I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3. 03

# Field Density and Management of *Pieris brassicae* under the Climatic Conditions of the Valley Region of Manipur

**M. Sharmila*, P. Devjani and N. Irabanta Singh**

***ABSTRACT:*** *Population trend of Pieris brassicae Linn. was studied on cauliflower for two cropping seasons i.e. during 2013-15 in the experimental field of Life Sciences Department, Manipur University. Infestation of Pieris brassicae larvae began from last week of November and extended upto last week of April under the climatic conditions of Manipur with maximum density during February and March in both the cropping seasons. Simple correlation analysis between the pest's population and biotic and abiotic factors showed that none of the abiotic factors significantly influenced the density of pest's incidence in the late crop whereas biotic factors significantly influenced the density of pest. As many as 22 different insect species were found associated with cauliflower. In addition 7 plants extract such as Azadirachta indica, Phlogacanthus thyrsiflorus, Vitex trifolia, Centella asiatica, Ageratum conyzoides, Lantana camara, Parthenium hysterophorus etc were evaluated against Pieris brassicae under laboratory condition. The overall results revealed that all plant extracts have antifeedent property. Among the plant extracts Azadirachta indica, Vitex trifolia, Phlogacanthus thyrsiflorus, Parthenium hysterophorus and Lantana showed antifeedent property and may be used as bio-pesticides under the field conditions.*

*Key words:: Larval population, Pieris brassicae, Cauliflower, Manipur.*

## INTRODUCTION

*Pieris brassicae* Linn (Lepidoptera: Pieridae) commonly known as large cabbage white butterfly is one of the major pests of cruciferous crops throughout the world and has been reported to cause significant economic loss [1]. The cruciferous vegetables like cabbage, cauliflower, knolkhol, radish and mustard are extensively grown in Manipur as winter crops. Among the cruciferous, *Brassica oleracea* var *botrytis* is an important crop which is widely cultivated and occupies an important status in agricultural economy of the state. Cauliflower covers about 1000 ha growing area in Manipur along with production of 10,000 tonnes per ha. annually[2]. However this crop is attacked by about 24 species of insect pest [3] and by 44 species throughout the world [4] among these *P. brassicae* is the most serious one. Sometimes massive outbreaks of this pest may occur and injury on cauliflower crops could be extensive. As the use of insecticides has its own limitation it has become necessary to evaluate the efficacy of plant extracts and their possible use in the integrated pest management strategy. Studies on seasonal incidence nature and extent of damage of this pest associated with the Cole crops had been done by many workers [5, 6]. However meagre information is presented with respect to this important pest on cauliflower in the state. Thus taking into consideration, the importance of *P. brassicae* as a key pest of cauliflower the present work thus initiated to study the population trend and its associated pest and its management under agro-climatic conditions of Manipur. The study also includes simple observations on efficiency of the plant extracts against the pest under the laboratory conditions.

## MATERIALS AND METHODS

Studies were carried out at the experimental site, Department of Life Sciences, Manipur University for two cropping seasons (2013-2015). About 30 days old seedlings were planted at the distance of 45cm. each

* Centre for Advance Study in Life Sciences, Manipur University
*E-mail: maibamsharmila@gmail.com*

between the plants and also rows. The crop was raised as per recommended practices of state Agricultural Department of Manipur to study the population trend of *P. brassicae,* 50 plants were randomly selected and screened for the occurrence of *P. brassicae* at 7 days interval. This exercise was continued till disappearance of the pest or harvest of crop and percentage of parasitism was calculated as percent of number of parasitized insects over total number of insects. The adults were collected from the field using simple nets whereas the immature stages (eggs and larvae) were brought to laboratory and reared separately at temperature of 25± 2°c by maintaining till adult emergence for identification. The data on the weather parameters like temperature, relative humidity, rainfall and sunshine were also collected from nearby meteorological observatory in order to correlate the fluctuation of the pest in response to the climatic factors. to test the efficacy of the plant extracts in the laboratory, egg clusters were collected from field and kept in Petri plates (10 cm. diameter). Newly hatched larvae were transferred to cauliflower leaves with their Petioles dipped in water in glass vials inside the wooden rearing cages. Fresh foliage was provided daily till pupation. Then the newly hatched adults were provided with sugar solutions (10%) soaked in cotton swabs and some shoots of cabbage/ cauliflower

**Collection of plant materials**

Samples of the test plants viz. *Azadirachta indicia A. Juss*, *Centella asiatica(Linn), Ageratum conyzoides L., Lantana camara Linn*, *Phlogacanthus thyrsiflorus Nees*, *Vitex trifolia Linn* and *Parthenium hysterophorus L.* were collected from different places of Manipur (Table 1). Selected plant materials were washed thoroughly and air dried in shade for 6-7 days and powdered using a mixer so as to make approximately uniform size coarse powder.

