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The ants (Insecta: Hymenoptera: Formicidae) of the Socotra Archipelago

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Abstract: The ant species recorded from Socotra Island and the outlying islands of Samha, Darsa and Abd al-Kuri are listed and a key to the workers is presented. Scanning electron micrographs are provided to facilitate identification. Only 18 species have been identified, one of which – *Monomorium nimihil* Collingwood, 2003 n. sp. – is described as new. At least eight of these species, but probably more, have been transferred to the islands by human commerce. There is little evidence that ecosystems have been strongly influenced by alien ants up to now. Those ants most feared globally for their invasive potential and destructive impact on native fauna are yet absent from Socotra. To preserve this situation, diligent quarantine measures are of great importance.

نمل أرخبيل سقطرى

(الحشرات Insecta : غشائية الأجنحة Hymenoptera : النمليات Formicidae)

سيدريك كولينجود و هانز بول و روبرت غستن و فولفغانغ فرانك و أنطونيوس فان هارتن

خلاصة: تم إدراج أنواع النمل المسجلة في سقطرى وجزر سمحا ودرسا وعبد الكوري. وتضمن البحث مفتاحاً تصنيفياً للعاملات. كما تضمن البحث صوراً أخذت بالمجهر الإلكتروني الماسح لتسهيل تصنيف الأنواع. وقد أمكن التعرف على ستة عشر نوعاً فقط، منها النوع *Monomorium nimihil*، الذي وصف كنوع جديد. انتقلت ثمانية أنواع من النمل على الأقل، وقد يكون العدد أكثر من ذلك إلى الجزر عن طريق ا لتجارة، وهناك دليل ضئيل حتى الآن يفيد بأن النظم البيئية قد تأثرت بشكل كبير نتيجة للنمل الوافد. ولا يوجد في سقطرى أنواع من النمل الذي يخشى عالمياً من قدرته على غزو بيئات جديدة ومن تأثيره المدمر على المجموعات الحيوانية المحلية، ومن أجل المحافظة على الوضع الراهن، فإن إجراءات الحجر الجادة مهمة جداً.

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INTRODUCTION

The only early record of ants from the Socotra Archipelago was that of *Camponotus maculatus* (Fabricius, 1782) collected by the 1898/1899 expedition of the Vienna museum (KOHL 1907). Although those specimens have not been studied by us, our current knowledge now indicates that this record should rather refer to *C. hova* Forel, 1891. COLLINGWOOD (1985) reported five species: *Pachycondyla sennaarensis* (Mayr, 1862), *Pheidole lamellinoda* Forel, 1902, *Lepisiota spinisquama* (Kuznetsov-Ugamsky, 1929), *Camponotus acvapimensis* Mayr, 1862 and *C. hova*, all collected by K.M. Guichard during the Middle East Command Expedition in 1967 (see DOE 1992: 181 ff.). In a guidebook to the ants of Yemen, COLLINGWOOD & VAN HARTEN (1994) listed ten species from Socotra without indicating localities and collection data. COLLINGWOOD & AGOSTI (1996) cited records for two species, *C. hova* and *L. spinisquama*, provided by A. van Harten in 1993.

During the last years, some faunistic collecting activities have taken place and even though it now is quite clear that the archipelago is poor in ant species, we present here a species synopsis reflecting present knowledge, also including all previous records. In total, 18 species are identified, one of them new to science. A few additional species appear to be present among the available collections. All but one of these are represented only by few sexuals which do not suffice for positive determination.

While it has turned out that ants are not nearly as numerous on Socotra and its outlying islands as in comparable habitats in the African tropics and the Arabian Peninsula, they still occur in all major terrestrial habitats on the island. Probably the majority of species has been transported to the islands by man, and their monitoring is of importance, as they may exert a negative impact on the native fauna. Also, like other non-native arthropods, they may be household pests and can cause economic damage.

With so few species present, identification is comparatively easy and will be possible for non-specialists in most cases. For these reasons, we present a key to the recorded species which we hope will be easy to use, as it is based on simple, readily observed morphological characters. In conjunction with the SEM images showing the general habitus of the species in question (Figs 2-16, 19-21), local operatives in biodiversity research and nature conservation will be able to identify ants on Socotra.

Nonetheless, some native species may remain to be discovered, and unfortunately there is a high probability that further alien species will be transferred to the islands by ever-increasing travel and commerce. Thus it is highly recommended that specimens suspected to pertain to yet unrecorded species are submitted to an eminent specialist in ant taxonomy.

MATERIALS AND METHODS

The specimens dealt with here were collected during several visits by three of us (H. Pohl, W. Wranik and A. van Harten) to the Socotra Archipelago between 1993 and 2000. Also included in the paper are the samples procured by K.M. Guichard in 1967. Collections were made during general investigations of the evertebrate fauna using various methods, including pitfall and light traps.

The specimens are deposited at the Hessisches Landesmuseum Darmstadt, the Naturhistorisches Museum Basel, the Staatliches Museum für Naturkunde Görlitz, the Faculty of Forestry of the Czech University of Agriculture and the collections of C.A. Collingwood and W. Wranik.

Half of the specimens originating from the project "Conservation and Sustainable Use of Biodiversity of Socotra Archipelago" are reserved for the National History Collection of Yemen, to be established.

For scanning electron microscopy (SEM), specimens were fixed in 70 % ethanol, dehydrated in ethanol of increasing concentration, critical-point dried, sputter-coated with gold, and examined using a Zeiss DSM 960 A scanning electron microscope. Some measurements and indices customary in ant taxonomy are used in the key and descriptions.

Abbreviations:

BMNH	The Natural History Museum, London, UK
CCC	Collection C.A. Collingwood
FCUA	Faculty of Forestry, Czech University of Agriculture, Praha, Czech Republic
HLMD	Hessisches Landesmuseum Darmstadt, Germany
NHCY	Natural History Collection Yemen
NHMB	Naturhistorisches Museum Basel, Switzerland
SMNG	Staatliches Museum für Naturkunde Görlitz, Germany
CWWR	Collection W. Wranik, Universität Rostock, Germany

Measurements:

AL	Alitrunk length
HL	Head length excluding mandibles, measured from midpoint of line between occipital corners, if these are projecting
HW	Head width behind eyes
PSL	Length of propodeal spines in dorsal view, measured from tip to a line perpendicular to the spine axis and touching the propodeum at midpoint between spines, see SEIFERT (2003)
PW	Petiolus width
SL	Scape length excluding basal neck

Indices:

CI	Cephalic index: HW × 100 divided by HL
SI	Scape index: SL × 100 divided by HW

Key to species (workers)

The following key uses a limited number of morphological features, most of them observable at low magnification under a stereo microscope. Consult Fig. 1 for explanation of the respective terms. For definition of terms regarding integument sculpture, refer to HARRIS (1979).

Included in the key are the 18 species positively identified and an additional, yet undetermined species of *Monomorium* for which workers have been available.

1	Body with a single reduced or isolated segment (the petiole) between alitrunk and gaster	2
–	Body with two distinct segments (the petiole and the postpetiole) between alitrunk and gaster	8
2	Gaster with a strong projecting sting	*Pachycondyla sennaarensis* (Fig. 2)
–	Sting absent	3

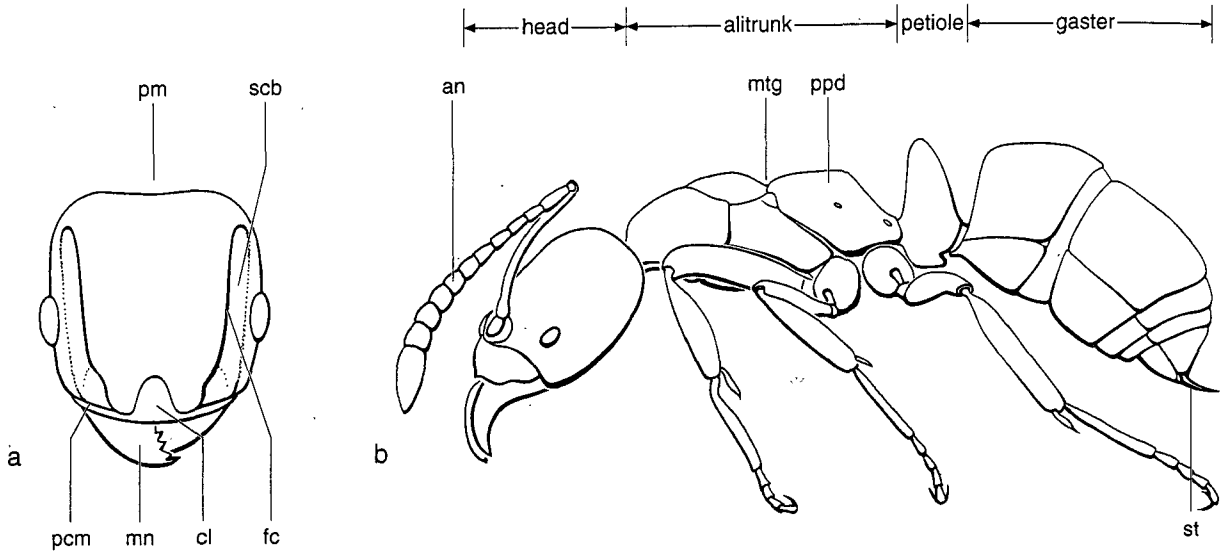


Fig. 1: Illustration of morphological features of ant workers used in the key; sculpture and pilosity omitted. a: head in full-face view, antennae omitted (composite drawing, original); b: whole body in lateral view (*Pachycondyla* sp., modified from BROWN 1958). an = antenna, cl = clypeus, fc = frontal carina, mn = mandible, mtg = metanotal groove, pm = posterior margin of head, pcm = posterior clypeal margin, ppd = propodeum, scb = antennal scrobe, st = sting.

3 Very small (HW < 0.45 mm), whitish base of gaster contrasting with brownish-black body ***Tapinoma melanocephalum*** (Fig. 13)

– Larger (HW > 0.45 mm), body colouration different 4

4 Antennal insertions close to posterior clypeal margin 5

– Antennal insertions distant from posterior clypeal margin (genus *Camponotus*) 6

5 Propodeum with two spines, petiole with two short projections dorsally ***Lepisiota spinisquama*** (Fig. 15)

– Propodeum and petiole unarmed ***Paratrechina longicornis*** (Fig. 14)

6 Body colour dull black, posterior margin of head with several hairs; one size class of workers ***Camponotus acvapimensis*** (Fig. 16)

– Body yellowish or bicoloured, posterior margin of head with two hairs at most; distinctly different small and large workers 7

7 Underside of hind tibiae bordered by at least six spiny hairs (Fig. 18) ***Camponotus hova*** (Figs 18, 21)

– Hind tibiae only with fine subdecumbent hairs (Fig. 17) ***Camponotus atlantis*** (Fig. 17, 19-20)

8 Propodeum simply rounded without a pair of teeth or spines (genus *Monomorium*) 9

– Propodeum often with conspicuous spines, at least with a pair of blunt knobs 13

9 Propodeum dorsally with transversely striate sculpture (may be faint in small specimens), body colour either dark brown, or yellow, contrasting with predominantly dark gaster 10

– Propodeum dorsally with very faint shagreened or punctate sculpture or unsculptured, body uniformly pale yellowish to brownish yellow 11

