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Taxonomic redescription of the species of Genus *Coccinella* (Coleoptera: coccinellidae) from Jammu and Kashmir, India

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Abstract

Ladybird beetles belong to family Coccinellidae of the order Coleoptera and are important group of beetles, they are voracious predators and occupies important place in biological control. In this paper three species of the genus *Coccinella* belong to the subfamily Coccinellinae have been collected and redescribed as no taxonomic work has been done on this group in Kashmir. This paper provides a detailed taxonomy of *Coccinella septempunctata*, *Coccinella undecimpunctata* and *Coccinella transversalis*. Detailed description of adults and male genitalia are provided for both species along with color plates. In addition to this a dichotomous key of all species of *Coccinella* has been provided.

Keywords: *Coccinella*, Kashmir, male genitalia, predators, taxonomy

Introduction

Coccinellids are commonly known as ladybird beetles. They belong to the order Coleoptera, suborder Polyphaga, super-family Cucujoidea and the family Coccinellidae. The family is a member of the phylogenetic branch referred to as the Cerylonid complex or series of families, which is composed of Alexiidae, Cerylonidae, Coccinellidae, Corylophidae, Discolomatidae, Endomychidae (*s. lat.* Including Mychotheninae, Eidoreinae and Merophysinae) and Latridiidae (Crowson 1955, Lawrence & Newton 1995) [3, 11]. Bothrididae were added later (Pal & Lawrence 1986) [17]. The family Coccinellidae comprises 6,000 described species in some 360 genera and 42 tribes worldwide and is divided into six subfamilies: Sticholotidinae, Chilocorinae, Scymninae, Coccidulinae, Coccinellinae and Epilachninae although a recent phylogeny suggests a seventh subfamily, Ortaliinae (Fursch 1990; Kovar 1996; Slipinski 2007) [6, 9, 22]. The coccinellids are beneficial tools in the biological control of phytophagous pests, such as aphids, mealy bugs, scale insects, jassids, psyllids, whiteflies and eggs of Lepidoptera insects as well as thrips (Thysanoptera) and mites (Acarina) in all parts of the world (Moreton, 1969 and Dixon 1999) [14, 4]. Dobzansky (1926) [5] laid the foundation of the modern classification of the genus *Coccinella* based on the structure of male and female genitalia. Poorani (2005) [20] established a complete checklist of coccinellidae of India, and Kumar (2006) [10] worked on the taxonomy of the subfamily coccinellinae from India. Diversity of predaceous coccinellids from temperate agro-ecosystems Jammu and Kashmir has been studied by many workers such as Verma and Joshi (1988) [23], Bhagat *et al.* (1988) [2], Pawar and Parray (1989) [18], Azim and Bhat (2005) [1] and Shah and Khan (2014) [21]. Shah and Khan (2014) [21] studied 17 species of predaceous coccinellids from agroecosystems of Kashmir, which belongs to 15 genera and three subfamilies viz. Coccinellinae, Chilocorinae and Platynaspinae. The above cited literature reveals that a very little taxonomic works have been done on this aspect in India as well as in Jammu and Kashmir. In the present study a comparative redescription has been made for three species of the genus *Coccinella* based on male genitalia and some morphological characters.

Materials and Methods

Collection of ladybird beetles was carried out from the selected localities during 2016 and 2017 in the active season of Ladybird beetles. Each locality was visited fortnightly. The method of Majerus and Kearns (1989) [13] with some modification was followed for dissection and genitalia extraction. With the help of two entomological needles, abdomen was detached from the body and boiled in 10% potassium hydroxide (KOH) solution for half an hour to dissolve extra body tissues and some partially clear dense body formations, the abdomen was then washed in hot water and transferred to pure glacial acetic acid for five minutes. To dehydrate it, abdomen was washed in 80% Ethanol and then in absolute alcohol for 5 minutes, respectively. The processed abdomen was put in a cavity glass slide containing one or two

drops of glycerin. After that abdomen was opened with the help of two entomological needles under binocular fluorescent microscope and the genitalia was extracted. The extracted genitalia was mounted on a Canada balsam after a brief dip in xylene. The permanent slides were kept for identification.

