

## DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN RESIDENTIAL AREA OF TARBELA, SWABI: NEW RECORDS FROM PAKISTAN

S. B. Rasheed\*, M. Ali, F. Zaidi And S. Noreen

Department of Zoology, University of Peshawar, Peshawar. Pakistan. 25120.

\*corresponding Author email: basitrasheed@uop.edu.pk

### ABSTRACT

Twenty-one species of ants, including nine new records from Pakistan were collected from residential colonies of Tarbela Power Station, Swabi. These species were classified into four subfamilies and thirteen genera. The most diverse genus was, *Camponotus* represented by four species i.e. *Camponotus angusticollis* Jerdon, 1851, *Camponotus compressus* Fabricius, 1787, *Camponotus oblongus* Forel, 1916, *Camponotus sericeus* Fabricius, 1798. Three species of *Pheidole* i.e. *Pheidole binghami* Forel, 1902, *Pheidole sykesi* and *Pheidole sagei* Forel, 1902, and two species each of *Monomorium* and *Lepisiota* i.e. *Monomorium indicum* Forel, 1902, *Monomorium sagei* Forel, 1890 and *Lepisiota frauenfeldi* Mayr, 1855, *Lepisiota capensis* Mayr, 1862 were reported in current study. Remaining ten genera i.e. *Crematogaster*, *Meranoplus*, *Messor*, *Cataglyphis*, *Cardiocondyla*, *Aenictus*, *Polyrachis*, *Paratrechina*, *Nylanderia* and *Tapinoma* were represented by single species each; *Crematogaster subnuda* Mayr, 1878, *Messor semirufus* Smith, 1858, *Cataglyphus setipes* Forel, 1894, *Meranoplus bicolor* Guerin-Meneville, 1844, *Cardiocondyla mauritanica* Forel, 1890, *Aenictus wroughtonii* Forel, 1890, *Polyrachis hauxwelli* Bingham, 1903, *Paratrechina longicornis* Latreille, 1802, *Nylanderia indica* (Forel, 1894) and *Tapinoma indicum* Forel (1895). The species first time recorded from Pakistan were *Camponotus angusticollis*, *Lepisiota capensis*, *Messor semirufus*, *Pheidole sykesi*, *Monomorium sagei*, *Nylanderia indica* and *Tapinoma indicum*.

**Keywords:** Diversity; Formicidae; New records; Pakistan; Swabi.

<https://doi.org/10.36899/JAPS.2021.2.0250>

Published online October 03, 2020

### INTRODUCTION

Ants are among the most abundant organisms, accounting for 90% of the individuals and up to 95% of the animal biomass in some localities (Moffett, 2000). Ant is a diverse group of eusocial insects both morphologically and behaviorally (Bolton, 2015). Ants are also bio-diverse terrestrially and occupy all terrestrial habitats from sub-arctic tundra to equatorial rainforest, from deep in the soil to the tips of the highest trees with the exception of cold and ever wet forests. Ants inhabit all the continents in the world except Antarctica. Islands like Iceland, Polynesia, Hawaii and Greenland do not have any native species of ant. Phylogenetic studies have shown that ants share its lineage with aculeate wasps and are considered as a sister group of Apoidea (Johnson et al., 2013) with about 17 extant subfamilies, 39 tribes, 336 genera and 13,624 species while a fossil record of 3 subfamilies, 8 tribes, 156 genera and 763 species (www.antcat.org).

In Pakistan very little has been done on the diversity and distribution of this important group of insects and it still requires exploration. First comprehensive study in the area now comprising Pakistan was conducted before the partition of Indo-Pak subcontinent by Bingham (1903). Since then only sporadic studies have been conducted in the region.

Menozzi (1939) surveyed the Himalayan belt of Pakistan and recorded ants of Gilgit-Baltistan region. Wilson (1955), Brown (1959) and Collingwood (1982) contributed to the ant diversity of Pakistan. Recently Ward (2001), Csoz et al. (2007), Seifert and Schultz (2009) and Bodlah (2017), while working on different genera, reported new species from Pakistan. Only a couple of comprehensive studies have been done on the ant diversity of Pakistan. In Punjab, Umair et al. (2012) reported 21 species placed in 13 genera and 3 subfamilies from Potohar plateau while Rasheed et al. (2019a) reported 19 species belonging to 13 genera and 3 subfamilies from Charsadda district of Khyber Pakhtunkhwa, in which 8 species were new reports from Pakistan.

Keeping in view the lack of comprehensive studies and unexplored areas in relation to ant fauna, current study was designed to investigate the diversity of ants in residential area of Tarbela power station in District Swabi of Khyber Pakhtunkhwa to highlight the potential present in the field of myrmecology in Pakistan.

