



Research Article

Exploring the Fascinating Diversity of Ant's (Hymenoptera: Formicidae) Fauna in Khyber Pakhtunkhwa, Pakistan

Khushbakht Asad¹, Muhammad Salman Khan^{1*}, Sumaira Shamas¹, Said Miraj Ud Din², Zahid Ullah³, Riaz Amin^{4,5}, Sehrish Asad⁶ and Farhad Badshah⁷

¹Department of Zoology, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan; ²Department of Zoology, Quaid-i-Azam University Islamabad, Islamabad 45320, Pakistan; ³Department of Basic and Applied Zoology, Shaheed Banazir Bhattu University Sheringal Dir Upper; ⁴Department of Zoology, Kohat University of Science & Technology, Kohat-26000 Khyber Pakhtunkhwa, Pakistan; ⁵Department of Zoology University of Lakki Marwat, Lakki Marwat 28420, Khyber Pakhtunkhwa, Pakistan; ⁶Department of Botany, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan; ⁷State Key Laboratory Biotech Breeding, Institute of Animal Science, Chinese Academy of Sciences, Beijing 100193, China.

Abstract | Ants are social insects with approximately 490,000 described living species worldwide. Ants are important element of an ecosystem structure and dynamic. Ants belong to order Hymenoptera and family Formicidae, live in colonies which are further divided into various casts including workers, queen, drone, and soldiers. The current survey was conducted to determine the species diversity of ant fauna in four districts of Khyber Pakhtunkhwa, Pakistan from February-October, 2023. The ants were randomly collected from Mardan, Charsadda, Swabi and Buner, and then identified morphologically with keys. The three sub-families identified were Myrmicinae, Formicinae, Dolichoderinae. The sub-family Myrmicinae was represented by four genera, Formicinae was represented by four genera, while Dolichoderinae were represented by only single genus. The most abundant genus was the *Pheidole* represented by three species, followed by *Camponotus* represented by two species, while other genera i.e., *Paratracheinae*, *Lepisiota*, *Cataglyphis*, *Messor*, *Monomorium*, *Crematogaster* and *Tapinoma*, each represented by a single species. *Camponotus aungusticolis*, *Camponotus compressus* and *Monomorium indicum*, were recorded from all areas of Khyber Pakhtunkhwa, while the *Crematogaster setipes*, *Messor orientalis*, *Tapinoma indicum*, *Crematogaster subnuda* *Paratracheinae longicornis*, *Lepisiota fraunfeldi*, *Pheidole sykesi*, *Pheidole binghami* and *Lepisiota fergusonii* were recorded from indoor sites. The seven species documented for the first time from Pakistan are *Monomorium indicum*, *Cataglyphis setipes*, *Crematogaster subnuda*, *Pheidole binghami*, *Pheidole fergusonii* and *Tapinoma indicum*. While the remaining species, *Camponotus compressus*, *Camponotus aungusticolis*, *Lepisiota fraunfeldi*, *Paratracheinae longicornis* and *Pheidole sykesi* were also recorded in this study as well as in previous researches.

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***Correspondence** | Muhammad Salman Khan; Department of Zoology, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan; **Email:** send2salman747@gmail.com

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Introduction

Ants are highly diverse, comprising more than 15,700 named species and subspecies (Bolton *et al.*, 2021). Ants are the most diverse and significant organism on the earth surface (Ryder *et al.*, 2010). Ants are integral components of terrestrial ecosystems, owing to their manifold interactions with other organisms. They serve as seed dispersers for plants (myrmecochory) mutualists with sap-sucking insects (trophobionts), and hosts for a wide range of associate organisms (myrmecophiles) and act as both predator and prey. While ant diversity is undoubtedly crucial for the functioning and maintenance of many ecosystems, it is the sheer number of ants—their abundance and by extension their biomass—and their activity that determines the scale of their impact (Schultheiss *et al.*, 2022). Ants belong to Family Formicidae which also include wasps and bees. Around 99 million years ago, during the Cretaceous period, ants diverged from their wasp-like predecessors. Of the estimated 22,000 species, more than 14000 have been classified (Agosti and Johnson, 2003). Ants are eusocial insects, live in colonies that may vary in shape from a few hundred predatory ants dwelling in tiny natural cavities to highly organized colonies that can occupy enormous territories and have millions of ants living together. The large colonies are mostly divided into various casts such as workers, soldiers, drones, queen (Flannery *et al.*, 2011).

Ants are ubiquitous in nature present throughout the world with the exception of Antarctica and few big islands such as Greenland (Jones and Alice 2008). Ants are differing in size from 0.75 to 52 millimeters (Hölldobler & Wilson 1990; Shattuck 1992). The largest species being the fossil *Titanomyrma giganteum* (Schaal, 2001). Its queen was 6 centimeters (2.4 in) in length and had a wing span of 15 centimeters (5.9 in). In early time it was considered that only environmental factors are responsible for ant diversity and behavior of workers, but later on it was confirmed that hereditary variations among castes have been observed in *Acromyrmex* species (Hughes *et al.*, 2003). These polymorphisms are the result of relatively little genetic variations; in *Solenopsis invicta*, variations in an only one gene can define whether one or more queens belong to this colony (Rosenblatt *et al.*, 2003). They communicate through a variety of chemical signal or pheromones, noises, and touch. The long thin and moveable paired antennae can be

