

# Checklist, biological notes and distribution of ants in the central Namib Desert

by

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## CONTENTS

1	Introduction.....	333
2	Procedure.....	333
3	Results and discussion .....	334
	3.1 Generic key.....	334
	3.2 Generic notes .....	335
	3.3 Specific notes .....	337
	3.4 General discussion and conclusions ..	342
4	Acknowledgements .....	343
5	References .....	343

## 1 INTRODUCTION

Ants play an important role in the ecology of most terrestrial habitats. Indeed, it is a little appreciated fact that "their biomass and energy consumption exceed those of vertebrates in most terrestrial habitats" (Wilson, 1971). In desert ecosystems, although ant species richness is comparatively low, they have a dominant position due to their numerical abundance (Crawford, 1981; Pisarski, 1978). For example, in the western Sahara Desert ants comprise 75% of the total fauna (Bernard, 1972). Ants play numerous roles in the economy of desert ecosystems but undoubtedly their most prominent, and probably most important, is that of a seed predator (eg Buckley, 1982).

Despite the established importance of ants in other deserts almost nothing is known about the ants of the Namib Desert. Here the results of an ant survey of the central Namib Desert are presented. A list and short description of all the species known to occur in the dune field, Kuiseb River and gravel plains is given, accompanied where possible with brief biological notes concerning their trophic role, habitat and activity period. To facilitate future ant research in the Namib Desert a generic key has been provided, a key to species level being inappropriate at present in view of the taxonomic confusion which exists for certain groups and the fact that certain genera are currently being revised (Bolton, pers. comm.).

## 2 PROCEDURE

Ants were collected using pitfall traps and searching by eye. Bait was occasionally used in both techniques. On the gravel plains sampling sites were restricted to areas accessible by road. In the dune-field, sampling sites coincided with the work sites of other scientists. With the exception of one study (Marsh, in press), the intensity of sampling, and the techniques used, were not identical at each site. The data obtained therefore give reliable presence but unreliable absence information. Most sampling occurred from 1981 to 1983.

## ABSTRACT

Thirty-six species of ant were collected in the central Namib Desert, South West Africa/Namibia during the period 1981 to 1985. The ant fauna was dominated by the Myrmicinae, comprising 29 species, followed by the Formicinae, comprising six species and the Pseudomyrmecinae with one species. The majority of ant species occurred on the gravel plains. Thirteen species were strongly associated with perennial vegetation reflecting the ant's requirements for honeydew, nectar and/or nesting sites. The vast majority of ant species were not dependent on perennial vegetation and relied primarily on seeds, insects or both for food. The taxonomic composition of the ant faunas from the Namib Desert and Sahara Desert are shown to share many similarities and examples of ecological convergence between these two ant faunas are indicated.

Data on the habits of the ants were obtained in a similar opportunistic manner. Certain species were the focus of other studies and considerably more information is available on them than on some of the rarer species. Where possible the literature has been referred to for confirmation of chance observations. However, as ant studies in southern Africa have been predominantly restricted to taxonomic and agricultural problems, published information is limited or absent for many species. Members of each species have been classified as either individual or group foragers. Individual foraging refers to ants which predominantly searched for and retrieved food objects on their own. Group foraging refers to those species which regularly used trunk trails to reach localized food sources. Total lengths (TL) are given in mm and refer to length of individuals, from the mandibular apex to the gastral apex.

3 RESULTS AND DISCUSSION

A map of the central Namib Desert showing major habitats and place names is shown in Fig. 1. Thirty-six

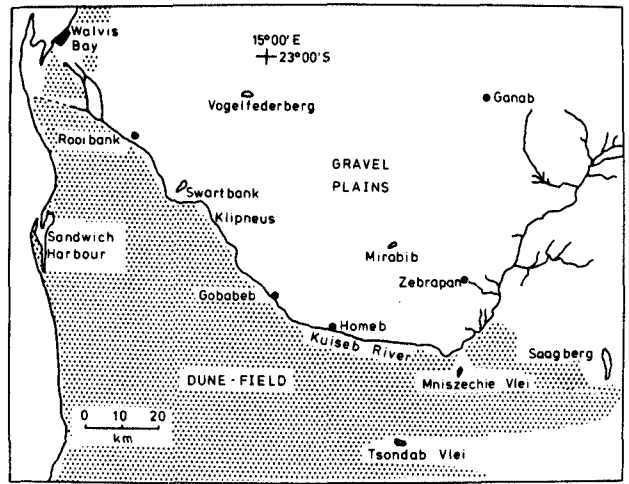


FIGURE 1: Map of the central Namib Desert indicating major geographic features.

TABLE 1: Ant species occurring in the central Namib Desert.

Myrmicinae	<i>Ocymyrmex robustior</i>
<i>Tetramorium rufescens</i> Stitz	Emery
<i>Tetramorium jordani</i> Santschi	<i>Ocymyrmex turneri</i>
<i>Tetramorium pogonion</i> Bolton	Donisthorpe
<i>Tetramorium solidum</i> Emery	<i>Ocymyrmex velox</i> Santschi
<i>Tetramorium grandinode</i> Santschi	<i>Crematogaster</i>
<i>Tetramorium peringueyi</i> Arnold	spp. (3 species)
<i>Tetramorium sericeiventre</i> Emery	Formicinae
<i>Tetramorium</i> sp. near <i>caldari</i> (Roger)	<i>Anoplolepis steingroeveri</i> (Forel)
<i>Monomorium viator</i> Santschi	<i>Anoplolepis</i> sp.
<i>Monomorium damarensis</i> (Forel)	<i>Acantholepis</i> sp.
<i>Monomorium</i> spp. (10 species)	<i>Camponotus detritus</i> Emery
<i>Pheidole tenuinodis</i> Mayr	<i>Camponotus fulvopilosus</i> (De Geer)
<i>Messor denticornis</i> Forel	<i>Camponotus maculatus</i> (F.)
	<i>Camponotus mystaceus</i> Emery
	Pseudomyrmecinae
	<i>Tetraponera ambigua</i> (Emery)

species belonging to three subfamilies and ten genera were collected in the central Namib Desert (Table 1). The ant fauna was dominated taxonomically by the Myrmicinae, comprising 6 genera and 29 species, followed by the Formicinae, comprising 3 genera and 6 species and lastly the Pseudomyrmecinae with only one representative.

