



# DIVERSITY OF PEST COMPLEX AND THEIR ASSOCIATED NATURAL ENEMIES IN CABBAGE

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## Abstract

Field experiments were conducted during *Rabi* season of 2012-13 and 2013-14. The study revealed that tobacco caterpillar, *Spodoptera litura* (Fab.), diamond back moth, *Plutella xylostella* (Linn.), cabbage semilooper, *Thysanoplusia orichalcea* (Fab.), flea beetle, *Phyllotreta chotanica* (Duviv) and the aphids, *Lipaphis erysimi* (Kalt.) and *Myzus persicae* (Sulze) were the major pests on cabbage crop; while the major natural enemies recorded were coccinellids, *Coccinella septempunctata* (Fab.), *Cheilomenes sexmaculatus* (Fab.) (Coleoptera : Coccinellidae); common green lacewing, *Chrysoperla* sp. (Neuroptera: Chrysopidae); aphid parasitoid, *Diaeretiella* sp. (Hymenoptera: Braconidae); diamond back moth and tobacco caterpillar on parasitoid of *Cotesia* sp. (Hymenoptera: Braconidae). However, their population were found fluctuate during the crop season. Among the major pests infesting cabbage, as per mean and relative density values for foliage feeding pests the tobacco caterpillar incidence was higher followed by diamond back moth. While, natural enemies the maximum mean and relative density was found for *Coccinella septempunctata* during both the years.

**Key words** : Diversity, insect pests, natural enemies, cabbage.

## Introduction

Cruciferous vegetables have an important place among *rabi* crops grown in India. Cabbage, *Brassica oleracea* var. *capitata* (Linn.) is a popular vegetable that is grown in all the states of India and has appreciable nutritional and economic value. The total area under cabbage cultivation in India is 372.40 million hectares with an annual production of 8534.20 million tonnes, while in Rajasthan the total area and production is 1188 ha and 5690 metric tonnes (NHB, 2013), respectively. Insect pests are a serious menace in the profitable cultivation of cabbage. The important insect pests that infest cabbage crop are the tobacco caterpillar (*Spodoptera litura* Fab.), diamond back moth (*Plutella xylostella* L.), cabbage semilooper (*Trichoplusia ni* Hubner), painted bug (*Bagrada hilaris* Burmeister and *Bagrada cruciferarum* Kirk.), cabbage butterfly (*Pieris brassicae* L.), flea beetle (*Phyllotreta cruciferae* Goeze), aphids (*Lipaphis erysimi* Kalt. and *Brevicoryne brassicae* L.), Cabbage leaf webber (*Crocidolomia bionotalis* Zell) and the mustard saw fly (*Athalia lugens proxima* Klug.) (Choudhari *et al.*, 2001; Rao and Lal, 2005). Therefore,

the present study was undertaken in the cabbage growing area to the insect biodiversity associated with this system.

## Materials and Methods

The experiment was carried out during *rabi*, 2012-13 & 2013-14 in cabbage variety Golden Acre. The experimental site is situated at Horticulture Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan), India. Weekly meteorological data were obtained from the Meteorology Unit at the Instructional farm of the College. All the normal agronomic practices were followed for raising the crop. The experiment was replicated thrice in a randomized block design. The observation on tobacco caterpillar, *Spodoptera litura* (Fab.), diamond back moth, *Plutella xylostella* (Linn.), cabbage semilooper, *Thysanoplusia orichalcea* (Fab.) and flea beetle, *Phyllotreta chotanica* (Duviv), coccinellids, *Coccinella septempunctata* (Fab.), *Cheilomenes sexmaculatus* (Fab.); common green lacewing, *Chrysoperla* sp., direct visual counting method was used and population was recorded on ten plants selected randomly from each replicate at weekly