Photography

In order to examine the adult specimens and fine details of genitalia, Binocular Fluorescent Microscope BX 43 and Stereo Zoom microscope SZX7 were used. Adult specimens and their genitalia was photographed with attached digital camera having image capturing and measuring software.

Identification

Identification was conducted on the basis of morphological characteristics and male genitalia. The collected specimens were identified up to species level with the help of available taxonomic keys, by comparison with already identified species in reference collections and with the help of experts working on this group in India or abroad.

Results and Discussion

Coccinella septempunctata (Linnaeus, 1758) ^[12]

Coccinella 7-punctata Linnaeus, 1758: 365. ^[12]

Coccinella confuse Mulsant, 1850:112 ^[16]

Coccinella bruckii Mulsant, 1866: 90.

Coccinella septempunctata: Korschefsky, 1932: 486.

Coccinella septempunctata: Gordon RD. 1987:13. ^[7]

Diagnostic characters

Body broadly oval moderately to strongly convex, nearly hemispherical. Body seven spotted, three on each elytra cover and one behind the middle of thorax. The size of the spots can vary considerably. Pronotum black with white spots of variable size. Head black in colour with two yellow pale spots near frons. Eyes small with minute facets. Elytra without hairs and finely pitted. Lateral elytral margins narrow, epipleuron nearly flat. Postcoxal lines incomplete. Antennae eleven segmented with basal segment longer (figure 1a).

Male genitalia

Phalobase: Trabes short and more or less uniform in thickness. Parameres thick, cylindrical, broader at tips bulb shaped, covered with densely hairs. Median lobe short, very broad at base tapering gradually beyond middle to apex, form triangle like structure (figure 1b).

Siphon: siphonal capsule is asymmetrical somewhat Y shaped thick, outer arm is thick and straight and inner arm is thin. Siphonal tube is long, bent at base, almost straight for most of its length; the distal end carries more or less sac like structure (figure 1b)

Remarks

This species is cosmopolitan in distribution. It is the most common coccinellid species found in all habitats and agro ecosystems of Jammu and Kashmir.

Past Record: Shah and Khan (2014) ^[21] reported this species from Jammu and Kashmir.

Host: It is a general predator feeds on almost every kind of aphid species.

Seasonal Occurrence

It can be seen throughout the year, but it is most active in May-July in Kashmir and July in Ladakh.

Local distribution: Kashmir and Ladakh

World distribution: All over India, Sri Lanka, Pala arctic region, North America, (Poorani, 2004) ^[19].

Coccinella undecimpunctata (Linnaeus, 1758) ^[12]

Coccinella undecimpunctata Linnaeus, 1758: 366. ^[12]

Coccinella (Dobzhanskia) undecimpunctata: Iablokoff-Khnzorian, 1982: 71. ^[8]

Diagnostic characters

Head black. Pronotum dark black with large oval pale spot in each anterior angle. Elytra yellow to red possessing five black spots on either side plus a common big scutellar spot is present (figure 2a).

Male genitalia

Phalobase: Trab long and thick, basal piece somewhat triangular. Parameres cylindrical in shape provided with apical hairs. Median lobe broad and thick at base, expanded medially, gradually becomes thin forming small lobe like structure at the distal end (figure 2a).

Siphon: Siphonal capsule is normal more or less thicker than siphonal tube, siphonal tube forms loop like structure upto maximum of its length, sub apical portion narrow at apex (figure 2b).

Remarks

Superficially it resembles with *C. septempunctata* but smaller in size. Both species can be separated by spotted pattern. In case of *Coccinella undecimpunctata* 11 black spots of nearly equal size are present.

Host plant: Found on mustard and oat plants. Feeds on aphid species.

Local distribution: Shalimar, Harwan, Chadoora, Kakapoora, Achabal, Wadura, Mansbal.

World distribution: India, Nepal, Pakistan, China, Mangolia, North Africa, North America, Europe, Australia, Russia, (Poorani 2004) ^[19].

Seasonal Occurrence

The specimens can be collected from May to June.

Coccinella transversalis (Fabricius, 1781)

Coccinella transversalis Fabricius, 1781: 97.

