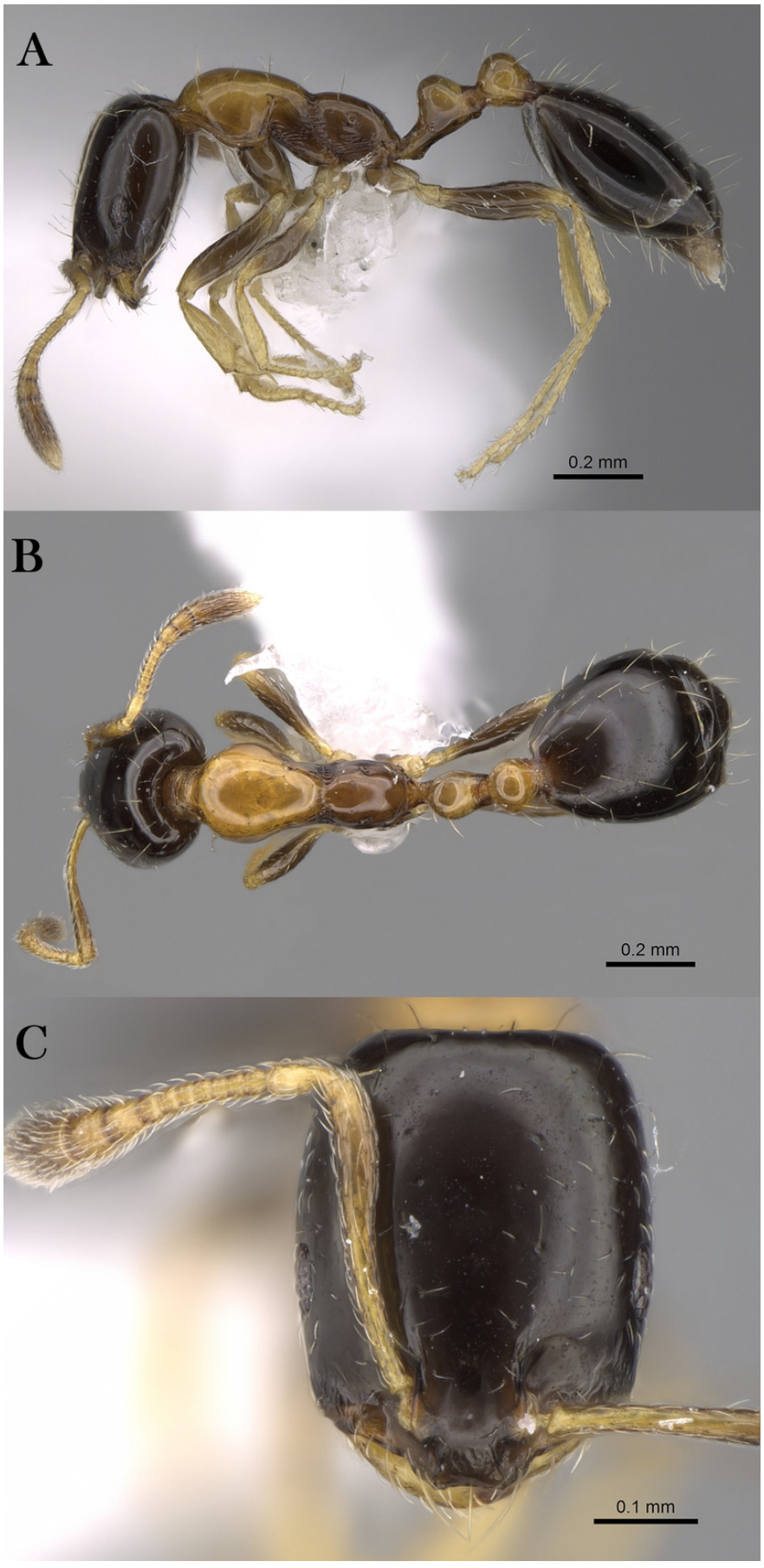

A
0.2 mm
B
0.2 mm
C
0.1 mm

Figure 15

Figure 15. *M. harithe*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0913802 (Will Ericson), www.AntWeb.org .

Figure 15. *M. harithe*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0913802 (Will Ericson), www.AntWeb.org .

