Biological Forum – An International Journal **14(3): 1229-1233(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Studies on Seasonal Incidence of Natural Enemies of Pest complex on Broad Leaf Mustard, *Brassica juncea* var. *rugosa* Roxb. Tsen and Lee in the Valley of Manipur

Dosa Rajeshwari[1*] and K. Mamocha Singh[2]
[1]M.Sc. Ag., Department of Entomology, College of Agriculture, Central Agricultural University, Imphal (Manipur), India.
[2]Professor, Department of Entomology, College of Agriculture, Central Agricultural University, Imphal (Manipur), India.

(Corresponding author: Dosa Rajeshwari)*
(Received 30 June 2022, Accepted 14 August, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: An experiment was conducted to know the seasonal incidence of natural enemies of Pest complex on broad leaf mustard, *Brassica juncea* var. *rugosa* was studied during *Rabi*, 2019-20. A local variety "Lamtachabi" was used for the experiment. Number of replications were 10 with a plot size of (4m × 5) sq. M. 5 natural enemies were found associated with mustard aphid, *Lipaphis erysimi*. The five natural enemies of mustard aphid were Braconid wasp, *Diaeretiellarapae* (M'Intosh), Seven-spot ladybird beetle, *Coccinella septempunctata*, Transverse ladybird beetle, *Coccinella transversalis*, Ladybird beetle, *Menochilus sexmaculata*; Common hoverfly, *Ischiodon scutellaris. Cotesia glomerata* was observed infesting *Pieris canidia*. The experiment was conducted to know the seasonal incidence of natural enemies of pest complex on broad leaf mustard as very less or no work has been done on this, especially on this crop.

Keywords: Aphid, Parasitoid, Naturalenemy, Pest

INTRODUCTION

Mustard production in India suffers from aphid, infestation considerably Rao *et al*. (2013). The predator species such as, green lacewing beetle, *Chrysoperla carnea*, eleven-spotted ladybird beetle, *Coccinella undecimpunctata* and seven-spotted ladybird beetle, *Coccinella septempunctata* were recorded when the pest population of aphids was sufficiently developed on the rapeseed varieties Talpur and Khuhro (2004). The incidence of the mustard aphid commenced from December 1st week and peaked in 3rd week of January with 300 aphids/plant. Where the aphidophagous predators namely *C. septumpunctata*, *C. transversalis* and *Menochilus sexmaculata* appeared high at January last week (20.00 coccinellid/plant) to March 1st week. The aphid predating syrphids populations were also recorded and its population were maximum at February 1st week (1.80 syrphids/plant). One aphid parasitoid, *Diaretiallarapae* (Hymenoptera: Braconidae) was also observed Hugar *et al*. (2008). Three coccinellids *viz. Coccinella septempunctata, Menochilus sexmaculatus* (*Cheilomenes sexmaculata*) and *Hippodamia variegate* and two chrysopids *viz. Chrysoperlacarnea* and *Anisochrysaboninensis*; the syrphid, *Episyrphus balteatus* and the chamaemyiid, *Leucopis* sp. were found associated with aphid colonies. Among them, only *Leucopis* sp., *C. septempunctata* and *E. balteatus* were recorded in significant numbers Kalra (1988). The density of the predator was observed to increase in response to increase in density of aphid prey in the field Bilashini and Singh (2010). *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). Singh *et al*. (2002) reported *C. glomerata* as important parasitoid of *P. Canidia* in Manipur.

MATERIALS AND METHODS

Experimental details: The experiment was conducted in the Experimental field of Department of Entomology, College of Agriculture, Central Agricultural University, Imphal, Manipur during *Rabi*; 2019-20. The experimental field was located at 24° 81`N latitude and 93° 89`E longitude in the valley of Manipur.

The soil type of the main field is clayey. 'Lamtachabi' a local cultivar of Broad leaf mustard was used for the experiment 4kg/ha seeds were sown in nursery. Fine sandy loam soil mixed with compost to prepare nursery bed. Line sowing was followed with a spacing of 10 cm between line to line. Nurseries were sown for 1st, 2nd and 3rd transplanting on 1st November, 2019; 1st December, 2019; and 1st January of 2020 respectively. Beds were made to a size of 4m × 5m. The recommended dose of NPK was applied at the rate of 80: 40: 40 g per plot. Seedlings were transplanted to the main field when they were 30 days old with a spacing of 45cm × 45cm.

