World Journal of Agricultural Sciences 5 (2): 143-145, 2009
ISSN 1817-3047

Feeding Response in *Pieris brassicae* Larvae to Host/Non-Host Plants

Ajaz Hassan Rather and M. Nayyar Azim

Department of Zoology, University of Kashmir, Srinagar - 190 006, India

Abstract: Feeding behaviour of *Pieris brassicae* larvae under laboratory conditions was studied, in response to different plants viz., *Brassica oleracea*, *Raphanus sativus*, *Lycopersicon esculentum*; different varieties of *Brassica oleracea* (*B. o.capitata/ B. o.botrytis*) and different forms of plants (intact/macerated) using Y-tube olfactometer. The results indicated that *Brassica oleracea* was highly preffered by the larvae as compared to *Raphanus sativus* and *Lycopersicon esculentum*. Besides, the macerated/injured form of *Brassica oleracea* was found to have more chemoattractant potential as compared to intact plant.

Key words: Feeding behaviour % *Pieris brassicae* larvae

INTRODUCTION

The systematic evaluation of different plants fed upon by the larvae of some butterflies leads to the conclusion that secondary plant substances play the leading role in the selection of host plant by the phytophagous insects. These chemical compounds of unknown physiological function may be alkaloids, quinines, essential oils, glycosides and flavonoids [1-5]. The mustard oil glucosides from cruciferae elicit feeding responses in larvae that feed on these plants, even if these glucosides were smeared on other, normally unacceptable leaves [6]. Chemical factors, thus, are of great importance in determining larval food choice.The secondary plant substances which have no nutritional value act as repellent for some insects, whereas for the insects exclusively feeding on the plants containing these substances, they may act as an attractant.

In the present study feeding response in *Pieris brassicae* larvae to different plants such as *Brassica oleracea*, *Raphanus sativus*, *Lycopersicon esculentum*; different varieties of *Brassica oleracea* (*B. o. capitata/ B. o.botrytis*); different forms of the plants (intact/macerated) was observed. The aim was to study the chemoattractant potential of secondary compounds present in these plants/varieties/forms and their role in selection of host plant by the larvae of *Pieris brassicae*. In all six experiments were conducted and the results are shown in the Table 1.

MATERIALS AND METHODS

Olfactometry Technique: The technique of [7,8] was used to observe the feeding response/preference of larvae towards the odour source of the plant in two way choice method. The Y-tube olfactometer was made in the blowing section of the Department of Chemistry, University of Kashmir, Srinagar. The main arm of the tube was 10.5 cm long and other two side arms were 10 cm long each. Diameter of the whole Y-tube was 1.6 cm and the angle between two arms was approximately 90º. Both the side arms were connected through the Teflon tubing with wash bottles (containing sample plants) tightly closed with Teflon sealed lids. Each wash bottle had two openings, one for purified air and one for sampling. The other opening of wash bottle was connected through Teflon tubing with another wash bottle containing activated charcoal for purification of air. The pressure of air flow was adjusted with the help of control knob of the aerator.

Rearing of *Pieris brassicae*: *Pieris brassicae* was reared in the research laboratory of P.G. Department of Zoology, University of Kashmir, Srinagar to get the maximum numbers of larvae for the experiments.

Sample Plants and Their Cultivation: Sample plants were grown in nurseries to keep the stock easily available for experimentation all the time. The sample plants used in the experiments include *Brassica oleracea capitata*, *Brassica oleracea botrytis*, *Raphanus sativus* and *Lycopersicon esculentum*. The appropriate sized plant samples were randomly selected from the 4-5 week old seedlings and washed thoroughly before use.

Experimental Design: The whole plant was enclosed in a 1.5 litre wash bottle tightly closed with Teflon sealed lid,

Corresponding Author: Ajaz Hassan Rather, Department of Zoology, University of Kashmir, Srinagar - 190 006, India

the air filtered through charcoal passed through the wash bottle containing one sample plant and connected with the short arm of Y-tube. The other wash bottle containing other plant sample was similarly connected with the second arm of Y-tube. Then, the larvae were collected from the rearing cages and introduced into the main arm of olfactometer, the movement of larvae towards the plant odour was recorded as positive response, if they crossed the marked-line (decision line) and remained there for at least 30 seconds or so. A total of twenty replications of each experiment were repeated using different larvae. In each experiment 5 min were given to the larvae to make the final choice. If the larvae did not respond and did not cross the marked-line within the stipulated time it was recorded as negative response.

RESULTS AND DISCUSSION

Experiments: In all six experiments were conducted using different plant species/different plant varieties/different forms of the plants as shown in Table 1.

In the first experiment all the larvae moved towards the cabbage plant, confirmed and validated the chemoattractant nature of this plant species. In the second experiment where intact/macerated forms of *B. oleracea capitata* were used, about 85% larvae moved towards the macerated form and only 15% larvae moved towards intact plant. It indicates that the concentration of chemoattractants increases many fold when plant cells are macerated or injured.

