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# Morphological Characteristics of Ladybird Beetles (Coccinellidae: Coleoptera) of District Buner, Khyber Pakhtunkhwa, Pakistan

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**ABSTRACT**

Ladybird beetle is important group of beetles because they are important universal predatory and occupies important place in biological control. However, the ladybird beetle fauna of Pakistan is not extensively explored area wise. In this connection, the present study was conducted to explore the Ladybird beetle fauna of district Buner, Khyber Pakhtunkhwa, Pakistan. The study area was divided into twelve different localities namely village (Pirbaba, Kingergali, Daggar, Gokand, Barkalay, Budal, Shaheede sar, Nawagai, Nagrai, Chinglai, Totalai and Malka). Collection surveys were conducted in these areas at fifteen days interval in the active season during 2013-14. The identification of the collected specimens during the study revealed that there are thirteen species of Ladybird beetle under eleven genera and three subfamilies (Subfamily Chilocorinae, Subfamily Coccinellini and Subfamily Epilachnini) were collected. These species are *Brumoidus suturalis, Coccinella septempunctata, Coccinella transversalis, Menochilus sexmaculatus, Propylea dissecta, Coelophora bissellata, Oenopia sauzeti, Aiolocaria hexaspilota, Psyllobora bisoctonotata, Harmonia dimidiata, Henosepilachna vigintioctopunctata, Henosepilachna septima* and *Afidentula manderstjernae.* The numerical data of these species reveals that *C. septempunctata, H. dimidiata, C. sexmaculatus* and *H. vigintioctopunctata* are highly abundant and were collected from all localities, while the rest of the species are moderately abundant except *A. hexaspilota* which is only collected from single locality pirbaba.

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**NA collected and FN identified the samples. KS conducted the study. KS, FK and NA wrote the manuscript. MNKK and FN supervised the study.**

**Key words**
**Ladybird beetles, Coccinellidae**

## INTRODUCTION

Ladybird beetles which also called Ladybugs belong to the family Coccinellidae of order Coleoptera. They are more or less distributed worldwide and can be found from seacoast to alpine pastures, however many tribes are restricted to particular biogeographically regions (Majerous and Kern, 1989). About 6000 species under 490 genera of Coccinellidae are known worldwide (Slipinski, 2007). Family Coccinellidae is further classified into six subfamilies namely; Chilocorinae, Coccinellinae, Coccidulinae, Scymninae, Sticholotidinae and Epilachininae.

Ladybird beetles are mostly considered beneficial because of their predatory activity and help in regulating pest population of soft bodied insects like aphids, jassids, etc (Khuznetsov, 1997). However, members of its subfamily Epilachninae are phytophagous and are pests of important agricultural crops belonging to the family Fabaceae and compositae (Dieke, 1947; Li and Cook, 1961). A ladybird may eat aphids equal to its body weight every day. One larva can consumes up to 50 aphids a day. *Hippodamia variegate* (Goeze) is a general predator specially feeding on soft- bodied nymphs of aphids, mealy bugs and also scale insects, whiteflies and mites. An adult can consume 3,23,29 eggs, larvae and adults of red spiders mites , respectively (Anwarullah *et al*., 1966). A single adult consumes around 5,000 aphids in its lifespan whereas an adult female consumes about 300 aphids before laying eggs (Dixon, 2000).

According to Majerus and Kearns (1989) adults over winter in sheltered locations such as tree holes and other natural hiding places. Many monovolantine coccinellids species migrate in response to unfavorable environmental conditions. Species of Coccinellidae hibernate separately in small groups under fallen leaves in the forest clearings and in other habitat. The most suitable places for hibernation are well warmed forest clearings. In the beginning of September the coccinellids beetles fight for the sites of hibernation. The most important features of the coccinellid beetles biology are their seasonal migration and mass aggregation. These aggregations at particular places for the purpose of hibernation have been noted all over the world (Iablokoff-Khnzorian, 1979).

