



Biodiversity and species composition of Coccinellid beetles (Coccinellidae: Coleoptera) from Poonch division, Azad Jammu and Kashmir

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Abstract

Poonch division is located in Azad Jammu and Kashmir, Pakistan. Poonch division comprises of three districts (Poonch, Sudhnoti, Bagh). This is mainly hilly area with alpine pastures and forest. Ladybird beetles are important due to its predatory nature and play its role in regulating population of important agricultural pest. This study was design to explore its biodiversity in the area. To develop sustainable agriculture pest management programme. For this purpose species diversity abundance, richness and evenness of ladybird beetles were calculated. The ladybird beetles were collected from 29 different localities of this division throughout the season (April to October) from 2009-2011. A total of 47 species under 29 genera belonging to 6 sub-families were identified. Among these, there are 40 species in district Poonch, 32 species in district Sudhnoti and 35 species in district Sudhnoti. Diversity was calculated by using Shannon-Wiener's and Simpson's index. Richness was calculated by Margalef's and Menhinick's, Indices and evenness was calculated by Shannon-Wiener's Equitability Index, Pielou's index and Nakamura's R-I index. The calculated values of diversity indices showed that overall highest diversity (4.873) was obtained from Abbaspur and lowest diversity (1.824) from Singhola of Poonch division. Both these localities are located in district Poonch. In District Bagh highest diversity (4.454) was calculated from Naumanpura and lowest (2.473) from locality Bagh. In district Shudnoti, lowest diversity (2.438) was calculated from Behtran and highest (4.309) from Azad Patan. Other diversity parameters i-e species richness and evenness are almost same in all the three districts. Among the localities, species richness is high (5.316) in Abbaspur and lowest (1.350) in Mang. Species evenness has high value (0.993) in Abbaspur and lowest (0.549) in Singhola. The results showed that Ladybird beetles are well distributed among all three districts of Poonch division. The richness, evenness and abundance were found to be normal in the surveyed area.

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Introduction

Coccinellid (Coccinellidae: Coleoptera), commonly known as ladybird beetles are the best known beneficial predatory insects. Family Coccinellidae consists of five predacious and one phytophagous subfamilies. Up till now about 490 genera and 6,000 species of Coccinellidae are known from the world (Slipinski, 2007). Ladybird beetles are beneficial in controlling pest population of soft bodied insects like aphids, jassids, psyllids, mealy bugs and scale insects. So it helps in suppressing the population of important insect pests. Therefore its diversity richness in certain area is important for ecosystem balance.

Due to the importance of Coccinellid beetles in biological control, many workers attempted to explore the ladybird beetle fauna of Pakistan. The initial work include Ashrafi (1966), Ahmad and Ghani (1966) and Ahmad (1968, 1970 and 1973). Later on, some comprehensive work on coccinellid of certain areas was explored. It includes Epilachninae of Pakistan (CIBC, 1982), Coccinellid of Peshawar valley (Shah, 1985), from Chitral (Khan *et al.*, 2007), and from Gilgit Baltistan (Ashafaque, 2012). Some countrywide studies on coccinellid of Pakistan were published by (Irshad 2001, 2003; Rafi *et al.*, 2005; Naz, 2012).

There is scanty work on coccinellid fauna of Azad Jammu and Kashmir. Farooqe *et al.* (1999) for the first time worked on coccinellid fauna of Azad Jammu and Kashmir. Other workers are Inayatullah *et al.* (2005) with 16 species; Rafi *et al.* (2005) with 30 species and Khan *et al.* (2008) with 40 species. Hayat *et al.* (2013) reported 9 species of sub family Chilocorinae in 5 genera from Azad Jammu and Kashmir.

Hayat and Khan (2014) for the first time worked on biodiversity and species composition of Mirpur division with highest diversity from district Bhimber. The above review reveals that the coccinellid biodiversity of Azad Kashmir is poorly studied in past.

The present study was conducted in the Poonch Division of Azad Kashmir which comprised of three districts namely: Bagh, Poonch and Sudhnoti. District Poonch of Azad Kashmir has green vegetation, alpine pastures and flowering plants.

This district has very cold winter and most of the areas are included in snowfall zone. Few places like Hajira are hot during summer. Climatically some places of district Sudhnoti are more or less the same as that of district Poonch like Nakka Bazar and Gorah but all the remaining places from district Sudhnoti are very hot during the summer and mild during the winter. The vegetation of this district is also very different from that of district Poonch. In this district small bushes and shrubs are very abundant, whereas high alpine trees are very patchy and dense vegetation is sparse. Most of the areas of district Sudhnoti are out of the snow zone. Bagh district is a mountainous area, generally sloping from northeast to south-west.

