

Original Article

Notes on three morphs of *Bulaea lichatschovii* (Hummel) (Coleoptera: Coccinellidae) from Northern Pakistan

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ZI, MFN: Planned, collected and identified the species, **IB:** confirmed and helped in photography of species, **RQ:** helped in identification of host plant and paper write up, **AA:** Helped in paper write up and review of manuscript

Key words

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New distributional records,
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Abstract

Bulaea lichatschovii (Hummel) is a phytophagous as well as pollinivorous species on many plants. In this study, three morphs of *B. lichatschovii* are reported during 2015-2017 from different localities of Northern Pakistan (Gilgit-Baltistan and Azad Jammu and Kashmir). Three food plants of the coccinellid are, *Krascheninnikovia ceratoides*, *Artemisia vulgaris* and *A. maritima*, are documented. Notes on diagnostics of the species are given with illustrations and new distributional records.

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INTRODUCTION

The family Coccinellidae, commonly known as ladybird beetles or lady bugs, is distributed in all zoographical regions of the world. Due to their predatory behavior, many of these beetles are utilized as biological control agents against notorious insect pests such as aphids, mealybugs, scales insects, mites, whiteflies, etc. (Hodek and Evans, 2012). Some coccinellids such as *Bulaea* spp. show phytophagy (tribe Epilachni) as well as pollinivory (Hodek, 1973). However, polymorphism in insect groups has been

intensively studied; in coccinellid it attracted only limited attention to a few species (Honek, 1996). Polymorphic ladybird beetles supposed to display very similar color patterns. This may be ascribed to similar genetic mechanisms and environmental factors (high temperature and low humidity), which tend to increase or reduce the melanic area in different species (Komai, 1956).

The genus *Bulaea* Mulsant, 1850 belongs to the tribe Coccinellini whereas, Savoiskaya (1969) proposed a tribe Bulaeini on the basis of its larval morphology. On the basis of recent molecular studies, Seago *et al.* (2011) placed this genus in Coccinellini under the subfamily Coccinellinae. Nedvĕd and Kovář

(2012) proposed another classification and included this genus in the tribe Tythaspidini (=Bulaeini) based on the several small teeth arranged in a row on mandibles.

Members of *Bulaea* have different types of feeding behavior (Hodek, 1973) and unlike the other phytophagous species of subfamily Coccinellinae, adults of this genus can also consume aphids under laboratory condition (Giorgi *et al.*, 2009). *Bulaea lichatschovii* (Hummel) and other closely related species were mainly known to be pollinivorous (Capra, 1947), but Dyadechko (1954), Bielawski (1959) and Savoiskaya (1970) also considered it as phytophagous. It is widely distributed in sandy and desert areas, from Senegal through Egypt and Arabia to central Asia and Persia (Iran) (Crotch, 1874; Kapur and Bhaumik, 1966)

Kovář (2007) listed only four species under *Bulaea* in his Palaearctic catalogue of Coleoptera (Coccinellidae): *B. lichatschovii* (Hummel, 1827), *B. lividula bocandei* Mulsant, 1850, *B. lividula lividula* (Mulsant, 1850) and *B. nevilli* (Dohrn 1882). Ali *et al.* (2014) reported *B. lichatschovii* from Sindh province of Pakistan. During the current study, updated information on the color morphs of *B. lichatschovii*, their diagnosis, host plants and new distributional records are provided.

MATERIALS AND METHODS

The specimens were collected during June to August of 2015-2017 from different localities of Northern Pakistan, situated in between three mountainous regions of the world, i.e., Himalaya, Karakorum and Hind Kush (Gilgit-Baltistan and Azad Jammu and Kashmir). Collection was done by using aerial net, hand picking and aspirator. Specimens were killed in killing bottle containing Potassium Cyanide. The dead specimens were mounted on a small triangular piece of white card with a Canada balsam and kept in wooden insects boxes. Male genitalia were dissected then boiled for 10 minutes in 10% KOH and examined with a Labomed microscope (CZS6). The classification proposed by Seago *et al.* (2011) and the terminology of Ślipiński (2007) and Ślipiński and Tomaszewska (2010) are followed. The specimens of ladybird beetles were identified as per Ali *et al.* (2014) and the host plants by Ashiq (2017). External morphology of the collected specimens was observed with a Labomed microscope (CZS6). The following

