Available Online at EScience Press
Plant Protection
ISSN: 2617-1287 (Online), 2617-1279 (Print)
http://esciencepress.net/journals/PP

POPULATION DYNAMICS OF DIAMOND BACK MOTH (*PLUTELLA XYLOSTELLA* L.) ON FIVE CAULIFLOWER CULTIVARS

Humayun Javed[1], Tariq Mukhtar[2]
[1] Department of Entomology, PMAS-Arid Agriculture University Rawalpindi, Pakistan.
[2] Department of Plant Pathology, PMAS-Arid Agriculture University Rawalpindi, Pakistan.

ARTICLE INFO

Article history
Received: 18th May, 2017
Revised: 26th June, 2017
Accepted: 1st July, 2017

Keywords
Cauliflower
Plutella xylostella
damage
infestation

ABSTRACT

In the present study, the population dynamics of diamond back moth (DBM) was monitored on five cauliflower cultivars over tin weeks under field conditions in Pakistan. The larval population of DBM on cultivar Snow Mystique was the minimum (0.27/leaf) on the first week and increased gradually till it reached to the maximum (1/leaf) on 7th week. A decline in the population was observed after 7th week. In case of cultivar Siria Fl, maximum population of one larva per leaf was recorded on 8th week. The population was low during the first two weeks and remained high from 3rd to 10th week. The population of DBM on White Diamond during the ten weeks remained below 0.5/leaf. The maximum population was observed during the 3rd week and remained more or less the same till the 10th week. As far as White Castle cultivar is concerned, the population of the insect pest was found to be low during the first and last two weeks which reached to the maximum on the 8th week. The population was found to be almost the same during 4th to 7th week. Except 7th week during which the population was the maximum, the population of the pest remained below 0.5 larvae per leaf on cultivar Fd-4. The damage and population of DBM was high on Snow Mystique, Siria Fl and White Castle cultivars as compared to White Diamond and Fd-4 cultivars which showed minimum damage and population of DBM and suffered less damage and hence recommended for cultivation.

Corresponding Author: Humayun Javed
Email: hjhumayun@gmail.com

INTRODUCTION

Vegetables play an important role in the foundation of human diet. Cauliflower (*Brassica oleraceae* var. *botrytis* L.) is a member of the cabbage family which literally means cabbage flower. It is one of the most important winter vegetable crops of Pakistan. Curds (the edible white flesh) have large amount of vitamins and some minerals in lesser amount. It is used as a vegetable in curries, soups and for pickles. The 100 g edible portion of cauliflower contains 90.8 g moisture, 25-30 g calories, 5 g carbohydrates, 2 g dietary fiber and protein, 20 mg magnesium, 33 mg calcium, 113 mg potassium, 53 mg sodium, 19 mg oxalic acid, 51 N vitamin-A and 6 IU vitamin-C besides other nutrient elements. It is also used for cancer treatment in humans. It grows best in cool, fairly moist climates, and therefore, foggy coastal climates are considered as prime growing areas *(Geisseler and Horwath, 2015)*.

Pakistan is a great producer of cauliflower. Plain areas of Punjab province are the most suitable for its quality production. During the year 2005-06 the crop was grown on an area of 11303 hectares producing about

0.2 million tons of the curds. This crop is originated from Europe and then extended towards other countries and now it is efficiently grown in many parts of the world. (Government of Pakistan, 2007).

Cauliflower is attacked by a large number of insect pests every year including whitefly (*Bemisia tabaci*), armyworm (*Spodoptera sp.*), cabbage looper (*Trichoplusia binotalis*) and cabbage butterfly (*Pieris brassicae*). Out of all these pests, the most threatening and damaging pest is diamond back moth (DBM) (*Plutella xylostella* L.) (Shuaib et al., 2007).

