

NOTA TÉCNICA

Diamondback moth oviposition preference on cabbage

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Abstract: The present study about the oviposition preference of the diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae), can contribute to the determination of the location and time of release of parasitoids and predators or application of insecticides or bio-insecticides in the cabbage culture, *Brassica oleracea* Capitata group (Brassicales: Brassicaceae). Thus, aimed to this study was to determine the oviposition pattern of diamondback moth on three leaves locations and age of cabbage plants. The locations of the evaluated leaves were external, intermediate and internal. The evaluated plant ages were 20, 40, 60 and 80 days after transplanting. The eggs deposition behavior by diamondback moth was influenced by the development stage of the cabbage plant ($F_{6, 96} = 438.21$; $p = 0.05$). The oviposition preference on the external leaves occurred on plants with 20 days old, on the intermediate leaves at 40 days and on the internal leaves at 60 and 80 days. The age with greater oviposition was at 40 days on the external and intermediate leaves; and at 60 days on the internal leaves. Therefore, the behavior of egg deposition of the diamondback moth was altered as the cabbage plant development.

Key words: insect-host; plant age; *Plutella xylostella*; posture.

Preferência de oviposição da traça-das-crucíferas em repolho

Resumo: O presente estudo sobre a preferência de oviposição da traça-das-crucíferas, *Plutella xylostella* (Lepidoptera: Plutellidae), pode contribuir para a determinação da localização e hora da liberação de parasitoides e predadores ou aplicação de inseticidas ou bio-inseticidas na cultura do repolho, *Brassica oleracea* Capitata group (Brassicales: Brassicaceae). Logo, o objetivo deste estudo foi determinar o padrão de oviposição da traça-das-crucíferas em três locais de folhas e idade das plantas de repolho. As localizações das folhas avaliadas foram externas, intermediárias e internas. As idades das plantas avaliadas foram 20, 40, 60 e 80 dias após o transplante. O comportamento de deposição de ovos por traça-das-crucíferas foi influenciado pelo estágio de desenvolvimento da planta de repolho ($F_{6, 96} = 438,21$; $p = 0,05$). Nas folhas externas, a preferência de oviposição ocorreu em plantas com 20 dias de idade. Nas folhas intermediárias, aos 40 dias e nas folhas internas, aos 60 e 80 dias. A idade com maior oviposição foi aos 40 dias nas folhas externa e intermediária; e aos 60 dias nas folhas internas. Portanto, o comportamento da deposição de ovos da traça-das-crucíferas foi alterado conforme o desenvolvimento da planta de repolho.

Palavras-chaves: idade da planta; inseto-hospedeiro, *Plutella xylostella*, postura

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INTRODUÇÃO

The oviposition preference is the main mechanism for insect-host relationship establishment, because this characteristic interacts with plant acceptability, spatial distribution and abundance to generate association patterns in the environment (THOMPSON, 1998). This theory fits most moths, which have first-instar larvae with limited mobility and are generally unable to move and locate a suitable food source if the insect oviposites on inappropriate place (ZALUCKI; CLARKE; MALCOLM, 2002).

The diamondback moth, *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae) is considered the main brassicas plague in the world, which can cause losses in crop production and abandonment (ZALUCKI et al., 2012). This is due to the control difficulty imposed by the pest, involving generations overlapping, high fertility index, rapid cycle, great migratory capacity and even the development of populations resistant to synthetic and natural insecticides.

The cabbage *Brassica oleracea* Capitata group (Linnaeus, 1758) (Brassicales: Brassicaceae) is a biennial plant with appreciable β -carotene, calcium and vitamin C contents, making it one of the most important brassicas in terms of volumes planted and marketed (CORREA; CARDOSO; CLAUDIO, 2013; CECÍLIO FILHO; CAVARIANNI; NOWAKI, 2016; BATISTA et al., 2017). In this culture, the injuries caused by *P. xylostella* caterpillars are perceived by the holes in the "cabbage heads", which reduces the product commercial value. These plants show large variations in size and canopy structure arrangement throughout the cycle, which may influence the oviposition location and, consequently, the pest management efficiency.

Therefore, *P. xylostella* oviposition preference knowledge can guide in determining the right moment of release of parasitoids and predators or application of insecticides or bioinsecticides. In addition, it can provide information on the most favorable time of insect infestation in cabbage culture. Thus, aimed to this work was to determine the oviposition pattern on three leaves locations and four cabbage plants ages.

MATERIAL E MÉTODOS

The study was conducted in a greenhouse located in the *Núcleo de Desenvolvimento Científico e Tecnológico em Manejo Fitossanitário de Pragas e Doenças* (NUDEMAFI) of the *Universidade Federal do Espírito Santo* (UFES). The cabbage used in the experiment was

cultivated in 10 liter plastic pots containing a soil mixture, bovine manure and sand in a 5: 3: 1 ratio.

