FIRST RECORDS OF TWO SPECIES OF GENUS MESSOR FOREL, 1890 (FORMICIDAE: MYRMICINAE) ALONG WITH TROPHIC ASSOCIATIONS WITH APHIDS FROM POTHWAR REGION OF PAKISTAN

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ABSTRACT

Two species of genus Messor Forel, 1890, namely Messor instabilis (Smith, 1858) and Messor himalayanus (Forel, 1902) have been recorded for the first time from Pothwar region of Pakistan. Trophic associations of both species with aphid partners are reported for the first time from Pakistan. Main identification characters supported with microphotographs, measurements and distribution are given. A key to both species based on worker caste has also been given.

Key words: New records, Messor, Hymenoptera, Myrmicinae, Trophic associations, Pothwar, Pakistan

INTRODUCTION

Genus Messor Forel, 1890 can be differentiated from other genera of Myrmicinae (Hymenoptera: Formicidae) on the basis of following typical characters, i.e. head square, striated longitudinally, mesosoma narrower than the head, gaster oval (Bingham, 1903). Messor was described for the first time as a subspecies of Aphenogaster, later on it was treated as a subspecies of Stenamma by Emery (1895). However, Bingham (1903) named Messor as a valid genus on the basis of type species Formica barbara. Bolton (1982) synonymized the genus Veromessor with Messor.

Members of Messor are considered as micro engineers or soil harvester due to their nest building activities of the soil ecosystem especially in arid region, and also affecting the surface and sub-surface in the rangeland (Ghobadia et al., 2016). Harvester ants of this genus perform the activities of seed collection and storage in the galleries of soil chamber (Hölldobler and Wilson, 1990). As a result of these activities, physical, chemical and hydrological features of the soil are changed (Cammeraat et al., 2002). Moreover, seed predation activity of these ants enhances evolutionary fluctuations in structure and reproductive behavior of plants (Harper et al., 1970; Louda, 1989). These harvester ants are also important from ecological point of view, as they are involved in nutrient recycling and micro-climate modification in plant communities (Boulton et al., 2003; Grasso et al., 2004; Azcárate and Peco, 2007; Martinez-Duro et al., 2010 and Majer et al., 2011).

Messor is a widely distributed genus with 118 known species (Bolton, 2018). The species of this genus were mainly reported by many taxonomists from Oriental and Palearctic regions, e.g. Bingham (1903) India, Marko et al., (2006) Israel, Vonshak and Hirsch (2009) Romania and Guénard and Dunn (2012) China. As far as Pakistan is concerned limited work was done on ants by Umair et al. 2012, Bodlah et al. 2016 and Bodlah et al., 2017. So various surveys were conducted to explore the ant fauna of Pakistan. These two species of genus Messor are reported for the first time from Pakistan.

Materials and Methods: Messor specimens were collected from district Attock, Jhelum, Bahawalpur (Uch Sharif), Muzaffargarh (Alipur), Layyah, Manshera (Balakot) and forest areas of Rawalpindi and Islamabad in 2015-2017 by using aspirator and net sweep. Ants were also collected from plants along with their aphid partners and preserved directly in 75% ethanol. Mounting of ant specimens was done using triangular card. Aphids were identified using Blackman and Eastop (2008) and Blackman and Eastop (2012). Messor individuals were identified up to species level with help of Bingham (1903). Measurements and indices of minor and major workers were done using stage and ocular micrometer. Micrographs were prepared with the help of NIKON 1500 SMZ stereo microscope. Identified species have been deposited in Biosystematics Laboratory, Department of Entomology, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan.
RESULTS AND DISCUSSION

*Messor instabilis* (Smith, 1858): Fig. 1 (a-c)
*Atta instabilis* Smith, 1858
*Aphaenogaster Barbara*, Linn., var. punctate Forel, 1886
*Aphaenogaster barbara sordida* Forel, 1892
*Formica binodis* Fabricius, 1775
*Formica juvenilis* Fabricius, 1804
*Formica megacephala* Leach, 1825
*Messor barbarus ambiguus* Santschi, 1925
*Myrmica rufitarsis* Foerster, 1850
*Messor barbarous nigricans* Santschi, 1929

**Identification characters:** Head square, as broad as long, opaque, a little striated, ocelli absent. Antennae shorter, scape little longer than top of head, flagellum gradually thicker toward apex. Eyes somewhat broader in width than length, placed above the middle of head. Clypeus finely carinate. Mandibles long, striated longitudinally, denticulate at inner margin. Mesosoma transversally striated. Pronotum broader than meso and metanotum, mesonotum compressed laterally, metanotum without spines or teeth. Petiole and post petiole equal in width. Gaster smooth and oval.

**Coloration:** Head and mesosoma dark shining red; gaster black. Scape of antennae and tarsi pale.

Fig. 1 (a-c). External morphology of *Messor instabilis* worker (a) Head in frontal view (b) Habitus in dorsal view (c) Habitus in lateral view.

Fig. 2 (a-d). *Messor instabilis* (Smith, 1858) (a) Metanotum unarmed or without teeth like structure, (b) Mesosoma coarsely and transversally striated (c) Mandibles longitudinally striated (d) Clypeus carinate.
Fig. 3 (a-c). External morphology of *Messor himalayanus* worker (a) Head in full-face view (b) Body in dorsal view (c) Body in lateral view.

