



Biodiversity of predaceous ladybird beetles (Coleoptera: Coccinellidae) in Kashmir

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ABSTRACT: An extensive survey for predaceous ladybird beetles was conducted in Srinagar district of Kashmir, India, over a period of 6 months (April - September) during 2006-2007. A total of 5525 specimens of coccinellids was collected from 12 ecosystems, viz., apple, pear, plum, cherry, kale, cabbage, cauliflower, mustard, blue pine, willow, rose and *Euonymus* during 2006 and 2007. Out of 15 identified species of ladybird beetles, 11 belonged to the subfamily Coccinellinae [*Callicaria superba* (Mulsant), *Harmonia dimidiata* (Fabricius), *Harmonia eucharis* (Mulsant), *Aiolocaria hexaspilota* (Hope), *Coccinella septempunctata* Linnaeus, *Calvia punctata* (Mulsant), *Adalia tetraspilota* (Hope), *Hippodamia variegata* (Goeze), *Oenopia conglobata* (Linnaeus), *Propylea luteopustulata* (Mulsant), and *Menochilus sexmaculatus* (Fabricius)] and four belonged to the subfamily Chilocorinae [*Platynaspis saundersi* Crotch, *Chilocorus infernalis* Mulsant, *Chilocorus rubidus* Hope and *Priscibrumus uropygialis* (Mulsant)].

KEY WORDS: Biodiversity, Coccinellidae, forest ecosystem, horticultural ecosystem, predaceous ladybird beetles.

The successful introduction of the vedalia ladybird *Rodolia cardinalis* Mulsant, from Australia into California in 1888 to control the cottony cushion scale, *Icerya purchasi*, which threatened the citrus industry, is widely regarded as the most successful instance of biological pest control (Majerus, 1994). Worldwide, there have been 155 attempts to control aphids by introducing predaceous ladybird beetles (Joshi *et al.*, 2003). The outcome of these attempts indicates the effectiveness of predaceous ladybird beetles. In recent years, predaceous ladybird beetles have drawn considerable attention as biological control agents, due to their ability to feed on a large number of prey (Oliveira *et al.*, 2004; Khan and Zaki, 2007) including aphids, coccids, phytophagous mites, adelgids and aleyrodids (Moreira, 2004). Therefore, before exploitation of these agents for biocontrol, there is a need to generate information on their biodiversity in new areas (Omkar and Parvez, 2003; Alia, 2002). Hence, this work was aimed to investigate the biodiversity of predaceous ladybird beetles in Kashmir.

Predatory ladybird beetles were collected from 12 crop ecosystems of Srinagar, Kashmir, during 2006 and 2007 over a period of 6 months (April to September). Predaceous coccinellids were collected on apple, pear, plum, cherry (fruit ecosystem), kale, cabbage, cauliflower, mustard (cruciferous crop ecosystem), blue pine, willow (forest

ecosystem), *Euonymus* and rose (ornamental / flower ecosystem). Collection was done by placing empty vials (5cm height and 3 cm diameter) beneath the leaf blades or inflorescences and coccinellids were then tapped loose with the cap. Smaller species were picked up with a moist finger, or a camel hair brush. All collected ladybird beetles were transported back to the laboratory for storing, counting and identification.

In this study, 5525 collected individuals under 15 species belonging to 13 genera and two subfamilies, viz., Coccinellinae and Chilocorinae, were identified. Most species belonged to the subfamily Coccinellinae followed by Chilocorinae. The details of the coccinellid species collected during 2006-2007 on various crops are given in Table 1. The information on the species collected is summarized below.

A. Subfamily Coccinellinae

Tribe Coccinellini

1. *Callicaria superba* (Mulsant)

This species is reported from willow plants of Himalayan region. In Kashmir, the authors recorded it for the first time on willow aphids. Not much is known about its feeding habit and biology.

2. *Harmonia dimidiata* (Fabricius)

Harmonia dimidiata was found in abundance in apple and blue pine plants in Kashmir. This species has been reported from north and north-eastern regions of India (Shantibala and Singh, 1991, 1994). May-June is the peak period of its occurrence in the temperate region and August-September in tropical and subtropical regions. It was found feeding on *Aphis pomi* and *Tetranychus urticae* in Kashmir.