used for odors detection. The primary means of their communication is pheromone and when they stay on the ground leave pheromone trails that other ants may follow (Jackson and Ratnieks, 2006). A large number of ecological roles are performed by ants, which are advantageous to humans, including the demolition of pest populations and aeration of the surrounding soil. In citrus cultivation the practice of weaver ants is considered one of the oldest known applications of biological control in Southern China. Ant societies function according to social group dynamics because such behavior allows them to protect their colonies together. They unite as one unit for colony defense due to their social behaviors. In case of an attack on their colony ants resort to defense *sua* together. Ant colonies employed three weapon tactics including poisonous stinging through injection and biting and chemical spraying mechanisms i.e chemicals such as formic acid. Fire ants along with their ant species possess an exceptional poison storage system. Ants possess a poisonous sac that contains piperidine alkaloids (Khan *et al.*, 2019). Various domesticated insects are used for multi-purpose in pharmaceuticals and biomedical purpose sectors (Van Itterbeeck and van Huis, 2012; Asad *et al.*, 2024) and fish feed (Khan *et al.*, 2025; Khubaib *et al.*, 2024).

Ants are considered the least studied insects with respect to their taxonomy and ecology in Pakistan. Identification of ant's diversity is highly important for understanding ecological interaction, soil aeration, nutrition cycle and perdition. The aim of the current study is to explore the diversity of ant's species in four districts of Khyber Pakhtunkhwa, Pakistan.

Materials and Methods

Sampling site

The ants' samples were randomly collected randomly from February-October, 2023 in four districts of Khyber Pakhtunkhwa: Mardan, Charsadda, Swabi and Buner. Ants were collected from different habitat such as agriculture fields, forests, mountains, caves and houses. The samples were collected indoor and outdoor during day and night. The study area is given in the Figure 1.

Specimen's collection

Various methods were adopted for samples collection. The ants collecting traps used were pitfall trap, leaf litter sampling, hand collection and baits used for

attracting (Rasheed *et al.*, 2021; Begum *et al.*, 2021).

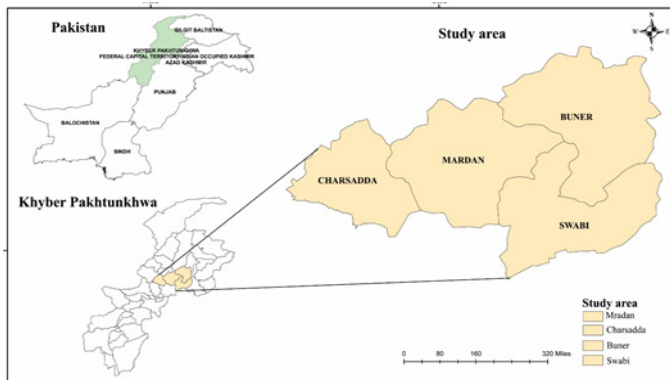


Figure 1: Map of study area, showing four districts of KPK.

Preservation and mounting

Collected ants were first killed and preserved in 75-90% alcohol taking in Eppendorf tubes and small bottles. The preserved ants were then mounted properly in the entomology lab of Abdul Wali Khan University Mardan. In mounting method, the seccotine glue was taken and put at the corner of small triangular tag. Then attached the tag on the ventral portion of mesothorax. After drying the ants then preserved in the box (Krogmann *et al.*, 2010).

Identification

The ants' samples were morphologically identified through a detail examination of external characteristics such as body color, size, shape of head, antennae structure, using many taxonomic keys. Identification up to genus level was done by using Ant genera of world "Bary Bolton, 1994". While identification up to species level was done by using fauna of British India, W.T Blandford (Bigger *et al.*, 1995).

Statistical analysis

Descriptive statistics were used in data analysis. Microsoft Excel (version 2019) was used to calculate percentages and summarized the results in tables to demonstrate the relative frequency of each parameter.

Results and Discussion

A total 939 specimens were collected which represented 12 species, nine genera and three subfamilies. The identified sub-families were Formicinae, Myrmicinae and Dolichoderinae. Myrmicinae has been the most dominant subfamily represented by six species. Genus *Pheidole* was represented by maximum number of species (three species) followed by *Camponotus* with two species, while *Monomorium*, *Messor*, *Cataglyphis*, *Paratracheina*, *Lepisiota* and *Crematogaster* were represented by single species (Table 1).

The seven species in current study were reported for the first time from Pakistan are *M. indicum*, *C. setipes*, *C. subnuda*, *P. binghami*, *P. fergusonii* and *T. indicum*, while other species i.e. *C. compressus*, *C. aungusticollis*, *L. fraunfeldii*, *P. longicornis* and *P. sykesi* were also reported in other studies conducted in Pakistan (Table 2). However, these 12 species are first time reported from Mardan locality. Collection has been done from indoor as well as outdoor including Crop fields, lawns, mountains, forest. The *C. compressus* and *C. aungusticollis* were the only species which were collected from indoor, while other species i.e. *P. sykesi*, *P. binghami*, *P. fergusonii*, *M. indicum*, *P. longicornis*, *L. fraunfeldii*, *T. indicum*, *C. subnuda* and *C. setipes* were collected from outdoor sites as well.

Table 1: Geographical distribution of ants' species collected from three districts of KPK.

