

Insect Pests and their Natural Enemies on Potato Plant *Solanum tuberosum* L. in Monhyin Environ, Kachin State

Hnin Myaing*, Yin Yin May**, Thet Thet***

Abstract

The present study on the insect pests and their natural enemies of potato plant in Mohnyin was conducted from December 2018 to November 2019. A total of 21 species of insect pests and their natural enemies distributed among 21 genera, 15 families and eight orders were identified and recorded. Among these species, insect pests were distributed to 13 species, 13 genera, 10 families and five orders were identified and recorded. Their natural enemies which were distributed among eight species, eight genera, five families and three orders were also identified and recorded. Systematic position, feeding and type of preys as studied species were tabulated. Each species was described along with colored photographs. Discussion is made with emphasis on the interesting information achieved in the study.

Keywords: Potato, Mohnyin, Insect pests, Natural enemies, Biocontrol

Introduction

Currently, Myanmar produces approximately 600,000 tons of potato on 40,000 ha and the present consumption number is about 10 kg per capita. Given consumption patterns in the other parts of Asia, it is expected that demand will increase considerably over the coming years. Potatoes in Myanmar are grown year round in four distinct seasons: irrigated spring, early monsoon, late monsoon and winter crop. At present, potato is already an important cash crop for many farmers in Myanmar and especially in Shan State. With the expected growth of the economy and income/capita the consumption of potatoes (in curries and processed: Crisps, French fries) will increase substantial in the coming years. This offers opportunities for employment and income, especially of smallholder farmers (Prank *et al.*, 2016).

Many farmers of Mohnyin (Kachin State) cultivate the potato plant. Insect pests and their natural enemies infest to the potato plants. Biocontrol is a method of controlling insect pests by using other organisms. Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids pathogens and competitors. The best way to manage insect pests of potato plant is to use the biological control method because the damage by pests to a minimal level with the smallest costs to health, and environment. The misuse of chemical pesticides affect the air, soil, water, and the health of biota. Therefore, the present research has been undertaken with the main objectives of recording insect pests and their natural enemies on

* Assistant Lecturer, Department of Zoology, Yadanabon University

** Lecturer, Department of Zoology, Mohnyin Degree College

*** Professor, Dr, Department of Zoology, Yadanabon University

potato plants which have not been undertaken by previous workers. Hence, the objectives of this study are

- to investigate and record the insect pests and their natural enemies species in the study site during the study period
- to control the insect pests on potato plant

Materials and Methods

Study area

The study site was Mohnyin, Kachin State ($24^{\circ} 46' 59.99''\text{N}$ and $96^{\circ} 21' 59.99'' \text{E}$) (Fig. 1) (Plate 1).

Study period

The study period lasted from December 2018 to November 2019.

Sampling method

Sweep net sampling and hand picking methods are used. Data on insect pests and their natural enemies were collected weekly. These specimens were collected by a fine nylon cloth sweep net (30 cm diameter). Sampling was done during morning and evening hours on all sampling dates. The insect pests and their natural enemies from potato field were collected in plastic container. The collected samples were properly sorted, counted, identified and preserved in the laboratory of Zoology Department, Yadanabon University.

Identification of the specimens

Identification of the specimens was followed after Borror and DeLong (1992) and Pathak and Khan (1994).



