JOURNAL OF PLANT PROTECTION RESEARCH Vol. 52, No. 1 (2012)

# EGG LAYING AND CATERPILLAR HATCHING DYNAMICS OF *OSTRINIA NUBILALIS* HBN. ON MAIZE (*ZEA MAYS* L.) IN SOUTH-EASTERN POLAND

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*Received: May 5, 2011*
*Accepted: October 26, 2011*

**Abstract:** During the study years, the European corn borer (ECB) (*Ostrinia nubilalis* Hbn.) females began depositing eggs on maize plants between the last ten days of June and the first ten days of July. A maximum number of eggs on plants was found at the beginning of the second ten days of July and at the beginning of the third ten days of July. The last egg clusters were recorded in August. During the five years of the study period, the female oviposition period lasted from 4.5 to 8 weeks. The shortest oviposition period took place during the warm and dry years, while the longest period was during the rainy and relatively cold years. During the study years, within the entire flight period, *O. nubilalis* females deposited from 1,564 to 3,393 eggs on 200 observed plants. The average number of eggs per cluster in the study years was from 10.0 to 15.2. The beginning of caterpillar hatching, based on the observation of empty egg clusters, was recorded in the last ten days of June or in the first and second ten days of July. Mass hatching of the caterpillars was observed in the second and third ten days of July, and only in 2004 was it in the first ten days of August. The last empty egg clusters were recorded in the second and in the third ten days of August.

**Key words:** *Ostrinia nubilalis* Hbn, ECB, maize, dynamics, egg laying, caterpillar hatching

## INTRODUCTION

The European corn borer (ECB) (*Ostrinia nubilalis* Hbn.) has been found on maize (*Zea mays* L.) in Poland since the 1950s. (Kania 1961; 1962a, b). Currently it is one of the most significant maize pests in many regions in Poland (Lisowicz 2001; 2003a, b; Wałkowski and Bubniewicz 2004; Żołnierz and Hurej 2005; Haliniarz and Bojarczyk 2007; Bereś and Konefał 2010). In regions where maize is intensely cultivated, caterpillars of this moth damage from 50 to 80%, and sometimes up to 100% of plants, causing up to a 40% loss in maize grain yield (Lisowicz and Tekiela 2004).

Caterpillars must be controlled because of the great harm they cause. Control of this pest is based on non-chemical and chemical methods, as well as the cultivation of the Genetically Modified Organisms (GMO) maize (Bereś and Pruszyński 2008). However, any control activities should be based on detailed investigation of selected elements of ECB biology which will allow for defining the optimal time for plant protection intervention. The timing for introducing control methods which intervene against *O. nubilalis* is crucial. Such methods include biological preparations and chemical insecticides and plant spraying. The objective of the conducted study was to investigate the dynamics of egg laying by ECB females, and caterpillar hatching, to indicate optimal times for the control of eggs and caterpillars of this species.

## MATERIALS AND METHODS

The studies were conducted during the time period of 2004–2008 in the Plant Cultivation Station in Krzeczowice (49°59′ N; 22°27′ E) near Przeworsk (south-eastern Poland). Observations on the dynamics of oviposition by *O. nubilalis* and the dynamics of caterpillar hatching were conducted on the San maize variety (FAO 240) on a 5–7 ha field.

To investigate the dynamics of oviposition by *O. nubilalis* females, 50 consecutive maize plants in a row were observed in four places of the maize field (in total 200 on the field). Twice a week, observations were carried out on the oviposition by ECB females. Observations were always carried out on the same plants. The following data were recorded:

– number of egg clusters on 200 plants,
– number of eggs in individual clusters.

Observations were carried out in the first ten days of June. At the moment the last egg cluster was found and when there were no new egg clusters of the pest found

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Table 1. Weather conditions in Krzeczowice in 2004–2008

