

- O'CONNOR, B. M., 1982a. - *Astigmata*. In PARKER ed.: *Synopsis and classification of living organisms*. Mac Graw Hill Co, New York: 146-169.
- O'CONNOR, B. M., 1982b. - Evolutionary ecology of astigmatid mites. *Ann. Rev. Entomol.* 27: 385-409.
- O'CONNOR, B. M., 1984. - *Acarine-Fungal relationships: The evolution of symbiotic associations*. in WHEELER, Q. & BLACKWELL, M. ed. *Fungus-Insects relationships: perspectives in ecology and evolution*. Columbia University Press, N.Y., pp. 354-381.
- PIELOU, D. P. and VERMA, A. N., 1968. - The arthropod fauna associated with the birch bracket fungus, *Polyporus betulinus*, in Eastern Canada. *Can. Entom.* 100: 1179-1199.
- PURVIS, G. and EVANS, G. O., 1982. - Astigmatic mites of the genera *Schwiebea* OUDMS and *Nanacarus* OUDMS from S. E. Ireland. *J. nat. Hist.* 16: 815-821.
- SAMSINAK, K. and VOBRAZKOVA, E., 1983. - Mites from the city pavement. *Vest. cs. Spolec. zool.* 47: 118-121.
- VOLGIN, V. I. and MIRONOV, S. V., 1979. - New species and genus of the family Saprogliphidae (Acarina, Acaroidea). In *Fauna and ecology of Arachnida*, Ed. Y. S. BALASHOV *Zool. Inst. Akad. Sci. SSSR.* 85: 91-98 (in Russian).

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Feeding and oviposition preference of cabbage butterfly *Pieris brassicae*

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Summary

Dual choice test indicated that *B. campestris* var. *sarson* (sarson), *B. oleracea* var. *botrytis* (cabbage) and *B. juncea* (raya) are the more preferred host plant of larvae of cabbage butterfly as compared to *B. oleracea* var. *capitata* (cauliflower). *B. campestris* var. *toria* (toria) is less preferred as compared to it. But the *B. oleracea* var. *capitata* was most preferred for oviposition followed by *B. oleracea* var. *botrytis*, *B. juncea*, *B. campestris* var. *toria* and *B. campestris* var. *sarson*. The larvae completed their development after passing through 5 instars. As compared to *B. campestris* var. *sarson* larval development was faster on *B. juncea*, *B. oleracea* var. *botrytis*, *B. oleracea* var. *capitata* and *B. campestris* var. *toria*. Maximum adults emerged on *B. oleracea* var. *botrytis* followed by *B. juncea*, *B. oleracea* var. *capitata*, *B. campestris* var. *sarson* and *B. campestris* var. *toria*. Highest growth index was recorded on *B. oleracea* var. *botrytis* followed by *B. oleracea* var. *capitata*, *B. juncea*, *B. campestris* var. *sarson* and *B. campestris* var. *toria*. A new method was developed to draw conclusion regarding susceptibility of host plants from different experiments.

Cabbage butterfly, *Pieris brassicae* is an important pest of cole crops in many countries of North Africa, Europe and Asia. In India it has been recorded as major pest of cruciferous crops from an altitude of 100 to 1800 m. (SACHAN and GANGWAR, 1980; BAKHETIA and BRAR, 1982). Defoliation of 8.97-10.41, 10.75-13.76, 13.80-16.89 and 7.79-9.63 percent of leaf area in early cabbage, late cabbage, early cauliflower and late cauliflower respectively have been found to cause economic damage (STRAKA, 1979) and direct correlation between number of larvae and yield loss was observed (TER-SIMONYAN and MIKHEEVA, 1981). The outbreak of the pest depends upon the availability of preferred host and favourable temperature and humidity. Preferred hosts of the same or different species play important role in population build up of the pest and the outbreak can be checked by giving due emphasis to less preferred plant types in agro-ecosystem. A few attempts have been made to search the resistant plant types of cabbage (CHANDRA and LAL, 1976; VERMA *et al.*, 1981). In the present investigation feeding, growth and development, and oviposition preference of cabbage butterfly have been studied on cole crops and a new method has been developed to draw conclusion from different experiments.