A. The study site

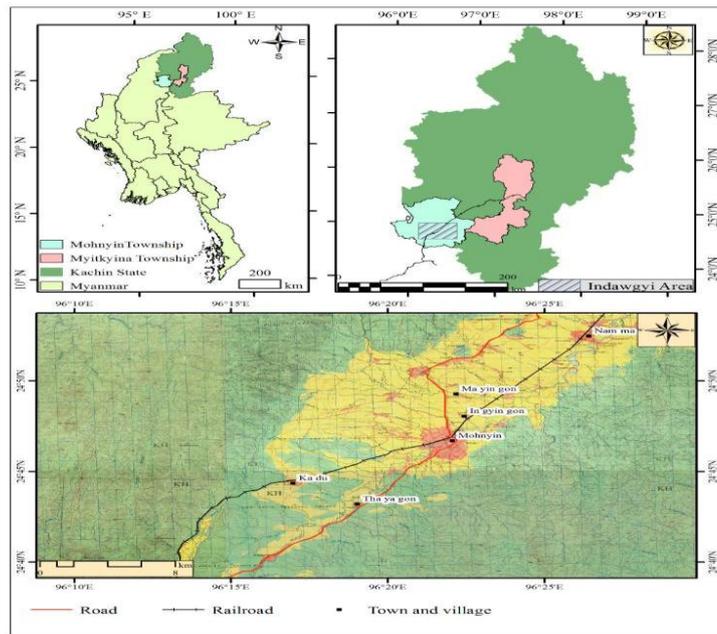


B. Plant with flowers



C. Plant with tubers

Plate. 1 Potato plant with different developmental stages



Source : 2196 – 01 (93 (-1) of UTM Map; Univresal Transverse Mercator Projection)

Fig. 1 Location map of study area

Results

A total of 21 species of insect pests and their natural enemies distributed among 21 genera, 15 families and eight orders were identified and recorded. Among these species, insect pests distributed to 13 species, 13 genera, 10 families and five orders were identified and recorded. Their natural enemies distributed among eight species, eight genera, five families and three orders were also identified and recorded (Table 1 and 2), (Plate 3 and 4).

The present study recorded the infestation of some insects and symptom of damage portion on leaf (Plate 2).

When familywise species of insect pest species were considered, it was recorded that Acrididae, Chrysomelidae and Gelechiidae showed the highest composition (15.38%), and Aphididae, Cicadellidae, Reduviidae, Coreidae, Coccinellidae, Curculionidae and Agromyzidae with the percentage (7.69% each) respectively (Fig. 2). Both adult and larvae of *Epilachna indica* (Coccinellidae) consumed the leaves to cause the defoliation and eventually death in cases of severe infestation. Similarly, both adult and larvae of *Liriomyza huidobrensis* (Agromyzidae) fed the leaves and tubers to death plant in severe infestation. The most observed insect pests were *Epilachna indica* and *Liriomyza huidobrensis*.

When familywise species of natural enemy species were considered, it was recorded that Coccinellidae, Formicidae and Araneidae represented the highest composition (25%) respectively. The lowest percentage (12.5%) was recorded in Staphylinidae and Braconidae respectively (Fig.3).



A. *Epilachna indica*



B. *Liriomyza huidobrensis*



C. *Monolepta signata*



D. *Phthorimaea operculella*



E. *Tecia solanivora*



C. Damage portion of leaf

Plate 2 Infestation of some insects to potato plant and damage portion of leaf



A. *Hieroglyphus banian*



B. *Melanoplus femurrubrum*



C. *Aulacorthum solani*



D. *Nephotettix nigropictus*



E. *Cydnocoris tabularis*



F. *Cletus trigonus*



G. *Premnotypes suturicallus*



H. *Altica lythri*



I. *Liriomyza huidobrensis*

Plate 3. The insect pest species recorded in the study site



A. *Cheilomenes sexmaculata*



B. *Coccinella transversalis*



C. *Paederus fuscipes*



D. *Opius oblongata*



E. *Oecophylla smaradina*



F. *Lasius niger*



G. *Argiope cantennulata*



H. *Oxyopes lineatus*

Plate 4. The natural enemy species recorded in the study site

Table. 1 The systematic position of insect pest species recorded in the study period