The general elevation is between 1500 and 2500 meters above sea level. The mountains are generally covered with coniferous forests. Mahl Nala and Betar Nala are the two main streams. Present work is first attempt to evaluate biodiversity of coccinellid beetles in Poonch division. The objectives of the present study were to explore the Ladybird beetle fauna, to estimate species richness, species evenness and species diversity of coccinellids from Poonch Division of Azad Kashmir.

Materials and methods

Localities

The ladybird beetles were collected from 29 localities of Poonch division of Azad Kashmir (Fig 3).

These localities from district Poonch are: Abbaspur, Banjosa, Hajira, Hussainkot, Khaigala, Paniola, Rawalakot city, Singhola, Thorar, Topa. District Bagh: Arja, Bagh city, Chamankot, Chamyati, Dhirkot, Harigal, Mong Bajri, Naumanpura, Paddar, Sudhan Gali. District Sudhnoti: Azad Pattan, Baloch, Baral, Behtran, Mang, Pallandri city, PattanSher Khan, Qillan, Trarkhel.

The localities were selected depending on the road links available. All sorts of localities were selected such as grassy patches, grassy fields, field crops, orchards, lawns of houses, grazing fields, bushes, forests with high trees and mountain peaks. The Altitude of each locality was measured by using Altimeter (Table 1).



Fig. 1. Map of Pakistan.

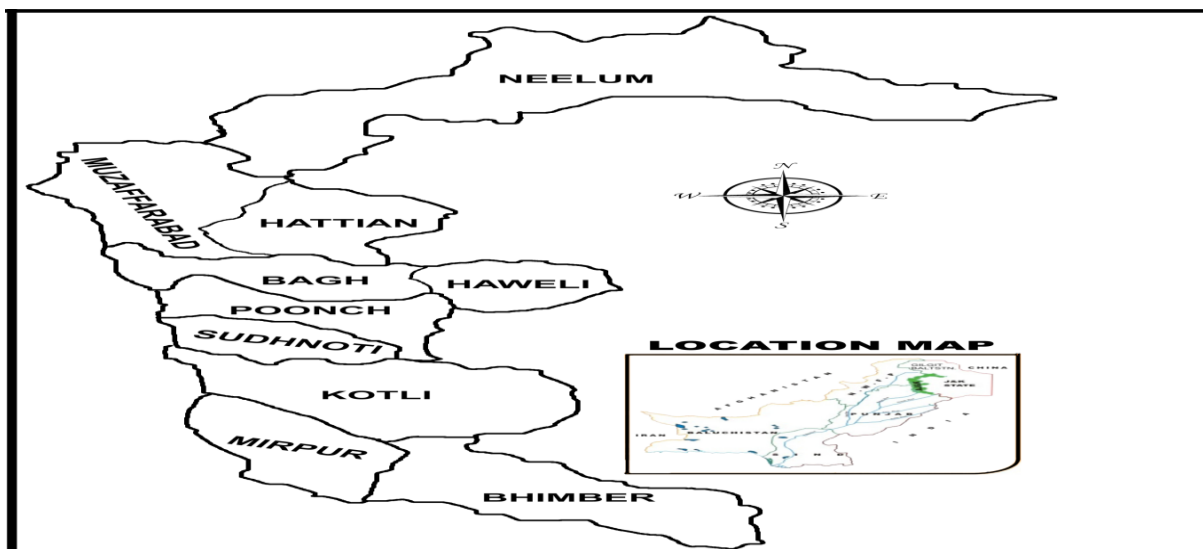


Fig. 2. Map of Azad Kashmir.

Collection of Ladybird beetles

The selected localities were visited fortnightly, starting from April to October (2009-2011). The ladybird beetles were collected from each locality during the day time, starting from 9:30 am to 3: 30 pm during the colder months and 9 am to 5 pm during the hotter months (May to August). Preferably the sunny days were chosen for collection, the specimens were collected by using aerial nets and hand picking method.