10 Head and alitrunk yellow, contrasting with predominantly dark gaster ***Monomorium destructor*** (Fig. 10)

– Whole body evenly dark brown ***Monomorium mayri***

11 Small to minute ants (HW < 0.40 mm) with small eyes (diameter less than 0.25 times the HW), petiolar and postpetiolar node not wider than long in dorsal view 12
– Larger ants (HW > 0.50 mm) with comparatively larger eyes (diameter greater than 0.27 times the HW), petiolar and postpetiolar node clearly wider than long in dorsal view *Monomorium nimihil* n. sp. (Fig. 12)
12 Antennae with 11 segments, head ventrally almost flat *Monomorium baushare* (Fig. 11)
– Antennae with 12 segments, head ventrally mildly convex *Monomorium* sp. prope *qarahe*
13 Dimorphic ants – major workers have broad heads and stout mandibles with two apical teeth and one basal tooth, minor workers have narrow heads and mandibles with seven or more evenly spaced teeth (genus *Pheidole*) 14
– Monomorphic ants – mandibles with four or five evenly spaced teeth 15
14 Postpetiolar node distinctly higher than petiolar node, petiole with a ventral translucent projection in major workers, head without any rugulose sculpture in minor workers *Pheidole lamellinoda* (Figs 3-4)
– Postpetiolar node at most as high as petiolar node, petiole without a ventral projection, usually some longitudinal rugae around eye in minor workers *Pheidole teneriffana* (Fig. 5)
15 Body dorsum entirely without erect hairs (genus *Cardiocondyla*) 16
– Body dorsum with several to many erect hairs (genus *Tetramorium*) 17
16 Propodeal spines distinct, acute (ratio of PSL to HL > 0.1) *Cardiocondyla emeryi* (Fig. 6)
– Propodeal spines reduced to blunt denticles (ratio of PSL to HL < 0.08) *Cardiocondyla longiceps*
17 Dorsal outline of alitrunk evenly curved without metanotal groove, whole body covered in long fine acute hairs *Tetramorium lanuginosum* (Fig. 7)
– Alitrunk outline rather flat with shallow metanotal groove, head and alitrunk with scattered short blunt hairs 18
18 Frontal carinae weak, antennal scrobes almost absent *Tetramorium caldarium* (Fig. 9)
– Strong frontal carinae bordering conspicuous antennal scrobes *Tetramorium simillimum* (Fig. 8)

SPECIES ACCOUNTS

Of the workers of most species (both major and minor workers in the case of *Pheidole lamellinoda*, large and small workers for *Camponotus atlantis*), two SEM micrographs are presented (Figs 2-16, 19-21): the head in full-face view and the whole specimen in lateral view, representing the general habitus of the species. *Monomorium mayri* was not considered, as it is distinguished from *M. destructor* solely on colour, while workers of *Cardiocondyla longiceps* are unknown. The specimens depicted on Figs 2-21 all originate from Socotra Island, with the exceptions of *Monomorium destructor* (Abd al-Kuri Island) and – for lack of appropriate specimens – *Cardiocondyla emeryi*, *Tetramorium simillimum* (both Philippines) and *Camponotus atlantis* (United Arab Emirates).

For all species, original descriptions and literature which includes records from the Socotra Archipelago are listed, as are all samples examined for the present study.

Subfamily Ponerinae

Genus *Pachycondyla* Smith, 1858

Pachycondyla sennaarensis (Mayr, 1862) Fig. 2

Ponera sennaarensis Mayr, 1862. — Verh. Zool.-Bot. Ges. Wien 12: 721. (Sudan).

Pachycondyla sennaarensis. — COLLINGWOOD 1985: 254; COLLINGWOOD & VAN HARTEN 1994: 39.

Specimens examined: Yemen, Socotra Island: spms from Adho Dimello, IV.1967, K.M. Guichard, NHMB; spms from Hadibo, 13-14.IV.1993, A. van Harten, CCC; spms from Hadibo, 17.IX.1998, W. Wranik, CWWR; spms from Di Lisheh, 05.X.1998, A. van Harten, CCC; 7 ☿☿, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2063, NHCY; 6 ☿☿, 1 ☿, coast road east of Hadibo, coastal sand dunes, 12°36'N 54°21'E, 04-06.II.1999, H. Pohl, HLMD-Hym-2064, NHCY; 2 ☿☿, Hoq, coast plain near cave, 12°36'N 54°21'E, 50-320 m, 05-06.II.1999, H. Pohl, HLMD-Hym-2065, NHCY ("hosts of Pselaphidae"); 15 ☿☿, Diksam Plateau, 12°32'N 53°59'E, 1020 m, pitfall trap, 22-24.II.1999, H. Pohl, HLMD-Hym-2067, NHCY; spms from Diksam, 22.II.1999, W. Wranik, CWWR; spms from Farmihin, 23.II.1999, W. Wranik, CWWR; spms from Hadibo, 15.II.2000, W. Wranik, CWWR; spms from Nojid, waterfall area, 16.II.2000, W. Wranik, CWWR; 2 ☿☿, Goeeh, 12°32'N 54°10'E, 240 m, 23.X.2000, A. van Harten, HLMD-Hym-2068, NHCY; 7 ☿☿, Dijoub, around cave, 12°23'N 54°01'E, 90 m, 24.X.2000, H. Pohl, HLMD-Hym-2069, NHCY. — Yemen, Samha Island: spms from coastal area, 15.II.1999, W. Wranik, CWWR. — Yemen, Abd al-Kuri Island: spms from coastal plain, 18.II.1999, W. Wranik, CWWR; 15 ☿☿, 1 pupa, west coast, 12°10'N 53°15'E, above 200 m, 18.II.1999, H. Pohl, HLMD-Hym-2066, NHCY.

Remarks: This ponerine ant is widely distributed throughout sub-Saharan Africa, where it inhabits savannas and open forests; it is also the most common member of the subfamily in southern Arabia. While it is regarded as native at least throughout Africa, it is also notably preferring man-impacted habitats, such as human settlements, rubbish dumps and waste ground. Thus it is in question whether the species is indigenous to the Socotra Archipelago. It is a general scavenger but will attack other insects and has a painful sting. Allergic reactions to the sting, sometimes severe, are a problem locally in Arabia (DIB 1992, RIZK et al. 1998), where it is called the "Samsun ant". Probably because of awareness of the painful sting, Socotri people refer to this ant by a specific denomination ("díftim"), as different to the word for ant ("nimihil").

Subfamily Myrmicinae

Genus *Pheidole* Westwood, 1839

Pheidole lamellinoda Forel, 1902 Figs 3-4

Pheidole lamellinoda Forel, 1902. — Rev. Suisse Zool. 10: 166. (India).

Pheidole lamellinoda. — COLLINGWOOD 1985: 254; COLLINGWOOD & VAN HARTEN 1994: 39.

Specimens examined: Yemen, Socotra Island: spms from Adho Dimello, IV.1967, K.M. Guichard, NHMB; spms from Hadibo, 03-06.X.1998, A. van Harten, CCC; spms from Di Lisheh, 05.X.1998, A. van Harten, CCC; 5 major ☿☿, 16 minor ☿☿, 2 pupae, 1 larva, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2070, NHCY.

Remarks: This interesting species was described from the Indian mainland, where records suggest that it is rather local. It has not been found in Arabia and has not been reported as an introduced species elsewhere. The presence of a ventral forward-directed translucent lobe on the petiole of the major workers characterises the species. Minor workers, lacking this character, may be difficult to tell apart from several congeners, including *P. teneriffana* Forel, 1893, which does have a distinctly lower postpetiolar node.

Pheidole teneriffana Forel, 1893 Fig. 5

Pheidole teneriffana Forel, 1893. — Ann. Soc. Entomol. Belg. 37: 465. (Spain: Canary Islands).

Specimens examined: Yemen, Socotra Island: spms from Hadibo, IX.1998, W. Wranik, CWWR; spms from Hadibo, III.1999, W. Wranik, CWWR. — Yemen, Darsa Island: 10.II.2000, W. Wranik, CWWR.

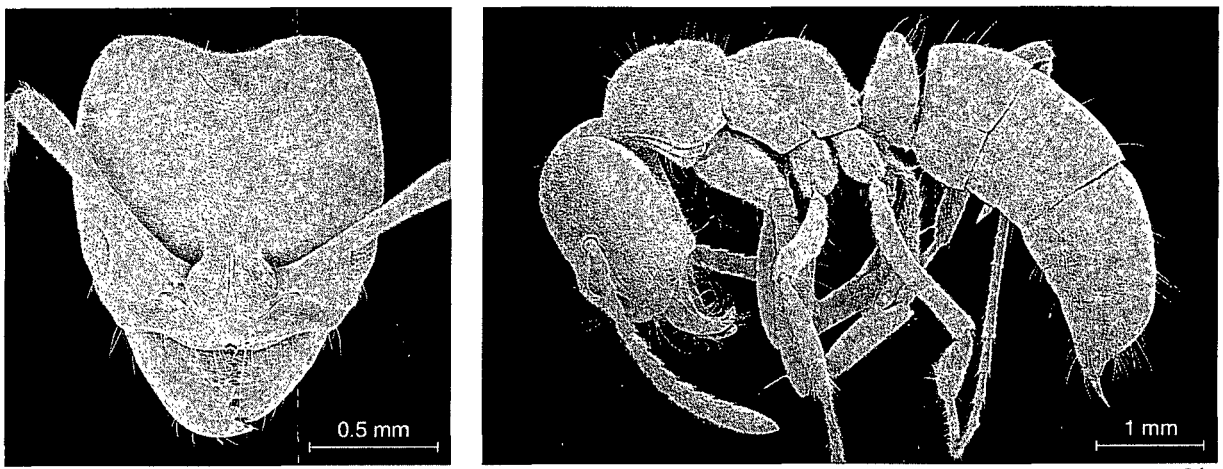


Fig. 2: SEM micrographs of *Pachycondyla sennaarensis* worker. a: head in full-face view; b: overall lateral view. SEM: H. Pohl.

Remarks: This species is probably native throughout northern Africa and appears to be spreading over a wide front in the Middle East, Arabia and the Mediterranean countries. The low and wide angulate postpetiole and the completely striate head in the major worker, with some sculpture present also in most minor workers, are diagnostic characters. In addition to Fig. 5, the detailed drawings by SNELLING (1992) may be studied.

Genus *Cardiocondyla* Emery, 1869

Cardiocondyla emeryi Forel, 1881 Fig. 6

Cardiocondyla emeryi Forel, 1881. — Mitt. Münch. Entomol. Ver. 5: 5. (Puerto Rico: St. Thomas Island).

Cardiocondyla emeryi. — COLLINGWOOD & VAN HARTEN 1994: 39.

Specimens examined: Yemen, Socotra Island: spms from Nojid, 16.IV.1993, A. van Harten, CCC; 2 ☿☿, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2071.

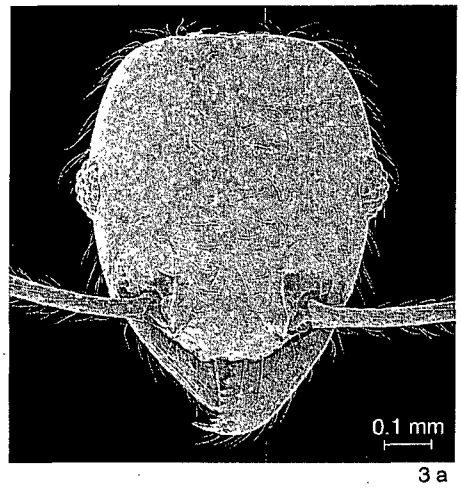
Remarks: This very successful tramp species has a nearly pantropical distribution nowadays. Even though it likely originates from the Ethiopian Region (BOLTON 1982), it is very probable that it has been transferred artificially to Socotra also. Colonies are small and cryptic and these ants are thus rarely collected. Like all its congeners, *Cardiocondyla emeryi* is characterised by the relatively wide postpetiole and total absence of erect dorsal body hairs.

