

Some biological observations on *Mamestra brassicae* (Linnaeus, 1758) (Lepidoptera: Noctuidae), an important cabbage pest in Erzurum, Turkey

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ABSTRACT: Biology, damage and infestation rate of *Mamestra brassicae* (L., 1758) (Lepidoptera: Noctuidae), an important cabbage (*Brassica oleraceae* L.) pest were studied under the ecological conditions of Erzurum, Turkey in 1999 and 2000. The results of field trials showed that *M. brassicae* overwinters in pupal stage, 3-5 cm deep in the soil. The first adult emergence occurs at the early June. Females deposit 693 eggs as average beneath the cabbage leaves. Oviposition of the females lasts 6-12 (8.4) days. The first hatch occurs in late June. The larvae initially feed on eggshell and continue to feed on lower epidermis and parenchyma up to upper epidermis. The fifth stage larvae enter inside and feed in the central part of cabbage. The remnants of larval feeding and frass are visible between cabbage leaves. After five molting, the larvae pupate in the soil at the beginning of August. *M. brassicae* mostly prefers to overwinter on the edge of beds where soil is softer and not in contact with water. Under Erzurum ecological conditions, *M. brassicae* produces only one generation per year and its infestation rate is 38.1% in the field conditions.

Key words: *Mamestra brassicae*, cabbage pest, biology, Erzurum, Turkey

Erzurum'da önemli bir lahana zararlısı *Mamestra brassicae* (Linnaeus, 1758) (Lepidoptera: Noctuidae)'nin biyolojisi üzerinde bazı gözlemler

ÖZET: Önemli bir lahana (*Brassica oleraceae* L.) zararlısı olan *Mamestra brassicae* (L., 1758) (Lepidoptera: Noctuidae)'nin biyolojisi, zarar ve bulaşıklık oranı Erzurum'da 1999 ve 2000 yıllarında araştırılmıştır. *M. brassicae*, kış toprağın 3-5 cm derinliğinde pupa döneminde geçirmektedir. İlk ergin çıkışı, haziranın ilk haftasının sonunda olmaktadır. Dişiler, yumurtalarını ortalama 693 adet olarak lahana yapraklarının alt yüzüne bırakmaktadır. Yumurta bırakma süresi, 6-12 (8.4) gün sürmektedir. Yumurtadan ilk larva çıkışı haziran sonunda görülmekte, çıkan larvalar başlangıçta yumurta kabuklarıyla beslenmekte, daha sonra yaprağın alt epidermisi ve parankima dokusuyla beslenmesini sürdürmektedir. Beşinci dönem larva, lahananın göbek kısmına girerek, burada beslenmektedir. Larva beslenme artıkları ve dışkıları, lahana yaprakları arasında görülebilmektedir. Larva, beş gömlek değiştirdikten sonra, ağustos başından itibaren toprakta pupa dönemine girmektedir. *M. brassicae*, genellikle kışlamak üzere, lahana tavalarının kenarlarındaki su ile temas etmeyen yumuşak toprak kısımlarını tercih etmektedir. Erzurum ekolojik şartlarında *M. brassicae*'nin yılda bir nesil verdiği ve bulaşıklık oranının % 38.1 olduğu belirlenmiştir.

Anahtar Kelimeler: *Mamestra brassicae*, lahana zararlısı, biyoloji, Erzurum

INTRODUCTION

Cabbage (*Brassica oleraceae* L.) is an important vegetable for human nutrition. Each 100 g cabbage contains 24 cal energy, 1.3 g protein, 0.2 g fat and 5.4 g carbohydrate. Additionally, the same amount of cabbage holds 1.30 IU vitamin A, 47 mg vitamin C, 0.05 mg thiamin, and 0.3 mg niacin as vitamins and 49 mg Ca, 29 mg P, 0.4 mg Fe, 20 mg Na, and 233 mg K as minerals (Pierce, 1987).

Cabbage is commonly grown in all of the regions in Turkey. According to the recent statistical data, Turkey produces 622,000 tons cabbage per year (Anonymous, 2002). Erzurum having a climate characterized with cold and snowy winters, and dry summers (Figure 1) has a cabbage production potential of 5469 tons per year (Anonymous, 2002).

The cabbage moth, *Mamestra brassicae* (L.), is widely distributed throughout most of Europe and Asia, from 30° N to about 70° N (Øgaard, 1983). The polyphagous larvae are mainly recognized as pests on cabbage (*Brassica oleracea* L.), but have also been reported from a wide range of other plant species

(Turnock and Carl 1995; Noldus and Potting 1990; Johansen, 1997; Rojas et al. 2001; Klingen et al. 2002). Its known host plants include more than 70 species of 22 families, of which Brassicaceae and Chenopodiaceae are among the most preferred (Popova, 1993). Biology of *M. brassicae* has been studied extensively (Birch et al. 1989; Noldus and Potting 1990; Popova, 1993; Poppy and Birch 1994; Kazimirova, 1996; Rojas et al. 2000, 2001).