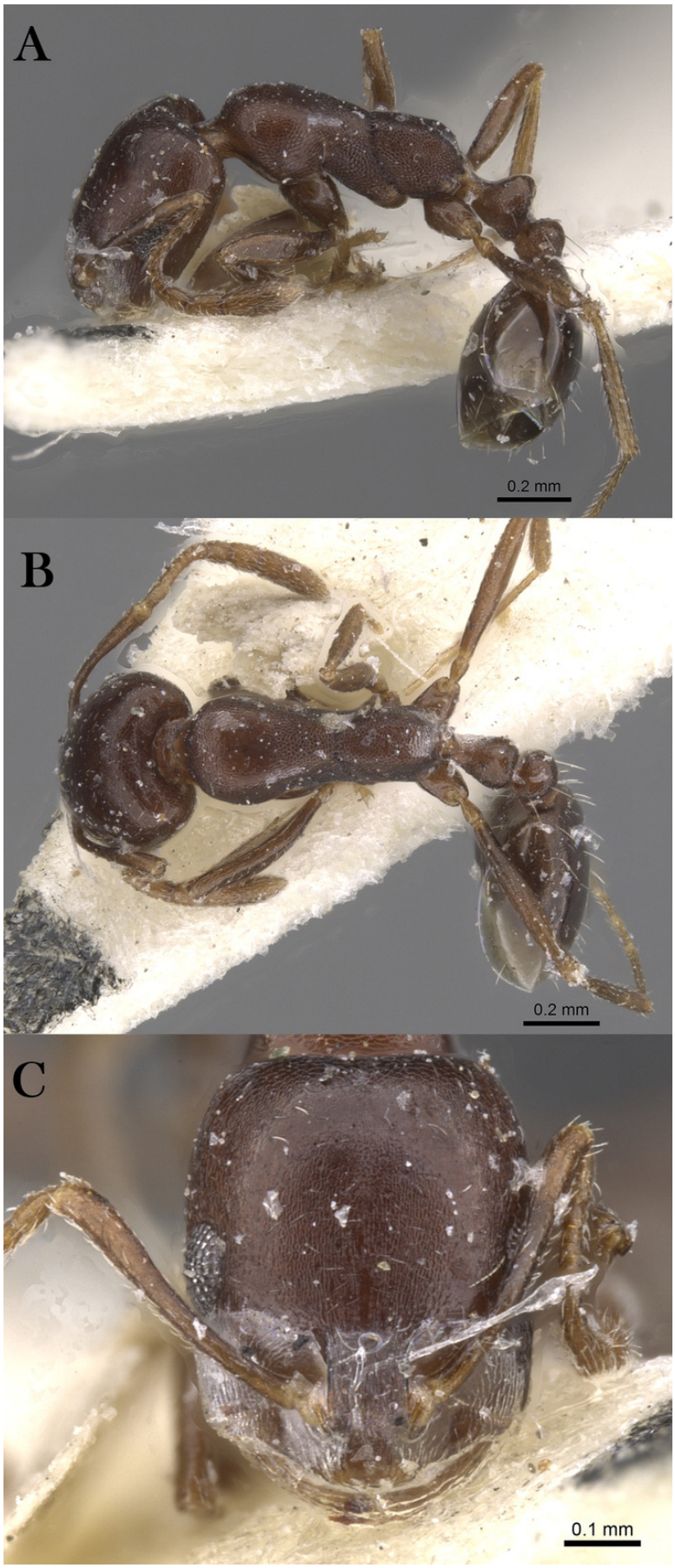

A
0.2 mm
B
0.2 mm
C
0.1 mm

Figure 16

Figure 16. *M. heggyi* sp. n., A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0746641 (Zach Lieberman), www.AntWeb.org .

Figure 16. *M. heggyi* sp. n., A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0746641 (Zach Lieberman), www.AntWeb.org .

