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INCIDENCE OF SOME INSECT SPECIES ON *SOLANUM MELONGENA* L., 1753 IN MAGWAY TOWNSHIP

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Abstract

Eggplant (*Solanum melongena* L.) also called aubergine or brinjal, is one of the top ten vegetables in the world. Eggplant is also one of the most important vegetables in Asia. The present study was conducted at eggplant plantations of Magway Township during December 2019 to August 2020. A total number of (3743) insects were recorded, and they were listed under 24 species of 24 genera belonging to 16 families of six orders during the study period. Among the recorded species, 20 species were identified as pests and the other four species as beneficial or predatory insects. In the present study, eight species of Lepidoptera (33.33%), seven species of Hemiptera (29.17%), and six species of Coleoptera (25%), while Orthoptera, Neuroptera and Diptera were recorded only one species (4.17%) each during the study period. In the present study, the maximum number of individuals was recorded in order Hemiptera by (1032) individuals (73.71%), while the minimum number of individuals in Orthoptera as one individual (0.07%) was recorded in the study site I. The maximum number of 1032 individuals (73.71%) was recorded in order Hemiptera while the minimum number of one individual (0.07%) in Orthoptera was recorded in the study site I. The maximum number of 917 individuals (74.92%) was collected in order Hemiptera, and the minimum number of eight individuals (0.65%) was collected in Neuroptera in the study site II. In the study site III, the maximum number of 851 individuals (76.05%) was recorded in order Hemiptera, while the minimum number of ten individuals (0.89%) in Neuroptera was recorded during the study period. Hemipterans species were predominant on eggplant growing in the study area.

Keywords Brinjal, insects, beneficial, predatory, Hemipterans

Introduction

Insects are the largest group of animals on earth by far: about 926,400 different species have been described. They are more than half of all known living species. They may be over 90% of animal species on Earth. Estimate of the total number of species ranged from 2 million to 30 million. The most species live in tropical area (Rasnitsyn and Quicke, 2002).

Several insect species are predators or parasitoids on other harmful pests and others are pollinators, decomposers of organic matter or producers of valuable products such as honey or silk. The majority of insects are directly important to humans and the environments. Less than 0.5 percentage of the total number of the known insect species are considered pests, and only a few of these can be a serious menace to people **(**Kyerematen *et al*., 2014). It is susceptible to several pests, especially the eggplant fruit and shoot borer. In the tropics, eggplant production is severely constrained by several insects and mite pests. Shoot and fruit borer, jassid, aphids, leaf roller and stem borer were the most common pests of eggplant in Madhay Pradesh, India (Bhadauria *et al*., 1999).

The cultivation of eggplant is more than 1600000 ha producing around 50 million Mt (Metric ton) throughout world, among which ninety percent of production from five countries, of which China shares 58 percent of output, India, 25 percent, followed by Iran, Egypt and Turkey. Insect pests inflict damage to humans, farm animals and crops. Herbivorous insects are said to be responsible for destroying one fifth of the world's total crop production annually (FAO, 2012).

Eggplant is by far the major vegetable representing some 41% by weight of all vegetables produced, occupying 19% of the land used to cultivate them. More than 4 million acres are

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devoted to the cultivation of eggplant in the world with total production of 32,072,972 tones. Eggplant is said to be native of India with secondary center as China and extensively grown in South East Asia (NHB, 2010).

However, eggplant production is in threat in recent years due to increased cost of production on management of insect pest complex. It also reduces the content of vitamin C in fruit up to 80 percent. Hence, many farmers were leaving growing eggplant because of this pest (Chakraborti *et al*., 2011).

Eggplant contains nutrients such as dietary fiber, folate, ascorbic acid, vitamin K, B_6, pantothenic acid, potassium, iron, magnesium, phosphorus and copper (USDA, 2009).

Eggplant occupies an important position in every day diet due to its high nutritive, dietary and medical values as 100 g of edible fruits contains 92.7 g water, 1.3 g carbohydrates, 1.4 g protein, 0.3 g mineral matter and 4 g calcium. It is low in calories and fats (Varmudy, 2011).

