Species Composition and Relative Abundance of Some Insects on Citrus Plants in Lel Pyin Village, Thazi Township

Pont Pont[1], Han Tin[2]

Abstract

The present study was conducted to investigate the occurrence of some insects on some citrus plants in Lel Pyin Village situated east of Thazi. A total of 34 species of insects belonging to 33 genera, 21 families and seven orders were recorded during December 2018 to July 2019. The specimens were collected twice per month. The species composition was (44.12%) in the order Coleoptera, (26.47%) in Hemiptera, (8.82%) each in Diptera and Hymenoptera, (5.88%) in Blattodea and (2.94%) each in Orthoptera and Lepidoptera. The total number of individuals (2372) was recorded during the study period. The highest number was that of *Lasius niger* and the lowest *Podisus maculiventris*. During the eight month study, the highest numbers of individuals were observed in March and the lowest in December. Among the 34 species recorded, the highest number of 30 species was revealed in June, the lowest number of 10 species in January and February. *Papilio demoleus* and *Lasius niger* were recorded as very common (vC), 15 species were recorded as common (C), 17 species were recorded as uncommon (uC) throughout the study period. The results of the present study are hoped to be of help in increasing awareness of the importance of controlling insects that occurr on citrus plants, some of which are serious pests affecting the yield of citrus fruits that are of economic importance.

Keywords: Species composition, relative abundance, insects

Introduction

The whole world is endowed with an uncalculable variety of animals and plants. Myanmar is a country with favourable ecological conditions and topography that is richly provided with natural resoures including rich fauna and flora. It is also an agricultural country, where farmers, gardeners and horticulturists cultivate edible and commercial crops, vegetables and fruits. The Rutaceae includes a number of important agricultural and food plants including lime and lemons.

The citrus is commercially important as many species are cultivated for their fruit, which is eaten fresh, pressed for juice, or preserved in marmalades and pickles. Lemons and limes are also used as garnishes or in cooked dishes. Their juice is used as an ingredient in a variety of dishes; it can commonly be found in salad dressings and squeezed over cooked meat or vegetables (Korlapati, 2014).

Citrus phytochemicals have potential antioxidant, anti-cancer, and cholesterol-lowering abilities (Tian *et al*., 2001; cited by Tennant *et al*., 2009). The fruit crop is widely produced and marketed as fresh fruit. The key to successful production of citrus lies in the effectiveness of long-term pathogen and pest-management strategies. As with many tropical and subtropical crops, citrus is host to various pathogens and pests, but it is also one of the few crops that is susceptible to a number of destructive diseases that are continuously emerging and which can severely limit or totally decimate production. Production of citrus fruits destined for processing may not require as stringent management of pests as those for the fresh fruit market (Tennant *et al*., 2009).

New research at the University of Washington shows that insect species living in warmer areas are more likely to undergo rapid population growth because they have higher metabolic rates and reproduce more frequently. The finding of scientists concerned was that

[1] Demonstrator, Department of Zoology, University of Yangon

[2] Associate Professor, Department of Zoology, Kyaing Tong University

global warming could give rise to faster growing insect population and that we could see a spike in a number of them. This growth may have a significant impact on agriculture, public health, conservation and ecosystems (David and Shankar, 2011).

Insects are very sensitive to human-mediated disturbances, habitat loss, pollution and climate change, and because of their sensitivity several insect taxa are used as indicators of global change. The majority of insects on earth are important to humans. A few are harmful such as agricultural pests and disease vectors whereas others are beneficial such as decomposers, seed dispersers, and pollinators. After citrus establishment, insect species colonize and over time progressively increase in diversity and abundance (Aidoo *et al*., 2016).

In Myanmar, citrus industry plants are widely cultivated as no previous detailed study as the fruits and leaves are of economic importance. The present research strives to give information data on the insects that occurred on citrus plantations in Thazi Township with the following objectives:

- to collect and identify the insect species on citrus plants in Lel Pyin Village, Thazi Township
- to determine the species composition and relative abundance of insects recorded
- to investigate the monthly occurrence of citrus insects during the study period

Materials and Methods

Study site

The present research was conducted on citrus plantations in Lel Pyin Village situated east of Thazi Township in the Mandalay Region. The village is situated at between 20°40′06.29″ N and 96°26′12.74″ E (Fig. 1) (Plate 1).

