



Research Article

A FIELD STUDY OF POPULATION DYNAMICS OF MAJOR INSECT PESTS AND THEIR NATURAL ENEMIES ON CAULIFLOWER OF AJMER DISTRICT

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Abstract- Cauliflower, *Brassica oleracea* var. *botrytis* is among one of the most cultivated vegetable crop of Ajmer. A field study was conducted at an experimental research farm, situated in Pal-Bichla, Ajmer. Observations were recorded to study the incidence and population dynamics of major insect pests and their natural enemies on cauliflower. Experiment was laid out in randomized block design (RBD) with three replications. Twenty-four days' old cauliflower seedlings were transplanted in the plot of 10 m² area with 40cm x 40cm spacing on 1st August 2014 to study the population dynamics of the major pest and its natural enemies during the monsoon season. The study continued from August 2014 – November 2014. The second study was conducted from January 2015– April 2015. In Aug.-Nov. crop season larval population of *Plutella xylostella*, DBM ranged from 0 to 17.60 larvae/ plant and DBM was first noticed in the field on 5th September, 2014 (2.76 larvae /plant) with gradual increase in its population and reached its peak on 7th November, 2014 (17.90 larvae/plant). Whereas, in Jan.-Apr. 2015 crop season, larval population of DBM ranged from 0 larvae per plant to 22.30 larvae per plant.

The *Spodoptera* larva was first spotted on 29th of August 2014 (2.0 larvae /plant) with gradual increase in its population and reached its peak by the end of September (8.60 larvae/plant). Severity of aphid incidence was found to be higher in winter season as compared to monsoon season. Highest larval parasitization by *Cotesia plutella* was recorded on 14th Nov. (9.66%) for the year 2014 and on 05th April (14.16%) for the year of 2015.

Keywords- Population dynamics, Pest, Natural enemies.

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Introduction

Cauliflower, *Brassica oleracea* var *botrytis* is one of the most cultivated vegetable crop in India. According Indian Horticulture Database-2014, annual production of cauliflower in the year 2014 was 85.73 lakh Tonnes. Pushkar, Kishanpura, Bhagwanpura, Datanda, Makreda, Pisangan, Daurai, Tabiji, Khanpura, Pal Bichhla, Sarwar are the major areas in and around Ajmer (Rajasthan), where cauliflower is cultivated. The edible part of cauliflower is known as curd, which consists of a shoot system with short internodes, branches, apices and bracts. It has high quality of proteins and peculiar in stability of vitamin C after cooking.

Pests like *Plutella xylostella*, DBM, green peach aphid, and *Spodoptera litura* are some of the major threats to crucifer plants. *Plutella* feeds on cruciferous crop such as cabbage, *Brassica oleracea* var. *capitata*; cauliflower, *B. oleracea* var. *botrytis*; Chinese cabbage, *Brassica rapa chinensis* L.; mustard, *Brassica campestris* L.; radish, *Raphanus sativus* L. etc [1]. Adult is small grayish moth. Damage is caused by caterpillars, which in their earlier stages feed upon veins on lower sides of the crucifers leaves and in the later stages expose on leaves [2]. *Spodoptera litura* is again one the most serious pest of the cruciferous crop. During past several years, the tobacco caterpillar (*Spodoptera litura*) has been the most difficult insect pest to control [3-5]. Another threat to the cauliflower crop are the aphids and the coccinellid beetles. Devjani and Singh [6] reported four species of aphids those are *Myzus persicae*, *Lipaphis erysimi*, *Brevicoryne brassicae* and *Aphis gossypii* infesting cauliflower in three crop varieties (early, mid an late).

Beetles damage the buds of curds.

To develop a successful and effective management tactic for combating insect threat on cauliflower cultivation, one needs to know the incidence pattern and population dynamics of major pests and their natural enemies. Keeping these views in mind, a field study was conducted to study the incidence of major insect pests and the occurrence of natural enemies on cauliflower in Ajmer of Rajasthan.

