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# Taxonomic studies of family (Formicidae: Hymenoptera) six genera from district Faisalabad Punjab Pakistan

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**Abstract**
Ants (Hymenoptera: Formicidae) are species rich and ecologically leading of all eusocial invertebrates. Cosmopolitan distribution across the tropical, subtropical and temperate zoogeographic regions. They are excellent bio indicator, predator, scavengers, omnivores, granivores and herbivores having good mutualistic behaviour with flora and fauna constitute greater part of biomass 16-20%. Ants were collected from diverse vicinities of District Faisalabad, Punjab, Pakistan by using aspirator belongs to 6 genera included 8 species Bingham taxonomic keys and other reliable literature were used for identification. All of these types are new to ant creatures of Faisalabad namely: are *described* for the first time from this District. Following genera were identified *Pheidole westwood,* 1840, *Monomorium Mayr*, 1855 *Meranoplus Smith*, 1854, *Solenopsis westwood,* 1840, *Atopomyrmex Andr,* 1889, *Crematogaster Lund*, 1832. Taxonomic keys are also provided for better identification.

**Keywords:** taxonomy, formicidae, genera, hymenoptera, Faisalabad, Punjab

## Introduction
Most dominant component of terrestrial ecosystem ants (*Solenopsis invicta*) belongs to family Formicidae and order Hymenoptera constitute a greater part of biomass. Conspicuous component of terrestrial biodiversity, Formicidae are the most divergent group of social insects. Ants known as ecosystem engineers because they play very important role by improving soil quality and helps in decomposition process (Watanasit *et al.*, 2000) [11]. Many species of ants provide ecosystem provisioning services such as food and medicine, Formicidae also utilized in entomo therapy or as alternate medicine in many regions of the world. Ants have well developed immunity system and anti-microbial chemicals used by ants for defence against pathogen which can be used for the treatment of human diseases. This taxon has potential for providing future benefits to mankind as a source of pharmaceuticals to increasing world population (Rastogi, 2011) [7]. Ants make their nests in or under cracks in pavements or other obscure sites and interconnected by underground passages over area. As they are social insects perform a variety of nest keeping tasks. Some ants produce short sounds by. Which are unable to listen for humans (Esperson, 1994) [3]. Social ant's consists of very unique features at colony level rather than individual, greater part of colony consist of sterile workers. They have unique eusocial behaviour and known as super organism (Murdock and Tschinkel, 2015) [6]. Lot of variation in life span of ants and in same colony queen live for many years while workers live for few months to few weeks respectively. Queens of ants are long lived and store viable sperms for long time in the specialized organ spermathecal. Ants have well developed communication system based on the production of pheromones. Fire ant Solenopsis richteri have 400 putative olfactory receptors (Favreau *et al.*, 2018) [4]. Ants are known 120 million years ago social insect of family Formicidae of order Hymenoptera having variation in colour green, black, red and metallic body play important role in predation, ecosystem indicator, pollinators and scavengers are important component of food chain. Hemi metabolic insect having versatile position such as soil turners also used for collection of seeds of herbal tea in South Africa. Army ants species used for operating stitches in Africa, fire ants Solenopsis having poisonous pouch with piperidine alkaloids their sting is aching and may be perilous for sensitive people (Umair *et al.*, 2012) [8]. In this present study 6 genera from family Formicidae were identified included Pheidole Westwood, 1840, Monomorium Mayr,

1855 Meranoplus Smith, 1854, Solenopsis westwood, 1840, Atopomyrmex Andr, 1889, Crematogaster Lund, 1832. Taxonomic keys are also provided for better identification. Species included in these genera are serious pest of household and first time studied from Faisalabad district**.**

## Materials and Methods

### Study site

Taxonomic study of (Hymenoptera: Formicidae) was conducted in taxonomy lab Department of Entomology University of Agriculture Faisalabad, District Faisalabad Punjab Pakistan during 2018-2019.

### Collection of specimen

Specimen of family (Hymenoptera: Formicidae) were collected from different habitats including cereal crops, vegetable area, forest area, soil surface, under the soil, along the road side, base of the trees, ornamental plants, residential areas, official buildings and from the leaf surface where soft bodied insect secrete honey dew for their taxonomic studies. Aspirator (consist of a glass vial, a mouth piece tube and an intake tube. Glass vial was fitted with a cork or rubber stopper having two holes in it. In one hole the mouth piece tube was inserted, while in the other hole the intake tube was fitted. The inner end of mouth piece tube was covered with a small piece of muslin cloth to prevent the insects from being sucked up into the mouth. This equipment were very useful for collecting small insects. The outer end of the intake tube was brought near the insect and then it was sucked in from the outer end of the mouthpiece tube) and soft camel hair brush were used for the collection of Formicidae specimen.