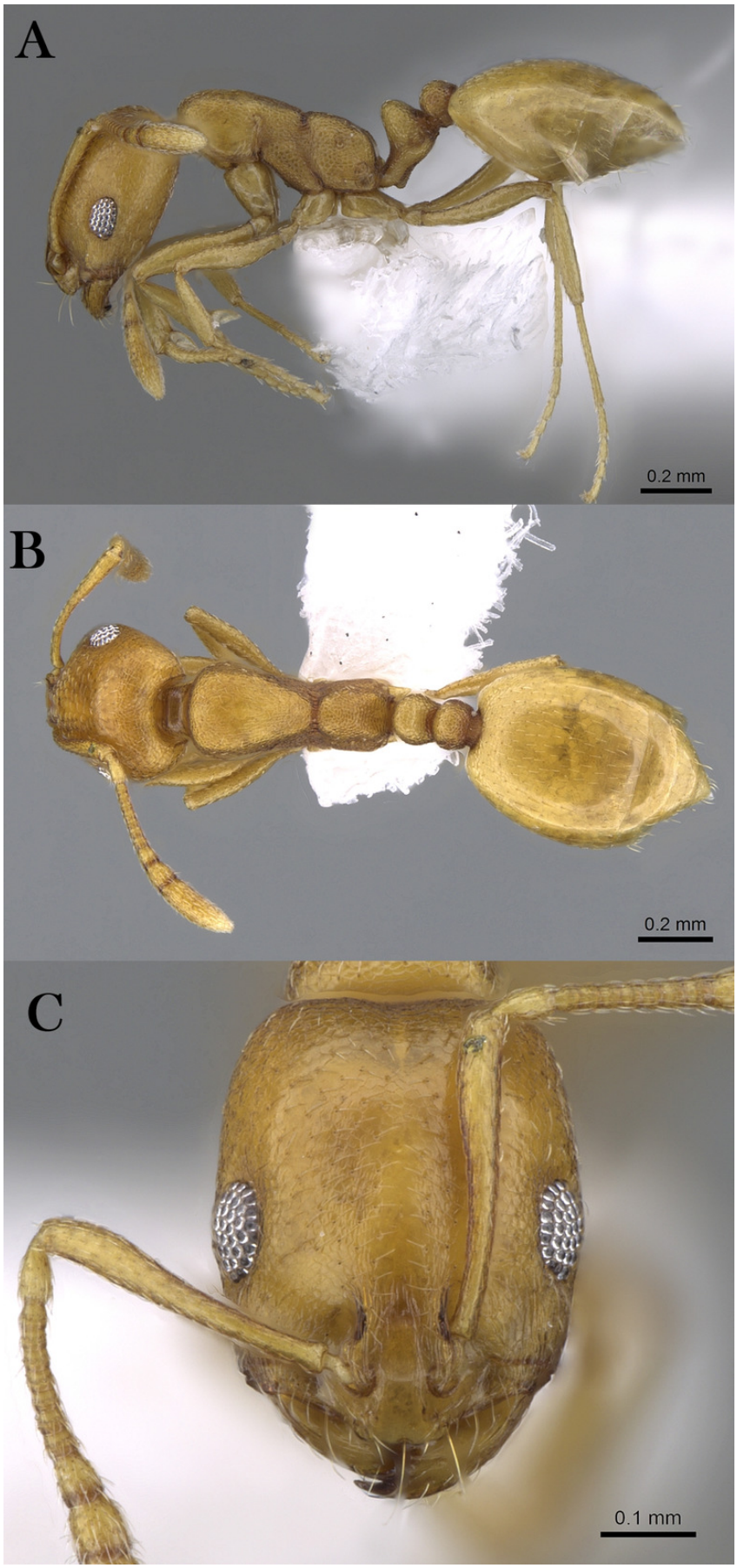

A
0.2 mm
B
0.2 mm
C
0.1 mm

Figure 17

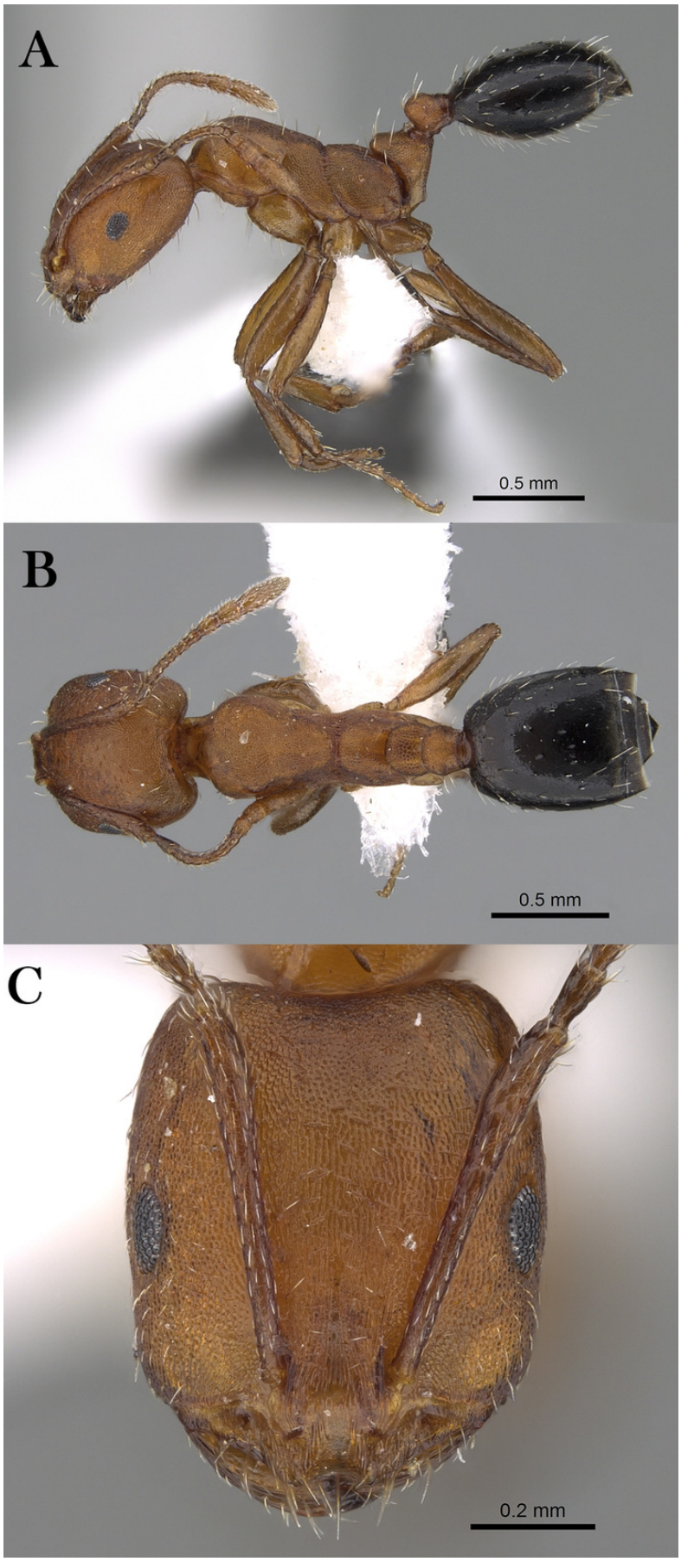
Figure 17. Shada Al A'la, the type locality of *M. heggyi* sp. n. (A. Shams Al Ola).

Figure 17. Shada Al A'la, the type locality of *M. heggyi* **sp. n.** (A. Shams Al Ola).

Figure 18

Figure 18. *M. khalidi* sp. n., A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922288 (Michele Esposito), www.AntWeb.org .

Figure 18. *M. khalidi* **sp. n.**, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0922288 (Michele Esposito), www.AntWeb.org .


A
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B
0.5 mm
C
0.2 mm

Figure 19

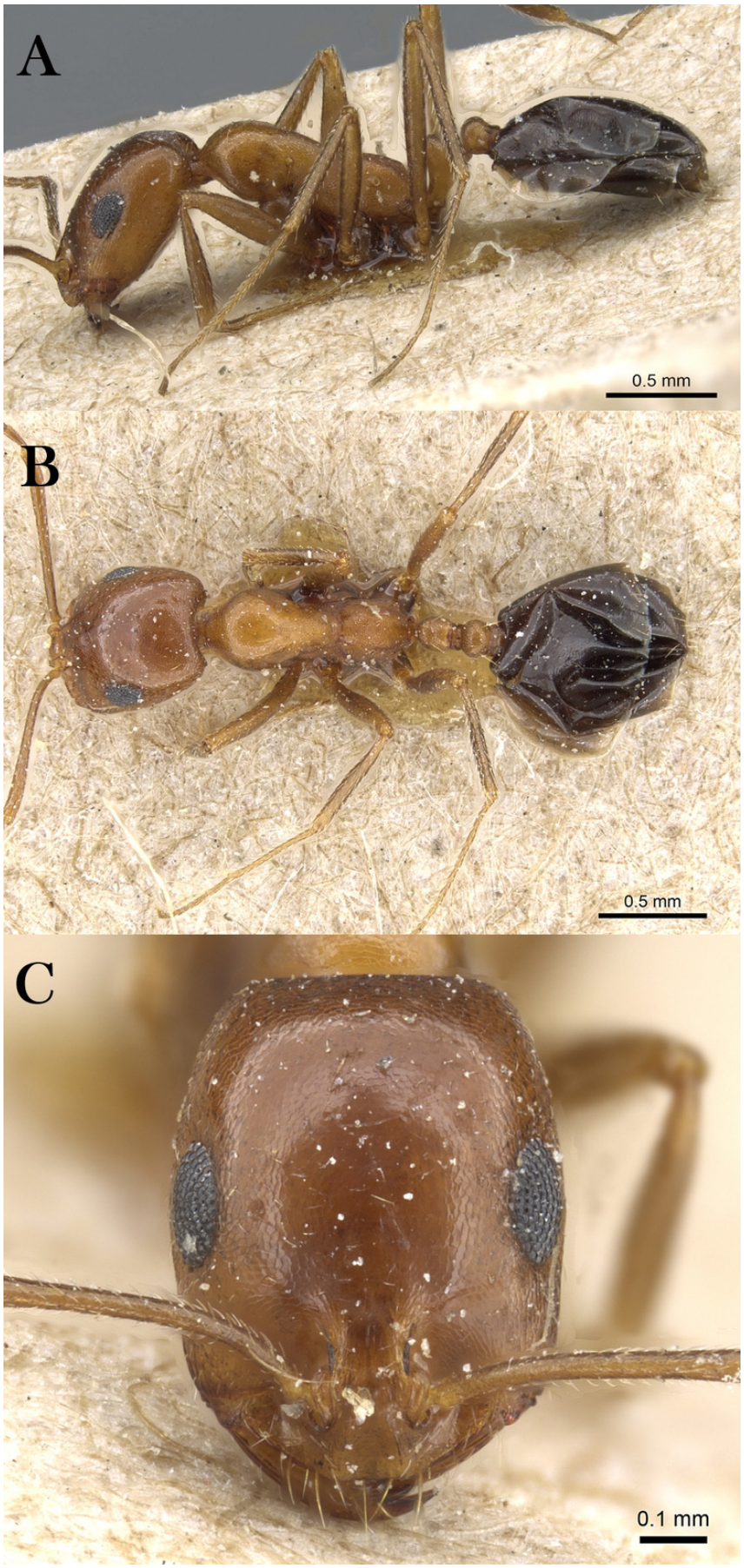
Figure 19. Shada Al A'la, the type locality of *M. khalidi* sp. n. (A. Shams Al Ola).