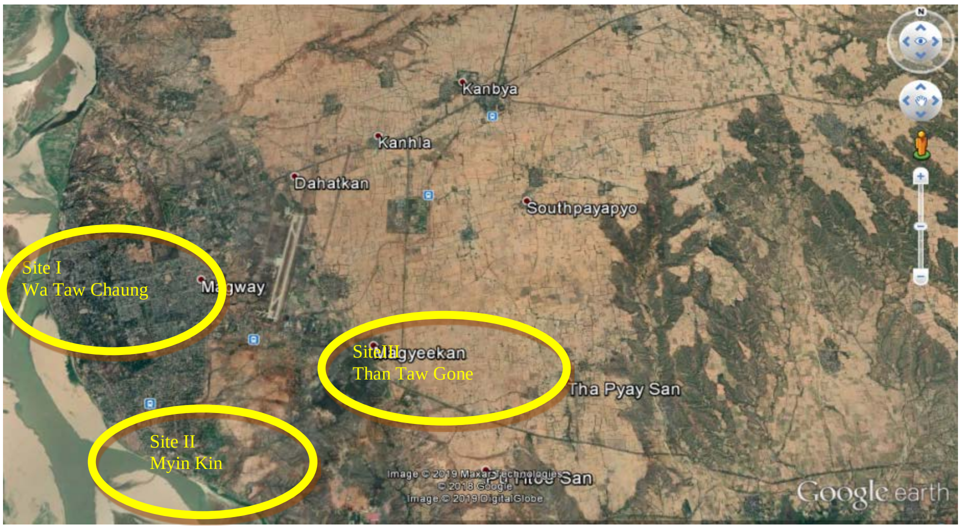
There is no previous research that focused on insect species of eggplant in Magway area. Therefore, the objectives of the present study were: to record and identify the insect species on eggplant in Magway Township, to examine the species composition of different orders of recorded insects and to determine the insects which are pests or beneficial insects of the eggplant.

Materials and Methods

Study Area

The study was conducted in Magway Region, which is situated on the East of the Ayeyarwady River and it has an area of 17, 305 square miles.

In Magway Region, the three villages were chosen as the present study sites. Study site I is Wa Taw Chaung Village (20° 10'41.33" N and 94° 54'52.34 " E), study site II is Myin Kin Village (20° 07' 0.71" N and 94° 56' 37.02" E) and study site III is Than Taw Gone Village (20° 08'03.42" N and 94° 58'22.81" E) (Fig.1).



(Source: Google earth, 2020)

Figure 1 Map of the study area and the locations of the study sites

Study period

The study was carried out from December 2019 to August 2020.

Collection of specimens

Specimens were collected during the day time. The study sites were visited once in every week for nine months. Some insects were easily collected by hand-picked and some were caught by insect net. Photographic records were taken from fresh specimens.

Preparation of specimens

The collected specimens were transferred into the killing bottle which contained cotton wool soaked with chloroform. Some were preserved in small plastic bottles, containing 70 percent alcohol with glycerin. Dissecting microscope was used for identification of insect species. Under each specimen, a label was added bearing the name of the species, locality and date of capture and then it was transferred into the insect box (Plate.1).

Data Analysis

Species composition was calculated using the method of Bisht *et al*. (2004).

$$\text{Species composition} = \frac{\text{Number of a recorded species}}{\text{Total number of all recorded species}} \times 100$$

Identification of specimens

The identification was carried out according to Borror and Delong, (2005), Gullan and Cranston, (2010), Awasthi, (2016) and Debbie, (2018).

A. Insect net

B. Collecting bottles

C. Dissecting microscope

Plate 1 Equipment used for collection and identification

Results

A total of 24 insect species belonging to 24 genera, 16 families and six orders were recorded during the period from December 2019 to August 2020 (Table.1).

Occurrence of insect species on eggplants in the three study sites

Total numbers of insect species (3743) individuals were recorded from three study sites throughout the nine months survey. During the study period, a total number of (1400) individuals were collected. The collected insects belonged to 23 species of insects, distributed among 23 genera, 15 families and six orders which occurred at the eggplant cultivation in study site I (Wa Taw Chaung Village) (Table.4).

In study site II (Myin Kin Village), a total number of (1224) individuals were collected and they belonged to 18 species of insects, distributed among 18 genera, 13 families and five orders occurring at the eggplant cultivation (Table.5).

A total number of (1119) individuals belonging to 15 species of insects, distributed among 15 genera, 10 families and five orders were collected from eggplant cultivation in the study site III (Than Taw Gone Village) (Table.6).

