



Development of *Crocidolomia binotalis* Zeller (Lepidoptera: Pyralidae) on a semi synthetic diet

K. SRINIVASA MURTHY, T. VENKATESAN and S. K. JALALI

Project Directorate of Biological Control (ICAR)
Post Bag No.2491, H. A. Farm Post, Bellary Road,
Bangalore 560 024, Karnataka, India
E-mail: ksm239@rediffmail.com

ABSTRACT: The mean developmental period of *Crocidolomia binotalis* Zeller was 32.5 days with a percentage larval survival of 65.1 per cent and adult emergence of 56.6 per cent on a semi- synthetic diet, while these were 26.6 days, 79.1 and 83.2%, respectively when reared on cabbage leaves. The factors for the variations in the biological attributes when reared on the diets and the feasibility of utilizing semi- synthetic diet reared host for rearing the parasitoids are discussed.

KEY WORDS: Biological parameters, cabbage leaf webber, *Crocidolomia binotalis*, semi- synthetic diet, rearing

The cabbage leaf webber caterpillar, *Crocidolomia binotalis* Zeller is an important pest of crucifer crops like cabbage, cauliflower, radish and mustard causing considerable yield losses. Maity *et al.* (2001) observed a loss of 1.71 q/ha in rapeseed for every one per cent increase in plant damage index. A larval density of 2-3/plant could destroy the primordia in cabbage and prevent establishment of young plants (Nagarkatti *et al.*, 1982). In nature, the leafwebber is parasitised by *Apanteles obliqua* Walker, *Enicospilus xanthocephalus* Cameron., *Cantheconidea furcellata* Wolff (Singh & Rawat, 1980), *Palexorista solennis* Walker (Peter *et al.*, 1983) and *Diplazon orientalis* Cameron (Raich, 1976). A semi- synthetic diet was synthesized for rearing the cabbage leaf webber, as mass rearing on the natural host is cumbersome and laborious. The pest reared on

semi- synthetic diet could also be utilized for mass production of the parasitoids listed above.

The initial culture of *C. binotalis* was obtained from the field and was maintained on cabbage leaves, kept inside a rearing cage (30x30x30cms). Pair of adults (male and female) obtained from the field culture was released in to another cage containing a bouquet of cabbage leaves, which served as a site for oviposition. The newly emerged larvae were provided with fresh bouquet of leaves, and the larvae at the 1-2 instar stage were transferred on to the semi-synthetic diet individually.

The composition of the semi-synthetic diet is given in Table 1. The ingredients under fraction-A were placed in a blender bowl. The cabbage leaf powder (5g) was added to 50 ml of hot water (60-

70°C) and was then transferred to the blender bowl containing ingredients under "A" and blended for one minute. Water under fraction "C" was heated to 70°C and 11.2g of agar-agar was added to it and stirred to a beading consistency. The agar-agar was cooled for a minute and then poured in to the blender bowl and blended for a minute. Finally, the ingredients under fraction "D" were added in to the bowl and again blended for a minute. The diet was then dispensed in to sterilized plastic vials (5 x 2.5 cm) up to a height of 2.5 cm and allowed to cool and solidify.

Table 1: Composition of semi-synthetic diet for *C. binotalis*

Ingredients	Quantity
Fraction A	
Casein	17.5 g
Soy flour	15.0 g
Yeast	8.1 g
Sucrose	17.5 g
Wesson's salt mixture	5.0 g
Choline chloride	0.5 g
Aureomycin	0.5 g
Methyl -p-hydroxy benzoate	1.0 g
Cholesterol	1.25 g
Soy oil	3.5 ml
KOH solution	2.5 ml
Fraction B	
Cabbage leaf powder	5 g
Water	50ml
Fraction C	
Agar agar	11.25 g
Water	420.00ml
Fraction D	
Multivitamin	0.5 g
Ascorbic acid	2.0 g
Sorbic acid	1.0 g
Vitamin E	1 capsule
Formaldehyde	1 ml

There were two treatments (T_1 – semi-synthetic diet and T_2 – cabbage leaves), the various biological parameters (larval and pupal periods, per cent larval survival, pupation, adult emergence and adult longevity) were considered as sub-treatments. There were nine replications under each treatment. There were 50-vials of semi-synthetic diet under each replication and 5 containers with 10 larvae each under natural diet. The rearing was carried out at ambient temperature of 25-27°C and 65 per cent relative humidity. The observations on biological parameters when reared on natural and semi-synthetic diets were recorded as means under each treatment and were compared using paired "t" test.

The mean developmental period of *C. binotalis* on the semi-synthetic diet was 32.5 days as compared to 26.6 days when reared on cabbage leaves (Table 2). Significant differences were observed in the developmental period of the larva when reared on the semi-synthetic diet (16.2 days) and on cabbage leaves (11.7 days), while the pupal period when reared on both the diets was on par (12.8 and 10.2 days, respectively). Rai *et al.* (1977) observed the larval and pupal period to be 11.9 and 11.6 days, respectively on cabbage, when reared at 25°C. Duration of both the larval and pupal periods when reared on the semi-synthetic diet were prolonged than when reared on cabbage leaves. This was in conformity with the observations of Kurihara *et al.* (1987).

