RESEARCH ARTICLE

STUDIES ON SEASONAL INCIDENCE AND EXTENT OF DAMAGE CAUSED BY DIAMONDBACK MOTH, *PLUTELLA XYLOSTELLA* (L.) IN CAULIFLOWER

K.L. Painkra*, G.P. Painkra, P.K. Bhagat and A. Kerketta

Indira Gandhi Krishi Vishwavidyalaya, Rajmohini Devi College of Agriculture & Research Station, Ambikapur (Chhattissgarh) – 497001 India
Email: kanha_igkv@rediffmail.com

Received-02.11.2016, Revised-16.11.2016

Abstract: **S**urvey of seasonal incidence and extent of damage caused by DBM (*Plutella xylostella* Linn.) was conducted at three locations having appreciable areas under cauliflower cultivation during the first fortnight of December to second fortnight of March. It was found that the pest infestation started on cauliflower crop from the first fortnight of January and the activity continued until second fortnight of March. The peak period of infestation was recorded in the second fortnight of February with an average of 7.1 larvae/plant leading to 32.9 per cent plant infestation. In general the incidence of DBM remained low to moderate from the first fortnight of January to the second fortnight of January. The maximum activity of *P. xylostella* confined in the second fortnight of January to the second fortnight of February. Hence, maximum plant protection measures should be taken up against the pest during this period. The plant infestation by the DBM on the cauliflower crop was observed from the first fortnight of January to the second fortnight of March. The maximum infestation of 32.9 per cent, out of which 12.5, 10.3 and 10.1 per cent plants were observed having less, moderate and high degree of damage, respectively. In the first and second fortnights of March the per cent plant infestation was suddenly decreased.

Keywords: Cauliflower, Diamondback moth damage, Population, Seasonal Incidence

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis*) is one of the most important cole crop of India. It occupies an important place in human diet. Cauliflower has high quality protein and is peculiar in stability of vitamin “C” after cooking. It is rich in minerals such as potassium, sodium, iron, phosphorus, calcium and magnesium. Cauliflower requires a cool and moist growing season and does not endure as much as cabbage does as it is more seriously affected by unfavorable conditions. Rich, heavy loam soils with good drainage and liberal supplies of moisture are ideal for cauliflower growing.

India is the world’s second largest producer of vegetables, next to China. The total production of vegetable in India is 98.50 million tones and the total area is about 6.2 million/ha (Anonymous, 2002). In India, cauliflower is more widely grown as compared with cabbage. It is generally grown throughout India during winter season. In summer season it is grown in parts of Bihar, Madhya Pradesh, Himachal Pradesh, Maharashtra and Nilgiri Hills in Chennai.

Diamondback moth (DBM), *Plutella xylostella* (L) (Lepidoptera: Yponomeutidae), is an important pest of cruciferous crops and enjoys worldwide distribution (CIE 1967). Hardy (1938) stated that the pest could breed and develop between 10°C and 40°C and that the adults were active at up to 50°C. Young pupae and the adults survived for several months and the eggs and pupae for two and six weeks, respectively, at 0°C. In India, DBM was first recorded in 1914 (Fletcher 1914) on cruciferous vegetables and a perusal of literature reveals that this species is distributed all over India wherever crucifers are grown. It is one of the more thoroughly studied pests in India. DBM in India infests important crucifers viz: cabbage, cauliflower, radish, khol rabi (knol khol), turnip, beetroot, mustard, *Brassica campestris* var *toria,* and *B. campestris* var *sarson* (Chand and Choudhary 1977, Dube and Chand 1977, Jayarathnam 1977; Singh and Singh 1982). Non-cruciferous crop like *Amaranthus virdis* L has also been reported to be the host of this species (Vishakantaiah and Visweswara Gowda 1975).