Cardiocondyla longiceps Seifert, 2003

Cardiocondyla longiceps Seifert, 2003. — Ann. Naturhist. Mus. Wien 104 B: 259. (Yemen: Socotra Island).

Specimens examined: Yemen, Socotra Island: 1 ☿ (holotype), 3 ☿☿ (paratypes), Hadibo, 14.IV.1993, A. van Harten, SMNG.

Remarks: This species has been just recently described (SEIFERT 2003) from winged gynes originating both from Socotra Island and the Yemen mainland (Ta'izz). The workers are as yet unknown. As a member of the *Cardiocondyla shuckardi*-group, the new species has the propodeal spines much shorter than in *C. emeryi*, a character true also for workers in this species group. On the known measurements of gynes and workers in related species, SEIFERT (2003) predicted morphometric data for *C. longiceps* workers, on the basis of which we include the species in the



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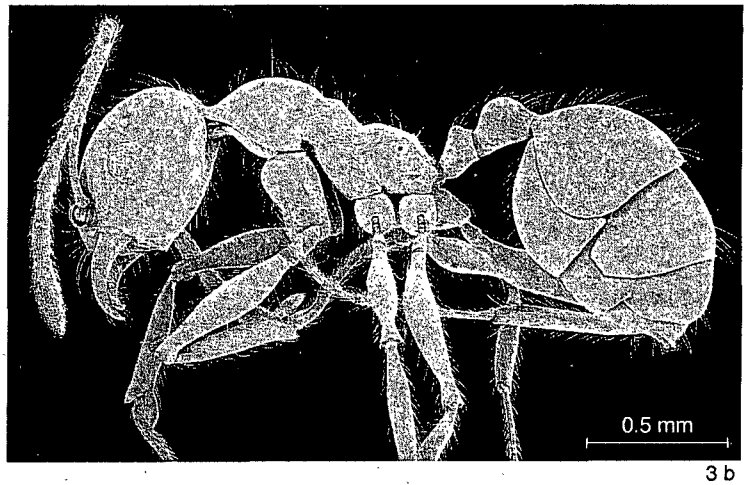

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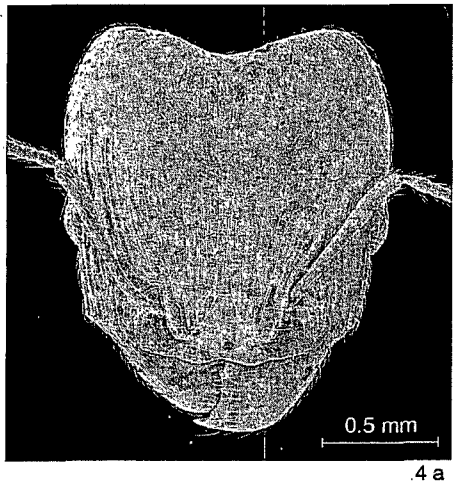

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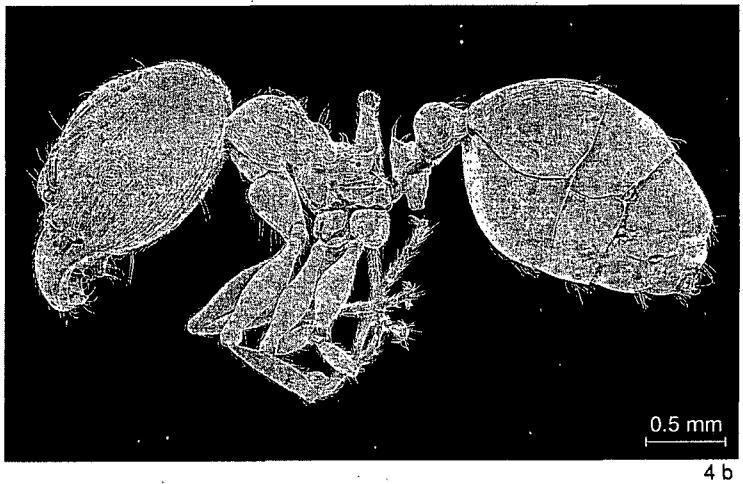

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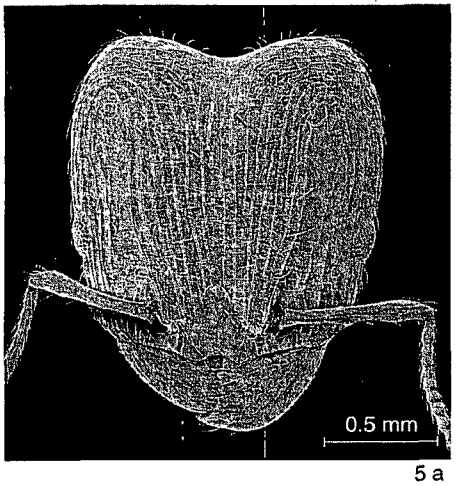

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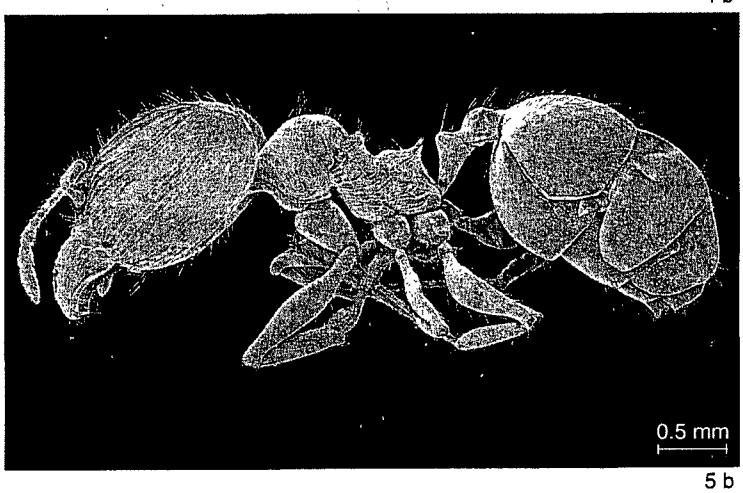
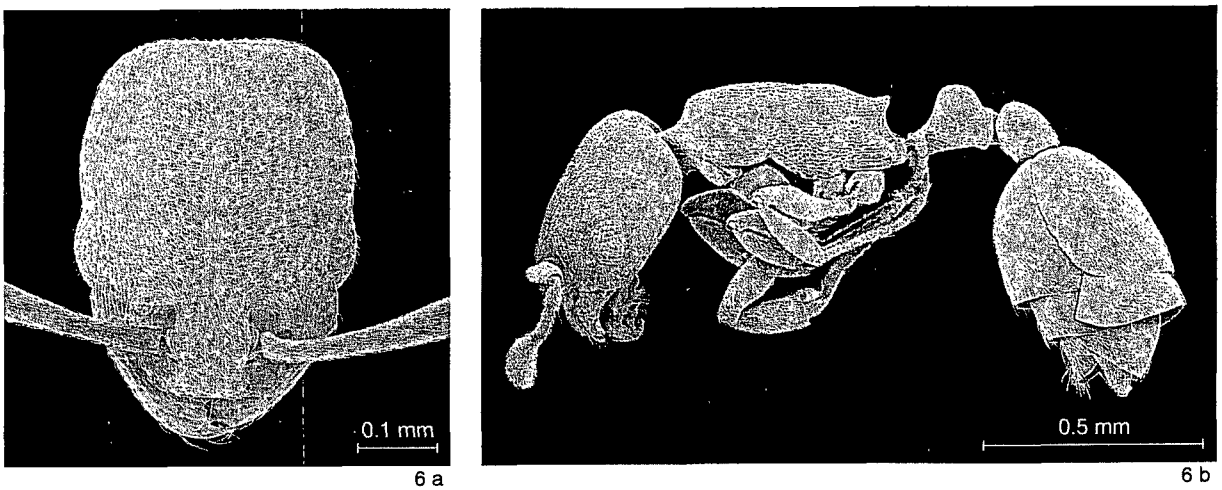


5 b

Figs 3-5: SEM micrographs of heads in full-face view (a) and overall lateral view (b) of ant workers. 3: *Pheidole lamellinoda*, minor worker. 4: *Pheidole lamellinoda*, major worker. 5: *Pheidole teneriffana*, major worker. SEM: H. Pohl.

key. The species of the *C. shuckardi*-group inhabit arid parts of Madagascar, Africa, southern Arabia and the Middle East. *Cardiocondyla longiceps* may be predicted to occur around the Horn of Africa also.



6 a 6 b

Fig. 6: SEM micrographs of *Cardiocondyla emeryi* worker. a: head in full-face view; b: overall lateral view. SEM: H. Pohl.

Genus *Tetramorium* Mayr, 1855

Tetramorium lanuginosum Mayr, 1870 Fig. 7

Tetramorium lanuginosum Mayr, 1870. — Verh. Zool.-Bot. Ges. Wien 20: 976. (Indonesia: Java).

Specimens examined: Yemen, Socotra Island: nest sample, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2072, NHCY.

Remarks: This species, likely of south-east Asian origin, is becoming an increasingly common tramp throughout tropical regions. It can be recognised by the smoothly rounded alitrunk dorsum and profuse long, often bifid body hairs.

Tetramorium simillimum (Smith, 1851) Fig. 8

Myrmica simillima Smith, 1851. — List of the specimens of British animals in the collection of the British Museum. Part VI. Hymenoptera, Aculeata: 118. (Great Britain).

Specimens examined: Yemen, Socotra Island: spms from Hadibo, 03-06.X.1998, A. van Harten, CCC.

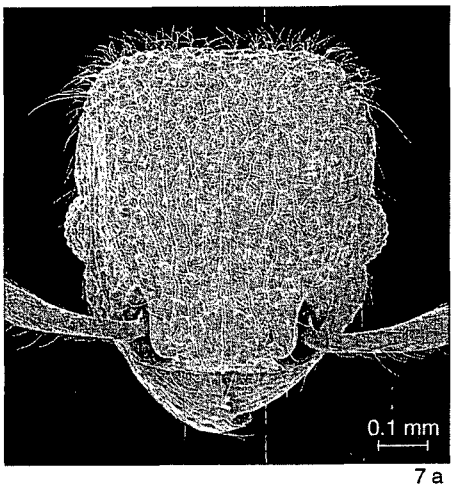
Remarks: Just one sample from Socotra is available for this tramp species, probably originating from Africa. Its distribution is cosmopolitan throughout the tropics and subtropics, and it is regularly found in heated greenhouses in the northern hemisphere. The most useful character to recognise the species are the blunt, erect hairs sparsely distributed all over the body surface, as well as the strongly developed frontal carinae and antennal scrobes which separate the species from *T. caldarium* (Roger, 1857).

Tetramorium caldarium (Roger, 1857) Fig. 9

Tetrogmus caldarius Roger, 1857. — Berl. Entomol. Z. 1: 12. (Poland).

Specimens examined: Yemen, Socotra Island: 1 ☿, Wadi Daneghan, 12°37'N 54°04'E, 90 m, 21-22.X.2000, H. Pohl, HLMD-Hym-2073; 4 ☿☿, 1 ♀, Goeeh, 12°32'N 54°10'E, 240 m, 23.X.2000, A. van Harten, HLMD-Hym-2074, NHCY; 1 ☿, Goeeh, 12°32'N 54°10'E, 240 m, 23.X.2000, H. Pohl, NHCY; 1 ☿, Nojid, Farmihin, Steroh, wadi, 12°24'N 54°09'E, 24.X.2000, A. van Harten, HLMD-Hym-2075; 7 ☿☿, Wadi Daneghan, 12°37'N 54°04'E, 90 m, pitfall traps, 28-30.X.2000, A. van Harten & H. Pohl, HLMD-Hym-2076, NHCY, CCC; 1 ☿, Hadibo and immediate surroundings, 12°37'N 54°01'E, 01.XI.2000, A. van Harten, HLMD-Hym-2077.

