



## BIOLOGY AND MORPHOMETRY OF CABBAGE HEAD BORER, *HELLULA UNDALIS* FAB (PYRALIDAE: LEPIDOPTERA)

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### ABSTRACT

Biology of cabbage head borer, *Hellula undalis* (F.), a pest of cabbage was studied during 2009 under laboratory conditions ( $25^{\circ}\text{C} \pm 2$  and 60% RH). The egg incubation period was  $2.3 \pm 0.48$  days. Length and breadth were  $0.43 \pm 0.01$  mm and  $0.31 \pm 0.01$  mm, respectively. The duration of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> larval instar was  $3.5 \pm 0.48$ ,  $5.0 \pm 0.82$ ,  $5.7 \pm 0.48$  and  $6.3 \pm 0.68$  days, respectively. The total larval duration was  $19.3 \pm 2.2$  days, prepupal period  $2.7 \pm 0.82$  days and pupal period  $17.7 \pm 0.82$  days. The full grown larvae measured  $22.09 \pm 0.71$  mm in length and  $4.32 \pm 0.46$  mm in breadth. The adult longevity of male  $3.8 \pm 1.0$  days and of female was  $5.7 \pm 1.3$  days, and the pre-oviposition, oviposition and post-oviposition periods were  $1.8 \pm 0.42$ ,  $3.7 \pm 0.63$  and  $1.2 \pm 0.38$  days, respectively. The wing expanse of male and female was  $24.55 \pm 0.78$  and  $21.35 \pm 0.48$  mm, respectively. The average fecundity was  $147.9 \pm 35$  eggs/female.

**Key words:** Biology, Morphometrics, *Hellula undalis*, *Brassica oleracea*, cabbage, head borer.

### INTRODUCTION

Cabbage (*Brassica oleracea* var. *capitata*) an important vegetable crop of world-wide importance is infested by many insect pests of which, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae), *Spodoptera litura* (F.) (Lepidoptera: Noctuidae), *Pieris brassicae* (L.) (Lepidoptera: Pieridae) and *Hellula undalis* (F.) (Lepidoptera: Pyralidae) cause appreciable loss (Bhalani, 1984). *H. undalis*, the cabbage worm, is a serious pest of crucifer crops in the tropics and subtropics. It has been reported on cabbage, cauliflower, turnip, radish and on mustard. Enclosed in a loose web, the larvae feed on the young leaves and bore into the growing tip. Feeding damage by single larvae may result in the termination of plant growth. Its biology has been studied to some extent in Japan by Watanabe (1927) and in Morocco by Bouhelier and Hudault (1935), but practically little work has been reported from India (Ayyar, 1940). Due to lack of information on the life cycle and information on morphometries of this pest, the present work has been undertaken.

### MATERIAL AND METHODS

The biology of *H. undalis* was studied during 2009–2010 in IPM laboratory ( $25^{\circ}\text{C}$  and 60% R.H) of Department of Entomology, Punjab Agricultural University, Ludhiana. To maintain the culture, larvae were collected from cabbage fields and confined in glass jars in the laboratory and daily

fresh cabbage was provided as food. The pupae were kept in a glass jar for adult emergence. The adults were provided with honey solution fortified with multivitamins. Blotting paper was provided for egg laying. The duration of eggs was studied on the basis of 20 eggs in a Petri plate having moist sponge covered with blotting paper. The duration of larval stages was determined by releasing 20 neonates, separately in Petri plates, which were provided with moist sponge having blotting paper on their surface. Each larva was provided with a small leaf for feeding and was covered with another leaf of the same size and food was changed daily. The observation on duration of different larval instars was recorded using a magnifying hand lens (15X). The pre-pupal period characterized by the contracted body and sluggishness of the larvae was studied on the basis of 20 larvae, which entered the pre-pupal stage on the same day.

For observations on pre-oviposition, oviposition and post-oviposition periods, 20 freshly emerged pairs were separately released in glass jars. The adults were provided with leaves for egg laying and 10 percent honey solution as food. After the start of egg laying, the females were transferred daily to new jars for recording fecundity, pre-oviposition, oviposition, post-oviposition period and longevity till they died. The pupae kept for adult emergence were observed at an interval of 3 hrs to record the time and mode of their emergence. Ten newly emerged pairs were released separately in jars during 2009 and observations were taken on the mating behaviour, pre-mating and mating

periods. The adults from laboratory reared culture were sorted out into males and females on the basis of the abdomen, which was broader in females. The length and breadth of eggs, different instars of larva, pupa and adult were measured by using a stereoscopic binocular microscope.

## RESULTS AND DISCUSSION

**Eggs:** Eggs were ovoid in shape and either pinkish or creamy white in colour soon after being laid. Eggs were laid singly their length and breadth being  $0.43 \pm 0.01$  and  $0.31 \pm 0.01$  mm, respectively. Eggs hatched out in  $2.3 \pm 0.48$  days (Tables 1 & 2). Bhalani (1984) recorded the egg duration to be 2.86 days at  $29^\circ\text{C}$  and 67.5% R.H. According to Sivaparagasam and Abdul Aziz (1990), it was 3 days at a mean temperature of  $82^\circ\text{F}$ .