Order-wise species composition of insect species recorded in eggplant cultivation of three study sites

Among the 24 recorded insect species, the order Lepidoptera was represented by eight species, followed by Hemiptera with seven species, six species in Coleoptera, while Orthoptera, Neuroptera and Diptera were recorded with only one species each.

Out of six orders, the highest species composition (33.33%) was observed in order Lepidoptera, followed by order Hemiptera (29.17%) and then Coleoptera (25%), and the lowest Orthoptera, Neuroptera and Diptera (4.17%) (Table.2) (Fig.2)

Beneficial insects and insect pest species from the three study sites

Among the total of 24 insect species recorded, four species of insects were observed as the beneficial insects namely, *Antilochus coquebertii, Chrysoperla carnea, Menochilus sexmaculatus,* and *Micraspis discolor,* while the rest 20 species were represented as pest species.

Fifteen species, (*Bemisia tabaci*, *Amrasca biguttula biguttula*, *Antilochus coquebertii, Dysdercus koenigii, Creontiades pallidus, Chrysoperla carnea, Aulacophora foveicollis, Monolepta signata*, *Menochilus sexmaculatus*, *Micraspis discolor*, *Henosepilachna sumbana, Bactrocera cucurbitae*, *Lineodes integra, Luecinodes orbanalis,* and *Plutella xylostella*), were collected in all three study sites during the study period.

Six species (*Schistocera nitens, Cletus bipunctatus, Scirpophaga nivella, Earias vittella, Utetheisa pulchella, and Anomis flava*) were recorded only in study site I and *Protaetia fusca* was collected in site II during the study period (Table.3 and Fig.3).

Table 1 Recorded insect species from the three study sites

No.	Order	Family	Species	Common name
1.	Orthoptera	Acrididae	*Schistocera nitens*	Large gray bird grasshopper
2.	Hemiptera	Pentatomidae	*Nezara viridula*	Southern Green stink bug
3.		Aleyrodidae	*Bemisia tabaci*	Sweet potato Whitefly
4.		Cicadellidae	*Amrasca biguttula biguttula*	Okra leafhopper
5.		Pyrrhocoridae	*Antilochus coquebertii*	True bug
6.		Pyrrhocoridae	*Dysdercus koenigii*	Red cotton bug
7.		Coreidae	*Creontiades pallidus*	Sheddeer bug
8.		Coreidae	*Cletus bipunctatus*	Spined legume bug
9.	Neuroptera	Chrysopidae	*Chrysoperla carnea*	Green lacewing
10.	Coleoptera	Scarabaeidae	*Protaetia fusca*	Mango flower beetle
11.		Chrysomelidae	*Aulacophora foveicollis*	Red pumpkin beetle
12.		Chrysomelidae	*Monolepta signata*	White spotted leaf beetle
13.		Coccinellidae	*Menochilus sexmaculatus*	Six spotted zigzag Ladybird
14.		Coccinellidae	*Micraspis discolar*	Ladybird beetle
15.		Coccinellidae	*Henosepilachna sumbana*	Cucurbit ladybird
16.	Diptera	Tephritidae	*Bactrocera cucurbitae*	Melon fly (fruit fly)
17.	Lepidoptera	Crambidae	*Cydalima perspectalis*	Box tree moth
18.		Crambidae	*Lineodes integra*	Leaf-roller moth
19.		Crambidae	*Scirpophaga nivella*	Sugarcane top borer
20.		Pyralidae	*Leucinodes orbanalis*	Eggplant fruit and shoot borer
21.		Nolidae	*Earias vittella*	Spiny bollworm

22.	Erebidae	*Utetheisa pulchella*	Crimson-speckled moth
23.	Erebidae	*Anomis flava*	Orange cotton moth
24.	Plutellidae	*Plutella xylostella*	Cabbage moth

Table 2 Species composition of insects from the eggplants of the three study sites

Order	Number of Family	Number of Genus	Number of Species	Composition of species in order (%)
Orthoptera	1	1	1	4.17
Hemiptera	5	7	7	29.16
Neuroptera	1	1	1	4.17
Coleoptera	3	6	6	25
Diptera	1	1	1	4.17
Lepidoptera	5	8	8	33.33
Total	16	24	24	100