Remarks: *Tetramorium caldarium* is generally considered a less common, though also widely recorded, tramp species than its close relative *T. simillimum*. The picture of their distribution is somewhat unclear, the two long having been considered synonyms. In contrast to *T. simillimum*,



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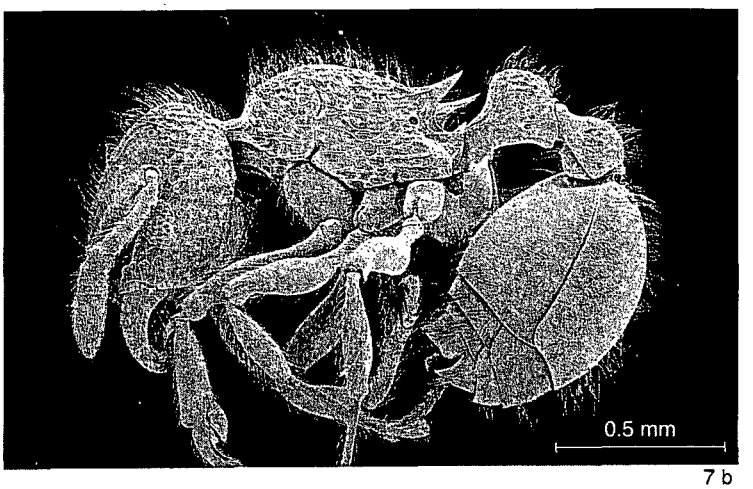

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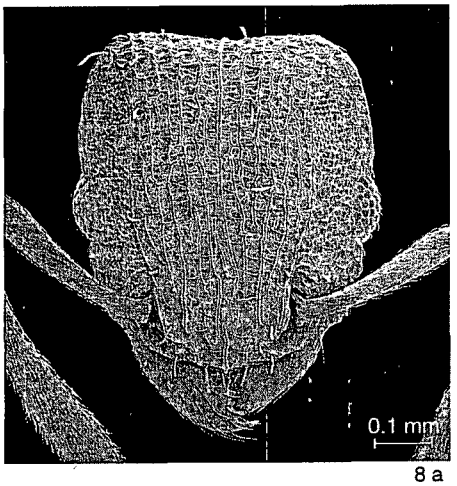

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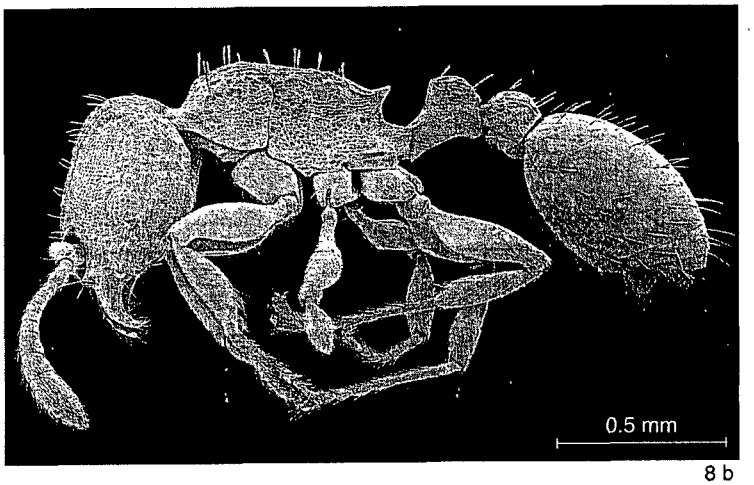

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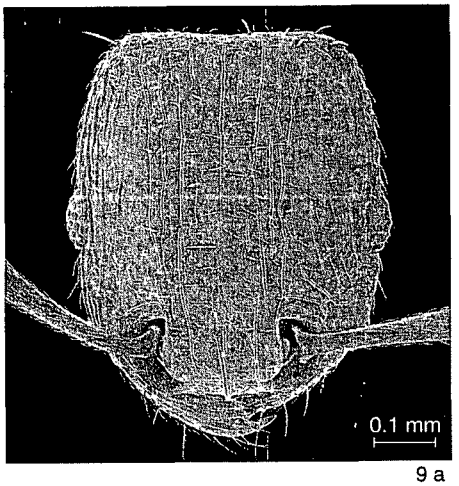

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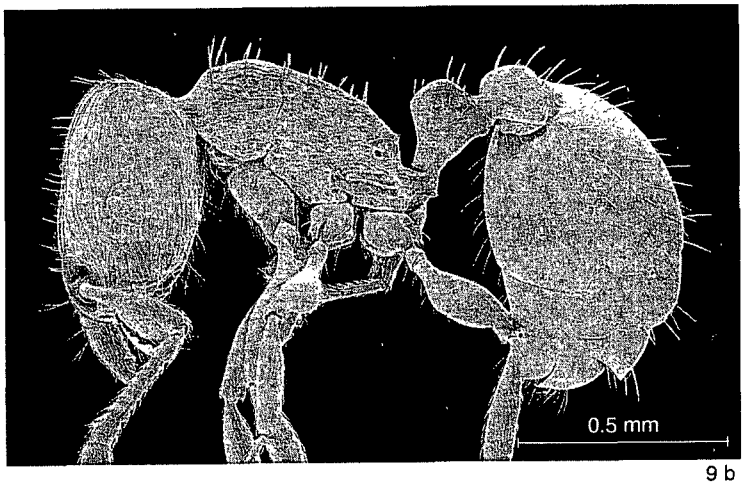
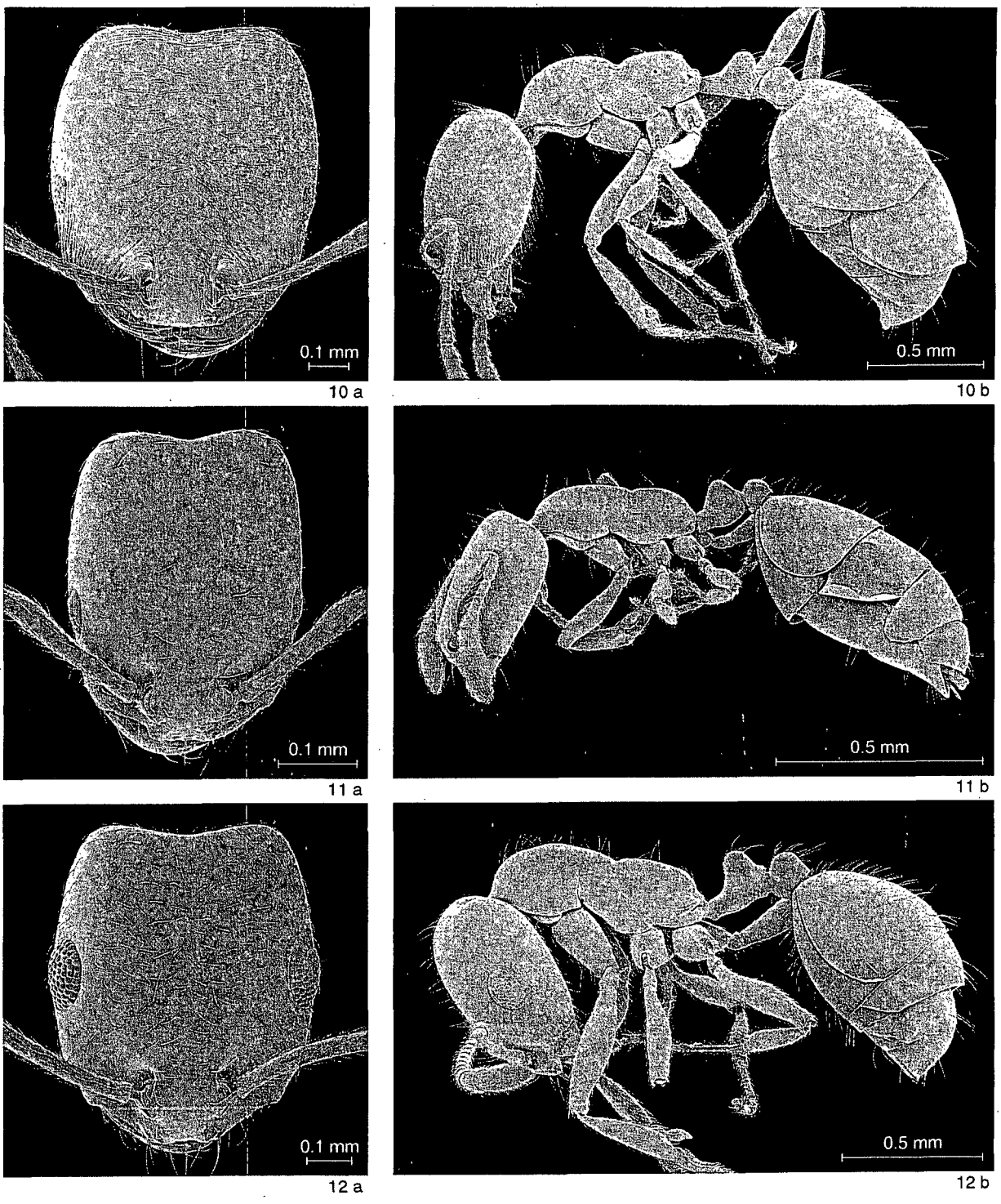


9 b

Figs 7-9: SEM micrographs of heads in full-face view (a) and overall lateral view (b) of ant workers. 7: *Tetramorium lanuginosum*. 8: *Tetramorium simillimum*. 9: *Tetramorium caldarium*. SEM: H. Pohl.

the frontal carinae are feebly developed and the antennal scrobes virtually absent in *T. caldarium*. The Socotran examples belong to a rarer variant ("*transformans*") which has the frontal carinae separated by less than half the head width behind the eyes. This form may constitute a separate



Figs 10-12: SEM micrographs of heads in full-face view (a) and overall lateral view (b) of ant workers. **10:** *Monomorium destructor*. **11:** *Monomorium baushare*. **12:** *Monomorium nimihil* n. sp. SEM: H. Pohl.

species and could originate from eastern Africa (BOLTON 1980), casting some doubt whether it has been transferred artificially to Socotra. No records of *T. caldarium* from the Arabian Peninsula have been brought forth.

Genus *Monomorium* Mayr, 1855

Monomorium destructor (Jerdon, 1851) Fig. 10

Atta destructor Jerdon, 1851. — Madras J. Lit. Sci. 17: 105. (India).

Monomorium destructor. — COLLINGWOOD & VAN HARTEN 1994: 39.

Specimens examined: Yemen, Socotra Island: spms from Adho Dimello, III.1967, K.M. Guichard, NHMB; spms from Mouri, IV.1997, W. Wranik, CWWR; spms from Farmihin, 24.IX.1998, W. Wranik, CWWR; spms from Diasma, 30.IX.1998, W. Wranik, CWWR; nest sample, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2079, NHCY; spms from Mogasu, 03.III.1999, W. Wranik, CWWR; 7 ☿☿, Wadi Daneghan, 12°37'N 54°04'E, 90 m, pitfall traps, 28-30.X.2000, A. van Harten & H. Pohl, HLMD-Hym-2081, NHCY. — Yemen, Abd al-Kuri Island: many ☿☿, west coast, 12°10'N 53°15'E, above 200 m, 18.II.1999, H. Pohl, HLMD-Hym-2080, NHCY.