Study period

The present study was conducted from December 2018 to September 2019.

Specimen Collection

Field surveys were conducted twice per month. Specimens were collected and recorded by using an M-shaped pattern (Boa and Chernoh, 2015). The collection materials include inset nets, plastic bags and plastic boxes. Specimen collections were done by using an inset net by hand. Plastic boxes were perforated by pores for living specimens. The collected specimens were put into the plastic boxes and brought back to the laboratory Department of Zoology, Meiktila University, for identification, taking photographs and further investigations. The species composition for each month was recorded throughout the study period. Then, the monthly occurrence and percentage species composition of each citrus insect were evaluated.

Data Analysis

Relative abundance of collected data was calculated using the formula given by Bisht *et al*., (2004)

$$\text{Relative abundance} = \frac{\text{Total no. of individuals of a species}}{\text{Total no. of individuals of all the species}}$$

The average relative abundance of insect species recorded was categorized as the method of Bisht *et al*., (2004).

uC (uncommon) = having relative abundance less than 0.0100

C (common) = having relative abundance of 0.0100 and above but less

than 0.0500

vC (very common) = having relative abundance of 0.0500 and above

Identification

Identification and classification of the citrus insects recorded were based on Ghosh (1940), Richards and Davies (1964), Hill (1983), Borror *et al.*, (1992), Futch (2011).

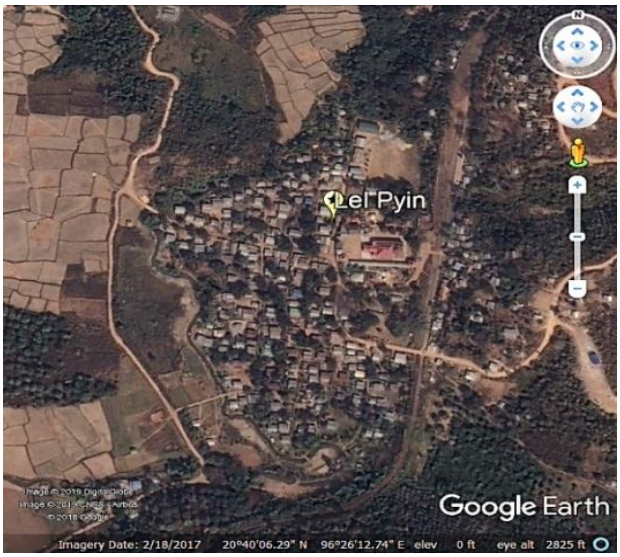


Fig. 1 Map of the study area, Lel Pyin Village, Thazi Township, Mandalay Region (Source: Google map, 2019)

Plate 1 Citrus plantations in the study site

Results

A total of 34 insect species on citrus plants belonging to 21 families under seven Orders- Orthoptera, Blattodea, Hemiptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera belonging to Class Insecta were recorded during December 2018 to August 2019 (Plate 2).

Species composition of some insect species on some citrus plants

Throughout the study period, 34 species, 33 genera, 21 families, seven orders and (2372) individuals of citrus insects were recorded during December 2018 to July 2019. The highest composition of insect species was that of the order Coleoptera with 44.12 %, followed by Hemiptera with 26.47 %, Diptera and Hymenoptera with 8.82 % each, Blattodea 5.88 % and Orthoptera and Lepidoptera with 2.94 % each (Fig. 2).

During the study representatives of seven orders of insects namely, Orthoptera, Blattodea, Hemiptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera were recorded. The order Orthoptera is represented by a single species *Atractomorpha crenulata* confined to the family Pyrgomorphidae. The order Blattodea is represented by two species confined to two genera and among two families. The order Hemiptera is represented by nine species confined to nine genera and among six families. The order Coleoptera is represented by 15 species confined to 14 genera and among six families. The order Lepidoptera is represented by a single species *P. demoleus* confined to the family Papilionidae. The order Diptera is represented by three species confined to three genera and among a two family. The order Hymenoptera is represented by three species confined to three genera and among three families (Fig. 2).

Monthly occurrences of insect species

In Lel Pyin Village, a total number of (2372) individuals, seven orders and 21 families were recorded during the study period. Out of 34 species, *Cheilomenes sexmaculata, Papilio demoleus, Sturmia bella, Carcelia bombylans, Lasius niger* monthly were observed throughout the study period. The highest number of 30 species recorded was in June, followed by 29 species in July, 26 species in May, 19 species in April, 17 species in March, 11 species in December and the lowest number of 10 species in January and February were recorded during December 2018 to July 2019 (Table 1 and Plate 1).