measurements were made with the help of an ocular micrometer: total length (TL), from apex of clypeus to apical margin of elytra; total width (TW=EW), along the widest part of both elytra; total height (TH), across the highest point of metaventrite elytra; head width (HW), across the head including eyes; pronotal length (PL), from the center of the pronotum base to anterior margin; pronotal width (PW), at widest part of pronotum; elytral length (EL), along the suture, from elytral base including scutellum to the apex. Images of whole specimens and male genitalia were taken using a Nikon Digital camera attached to the stereo microscope. Photographs were cleaned up with Zerene Stacker and Adobe Photoshop CS 6.0. The identified specimens are deposited in Biosystematics Laboratory, Department of Entomology, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan.

RESULTS

Genus Bulaea (Mulsant, 1850)

Bulaea (Mulsant, 1850: 69). Type species: *Coccinella lichatschovii* Hummel, 1827 by original designation.

Diagnosis

Bulaea can easily be distinguished from the other genera of Coccinellini by the following combination of characters: body (Fig. 2A, 2B, 2C) usually medium (3-5 mm), elongate oval, strongly convex, dorsum glabrous. Elytra usually yellow to yellowish brown with black spots or entirely black or sometimes with elytral spots variously fused or not fused with each other. Head (Fig. 1A) exposed, clypeus straight with anterior margins laterally slightly or distinctly emarginated. Antennae (Fig. 1B) 11-segmented, smaller than head width, club 3 segmented and compact, terminal antennomere large and transverse. Terminal maxillary palpomere (Fig. 1C) weakly securiform. Mandible (Fig. 1D) with bifid apex, lateral margin of mandible weakly curved with arrangement of very minute teeth, molar part with basal tooth. Pronotum (Fig. 1A) anteriorly convex, prosternal process narrow, with carinae and rounded at apex. Elytral epipleuron distinctly descending, with foveae. Abdomen (Fig. 2D) with six ventrites, abdominal postcoxal lines incomplete. Tarsi (Fig. 1F) 4-segmented, claws bifid.

Bulaea lichatschovii (Hummel, 1827)

Coccinella lichatschovii Hummel, 1827: 43. *Bulaea bocandei* Mulsant, 1850: 71, 1016; Gordon, 1987: 12 (wrongly spelt as *B. bocandei*). *Bulaea flavidula* Mulsant, 1850: 73; Gordon, 1987: 12. *Bulaea lichatschovii*: Crotch, 1874: 105; Kapur and Bhaumik, 1966: 446.

Material examined

Pakistan; Gilgit-Baltistan, Ghizer, 1♂, Gahkuch Bala, 3.viii.2015 leg. Z. Iqbal; 2♀,

Gahkusch Bala, 18.ix.2016, leg. I. Bodlah; 21♀, 19♂, Phander valley, 30.vi.2017, leg. Z. Iqbal; 17♀, 13♂, Gahkuch Bala, 1.vii.2017, leg. Z. Iqbal; Gilgit, 14♀, 10♂, Jutial Nala, 29.viii.2015, leg. Z. Iqbal; 14♀, 10♂, Jutial Nala, 24.vi.2017, leg. M.F. Nasir; Azad Jammu and Kashmir, Neelum, 1♀, 1♂, Sharda, 20.viii. 2016, leg Z. Iqbal.