Identification of Ladybird beetles

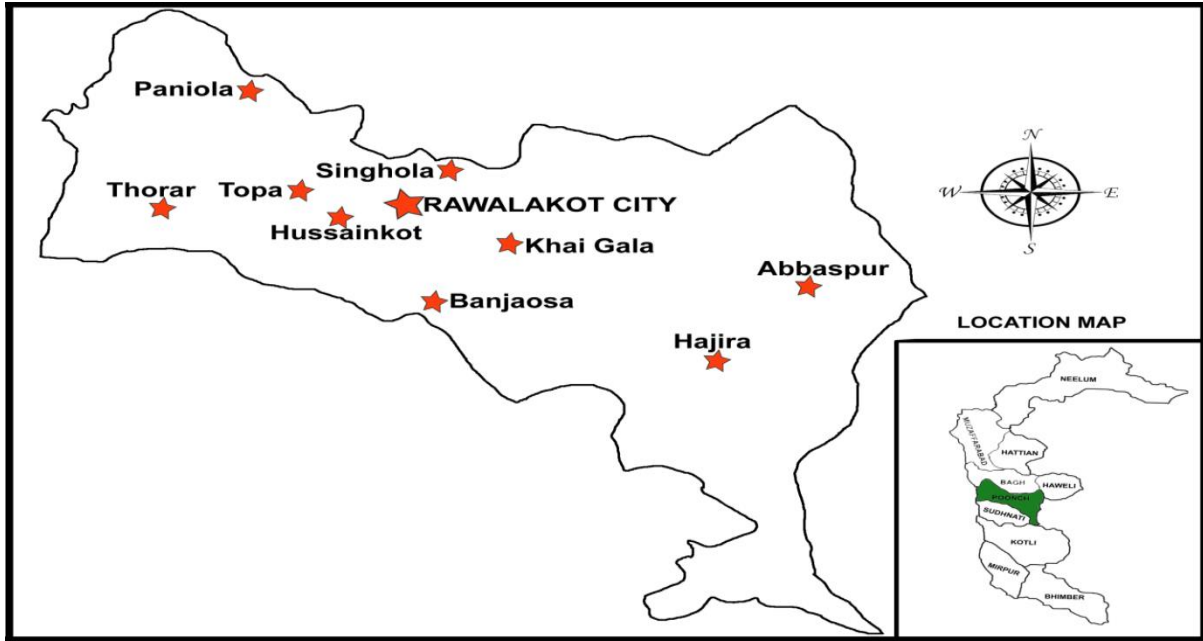
The collected specimens were identified up to species level by genitalia study following the literature of Kapur (1958, 1965); Dieke (1947) and Shunxiang (2009).

Statistical analysis

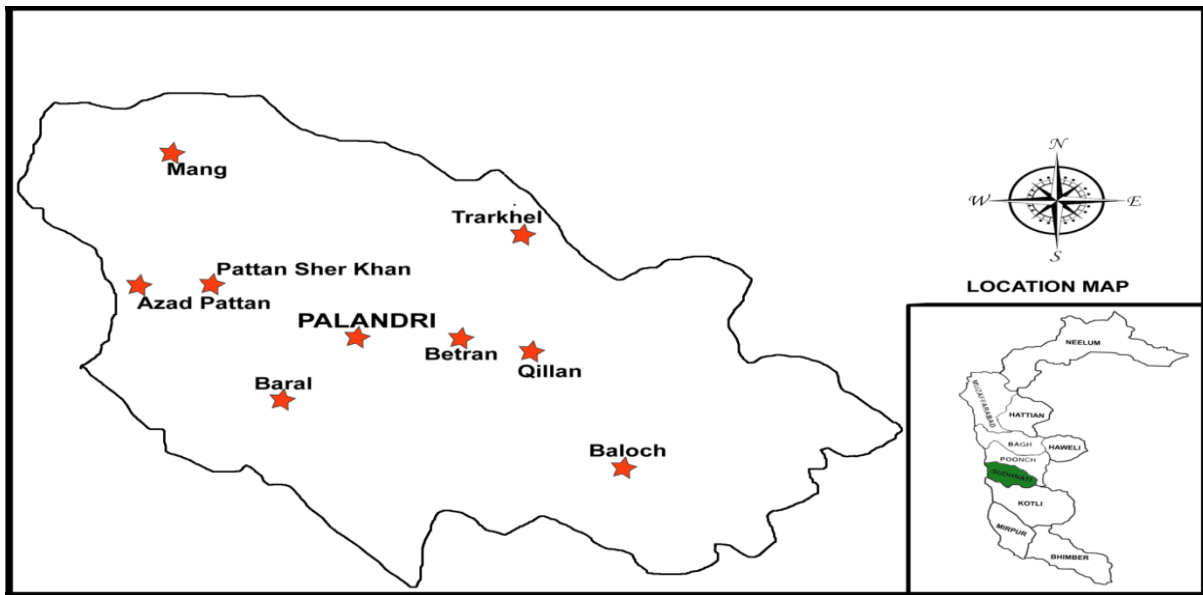
The rank lists were prepared from each locality according to the maximum abundance with the help of which the diversity indices were calculated and the collective rank lists along with the lists of the taxa from each district were also prepared (Table 2).

