OBSERVATIONS ON THE BIOLOGY, ECOLOGY AND ETHOLOGY OF THE POPPY WEEVIL *Neoglocianus maculaalba* (Herbst, 1795) (COLEOPTERA, CURCULIONIDAE) IN A GARDEN WITH SPONTANEOUS POPPY IN THE CITY OF SIBIU (ROMANIA) UNDER 2014 CLIMATE CONDITIONS

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Abstract. Results of research work carried out in Sibiu (Romania) on the biology, ecology and ethology of Neoglocianus maculaalba (Herbst, 1795) (Coleoptera, Curculionidae) are reported. The adults hibernate at 10-40 cm deep in the soil where from they came out in the first ten days of June in the year 2014 when the average temperature was 14 °C, the maximum number of individuals that got out was achieved at 16 °C. Copulations and laying of eggs begun at 18 °C.

A maximum attack was recorded when 75% of the plants were in blossom with very young capsules. Under laboratory conditions the rate per day of egg laying by a female was between one and 50 eggs, the maximum number of eggs laid was 114 in 10 days. The larva growth period was of 13-20 days at 26-27 °C and 65-70% moisture. The larvae hatched out from the capsules and the pupa period began particularly around 6-7 a.m. and 8-9 p.m., the number of larvae getting out from the capsules to become pupae ranged from 1 to 18 p.m.

Based on the observations on insect biology, ecology and ethology, treatment is recommended at the moment when 70% of the poppy plants are budding and when almost all insects are coming out from soil.

Keywords: poppy; biology; ecology; ethology; *Neoglocianus maculaalba.*

INTRODUCTION

The poppy is to be found in Romania both as a species cultivated and spontaneous species. It belongs to the family *Papaveraceae*, which includes up to 10 species of annual, biannual or perennial herbaceous plants. The simple flowers have four superposed petals which form a cup, while the double flowers are dense and wrinkled, similar to those of the peonies. Out of the 57 pests known until now, 21 species are cited for Romania. The data on the biology of *Neoglocianus maculaalba* (Herbst, 1795) in Romania are rather poor and this study completes the research on this pest and proposes solutions for limiting its populations [3, 9].

MATERIALS AND METHODS

The study on the biology and ecology of *Neoglocianus maculaalba* (Herbst, 1795) (Coleoptera, Curculionidae) was effectuated on the terms of 2014 year, in the personal garden in Sibiu (Romania), on a 100 sq.m. plot, where there was a spontaneous species of poppy. In order to follow the ethology of adults to the host plant, the poppy plants were marked with a thread; the number of holes made for laying eggs and the results of feeding the adult insects, were daily scored. Thus it was noticed which parts of the plant were preferred for food, the site where the eggs were laid, the period when the larvae get out of the poppy capsules.

To establish the longevity of females during the ovipositary period and the number of laid eggs, in addition to examinations made in the garden, I carried, under laboratory conditions, the females found in copulation, by setting up each female in a breeding room. In laboratory conditions, the following parameters were used: 14 hours light, 26-27 °C temperature and 65-70% relative humidity.

The attacked capsules were severed and the laid eggs were counted. In order to study the larvae hatching, 100 mature capsules were studied, each of them on stem 15 cm long; the stems were marked from 1 to 100 and placed in the airing holes of vegetative pots which have been put in trays with water. In other vegetative pots with sand, marked from 1 to 100, I introduced the hatched larvae. At each capsule I noted the number of scars, the capsule size, the moment when the larva hatched and place where it went out. The pots with sand were kept under laboratory conditions until 2014, December.

RESULTS

Under 2014 climate conditions, the adults have emerged from the soil in early June, when the average temperature was over 14 °C, when many poppy plants had already formed buds. The maximum emergence of the *Neoglocianus maculaalba* (Herbst, 1795) from the soil was when the average air temperature was over 16°C. In my surveys I found nymphs cases even at 40 cm soil depth.