### Killing and preservation

Killing of Formicidae specimen were done by using 75% Ethanol solution. Ants were glued on the tip of specially prepared cards, these cards are pinned with pin No. 16 in a collection box, measures 18" × 12" × 3" covered with a tightly fitted hinged lid. Prevent the insect from enemies such as dermestid beetles, booklice and ants naphthalene balls were used, balls were mounted on pins by heating the pin-head and thrusting it into them. Para-dichlorobenzene fumigation and coopex powder are also used for this purpose.

### Identification

Collected specimens of (Hymenoptera: Formicidae) were taken in the taxonomy lab University of Agriculture Faisalabad. Binocular with 4x object lens, 10x eye piece lens and 40x magnification were used to observe the key characters of ants. Nikon SMZ 1500 stereo zoom microscope with 12x zoom, 30x eye piece lens, 2x objective lens and 720x magnification was used to capture magnified image of specimen in the laboratory. Morphological characters of specimens will be recognized with the help of Optical microscope up to species level. Ant specimens were classified up to species level via the taxonomic keys of (Natalie and Steve, 2001) [2] and (Binghum, 1897) [1].

## Results and Discussion

### Survey and Collection

Survey for ant's collection was carried out throughout Faisalabad district Punjab Pakistan during the year 2018-19 and total 260 specimen were collected. In all 6 genera having 9 species were identified belongs to Formicidae family.

### Family Formicidae

All ants have its place in single family Formicidae. Morphological key characters used in taxonomic key formation and their text illustration include antennal segment, size of ayes, metanotum of thorax, colour of body, pedicel joint with abdomen, number of maxillary palpi, size of scape of antennae and other morphological characters description.

### I. Genus pheidole westwood, 1840

### Key to the species of genus pheidole

Pronotum and mesonotum of thorax not creating a single convexity. Posterior third of head smooth ……nietneri, Emery.

Pronotum and mesonotum of thorax creating a single convexity. ……..2

Occiput smooth and shinning. Lateral lob broad and round ……Pronotails, forel.

Occiput sculptured. Frontal grooves for reception of scape of……mus forel.

Species. 1. Pheidole nietneri Emery, 1901

**Head:** Brown red Eyes moderate in size. Antennae and mandible red. Head smooth and shinning. Flagellum of antennae with different club.

**Mesosoma:** Shinny and red yellow. Pro-Meso- and metanotum not fused tighter, Spine present on metanotum of thorax.

**Pedicel:** First bump of pedicel round and additional node is flat and concave. Posterior node thicker, broader and rounded above.

**Metasoma:** Abdomen oval and black. Egg laying structures modified into sting used for defending their nests.

**Length:** Body length is 7mm. this species is dissimilar on the base of its flagellum of antennae without different club, clypeus bicarinate and bidentate. Head vertex smooth and shinning.

**Habitat:** This species found on grass land, field crop of maize and wheat, Apple orchard, on Aphid, Mealy bug, dead body of cockroaches and hen bone.

**Comments:** Tally with the published description of pheidole nietneri given by Bingham 1897 this species is different on the base of its Pro-Meso and Metanotum not show single convexity. Head smooth, shinning and not sculptured.