3.1 Generic key

The Namib ants can be separated to genus level with the key which follows. The key is based on worker characters and relevant morphological features are illustrated in Fig. 2. It is important to note that this key

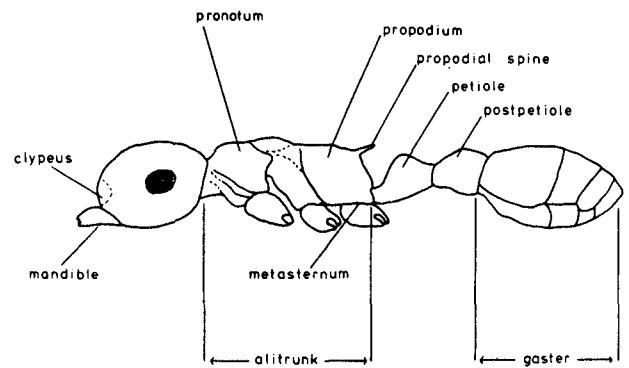


FIGURE 2: Stylized ant showing morphological features used to distinguish the Namib genera.

is applicable to central Namib Desert Formicidae only, it has little or no predictive value in other areas.

1. Alitrunk separated from gaster by two reduced segments, the petiole and postpetiole.....2
  - Alitrunk separated from gaster by a single reduced segment, the petiole. Sting absent [subfam. Formicinae] .....8
  2. Tibial spurs of hind legs broadly pectinate. Palp formula 6,4. Pretarsal claws equipped with a preapical tooth. Median portion of clypeus posteriorly not deeply inserted between the frontal lobes [subfam. Pseudomyrmecinae] .....8
- Tetraponera* Smith

- Tibial spurs of hind legs simple or absent, not broadly pectinate. Palp formula less than 6,4. Pretarsal claws simple. Median portion of clypeus posteriorly deeply inserted between the frontal lobes [subfam. Myrmicinae] .....3
- 3. Postpetiole articulated on dorsal surface of first gastral segment; the gaster in dorsal view roughly heart-shaped and capable of reflexion over the alitrunk. Petiole dorsoventrally flattened and without a node ..... *Crematogaster* Lund
- Postpetiole articulated on anterior surface of first gastral segment; the gaster in dorsal view not heart-shaped, not capable of reflexion over the alitrunk. Petiole not dorsoventrally flattened, with a node of some form .....4
- 4. Propodeal spiracle long and narrow, its orifice slit-like. Mesothoracic spiracles opening on dorsum of alitrunk ..... *Ocymyrmex* Emery
- Propodeal spiracle circular or subcircular, not long and narrow. Mesothoracic spiracles concealed by a pronotal flap on the sides of the alitrunk .....5
- 5. Lateral portions of clypeus raised into a narrow ridge or wall in front of the antennal insertions. Sting terminating in an apical or apicodorsal lamelliform appendage which may be triangular or spatulate ..... *Tetramorium* Mayr
- Lateral portions of clypeus not raised into a narrow ridge or wall in front of the antennal insertions. Sting simply pointed apically, without a lamelliform appendage .....6
- 6. Palp formula 5,3 or 4,3. Antennal funiculae without a strongly differentiated 3-segmented club. Metasternal process large and powerfully developed ..... *Messor* Forel
- Palp formula 3,2 or 2,2 or less. Antennal funiculae terminating in a conspicuous 3-segmented club. Metasternal process absent .....7
- 7. Propodeum unarmed. Monomorphic or polymorphic species, the mandibles with 3—4 teeth, the workers never with grossly enlarged head ..... *Monomorium* Mayr
- Propodeum armed with a pair of spines or teeth. Sharply dimorphic species; soldier with grossly enlarged head, the mandible with 3—4 teeth; worker with normal head and more than 5 teeth on the mandible ..... *Pheidole* Westwood
- 8. Antennae with 12 segments. Orifice of metapleural glands absent. Antennae inserted well behind the posterior margin of the clypeus ..... *Camponotus* Mayr
- Antennae with 11 segments. Orifice of metapleural glands present and usually traversed by guard-hairs. Antennae inserted close to posterior margin of clypeus .....9

- 9. Propodeum armed with a pair of spines, teeth, or blunt prominences. Petiole usually emarginate, bidentate or bispinose on dorsal margin ..... *Acantholepis* Santschi
- Propodeum unarmed. Petiole without teeth or spines ..... *Anoplolepis* Mayr

### 3.2 Generic notes

#### *Tetramorium* Mayr

The genus has a world-wide distribution with members occupying a diversity of habitats. The majority of species, however, are confined to the Ethiopian zoogeographical area (Bolton, 1980). Eight species have been found in the central Namib Desert. *Tetramorium grandinode*, *T. jordani*, *T. peringueyi*, *T. pogonion*, *T. rufescens* and *T. solidum* belong to the *solidum*-group. These closely related species are granivorous and are confined to the arid and semi-arid regions of southern Africa (Bolton, 1980). *Tetramorium grandinode*, *T. peringueyi* and *T. solidum* have not previously been recorded in or near the Namib Desert. *Tetramorium sericeiventre*, a member of the *sericeiventre*-group, is the commonest *Tetramorium* in Africa (Bolton, 1980). This species occurs from the Mediterranean to the Cape wherever there is sandy or well drained soil which receives direct insolation. Despite its abundance little is known about its habits. In savannah regions of the Ivory Coast, Levieux (1972) reports that it is predatory on other insects. *Tetramorium* sp. near *caldarium* is a new species that belongs to the *simillimum*-complex (Bolton, pers. comm.). All the *Tetramorium* species are monomorphic.

#### *Monomorium* Mayr

This large genus has a world-wide distribution (Arnold, 1916). The African species, including 100 sub-Saharan species, are currently being revised (Bolton, in prep.) and consequently it is not possible to give species names or distributions for most species. All members of the genus are monomorphic. Twelve species occur in the central Namib Desert making this the largest genus in this area. Nine of the Namib *Monomorium* species belong to the *salomonis*-group which is the dominant *Monomorium* group throughout savannah to desert regions in Africa (Bolton, pers. comm.). Only *Monomorium* spp. C, D and G belong to other species groups. Of the species that have been recently examined by a taxonomist, *Monomorium* spp. B, C, E, F, G, H, I and J are new to science, and have not been collected outside the Namib Desert. I are new to science, and have not been collected outside the Namib Desert. *Monomorium viator* is known only from SWA/Namibia (Bolton, in prep.), whereas, as the name implies, *M. damarense* has been collected previ-

ously in Damaraland, SWA/Namibia (Arnold, 1916) but more recent distributional data on this species are not presently available.