The average depth in the loose soil was around 10 cm. A correlation exists between the time of emergence of these adults and meteorological factors such as soil temperature and precipitation [2, 4, 6, 8, 11].

Under laboratory conditions, the larvae made in sand nymphs cases at depths between 3 and 8 cm. The duration of larval development under laboratory conditions was 13-20 days. The adults have left the nymphs cases according the warming the soil.

When the temperature dropped, after 1-2 hot days, the adults remained in the soil in diapause until the optimal conditions reappeared. To be mentioned that, under laboratory conditions, in the pots at temperatures ranged between 10 and 25 °C, among the larvae entered into impupation in the period between 15 to 30

June, I found on 1-st of December 50 % adults in the nymphs cases, but in the pots kept at temperatures between 25-26 °C, the adults went out and left the place.

In natural conditions, the appearance and increase of the adults number coincided with the periods when the poppy flowered; it decreased according as the capsules grew mature. I established the dynamics of the adult emergence (Table1) and of the attack as a result of a survey on 250 poppy plants.

From studies and observations in the garden, I noticed that the adults ate the epidermis of the leaves, causing prolonged or oval sores on the poppy stems and capsules.

The number of insect samples collected in an unit of time was reported every hour, so as to establish the maximum emergence of the insects, in order to be able to apply proper treatments. Thus on June 8-th I collected 5 insects per hour, on June 20-th 60 insects, on June 23-rd and 26-th 100 insects each and on June 30-th less than 70 insects.

The number of adults decreased significantly at the end of the first decade of July 2014, so that they almost disappeared. The poppy flowers were preferred in 46% of cases, as the capsules were very young and only 12% of the capsules had begun to mature.

During the warm days, the altitude of the adults flight was from the level of the plants to 3-4 m high. At average temperatures above 18°C, they started to copulate and to lay eggs. Out of my studies, I noticed that the males are smaller than the females. Following to the measurements effectuated, I found a variability in the rostrum length (1.72 to 1.91 mm in males and 1.37 to 1.48 mm in females) and in the antennas length (males=1.17 to 1.31 mm; females from -1.10 to 1.24 mm), without the basal article.

The mating ethology at *Neoglocianus maculaalba* (Herbst, 1795) species is very interesting;

I noticed that during the mating flight, the female chooses only one male, even if around her there are more males. The accepted male is coupled to the female in such a manner that the other males cannot remove it. During the period of budding and blooming of the poppy flowers, a lot of individuals of *Neoglocianus maculaalba* (Herbst, 1795) were in copulation.

Also from the field surveys, I found that, in order to lay eggs, the female investigates thoroughly the surface of the young capsule, then with its rostrum smoothes the place where starts to eat, making a hole in the depth of the wall of the capsule; when the rostrum penetrated into a septa, the female withdraws it and, turning back, it lays the egg or the eggs.

Then the female turns back again and levels the hole through which it laid the egg. After a rest period, it begins to prepare a new hole for laying eggs. After the latex secreted by the plant is withered, the holes on the surface of poppy capsules scar over. By counting the scars on the capsules, I found that they ranged from 1 to 65 holes. On one single capsule found 1, 2, 3, even 4 females laying eggs.

The egg is yellowish white, looking like young poppy seeds (the egg length varied from 0.83 to 1 mm and its width from 0.45 to 0.60 mm). Distribution of *Neoglocianus maculaalba* (Herbst, 1795) adults in the poppy culture under 2014 climate conditions (Table 2).

Under laboratory terms, in order to learn about the females‘ prolificacy and longevity, I effected daily observations (26.VI-15.VII. 2014). The daily rate of a female to lay the eggs varied from 1 to 50 eggs. The maximum quantity of eggs laid by a female was 114 eggs in 10 days.

That female lived then nine days without laying eggs. The eggs were laid only during daytime hours, with intervals of 1-3 days between each egg laying.

Under laboratory conditions also, the larval development lasted from 13 to 20 days, after which the larva hatched and ate the poppy capsule wall. After hatching, the larva sat on the sand, then entered into it in a few seconds, to a depth of 3-8 cm. In the wet sand, the penetration was much faster.