Khyber Pakhtunkhwa	Sub-Family	Genus	Species identified	Sites of collection			
				Houses	Agriculture fields	Forests	Mountains
	Formicinae	Camponotus	<i>C. Compressus</i>	+	+	+	+
		Componotus	<i>C. aungusticollis</i>	+	—	+	+
		Cataglyphis	<i>Ca. setepis</i>	—	+	—	—
		Paratracheina	<i>P. longicornis</i>	—	+	—	—
		Lepisiota	<i>L. fraunfeldii</i>	—	+	—	—
	Myrmicinae	Pheidole	<i>P. sykesi</i>	+	—	—	+
			<i>P. bingham</i>	+	—	+	—
			<i>P. fergusonii</i>	—	+	+	+
			<i>C. subnuda</i>	—	+	—	—
		Monomorium	<i>M. indicum</i>	+	+	—	—
	Dolichoderinae	Tapinoma	<i>M. orientalis</i>	—	+	+	—

Table 2: *Ant species reported for first time from Pakistan and from other studies.*

Species reported for the first time from Pakistan.	Species reported from other studies	
Tapinoma indicum	<i>Camponotus compressus</i>	Umair <i>et al.</i> , 2012
Messor orientalis	<i>Paratracheinae longicornis</i>	Wetterer, 2008
Monomorium indicum	<i>Lepisiota fraunfeldti</i>	Umair <i>et al.</i> , 2012
Cataglyphis setipes		
Pheidole binghami		
Pheidole fergusonii		
Crematogaster sunuda		
Pheidole sykesi		
Camponotus aungusticollis		

(67.3%), followed by Formicinae (30.3%) whereas Dolichoderinae was least abundant (2.6%). Genus wise *Monomorium* was represented by maximum number of specimens (39.08%) followed by *Camponotus* (20.45%), while *Messor* and *Cataglyphis* were represented by minimum number of specimens. *M. indicum* was found to be the most abundant species represented by 39.08% of the overall collection, followed by *C. compressus* (12.99%), while *P. sykesi*, *P. fergusonii*, *C. setipes* and *M. orientalis* were represented by minimum number of specimens (0.32%). In khyber pakhtoon khuwa (KPK.Pakistan). Both major and minor workers of certain species i.e *C. setipes* were collected from various Districts maximum in number in July and August while in month of October minor worker of *C. compressus* were maximum. Similarly, *C. aungusticollis* minor worker were maximum in month of October while major worker was abundant in month of July. *Pheidole* spp. were more in month

Myrmicinae was the most abundant subfamily

Table 3: *Monthly wise number of different species of ant's.*

Species	Month February	March	April	May	June	July	August	September	October
<i>C. compressus</i> <i>C. aungusticollis</i>	0302	0202	0203	0605	0505	1213	0505	0505	42
<i>C. setipes</i>	00	00	00	00	01	00	01	00	01
<i>L. fraunfeldti</i>	02	04	02	02	02	10	02	02	15
<i>C. subnuda</i>	04	40	18	22	10	06	10	19	08
<i>M. indicum</i>	67	50	40	45	30	30	40	30	30
<i>P. sykesi</i>	40	30	00	10	05	06	02	02	10
<i>P. binghami</i>	10	05	00	00	00	05	00	05	00
<i>p. fergusonii</i>	1	02	00	00	00	00	00	00	00
<i>M. orientalis</i>	00	01	01	00	00	00	00	00	01
<i>T. indicum</i>	05	10	00	05	00	00	05	00	00

Table 4: *Percentage of different species of ant at four districts of Khyber Pakhtunkhwa.*

Subfamily	No. of specimens	%age	Genus	NO. of Specimens	%age	Species	No. of Specimens	%age
Formicinae	282	30.03	Camponotus	192	20.45	<i>C. compressus</i>	122	12.99
						<i>C. aungusticollis</i>	70	7.54
						<i>C. setipes</i>	3	0.32
			Paratracheina	51	5.43	<i>P. longicornis</i>	51	5.43
			Lipisiota	36	3.83	<i>L. fraunfeldti</i>	36	3.83
						<i>C. subnuda</i>	129	13.74
Myrmicinae	632	67.30	Crematogaster	129	13.74	<i>M. indicum</i>	367	39.08
			Monomorium	367	39.08	<i>P. sykesi</i>	105	11.18
			Pheidole	133	14.16	<i>P. binghami</i>	25	2.66
						<i>p. fergusonii</i>	3	0.32
						<i>M. orientalis</i>	3	0.32
			Messor	3	0.32			
Dolichoderinae	25	2.66	Tapinoma	25	2.66	<i>T. indicum</i>	25	2.66

of February and March. *Monomorium* spp. were abundant in February as compared to other months. *Paratrechina* were more in October while *Cataglyphis* and *Messor* were less in number. On the other hand, *Lepisiota* were more in October but *Crematogaster* and *Tapinoma* were more in the month of March. Monthly wise number of ant's species were showed in (Table 3). Percentage of different species of ant at Mardan locality were showed in (Table 4).

Description of the identified species of KPK

Subfamily: Formicinae

Species Camponotus compressus (Mayr, 1861) (Fabricius, 1787):

Generic character

Antennae twelve segments. Antennal insertion located behind the posterior clypeus margin. Orifice gland is absent. Tuberculiform prominence is absent in metathoracic spiracle. Antennal funiculums not forming a club. Teeth are 5-7 in number, in mandibles. Mandibles sub-triangular to triangular. Maxillary palpi is 6, 4. First tergite of gaster is short not covering the whole gaster showed in Table 5.