**Table 1**
**Description of selected plant species**

| *Local name* | *Botanical name* | *Family* | *Plant part used* |
|---|---|---|---|
| Neem | *Azadirachta indica* A. Juss | Meliaceae | Leaves |
| Snake Jasmine | *Phlogacanthus thyrsiflorus* Nees | Acanthaceae | Flower and leaves |
| Indian pennywort | *Centella asiatica (L.)Urban* | Apiaceae | Whole plant |
| Goatweed | *Ageratum conyzoides* L. | Asteraceae | Flower and leaves |
| Indian three-leaf | *Vitex trifolia* Linn. | Verbenaceae | Flower and leaves |
| Lantana | *Lantana camara L.* | Verbenaceae | Whole plant |
| Congress grass | *Parthenium hysterophorus L.* | Asteraceae | Flower and leaves |

**Preparation of aqueous extract**

The aqueous extract of plant material was prepared under laboratory conditions by taking 10 gm. of dried powder of each test plant in a beaker separately and 90 ml of distilled water was added, stirred thoroughly and kept for 24 hours. Then it is filtered and the filtrate is used for the experiment. Fresh host leaves were sprayed with aqueous plant extract individually and later air dried. Three replicates were maintained for each treatment and one without plant extract. Therefore altogether 21 cultures were maintained. In each culture, three larvae were introduced after starving for one hour before the experiment. Observation was taken after 24 hours.

**RESULTS AND DISCUSSION**

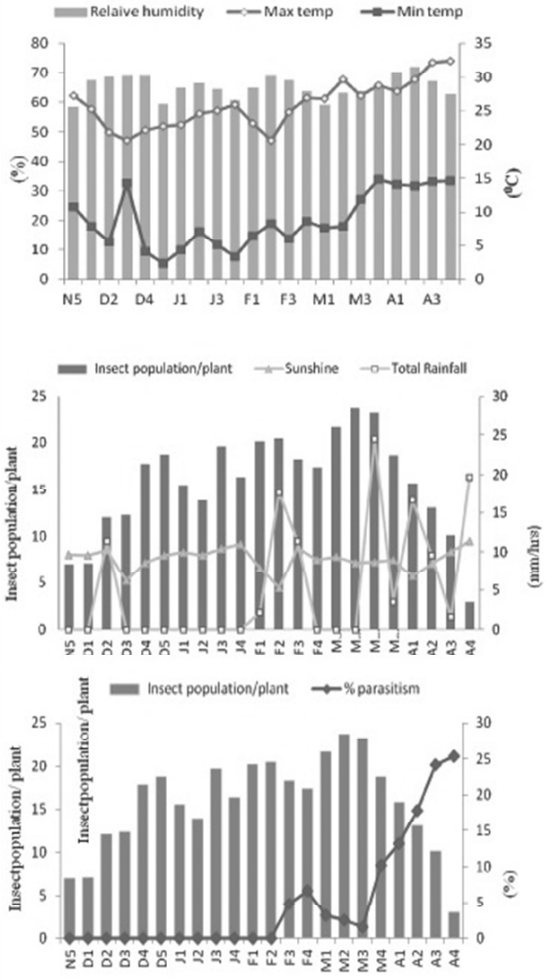
The data on *P. brassicae* infestation on Cauliflower (Fig. 1 and 2 ) during the two cropping seasons (2013-14 and 2014-15) revealed that the infestation of the pest commenced during the last week of November and continued till harvesting upto April. In the first cropping season (2013-14), initially the population of the pest was very low (7.04 pests/sample) and it gradually increased with slight fluctuation and a maximum population of 23.22 larvae/ sample was recorded during third week of March and then gradually decreased. However, this trend showed slight variation during 2014-15. The initial population of the pest was 6.02 pests/sample and it gradually increased with a maximum of 21.35 individuals during the last week of March. Thereafter, a decline in the population was observed from second week of April. *Devi & Singh* [7] recorded the peak activity of *P. brassicae* on cauliflower during March which was in agreement with the present finding. In both the cropping seasons period of pest infestation was almost similar. During the peak period of the pest, the average temperature, relative humidity, sunshine and rainfall was 27°C, 67%, 5.66 hrs and 22.6 mm.

