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Full Length Research Paper

Chemical treated IPM strategies for insect pests of cauliflower vegetable crop

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In order to compare the population of insect pests and predators under IPM and chemical control application in cauliflower, the studies were carried out during the year 2010-2011. Riverm (Biopesticide) along with farmyard manure (FYM), *Chrysoperla carnea* and *Trichograma chilonis* were used as IPM strategies. While, Confidor 20SL and Prophenophos 50EC pesticides were applied for controlling cauliflower insect pests. The data of both the plots were compared with Check plot.

The results indicated that lowest activities of all insect pests were recorded in non-IPM except whitefly. The overall mean population 23.29, 3.32, 1.92, 0.36 and 0.09 per leaf/plant of thrip, whitefly, aphid, diamond backmoth and semilooper were recorded in non-IPM while, their populations 27.40, 3.17, 2.25, 0.77 and 0.12, respectively were recorded in IPM plot as compared to check plot where their populations were recorded as 47.22, 8.88, 7.72, 1.18 and 0.38, respectively. In contrast to pest population, the predators, parasitoid were found more active in check plot. In check plot the population of predators such as spiders, paedeurs, zigzag beetle, *Chrysoperla carnea* and *Trichograma chilonis* were recorded as 0.119, 0.076, 0.073, 0.043 and 0.016, respectively. However their populations 0.17, 0.06, 0.05, 0.26 and 0.005, respectively were recorded in IPM plot. The T-test showed significant different in pest and predators population between IPM and non-IPM and between non-IPM and check plot except parasitoid which non-significantly appeared in IPM and non-IPM plots.

Key words: *Brassica oleraceae*, sucking complex, DBM, IPM, Chemical control.

INTRODUCTION

Cauliflower, (*Brassica oleraceae* L. cv. Botrytis) is a member of the cabbage family which literally means cabbage flower. It is one of the most important winter vegetable crops of Pakistan. It is so delicate and need more care to grow successfully than most of the other vegetables (Khoso, 1994). It is used as a vegetable in curries, soups and for pickles. The 100gm edible portion of cauliflower contains 90.8gm moisture, 25-30gm calories, 5gm carbohydrates, 2gm dietary fiber and protein, 20mg magnesium, 33mg calcium, 113mg potassium, 53mg sodium, 19mg oxalic acid, 51 IU vitamin-A and 6 IU vitamin-C beside other nutrient elements. It grows best in cool, fairly moist climates, so the foggy coastal climates are considered as prime growing areas (Steven, *et al.,* 2000).

Besides the nutritional importance, all of the crucifers are subjected to attack by number of insect pests. Some such as radishes can usually be grown without insect damage and others like as cabbage and cauliflower, must be managed carefully to avoid serious insect damage. Cauliflower is attacked by as many as 24 insect pests (Devjani and Singh, 2002), number of diseases and disorders. However, the most are aphid, jassid, whitefly, thrip, diamondback moth, seemilooper and leafhopper are the considered as serious pests under local condition. These insects pests suck the cell

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sap of the leaves resulting poor growth of plant, and produced lower yield of poor quality cause serious economic loss to the cauliflower. Kumar and Yadav, (1998) was conducted an experiment in India on cauliflower crop and the population dynamics of seven insect pests were found in the crop i.e. *Plutella xylostella, Spodoptera litura, Plusia orichalcea,* (Thysanoplusia orichalcea) *Crocidolomia binotalis,* (Crocidolomia pavonana), *Hellula undalis, Bagrada cruciferarum* (Bagrada hilaris) and *Chromatomyia horticola*. Where as, *P. xylostella* and *S. litura* were found the major cauliflower pests and presented throughout crop growth. Loganathan, (2002) identified the various insect pests of cauliflower from the seeding to harvesting of cauliflower and recorded 15 species of insect pests. Selkar, *et al*., (2004) observed *P. xylostella* effect, food consumption of cauliflower through utilization of 3rd instar larvae under laboratory conditions. Several insect pest management strategies are available including chemical, cultural, mechanical, use of pathogens etc. of insect pests are less economical because of time dependent and more investment of many while chemical control method causes environmental, soil and water. However, applying integrated pest management (IPM) using organic matter and bio pesticides are more feasible because it is safest and has no toxic effects. Natural enemies are more useful and reduce the population of harmful insects without damage to the target crop (Atwal, 1996).