Figure 19. Shada Al A'la, the type locality of *M. khalidi* **sp. n.** (A. Shams Al Ola).

Figure 20

Figure 20. *M. niloticum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0905755 (Will Ericson), www.AntWeb.org .

Figure 20. *M. niloticum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0905755 (Will Ericson), www.AntWeb.org .


A
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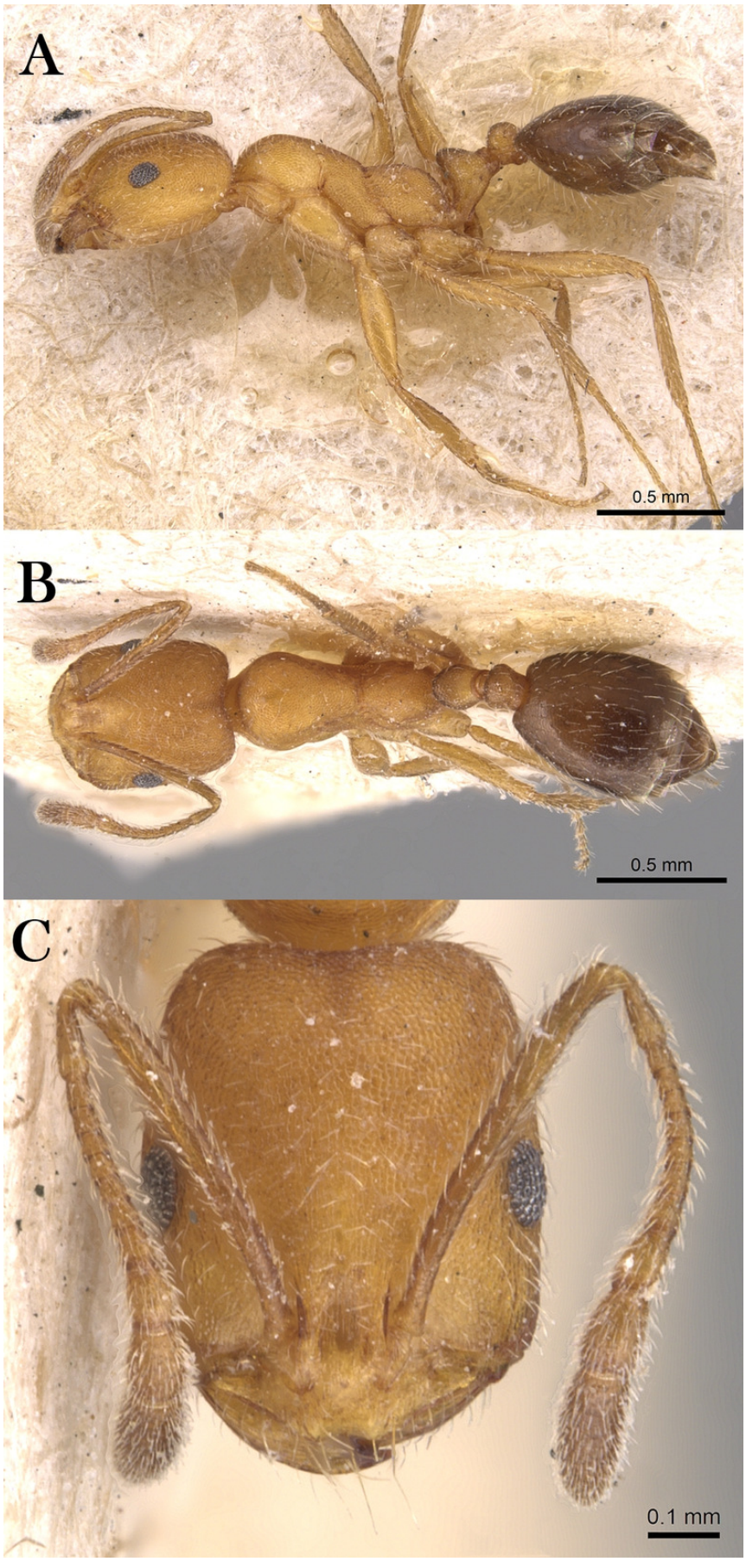
B
0.5 mm
C
0.1 mm

Figure 21

Figure 21. *M. nitidiventre*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0904602 (Will Ericson), www.AntWeb.org .

Figure 21. *M. nitidiventre*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0904602 (Will Ericson), www.AntWeb.org .


A
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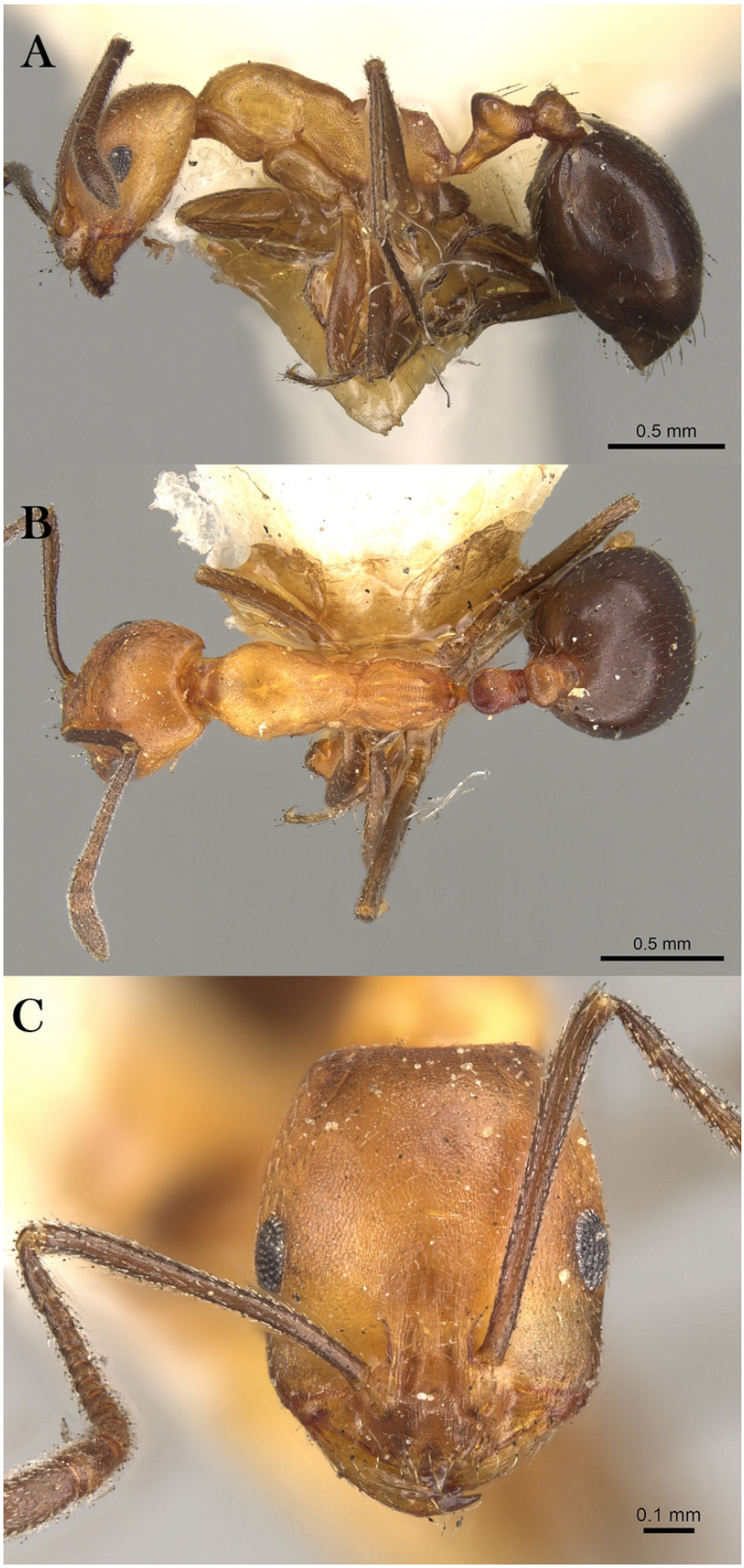
B
0.5 mm
C
0.1 mm