In Pakistan, DBM is a highly damaging pest in Sindh and farmers are frequently compelled to destroy their standing crops because of its too much infestation in fields instead of some chemical applications (Abro et al., 1994). During the latest few years, *P. xylostella* has been described as devastating and notorious insect pest of cauliflower in the whole world and the total annual cost/year to manage this pest has been increasing (Talekar, 1996; Talekar and Shelton, 1993; Verkerk and Wright, 1996).

DBM caterpillers chew and destroy the lower leaves, parts of leaves and underneath tissues of plant (Capinera, 2001). Cultivars having great ability of resistance may lessen its attack and infestation resulting in reduced management cost for the farmers (Reagan et al., 1997). Cruciferous plants exhibit multi and unique sensitive characters like presence of wax on the leaf surface to *P. xylostella.* Turnip and kohlrabi having the greatest ability to resist the attack of DBM (Capinera, 2001).

Some unique morphological and biochemical characters of plants or a combination of these may encourage resistance against *P. xylostella.* Some plants having the special features of antibiosis can decrease insect body size or weight, enhanced trend to travel from one place to another, or having not direct influence by raising the contact of the insect to its predators or parasites is in consequence of extended life span. Wax on leaf surface has been suggested as basic element of resistance in cauliflower towards DBM. This pest is mostly attracted towards its host plants by chemical, physical, visual, tactile and olfactory stimuli (Badenes-Perez et al., 2004; Bukovinszky et al., 2005). Keeping in view the importance of cauliflower and damage done by this destructive pest, the present research was carried out to study the population dynamics of this pest on five cauliflower cultivars.

MATERIALS AND METHODS

The study regarding population dynamics of diamond back moth (*Plutel1a xylostella*) on five cauliflower cultivars was carried out in the University Research Farm Koont. The test cultivars of cauliflower were obtained from the National Agriculture Research Center, Islamabad and comprised Snow Mystique, Siria Fl, White Diamond, White Castle, and Fd-4.

The test cultivars of cauliflower were sown in a subplots following randomized complete block design. A row to row and plant to plant distance of 75 and 45 cm respectively was maintained. There were five rows in each plot and each row contained 15 plants making a total of 75 plants in each plot. There were four replications for each cultivar. Seeds of the selected cauliflower cultivars were sown in the month of January and were transplanted in the month of February. Fertilizer, irrigation and all other agronomic practices were followed as per recommendation. Population density of DBM was determined on 15 randomly selected plants from each plot on weekly basis.

For calculation of larvae per plant, total numbers of larvae of *P. xylostella* from 15 randomly selected plants from each test plot was recorded at weekly intervals from 18th February to 29th April 2014. The mean larvae per plant were determined. The healthy and damaged leaves were counted from the fifteen randomly selected plants at weekly intervals. Percentage damage of leaves was calculated by the given formula:

$$Damaged\ Leaves = \frac{Total\ No.of\ damaged\ leaves}{Total\ no\ pf\ leaves} \times 100$$

All the data were analyzed statistically by using analysis of variance and treatments mean were compared by DMRT using the Statistic 8.1 programme at 5% level of significance.

RESULTS AND DISCUSSION

The larval population of DBM on cultivar Snow Mystique over 10th week is given in figure 1. The population was the minimum (0.27/leaf) on the first week and increased gradually till it reached to the maximum (1/leaf) on 7th week. A decline in the population was observed after 7th week. In case of cultivar Siria Fl, maximum population of 1 larva per leaf was recorded on 8th week. The population was low during the first two weeks and remained high from 3rd to 10th week as shown in figure 2.