Species characters (major workers, Length: 11-16mm)

They are black, opaque, very delicately and closely reticulate and punctured, and base of the abdomen

sometimes shining. Petiole and the anterior most part of the gaster rarely shining, antennae flagellum, mandibles and legs chestnut brown, seldom black; pubescence rare, upright, commonly absent on the head and alitrunk. Head visibly triangular, seven teeth are present in mandibles, clypeus centrally vertically carinated, with a protruded rectangular lobe at the anterior end; cylinder-shaped antennal scape. Eyes relatively small, positioned at the front. Thorax narrow, front margin shaped into a collar; long legs with a flattened tibia. Petiole ovoid, rounded in front, gaster somewhat wide and large. The structure of the head was showed in (Figure 2).



Figure 2: Head structure of *componutus compressus*.

Minor worker

Length 7-11mm. Minor worker is similar to major

Table 5: Morphometry of major and minor workers of ants' species.

Species	Morphometry											
	Scape	Flagel- lum	Head length	Head width	Eye	Distance b/w eyes	Mandi- ble	Thorax	Gaster	petiole	Femor	Tibia
<i>C. Compres- sus</i> (major)	6.8mm	9.0mm	6.84mm	7.44mm	1.3mm	5.76mm	3.24mm	10.5mm	9.6mm	1.6mm	8.1mm	8.7mm
<i>C. Compres- sus</i> (minor)	2.mm	3.2mm	1.8mm	3.0mm	0.6mm	0.8mm	0.6mm	2.6mm	3.2mm	0.9mm	5.4mm	2.4mm
<i>C. aungustic- olis</i> (major)	8.4mm	11.8mm	9.2mm	7.8mm	1.5mm	6.12mm	3.24mm	11.7mm	11.8mm	2.5mm	7.4mm	5.8mm
<i>C. aungustic- olis</i> (minor)	4.2mm	6.3mm	1.8mm	3.0mm	0.56mm	1.56mm	2.58mm	5.5mm	5.2mm	0.8mm	3.6mm	3.4mm
<i>C. setipes</i>	7.2mm	6.7mm	5.1mm	5.4mm	0.9mm	3.6mm	8.4mm	6.6mm	1.4mm	8.5mm	6.2mm	-----
<i>P. longicor- nis</i>	2.88mm	4.2mm	2.1mm	1.5mm	.08mm	2.1mm	.48mm	2.16mm	2.5mm	0.4mm	2.1mm	1.9mm
<i>L. fraunfeldi</i>	1.6mm	2.4mm	2,1mm	1.5mm	0.4mm	1.2mm	1.4mm	2.18mm	2.0mm	2.5mm	2.0mm	3.0mm
<i>C. subnuda</i>	1.4mm	1.9mm	1.9mm	2.4mm	0.4mm	1.6mm	1.1mm	2.4mm	3.2mm	0.3mm	1.8mm	1.56mm
<i>M. indicum</i>	1.8mm	2.6mm	2.0mm	1.8mm	0.36mm	-----	0.8mm	2.2mm	2.6mm	0.48mm	1.9mm	2.0mm
<i>P. fergusonii</i>	3mm	3.3mm	4.8mm	5.1mm	0.8mm	3.8mm	0.9mm	4.2mm	6mm	-----	5.4mm	4.2mm
<i>P. binghami</i>	2.0mm	2.4mm	3.4mm	3.2mm	0.3mm	4.5mm	1.2mm	3.6mm	4.4mm	0.8mm	3.1mm	2.4mm
<i>P. sykesi</i>	2.1mm	2.6mm	3.4mm	4.4mm	0.3mm	2.7mm	1.5mm	2.7mm	3.6mm	0.4mm	3.4mm	1.6mm
<i>M. orietalis</i>	2.0mm	2.4mm	3.6mm	2.6mm	0.4mm	3.0mm	1.44mm	5.6mm	4.9mm	0.8mm	2.5mm	2.2mm
<i>T. indicum</i>	1.5mm	2.0mm	2.4mm	2.0mm	0.4mm	1.8mm	0.6mm	2.7mm	2.9mm	1.9mm	-----	1.5mm

worker but a little difference. They are smaller, and slender. Head is elongated and narrow posteriorly. The side of the head straight not convex. Mandibles having 5 teethes (Figure 3).



Figure 3: Lateral view of *camponotus compressus*.



Figure 4: (A) Showed the head structure (B) showed the teeth and (C) showed the lateral view of major worker of *Camponotus aungusticolis*.

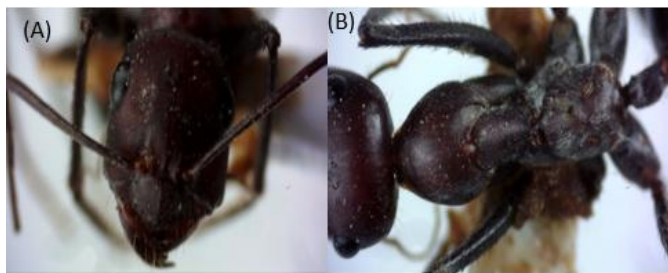


Figure 5: Head and dorsal view of *cataglyphis setipes*.

Specie camponotus aungusticolis

Major worker

Length: 17-21mm. they are black in color. Antennae tarsi are brown in shade. Head are subtriangular in shape. Occipital angles are prominent, but rounded. Mandibles having 6 or sometimes more than 6. Thorax elongate but narrow. Legs elongate rather slender, tibia prismatic, compressed and longitudinally extended. Head were showed in (Figure 4).