Figure 22

Figure 22. *M. subdenticorne,* A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0914318 (Zach Lieberman), www.AntWeb.org .

Figure 22. *M. subdenticorne,* A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0914318 (Zach Lieberman), www.AntWeb.org .


A
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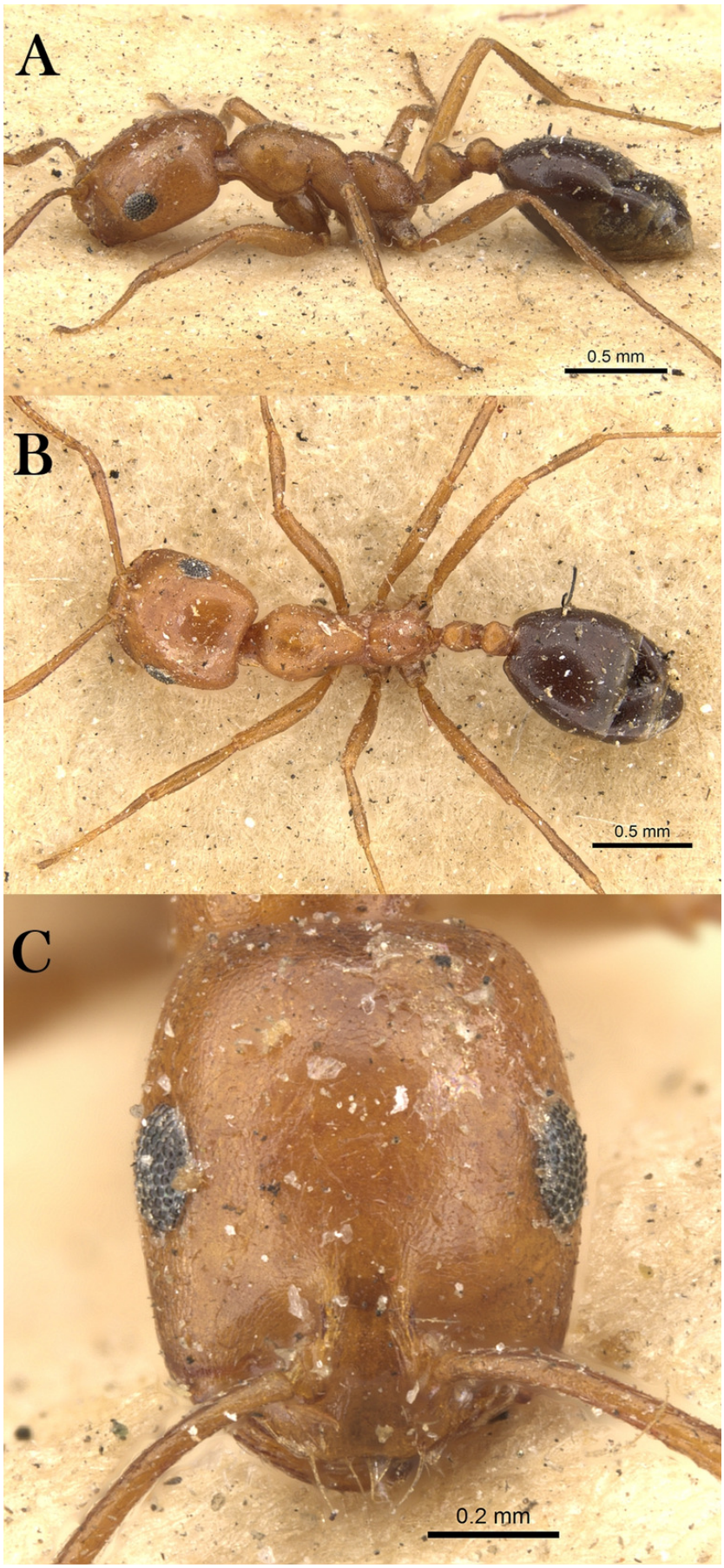
B
0.5 mm
C
0.1 mm

Figure 23

Figure 23. A: *M. venustum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0902221 (Will Ericson), www.AntWeb.org .

Figure 23. A: *M. venustum*, A: body in profile; B: body in dorsal view); C: head in full-face view, CASENT0902221 (Will Ericson), www.AntWeb.org .


A
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B
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C
0.2 mm

Figure 24

Figure 24. Distribution map of *M. abeillei*.

Figure 24. Distribution map of *M. abeillei*.

