First description of male of *Cataglyphis cugiai* Menozzi, 1939
(Hymenoptera: Formicidae) from Himalaya, with notes on the species ecology and biodiversity conservation of the region

Призывание самца *Cataglyphis cugiai* Menozzi, 1939 (Hymenoptera: Formicidae) из Гималаев, с заметками по экологии вида и сохранению биоразнообразия региона

H. Bharti¹, I. Gul¹, D.A. Dubovikoff²
Х. Бхарти¹, И. Гул¹, Д.А. Дубовиков²

¹Punjabi University, Department of Zoology and Environmental Sciences, Patiala, Punjab 147002 India. E-mail: himenderbharti@gmail.com
²Saint Petersburg State University, Faculty of Biology, Department of Applied Ecology, 16th line of Vasilyevsky Island, 29, St. Petersburg 199178 Russia. E-mail: dubovikoff@gmail.com

Key words: Hymenoptera, Formicidae, *Cataglyphis cugiai*, Himalaya, ecology, biodiversity conservation.

Abstract. A male of *Cataglyphis cugiai* Menozzi, 1939 is described for the first time. The diagnosis of this species by workers is given. Information on the ecology of this species and data for conservation of biodiversity in the Indian Himalayas are given.

Резюме. Впервые описан самец *Cataglyphis cugiai* Menozzi, 1939. Дан диагноз этого вида по рабочим. Приведены сведения по экологии этого вида и данные по сохранению биоразнообразия в индийских Гималаях.

Introduction

The genus *Cataglyphis* Foerster, 1850 contains 89 valid species and 20 subspecies in the world fauna [Bolton, 2014]. This genus is represented by 3 species in India [Bharti, 2011], which are *C. cugiai* Menozzi, 1939, *C. indica* Pisarski, 1962 and *C. longipedem* (Eichwald, 1841). *Cataglyphis cugiai* was described for the first time by Menozzi based on worker and queen caste from Karakorum region of Himalaya [Menozzi, 1939; Radchenko, 1997; Bharti, 2008]. More recently, the worker caste of this species has been also reported from Iran [Pakina et al., 2010]. Here we report its hitherto undescribed male caste. In recent times, more emphasis is laid on the male caste for identification of species in ant taxonomy due to significant apomorphic characters expressed by them. But unfortunately it is difficult sometimes to collect males since they have specific characters expressed by them. With the discovery of more male caste in different species of this genus in future, it would become easier to classify species based on the characters expressed by males.

Material and methods

The specimens were collected by handpicking method. The morphological analysis was carried with Nikon SMZ 1500 stereozoom microscope. For the digital images, a MP evolution digital camera was used on same microscope with subsequent use of Auto-Montage software (Syncroscopy, Division of Synoptics, Ltd.). Later, images were processed with Adobe Photoshop CS5. All measurements were taken using ocular-micrometer with accuracy of 0.01 mm. The specimens have been deposited in Punjab University Patiala Ant Collection at Department of Zoology and Environmental Sciences, Punjab University, Patiala, Punjab, India. The following linear measurements (in mm) and indices are used: HL – length of the head measured in full face view in a straight line from the middle of the anterior clypeal margin to the middle of the occipital margin; HW – maximum width of the head in full face view, behind the eyes; EL – maximum eye length with eye in full face view; SI (scape index) = SL/HL × 100; CI (cephalic index) = HL/HW × 100; EI (eye index) = EL/HW × 100; SL, (scape index 1) = SL/HL × 100; SI₂ (scape index 2) = SL/HW × 100.

*Cataglyphis cugiai* Menozzi, 1939
(Color plate 13: Figs 1–6)

Material. India, Jammu and Kashmir: Bhaderwah, 2000 m, 33°09'11.28"N / 75°41'42.80"E, 14.06.2009, 5 ww, 3² (I. Gul); Kargil, 2750 m, 34°22'27.02"N / 76°08'26.40"E, 26.06.2009, 9 ww (I. Gul).

Worker (Figs 1–3). Measurements (n=14): HL 1.2–1.86; HW 1.05–1.8; EL 0.38–0.49; SL 1.48–1.9; WL 1.92–2.77; PW 0.84–1.2; PEL 0.19–0.28; GL 1.56–2.34; TL 4.92–7.25; CI 103.33–118.57; EI 27.5–36.66; SI, 102.5–119.27; SI₂, 105.55–141.42.

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Worker diagnosis. Head almost as long as broad (in larger workers); scape long, distinctly surpassing the posterior margin of head by two third of its length; frontal ocellum reaching the middle groove; pronotal dorsum almost equal in length and width (in larger workers); anterior dorsum of mesonotum somewhat higher than pronotum; petiolar node more or less convex anteriorly, slightly concave posteriorly, node narrowed and thicker in larger workers; pubescence whitish and dense on metanotum and coxae of legs; colour dull, dark brown to chestnut brown, mandibles antennae and legs reddish brown.

Male. Measurements (n=3): HL 1.24–1.3; HW 1.23–1.26; EL 0.44–0.45; SL 1.56–1.62; WL 2.37–2.4; PEL 0.22–0.27; GL 2.58–2.7; TL 6.47–6.62; CI 100.64–103.17; EL 35.56–35.71; SI 120–13; SL 123.8–130.96.

Description of male. Head about as long as broad in full face view; posterior margin of head slightly convex; postero-lateral corners rounded; frontal triangle dull; frontal groove distinctly developed from the frontal triangle to mid-ocellum; lateral sides of head distinctly converging towards the apex of mandibles; anterior clypeal margin broad but strongly convex, weakly notched in the middle; clypeus with distinct median keel; lateral clypeal profile weakly convex; eyes large and bulging beyond head outline in frontal view; mandibles triangular, the masticatory margin smooth, without any teeth or denticles; antennae 13 segmented, filiform, scape long, distinctly surpassing the posterior margin of head by more than half of its length.