The highest number of (355) individuals in March followed by (332) individuals in April, (330) individuals in July, (321) individuals in May, (316) individuals in June, (273) individuals in February, (248) individuals in January. The lowest number of (197) individuals in December (Table 1).

Relative abundance of insect species

During the study, the most abundance species was *Lasius niger* (1125 individuals), followed by *Papilio demoleus* (119 individuals), *Carcelia bombylans* (108 individuals) and *Bothrogonia ferruginea* (105 individuals) during the study period. The lowest was that of *Podisus maculiventris* with only four individuals. According to the relative abundance, of the 34 species recorded, *P. demoleus* and *L. niger* appeared as very common (vC), 15 species represented common (C), 17 species as uncommon (uC) (Table 1). The highest composition of insect species was that of the order Coleoptera with 44.12 %, followed by Hemiptera with 26.47 %, Diptera and Hymenoptera with 8.82 % each, Blattodea 5.88 % and Orthoptera and Lepidoptera with 2.94 % each (Table 1 and Fig. 2).

Table 1 Monthly number of individuals and relative abundance of insect species recorded during December 2018 to July 2019

Scientific name	December	January	February	March	April	May	June	July	Total	Relative abundance	Average Relative abundance
Atractomorpha crenulata	2	3	0	0	0	0	4	6	15	0.006	uC
Hemithyrsocera vittata	0	0	0	0	0	8	6	4	18	0.008	uC
Blattella germanica	0	0	0	0	0	6	4	3	13	0.005	uC
Riptortus linearis	0	0	0	6	13	7	9	5	40	0.017	C
Bothrogonia ferruginea	0	0	0	28	26	19	16	16	105	0.044	C
Cletus trigonus	0	0	0	0	18	15	10	11	54	0.023	C
Coreus marginatus	0	0	0	0	0	5	3	2	10	0.004	uC
Savius jurgiosus	11	8	9	4	2	1	1	0	36	0.015	C
Halyomorpha halys	0	0	0	7	6	4	1	1	19	0.008	uC
Podisus maculiventris	0	0	0	0	0	0	2	2	4	0.002	uC
Sycanus croceovittatus	0	0	0	0	8	6	6	3	23	0.010	C
Chrysocoris stollii	9	11	8	10	9	6	0	0	53	0.022	C
Cheilomenes sexmaculata	3	7	13	11	9	7	4	4	58	0.024	C
Epilachna admirabilis	0	0	9	7	6	5	1	2	30	0.013	C
Harmonia axyridis	0	0	0	16	13	9	6	6	50	0.021	C
Epicauta atrata	0	0	0	0	0	8	7	7	22	0.009	uC
Mylabris pustulata	0	0	0	0	0	4	2	2	8	0.003	uC
Gleanea beatrix	0	0	0	0	0	5	5	4	14	0.006	uC
Aspidimorpha sanctaecrucis	6	0	0	0	0	0	3	3	12	0.005	uC
Aulacophora lewisii	0	0	0	12	9	7	4	2	34	0.014	C
Argopus brevis	0	0	0	0	0	0	5	5	10	0.004	uC
Lilioceris cheni	0	0	0	28	26	22	7	9	92	0.039	C
Lilioceris quadripustulata	0	0	0	0	0	9	5	7	21	0.009	uC
Hypomeces squamosus	5	12	10	22	29	17	0	0	95	0.04	C
Odoiporus longicollis	0	0	0	0	0	0	3	3	6	0.003	uC
Polydrusus formosus	0	0	0	0	0	0	8	15	23	0.01	C
Athous haemorrhoidalis	0	0	0	9	4	4	0	0	17	0.007	uC
Papilio demoleus	42	22	16	8	5	6	7	13	119	0.05	vC
Lucilia sericata	0	0	0	0	0	0	5	7	12	0.005	uC
Sturmia bella	16	13	21	15	13	9	4	5	96	0.04	C
Carcelia bombylans	12	15	18	18	15	8	11	11	108	0.046	C
Cotesia congregata	2	3	6	0	0	0	0	0	11	0.005	uC
Lasius niger	89	154	163	148	117	120	164	170	1125	0.474	vC
Polistes olivaceus	0	0	0	6	4	4	3	2	19	0.008	uC
Total number of individuals	197	248	273	355	332	321	316	330	2372		
Total number of species	11	10	10	17	19	26	30	29			

uC = uncommon (less than 0.0100), C = common (0.0100 and above but less than 0.0500), vC = very common (0.0500 and above)

