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## Diversity of Ants in North Kordofan, Sudan

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### Abstract

The purpose of this study is to record the ant (Hymenoptera, Formicidae) species and their habitat preference in Algafeel area, North Kordofan. Specimen were collected by hand and/or a strip paper. Nine genera were identified to the species level. These constitutes the following 14 species: *Camponotus oasisium*, *Camponotus sericeus*, *Camponotus maculatus*, *Cataglyphis abyssinicus*, *Cataglyphis auratus*, *Messor galla*, *Monomorium areniphilum*, *Monomorium bicolor*, *Tetramorium sericeiventre*, *Pheidole escherichii*, *Pheidole rotundata*, *Trichomyrmex oscaris*, *Brachyponera chinensis* and *Megaponera analis*. The following were identified to the generic level: *Dorylus* sp., *Paratrechina* sp., *Lepisiota* sp., *Monomorium* sp., and *Pheidole* sp. around 35% of the studied ant species were found in human dwellings. *Camponotus maculatus*, *Paratrechina* sp., *Lepisiota* sp., male of *Messor* sp., *Pheidole* sp. (major +minor) and *Cataglyphis* sp., are record for the first time in North Kordofan.

**Keywords:** Formicidae, Diversity, Algafeel, Sudan

### Introduction

According to Bolton (1994) [4] ants are highly coloured social insects that live in organized colonies, with distinct division of labor. Their colour mostly black or red, few are green and some tropical species have a metallic glow (<https://en.wikipedia.org/wiki/Ant>, 2022). Colours in social insects such as ants, assist in body protection, chemo communication, and physiological adaptations (Badejo *et al.*, 2020) [2].

The colony may contain from a few hundreds to over 20 million individuals (Oster and Wilson, 1978) [19]. Ants occupy a wide range of ecological niches exploiting a wide range of food as herbivores, predators, and scavengers (Holldobler and Wilson, 1990) [7], but leafcutter ants *Acromyrmex* spp. and *Atta* spp., feed exclusively on a fungus that grows only within their colonies (Goes *et al.*, 20210) [6]. Ants range in size from 0.75 to 52 mm (Shattuck, 1999) [17].

Most ant species have significant functional role in the environment. In the tropic they protect many plant species from other insects and perhaps from pathogens (Bolton, 1982) [3]; they turn and enrich more soil than earthworms (Wilson, 1971; Jeanne, 1979) [19, 9]. *Acromyrmex* spp. and *Atta* spp., are the principal destructive insect pests of Central and South America (Weber, 1972) [18], and Southwestern United States (Davidson *et al.*, 1980) [5].

North Kordofan entertain a diversity of habitat ranging from semi dessert with oases and sand dunes in the north, savannah belt with diverse shrubs and tree stands depending on the water table, rain fall, water harvesting system and permanent and ephemeral inland water bodies. The area is endowed with mountains including Jebel El Dayer Biosphere Reserve. According to Ahmed (2021) [1] the Biosphere Reserve is is very rich in biotic forms and harbours at least 50% of Sudan Avifauna.

Ants of North Kordofan were studied from *Acacia senegal* plantations by Mathews (2006) [11], and from *Phoenix dactylifera* in Eltaweel, Elbasheery and Abugida Oases by Mohamed and Mohamed (2014) and from a number of places by Omer (2017) [13]. The consolidated list of Sudan ants (collected by Awatif K. Omer and Zuheir N. Mahmoud) contains notes on species locations, notes and prior reports from North Kordofan. The list was compiled and published on line by Taylor (2015 and 2018) [15, 16].

The objectives of this work is to record ant species in Algafeel area and compare it with previous data from various localities of North Kordofan.

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**Materials and Methods**

**Study area**

Ant specimens were collected during May, 2017 from different localities in Alga feel village, North Kordofan (Fig. 1). The figure (map) also showed other collection sites by different investigators.

**Collection and identification of ant specimens**

Ants were collected by a strip of paper and sometimes by hands. Each specimen was preserved by dropping into a numbered bottle containing 70% alcohol and a drop of glycerol.