#### *Ocymyrmex* Emery

The genus is confined to the Ethiopian zoogeographical region in arid to semi-arid habitats of eastern and southern Africa (Bolton, 1981). Three species have been found in the central Namib Desert. *Ocymyrmex velox* has not been previously recorded near or in the Namib Desert although it has been collected in Angola and northern SWA/Namibia (Bolton, 1981). Prior to the present study *O. turneri* was known only from one specimen, the holotype, taken in Walvis Bay (Bolton, 1981). In contrast *O. robustior* has a much wider distribution, having been collected in numerous regions of SWA/Namibia and on the western side of South Africa as far south as Cape Town (Arnold, 1916; Bolton, 1981). Various spectacular features that characterize this genus have been reported previously, such as their rapid, apparently erratic locomotion (Arnold, 1916; Bolton, 1981; Kemp, 1951) and their unusual temporal niche, the ants being active during the heat of the day (Arnold, 1916; Kemp, 1951). According to Prins (1963, 1965) members of this genus are primarily granivorous but sometimes prey on live insects, particularly termites. All are monomorphic.

#### *Crematogaster* Lund

This large genus has a world-wide distribution (Arnold, 1920). The taxonomy of the African species is confused and reliable species determinations are not at present possible (Bolton, pers. comm.). Arnold (1920) records that members of this genus are primarily arboreal and feed on honeydew. Three monomorphic morphospecies have been found in the central Namib Desert.

#### *Pheidole* Westwood

This large genus has a world-wide distribution (Arnold, 1920). Workers are dimorphic, with two discrete castes, minors and majors, based on large size differences. Unfortunately the taxonomy of the African species is confused and previous determinations are untrustworthy (Bolton, pers. comm.), thus the literature containing distributional records is unreliable. Only one species, *P. tenuinodis*, has been recorded in the central Namib Desert. This species appears to have a wide distribution in southern Africa. Arnold (1920) reports that *Pheidole* spp. are omnivorous with some species exhibiting preferences for seeds and/or honeydew.

#### *Messor* Forel

This genus inhabits grassland, savannah and arid areas in the Palearctic, Nearctic, Madagascar and

Afrotropical regions. The Palearctic, including North Africa, is the centre of distribution, with the Afrotropical region, which includes the Namib Desert, having relatively few species (Bolton, 1982). Only one species, *M. denticornis*, has been found in the central Namib Desert. This species has been previously recorded at Luderitz and Spitzkop in the Namib Desert and has a reasonably broad distribution in SWA/Namibia, Botswana and the western side of the Cape Province of South Africa. All members of the genus are granivorous (Bolton, 1982). Workers exhibit continuous polymorphism whereby there is a continuous gradation from small to large workers.

#### *Anoplolepis* Santschi

This is a very small genus, comprising only four described species, which is confined to southern Africa including Angola and Zimbabwe (Prins, 1982). Two species, *A. steingroeveri* and an unidentified species, occur in the central Namib Desert. *Anoplolepis steingroeveri* is confined to semi-arid and arid regions of southern Africa and has previously been collected in SWA/Namibia on a farm, Choaherib (Arnold, 1922), which is located on the eastern edge of the central Namib Desert. Members of this genus are very aggressive and feed predominantly on honeydew (Arnold, 1922; Prins, 1982). *Anoplolepis steingroeveri* workers exhibit continuous polymorphism whereby there is a continuous gradation from small to large individuals. Repletes, a caste with large distensible gasters which can store liquid food in their crops, occur in this species (Arnold, 1922; Prins, 1982). The unidentified *Anoplolepis* species appears to be monomorphic but, owing to the small sample size and a lack of detailed observations, this has not been confirmed.

#### *Acantholepis* Mayr

The taxonomy of this genus is confused, even the genus name is preoccupied by a fish (B. Bolton, pers. comm.). According to Arnold (1920) the genus is widespread, occurring in the Palearctic, Ethiopian and Indo-Malayan regions. Members of the genus are predominantly honeydew feeders and some appear to have a replete caste. Only one monomorphic species has been recorded in the central Namib Desert. In this species the gaster of foraging workers is very distensible, accounting for most of the size variation in workers. It is not known whether sedentary repletes occur in the nest.

#### *Camponotus* Mayr

This large genus has a world-wide distribution. Workers exhibit continuous polymorphism whereby there is a continuous gradation from small to large individu-

als. Four species occur in the central Namib Desert; *C. maculatus*, *C. mystaceus*, *C. fulvopilosus* and *C. detritus*. *Camponotus maculatus* is widely distributed in Africa, occurring in the Sahara Desert (Delye, 1968), and is common in southern Africa (Arnold, 1922). *Camponotus mystaceus* is widespread in southern Africa and has previously been recorded from Rooibank in the central Namib Desert (Arnold, 1922). *Camponotus fulvopilosus* is common in the arid western half of southern Africa and *C. detritus* has been recorded in the central Namib Desert at various locations within the dune field (Arnold, 1924; Curtis, 1983). There is some debate as to whether *C. detritus* is a valid species and whether it is endemic to the dune-fields of the Namib Desert (A.J. Prins, pers. comm.). Electrophoretic studies indicate that *C. detritus* is not distinct from *C. fulvopilosus* (Lighton, unpubl.). Specimens resembling *C. detritus* have recently been collected at Springbok, Cape Province (M. Molteno, pers. comm.) and there is an unsubstantiated report of *C. detritus* having been collected at Matjiesfontein in the Cape Province (A.J. Prins, pers. comm.). *Camponotus maculatus* and *C. mystaceus* are nocturnal (Arnold, 1922) whereas *C. fulvopilosus* and *C. detritus* are diurnal (Arnold, 1924; Curtis, 1983). All four species are predominantly honeydew feeders (Arnold, 1922, 1924; Curtis, 1983).

#### *Tetraoponera* Smith

This small genus has a widespread distribution in southern Africa (Arnold, 1916). Most members of the genus are arboreal, nesting in hollow twigs or thorns. Only one species, *T. ambigua*, has been recorded in the central Namib Desert. *Tetraoponera ambigua* is known to use *Acacia* spp. thorns as a nesting site and has previously been recorded in Botswana (Arnold, 1916). No record of *T. ambigua* occurring in SWA/Namibia has apparently been published.

### 3.3 Specific notes

#### *Tetramorium rufescens* Stitz

TL 4,0—5,1; dull red, gaster sometimes darker than head and alitrunk. This species is widely distributed in the eastern half of the gravel plains and dune-field (Fig. 3). In the dune-field it occurs predominantly on the interdune valleys but has also been seen foraging on dune slopes. On the gravel plains nests are frequently located in small hollows and are fairly conspicuous, comprising up to six entrances of 2—5 mm diameter. Members of this species are predominantly diurnal, individual foraging granivores.