Remarks: As another commonly transferred species, *M. destructor* has been particularly successful in south-east Asia and on islands throughout the tropics. Recent sampling has proved it also to be common in Arabia (COLLINGWOOD & AGOSTI 1996). Its origin is probably the Indian subcontinent. Larger colonies may contain several sizes of workers. They usually have yellowish alitrunks and darker gasters.

Monomorium mayri Forel, 1902

Monomorium gracillimum var. *mayri* Forel, 1902. — Rev. Suisse Zool. 10: 209. (India).

Monomorium mayri. — COLLINGWOOD & VAN HARTEN 1994: 39.

Specimens examined: Yemen, Socotra Island: spms from Hadibo, 13-14.IV.1993, A. van Harten, CCC; spms from Nojid, 16.IV.1993, A. van Harten, CCC; spms from Wadi Daneghan, 04.X.1998, A. van Harten, CCC; spms from Hasaant, X.1998, W. Wranik, CWWR; spms from Diksam, X.1998, W. Wranik, CWWR; 1 ☿, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, NHCY; spms from Hadibo, 04.II.2000, W. Wranik, CWWR; spms from Wadi Daneghan, 19.II.2000, W. Wranik, CWWR; 1 ☿, Goeeh, 12°32'N 54°10'E, 240 m, 23.X.2000, A. van Harten, NHCY; 1 ☿, Diksam, camp, 12°31'N 53°57'E, 26-27.X.2000, A. van Harten, HLMD-Hym-2082; 1 ☿, Hadibo and immediate surroundings, 12°37'N 54°01'E, 20.X.-01.XI.2000, H. Pohl, HLMD-Hym-2083. — Yemen, Samha Island: spms from coastal area, 15.II.1999, W. Wranik, CWWR.

Remarks: This species is distinguished from *M. destructor* only by the evenly dark colour in all individuals. The Socotran samples are of single or few specimens, and a few individuals thus coloured are present in larger *M. destructor* nest samples. It is hence possible that the *M. mayri* records from Socotra in fact refer to *M. destructor*, or even that these species are really synonymous. A study on more samples of different provenance will be necessary to clarify the situation. Records of *M. mayri* originate generally from the same geographical areas as those of *M. destructor*, though *M. mayri* has been collected more commonly in the northern Ethiopian Region.

Monomorium baushare Collingwood & Agosti, 1996 Fig. 11

Monomorium baushare Collingwood & Agosti, 1996. — Fauna of Saudi Arabia 15: 342. (Oman).

Specimens examined: Yemen, Socotra Island: 11 ☿☿, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2084, NHCY, CCC; 8 ☿☿, Goeeh, 12°32'N 54°10'E, 240 m, 23.X.2000, H. Pohl, HLMD-Hym-2085, NHCY, CCC.

Remarks: This minute yellow species has been described from Yemen and Oman and is very similar to a group of Afrotropical *Monomorium* species with 11-segmented antennae, including *M. exiguum* Forel, 1894, which in itself is probably an amalgamate of sibling species (BOLTON 1987). It differs from *M. exiguum* by the flatter ventral head surface and longer scapes (SI 85-91 compared to 74-84). Like other species of the *M. monomorium*-group sensu BOLTON (1987), particularly those with reduced eyes, *M. baushare* apparently inhabits leaf litter or topsoil.

Monomorium sp. prope *qarahe* Collingwood & Agosti, 1996

Specimens examined: Yemen, Socotra Island: 2 ☿☿, Diksam, camp, 12°31'N 53°57'E, 26-27.X.2000, A. van Harten, HLMD-Hym-2086, NHCY.

Measurements and indices: AL 0.48 mm, HL 0.45 mm, HW 0.31 mm, SL 0.26 mm, CI 69, SI 84.

Description: Mandibles unsculptured with three teeth, antennae 12-segmented with enlarged apical club. Clypeus with concave front margin, occiput mildly concave, eyes small (diameter 0.22 times the HW). Alitrunk with distinct metanotal groove, petiole with somewhat flattened dorsum, a ventral bulge and a long anterior peduncle. Vertex with four hairs, pronotum with two dorsal hairs. Colour brownish yellow, shining with reduced sculpture.

Remarks: Only two specimens were available of this *Monomorium* species of the *M. monomorium*-group sensu BOLTON (1987). As *M. baushare*, it could be accommodated in the vaguely defined *M. boerorum*-complex, but unlike the previous species it has 12-segmented antennae. There may be relations also to the species of the *M. mediocre*-complex of the *M. salomonis*-group which grade into the *M. monomorium*-group. A worker very similar to the two treated here was taken by A. van Harten and A. Sallam in a Malaise trap at Lahj near Aden (Yemen). Apparently these specimens are not referable to any species described from Africa or Arabia. *Monomorium qarahe* Collingwood & Agosti, 1996 from the Asir Mountains in Saudi Arabia, also known from only two workers, appears to be most similar but is somewhat larger.

The samples available are altogether insufficient for definite appraisal at the present time, therefore this species is omitted from Table 1 and the discussion of zoogeographic affinities of the ants of Socotra.

Monomorium nimihil Collingwood n. sp. Fig. 12

Holotype: ☿, Yemen, Socotra Island, Wadi Daneghan, 12°37'N 54°04'E, 90 m, pitfall trap, 28-30.X.2000, A. van Harten & H. Pohl, HLMD-Hym-2087-HT. — Paratypes: Yemen, Socotra Island: 3 ☿☿, same data as holotype, HLMD-Hym-2087-PT1 to -PT3 [HLMD-Hym-2087-PT3 preserved as SEM preparation]; 4 ☿☿, same data as holotype, NHCY; 4 ☿☿, same data as holotype, CCC; 1 ☿, same data as holotype, BMNH.

Diagnosis: The combination of sculptured mandibles, circular propodeal spiracle and round eyes near the midlength of head sides places *Monomorium nimihil* n. sp. in the *M. salomonis*-group sensu BOLTON (1987). Almost unsculptured dorsal surfaces of head and alitrunk in conjunction with numerous long hairs in these areas are not found in any other African or Arabian representative of that species-group.

Measurements and indices: AL 0.71 mm, HL 0.63 mm, HW 0.59 mm, SL 0.63 mm, CI 94, SI 106 (4 specimens measured).

Description: Head almost square with mildly convex sides and slightly concave occiput. Many long hairs present over the whole body, slightly shorter on the ventral head. Scapes and legs thickly clothed with suberect pubescence. Eyes, placed medially, relatively large (diameter 0.30 times the HW) with 10-11 ommatidia in the longest row. Petiole and postpetiole nodes wider than long in dorsal view (PW = 0.30 × HW). Body colour entirely yellow, shining with very superficial sculpture on the head and propodeum.

Affinities: In body profile and with the abundant pilosity, *M. nimihil* n. sp. is quite like the southern African *M. albopilosum* Emery, 1895 – a member of the *M. opacum*-complex of the *M. salomonis*-group. However, *M. albopilosum* is much larger (HL ~ 0.91 mm, HW ~ 0.68 mm) with comparatively smaller eyes (diameter at most 0.25 times the HW) and has – as all species in the *M. opacum*-complex – conspicuous reticulate-punctate sculpture on head and alitrunk. Only one other African species of the *M. salomonis*-group, *M. hirsutum* Forel, 1910, and one Arabian species, *M. yemene* Collingwood & Agosti, 1996, are densely hairy. They belong to the *M. bicolor*-complex and thus have a distinctly contrasting dark gaster, are even more strongly sculptured than *M. albopilosum* and have even smaller eyes.

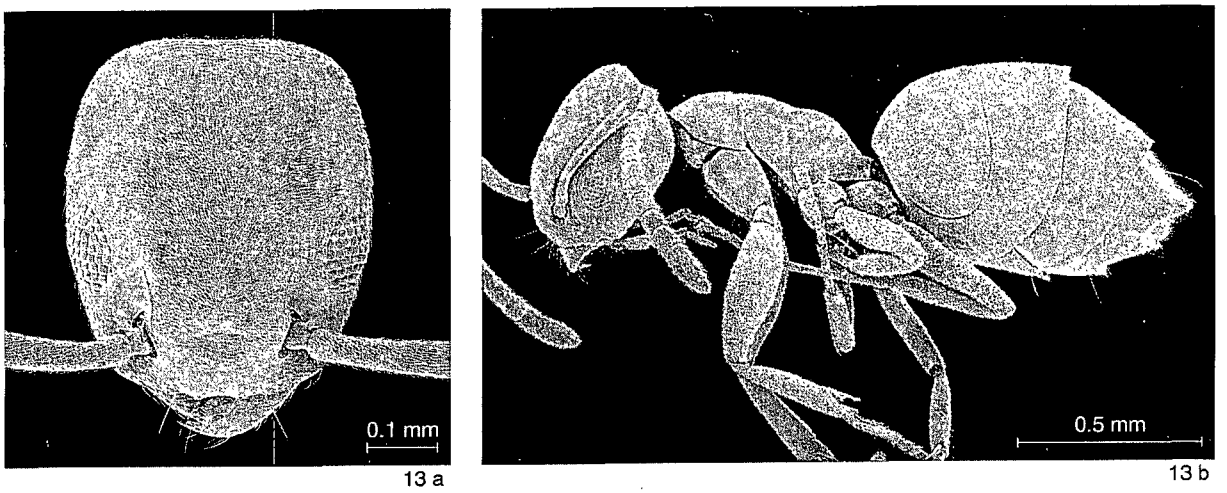


Fig. 13: SEM micrographs of *Tapinoma melanocephalum* worker. a: head in full-face view; b: overall lateral view. SEM: H. Pohl.

Remarks: The new species was only encountered in one sample, procured from pitfall traps set up on a steep slope near a permanent brook, among well-developed leaf and humus layers under and around fig trees (most likely *Ficus cordata* var. *salicifolia* (Vahl) C.C. Berg). In the samples from these traps, it was the most numerous ant (13 of 34 specimens).

The authorship of the name of this species is to be attributed to the senior author.

Etymology: The specific name (a noun in apposition) is the term for "ant" in the Socotri language.

Subfamily **Dolichoderinae**

Genus *Tapinoma* Foerster, 1850

Tapinoma melanocephalum (Fabricius, 1793) Fig. 13

Formica melanocephala Fabricius, 1793. — Entomologia systematica emendata, T. 2: 353. (French Guiana).

Specimens examined: Yemen, Socotra Island: spms from Dirhashas, 28.IX.1998, W. Wranik, CWWR; - 20 ☿☿, Hoq, coast plain near cave, 12°36'N 54°21'E, 50-320 m, 05-06.II.1999, H. Pohl, HLMD-Hym-2088, NHCY; spms from Farmihin, 23.II.1999, W. Wranik, CWWR; spms from Wadi Daneghan, 19.II.2000, W. Wranik, CWWR; 3 ☿☿, Goeeh, 12°32'N 54°10'E, 240 m, 23.X.2000, A. van Harten, HLMD-Hym-2089, NHCY; 2 ☿☿, Homhil, source with *Ficus* stand, 12°34'N 54°19'E, 29-30.X.2000, H. Pohl, HLMD-Hym-2090, NHCY.

Remarks: The very small size and its broken dark and pale colour pattern characterise this species. It is a frequent domestic pest in Africa and Arabia, where nests may contain thousands of workers and many queens. Records from natural habitats are rare. The origin of this ant, found in all zoogeographic regions, is unknown. It attends Sternorrhyncha for sugary exudates, and workers are usually seen in long trails to and from a food source.