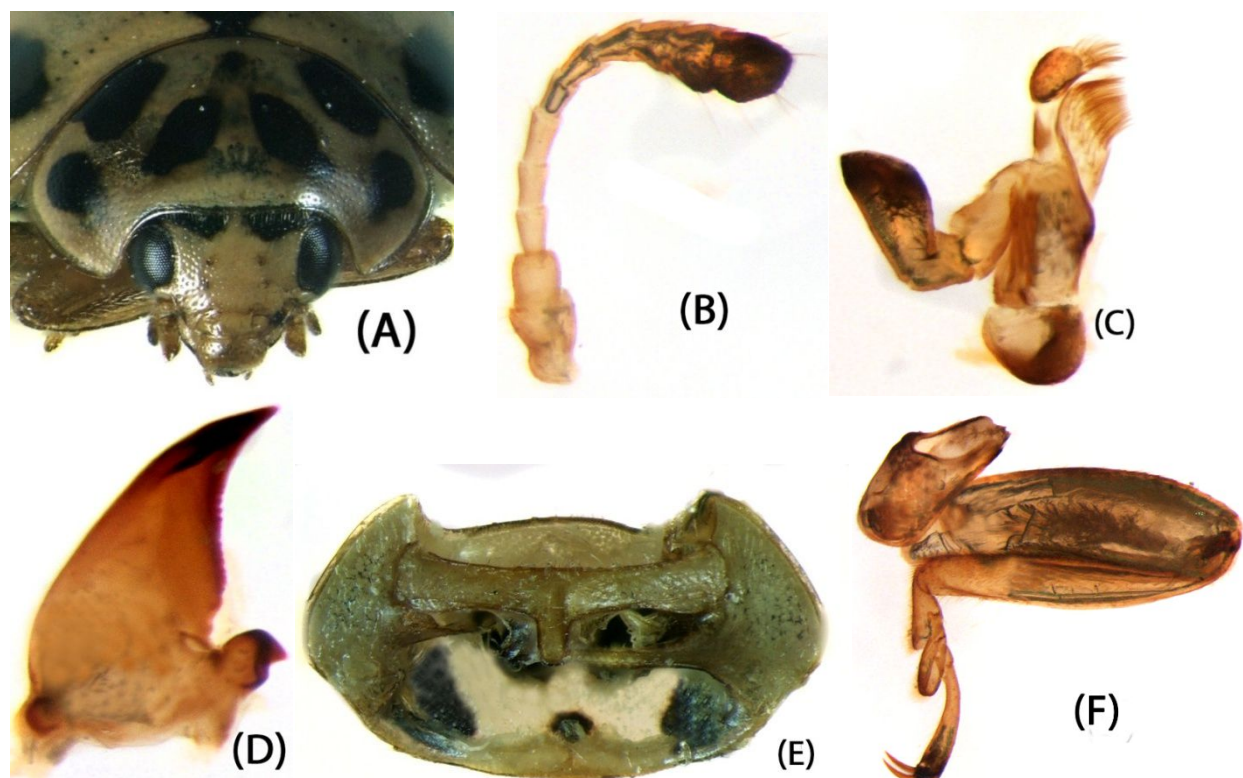


Figure 1. *Bulaea lichatschovii*: frontal view of head and pronotum (A), antenna (B), maxilla (C), mandible (D), prosternum (F), proleg (E).

Table I: Previous and New Distributional records of *B. lichatschovii* (Hummel) from Pakistan along with their latitude, longitude and elevation.

Studies	Localities	Provinces	Latitude	Longitude	Elevation
Previous study (Ali et al., 2014)	Karachi	Sindh	24°51.15'N	067°00.01'E	13m
	Larkana	Sindh	27°33.27'N	068°13.77'E	55m
	Hyderabad	Sindh	25°22.91'N	068°22.16'E	26m
	Sukkhhar	Sindh	27°42.01'N	068°49.63'E	63m
	Mirpur Khas	Sindh	35°31.66'N	069°00.8'E	21m
Current study	Sharda	Azad Jammu and Kashmir	34°47.63'N	074°11.07'E	1979m
	Gilgit (Jutial Nala)	Gilgit-Baltistan	35°53.33'N	074°20.63'E	1815m
	Ghizer (Gahkuch Bala)	Gilgit-Baltistan	36°10.6'N	073°44.83'E	2129m
	Ghizer (Phandar valley)	Gilgit-Baltistan	36°10.1'N	072°56.96'E	2960m