Table 3 Status of insect species from the three study sites

No.	Scientific name	SiteI	SiteII	SiteIII	Status
1.	*Schistocera nitens*	+	-	-	Pest
2.	*Nezara virudula*	+	+	-	Pest
3.	*Bemisia tabaci*	+	+	+	Pest
4.	*Amrasca biguttula biguttula*	+	+	+	Pest
5.	*Antilochus coquebertii*	+	+	+	Beneficial
6.	*Dysdercus koenigii*	+	+	+	Pest
7.	*Creontiades pallidus*	+	+	+	Pest
8.	*Cletus bipunctatus*	+	-	-	Pest
9.	*Chrysoperla carnea*	+	+	+	Beneficial
10.	*Protaetia fusca*	-	+	-	Pest
11.	*Aulacophora foveicollis*	+	+	+	Pest
12.	*Monolepta signata*	+	+	+	Pest
13.	*Menochilus sexmaculatus*	+	+	+	Beneficial
14.	*Micraspis discolar*	+	+	+	Beneficial
15.	*Henosepilachna sumbana*	+	+	+	Pest
16.	*Bactrocera cucurbitae*	+	+	+	Pest
17.	*Cydalima perspectalis*	+	+	-	Pest
18.	*Lineodes integra*	+	+	+	Pest
19.	*Scirpophaga nivella*	+	-	-	Pest
20.	*Leucinodes orbanalis*	+	+	+	Pest
21.	*Earias vittella*	+	-	-	Pest
22.	*Utetheisa pulchella*	+	-	-	Pest
23.	*Anomis flava*	+	-	-	Pest
24.	*Plutella xylostella*	+	+	+	Pest

(+) found, (-) not found

Table 4 Monthly occurrence of insect species and number of individuals from the study site I (Wa Taw Chaung Village)

No.	Order	Scientific name	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Total
1.	Orthoptera	*Schistocera nitens*	0	0	0	1	0	0	0	0	0	1
2.	Hemiptera	*Nezara viridula*	0	1	0	0	0	0	0	0	0	1
3.		*Bemisia tabaci*	0	25	15	9	5	0	7	10	14	85
4.		*Amrasca biguttula biguttula*	33	53	195	150	170	80	85	80	45	891
5.		*Antilochus coquebertii*	0	1	0	0	0	2	1	0	2	6
6.		*Dysdercus koenigii*	5	3	0	3	1	6	0	2	4	24
7.		*Creontiades pallidus*	4	2	2	2	2	0	3	0	3	18
8.		*Cletus bipunctatus*	0	1	2	1	0	1	0	0	2	7
9.	Neuroptera	*Chrysoperla carnea*	1	0	3	0	0	2	1	1	2	10
10.	Coleoptera	*Aulacophora foveicollis*	3	1	2	9	0	5	2	5	8	35
11.		*Monolepta signata*	0	0	3	0	0	2	0	0	0	5
12.		*Menochilus sexmaculatus*	0	0	4	0	0	0	3	6	7	20
13.		*Micraspis discolar*	2	4	0	3	0	2	0	2	3	16
14.		*Henosepilachna sumbana*	0	0	0	0	0	0	2	4	6	12
15.	Diptera	*Bactrocera cucurbitae*	0	5	6	7	10	4	0	0	1	33
16.	Lepidoptera	*Cydalima perspectalis*	0	1	0	0	0	0	1	0	0	2
17.		*Lineodes integra*	0	0	2	1	0	0	0	0	0	3
18.		*Scirpophaga nivella*	0	1	0	0	0	0	0	0	1	2
19.		*Luecinodes orbanalis*	23	36	45	30	25	5	10	12	9	195
20.		*Earias vittella*	0	0	0	1	0	2	0	0	2	5
21.		*Utetheisa pulchella*	0	0	0	3	1	2	2	0	4	12
22.		*Anomis flava*	0	1	0	0	0	0	0	0	3	4
23.		*Plutella xylostella*	0	0	2	4	1	1	0	0	5	13
Number of individuals			71	135	281	224	215	114	117	122	121	1400
Number of species			7	14	12	14	8	13	11	9	18	

Table 5 Monthly occurrence of insect species and number of individuals from the study site II (Myin Kin Village)