| Month | Decade | Mean air temperature [°C] | | | | | Sum of precipitation [mm] | | | | | Number of days with precipitation | | | | | Number of windy days (average wind speed over 6 m/s) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2004 | 2005 | 2006 | 2007 | 2008 | 2004 | 2005 | 2006 | 2007 | 2008 | 2004 | 2005 | 2006 | 2007 | 2008 | 2004 | 2005 | 2006 | 2007 | 2008 |
| June | I | 16.3 | 13.8 | 11.5 | 18.6 | 17.9 | 10.7 | 84.4 | 37.1 | 28.4 | 1.4 | 3 | 5 | 6 | 3 | 1 | 4 | 4 | 4 | 1 | 3 |
| | II | 16.6 | 17.9 | 18.0 | 20.4 | 16.2 | 28.7 | 20.0 | 6.7 | 13.7 | 40.0 | 8 | 4 | 1 | 4 | 3 | 4 | 4 | 1 | 3 | 2 |
| | III | 16.5 | 18.4 | 21.3 | 17.7 | 19.7 | 24.9 | 5.2 | 47.4 | 28.4 | 45.3 | 5 | 1 | 5 | 6 | 6 | 5 | 3 | 2 | 6 | 5 |
| | mean/ sum monthly | 16.4 | 16.7 | 16.9 | 18.9 | 17.9 | 64.3 | 109.6 | 91.2 | 70.5 | 86.7 | 16 | 10 | 12 | 13 | 10 | 13 | 11 | 7 | 10 | 10 |
| July | I | 17.8 | 18.4 | 18.8 | 17.5 | 17.8 | 26.7 | 59.3 | 2.7 | 40.0 | 35.9 | 5 | 2 | 1 | 7 | 5 | 4 | 2 | 2 | 6 | 6 |
| | II | 17.9 | 19.4 | 20.5 | 21.8 | 19.2 | 13.6 | 20.2 | 7.6 | 19.3 | 43.3 | 5 | 6 | 3 | 3 | 4 | 3 | 5 | 4 | 5 | 3 |
| | III | 19.5 | 21.3 | 23.2 | 20.4 | 19.0 | 139.3 | 29.6 | 5.6 | 14.3 | 38.4 | 7 | 5 | 3 | 4 | 5 | 4 | 2 | 2 | 8 | 4 |
| | mean/ sum monthly | 18.4 | 19.7 | 20.8 | 19.9 | 18.6 | 179.6 | 109.1 | 15.9 | 73.6 | 117.6 | 17 | 13 | 7 | 14 | 14 | 11 | 9 | 8 | 19 | 13 |
| August | I | 18.1 | 17.2 | 19.2 | 18.2 | 19.6 | 22.9 | 81.6 | 31.0 | 36.8 | 21.2 | 8 | 7 | 6 | 5 | 3 | 4 | 4 | 2 | 1 | 5 |
| | II | 19.6 | 17.3 | 19.7 | 19.3 | 19.9 | 9.5 | 25.5 | 29.8 | 51.1 | 18.2 | 3 | 3 | 8 | 5 | 3 | 5 | 2 | 4 | 2 | 5 |
| | III | 19.3 | 17.9 | 16.2 | 19.5 | 17.3 | 66.4 | 16.9 | 42.7 | 0.0 | 15.9 | 7 | 4 | 7 | 0 | 4 | 2 | 2 | 6 | 3 | 4 |
| | mean/ sum monthly | 19.0 | 17.4 | 18.3 | 19.0 | 18.9 | 32.9 | 124.0 | 103.5 | 87.9 | 55.3 | 18 | 14 | 21 | 10 | 10 | 11 | 8 | 12 | 6 | 14 |
| September | I | 14.3 | 16.8 | 16.0 | 12.8 | 19.3 | 0.1 | 0.0 | 22.1 | 115.6 | 5.0 | 1 | 0 | 4 | 8 | 2 | 1 | 3 | 7 | 7 | 6 |
| | II | 14.6 | 14.4 | 15.7 | 12.0 | 9.0 | 1.9 | 44.0 | 1.3 | 18.5 | 84.1 | 2 | 6 | 1 | 4 | 9 | 5 | 4 | 1 | 7 | 3 |
| | III | 10.9 | 13.2 | 13.3 | 12.7 | 10.7 | 20.5 | 18.4 | 1.2 | 7.6 | 14.1 | 4 | 2 | 1 | 2 | 4 | 5 | 3 | 1 | 3 | 2 |
| | mean/ sum monthly | 13.2 | 14.8 | 15.0 | 12.5 | 13.0 | 22.5 | 62.4 | 24.6 | 141.7 | 103.2 | 7 | 8 | 6 | 14 | 15 | 11 | 10 | 9 | 17 | 11 |

Table 2. Number of *O. nubilalis* eggs in clusters in 2004–2008

| Year | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Number of eggs clusters | 161 | 139 | 141 | 109 | 90 |
| Total number of eggs in clusters | 2,558 | 2,798 | 3,393 | 2,130 | 1,564 |
| Average number of eggs per cluster | 10.0 | 14.7 | 15.2 | 13.9 | 14.2 |
| Minimum number of eggs per cluster | 2 | 2 | 6 | 3 | 5 |
| Maximum number of eggs per cluster | 48 | 79 | 83 | 59 | 38 |