The *P. xylostella* population used in the experiment came from the laboratory stock, kept in organic production cabbage leaves. The experimental units consisted of cages with wooden frames (0.5 x 0.5 x 0.5 m) and anti-Aphid screen. Each cage was occupied by a cabbage plant and a *P. xylostella* couple. The moths were 24 hours old and were at the beginning of the posture activity when they were packed in the cages. The eggs counting in cabbage plants occurred after 12 h exposure to *P. xylostella* couples.

The eggs number was evaluated in a completely randomized design (CRD) in double factorial (3 x 4), with three leaves locations (external, intermediate and internal) (Factor A) and four cabbage plant ages (20, 40, 60 and 80 days after transplant) (Factor B), with nine replications.

The variance analysis was performed, and in the significance case, the means were compared by the Tukey test at 5% probability.

RESULTS AND DISCUSSION

The eggs deposition behavior by *P. xylostella* was influenced by the cabbage plant development stage ($F_{6, 96} = 438.21$; $p = 0.05$). At 20 days after transplanting, the oviposition was higher on the external leaves (8.3 eggs) (Figure 1). However, at 40 days, the highest value occurred on the intermediate leaves (17.10 eggs). After 60 days, the eggs number on the internal leaves was superior to the others, followed by the intermediate leaves.

The intermediate and internal leaves were protected by external leaves still tender until, approximately, at 40 days. After this period, the intermediate leaves were exposed. At 60 days, with the formation of a compact structure by imbricated leaves, popularly called "cabbage head", the complete exposition of the internal leaves occurred, which were more tender than the external and intermediate ones, given the opening and senescence of these.

The first instar larvae present a limitation in the mobility and are generally unable to feed if oviposition occurs on inappropriate location, which may hinder these individuals survival². Therefore, the food need for tender leaves may have influenced the oviposition preference for external leaves only on the plants with 20 days, while the intermediate leaves only at 40 days and the internal leaves at 60 and 80 days.

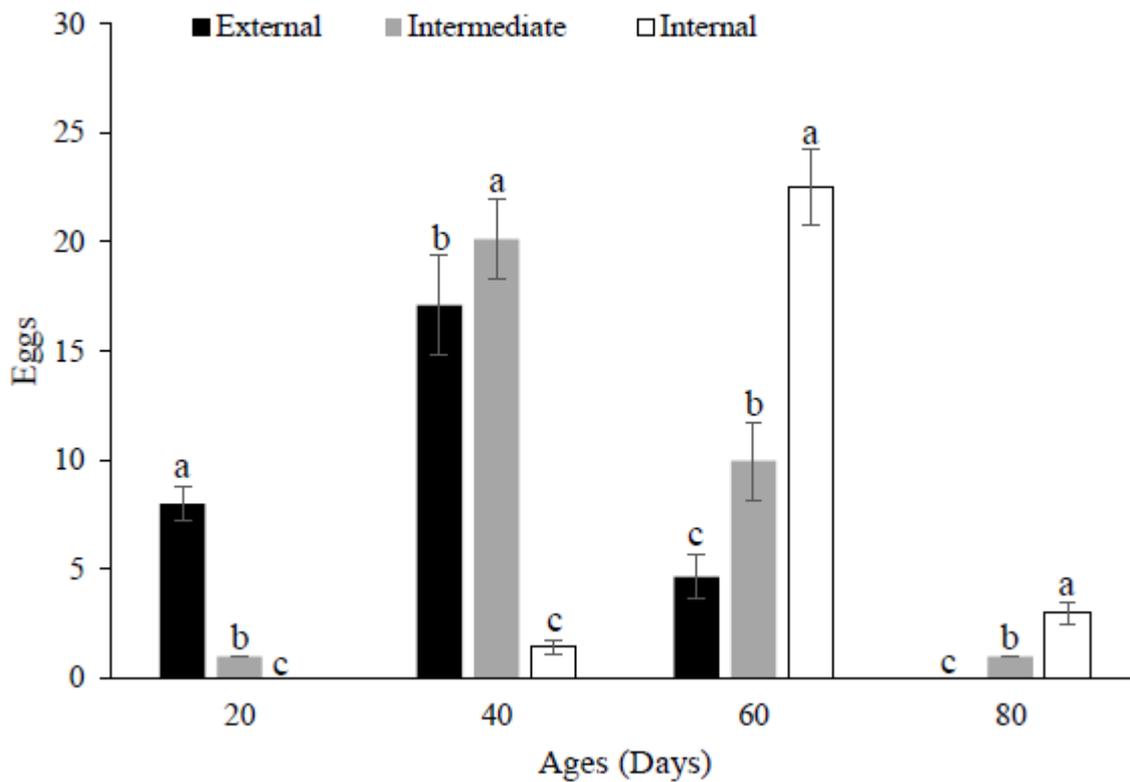


Figure 1: *Plutella xylostella* eggs number at three leaves locations in the four cabbage plants ages. Averages followed by the same letter are statistically the same by the Tukey test ($p > 0.05$).