**Table 2**
**Correlation coefficient(r) between pest population and abiotic and biotic factors**

| *Factors* | *Cropping seasons* | |
|---|---|---|
| | *2013-14* | *2014-15* |
| Max Temp. | -0.30 | -0.15 |
| Min Temp | -0.25 | -0.8 |
| R.H. | -0.10 | -0.03 |
| Rainfall | 0.17 | 0.20 |
| Sunshine | -0.41 | -0.39 |
| Parasitism | 0.52* | 0.86* |

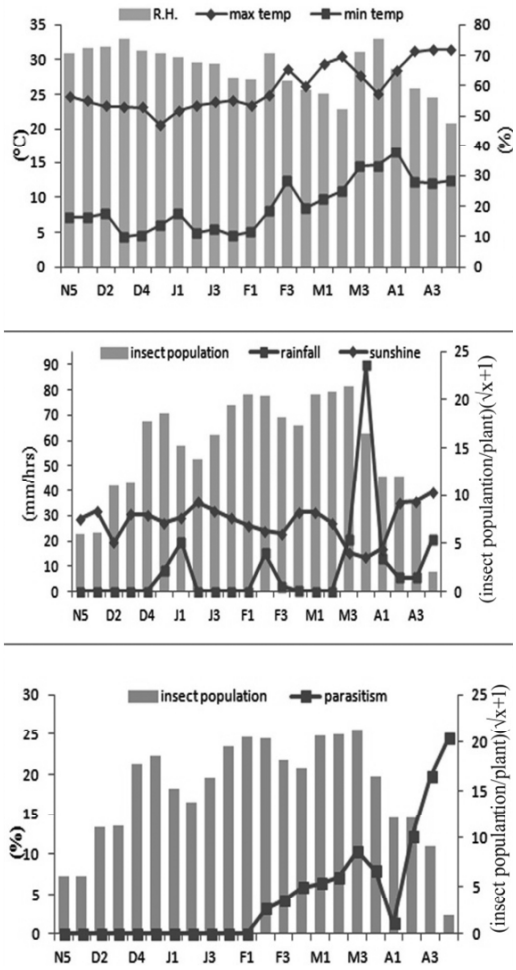
*P< 0.05

Simple correlation analysis of *Pieris brassicae* population with different climatic factors (Table 2) revealed that none of the environment factors significantly influenced the incidence of pest during the cropping seasons, whereas biotic factors significantly influenced the pest incidence. These observations are in agreement with those of *Devi and Singh* [7].




Observation in week

**Figure 1. Population incidence of *Pieris brassicae* in relation to abiotic and biotic factors on Cauliflower (2013-14)**




Observation in week

**Figure 2. Population incidence of *Pieris brassicae* in relation to abiotic and biotic factors on Cauliflower (2014-15)**

During the cropping season in addition to *P. brassicae*, a number of other pest species were observed and they consisted of three species of aphids, two members of the genus *Pieris*, semilooper (*Thysanoplusia orichalcea*), diamond back moth (*Plutella xylostella*), the polyphagous pest species *viz H. armigera*, *S. litura,* and *S.obliqua*, the *Chrysomellid P.nemorum* and grasshoppers *A. crenulata* and *Oxya hyla hyla*. Further natural enemies such as three coccinellid predators and one species each of braconid parasitoids and crambidae were also collected from the cauliflower field.