#### *Tetramorium pogonion* Bolton

TL 3,8—4,1; blackish-brown. This species has been collected only twice, once in a pitfall trap situated on

a sand dune and once by hand on the gravel plains just east of the dune field (Fig. 3). No nests have been located. *Tetramorium pogonion* is a diurnal, individual foraging granivore.

#### *Tetramorium solidum* Emery

TL 4,1—5,1; dark brown to blackish-brown. This species has been collected at only two sites on the gravel plains (Fig. 3) and no nests have been located. This species is a diurnal, individual foraging granivore.

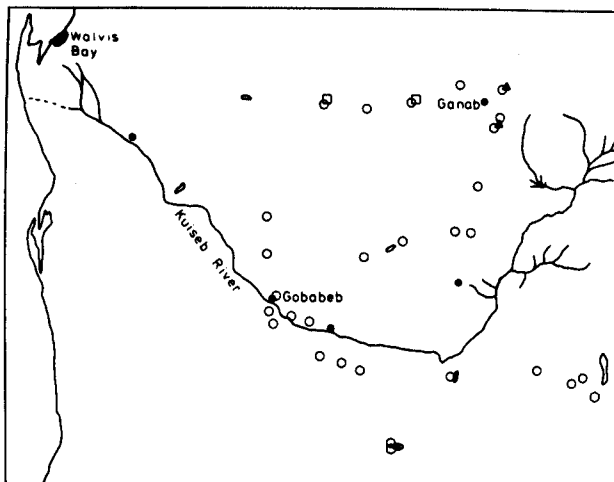


FIGURE 3: Distribution map for *Tetramorium rufescens* ○, *T. grandinode* ▲, *T. pogonion* and *T. solidum* □.

#### *Tetramorium grandinode* Santschi

TL 5,0—5,3; bicoloured with deep reddish-brown to blackish-brown head and alitrunk and a dull red gaster. *Tetramorium grandinode* occurs on the gravel plains on the eastern edge of the Namib Desert (Fig. 3). Nests are inconspicuous and contain up to four entrances of 3—5 mm diameter. Members of this species are diurnal, individual foraging granivores.

#### *Tetramorium jordani* Santschi

TL 5,3—5,8; black to blackish-brown. *Tetramorium jordani* occurs on the eastern half of the dune-field (Fig. 4) where it is found predominantly on sand dunes but also occurs on the interdune valleys. Nests are inconspicuous, usually comprising a single entrance of 2—5 mm diameter, situated at the base of perennial grass species such as *Stipagrostis lutescens*. Members of this species are diurnal, individual foraging granivorous ants.

#### *Tetramorium peringueyi* Arnold

TL 4,4—5,7; orange-red to deep red. This species occurs on the gravel plains on the eastern edge of the

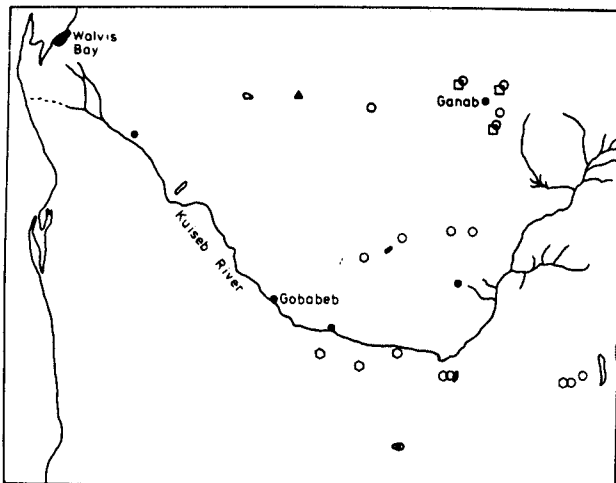


FIGURE 4: Distribution map for *Tetramorium sericeiventre* ○, *Tetramorium* sp. near *caldarium* ▲, *T. jordani* ● and *T. peringueyi* □.

Namib Desert (Fig. 4). No nests have been located. *Tetramorium peringueyi* is a diurnal, individual foraging granivore.

#### *Tetramorium sericeiventre* Emery

TL 3,3—4,4; bicoloured with a dull red head and alitrunk and a black gaster. *Tetramorium sericeiventre* is widely distributed on the eastern half of the gravel plains and on interdune valleys in the dune field (Fig. 4). Nests have a single entrance of 3—5 mm diameter. The conspicuousness of the nests is enhanced by a ring of discarded refuse about the entrance. In contrast to the predatory nature of *T. sericeiventre* in the Ivory Coast (Levieux, 1972), in the Namib Desert this diurnal, individual foraging species is an omnivore, taking a diversity of food types including arthropod fragments, grass stems, leaves and seeds.

#### *Tetramorium* sp. near *caldarium* (Roger)

TL 2,1—2,4; yellow or light yellowish-brown with the gaster a darker shade than the head and alitrunk. Only a few specimens have been collected in a pitfall trap on the gravel plains (Fig. 4). Nothing is known about the habits of this species.

#### *Monomorium viator* Santschi

TL 3,5—3,9; bicoloured with dark brown head and gaster, and an orange alitrunk. *Monomorium viator* is widely distributed on the gravel plains and also occurs on interdune valleys (Fig. 5). Nests are inconspicuous with one, sometime two, entrances of 1—2 mm diameter. Members of this species are predominantly nocturnal, individual foraging granivores.

#### *Monomorium* sp. B

TL 2,7—3,1; dark brown. *Monomorium* sp. B is widely distributed on the gravel plains (Fig. 5). Nests are inconspicuous and have a single entrance of 1—2 mm diameter. Members of this species are diurnal, individual foraging omnivores which take a variety of food

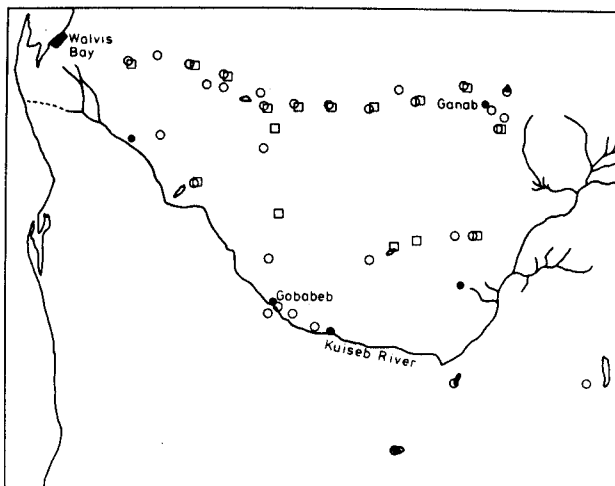


FIGURE 5: Distribution map for *Monomorium viator* □, *Monomorium* sp. K ▲ and *Monomorium* sp. B ○.

types including seeds, vegetative parts of plants (especially grasses), arthropod fragments and honeydew.