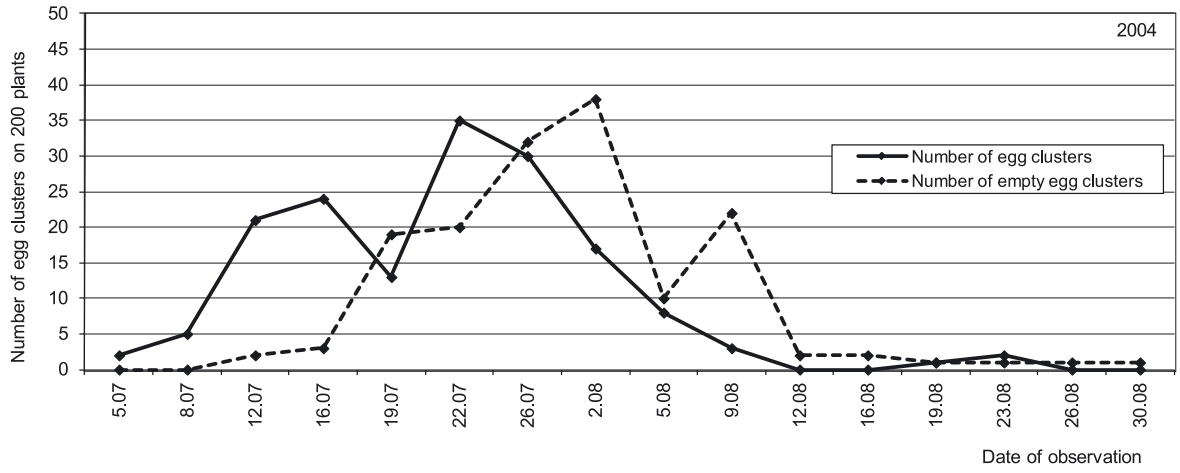


Fig. 1. The dynamics of oviposition and hatching of *O. nubilalis* caterpillars on maize in 2004

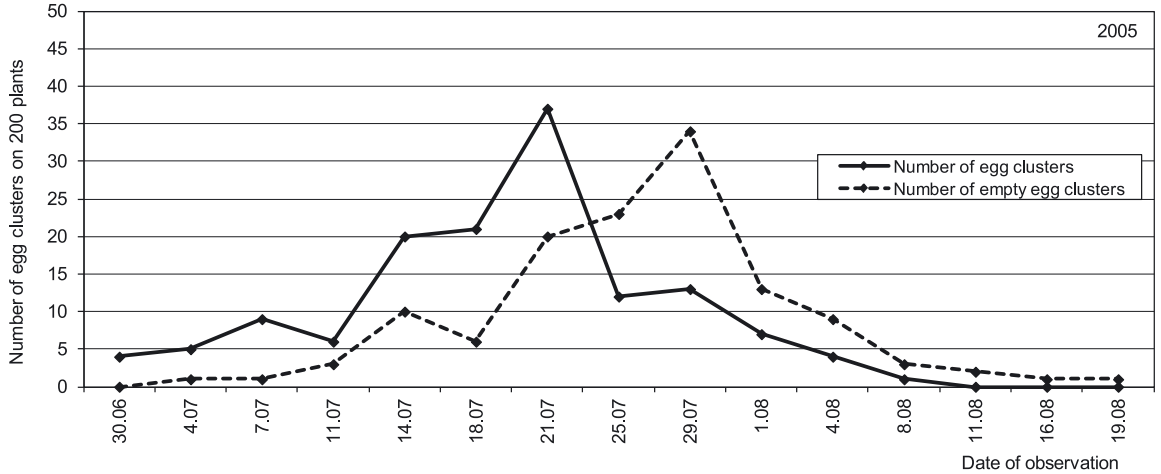


Fig. 2. The dynamics of oviposition and hatching of *O. nubilalis* caterpillars on maize in 2005