In Pakistan, the work on coccinellids is also started from the beginning as a consequence of biological control

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work from 1957 onwards (Ahmad and Ghani, 1966a). However, some taxonomic work was also carried out side by side during this period. The taxonomic work includes a new species *Pseudoscymnus murriensis* described by Ahmad (1968); a new tribe by Ahmad (1973) and a new genus by Ahmad and Ghani (1966a). As far as phytophagous ladybird beetles are inadequately treated. Ashrafi (1966) first time reported two Epilacnine species *i.e. E. sparsa* and *E. chrysomelina*. Furthermore, seven species of Epilachninae were reported from Pakistan by CIBC (1982). Shah (1983) confirmed sixteen species of family Coccinellidae along with their geographical distribution and host plants from Peshawar valley. Gilani (1976) studied the coccinellid fauna of Faisalabad. Other work on coccinellid from Pakistan include Khan *et al.* (1999a,b) from Bagh (AJK), Inayatullh *et al.* (2005) from Poonch (AJK).

The fauna of District Buner is almost unexplored in this regard despite the diverse and unique habitat. Only three phytophagous species are reported so far by Naz (2012). Buner is the district of Malakand division (Khyber Pakhtunkhwa) which is mostly hilly area. It is surrounded by Swat in North, Malakand agency in west, Shangla in east and Swabi and Mardan in south. The study area is mostly mountainous and there are some plain tracts in between. Agriculture in this area is mainly focused on tobacco, wheat, maize and to some extent citrus, persimmon and Peach orchards. The biodiversity of the area is facing threat from urbanization, marble industry and tobacco cultivation. Before diminishing of the important taxa from the area it is aught most important to explore and document the fauna and flora of the area and make a comprehensive plan for its conservation.

Keeping in view in importance of these useful predators and its blank chapter in Buner district, the present studies were conducted to enlist the species of Coccinellidae in Buner district with an object to explore the ladybird beetle fauna of District Buner, and to record the distribution and seasonal occurrence of the Ladybird beetle in Buner District.

## MATERIALS AND METHODS

*Sample collection*

Extensive year round surveys was conducted at different intervals in the active season of ladybird beetles, especially of solanacious and cucurbitaceous vegetable fields, general vegetation was also searched for occurrence of ladybird beetles.

The ladybird beetles of Buner District, were collected from the following localities of the area during 2013-2014: Pirbaba (72°27'13.81E, 34°36'8.55"N), Kingergali (72°14'44"E, 34°30'38"N ), Daggar (72°29'3"E, 34°30'38"N ), Gokand (72°30'56"E, 34°34'55"N ), Barkalay, (72°29'15"E, 34°28'3"N ), Budal (72°38'59"E, 34°29'27"N), Shaheede sar (72°39'26"E, 34°37'46"N ), Nawagai (72°33'29"E, 34°24'24"N ), Nagrai (72°40'58"E, 34°22'49"N ), Chinglai (72°30'41"E, 34°19'9"N ), Totalai ( 72°29'49"E, 34°11'36"N ) and Malka ( 72°40'16"E, 34°19'6"N ).

Each locality was visited fortnightly. The coccinellid specimens were collected by aerial netting and hand picking, and killed in a killing bottle containing ethyl acetate, with 1 cm thick filter paper at the bottom. The killing agent was pasted on a piece of cotton. After killing the specimens were pinned with stainless steel entomological pin (Size: 1, Manufactured by Bioequipp, USA). After proper drying ladybird beetles were placed in a collection box. Field data of each specimen was recorded. In the absence of adult, larvae and pupae were collected and were brought to laboratory for rearing to adult emergence.

The dead small sized beetles were mounted on a small rectangular piece of white card, a small drop of hydrosoluble glue was pasted on the card and the beetle was set on this with the legs and antennae spread out, the card was then supported on a stainless steel entomological pin. Very small specimens were mounted on points. Each specimen was labeled noting the place of collection, date of collection, collector's name and host plant species. Comparatively large specimens ware pinned on right elytra just behind pronotum. The specimens were then kept in wooden insect boxes. Proper curation of these stored insects was conducted regularly.

Beside fresh collection, insect depositories of National Insect Museum, National Agricultural Research Center, Islamabad, Pakistan Museum of Natural History, Islamabad, Museum of Abdul Wali Khan University Mardan (Buner Campus), Entomological Museum of Nuclear Institute of Food and Agriculture, Khyber Pakhtunkhwa Agriculture University, Peshawar and Pakistan Forest Institute, Peshawar were also visited for ladybird beetles study.