Design	Randomized Block Design
Crop variety	Lamtachabi
Crop season	Rabi
Plot size	(4m × 5) sq. M
No. of replications	10
No. of treatments	3
Spacing	45cm × 45cm
Year of study	2019-2020
Observation Units	05 Plants
NPK	**NPK** **80: 40:40 g/plot**

Method of observations: Population of predatory lady bird beetles, syrphid flies and generalist predator like spiders were counted from the whole plants. Five plants were randomly selected from each replication and average population per plant were worked out for the Population of predatory lady bird beetles, syrphid flies and generalist predator like spiders. For aphid parasitoids, population of mummified aphids among the aphid population and total population of aphids from 3 leaves (one leaf each from top, middle and lower portion of plant) of each of the 5 randomly selected plants were counted. Parasitisation rate of the cabbage butterfly were counted by observing the parasitized larva among the larvae and per cent parasitisation were worked out. Percent parasitisation were worked out by using the following formula.

$$\text{Percent parasitisation} = \frac{\text{Number of parasitized aphids}}{\text{Total number of aphids}} \times 100$$

$$\text{Percent parasitisation} = \frac{\text{Number of parasitized larvae}}{\text{Total number of larvae}} \times 100$$

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 analyzed 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.

RESULTS

Braconid was p, Diaeretiella *rapae* M. *Diaeretiella rapae* was observed parasitizing mustard aphid, *Lipaphis erysimi* during the cropping period. Highest parasitisation of 5.30 percent was observed in the 42 DAT in the 1st November transplanted crop and lowest at 21 DAT with 1.95 per cent parasitisation. In the 1st December transplanted crop, maximum parasitisation of 6.07 percent was recorded in the 42 DAT and minimum at 21 DAT with 2.86 per cent. In the late transplanted crop *i.e.*, 1st January transplantation peak parasitisation with 5.73 per cent was observed at 35 DAT and least parasitisation at 70 DAT with 3.51 percent.

Seven-spot ladybird beetle, *Coccinella septempunctata* L. *Coccinella septempunctata* was one of the species of ladybird beetle which was recorded predating the aphid populations in the broad leaf mustard. During the observation, grub, pupae and adult populations of the ladybird beetles were counted together. From 35 DAT population of the ladybird beetle was observed (0.06 *C. septempunctata*/plant) and its population gradually increases and reaches its peak at 70 DAT with 1.20 *C. septempunctata*/plant. No record of the predator was observed up to 21 DAT in the 1st December transplanted crop. First population of the predator was observed at 28 DAT with least population of 0.08 *C. septempunctata*/plant. The maximum population in this plantation was recorded at 70 DAT with 1.48 *C. septempunctata*/plant. In the 1st January transplantation, the population was recorded from 21 DAT with minimum population of 0.12 *C. septempunctata*/plant. The population gradually increases and attains its maximum population of 1.70 *C. septempunctata*/plant at 70 DAT.

Among the three plantations, 1st January transplantation recorded highest average population (0.83 *C. septempunctata*/plant) and it was followed by 1st December plantation (0.65 *C. septempunctata*/plant) and 1st November plantation (0.48 *C. septempunctata*/plant) in descending order.

Transverse ladybird beetle, *Coccinella transversalis* F. Unlike *Coccinella septempunctata*, the population of *C. transversalis* was observed from 21 DAT in all the three transplantations. In 1st November transplantation, the population of *C. transversalis* range from 0.12 *C. transversalis*/plant to 0.44 *C. transversalis*/plant. The maximum population of the predator was observed at 49 DAT and the minimum at 70 DAT. 0.06 to 0.28 *C. transversalis/*plant was the range of *C. transversalis* in 1st December transplantation. In 1st January transplanted crop, no population of *C. transversalis* was recorded at 70 DAT and maximum population of 0.16 *C. transversalis* was observed at both 49 and 56 DAT.

An average population of 0.26 *C. transversalis*/plant was observed in 1st November transplantation, which was the highest among the three transplantations. 1st December and 1st January transplantation recorded 0.15 and 0.07 *C. transversalis*/plant average population, respectively.

