



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(4): 2043-2045

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Received: 10-05-2020

Accepted: 14-06-2020

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A field study on insect pest complex of Brassicaceous crops in some areas of Cachar, Assam

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Abstract

A study was conducted to explore the diversity of the insect fauna associated with brassicaceous ecosystem of Cachar district, Assam during 2019 - 20. The total collection of insects comprises with 12 species of herbivores and 16 species of predators. In present study, diamondback moth (*Plutella xylostella*), Mustard aphid (*Lipaphis erysimi*), Cabbage butterfly (*Pieris canidia*), mustard sawfly (*Athalia lugens proxima*) and flea beetle (*Phyllotreta cruciferae*) were found as major pests of brassicaceous plants in this region; while Cabbage leaf worm (*Pieris rapae*), flea beetle (*Monolepta signata*), Cutworm (*Agrotis epsilon*), leaf eating caterpillar (*Spodoptera litura*), cabbage semilooper (*Plusia orichalcea*), leaf webber (*Crocidolomia binotalis*), Green bug (*Nazara viridula*) were appeared as minor pests. Among the natural enemies, *Coccinella transversalis*, *Menochilus sexmaculatus*, *Syrphus* spp, *Sphaerophoria* spp and *Sphaerophoria scripta* were dominant predators in field.

Keywords: Diversity, brassica crop, insect pests, natural enemies

1. Introduction

Brassica vegetables are economically important and highly diversified group of crops grown world-wide. Owing to its high nutritional value brassica vegetables viz., cabbage, cauliflower, knol khol, brocolii, radish, Chinese kale, mustard, rapeseed, toria, sarson etc. are now being widely used as a food crops all over the world [1]. It provides much needed dietary fibres, essential minerals and vitamins (C, A, B1, B6, B9, and E) and phytochemicals [2]. Cabbage and cauliflower are two important vegetables produced and consumed in India. Because of their consumer's preference, common availability in local markets and year-around availability, they represent a significant source of phytonutrients in the human diet. According to Agricultural Ministry annual report 2017-18, India ranks second in production of cabbage and cauliflower in the world [3]. In India, area and production of cauliflower are 469,000 ha and 9103,000 MT, also in cabbage area and production are 399,000 ha and 9095,000 MT respectively [3]. Mustard is another important brassica crop and India is the third largest producer in the world next to China and Canada. India's mustard seed production in 2018-19 is estimated at around 86.93 lakh MT [4].

Despite large area and quite a good number of cultivars, the supply of brassica crops in Indian market is not matching to its demand. The productivity is low due to many factors and one of the most important constraint in production is the attack of insect pests. A total of 51 insect pests species damaging cruciferous crops have been reported from throughout the world [5]. In India a total of 37 insect pests were reported to infest the cole crops from seedling to harvest stage [6]. Amongst all, diamondback moth, (*Plutella xylostella*), webworm (*Hellula undalis*), cabbage butterflies (*Pieris brassicae* and *Pieris rapae*), aphids (*Lipaphis erysimi* and *Brevicoryne brassicae*) are most common insect pests on vegetable brassicas in India [7]. It has been documented that *P. xylostella* inflicts 17-99% damage, while as cabbage butterfly, *P. brassicae* and Cabbage leaf webber, *Crocidolomia binotalis* causes 69% & 28-51% damages respectively to the cole crops in India [8]. In a study, cabbage butterfly (*Pieris canidia*), mustard aphid (*Lipaphis erysimi*), mustard sawfly (*Athalia lugens proxima*) and mustard flea beetle (*Phyllotreta cruciferae*) were reported as major pests of brassica vegetable in Assam [9]. The Assam is the part of north eastern (NE) region of the India and considered to be a one of the components of mega-biodiversity hot spot. The moist climatic and soil conditions of this region are highly favourable for cultivation of vegetables. But the production of the crop is

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regulated by different biotic and abiotic factors and amongst those factors, insect pests plays a pivotal role. To control insect pests, farmers of that region use huge quantity of pesticides in field, which leads to several problems like toxic residues, elimination of natural enemies, development of resistance, resurgence and environmental disharmony.

Biological control plays an important role as an alternative of pesticides and as a part of IPM to reduce pest outbreak. Biological control has traditionally relied on microbial pesticides, predators and parasitoids [10]. Thus, before implementation of biological control programmes, it is very essential to know the arthropod fauna of that ecosystem. Realizing the importance of above facts, the present study was undertaken to record the insect pests and their natural enemies of brassica crop ecosystem of Assam.