The biopesticides offer desirable alternative to using synthetic chemicals in agricultural system, where protection of the environment and conservation of beneficial organisms are considered as most important part. Biopesticides are less toxic and generally affect only the target pest. These can also save our environment and natural fauna. Increasing use of agro-chemicals, higher production cost and deteriorating ecosystem health have advocated the need to change traditional and external input use agriculture towards safe and sustainable organic production. Moreover, environmental pollution and food safety due to chemical contamination has become a great concern world wide IPM. Food and Agriculture Organization (FAO) proposed "Integrated Pest Management Plan of Action in recognition with the importance of integrating all possible and safe efforts for control of insect pests (Atwal, 1996). Integrated Pest Management is an approach to keeping pest populations below a level causing economic loss, through the judicious and compatible use of two or more of several possible control measures: biological, cultural, biology-based, genetic, mechanical and chemical (Facknath, 1997). The key to the success of the IPM program is based on increasing uptake by growers who are prepared to continually monitor their crops, minimizing the use of insecticides, and utilizing the benefits of the insecticide rotation strategy in an area-wide, coordinated manner. The present studies have therefore been carried out to examine the safe controlling methods by adopting IPM strategies against sucking complex on cauliflower. Information should be given to the growers on insect life cycles and habits to make pest control recommendations more understandable and usable. This study will be helpful to control through the Integrated Pest Management of these insect pests.

MATERIALS AND METHODS

The experiment was conducted in Entomology Section, Agriculture Research Institute, Tandojam to examine the integrated pest management strategies of insect pests in cauliflower vegetable crop during the year 2010-11. The cauliflower was sown in a one acre plot, which was divided into three equal plots. Plot no.1 was kept for IPM strategies, plot no.2 for non IPM and plot no.3 was kept as check plot to compare pest population with IPM and non IPM plots.

IPM plot

The following strategies were applied;

1. Riverm (Biopesticide) along with farmyard manure (FYM) was applied when the cauliflower became 4-5 leaf stage at 15 days interval in the IPM plot.
2. *Chrysoperla carnae* and *Trichograma* spp. *Chilonis* were released at 15 days interval in IPM plot.

Non-IPM plot

In non IPM plot, two applications of Confidor 20SL and Prophenophos 50EC pesticides were applied at 15 days interval in the Non-IPM plot at recommended dose.

Check plot

In check (control plot) nothing was applied in connection to pest control except agronomical practices. All three plots were monitored strictly following the pest scouting system. For sucking insects leaves from 20 plants were examined whereas, for chewing insects whole plant was closely examined at weekly intervals. For recording observations, weekly observations were recorded on the population of predators and parasitoids. Predator population was counted on plant and thorough sweep net method, whereas parasitoids observed from body of insect affecters. At the end of experiment all the observations were subjected to average of insect pest population per leaf/plant basis and the yield per plot of IPM managed plot and non IPM plot was compared with the yield obtained from check plot. The data thus managed were subjected to statistical analysis, using analysis of variance to assess the significance of treatments, while LDS was performed to compare the treatment means, following the statistical method suggested by Gomez and Gomez (1984).

RESULTS

Studies were carried out during the year 2010-11 to examine the impact of adopting IPM strategies v/s Non-IPM strategies for controlling various insect pests

Table 1. Comparative insect population of thrip (*Thrips tabaci*) per leaf on Cauliflower under IPM, Non-IPM strategies and check plots

Date of observation	Insect population		
	IPM plot	**Non-IPM plot**	**Check plot**
1-12-2010	30.11	32.85	34.05
7-12	18.27	44.95	48.60
15-12	28.39	12.50	52.20
22-12	30.49	25.60	58.45
30-12	18.12	36.40	60.65
7-1-2011	17.80	15.50	47.05
15-01	35.60	16.55	51.35
22-01	28.35	27.90	48.00
30-01	42.40	31.50	56.20
7-02	35.05	14.90	52.55
15-02	24.00	17.00	64.40
22-02	30.00	18.00	27.80
28-02-2011	16.80	19.85	12.65
Average	27.40 b	23.29 b	47.22 a

including sucking complex as well as parasitoids activity on cauliflower. Among insect pests, Thrips, *Thrips tabaci,* whitefly, *Bemisia tabaci*, Aphid, *Aphis gossypi*, Diamond back moth, *Plutella xylostela* and Semi looper, *Autographa nigrisigma* were recorded, while among natural enemies spiders and zigzag beetles were recorded. The results on each insect are separately presented under respective headings in this chapter.

