

## Studies on pest complex of broad leaf mustard, *Brassica juncea* var. *rugosa* Roxb.

Tsen and Lee in the Valley of Manipur

### Abstract

A field experiment was conducted in the Experimental field of Department of Entomology, Entomological Research Farm, College of Agriculture, Central Agricultural University, Imphal, during Rabi, 2019-20 to study the seasonal incidence of pest complex of broad leaf mustard and abundance of natural enemies of pest complex. During the experiment, 11 (eleven) insect pest species were found to infest the crop. Large cabbage white butterfly, *Pieris brassicae*; Asian cabbage white butterfly, *Pieris canidia*; mustard aphid, *Lipaphis erysimi* and striped flea beetle, *Phyllotreta striolata* were observed frequently. Cabbage aphid, *Brevicoryne brassicae*; green peach aphid, *Myzus persicae*; crucifer flea beetle, *Phyllotreta cruciferae*; mustard sawfly, *Athalia lugens proxima*; cabbage semilooper, *Trichoplusia ni*; fungus beetle, *Monolepta signata* and tobacco grasshopper, *Atractomorpha crenulata* were observed rarely.

**Keywords:** Pest complex, Broad leaf mustard, Sucking pests, Defoliators

### Introduction

Broad leaf mustard, *Brassica juncea* var. *rugosa* Roxb. Tsen and Lee belongs to the family Cruciferae of the genus *Brassica*. This Broad leaf mustard crop is different from commercial mustard species meant for oil production. It is one of the most important vegetable crops found in Manipur and other N.E States of India. The vegetable is a rabi season crop, but for last one or two decades it has been cultivated throughout the year as the demand increases. The estimation of crop damage due to insect pests is important since it provides updated information about the amount of damage inflicted to crops by different insect pests, helps in assigning priorities based on the relative importance of insect pests, for deciding the allocation to research and extension in plant protection and for evaluating crop varieties for their susceptibility/resistance to insect pests.

### Materials and Methods

To identify the Seasonal incidence of pest complex of Broad leaf mustard, *Brassica juncea* var. *rugosa* in Manipur an experiment was conducted during Rabi, 2019-20 in the Experimental field of Department of Entomology, Entomological Research Farm, College of Agriculture, Central Agricultural University, Imphal. The soil type was clayey. The experimental was located at 24° 81'N latitude and 93° 89'E longitude in the valley of Manipur.

The local cultivar of Broad leaf mustard 'Lamtachabi' seeds @ 4kg/ha were sown in nursery bed prepared with fine sandy loam soil mixed with compost. Linesowing was followed with a spacing of 10 cm between line to line. Proper watering was done at regular intervals till the

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seedlings attain transplanting stage. Three sowing dates were maintained for 3 transplanting dates i.e., nurseries were sown on 1<sup>st</sup> November, 2019; 1<sup>st</sup> December, 2019; and 1<sup>st</sup> January of 2020. The recommended agronomic and inter cultural practices for cultivation of Broad leaf mustard were adopted. The field was ploughed four times for fine tilth. Recommended FYM was added at the time of ploughing for proper mixing with the soil. Beds were made to a size of 4m x 5m. The recommended dose of NPK was applied at the rate of 80: 40: 40 g per plot. Thirty days old seedlings from the nursery were transplanted from to the main field with a spacing of 45cm X 45cm. Irrigation was provided at the time of transplantation and throughout the cropping period as and when needed. Earthing up was done. Weeding were also carried out regularly for reducing the crop weed competition.

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#### **Sucking pests**

Population of sucking pests viz. aphids and hoppers were counted from 3 randomly selected leaves (i.e., 1 leaf each from top, middle and lower portion) of a plant. From each plot five plants were randomly selected for observation. Hence in a plot, 15 leaves were observed. However, for painted bug, total number of bug population in a plot from the five randomly selected plants was counted. After counting the population average number of aphids/leaf or hopper/leaf were worked out. For painted bug average number of bugs/plants were worked out.

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#### **Defoliators**

The population of beetles, grasshoppers, caterpillars, etc. were counted from the whole parts of the randomly selected 5 plants of each replication for observation. Different cabbage butterfly species were counted separately. After counting the population, average population per plant were worked out.