Diversity was assessed by:

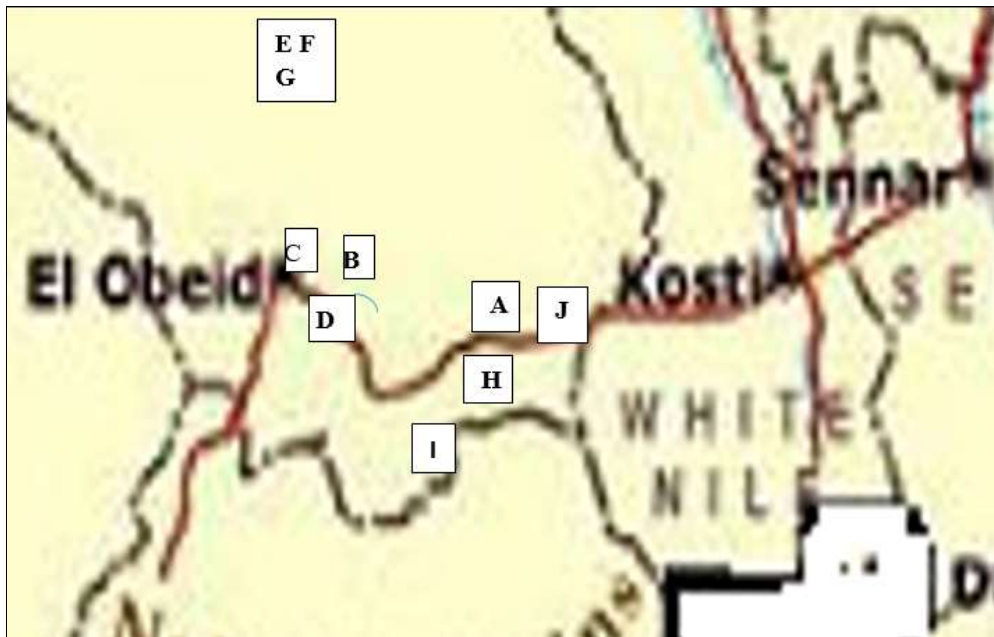
$$\text{Quotient of Similarity Index (QSI)} = 2C \div [C1 + C2].$$

Where

C=common species between two studies; C1 species reported in one study and C2 species reported in another study.

Collection was performed from 10:00 am to 3:00 pm. The specimens were examined under a Will Strubin Wetzlar binocular microscope.

Taxonomy of collected ant specimens followed Bolton (1994) [4].



**Fig 1:** The studied locations: A=Elgafel, B=Khor Tagat, C=El Obeid, D=AlAin, E=Eltaweel, E=Elbasheery, G=Abugaida, H=Elrahad, I=Jebel El dayer, J=Tandalti.

**Results**

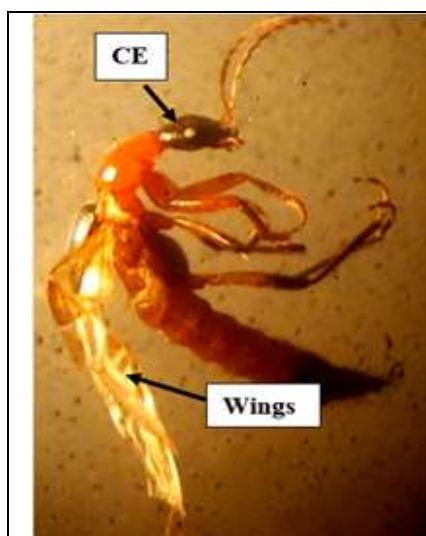
The study revealed the presence of 18 ant species falling into four subfamilies: Myrmicinae (three genera and eight species), Formicinae (four genera and seven species), Ponerinae (one genera and two species) and Dorylinae (one genera and one species). Letters in Table 1 represent the site

of collection.

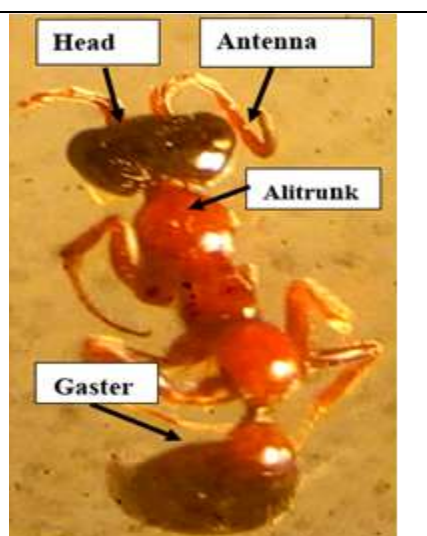
Subfamily: Dorylinae [Leach, 1815](#)

*Dorylus* sp. [Fabricius, 1793](#)

*Dorylus* spp., are [army ants](#) (Figs. 2a and b) found primarily in central and east [Africa](#). Distinct black head and gaster.



**Fig 2a:** Male of *Dorylus* sp.



**Fig 2b:** *Dorylus* sp.

CE= Compound eye, H=Head, An=Antrmma, Al= Alitrunk. G= Daster, W= Wing. The labels of Fig. 2 apply for Figs. 3 to 9. The abbreviations are common in all ant figures.