**Larva:** The larva passes through four instars, the first instar larva being creamy white in colour with a duration of  $3.5 \pm 0.48$  days. It measured  $3.64 \pm 0.01$  mm in length and  $0.46 \pm 0.05$  mm in breadth. The second instar larvae were creamy yellowish in colour with duration of  $5 \pm 0.82$  days and they measured  $9.91 \pm 0.7$  mm in length and  $1.54 \pm 0.05$  mm in breadth. The third instar larva is characterized by pinkish brown longitudinal stripes, which become more distinct in colour, the duration of third instar larva was  $5.7 \pm 0.48$  days. It measured  $16.73 \pm 0.91$  mm in length and  $2.93 \pm 0.08$  mm in breadth. The fourth larval instar measured  $22.09 \pm 0.71$  mm in length and  $4.32 \pm 0.46$  mm in breadth with a duration of  $6.3 \pm 0.68$  days (Tables 1 & 2). The last instar larva is creamy yellow with pinkish tinge and five distinct pinkish brown longitudinal stripes on the back: one mid dorsal and two dorsolateral on either side. Just below the lower dorso-lateral stripes there are brownish circular minute spiracles. Small setae, borne on minute tubercles, are found sparsely situated over the body. Sandhu and Bhalla (1973) reported the total larval period to be 17–27 days at  $25 \pm 2^\circ\text{C}$  and  $65 \pm 10\%$  R.H.; whereas, it was 10.80 days at  $29^\circ\text{C}$  and 67.5% R.H. according to Bhalani (1984).

**Prepupa and Pupa:** Prepupal period is characterized by the contracted body and sluggishness of the larvae that lasted  $2.7 \pm 0.82$  days. It measured  $17.14 \pm 0.32$  in length and  $3.41 \pm 0.55$  in breadth (Tables 1 & 2). According to Rawat *et al.* (1968), the prepupal period varied from 1–3 days at  $27.9$  to  $33.7^\circ\text{C}$ , whereas Harakly (1969) reported this period to be 4.1 days at  $16.4^\circ\text{C}$  and 21.4 hours at  $32.2^\circ\text{C}$ . Pupation occurs between the leaves, after few hours of pupation, pupa get much contracted and turns a dark brown. The pupa is about  $16.92 \pm 0.78$  mm in length and  $3.23 \pm 0.46$  mm in width and the pupal period lasts for  $12.7 \pm 0.82$  days. Bouhelier and Hudault, (1935) reported this

period to vary from 10 to 15 days in Morocco. In Egypt, Assem and Nasar (1969) reported this period to be 20 days.

**Table 1. Duration of various stages of *Hellula undalis***

Insect stages		Duration (in days)
Egg		2–3 ( $2.3 \pm 0.48$ )
Larvae	1 <sup>st</sup> instar	3–4 ( $3.5 \pm 0.48$ )
	2 <sup>nd</sup> instar	4–6 ( $5.0 \pm 0.82$ )
	3 <sup>rd</sup> instar	5–6 ( $5.7 \pm 0.48$ )
	4 <sup>th</sup> instar	5–7 ( $6.3 \pm 0.68$ )
Total larval period		17–23 ( $19.3 \pm 2.2$ )
Pre–Pupa		2–3 ( $2.7 \pm 0.82$ )
Pupa		10–14 ( $12.7 \pm 0.82$ )
Adult	Male	3–5 ( $3.8 \pm 1.0$ )
	Female	5–7 ( $5.7 \pm 1.3$ )
	Pre–oviposition	2–4 ( $3.7 \pm 0.63$ )
	Post–oviposition	1–2 ( $1.2 \pm 0.38$ )
Fecundity		120–185 ( $147.9 \pm 35$ )

**Table 2. Morphometry of different stages of *Hellula undalis***

Insect stages		Mean length (mm)	Mean width (mm)
Egg		$0.43 \pm 0.01$	$0.31 \pm 0.01$
Larvae	1 <sup>st</sup> instar	$3.64 \pm 0.01$	$0.46 \pm 0.05$
	2 <sup>nd</sup> instar	$9.91 \pm 0.7$	$1.54 \pm 0.05$
	3 <sup>rd</sup> instar	$16.73 \pm 0.91$	$2.93 \pm 0.08$
	4 <sup>th</sup> instar	$22.09 \pm 0.71$	$4.32 \pm 0.46$
Pre–Pupa		$17.14 \pm 0.32$	$3.41 \pm 0.55$
Pupa		$16.92 \pm 0.78$	$3.23 \pm 0.46$
Adult wing expanse	Male	–	$24.55 \pm 0.78$
	Female	–	$21.35 \pm 0.48$

**Adult:** Moths usually emerge during night. At the time of emergence, the pupal covering gets ruptured at the anterior end and moth slowly wriggles out through the longitudinal slit. The male moths are grayish brown, the forewing has wavy grey markings and hind wings are pale dusky, however in newly emerged female, these markings are relatively darker than those in the male. Further, in the female, the terminal segment of the abdomen is long and pointed whereas in the male it is relatively blunt. Adults were found in mating position mostly at night or in early hours of the day. Copulation occurs a few hours after emergence that takes place in an end to end position.

The male and female moths measure  $24.55 \pm 0.78$  and  $21.35 \pm 0.48$  mm across the spread of wings. Females live longer ( $5.7 \pm 1.3$  days) than males ( $3.8 \pm 1.0$  days). Earlier, Singh *et al.* (1990) also reported that females live longer than males. The pre-oviposition, oviposition and post-oviposition periods were  $1.8 \pm 0.42$ ,  $3.7 \pm 0.63$  and  $1.2 \pm 0.38$ , respectively. Rawat *et al.* (1968) reported the pre-oviposition, oviposition and post-oviposition periods to be 1–2, 1–2, 0–1 days respectively at  $27.9$ – $33.7^\circ\text{C}$ ; whereas Youssef *et al.* (1973) reported these periods to be 16–20 hrs, 10–12 hrs and 3–4 days respectively at  $29^\circ\text{C}$  and 71% R.H. The fecundity varied from 120 to 185 eggs (average of  $147.9 \pm 35$  eggs) per female. Sandhu and Bhalla (1973) reported fecundity to be 125–150 eggs at  $25^\circ\text{C}$  and 65% R.H.

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