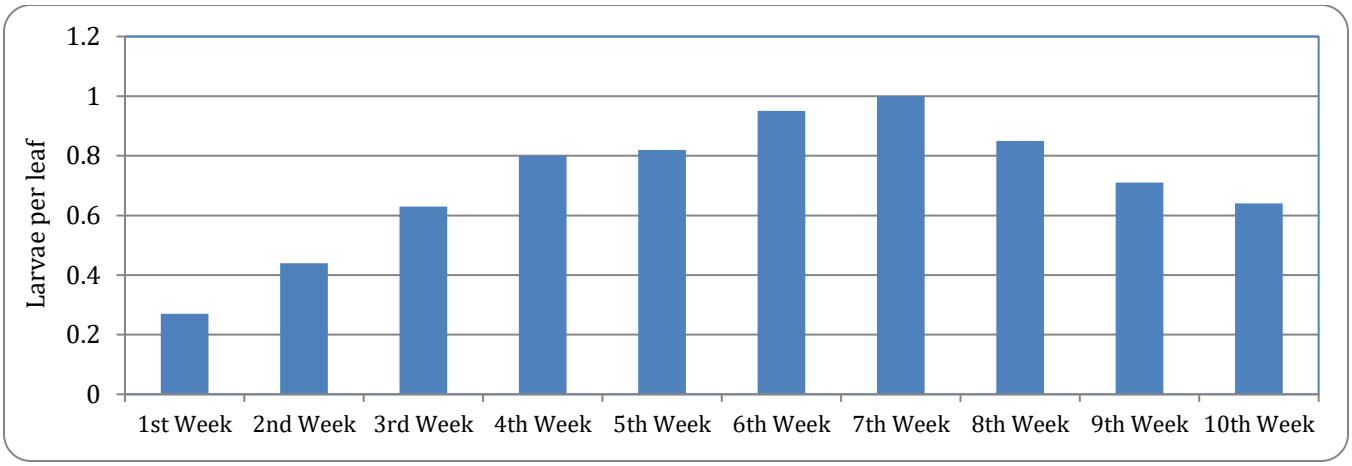

Figure 1. Population of DBM (larvae/leaf) on Snow Mystique over 10th week.

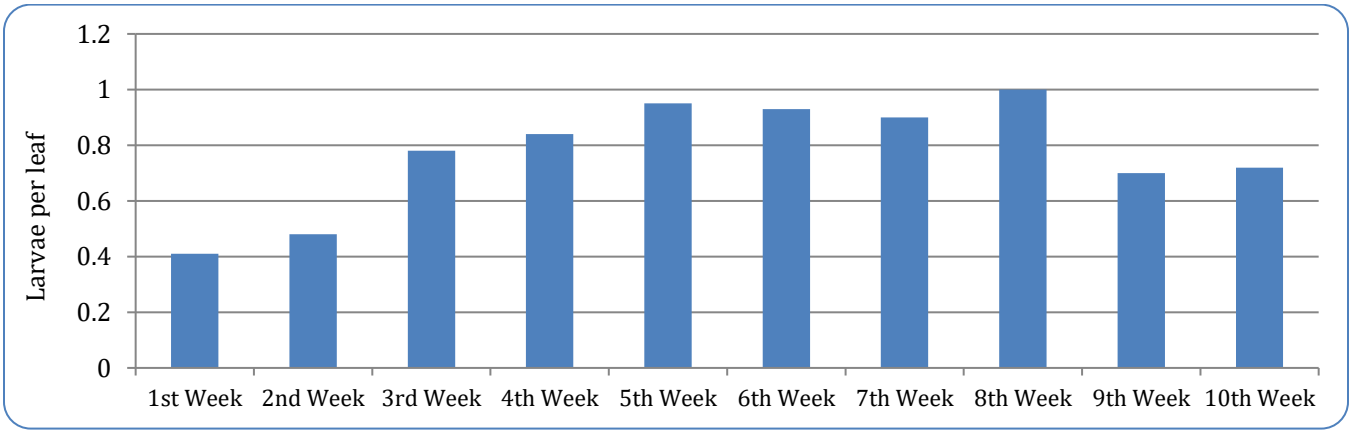

Figure 2. Population of DBM (larvae/leaf) on Siria Fl over 10th week.