Subfamily: Formicinae Latreille, 1809

*Camponotus* sp. Mayr, 1861

The petiole is a node or a scale with no teeth or spines. The propodeum was unarmed. The gaster was not capable of reflexing over the alitrunk. The mandible was usually with seven teeth at most, sometimes fewer and only very rarely with more than seven teeth.

*Camponotus oasisium* Forel, 1890.

The petiole of the species is rounded (Fig. 3a.). The body is tallow with brown blotch on the head and on the elongated

gaster.

*Camponotus maculatus* Fabricius, 1781.

Yellow transverse patches on gaster appear as a row of two or three pale spots; sub cephalic hairs numerous (Fig. 3b.). Head is black, alitrunk and gaster with black blotch. The rest of the body is brown.

*Camponotus sericeus* Fabricius, 1798.

The body is hairy and propodeum broadly dentate. This species usually feeds honey dew and was always associated with plants infested with aphids, scale insects and mealy bugs.



Fig 3a: *Camponotus oasisium*



Fig 3b: *Camponotus maculatus*

Genus: *Cataglyphis* Foerster, 1850.

*Cataglyphis abyssineus* Forel, 1904.

The metapleura have a distinct wide orifice for the metapleural gland, situated above the hind coxa and below the level of the propodeal spiracle which is elongate vertical or near-vertical slit. Ocelli present. First gastral sternite in

ventral view with a transverse sulcus immediately behind the helcium. Usually move on the surface of the ground even if its temperature was very high. The local name it (Sun dog) possibly due to this habit (Fig. 4a).

*Cataglyphis auratus* (Andre 1881). The whole body was yellow (Fig. 4b).



Fig 4a: *Cataglyphis abyssineus*



Fig 4b: *Cataglyphis auratus*

*Paratrechina* sp. Motschoulsky, 1863:

The ocelli were absent. The first gastral sternite and immediately behind the helcium entire, without a transverse sulcus. The eyes are large and very conspicuous (Fig. 5a).

*Lepisiota* sp. Santschi, 1926

The antennae were formed of eleven segments Propodeum was armed with a pair of spines, a pair of teeth, or a pair of tubercles. The dorsal edge of the petiole was usually armed with a pair of teeth or a pair of spines (Fig. 5b).



**Fig 5a:** *Paratrechina* sp.



**Fig 5b:** *Lepisiota* sp.

Subfamily: Myrmicinae Lepeletier de Saint-Fargeau, 1835

*Messor* sp. Forel, 1890

*Messor gala* Mayr, 1904

These are slow-moving ants and form long, seed-carrying chains. The colony tends to be monogynous and founded by one single queen alone (Fig. 6 a and b)

*Monomorium* Mayr, 1855

*Monomorium bicolor* (Emery, 1877).

The dorsal part of the propodeum of the ant had a slight

shallow cavity. The head and alitrunk were red bright orange-yellow in colour and the gaster was black. This species was very common in houses, stores, farms and considered as a domestic pest (Fig. 4).

*Monomorium areniphilum* (Santschi, 1911).

The ventral side of the head had always a few projecting hairs. This species is considered as pest in houses, stores and farms (Fig. 7a).



**Fig 6a:** *Messor gala*



**Fig 6b:** Male of *Messor* sp.



**Fig 7a:** *Monomorium bicolor*



**Fig 7b:** *Monomorium areniphilum*

Genus *Pheidole* (Westwood, 1839).

*Pheidole* sp.

The antenna terminated in a strongly defined three segmented clubs. The pronotum and anterior mesonotum of the ant formed a high dome or a markedly convex arc. The propodeum had a separate convex or flat plate behind the metanatal groove. Pronotum and mesonotum were usually distinct (Fig. 8a)



Fig 8b: *Pheidole* sp.

Genus *Tetramorium* (Mayr, 1855).

*Tetramorium sericeiventre* (Emery, 1877).

The head, alitrunk and pedicel are dense and fine punctate with over rugo-reticulation. Gaster with extremely fine punctuation. Propodeal spines relatively long, narrow and triangular. The dorsal side of the propodea was without hairs. The general colour was orange-brown, except the gaster which was black (Fig. 8b).



Fig 8b: *Tetramorium sericeiventre*

Subfamily: Ponerinae Lepelefier, 1835.

Genus *Brachyponera* Emery, 1900.

*Brachyponera sennaarensis* (Mayr, 1862).