Class	Order	Family	Scientific Name	Common name	Feeding		Type of prey
Insecta	Orthoptera	Acridiidae	<i>Hieroglyphus banian</i>	Rice grasshopper	Shoot and leaf		Small insects
			<i>Melanoplus femurrubrum</i>	Grasshopper	leaf nd stem	Small insects and aphids	
	Hemiptera	Aphididae	<i>Aulacorthum solani</i>	Aphid	Leaf		Small insects and aphids
		Cicadellidae	<i>Nephotettix nigropictus</i>	Green leafhopper	Leaf		Small insects and aphids
		Reduviidae	<i>Cydnochoris tabularis</i>	Bug	Leaf		Small insects
		Coreidae	<i>Cletus trigonus</i>	Slender bug	Leaf		Aphids
	Coleoptera	Coccinellidae	<i>Epilachna indica</i>	12 spotted ladybird	Leaf		Plant and leaf hoppers
		Curculionidae	<i>Premnotrypes suturicallus</i>	Ladybird	Leaf		
		Chrysomelidae	<i>Monolepta signata</i>	White spotted leaf beetle	Leaf		Planthopper nymphs
			<i>Altica lythri</i>	Flea beetle	Leaf of young plant		
	Diptera	Agromyzidae	<i>Liriomyza huidobrensis</i>	Potato leaf miner fly	Leaf and tuber		
	Lepidoptera	Gelechiidae	<i>Phthorimaea operculella</i>	Potato tuber moth	Leaf and tuber		
			<i>Tecia solanivora</i>	Potato tuber moth	Leaf and tuber		

Table.2 The systematic position of the natural enemies recorded in the study site

Class	Order	Family	Scientific Name	Common name	Type of prey	Type of prey
Insecta	Coleoptera	Coccinellidae	<i>Cheilomenes sexmaculata</i>	Six spotted zigzag ladybird	Aphids, other insect eggs and larvae	Small insects
			<i>Coccinella transversalis</i>	Ladybird beetle	Aphids and leafhopper	Small insects and aphids
		Staphylinidae	<i>Paederus fuscipes</i>	Rove beetle	Leaf and planthopper nymphs	Small insects and aphids
	Hymenoptera	Braconidae	<i>Opius oblongata</i>	Wasp	Aphids and small insect	Small insects and aphids
		Formicidae	<i>Oecophylla smaradina</i>	Red ant	Honeydew and aphids	Aphids
			<i>Lasius niger</i>	Black ant	Honeydew and aphids	
Arachnida	Araneae	Araneidae	<i>Argiope cantenulata</i>	Orb-weaver spider	Small insects	Plant and leaf hoppers
			<i>Oxyopes lineatus</i>	Lynx spider	Small insects	Planthopper nymphs

Fig. 2 Percentage of the Family of recorded insect pest species in the study site

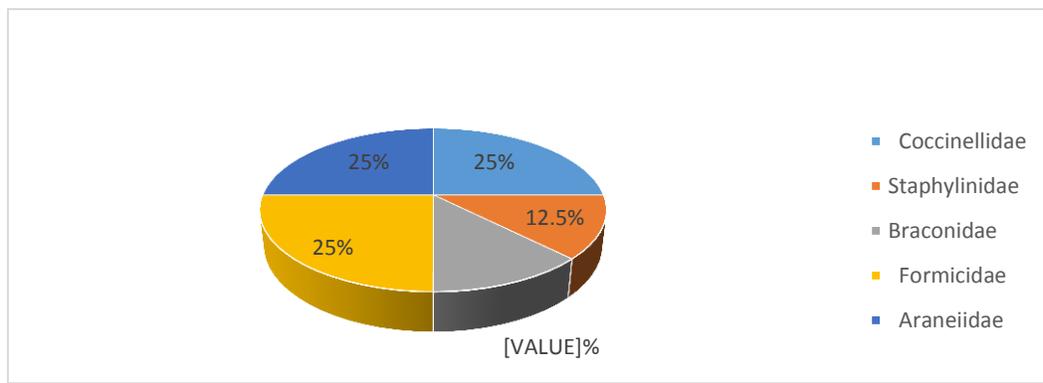
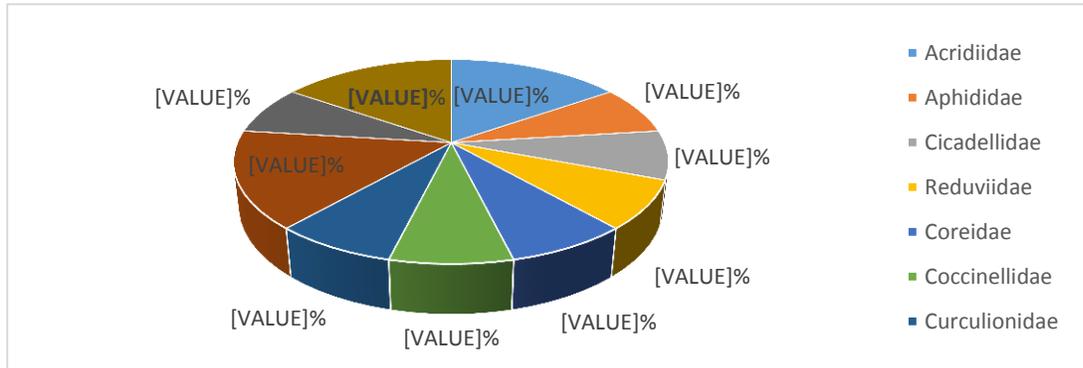