*Identification*

The specimens were identified with the help of Kapur (1958) and Rafi *et al.* (2005).

## RESULTS

There are thirteen species of ladybird beetle under eleven genera and three subfamilies (Subfamily Chilocorinae, Subfamily Coccinallinae and Subfamily Epichlicninae). Table I shows the number of samples collected from District Buner. Table II shows morphometric measurements of different species of ladybird beetle.

**Table I.- Number of samples collected from the study area 1, Pirbaba; 2, Kingergali; 3, Daggar; 4, Gokand; 5, Barkaly; 6, Budal; 7, Shaheedsar; 8, Nawagai; 9, Nagrai; 10, Chinglai; 11, Totali; 12, Malka.**

| Subfamily | Genus | Species | Locations of District Buner | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| 1.Chilocorinae | 1.Brumoidus | 1.*B.suturalis* | 10 | 13 | 15 | 20 | 15 | 20 | 60 | 45 | 40 | 45 | 50 | 60 |
| 2.Coccinellinae | 2.Coccinella | 2.*C. septempunctata* | 60 | 45 | 55 | 62 | 40 | 30 | 65 | 55 | 48 | 50 | 40 | 65 |
| | | 3.*C. transversalis* | 50 | 37 | 45 | 40 | 30 | 35 | 45 | 34 | 44 | 30 | 35 | 45 |
| | 3.Menochilus | 4.*M. sexmaculatus* | 15 | 10 | 12 | 10 | 6 | 18 | 22 | 15 | 20 | 15 | 10 | 28 |
| | 4.Propylea | 5.*P. dissecta* | 14 | 8 | 5 | 10 | 8 | 10 | 12 | 5 | 10 | 8 | 5 | 15 |
| | 5.Choelophora | 6.*C. bissellata* | 8 | 10 | 8 | 5 | 5 | 15 | 5 | 5 | 10 | 8 | 5 | 10 |
| | 6.Oenopia | 7.*O.sauzeti* | 16 | 8 | 15 | 18 | 13 | 18 | 10 | 8 | 16 | 6 | 8 | 12 |
| | 7.Aiolocaria | 8.*A. hexaspilota* | 05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 8.Psyllobora | 9.*P. bisoctonotata* | 7 | 10 | 5 | 12 | 7 | 10 | 10 | 6 | 8 | 10 | 6 | 10 |
| | 9. Harmonia | 10. *H. dimidiate* | 18 | 12 | 17 | 20 | 10 | 15 | 15 | 12 | 6 | 3 | 6 | 8 |
| 3.Epilachninae | 10.Henosepilachna | 11. *H.vigintioctopunctata* | 12 | 15 | 10 | 18 | 8 | 10 | 10 | 14 | 8 | 8 | 5 | 12 |
| | | 12. *H. septima* | 9 | 5 | 12 | 15 | 10 | 12 | 8 | 5 | 10 | 5 | 3 | 8 |
| | 11. Afidentula | 13. *A. manderstjernae* | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 1 |
| | | **Sub Total** | **226** | **174** | **200** | **232** | **153** | **195** | **264** | **205** | **223** | **190** | **175** | **274** |
| | | **Total** | | | | | | | **2511** | | | | | |
| | | **Percentage** | **9.0%** | **6.9%** | **7.9%** | **9.2%** | **6.0%** | **7.7%** | **10.5%** | **8.1%** | **88%** | **75%** | **6.9%** | **10.9%** |

## DISCUSSION

During this exploration, thirteen species of Ladybird beetle under eleven genera and three subfamilies (Subfamily Chilocorinae, Subfamily Coccinalae and Subfamily Epichlicninae) were confirmed.

Subfamily Chilocorinae is represented by only Genus Brumoides in district Buner. The members of this subfamily are predators of scale insect but some species feed on aphids, mealybugs and psyledlids (Kuznetsov, 1997). In Buner region this genus is represented by only one species *Brumoidus suturalis.*

It is important predator and feeds on different hosts like mites, psyllids, coccids and aphids and protects the cereal crops from the damage of these pests. Kapur (1942) found *Brumoides suturalis* feeding upon three species of aphids, one species of mite and six species of coccids. Ullah *et al.* (2011) recorded this species from Dir Lower of Malakand division. Subfamily Coccinellinae is comparatively group and hence also represent high number of species from Buner. The members of this subfamily are usually medium to large in size and some genera are cosmopolitan.