No.	Order	Scientific name	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Total
1.	Hemiptera	*Nezara viridula*	0	2	0	0	0	0	0	0	0	2
2.		*Bemisia tabaci*	0	15	10	8	5	0	5	7	10	60
3.		*Amrasca biguttula biguttula*	33	50	180	150	170	95	70	45	30	823
4.		*Antilochus coquebertii*	0	0	0	2	0	0	0	0	1	3
5.		*Dysdercus koenigii*	3	2	0	2	0	5	0	0	3	15
6.		*Creontiades pallidus*	3	2	0	3	1	0	2	0	3	14
7.	Neuroptera	*Chrysoperla carnea*	2	0	2	1	0	0	1	0	2	8
8.	Coleoptera	*Protaetia fusca*	0	0	0	0	0	0	2	4	6	12
9.		*Aulacophora foveicollis*	0	0	3	6	0	0	1	3	5	18
10.		*Monolepta signata*	0	0	2	0	0	0	0	0	0	2
11.		*Menochilus sexmaculatus*	0	0	2	0	2	0	0	3	5	12
12.		*Micraspis discolar*	1	3	2	3	0	1	0	2	3	15
13.		*Henosepilachna sumbana*	0	0	0	0	0	0	0	3	5	8
14.	Diptera	*Bactrocera cucurbitae*	0	3	4	7	8	5	0	0	0	27
15.	Lepidoptera	*Cydalima perspectalis*	0	0	1	0	0	0	0	0	0	1
16.		*Lineodes integra*	1	0	1	0	0	0	1	0	0	3
17.		*Luecinodes orbanalis*	20	32	30	35	28	18	16	10	5	194
18.		*Plutella xylostella*	1	0	0	3	0	1	0	0	2	7

	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Total
Number of individuals	64	109	237	220	214	125	98	77	80	1224
Number of species	8	8	11	11	6	6	8	8	13	

Table 6 Monthly occurrence of insect species and number of individuals from the study site III (Than Taw Gone Village)

No.	Order	Scientific name	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Total
1.	Hemiptera	*Bemisia tabaci*	0	10	8	10	4	0	3	6	5	46
2.		*Amrasca biguttula biguttula*	30	35	170	145	150	100	65	50	30	775
3.		*Antilochus coquebertii*	0	0	1	0	0	0	0	1	1	3
4.		*Dysdercus koenigii*	3	2	1	1	0	0	2	0	3	12
5.		*Creontiades pallidus*	4	0	2	3	0	1	0	2	3	15
6.	Neuroptera	*Chrysoperla carnea*	0	3	2	3	0	0	0	1	1	10
7.	Coleoptera	*Aulacophora foveicollis*	0	2	0	4	0	0	2	0	3	11
8.		*Monolepta signata*	1	0	0	1	0	0	0	0	0	2
9.		*Menochilus sexmaculatus*	0	0	0	1	2	1	1	0	3	8
10.		*Micraspis discolar*	2	3	0	4	0	1	1	0	1	12
11.		*Henosepilachna sumbana*	0	0	0	0	0	0	0	3	4	7
12.	Diptera	*Bactrocera cucurbitae*	0	2	4	6	7	4	0	0	0	23
13.	Lepidoptera	*Lineodes integra*	0	0	0	1	0	1	0	1	0	3
14.		*Luecinodes orbanalis*	20	28	25	30	32	22	15	10	5	187
15.		*Plutella xylostella*	0	0	0	2	0	0	1	0	2	5
Number of individuals			60	85	213	211	195	130	90	74	61	1119
Number of species			6	8	8	13	5	7	8	8	12	

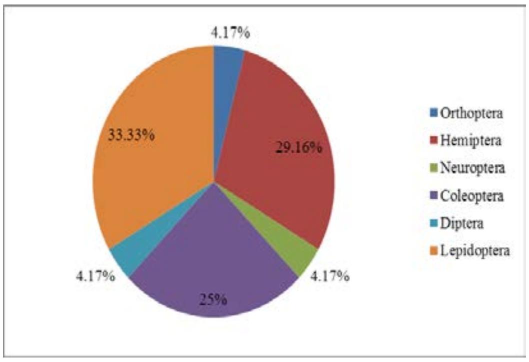


Figure 2 Composition of insect species in different orders from the three study sites