Fig. 4 (a-f). *Messor himalayanus* (Forel, 1902) (a) Metanotum bidentate (b) Head longitudinally striated (c) Clypeus carinate (d) Emarginated frontal carinate (e) Clypeus triangular in shape (f) Gaster covered with yellowish erect hair.
**Distribution**

India, Israel, Romania, China (Bingham, 1903; Marko et al., 2006; Vonshak and Hirsch, 2009; Guénard and Dunn, 2012)

**Measurements (mm) of Worker:** Head length 1.6 mm; Head width 1.6 mm; Scape length 1.3 mm; Eye length 0.36 mm; Eye width 0.38 mm; Mesosoma length: 2.2 mm; Pronotum width 1 mm; Petiole length 0.2 mm; Petiole height: 0.33 mm; Petiole width 0.4 mm; Post petiole length 0.2 mm; Post petiole width 0.4 mm; Post petiole height: 0.5 mm; Gaster length: 1.60 mm; Body length 8.5 mm; Cephalic index: 100; Scape index: 81.25; Petiole index: 60.60; Post petiole index: 40


**Trophic associations with aphids:** 5♀, Kamrrial (Attock): (N 33°54.762 E 72°28.237), 1846 ft. elev., 21.xi.2016 *Setaria viridis* (Green Foxtail); 3♀, Kamrrial (Attock): (N 33°54.762 E 72°28.237), 1846 ft. elev., 2.x.2016 *Setaria viridis* (Green Foxtail)

**Comments:** This species was collected from Murree (Rawalpindi), Kachnar Park (Islamabad), Uch Sharif (Bahawalpur), Balakot (Mansehra), Pindi Gheb (Attock) and Fateh Jang (Attock). During present study it was observed performing harvesting activities like seed dispersion. Nest was observed under the ground surface near dense vegetation and water source.

*Messor instabilis* was found associated with black bean aphid (*Aphis fabae*) on *Setaria viridis* (Green Foxtail) from Kamrrial area of district Attock. Ants were found getting honey dews secretion from aphid cornicles. All the collected specimens were identified and found similar to the published description of species by (Bingham, 1903). *M. instabilis* is reported for the first time in association with an aphid species from Pakistan, so it is a new country record.

**Key to the species of genus *Messor* of Pakistan based on worker caste**

1. Metanotum without spines or teeth (Fig. 2a); Scape of antennae little longer than top of head (Fig. 1a); Head and mesosoma dark reddish (Fig. 1a, b) ………………… *Messor instabilis* (Smith, 1858)

   - Metanotum denticulate or sub bi-dentate dorsally (Fig. 3a); Scape of antennae shorter than top of head (Fig. 3a); whole body black and shining (Fig. 3c)………*Messor himalayanus* (Forel, 1902)

*Messor himalayanus* (Forel, 1902): Fig. 3 (a-c)

**Stenamma (Messor) barbarum himalayanum** Forel (1902)

**Identification characters:** Head somewhat shiny, rectangular, longer than width with emarginated frontal carina, without ocelli, and finely longitudinally striated. Eyes longer than broader placed in the middle of head. Clypeus finely longitudinally striated forming a triangular shape with distinct clypeal carina. Mandibles striated longitudinally and reddish brown. Scape of antennae shorter than top of head, flagellum slightly thickened toward apex. Pronotum broader than meso and metanotum, mesonotum slightly raised metanotum transversally striated and bidentate. Petiole slightly longer in length than width having reticulated striation. Gaster smooth, highly polished having yellowish erect hairs.


**Distribution:** India, China (Bingham, 1903; Guénard and Dunn, 2012)

**Measurements (mm) worker:** Total length 4.5-8.5 mm; Head length 1.4-2.0 mm; Head width 0.27-2.2 mm (including eyes in width); Eye length 0.2-0.4 mm; Eye width 0.17-0.27 mm; Prothorax width 0.8-1.2 mm;
Thorax length 1.8-2.3 mm; Petiole length: 0.56-0.85 mm; Petiole height: 0.52-0.62; Petiole width: 0.4-0.6 mm; Post petiole length: 0.3-0.4 mm; Post petiole width: 0.3-0.5 mm; Post petiole height: 0.67-0.70 mm; Scape length: 1.1-1.5 mm; Cephalic index: 90.90-518; Scape index 1: 75-78.57; Scape index 2: 68.18-407.40; Petiole index: 107.69-137.0; Post petiole index: 44.77-57.14.


**Comments:** *M. himalayanus* closely related to *M. instabilis* but can be separated distinctly; metanotum posteriorly dentate or sub-dentate in *M. himalayanus*, while metanotum wholly unarumed in *M. instabilis* (Bingham, 1903). This species was mostly observed in forest areas of Rawalpindi and Islamabad. During collection, ants were observed under stone surface forming long interconnected galleries. This ant species was found in association with *Aphisgossypii* on *Parthenium hysterophorus* (Parthenium weed) from forest area of Neela Sand and Charapani of district Rawalpindi. Aphids were present in abundance on the buds and leaves sucking sap. Ants were moving on the branches and also present along the group of aphids for getting honey dew secretion from them. All the observed specimens were collected, identified and found similar to the species description by Bingham (1903). *M. himalayanus* is reported for the first time in association with an aphid species from Pakistan, so it is added to the fauna as new country record.

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**REFERENCES**