Genus *Ailocaria* is represented by *A. hexaspiolota.* This species is variable in colour pattern. The Type locality of the species is Nepal. The species appears to be widespread in the Himalayas (Kapur, 1958). Canepari (1997) also confirmed this species from Nepal Himalaya. Recently Rafi *et al.* (2005) reported this species from the Himalayan region of Pakistan including Kashmir whereas Shunxiang *et al.* (2009) reported this species from China.

Another genus is Genus Coccinella which is represented by three species namely *Coccinella septempunctata* Linnaeus, 1758, *C. transeversalis* and *C. undesepunctata*. The species *C. septempuctata* is cosmopolitan and adopted to almost all habitats of agricultural crops, range lands and forests. This wide spread lady beetle seems to be very common in the whole Azad Jammu and Kashmir like other parts of the country. The elytral spots are considerably variable in size and may be much enlarged or sometimes connected with each other or confluent. This variation is classified into four morphs.

*C. transversalis* is originally described from South India, however the species extends to other parts of Palaearctic region, upto Japan in north and to Australia in south. Khan *et al*. (1999a) record this species from Pattan Sher Khan (Sudhnuti), while Inayatullah *et al.* (2005) reported from Rawalakot, Hajera (Poonch). Khan *et al.* (2008) reported from Azad Jammu & Kashmir.

*Coccinella undecimpunctata* Linnaeus, 1758 superficially similar to *C. septempunctata* but smaller in size. Therefore, sometime it is confused with

**Table II.- Morphometric measurement and ground colorations of different species of ladybird beetle.**

| Name of species | Measurement | | Hairs on body | Body shape | Coloration | | | |
|---|---|---|---|---|---|---|---|---|
| | Length(mm) | Width(mm) | | | Head | Pronotum | Scutellum | Elytra |
| *B. suturalis* | 3-5 | 3.5 | Glabrous | Rounded | Brownish | Brownish, anterior laterally and in center creamy | Brownish | Yellowish white |
| *C. septempunctata* | 5-8 | 4-5.5 | Glabrous | Slightly elongate | Black | Black. Anterio laterally orange yellow | Black | Yellowish brown to reddish brown |
| *C. transversalis* | 6-6.5 | 4.5-5 | Glabrous | Slightly elongate | Black | Black. Anterio laterally orange | Black | Dull orange to yellowish brown |
| *M. sexmaculatus* | 3.6-5.5 | 2.8-4.5 | Glabrous | Rounded | Yellowish brown | Yellowish brown with transverse black band in the middle near the posterior margin | Black | Generally brownish yellow |
| *P. dissecta* | 4-5 | 3-4 | Glabrous | Slightly elongate | Yellowish black | Black. Anterio laterally brownish | Black | Yellowish to orange |
| *C. bissellata* | 4.56-4.98 | 3.95-4.25 | Glabrous | Rounded | Creamy Yellow | Creamy yellow | Black | Dull orange |
| *O. sauzeti* | 3-5 | 2.5-3.5 | Glabrous | Rounded | Black | Black, anterio laterally yellowish white | Black | Yellowish white |
| *A. hexaspilota* | 8.5-12 | 4.5-7 | Glabrous | Large rounded | Black or dark brown | Black | Black | Reddish and Black |
| *P. bisoctonotata* | 2.74 | 1.67 | Glabrous | Small elongated | Brownish yellow | Uniform color | Yellowish | Yellow |
| *H. dimidiate* | 4-5 | 3-5 | Glabrous | Slightly elongate | Black | Straw yellow. Black | Brownish | Brownish |
| *H. vigintioctopunctata* | 6-7 | 7-10 | Glabrous | Rounded | Yellowish red | Reddish brown | Brownish | Pale brown or reddish brown |
| *H. septima* | 4-7.5 | 3-6 | Glabrous | Slightly rounded | Brownish | Brownish with black coloration in center | Black | Brownish |
| *A. manderstjernae* | 2.83-3.68 | 2-3 | Glabrous | Oval | Light brown | Brown | Brown | Light brown |

*C. septempunctata*. These two species can be separated by spotted pattern. In the case of *Coccinella undecimpuncta*, elytra red with 11 black spots of nearly equal size. Khan *et al*. (1999a), Inayatullah *et al*. (2005) and Rafi *et al*. (2005) reported this species from Pakistan.

