



Insect pests of cabbage and cauliflower and their natural enemies in agro ecosystem of Kerala

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ABSTRACT: Pests and natural enemies occurring on cool season vegetable crops, cabbage and cauliflower, grown in hill tracts and the newly cultivated plains of Kerala were studied. Analysis of fauna showed that these crops were attacked by eleven pests. The occurrence of pierid butterfly, *Appias lyncida* Cramer on cruciferous crops is reported for the first time. Incidence of flea beetle, *Phyllotreta chotanica* Duv. noted during the seedling stage is the first report from these crops. The key pest affecting the crop grown in plains was the cut worm, *Spodoptera litura* (F.) and in the hilly tracts it was Diamond back moth (DBM) *Plutella xylostella* (L.). Damage in terms of yield loss by *S. litura* was 30 per cent in cabbage and cauliflower and that by *P. xylostella* was 38 per cent to heads and 26 per cent to curds. Two coccinellid predators, *Chilomenes sexmaculata* (F.) and *Coccinella transversalis* (F.) and the syrphid, *Ischiodon scutellaris* (F.) were identified from the colonies of aphid, *Lipaphis erysimi* (Kaltenbach). One parasitoid, *Protapanteles* sp. was identified from larvae of *Plusia signata* (F.). ©2014 Association for Advancement of Entomology

Key words: cabbage and cauliflower pests, incidence, extent of damage, Kerala, *Spodoptera litura*, *Plutella xylostella*, *Appias lyncida*, *Phyllotreta chotanica*

INTRODUCTION

Cabbage (*Brassica oleracea* L. var. *capitata*) and cauliflower (*Brassica oleracea* L. var. *botrytis*) are the two important cool season vegetables widely grown in all parts of India. In Kerala, cultivation of cabbage and cauliflower was earlier restricted to the cooler seasons in the hilly tracts. With the introduction of new tropical varieties it has become popular in the plains too. Being succulent, these crops are severely attacked by many pests. Bonnemaison (1965) reviewed the distribution of pests attacking crucifers all over the world and reported nearly 51

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insect species. In India, a total of 37 insect pests have been reported to feed on cabbage (Lal, 1975). The diamondback moth (DBM), *Plutella xylostella* (L.), cut worm, *Spodoptera litura* (F.) cause appreciable loss (Bhalani, 1989). Incidence of these pests varies from season to season (Sachan and Gangwar, 1990) and region to region (Chaudhuri *et al.*, 2001). Pests infesting these crops in agro ecosystems of Kerala is being documented in this paper for the first time.

MATERIALS AND METHODS

Identification of pests and natural enemies

The occurrence of pests and natural enemies in cabbage and cauliflower grown in the plains and hilly tracts was monitored during 2011-13. The pest attack was recorded from four districts viz. Thiruvananthapuram, Kollam and Thrissur, representing the plains and from Idukki district in the hilly tracts. From each district five plots having two cents or more were selected. The period of observation was from November to February that coincided with the peak cultivation of these crops in Kerala. Pests attacking the crops at different growth stages were recorded. The distinct growth stages of cabbage and cauliflower described by Andaloro *et al.* (1983) as given under was utilized for this purpose.

Crop specific growth stages

Cabbage		Cauliflower	
WAP	Specific stage*	WAP	Specific stage*
1 – 4	Seedling stage	1 – 4	Seedling stage
5-7	True Leaf stage	5-7	True Leaf stage
8	Pre cupping stage	8-10	Curd initiation stage
9 – 10	Cupping stage	11 – 13	Curd development stage
11- 12	Early head formation stage	14- 15	Curd maturity stage
13-14	Head fill stage	-	-
15	Head maturity stage	-	-

WAP- Weeks after planting

The adult and immature stages of the pests were collected from field and brought to the laboratory for identification. The unknown species were identified with the help of experts in the concerned field.

Natural enemies

The predators were collected from the field and were identified and preserved as dry specimens. Parasitised insects were brought to the laboratory and maintained for adult emergence. The adults preserved in 70 percent alcohol were sent for identification.

Extent of infestation and damage caused by pests

From the selected district five plots, each having 2 cents or more were selected for and Pest Infestation Index (PI) was calculated using the formula

$$\text{PI} = \text{Number of plants infested} / \text{total number of plants observed} \times 100$$

Extent of damage caused by the major pests during the vegetative stage was worked out by counting the total number of leaves and the number of leaves damaged per plant. During the reproductive phase it was calculated by counting the number of heads or curds damaged out of the thirty observational plants. Mean number of leaves and heads or curds damaged was worked out using standard deviation.