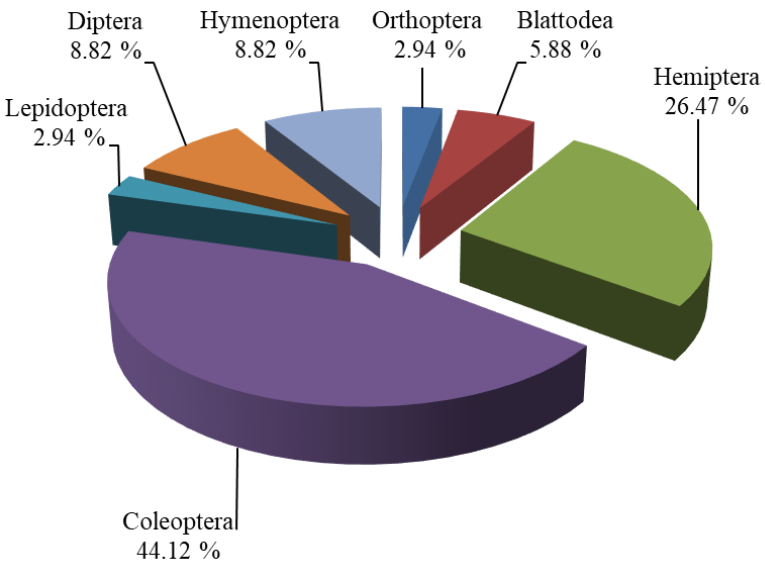
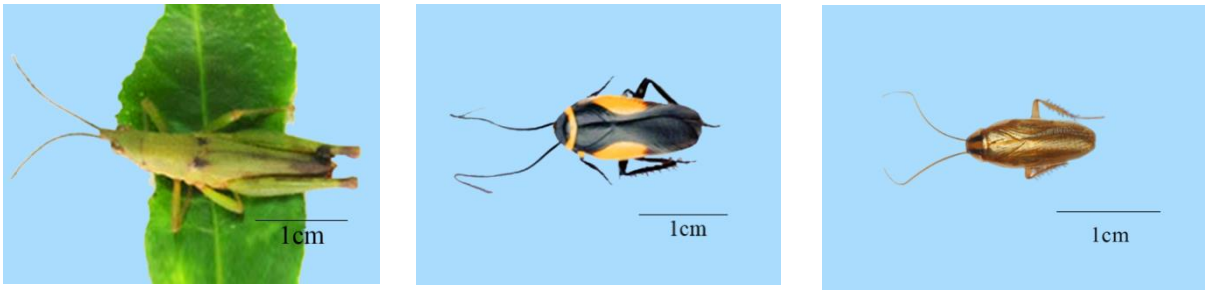
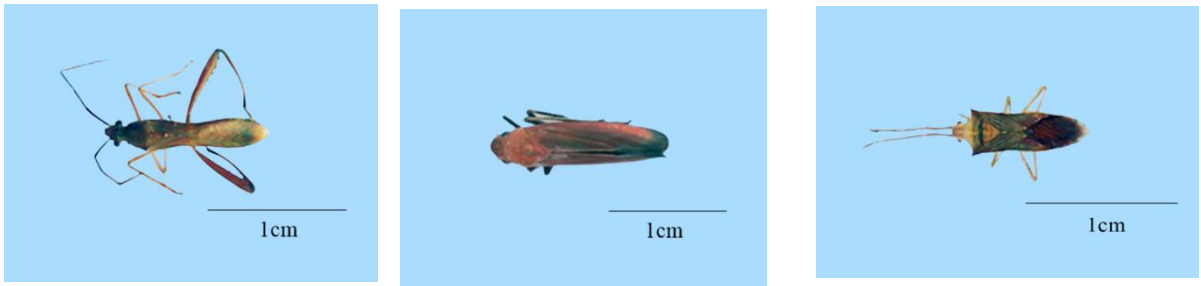


