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Insect Plant-Interaction in relation to oviposition in diamondback moth *Plutella xylostella* (Linn.) (Lepidoptera: Plutellidae)

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Abstract

Host plant selection for oviposition in *Plutella xylostella* (Linn.) , a pest of cruciferous crops was observed. Two plants (*Brassica oleracea capitata* and *Lycopersicon esculentum*); two varieties (*Brassica oleracea capitata*, *Brassica oleracea botrytis*) in different forms (intact plant, macerated) were used in different experiments to understand the chemoattractant potentials of these plants for the female moth. The results indicated that the females selected cruciferous plants for egg laying, the macerated forms were found to have more chemoattractant potential than the intact plants.

Key words: Insect plant interaction, Oviposition, Diamondback moth, *Plutella xylostella* (L.)

Introduction

It is believed that insects and their hosts have been engaged in the process of food allocation by natural selection for a very long time. In this process some of the plants had evolved a defensive mechanism in the form of chemicals in order to counter the attack of phytophagous insects. Some plants manufacture a particular group of chemicals and others do not; this phenomenon suggests that these chemicals are not an essential ingredient of plant metabolism. These chemicals have been called as secondary metabolic products or secondary plant substances. Closely related plants are likely to share similar metabolic pathways to manufacture such compounds.

The evolution of these secondary plant substances and the stepwise evolutionary responses by the phytophagous insects to these substances had been the dominant factor in their co-evolution. A systematic evaluation of the kinds of plants fed upon by the larvae of certain subgroups of butterflies leads unambiguously to the conclusion that secondary plant substances play a leading role in determining patterns of utilization. This seems true not only for butterflies but for all phytophagous groups. In this context, the irregular distribution in plants of such chemical compounds of unknown physiological function are classified as alkaloids, flavonoids, glycosides and essential oils. According to Dethier (1954) , in certain insects having narrow range of food plants, these compounds act as chemoattractants. It has been observed that mustard oil glucosides in crucifers elicit feeding responses in the larvae that feed on these plants. Chemical factors, thus , are of great general importance in determining larval food choice. The selection of suitable host plants for larvae is usually made by the adult female, the mistake committed by the ovipositing female would be detrimental for her offsprings.

Keeping in view the intricate and interesting mechanism involve in the selection of host plants for oviposition by the females of a group of insect pests, the present study was undertaken. Different plants (*Brassica oleracea capitata*, *Lycopersicon esculentum*);

Different varieties of *Brassica oleracea* (*B. o. capitata, B. o. botrytis*) in different forms (intact plant, macerated plant) were used.

Material and Methods

The techniques of Tabashnik et al. (1981) were followed to observe the oviposition in relation to different plants/varieties and forms to observe the selection of host plant for oviposition. The moths were reared in the screen cages. Newly emerged moths in

(1:1 sex ratio) were isolated and placed inside the copulation cage for 24 hours. After that females were isolated and put inside the ovipositon cage having two plant samples in pot A and pot B, the number of eggs laid on each plant were counted, to calculate the index of preference by the female. In all five experiments were conducted using different plant samples. Each experiment was repeated ten times to confirm the findings.

The index of preference values were calculated using the following formula:

$$\frac{eA}{eA + B} \times 100 = \%eAB$$

where:

eA = Number of eggs laid on plant A; aA+B = Number of eggs laid on plants A+B; %eAB = percent of eggs on plant A over B.

The values of >50% show the tendency of female to prefer plant sample A over B and vice versa, if the values <50%. While values close to 50% show weak or no preference._

Observations

Pot Nos	Plant Source	Number of eggs laid										
		Number of experiments										
		1	2	3	4	5	6	7	8	9	10	Total
A	*B.o.capitata* (intact)	60	65	56	60	43	50	69	67	88	74	**632**
B	*B. o. botrytis* (intact)	30	50	60	73	67	92	75	73	55	65	**640**
I. P. Value of plant A over B= 49.68%												
A	*B.o.capitata* (macerated)	100	125	117	109	102	130	99	105	118	128	**1133**
B	*B.o.botrytis* (macerated)	108	101	103	116	125	111	129	108	121	101	**1123**
I. P. value of plant A over B= 50.24%												
A	*B.o.capitata* (intact)	70	50	43	35	47	68	56	66	35	51	**521**
B	*B.o.botrytis* (macerated)	128	142	158	137	166	131	144	128	147	116	**1397**
I. P. value of plant A over B= 27.16%												
A	*B.o.capitata* (macerated)	130	119	178	186	137	200	153	139	166	143	**1551**
B	*B.o.botrytis* (intact)	47	49	41	48	52	56	45	61	45	59	503
I. P. value of plant A over B=75.51%												
A	*B.o.capitata* (macerated)	148	132	151	194	183	149	176	155	150	171	**1609**
B	*L. esculentum* (macerated)	10	18	16	09	25	14	19	28	08	16	**163**
I. P. value of plant A over B= 90.80%												

In the first and second experiments where two varieties (*Brassica oleracea capitata* and *Brassica oleracea botrytis*) were used in the forms of intact plant or macerated the index of preference was about 50% indicate that both the varieties were equally attractive confirming the oligophagous nature of the pest.

In the third and fourth experiments where the intact plant/ macerated were compared the macerated form was found to be highly attractive as compared to intact plant. In the fifth experiment where two plant species were compared. The preference was for *Brassica oleracea* over *Lycopersicon esculentum.*

Discussion

Large amount of literature is available to support the role of chemicals in oviposition. For many insect herbivores, appropriate concentrations of "key" host plant chemicals are considered to be primary factors mediating host selection (Renvick & Radke 1983, Stadler 1992). Thorsteinson (1953) suggested that minute amount of mustard oil emanating from the leaves of cruciferous host plants may stimulate the olfactory receptors of *P. xylostella* larvae. Gupta & Thorsteinson (1960) showed that more eggs were deposited on plants that contain isothiocyanates than those that do not have these compounds, and on artificial oviposition substrates treated with allyl isothiocyanates or mustard leaf juice than on untreated substrate. Palaniswamy et al. (1986) also supported the views that glucosinolates attract the adult females diamondback moth for oviposition.

The observations in the above mentioned experiments were also in agreement of all these workers. Besides, the total egg count in macerated plants was very high as compared to intact plants. The reason seems to be the increased quantity of hydrolysis products of glucosinolates. The hydrolysis of glucosinolates into various volatile compounds increases many fold when foliage is disrupted either by insect feeding or mechanical damage, which act as an attractant for the adult female to oviposit eggs in *Plutella xylostella*.

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