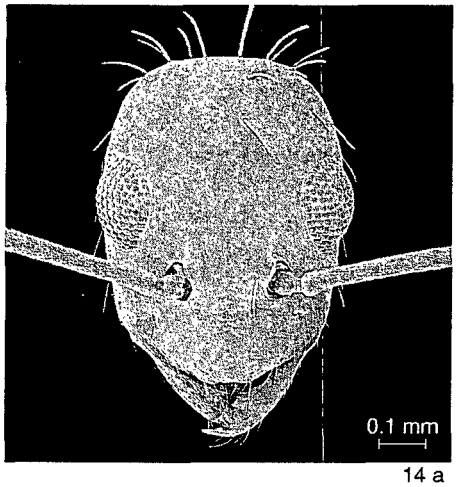
Subfamily **Formicinae**

Genus *Paratrechina* Motschulsky, 1863

Paratrechina longicornis (Latreille, 1802) Fig. 14

Formica longicornis Latreille, 1802. — Histoire Naturelle des Fourmis: 113. (Senegal).

Paratrechina longicornis. — COLLINGWOOD & VAN HARTEN 1994: 39.



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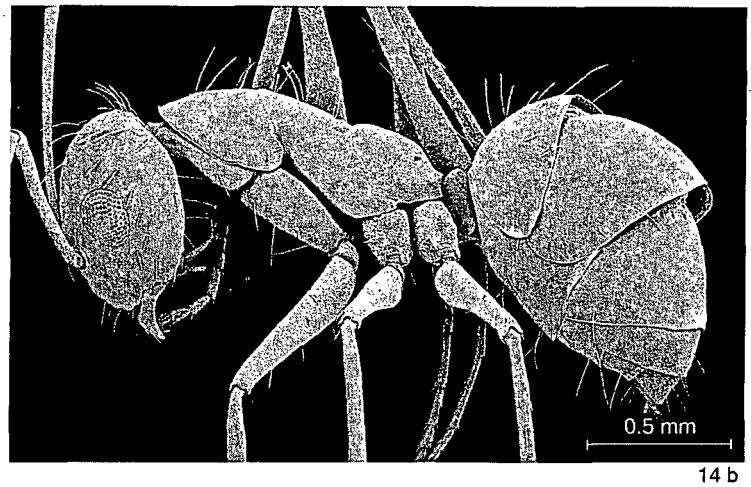

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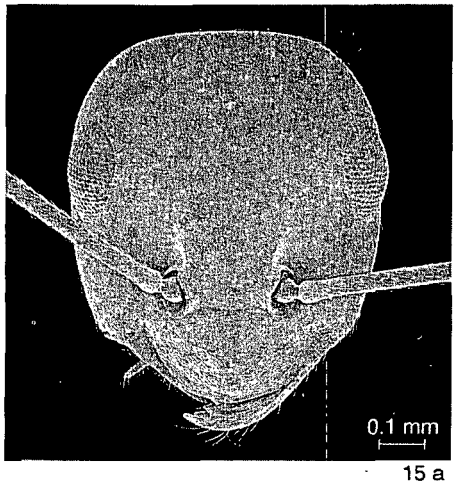

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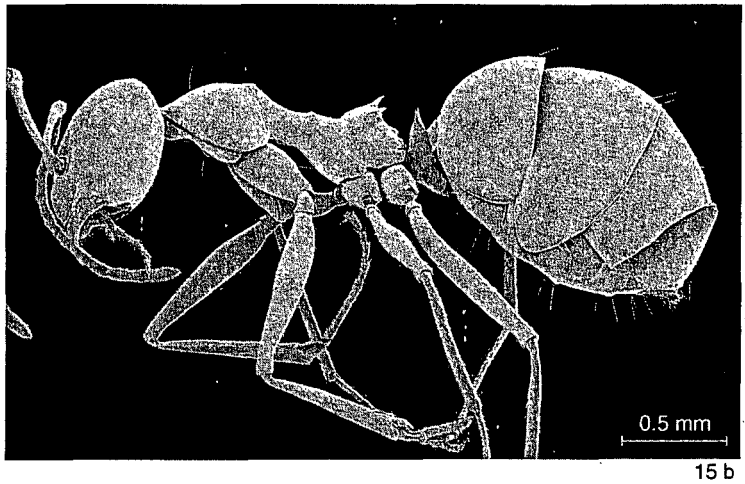

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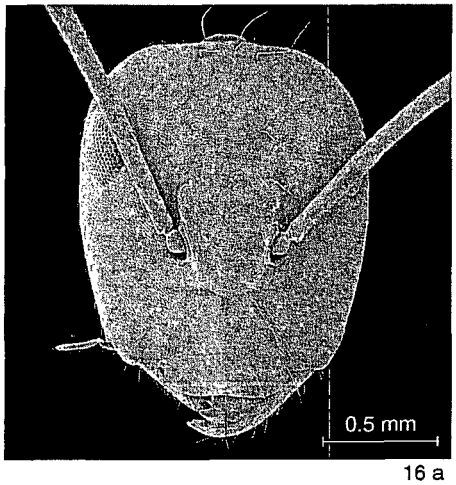

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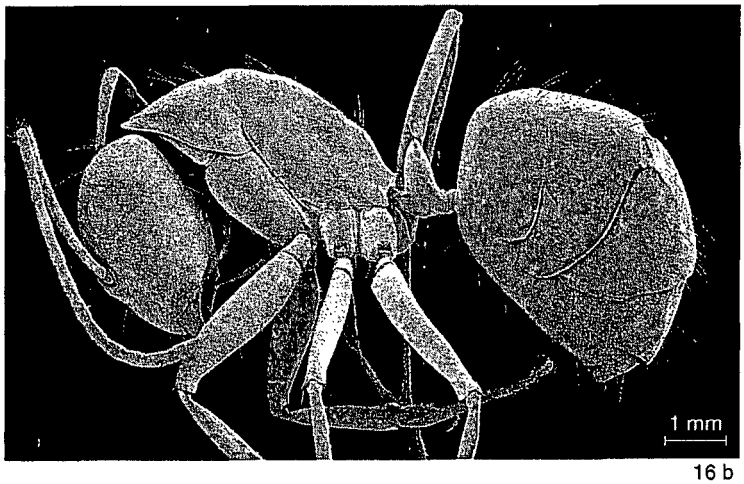


16 b

Figs 14-16: SEM micrographs of heads in full-face view (a) and overall lateral view (b) of ant workers. 14: *Paratrechina longicornis*. 15: *Lepisiota spinisquama*. 16: *Camponotus acvapimensis*. SEM: H. Pohl.

Specimens examined: Yemen, Socotra Island: spms from Hadibo, 13-14.IV.1993, A. van Harten, CCC; spms from Farmihin, 24.IX.1998, W. Wranik, CWWR; spms from Dimere, 25.IX.1998, W. Wranik, CWWR; spms from Hasaant, X.1998, W. Wranik, CWWR; spms from Diksam, X.1998, W. Wranik, CWWR; ~ 40 ☿☿, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2092, NHCY; spms from Hadibo, 15.II.2000, W. Wranik, CWWR; spms from Nojid, Dijoub Cave, 16.II.2000, W. Wranik, CWWR; 2 ☿☿, Wadi Daneghan, 12°37'N 54°04'E, 90 m,

pitfall traps, 28-30.X.2000, A. van Harten & H. Pohl, HLMD-Hym-2093, NHCY. — Yemen, Samha Island: spms from coastal area, 15.II.1999, W. Wranik, CWWR. — Yemen, Abd al-Kuri Island: spms from coastal plain, 18.II.1999, W. Wranik, CWWR.

Remarks: This is probably the most widely distributed pantropical tramp species, often becoming abundant in highly disturbed habitats. Its native distribution is uncertain but may in fact be the Afrotropical Region. The workers are narrow-bodied ants with very fast, erratic movements ("crazy ant"). They are generally non-aggressive and opportunistic. For building up large population densities they appear to require a resource of Coccoidea which they tend for harvesting their sugary excretions (WETTERER et al. 1999).

Genus *Lepisiota* Santschi, 1926

Lepisiota spinisquama (Kuznetsov-Ugamsky, 1929) Fig. 15

Acantholepis frauenfeldi subsp. *spinisquama* Kuznetsov-Ugamsky, 1929. — Zool. Anz. (Leipzig) 82: 483. (Kazakhstan).

Acantholepis spinisquama. — COLLINGWOOD 1985: 296; COLLINGWOOD & VAN HARTEN 1994: 39.

Lepisiota spinisquama. — COLLINGWOOD & AGOSTI 1996: 369.

Specimens examined: Yemen, Socotra Island: spms from Adho Dimello, IV.1967, K.M. Guichard, NHMB; spms from Hadibo, 13-14.IV.1993, A. van Harten, CCC; spms from Momi, 15.IV.1993, A. van Harten, CCC; spms from Nojid, 16.IV.1993, A. van Harten, CCC; spms from Mouri, 17.IV.1993, A. van Harten, CCC; spms from Farmihin, IX.1998, W. Wranik, CWWR; spms from Dirhashas, 28.IX.1998, W. Wranik, CWWR; spms from Hasaant, X.1998, W. Wranik, CWWR; spms from Diksam, X.1998, W. Wranik, CWWR; spms from Wadi Daneghan, 04.X.1998, A. van Harten, CCC; nest sample, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2094, NHCY; 1 ☿, 4 ♀♀, coast road east of Hadibo, coastal sand dunes, 12°36'N 54°21'E, 04-06.II.1999, H. Pohl, HLMD-Hym-2095, NHCY; 5 ☿☿, Diksam Plateau, 12°32'N 53°59'E, 1020 m, pitfall trap, 22-24.II.1999, H. Pohl, HLMD-Hym-2097, NHCY; spms from Hasaant, 26.II.1999, W. Wranik, CWWR; spms from Rhiy di-Shu'ub, 28.II.1999, W. Wranik, CWWR; spms from Momi, 12.II.2000, W. Wranik, CWWR; spms from Homhil, 12.II.2000, W. Wranik, CWWR; spms from Rhiy di-Shu'ub mangrove, 14.II.2000, W. Wranik, CWWR; spms from Wadi Daneghan, 19.II.2000, W. Wranik, CWWR; spms from Diksam, 22.II.2000, W. Wranik, CWWR; 1 ☿, Wadi Daneghan, 12°37'N 54°04'E, 90 m, pitfall trap, 28-30.X.2000, A. van Harten & H. Pohl, HLMD-Hym-2098. — Yemen, Samha Island: spms from coastal area, 15.II.1999, W. Wranik, CWWR; spms from village area, 08.II.2000, W. Wranik, CWWR. — Yemen, Abd al-Kuri Island: spms from coastal plain, southern part, 18.II.1999, W. Wranik, CWWR; ~ 20 ☿☿, west coast, around base camp, 12°11'N 53°14'E, 17-18.II.1999, H. Pohl, HLMD-Hym-2096, NHCY; spms from coastal plain, northern part, 06-07.II.2000, W. Wranik, CWWR.

Remarks: Both the original description and information by PISARSKI (1967) demonstrate that this species is distinct from *L. semenovi* (Ruzsky, 1905), so the synonymy of the two species recently proposed by DLUSSKY et al. (1990) cannot be accepted. The occurrence of *L. spinisquama* on Socotra, where it appears to be one of the commonest ants, is something of a riddle. The species is distributed in central Asia, and there are records from coastal southern Arabia (COLLINGWOOD 1985, COLLINGWOOD & AGOSTI 1996), but otherwise introductions have not been reported. This shiny black ant is characterised by spinal ornamentation on both the propodeum and the petiole. Nests may include several queens and many hundreds of workers. These ants are general scavengers and will attack other insects. In Socotri, "nimihil háher" (black ant) will usually refer to this species.