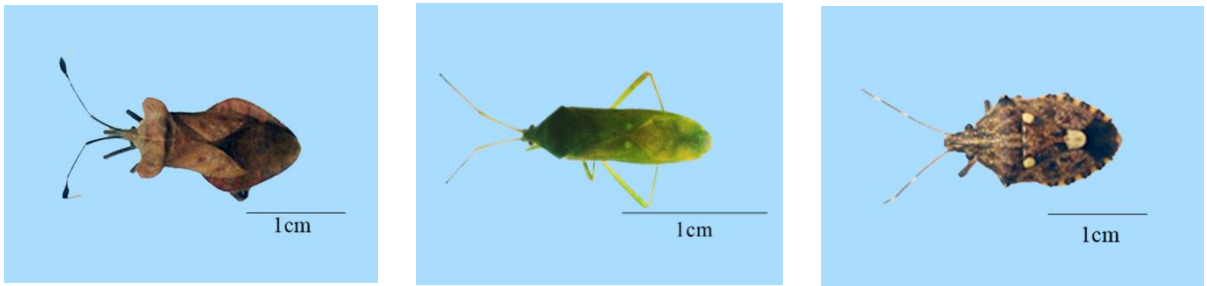
Fig. 2 Relative percentage composition of insect species in different orders recorded during December 2018 to July 2019



A. *Atractomorpha crenulata* B. *Hemithyrsocera vittata* C. *Blattella germanica*

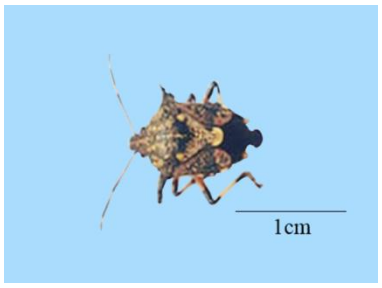


D. *Riptortus linearis* E. *Bothrogonia ferruginea* F. *Cletus trigonus*

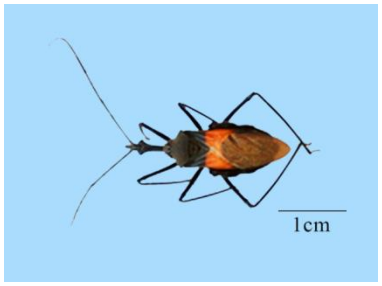


G. *Coreus marginatus* H. *Savius jurgiosus* I. *Halyomorpha halys*

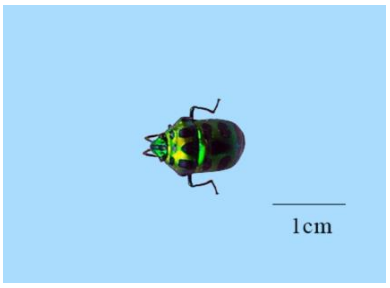
Plate 2 Some insects recorded on citrus plants from the study site during December 2018 to July 2019