Materials and Methods

Two year field experiment was conducted at an experimental research Farm, Pal-Bichla, Ajmer to study the population dynamics of major insect pests and their natural enemies on cauliflower during two seasons i.e., Aug.-Nov. 2014 and Jan.-Apr. 2015. Experiment was laid out in randomized block design (RBD) and replicated thrice. Twenty to twenty-five day-old cauliflower seedlings were transplanted in the plot of 10 m² area with 40cm x 40cm spacing on 1st August 2014. While raising the crop, required irrigation and fertilizers were provided to the crop, except pest control measures. Weekly observations were recorded since one week of transplanting till harvesting of the crop. Count of major insect pest: To estimate the larval population of DBM and others direct visual counting method was used [7]. According to it ten plants were selected randomly from each plot and the total population of

the pest was counted at weekly intervals. Crop was thoroughly inspected leaves, shoot and curd (if present) for identification of different pests. The observations were photographed. Count of Aphids: The estimation of aphid population was based on the numerical count method as described by [7]. The whole plant was examined and total number of aphids, two leaves per plant was counted visually with the help of magnifying lens. For recording the aphid population at early plant stage, leaves were grasped in a way, so that entire underside of the leaves was visible. In the advance plant stage, these observations were recorded only from the outer leaves surface. Count of Coccinellid beetle and parasitized DBM larvae by *Cotesia plutellae* were recorded from same plants on respective dates of observation. To study the pupal parasitism, pupa were collected and brought to the laboratories for further study. Other crops-beneficial insect observed during the study was also recorded and details were compiled in a tabular form. The whole study was done in the morning hours as pests are sensitive to temperature so we can't notice their activity in sunlight.



Fig-1 *Plutella xylostella*



Fig-2 *Spodoptera litura*



Fig-3 Cluster of coccinellid beetles



Fig-4 Green lace wing insect

Infestation of diamond back moth (DBM): on cauliflower during Aug.-Nov. 2014 and Jan.-Apr. 2015 crop seasons was recorded and summarized. Cauliflower was attacked by this pest about one month after transplanting during Aug.-Nov. 2014 season, whereas during Jan.-Apr. 2015 season crop was attacked by DBM just 15 days after transplanting.

Result and Discussion

Table 1 - Insect record sheet when DBM was first spotted

Date 05:09:2014		Major insect pest observed on cauliflower crop.					Other threats to the crop		Natural enemies
Plant	DBM	DBM larvae		DBM pupae	eggs of <i>S. litura</i>	larvae of <i>S. litura</i>	APHIDS 2-leaves	coccinellid beetles	parasitoids and others
	Eggs Mass	S	L						
1	-	3	2	-	-	2	6	-	1-S
2	-	1	-	-	-	3	5	1-b***	-
3	1c*	-	-	1	-	-	8	2b***	-
4	-	1	4	-	-	2	9	-	1-dead larva (cocoon), 1-S
5	-	2	-	-	-	4	11	2b***	-
6	1c*	4	1	2	1c*	3	4	-	1-dead larva (cocoon)
7	-	2	2	-	-	4	4	-	1-glw, 1-S
8	-	1	2	1	-	3	8	-	-
9	-	1	-	-	-	2	2	-	-
10	-	-	1	1	-	4	5	-	-
Total	2c*	15	12	05	1c*	27	62	5-b***	2dead larva (2cocoons) 3-S, 1-Glw

Here c*refers to cluster of eggs, refers to spider, b*** refers to coccinellid beetles (*Epilachna vigintioctopunctata*, Fab), Aphids indentified as *Myzus persicae*, cocoons identified of *Cotesia plutella*, glw is Green lace wing insect (*Chrysoperla carnea*).

Table 1 - Insect record sheet when DBM count was recorded maximum

Date 07:11:2014		Major insect pest observed on cauliflower crop.					Other threats to the crop		Natural enemies
Plant	DBM	DBM larvae		DBM pupae	eggs of <i>S. litura</i>	larvae of <i>S. litura</i>	<u>APHIDS</u> 2 leaves	coccinellid beetle	parasitoids and others
		Eggs Mass	S						
1	-	10	8	-	-	2	20	8-b***	1-S
2	1c*	12	5	1	-	1	25	3-b***	1-S
3	-	17	8	3	-	1	10	4-b***	1-glw
4	-	18	7	-	-	2	15	-	1dead larva, (cocoon)*
5	-	21	10	-	-	1	18	7-b***	2dead larva, (cocoon)*
6	2c*	14	6	2	-	1	20	5-b***	1-wasp
7	-	12	6	4	1c*	2	14	6-b***	-
8	1	15	7	2	-	1	10	5-b***	1-S
9	-	16	4	1	-	1	17	5-b***	1-wasp
10	1c*	11	5	-	-	2	13	6-b***	2-S
Total	5c*	146	66	13	1c*	14	162	49b***	5-S, 2-wasp, 1-glw

Here c*refers to cluster of eggs, is spider, b*** is coccinellid beetles (*Epilachna vigintioctopunctata* Fab, Aphids identified as *Myzus persicae*, Wasp identified as: *Daidromus collaris*, cocoons* identified of *Cotesia plutella*, glw is Green lace wing insect (*Chrysoperla carnea*).