Mamestra brassicae is also one of the important pests of cabbage in Turkey (Doğanlar et al. 1981; Avcı and Özbek 1990; Başar and Uğur 1995; Tozlu et al. 1998, 2002). Başar and Uğur (1995) determined some morphological and biological characteristics of *M. brassicae* in a laboratory study. However, there is no such a study that determines biological characteristics of this pest under field conditions in Turkey.

The aim of present work is to determine the biology of *M. brassicae* under field conditions in Turkey.

MATERIAL AND METHODS

Biological observations on *M. brassicae* were made on cabbage plants grown in Atatürk University, Agricultural Research and Extension Center Experimental Fields, and in private farms from May to October in 1999 and 2000.

In order to determine the emergence of adults, the pupae of *M. brassicae* were removed from the soil in cabbage fields at the beginning of October. The pupae, 82 in 1999 and 90 in 2000, were placed at upward position in 3-5 cm deep of the soil suitable for insect and covered by a cage (40x40x50 cm in dimensions) to overwinter under natural conditions. The cage was observed and adult emergence was periodically (three times in a week) recorded in the springs of both seasons. Adults obtained from the main cages, two males and two females, were transferred to each of 5 cages having two cabbage seedlings to provide egg numbers and deposition sites. Adults were fed with a 10% sugar solution dispensed on cotton wool placed on the floor of the cages. The larval development of *M. brassicae* was closely observed after hatch. These procedures were carried out and repeated by the end of each season. During the observations, such biological characteristics of *M. brassicae* as the number of generation per year, egg hatching time, larval and pupal development and adult flight time were determined.

Additionally, the numbers of larvae per plant and infestation rate were recorded by weekly observations in field conditions.

RESULTS AND DISCUSSION

Biology

Mamestra brassicae overwintered in pupal stage, at upward position, 3-5 cm deep in the soil. The first adult emergence was recorded on 11 June and 9 June in 1999 and 2000, respectively. From the pupae placed in the soil for overwintering (82 in 1999 and 90 in 2000) 21 (25.6%) and 27 (30%) became adult in 1999 and 2000, respectively. The females began to oviposit during the 3rd-5th days after emergence (15 June 1999 and 12 June 2000). Oviposition of the females lasted 5-6 days. Great variability in daily female fecundity was observed, with a peak on fifth day and then decreased regularly. The number of eggs laid per female was counted from 235 to 1586 (as mean 693). They were grouped in egg-rafts of 25 to 30 eggs on the underside of cabbage leaves. The first hatch occurred on 23 June 1999 and 19 June 2000. An intensive egg hatching was observed and 80-85% of the hatching was completed in 1-2 days. The larvae initially fed on eggshell and continued to feed underside of the leaves, starting with the around

eggshell. The larvae moved on the other leaves in the first 1-3 days after hatching. Most of the larvae died within first 1-3 days. There are considerable similarity between this result and the data obtained by Johansen (1997). However, in the study of Johansen (1997) was recorded that egg mortality ranged from 0-22 % in the different cohorts, with a mortality of 15 % in total for the pooled population; larval mortality was highest in the first larval instar, when a total of 80 % of the larvae were killed (range 9-97% for individual cohorts). In five out of the seven cohorts, most larvae died within the first 1-3 days after hatching, with a mortality ranging from 64-87 % during these days. Mortality then decreased from 35 % in instar II, 11% in instar III to 4% in instar IV, and increased again to 21 % in both instars V and VI; total larval mortality was 93 % (range 72-97%), and total mortality during both the egg and larval stages was 94% (range 77-97%).

To reach lower level leaves, larvae produced a web with which they are hung down. The damage on leaves became more visible and intense during the larval feeding. The fourth stage larvae that started appearing on 9 July 1999 and 7 July 2000 mostly hid during daylight hours. The fifth stage larvae appeared on 17 July and 16 July in 1999 and 2000, respectively and they were slower in their movement. The fifth stage larvae entered inside and fed on the central part of cabbage. The remnants of larval feeding and feces were visible between cabbage leaves. The larvae were present on cabbage by 5 September and 26 August in 1999 and 2000, respectively. After five molting, the larvae pupated at upward position, in 3-5 cm deep of soil. Under natural conditions, the first pupae were determined in 13 August 1999 and 4 August 2000. *M. brassicae* mostly preferred to overwinter on the edge of beds where soil was softer and not in contact with water. There were 3-4 pupae per meter of the high edge of the beds while only a few pupae (5-6/15 m²) existed between beds.