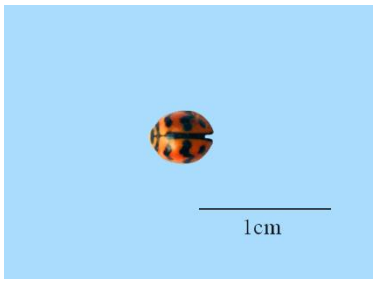
J. *Podisus maculiventris*



K. *Sycanus croceovittatus*

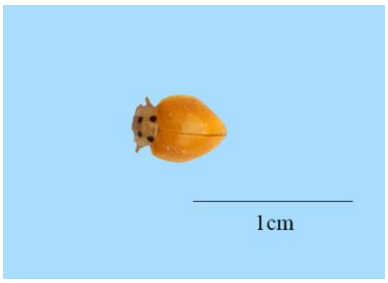


L. *Chrysocoris stollii*

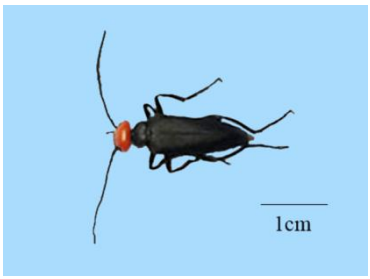


M. *Chelomenes sexmaculata*

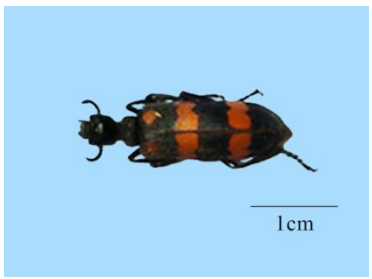
N. *Epilachna admirabilis*



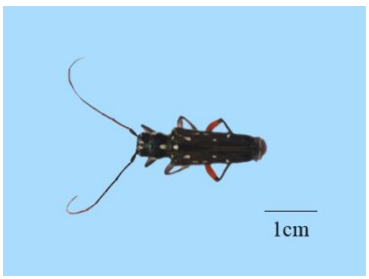
O. *Harmonia axyridis*



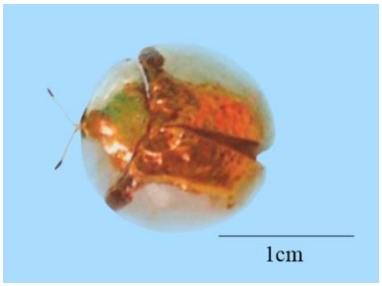
P. *Epicauta atrata*



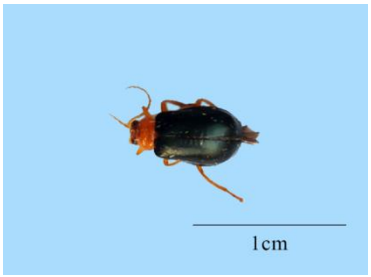
Q. *Mylabris pustulata*



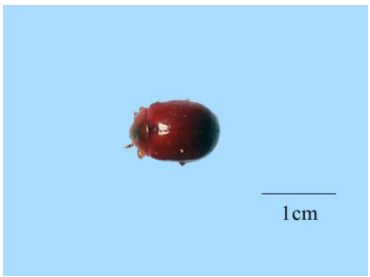
R. *Glenea Beatrix*



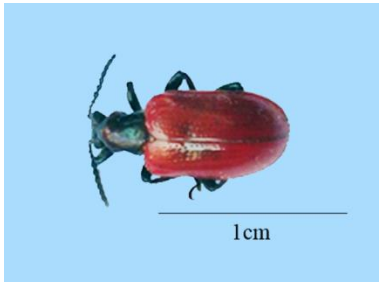
S. *Aspidimorpha sanctaecrucis*



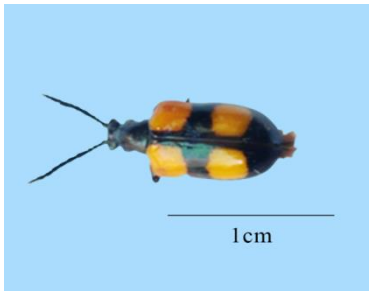
T. *Aulacophora lewisi*



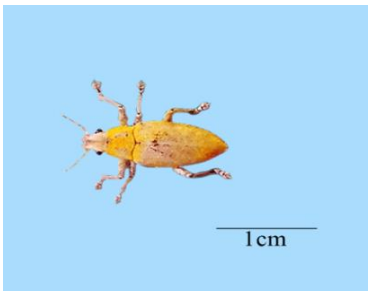
U. *Argopus brevis*



V. *Lilioceris cheni*

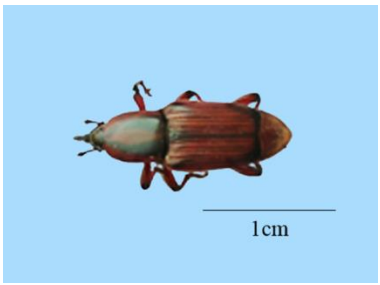


W. *Lilioceris quadripustulata*

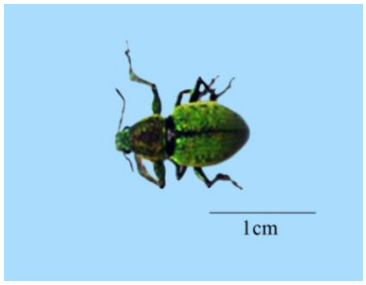


X. *Hypomeces squamosus*

Plate 2 Some insects recorded on citrus plants from the study site during December 2018 to July 2019