The population of DBM on White Diamond during the 10 weeks remained below 0.5/leaf. The maximum population was observed during the 3rd week and remained more or less the same till the 10th week as shown in figure 3. As far as White Castle cultivar is concerned, the population of the insect pest was found to be low during the first and last two weeks which reached to the maximum on the 8th week. The population was found to be almost the same during 4th to 7th week (Figure 4).

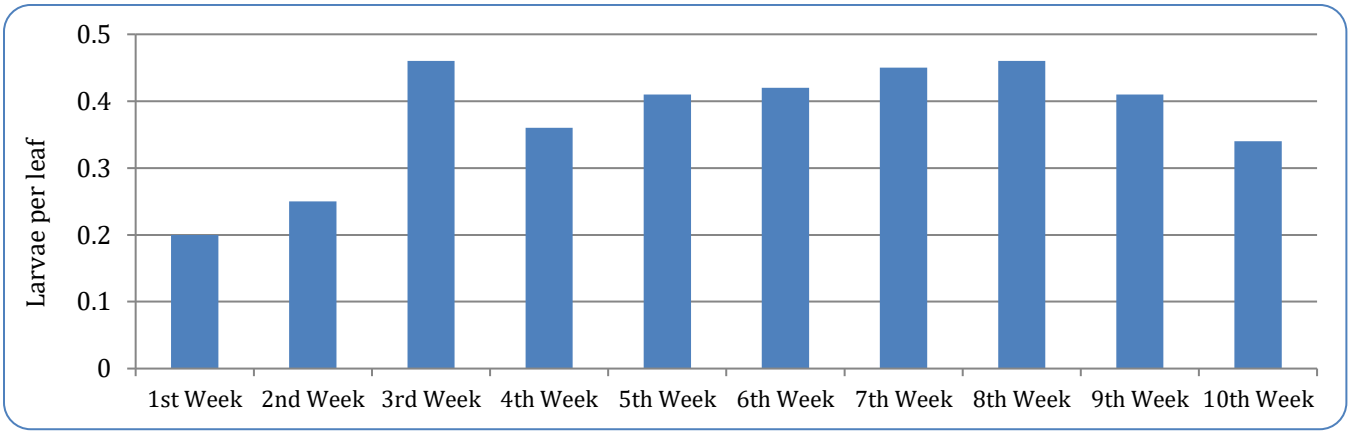

Figure 3. Population of DBM (larvae/leaf) on White Diamond over 10th week.

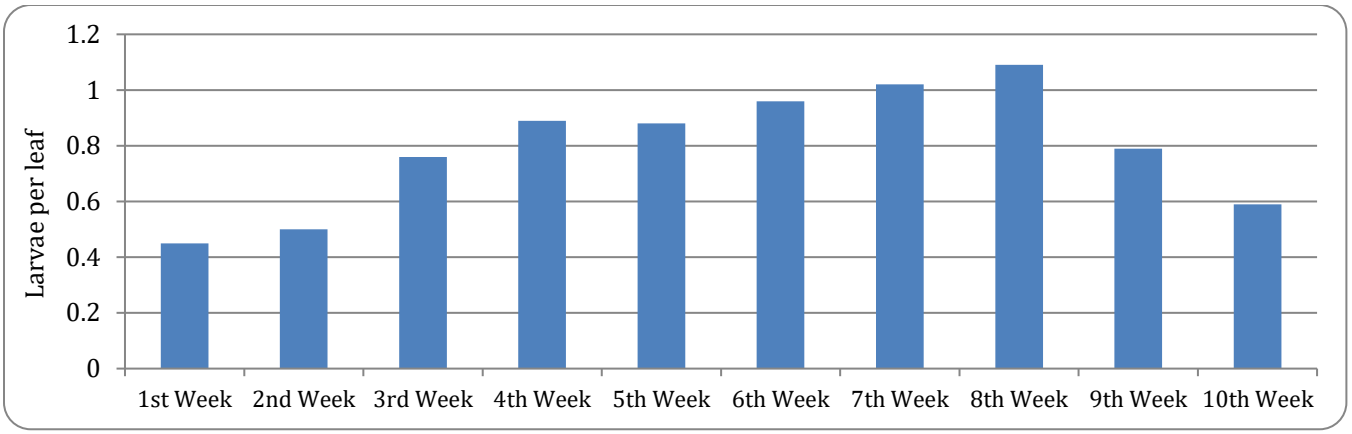

Figure 4. Population of DBM (larvae/leaf) on White Castle over 10th week.