The list of sampled localities along with their altitude from each locality is also given in Table 1.

The relative Abundance was calculated by the formula, $R = n_i/N$, where, “ n_i ” is the total number of individuals in “ i th” species and “ N ” is the total number of the individuals in the sample. The diversity was calculated by using Shannon- Wiener’s diversity index (Shannon and Weiner, 1963) and Simpson’s index (Simpson, 1949).



Poonch: Paniola, Thorar, Topa, Singhola, Abbaspur, Banjosa, Hajira, Hussainkot, Khaigala, Rawalakot city
Fig. 3. Map of district Poonch.



Sudhnoti: Azad Pattan, Baloch, Baral, Behtran, Mang, Pallandri city, Pattan Sher Khan, Qillan, Trarkhel
Fig. 4. Map of district Sudhnoti.

The richness was calculated by using Margalef's index (Margalef, 1968 & 1969) and Menhinick's index (Menhinick, 1964) and evenness was calculated by using Shannon-Wiener's Equitability index (Shannon and Wiener, 1963), Nakamura's RI index (Nakamura and Toshima, 1995, 1999).

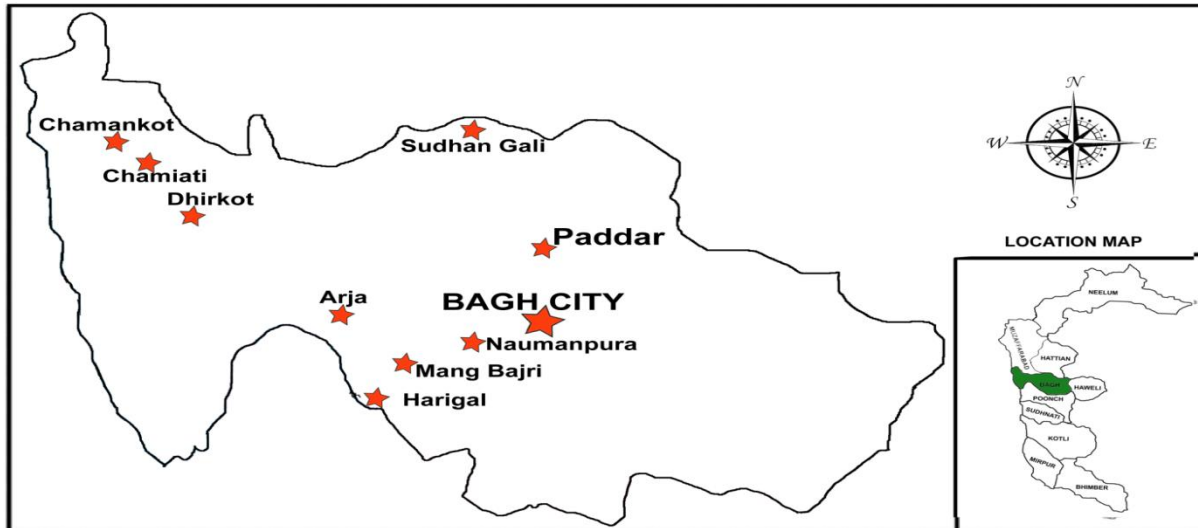
Shannon-Weiner index (1963)
 $H = C \{ \log_{10} N - 1/N \sum (nr \log_{10} nr) \}$

The Simpson's index

$$D = 1 / \sum (p_i)^2$$

Shannon's equitability index: $\{ n_i(n_i - 1) / (N(N - 1)) \}$
 where, "n_i" is the number of individuals in "ith" species and "N" is the total number of individuals in the sample.

Margalef's index $d = S - 1 / \log_e N$.



Bagh: Arja, Bagh city, Chamankot, Chamyati, Dhirkot, Harigal, MongBajri, Naumanpura, Paddar, Sudhan Gali

Fig. 5. Map of District Bagh.

Where, “S” is the number of species and “N” is the total number of individuals.

$$\text{Nakamura's RI index } RI = \sum Ri / S(M-1)$$

where “S” is the number of investigated species of insects, “M” is the number of rank of abundance (0,1,2,3,..... M-1) and “RI” is the rank value of “ith” species in the sample.

Results

During the present study 3751 specimens of lady bird beetles were collected from study sites which were identified into forty seven species under 30 genera from six subfamilies: Coccinellinae, Coccidulinae, Sticholotidinae, Chilocorinae, Scymninae and Epilachninae.