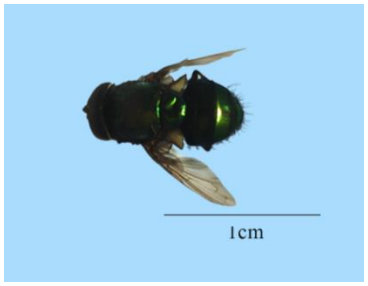
Y. *Odoiporus longicollis*



Z. *Polydrusus formosus*

AA. *Athous haemorrhoidalis*

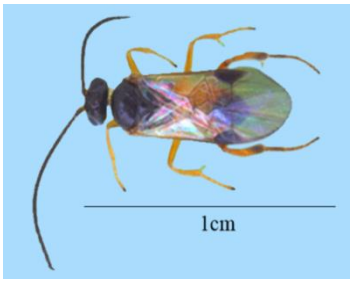
AB. *Papilio demoleus*



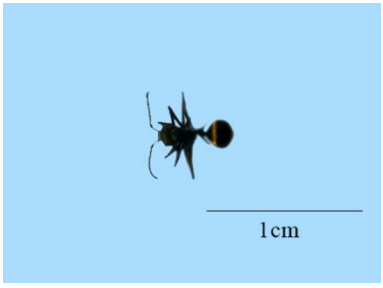
AC. *Lucilia sericata*

AD. *Sturmia bella*

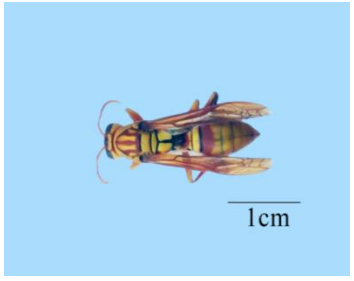
AE. *Carcelia bombylans*



AF. *Cotesia congregate*



AG. *Lasius niger*



AH. *Polistes olivaceus*

Plate 2 Some insects recorded on citrus plants from the study site during December 2018 to July 2019

Discussion

The present work was conducted from December 2018 to July 2019. During the study period, a total of 34 species under 33 genera belonging to 21 families and seven orders were identified and collected on some citrus plants from Lel Pyin Village.

Aidoo *et al*., (2016) stated that the diversity and abundance of entomofauna associated with citrus plantations in two different agroecological zones of Ghana. In the Semi-Deciduous

Rain Forest zone, the four most dominant orders were Hymenoptera (86.34%), Hemiptera (3.48%), Orthroptera (3.12%), and Coleoptera (2.34%), whereas Hymenoptera (77.12%), Hemiptera (5.96%), Diptera (5.56%) and Coleoptera (3.15%) were the four most dominant orders in the Coastal Savannah zone.

In the present study, the percentage species composition was revealed. 15 species in order Coleoptera (44.12%), nine species in order Hemiptera (26.47%), three species in order Diptera (8.82%) and order Hymenoptera (8.82%), two species in Blattodea (5.88%) and only one species each (2.94%) in the orders Orthoptera and Lepidoptera.

Insect species belonging to various orders are associated with the flowers, shoots and roots of citrus. They often colonize more than one part of the tree, resulting in a multidimensional impact on the productivity and life of the citrus tree (Browing 1999) (cited by Tennant *et al*., (2009). In the present study, insect species are also found in more than one part of the tree.

During the wet season, from September to November as there were no matured citrus fruits, only a few insects were observed in the orchards but during the dry season, from January to March, the fruits matured and ripened, hence the higher number of insects in the orchards. This could account for the higher diversity in the dry season than in the wet season (Aidoo *et al*., 2016).

Similarly, the highest number of individuals was found in March (355), followed by April (332). The lowest number of individuals was found in December (197). Lower number of individuals were recorded during the cooler months and is alluded to pre-sprouting and pre-fruting season. The highest number of individuals (1125 individuals) was that of black garden ant (*Lasius niger*) and thus assumed to be most abundant on the citrus plants. The lowest number of only four individuals was that of spined solider bugs (*Podisus maculiventris*) on citrus plants and thus taken as rare on citrus plants in the study site.

Numerous species of insects have attained pest status at various locations at different times because of the damage they cause to citrus trees and fruits and the pathogens they transmit. Lepidopterans of major importance are *Papilio* spp., particularly the lime swallowtail butterfly, *Papilio demoleus*, which has recently invaded the western hemisphere. Several *Papilio* spp that have been reported as pests of citrus, the lime swallowtail butterfly, *P. demoleus* Linnaeus, 1758 (Lepidoptera: Papilionidae), is of greatest significance to the citrus industry at this time. The pest is widely distributed throughout southern Asia, from the Middle East to India, and from the Indo-Pacific region to New Guinea and Australia. They feed mainly on the young leaves of citrus plants (Tennant *et al*., 2009).