In Aug.-Nov. 2014, larval population of DBM ranged from 0 to 17.90 and DBM was first noticed in the field on 5th September, 2014 (2.76 larvae /plant) with gradual increase in its population and reached its peak on 07th November, 2014 (17.90 larvae/plant). After that, population of DBM declined gradually remained considerable till harvesting of the crop. Whereas during Jan.-Apr 2015, larval population of DBM ranged from 0 larvae per plant to 22.30 larvae per plant. Larval population was first observed on 08th February, 2015 averaging 1.23 larvae /plant. Though, peak population of DBM was found on 29th March, 2015(22.30 larvae/plant) but population slightly declined till harvesting of the crop (16.8. larvae/plant). Similar results were also concluded by Patra [8]. He found that temperature (maximum, minimum and average) had positive influence on population growth of DBM. As incidence of pest depends on host suitability and climatic condition, therefore, incidence and peak infestation of pest varies season to season.

Another similar findings was concluded by Chauhan et al. [9] observed the bio-ecology of *Plutella xylostella* (L.) in the mid Hills of Himachal Pradesh and found that the pest appeared in the first fortnight of March on cabbage and cauliflower. Kumar and Singh [10] studied the insect pests of crucifers and their management practices in Punjab region. They reported that diamond back moth, *Plutella xylostella* attack during August-September on cabbage or cauliflower, respectively. Shukla and Kumar [11] observed that DBM appeared at Udaipur (Rajasthan) in the beginning of September and population steadily reached its peak by the end of November. The above results can be corroborated with the findings of present study, which also reported that *Plutella* infestation was visible in the field of Ajmer, for the first time in the month of September and reached its peak population in the month of November.

Incidence of *Spodoptera litura* larva

The *Spodoptera* larva was first spotted on 29th August 2014 (2.0 larvae /plant) with gradual increase in its population and reached peak by the end of September (8.60 larvae/plant). Initially the population was more in comparison to DBM population but gradually as the climate got dry and temperature decreased, its population declined. Observations supported by the findings of Sojitra [12] who reported the infestation of *S. litura* during July to September in Soyabean cultivated at Junagadh. The minimum temperature, morning and evening relative humidity, rainfall showed negative effect on larval development and population of

S. litura infesting onion crops in Guntur area [13].

Infestation of aphid: The aphids observed were *Myzus persicae*. Number of aphids/2 leaves varied from 0 to 26.06 and 0 to 15.26 in 2014 and 2015 crop seasons, respectively. Peak aphid population (34.96 and 25.73 aphids/2 leaf) was observed on 21st November 2014 and 15th February 2015 respectively. Severity of aphid incidence was higher when the temperature was low (22°C+5). Results observed can be corroborated with the findings of Sidhu and Singh [14] who revealed that October to March was active period for aphid multiplication as during this period all the cruciferous vegetables viz., cauliflower, cabbage, turnip, radish etc. were found in abundance in field, and favoured the aphid multiplication rising up to eleven generations. Maximum activity was observed during January to March, thereafter excessive heat during April to September resulted with shortage of food plants and hence activity of pests also declined.

Incidence of Natural enemies and others:

Cotesia plutellae was first noted on 12th September, 2014 and 22nd February, 2015. Highest larval parasitization was recorded on 14th Nov. (9.66%) for the year 2014 and on April 05th (14.16%) for the year of 2015. More abundance of *C. plutellae* was observed in Jan-April 2015(temperature recorded 35±5°C.) as compared to Aug.-Nov. 2014 season (temperature recorded 25±5°C.). Present findings are similar to the one recorded by Hemchandra and Singh [15]. They reported that the activity of the parasitoid had a significant positive correlation with the availability of host larval population, as well as.

Coccinellid beetles (*Epilachna vigintioctopunctata*, Fab), population ranged from 0 to 6.56 and 0 to 8.53 per plant during Aug.-Nov. 2014 and Jan-April 2015 seasons respectively. Both the grubs and the adult beetles damage the leaves of the crop. They also prevent the curd to develop by damaging the bud at the early stage.

Conflict of Interest: None declared

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