Coccinella transversalis Fabricius, 1943: 14

Coccinella transversalis Fabricius, 1962: 479.

Coccinella transversalis Fabricius, 1966: 178.

Diagnostic characters

Body slightly elongate, bulged and strongly convex dorsally. Head not visible from above. Pronotum broad, black and finely punctate. Elytra dull orange and yellowish brown, with black variably arranged spots. Epipleuron well developed. One common black spot present near Scutellum; the second black transverse band is present near posterior side

across the elytra and the third common large spot is covering the posterior of elytra (figure 3a).

Male genitalia

Phalobase: trab long, flat and thick. Basal piece quadrate. Median lobe broad apically narrows. Parameres slender, longer than median lobe, apex provided with long hairs.

Siphon: capsule is broad, asymmetrical, outer arm thick and long, inner arm short and hook like. Siphonal tube semicircular at base, then straight upto sub apical portion, uniform in thickness except thin sub apical portion. Tip pointed form a hook like structure (figure 3b).

Remarks

This species was originally described from south India; however, the species extends to other parts of Palaearctic region, upto Japan in north and to Australia in south.

Host

Cabbage, Cauliflower, Apple feeds on aphid species.

Past record

Azim and Bhat (2005) [1] and Shah and Khan (2014) [21] reported this species from Indian Kashmir.

Present record

During present course of work specimens of this species were collected from Narkara, Bugam (District Budgam).

Seasonal occurrence

This species was collected in the month of May and June.

Distribution

Australia, Bangladesh, China, India, Indochina, Indonesia, Japan, Nepal, New Zealand, Sri Lanka and Pakistan.

Key to the species of genus *Coccinella* of Kashmir

1. Elytra with seven black round spots, including one common sutural black spot, male genitalia with parameres cylindrical, tips broad, bulb shaped covered with dense hairs, median lobe broad at base apex pointed forming triangle like structure, siphonal capsule is “Y” shaped thick, the distal end carries more or less sac like structure.....*Coccinella septumpunctata* Linnaeus.
....Elytra with eleven black round spots.....2
2. Siphonal capsule is normal more or less straight, basal piece somewhat triangular, parameres cylindrical throughout its length provided with apical hairs, tips not bulb shaped.....*Coccinella undecimpunctata* Linnaeus.
3.Siphonal capsule asymmetrical, inner arm short and forms a hook like structure. Basal piece quadrate. Parameres longer than median lobe. Elytra with black variably arranged spots. One common black spot is present near Scutellum; the second black transverse band is present near posterior side across the elytra and the third common large spot is covering the posterior of elytra.....*Coccinella transversalis* Fabricius.

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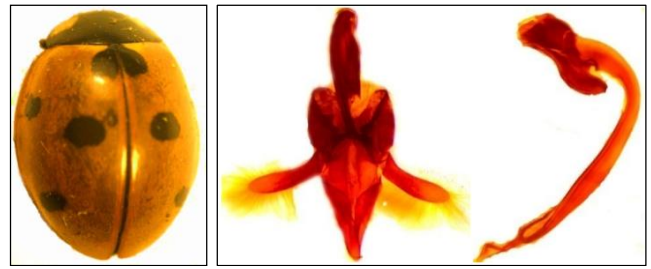


Fig 1: *Coccinella septumpunctata* a: Adult; b: male genitalia

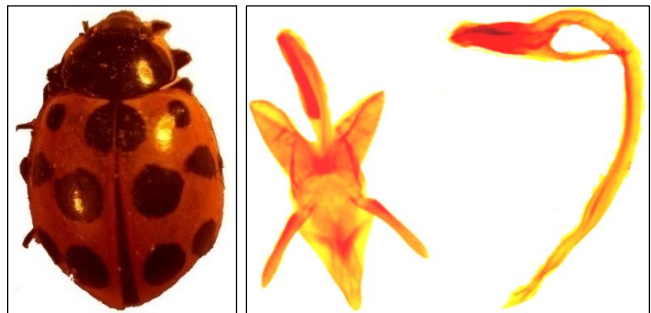


Fig 2: *Coccinella undecimpunctata* a: Adult; b: male genitalia



Fig 3: *Coccinella transversalis* a: Adult; b: male genitalia

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