Table 1. Altitude of the selected localities in three districts of Poonch division.

S. No.	District Bagh		District Poonch		District Sudhnoti	
	Locality	Altitude (f)	Locality	Altitude (f)	Locality	Altitude (f)
1	Dhirkot	5499	Banjosa	6603	Baloch	
2	Chamyati	4719	Paniola	4425	Mang	5479
3	Chamankot	4936	Topa	6626	PattanSher Khan	3500
4	Arja	2607	Singhola	5765	Azad Pattan	3200
5	MongBajri	3170	Hussainkot	5999	Trarkhel	
6	Sudhangali	7042	Rawalakot city	5242	Pallandri City	4750
7	Harigahl	3250	Thorar	6610	Behtran	4400
8	Bagh city	3670	Khaigala	5747	Baral	4300
9	Naumanpura	3415	Abbaspur	1540	Qillan	4420
10	Paddar	3450	Hajira	2920		

Total number of species confirmed from district Poonch are 47 (n=1483), from district Sudhnoti 32 (n=1149) and from Bagh 35 (n=1229) as shown in Table 3, 4 and 5 respectively.

Species diversity

The calculated values of diversity indices from each district of division Poonch (Table 3) show that district Poonch yielded the highest values and the same district yielded the lowest values.

Table 2. Collective Rank list of the Ladybird beetles Taxa recorded from three Districts of Poonch Division.

Rank	Name of Taxa	District Poonch	District Bagh	District Sudhnoti	Total
1	<i>Coccinellas septempunctata</i>	234	228	259	721
2	<i>Chilocorus infernalis</i>	169	85	15	269
3	<i>Hippodamia variegata</i>	124	53	54	231
4	<i>Cheilomenes sexmaculata</i>	86	72	85	243
5	<i>Harmonia dimidata</i>	66	73	69	208
6	<i>Psyllobora bisoctonotata</i>	62	53	45	160
7	<i>Oenopia sauzeti</i>	60	34	43	137
8	<i>Coccinella transversalis</i>	59	95	65	219
9	<i>Halyzia tschitscherini</i>	52	---	13	65
10	<i>Pricibrumus uropygialis</i>	50	11	6	67
11	<i>Scymnus nubilus</i>	48	73	16	137
12	<i>Oenopia conglobate</i>	47	30	36	113
13	<i>Coelophora bisellata</i>	42	61	6	109
14	<i>Anegleis cardoni</i>	38	43	51	132
15	<i>Calvia punctate</i>	36	37	40	113
16	<i>Illesis confuse</i>	35	12	49	96
17	<i>Brumoides suturalis</i>	32	45	47	124
18	<i>Oenopia mimica</i>	28	39	28	95
19	<i>Henosepilachna vigintioctopunctata</i>	23	28	40	91
20	<i>Henosepilachna ocellata</i>	20	---	77	97
21	<i>Propylea dissecta</i>	19	14	38	71
22	<i>Stethorus pauperculus</i>	19	19	3	41
23	<i>Stethorus gilvifrons</i>	18	23	10	51
24	<i>Adalia tetraspilota</i>	17	11	10	38
25	<i>Serangium parcesetosum</i>	15	2	---	17
26	<i>Platynaspidius saundersi</i>	13	17	3	33
27	<i>Rodolia ruficollis</i>	12	---	---	12
28	<i>Henosepilachna septima</i>	11	---	---	11
29	<i>Scymnus posticalis</i>	11	---	---	11
30	<i>Illeis timberlakei</i>	9	18	15	42
31	<i>Micraspis allardi</i>	66	22	5	93
32	<i>Cryptogonus nepalensis</i>	5	---	---	5
33	<i>Coccinella undecimpunctata</i>	3	---	5	8
34	<i>Chilocorus nigrita</i>	3	---	---	3
35	<i>Macroilleis hauseri</i>	3	---	---	3
36	<i>Halyzia sanscrita</i>	2	---	---	2
37	<i>Harmonia eucharis</i>	2	---	---	2
38	<i>Serangium montazerii</i>	2	---	---	2
39	<i>Paleoneda auriculata</i>	1	1	1	3
40	<i>Phrynocaria perrotteti</i>	1	---	---	1
41	<i>Ailolocaria hexaspilota</i>	---	4	1	5
42	<i>Chilocorus nigrita</i>	---	8	---	8
43	<i>Scymnus posticalis</i>	---	8	---	8
44	<i>Chilocorus rubidus</i>	---	5	---	5
45	<i>Afidentula manderstjerna</i>	---	---	---	3
46	<i>Harmonia eucharis</i>	---	1	---	1
47	<i>Halyzia sanscrita</i>	---	1	---	1
	Total number of ladybird specimens	1483	1229	1149	3751
	Total number of ladybird beetle species	47	35	32	47

The calculated values of Shannon-Wiener's diversity index at various localities of district Poonch ranged from 1.824 (Singhola) to 4.873 (Abbaspur). Comparatively lower diversity was from Singhola (1.824) and the higher diversity was from Hajira (4.326) followed by Khaigala (4.356),

Rawalakot city (4.509) and Abbaspur (4.873) as shown in Table 3). Most of the sites show values near 3-4.