RESULTS

Pests

The pests encountered during different growth stages, plant parts affected, susceptible stage of the crop and other relevant information are detailed in Table 1. Eleven insect pests from the order Lepidoptera, two each from Hemiptera and Orthoptera and one each from Diptera and Coleoptera were observed. An unidentified species of slug was also recorded.

Predators

Predators were observed only in fields where there was aphid infestation. The natural enemies recorded from the colonies of *Lipaphis erysimi* were the coccinellid beetles, *Chilomenes sexmaculata* (F.) and *Coccinella transversallis* (F.). The syrphid predator collected was identified as *Ischiodon scutellaris* (F.).

Parasitoids

Larvae of *P. signata* were found to be parasitised by a braconid endo-parasitoid, *Protapanteles* sp..

Extent of infestation and damage caused by pests

The extent of infestation caused by different pests in different districts was worked out based on the Pest infestation Index (PI). In Thiruvananthapuram, Kollam and Thrissur districts, the major infestation was that of *S.litura*, the PI were 71.99, 71.33, and 69.99 respectively (Table 2). Infestation of other pests in these districts was very low. The minor pests, mustard aphid, *L. erysimi*, semi loopers, *Plusia signata* (F.), *Plusia orichalcea* (F.), hairy caterpillars, *Pericallia ricini* (F.), *Dasychira mendosa* Hb. *Spilosoma obliqua* (Walker) and leaf miner, *Liriomyza trifolii* (Burgess), were also prevalent in all the above districts. Their pest infestation index ranged from 8.66 to 12.66, 6.66 to 11.99, 1.33 to 2, 2.66 to 3.99, 2 to 5.33, 2.66 to 4.66 and 7.33 to

Table 1. Details of the pests infesting cabbage and cauliflower in Kerala

Sl No.	Pests		Family	Destructive stage	Susceptible stage of host plant	Plant parts affected
	Common name	Scientific name				
Order: Lepidoptera						
1	Cut worm	<i>Spodoptera litura</i> (Fabricius)	Noctuidae	Caterpillar	All stages except seedling stage	Leaves,Head, Curd
2	Diamondback moth	<i>Plutella xylostella</i> (Linnaeus)	Plutellidae	Caterpillar	All stages	Leaves, Head, Curd
3	Semilooper	<i>Plusia signata</i> Fab.	Noctuidae	Caterpillar	True leaf stage, Precupping and cupping/curd initiation stages	Leaves
4	Semilooper	<i>Plusia orichalcea</i> Fab.	Noctuidae	Caterpillar	True leaf stage, Precupping and cupping/curd initiation stages	Leaves
5	Hairy caterpillar	<i>Dasychira mendosa</i> Hb.	Lymantriidae	Caterpillar	True leaf stage	Leaves
6	Hairy caterpillar	<i>Spilosoma obliqua</i> Walker	Arctiidae	Caterpillar	True leaf stage	Leaves
7	Hairy caterpillar	<i>Pericallia ricini</i> F.	Arctiidae	Caterpillar	True leaf stage	Leaves
8	Beet army worm	<i>Spodoptera exigua</i> Hb.	Noctuidae	Caterpillar	True leaf stage	Leaves
9	Pierid butterfly	<i>Appias lynceida</i> (Cramer)	Pieridae	Caterpillar	True leaf stage	Leaves
10	Bag worm	Unidentified	Psychidae	Caterpillar	Seedling stage	Leaves
11	Bell moth*	Unidentified	Tortricidae	Caterpillar	Early head formation Stage	Growthprimordia

Order: Hemiptera						
12	Mustard aphid	<i>Lipaphis erysimi</i> (Kaltenbach)	Aphididae	Nymph, Adult	True leaf stage, Precupping, Cupping/ curd initiation and Early head formation stage	Leaves, Head
13	Cabbage aphid	<i>Brevicoryne brassicae</i> (Linnaeus)	Aphididae	Nymph, Adult	True leaf stage, Precupping, cupping/ curd initiation and Early head formation stage	Leaves, Head
Order: Diptera						
14	Leaf miner	<i>Liriomyza trifolii</i> (Burgen)	Agromyzidae	Caterpillar	Seedling, True leafStage	Leaves
15	Flea beetle	<i>Phyllotreta chotanica</i> Duv.	Alticidae	Adult	Seedling, True leafStage	Leaves, Roots
Order: Orthoptera						
16	Short horned Grasshopper	<i>Atractomorpha crenulata</i> (Fabricius)	Pyrgomor- phidae	Nymph, Adult	Seedling, True leafStage	Leaves
17	Long horned grasshopper	Unidentified		Nymph, Adult	Seedling, True leafStage	Leaves
Phylum: Mollusca						
18	Slugs*	Unidentified			Early head formationand head fill stage	Head