Minor worker

Length: 12-15mm. Similar like that of major workers. But a little bit different.

Node of pedicel much wider. Abdomen very massive and heavy.

Species cataglyphis setipes (Forel, 1894) (Foerster, 1850) *Generic characters*

Antennae 12 segmented. Mandibles sub triangular to triangular. Antennal sockets closely situated to the posterior clypeal margin. Maxillary palpi 6 segmented. Alitrunk in profile the mesonotum together not forming a roughly triangular wedge b/w pronotum and alitrunk. Orifice of propodeal spiracle oval, elliptical. Mandibles having 5-7 teeth (Figure 5).

Species characters

Length 10-12mm. The head, thorax, and petiole of *Cataglyphis setipes* were red in color, legs more or less black. Sometimes whitish and yellowish hairs are present on the surface of the whole body. A small number of dispersed hairs, most frequent on the lower side of the gaster. Legs compactly covered with coarse hairs. Pubescence very fine with a silver shine giving a sub opaque look. Head appears quadrangular without mandibles, posteriorly not emarginated. Jaws relatively large with a strong dentation and an extraordinarily large apical tooth. Clypeus slightly convex, and with a little curved anterior margin. The suture between clypeus and frontal is well marked. The carina of antennae too short and parallel not diverging. Eyes positioned very above the middle line of head. Thorax in lateral view appears saddle shape; pronotum rounded above; mesothorax elongated and round above; metathorax small and gibbous. Gaster small and ovoid. Ocelli are visible on the frontal region of the head. morphometry of *Cataglyphis setipes* were showed in Table 5.

Subfamily formicinae

Species Paratrechina longicornis (Latreille, 1802)
(Motschulsky, 1863)

Generic characters

Single petiole. Apex of gaster with a semicircular to circular acidopore. Sting is absent. Antennae 12 segmented. Mandibles sub triangular to elongate triangular. Less than 0.85 times the head length. Antennal sockets were closely situated to the posterior clypeal margin. Maxillary palpi 2-4 segmented. In Head the eyes at or in front of the mid length of the sides (Figure 6).

Species characters

Length 2.3-3mm. The head, thorax, petiole and gaster were brown, black in color; the antennae and legs were pale brown; the junctions of the legs and gaster were

much paler as compared to antennae. And sometimes the whole body is in black color. The head, thorax and gaster with slightly ample erect long whitish hairs. The head ovoid, almost equally wide at anterior and posterior side; eyes unusually large; jaws short and weak, with 5 or 6 teeth; clypeus extremely convex and round; Antennae very long and filiform. Cape are so mush elongated and extended from the head region. Thorax dorsally round, elongated, all the joints well marked, propodeum nearly round; limbs very long and thin. [Table 5](#). Showed the morphometry of *P. longicornis*



Figure 6: Head and full view of *paratracheinae longicornis*.



Figure 7: (A) Showed the full view (B) showed the dorsal view (C) showed the head of *lepsiota fraunfeldti*.

Specie Lepisiota fraunfeldti (Santschi, 1926) (Mayr, 1855)

Generic characters

Antennae are 11 segmented. Propodeum is armed with teeth or spines etc. Petiole is also armed.

Specie characters

Length 2.5-3 mm. The head, thorax, legs and petiole brown are somewhat yellow, in color. Head slightly darker than the thorax; gaster completely brown or in some specimens appears blackish in color. Pubescence almost absent; head thorax, and gaster smooth and shiny, gaster very refined. The head in front side view appears to be longer than wide, round above; mandibles somewhat slim, bowed, with a long and acute apical tooth; clypeus strongly convex, eyes were in the middle of the head. Gaster ovoid and somewhat large ([Figure 7](#), [Table 5](#)) showed the morphometry of

L. fraunfeldti.

Sub family Myrmicinae

Specie Crematogaster subnuda (Lund, 1831) (Mayr, 1878)

Generic characters

Antennae 12 segmented. Antennal scrobe absent. Post petiole is articulated on the dorsal surface of first gastral segment.



Figure 8: (A) Showed the head (B) showed the gaster (C) Dorsal view of *crematogaster subnuda*.

Specie characters

Length 0.3-3.5mm, Dark red, the gaster deepening at posterior end to chestnut-black; Pubescence nearly wanting. Head glossy, with a small number of delicate ill-defined vertical striate on genae and above antennal sockets. Observed from the front occiput is across, as wide as the head in front. Mandibles perforated, in specific lights delicately striated. Clypeus at front not completely transverse, a little round, convex to a high degree in the middle. Antennae fairly long and thin, scape extends slightly above the upper edge of the head, the last three segments formed the club, the last two of which are sharply thickened; eyes on the sides positioned more towards the posterior margin of the head and rounded in shape. promesonotal joint prominent; small mesonotum, slightly incline posteriorly, the suture between mesonotum and metanotum very distinct. Metanotum rectangular at base, incline posteriorly, metanotal spine shorter and sharp. Apex of the metanotum more perpendicular, polished and somewhat perforated. Abdomen mostly heart shaped ([Figure 8](#), [Table 5](#)) showed the morphometry of *C. subnuda*.

