Sampling adult male populations of *Hellula undalis* (Lepidoptera:Pyralidae) in cabbage using virgin-females baited sticky trap

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Abstract

The activity of adult males of *Hellula undalis* (Fabr.) in a cabbage field was determined using a sticky trap baited with two laboratory-reared one-day old virgin females. The daily activity pattern of *H. undalis*, based on the number of males trapped, was also determined at hourly intervals in four crop areas. The relationship between trap catches, larval populations on the cabbage plants and amount of rainfall was examined.

Trap catches of adult males of *H. undalis* were consistently high suggesting that immigration could be an important factor influencing the dynamics of the *H. undalis* population on cabbage. There was a poor relationship (r = 0.03) between trap catches and larval populations in the field. Rain also did not influence trap catches. Daily activity of male moths, based on trap catches, suggested a bimodal pattern with a higher peak between 5.30 h to 6.30 h and a relatively smaller around 20.30 h.

Key words: *Hellula undalis*, cabbage, virgin-female, trap, activity

Introduction

Amongst the insect pests which inflict serious damage to head cabbage, *Brassica oleracea* var. *capitata*, particularly in the lowlands of Malaysia, is the cabbage webworm (CWW), *Hellula undalis* (Fabr.) (Syed et al, 1992; Sivapragasam, 1994). Crop life tables on cabbage indicated that this pest is responsible for about 41 percent of total mortality of plants during the preheading stage (Sivapragasam, 1994). One of the major problems contributing to the pest status of *H. undalis* is the fact that there is no economic threshold level for *H. undalis* to initiate insecticidal treatments. Thus, a single larva boring into the growing shoot of the cabbage plant during the preheading stage, can result in either the death of the plant or produce two or more small-sized heads that are not marketable. Consequently, control measures initiated against this pest are preemptive and employed chemical insecticides on a weekly or twice weekly basis. The frequent use of pesticides elevates the cost of production and increases selection pressure towards resistance development (Sivapragasam, 1994). This poses a major problem for the implementation of the integrated pest management programme for cabbage in the lowlands (Syed et al, 1992).

Understanding the behaviour and ecology of *H. undalis* in the field could contribute towards the effective management of *H. undalis*. Amongst the important ecological factors that need to be investigated are that of understanding adult activity in the field. Although some information on adult activity of *H. undalis* in the field had been reported elsewhere (Yamada, 1981; Shirai and Kawamoto, 1990), such information is lacking in Malaysia. In this study, the activity of the adult male population of *H. undalis* were examined using virgin-females baited sticky traps. The latter method was used by Shirai and Kawamoto (1990) to examine flight distances of *H. undalis*. The use of virgin females is necessary as the sex pheromone, identified as an aldehyde (E11, E13)-11,13-hexadecadienal (Arai et al, 1982; Ando et al., 1988), has not been commercially available as yet.

Materials and Methods

Adult activity on cabbage

This study was conducted in a cabbage (var. K-K cross) plot at the experimental field at MARDI, Serdang, which was surrounded by other non-c cruciferous plants such as tomato, beans and fruit trees. The cabbage plot measured 12.0 m x 12.5 m with about 500 transplanted cabbage plants grown using recommended agronomic practices. Except for the preplant insecticidal spray, which was done one week before transplanting, no insecticides were used on the cabbage plants in the field.

The activity of *H. undalis* adult males in the field was monitored using a trap which had two laboratory-reared one-day old virgin females (Shirai and Kawamoto, 1990). The design of the trap was similar to the one used for trapping the diamondback moth (Reagon Pluma®) (Irfan et al, 1991). Both the adult females were confined in a small cage measuring 10.0 cm in length and 3.5 cm in diameter constructed with 14 mesh plastic wire screen. A 10 % honey solution was provided as food for the adults. The cage was then hooked to the inside top portion of the trap. The inside bottom of the trap was covered with a thin polyethylene sheet held in place by clips and sprayed with a sticker (Kinryu®, SDS Biotech). The trap was then mounted on a wooden stake and set at a height of 0.5 m above
the ground in the center of the cabbage field. The base of the wooden stake was sprayed regularly with sticker to prevent predacious insects such as ants from getting into the trap. Considering the size of the cabbage field, only one trap was used in this study. The number of *H. undalis* male moths in the trap was recorded and removed daily. The females in the small cage were replaced weekly using laboratory-reared females. Trapping was done from four days before transplanting cabbage until harvest of the cabbage. Daily records of temperature and rainfall were also made using the meteorological station at MARDI, Serdang during the duration of the experiment. To correlate trap catches with the larval population, the number of larvae on 40 cabbage plants in the same field was also counted. For sampling, the cabbage field was divided into four subplots and ten plants selected randomly in each quadrant were sampled *in situ* at 3 to 4 day intervals from 7 days after transplanting until harvest.