Studies on the food plant preference of DBM have revealed that among several crucifers, the pest exhibits a marked preference for cauliflower and cabbage. This is probably due to the fact that both plants possess fleshy and succulent leaves compared to rest of the crucifers tested, and this probably provides olfactory and gustatory stimuli for successful host selection and development (Chand and Choudhary 1977, Dube and Chand 1977, Singh and Singh 1982).

Economic significance and remunerative nature of the cole crops in short span have compelled the growers to adopt intensive vegetable cultivation. It has been estimated that the insect pests are responsible for reducing more than 40 per cent yield in vegetables. Among these the diamondback moth is the most devastating and cosmopolitan pest of crucifer vegetables (CIE, 1967).

The incidence and the damage of DBM is causing 50 to 80 per cent loss in marketable yield and has the pest status of national importance (Srinivasan and Krishnakumar, 1982). The pest is found to be active from July to April with two peak periods, one during September when up to 38 per cent cauliflower plants

*Corresponding Author

are infested and the other during December to February when 23 to 36.9 per cent cauliflower, 27 to 49 per cent cabbage and 27 to 29 per cent radish plants are infested (Choudhary and Rawat, 1967). The yponomeutid , *Plutella xylostella* was abundant in December- March with a population peak in February, as reported by Lee (1986) and Vishwakarma and Pachori (2002).

MATERIAL AND METHOD

The present investigation was conducted during rabi season. The variety Madhuri was used for investigation. The experiments were conducted at three locations, namely, Amkhera, Maharajpur and Panagar of district Jabalpur (M.P.).

Survey of *Plutella xylostella* L. was carried at three distant locations, namely, Amkhera, Maharajpur and Panagar, where cauliflower and cabbage were grown in large areas. The observations were recorded on two different dates of transplantation of cauliflower till its harvest at fortnightly interval.

For recording the pest incidence at each location, five samples of 20 sq m each were selected, within which five plants were selected randomly and tagged. The plants were observed for recording the incidence of DBM and the total larval population per tagged plant was recorded. Besides recording the pest incidence, the degree of infestation as seen visually was categorized as less, moderate and high, by randomly selecting 10 plants from each plot. Five such samples were recorded from each location. Sampling was carried out by random selection method. The samples were kept free from any insecticidal treatment during the study.

RESULT

Observations recorded at three locations in Jabalpur district from December, soon after the transplantation of cauliflower seedlings, for the seasonal incidence of the pest and per cent plant infestation caused by the DBM larvae are presented in Table 1 and 2.

Table 1. Seasonal incidence of DBM

Locations	Larval population per plant*							
	December		January		February		March	
	1st fortnight	2nd fortnight	1st fortnight	2nd fortnight	1st fortnight	2nd fortnight	1st fortnight	2nd fortnight
Amkhera	0.0	0.0	3.2	4.1	5.5	6.9	6.2	3.3
Maharajpur	0.0	0.0	2.7	4.3	6.4	7.3	6.1	2.9
Panagar	0.0	0.0	2.8	3.9	5.6	7.1	5.8	3.4
Average	0.0	0.0	2.9	4.1	5.8	7.1	6.0	3.2

*Mean of 25 plants

The pest did not appear during the first and second fortnights of December. It appeared in the first fortnight of January at all location and remained in the field until the second fortnight of March. The average larval population range of 2.9 larvae/plant was recorded during the first fortnight of January. The larval population increased in the second fortnight of January to 4.1 larvae/plant. At initial stage 7.2 per cent plants were infested during the first fortnight of January and the per cent plant infestation also increased in the second fortnight of January to 15.6 per cent. The larval population remained low but suddenly increased, because of changes in weather factors and rainfall of 37.0 mm, with an average of 5.8 larvae/plant and per cent plant infestation during the first fortnight of February. The larval population after rainy day suddenly increased in the second fortnight of February with an average of 7.1 larvae/plant and maximum of 32.9 per cent plant infestation.

The larval activity suddenly decreased at the increased maximum temperature of 36.4◦C and relative humidity of 66 per cent with an average of 6.0 and 3.2 larvae/plant with 26.7 and 20.1 per cent plant infestation during the first and second fortnight of March, respectively.