## Statistical Analysis

The experiment on the evaluation of seasonal incidence of pest complex and their natural enemies of broad leaf mustard was conducted by using Randomized Block Design (RBD). The data were analysed through Microsoft Excel with the help of analysis of variance (two-way classification). The data of the experiment was transformed by using square root transformation and angular transformation wherever necessary in order to make the analysis of variance valid and feasible. When F values were found significant, then treatment means were compared by using CD (critical difference) values at 5% level of probability. The CD value was obtained by multiplying the standard error of mean difference with table value of t at 5% level of probability for error degrees of freedom (d.f.). Proper results and interpretation were made based on this analysis.

### Result and discussion:

#### Asian white cabbage butterfly, *Pieris canidia* (L.)

During the study period, two species of cabbage butterfly i.e., *Pieris canidia* and *Pieris brassicae* were observed. In the 1<sup>st</sup> November transplanted crop, cabbage butterfly population range from 0.10 larvae/plant to 2.24 larvae/plant and the highest population was recorded at 56 days after transplanting (DAT). The incidence of *P. canidia* was higher in 1<sup>st</sup> December transplanted crop. The population range from 0.26 larvae/plant to 3.24 larvae/plant and peak population was observed at 49 DAT. In late transplanted crop i.e., at 1<sup>st</sup> January, the population range from 0.16 larvae/plant to 2.68 larvae/plant. The maximum population of 2.68 larvae per plant was observed at 42 DAT.

Overall mean population of the pest in the three transplanting dates shown that a significantly higher incidence was observed at 1st December transplanted crop and it was followed by 1st January transplanted crop and 1st November transplanted crop in descending order. In all the transplanting dates, the incidence of the pest was low in the early crop stage and it increases gradually and reaches its maximum during maximum leaf development stage. *Pieris canidia*, an important insect pest of cabbage, *Brassica oleracea* var. capitata Linn., a related vegetable crop with broad leaf mustard in Manipur was reported by Singh *et al.* (2017). However, little or no information is available on the incidence of *P. canidia* in broad leaf mustard at Manipur.

#### Large cabbage white butterfly, *Pieris brassicae* (L.)

Another species of cabbage butterfly observed along with *Pieris canidia* was large cabbage white butterfly, *Pieris brassicae*. The large cabbage butterfly population range from 0.08 larvae/plant to 0.30 larvae/plant in the 1<sup>st</sup> November transplanted crop and the highest

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population was recorded at 35 DAT. In 1<sup>st</sup> January transplanted crop, the population range from 0.14 larvae/plant to 0.46 larvae/plant and peak population was observed at 42 DAT. However, in 1<sup>st</sup> December transplanted crop, the population range from 0.18 larvae/plant to 0.44 larvae/plant. The maximum population of 0.44 larvae/plant was observed at 28 DAT. Overall mean population of the pest in the three transplanting dates shown that the average incidence observed at both 1<sup>st</sup> December transplanted crop and 1<sup>st</sup> January transplanted crop was almost same with 0.31 and 0.32 larvae/plant followed by 1<sup>st</sup> November transplanted crop with 0.18 larvae/plant. In all the transplanting dates, the incidence of the pest was low in the early crop stage and it increases gradually and reaches its maximum during maximum leaf production stage of the crop.

Devjani and Singh (2002) also reported *P. brassicae*, an important pest of related vegetable crop of broad leaf mustard i.e., Cauliflower, *Brassica oleracea* var. botrytis in Manipur. Sharmila *et al.* (2015) also reported that the infestation of the pest began from last week of November and extended upto last week of April at Manipur in cauliflower crop. Present finding is in conformity with the finding of Sharmila *et al.* (2015) however, in different related crops.

