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## Diversity of coleopteran fauna in *kharif* pulses from three different locations of Southern Rajasthan

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#### Abstract

An investigation on “Diversity of coleopteran fauna in *kharif* pulses” were carried out at the Department of Entomology, RCA, MPUAT, Udaipur, during the *kharif* season 2015 with a view to record the species diversity of coleopteran fauna in *kharif* pulses *viz.*, blackgram greengram and cowpea at three locations (College Instructional farm, Farmer’s field at Vallabh Nagar and Farmer’s field at Badgaon village). The conducted survey resulted in the collection of members of 8 coleopteran families (2 foliage feeding: Curculionidae and Chrysomelidae, 3 flowers and pods feeding: Scarabaeidae, Bruchidae and Meloidae and other families: Coccinellidae, Staphylinidae and Anthicidae). Based on relative density the curculionids and chrysomelids were dominant in pulse crops. The location-wise and as per crop Shannon diversity indices ranged from 1.72 to 1.54 and maximum for the fauna in greengram at the farmer’s field of Vallabh Nagar (1.72) and lowest for fauna in blackgram at farmer’s field of Badgaon (1.54).

**Keywords:** Pulse crops, diversity indices, relative density, coleopteran fauna

#### 1. Introduction

Food legumes have been grown by farmers since millennia providing nutritionally balanced food to the people of India <sup>[1]</sup> and many other countries in the world. Pulses are the major source of protein in the vegetarian diet in our country; besides being a rich source of protein, they maintain soil fertility through biological nitrogen fixation in soil and thus play a vital role in furthering sustainable agriculture <sup>[2]</sup>. About 200 insect pests that belong to 48 families of Coleoptera, Diptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Orthoptera, Thysanoptera, and 7 species of mites of order *Acarina* are known to infest greengram and blackgram. Under severe infestation stem fly may alone cause more than 90 per cent damage to these crops with a yield loss of 20 per cent <sup>[3]</sup>. With regard to the insect fauna of order Coleoptera, some predatory coleopteran fauna are well known; but, many pestiferous insect fauna of Coleoptera happen to be incompletely documented for *kharif* pulses in Southern Rajasthan. Keeping these facts in view, the present investigation on the species-rich insect order Coleoptera associated with *kharif* pulse crops has been planned out with the objectives to study the species diversity of coleopteran fauna in pulse crops during *kharif* 2015.

#### 2. Material and methods

The cultivated pulse crops (greengram, blackgram and cowpea) at the Instructional Farm of Rajasthan College of Agriculture, MPUAT, Udaipur and the two farmer’s field one at village Badgaon and the other at Vallabh Nagar, were observed for pestiferous and beneficial coleopteran (beetles and weevils) fauna during July to December, 2015. The collection was made from three different spots of the crop area selecting 10 plants at random, from each of the cultivated pulse crop at weekly intervals. In all 30 plants were sampled at one time in each crop. Standard sampling procedures for the different insect pests and natural enemies were followed making use of insect sweep net, aspirator, and hand picking as per requirement. The foliage and flower feeding coleopteran fauna including adult leaf beetles, chafer beetles and weevils and blister beetles were observed and collected during early hours (7 am to 9 am) of the day on the 10 selected plants and expressed as mean numbers per plant. The natural enemies of pestiferous insects belonging to order Coleoptera, the coccinellids and staphylinids were observed visually and counted. The collected insects were killed in a poison bottle charged with ethyl acetate. Larger insects were pinned and dry preserved and the smaller insects were preserved in ethanol (70%). The collected insects were grouped into families based on their morphological characteristics.

**2.1 Data analysis**

Relative density and diversity indices (Shannon-Wiener index, Simpson's index) were calculated by using following formula, detailed below.

**2.1.1 Relative density (RD %) =**

$$\left[ \frac{\text{Number of individual of one species}}{\text{Total number of individual of all species}} \times 100 \right]$$

**2.1.2 Diversity Indices**

**Simpson's Index**

$$D = \frac{1}{\sum p_i^2}$$

Where:

- S is the number of species
- N is the total percentage cover or total number of organisms
- n<sub>i</sub> is the percentage cover of a species or number of organisms of species i

**Shannon-Wiener index:**

$$H' = - \sum_{i=1}^s p_i \ln p_i$$

Where

- n is total number of organisms of a particular species,
- N is the total number of organisms of all species

**3. Results**

The comparative diversity of coleopteran fauna in pulses sampled from three different locations based on the estimated diversity indices presented in the Table (1). The Shannon's diversity index values were recorded maximum at Vallabh Nagar in all three crops i.e., blackgram, greengram and cowpea compared to the other two locations, ranging from 1.66 to 1.72 with the highest 1.72 recorded in greengram followed by that in cowpea (1.71) and blackgram (1.66). At the college instructional farm the diversity recorded was maximum in cowpea (1.62) followed by that in blackgram (1.59) and greengram (1.56). The diversity index at the farmer's field of Badgaon village was recorded maximum in greengram (1.64) followed by cowpea (1.60) and blackgram (1.54). The diversity index was lowest at the farmer's field of