Thrip, *Thrips tabaci* Lindeman

Thrip is a disastrous insect pest in agriculture ecosystem and farmers spend millions of rupees annually on control measures to save their crops. The results (Table-1) showed that thrip population on cauliflower crop was found considerably high in early growth stage. In all test plots the early population of thrip was found non-significant i.e. 30.11, 32.85 and 34.05 per leaf in IPM, non IPM and check plots, respectively. However, an obvious effect as observed in the population of thrip when IPM strategies were applied particularly use of biopesticide. The first spray of biopesticides reduced thrip population to 18.27 per leaf on 7-12-2010, whenever it as 48.60 per leaf in check plots. Further increase 30.49 per leaf in population was recorded on 22-12-2010. The second application of biopesticides reduced thrips population to 18.12 per leaf in IPM plot as compared to 60.25 thrips in check plot on 30-12-2010. The third spray of biopesticides reduced thrips population to 35.05 per leaf as compared to 52.55 thrips in check plot on 7-2-2011. Thereafter the population of thrips was continuously declining towards the maturity of the crop in IPM and check plot as well. The overall mean population of thrips (51.40) and (47.22) per plant were recorded in IPM and check plot, respectively. T-test showed significant difference between IPM and check plot (T= 12.37, DF= 12, P<0.01).

Similarly, in non IPM plot where pesticides were applied at different time intervals, the thrips showed a different population trend. The data presented in Table-1 showed the pesticides reduced thrips population much more than bio-pesticides. The post treatment population of thrip was reduced as 12.50 per leaf on 15-12-2010 as compared to 52.20 thrips per leaf in check plot. Overall mean population of thrips (23.29) and (47.22) was recorded in non IPM and check plots, respectively. T-test (T= 8.73, DF= 12, P<0.01) showed significant difference in the population of thrip recorded in IPM and check plots.

At second spray, the post treatment population (15.50) of thrips was recorded, when ever it was 47.05 in check plot on 7-1-2011. The pesticides application reduced thrips population to 14.90 in non IPM plot on 7-2-2011 as compared to 52.55 in check plot. Afterwards the population of thrips was naturally declined in all plots towards the crop maturity. Similar difference in (T= 12.37, DF 12, P<0.01) were recorded in the population of thrip between non IPM plot and IPM plots. This concludes that IPM strategies may reduce thrips population more or less in such way as pesticides reduced the population at their application. However, cost benefit ratio also denotes the use of IPM strategies against population. This means that IPM strategies are the better substitute of pesticides application in reducing pest population.

White fly, *Bemisia tabaci* Ronald.

Table 2. Comparative insect population of whitefly (*Bemisia tabaci*) per leaf on cauliflower under IPM, Non-IPM strategies and check plots

Date of observation	Insect population		
	IPM plot	**Non-IPM plot**	**Check plot**
1-12-2010	5.20	6.15	6.75
7-12	2.20	8.10	8.00
15-12	4.05	1.05	12.40
22-12	6.20	0.15	10.50
30-12	0.15	7.10	14.20
7-1-2011	0.05	2.02	9.70
15-01	5.10	6.10	12.25
22-01	6.00	5.00	10.10
30-01	7.05	6.05	13.20
7-02	3.20	1.15	10.10
15-02	2.00	0.25	6.10
22-02	0.00	0.00	2.05
28-02-2011	0.05	0.05	0.10
Average	3.17 b	3.32 b	8.88 a

In all test plots the early population of whitefly was found non significant i.e. 5.20, 6.15 and 6.75 per leaf in IPM, non IPM and check plots, respectively. However, an obvious effect was observed in the population of whitefly when IPM strategies were applied, particularly use of biopesticides. The first spray of biopesticide reduced whitefly population to 2.20 per leaf on 7-12-2010 when ever, it was 8.00 per leaf in check plot. Further increase 6.20 per leaf in population was recorded on 22-12-2010. The second application of biopesticide reduced whitefly population to 0.15 per leaf in IPM plot as compared to 14.20 in check plot on 30-12-2010. The third spray of biopeticide reduced whitefly population to 3.20 per leaf as compared to 10.10 in check plot on 7-2-2011. Thereafter the populations of whitefly was continuously declining towards the maturity of the crop in IPM and check plot as well as the overall mean population of whitefly (3.17) and (8.88) were recorded in IPM and check plot, respectively. T-test showed significant difference in the population of whitefly in both the plots (T= 4.38, DF= 12, P<0.01).