3. *Harmonia eucharis* (Mulsant)

Harmonia eucharis was collected from fruit trees, *Euonymus* hedges and forest trees of Kashmir. Just before the start of autumn, it is found on blue pine trees in abundance and migrates to fruit trees in May. This beetle was reported feeding in large numbers on different species of aphids in western, north-west Himalayas and north-eastern regions of India in October and November (Singh and Singh, 1986).

4. *Aiolocaria hexaspilota* (Hope)

It was found in apple orchards and an agro-forest plant willow in Kashmir. It has been also reported from Chitral Town and Drasan sites of Pakistan (Khan *et al.*, 2007). This species was collected while feeding on scale insects. Irshad (2001) recorded this species feeding on *Quadraspidiotus perniciosus* Comstock from Northern Pakistan and it was also recorded from Nepal by Canepari (1997).

5. *Coccinella septempunctata* Linnaeus

Coccinella septempunctata was found on all fruit trees and cruciferous crops in Kashmir. It is one of the most common and widely studied ladybird beetles, reported from India as well as different parts of the world (Hagen, 1962; Kapur, 1973; Singh and Singh, 1991; Shantibala and Singh, 1991; Omkar and Bind, 1993; Alia, 2002). In Kashmir, it feeds upon *Aphis pomi*, *Lipaphis erysimi*, *Myzus persicae*, *Brevicoryne brassicae* and other aphids. It can be seen throughout the year, but it is more abundant and active in May-July in Kashmir. Both the larvae and adults are voracious feeders of aphids and are effective in reducing their heavy infestations. This coccinellid was found to be predacious on almost every species of aphid.

6. *Calvia punctata* (Mulsant)

Calvia punctata was recorded from apple, wild apple, pear, plum, mustard, willow, *Euonymus* and rose plants. It has been collected from Drosh, Drasan, Kosht and Bang in Pakistan.

This species was found feeding on scale insects on walnut trees and wild vegetation (Khan *et al.*, 2007).

7. *Adalia tetraspilota* (Hope)

It is most abundant in Kashmir and was recorded on all crops / plants surveyed except blue pine. In Kashmir, it was found to feed on *A. pomi*, *M. persicae*, *L. erysimi*, *B. brassicae*, *A. fabae*, *A. craccivora*, etc. In Kashmir region, the peak period was May-June. In Pakistan, it has been found in Chitral Town and Drasan (Khan *et al.*, 2007). This species has also been reported from Murree (Pakistan) feeding on *Adelges* spp.; *Q. perniciosus* and *D. abietiella* by Irshad (2001) and from Nepal by Canepari (1997).

8. *Hippodamia variegata* (Goeze)

Hippodamia variegata was found very abundant, next only to *Adalia tetraspilota* in Kashmir. It was found mainly from May-June in peak numbers in Kashmir and February-May in other parts of northern India. In Kashmir, it feeds on *A. pomi*, *M. persicae*, *A. fabae*, *B. brassicae*, *A. craccivora* and some mites.

9. *Oenopia conglobata* (Linnaeus)

Oenopia conglobata was recorded on apple, pear and *Euonymus* hedges in abundance, feeding on *A. pomi* and *A. fabae*. In Pakistan, this species was recorded from Drasan site attacking wheat aphid (Khan *et al.*, 2007). Kuznetsov (1997) also reported this species from Eastern Russia.

10. *Propylea luteopustulata* (Mulsant)

This species is reported for the first time from Kashmir. This was recorded only from fruit orchards, feeding on aphids and mites. The adults and grubs of these beetles were feeding on *A. craccivora*, *A. gossypii*, *L. erysimi* and *B. brassicae*.

11. *Cheilomenes sexmaculata* (Fabricius)

It is the most common, abundant and widely distributed species throughout the Orient, especially in India (Puttarudriah and ChannaBasavanna, 1953; Johnson, 1983; Omkar and Bind, 1993; Bhattacharya and Dutt, 1998), but in Kashmir its population was very low. It was recorded in fruit ecosystem and some cruciferous crops on inflorescence and found to be feeding on aphids, especially, *A. pomi* and *L. erysimi* and occasionally on *B. brassicae*.