2. Materials and Methods

The survey was conducted in different farmer's field to study the diversity of insect pests and their natural enemies in brassicaceous crop ecosystem (cabbage, cauliflower and mustard) of Cachar district, Assam during rabi 2019 - 20. Monitoring of insect fauna was initiated at the seedling emergence of the crop and continued until the last picking. Observation on insect pests and natural enemies was recorded at weekly interval starting from 15 days after the sowing of crop. Different species of insect pests and natural enemies were collected by hand picking, using pheromone trap and insect collecting net. After killing the arthropods were preserved in 70% alcohol in glass vials for small and soft bodied insects. However, pinning was done for comparatively large insects. The collected arthropods were sorted, counted and observed the morphological characters under the binocular stereoscope microscope Carl Zeiss 426126, model no. Stemi 2000 - C and identified by consulting the published taxonomic keys and related literature.

3. Results and Discussion

In the present study total of 12 species of herbivores and 16 species of predators were collected from the brassica crop field throughout the cropping season and are presented in table 1 and table 2 respectively. The occurrence and abundance of various insect fauna from seedling to harvesting stages were different. The data (Table 1) also revealed the relative abundance of different herbivores present in brassica crop ecosystem. Among the different observed insect pests five species of herbivores were identified as 'major' based on their relative abundance. These are Diamondback moth (*Plutella xylostella*), Mustard aphid (*Lipaphis erysimi*), Cabbage butterfly (*Pieris canidia*), mustard sawfly (*Athalia lugens proxima*) and flea beetle (*Phyllotreta cruciferae*) which were comparatively more abundant species in

brassicaceous field. Therefore, by number, these pests occupied the top position in brassicaceous agroecosystem during the current study. Diamondback moth, Cabbage butterfly were observed as serious pest of cabbage and cauliflower whereas aphid, (*L. erysimi*) and mustard sawfly (*A. lugens proxima*) were found as major pests of mustard. Flea beetle (*P. cruciferae*) was found in both the crop field. During monitoring, besides the major pests, some other insect pests were observed as phytophagous and they were cabbage leaf worm (*Pieris rapae*), flea beetle (*Monolepta signata*), Cutworm (*Agrotis ipsilon*), leaf eating caterpillar (*Spodoptera litura*), cabbage semilooper (*Plusia orichalcea*), Leaf webber, Green bug (*Nazara viridula*). But their incidence was low and these insects were categorized as minor pests based on their relative abundance on crop ecosystem. Insect pests of brassica crops, their status and seasonal activity recorded during the study are presented in table 1.

Although there is cognizance in many cases as reported by other researchers. Present findings are in line with the findings of Firake *et al.* (2013) [1] who reported that *P. xylostella*, *L. erysimi*, *P. brassicae* major pest of brassica crops and among predators, coccinellids was the most abundant predator of aphids throughout the season followed by syrphid flies. Keot *et al.* (2002) studied the insect pest complex of brassica vegetable and reported that cabbage butterfly (*Pieris canidia*), mustard aphid (*Lipaphis erysimi*), mustard sawfly (*Athalia lugens proxima*) and mustard flea beetle (*Phyllotreta cruciferae*) as major pests whereas cutworm (*Agrotis ipsilon*), flea beetle (*Monolepta signata*), cabbage semilooper (*Plusia orichalcea*) leaf eating caterpillar (*Spodoptera litura*) and ladybird beetle (*Henosepilachna vigintioctopunctata*) as minor pests in Assam [9]. The cabbage butterflies, *Pieris brassicae*, *P. canidia* and *P. rapae* have found as major pests of cabbage and cauliflower in India [1] [6] [11, 12, 13]. In one of the studies, it has been documented that aphid, *Lipaphis erysimi* is the most devastating agent in oilseed brassica [14]. In 2018, Bhat studied the pest species of cole crops in J & K and observed 16 lepidopterous pests in brassicaceous crop ecosystems among which, *Thysanoplusia orichalcea*, *Pieris brassicae*, *Pieris rapae*, *Plutella xylostella*, *Agrotis ipsilon* and *Helicoverpa armigera* were the abundant ones [15]. During the present investigation altogether fourteen species of natural enemies were observed (Table 2). The result revealed that *Coccinella transversalis*, *Menochilus sexmaculatus* were found as most abundant predator of aphids throughout the season followed by syrphid flies. The predators which were not caught but found hovering in the field included spider, mantid, green lace wing and dragonfly and damselfly etc. which were categorized under minor group of predator.