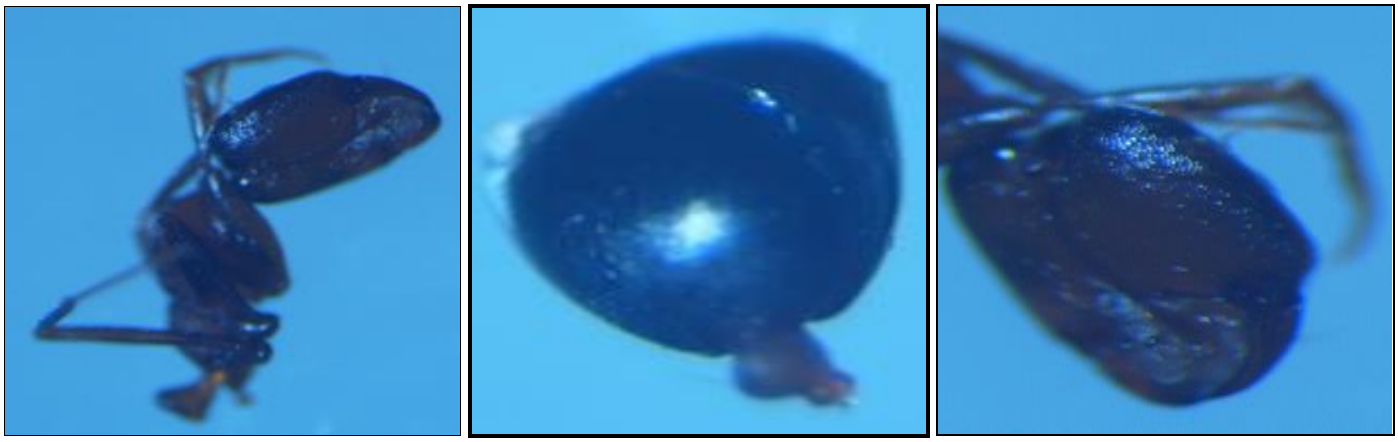

**Fig 1:** Head Thorax and Abdomen View of *Pheidole neither*

**Species. 2. *Pheidole pronotalis* Forel, 1902**
**Head:** Head longer than body. Occiput smooth and shinning. Head slightly yellow colour. Eyes small.

**Mesosoma:** Pro and mesonotum form one cavity. Pronotum tuberculate. Metanota spine short and straight critical.

**Pedicel:** Anterior node of pedicel without attachments beneath, outline tri-lateral, Upper border thin. Posterior node thicker, broader and rounded above.

**Metasoma:** Abdomen oval shape and black colour. Posterior node thicker, broader and rounded above.

**Length:** Its body length 3-4mm. this species is different on the base of its flagellum of antennae without different club, clypeus bicarinate and bidentate. Head vertex smooth and shinning.

**Habitat:** This species found on grassland, field crop of maize and wheat, Gurages beside footpath, road and walking path. They are good scavenger and decomposer.

**Comments:** Tally with the published description of *phidole pronotalis* given by Bingham 1897 this species is different on the base of its shinning brownish yellow colour.

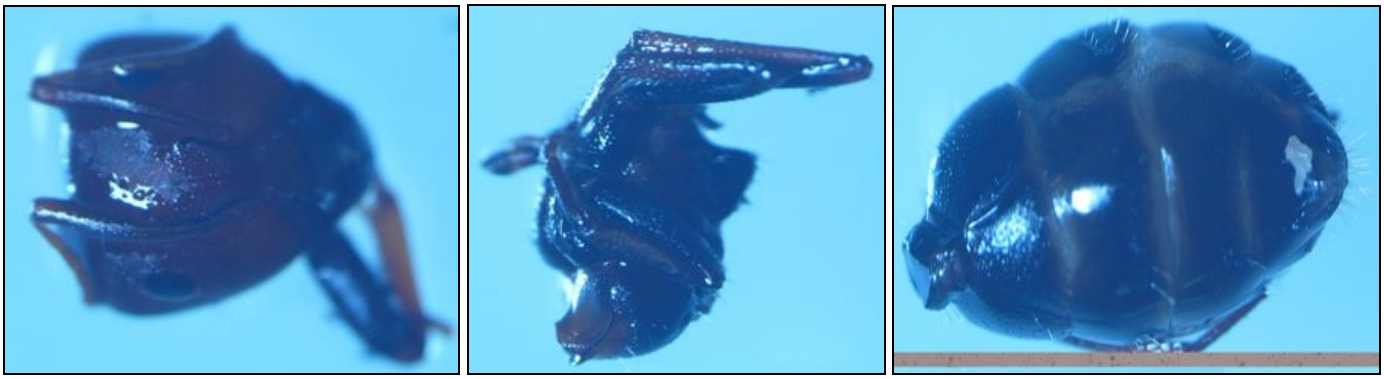

**Fig 2:** Head Thorax and Abdomen of *Pheidole pronotalis*

**Species. 3. Pheidole MUS Forel, 1902**
**Head**
Dark brown, antennae brownish yellow. Head closely punctured. Opaque, longer than broad.

**Mesosoma**
Dark brown and sculptured. Pronotum tuberculate. Metanotum dentate and its basal portion flat.

**Pedicel**
Elongate, first node rounded and smaller thansecond node.

**Metasoma**
Oval shape. Metanotum dentate and its basal portion flat.

**Length**
Body length 3-4 mm. metanotum dentate and its basal portion flat.

**Habitat**
This species found on grass land, field crop of maize and wheat, beside foot path, road and walking path. They are good scavenger and decomposer.

**Comments**
Tally with the published description of *pheidole mus* given by Bingham 1897 this species is dissimilar on the base of its head and thorax dark brown, antennae, legs and abdomen brownish yellow.