***Menochilus sexmaculata* F.** Another species of lady bird beetle, *Menochilus sexmaculata* was also observed predating on aphid during the cropping season. However, the predator was recorded only from 28 DAT to 56 DAT. The population of *Menochilus sexmaculata* range from 0.04 to 0.22 *Menochilus sexmaculata*/plant in 1st November transplantation and maximum population was recorded at 42 DAT. A slightly higher population of the predator was recorded in 1st December transplantation and the population range from 0.08 to 0.40 *Menochilus sexmaculata*/plant with highest population at 49 DAT. In 1st January transplantation, the peak population of the predator with 0.26 *Menochilus sexmaculata*/plant was observed at 42

DAT and lowest population of 0.10 *Menochilus sexmaculata*/plant was recorded at 56 DAT.

Among the three transplanting dates, maximum average population of the predator was observed in 1st December transplanting crop with 0.20 *Menochilus sexmaculata*/plant. 1st January transplantation recorded 0.15 *Menochilus sexmaculata*/plant and lowest average population of 0.11 *Menochilus sexmaculata*/plant in 1st November transplantation.

Common hoverfly, *Ischiodon scutellaris* F. Two species of syrphid flies *viz.*, *Ischiodon scutellaris* and *Episyrphus balteatus* were also recorded predating on the aphid populations. Among the syrphid flies, population of *Ischiodon scutellaris* was predominant species and other syrphid species was negligible, hence it was not depicted in the table. Similar with *Menochilus sexmaculata*, the population of *I. scutellaris*/plant was depicted only from 28 DAT to 56 DAT as after 56 DAT population was negligibly low. In 1st November transplantation, the highest population of 0.60 *I. scutellaris*/plant was observed at 49 DAT and lowest with 0.16 *I. scutellaris*/plant at 28 DAT. In 1st December transplantation, the highest population of predatory fly was recorded at 56 DAT with 0.46 *I. scutellaris*/plant and lowest with 0.12 *I. scutellaris*/plant at 28 DAT. Similar with 1st December transplantation, in 1st January transplantation also, the highest predatory fly population was observed at 56 DAT with 0.34 *I. scutellaris*/plant and lowest population of 0.08 *I. scutellaris*/plant at 28 DAT.

The highest average population of the predatory fly during the cropping period was observed in 1st November transplantation with 0.40 *I. scutellaris*/plant and it was followed by 0.30 *I. scutellaris*/plant in 1st December transplantation. The lowest average population of 0.22 *I. scutellaris*/plant was observed in 1st January transplantation.

White butterfly parasitoid, *Cotesia glomerata* L. *Cotesia glomerata* was observed infesting *Pieris canidia*. Larval parasitoid was observed starting from 42 DAT in all the dates of transplantation. In the 1st November transplanted crop, the parasitisation of *P. canidia* by *C. glomerata* ranged from 1.00 per cent to 1.83 per cent parasitisation and the highest parasitisation was recorded at 63 DAT. A little higher parasitisation rate was recorded in 1st December transplanted crop and it range from 1.60 per cent to 2.27 per cent parasitisation. The peak parasitisation was recorded at 63 DAT. In the 1st January transplanted crop, the lowest parasitisation was recorded at 56 DAT with only 0.59 per cent parasitisation and highest at 42 DAT and 70 DAT. In all the transplanting dates the per cent parasitisation were high up to 70 DAT.

Table 1: Mean population of Natural enemies.

Treatment	Mean population of natural enemies of aphid and Cabbage butterfly					
	Diaeretiellarapae	***Coccinella septempunctata***	***Coccinella transversalis***	***Menochilus sexmaculata***	***Ischiodon scutellaris***	***Cotesia glomerata***
1st November transplantation	3.53	0.48	0.26	0.11	0.40	1.39
1st December transplantation	4.34	0.65	0.15	0.20	0.30	1.82
1st January transplantation	4.75	0.83	0.07	0.15	0.22	0.86

Table 2: Weather Data.

Month	Temp(°C)		RHumid (%)		Rainfall	Sunshine
	Max.	Min.	700h	1300h	(mm)	(Hours)
November	26.3	13.5	93.5	56.2	1.3	7.9
December	22.5	6.4	92.6	46.4	0.4	8.1
January	21.2	7.5	91.4	50.0	2.1	6.7
February	21.8	7.6	87.0	38.1	0.4	0.0
March	27.5	12.1	83.0	37.5	0.4	0.0

DISCUSSION

Braconid was p, *Diaeretiellarapae* M. Highest average parasitisation among the three transplantations wasobserved in 1st January transplanted crop with 4.75 per cent. The aphid parasitoid, *Diaeretiella rapae* was found to be an important nymphal-adult parasitoid of mustard aphid, *Lipaphis erysimi* in Manipur condition. During the present investigation maximum percent parasitisation of 6.07 was recorded at 42 DAT in 1st December transplanted crop. Although the parasitoid arrived little late, it was found to be associated with the pest even up to late stage of the crop. Singh and Singh (2015) also reported *D. rapae* as important parasitoid of *L. erysimi*.