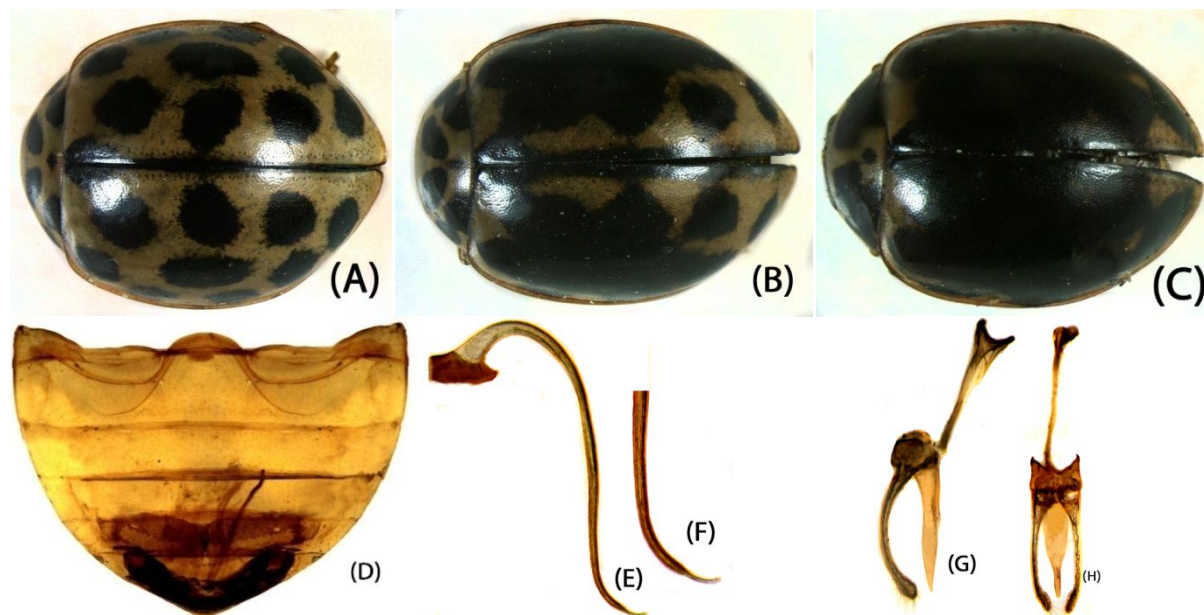


Figure 2. *Bulaea lichatschovii*: Morphs (A–C), Abdomen (D), Male genitalia (E–H); penis (E), penis apex (F), tegmen lateral view (G) and tegmen ventral view (H).

Diagnosis:

Bulaea lichatschovii is polymorphic and can be distinguished by the male genitalia, particularly the penis with narrow and long cylindrical apex and penis guide apically narrow and cylindrical

Description:

TL: 3.1–4.3 mm, TW: 2.6–3.5 mm, TH: 1.5–2.0 mm, HW: 0.91–1.08 mm, TL/TW: 1.19–1.23; PL/PW: 0.40–0.50; EL/EW: 1.25–1.08.

Body elongate-oval, strongly convex, dorsally glabrous. Head light yellow, posterior margin with black markings, antennae and mouth parts yellowish brown. Pronotum light yellow to yellowish brown, with three pairs of black spots and a single small black spot medially, a pair of large spots at posterior area, one pair at lateral margin, another pair of elongated spots at median region above anterior margins, diverging from each other and single small spot at middle, slightly above the diverging spots (Figs. 2A, 2B). Sometimes pronotum black, with lateral and middle region light yellow to yellowish brown (Fig. 2C). Scutellum black. Elytra light yellow to yellowish brown with nine black spots on each elytron and one black spot at elytral base on suture (Fig.2A); or, elytral spots fused with each other except the apical

two pairs of spots at suture (Fig. 2B); or, elytra fully black except basal and apical areas light yellow to yellowish brown along suture (Fig.2C).