In the third and fourth experiments where different forms of the two varieties viz., *Brassica oleracea capitata* and *Brassica oleracea botrytis* were used in succession

Table 1: Showing results of experimental trials on the feeding response of *Pieris brassicae* larvae to different plant species/varieties/forms

Experiment No.	Odour source	No. of larvae	Percentage
1	*B.oleracea capitata*	20	100%
	Water	0	0%
2	*B. oleracea capitata*(intact)	3	15%
	B.oleracea capitata(macerated)	17	85%
3	*B.oleracea capitata*(intact)	11	55%
	B.oleracea botrytis(intact)	9	45%
4	*B.oleracea capitata*(macerated)	9	45%
	B. oleracea botrytis(macerated)	11	55%
5	*B.oleracea capitata*(macerated)	18	90%
	Raphanus sativus(macerated)	2	10%
6	*B.oleracea capitata*(macerated)	20	100%
	Lycopersicon esculentum(macerated)	0	0%

(intact/macerated) showed no significant difference in selection of host plant by *Pieris* larvae, indicating oligophagous nature of the pest.

In the subsequent experiments (fifth and sixth) where different plant species viz., *Raphanus sativus* and *Lycopersicon esculentum* along with *Brassica oleracea capitata* in different forms (intact/macerated) were used, showed clear cut preference by the larvae for *B. oleracea capitata* as compared to other plant species.

Statistical Analysis: The observations made in the different experimental trials as mentioned above were compared through chi-square test in order to find out the significant differences (if any) in the chemoattractant potential present in these plant species/varieties/forms.

The chemoattractant nature of *B. oleracea capitata* and *B. oleracea botrytis* intact and macerated (chi-sq.=2.339, df=1, p=0.126) and (chi sq=0.762, df=1, p=0.383) respectively did not differ significantly at p=0.05. The macerated form of *Brassica oleracea capitata* was preffered by the pest over the intact form, the statistical analysis showed the significant difference (ch sq.=6.910, df=1, p=0.009). Similarly the macerated form of *B. oleracea capitata* was highly preffered by the pest over the macerated forms of *Raphanus sativus* and *Lycospersicon esculentum* used in two separate experiments. The statistical calculations also showed the difference at a significant levels. The statistical values obtained for the experiment involving *B.oleracea capitata* and *Raphanus sativus* and between *B. oleracea capitata* and *Lycopersicon esculentum* were(chi sq.=9.187, df=1, p=0.002) and (chi sq.=15.00, df=1, p=0.00) respectively. The observations showed that macerated forms of *B. oleracea capitata* and *B. oleracea botrytis* are highly potent chemoattractant for the larvae of *Piers brassicae*.

A lot of work has been done on the chemical composition of *B. oleracea* plant and concluding results of most of these workers stress on the role of volatile compounds as a chemoattractant for the crucifer specialist pests. The observations in the present study are also in agreement with these workers, as suggested [9] that the volatiles obtained following the maceration of plant tissues are different from the volatiles given off by intact plants. Finch [10] reported that an intact plant released approximately 7 µg of volatile aglucones/day. In contrast, macerated plants contained approximately 1000 µg of attractant chemicals, demonstrating that these rape plants were releasing the equivalent of about 0.7% of their glucosinolates as volatiles each day. These results support the observations of the second experiment where attraction towards macerated plants was very high as compared to the intact plant.

The findings of the present investigations suggest that *B. oleracea* acts as a powerful chemoattractant for the larvae in all the six experiments. Further, the macerated form proved to be more powerful as compared to the intact one. The reason for this behaviour seems to be the presence of higher concentration of chemical compounds in the macerated form.

ACKNOWLEDGMENTS

The authors are thankful to Prof. Ghulam Mustafa Shah, Head, P. G. Department of Zoology, University of Kashmir, Srinagar, for providing research facilities.

REFERENCES

1. Chew, F.S., 1980. Food plant preferences of *Pieris caterpillars* (Lepidoptera). Oecologia, 46: 347-353.
2. Dethier, V.G., 1954. Evolution of feeding preferences in phytophagous insects. Evolution, 8: 33-54.
3. Fraenkel, G., 1956. Insects and plant biochemistry. The specificity of food plants For insects. Proc. 14th Internl. Congr. Zool., pp: 383-387.
4. Gordon, H.T., 1961. Nutritional factors in insect resistance to chemicals. Ann. Rev. Entomol., 6: 27-54.
5. Thorsteinson, A.J., 1960. Host selection in phytophagous insects. Ann. Rev. Entomol., 5: 193-218.
6. Thorsteinson, A.J., 1953. The chemotactic responses that determine host specificity in an oligophagous insect (*Plutella maculipennis* [Curt.]Lepidoptera). Can. J. Zool., 31: 53-72.
7. Vuorinen, T., A.M. Nerg, M.A. Ibrahim, G.V.P. Reddy and J.K. Holopainen, 2004a. Emission of *Plutella xylostella* induced compounds from cabbages grown at elevated carbon dioxide and orientation behaviour of the natural enemies. Plant Physiol., 135: 1984-1992.
8. Vuorinen, T., G.V.P. Reddy, A.M. Nerg and J.K. Holopainen, 2004b. Monoterpene and herbivore-induced emission from cabbage plants grown at elevated atmospheric carbon dioxide concentration. Atmos. Environ., 38: 675-682.
9. Ettlinger, M.G. and A. Kjaer, 1968. Sulphur compounds in plants. Rec. Adv. Phytochem., 1: 59-144.
10. Finch, S., 1978. Volatile plant chemicals and their effect on host plant finding by the cabbage root fly (*Delia brassicae*). Ent. Exp. Appl., 24: 150-159.