#### *Monomorium* sp. I

TL 2,7—2,9; bicoloured with pale reddish-brown head and alitrunk and dark brown to black gaster. This is a rare, apparently arboreal species, that has been found on the gravel plains, at the eastern edge of the dune field and at Tsondab vlei (Fig. 6). Nests have not

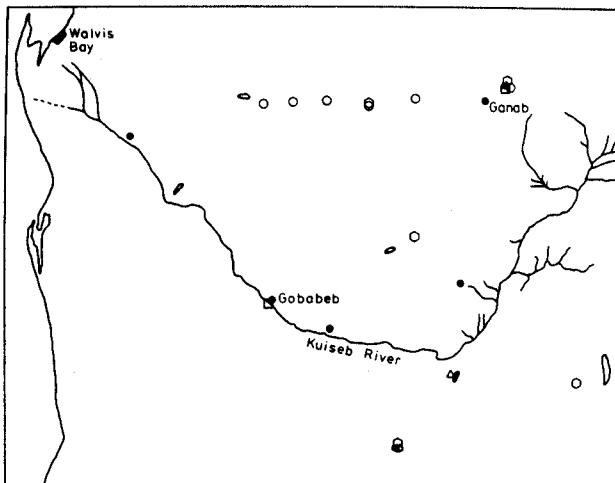


FIGURE 6: Distribution map for *Monomorium* sp. G ○, *Monomorium* sp. J ▲, *Monomorium* sp. H ●, *Monomorium* sp. I ■ and *M. damarensis* □.

been located but are likely to be situated in trees. Workers are diurnally active and have been observed collecting nectar from the extrafloral nectaries on *Moringa ovalifolia* and honeydew from Homoptera on *Acacia* spp..

#### *Monomorium* sp. G

TL 1,7—1,9; translucent, pale orange-brown. This small species occurs in the eastern half of the central Namib Desert on the gravel plains (Fig. 6). Nothing is known about the habits of this ant. All specimens were taken in pitfall traps, some located at the base of plant, whereas others were over 50 m from the nearest plant. It seems likely therefore that they are not dependent on perennial vegetation or honeydew-exudate foods. In view of their pale, translucent coloration they are probably nocturnal.

#### *Monomorium damarensis* Forel

TL 2,4—2,6; orange-brown. *Monomorium damarensis* was found at only two localities, on the eastern plains of the Namib Desert in an ephemeral water course, and in the Kuiseb River bed at Gobabeb (Fig. 6). Nests were located in soft sand at the base of perennial shrubs; on the gravel plains in association with *Boscia foetida* and *Pecheul Loeschia leubnitziae* and in the Kuiseb River in association with *P. leubnitziae*. The ants were diurnally active but their feeding habits are unknown.

#### *Monomorium* sp. C

TL 2,2—2,6; dark brown to black. *Monomorium* sp. C is widely distributed on the gravel plains and also occurs on interdune valleys (Fig. 7). Nests are inconspicuous with a single entrance approximately 1 mm in diameter. Members of this species are diurnal, individual foraging granivores, taking predominantly *Stipagrostis* spp. seeds.

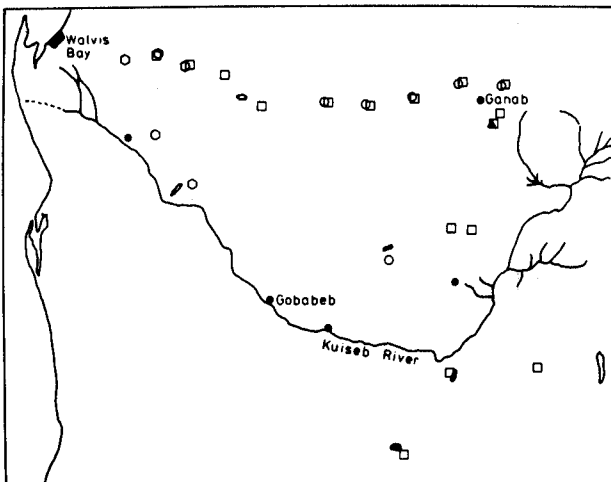


FIGURE 7: Distribution map for *Monomorium* sp. E ○, *Monomorium* sp. D ▲, *Monomorium* sp. F □ and *Monomorium* sp. C □.

#### *Monomorium* sp. D

TL 1,3—1,5; translucent, pale orange-brown. This minute species has been collected at only one locality, near Ganab on the gravel plains (Fig. 7). The ants appeared to nest within perennial clumps of *Stipagrostis* sp.. Members of this species are diurnal, honeydew feeders and were observed tending Homoptera on perennial *Stipagrostis* sp. clumps. Because of its size and habits this is an inconspicuous species likely to be overlooked and may have a much wider distribution in the Namib Desert.

#### *Monomorium* sp. K

TL 2,0; pale brown. This species is known from two specimens only, both collected in a pitfall trap situated at the base of *Pecheul Loeschia leubnitziae* on the eastern edge of the gravel plains (Fig. 5). Nothing is known about the habits of this ant species.

#### *Monomorium* sp. J

TL 2,2; pale brown. This species is known from only three specimens taken in a pitfall trap situated on the slope of a sand dune (Fig. 6), and consequently nothing is known about its habits.

#### *Monomorium* sp. H

TL 2,0—2,2; medium brown. *Monomorium* sp. H was found at one site on the eastern plains of the Namib Desert (Fig. 6). All specimens were collected in pitfall traps situated at the base of *Boscia foetida*. Nothing is known about the habits of this ant species.

#### *Monomorium* sp. E

TL 2,3—2,6; dark brown to black. This species is apparently restricted to the eastern half of the Namib Desert gravel plains (Fig. 7). Nests have not been located. *Monomorium* sp. E is a diurnal, individual foraging granivore.

#### *Monomorium* sp. F

TL 2,9—3,1; dark brown to black. *Monomorium* sp. F is the only Namib ant species that is apparently restricted to the western half of the desert, in the cool fog zone, on the gravel plains (Fig. 7). Nests are inconspicuous and have a single entrance of 1—2 mm diameter. Members of this species are diurnal, individual foraging omnivores which take a variety of food types, especially seeds and arthropod fragments.