Lime butterfly (*P. demoleus*) are common found on citrus plants in the present study. The second large number of *P. demoleus* (119) individuals was observed during the study period. This butterfly eats leaves, especially young plants which may be defoliated.

Citrus is the leading fruit and its better productivity is vital for the farmers and national economy but per acre production is lower than potential. Insect pests and diseases roles are counted as significant in lowering the production. These insects, pests and diseases not only affect the yield of citrus but also deteriorate the fruit quality. (Tariq *et al*., 2007) (cited by Ashraf *et al*., 2014).

Plant health is affected by a number of living and non-living factors. Living factors include insect-pests, mites, weeds, disease and other living organisms, while non-living factors include environmental variables like temperature, humidity, rainfall, hailstorms, winds, droughts, sunshine and soil condition, etc. To determine what factors adversely affected the plant requires an investigative approach combined with careful observation and the ability to

put all the pieces together to reconstruct the events that affected the plant. Insects may harm the plants by disease transmission (Saini, 2011).

Conclusion

In conclusion, both the yield of citrus and the fruit quality are affected by citrus insects. Farmers, gardeners and horticulturists know the extent of the damage caused by insect pests but are unaware of the management tactics. The results of the present study are hoped to be of help in increasing awareness of the importance of controlling insects that occur on citrus plants, some of which are serious pests affecting the yield of citrus fruits that are of economic importance.

Acknowledgements

I would like to thanks Dr. Kay Lwin Tun, Professor and Head of the Zoology Department, University of Yangon, for her valuable advice. I would like to knowledge Dr Sandar Win, Dr Aye Aye Khaing, Dr Khin Wai Hlaing, Professor, Department of Zoology, University of Yangon.

References

Aidoo, O.F., Kyerematen, R., Akotsen-Mensah, C. and Afreh-Nuamah, K. 2016. Abundance and Diversity of Insects Associated with Citrus Orchards in Two Diferent Agroecological Zones of Ghana. *American Journal of Experimental Agriculture* 13(2): 1-18, 2016, Aitical no.AJEA.26238.

Bisht, M.S., Kukreti, M. and Shantikhuson. 2004. Relative abundance and distribution of bird fauna of Garhwal Himalaya. *Eco. Env. & Cons.*, 10(4): 451-460.

Boa, E. and Chernoh, E. 2015. Pest and disease Manual. *Africa Soil Health Consortium: Crop pests and diseases*.pp.7.

Borror, D.J., Triplehorn, C.A. and Johnson N.F. 1992. *An Introduction to the Study of Insects.* 6th ed. Saunders College Publishing and Harcourt Brace College Publishers, Printed in the United States of America.

David, B.V. and Shankar, G. 2011. *Effect of Climate Change on Insects, Plants and Pathogens, Pestide Usage*. An Unit of BSP Books Pvt., Ltd. India. 337-352

Futch, S.H. 2011. *Identification of Mites, Insects, Diseases, Nutritional Symptoms and Disorders on Citrus*. University of Florida, Institute of Food and Agricultural Science.

Ghosh, C.C. 1940. *Insect Pests of Burma*. Rangon; Superintedent's Government Printing Station, Burma. 30 pp.

Hill, D.S. 1983. *Agricultural Insect Pests of the Tropics and their Control.* 2nd ed. Cambridge, UK. Cambridge University Press. New York. pp. 539-542

Korlapati, S. 2014. *Important Natural Enemies of Citrus Insect Pests*. Balaji Scan pvt. Ltd., A.C. Guards, Hyderabad. pp. 53.

Richards, O.W. and Davies, R.G. 1964. *A General Textbook of Entomology*. Printed and bound in Great Britain by Butler and Tanner Ltd., Frome and London.

Tennant, P.F., Robinson, D., Fisher, L., Bennett, S., Hutton, D., Coates-Beckford, P. and Laughlin, W.M. 2009. *Diseases and Pests of Citrus (Citrus spp.)* Tree and Forestry Science and Biotechnology © 2009 Global Science Books. pp. 81-107