Similarly, in non IPM plot, where pesticides were applied at different time intervals, the whitefly showed their different population trend. Table-2 showed that pesticide reduced whitefly population much more than biopesticides during the post treatment observation on 15-12-2010. The whitefly population was 1.05 per leaf as compared to 12.40 in check plot. At second spray, the post treatment population 2.02 of whitefly was recorded, whenever it was 9.70 in check plot on 7-1-2011. The pesticide application reduced whitefly population to 1.15 in non IPM plot on 7-2-2011 as compared to 10.10 in check plot afterwards the population of whitefly was naturally declined in all plots, towards the crop maturity. Overall mean population of whitefly (3.32) and (8.86) was recorded in non IPM and check plot respectively. T-test (T= 3.85, DF= 12, P<0.01) showed significant difference in the population of whitefly recorded in IPM and check plots. Similar difference (T= 4.34, DF= 12, P<0.01) were recorded between non IPM and non IPM plot.

This concluded that IPM strategies may reduce whitefly population more or less in such way as pesticide reduced the population at their applications. This denotes the usefulness of IPM strategies against whitefly population. It also means that IPM strategies are the better substitute of pesticide application in reducing pest population.

Aphid, *Aphis gossypi* Glover

In all test plots the early population of aphid was found non significant i.e. 0.00, 0.00 and 0.00 per leaf in IPM, non IPM and check plots, respectively. However, an obvious effect was observed in the population of aphid when IPM strategies were applied particularly of biopesticides. The first spray of biopesticide reduced aphid population to 0.05 per leaf on 7-12-2010 when ever, it was 1.60 per leaf in check plot. Further increase 0.0 per leaf in population was recorded on 22-12-2010. The second application of biopesticide reduced aphid population to 0.10 per leaf in IPM plot as compared to 14.40 aphids in check plot on 30-12-2010. The third spray of biopeticide reduced aphid population 2.00 per leaf as compared to 12.30 aphids in check plot on 7-2-2011. Thereafter, the populations of aphids was continuously declining towards the maturity of the crop in IPM and check plots as well as the overall mean

Table 3. Comparative insect population of aphid (*Aphis gossypi*) per leaf on cauliflower under IPM, Non-IPM strategies and check plots

Date of observation	Insect population		
	IPM plot	**Non-IPM plot**	**Check plot**
1-12-2010	0.00	0.00	0.40
7-12	0.05	0.00	1.60
15-12	0.00	0.00	0.50
22-12	0.00	0.00	0.10
30-12	0.10	10.17	14.40
7-1-2011	5.60	6.40	19.80
15-01	9.30	2.60	21.65
22-01	7.65	1.30	12.00
30-01	2.40	2.10	10.80
7-02	2.00	1.60	12.80
15-02	1.10	0.40	4.00
22-02	1.00	0.40	2.00
28-02-2011	0.16	0.10	0.80
Average	2.25 b	1.92 b	7.72 a

population of aphid (2.25) and (7.72) were recorded in IPM and check plots, respectively.

Similarly, in non IPM plot, where pesticides were applied at different time intervals, the aphid showed their different population trend. Table-3 showed that pesticide reduced aphid population much more than biopesticides the pest treatment observation on 15-12-2010. The aphid population was 0.00 per leaf as compared to 0.50 in check plot. At second spray, the pest treatment population 6.40 of aphid was recorded, whenever it was 19.80 in check plot on 7-1.2011. The pesticide application reduced aphid population to 1.60 in non IPM on 7-2-2011 as compared to 12.80 in check plot afterwards the population of aphid was naturally declined in all plots, towards the crop maturity. Overall mean population of aphid (1.92) and (7.72) was recorded in non IPM and check plot respectively. T-test (T= 2.55, DF= 12, P<0.01) showed significant difference in the population of aphid recorded in IPM and check plot. Similar difference (T= 2.28, DF=12, P<0.01) were recorded between non IPM and check plot.

However, non-significant difference in aphid population (T= 2.28, DF= 12, P<0.01) were recorded in IPM and non IPM plot. This concluded that IPM strategies may reduced aphid population more or less in such way as pesticide reduced the population at their application also denotes the use IPM strategies against insect population. This means that IPM strategies are the better substitute of pesticide application in reducing pest population.

Diamond-back moth, *Plutella xylostela* Linnueus.