*Pest of cabbage only

Table 2. Extent of pest infestation in cabbage and cauliflower grown in different districts of Kerala

Sl. No.	Pests	Mean pest infestation index			
		Plains			Hilly tract
		Thiruvananthapuram	Kollam	Thrissur	Idukki
1	<i>Spodoptera litura</i>	71.99	71.33	69.99	—
2	<i>Plutella xylostella</i>	—	—	—	73.99
3	<i>Plusia signata</i>	6.66	11.99	10.66	—
4	<i>Plusia orichalcea</i>	2	1.33	1.33	—
5	<i>Spilosoma oblique</i>	3.33	4.66	2.66	1.33
6	<i>Dasychira mendosa</i>	2	5.33	3.99	2.66
7	<i>Pericallia ricini</i>	3.33	3.99	2.66	3.33
8	<i>Spodoptera exigua</i>	1.33	—	1.33	—
9	<i>Appias lyncida</i>	1.33	—	—	—
10	<i>Lipaphis erysimi</i>	9.99	8.66	12.66	—
11	<i>Brevicoryne brassicae</i>	—	—	—	19.33
12	<i>Phyllotreta chotanica</i>	14.66	7.33	—	—
13	<i>Liriomyza trifolii</i>	7.33	15.33	8.66	11.99
14	Grass hoppers	7.99	8.66	9.99	7.33
15	Bell moth	4.66	7.33	10.66	—
16	Bag worm	2.66	3.99	1.33	—
17	Slug	4.66	—	—	11.33

Mean of five locations per district

15.33 respectively. The incidence of flea beetle, *Phyllotreta chotanica* Duv. was observed only in Thiruvananthapuram (PI 14.66) and Kollam districts (PI 7.33). It was not observed in Thrissur district. The pierid butterfly *A. lyncida* was observed only from one location at Thiruvananthapuram district. Other pests with lesser indices were, *Spodoptera exigua* (Hb.), *Atractomorpha crenulata* (F.) and unidentified species of bell moth, bag worm and long horned grass hopper.

The PI of DBM was high (73.99) in the major cool season vegetable growing areas *viz.* Devikulam, Vattavada and Kanthalloor comprising the hilly tracts of Idukki district. In these

areas, infestation index of *S. litura* was zero. The cabbage aphid, *Brevicoryne brassicae* was observed in the hilly tracts only with a PI of 19.33. Other pests observed with less infestation indices were *D. mendosa*, *S. obliqua*, *P. ricini*, *L. trifolii* and *A. crenulata*.

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Extent of damage caused by major pests

Spodoptera litura

In cabbage, (Table. 3) the mean number of leaves damaged per plant ranged from 1.4 ± 1.77 to 2.90 ± 1.79 . Percentage of leaves damaged during vegetative phase was estimated as 15.32 only but in the bearing stage it caused 30.00 per cent damage to heads. In cauliflower (Table. 4), the mean number of leaves damaged per plant, ranged from 3.2 ± 1.81 to 3.7 ± 1.63 and the per cent damage caused to leaves was 20.80 only but in the bearing stage the damage caused to curds was 30 per cent.

Plutella xylostella

The mean number of leaves damaged per cabbage plant ranged from 2.1 ± 1.52 to 2.9 ± 1.52 . Percentage of leaves damaged during vegetative phase was estimated as 17.58. In the bearing stage it caused 38 per cent damage to heads.

In cauliflower (Table. 4), the mean number of leaves damaged ranged from 2.4 ± 1.71 to 3.3 ± 1.88 . Percentage of leaves damaged during vegetative phase was estimated as 17.63 and the extent of damage caused to curds was 26 per cent.

DISCUSSION

The occurrence of the pierid butterfly, *Appias lyncida* Cramer on cabbage is reported for the first time. Earlier this species was not reported from Brassicaceae plants. The pest was collected from Thiruvananthapuram district, where it was found to defoliate cabbage. Later it was observed to feed on cauliflower too when reared in laboratory. Originally the species was reported to feed on plants belonging to the family Capparidaceae only. The observation on the dominance of *S. litura* in plains during the study period of November to February is in agreement with the findings of Murthy (1994), who reported that November to March was the ideal season of multiplication of *S. litura* in warmer climates where cabbage was grown. It was reported as a pest that caused extensive damage to cabbage and cauliflower in Bihar (Chand and Triparthi, 2008), in Dapoli (Ambekar *et al.*, 2009). *S. litura* was reported to be limiting

Table 3. Extent of damage caused by *Spodoptera litura* and *Plutella xylostella* during vegetative and reproductive stages of cabbage in Kerala