The workers of this species have a deep mesopropodeal furrow and their mandibles had a dorsolateral pit. The eyes were relatively large. The overall body colour was black and

the appendages had a deep red brown colour. The alitrunk and gaster are large. This species is famous for its painful sting especially the winged reproductive females, which were common during the early rainy season (Figs. 9a and b).



Fig 9a: *Brachyponera sennaarensis*



Fig 9b: Queen of *B. sennaarensis*

The Quotient of Similarity Index (QSI), Table 2 showed zero similarity with Mathews (2006) <sup>[11]</sup> and low similarity (16.7) with Mohamed and Mohamed (2014) <sup>[12]</sup>. The present work and Omer (2017) <sup>[13]</sup> showed a relatively high similarity index (53.84).

#### Habitat preference by ants in Algafeel

The distribution of the studied species showed a tendency towards specific habitat preference probably to avoid competition (Table 3).

#### Table 3 showed that

1. There is a high preference for human dwellings by ants and 6 species were encountered.
2. *Monomorium bicolor*, *M. analis*, *Lepisiota* sp. are confined to *Acacia senegal* trees.
3. *Panicum miliane* field and *Sesamum indicum* field each harbored three different ant species.
4. Four species of ants were found in open areas with scattered grasses.
5. *Monomorium areniphilum* was confined to *Caltorpis*

*procera* probably as opportunistic feeder.

6. A colony of *Pheidole* sp. was found in a grass land.

### Discussion

Four subfamilies of were recorded during this study. These were Dorylinae (one genera and one species), Formicinae (four genera and seven species), Myrmicinae (three genera and eight species) and Ponerinae (one genera and two species). The Subfamily Dolichoderinae was recorded by Mathews (2006) <sup>[11]</sup> from Al Ain near El Obeid and from Tandelti. The present study recorded Subfamily Dorylinae for the first time in North Kordofan. Subfamily Ponerine which was recorded from El Obeid, Elrahad and Jebel El dayer by (2017) <sup>[13]</sup> was also reported from Aljafel.

The QSI of the present work, of Mohamed and Mohamed (2014) and of Omer (2017) <sup>[12]</sup> showed zero similarity index with Mathews (2006) <sup>[11]</sup>. Mathews (2006) <sup>[11]</sup> confined his work on ants foraging on *Acacia senegal*. The present work showed low QSI (16.7) with Mohamed and Mohamed (2014) <sup>[12]</sup> who confined their work to *Phoenix dactylifera* in oasis. The present work and Omer (2017) <sup>[13]</sup> was a general survey that is why they showed a relatively higher QSI (53.84) compared with other surveys. The QSI between Mohamed and Mohamed (2014) <sup>[12]</sup> and of Omer (2017) <sup>[13]</sup> was 7.14. Thus confining the survey to a specific niche is a limiting

factor in diversity analysis.

The preset study found that *M. bicolor* and *B. sennarrensensis* had a wider range of occurrence.

Logan and El Bakri (1990) <sup>[10]</sup> reported ant *Dorylus* sp., *C. oasium*, *Camponotus niveoetsus*, *C. bicolor*, *Crematogaster* sp., *M. bicolor* and *Monomorium sulomonia* from *P. dactylifera* from Dongola. Of these *Dorylus* sp., *C. oasium* and *M. bicolor* were encountered during this study.

Mohamed and Mohamed (2014) <sup>[12]</sup> found *C. oasium*, *C. niveoetsus*, *Cataglyphis bicolor*, *Crematogaster* sp., *M. bicolor* and *M. sulomonia* ants from Eltaweel, Elbasheery, Abugaida in Northern Kordofan State. In common with them are *C. oasium* and *M. bicolor*.

*Camponotus sericeus*, *C. abyssinicus*, *C. congolensis*, *M. galla*, *M. areniphilum*, *M. bicolor* and *B. sennarrensensis*; encountered by Omer (2017) <sup>[13]</sup> from El Obied, Elrahad, Jebel El dayer were found in Algafeel during this study.

Ants were collected from different habitat in Algafeel, with clear abundance in human dwellings. Mathews (2006) confined his work to acacias of AlAin and Tandalti, and Mohamed and Mohamed (2014) <sup>[12]</sup> concentrated their ant collection to the species attacking *Phoenix dactylifera* in Eltaweel, Elbasheery and Abugaida oases. Omer (2017) <sup>[13]</sup> made no correlation between collection sites and the habitat.

**Table 1:** List of Ants of North Kordofan. A=Elgafel, B=Khor Tagat, C=El Obeid, D=AlAin, E=Eltaweel, F=Elbasheery. G=Abugaida, H=Elrahad, I= Jebel El dayer, J=Tandalti.