### MATERIALS AND METHODS

**Study Area:** Current study was conducted in residential colonies of Tarbela Power station in Tehsil Topi of District Swabi, Khyber Pakhtunkhwa located at 34°6'51"

N latitude and 72° 45'55." E longitude and 335 m above sea level. The study area lies at a distance of 112 km from the Federal Capital of Islamabad and 142 km from provincial capital of Peshawar. Climate of this area is warm and temperate with an average annual temperature of 22.2°C and annual precipitation of 639mm. Most rain falls in summer months of monsoon specially during August. The residential area of Tarbela Hydroelectric Power station lies between Indus and Kabul rivers. The area has residential colonies for the employees of the power station, parks and grounds which are well maintained as well open spaces and vegetation area.

**Collection, Preservation, Stretching and Mounting:** A survey was conducted from November 2015 to October 2016, once a month from various habitats, to collect ants randomly from houses, playgrounds, park, roadsides, jungle, graveyard and dam area. Indoor collection from houses was done from room, kitchens, washrooms and courtyards. Ants were also collected from birds nests as well as trees. Information regarding habitat, time, date and collector were noted down. Collection was done by hand picking, using bait trap and pit fall method. In hand collection samples were collected with the help of hand picking. From each nest 10 to 15 samples were collected in an Eppendorf tube. In bait collection method, food was used as an attractant. Minced meat, sugar solution, honey or biscuits were placed at equal interval of 1 to 2 meters. The area of the bait was checked after 30 minutes of bait placement and any ant present were collected. In pit fall method a 10 cm long and 3 to 5 cm in diameter plastic bottles were filled with 30 ml ethylene glycol or 90% alcohol mixed with 3 drops of glycerin to prevent evaporation. Five pit falls were arranged per plot, one in center and four at corners by inserting the bottle to ground level in a pit made in the ground. These pits were left in open for 1 to 2 days. Ants fallen and got killed in these traps were then collected, washed with saltwater or alcohol and preserved.

The collected ants were killed by using standard entomological cyanide killing bottles (Youdeowei, 1977). The collected ants were preserved in 90% ethanol, which was changed after a day to prevent the specimens from ruining due to chemicals present in ant chitin (Upton 1991). As same type of ants are collected in one tube so few representative ants were mounted from each tube. The ants were mounted on a triangular cut cards by using seccotine glue. The legs and mandibles were stretched before gluing the thin side of card between first two pairs of legs on ventral surface of the body. The ants mounted on cards were then pinned by inserting a stainless-steel pin in the broad side of the mounting card.

**Identification:** The mounted specimens were identified using morphological characters under stereo microscope (Olympus SD30) having 10x to 60x magnification. The ants were classified into subfamilies and then genera by

using keys described in Bolton (1994) and Borowiec (2016). Species level identification was carried out by keys described in Bingham (1903), Radchenko (1998), Seifert (2003), Bharti *et al.* (2012) and Abdul-Rassoul (2013). The identified specimens were then compared with online resources (www.antweb.org, www.antwiki.org) for confirmation purpose.

## RESULTS

Current study was designed to know the species composition of ants in a residential area of district Swabi. A random collection was carried out by hand picking and food traps. A total of 2,264 specimens collected in current study were classified into 21 species belonging to 14 genera placed in 4 subfamilies. The four subfamilies were Myrmicinae, Formicinae, Dolichoderinae and Dorylinae, of which Formicinae was the most dominant with 6 genera i.e. *Camponotus*, *Lepisiota*, *Nylanderia*, *Paratrechina*, *Cataglyphis* and *Polyrachus* and 10 species followed by Myrmicinae having 6 genera i.e. *Cardiocondyla*, *Meranoplus*, *Messor*, *Monomorium*, *Pheidole* and *Crematogaster* and nine species while Dolichoderinae and Dorylinae were represented by a single genus *Tapinoma* and *Aenictus* respectively. The most diverse genus was found to be *Camponotus* having four species followed by *Pheidole* with three species. *Monomorium*, *Paratrechina* and *Lepisiota* were represented by two species each whereas remaining eight genera were having a single species each (Table 1).

Among the twenty-one species sampled from study area about nine species (*Camponotus compressus*, *C. oblongus*, *Crematogaster subnuda*, *Lepisiota fraunfeldi*, *Paratrechina longicornis*, *Monomorium indicum*, *Pheidole binghami*, *P. skyesi*, and *Tapinoma indicum*) were collected from different habitats of indoor as well as outdoor sites such as rooms, kitchens, graveyard, cultivated fields, grass fields and streets. Nine of the species (*Camponotus sericeus*, *C. angusticollis*, *Lepisiota capensis*, *Nylanderia indica*, *Cataglyphis setipes*, *Polyrachis hauxwelli*, *Cardiocondyla mauritanaica*, *Messor semirufus* and *Meranoplus bicolor*) collected in present study were exclusively collected from outdoor sites such as graveyard, cultivated fields, grass fields, streets, play grounds, road sides and green areas (trees and grasses) of the study area. Only three species (*Monomorium sagei*, *Pheidole sagei* and *Aenictus wroughtonii*) were exclusively collected from indoor sites like rooms, washrooms and kitchens.

