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Population dynamic of cabbage butterfly (*Pieris brassicae* (L.)) in district Sultanpur (U.P.) - A review

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Abstract

Cabbage or headed cabbage (comprising several groups of cultivars of *Brassica oleracea*) is a leafy green or purple biennial, grown as an annual vegetable crop for its dense-leaved heads. Cabbage butterfly, *Pieris brassicae* (L.) has emerged as one of the major insect pest of cabbage. Lot of works has been done by several researchers on the population dynamics and evaluation of synthetic and biological pesticides for its management. In the Lenkoran' region of Azerbaijan the seasonal occurrence, number of generations and percentage of the population entering diapause of *Pieris brassicae* which were mainly influenced by changes in day length and ambient temperature. The population dynamics of *Pieris rapae* in Skierniewice and the number of larvae per plant varied from 1.2 to 1.7. *Pieris rapae* was observed at the beginning of July in all years. In Lipnik, the pest was initially observed at the end of August in 1997, in the second fortnight of July in 1998, and at the beginning of June in 1999. In all years, infestation lasted up to the second half of November, suggesting that two generations developed per year.

Keywords: Cabbage, *Pieris brassicae*, Brassica, Population

Introduction

Cabbage or headed cabbage (comprising several groups of cultivars of *Brassica oleracea*) is a leafy green or purple biennial, grown as an annual vegetable crop for its dense-leaved heads. Closely related to other Cole crops, such as a broccoli, cauliflower, and Brussels sprouts, it descends from *B. oleracea* var. *oleracea*, a wild field cabbage (Cabbage Wikipedia). Cabbage butterfly, *Pieris brassicae* (L.) has emerged as one of the major insect pest of cabbage. Lot of works has been done by several researchers on the population dynamics and evaluation of synthetic and biological pesticides for its management. However, the entire information is scattered and not available at one place, as such the work done by several scientists on different topics indicated as above has been reviewed here under topic wise.

Population dynamic of cabbage butterfly [*Pieris brassicae* (L.)]

Gupta *et al.* (1984) [3] reported that adults appear in mid-February from the plains of Punjab and eggs were laid soon after. There were at least 4 generations before September on cauliflower. Larvae of the first generation were also observed to feed on other *Brassica* crops (mainly radish and mustard) and also on wild crucifers. Studies on potted cauliflowers kept outdoors using eggs collected from the field, revealed that eggs hatched in 5-7 days and the larval period for each of the 4 generations was 30, 22, 15.5 and 18.5 days, respectively. The pre-pupal and pupal stages lasted in 1.5-2 and 8.5-10 days, respectively. The larval period of individuals were hatched from eggs collected in the field in November was 50, respectively, indicating that there is no pupal diapause in this region, but that development is slower in winter. It was also reported that the sudden appearance of *P. brassicae* in February is due to migration and the exclusion of overwintering pupae. Mortality of larvae due to parasitism and bacterial infections was 50-70%. The braconid *Apanteles glomeratus* was heavily parasitized by eulophid *Tetrastichus* sp. and *T. rapo*.

Atak *et al.* (1984) [1] studied the ecology of cabbage butterfly in 1973-81 in the Marmara, Turkey. *P. brassicae* had 4-6 generations in a year. *Bacillus thuringiensis* was applied for several months to the control of *Pieris brassicae* under differing weather conditions. In the Erenkoy and Cayirova districts, both the preparations used (Dipel® and Thuricide®) compared favourably with DDVP [dichlorvos], giving 89-100% control as compared with 58-72%.

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Zuranska and Ciepiewska (1985)^[10] reported in the Olsztyn region, Poland that the first larvae appeared after 6 days and large number of eggs was laid in early August and early September, while larval abundance was greatest in mid-August and September. The time of appearance of adults, eggs and larvae and population size depend on weather conditions, especially temperature; high temperatures and low precipitation were favourable. 31.5 to 80.8% of larvae were killed by the braconid parasite.

Mustafaeva *et al.* (1989)^[6] reported in the Lenkoran' region of Azerbaijan the seasonal occurrence, number of generations and percentage of the population entering diapause of *Pieris brassicae* which were mainly influenced by changes in day length and ambient temperature.

Sachan and Gangwar (1990)^[8] reported the incidence of insect pests of cabbage, cauliflower and knol-khol at shillong area of Meghalaya, India, in 1968-1978. *Pieris brassicae* was the major pest and found throughout the year, with maximum activity from February to October. Other pests like *Brevicoryne brassicae*, *Agrotis ipsilon* and *A. flammatrix* damaged the crop from July to December.