The diversity values of this index from district Sudhnoti were between 2.438 (Behtran) to 4.309 (Azad Patan).

In other sampled localities the values were from 2.863 (Mang) to 4.179 (Baloch) as shown in Table 4).

In district Bagh the calculated values of this index ranged from 2.473 (Bagh) to 4.454 (Numanpura).

Other stations of this district yielded the values in between these two (Table 5). The results showed that Ladybird beetles are well distributed among all three districts of Poonch division.

Table 3. Calculated value of diversity indices from different localities of district Poonch (AJK).

Sr. No.	Name of Locality	Shannon	Wiener's	Shannon's	Margalef's	Simpson's Index (D)			Menhinck's	RI Index
		Index (H')	Index (H')	Equitability Index (J')	Index (R)	D	1-D	1/D	Index (R)	
1	Rawalakot city	4.509		0.959	4.688	0.064	0.936	15.625	1.807	0.540
2	Thorar	3.123		0.711	4.207	0.078	0.922	12.788	1.950	0.550
3	Topa	3.124		0.673	4.946	0.069	0.931	14.493	2.210	0.542
4	Paniola	3.356		0.722	4.836	0.064	0.936	15.601	2.091	0.542
5	Singhola	1.824		0.549	2.325	0.142	0.858	7.042	1.443	0.611
6	Khaigala	4.356		0.916	4.880	0.057	0.943	17.544	1.881	0.538
7	Hussainkot	2.994		0.766	3.060	0.095	0.905	10.559	1.523	0.571
8	Banjosa	3.854		0.943	3.298	0.110	0.890	9.091	1.503	0.562
9	Hajira	4.326		0.985	3.868	0.069	0.931	14.493	1.583	0.550
10	Abbaspur	4.873		0.993	5.316	0.068	0.932	14.749	1.961	0.534

Among all the three districts the, comparatively lower diversity was in locality Singhola (1.824) in district Poonch. Here vegetation was sparse and the flowering plants were scanty which attracts less number of insects towards them. Moreover large trees were also less abundant. On the other hand comparatively higher diversity was also

obtained in the same district (Abbaspur, 4.873). The reasons could be dense vegetation and abundant flowering plants in this area, which provide very favorable habitat to the coccinellids. The data of these districts showed that the coccinellids are normally distributed in Poonch Division.

Table 4. Calculated value of diversity indices from different localities of district Sudhnoti (AJK).

Sr. No.	Name of Locality	Shannon	Shannon's	Margalef's Index (R)	Simpson's Index (D)			Menhinck's Index (R)	RI Index
		Wiener's Index (H')	Equitability Index (J')		D	1-D	1/D		
1	Pallandri city	4.096	0.964	3.627	0.107	0.893	9.363	1.589	0.555
2	Baral	3.300	0.777	3.779	0.182	0.818	5.491	1.757	0.555
3	Behtran	2.438	0.609	3.404	0.079	0.921	12.658	1.767	0.566
4	Tararkhel	3.857	0.943	3.314	0.124	0.876	8.065	1.521	0.562
5	Baloch	4.179	0.984	3.547	0.089	0.911	11.236	1.502	0.555
6	Mang	2.863	0.798	2.517	0.130	0.870	7.692	1.350	0.590
7	Qillan	4.068	0.975	3.393	0.094	0.906	10.616	1.470	0.558
8	PattanSher Khan	3.091	0.727	3.900	0.113	0.887	8.818	1.891	0.555
9	Azad Patan	4.309	0.928	4.565	0.068	0.932	14.706	1.804	0.542

The second index used for the measurement of diversity was the Simpson's diversity index. This index is sample size dependent and values decrease with the increase in sample size. Therefore, it's reciprocal form I-D or 1/D is usually used in ecological data. This ensures that the calculated values of index increase with increasing diversity).