In all test plots the early population of Diamond back moth was found non significant i.e. 0.00, 0.00 and 0.00 per leaf in IPM, non IPM and check plot, respectively. However, an obvious effect was observed in the population of Diamond back moth when IPM strategies were applied particularly of biopesticides. The first spray of biopesticide reduced the population to 0.00 per leaf on 7-12-2010 when ever, it was 8.00 per leaf in check plot. Further increased 0.62 per leaf in population was recorded on 22-12-2010. The second application of biopesticide reduced the population to 0.24 per leaf in IPM plot as compared 0.70 to check plot on 7-1-2010. Third spray of biopeticide reduced this pest population to 1.82 per leaf as compared 2.05 in check plot on 7-2-2011. Thereafter, the population continuously declining towards the maturity of the crop in IPM and check plot as well as the overall mean population observed was (0.77) per leaf and (1.18) were recorded in IPM and check pot, respectively.

Similarly, in non IPM plot, where pesticides were applied at different time intervals, that showed their different population trend. Table-4 showed that pesticide reduced the population much more than biopesticides the pre treatment observation on 15-12-2010. The Diamond back moth population observed was 0.00 per leaf as compared to 12.40 in check plot. At second spray, the post treatment population 2.02 was recorded, whenever it was 0.40 in check plot on 7-1-2011. The pesticide application reduced the population to 0.68 in non IPM on 7-2-2011 as compared to 2.05 in check plot afterwards the population was naturally declined in all plots, towards the crop maturity. Overall mean population observed was (0.36) and

Table 4. Comparative insect population of Diamond-back moth (*Plutella xylostela*) per leaf on cauliflower under IPM, Non-IPM strategies and check plots

Date of observation	Insect population		
	IPM plot	**Non-IPM plot**	**Check plot**
1-12-2010	0.00	0.00	0.00
7-12	0.00	0.00	0.00
15-12	1.28	0.24	2.16
22-12	0.62	0.00	1.20
30-12	0.24	0.00	0.70
7-1-2011	0.05	0.00	0.40
15-01	0.64	0.00	1.10
22-01	1.45	1.65	2.10
30-01	2.66	2.04	3.10
7-02	1.82	0.68	2.05
15-02	0.85	0.10	1.10
22-02	0.40	0.05	0.85
28-02-2011	0.10	0.00	0.30
Average	0.77 b	0.36 b	1.18 a

(1.18) in non IPM and check plot, respectively. T-test (T= 1.92, DF= 12, P<0.01) showed significant difference in the population in IPM and check plot. Similar difference (T= 3.43, DF= 12, P<0.01) was recorded between non IPM and check plot. However, non-significant difference in population (T= 3.43, DF= 12, P<0.01) was recorded in IPM and non IPM plot. This concluded that IPM strategies may reduce pest population more or less in such way as pesticide reduced the population. This means that IPM strategies are the better substitute of pesticide application in reducing pest population.

Semi looper, *Autographa nigrisigma* Hubner.

In all test plots the early population of Semi looper was found non significant i.e. 0.24, 0.31 and 0.20 per leaf in IPM, non IPM and check plot, respectively. However, an effect was observed in the population of semi looper when IPM strategies were applied particularly of biopesticides. The first spray of biopesticide reduced the population to 0.00 per leaf on 7-12-2010 whenever, it was 0.36 per leaf in check plot. Further increase 0.52 per leaf that was recorded on 22.12.2010. The second application of biopesticide reduced the population to 0.24 per leaf in IPM plot as compared 0.80 to check plot on 7-1-2011. Third spray of biopeticide reduced the population to 0.10 per leaf as compared 0.30 to check plot on 7-2-2011. Thereafter, the populations was continuously declined the maturity of the crop in IPM and check plot as well as the overall mean population of (0.12) and (0.38) was recorded in IPM and check plot, respectively.

Similarly, in non IPM plot, where pesticides were applied at different time intervals, that showed their different population trend. Table-5 showed that pesticide reduced the population much more than biopesticides to the pre treatment observation on 15-12-2010. The population observed was 0.00 per leaf as compared to 0.20 in check plot. At second spray, the post treatment population 0.00 was recorded, whenever it was 0.40 in check plot on 7-1-2011. The pesticide application reduced the population to 0.68 in non IPM on 7-2-2011 as compared 0.30 to check plot afterward, the population was naturally declined in all plots. Overall mean population of *A. nigrisigma* (0.09) and (0.39) was recorded in non IPM and check plot respectively. T-test (T= 2.74, DF= 12, P<0.01) showed non-significant difference in the population that was recorded in IPM and check plot and difference (T= 2.74, DF= 12, P<0.01) was recorded between non IPM and check plot. However, non-significant difference in the population (T= 2.24, DF= 12, P<0.01) was recorded in IPM and non IPM plot. This concluded that IPM strategies may reduce the pest population more or less in such way as pesticide reduced the population at their application which favors to IPM strategies.