The population of DBM on cultivar Fd-4 is given in figure 5. Except 7th week during which the population was the maximum, the population of the pest remained below 0.5 larvae per leaf. The average damage and population of DBM on five cauliflower cultivars is given in figures 6 and 7 respectively. The damage and population of DBM was the minimum on White Diamond and Fd-4 cultivars as compared to Snow Mystique, Siria Fl and White Castle which showed high damage and population of DBM.

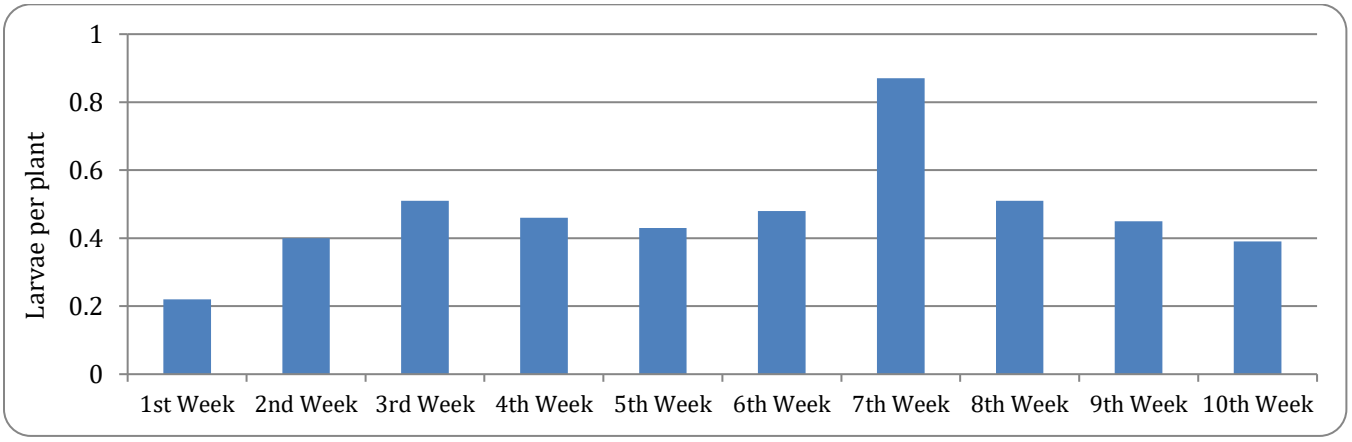

Figure 5. Population of DBM (larvae/leaf) on Fd-4 over 10th week.