Details for collected fauna is as following.

### **Subfamily: Myrmicinae**

#### **Genus: *Cardiocondyla* Emery, 1869**

#### ***Cardiocondyla mauritanica* Forel, 1890**

#### *Distribution*

Pakistan: Swat, Madyan, Swabi.

Elsewhere: India, Afghanistan, Iran and almost all zoogeographical regions.

*Material examined*

Swabi: Tarbela, 17.X.2016, leg. Abdullah, 2 workers.

*Comments*

Two workers were collected from grass field.

**Genus: *Crematogaster* Lund, 1831**

***Crematogaster subnuda* Mayr, 1879**

*Distribution*

Pakistan: Charsadda, Swabi.

Elsewhere: India and Singapore

*Material examined*

Swabi: Tarbela, 16.XI.2015, leg. Naseem, 5 workers; 12.XII.2016, leg. Abdullah, 19 workers; 07.I.2016, leg. Abdullah, 15 workers; 23.II.2016, leg. Maleeha, 20 workers; 16.III.2016, leg. Maria, 05 workers; 5.IV.16, leg. Maria, 21 workers; 19.VIII.16, leg. Maria, 20 workers; 7.IX.16, leg. Abdullah, 15 workers; 8.X.16, leg. Abdullah, 12 workers.

*Comments*

Ants were captured from indoor (kitchens) and outdoor collection sites like street, bare grounds and vegetation (trees).

**Genus: *Meranoplus* Smith, 1853**

***Meranoplus bicolor* (Guerin-Meneville, 1844)**

*Distribution*

Pakistan: Charsadda, Kohat, Rawalpindi, Swabi.

Elsewhere: India, China, Sri Lanka, Bhutan, Thailand, Indonesia, Malaysia, Myanmar, Singapore, Nepal.

*Material examined*

Swabi; Tarbela, 15.I.2016, leg. Maria, 10 workers, 10.IX.2016, leg. Abdullah, 12 workers.

*Comments*

Ants were captured from grass fields.

**Genus: *Messor* Forel, 1890**

***Messor semirufus* Andre, 1883**

*Distribution*

Pakistan: Swabi

Elsewhere: Afghanistan, Iran, Jammu and Kashmir, Iraq, Italy, Turkey

*Material examined*

Swabi: Tarbela, 02.II.2016, leg. Abdullah, 5 workers; 11.III.2016, leg. Maria, 8 workers; 5.IV.2016, leg. Maria, 23 workers; 15.V.2016, leg. Maria, 37 workers; 13.VIII.2016, leg. Abdullah, 35 workers; 11.IX.2016, leg. Maria, 13 workers; 22.X.2016, leg. Maria, 41 workers.

*Comments*

This species was only collected from outdoor sites like grass fields, streets, bare grounds and vegetation (trees).

*Remarks*

Reported for the first time from Pakistan.

**Genus: *Monomorium* Mayr, 1855**

***Monomorium indicum* Forel, 1902**

*Distribution*

Pakistan: Kalat, Makran, Thatta, Charsadda, Swabi.

Elsewhere: India, Afghanistan, Iran, United Arab Emirates (UAE).

*Material examined*

Swabi: Tarbela, 05.I.2016, leg. Maria, 8 workers; 10.II.2016, leg. Maleeha, 15 workers; 17.III.2016, leg. Abdullah, 30 workers; 11.VI.2016, leg. Maria, 35 workers, 06.VII.2016, leg. Maria, 40 workers; 21.X.2016, leg. Maria, 7 workers.

*Comments*

Indoor collection was made from rooms, washrooms and kitchens while outdoor collection was done from streets, grass fields and bare grounds.

***Monomorium sagei* Forel, 1890**

*Distribution*

Pakistan: Karakorum, Baltistan, Swabi.

Elsewhere: Afghanistan, China, India.

*Material examined*

Swabi: Tarbela, 02.III.2016, leg. Maria, 10 workers; 08.V.2016, leg. Naseem, 5 workers; 03.VI.2016, leg. Maleeha, 35 workers; 16.VII.2016, leg. Maria, 40 workers.

*Comments*

Ants were collected from indoor sites like rooms and kitchen only.

**Genus: *Pheidole* Westwood, 1840**

***Pheidole binghamii* Forel, 1902**

*Distribution*

Pakistan: Charsadda, Swabi.

Elsewhere: Jammu and Kashmir, Vietnam.

*Material examined*

Swabi: Tarbela, 11.V.2016, leg. Naseem, 2 workers; 02.VI.2016, leg. Maria, 4 workers; 16.VII.2016, leg. Maria, 1 worker; 12.X.2016, leg. Abdullah, 9 workers.