Specie Monomorium indicum (Mayr, 1855) (Forel, 1902)

Generic characters

Antennae 12 segments. Antennal scrobe absent. Post petiole is articulated on anterior surface of first gastral segment. Gaster dorsally not heart shaped. Petiole

not dorsoventrally flattened with a node shape. Antennae forming a 3-club segment. Mandibles dentate. Maxillary palpi absent. Ventrolateral margin of the head has no carina on each side. Pronotum and propodeum is unarmed. Mandibles not sharply falcate. Petiole pedunculated. Peduncle is present between the alitrunk and petiole. Propodeum unarmed and rounded.

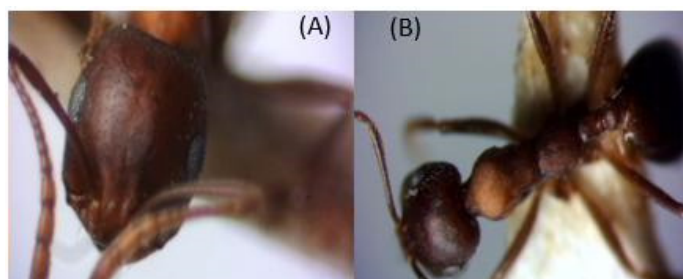


Figure 9: Showed the head structure (A) showed the dorsal (B) view of *M. indicum*.

Specie characters

Length 2.5 to 3.5 mm. Head thorax and petiole reddish brown, in some specimens the head and the legs were brownish, gaster black or dark brown in color. Head appears broader, almost as wide as long, anterior end wider than posterior, posterior margin slightly bent in; mandibles slender longitudinally striate, in closed position they partly covered by the protruding margin of the clypeus. Somewhat elongated antennae. Scape hardly reaching the posterior edge of the head; relatively large and flat eyes, positioned in the mid of the sides margin of the head. Alitrunk rounded at anterior end, fairly broad, with very compressed and narrow meso- and metanotum, meso-metanotal joint distinct. Metanotum base broadens posteriorly. Petiole: when observed from above both the segment appears nearly equal, the first nodes seem higher than the second. Gaster more or less oval (Figure 9, Table 5), showed the morphometry of *M. indicum*.

Specie Pheidole fergusoni (Westwood, 1840) (Forel, 1902)

Generic characters

Antennae 12 segments. Antennal scrobe absent. Sting is absent. Mandibles are edentate. First tergite not overlapping on to the anteroventral surface and not forming m-shaped structure. Palpi are reduced. Eyes present behind the mid length. Head not forming rectangular shape.

Species characters

Major workers

Length 0.6-6.5mm. Head, alitrunk and petiole dark reddish brown; gaster dark brown, more or less black in some samples. Head, alitrunk and petiole coarsely sculpted, head with longitudinal striations, that posteriorly breaks into rough reticulations on the side lobes, alitrunk and petiole coarsely punctured and obliquely striated, gaster with fine longitudinal striate; pubescence profuse and of light yellowish color. Head almost quadrate, with slight constriction at the anterior end, superficial concavity on the vertex; mandibles perforated and striated longitudinally, clypeus with a small longitudinal central carina; antennae slightly short, scape smaller not reaching to top margin of the head; antennal furrow not well-defined; occiput with moderate deep notch. Alitrunk with lateral tuberosity, mesonotal groove well-marked, metanotum small, with strongly built, short and blunt spines. Petiole: upper margin of the first node transverse and appendage below; Second node just twice as wide as long, with obtuse side angles. Gaster roughly oval, with depressed and truncated anterior end (Figure 10, Table 5) showed the morphometry of *P. fergusoni*.

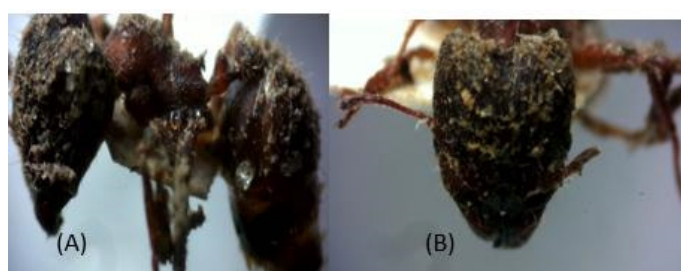


Figure 10: lateral view (A) and head structure (B) of *Pheidole fergusoni*.

Minor workers

Length 3.5 to 4 mm. Reddish brown color; Head, alitrunk and petiole densely punctured and opaque; gaster smooth, polished and shining, sparingly punctured at the anterior most part; pubescence abundant and of light yellowish color. Head oval, with round occiput; the antennae strongly built, pilose, scape extends over the top of head by about one quarter of its length. Alitrunk lengthen, the mesonotal ridge and groove indistinct, somewhat inclined metanotum, with acute, short and erect metanotal spines. Petiole: lengthen, with a cone shape first node and globular second node which is very broad and long; gaster almost oval.

Specie Pheidole binghami (Westwood, 1840) (Forel, 1902)

Major worker

The lengths of the species were in between 3.5 to 4 mm. light brownish red, with brownish yellowish legs, gaster brown. Pubescence very scanty; head with longitudinal markings anteriorly; Alitrunk crosswise sporadically sculptured, metanotum striated at the anterior portion, nodes of the petiole opaque and punctured; gaster smooth and shiny. Head ovoid, genae convex, margin of the occiput slender, mandible somewhat large and punctured, clypeus a little notched at the anterior end; antennae thin, scape remain short of the peak of head by one third of its length, groove of the antennae wide but superficial not deep. alitrunk have small lateral tubercles; with extensive and superficial transverse mesonotal groove, metanotal base rectangular and flat, metanotal spines somewhat oblique pointing backwards. Petiole: first segment slightly coniform, with a clear transverse upper edge, appendage below absent; second segment. Transversely spindle shaped, very wider than long; gaster ovoid.