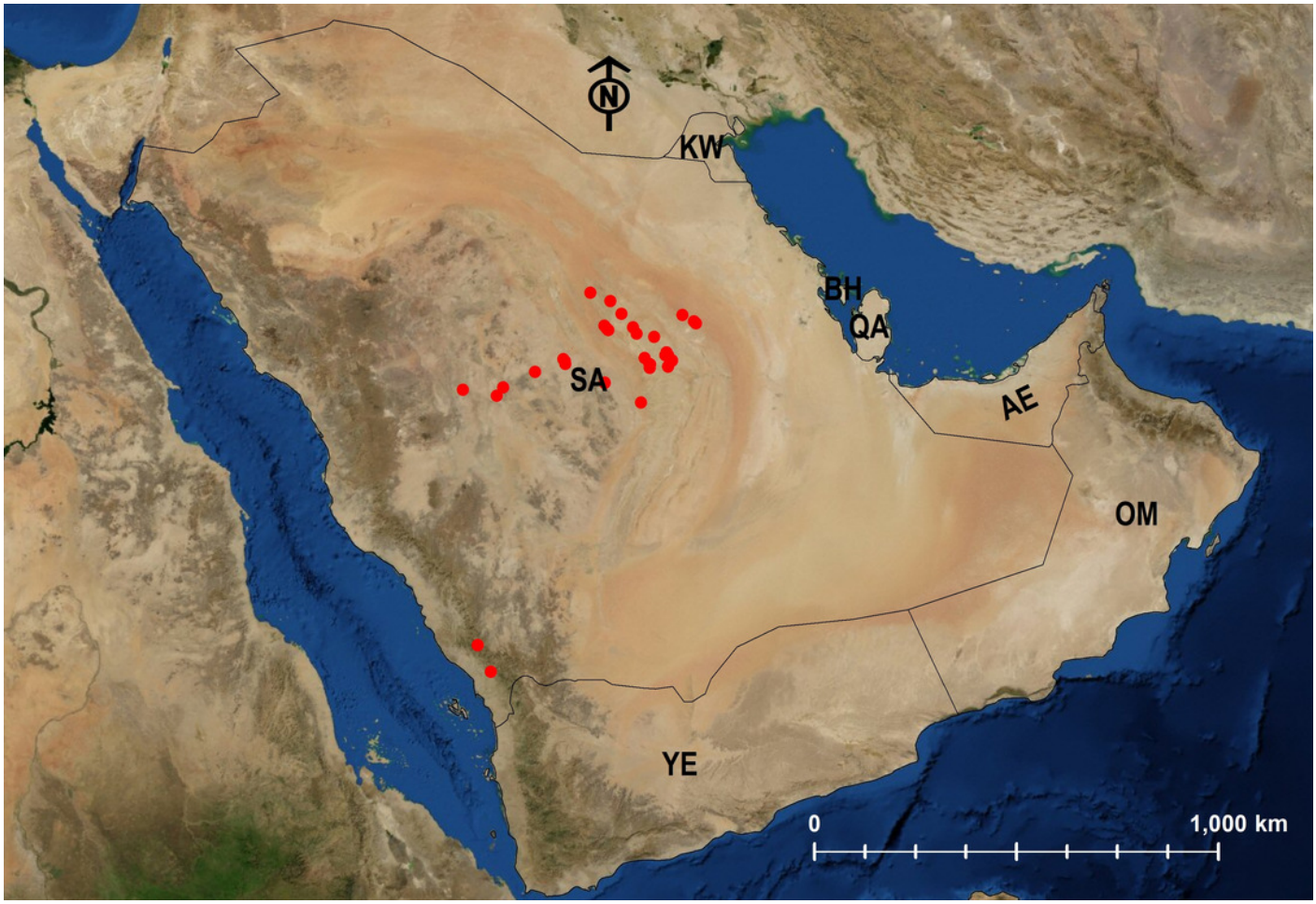

Figure 25

Figure 25. Distribution map of *M. niloticum*.

Figure 25. Distribution map of *M. niloticum*.

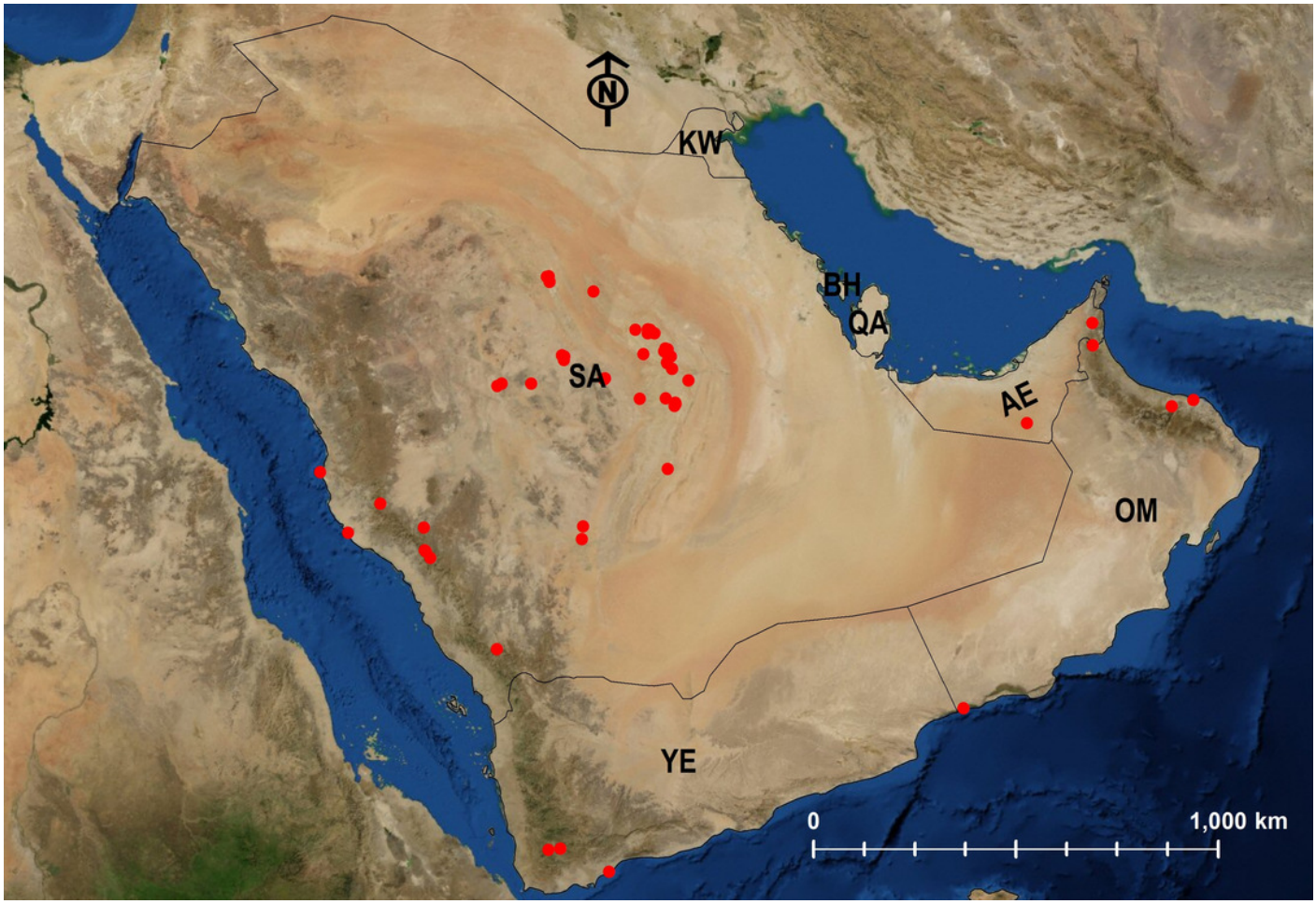

Figure 26

Figure 26. Distribution map of *M. venustum*.