Predators and parasitoids activities

Predators such as spiders, paedeurs, zigzag beetles and *Chrysoperla* were found active in predating and *T. chilonis* parasitizing the insect species in all plots. However, their maximum activities were recorded in check plot. Reason was maximum pest activities, no

Table 5. Comparative insect population of semi looper (*Autographa nigrisigma*) per leaf on cauliflower under IPM, Non-IPM strategies and check plots

Date of observation	Insect population		
	IPM plot	**Non-IPM plot**	**Check plot**
1-12-2010	0.24	0.31	0.20
7-12	0.00	0.42	0.36
15-12	0.00	0.00	0.20
22-12	0.00	0.00	0.05
30-12	0.52	0.00	0.40
7-1-2011	0.24	0.40	0.80
15-01	0.15	0.10	1.20
22-01	0.00	0.00	0.70
30-01	0.30	0.00	0.50
7-02	0.10	0.00	0.30
15-02	0.00	0.00	0.10
22-02	0.00	0.00	0.05
28-02-2011	0.05	0.00	0.20
Average	0.12 b	0.09 b	0.38 a

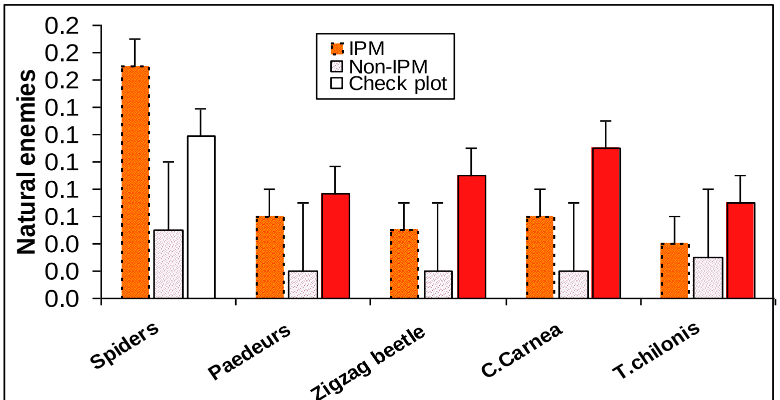

Fig. 1. Mean of natural enemies recorded on cauliflower at different plots during, 2010-11

disturbance due to rational and irrational pesticides. Next to check plot, their maximum activities were recorded in IPM plot as compared to non IPM plot where pesticides were applied at different time intervals (Fig. 1). This gives a clear message that biopesticides caused a little disturbance in the activities of predators but not lethal to them. T-test showed significant differences in the population of predator i.e. spider (T= 7.01, DF= 12, P<0.01), paedeurs (T= 2.42, DF= 12, P<0.05), zigzag beetle (T= 0.44, DF= 12, P<0.66) and chrysopa (T= 2.36, DF= 12, P<0.05) with IPM and non IPM plots. Similarly, parasitoid (*T. chilonis*) was found the most active in check plot (0.07) and second in IPM plot (0.04) per larvae of diamond back moth. However, the difference between IPM and non-IPM was non-significant.

DISCUSSION

The results of the present study indicated that seasonal average of thrips population maximum observed was (47.40) in check plot as compared to IPM plot 27.40 and non-IPM (23.20)/leaf. While, average whitefly population on the plants of IPM plants was (3.17) and (3.32) in non-IPM plots whereas, in check plots, it was (8.88); similarly, seasonal average aphid population in IPM plot was (2.25) as compared to non-IPM plot (1.92)/leaf. Maximum aphid population (7.72)/leaf were recorded in check plot. These results are in agreement with those of Facknath, (1997) found that IPM approach kept pest populations below a level causing economic loss. Devjani, *et al*., (1997) conducted studied over the prey predator interaction to *L. erysimi* on cauliflower.