By contacting a fine, dry sand, 20% of larvae were very restless and their deep penetration lasted much longer. During my studies, I noticed that the larvae formed in the soil a nymphs case where they pupate. The larvae went out of the capsule particularly between 20 and 21 o’clock and between 6 and 7 o’clock.

During daytime hours the hatched larvae were extremely few. The larvae which went out of the capsules made holes, which were subsequently utilized by other larvae. The number of the exit holes ranged from 1 (in 2 situations) to 11 (in 4 situations), and the number of the hatched larvae from a capsule ranged from 11 to 18.

According to the investigations in the laboratory [5], where the temperature was 26-27 °C (what can be considered the optimum temperature for the development of species), only 15% of adults left the nymphs case until December 1-st, they remaining in the soil. Thus we found that temperature and humidity are decisive conditions which favoured the multiplication and development of *Neoglocianus maculaalba* (Herbst, 1795) species.

As a result of the survey effectuated in terms of 2014 year, I noticed that, out of the 80% of the attacked plants, moulds were installed in over 50% of them, and the rest of them were attacked by larvae of the *Dasineura papaveris* (Winnertz, 1853) (Diptera, Cecidomyiidae) species and completely destroyed. The *Dasineura papaveris* (Winnertz, 1853) (Diptera, *Cecidomyiidae*) larvae were placed in the sand.

In the Table 2 on can observe that the most numerous attacked plants were at the border of the culture and less in the center.

When the attacked capsules were up to 5%, the larvae density did not exceed 1-2 larvae in a single capsule and the losses of the attacked capsules was insignificant.

Table1. Adult emergence dynamics related to the number of poppy plants attacked, under 2014 climate conditions

Date	Number of surveyed plants			Number of attacked plants		
	flower bud	flower	capsule	flower	capsule	%
June 30-th.	157	84	1	12	0	0.2
July 1-st	76	99	74	32	23	22.2
July 2-nd	18	71	160	12	54	28.2
July 3-rd	2	68	181	15	71	34.0
July 4-th	6	9	237	3	85	35.1
July 5-th	0	3	248	0	91	38.1
July 6-th	0	0	252	0	100	40.1

Table 2. The distribution of *Neoglocianus maculaalba* (Herbst, 1795) adults in the poppy culture under 2014 climate conditions, in its flowering period May 18-June 20, 2014

To 100 poppy plants	At the border of the culture	5 meters from the culture border	50 meters from the culture border
Number of adults *Neoglocianus maculaalba*	46 (May 18, 2014) - 97 (June 20, 2014)	9	1 (May 18,2014) - 19 (June 20,2014)
The number of plants with adults	38-59	8	1 - 16
The number of plants attacked	56	27	5

DISCUSSIONS

As a result of the research effectuated, it is recommendable that the applications of insecticide treatments be made when the occurrence of the pest reaches its highest point, which is corresponding to the period when 75% of poppy plants are in the budding phase in this period when intervention is most effective pest showing the highest sensitivity [1, 7, 10]. In this period, it is not affected the useful fauna consisting in pollinating insects which visit the poppy flowers.

In case of strong attacks, agro-technical measures should be taken. In autumn, when the soil of the respective cultivated area is processed, and in spring, when the occurrence of the pest in soil is at its highest point, a treatment will be applied in the place of the pest occurrence. In this way we can contribute to the reduction of the insect biological reserve in the poppy cultures endangered by the occurrence of *Neoglocianus maculaalba* (Herbst, 1795) species.

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Received: 11 August 2016
Accepted: 11 November 2016
Published Online: 14 November 2016
Analele Universităţii din Oradea, Fascicula Biologie
http://www.bioresearch.ro/revistaen.html
Print-ISSN: 1224-5119
e-ISSN: 1844-7589
CD-ISSN: 1842-6433
University of Oradea Publishing House