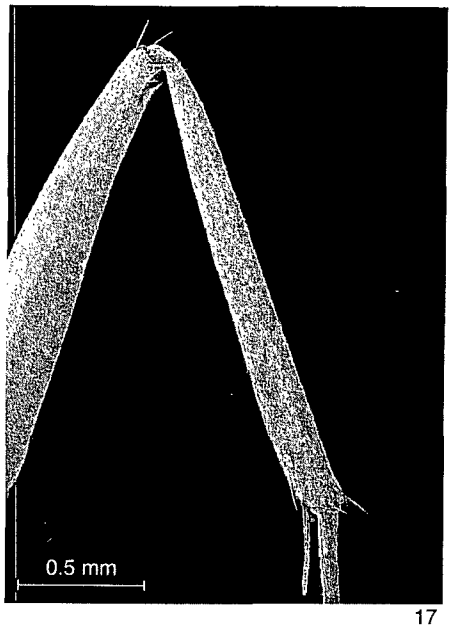
Genus *Camponotus* Mayr, 1861

Camponotus acvapimensis Mayr, 1862 Fig. 16

Camponotus acvapimensis Mayr, 1862. — Verh. Zool.-Bot. Ges. Wien 12: 664. (Ghana).

Camponotus acvapimensis. — COLLINGWOOD 1985: 277; COLLINGWOOD & VAN HARTEN 1994: 39.

Specimens examined: Yemen, Socotra Island: spms from Adho Dimello, IV.1967, K.M. Guichard, NHMB; 6 ☿☿, Diksam Plateau, above camp, 12°32'N 53°59'E, 1000-1200 m, 22-24.II.1999, H. Pohl, HLMD-Hym-2100, NHCY.



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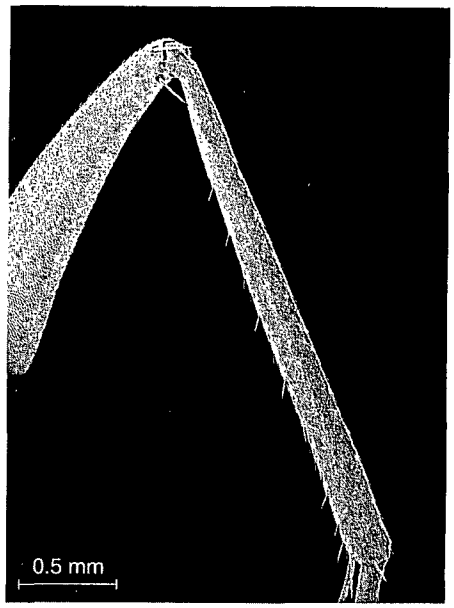


18

Figs 17-18: SEM micrographs of left hind tibiae of *Camponotus* spp. workers (specimens from Socotra Island) in semi-lateral view.
17: *Camponotus atlantis*.
18: *Camponotus hova*.
SEM: H. Pohl.

Remarks: This is a dull black ant of moderate size, which is commonly found throughout open forest in tropical Africa and extends to southern Arabia (COLLINGWOOD 1985). Hairs are present on the ventral head and on the vertex. Size variation in workers is low, the species appears monomorphic. In contrast, many other species of the genus (including the two others present on Socotra) show extensive size variation and allometric effects, making small and large workers appear very different.

Camponotus atlantis Forel, 1890 Figs 17, 19-20

Camponotus rubripes r. *atlantis* Forel, 1890. — Ann. Soc. Entomol. Belg., C.R. 34: lxiii. (Tunisia).

Specimens examined: Yemen, Socotra Island: spms from Farmihin, X.1998, W. Wranik, CWWR; spms from Diksam, 21.II.2000, W. Wranik, CWWR.

Remarks: This species is generally common throughout North Africa and Arabia.

Camponotus hova Forel, 1891 Figs 18, 21

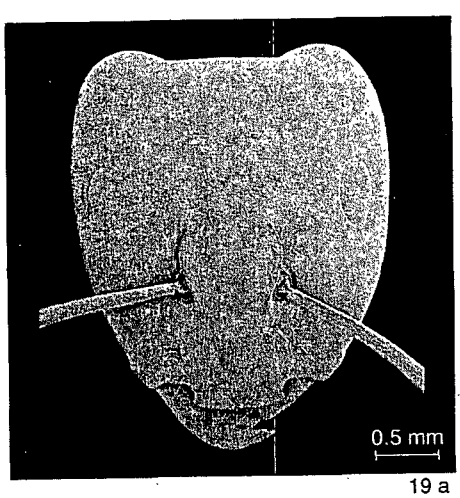
Camponotus rubripes r. *maculatus* var. *hova* Forel, 1886. — Ann. Soc. Entomol. Belg. 30: 150 (name unavailable). (Madagascar).

Camponotus maculatus r. *hova* Forel, 1891. — Histoire Physique, Naturelle, et Politique de Madagascar 20: 35.

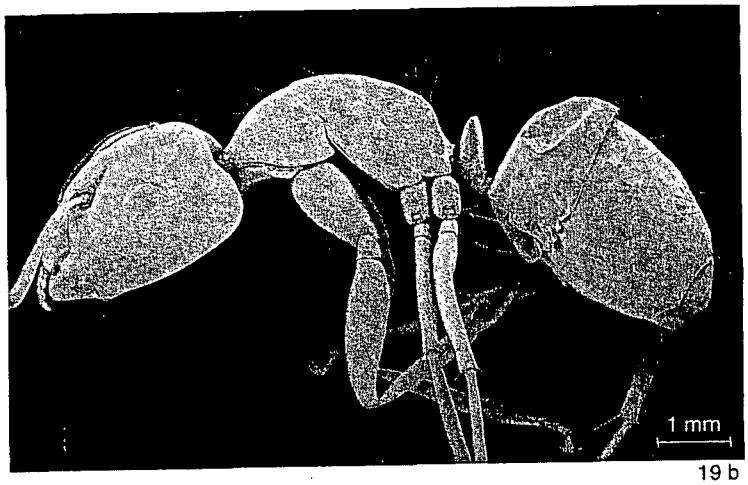
Camponotus maculatus (Fabricius, 1782). — KOHL 1907: 282 (misidentified).

Camponotus hova. — COLLINGWOOD 1985: 277; COLLINGWOOD & VAN HARTEN 1994: 39; COLLINGWOOD & AGOSTI 1996: 373.

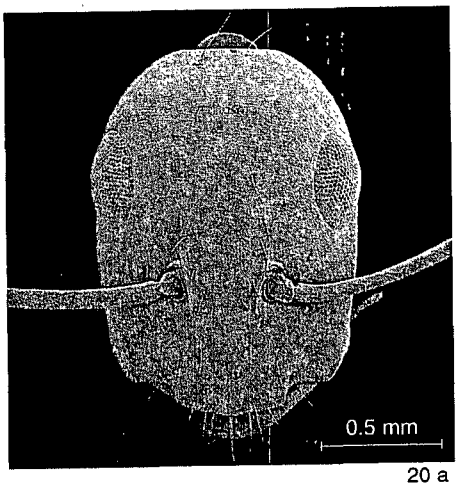
Specimens examined: Yemen, Socotra Island: spms from Adho Dimello, IV.1967, K.M. Guichard, NHMB; spms from Nojid, 16.IV.1993, A. van Harten, CCC; spms from Farmihin, X.1998, W. Wranik, CWWR; nest sample, Adho Dimello, base camp, 12°34'N 54°02'E, 940 m, 03.II.1999, H. Pohl, HLMD-Hym-2101, NHCY; 1 large ☿, same data, NHCY; 5 ☿☿, coast road east of Hadibo, coastal sand dunes, 12°36'N 54°21'E, 04-06.II.1999, H. Pohl, HLMD-Hym-2102, NHCY; 1 small ☿, Diksam Plateau, 12°32'N 53°59'E, 1020 m, pitfall trap, 22-24.II.1999, H. Pohl, HLMD-Hym-2103; spms from Hasaant, 29.XI.1999, W. Wranik, CWWR; 1 small ☿, 2 large ☿☿, Za'pad, XI.1999, FCUA; spms from Hoq, 13.II.2000, W. Wranik, CWWR; 1 ♂, Diksam, camp, 12°31'N 53°57'E, 26-27.X.2000, H. Pohl, HLMD-Hym-2104; 4 ☿☿, Wadi Daneghan, 12°37'N 54°04'E, 90 m, pitfall traps, 28-30.X.2000, A. van Harten & H. Pohl, HLMD-Hym-2105, NHCY; 1 large ☿, 1 ♂, Nit, X.2000, V. Bejček & K. Šťastný, FCUA; 1 small ☿, 1 large ☿, Homhil, 12°35'N 54°18'E, 330 m, 20-21.XI.2000, V. Bejček & K. Šťastný, FCUA; 4 ♂♂, Wadi Fahr, 12°26'N 54°12'E, 70 m, 01.IV.2001, V. Bejček & K. Šťastný, FCUA. — Yemen, Samha Island: spms from coastal area, 08.II.2000, W. Wranik, CWWR. — Yemen, Abd al-Kuri Island: spms from coastal plain, 18.II.1999, W. Wranik, CWWR.



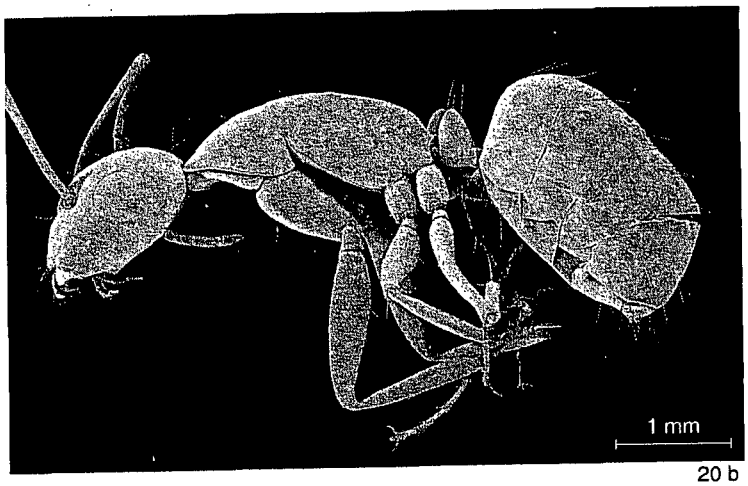
19 a



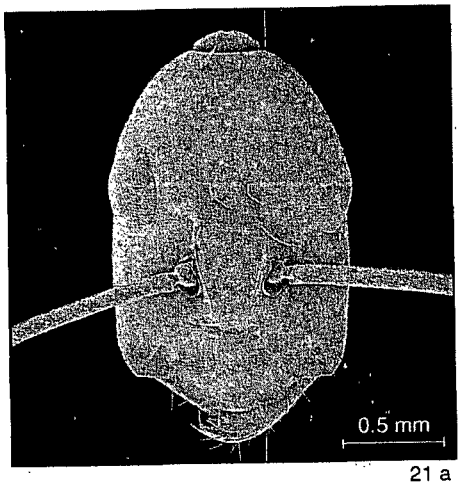
19 b



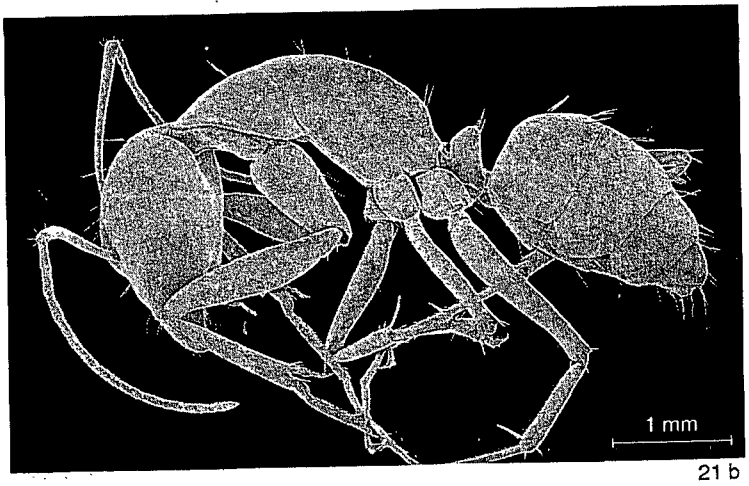
20 a



20 b



21 a



21 b

Figs 19-21: SEM micrographs of heads in full-face view (a) and overall lateral view (b) of ant workers. **19:** *Camponotus atlantis*, large worker. **20:** *Camponotus atlantis*, small worker. **21:** *Camponotus hova*, small worker. SEM: H. Pohl.

