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Bioagents of the *Chrysopidae* (Neuroptera) feeding on *Myzus persicae* Sulzer (Hemiptera; *Aphididae*) in a crop of oriental tobacco

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Abstract. *This study was conducted with the aim to establish the bioagents of the Chrysopidae (Neuroptera) family feeding on green peach aphid Myzus persicae Sulzer (Hemiptera; Aphididae) in an oriental tobacco crop. The results showed low multiplication density of the aphidophagous species throughout the two-year course of the study. Four representatives of the Chrysopidae were established and the species with the highest densities were seven-spotted lacewing Chrysopa septempunctata Wesmael and beautiful lacewing Chrysopa formosa Brauer – 55.6% and 27.8%, respectively. Ordinary lacewing Chrysopa carnea Stephens and green lacewing Chrysopa prasina Burmeister related to the control of the green peach aphid represented correspondingly 11.1% and 5.5% of the total number of lacewings, but single representatives were found and hence it could be assumed that they did not play a significant role in the limitation of M. persicae. Later emergence of the lacewings in the tobacco crop was observed, in the period 20th – 30th June of 2021 and 2022, which is a period of relatively high multiplication rate of the green peach aphid.*

Keywords: aphidophagous, predators, lacewings, green peach aphid

Introduction

Limiting the use of crop protection chemicals in order to harvest cleaner produce and protect the environment encourages us to look for alternative methods for pest control in crops. *Myzus persicae* Sulzer is an important pest with economic significance in many crops (Bass et al., 2014) with a tendency to develop resistance to insecticides (Fuentes-Contreras et al., 2013). Predators regulate pests naturally thus performing biological control. The species of the *Chrysopidae* family are among the bioagents which are successfully used in greenhouses to control aphids, including *M. persicae* (Benuzzi et al., 1991; van der Ent et al., 2017), and feed on various insects in numerous crops (McEwen et al., 2001). The lacewings are widely distributed and can be used successfully for biological control (Pappas et al., 2011). More than 1200 species have been recorded (Brooks and Barnard, 1990). The use of Chrysopidae in plant protection leads to reduced application of pesticides (Hokkanen, 1997).

The *Chrysopa formosa* Brauer species is widely distributed in Europe and Asia (Popov, 2002), the larvae and adults feed on various pests (Canard et al., 1984), but the available data is mainly for *M. persicae* in tobacco (Babrikova, 1980) and *Aleurodicus dispersus* Russell (Li et al., 2010). The adult *Chrysoperla* spp. and *Chrysopa* spp. are also predators (Bozsik, 1992). Babrikova (1980) also presents data on the behavior of *Chrysopa septempunctata* Wesm. towards the green peach aphid in tobacco.

Following bioecological approaches for pest control of agricultural crops and the insufficient literature information on the distribution of lacewings, the present study was conducted. The aim of this study is acquaintance with the bioagents in the *Chrysopidae* family in oriental tobacco with respect to *M. persicae*.

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Material and methods

The study was conducted in a crop of oriental tobacco Dupnitsa 733 with a size of 0.2 ha, without use of insecticides in 2021-22 on the territory of the Institute of tobacco and tobacco products – Markovo. From planting to harvesting of tobacco, regular phytosanitary monitoring along the crop field diagonals were performed to determine the type and density of *Chrysopidae*, as well as the population dynamics of *M. persicae* aphids using the 100-leaf sampling method, 2 leaves collected from each tobacco plant. Visual method is used together with shaking tobacco leaves in an entomological bag. The number of aphids and lacewings was registered after each examination. Adults of lacewings were found. The identification of *Chrysopidae* was done with the help of identification for insect species in adult stage (Dorokhova et al., 1989). Climatic data during the study were taken from a stationary meteorological station.

Results and discussion

The phytosanitary monitoring in a crop of oriental tobacco for the period 2021-2022 established only 18 representatives of four varieties of *Chrysopidae*. The results showed the species with the highest density to be *Chrysopa septempunctata* and *Chrysopa formosa*: 55.6% and 27.8%, respectively. In 2021, out of one hundred tobacco plants collected, as few as 14 lacewings were collected, whereas in 2022 only 4 were collected which belonged to the species specified above (Table 1).

Table 1. Species composition and quantity of caught *Chrysopidae* in oriental tobacco

	2021		2022		Total	
Chrysopidae	Number on 100 leaves	%	Number on 100 leaves	%	Number on 100 leaves	%
Chrysopa septempunctata	7	50	3	75	10	55.6
Chrysopa formosa	4	28.6	1	25	5	27.8
Chrysopa carnea	2	14.3	0	0	2	11.1
Chrysopa prasina	1	7.1	0	0	1	5.5
Total	14	100	4	100	18	100

The seven-spotted *Chrysopa septempunctata* lacewing had the highest density in both years, followed by *Chrysopa formosa* which had only one representative established in 2022. For both species, the larvae and adults are predatory, which was most probably the reason for their larger number in the tobacco crop. According to Babrikova (1980), to control *M. persicae* in 100 tobacco plants with 22.0-28.5 aphids/plant density, 850 larvae of *Chrysopa formosa* are needed and 920 of *Chrysopa septempunctata*. It is worth noting that the most common species *Chrysopa carnea* had two representatives reported and took the third place, while the last *Chrysopa prasina* had only one in 2021; in 2022 neither species was represented.