**Fig 3:** Head thorax and abdomen of phiedole mus

**II. Genus *Monomorium* Mayr, 1855**

**Key to the species of genus *monomorim***

1.Antennae long, scape reaching beyond top of head very, sides of head very convex……..…*longi*, forel.

Antennae short, scape not reaching beyond top of head. Pronotum and mesonotum very convex, not margined at the side……...*schurri*, forel.

**Species. 4. *Monomorium longi* Forel, 1902**

**Head:** Head dark red. Flagellum of antennae with 3 different club. Scape of antennae larger than head. Antennae and head cover with small hairs. Clypeus bicarinate.

**Mesosoma:** Thorax red colour. Tibia cover with hair and spine. Metanotum dentate and its basal portion flat.

**Pedicel:** Second node of pedicel broader than 1st node.

**Metasoma:** Black, shinning and cover with hair. Clypeus bicarinate.

**Length:** Body length is 4mm. Metanotum dentate and its basal portion flat. Antennae with 3-different club. Scape of antennae larger than head.

**Habitat:** This species found on grassland, field crop of maize and wheat, Apple orchard.

**Comments:** Tally with the published description of Monomorium long given by Bingham 1897 this species is dissimilar on the base of its clypeus bicarinate, Pronotum and mesonotum convex. Scape of antennae larger than head.

**Fig 3:** Head thorax and abdomen of *Monomorium longi*

**III. Genus *Monomorium schurri* Forel, 1902**

**Species 5**

**Head:** Dark red, sculptured and ocelli present. Clypeus bicarinate and dentate. Mandible, scape of antennae light brown and apex of flagellum dark red. Scape of antennae shorter than head.

**Mesosoma:** Dark red and legs light brown. Metanotum have spine. Pro-meso and metanotum of thorax fused together.

**Pedicel:** First node round and light brown. Second node is broad than 1st node and black.

**Metasoma:** Black and oval shape, Thorax red. Tibia cover with hair and spine. Metanotum dentate and its basal portion flat.

**Length:** Body length is 2.5mm. Bicarinate and dentate. Mandible, scape of antennae light brown and apex of flagellum dark red.

**Habitat**: This species found on grass land, field crop of maize

wheat, apple orchard and pine trees.

**Comments:** Tally with the published description of *Monomorium* long given by Bingham 1897 this species is different on the base of its clypeus bicarinate, Pronotum and mesonotum convex. Scape of antennae larger than head.

**Fig 4:** Head thorax and abdomen of *Monomorium schurri*

**IV. Genus *Meranoplus* Smith, 1854**
**Species. 6 *Meranoplus* bicolor**
Only one species under this genus were identified.

**Head:** Bright ferruginous red. Antennae grove present. Head little longer than broad. Mandible narrow and pubescent. Clypeus narrows in middle. Antennae 9-segment.

**Mesosoma:** ferruginous red. Pro-meso shield as broad as long. Pronotum dentate. Mesonotum armed posteriorly with two long acute spines.

**Pedicel:** First node smooth, viewed from the side triangular and second node globose.

**Metasoma:** Cordate and black. Mandible narrow and pubescent. Clypeus narrows in middle.

**Length:** Body length 4-5mm. Bright ferruginous red. Pro-meso shield as broad as long. Pronotum dentate. Mesonotum armed posteriorly with two long acute spines.

**Habitat:** This species found on grassland, field crop of maize and wheat and Apple orchards.

**Comments:** Tally with the published description of *Meranoplus* bicolor given by Bingham 1897 this species is different on the base of its head, thorax, legs and pedicel of abdomen bright ferruginous red, abdomen black. Pronotum dentate. Metanotum armed posteriorly with two long acute spines.

**V. Genus. *Solenopsis*, Westwood, 1840**
**Species. 7. *Solenopsis geminate* Fabricius, 1840**

**Head**: Reddish yellow, Antennae 10 segmented. Tip of the mandible black and eyes absent.

**Mesosoma:** Reddish yellow colour, smooth and shinning pronotum, mesonotum and metanotum fused together.

**Pedicel:** Reddish yellow. First and second nodes have same length.

**Metasoma:** Oval shape and reddish yellow but tip is black.

**Length:** Body length is 4mm. pro-meso and metanotum of thorax fused together. Bright ferruginous red.

**Habitat:** This species found on grass land and shrubs beside the road sides.

**Comments:** Tally with published description of *Solenopsis geminate* given by Binghum1897 this species is dissimilar on the base of its antennal 10 segmented, Eyes are absent and with shining body.