M. brassicae produced only one generation per year under the Erzurum ecological conditions in 1999 and 2000 (Figure 2).

Damage and infestation

The larvae of *M. brassicae* fed on both leaves and in the central part of cabbage heavily. Under heavy infestation of this pest, total loss of plant could occur in seedling stage. The result of this study showed that the infestation rate of *M. brassicae* was average of 38.1% (34.4 - 41.6%). The number of larvae in infested plants decreased by 1.6 (1-2) per plant toward the end of season. Besides of larval mortality

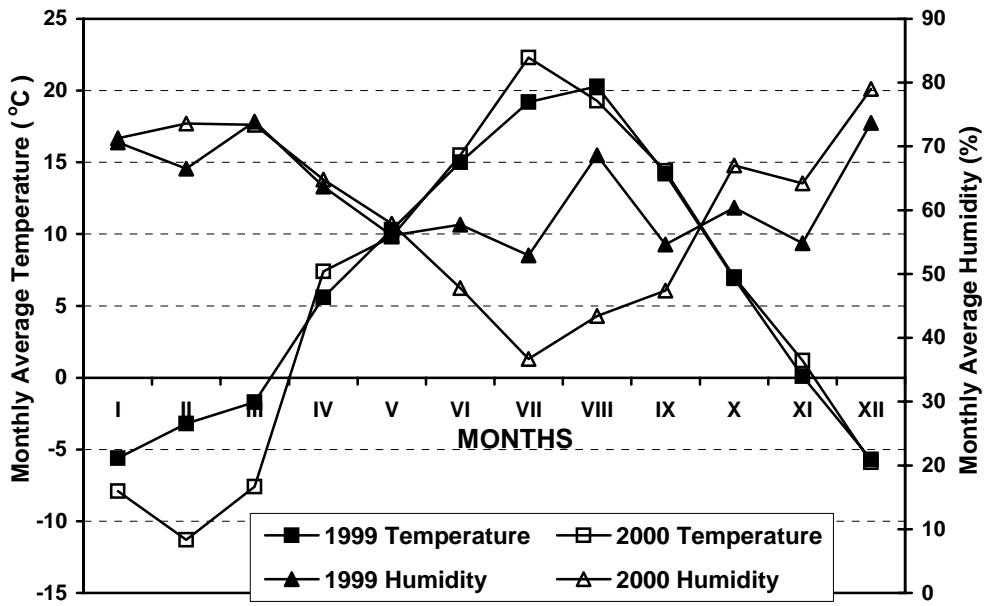


Figure 1. Monthly average temperature and humidity of Erzurum, Turkey, in 1999 and 2000.

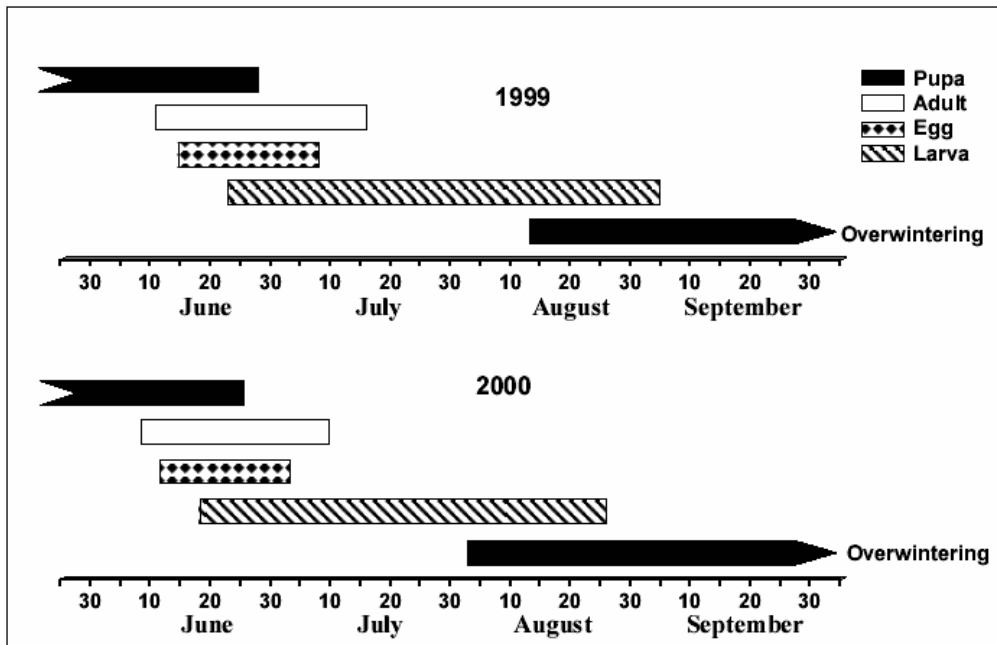


Figure 2. Duration of biological stages of *Mamestra brassicae* (L.) in Erzurum, Turkey, in 1999 and 2000.

in the first instar, *Enoplognatha ovata* (Clerck, 1757) (Arenea: Theridiidae), a spider predated on the larvae and existing at the density of 2.6 (2-3) individuals per plant could limit *M. brassicae* populations under field conditions (Tozlu et al. 2002). No any other predators or parasitoids were found. Likewise, Avcı and Özbek (1990) studying the parasitoids of lepidopteran species causing damage on cabbage in Erzurum reported that they did not find any parasitoids of *M. brassicae*. Despite the fact that relatively few *M. brassicae* larvae existed on plants, due to the intensive feeding of the last stage larvae in the heart of cabbage and their feces between leaves, crops would not be used for market purposes.

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