Badgaon village in blackgram (1.54). The Simpson's diversity index values ranged highest from 5.16 in cowpea to 4.77 in blackgram at Vallabh Nagar farmer's field. At farmer's field Badgaon the Simpson's diversity value ranged from 4.47 in greengram to 4.04 in cowpea. At college instructional farm the Simpson's values ranged from 4.77 in blackgram to 4.01 in greengram. It is evident from Table (2) that the relative density of chrysomelids in blackgram was maximum at the college instructional farm (38.56%), followed by curculionids (33.99%) and coccinellids (18.30%). In greengram the maximum relative density was recorded at the college instructional farm for chrysomelids (47.88%), followed by that for curculionids (27.27%) and coccinellids (13.94%). On cowpea the maximum relative density of coleopteran fauna was recorded at farmer's field in village Badgaon for chrysomelids (45.51%) followed by that for curculionids (12.57%) and coccinellids (11.98%).

**4. Discussion**

The present study showed that the insect fauna in kharif pulses was diverse in higher and lower levels of taxa. Among the collected insect pest families, Chrysomelids and Curculionidae were most abundant in blackgram, greengram and cowpea at all three locations. The findings of present investigation confirm with the earlier findings of Verma and Henry (1988) [4], who studied the incidence of insect pests on mungbean (*Vigna radiata*) in Rajasthan, during July-September 1985, as the result of their investigation an average, 10.8 and 16.8 individuals of the curculionids, *Myloccerus maculosus* (*M. undecimpustulatus*) and *Cytrozemia cognata* were recorded per 10 plants, respectively. Likewise Pawar et al. (2014) [5] also reported blister beetle (*Mylabris phalerata*) on greengram under regular and late sown condition the abundance of blister beetle and crop phenology revealed population from bud initiation stage with a peak during flowering and early pod formation stage, clearly indicating its preference for the buds and flowers. Similarly under our investigation the members of weevils, pulse beetles and blister beetles were observed, the weevils prevailed throughout the crop season, whereas pulse beetles and blister beetles were appeared during flowering and pod formation stage.

**Table 1:** Seasonal mean population and diversity indices of coleopteran fauna in kharif pulses at different locations during 2015

Coleopteran family	Blackgram			Greengram			Cowpea			
	CIF	FFB	FFV	CIF	FFB	FFV	CIF	FFB	FFV	
Defoliators/Leaf feeders	Curculionidae	0.65	0.75	0.98	0.45	0.33	0.76	0.53	0.21	0.56
	Chrysomelidae	0.59	0.68	0.94	0.79	0.68	0.64	0.68	0.76	0.77
Flowers and pod/seed feeders	Bruchidae	0.13	0.13	0.25	0.12	0.13	0.23	0.10	0.23	0.33
	Scarabaeidae	0.20	0.08	0.42	0.10	0.14	0.40	0.23	0.14	0.32
	Meloidae	0.13	0.48	0.80	0.23	0.28	0.68	0.20	0.26	0.60
Natural enemies of pestiferous insects	Coccinellidae	0.28	0.19	0.26	0.32	0.31	0.41	0.29	0.20	0.23
Shannon diversity Index		1.59	1.54	1.66	1.56	1.64	1.72	1.62	1.60	1.71
Simpson's diversity Index		4.25	4.06	4.77	4.01	4.47	5.32	4.43	4.04	5.16

CIF, FFB and FFV denote the College Instructional farm, farmer's field at Badgaon and farmer's field at Vallabh Nagar village respectively.

**Table 2:** Relative population density of coleopteran fauna in kharif pulses at different locations during 2015

Coleopteran family	Blackgram			Greengram			Cowpea			
	CIF	FFB	FFV	CIF	FFB	FFV	CIF	FFB	FFV	
Defoliators/Leaf feeders	Curculionidae	33.99	34.25	33.00	27.27	17.65	29.80	34.42	12.57	25.11
	Chrysomelidae	38.56	31.05	31.65	47.88	36.36	25.10	35.06	45.51	34.53
Flowers and pod/seed feeders	Bruchidae	2.61	2.28	3.37	3.64	2.67	5.49	1.95	5.39	5.83
	Scarabaeidae	3.92	1.37	8.42	3.03	3.74	6.27	5.84	4.19	8.52
	Meloidae	2.61	8.68	10.77	4.24	7.49	10.59	3.90	7.78	10.76
Natural enemies of pestiferous insects	Coccinellidae	18.30	8.68	8.75	13.94	16.58	16.08	18.83	11.98	8.07
Beneficial insects	Staphylinidae	--	8.68	3.03	--	9.09	4.71	--	5.99	5.38
	Anthicidae	--	5.02	1.01	--	6.42	1.96	--	6.59	1.79

CIF, FFB and FFV denote the College Instructional farm, farmer's field at Badgaon and farmer's field at Vallabh Nagar village respectively

### **5. Conclusion**

Identification of the insect pests of *kharif* pulse needed to ascertain value or risk of each species and incorporate such knowledge in pest management recommendations. The present findings will help to warn the farmers about the population build-up during different crop stages and will be helpful for devising pre-planned management strategies against insect pests of *kharif* pulses.

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