**Fig 5:** Head, thorax and abdomen of *Solenopsis geminate*

**VI. Genus Atopomyrmex Andr, 1889**
**Species. 8. Atopomyrmex ceylonicus Emery, 1901**

**Head:** Dark red and sculptured. Eye small. Clypeus interiorly dentate.

**Mesosoma:** Dark red. Pro-meso and metanotum not fused together. Spines present on metanotum. Its leg has light red.

**Pedicel:** First node of pedicel dentate and second node of pedicel broad and round.

**Metasoma:** Oval and black color.

**Length:** Body length is 5mm. dark red and sculptured. Eye small. Clypeus interiorly dentate.

**Habitat:** This species found in cockroach dead bodies, grasslands and bread pieces.

**Comments:** Tally with the published description of Atopomyrmex ceylonicus given by Bingham 1897 this

species id different on the base of its broader head than other part of body and first node of pedicel dentate.

The city of Faisalabad is located in eastern Punjab province known as Manchester city of Pakistan have internationally well famous cloth industry. The closest major city is Nankana sahib valued for Sikhism. The area around the city is flat and ideal for agricultural crops. Major crops are cotton, wheat, sugarcane, maize, vegetable and fruits. The study conducted in the month of July 2018 through May 2019. Wild (2005) [12] studied the taxonomy of *Pachycondyla apicalis* species complex (Hymenoptera: Formicidae) that comprises 2 species *P. apicalis* (Latreille 1802) and *P. obscuricornis* Emery 1890. *P. obscuricorinis* misdiagnosed as *P. verenae*, taxonomic keys along with distributional map and morphological illustrations also given. Forti *et al* (2006) [5] studied about the description and bionomics of Acromyrmex (Hymenoptera: Formicidae) by using taxonomic keys. Sample collected from 60 different localities and identified 11 species and 6 subspecies of Acromyrmex from Sao Paulo State. Two species *A. diasi* and *A. subterraneus molestans*. Are newly described on the base of morphological character. Wang *et al*. (2013) [9] revised the current status of *Solenopsis invicta* (Hymenoptera: Formicidae) invasive red fire ant from Mainland China. Detailed study about biology, ecology, ecosystem impacts, quarantine techniques, risk of spread, potential distribution and management techniques, effective biological control also detailed with. Ward and Brady (2003) [10] studied about the Myrmeciinae (Hymenoptera: Formicidae) subfamily of ants and use the morphological and molecular data to illustrate the phylogenetic relationship of the primitive Australian ant genera Myrmecia, Nothomyrcia and amber fossil Baltic genus Prionomyrmex their biogeography is also detailed with. Yamauchi and Hayashida (1970) [13] carried out taxonomic study about Lasius genus (Hymenoptera: Formicidae) in Hokkaido and provide their ecological and ethological notes. Describe jet black ant which is most troublesome and predominant subgenus.

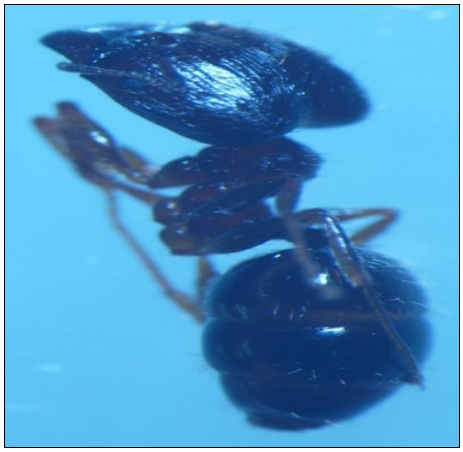

**Fig 6:** Body profile of *Atopomyrmex ceylonicus*

## Conclusions

Ant (Hymenoptera: Formicidae) are the advantageous and damaging insects. Ants damage yields, seeds, leaf and grassland. Ants are good decomposer, pollinator and scrounger. Ants perform cooperative relationship with aphid, mealy bug, fungi and Lepidoptera insects. Ants larvae feeds on mold dead animal body and honey dew. Sugar is required for its health and growth. They are originating in arid and semiarid areas. In Pakistan no work is done on its taxonomy since 1897 when Bingham worked on ants before indo-Pak partition. The results of this show that 6 genera and 8 species were identified and these species are household pests. Following genera were identified *Pheidole Westwood*, 1840, *Monomorium Mayr*, 1855 *Meranoplus Smith*, 1854, *Solenopsis westwood*, 1840, *Atopomyrmex Andr*, 1889, *Crematogaster Lund*, 1832.

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