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Materials and methods

The feeding preference of cabbage butterfly, *P. brassicae* was studied under laboratory condition in dual choice test on five plants, viz. *Brassica campestris* var. *sarson* (BSH-1), *B. juncea* (Varuna), *B. campestris* var. *toria* (DK-1), *B. oleracea* var. *capitata* (Pride of India), *B. oleracea* var. *botrytis* (Pusa snowball-1), belonging to family cruciferae. The *B. oleracea* var. *capitata* was taken as standard host. Four leaf discs, two each of test and standard plant, measuring 2 cm² (were cut and fixed alternatively and equidistantly (i.e. standard vs test plant) near the perimeter of the petridish (5') with an entomological pin. For proper fixing of pins one cm thick layer of wax was placed in petridish whose top was lined with moist filter paper. Each treatment was replicated 10 times. The last instar larvae of cabbage butterfly (starved for 20 hours) were allowed to feed on the discs of the plants for 3 hours after which they were removed and area eaten by them was measured. The preference index was calculated by using KOGAN and GOEDEN (1970) formula.

To study the oviposition preference of cabbage butterfly eight crops namely *Triticum aestivum* (wheat), *Cicer arietinum* (gram), *Pisum sativum* (pea), *B. campestris* var. *sarson* (sarson), *B. juncea* (raya), *B. campestris* var. *toria* (toria), *B. oleracea* var. *capitata* (cauliflower) and *B. oleracea* var. *botrytis* (cabbage) which belong to different orders and families were sown in 3 blocks in the field. During the crop season the total eggs laid on these crop and number of eggs batches were recorded at two days interval and the total number of eggs laid on each crop was determined.

The growth and development of cabbage butterfly was studied under laboratory condition, on five cruciferous plants namely *B. campestris* var. *sarson*, *B. juncea*, *B. campestris* var. *toria*, *B. oleracea* var. *botrytis* and *B. oleracea* var. *capitata*. Thirty newly hatched larvae were reared on each host plants in individual plastic vials in five groups. Observation was recorded on percent pupation, larval period, number of instars, percent adult emergence and pupal period. Growth index and Howe's growth index were calculated as per formula given by SRIVASTAVA (1959) and HOWE (1971) respectively. Data were subjected to analysis of variance.

Results and discussion

Except *B. campestris* var. *toria* all the host plants were more preferred by larvae of cabbage butterfly as compared to standard host plant. The *B. campestris* var. *sarson* was the most preferred host followed by *B. oleracea* var. *botrytis* and *B. juncea* (table-1).

The adults of cabbage butterfly selected only cruciferous plants for egg laying and no eggs were laid on *T. aestivum*, *C. arietinum* and *P. sativum*. Marked difference existed in the number of eggs laid on different plants. Maximum number of eggs (3929) were laid on *B. oleracea* var. *capitata* followed by *B. oleracea* var. *botrytis* (3526) and *B. juncea* (3508). But, as compared to these plants, the number of eggs laid was very low on *B. campestris* var. *sarson* and *B. campestris* var. *toria*. Number of attempts made for oviposition were also in the same order. Maximum clusters of eggs were found on *B. oleracea* var. *capitata* followed by *B. oleracea* var. *botrytis* and *B. juncea*. The clusters of eggs were

in very low number on *B. campestris* var. *sarson* and *B. campestris* var. *toria*. Clusters laid on *B. juncea* and *B. campestris* var. *toria* had 106.5 to 106.30 eggs while on *B. oleracea* var. *capitata* and *B. oleracea* var. *botrytis*, 91.37 to 95.29 eggs were laid per cluster. The number of eggs laid per batch were low on *B. campestris* var. *sarson* plant. No significant difference existed in number of eggs per batch on different host plants (Table-1).