Matin *et al.* (1992)^[5] conducted a field cage studies in the cauliflower with varieties of Snowball and Snowdrift which were artificially infested with *Pieris brassicae*, in order to find out a quantitative relationship between the population of the pierid and the amount of damage. The relationship between the number of eggs produced and per cent leaf damaged was described by the equation $y = 19.91 + 0.5x$ ($r = 0.87$), and $y = 6.18 + 0.58x$ ($r = 0.98$) for Snowball and Snowdrift, respectively.

Ranjeet *et al.* (1995)^[7] revealed that, *Brevicoryne brassicae*, *Pieris brassicae*, *Plutella xylostella* and *Plusia orichalcea* as for regular pest in the cole crops. Their sequence of appearance and number was in descending order.

Bhatia *et al.* (1995)^[2] observed the six insect pests attacking cole crops in West Bengal, India. Among which *Pieris brassicae* was the most serious and abundant, followed by *Spilosoma obliqua*. Both pest preferred to infest the cabbage. *Brevicoryne brassicae*, *Plusia orichalcea*, *Pieris rapae* and *Plutella xylostella* were recorded as low density pests on the cole crops.

Jitender *et al.* (2000)^[4] reported that 8 insect species (*Agrotis ipsilon*, *A. segetum*, *Pieris brassicae*, *Plutella xylostella*, *Plusia orichalcea*, *Helicoverpa armigera*, *Lipaphis erysimi*, *Brevicoryne brassicae*) infesting the cabbage cv. Golden Acre planted at one month interval from March to June 1992 and 1993. While aphids, *B. brassicae* and *L. erysimi*, were found to infest only the crops planted in March and April. Total yield was statistically similar in March (85.62 q/ha), April (99.03 q/ha) and May (79.71 q/ha) transplanted crops. Marketable yield was significantly higher in the crop transplanted in March (74.83 q/ha) than April (52.72 q/ha) but at par with May (61.99 q/ha) transplanted crop. From transplanting to marketing of heads, damage to the crop due to insect pests was maximum in April transplanted crop (42.11%).

Tratwal and Grendowicz (2000)^[9] reported the occurrence of *Mamestra brassicae*, *Pieris brassicae* and *Laspeyresia nigricana* during the last seven years in Poland. The average level of damage caused by these pests were differed for, *Mamestra brassicae* L. (12.8%) and *Pieris brassicae* (18.9%) and for *Laspeyresia nigricana* (4.1%) damage, respectively. For this reason, it is important to run continuous monitoring of their incidence in order to assist the best control measures.

Chaudhuri *et al.* (2001) investigated the seasonal incidence of several insect pests (aphids, *Lipaphis erysimi*; flea beetles,

Phyllotreta brassicae; cabbage butterfly, *Pieris brassicae*; cabbage leaf webber, *Crociodolomia binotalis* [*C. pavonana*]; and diamond back moth, *Plutella xylostella*) infesting cabbage cv. Sabitri grown during winter and spring in a field in West Bengal, India, during 1996-98. Aphid, flea beetle, cabbage butterfly, leaf webber and moth population was maximum during 3rd, 4th, 2nd, 1st and 4th week of March, on spring crop. Winter aphid population was negatively correlated with temperature, sunshine hours per day, and total rainfall and positively correlated with average relative humidity. Flea beetle showed positive correlation with average temperature and sunshine hours per day. During spring, aphid, flea beetle and cabbage butterfly populations showed positive correlation with average relative humidity and total rainfall. Larval populations of leaf webber and diamond back moth showed positive correlation with average temperature, relative humidity and total rainfall, but negative correlation with average sunshine hours per day. Results indicate that increase in temperature, sunshine hours per day and rainfall, and decrease in relative humidity favoured the multiplication of the pests on spring cabbage. Spring cabbage was infested by greater pest populations compared to winter cabbage.

Devi and Singh (2002) conducted a field experiment in Manipur, India during 1996-97 and 1997-98 to investigate the population dynamics of *Pieris brassicae* on Chinese cabbage. *P. brassicae* infestation was observed throughout the year. Pest was observed from November to February in the heading stage, and from March to June in the ratoon stage. It was associated with a braconid larval parasitoid and chalcid pupal parasitoid. These parasitoids were observed only in the ratoon crop. Larval mortality was in the range 0.52-11.10%, while pupal mortality during April/May was in the range 0.85-5.63%.