Mesosoma and petiote. Mesosoma enlarged to accommodate flight muscles; weakly convex pro-mesonotal dorsum; pronotum small; scutum smooth; scutellum raised; declivity steep; in frontal view petiote dorsally rounded, lateral sides weakly convex.

Gaster lengthened, tapering towards the apex.

Pilosity. Setae of varying length more or less straight present on anterior clypeal margin, mandibles and more dense on ventral side and towards the apex of gaster, occasionally a few present on front of head; pubescence scarcely distributed on head dorsum and legs.

Genitalia. Parameres elongated, roughly triangular, slightly bent inwards with rounded apices, covered with long setae; cuspia almost smooth and bent towards digitii; digitii straight, length about 2 times the length of cuspia; penis valve projecting.

Colour black; eyes black; legs brown, wings creamish yellow; body smooth and more or less shiny.

Ecology, conservation: causes and concerns and the case of ants

The species was collected from an altitudinal range of 2000 to 2750 m above mean sea level in North-West Himalaya. This range represents the transitional boundary between Indo-Malayan and Palearctic regions in Indian Himalaya [Bharti, 2008]. The species was collected from two localities in the state of Jammu and Kashmir. The nest of species was located on a slope of a hill under small stone in open grassland without any forest cover in the Kargil region. The average high temperature of the region is 16 °C and average low temperature 4 °C with a precipitation of 20 mm during the month of June. From the other collection site (Bhadarwah), foraging workers were collected by hand-picking. This site has dense coniferous forest which consists of Pinus, Cedrus, Abies, Quercus species along with herbs and other plants. The average high and low temperature of this region is 20 and 14 °C respectively with a precipitation of 6 mm in the month of June.

Himalayan mountain system where altitudinal change has a pronounced effect on flora and fauna due to varied climatic conditions over a short distance is a hotspot of biological diversity and richness [Myers et al., 2000; Myers, 2003; Körner, 2004; Bharti, 2008]. This effect of changing altitude/climatic conditions has recently been studied in case of ants with respect to species richness, endemism, and distributional pattern of invasive species along an elevational gradient in Himalaya [Bharti et al., 2013]. The Himalayan region is currently exposed to high degree of anthropogenic activities and is thus a threatened ecosystem [Bharti et al., 2013; Rashid et al., 2013]. Such type of anthropogenic pressure in terms of deforestation, illegal cutting of trees for wood and timber, fragmentation of habitat, tourism, industrialization, human habitation and agriculture has already led to the penetration of number of invasive ant species in Himalaya with an alarming threat to endemic ant fauna, few of which are already redlist species [Wilson, 1984; Bolton, 1988; Bharti, 2008, 2012; Bharti et al., 2013]. Furthermore, the recent concerns about the effect of changing climate on Himalayan ecology [Ramstein et al., 1997; Hughes, 2000; Holtmeier, Broll, 2005; Cruz et al., 2007; Trenberth et al., 2007; Akhtar et al., 2008; Eriksson et al., 2009; Xu et al., 2009; Climate..., 2010], on ant community compositions and on spread of invasive species [Colwell et al., 2008; Hellmann et al., 2008; Bertelsmeier et al., 2013; Menke et al., 2014] are alarming. Thus the cumulative effect caused by anthropogenic activities and climate change would obviously be taxing/challenging for native/endemic ant fauna and a cascade one on ecosystem functioning in Himalaya. Moreover, it has been observed during the field studies conducted during the last 15 years to various Himalayan regions that most of the endemic ant fauna has pocketed distribution (the ant colonies are not distributed over a wide scale in a particular area, instead are limited to certain specific areas at a particular altitude, worker density per nest is less as compared to species occupying tropical/subtropical regions, additionally at higher altitudes the nest site availability is less, resources are meagre and seasonally controlled, some ant species are narrow habitat specialists). Consequently such type of distributional pattern is directly exposed to above stated threats. However, unfortunately most of the conservation policies are based on few emblematic groups, the so called umbrella species, with most of the invertebrates being ignored, even though the 80% of the described species on Earth are invertebrates [Cardoso et al., 2011a, b, 2012]. In addition, invertebrates are more prone to extinction factors as compared to vertebrates [Dunn, 2005]. It has recently been observed that global conservation policies based on major vertebrate groups (birds, amphibians and mammals) may not yield well for ants and other invertebrates [Jenkins et al., 2013]. Among invertebrates, ants have recently been thought of as a suitable indicator group, since ants are more diverse, occupy variety of habitats, are keystone species and of course more scientific community is involved to study the ants as compared to other insect groups. The best way to make risk assessments would be to focus on regions
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Color plate 13.

Figs 1–6. *Cataglyphis cugiai* Menozzi, 1939 (1–3 – worker; 4–6 – male).

1, 4 – head, full face view; 2, 5 – body, lateral view; 3, 6 – body, dorsal view.

Рис. 1–6. *Cataglyphis cugiai* Menozzi, 1939 (1–3 – рабочий; 4–6 – самец).

1, 4 – голова, анфас; 2, 5 – тело, вид сбоку; 3, 6 – тело, вид сверху.
which harbor endemic species of ants, species which have narrow distributional ranges, occupy specific habitats, have specific dietary preferences, and are exposed to direct anthropogenic threats.

This species referred in the article like most of the other ant species which occupy high altitude regions of Himalaya has been found to be of uncommon occurrence collected only from two localities. Probably such species which occupy specific habitats or are restricted to higher elevations need more attention in terms of conservation.

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