Data recorded on growth and development of cabbage butterfly revealed that the larvae completed their development in 26.60 to 28.03 days on different host plants after passing through 5 instars. Similar observations were recorded by GARDINER (1978) on *P. brassicae*. As compared to *B. campestris* var. *sarson* on which larvae completed their development in 28.03 days, faster larval development was observed on *B. juncea*, *B. campestris* var. *toria*, *B. oleracea* var. *botrytis* and *B. oleracea* var. *capitata*. Percent pupation varied non significantly from 63.33 to 93.33 being lowest on *B. campestris* var. *toria* and highest on *B. oleracea* var. *botrytis*. Percent pupation on *B. campestris* var. *sarson*, *B. juncea* and *B. oleracea* var. *capitata* varied from 70.00 to 76.66. Pupal development was completed in 11.02 to 11.22 days. On different varieties of cabbage, the larval and pupal periods have been found to vary from 30-33.4 and 7.9 days respectively (CHANDRA and LAL, 1976). Maximum adults emerged on *B. oleracea* var. *botrytis*, while rearing on *B. campestris* var. *toria* resulted in emergence of minimum adults. No marked difference was recorded in adult emergence on *B. campestris* var. *sarson*, *B. oleracea* var. *capitata* and *B. juncea* which varied from 70-73.33 percent. Growth index was highest on *B. oleracea* var. *botrytis* followed by *B. oleracea* var. *capitata*, *B. juncea*, *B. campestris* var. *sarson*, *B. campestris* var. *toria*.

A small difference existed in the preference of host for feeding, oviposition and growth and development. To get a clear picture regarding susceptibility of different host plants a method based on ranking of the host plant was developed (Table-2). We selected four parameters, preference index, total number of eggs laid, percent adult emergence and growth index, and ranked the host plants with respect to each parameters. The most favourable host plant got the rank 1 while most unfavourable was ranked at 5. Rank total and rank average for each host were calculated and finally the hosts plants were ranked on these basis. Final rank was in the same sequence as the growth index. It is evident that *B. oleracea* var. *botrytis* (Pusa snowball-1) is the most preferred host plant of cabbage butterfly followed by *B. oleracea* var. *capitata*, *B. juncea*, *B. campestris* var. *sarson* and *B. campestris* var. *toria* was the least preferred host plant.

A small difference was observed in feeding and oviposition preference of cabbage butterfly. The *B. campestris* var. *sarson* was most preferred for feedings while it was least preferred for oviposition. The *B. oleracea* var. *botrytis* and *B. juncea* got the same rank in both types of preferences but marked difference existed on *B. oleracea* var. *capitata* which was the most preferred host for egg laying even after having poor response in food preference. JERMY and SZENTESI (1979) are of the view that though females select the suitable oviposition media for progeny, oviposition stimuli still do not reflect the quality of substrate as larval food.

Parameters studied	<i>B. campestris</i>		Host Plants		<i>B. oleracea</i>		S. En. Index
	var. <i>sarson</i>	<i>B. juncea</i>	<i>B. campestris</i> var. <i>toria</i>	<i>B. oleracea</i> var. <i>capitata</i>	<i>B. oleracea</i> var. <i>botrytis</i>		
I. FEEDING PREFERENCE							
a. Preference index	1.70 (1)	1.45 (3)	0.70 (5)	1.00 (4)	1.65 (2)		
II. OVIPOSITION PREFERENCE							
a. Number of eggs batches	3	33	17	45	17		
b. Total number of eggs laid	287 (5)	3508 (1)	1503 (4)	3929 (3)	3520 (2)		
c. Number of eggs per batch	85.67	106.33	106.05	91.27	95.27		NS
III. GROWTH AND DEVELOPMENT							
a. Number of larval instars	5	5	5	5	5		
b. Percent pupation	79	73.33	53.33	26.66	26.67	8.03	NS
c. Larval period (days)	28.03	26.75	26.66	26.77	26.50	0.24	S
d. Percent adult emergence	70.00 (2.5)	73.33 (2)	63.33 (3)	70.00 (1)	90.00 (1)	8.10	NS
e. Pupal period	11.22	11.92	11.24	11.33	11.02		
f. Growth index	2.50 (4)	2.74 (3)	2.38 (5)	2.84 (2)	3.51 (1)	0.21	NS
g. Howe's growth index	0.152	0.161	0.156	0.162	0.171		

Table 1. Feeding and oviposition preference, growth and development of cabbage butterfly, *Pieris brassicae*.