#### **Mustard aphid, *Lipaphis erysimi* (Kalt.)**

Among all the aphid species viz., *Myzus persicae*, *Brevicoryne brassicae* and *Lipaphis erysimi* which infest the broad leaf mustard, the population of *L. erysimi* recorded the maximum and the population of remaining two species were negligibly low during the cropping season. Hence, only the population of *L. erysimi* was recorded. In all the transplanting dates, the population of *L. erysimi* were low in the early crop stage, however, it gradually increases as the crop advances its growth stages and even remain high upto early reproductive stage of the crop. In 1<sup>st</sup> January transplanted crop maximum population of mustard aphid, 44.24 aphids/leaf was recorded at 49 DAT. However, in 1<sup>st</sup> December transplanted crop, the maximum aphid population of 52.04 aphids/leaf was recorded at 56 DAT and in 1<sup>st</sup> January transplanted crop at 49 DAT with 64.60 aphids/leaf. Even at 70 DAT, the aphid population were as high as 25.20, 26.96 and 29.46 aphids/leaf in 1<sup>st</sup> November, 1<sup>st</sup> December and 1<sup>st</sup> January transplanted crops, respectively.

The highest average population of aphid was recorded in the 1<sup>st</sup> January transplanted crop with 42.72 aphids/leaf followed by 1<sup>st</sup> December transplanted crop with 34.77 aphids/leaf and 1<sup>st</sup> November transplanted crop with 29.37 aphids/leaf in descending order. *L. erysimi* an important insect pests of mustard *Brassica campestris* was reported by Mandal sunil kumar, Barun (2020) and Singh *et al.* (1999). A decline in the population of the aphid in leaves in the later stage of crop may be due to their shifting towards prefer site of infestation i.e., the terminal shoot and also increase in the number of natural enemies population. The

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high infestation of the pest in the terminal shoot of *B. campestris* was also reported by Singh *et al.* (1999).

#### **Striped flea beetle, *Phyllotreta striolata* (F.)**

The incidence of flea beetle gradually increases as the crop stage advances in all the three transplanting dates. Among all the observations, maximum population of 6.34 flea beetles/plant was recorded at 70 DAT in 1<sup>st</sup> January transplanted crop. In the other two transplanting dates also, the maximum population was recorded at 70 DAT with 5.62 beetle/plant in 1<sup>st</sup> December transplantation and 4.98 beetles/plant in 1<sup>st</sup> November transplantation.

Comparing the average population of flea beetle of three transplanting dates, it was observed that the highest population of 3.29 beetle/plant was observed in the 1st January transplanted crop and it was followed by the 1st December transplanted crop with 2.82 flea beetle/plant. The least average population of 2.44 beetles/plant among the three transplanted crops was recorded in the 1st November transplanted crop.

Patel *et al.* (2017) reported *P. cruciferae* at Uttarakhand. However, in conformity with the present finding, Anooj *et al.* (2020) reported striped flea beetle, *P. striolata* as an important emerging pest of cruciferous vegetables including mustard at Delhi and its neighbouring states.

#### **Cabbage semilooper, *Trichoplusia ni* (Hub.)**

During the cropping season, the population of cabbage semilooper was very low. In three different transplanting dates, the population of cabbage semilooper ranged from 0.00 larvae/plant to 0.38 larvae/plant. The highest population of 0.38 larvae/plant was observed at 42 DAT in 1<sup>st</sup> January transplanted crop. In the later stage of the crop the population of the pest was almost nil.

Average highest population of the pest was recorded at late transplanted crop (1st January transplanted crop) with 0.30 larvae/plant and it was followed by 1st December transplanted crop (0.20 larvae/plant) and 1st November transplanted crop (0.07 larvae/plant) in descending order.

*Trichoplusia ni* as a pest of mustard was also reported by Moir and Szito (2008). According to Coapio *et al.* (2017) *T. ni* is a polyphagous pest and feed more than 150 plant species from 36 families and prefer cabbage than other crops, they recorded. Cameron *et al.* (2007) reported broccoli as preferred host of *T. ni* among the host plant they recorded. Low population observed in the present study may be due to broad leaf mustard as a non-preferred host available during the cropping season.

#### **Mustard sawfly, *Athalia lugens proxima* (Klug.)**

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In all the planting dates, the populations of sawfly were very low after 56 DAT, hence population of sawfly are shown only upto 56 DAT. The population gradually increases as the crop stage advances and peak population was recorded at 42 DAT in all the planting dates. In 1<sup>st</sup> November transplanted crop the maximum population was 0.20 larvae/plant. In 1<sup>st</sup> December transplanted crop it was 0.36 larvae/plant and in the 1<sup>st</sup> January transplanted crop it was 0.24 larvae/plant. The lowest population was recorded at 56 DAT in all the different dates of transplanting.