Seven-spot ladybird beetle, *Coccinella septempunctata* L. The predatory ladybird beetle, *Coccinella septempunctata* was observed to be associated with the aphid population in the broad leaf mustard ecosystem. During the observation both grubs and adults were found predating on the aphid. The population of *C. septempunctata* was low during the early stage of the crop however it increases slowly with the advancement of crop stages as the population of the aphid also increases. In the later stage of the crop even the population of aphid start declining, the population of *C. septempunctata* remain high. The highest population of 1.70 *C. septempunctata*/plant was recorded at 70 DAT of 1st January transplanted crop. Bilashini and Singh (2010) reported *C. septempunctata* as important predator of *L. erysimi* in Manipur. Further, in another investigation at Manipur. Lokeshwari *et al*. (2012) reported *C. septempunctata* as efficient predator of *L. erysimi* in Manipur. The present finding is in conformity with the earlier findings from Manipur but

in different crops.

Transverse ladybird beetle, *Coccinella transversalis* F. A low population of *Coccinella transversalis* was found to be associated with the aphid population in the broad leaf mustard ecosystem. The predator population was found higher when the aphid population was high. The highest average population was recorded in the early transplantation *i.e*., 1st November transplantation with 0.26 *C. transversalis*/plant. Maximum population of the pest with 0.44 *C. transversalis*/plant was observed at 49 DAT of 1st November transplanted crop. The present finding is in conformity with Devi (2018), as she also reported *C. transversalis* as a predator of *L. erysimi* in Manipur. From other parts of the country like Uttar Pradesh, Shankar (2010) also reported *C. transveraslis* as an important predator of *L. erysimi*.

***Menochilus sexmaculata* F.** A low population of *Menochilus sexmaculata* was found to be associated with the aphid populations in the broad leaf mustard crop. Highest population of 0.40 *M. sexmaculata*/plant was observed at 49 DAT of 1st December transplanted crop. The predator population was higher when the aphid population is high on the crops. *M. sexmaculata*an important predator of *L. erysimi*at Gujarat was reported by Kalasariya *et al*. (2017). Rana (2006) also reported predation of *L. erysimi* by *M. sexmaculata* at Haryana, India.

Common hoverfly, *Ischiodon scutellaris* F. Among the syrphid flies, *Ischiodon scutellaris* was the predominant species which predates on the aphid population of mustard crop. The highest population of 0.60 maggots/plant was recorded at the 49 DAT of 1st November transplanted crop and also the highest average population was recorded in the 1st November transplanted crop. The syrphid flies population remains high even if the population of aphid started declining. *I. scutellaris* predating on mustard aphid at Manipur was also reported by Devi (2018). Devi *et al.* (1996) also earlier reported that *I. scutellaris* is an important predator of *L. erysimi* in Manipur.

White butterfly parasitoid, *Cotesia glomerata* L. The population of *P. canidia* in 1st December transplanting crop recorded highest average parasitisation rate with 1.82 per cent parasitisation followed by 1st November transplanted crop (1.39 per cent parasitisation) and 1st January transplanted crop (0.86 per cent parasitisation) in descending order. The larval parasitoid, *Cotesia glomerata* was found to be parasitizing larvae of *Pieris canidia*. The parasitoid population came little late. Parasitized larvae of *P. canidia* were recorded from the 42 DAT. Parasitisation per cent during the study period was low and maximum parasitisation of 2.27 per cent was recorded at 63 DAT of 1st December transplanted crop. The present finding is in the line of the finding of Singh *et al.* (2002).

CONCLUSION

Out of 6 natural enemies 5 are of mustard aphid and one found parasitizing on cabbage white butterfly, *Pieris canidia i.e., Cotesia glomerata. Diaeretiella rapae* was found parasitizing on Mustard aphid, *Lipaphis erysimi*, *Coccinella septempunctata*, *Coccinella transversalis*, *Menochilus sexmaculata*, *Ischiodon scutellaris* were predating on *Lipaphis erysimi*.