Location	Mean number of leaves/plant		Mean number of leaves damaged/plant		Extent of leaves damaged (%)		Number of heads damaged		Extent of heads damaged (%)	
	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>
1	11.2	13.3	1.6 ± 1.26	2.1 ± 1.72	14.28	15.78	3 ± 0.48	3 ± 0.48	30	30
2	12.5	13.6	2 ± 1.76	2.7 ± 1.70	16	19.85	2 ± 0.42	5 ± 0.52	20	50
3	13.9	15.1	1.4 ± 1.77	2.9 ± 1.52	10.07	19.20	3 ± 0.48	5 ± 0.52	30	50
4	14.6	14.9	2.9 ± 1.79	2.9 ± 1.44	19.86	19.46	3 ± 0.48	3 ± 0.48	30	30
5	13.4	15.4	2.2 ± 1.47	2.1 ± 1.52	16.41	13.63	4 ± 0.51	3 ± 0.48	40	30
Mean	—	—	—	—	15.324	17.58	—	—	30	38

Mean of ten plants

Table 4. Extent of damage caused by *S. litura* and *P. xylostella* during vegetative and reproductive stages of cauliflower in Kerala

Location	Mean number of leaves/plant		Mean number of leaves damaged/plant		Extent of leaves damaged (%)		Number of curds damaged		Extent of curds damaged (%)	
	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>	<i>S. litura</i>	<i>P. xylostella</i>
1	17.3	16.2	3.6 ± 2.06	3.3 ± 1.88	20.80	20.37	3 ± 0.48	3 ± 0.48	30	30
2	15.9	15	3.2 ± 1.81	2.6 ± 1.83	20.12	17.33	2 ± 0.42	2 ± 0.42	20	20
3	16	15.6	3.3 ± 1.88	3.1 ± 2.46	20.62	19.87	3 ± 0.48	4 ± 0.51	30	40
4	16.9	15.8	3.7 ± 1.63	2.4 ± 1.71	21.89	15.18	3 ± 0.48	3 ± 0.48	30	30
5	17	14.9	3.5 ± 2.01	2.3 ± 1.25	20.58	15.43	4 ± 0.51	1 ± 0.31	40	10
Mean	--	---	----	---	20.80	17.63	---	----	30	26

Mean of ten plants

factor for successful cultivation of crucifers (Singh *et al.* 2012; Ratnasri 2012). The finding that *P. xylostella* as the key pest in Vattavada, Kaanthallur and Devikulam of Idukki district which is at a higher altitude of 1980 M above mean sea level, is substantiated with the earlier observations made by Saucke *et al.* (2000). There are numerous reports that reveal *P. xylostella* as the key pest of cabbage and cauliflower in various part of the country (Chaudari *et al.* 2001; Mishra 2009; Kumar *et al.* 2011). Most of the studies were confined to the cooler seasons of the year, which coincided with the major growing season of cabbage and cauliflower.

Among the minor pests, the infestation index was higher (14.66 per cent) for the flea beetle *Phyllotreta chotanica* Duv., but during the study, was under control with the use of any of the botanical or synthetic insecticides. Its incidence was more in non weeded plots. Though it is reported from India for the first time, earlier reports are there on its incidence in kale, *Brassica oleracea* L. from south east Asia (Kianmeesuk *et al.*, 1999; Kianmatee and Ranamukhaarachchi, 2007). The other pests observed during this study with lesser infestations were, the hairy caterpillars, *Pericallia ricini* F., *Spilosoma obliqua* Walker, *Dasychira mendosa* Hb, beet army worm, *Spodoptera exigua* Hb., and semi looper caterpillars, *Plusia signata* Fab. and *P. orechalcea* Fab. were earlier reported in India, by various workers, as cited in the check list of vegetable pests of India prepared by Sharma (2011). The aphid species observed in plains differed from that seen in hilly areas. *B.brassicae* was seen only in hilly tracts, whereas *L.erysimi* was the species observed in plains.

During the course of this investigation, predators were observed only from those fields where aphid infestation was there. The present study was in conformity with the Anjumoni *et al.* (2011). They reported that the predominant coccinellid species in *L. erysimi* colonies is *C. septumpunctata*.

The extent of damage caused by *S. litura* to the heads and curds was 30 per cent in both cabbage and cauliflower, but the population levels recorded during the two consecutive seasons indicated the crop preference of *S. litura* to cauliflower. However the damage caused by *P. xylostella* varied in these two crops. It was higher in cabbage (38 per cent) when compared to cauliflower (26 per cent). Such studies on comparative susceptibility of these two crops to two different major pests observed at two different altitudes were not seen carried out earlier.

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