Extent of damage due to DBM

The extent of crop damage due to *P. xylostella* (grading as less, moderate and high) is presented in Table 2.

Table 2. Extent of damage due to DBM

Infestation intensity	Per cent plant infestation*							
	December		January		February		March	
	1st fortnight	2nd fortnight	1st fortnight	2nd fortnight	1st fortnight	2nd fortnight	1st fortnight	2nd fortnight

Less	0.0	0.0	4.1	7.8	10.2	12.5	9.9	6.1
Moderate	0.0	0.0	2.0	4.7	8.3	10.3	9.2	8.9
High	0.0	0.0	1.1	3.1	6.3	10.1	7.6	5.1
Total	0.0	0.0	7.2	15.6	24.8	32.9	26.7	20.1

*Mean of 50 plants

Infestation of *P. xylostella* started in the first fortnight of January. Visual observations led to the determination of 7.2 per cent plant infestation during that period, out of which 4.1 per cent plants were less damaged, 2.0 per cent were moderately damaged and 1.1 per cent were highly damaged, when the maximum temperature was 23.1◦C and relative humidity was 63.5 per cent. In the second fortnight of January the plant infestation increased to 15.6 per cent, out of which 7.8 per cent plants were placed under less damaged category, 4.7 per cent were moderately damaged and 3.1 per cent were highly damaged. The first fortnight of February witnessed further increase in per cent plant infestation which was 24.8, out of which 10.2, 8.3 and 6.3 per cent plants were observed with less, moderate and high degree of damage. During the second fortnight of February a maximum of 32.9 per cent plant infestation was recorded, out of which 12.5, 10.3 and 10.1 per cent plants were observed with less, moderate and high degree of damage respectively, when the maximum temperature was 27.7◦C and relative humidity was 62.0 per cent. In the first fortnight of March the per cent plant infestation decreased abruptly to 26.7 per cent with 9.9, 9.2 and 7.6 per cent of less, moderate and high degree of damaged plants. The second fortnight of March witnessed a further decline trend with 20.1 per cent infestation of cauliflower plants, out of which 6.1, 8.9 and 5.1 per cent plants showed less, moderate and high degree of damage, respectively.

DISCUSSION

Diamond back moth, *Plutella xylostella* (Linn.) is a major pest of cruciferous vegetables crop like cauliflower, cabbage and rapeseed and enjoys worldwide distribution (CIE, 1967; Choudhary and Rawat, 1967; Chelliah and Srinivasan, 1986 and Talekar, 1990). The larvae feed on the crop foliage from the seedling stage up to harvest, ultimately reducing the yield and quality. The pest poses a serious problem due to high reproductive potential, rapid turnover of generations and ability to withstand the diversified conditions of environment.

In Madhya Pradesh no systematic information on the seasonal incidence of DBM is available, though it is of common occurrence. The pest was not observed during the first and second fortnights of December at all three locations. The incidence of the pest on cauliflower was noticed during the first fortnight of January. At the peak period of insect activity, on an average the population was 7.1 larvae/plant with an average of 32.9 per cent plant infestation was recorded during the second fortnight of February at all the three locations. These findings revealed that the second fortnight of February was congenial for the development of *P. xylostella* under the agro-climatic condition of Jabalpur district. This necessitated the plant protection measures to be adopted during the aforesaid period.

This finding was in accordance with the earlier worker Vishwakarma and Pachori (2002), who observed the *P. xylostella* activity on cabbage crop at Jabalpur during the second fortnight of December to second fortnight of March, with peak period during the second fortnight of February. Similarly, Lee (1986) had also reported that *P. xylostella* was abundant from December to March with peak population in February.

Devjam and Singh (1999) noted the density of *P. xylostella* on cauliflower over a period of two cropping seasons from January to April during 1994 and 1995 in Manipur, India. In the present study also the DBM appeared in the first fortnight of January until second fortnight of March.