Remarks: Occurring throughout the island complex off the African coast in the Indian Ocean, this species can be regarded as a Malagasy faunal element. It has a superficial resemblance to the Afrotropical *C. maculatus*, but differs in the reduced number of ventral head hairs, less

clearly defined pale spots on the gaster and generally smaller size. The old record of *Camponotus maculatus* for Socotra (KOHL 1907), based on specimens collected in 1899 by the expedition of the Vienna museum, should certainly be referred to *C. hova*. Small workers of *C. atlantis* and *C. hova* may be uniformly pale and difficult to distinguish, but the spines on the hind tibiae of *C. hova* are absent in *C. atlantis* (Figs 17-18). In addition, large workers of *C. atlantis* usually lack the two to six suberect hairs present on the underside of the head in *C. hova*.

As the largest ants present on Socotra, a separate name for *C. hova* and *C. atlantis* – "kazér" – is used in the native language.

DISCUSSION

Oceanic islands usually support impoverished native ant faunas supplemented with many species introduced by man (MCGLYNN 1999). As import of ants to areas outside their natural distribution through human influence has been taking place for a long time, it is sometimes difficult to say whether a species recorded on a given island is native there or not. Eight of the 18 ant species recorded on Socotra Island are definitely adventive, as they are well-known, mostly cosmopolitan or pantropical tramps (see Table 1), often with uncertainty regarding their native distribution. *Tetramorium caldarium*, though also a common tramp, might conceivably be indigenous to Socotra. For a further three species, translocations have not yet been documented elsewhere, but their human-associated habits (*Pachycondyla sennaarensis*) or the distance to their main range (*Pheidole lamellinoda*, *Lepisiota spinisquama*) make it questionable whether they have reached Socotra by natural means. The remaining six species – three large *Camponotus*, two cryptic *Monomorium* and a recently described *Cardiocondyla* – can be regarded as likely native, though that is difficult to prove with certainty. In view of the incomplete knowledge of the East African ant fauna, it is doubtful whether *M. nimihil* n. sp., the only species hitherto found only on Socotra, is a true endemic.

In any case, the number of indigenous species is very low, considering the size of the island (about 3600 km^2) and its relative proximity to the African continent (ca. 250 km distance). This may be a reflection of early separation from all major landmasses. According to some current theories, at the beginning of the Tertiary, Socotra had already been isolated from the African continent for good (BEYDOUN & BICHAN 1970). If so, the island was already beyond reach when elsewhere the evolution of the Formicidae towards their dominant ecological role began. In terms of species richness, a comparison can be made to New Zealand with its less than 50 native species, in contrast to about 3000 present in Australia (TAYLOR 1987). Obviously, ants generally show limited potential to colonise islands unaided across larger bodies of water, which is also demonstrated by the fact that the isolated Hawaiian Islands do not have native ants at all (REIMER 1994). On the other hand, a recent survey of the ants of Silhouette Island in the Seychelles (Gerlach, in litt.) has procured about twice as many native and transferred species as reported here for Socotra Island, which is about 200 times larger than Silhouette. Thus the arid climate of the Socotra Archipelago may account for particularly low species richness in comparison with wet tropical islands. That said, it should be noted that the surveys conducted on Socotra up to now have been largely limited to the more anthropogenically influenced lowlands. A few specimens of some additional, probably native species indicate that further sampling in remote places, especially using pitfall traps, is bound to discover more indigenous and possibly endemic ants.

As concerns the outlying islands of the Socotra Archipelago, only one species classified as likely native, *Camponotus hova*, has been recorded on Samha and Abd al-Kuri (Table 1). It is a possibility

Table 1: Ant species found in the Socotra Archipelago with records from single islands and overall range. Range of widespread tramps (cosmopolitan or pantropical) and status categories are given following PEZZATTI et al. (1998). * = Old and recent introductions cannot be distinguished due to lack of earlier data.

Species	Socotra	Samha	Darsa	Abd al-Kuri	Status	Range outside the Socotra Archipelago
Subfamily **Ponerinae**						
Pachycondyla sennaarensis	+	+		+	Possibly native	Ethiopian Region, Arabia
Subfamily **Myrmicinae**						
Pheidole lamellinoda	+				Possibly native	India
Pheidole teneriffana	+		+		Introduced *	North Africa, Arabia
Cardiocondyla emeryi	+				Introduced *	Pantropical
Cardiocondyla longiceps	+				Probably native	southern Arabia
Tetramorium lanuginosum	+				Introduced *	Cosmopolitan
Tetramorium simillimum	+				Introduced *	Cosmopolitan
Tetramorium caldarium	+				Possibly native	Pantropical
Monomorium destructor	+			+	Introduced *	Pantropical
Monomorium mayri	+	+			Introduced *	Pantropical
Monomorium baushare	+				Probably native	southern Arabia
Monomorium nimihil n. sp.	+				Probably endemic	—
Subfamily **Dolichoderinae**						
Tapinoma melanocephalum	+				Introduced *	Pantropical
Subfamily **Formicinae**						
Paratrechina longicornis	+	+		+	Introduced *	Pantropical
Lepisiota spinisquama	+	+		+	Possibly native	Central Asia, Oman
Camponotus acvapimensis	+				Probably native	Ethiopian Region, Oman
Camponotus atlantis	+				Probably native	North Africa, Arabia
Camponotus hova	+	+		+	Probably native	Malagasy Region, Arabia

that this species is native to Socotra Island but has been transferred to the other islands from there. Further collecting on these islands needs to be done to determine whether native ants occur. Particularly Darsa is virtually unstudied up to now.

Obviously, a zoogeographic assessment of the indigenous ant fauna would be premature, based on current knowledge. It may be noted that the species regarded as potentially native show ties to several zoogeographic regions. Five species originate from the Ethiopian Region (*P. sennaarensis*, *C. longiceps*, *T. caldarium*, *M. baushare* and *C. acvapimensis*), one species each shows a Malagasy (*C. hova*), Saharo-Arabian (*C. atlantis*), Oriental (*P. lamellinoda*) and Central Asian (*L. spinisquama*) distribution.

Among ants introduced to areas outside their natural distribution, MCGLYNN (1999) distinguishes two particular categories: invaders and tramp species. Tramps are ants which remain tied to areas of strong human influence in their new environment. In contrast, the strongly invasive species, while usually also successful in urban habitats, are able to colonise and quickly monopolise unaltered habitats, thereby displacing native ants and also strongly affecting the invertebrate fauna, usually by favouring few species and diminishing or eradicating all others. Ant invaders are therefore considered the greatest threat to the unique ecosystems of oceanic islands.

Three of the alien species on Socotra are of some concern regarding their invasive potential, and the future development of their populations should be monitored. There are discordant reports of the impact of *Pheidole teneriffana* on local fauna. In California, SNELLING (1992) reports its threat to be probably low, while it may displace native species in the United Arab Emirates (COLLINGWOOD et al. 1997). Both *Monomorium destructor* and *Paratrechina longicornis* are generally thought not to be dangerous invaders and are often competitively excluded by other alien species (WETTERER & O'HARA 2002), even though *P. longicornis* has been transferred very widely around the world. On Floreana, Galápagos Islands, an endemic *Camponotus* species may have been outcompeted by *M. destructor* in urban situations (PEZZATTI et al. 1998). The "crazy ant" (*P. longicornis*) has become the dominant "invader" of the man-made experimental ecosystems at "Biosphere 2" in Arizona, USA (WETTERER et al. 1999), almost eradicating all other ants and decisively shaping the invertebrate community structure. These two species are moderately common on Socotra and are recorded away from man-impacted habitats. Obviously, the spread to natural areas even of less competitive introduced ants is aided when native ants are uncommon, thus leaving unoccupied ecological niches.

Ant species with an obvious destructive impact on ecosystems do not seem to be present on Socotra yet. The indigenous species-poor ant fauna has probably not suffered a great decrease, though displacement may have occurred locally, especially in disturbed habitats. There are no reports of important economic damage by ants either, as is known e.g. from the Seychelles Islands, where *Anoplolepis gracilipes* (Smith, 1857), previously known under the preoccupied name *A. longipes* (Jerdon, 1851), severely damages poultry and livestock (HAINES & HAINES 1978). The impression of collectors has been that ants in general – native or alien – are conspicuously uncommon on the Socotra Archipelago in comparison to continental faunas. More inclusive, qualitative studies will be necessary to better understand the effect of introduced ants on Socotran ecosystems.

A handful of ant species of global concern have emerged, which pose great threats to native faunas worldwide, island ecosystems being particularly vulnerable. The "Argentine ant" *Linepithema humile* (Mayr, 1868) is widely established from warm temperate to cooler tropical regions. Often it remains a commensal tramp species, but when natural ecosystems are colonised, *L. humile* is one of the most dangerous invaders. Native ants and other invaders alike may be completely displaced and endemic invertebrate species much reduced, as observed locally on the Hawaiian Islands (REIMER 1994). Equally destructive to indigenous fauna on Hawaii, and some other places, is the "big-headed ant" *Pheidole megacephala* (Fabricius, 1793), which also commonly acts as a serious household pest. The tropical American "little fire ant" *Wasmannia auropunctata* (Roger, 1863) has recently become established on several Pacific islands such as Galápagos (LUBIN 1984) and New Caledonia (FABRES & BROWN 1978, JOURDAN 1997), now endangering the rich endemic fauna of these islands. The greatest degree of popular and scientific attention has been focused on the case of the "fire ant" *Solenopsis invicta* Buren, 1972, introduced to the south-eastern USA from South America (e.g. VINSON 1994, 1997).

It is likely that the arrival of any of these pest ants on the Socotra Archipelago would cause both serious economic problems and dramatic alterations to native ecosystems. With transport and commerce to and from the main island now strongly on the increase, the threat of that occurring is very imminent. Even though *S. invicta* is restricted to the New World and Australia as yet, *S. geminata* (Fabricius, 1804), a native of North and Central America, has lately been recorded from the United Arab Emirates (COLLINGWOOD et al. 1997). Establishment of *W. auropunctata* in West Africa has been reported by WETTERER & PORTER (2003). Both *P. megacephala* and *L. humile* occur in Arabia, including Yemen (COLLINGWOOD & AGOSTI 1996, COLLINGWOOD & VAN HARTEN

2001), which should prompt immediate measures to prevent their spread to Socotra. It is not possible to intercept every colony of small, cryptic ants hidden in transported goods, but an effective quarantine scheme is the only way of relative protection against invasions. The chances of eradicating a pest ant that has become well established are virtually nil.

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