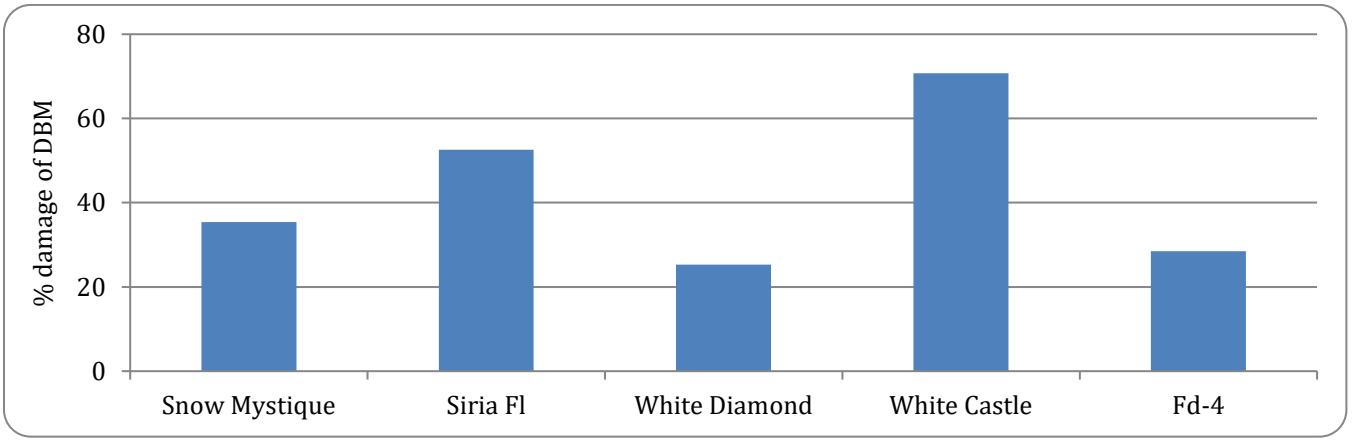

Figure 6. Damage of DBM on five cauliflower cultivars.

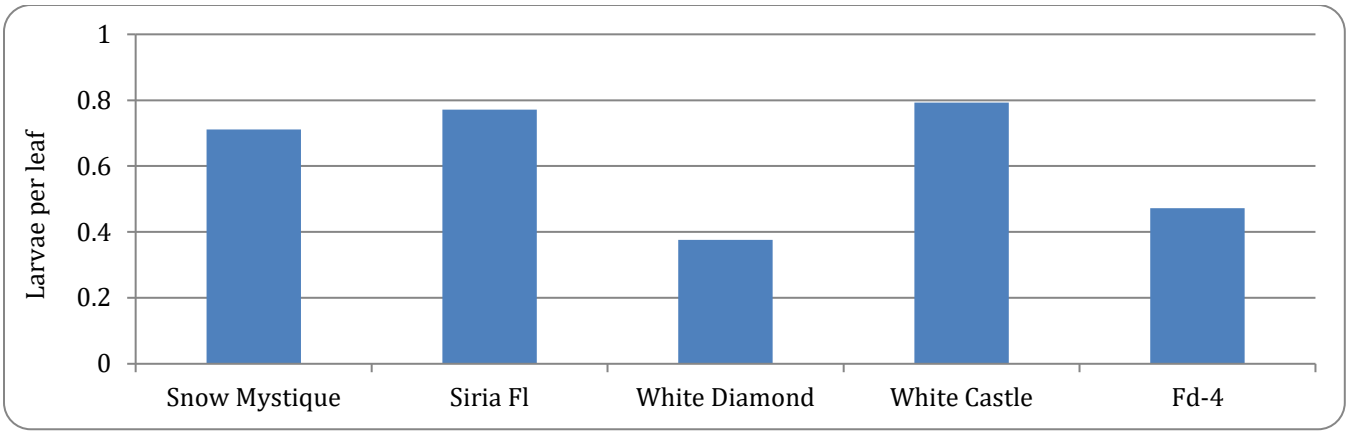

Figure 7. Average population of DBM (larvae/leaf) on five cauliflower cultivars.