*Comments*

Specimens were collected both from indoor (rooms, washrooms and kitchen) as well as outdoor (grass fields, streets, bare grounds and trees) collection sites.

***Pheidole sagei* Forel, 1902**

*Distribution*

Pakistan: Gilgit-Baltistan, Swabi.

Elsewhere: China, India, Nepal.

*Material examined*

Swabi: Tarbela, 07.III.2016, leg. Maria, 10 workers; 04.IV.2016, leg. Maria, 6 workers; 13.V.2016, leg. Naseem, 35 workers; 04.VI.2016, leg. Maria, 23 workers; 06.VII.2016, leg. Maleeha, 40 workers.

*Comments*

Specimens of this species were collected from rooms and kitchens.

***Pheidole sykesi* Forel, 1902**

*Distribution*

Pakistan: Swabi.

Elsewhere: India.

*Material examined*

Swabi: Tarbela, 07.VIII.2016, leg. Maria, 06 workers; 17.IX.2016, leg. Naseem, 3 workers; 11.X.2016, leg. Maria, 01 worker.

*Comments*

Sampling was done from room, washrooms, kitchens and grass fields.

*Remarks*

Reported for the first time from Pakistan.

**Subfamily: Formicinae****Genus: *Camponotus* Mayr, 1861*****Camponotus angusticollis* Jerdon, 1851***Distribution*

Pakistan: Swabi.

Elsewhere: Bangladesh, Borneo, India, Indonesia, Malaysia, Nepal.

*Material Examined*

Swabi: Tarbela, 07.II.2016, leg. Maria, 02 workers; 03.VII.2016, leg. Maria, 02 workers; 13.IX.2016, leg. Maria, 06 workers.

*Comments*

Collection was done from fields, streets and bare grounds.

*Remarks*

Reported for the first time from Pakistan.

***Camponotus compressus* Fabricius, 1787***Distribution*

Pakistan: Charsadda, Rawalpindi, Islamabad, Swabi.

Elsewhere: Bangladesh, Borneo, Canary Islands, China, India, Indonesia, Liechtenstein, Malaysia, Nepal, Philippines, UAE.

*Material examined*

Swabi: Tarbela, 12.IX.2015, leg. Abdullah, 04 workers, 14.XII.2015, leg. Maria 12 workers, 19.I.2016, leg. Abdullah, 45 workers, 16.II.2016, leg. Maria, 11 workers, 15.III.2014, leg. Maria, 07 workers, 04.IV.2016, leg. Maria, 04 workers, 09.V.2016, leg. Maria, 5 workers, 11.VI.2016, leg. Maria, 02 workers, 03.VII.2016, leg. Maria, 03 workers, 11.VIII.2016, leg. Maleeha, 49 workers, 21.IX.2016, leg. Abdullah, 61 workers, 17.X.2016, leg. Maria, 10 workers.

*Comments*

Specimens were collected from rooms, washrooms, kitchen, fields, grass fields, trees and bare grounds.

***Camponotus oblongus* Forel, 1916***Distribution*

Pakistan: Charsadda, Rawalpindi, Swabi.

Elsewhere: Bangladesh, India, Myanmar.

*Material examined*

Swabi: Tarbela, 01.II.2016, leg. Abdullah, 07 workers, 28.IV.2016, leg. Maria, 06 workers, 24.VI.2016,

leg. Maria, 04 workers, 03.VII.2016, leg. Maria, 12 workers, 01.VIII.2016, leg. Haleema, 01 worker.

*Comments*

Samples were collected from rooms, washrooms, kitchen, fields, grass fields, streets and bare grounds.

***Camponotus sericeus* Fabricius, 1798***Distribution*

Pakistan: Charsadda, Islamabad, Rawalpindi, Swabi.

Elsewhere: Afghanistan, India, Srilanka, Thailand, Afrotropical, Malagasy and Palearctic regions.

*Material Examined*

Swabi: Tarbela, 06.IV.2016, leg. Maria, 05 workers, 05.V.2016, leg. Maria, 04 workers.

*Comments*

Ant specimens were collected from outdoor sites like fields, streets and bare grounds.

**Genus: *Cataglyphis* Foerster, 1850*****Cataglyphis setipes* Forel, 1894***Distribution*

Pakistan: Kalat, Makran, Pasni, Quetta, Charsadda, Swabi, Sindh.

Elsewhere: Afghanistan, India, Iran, Kyrgyzstan.

*Material examined*

Swabi: Tarbela, 03.IX.2016, leg. Abdullah, 05 workers, 10.II.2016, leg. Maria, 09 workers, 23.III.2016, leg. Maria, 14 workers, 11.IV.2016, leg. Maria, 18 workers, 05.V.2016, leg. 21 workers, 07.VI.2016, leg. Maleeha, 24 workers.

*Comments*

Specimens were collected from the fields, grass fields, streets and bare grounds.