Prothoracic hypomeron, prosternum, mesoventrite and metaventrite are light yellow. Elytral epipleuron yellow, both margins dark yellow. Legs yellowish brown to brown. Head transverse, frontal punctures coarse, larger than eye facets, 2-3 diameters apart. Eyes small, dorsally exposed, densely faceted, interocular distance about 0.61 times head width. Pronotum punctures similar to those on frons, separated by 1-2 diameters. Surface of elytra with coarse punctures, similar to those on pronotum, about 1-2 diameters apart. Prosternal carinae distinct. Prosternal process 4 times as long as its width at base. Abdominal postcoxal lines incomplete, obliquely curved towards lateral margins (Fig. 2D).

Male genitalia

Penis (Fig. 2E) s-shaped. Penis capsule stout, with outer arm similar in length as inner arm. Apex of penis (Fig. 2F) cylindrical and narrow, apically slightly curved. Tegmen with terminal strut stout, apically bifurcated. Penis guide gradually pointed toward apex in ventral view (Fig. 2G), in lateral view apex narrow and

cylindrical (Fig. 2H). Parameres as long as penis guide, apically round, with fine setae.

Host plants

This species was collected on *Krascheninnikovia ceratoides* (Caryophyllales: Amaranthaceae), *Artemisia vulgaris* and *A. maritima* (Asterales: Asteraceae).

World distribution

Afghanistan, Bulgaria, China, Central and West Asia, Greece, India, Mediterranean Region, Mongolia, North, Central Africa, Poland (Kapur and Bhaumik, 1966; Gordon, 1987; Poorani, 2002; Kovář, 2007) and Pakistan (Ali *et al.*, 2014).

Pakistan distribution

Ali *et al.* (2014) reported *B. lichatschovii* from Mirpur Khas, Larkana, Sukkur, Hyderabad, Karachi of province Sindh. In this study, it was collected from new localities i.e. Gilgit and Ghizer of Gilgit-Baltistan and Neelum (Sharda) of Azad Jammu and Kashmir

DISCUSSION

Members of genus *Bulaea* are mainly phytophagous and have specialized form of feeding behavior including pollinivory, because of having modified type of mandibles than standard aphidophagous and phytophagous coccinellid beetles (Samways *et al.*, 1997). Capra (1947) recorded *B. lichatschovii* as a pollinivorous species (both as larvae and adults), with food preference for Chenopodiaceae. Dyadechko (1954) and Bielawski (1959) reported pollinivory of this species from Kazakhstan on different plants like *Artemisia*, *Atriplex*, *Clematis*, *Euphorbia*, *Eurotia*, *Nitraria* and *Tamarix*. Savoiskaya (1966 and 1970) provided the food preference of *B. lichatschovii* from Central Asia: feeding on pollens of plants like *Euphorbia*, *Artemisia*, *Eurotiaceratoides*, *Atriplex*; on nectar of *Nitraria* and *Clematis*; on leaves of sugar-beet and young apple trees. Ozbek and Cetin (1991) documented the phytophagy of *B. lichatschovii* on sugar beet, lentil and alfalfa from Turkey. Giorgi *et al.* (2009) showed that genus *Bulaea* represented an independent shift into phytophagy. Kapur and Bhaumik (1966) reported *B. lichatschovii* from India.

From Pakistan, Ali *et al.* (2014) reported this species from desert areas and agricultural

fields of Sindh province (elevation of 13-63 m as shown in Table I), feeding on aphids on wheat crop and mustard pollen. In this study, three morphs of *Bulaea lichatschovii* were recorded from different localities of district Gilgit, Ghizer and Neelum (elevation of 1815-2960 m as shown in Table 1) of Northern part of Pakistan, which exhibited pollinivory on Amaranthaceae and Asteraceae. The activity of *B. lichatschovii* was observed on *Krascheninnikovia ceratoides* (Caryophyllales: Amaranthaceae) and *Artemisia maritima* (Asterales: Asteraceae) during June–September in district Ghizer (Gahkuch Bala and Phander), whereas in district Gilgit (Jutial Nala) at the mid of July to August on *A. maritima* (Asterales: Asteraceae). Few specimens were observed on *A. vulgaris* (Asterales: Asteraceae) during the month of August at district Neelum (Sharda), Azad Jammu and Kashmir.

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