Population of DBM on five cauliflower cultivars showed variations over ten weeks. The variations in populations of DBM could be attributed to multiple factors. The overall finding of the present study was that none of the cauliflower cultivars was completely immune to DBM. However, they varied considerably in susceptibility as variations were observed in their infestation. The cultivar White Diamond was found comparatively more resistant to DBM with lowest population of larvae which was statistically at par with Fd-4. Highest populations of the pest were observed on the cultivar White Castle followed by Siria F1 and Snow Mystique which were found comparatively more susceptible to the DBM. The results are in conformity with those of Qureshi (1969) and (Atwal, 1976) who reported that DBM was observed on cauliflower crop from the month of February to April. In the present study, maximum population of DBM was observed during seventh week on the cultivar Diamond Castle followed by Snow Mystique and Siria Fl respectively, while the minimum population was observed during first week on the cultivar Diamond followed by Fd-4. Comparison of means of the data regarding percentage damage revealed that maximum percent damage was observed on the cultivar White Castle (70.71%) followed by Siria Fl (52.6%) and Snow Mystique (35.38%) respectively, while minimum percentage damage was observed on the cultivar White Diamond (25.26%) followed by Fd-4 (28.5%) respectively. Maximum percentage damage throughout the season was observed during seventh week on the cultivar White Castle which was found to be the highest. White Diamond had minimum damage during this week followed by Fd-4, Snow Mystique and Siria F1. These findings are in similarity with those of (Younas et al., 2004) and (Matin et al., 1992) who observed maximum damage from 15th March to 15th April. The results are also comparable with the findings of previous workers (Younas et al., 2004). It is concluded from the present study that the damage and population of DBM was the minimum on White Diamond and Fd-4 cultivars as compared to Snow Mystique, Siria Fl and White Castle which showed high damage and population of DBM. As the cultivars White Diamond and Fd-4 suffered less damage and hence recommended for cultivation.

REFERENCES

Abro, G.H., Jayo, A.L., Syed, T.S., 1994. Ecology of diamondback moth, *Plutella xylostella* (L.) in Pakistan 1. host plant preference. Pakistan Journal of Zoology 26, 35-38.

Atwal, A.S., 1976. Agricultural Pests of India and South-East Asia. CAB International, Wallingford, Oxfordshire, United Kingdom, p. 502.

Badenes-Perez, F.R., Shelton, A.M., Nault, B.A., 2004. Evaluating trap crops for diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae). Journal of Economic Entomology 97, 1365-1372.

Bukovinszky, T., Potting, R.P.J., Clough, Y., van Lenteren, J.C., Vet, L.E.M., 2005. The role of pre- and post-alighting detection mechanisms in the responses to patch size by specialist herbivores. Oikos 109, 435-446.

Capinera, J., 2001. Handbook of vegetable pests. Elsevier.

Geisseler, D., Horwath, W.R., 2015. Cauliflower production in California, Fertilizer Research and Education Program, 30th March 2016 ed.

Government of Pakistan, 2007. Fruit, vegetables and condiments statistics of Pakistan. Ministry of Food, Agriculture and Livestock, Food and Agriculture

Division, Islamabad, Pakistan.

Matin, M.A., Saghir, S.A., Rafi, M.A., 1992. Quantitative relationship between *Pieris brassicae* population and damage in cauliflower. The Philippine Entomologist 8.

Reagan, T.E., Ostheiner, E.A., Rodrigues, L.M., Woolwine, A.E., Schexnayder, H.P., 1997. Assessment of varietal resistance to the sugarcane borer, Sugarcane research: Annual progress report. The LSU Agricultural Center.

Shuaib, M., Khan, S.H., Kazmi, S.M.R., 2007. Effect of different a biotic factors on population dynamic of insect pests on cabbage crop (*Brassica oleracea* L.) in Dera Ghazi Khan district, Punjab, Pakistan, 8th African Crop Science Society Conference. African Crop Science Society, El-Minia, Egypt, pp. 943-946.

Talekar, N.S., 1996. Biological control of diamondback. Plant Protection Bulletin 38, 167-189.

Talekar, N.S., Shelton, A.M., 1993. Biology, ecology and management of the diamondback moth. Annual Review of Entomology 38, 275-301.

Verkerk, R.H.J., Wright, D.J., 1996. Multitrophic interactions and management of the diamondback moth: a review. Bulletin of Entomological Research 86, 205.

Younas, M., Naeem, M., Raqib, A., Masud, S., 2004. Population dynamics of cabbage butterfly (*Pieris brassicae*) and cabbage aphids (*Brevicoryne brassicae*) on five cultivars of cauliflower at Peshawar. Asian Journal of Plant Sciences 3, 391-393.