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Among the average population of sawfly in three transplanted crops, maximum infestation of 0.22 larvae/plant was observed in 1<sup>st</sup> December transplanted crop. 1<sup>st</sup> November transplanted crop showed the least infestation with 0.12 larvae/plant.

Kalasariya and Parmar (2019) also reported mustard sawfly *A. lugens proxima* as a pest of mustard at Gujarat, India.

#### **Fungus beetle, *Monolepta signata* (Oliver)**

The population of fungus beetle, during *Rabi*, 2019-20 ranged from 0.02 beetles/plant to 0.20 beetles/plant in 1<sup>st</sup> November transplanted crop. The peak incidence was recorded at 56 DAT and afterward it declines slowly. In 1<sup>st</sup> December transplanted crop, Incidence of the pest was first observed at 28 DAT with beetles/pant and population increases gradually and reach its peak at 56 DAT with 0.10 beetles/plant. Similar with 1<sup>st</sup> November transplanted crop, fungus beetle was recorded from 21 DAT with 0.06 beetle/plant and reach its peak at 56 DAT with 0.28 beetles/plant.

The highest average population of 0.17 beetles/plant was observed at the 1<sup>st</sup> January transplanted crop among the three different transplantations and it was followed by 1<sup>st</sup> November transplanted crop with 0.11 beetles/plant and with 0.06 beetles/plant in 1<sup>st</sup> December transplanted crop in descending order.

Sarma *et al.* (2018) also reported fungus beetle *M. signata* as an important pest of cabbage, a closely related vegetable crop of broad leaf mustard in Assam a neighbouring state of Manipur. However, Das, R. (2020) reported, *M. signata* as a pest of mustard in Cachar district of Assam.

#### **Tobacco grasshopper, *Atractomorpha crenulata* (F.)**

A small population of grasshopper was also recorded infesting broad leaf mustard during *Rabi*, 2019-20. In the 1<sup>st</sup> November transplanted crop, grasshopper population was recorded

from 14 DAT (0.02 grasshopper/plant) and maximum population of 0.10 grasshopper/plant was observed at 49 DAT. However, grasshopper population of 0.02 grasshopper/plant was recorded from 7 DAT in 1<sup>st</sup> December transplanted crop and highest population of 0.14 grasshopper/plant at 42 DAT. Similar with 1<sup>st</sup> December transplanted crop, in 1<sup>st</sup> January transplanted crop the population of grasshopper was recorded from 7 DAT, however, the peak population with 0.16 grasshopper/plant was recorded at 56 DAT. Even upto 70 DAT, the populations of grasshopper were recorded as 0.08 and 0.10 grasshopper/plant in 1<sup>st</sup> December and 1<sup>st</sup> January transplanted crop, respectively. However, no grasshopper population was recorded at 70 DAT in 1<sup>st</sup> November transplanted crop.

1<sup>st</sup> December and 1<sup>st</sup> January transplanted crop showed similar average population of grasshopper with 0.09 grasshopper/plant and 1<sup>st</sup> November transplanted crop recorded 0.04 grasshopper/plant as average population.

Table 1: Bustami *et al.* (2019) also reported green grasshopper as important pest of *Brassica juncea* at Indonesia.

| Treatment                                | Mean population of Pest/plant |                         |                         |                              |                        |                               |                          |                                |
|------------------------------------------|-------------------------------|-------------------------|-------------------------|------------------------------|------------------------|-------------------------------|--------------------------|--------------------------------|
|                                          | <i>Pieris canidia</i>         | <i>Pieris brassicae</i> | <i>Lipaphys erysimi</i> | <i>Phyllotreta striolata</i> | <i>Trichoplusia ni</i> | <i>Athalia lugens proxima</i> | <i>Monolepta signata</i> | <i>Atractomorpha crenulata</i> |
| 1 <sup>st</sup> November transplantation | 1.26                          | 0.18                    | 29.37                   | 2.44                         | 0.07                   | 0.12                          | 0.11                     | 0.04                           |
| 1 <sup>st</sup> December transplantation | 1.83                          | 0.31                    | 34.77                   | 2.82                         | 0.20                   | 0.22                          | 0.06                     | 0.09                           |
| 1 <sup>st</sup> January transplantation  | 1.51                          | 0.32                    | 42.72                   | 3.29                         | 0.30                   | 0.14                          | 0.17                     | 0.09                           |