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intervals. The estimation of aphid population was based on the numerical count method as described by Heathcoate (1972). The population was counted only on three leaves. For recording the aphid population marked leaves were grasped at the petiole by thumb and fore finger and twisted until entire underside of the leaves were clearly visible. The aphid population was counted weekly with the help of magnifying lens. To record the larval parasitization of *P. xylostella* and *S. litura* known numbers of larvae were collected from cabbage field at weekly intervals brought to the laboratory and reared in glass jars (500ml capacity) separately on fresh cabbage leaves. The jars were covered with a muslin cloth secured with rubber bands and placed in the laboratory at ambient conditions of temperature and humidity. The larvae were observed upto the emergence of parasitoids and the numbers of parasitization larvae were counted. The emerged parasitoids from larvae were identified. The seasonal mean population counts of different insect pests and their natural enemies were expressed as mean density and relative density (%):

#### Mean density (M.D.)

$$\text{Mean density} = \frac{\sum Xi}{N} \times 100$$

Where,

$X_i$  = Numbers of insects or natural enemies in  $i$ th sample

$N$  = Total numbers of plants sampled

#### Relative density (R.D.)

$$\text{RD (\%)} = \frac{\text{Number of individuals of one species of insect}}{\text{Total number of individuals of all species}} \times 100$$

## Results and Discussion

### Pest faunal complex

Cabbage crop during both years of study (2012-13 and 2013-14) was infested by five major insect pests (table 1) *viz.*, tobacco caterpillar, *Spodoptera litura* (Fab.) (Lepidoptera : Noctuidae), diamond back moth, *Plutella xylostella* (Linn.) (Lepidoptera : Plutellidae), cabbage semilooper, *Thysanopulsia orichalcea* (Fab.) (Lepidoptera: Noctuidae), flea beetle, *Phyllotreta chotanica* (Duviv) (Coleoptera: Chrysomelidae) and aphid, *Lipaphis erysimi* (Kalt.) (Hemiptera: Aphididae)]. Among the foliage feeding insects, the tobacco caterpillar population had a mean density of 11.33 per cent and relative density value of 29.37 per cent during *rabi* 2012-13 whereas, during *rabi* 2013-14 the tobacco caterpillar population had a mean density of 12.23 per cent and

relative density value of 32.50 per cent. The diamond back moth population had a mean density of 11.27 per cent and relative density value of 29.33 per cent, on cabbage during *rabi* 2012-13; whereas, during *rabi* 2013-14, the diamond back moth population had a mean density of 10.33 per cent and relative density value of 27.41 per cent. The cabbage semilooper population had a mean density of 8.73 per cent and relative density value of 22.61 per cent during *rabi* 2012-13; whereas, during *rabi* 2013-14 the cabbage semilooper population had mean density of 7.77 per cent and relative density value of 20.60 per cent. The flea beetle population had a mean density of 7.23 per cent and relative density value of 18.79 per cent during *rabi* 2012-13; whereas, during *rabi* 2013-14 the flea beetle population had a mean density of 7.33 per cent and relative density value of 19.45 per cent. The aphid population had mean density of 70.93 per cent during *rabi* 2012-13, while 69.80 per cent during *rabi* 2013-14. Among the major pests infesting cabbage, as per relative density values for foliage feeding pests the tobacco caterpillar incidence was higher followed by diamond back moth. The population of tobacco caterpillar were relatively more in 2013-14 than in 2012-13. Critical evaluation of the rise and fall in the population of various pests during the year of study and their relationship with existing weather conditions revealed some interesting points, depicting different trends in population build up and formation of peaks. Abiotic factors played important role in the population buildup of these pests. Earlier, these pests have been recorded as serious pests of cabbage crop in and around Udaipur region (Kushwaha, 1983).