#### *Ocymyrmex robustior* Emery

TL 6,7—7,2; reddish-brown. *Ocymyrmex robustior* is widespread on the gravel plains and interdune valleys

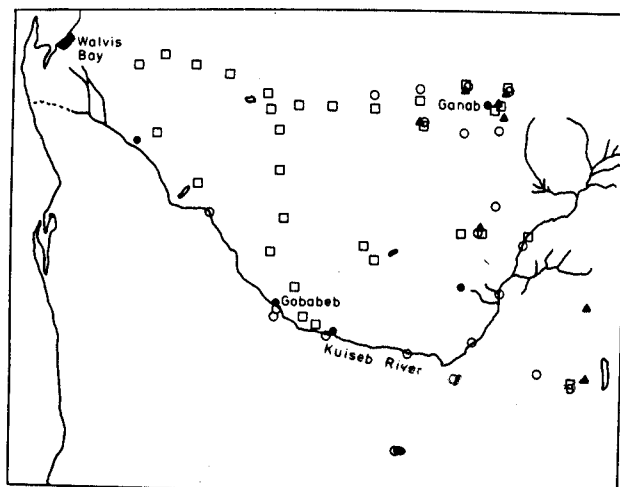


FIGURE 8: Distribution map for *Ocymyrmex robustior* ○, *O. velox* ▲ and *O. turneri* □.

in the eastern half of the desert, but in the Kuseb River and on the interdune valleys near the river, it penetrates westwards to at least Klipneus. At the eastern edge of the dune-field this species also occurs on the sand dunes (Fig. 8). Nests are inconspicuous, normally have one entrance hole 5–10 mm in diameter and in sandy areas, such as the Kuseb River, are usually situated at the base of some vegetation or in silt beds. *Ocymyrmex robustior* is a diurnal, individual foraging insectivorous ant, almost exclusively scavenging dead insects and taking particular advantage of heat-stressed victims. These findings are contrary to the views of Prins (1963, 1965) that members of the genus are primarily granivorous.

#### *Ocymyrmex turneri* Donisthorpe

TL 5,4–5,8; blackish-brown. *Ocymyrmex turneri* is widespread on the gravel plains, occurring across the entire width of the Namib Desert (Fig. 8). Nests are inconspicuous, with one entrance hole 2–5 mm in diameter. Like *O. robustior*, this species is a diurnal, individual foraging insectivore that primarily retrieves dead insects.

#### *Ocymyrmex velox* Santschi

TL 10,0–10,7; bicoloured with a red head and brownish-black alitrunk and gaster. This species is restricted to the gravel plains in the east, occurring particularly near inselbergs and in stony ground (Fig. 8). Nests are inconspicuous and normally have one entrance hole 5–20 mm in diameter. A semilunar crater, comprising sand and pebbles removed from the nest, occasionally occurs at the nest entrance. *Ocymyrmex velox* is a diurnal, individual foraging insectivorous species that preys principally on *Hodotermes* sp. during termite eruptions and scavenges for dead arthropods when termites are not active.

#### *Crematogaster* sp. A

TL 3,3–3,8; bicoloured with a red-brown head and alitrunk and a black-brown gaster. This species has only been found in the vicinity of Gobabeb in the Kuseb River and in one of its tributaries where it occurred on *Acacia* spp. (Fig. 9). Nests have not been located but are almost definitely situated in trees (Arnold, 1920). Members of this species are diurnal, individual foraging honeydew feeders.

#### *Crematogaster* sp. B

TL 3,6–3,9; bicoloured with a red head and alitrunk and a black gaster. *Crematogaster* sp. B occurs on *Acacia* trees on the gravel plains in the eastern side of the Namib Desert, on *Acacia* sp. trees in the Kuseb River and on *Stipagrostis* grasses on the sand dunes in the eastern dune-field (Fig. 9). In the dune-field nests are located at the base of *Stipagrostis* spp.. No nests have been located on the gravel plains or Kuseb River but they are most probably situated in trees (Arnold, 1920). Members of this species are diurnal, individual foraging honeydew feeders.

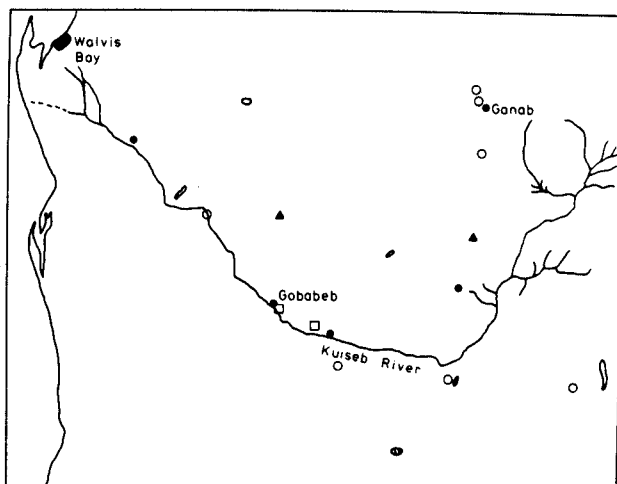


FIGURE 9: Distribution map for *Crematogaster* sp. B ○, *Crematogaster* sp. C ▲ and *Crematogaster* sp. A □.

#### *Crematogaster* sp. C

TL 3,6–3,8; red-brown. This species has been found at only two localities, 30 km north of Gobabeb on a *Euclea pseudobenus* tree and 56 km north-east of Gobabeb on an *Acacia erioloba* (Fig. 9). No nests were located but they were probably situated in the trees. *Crematogaster* sp. C is a diurnal, individual foraging honeydew feeder.

#### *Pheidole tenuinodis* Mayr

TL 2,5–2,6 (minor), 4,5–4,9 (major); medium brown to blackish-brown. *Pheidole tenuinodis* is widely dis-



tributed on the gravel plains and also occurs on interdune valleys at Sandwich Harbour and at the eastern edge of the dune-field (Fig. 10). Nests are inconspicuous, typically with one, but occasionally up to five, entrances of 3–5 mm diameter. Members of this species are predominantly nocturnal to crepuscular. They are primarily seed eaters but also regularly take honeydew and nectar. Foragers collect food individually but sometimes employ group foraging along trunk trails leading to specific, localized food sources, such as a nectar secreting plant, or a plant heavily infested with honeydew-secreting Homoptera.