However, Khaire *et al.* (1987) in Maharashtra found that *P. xylostella* reached at peak during the first fortnight of November, which contradicted the current findings.

In the present investigation, it was observed that the cool temperature and comparatively high relative humidity favored quick multiplication of *P. xylostella*, while the high temperature along with high relative humidity reduced its population considerably, which was in accordance with the findings of Lee (1986) and Vishwakarma and Pachori (2002).

REFERENCES

Anonymous (2002). *Economic Survey of Govt. of India*, 2001-02, p.191.

Chand, P. and Choudhary, R. (1977). Patterns of insect plant relationships determining susceptibility of food plants in the diamondback moth, *Plutella xylostella* (L) Curtis. *Mysore. J. Agric. Sci.* 11:547-549.

Chelliah, S. and Srinivasan, K. (1986). Bioecology and management of diamond back moth in India. *In Diamond- back moth management. In : Proceeding of the First International Workshop*, Tainan, Taiwan, 11-15 March, 1985; p. 63-76.

Choudhary, B.S. (1967). Survey of insect pest of crucifer and bionomics of diamondback moth, *Plutella xylostella*. *M. Sc. (Ag.) Thesis, Department of Entomology*, JNKVV. Jabalpur (M.P.), P. 20-45.

CIE (1967). Distribution Maps of Pests-Map No. 32 (Revised), Commonwealth Institute of Entomology, London, UK.

Devjam, P. and Singh, T.K. (1999). Field density and biology of diamondback moth on cauliflower in Manipur. *J. Adv. Zool.,* 20 (1):53-55.

Dube, R. B. and Chand, P. (1977). Effect of food plants on the development of *Plutella xylostella* (L) (Lepidoptera, Plutellidae). Entomon. 2: 139-140.

Fletcher, T. B. (1914). Some South Indian Insects. Superintendent Government Press, Madras. pp. 565.

Hardy, J. E. (1938). *Plutella maculipennis* (Curt.) its natural and biological control in England. Bull. Entomol. Res. 29:343-372.

Jayarathnam, K. (1977). Studies on the population dynamics of the diamondback moth, *Plutella xylostella* (Linnaeus) (Lepidoptera: Yponomeutidae) and crop loss due to the pest in cabbage. *Ph. D. Thesis*. University of Agricultural Sciences. Bangalore. pp. 215.

Khaire, V.A.; Lawande, K.E.; Ajri, D.S. and Kale, P.N. (1987). Occurrence of insect pests on different cauliflower cultivars. *Current Research Reporter, Mahatma Phule Agricultural University*, 2 (2): 205-208.

Lee, H.S. (1986). Seasonal occurrence of the important insect pests on cabbage in Southern Taiwan. *J. Agric. Res. China,* 35(9): 530-542.

Singh, S. P. and Singh, D. (1982). Influence of cruciferous host plants on the survival and development of *Plutella xylostella* L. *J. Res. Punjab Agric. Univ*. 19:100-104.

Srinivasan, K. and Krishnakumar, N.K. (1982). Pest management in cabbage, In *Ann. Rep. Ind. Inst. Hort. Res*., Bangalore, India. pp. 80-81.

Talekar, N.S. (1990). Development of an integrated pest management program for the control of diamond-back moth on crucifers vegetables. In : Opena, T.T. and Kyomo, M.L. (ed.) Vegetable Research and Development in SADCC countries, AVRDC, Shanhua, Taiwan, p. 147-157.

Vishakantaiah, M. and Gowda, B.L.V. (1975). Record of *Plutella xylostella* (Linnaeus) as a new pest of *Amaranthus viridis* in Karnataka. Curr. Sci. 44:869.

Vishwakarma, R.K. (2002). Management of diamondback moth, *P. xylostella* (L.) on cabbage. *M. Sc. Thesis,* Department of Entomology, JNKVV, Jabalpur (M.P.).