This could be attributed to meteorological factors and the difference in weather in the region. In 2022 the period until the second third of March was characterized by lower temperatures, followed by temperature increase and another decrease, as well as less rain compared to the same period in 2021. The period March - May 2022 was characterized by less rainfall and lower temperatures; June with higher temperatures and higher amounts of rainfall, and July with less rainfall and lower atmospheric humidity compared to 2021 (Figures 1 and 2).

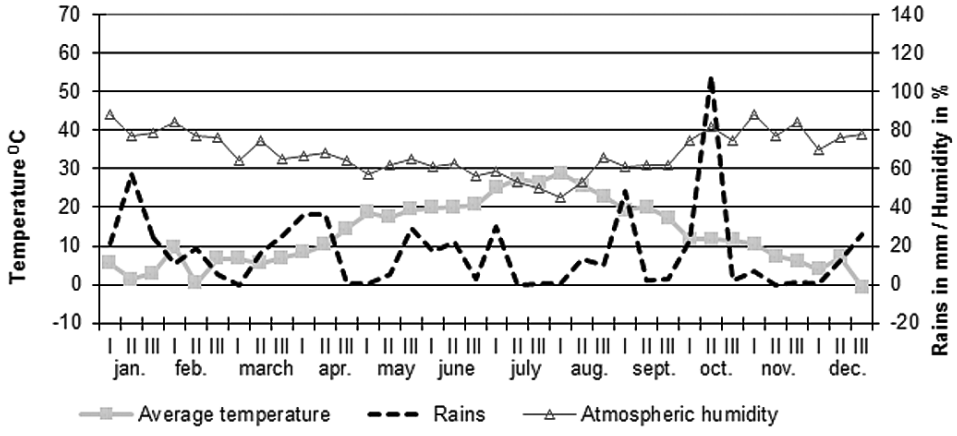

Figure 1. Dynamics of climatic factors in 2021 for Plovdiv region

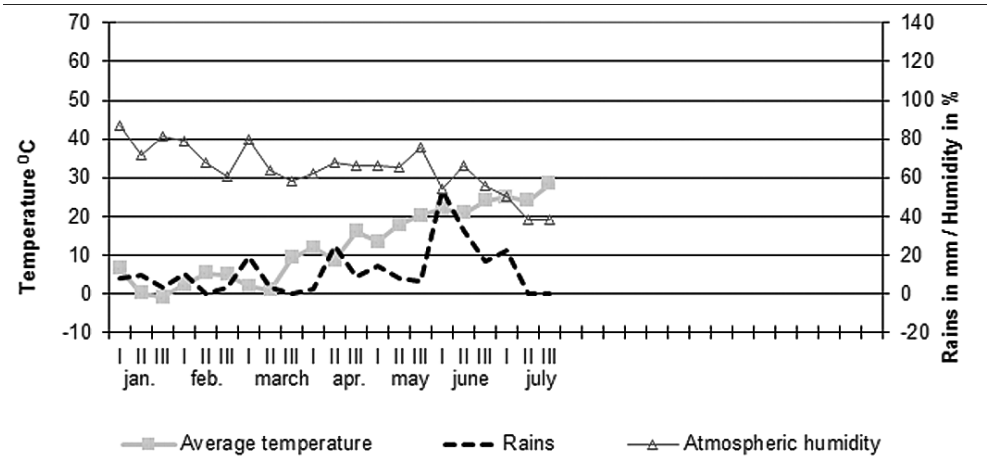

Figure 2. Dynamics of climatic factors in 2022 for Plovdiv region

According to the meteorological characteristics the weather factors had an impact on the development of the green peach aphid in tobacco (Figures 3 and 4). Probably because of them, in 2022 the density of *M. persicae* individuals was lower and their development peak was reported earlier compared to 2021.

Better climatic factors in terms of precipitation and temperature during the period May-June 2021 provided a more favorable development of aphids compared to the same period of 2022. The influence of climatic factors was mentioned in a previous study (Radev, 2020).