Species	Present Study	Mathews, 2006 <sup>[11]</sup>	Mohamed and Mohamed, 2014 <sup>[12]</sup>	Omer, 2017 <sup>[13]</sup>
Subfamily Dolichoderinae				
<i>Tapinoma luteum</i>		D and J		
Subfamily Dorylinae				
<i>Dorylus</i> sp.,	A			
Male of <i>Dorylus</i> sp.	A			
Subfamily Formicinae				
<i>Camponotus oasium</i>	A		E, F and G	
<i>Camponotus sericeus</i>	A			H
<i>Camponotus maculatus</i>	A			
<i>Camponotus niveoetsus</i>			E, F and G	
<i>Cataglyphis abyssinicus</i>	A			H and I
<i>Cataglyphis auratus</i>	A			
<i>Cataglyphis congolensis</i>				H and I
<i>Cataglyphis bicolor</i>			E, F and G	
<i>Paratrechina</i> sp.	A			
<i>Lepisiota</i> sp.	A			
<i>Lepisiota gracilicorni</i>		D		
<i>Lepisiota laevis</i>		D		
<i>Mesanotholepis mediterranea</i>		D		
<i>Mesanotholepis pernix</i>		D		
Subfamily Myrmicinae				
<i>Crematogaster acacia</i>		D		
<i>Crematogaster rivai</i>		D		
<i>Crematogaster senegalensis</i>		D		
<i>Crematogaster</i> sp.			E, F and G	
<i>Messor galla</i>	A			C
Male of <i>Messor</i> sp.	A			
<i>Monomorium areniphilum</i>	A			C
<i>Monomorium bicolor</i>	A		E, F and G	C
<i>Monomorium</i> sp.	A			
<i>Monomorium pullulum</i>		D		
<i>Monomorium robustior</i>		D		
<i>Monomorium sulomonia</i>			E, F and G	
<i>Tetramorium sericeiventris</i>	A			
<i>Pheidole</i> sp.	A			
<i>Pheidole</i> sp. (Major + Minor)	A			

<i>Pheidole escherichii</i>	A	J		
<i>Pheidole rotundata</i>	A	J		
<i>Trichomyrmex oscaris</i>	A	D		
<b>Subfamily Ponerine</b>				
<i>Brachyponera sennaarensis</i>	A			C and H
Queen of <i>B. sennaarensis</i>	A			
<i>Megaponera analis</i>	A			I
Percentage of total	47%	34%	16%	21%

**Table 2:** Quotient of Similarity Index

Study	Present Study	Mathews, 2006 <sup>[11]</sup>	Mohamed and Mohamed, 2014 <sup>[12]</sup>	Omer, 2017
Present Study	-	0.0	16.7	53.84
Mathews, 2006 <sup>[11]</sup>	0.0	-	0.0	0.0
Mohamed and Mohamed, 2014 <sup>[12]</sup>	16.67	0.0	-	7.14
Omer, 2017 <sup>[13]</sup>	53.84	0.0	7.14	-

**Table 3:** Habitat preference by ant species in Algafeel

Species	Habitat
<i>Monomorium bicolor</i> , <i>Megaponera analis</i> , <i>Lepisiota</i> sp.	<i>Acacia senegal</i> .
<i>Camponotus oasium</i> , <i>Camponotus maculatus</i> , <i>Messor galla</i> , <i>Brachyponera chinensis</i> , <i>Monomorium</i> sp., <i>Dorylus</i> sp.	Human dwellings.
<i>Pheidole escherichii</i> , <i>Pheidole rotundata</i> , <i>Messor</i> sp., <i>Messor</i> male.	<i>Panicum miliane</i> field.
<i>Camponotus sericeus</i> , <i>Tetramorium sericeiventre</i> , <i>Trichomyrmex oscaris</i> .	<i>Sesamum indicum</i> field.
<i>Cataglyphis abyssinicus</i> , <i>Cataglyphis auratus</i> , <i>Cataglyphis</i> sp., <i>Pheidole</i> sp. (major +minor).	Open areas with scattered grasses.
<i>Monomorium areniphilum</i> .	<i>Caltorpis procer</i> .
<i>Pheidole</i> sp.	Colony in a grass land.

## Conclusions

The present study recorded 18 ant species in Algafeel area. *Camponotus maculatus*, *Paratrechina* sp., *Lepisiota* sp., *Messor* sp. male, *Pheidole* sp., (major +minor) and *Cataglyphis* sp. seems to be new record to North Kordofan.

## Ethics

**Ethics** approval, consent to participate and publish, human and animal rights, availability of data and materials are not applicable.

**Conflict of interest:** The authors declare no conflict of interest, financial or otherwise.

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