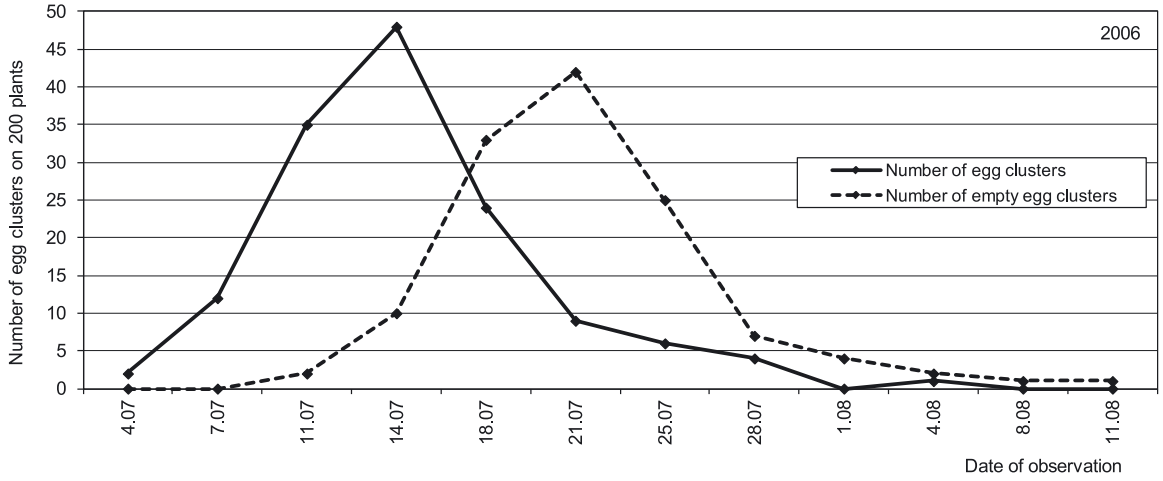


Fig. 3. The dynamics of oviposition and hatching of *O. nubilalis* caterpillars on maize in 2006

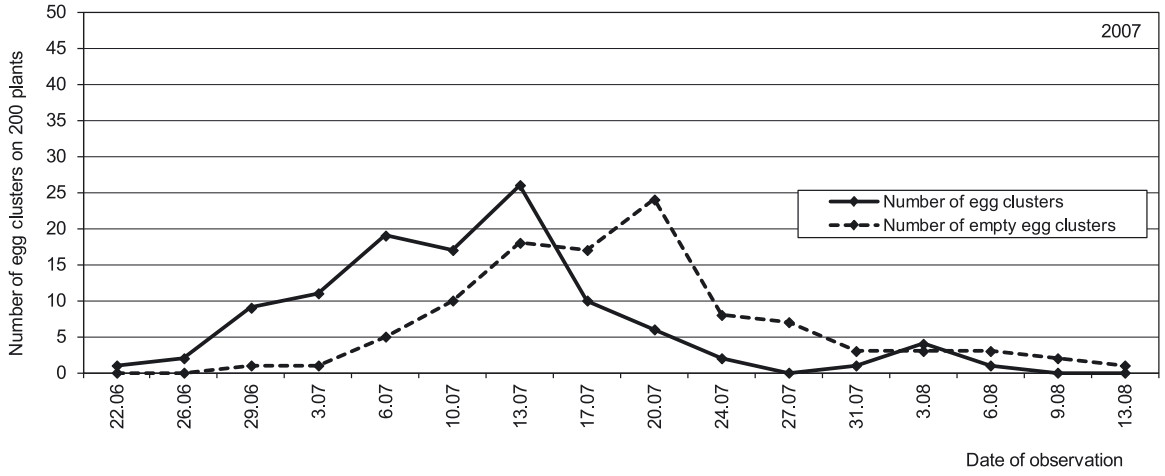


Fig. 4. The dynamics of oviposition and hatching of *O. nubilalis* caterpillars on maize in 2007

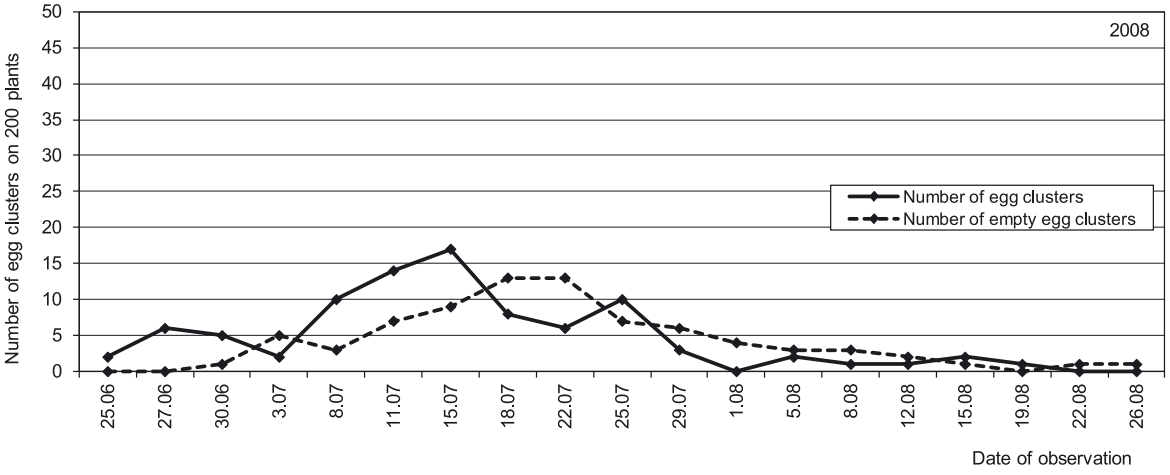


Fig. 5. The dynamics of oviposition and hatching of *O. nubilalis* caterpillars on maize in 2008