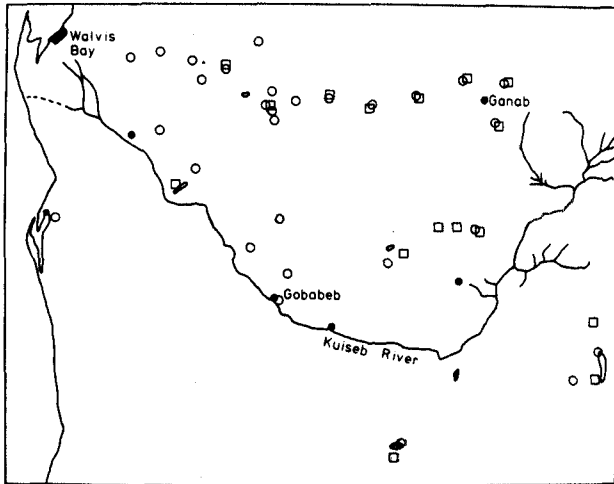


FIGURE 10: Distribution map for *Pheidole tenuinodis* ○ and *Messor denticornis* □.

#### *Messor denticornis* Forel

TL 5,5–11,0; black. *Messor denticornis* is widely distributed on the gravel plains, particularly on the eastern half of the Namib Desert, and at Tsondab vlei (Fig. 10). Nests are fairly conspicuous, usually comprising a nest disk of 0,5–1,0 m diameter and a system of radiating pathways from which small pebbles have been cleared by the ants. Each nest has one to four entrance holes of 10–30 mm diameter. Colonies are polydomous, containing up to four nests which are often interconnected by surface pathways. In terms of biomass this is the dominant ant species on the eastern plains (Marsh, in prep.) and it is occasionally preyed upon by antbear, *Orycteropus afer*. As a consequence of antbear activity the nest disks frequently contain large holes (approximately 50–70 x 30 x 30 cm). Members of this species are predominantly nocturnal, group foraging granivores. Workers employ individual foraging to collect insect matter and seeds when seeds are relatively scarce.

#### *Anoplolepis steingroeveri* (Forel)

TL 2,9–8,0; blackish-brown. This species is widely distributed on the gravel plains and also occurs at Tsondab and Mniszeckie vleis in the dune field (Fig.

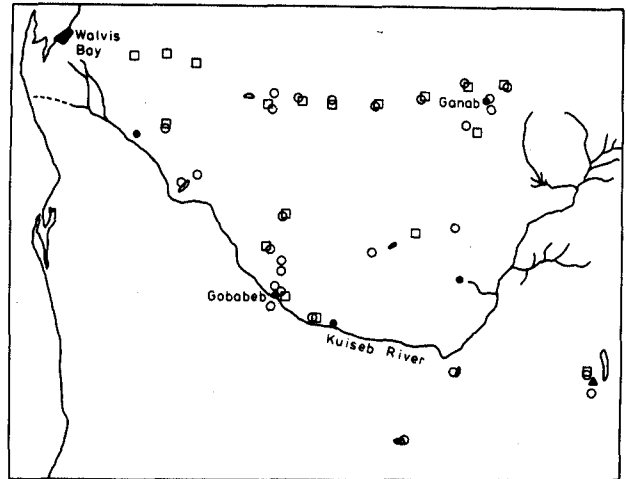


FIGURE 11: Distribution map for *Anoplolepis steingroeveri* ○, *Anoplolepis* sp. ▲ and *Acantholepis* sp. □.

11). Nests are relatively conspicuous, with a series of entrances of about 5–10 mm diameter which are usually situated at the base of some perennial vegetation or below rock slabs. The conspicuousness of the nests is enhanced by the aggressive habits of these ants which swarm out towards, and sting, any animal large enough to set up vibrations on the surface near their nests. Members of this species are diurnal, individual foraging honeydew and nectar feeders. Their distribution is dependent on perennial vegetation. Nests have been located below or near the following plants: *Salso-la tuberculata*, *Arthraerua leubnitziae*, *Welwitschia mirabilis*, *Moringa ovalifolia*, *Calicorema capitata*, *Acacia* spp., *Asclepias buchenaviana* and *Stipagrostis* spp..

#### *Anoplolepis* sp.

TL 2,4–3,0; medium brown. This species has been located once only, on the gravel plains in soft sand on the eastern edge of the Namib Desert (Fig. 11). Workers were active during the heat of the day but nothing further is known about their habits.

#### *Acantholepis* sp.

TL 2,0–3,2; black. This species is widely distributed on the gravel plains and also occurs at Sandwich Harbour (Fig. 11). Nests are inconspicuous, normally with one entrance of 1–2 mm diameter, and are situated at the base of some perennial vegetation. Members of this species are diurnal, individual foraging honeydew and nectar feeders. Their distribution is dependent on perennial vegetation and nests have been located below or near the following plants: *S. tuberculata*, *A. leubnitziae*, *W. mirabilis*, *B. foetida*.

#### *Camponotus detritus* Emery

TL 7,0–16,0; dorsally bicoloured with dark reddish-brown to black head and alitrunk and predominantly

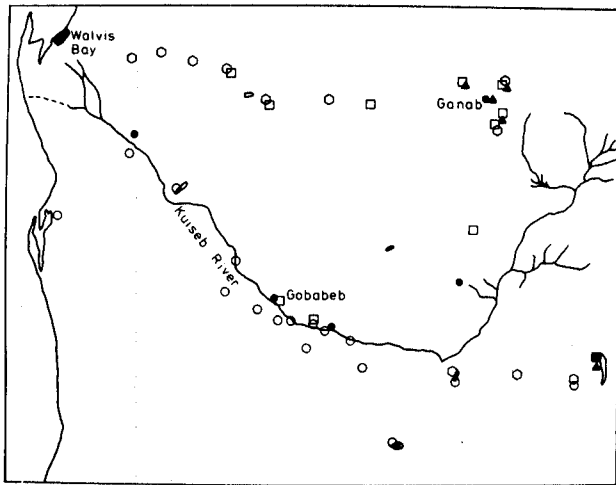


FIGURE 12: Distribution map for *Camponotus detritus* ○, *C. fulvopilosus* ▲, *C. mystaceus*, *C. maculatus* □ and *Tetraponera ambigua* ■.

ochre to buff gaster with a few black blotches, ventrally a uniform dark reddish-brown to black. *Camponotus detritus* is widespread on sand dunes across the width of the desert and in the Kuseb River from approximately 20 km east of Homeb to Walvis Bay (Fig. 12). With the exception of a small population on the west side of Swartbank Mountain, these ants do not occur on the gravel plains or on interdune valleys. Nests are situated at the base of vegetation, usually a clump of perennial grass, and typically contain one entrance hole 10–15 mm in diameter. Colonies are polydomous, containing up to four nests (Curtis, 1983). *Camponotus detritus* is predominantly a diurnal, individual foraging honeydew feeder.