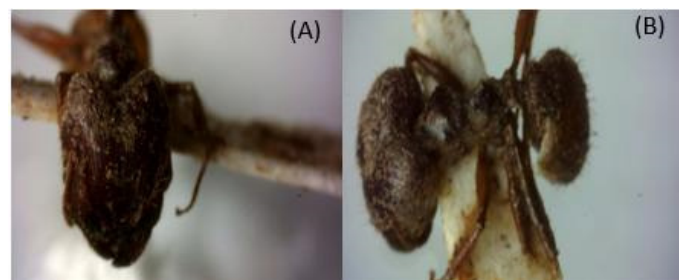


Figure 11: Head (A) and (B) dorsal (B) view of *P. binghami*.

Minor workers

Length 2. 5mm. Yellowish red color, the gaster brownish, legs light in color than the head and alitrunk. Head ovoid, antennae elongated, scape extends above the top of the head for about one third of its length. Alitrunk: Two slight tubercles on the pronotum, with distinct mesonotal groove, elongated and bidentate metanotum, Gaster ovoid (Figure 11).

Specie Pheidole sykesi (Westwood, 1840) (Forel, 1902)

Length 6.5-7.5mm. Dark brownish color. While the flagellum of the antennae, thorax and legs lighter in color. Head, thorax and abdomen covered with soft erect red hair. Head are large, closely longitudinally striate, and longer than broad. Mandibles are sharply punctured. Thorax polished and shining, emarginated

at the mesonotal suture. The pro-mesonotum form convexity. Metanotal spines are short. Pedicel without an appendage beneath the first node (Figure 12).

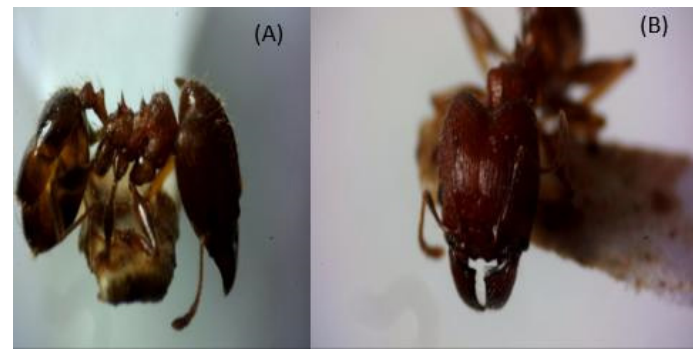


Figure 12: Full view (A) and the head structure (B) of *P. sykesi*.



Figure 13: Head structure (A) Antennae (B) lateral view (C) of *Messor orientalis*.

Specie Messor orientalis

Generic character

Antennae 12 segmented. Antennal scrobe absent. Mandibles are edentate. First tergite not overlapping on to the anteroventral surface and not forming m-shaped structure. Palpi reduced. Hairs on the lower margin of the face area are not in sequence.

Specie character

It occurs in the Middle East and South East Europe (Abdul-Rassoul *et al.* 2013). They are dark brownish in color; mandibles are long but edentate. Head are broad as long pedicel has no appendage beneath the first node. Scape of antennae is long and broad while the last three segments of the antennae forming a 3-segment club. Head contain a longitudinal striate on the lower sides of the face area. Eyes are small and present on the sides of the head. Abdomen is smooth and sometimes in species are shining. Antennal scrobe is absent in these specimens (Figure 13).

Subfamily dolichoderinae

Specie tapinoma indicum

Generic character

Simple, somewhat swollen, but when gestural part and alitrunk are in same plan, so the petiole is not visible.

Table 6: *Showed the keys used for identification of species in KPK.*

Genera	Author	Key used for genera	Species	Author	Key used for species
Componotus	Bary Bolton, 2021	Identification Guide to the ant genera of the world	C. compressus C. aungusticolis	Bingham, 1903	Fauna of British India
Cataglyphis			C. setipes	Radchencho, 1998	Key to Asian species of the genus Cataglyphis.
Paratracheinae			P. longicornis		
Lepisiota			L. fraunfeldti		
Monomorium			M. indicum		
Messor	Abdul-Rasoul <i>et al.</i> 2013		M. orientalis		New Records of Unidentified Ants worker (Hymenoptera: Formicidae: Myrmicinae) stored in Iraqi Natural History Museum with key to Species
Crematogaster			C. subnuda		
Pheidole			P. sykesi P. fergusonii P. binghami		
Tapinoma			T. indicum		

When we see from dorsal side 4 gastral segment is visible.

Specie character

Length, 1.5-mm 2.0mm. Brownish or yellowish color. Not very much shining. The mandibles legs and antennae are pale yellowish in color. pilosity absent. Pubescence is thin silky white, visible only in certain lights. Head broader posteriorly and shorter. Mandibles and clypeus are similar. Antennae shorter. Thorax much prominently broader in front, posteriorly laterally compressed (Table 6).