The percentage larval survival (65.1), pupation (67.0) and adult emergence (56.6) on the semi-synthetic diet was significantly less as compared to cabbage leaves (79.1, 83.2 and 75.0 %, respectively). A larval survival of 91 per cent was reported on the diet synthesized by Jayanth & Nagarkatti (1981). The mean fecundity of the pest was 63.8 on semi-synthetic diet and 74.1 on cabbage leaves. Irrespective of the diet, no significant difference in adult life span was observed in the present studies, which coincided with the findings of Kurihara *et al.* (1987). However, significant difference was observed with respect to fecundity (63.8 on semi-synthetic diet and 74.1 on cabbage leaves).

Table 2. Comparative biology of *C. binotalis* reared on semi-synthetic diet and cabbage leaves

Biological parameters	Reared on semi-synthetic diet	Reared on cabbage leaves	Students "t" test (p<0.05)
Larval period (days)	16.2 ^a	11.7 ^b	3.51 *
Larval survival (%)	65.1 ^a	79.1 ^b	5.36 **
Pupal period (days)	12.8 ^a	10.2 ^a	5.00 NS
Pupation (%)	67.0 ^a	83.2 ^b	8.51 *
Total development (days)	32.5 ^a	26.6 ^b	3.71*
Adult emergence (%)	56.6 ^a	75.0 ^b	12.0 **
Adult longevity (days)	10.1 ^a	11.4 ^a	3.75 NS
Fecundity	63.8 ^a	74.1 ^b	5.36 **

Means accompanied by the same letter in a row are not significant.

The variations in the biological parameters between the semi-synthetic diet and the natural host leaves could be attributed to the differences in the chemical constituents (proteins, lipids, carbohydrates and the C-N ratio) in the semi-synthetic diet and or absence of feeding stimulants. It is evident from the present study that the semi-synthetic diet sustained the development of the cabbage webworm, though the larval survival, adult emergence and fecundity was comparatively low than when reared on cabbage leaves. Refinement of the semi-synthetic diet with nutritional supplements found wanting along with changes in the structure and moisture level would probably promote increased feeding and enhance the biological attributes of the pest when reared on semi-synthetic diet. Laboratory rearing of cabbage webworm on leaves is laborious and time consuming as each of the larva has to be carefully transferred on to fresh leaves while replacing old leaves: Therefore, the use of semi-synthetic diet has an added advantage in mass rearing programmes and production of some of the natural enemies, though biological parameters may not be exactly comparable with those observed while rearing on natural host.

REFERENCES

- Jayanth, K. P. and Nagarkatti, S. 1981. An artificial diet for rearing *Crocidolomia binotalis* Zeller and *Hellula undalis* Fabr. (Lepidoptera: Pyralidae), two major pests of cole crops in India. *Entomon*, **6**: 95-97.
- Kurihara, M., Tatsuki, S., Jutisno, S. and Fukami, J. I. 1987. Artificial diet for the large cabbage heart caterpillar, *Crocidolomia binotalis* (Zell.) (Lepidoptera: Pyralidae). *Applied Entomology and Zoology*, **22**: 232-234.
- Maity, B. K., Tripathy, M. K. and Panda, S. K. 2001. Estimation of crop losses due to *Crocidolomia binotalis* Zell. in Indian rapeseed and determination of its economic threshold level. *Indian Journal of Agricultural Research*, **35**: 52-55.
- Nagarkatti, S., Jayanth, K. P., Heong, K. L., Lee, B. S., Lim, T. M., Teoh, C. H. and Ibrahim, Y. 1982. Population dynamics of major insect pests of cabbage and of their natural enemies in Bangalore District (India). Proceedings of the International Conference on Plant Protection in the Tropics, 1-4 March, 1982. Kuala Lumpur, Malaysia, 325-347.
- Peter, C., Singh, I. and ChannaBasavanna, G. P. 1983. Biology and seasonal incidence of *Palexorista*

- solennis* (Diptera: Tachinidae) in South India. *Entomon*, **8**: 317-320.
- Rai, P. S., Chandra, B. K. N. and Nagesh Chandra, B. K. 1977. Bionomics of the cabbage leaf webbing caterpillar, *Crocidolomia binotalis* Zeller. *Indian Journal of Entomology*, **38**: 233-235
- Raich, K. V. 1976. New parasites of cabbage webworm. *Science & Culture*, **42**: 434-435.
- Singh, O. P. and Rawat, R. R. 1980. Natural enemies of cabbage leaf web worm, *Crocidolomia binotalis* Zell. at Jabalpur (Madhya Pradesh). *Indian Journal of Entomology*, **42**: 326.