The occurrence of these insect pests showed variations in terms of density and species composition at various stages of plant growth. Earlier, *Devjani* [8] had recorded 20 species of natural

**Table 3**
**Associated pests and their incidence period during cropping season (2013-2015)**

| *Family* | *Insect pests* | *Stage* | *Period of incidence* |
|---|---|---|---|
| Aphididae | *Myzus persicae* (Sulzur) | nymph, adult | Jan-March |
| | *Lipaphis erysimi* (Kaltenbach) | nymph, adult | Jan-March |
| | *Brevicoryne brassicae* L. | nymph, adult | Jan-March |
| Pentatomidae | *Eurydema pulchrum* Westwood | adult | Nov-March |
| Pieridae | *Pieris canidia* (Sparr | larva, pupa, adult | Oct-March |
| | *Pieris daplidica* moorei R. | larva ,pupa, adult | Nov-Jan, April |
| | *Pieris brassicae* Linn. | larva, pupa, adult | Oct-April |
| Noctuidae | *Thysanoplusia orichalcea* | larva | Nov-March |
| | Fabr.*Helicoverpa armigera* | larva, adult | March |
| | Hub.*Spodoptera litura(*Fabr.*)* | larva | Feb-March |
| Plutellidae | *Plutella xylostella* Linn | larva, pupa, adult | Nov-April |
| Arctiidae | *Spilosoma obliqua* Walk | larva | Mar-April |
| Chrysomellidae | *Phylotreta nemorum*(L) | adult | Nov-March |
| Acridiidae | *Atractomorpha crenulata* | adult | Nov-December |
| | Fabr.*Oxya hyla hyla Serv.* | adult | Jan-Feb |
| Syrphidae | *Episyrphus balteatus* (De Geer) | larva, adult | Jan-March |
| | *Ischiodon scutellaris* (Fabr.) | larva, adult | Jan-March |
| | *Paragus serratus* (Fabr) | adult | Jan-March |
| Coccinellidae | *Coccinella septempunctata L* | larva, adult | Jan-March |
| | *Coccinella transversalis* (Fabr.) | larva, adult | Feb-March |
| | *Cheilomenes sexmaculata(*Fabr.*)* | larva, adult | March |
| Braconidae | *Cotesia glomeratus* Linn. | larva, adult | Feb-March |
| Crambidae | *Diaphania hyalinata* Linnaeus | larva, adult | Oct-Nov |

enemies from the cauliflower ecosystem in Manipur. *Badjena and Mandal*[9] recorded only six species (four coccinellids and two syrphids) from Orissa. From the above observation it is evident that due to variations in cropping seasons and agro- climatic conditions from place to place there are a change in seasonal incidence and predatory complex of Cauliflower.

Plant products have proved to be useful in formulating sound pest management strategies [10]. Several plant parts and their products are known to be potent source of insecticides [11]. Therefore, the use of plant insecticides has been recommended as a suitable alternative of plant protection with minimum negative risk [12]. Overall observations on the effect of aqueous extract of selected plant species against *Pieris brassicae* after 24 hour is presented in (fig. 3).