*H. dimidiata* (Fabricius, 1781)is among the most abundant species of District Buner. It is very variable in color patten and size; two distinct polymorphic forms exist in the area. The species is widely distributed in the Himalayas, being known from Kashmir to Assam. Khan *et al*. (1999a), Inayatullah *et al*. (2005) and Rafi *et al.* (2005) recorded this species from Pakistan.

*Coelophora bissellata* Mulsant (1850**)** is also found in some areas of District Buner. It is medium sized rounded beetle with black spots. It is also reported by by Inayatullah *et al*. (2005) and Rafi *et al.* (2005) from Pakistan.

Genus *Cheilomenes* Dejean, 1836 with *Coccinella lunata* F. is distributed world wide, but they are in large number found in Indo-Malayan subregion; the species of this genus has been reported to feed upon aphids. During this study one species of this genus *Cheilomenes sexmaculata* which is commonly known as *Menochilus sexmaculatus* was collected from Buner. Geographically this is oriental species and mostly found in plain areas, however sometime can be found in foot hills. The size and colour pattern of the species are variable. This is the commonest, highly misidentified coccinellid due to the occurrence of numerous colour variants. The following variations are frequently seen: (a) Elytra yellowish /pink/orange without any markings except for a black sutural stipe, (b) elytra and pronotum partially black leaving only the margins,(c) more or less completely black, and (d) the elytral markings coalesce and form broader bands. The pronotal marking is always constant and can be faintly seen even in completely black forms. All these intermediate forms are found in the field. This species has been reported to feed upon aphids.

Poorani (2004), Slipinski (2007) has used the name *Menochilus sexmaculatus* for this species. Sharma and Joshi (2010) named this species as *Cheilomene sexmaculata*. It is widely distributed throughout the country and reported almost by all previous workers.

*Oenopia sauzeti* Mulsant is medium sized yellowish beetle. During present study it was collected from 5 localities of Buner. It has resemblance with *O. mimica.* Its distinguishing character from *O. mimica* was already given. Rafi *et al.* (2005) recorded it from Northen Pakistan and Azad Jammu Kashmir. According to the Zoological survey of India this species was reported from Murree and Dalhousie Hills (Punjab), Kumaun Hills (U. P) Sikkim and Darjeeling District (N. Bengal) (Kapur 1958). Miyatake (1985) named this species *Gyrocaria sauzeti.* Khan *et al*. (1999a), Inayatullah *et al*. (2005) and Rafi *et al*. (2005) reported it from Pakistan.

Genus *Henosepilachna* contain two species *H. vigintioctopunctata* and *H. septima* in district Buner. *H. vigintioctopunctata* is most commonest but highly variable beetle, which is known as a serious pest on potato, It is variable both in the pronotal and elytral spots but can easily be distinguished by its characteristic male and female genitalia. Naz (2012) reported it as widely distributed species of Pakistan including Buber and with wide range of host plants. During present course of work this species is collected from Daggar, Nawagai, Chinglai, Barkalay and Budal. Another species *H. septima* was collected from Daggar, Barkaly and Pirbaba, Budal and Shaheed e Sar. Naz *et al*. (2103) also reported it from Buner.

Genus *Afidentula* is represented by a single species *A. manderstgerne*, which is a small size Epilachna beetle, reported from hilly areas of Northern Pakistan. Naz (2012) also reported this species from Buner. The type locality of the species is Asia and was also reported from India (Dieke, 1947) and Nepal. Kapur (1958) erected new genus for this species *Afidentula* and designated this species as its type species.

## CONCLUSION

It is concluded from the current study that the Coccinalid fauna of district Buner is diverse with thirteen specie and eleven genera and the plain area of Buner district is less diverse in Coccinalid composition than hilly areas because of suitable habitat, multiple floral diversity and more greenery in hilly areas.

*Conflict of interest declaration*

Authors have declared that there is no conflict of interest.

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