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Impact of Temperature on Distribution of Diamondback Moth(Lepidoptera: Plutellidae) on Cabbage Leaves

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Diamondback moth (*Plutella xylostella* L) is an important pest of head cabbage. It is one of very destructive insect pest of cruciferous vegetables. The larvae prefer leaves of all plants in the Brassicaea family. It has a short life cycle and very high fecundity. Pattern of egg distribution was clumped rather than spread evenly. High number of eggs and pupa was found on the dorsal side of the leaves. The larvae occur more on the ventral side of the leaves than the dorsal side in the morning and evening and vise versa at noon. High temperature might make the larvae move toward the shaded area, consequently during noon the larvae were found more on the dorsal leaf surface than the ventral part.

Keywords: brassicaceae vegetables, daiamondback moths, distribution pattern,

Introduction

Diamondback moths (DBM: *Plutella xylostella* L.) (Lepidoptera: Plutellidae) has worldwide distribution. It is observed in all regions of Thailand. Adult of diamondback moth is a small, brownish grey moth with prominent antennae. It lived for averaged of 14 days. They are active at night and their principle host plants are the cruciferous plants. In Thailand, infestation damage was heavy in winter and it increase the severe loss both winter and summer. Diamondback moth control is quite difficult due to short life cycle and insect resistance faster than other insect pest. Furlong *et al*. (2013) stated that DBM problems may cost the global economy US$4–5 billion/year. Numerous tactics are available for DBM control (Philips *et al*., 2014). Inappropriate of insecticide usage and DBM resistance still continue. and sometimes it required high dosage for insect control. Therefore, the ecological studies of DBM is important including its distribution on leaves which may lead to better insect management.

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The objective was to investigate the temperature effect on DBM larvae distribution on cabbage at morning, noon and evening.

Materials and methods

Rearing of diamondback moth

Larvae and pupae of DBM were collected from cabbage in the experimental area of Faculty of Agricultural Technology, KMITL. They were kept in a plastic rearing box and fresh cabbage leaves were provided as larval diet. Cabbage leaves were changed every alternate days in order to prevent fungal contamination. Pupae were collected and transferred to adult rearing cages. Emerged adults were provided 25% honey solution and a folded paper for egg laying. Eggs were collected everyday for further studies.

Cabbage Planting

Cabbage was planted with seeds. Cabbage seedlings will be grown in a shed for two weeks, and then transplanted outside for 10 weeks. When the cabbage was fully grown and developed head then transferred 5 plants to each insect rearing cages. The 200 pupae of DBM were placed inside.

Distribution of diamondback on cabbage

The 200 pupae of DBM were placed inside. After adult emergence, they are mating and laying eggs. All DBM adults were removed from the cages. The host plant was observed for egg and pupa distribution on leaves. The number of larvae was monitored on the ventral and dorsal part of leaves in 3 different times: 8 am 12 noon and 4 pm for 8 days. The experiments were repeated twice.

Data analysis

Different number of larvae in the first and second experiment was analysed by a using paired t- test with SPSS version 20.

Results and Discussion

The results showed that more eggs and pupae were found on the dorsal parts than the ventral part of the leaves (Table 1). Temperature had effect on larval distribution pattern, more larvae were found on the ventral part than the

dorsal part in the morning(t=5.822 df 19 p<0.000) and evening(t=5.112 df19 p<0.000) and vise versa at noon(t=7.413 df 19 p<0.000) (Table 2). The second experiment had the similar result like in the first experiment which more caterpillars were found on the ventral part than the dorsal part of the leave in the morning(t=7.664 df 19 p<0.000) and evening t=5.970 df 19 p<0.000 and vise versa at noon(t=7.742 df19 p<0.000) (Table 3). Caterpillars rarely move from one plant to another plant for the 1st to 3rd larval instar because these larvae are small and do not require much food (Harcourt, 1968). Chau and Lim (1979) reported adult of diamondback moth had random distribution and their larvae and pupa distribution is clump or sometime negative binomial distribution. Pupation occur on the dorsal part of leaves or leaf nodes. Fongsmut (1992) indicated that most of second instar larvae were feed and hide on the young folded leaves of Chinese kale while the fourth instar larvae and pupae were observed on lower part of mature leaves. Maximum temperature had positive relation to the aggregation index (Ayalew *et al.*, 2008).

Table 1. No of eggs and pupae on cabbage leaves

Stage of insects	leaves	
	Ventral part	Dorsal part
egg	25.90±4.27	46.34±2.13
pupa	2.26±0.75	19.98±2.41

Table 2. Different number of DBM larvae on leaf parts in the first experiment

time	Temp.(°C)	leaf position	no of DBM larvae
Mornig (7 am)	23-26	venter	23.70±8.87
		dorsum	13.95±3.62
Noon(12 noon)	37-40	venter	6.60±3.34
		dorsum	30.00±11.35
Evening(5 pm)	25-28	venter	21.85±6.31
		dorsum	15.40±4.25

Table 3. Different number of DBM larvae on leaf parts in the second experiment

time		leaf position	no of DBM larvae
Mornig (7 am)	23-26	venter	25.45±8.48
		dorsum	15.30±3.52
Noon(12 noon)	37-40	venter	7.65±3.63
		dorsum	32.65±11.35
Evening(5 pm)	25-28	venter	23.35±6.92
		dorsum	15.10±3.43

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