Similarly, Singh and Lal, (1999) suggested adoption of IPM practices such as planting time, cropping pattern and trap crop, intercropping and field sanitation, predators, parasitoids and neem based formulations for control of insect pests in cauliflower. Mikhael, (2004) conducted the ecological studies on whitefly, *B. tabaci* on some vegetable crops is known as a vector disease reported by (Basu, 1995). Palumbo, *et al*., (2001) controlled *Bemisia tabaci* through conventional insecticides. The most immediate impact on *B. tabaci* included systemic neurotoxins (nicotinoids) and insect growth regulators non-neurotoxic (IGRs). Zaz, (2001) observed the maximum aphid population on cauliflower during the study and other host plants described by (Greathead, 1986). Devjani and Singh (2001) studied insect pests of cauliflower among five insecticides phosalone (0.05%), dichlorvos (0.05%) and fenvalerate insect pest infestation in cauliflower through chemical spray with Marshal, Bt., based products and endosulfan. The confidor and prophenophos pesticides were applied for controlling cauliflower insect pests in our study to compare the yield of infested and non-infested plot plants for estimation of yield loss over chemical protection. In spite use of pesticides our agro ecosystem in rich with beneficial insects those were present in all plots. Devi and Raj, (1995); Idris, *et al*., (2004); Tiang and Chang, (2005); Momanyi, *et al*., (2006); La Thi Nga and Kumar, (2008) tested an integrated technique using 2-3 larval parasitoids and sprays of *Bacillus thuringiensis.* Sailaza and Krishnayya, (2003) controlled through neem oil sprays on different cauliflower varieties and got highest yield. Kandoria, *et al.,* (2000) screened 21 cauliflower varieties for resistance against to *P. xylostella.* In another study, Ganesan and Narayanasamy, (2001) evaluated the 40 varieties; none was found resistant to the DBM feeding and received more than 20% infestation. Where as in our study the variety cultivated in all plots was observed infested. Further continuation of information this pest visited the crop in the month of Dec-Jan remained at zero and in the 3rd and 4th week of February observed in negligible infestation in IPM, non-IPM and check plot. The semi looper was found in the month of December with rare population. It was recorded during rest of the period but the infestation was far below to the economic injury level at IPM and non-IPM plots but at check plot the average population was recorded equally. Relatively higher population of insect pests under IPM plot as compared to non-IPM (using pesticide) was observed due to the use of highly toxic insecticides which caused higher insect mortality as compared to insect control through IPM and check plot.

The seasonal population of beneficial insects such as; spiders, paedeurs, zigzage beetle, *C. carnea* and *T. chilonis* parasitizing in the IPM, non-IPM and check (0.01%) were found effective without harming the biological control agents. Eric and Hutchison, (2008) found that IPM program showed potential decrease due to insecticide applications that increased in net profit.

The results of present studies further indicated that the chewing insects such as, *P. xylostela* maximum observed was (1.18) per leaf in check plot as compared to IPM plot (0.77) and non IPM (0.36), while average of *A. nigrisigma* population on the plant of IPM plot was (0.12/leaf) as compared to the non IPM 0.09/leaf. Maximum semilooper 0.38 per leaf was recorded in check plot. Reddy, *et al.,* (2004) mediated orientation by *P. xylostella* and its predator *Chrysoperla carnea* in response to four different brassica host plants including cauliflower was well controlled through IPM techniques. Consequently, Jeyarani and Kennedy (2004); Nathu and Raju, (2002) controlled the *P. xylostella* and other plots were observed through the study period. But the populations of beneficial insects were relatively higher in cauliflower crop under IPM strategies as compared to non-IPM (pesticide use) strategy in plots. The results are in agreement with Sastrosiswojo, (2005) who conducted research to over-dependence on pesticides, several pesticide-related problems such as pest resistance, hazards to non target organisms, pest resurgence and pesticide residue have become serious. Mani and Krishnamoorthy, (2004) discussed the role of predators in controlling method and provided a list of predators used for the biological control of pests in vegetables including cauliflower. In order to compare the population of insect pests and predators under IPM and Non-IPM plant protection strategies in cauliflower, this study was carried out. The results are satisfactory to Yadav, (2004) who stated that indiscriminate use of chemical pesticides on vegetable crops is raising health and environmental concerns in the country. IPM will be very helpful in educating the vegetable growers and consumers about the judicious use of pesticides for the prevention of health and environmental hazards. In view of the results, it is recommended that IPM strategy for control of insect pests may be adopted, because it provides safest control of insect pests and positive impact on the environment.

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