Although the outer leaves were preferred at 20 days, it was observed that the highest oviposition value occurred at 40 days (17.10 eggs), with tendency to cease at 80 days (0 eggs) (Figure 2). In the intermediate leaves, the oviposition peak also occurred at 40 days (20.11 eggs), however, without ceasing at 80 days (1 egg). This result may be due to the senescence stage being less advanced than on the external leaves. The oviposition on the internal leaves began at 40 days (1.44 eggs), with the partial opening of the external and intermediate leaves, with higher value at 60 days (22.50 eggs).

The nutritional value of the first leaves defined in the plant tends to decrease with the "cabbage head" formation at 60 days. In cabbage, there is a nutrients transfer from the older leaves to the young ones, with the external leaves partial fall, intermediates curving and the internal leaves compaction (AQUINO, 2009; MOREIRA; VIDIGAL, 2011). Therefore, the results obtained in this study are in agreement with the cabbage plant development, and it can be inferring that *P. xylostella* moths prefer to oviposit in younger leaves, according to the accessibility over time, on the cabbage plants structure.

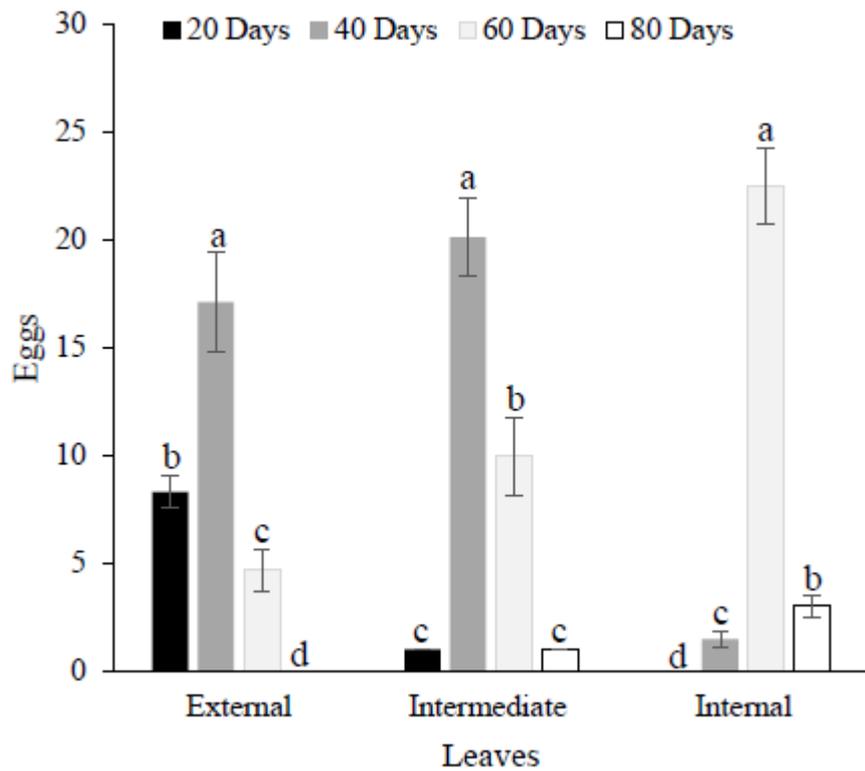


Figure 2: *Plutella xylostella* eggs number at four cabbage plant ages at the three leaves locations. Averages followed by the same letter are statistically the same by the Tukey test ($p > 0.05$).

The change in leaves preference observed in the present study, associated with variation in the oviposition site verified by Zago et al. (2010) can influence the *P. xylostella* management in cabbage. In this sense, the offspring allocation in greater depth on the plants during the trial period, besides favoring the parasitism escape, also provides greater protection to other mortality factors, such as insolation and insecticides with contact action.

CONCLUSION

In this study were determined the locations and age of the cabbage plant preferred by *P. xylostella* moths for laying eggs. Thus, it was observed that the egg deposition peak occurred in the internal leaves at 60 days.

The results obtained can help in the monitoring and management of this species on the cabbage crop, providing information on the infestation season and the appropriate moment for decision making of *P. xylostella* management methods.

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