### Diversity of natural enemies in cabbage

The major natural enemies (table 1) recorded were the coccinellids, *Coccinella septempunctata* (Fab.), *Cheilomenes sexmaculatus* (Fab.) (Coleoptera: Coccinellidae); common green lacewing, *Chrysoperla* sp. (Neuroptera: Chrysopidae); aphid parasitoid, *Diaeretiella* sp. (Hymenoptera: Braconidae); diamond back moth and tobacco caterpillar on parasitoid of *Cotesia* sp. (Hymenoptera: Braconidae). *C. septempunctata* had a mean density of 3.70 per cent and relative density value of 56.06 per cent during *rabi* 2012-13; whereas, during *rabi* 2013-14, *C. septempunctata* had a mean density value of 4.10 per cent and relative density value of 53.71. *C. sexmaculata* had a mean density of 3.23 per cent and relative density value of 43.94 per cent during *rabi* 2012-13, whereas, during *rabi* 2013-14, *C. sexmaculata* had a mean density value of 3.93 per cent and relative density value of 46.29 per cent. The mummified aphids had a mean density value of 24.57 per cent during *rabi* 2012-13, and 25.97 per cent during *rabi* 2013-14. The parasitoid

**Table 1** : Diversity of pests faunal complex and natural enemies recorded in cabbage ecosystem during *rabi* 2012-13 and 2013-14.

S.no.	Common name	Scientific name	Order and Family	Period of activity	Crop stage	Mean Density (%)		Relative Density (%)	
						2012-13	2013-14	2012-13	2013-14
<b>(A) Insect-pests</b>									
1.	Tobacco caterpillar	<i>Spodoptera litura</i> (Fab.)	Lepidoptera: Noctuidae	Second week of December to first week of March	Vegetative and head formation	11.33	12.23	29.37	32.50
2.	Dimond back moth	<i>Plutella xylostella</i> (Linn)	Lepidoptera: Plutellidae	Second week of December to first week of March	Vegetative and head formation	11.27	10.33	29.33	27.41
3.	Cabbage semilooper	<i>Thysanopulsia orichalcea</i> (Fab.)	Lepidoptera: Noctuidae	Second week of December to first week of March	Vegetative and head formation	8.73	7.77	22.61	20.60
4.	Flea beetle	<i>Phyllotreta chotanica</i> (Duviv)	Coleoptera: Chrysomelidae	Second week of December to first week of March	Vegetative and head formation	7.23	7.33	18.79	19.45
5.	Aphid	<i>Lipaphis erysimi</i> (Kalt.)	Hemiptera: Aphididae	Mid of December to first week of March	Vegetative and head formation	70.93	69.80	-	-
<b>(B) Natural enemies</b>									
1.	Ladybird beetle	(a) <i>Coccinella septempunctata</i> (Fab.) (b) <i>Cheilomenes sexmaculata</i> (Fab.)	Coleoptera: Coccinellidae Coleoptera: Coccinellidae	Fourth week of December to first week of March First week of January to first week of March	Vegetative and head formation Vegetative and head formation	3.70	4.10	56.06	53.71
2.	Larval parasitoid	<i>Cotesia</i> sp.	Hymenoptera: Braconidae	Fourth week of December to first week of March	Vegetative and head formation	1.27	1.20	-	-
3.	Mummified aphid	<i>Diaeretiella</i> sp.	Hymenoptera: Braconidae	Second week of January to first week of March	Head formation	24.57	25.97	-	-
4.	Common green lacewing	<i>Chrysoperla</i> sp.	Neuroptera: Chrysopidae	Second week of January to first week of March	Head formation	1.33	1.40	-	-

*Cotesia* sp. had a mean density value of 1.27 per cent during *rabi* 2012-13, and 1.20 per cent during *rabi* 2013-14. Based on the field collected infested parasitized larvae. The predator, *Chrysoperla* sp. had a mean density value of 1.33 per cent during *rabi* 2012-13, and 1.40 per cent during *rabi* 2013-14. The present findings are in agreement with that of Singh *et al.* (2006), Mandal and Patnaik (2008), Ahuja *et al.* (2012) and Patra *et al.* (2013).

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