Acknowledgement. Authors are thankful to I. Ibohalsingh (College of Agriculture, Central Agricultural University) for providing inputs required for the experiment.
Conflict of Interest. None.

REFERENCES

Bilashini, Y. and Singh, T. K. (2010). Population dynamics of *Coccinella septempunctata* L. and *Lipaphis erysimi* (Kaltenbach) colonies on *Brassica juncea* var. *rugosa* in relation with abiotic factors in Manipur. *Journal of Insect Science* (Ludhiana), *23*(4): 434-437.

Devi, L.C., Varatharajan, R. and Singh, T. K. (1996). Prey-predator relations of *Lipaphis erysimi* K. (Homoptera: Aphididae) and aphidophagous syrphids on mustard. *Uttar Pradesh Journal of Zoology*, *16*(1): 9-12.

Devi, Y. R. (2018). Diversity of Predatory Complex of *Lipaphis erysimi* K. on certain cruciferous crops in Manipur, North-East India. *International Journal of Scientific Research and Education*, *6*(6): 7958-7961.

Dey, D., Routray, S., Baral, S. and Mahantheshwara, B. (2017). Effect of planting dates and botanical insecticides against major Lepidopterous pests of cabbage: A review. *Agricultural Reviews*, *38*(1): 60-66.

Hugar, P. G., Anandhi, P., Varma, S. and Sarvanan, L. (2008). Seasonal incidence of important insect pests of mustard and their natural enemies in relation to weather parameters, in Allahabad region. *Journal of Entomological Research*, *32*(2): 109-112.

Kalasariya, R. L., Parmar, K. D. and Zala, M. B. (2017). Relative abundance of ladybird beetle, *Menochilus sexmaculatus* Fabricius in relation to aphid *Lipaphis erysimi* K. infesting mustard. *AGRES – An International e. Journal*, *6*(2): 356-360.

Kalra, V. K. (1988). Population dynamics of various predators associated with mustard aphid, *Lipaphis erysimi* K. *Journal of Biological Control*, *2*(2): 77-79.

Lokeshwari, R. K., Devikarani, K. and Singh, T. K. (2012). Potential Biocontrol Agents of *Lipaphis Erysimi* K. in Cruciferous Crops of Manipur. *Annals of Plant Protection Sciences*, *20*(1): 47-50.

Rana, J. S. (2006). Response of *Coccinella septempunctata* and *Menochilus sexmaculatus* (Coleoptera: Coccinellidae) to their aphid prey, *Lipaphis erysimi* (Hemiptera: Aphididae) in rapeseed-mustard, *European Journal of Entomology*, *103*(1): 81-84.

Rao, B. B., Rao, V. U. M., Nair, L., Prasad, Y. G., Ramaraj, A. P. and Chattopadhyay, C. (2013). Assessing aphid infestation in Indian mustard, *Brassica juncea* L. under present and future climate scenarios. *Bangladesh Journal of Agricultural Research*, *38*(3): 373-387.

Shankar, U., Rai, S. and Singh, N. N. (2010). Functional response of grub and adult of *Coccinella septempunctata* L. and *Coccinella transversalis* F. on mustard aphid, *Lipaphis erysimi* K.*Archives of Phytopathology and Plant Protection*, *43*(18): 1829-1835.

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, O. H., Devjani, P. and Singh, T. K. (2002). Life table of *Cotesiaglomeratus* L., a larval parasitoid of *Pieris*

canidia S. *Journal of Biological Control*, *16*(1): 11-14.

Singh, R. and Singh, G. (2015). Systematics, distribution and host range of *Diaeretiella rapae* M. (Hymenoptera: Braconidae, Aphidiinae). *International Journal of Research Studies in Biosciences*, *3*(1): 1-3.

Talpur, M. A. and Khuhro, R. D. (2004). Relative occurrence and abundance of mustard aphid, *Lipaphis erysimi* K. and their predators on Rainbow and Oscar canola varieties. *Journal of Asia-Pacific Entomology*, *7*(2): 215-219.

How to cite this article: Dosa Rajeshwari and K. Mamocha Singh (2022). Studies on Seasonal Incidence of Natural Enemies of Pest complex on Broad Leaf Mustard, *Brassica juncea* var. *rugosa* Roxb. Tsen and Lee in the Valley of Manipur. *Biological Forum – An International Journal*, *14*(3): 1229-1233.