#### *Camponotus fulvopilosus* (De Geer)

TL 10,0–16,0; dorsally bicoloured with a dark brown to black head and alitrunk and an ochre to buff gaster, ventrally a uniform dark brown to black. This species is confined to the eastern edge of the gravel plains where it commonly occurs in well vegetated ephemeral water courses (Fig. 12). Nests are typically situated below rock slabs and contain one entrance hole of 10–15 mm diameter. Members of this species are predominantly diurnal, individual foraging honeydew feeders which derive their food primarily from Homoptera occurring on *Acacia* trees.

#### *Camponotus maculatus* (F.)

TL 7,7–12,0; translucent, pale brown. *Camponotus maculatus* is widely distributed on the gravel plains (Fig. 12). The nests of these nocturnal, individual foraging ants have not been located.

#### *Camponotus mystaceus* Emery

TL 7,0–15,0; translucent, pale brown but sometimes with dark brown on head and gaster. This species is widely distributed on the gravel plains, occurring across the width of the desert, and occurring on sand dunes on the eastern dune-field (Fig. 12). Nests of this species have not been located. *Camponotus mystaceus* is a nocturnal, individual foraging honeydew feeding species. Workers obtain honeydew from Homoptera occurring on *Stipagrostis* spp. on sand dunes. On the gravel plains workers have been observed taking nectar from *A. leubnitziae* flowers.

#### *Tetraponera ambigua* (Emery)

TL 3,8–4,1; orange-brown. This species has been located only once, on the eastern edge of the Namib Desert (Fig. 12), where it was seen foraging on an *Acacia* sp. during the day. Nothing is known about the habits of this species.

### 3.4 General discussion and conclusions

As all habitats were not sampled with equal intensity, interhabitat comparisons could be misleading. The gravel plains were sampled most intensively, and perhaps because of this the majority of ant species were found in this habitat. Of the 36 ant species recorded in the central Namib Desert, 32 were found on the gravel plains. In contrast, only 13 species were found in the dune-field and 10 of these also occurred on the gravel plains. The predominance of ants on the gravel plains may however be genuine and not a reflection of biased sampling, as Bernard (1964) and Delye (1968) noted a similar distribution for Sahara Desert ants. Only three species, *C. detritus*, *T. jordani* and *Monomorium* sp. J, have been recorded in the Namib dune-field alone. Of these three species, the former two were common and conspicuous in the dune-field and their apparent absence on the gravel plains is probably real and not due to inadequate sampling. *Monomorium* sp. J was collected only once in the dune-field and there is thus insufficient evidence to assess whether this is a dune-endemic species or not.

Thirteen of the 36 Namib Desert ant species were strongly associated with perennial vegetation. This dependence on perennial vegetation reflects the ants' requirements for a regular source of honeydew, nectar and/or nesting sites. All of the Formicinae and Pseudomyrmecinae fall into this category, as do the *Crematogaster* species and three *Monomorium* species in the Myrmicinae. The majority of Myrmicinae were not dependent on perennial vegetation, relying primarily on seeds, insects or both for their food. This freedom from perennial vegetation probably explains in part the dominance of the Myrmicinae in the ex-

tremely arid, central Namib Desert where perennial vegetation is sparse or absent for much of the region (Robinson, 1978).

Of the 28 Namib Desert ant species for which trophic roles could be assigned with reasonable confidence, 11 were granivorous, 11 were honeydew-nectar feeders, 3 were omnivores and 3 were insectivores. This accords well with data from other deserts of the world where the major trophic categories into which ants fall are seed, honeydew-nectar and insect feeders and omnivores (Chew, 1977; Delye, 1968; Pisarski, 1978; Whitford, 1978).

Bearing in mind possible differences in the depth of taxonomic knowledge and sampling intensity, the ant fauna of the central Namib Desert is strikingly similar in its overall composition to that of the central Sahara Desert (Table 2). In both deserts the same three subfamilies of ants are present with the fauna being dominated by the Myrmicinae, followed by the Formicinae and with the Pseudomyrmecinae very poorly represented. Similarities also exist at the generic level, with the majority of ants in both deserts belonging to the same genera. The importance of the various genera in each desert varies however. Only one species, *C. maculatus*, occurs in both deserts, although once the revisions of *Crematogaster*, *Monomorium* and *Acantholepis* (Bolton, in prep.) are completed, other species common to both deserts may be revealed.

There are some interesting examples of convergence between the ant faunas of the two regions: The role of

insectivore is occupied by the myrmicine genus *Ocymyrmex* in the Namib Desert and by the formicine genus *Cataglyphis* in the Sahara Desert (Delye, 1968; Harkness and Wehner, 1977; Schmidt-Hempel, 1983; Wehner et al., 1983; Wehner and Marsh, in prep.). Despite their different phylogenetic origins, members of both genera also occupy the same temporal niche during the heat of the day and exhibit similarities in foraging behaviour and speed of locomotion (Wehner and Marsh, in prep.). The myrmicine genera *Leptothorax* and *Tetramorium* are examples of morphological convergence (Bolton, 1980) and probably occupy the same granivorous niche. In this respect it is interesting that *Tetramorium* species are relatively rare in the Sahara Desert, where *Leptothorax* is abundant, whereas, in the Namib Desert, where *Leptothorax* does not occur, *Tetramorium* is common.

Although the Myrmicinae and Formicinae also dominate the ant faunas of deserts in Australia (Briese and Macauley, 1981; Greenslade and Halliday, 1983) and North America (Chew, 1977; Whitford, 1978), the Dolichoderinae are also prevalent and Dorylinae and Ponerinae subfamilies are present. These differences may reflect different evolutionary histories of the African deserts and these other, more isolated and distant, deserts. They may also reflect differences in aridity, with the more xeric African deserts supporting a relatively simple trophic web excluding the obligatory, predatory doryline and ponerine ants.

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TABLE 2: Composition of ant faunas in the central Sahara and central Namib Deserts. Data on Sahara Desert ants are from Delye (1968).

Ant taxon	Number of ant species	
	Namib	Sahara
Myrmicinae		
<i>Messor</i>	1	8
<i>Pheidole</i>	1	3
<i>Tetramorium</i>	8	3
<i>Leptothorax</i>	0	7
<i>Monomorium</i>	12	7
<i>Crematogaster</i>	3	5
<i>Cardiocondyla</i>	0	1
<i>Oxyopomyrmex</i>	0	1
<i>Ocymyrmex</i>	3	0
Formicinae		
<i>Cataglyphis</i>	0	5
<i>Camponotus</i>	4	9
<i>Acantholepis</i>	1	2
<i>Anoplolepis</i>	2	0
Pseudomyrmecinae		
<i>Tetraponera</i>	1	2
Total	36	53

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