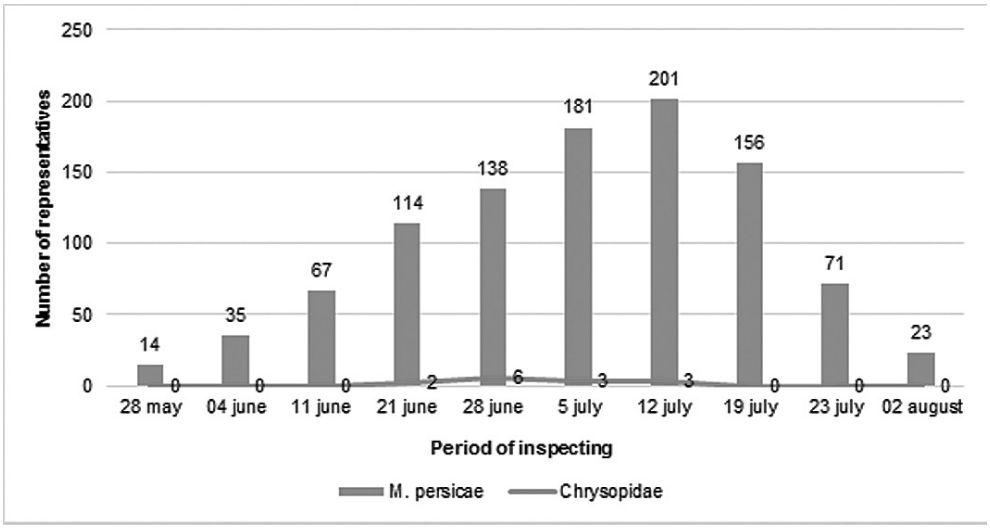

Figure 3. Density and dynamics of *M. persicae* and *Chrysopidae* in 2021

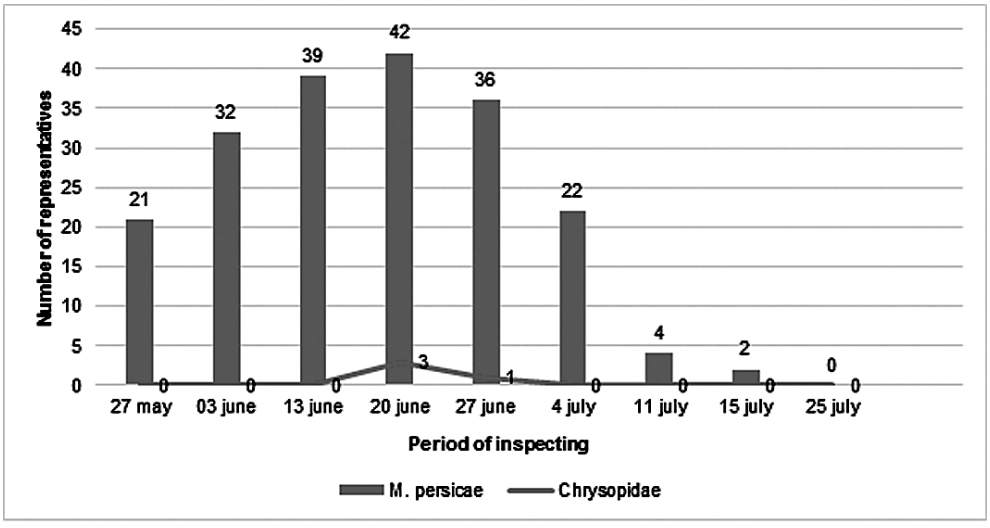

Figure 4. Density and dynamics of *M. persicae* and *Chrysopidae* in 2022

Later emergence of lacewings in the tobacco crop was observed, in the period of relative multiplication of *M. persicae*. The first predator found was a seven-spotted lacewing. The data showed low density of the predators even in 2021, when aphid density was higher. Taking into account this fact, the predators were reasonably fewer in 2022, when aphid density was also significantly lower than in 2021, even at their multiplication peak. The significant reason to which the small number of predators in the tobacco crop could be attributed is the presence of other competitive agrocenoses providing better conditions for lacewings and other competitive aphidophagous species.

Chrysopa carnea and *Chrysopa prasina* related to the control of the green peach aphid represented by single individuals were found and hence it could be assumed that they did not play a significant role in the limitation of *M. persicae*. During the study period 2021-2022 the presence of species of the *Chrysopidae* family was established only when the density of aphids increased, regardless of the multiplication difference of *M. persicae* in the two years and the rapid withdrawal of the lacewings from the cenosis afterwards. According to the results, the lacewings did not stay long and did not exhibit constancy in the tobacco crop until harvest (Figures 3 and 4).

Conducting phytosanitary monitoring of the various agrocenoses provides us with information of the present entomofauna. The analysis of the collected data allows for a better assessment of the crop condition and the crop protection activities that need to be undertaken.

Conclusion

The study analysis showed low multiplication density of the bioagents of *Chrysopidae*. Only four representatives of the lacewings were found, *Chrysopa septempunctata* and *Chrysopa formosa* being with the highest densities – 55.6% and 27.8%, respectively. *Chrysopa carnea* and *Chrysopa prasina* related to the control of the green peach aphid represented, correspondingly 11.1% and 5.5% of the total number of lacewings, but only single representatives were found and hence it could be assumed that they did not play a significant role in the limitation of *M. persicae*.

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