Table 1: Biodiversity and seasonal activity of insect pests in brassicaceous crops

Sl No	Common name	Scientific name	crops	season	Peak activity	Relative abundance %	Status
1	Diamondback moth	<i>Plutella xylostella</i>	Cauliflower, cabbage	Nov-March	Jan - March	25.84	Major
2	Mustard aphid	<i>Lipaphis erysimi</i>	Mustard	Nov- March	Jan-Feb	20.09	Major
3	Cabbage butterfly	<i>Pieris canidia</i>	Cauliflower, cabbage	Oct- May	Jan - March	17.94	Major
4	mustard sawfly	<i>Athalia lugens proxima</i>	Mustard	Nov- Feb	Dec- Jan	10.17	Major
5	Flea beetle	<i>Phyllotreta cruciferae</i>	Mustard, cabbage, cauliflower	Jan - March	Jan – Feb	1.08	Major
6	Cabbage leaf worm	<i>Pieris rapae</i>	Cabbage, cauliflower	Nov- Feb	Jan	0.78	Minor
7	flea beetle	<i>Monolepta signata</i>	Cabbage, cauliflower, mustard	Dec - Feb	Jan- Feb	0.33	Minor
8	Cutworm	<i>Agrotis ipsilon</i>	Cauliflower, cabbage	Oct-Feb	Dec- Jan	3.35	Minor
9	leaf eating caterpillar	<i>Spodoptera litura</i>	cauliflower	Nov-Jan	Jan	0.30	Minor
10	cabbage semilooper	<i>Plusia orichalcea</i>	Cabbage, cauliflower	Nov-Jan	Jan - Feb	0.27	Minor
11	Leaf webber	<i>Crocidiolomia binotalis</i>	Cauliflower, cabbage	Nov- Jan	Jan	0.18	Minor
12	Green bug	<i>Nazara viridula</i>	Cabbage, cauliflower, mustard	Jan - March	Feb - March	0.18	Minor

Table 2: Biodiversity and seasonal activity of natural enemies in brassicaceous crops

Sl No	Common name	Scientific name	Season	Peak activity	RA %	Remark	Status
1	Transverse lady bird	<i>Coccinella transversalis</i> (Fabricius)	Nov-March	Jan-Feb	19.32	Predator of aphid	Major
2	Six-spotted zigzag Lady bird	<i>Menochilus sexmaculatus</i> (Fabricius)	Nov-March	Jan-Feb	13.05	Predator of aphid	Major
3	Hover fly	<i>Syrphus</i> spp	Jan- March	Feb	8.14	Predator of aphid	Major
4	Hover fly	<i>Sphaerophoria</i> spp	Jan- March	Feb	7.65	Predator of aphid	Major
5	Hover fly	<i>Sphaerophoria scripta</i>	Jan- March	Feb	7.40	Predator of aphid	Major
6	Spider	unidentified	Nov-March	Jan- March	7.46	Generalist predator	Major
7	Lady bird beetle	<i>Coccinella septempunctata</i> (Linnaeus)	Jan- March	Jan- Feb	5.59	Predator of aphid	Minor
8	Uzi fly	<i>Exorista bombysis</i>	Jan- March	Feb	5.35		
9	Indian honey bee	<i>Apis cerana indica</i>	Dec- Feb	Jan	2.83	Pollinator	Frequently observed in field
10	Lady bird beetle	<i>Micraspis discolor</i>	Dec- March	Jan- Feb	1.89	Predator of aphid	Minor
11	Lady bird beetle	<i>Brumoidis suturalis</i> (Fabricius)	Jan-Feb	Feb	0.94	Predator of aphid	Minor
12	Lady bird beetle	<i>Scymnus</i> spp	Feb	Feb	1.10	Predator of aphid	Minor
13	Praying mantid	<i>Mantis</i> spp	Nov- March	Jan- Feb	1.57	Pradator of soft bodied insects	Major
14	Green lace wing	<i>Chrysoperla carnea</i> (Stephens)	Nov-March	Jan-feb	3.15	Predator of soft bodied insects	Minor
15	Dragonfly	unidentified	Jan- March	Feb- March	0.94	Generalist predator	Minor
16	Damsel fly	unidentified	Jan- March	Feb-March	0.90	Generalist predator	Minor

4. Conclusion

The biodiversity of insect pest complex of brassica vegetables was not reported earlier from that area and henceforth the present study highlighted the diversity of various existing insect fauna of brassica agroecosystem which will be helpful to conserve bicontrol agents to keep the insect pests below the economic threshold level under integrated pest management program. However it would be useful for future studies of insect pests of not only brassica vegetables, but also, of other crops too.

5. Acknowledgments

I am grateful to Department of Entomology, Assam Agricultural University, for support and fruitful suggestions during the course of the study.

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