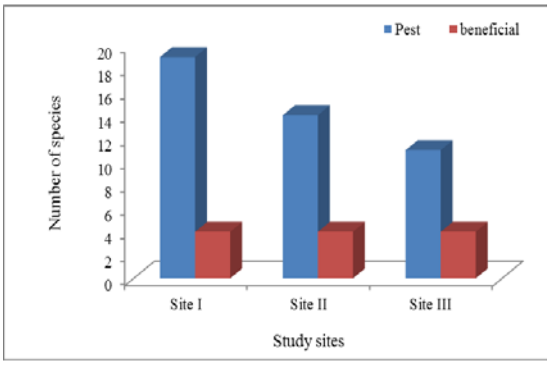


Figure 3 Pest and beneficial species from the three study sites during the study period

Discussion

A total of 24 insect species belonging to 24 genera, 16 families and six orders were recorded during December 2019 to August 2020. In the present study, eight species of Lepidoptera, seven species of Hemiptera, and six species of Coleoptera were recorded while only one species of each of Orthoptera, Neuroptera and Diptera was recorded from the three study sites.

Among the recorded species, the highest number was observed in order Lepidoptera (33.33%) follow by Hemiptera (29.17%), Coleoptera (25%), and the lowest number of Orthoptera, Neuroptera and Diptera (4.17%) was recorded from the three study sites during the study period. Lepidopterans and Hemipterans therefore appeared to predominate in the three study sites, while Orthopterans, Neuropterans and Dipterans appeared as rare species.

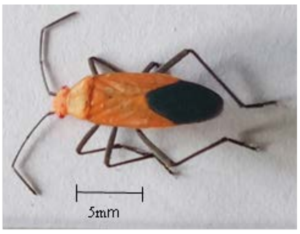
Among the recorded species, 20 species were identified as pests and the other four species as beneficial or predatory insects. The recorded species in orders Coleoptera, namely *Menochilus sexmaculatus*, *Micraspis discolor*, and members of order Neuroptera, and *Chrysoperla carnea*, were regarded as beneficial insects while those of orders Orthoptera, Hemiptera, except *Antilochus coquebertii*, Diptera and Lepidoptera appeared as pests.

A. *Schistocera nitens*

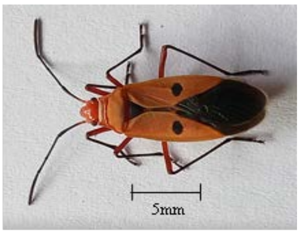
B. *Nezara viridula* (3rd instar)


C. *Bemisia tabaci*

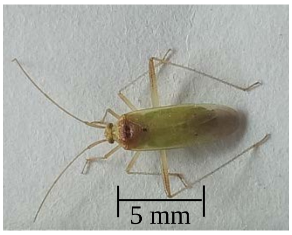
D. *Amrasca biguttula biguttula*



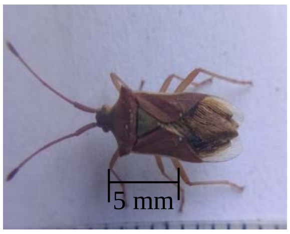
E. *Antilochus coquebertii*



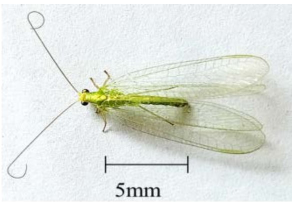
F. *Dysdercus koenigii*



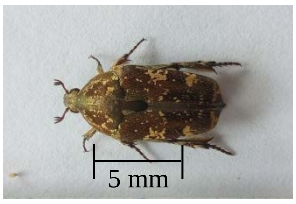
G. *Creontiades pallidus*



H. *Cletus bipunctatus*

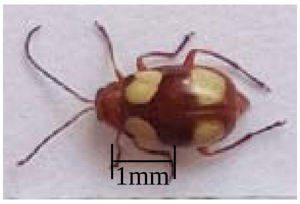


I. *Chrysoperla carnea*



J. *Protaetia fusca*

K. *Aulacophora foveicollis*



L. *Monolepta signata*

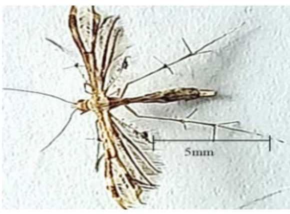
M. *Menochilus sexmaculatus*

N. *Micraspis discolar*

O. *Henosepilachna sumbana*

P. *Bactrocera cucurbitae*

Q. *Cydalima perspectalis*



R. *Lineodes integra*


S. *Scirpophaga nivella*


T. *Leucinodes orbanalis*

U. *Earias vittella* V. *Utetheisa pulchella* W. *Anomis flava* X. *Plutella xylostella*

Plate 2 Recorded insect species of Order Orthroptera, Hemiptera, Neuroptera, Coleoptera, Diptera and Lepidoptera

Mote (2003) reported that *Amrasca biguttula biguttula*, commonly known as jassid and *Leucinodes orbonalis*, commonly called as brinjal shoot and fruit borer were the serious pests of eggplant. In the present study, these species were destroying the eggplants.