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## Conclusion

There were 11 pests found associated Broad leaf mustard, *Brassica juncea* var *rugosa*. Pest infestation was less in Early transplanted crop i.e 1<sup>st</sup> November transplanted crop. In all the planting dates, the pest found to be associated with crop from early to late stage, however higher populations were recorded at maximum leaf development stages. Maximum incidence was observed in the 1<sup>st</sup> December transplanted crop. As very little or no work has been done on the pest complex of broad leaf mustard, there is a scope to research more on this topic in different regions of Manipur.

## References

Anooj, S.S., Raghavendra, K.V., Shashank, P.R., Nithya, C., Sardana, H.R. and Vaibhav, V. (2020). An emerging pest of radish, striped flea beetle

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*Phyllotreta striolata* (Fabricius), from Northern India: incidence, diagnosis and molecular analysis. *Phytoparasitica*, 48(5): 743-753.

- Bustami, Y., Wahyuni, F.R.E., Syafruddin, D. and Mulyono (2019). Control of pests in the green mustard plant through papaya leaf extract. *Eurasian Journal of Biosciences*, 13: 913- 919.
- Cameron, J.H., Isman, M.B. and Upadhyay, M.K. (2007). *Trichoplusia ni* growth and preference on broccoli and eight common agricultural weeds. *Canadian Journal of Plant Sciences*, 87: 413-421.
- Coapio, G.G., Cruz-López, L., Guerenstein, P., Malo, E.A. and Rojas, J.C. (2017). Oviposition preference and larval performance and behavior of *Trichoplusia ni* (Lepidoptera: Noctuidae) on host and nonhost plants. *Arthropod-plant interactions*, 12(2): 267-276.
- Das, R. (2020). A field study on insect pest complex of Brassicaceous crops in some areas of Cachar, Assam. *Journal of Entomology and Zoology Studies*, 8(4): 2043-2045.
- Devjani, P. and Singh, T.K. (2002). Insect pest and natural enemy complex of cauliflower in the agro-ecosystem of Manipur. *Indian journal of entomology*, 64(3): 275-278.
- Kalasariya, R.L. and Parmar, K.D. (2019). Population dynamics of the mustard sawfly *Athalia lugens proxima* (Klug). *Indian Journal of Entomology*, 81(1): 159-162.
- Mandal, S.K., 2020. Management of mustard aphid, *Lipaphis erysimi* Kalt on mustard crop. *International Journal of Farm Sciences*, 10(1): 73-75.
- Moir, M. and Szito, A. (2008). Cabbage looper, *Trichoplusia ni* (Hubner,1803) (Lepidoptera: Noctuidae) Pest risk review Technical Report, Department of Agriculture and Food, Government of Western Australia. pp-1-43.
- Patel, S., Singh, C.P. and Yadav, S.K. (2017). Seasonal Incidence of mustard flea beetle, *Phyllotreta cruciferae* on *Brassica* species in relation to weather parameters at different dates of sowing. *Journal of Entomology and Zoology Studies*, 5(4): 673-77.
- Sarma, D., Saikia, D.K. and Deves, A. (2018). Effect of different intercrops and border crops on major insect pests and natural enemies of cabbage. *Journal of Entomology and Zoology Studies*, 6(3): 763-765.
- Sharmila, M., Devjani, P. and Singh, N.I. (2015). Field density and management of *Pieris brassicae* under the climatic conditions of the valley region of Manipur. *International Journal of Tropical Agriculture*, 33(2): 1697-1701.
- Singh Yadav, G. P., Singh, M. P., Kumar Akshay and Vikrant (2017). Studies on the Eco- Friendly Insecticidal Management of Major Insect Pests of Cabbage under Agro- Climatic Conditions of Imphal, Manipur. *International Journal of Pure Applied Bioscience*, 5(6): 273-277.
- Singh, M.P., Singh, K.M. and Singh, K.I. (1999). Efficacy and economics of some insecticides against mustard aphid, *Lipaphis erysimi*, and their safety to predators and foraging bees. *Indian Journal of Entomology*, 61: 11-18.

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