**Genus: *Lepisiota* Santschi, 1926*****Lepisiota frauenfeldi* Mayr, 1855***Distribution*

Pakistan: Charsadda, Rawalpindi, Islamabad, Swabi.

Elsewhere: Afghanistan, India and Palearctic region.

*Material examined*

Swabi: Tarbela, 12.I.2016, leg. Abdullah, 30 workers, 08.II.2016, leg. Maria, 19 workers, 16.III.2016, leg. Maria, 49 workers, 07.IV.2016, leg. Abdullah, 61 workers, 23.V.2016, leg. Maria, 67 workers, 13.VI.2016, leg. Maria, 85 workers, 13.VIII.2016, leg. Maleeha, 22 workers, 24.X.2016, leg. Abdullah, 46 workers.

*Comments*

Specimens were collected from all indoor collection sites as well as from bare grounds, fields, streets and trees.

***Lepisiota capensis* Mayr, 1862***Distribution*

Pakistan: Swabi.

Elsewhere: China, India, Madagascar, Afrotropical region.

*Material examined*

Swabi: Tarbela, 12.III.2016, leg. Maria, 05 workers, 08.IX.2016, leg. Maria, 25 workers.

*Comments*

Specimens were collected from graveyard, grass fields and trees.

*Remarks*

Reported for the first time from Pakistan.

**Genus: Nylanderia Emery, 1906**

**Nylanderia indica (Forel, 1894)**

*Distribution*

Pakistan: Swabi.

Elsewhere: China, Bangladesh, India, Nepal, Nicobar Island, Srilanka.

*Material examined*

Swabi: Tarbela, 15.X.2016, leg. Maria, 02 workers.

*Comments*

Specimens were collected from outdoors sites like graveyards and grass fields only.

*Remarks*

Reported for the first time from Pakistan.

**Genus: Paratrechina Motschulsky, 1863**

**Paratrechina longicornis Latreille, 1802**

*Distribution*

Pakistan: Charsadda, Karachi, Swabi.

Elsewhere: Worldwide.

*Material examined*

Swabi: Tarbela, 07.I.2016, leg. Maria, 06 workers, 12.II.2016, leg. Maria, 04 workers, 15.X.2016, leg. Abdullah, 10 workers.

*Comments*

Specimens were collected both indoors and outdoors collection site such as kitchens, grass fields and trees.

**Genus: Polyrhachis Smith, 1857**

**Polyrhachis hauxwelli Bingham, 1903**

*Distribution*

Pakistan: Charsadda, Swabi.

Elsewhere: India, Jordan, Myanmar, Thailand

*Material examined*

Swabi: Tarbela, 17.III.2016, leg. Maria, 04 workers, 18.VI.2016, leg. Maria, 08 workers.

*Comments*

Ants were collected from grave yard, streets and bare grounds.

**Subfamily: Dolichoderinae**

**Genus: Tapinoma Foerster, 1850**

**Tapinoma indicum Forel, 1895**

*Distribution*

Pakistan: Karachi, Charsadda, Swabi.

Elsewhere: Borneo, China, India, Indonesia, Laos, Malaysia, Sri Lanka, Vietnam.

*Material examined*

Swabi: Tarbela, 03.III.2016, leg. Naseem, 45 workers, 19.VI.2016, leg. Maria, 15 workers, 05.VII.2016, leg. Maria, 13 workers, 07.X.2016, leg. Maria, 15 workers.

*Comment*

Ants were collected from kitchen, grass fields, streets, bare grounds and trees.

*Remarks*

Reported for the first time from Pakistan.

**Subfamily: Dorylinae**

**Genus: Aenictus Shuckard, 1840**

**Aenictus wroughtonii Forel, 1890**

*Distribution*

Pakistan: Swabi.

Elsewhere: India.

*Material examined*

Swabi: Tarbela, 03.VI.2016, leg. Maria, 25 workers, 19.IX.2016, leg. Naseem, 55 workers.

*Comment*

These ants were collected from washrooms only.

*Remarks*

Reported for the first time from Pakistan.

**Table 1** Ants species collected from different areas of Tarbela colony.

Subfamilies	Genera	Species	No. of Specimens
Formicinae	<i>Camponotus</i>	<i>Camponotus compressus</i>	283
		<i>Camponotus oblongus</i>	31
		<i>Camponotus angusticollis</i>	11
		<i>Camponotus sericeus</i>	9
	<i>Cataglyphis</i>	<i>Cataglyphis setipes</i>	134
		<i>Lepisiota frauenfeldi</i>	743
	<i>Lepisiota</i>	<i>Lepisiota capensis</i>	30
		<i>Nylanderia</i>	<i>Nylanderia indica</i>
	<i>Paratrechina</i>	<i>Paratrechina longicornis</i>	20
		<i>Polyrachis</i>	<i>Polyrachis hauxwelli</i>
Myrmicinae	<i>Cardiocondyla</i>	<i>Cardiocondyla mauritanica</i>	2
	<i>Messor</i>	<i>Messor semirufus</i>	241
	<i>Meranoplus</i>	<i>Meranoplus bicolor</i>	22