Figure 26. Distribution map of *M. venustum*.

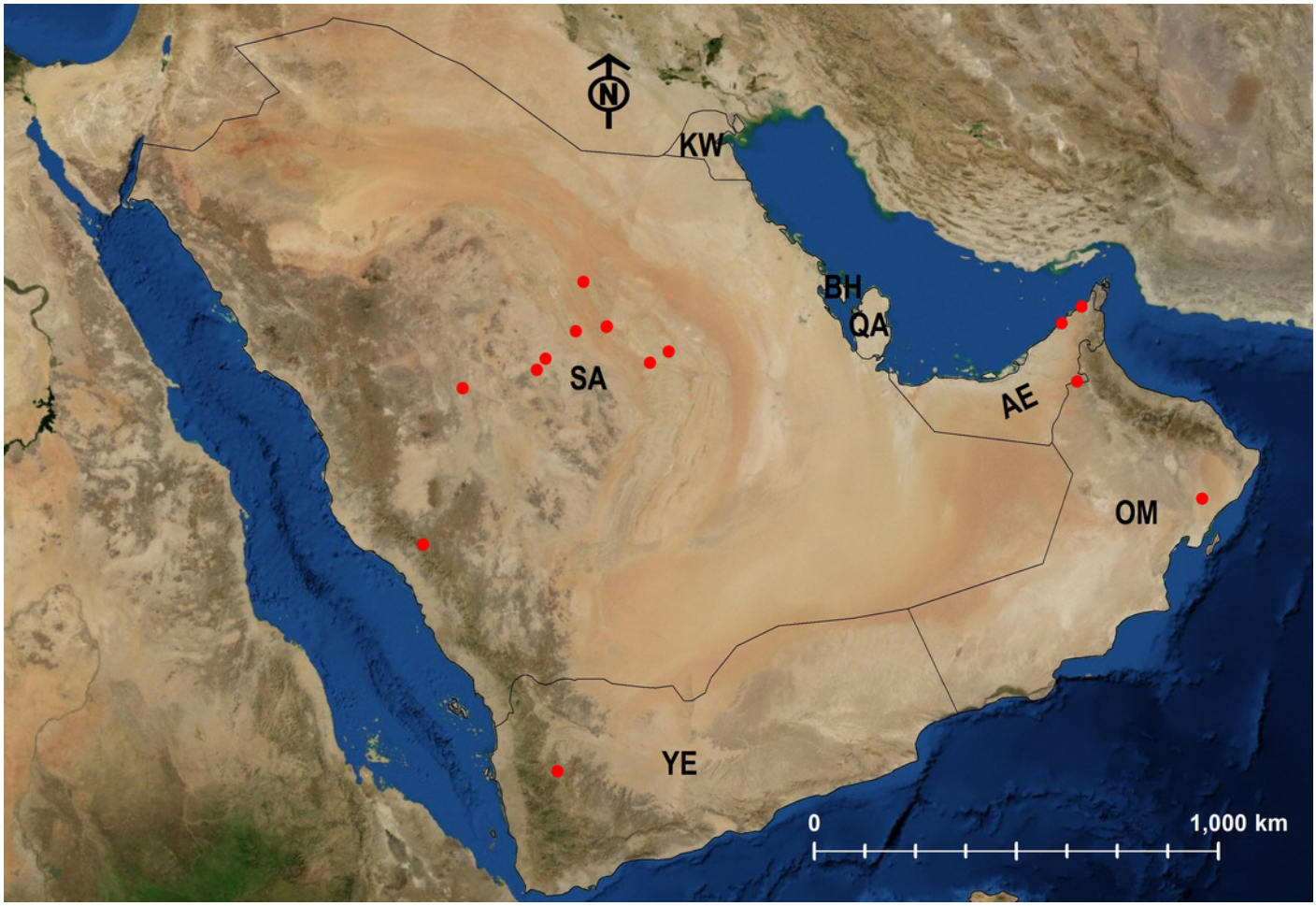

Figure 27

Figure 27. Distribution map of *M. barbatulum*, *M. bicolor*, *M. floricola*.

Figure 27. Distribution map of *M. barbatulum*, *M. bicolor*, *M. floricola*.