The calculated values of Simpson' diversity index D of coccinellids from district Poonch ranged from 0.057 in locality Khaigala to 0.142 in Singhola. The calculated value of 1-D ranged from 0.858 in Singhola to 0.943 in Khaigala. The values of 1-D for most of the sites were quite close to each other (Hajira 0.931, Topa 0.931, Abbaspur 0.932, Paniola 0.936, and Rawalakot city 0.936).

Similarly 1/D ranged from 7.042 (Singhola) to 17.544 (Khaigala) (Table 3). This index showed that the comparatively lower abundance was obtained from Singhola and the highest abundance was obtained from Khaigala. The flora of the Khaigala is rich which supported high diversity.

The calculated values of this index (D) of the coccinellids collected from district Sudhnoti ranged from 0.068 in Azad Patan to 0.182 in Baral. Similarly 1-D ranged from 0.818 in Baral to 0.932 in

Azad Patan and 1/D ranged from 5.491 in Baral to 14.706 in Azad Patan (Table 4). It is indicating that maximum richness was calculated from Azad Pattan.

Diversity index (D) in district Bagh ranged from 0.044 (Harigal) to 0.120 (Sudhan Gali).

The values of 1-D ranged from 0.880 (Sudhan Gali) to 0.956 (Harigal) and 1/D ranged between 8.319 (Sudhan Gali) to 22.73 (Harigal) (Table 5).

Table 5. Calculated value of diversity indices from different localities of district Bagh (AJK).

Sr. No.	Name of Locality	Shannon	Wiener's	Shannon's	Equitability	Margalef's	Simpson's Index (D)			Menhinck's	RI Index
		Index (H')	Index (J')	Index (J')	Index (R)	Index (R)	D	1-D	1/D	Index (R)	
1	Bagh city	2.473	0.605	0.605	3.583	3.583	0.116	0.884	8.621	1.823	0.562
2	Numanpura	4.454	0.999	0.999	4.080	4.080	0.107	0.893	9.346	1.677	0.547
3	Padar	3.294	0.789	0.789	3.551	3.551	0.076	0.924	13.106	1.643	0.558
4	Harigal	2.939	0.625	0.625	5.105	5.105	0.044	0.956	22.73	2.246	0.540
5	SudhanGali	3.393	0.829	0.829	3.403	3.403	0.120	0.880	8.319	1.621	0.562
6	Arja	2.889	0.722	0.722	3.250	3.250	0.091	0.909	10.930	1.592	0.566
7	Mongbajri	2.565	0.615	0.615	4.108	4.108	0.054	0.946	18.519	1.980	0.552
8	Dhirkot	3.944	0.912	0.912	3.411	3.411	0.081	0.919	12.346	1.490	0.558
9	Chamyati	3.807	0.881	0.881	3.823	3.823	0.086	0.914	11.628	1.667	0.552
10	ChammanKot	2.917	0.687	0.687	3.807	3.807	0.058	0.942	17.268	1.787	0.555

This index shows that the abundance was high in Harigal. This district of Azad Kashmir has very diverse flora. Some areas like Harigal and Chamman Kot are densely rich with diverse flora and some areas has patchy flora like Numanpura and Bagh city.

The richness was calculated by using Margalef's index and Menhenick' index.

The calculated values of Margalef's diversity index at different localities of district Poonch ranged between 2.325 (Singhola) to 5.316 (Abbaspur) (Table 3). This index indicates that the species richness was slightly higher at the localities like Abbaspur, Topa, Khaigala, Paniola and Rawalakot city whereas it was slightly lower at Singhola and Hussain Kot (Table 3). The calculated values of this index at different localities of district Sudhnoti ranged from 2.517 (Mang) to 4.565 (Azad Patan), indicating that coccinellids are more abundant at Azad Patan and less abundant at Mang, remaining all the stations showed more or less the same abundance (Table 4).

Similarly the values of this index collected from district Bagh ranged from 3.250 (Arja) to 5.105 (Harigal) whereas all the other stations the value of this index ranged from 3.403 to 4.108 which indicates that species richness was higher in this district (Table 5).

The calculated values of Menhinck's diversity index of the coccinellids collected from district Poonch ranged between 1.443 (Singhola) to 2.210 (Topa). Whereas, all other stations yielded the values ranged from 1.503 (Banjosa) to 2.091 (Paniola) (Table 3). The values of this index collected from district Sudhnoti ranged between 1.350 (Mang) to 1.891 (Pattan Sher Khan). In other localities the values were between these two (Table 4). The richness was slightly lower compared to district Poonch. Similarly, the calculated values of this index at different localities of district Bagh ranged from 1.490 (Dhirkot) to 2.246 (Harigal). All the remaining sites yielded the value ranged from 1.592 to 1.980 (Table 5).