	<i>Monomorium</i>	<i>Monomorium indicum</i>	60
		<i>Monomorium sagei</i>	90
		<i>Pheidole binghami</i>	449
	<i>Pheidole</i>	<i>Pheidole sykesi</i>	10
		<i>Pheidole sagei</i>	114
	<i>Crematogaster</i>	<i>Crematogaster subnuda</i>	169
Dolichoderinae	<i>Tapinoma</i>	<i>Tapinoma indicum</i>	88
Dorylinae	<i>Aenictus</i>	<i>Aenictus wroughtonii</i>	80

## DISCUSSION

Ants are the most diverse group among insects but very little has been done to explore this important and diverse group in Pakistan. After the comprehensive study of Bingham (1903) few studies have been conducted following the inception of Pakistan and all these studies have reported 21 subfamilies, 35 genera and 111 species (Rasheed *et al.* 2019a; Rasheed *et al.*, 2019b). Present study further adds one genus and seven species to the ant fauna of Pakistan. This study has been conducted in a very limited residential area of Tarbela which shows great potential in the field of myrmecology in Pakistan.

Pakistan is located in south Asia between India in the east and Afghanistan and Iran in the west. Zoogeographically Pakistan lies in two zoogeographical range, the western parts border the east of Palearctic region which in north Pakistan covers the foot hills of Himalayas and Kashmir area. The east of Pakistan borders the western oriental region. Since Pakistan is situated at the boundary of these two zoogeographical regions so it forms an ecotone between the two regions and fauna of this country is an intermediate between the Palearctic and oriental regions (Zaidi *et al.* 2016).

Species reported in current study have variable range of distribution across the world. Some species have wide range of distribution and occur in various zoogeographical region e.g. *Camponotus compressus* (Borowiec and Salata, 2013), *Camponotus sericeus* (Dey and Kumar, 2008), *Cardiocondyla mauratanica* (Seifert *et al.* 2017), *Lepisiota fraunfeldi* (Schifani *et al.* 2018), *Lepisiota capensis* (Xu, 1994), *Meranoplus bicolor* (Schodl, 1998) and *Paratrechina longicornis* (Sharaf *et al.* 2017). Human activities have played an important role in the transport of *P. longicornis* to almost all populated tropical and subtropical areas of the world. Its diverse habitat adaptation and scavenger mode of feeding has enabled it to establish as exotic and indoor introduced species across the world (Sharaf *et al.* 2017). Certain species has very limited distribution and is either endemic to a country or occur in one or two zoogeographic regions. *Cataglyphis setipes*, *Monomorium indicum*, *Monomorium sagei*, *Nylanderia indica*, *Pheidole sagei* and *Tapinoma indicum* occurs both in Palearctic and Oriental regions but their distribution is restricted to few neighbouring countries like Pakistan, India, China,

Afghanistan, Iran and Nepal only (Bingham 1903, Wachkoo and Bharti 2015).

As described above Pakistan lies in an ecotone between the Palearctic and Oriental region, which is also reflected in its ant fauna. The ant fauna of Pakistan has species which exclusively either occur in Palearctic region e.g. *Messor semirufus* (Collingwood, 1961; Abdul-Rasool, 2013) or in Oriental region e.g. *Aenictus wroughtonii*, *C. angusticollis*, *C. oblongus*, *Pheidole binghamii* and *Pheidole sykesi* (Bingham, 1903). *Messor semirufus* range does not extend to oriental region as it has been reported only from Jammu and Kashmir (Bharti *et al.* 2016) and northern parts of Pakistan (Rasheed *et al.* 2019a) which lies in Palearctic region. Other studies conducted in India as well as in Pakistan (Umair *et al.* 2012) has not reported this species from these areas. On the other hand species exclusively distributed in oriental region confirms the ecotone status of this northwestern part of Pakistan. Indo-Pak subcontinent have same climatic conditions, and the geography of two countries is open towards each other so both countries have the possibility of sharing most of their fauna including ants, so species like *Aenictus wroughtonii* and *Pheidole sykesi*, which remained endemic to India has been reported from Pakistan in current study.