B. Subfamily Chilocorinae

Tribe Chilocorini

12. *Chilocorus infernalis* Mulsant

Chilocorus infernalis is common in Kashmir and widely distributed in apple growing areas. It is an important predator of scale insects, especially *Q. perniciosus*. The peak period of activity is from 15th

Table 1. Biodiversity of lady bird beetles in different crop ecosystems of Kashmir during 2006-2007

S. N.	Lady bird beetle species	Biodiversity of ladybird beetles in																
		Fruit ecosystem				Cruciferous ecosystem				Other ecosystem (Forest / ornamental / Flower)								
		Apple	Pear	Plum	Wild Apple	Kale	Cabbage	Cauliflower	Mustard	Blue Pine	Willow	Euonymus	Rose					
A.	Subfamily Coccinellinae																	
	Tribe Coccinellini																	
1.	<i>Callicaria superba</i> (Mulsant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.	<i>Harmonia dimidiata</i> (Fabricius)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.	<i>Harmonia eucharis</i> (Mulsant)	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	-
4.	<i>Aiolocaria hexaspilota</i> (Hope)	+	-	-	+	-	-	+	+	+	+	+	+	+	+	+	+	-
5.	<i>Coccinella septempunctata</i> L.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-
6.	<i>Calvia punctata</i> (Mulsant)	+	+	+	+	-	-	-	+	+	+	+	+	+	+	+	+	+
7.	<i>Adalia tetraspilota</i> (Hope)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8.	<i>Hippodamia variegata</i> (Goeze)	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
9.	<i>Oenopia conglobata</i> (L.)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.	<i>Menochilus sexmaculata</i> (Fab.)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11.	<i>Propylea luteopustulata</i> (Mulsant)	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
B.	Subfamily Chilocerinae																	
	Tribe Chilocerini																	
12.	<i>Chilocorus infernalis</i> Mulsant	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
13.	<i>Chilocorus rubidus</i> (Hope)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.	<i>Priscibrum uropygialis</i> Mulsant	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tribe Platynaspidini																	
15.	<i>Platynaspis saundersi</i> Crotch	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. of species collected	13	13	7	7	3	3	5	5	3	3	5	5	2	8	7	2	2

May to 30th June. In winter, it hibernates in the rolled, dried leaves and crevices on trunks of fruit trees. In Kashmir, it was recorded on apple, wild apple, pear, kikar and *Euonymus* hedge. Its vertical distribution has been found to be uniform regardless of the diversity of adults (Ahmad *et al.*, 1999). It seems to concentrate in the lower canopy for egg laying and feeds on *Adelges* spp. (Adelgidae: Homoptera), *Chloropulvinaria polygonata*, *Cornimytilus afganensis*, *Lepidosaphes* sp., *Q. perniciosus* and *Tecaspis* sp. (Diaspididae) from Kashmir, Abbottabad, Pakistan (Irshad, 2001). In Kashmir it has been recorded to feed on mites.

13. *Chilocorus rubidus* Hope

Chilocorus rubidus was not very abundant and was recorded on *Q. perniciosus* from Kashmir and at times from willow plant feeding on willow scale. In Pakistan, it has been recorded to feed on *Q. perniciosus* at Drasan and on scale insects on apricot trees (Khan *et al.*, 2007). Irshad (2001) found this species feeding on *Eulecanium tiliae*, *Q. perniciosus*, *Lecanium* sp. and *Parlatoria* sp. from Abbottabad, Peshawar, and Parachinar. Canepari (1997) reported *C. rubidus* from Nepal Himalayas.

14. *Priscibrumus uropygialis* (Mulsant)

It was recorded on apple, pear and sometimes *Euonymus* hedge in low abundance. Khan *et al.* (2007) collected it while feeding on *Q. perniciosus* on apple and pear orchards in the Chapali site of Pakistan. Irshad (2001) reported that it was widely distributed in fir forests of Pakistan and preyed on adelgids. It goes into hibernation by the end of November but in sunny days goes for sun basking and hibernation by end by March. During summer, adults can be seen on shoots of trees. Kapur (1973) and Canepari (1997) reported it from Himalayan region of India and Nepal.

Tribe Platynaspidini

15. *Platynaspis saundersi* Crotch

This ladybird beetle was found on apple, pear and wild apple trees. It has been reported as an accidental predator of certain unidentified aphids (Agarwala and Ghosh, 1988).

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