The yielded values of this index from all the localities visited indicate that there was no big difference in the richness of coccinellids in this division.

The evenness was calculated by using Shannon-Wiener's equitability index and Nakamura's RI index.

The Shannon's equitability component from district Poonch ranged between 0.549 (Singhola) to 0.993 (Abbaspur), indicating that the lowest equitability was calculated from Singhola and the highest diversity was calculated from Abbaspur. Both the values indicate that the coccinellid fauna was more or less evenly distributed at all the localities of district Poonch. The calculated values of this index showed that the distribution of coccinellids at all the station of this district was even (Table 3). Shannon's equitability calculated from district Sudhnoti ranged from 0.609 (Behtran) to 0.984 (Baloch) which showed that the coccinellid evenness at all the stations of this district was more or less the same (Table 4). Similarly Shannon's equitability from district Bagh ranged from 0.605 (Bagh city) to 0.999 (Numanpura) which shows that fauna was well distributed because the calculated values did not show the much difference among the surveyed places (Table 5). The calculated values of Shannon-Wiener's diversity index very much coincide with the values of Shannon's equitability which means the evenness, richness and abundance of coccinellids from all the localities of the sampled districts support normal distribution and none of the above sampled places showed disturbed communities of ladybird beetles.

The second index used for the measurement of evenness was RI index of Nakamura and Toshima's index. The index shows the number of species and individuals in the sampled area. If the calculated values go near to 1 it indicate that higher number of species and individuals are recorded from the area. The calculated values of RI from district Poonch ranged from 0.534 (Abbaspur) to 0.611 (Singhola). Remaining all the stations yielded the values from 0.538 to 0.571 (Table 3). The calculated values of this index from district Sudhnoti ranged from 0.542 (Azad Patan) to 0.590 (Mang) (Table 4).

This index showed that coccinellids at all the stations of district Sudhnoti were more or less equally distributed. Similarly the values of RI from district Bagh ranged between 0.540 (Harigal) to 0.566 (Arja). Remaining all the sampled localities yielded the values in between them (Table 5).

Discussion

Pakistan is representing rich fauna of coccinellid beetles. The major studies include Irshad (2002 and 2003), Rafi *et al.*, (2005) with 74 species. Other prominent studies include Khan *et al.* (2007) from Chitral with 12 species, Rahtullah *et al.* (2011) with 23 species from Lower Dir. Reports of ladybird beetles from Azad Jammu and Kashmir include (Khan *et al.* 1999; Inayatullah 2005 and Hayat and Khan (2013). Among these workers, only Hayat and Khan (2013) worked on the diversity of the coccinellid beetles while other works are mainly faunistic.

Present study revealed that the coccinellid fauna of the study area (Poonch Division of AJK) is rich with 47 species. Among these *Coccinella septempunctata* is highly abundant (n= 721) followed by moderately abundant species *Cheilomenus sexmaculatus*, *Hippodamia variegata* and *Coccinella transvasalis*. According to Hodek & Honek (1996) and Majerus and Majerus (1996), *C. septempunctata* gets sudden population increase as its number largely depends on the number of aphids. Generally, Coccinellids are density-dependent predators, i.e. their number rises as the prey number increases (Dixon, 2000). Similarly Akhavan *et al.* (2013) also reported *C. septempunctata* and *Hippodamia variegata* as highly abundant species in the Hamedan district, Iran.

The calculated values of all the indices used in this study concluded that species of ladybird beetles were normally distributed in all the districts of the area under study.

The present work shows the extreme richness of the Coccinellid fauna from Azad Jammu and Kashmir. These results are supported by our previous work from the neighbouring division (Mirpur) with 51 species of coccinellid beetles, (Hayat and Khan, 2013).

Zahoor *et al* (2003) reported from Faisalabad, Punjab (Pakistan) that forest area has high species diversity and evenness of coccinellid beetles than crop area.

The present study is the first study of this type in the area and provides baseline information on the diversity of ladybird beetles in the area known as Poonch Division of Azad Kashmir.

Therefore, it is very difficult to say whether any species are supported by the enriched flora or any species are endangered or at the verge of extinction. However, it is suggested that the area under study should be continuously monitored to observe any changes in the diversity of ladybird beetles, because the changes in the diversity can only be observed through continuous monitoring and comparing the data of every year. With the help of continuous monitoring and study of other factors will enable us to establish relationship of the diversity and distribution of ladybird beetles with other factors like Vegetation both natural forests & shrubs, manmade orchards and cultivated crops, use of pesticides and environmental changes –destruction of habitats.

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