Previously Umair *et al.*, (2012) reported 21 species placed in 13 genera from Pakistan. Five species of present survey i.e. *Camponotus oblongus*, *Lepisiota fraunfeldi*, *Camponotus compressus*, *Camponotus sericeus*, *Meranoplus bicolor* were also reported by Umair *et al.*, (2012) from Potohar region of Punjab, Pakistan. Sixteen species documented by Umair *et al.*, (2012) i.e. *Camponotus confucii*, *C. japonicas*, *Atopomyrmex ceylonicus*, *Crematogaster rothneyi*, *Holcomyrme glaber*, *H. scabricps*, *Monomorium logni*, *M. schurri*, *Pheidole mus*, *P. nietneri*, *P. pronotalis*, *Solenopsis geminate*, *Tetramorium smithi*, *Polyrachis hodgsoni*, *Lasius alienus* and *Liponera longitarsus* were not reported in current survey. Bodlah *et al.*, (2016) reported two species of genus *Tetraponera* i.e. *Tetraponera allaborans* (Walker, 1859) and *Tetraponera nigra* (Jerdon, 1851) for the first time from Pakistan. And these species were not reported in the present study.

Rasheed *et al.* (2019a) reported 19 species belonging to eleven genera and three subfamilies from district Charsadda of Khyber Pakhtunkhwa Pakistan. Subfamily Dorylinae reported in current study was not

reported from Charsadda. Similarly, *Aenictus* and *Nylanderia* are also new in this study. Species first time recorded from Pakistan in present study were not reported from Charsadda, however *Messor instabilis*, *Monomorium abberans*, *M. dichorum*, *Pheidole fergusonii*, *P. indica*, *P. latinoda*, *P. sulcaticeps* and *Tapinoma indicum* reported by Rasheed *et al.* (2019a) were not collected from Tarbela. The difference in species may be due to variation in ecology and land scape of the two study areas.

India, neighbouring country of Pakistan in among countries having most diverse ant fauna with 828 species, of which 342 are endemic to the country (Bharti *et al.* 2016). This high diversity can be attributed to the vast area of India, and secondly, lot of work has been done on the diversity of ants in India. On the contrary only 69 species have been reported from Pakistan including the new records reported in current study. This scarcity of data is due to lack of work done on the ant fauna of Pakistan as very little has been done on ant diversity of Pakistan (Umair *et al.* 2012; Bodlah *et al.* 2016; Rasheed *et al.*, 2019a, Rasheed *et al.*, 2019b). Present study not only highlights the potential of this field but also emphasizes the need to fully explore this important group of insects in Pakistan.

## REFERENCES

- Abdul-Rassoul, M.S., H.B. Ali and R.S.H. Augul (2013). New Records of Unidentified Ants worker (Hymenoptera: Formicidae: Myrmicinae) stored in Iraqi Natural History Museum with key to Species. *Adv. Biores.* 4(2): 27-33.
- Bharti, H., B. Guenard, M. Bharti and E.P. Economo (2016). An updated checklist to the ants of India with their specific distributions in Indian states (Hymenoptera, Formicidae). *ZooKeys.* 551: 1-83.
- Bharti, H., A.A. Wachkoo and R. Kumar (2012). Two remarkable new species of *Aenictus* (Hymenoptera: Formicidae) from India. *J. Asia-Pac Entomol.* 15:291-294.
- Bingham, C.T. (1903). *Hymenoptera. Vol. II: Ants and Cuckoo-wasps.* Taylor & Francis, London (United Kingdom).
- Bodlah, I., M.T. Rasheed, A. Gull-e-Fareen, M.S. Ajmal and M.A. Bodlah (2016). First record of two new species of genus *Tetraoponera* (Hymenoptera: Pseudomyrmecinae: Formicidae) from Pakistan. *J. Entomol. Zool. Stud.* 4(4): 1028-1030.
- Bodlah, I., Rasheed, M.T. & Bodlah, M.A. (2017). New distributional records of *Tetraoponera rufonigra* (Jerdon) from Gilgit Baltistan, Pakistan. *Asian J. Agric. Biol.* 5: 56-59.
- Bolton, B. (2015). An online catalog of the ants of the world. Accessed at <http://www.antcat.org/catalog>, 14 June 2015
- Bolton, B., (1994). *Identification guide to the ant genera of the world.* Haward University Press, London (United Kingdom).
- Borowiec, L. and S. Salata (2013). Ants of Greece – additions and corrections (Hymenoptera Formicidae). *Genus.* 24: 335-401.
- Borowiec, M. L. (2016). Generic revision of the ant subfamily Dorylinae (Hymenoptera, Formicidae). *ZooKeys.* 608: 1-280.
- Brown, W.L.Jr. (1959). Appendix G. Insecta collected by the expedition. In H. Field (Ed.), *An anthropological reconnaissance in West Pakistan, 1955, with appendixes on the archaeology and natural history of Baluchistan and Bahawalpur* (pp. 229-230).
- Collingwood, C. A. 1961a [1960]. The third Danish Expedition to Central Asia. *Zoological Results* 27. Formicidae (Insecta) from Afghanistan. *Vidensk. Medd. Dan. Naturhist. Foren.* 123: 51-79
- Collingwood, C.A. (1982). Himalayan ants of the genus *Lasius* (Hymenoptera: Formicidae). *Syst. Entomol.* 7: 283-296.
- Csösz, S., Radchenko, A. & Schulz, A. (2007). Taxonomic revision of the Palearctic *Tetramorium chefketi* species complex (Hymenoptera: Formicidae). *Zootaxa.* 1405: 1-38.
- Dey, D. and A. Kumar (2008). Report of a third *Camponotus* species with metapleural gland from the world and first from India (Hymenoptera: Formicidae: Formicinae: Camponotini). *Acta Entomol. Sin.* 51:234-236
- Johnson, B.R., M.L. Borowiec, J.C. Chiu, E.K. Lee, J. Atallah and P.S. Ward (2013). Phylogenomics resolves evolutionary relationships among ants, bees, and wasps. *Curr. Biol.* 23(20): 2058-62.
- Menozi, C. (1939). *Formiche dell'Himalaya e del Karakorum raccolte dalla Spedizione italiana comandata da S. A. R. il Duca di Spoleto* (1929). *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano,* 78: 285-345.
- Moffett, M.W. (2000). A critical look at the basic terms in canopy biology. *Biotropica* 32(4): 569–596.
- Radchenko, A. G. (1998). A key to the genus *Cataglyphis* Forester (Hymenoptera, Formicidae) from Asia. *Entomol. Rev.* 78(4): 475-480.
- Rasheed, S.B., A. Yar, F. Zaidi and Q. Jamal (2019a). The diversity of Ants (Hymenoptera: Formicidae) in District Charsadda, Khyber Pakhtunkhwa: New Reports from Pakistan. *Pakistan J. Zool.* 52: 1363-1370