Fig.3 Percentage

of the Family of the natural enemy species recorded in the study site

Discussion

A total of 21 species of insect pests and their natural enemies distributed among 21 genera, 15 families and eight orders were identified and recorded. Among these species, insect pests distributed to 13 species, 13 genera, 10 families and five orders were identified and recorded. Their natural enemies distributed among eight species, eight genera, five families and three orders were also identified and recorded.

Epilachna species form a large genus of phytophagous coccinellids which feed chiefly on foliage of the Solanaceae. Where predator observations have been made on *Epilachna*, as with *E.varivestis* in USA and Mexico, a large number species of coccinellids, carabids, reduviids, pentatomids, and chrysopids have been found as predators (Giordanengo, *et al.*, 2013). While this research observed that *Epilachna indica* (Cocinellidae) was recorded the species composition (7.69%), this potato field encountered the moderate composition of *Epilachna indica*. The natural enemies of *Epilachna indica* were *Argiope cantenulata* and *Oxyopes lineatus* according to their feeding habits.

Several species of aphids feed on potatoes throughout the world; the most important are green peach aphid, potato aphid and *Aulacorthum solani*; they may vector of several damaging

viruses in a persistent or non-persistent manner. In potatoes, aphids rarely reach populations which lower potato yields by their feeding alone, due to nocturnal enemy complexes typically including Coccinellidae, spiders and syrphid fly larvae (Giordanengo, *et al.*, 2013). The present research investigated the small number of aphids. Coccinellidae and spiders are essentially the natural enemies of aphids and leafhoppers.

The potato leafminer fly (*Liriomyza huidobrensis*) damages plants during its larval and adult stages mainly on the lower third of plants. Affected leaves become dry and drop off the plant. Adult flies puncture holes in leaves in order to lay eggs and feed on plant juices. If this pest infests a crop during the plant growth stage, potato yield can be reduced by up to 70% (Tantowijoyo,*et.al.*,2006). The present study investigated *Liriomyza huidobrensis* in the study site.

There are two kinds of ladybirds; dull-colored ladybirds that eat plant and shiny ones that are predators of other insects. Numerous species of predatory ladybird can be found on potato crops. Both pre-adult and adult insects are equally effective preying and at controlling pests. They particularly prey on aphids, thrips and mites. Pre-adult insects are more voracious, and can eat more than 30 preys in a day. They kill and eat all parts of their prey (Tantowijoyo, *et. al.*, 2006).The present study recorded dull-colored *Epilachna indica* as insect pest while *Cheilonemes sexmaculata* and *Coccinella transversalis* as natural enemies.

The Andean potato weevil (*Premnotrypes* spp.), in the larval and adult stages, causes damage to the potato. Adults feed on leaves starting down their edges, marking a very characteristic form of semicircle. Andean potato weevils cause substantial yield losses that seriously threatened Andean farmers' food security. (Kroschel,*et. al.*, 2020). The present study investigated the adult *Premnotrypes suturicallus* in the study site.

Spiders prey on either flying or crawling insect species that move around actively. Their predatory capacity depends on the spider species and type; these could be butterflies, moths, grasshoppers, flies, etc. (Tantowijoyo, *et.al.*,2006). This study recorded *Argiope cantenulata* and *Oxyopes lineatus* in the study site. *Argiope cantenulata* was the orb-weaver spider and *Oxyopes lineatus* was the hunting spider.

Spiders and beetles have great potential as predators on potato crops. Predatory behavior and prey choice of the spiders and beetles are the most important aspects in biological control.