Statistically percentages

The proportion of each ant genus and species was found by dividing the individuals of a taxon by the total count of a collected ant and multiplied by 100. Such a statistical value demonstrates a percentage and prevalence of each group in the community. Pheidole recorded the highest percentage which means that it was dominant and then Camponotus, and other genera recorded lesser percentages means that they were not widely spread.

The total 12 species of 9 genera and three subfamilies of gujrat area of district mardan were recorded in present study. Future research must involve additional unexplored regions and habitat variation that must be surveyed on the ant, fauna of gujrat area district mardan. It should also be accompanied with ant

diversity ecological studies to understand how the presence or absence of these significant bioengineers and ecological indicators can influence the ecology of a specific location. The ants belonging to three subfamilies, among these Pheidole was the most abundant genus with three species, then there were Camponotus with two species, Paratrechina, Lepisiota, Crematogaster, Cataglyphis, Messor, Monomorium, and Tapinoma with one each. These results are in agreement with the earlier works of surrounding areas which show regional overlap and fauna specificity. The seven species reported for the first time from Pakistan are *Monomorium indicum*, *Cataglyphis setipes*, *Crematogaster subnuda*, *Pheidole binghami*, *Pheidole fergusonii*, *Tapinoma indicum*. All the species of the present study are also found by other studies in India and are included in the list of Indian ants species listed by Bharti (2016). Chavhan and Pawar (2011) previously described five subfamilies, namely Formicinae, Myrmicinae, Ponerinae, Dolichoderinae, and Pseudomyrmicinae, with Crematogaster being the predominant genus, then Pheidole and Camponotus. In a similar study, 21 species in 13 genera were documented in Pakistan, including *Camponotus oblongus*, *Lepisiota frauenfeldti*, *Camponotus compressus*, *Camponotus sericeus*, and *Meranophus bicolor* in the Potohar region of Punjab (Umair *et al.*, 2012). These observations are corroborated by the current findings which reveal the dominance and wide distribution of Pheidole and Camponotus in Pakistan. Interestingly,

the genera *Paratrechina*, *Lepisiota*, *Cataglyphis*, and *Messor* are also noted in the region as a first record of the genera in Khyber Pakhtunkhwa (KPK), broadening the geographical scope of the genera in Pakistan. Some of the species found in this research, including *Camponotus compressus* (Borowiec and Salata, 2013), *Cardiocondyla mauritanica* (Seifert *et al.*, 2017), *Lepisiota fraunfeldi* (Schifani *et al.*, 2018), and *Paratrechina longicornis* (Sharaf *et al.*, 2017), have extensive zoogeographical coverage, which includes tropical and subtropical areas of the world. The role of anthropogenic activities in the development of these distributions is much greater. The cosmopolitan tramp ant *Paratrechina longicornis* has been able to colonize almost every place where humans live because of the high degree of its adaptability, scavenging tendencies and its capacity to live in indoor settings (Sharaf *et al.*, 2017). These characteristics ease its formation and maintenance within the various ecological environments. The same patterns of diversity were seen in other parts of Pakistan. Hina *et al.* (2013) reported a total of seven species in 7 genera and three subfamilies in Balochistan, and Usman *et al.* (2017) listed 17 species in 12 genera under two subfamilies in Karak, Khyber Pakhtunkhwa. These studies, together with the present results, suggest that the ant fauna in Pakistan is not only rich in terms of taxa but also biogeographically diverse and thus requires further systematic and ecological surveys that would record unrecorded and possibly endemic taxa.

Conclusions and Recommendations

A survey conducted from February to October 2023 assessed the ant fauna of Khyber Pakhtunkhwa (KPK), Pakistan, with samples collected from Buner, Swabi, and Charsadda districts. The species were identified as belonging to three subfamilies, namely Myrmicinae and Formicinae (four genera each) and Dolichoderinae (one genus). The richest genus was *Pheidole* with three species, followed by *Camponotus* (two), and *Paratrechina*, *Lepisiota*, *Cataglyphis*, *Messor*, *Monomorium*, *Crematogaster*, and *Tapinoma* (one species each). All surveyed districts were recorded with the species *Camponotus aungusticollis*, *C. compressus*, *Monomorium indicum*; only indoor habitats were found to harbor *C. setipes*, *Messor orientalis*, *Tapinoma indicum*, *Crematogaster subnuda*, *Paratrechina longicornis*, *Lepisiota fraunfeldi*, *Pheidole sykesi*, *P. binghamii* and *P. fergusonii*.

Novelty Statement

This study presents the first record of 12 ants species from Mardan, Pakistan, with seven species newly reported for the country. It highlights *Myrmicinae* as the dominant subfamily and *M. indicum* as the most abundant species. The research also provides insights into habitat preferences, with some species found exclusively indoors. Additionally, seasonal abundance patterns reveal peak activity for different genera, enhancing ecological understanding of ant distribution in the region.

Author's Contribution

Khushbakht Asad, Muhammad Salman Khan and Said Miraj Ud Din: Did research, analysis and write-up of this manuscript.

Sumaira Shamas: Supervised the research work contributed in Review & editing the manuscript.

Khushbakht Asad and Zahid Ullah: Conducted the fieldwork, collected data and analysed and visualised the data.

Riaz Amin, Sehrish Asad and Farhad Badshah: Review & editing the manuscript.

All authors read and approved the final manuscript.

Generative AI or AI assisted technology statement

No generative AI and AI-assisted technologies were used in the writing process.

Conflict of interest

The authors have declared no conflict of interest.

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