- Rasheed, M.T., Bodlah, I., Fareen, A.G., Wachkoo, A.A., Huang, X. and S.A. Akbar. (2019b). A checklist of ants (Hymenoptera: Formicidae) in Pakistan. *Sociobiology*. 66: 426-439.
- Schifani, E., V. Gentile, A. Scupola and X. Espadaler (2018). Yet another alien: a second species of *Lepisiota* spreading across the Canary Islands, Spain (Hymenoptera: Formicidae). *Frag. Entomol.* 50: 61-64.
- Schodl, S. (1998). Taxonomic revision of Oriental *Meranoplus* F. Smith, 1853 (Insecta: Hymenoptera: Formicidae: Myrmicinae). *Annalen Des Naturhistorischen Museums in Wien. B. Bot. Zool.* 100: 361-394.
- Seifert, B. (2003). The ant genus *Cardiocondyla* (Insecta: Hymenoptera: Formicidae)-a taxonomic revision of the *C. elegans*, *C. bulgarica*, *C. batesii*, *C. nuda*, *C. shuckardi*, *C. stambuloffii*, *C. wroughtonii*, *C. emeryi*, and *C. minutior* species groups. *Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie*, 203-338.
- Seifert, B. & Schultz. R. (2009). A taxonomic revision of the *Formica rufibarbis* Fabricius, 1793 group (Hymenoptera: Formicidae). *Myrmecol. Nach.* 12: 255-272.
- Sharaf, M.R., B.L. Fisher, C.A. Collingwood and A.S. Aldawood (2017). Ant fauna (Hymenoptera: Formicidae) of the Socotra Archipelago (Yemen): zoogeography, distribution and description of a new species. *J. Nat. Hist.* 51: 317-378.
- Umair, M., A. Zia, M. Naeem and M.T. Chaudhry (2012). Species composition of ants (Hymenoptera: Formicidae) in Potohar Plateau of Punjab Province, Pakistan. *Pakistan J. Zool.* 44(3): 699-705.
- Upton, M.S. (1991) *Methods for Collecting, Preserving, and Studying Insects and Allied Forms*, 4th edn. Australian Entomological Society, Brisbane (Australia).
- Wachkoo, A. A. and H. Bharti (2015). Taxonomic review of ant genus *Nylanderia* Emery, 1906 (Hymenoptera: Formicidae) in India. *J. Asia-Pac. Entomol.* 8:105-120.
- Ward, P.S. (2001). Taxonomy, phylogeny and biogeography of the ant genus *Tetraponera* (Hymenoptera: Formicidae) in the Oriental and Australian regions. *Inverteb. Syst.* 15: 589-665.
- Wilson, E.O. (1955). A monographic revision of the ant genus *Lasius*. *Bull. Mus. Comp. Zool.* 113: 1-201.
- Xu, Z. 1994c. A taxonomic study of the ant genus *Lepisiota* Santschi from southwestern China (Hymenoptera Formicidae Formicinae). *J. Southwest For. Coll.* 14: 232-237
- Youdeowei, A. 1977. *Laboratory manual of entomology*. Oxford university press. (United Kingdom) 208p.
- Zaidi, F., S.H. Fatima, M. Khisroon and A. Gul (2016). Distribution Modelling of three screw worm species in the ecologically diverse landscape of North West Pakistan. *Acta tropica*, 162: 56-65.