Oecophylla smaragdina prey on small insects and supplement their diet with carbohydrate-rich honeydew excreted by small insect (Hemiptera) (Langthasa *et al.*, 2017). This research discovered that *Oecophylla smaragdina* fed small insects on potato plant and found near the aphid

Parasitoid wasps lay their eggs on or in the bodies of other insects to cause the death of these hosts. In the present research, *Opius oblongata* was the parasitoid wasps. Therefore, those species studied of wasps were the natural enemies of insect pests.

Biological control method of potato leaf miner fly (*Liriomyza huidobrensis*) relies on farmers helping these natural enemies build up to attack adult flies and their maggots. Other natural enemies are parasitic wasps (*Opius oblongata*) killing the maggot larvae of potato leaf miner fly.

Integrated pest management (IPM) will require farmers to be trained to identify pests and their biological control agents, to do pest surveillance in their fields, and to apply various control measures (Pathak and Khan, 1994). Traditional cultivation practice and the lack of proper crop management also lead to low economic productivity and environmental degradation. Improved cultivation technology coupled with good agriculture practices should be able to balance improved economic viability and environmental conservation (Moe Aung, 2017). Therefore, farmers should notice the nature of insect pests and their natural enemies, choice of seed type to plantation, the time of sowing, the knowledge to promote the quality and productions of potato, and the modern improved cultivation technology.

Since Mohnyin is the suitable weather for potato plantation, the farmers chiefly cultivate the potato plants. Mohnyin is also the most cultivated area of potato plants in Kachin State. Therefore, the farmers should notice the natural enemies of insect pests instead of using chemical insecticides for the quality and quantity of potatoes.

Conclusion

The substantial yield losses of potato were *Premnotypes suturicallus* (Andean potato weevil) and *Liriomyza huidobrensis* (potato leaf miner fly) and *Epilachna indica* (12 spotted ladybird) while their effective natural enemies were *Coccinella transversalis* (ladybird beetle) and *Opius oblongata* (parasitoid wasp). Therefore, the potato farmers need to get the knowledge of insect pests and their natural enemies for sustainable ecosystem.

Acknowledgements

We are thankful to Rector Dr Maung Maung Naing, Yadanabon University for his permission accepting this research topic. Special thanks are due to Dr Si Si Khin and Dr Tint Moe Thuzar, Pro Rectors, Yadanabon University, for their permission to work this research paper.

References

- Borror, D. J., D.M. DeLong. 1992. *An introduction to the study of insects*. Revised Edition. Hott. Rinehart and Winston L.Y.
- Giordanengo, P., C. Vincent and A. Alyokhin. 2013. *Insect pests of potato*. The Boulevard, Oxford, UK.
- Kroschel, J., N. Mujica, J.MOkonya, and A.Alyokhin. 2020. Insect pests of affecting potatoes in tropical, subtropical, and temperate regions. *In: The potato crop*.
<http://doi.org/10.1007/978-3-030-28683-5>
- Langthasa, S., R. Teron and A.K. Tamuli. 2017. Weaver ants (*Oecophylla amaragdina*) : a multi-utility natural resource in Dima Hasao district, Assam. *International Journal of applied Environmental Sciences*, Vol. 12, No. 4. pp.709–715
- Moe Aung. 2017. Roots and tuber crops: Untapped potential for food and nutrition security and rural livelihood development in Myanmar. *In: Food resilience through root and tuber crops in upland and coastal communities of the Asia-Pacific. Results of a scoping study*.
- Pathak, M.D. and Z.R. Khan. 1994. *Insect pests of rice*. International Rice Research Institute, International Centre of Insect Physiology and Ecology, Manila, Philippines.
- Prank, A., F.Beke, K. Minderhoud, M.Goosen, M. T. Phoo, and N. Nang. 2016. *Baseline potato cultivation in Myanmar*. Wageningen University and Research Center, The Netherlands.
- Tantowijjiyo, W., and E.V.D. Fliert.2006. All about potatoes: A handbook to the ecology and integrated management of potato. International potato center (CIP-ESEAP region) and FAO regional vegetable IPM program in South and Southeast Asia. www.vegetableipmasia.org.