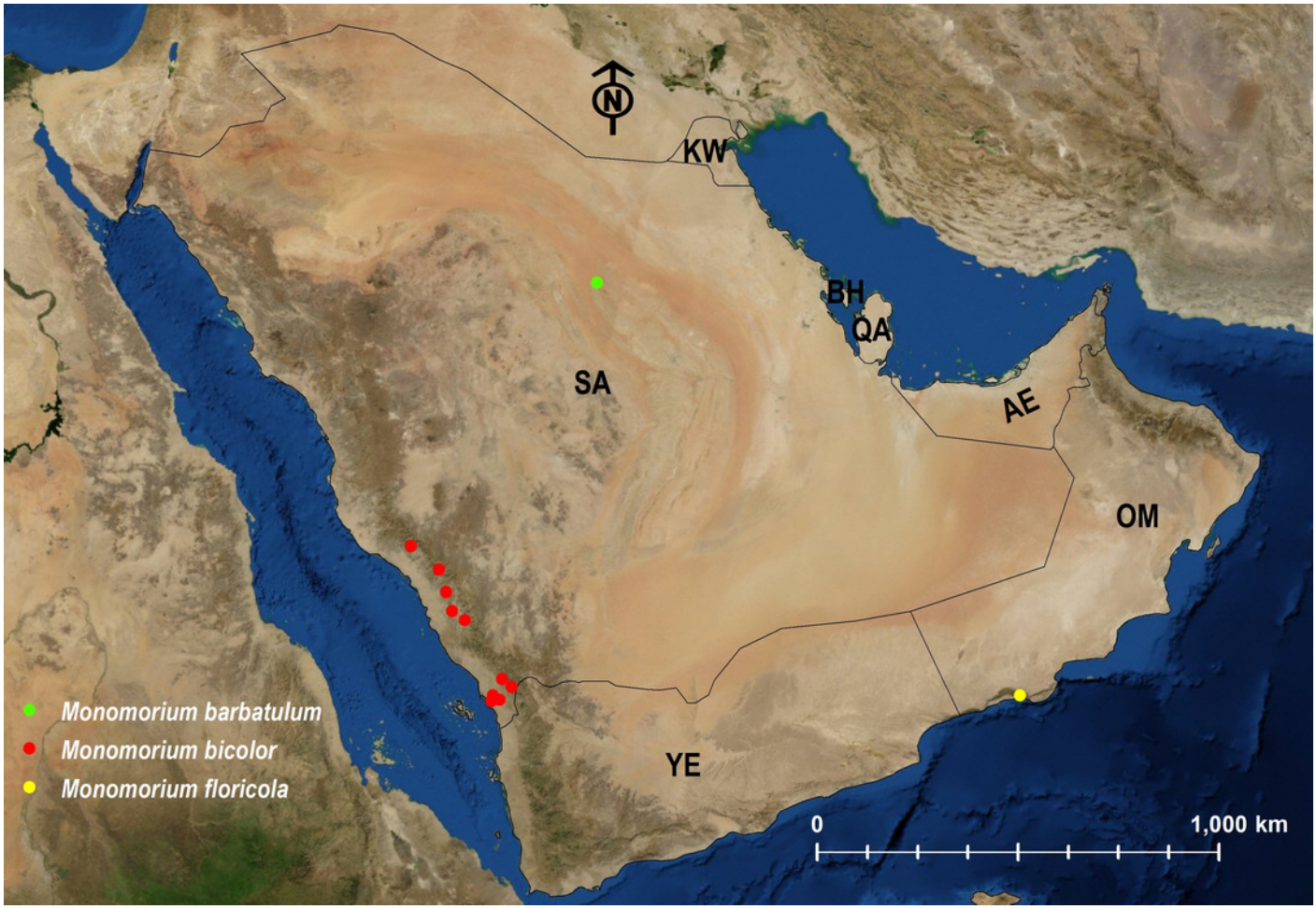

Figure 28

Figure 28. Distribution map of *M. harithe*, *M. khalidi* sp. n., *M. nitidiventre*, *M. heggyi* sp. n.

Figure 28. Distribution map of *M. harithe*, *M. khalidi* **sp. n.**, *M. nitidiventre*, *M. heggyi* **sp. n.**

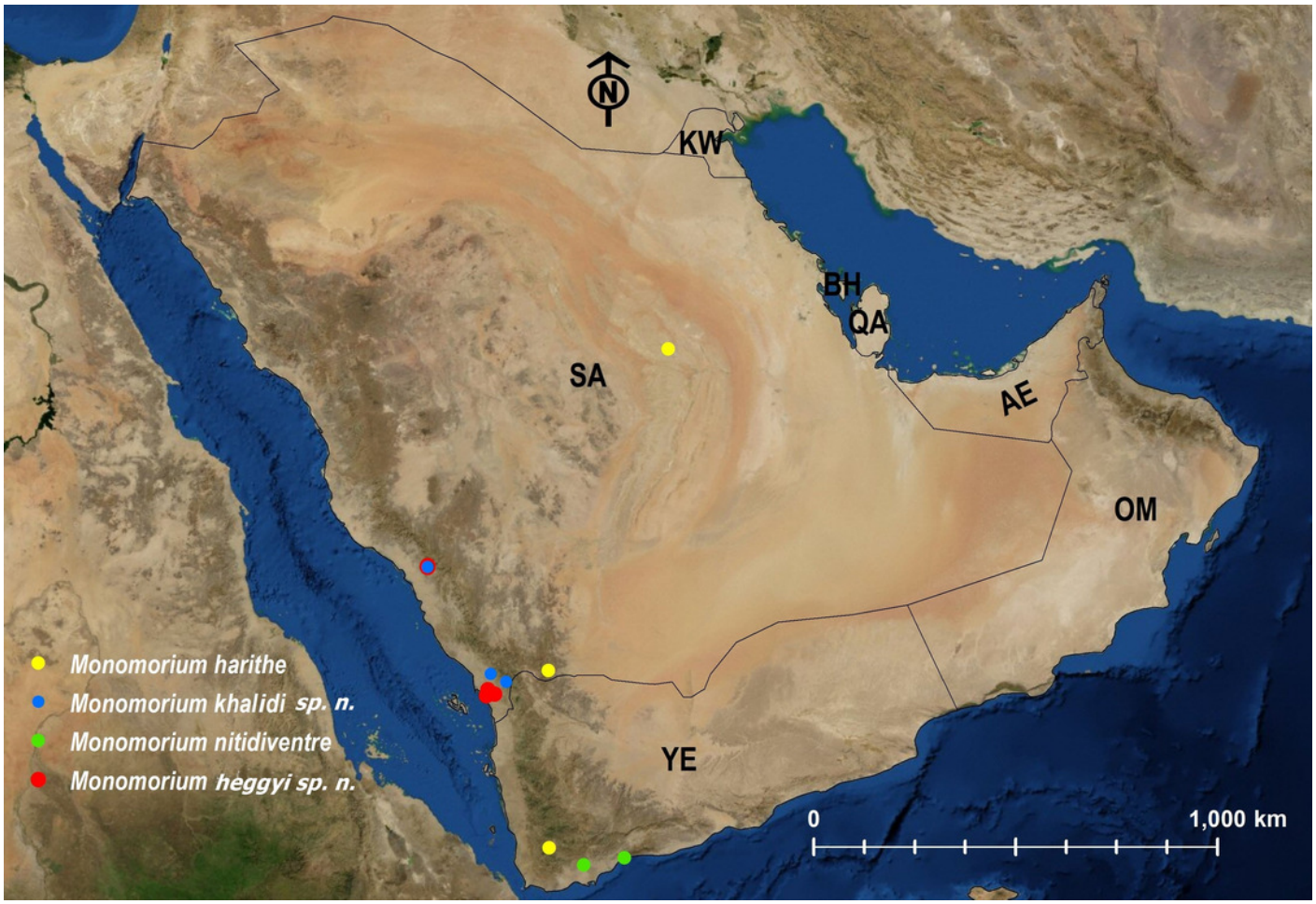

Figure 29

Figure 29. Distribution map of *M. subdenticorne*.

Figure 29. Distribution map of *M. subdenticorne*.