Rogowska and Szwejdka (2002) studied the population dynamics of *Pieris rapae* in Skierniewice and the number of larvae per plant varied from 1.2 to 1.7. *Pieris rapae* was observed at the beginning of July in all years. In Lipnik, the pest was initially observed at the end of August in 1997, in the second fortnight of July in 1998, and at the beginning of June in 1999. In all years, infestation lasted up to the second half of November, suggesting that two generations developed per year.

Younas *et al.* (2004) carried out studies on population dynamics of Cabbage butterfly and cabbage aphids on different Cultivars of cauliflower namely Snowball, Snowdrift, Tropical, Pioneer and Meigettsal at the Research Farm of Entomology Section, Agricultural Research Institute, Tarnab, Peshawar. Cabbage butterfly and aphids were recorded as the major insect pests of Cauliflower crop at ARI, Tarnab and Peshawar. None of the five cultivars was found completely resistant to the infestation of cabbage butterfly and aphids. The highest population of 86.67 larvae/plant was recorded in the first week of November and the lowest population of 0.67 larvae/plant was recorded in the first week of December. The lowest and the highest mean population of larvae was observed on Cultivars Meigettsal and snow ball, respectively.

Lal and Bhajan (2004) reported that cabbage butterfly as emerging serious pest of *Brassica* oilseeds in Eastern Uttar Pradesh and other parts of India during Rabi 2001 and 2002. It has been found to cause severe damage to *B. campestris* var. sarson in February 2002 and *B. carinata* in March of the same year. Thus, the occurrence of cabbage butterfly in *Brassica* oilseed crops has become a serious threat and deserves concerted research efforts.

Jainulabdeen and Prasad (2004) studied the impact of abiotic factors on population fluctuations of cabbage butterfly under agroclimatic conditions of New Delhi (India) during the 2000-2001 rabi season on six species of *Brassica* (*B. campestris* cv. Pusa Kalyani, *B. juncea* cv. Pusa Bold, *B. napus*, *B. carinata*, *B. nigra* and *B. Alba*). *P. brassicae* appeared during the 9th standard week and reached its peak (12 larvae per plant) in the 11th standard week, i.e. 3rd week of March, and thereafter the population declined but pest remained in the field till 13th standard week. The mean temperature (ranging from 17.6 to 23.8 degrees °C), relative humidity (65.3%), wind velocity (1.8 km/h) and sunshine (7.3 h) were found favourable for mass multiplication of *P. brassicae*. Correlation studies showed that the population was non-significantly and negatively correlated with maximum, minimum and mean temperature, while relative humidity, at morning and evening, mean showed significant negative correlation on population dynamics with (r) values of -0.782, -0.933, -0.938, respectively. Wind velocity showed non-significant, negative correlation, but sunshine hours showed non-significant positive correlation with population of *P. brassicae*.

Jankowska (2006) observed that the pests differentiated among the host species for oviposition. The females of all species preferred Brussels sprouts for oviposition and deposited a substantially larger number of eggs on leaves of this plant. Plant species with green leaves were more preferred than plants with red leaves.

Ahmad *et al.* (2007) revealed in Jammu that the pest appeared in the 43rd standard week and remained active up to 7th standard week, with the peak population (58.10 larvae per plant) in the 50th standard week. However, the pest population was not significantly correlated with the abiotic factors.

Pankaj (2007) reported that cabbage butterfly as the most serious pest of cabbage in the Sangla valley of Himachal Pradesh. It appeared in the first week of May, immediately after transplantation of cabbage. The infestation of *P. brassicae* varied throughout the season. Higher incidence of *P. brassicae* was recorded in cabbage crop transplanted during last week of April and second fortnight of May. The incidence of *P. brassicae* was very low in cabbage transplanted after mid-June. However, low temperature and frost injury at the time of crop maturity resulted in poor cabbage yield. Significantly higher marketable cabbage yield was recorded in June second week (267.47 q/ha) and May second week (260.07 q/ha) transplanted crop. The yield losses due to *P. brassicae* was almost similar in all the transplanted dates (25.83 to 47.06 q/ha), except in the crops transplanted after First week of June. Yield losses due to other factors (diseases and abiotic stresses) were maximum in June third week (98.50 q/ha) and June fourth week (108.75 q/ha) transplanted crop.

Prashant *et al.* (2007) reported at Crop Research Centre, S.V.B.P.U.A. & T, Meerut that *Pieris brassicae* appeared only on late season crop, i.e. the last week of January to the last week of March. The population was positively correlated with the mean temperature but negatively correlated with relative humidity.

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