NS: Non significant
S: Significant

Rank	<i>B. campestris</i>		<i>B. juncea</i>		<i>B. campestris</i>		<i>B. oleracea</i>		<i>B. oleracea</i>	
	var. <i>sarson</i>				var. <i>toria</i>		var. <i>capitata</i>		var. <i>botrytis</i>	
	n	rn	n	rn	n	rn	n	rn	n	rn
Rank = (1)	1	1	0	0	0	0	1	1	2	2
Rank = (2)	0	0	1	2	0	0	1	2	2	4
Rank = (3)	0	0	3	9	0	0	0	0	0	0
Rank = (3,5)	1	3.5	0	0	0	0	1	3.5	0	0
Rank = (4)	1	4	0	0	1	4	1	4	0	0
Rank = (5)	1	5	0	0	3	15	0	0	0	0
Rank total	rn	13.5		11.0		19.0		10.5		6
Rank average	$\frac{rn}{n}$	3.37		2.75		4.75		2.62		1.50
Final rank of host		(4)		(3)		(5)		(2)		(1)

Table 2. Difference in preference of host based on ranking of preference index, total number of eggs laid, percent adult emergence and growth index.

r: Rank
n: Number of times a host has got the rank
rn: Rankxn

References

BAKHETIA, D. H. C. and BRAR, K. S., 1982. - Pest control in rape seed and mustard. *Indian Fmg.*, 32: 60-63.

CHANDRA J. and LAL, O. P., 1976. - Development and survival of caterpillar of cabbage butterfly, *Pieris brassicae*. *Indian J. Ent.*, 38: 187-188.

GARDINER, B. O. C., 1978. - Instar number and pupal colouration in Palestinian *Pieris brassicae* L. *Proceedings and Transactions of British Entomological and Natural History Society*, 11: 21-23.

HOWE, R. E., 1971. - A parameter for expressing suitability of environment for insect development. *J. Stored Prod. Res.*, 7: 63-65.

JERMY, T. and SZENTESI, A., 1979. - The role of inhibitory stimuli in the choice of oviposition site by Phytophagous insects. *Proceeding of 4th International Symposium-Insect and Host plant-held at Fulmer Grange, Slough, England 4-9 June, 1978. Entomologia exp. appl.*, 24: 458-471.

KOGAN, M. and GOEDEN, R. O., 1970. - The host plant range of *Lema trilineata daturaphila* (Coleoptera: Chrysomelidae). *Ann. ent. Soc. Am.*, 63: 1175-1180.

SACHAN, J. N. and GANGWAR, S. K., 1980. - Vertical distribution of important pests of cole crops in Meghalaya, as influenced by environmental factors. *Indian J. Ent.*, 42: 414-421.

SRIVASTAVA, B. K., 1959. - Growth potential of *Laphygma exigua* in relation to certain food plants. *Madras agric. J.*, 46: 255-259.

STRAKA, F., 1979. - The level of economic damage caused by leaf-gnawing pests during the first half of vegetation period of cabbage and cauliflower. *Gradinarska i Lozarska Nauka*, 16: 84-92.

TER-SIMONYAN, L. G. and MIKHEEVA, A. P., 1981. - Criteria of the desirability of chemical treatment of cabbage. *Zaschita Rastenii*, 12: 54-55.

VERMA, T. S., BHAGCHANDANI, P. M., SINGH, N. and LAL, O. P., 1981. - Screening of cabbage germplasm collection for resistance to *Brevicoryne brassicae* and *Pieris brassicae*. *Indian J. agric. Sc.*, 51: 302-305.

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