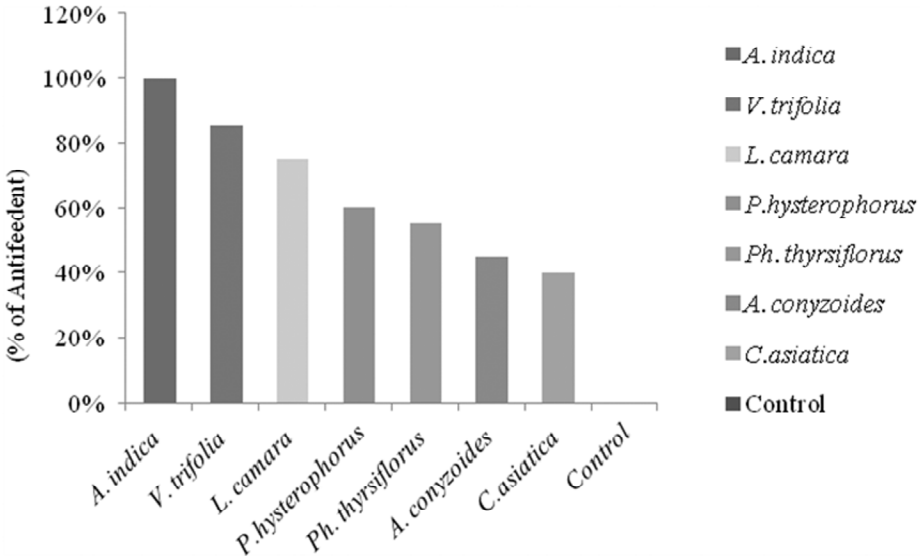



**Figure 3. Antifeedent effect of plant extracts on the *Pieris brassicae* larvae after 24 hrs of treatments**

All the seven plant extracts have antifeedent properties. The aqueous extract of *Azadirachta indica* A. Juss, *Vitex trifolia* Linn., *Lantana camara L., Parthenium hysterophorus L.,* and *Phlogacanthus thyrsiflorus* Nees showed better efficient antifeedent property against larvae of *P. brassicae* . Sharma and Gupta [13] also obtained somewhat similar results while testing *P. brassicae* with *Azadirachta indica* A. Juss and *Lantana camara.* The above observations indicate that *P. brassicae* could be managed effectively by adopting appropriate integrated pest management (IPM) measures. *Azad Thakur*[14] also suggested that IPM is the better management economics for *P. brassicae* without harming the bioagents and environment. Similar findings on effect of plant extracts against *P. brassicae* were emphasized by *Sharma*[15] and *Sirzad et al.*,[16] in the context of *P. brassicae* management.

**ACKNOWLEDGEMENT**

I would like to acknowledge Science and Engineering Research Board (SERB) for funding. I wish to thank Professor R.Varatharajan for his efforts in improving this paper. I am grateful to the Head, Department of Life Sciences, Manipur University for providing necessary facilities to carry out the present work.

**REFERENCES**

Sachan, J.N. and Gangwar, S.K. (1990), Seasonal incidence of insect pests of cabbage, cauliflower and knoll-khol. Indian J. Ent. **52**: 111-124.

Anonymous (1999-00), *Yield Estimation,* Department of Horticulture & Soil Conservation.

Devjani, P. and Singh T.K. (2002), Insect pest and natural enemy complex of cauliflower in agro-ecosystem of Manipur. Indian Journal of Entomology., 64(3); 275-278.

Bonnemaison, L. (1965), Insect pests of cruciferous and their control. Ann.Rev. Ent. **10:** 233- 256.

Dutta, S.K.(1994), Absolute population trends of *Pieris brassicae (*L) larvae on *Brassica* oilseed crops. Geobios. 21: 192-194.

Bhalla, S., Kapur, M.L., Verma, B.R. and Singh, R.(1997), An unusual abundance of cabbage butterfly *Pieris brassicae (*Linn) on various Brassicae species in the environs of Delhi for locating source of resistance among different cultivars. J. Ent. Res. 21(2): 147-151.

Devi and Singh (2000), 'Systematic Survey, Bio- Ecology and Nutritional ecology of Major insect pest of Cauliflower in Manipur'. Final technical report of CSIR sponsored research project.

Devjani, P. (1999), Bio-ecology and management of insect pests of cauliflower in Manipur. Ph.D. Thesis, Manipur University.

Badjena T., Mandal , S.M.A.(2005), Seasonal incidence of major insect pests and predators in cauliflower. Annals of Plant Protection Sciences, 13(2): 472-473.

Kashyap, N.P.; Sharma, D.C.; Bhagat, R.M. and Suri S.M. (1993), Bioefficacy of insecticides against potato tuber moth. Journal of Indian Potato Association. 20(2): 179-181.

Parmar, B.S. (1993), Scope of botanical pesticides in Integrated Pest Management. Journal of Insect Science, 6(1): 15-20.

Pavela, R. (2009), Effectiveness of some botanical insecticides against *Spodoptera littoralis* Biosduvala (Lepidoptera: Noctudiae), *Myzus persicae* Sulzer( Hemiptera: Aphididae) and *Tetranuchus urticae* Koch(Acari: Tetranychidae). Plant Protection Science, 45:161-167.

Sharma, A. and Gupta R. (2009), Biological activity of some plant extracts against *Pieris brassicae* (Linn.). Journal of Biopesticides, 2(1): 26-31.

Azad Thakur, N.S. (1996), Management of cabbage butterfly, *Pieris brassicae (*Linn) in Meghalaya. IPM and Sustain -Agri- an ent. Appr.6: 183-186.

Sharma, S.(2008), Bio-efficacy of some plant derivatives against cabbage butterfly (*Pieris brassicae*). Pestology, 32(5): 20-22.

Sirzad, V., Sahak, B., Pourmirza, A. And Gosta, Y.(2011), Study on the combined ipact of citowett and commercial neem extract against *Pieris Brassicae* L. under laboratory conditions(Lepidoptera: Pieridae). Munis Entomology & Zoology, 6(1): 460-463.