**Daily activity pattern of adults**
The daily activity pattern of the *H. undalis* males was determined at hourly intervals using one-day old virgin female moths in the trap described above. One trap was placed at four different locations in the MARDI Research Station, which also included a plot planted with cabbage. Preliminary trapping studies had shown the presence of moth in all the four locations. The experiment was repeated on five separate days which had no rain and quite similar temperature conditions. However, wind speed and direction were not recorded.

**Results**
Male moth catches showed random fluctuations with no apparent relationship to the larval populations in the field (*Figure 1*). Trap catches were already high even before any *H. undalis* larvae were recorded on the cabbage, i.e. <20 days after transplanting cabbage. Similarily, at the later stage of the crop, i.e. after 40 days, adults trapped were also high. Although the local larval populations on cabbage could have contributed to the adults trapped, it does not account for the relatively high number of adults trapped after this period. In any case, larval survival to adult is generally very low (ca 1%) for *H. undalis* under field conditions (Sivapragasam, 1994). There was also no significant relationship (*r* = 0.22; *P >*0.05) between mean weekly trap catches at time *t* and the number of larvae on 10 cabbage plants at time *t + 2*.

Rain did not seem to influence the activity of the moths (*Figure 2*) as indicated by the low correlation (*r* = 0.03) between the number of adults caught and the incidence of rainfall.

The daily trap catches, based on the mean from four locations, suggested a bimodal activity pattern; the first and higher peak from 5.30 to 6.30 h and a relatively smaller peak at 20.30 h (*Figure 3*).

**Discussion**
Trap catches of adult male *H. undalis* were higher than that expected from the field population of larvae, suggesting possible immigration of moths into the cabbage plot. The relatively high numbers of adult catches vis-a-vis the low larval numbers on cabbage suggested that the local population of the larvae on cabbage had little influence on the subsequent trap catches. Considering that local dispersal of *H. undalis* was common (Shirai and Kawamoto, 1990), one major source of the immigrant population on cabbage could be from its ubiquitous weed host, *Cleome rutidosperma* (D and C.). The latter is a common denizen in areas cultivated with vegetables in Serdang (Sivapragasam, 1994). One possible explanation for the fluctuating numbers trapped could be related to the age of virgin females. We found a significant correlation (*r* = 0.98; *P <*0.01) between the age of females and the numbers trapped with fresh females generally attracting higher number of adults and their attractancy reducing with age.

![Figure 1. Trends in larval numbers and trap catches for Hellula undalis on cabbage](image-url)
Figure 2. Fluctuations in daily adult trap catches and rainfall

Although rain may be important during the early larval stages of *H. undalis*, it may not be so against the other stages (Sivapragasam, 1994). Kawamoto *et al.*, (1987) however reported that temperature is more important for flight activity of *H. undalis* and the optimal temperature for this purpose is about 20 °C. However, in the Malaysian lowlands, minimum temperatures exceeded the latter value.

Talekar *et al.* (1981), also reported that in *H. undalis* adult emergence was predominantly at night. This is quite similar to that reported for the diamondback moth *Plutella xylostella* (Ashihara, 1977). But, the reason for the higher activity of the moths towards dawn needs to be investigated in the future.

Although pheromone traps have been useful to predict and time the initiation of control measures (van Steenwyk *et al.* 1983), this study suggested that the virgin female baited sticky traps per se might be limiting as a reliable predictive tool. However, in the absence of the commercial pheromones, this approach could be useful in detecting and monitoring adult populations of the moth especially in areas where crucifers are grown. Besides pheromone traps, other traps, such as the mercury vapor lamp (Sasaki, 1986) and light traps (Yamada, 1981), have also been used for trapping *H. undalis*. However, the attractancy of either sex to these traps has been reported to be very low.

References