Amrasca biguttula biguttula is an important sucking pest of brinjal crop recorded from July to November. Both nymphs and adults of Jassid have a piercing and sucking type of mouth parts and suck the sap from the lower surface of the leaf. When the several insects suck the sap from same leaf, yellow spot appear on the leaf followed by crinkling, curling and “hopper burn” as reported by Borah *et al*. (2017).

Bharadiya *et al*. (2005) have also reported that *Leucinodes orbonalis* was most destructive and major insect pest of brinjal in North Gujarat. The incidence of this insect started soon after transplanting of the seedlings and continued till the harvest of the crop. The larvae of this insect initially bored the tender shoots and fed internally resulting in weathering and drying of the shoot. In the present study, Larvae of *Leucinodes orbonalis* destroyed the eggplants in the three study sites. This resulted that the fruit became unfit for human consumption and fetched fewer prices in the market. During the present study, two out of the 20 pest species, *Amrasca biguttula biguttula* (2489 individuals) and *Leucinodes orbonalis* (576 individuals) appeared as predominant pests from the three study sites.

Schaefer and Ahmad (2000) described that Heteropteran predators were important natural enemies of phytophagous insects and have thus potential in biological control of crop pests. The red cotton bug, *Dysdercus koenigii* and its natural predator *Antilochus coquebertii* were recorded as the most abundant insects in Asian cotton agro-ecosystem, suggesting that the importance of *Antilochus coquebertii* in controlling *Dysdercus koenigii.* During the present study, *Antilochus coquebertii* (predator) and *Dysdercus koenigii* (prey) were recorded in eggplant cultivation from the three study sites in Magway Township. The result showed predator-prey relationship.

Chakraborti *et al*. (2011) stated that eggplant fruit and shoot borer, *Leucinodes orbonalis* was the key pest of eggplant, inflicting sizeable damage in the eggplant growing area and it’s most destructive, especially in South East Asia. In the present study, *Leucinodes orbonalis* was the most important pest from the three study sites.

Aye Aye Myint (2014) stated that three predators species of *C. transversalis*, *M. sexmaculata* and *H. octomaculata* fed on aphids, eggs of Lepidopterans and other soft bodied insect pests. In the present study, two predators species of *Menochilus sexmaculata* and *Micraspis discolor* were collected on eggplants from the three study sites.

Concerned with study sites, 23 species were recorded at site I (Wa Taw Chaung Village) followed by 18 species of site II (Myin Kin Village) and 15 species of site III (Than Taw Gone Village). Moreover, total numbers of insects (3743 individuals) were recorded from all sites throughout the nine months survey in which the highest species number was found in site I. This place situated on river alluvial plain near Wa Taw Chaung Village, it might be more suitable place for insect species.

Maximum numbers of individuals were collected under order Hemiptera from the three study sites during the study period. Hemipterans were the largest order of insect species and the insects in this order were extremely diverse. Minimum number of individuals on the other hand was collected under order Orthoptera from site I, Neuroptera from site II and site III. Highest numbers of insect species were collected in the month of August; it might be assumed that some of the pests were active during the rainy season. Lowest number was collected in the month of December during the study period. Cold season seems to be a suitable season of the pests.

Conclusion

A total of 24 insect species belonging to 24 genera, 16 families and six orders were recorded on eggplant growing area of Magway Township. Twenty species of the insects were recorded as the insect pests and four species of the insects were found as the beneficial insects. A total of 1400 individuals in site I, 1224 individuals in site II and 1119 individuals in site III were recorded in the study period. Lepidopteran species were predominant on eggplant cultivation in the study area. Since Lepidopteran species inhabit the agricultural lands, they are of economic importance. This research contributes some information concerning with insect pest and beneficial species of eggplants and suggests the potential of biological control of insect pests in agricultural field.

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