

OCCURRENCE OF PESTS IN MAIZE CROP ACCORDING TO THE CLIMATIC CONDITIONS

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Abstract

*In recent years, the pest attack on the maize crop has proven to be a huge problem for all farmers in Romania, both from the point of view of the technological base and from the perspective of the pesticides used. Due to the long monoculture of the maize crop, a major increase in the attack of *Tanymecus dilaticollis* and the larvae of *Ostrinia nubilalis* and *Helicoverpa armigera* was found. However, not only monoculture or the impossibility, respectively the limited possibilities of combating pests favored their multiplication, but also climatic factors. In recent years, the temperatures during the winter are very advantageous for pests, the winters being quite mild from the point of view of low temperatures. The aim of the present paper is to present the influence of climatic conditions of the year from South Romania regarding the moment of appearance of pests and their density in the maize crop. The research was done in the southern part of the Romania, in Giurgiu County, Putineiu village, in the years 2022 and 2023, and they showed that the occurrence of pests as well as the pest density is significantly influenced by the temperature conditions. Thus, the appearance of pests occurs much early and their density is much higher.*

Key words: maize, *Tanymecus dilaticollis*, *Ostrinia nubilalis*, *Helicoverpa armigera*, climatic factors.

INTRODUCTION

The area cultivated with maize in Romania, according to the data of the Ministry of Agriculture and Rural Development and the National Institute of Statistics, annually exceeds 2.2 million ha, thus making maize one of the most important crops in the country (Popescu, 2018; Tudor et al., 2017). As harvested area of grain maize, Romania ranges the first place in European Union (Ion et al., 2015.a). The large surfaces grown with maize in Romania are due to favorable climatic conditions for this crop (Dumbravă et al., 2017).

Maize production in favorable years can exceed 10 million tons. Following the information given by Eurostat, at the level of the European Union, in 2018 and 2019, with a production of 18.66 respectively 17.43 million tons, Romania ranked the first place.

A multitude of stress factors can radically influence the maize crop. These can be abiotic stress factors, such as low temperatures at the beginning of the vegetation period, drought or high temperatures during pollination and grain formation period, but also biotic stress factors

such as weeds, pest and disease attacks (Meisille et al., 2010; Malschi et al., 2013; Troțuș et al., 2011). Popov and Barbulescu specified in 2007 that the attack of pests can cause significant damage in the climatic conditions of Romania, which was confirmed by several subsequent works (Manole et al., 2017; Ciceoi et al., 2017). Thus, the influence of winter temperatures and long-term monoculture on the population of pests and the moments of appearance in the crop was followed.

The preceding crop is an important crop technology measure with a significant influence upon the yield (Ion et al., 2015b), this having a significant influence of the pest occurrence in the maize crop. Practically, the issue of placing the maize into the crop rotation has represented, and continues to do so, the object of many researches performed under different soil and climatic conditions (Ștefan et al., 2018).

The main pests of the maize crop in Romania are *Tanymecus dilaticollis*, *Ostrinia nubilalis* and *Helicoverpa armigera*. The favorability areas of these pests are in all the western,

southern and eastern regions of the country (Barbulescu et al., 2001).

The aim of the present paper is to present the influence of climatic conditions of the year from South Romania regarding the moment of appearance of pests and their density in the maize crop.

MATERIALS AND METHODS

Research was conducted in experimental plots located in Southern area of Romania, in Burnaz Plain, respectively in Giurgiu county, Putineiu location (43°52'59" North Latitude, 25°40'1" East Longitude, 67 m altitude). The years in which the research was carried out were 2022 and 2023.

Romania is characterized by a temperate continental climate, with four distinct seasons. In recent years, significant differences have appeared in terms of temperatures, with temperatures higher than the normal average for each season. Thus, in the cold season, with temperatures much higher than normal for the period, the moment of appearance of pests occurs much faster. The studied maize plots were located after different preceding crops, respectively: maize with three treatments, maize monoculture of one year, two years and three years; wheat, soybean, and peas.

After establishing the areas of interest, determinations were made before and after sowing in terms of time of appearance of pests and the density of the pest population. The pests of interest were maize leaf weevil (*Tanymecus dilaticollis* Gyll.), cotton bollworm (*Helicoverpa armigera* Hbn.), and European corn borer (*Ostrinia nubilalis* Hübn.).

Knowing the biology of the pest *Tanymecus dilaticollis*, it leaves the wintering place when the soil temperature is 4°C and comes to the surface to feed at 9°C. The pest is particularly active in sunny and warm periods, when the soil temperature exceeds 16°C. Regarding the biology of *Helicoverpa armigera* and *Ostrinia nubilalis* pests, they appear at the end of May, beginning of June, when temperatures exceed 20°C for several consecutive days. Adults are active at night, especially when the relative humidity of the air is high, and they feed on the nectar of flowers. The droppings are deposited on the lower part of the corn leaves, the incubation lasting 8-10 days.

Maize sowing was carried out in the first decade of April. Comparing the month of April of 2022 with the month of April of 2023, one observes significant changes in terms of average temperatures and precipitations (Figures 1 and 2).

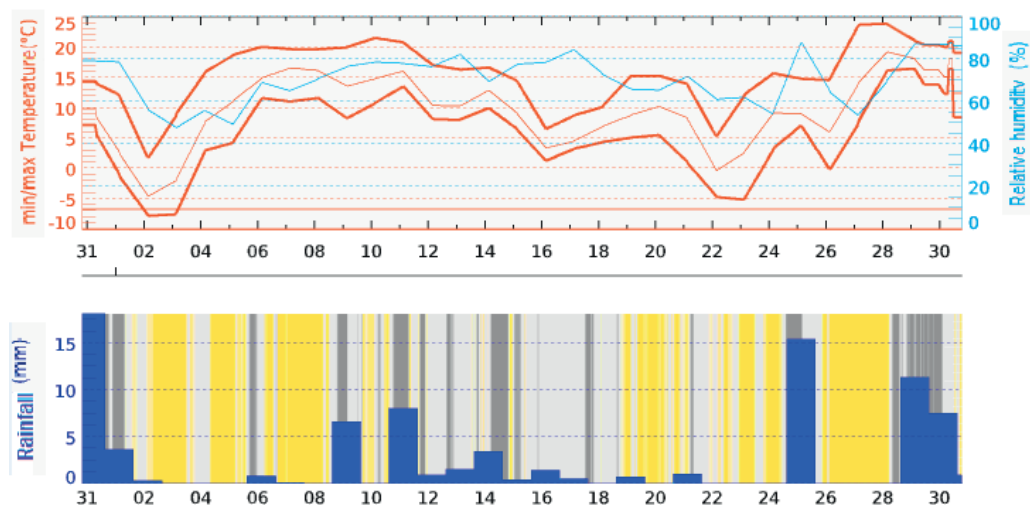


Figure 1. Temperatures recorded and the amount of rainfall in April 2022 (source: <https://www.meteoblue.com/>)

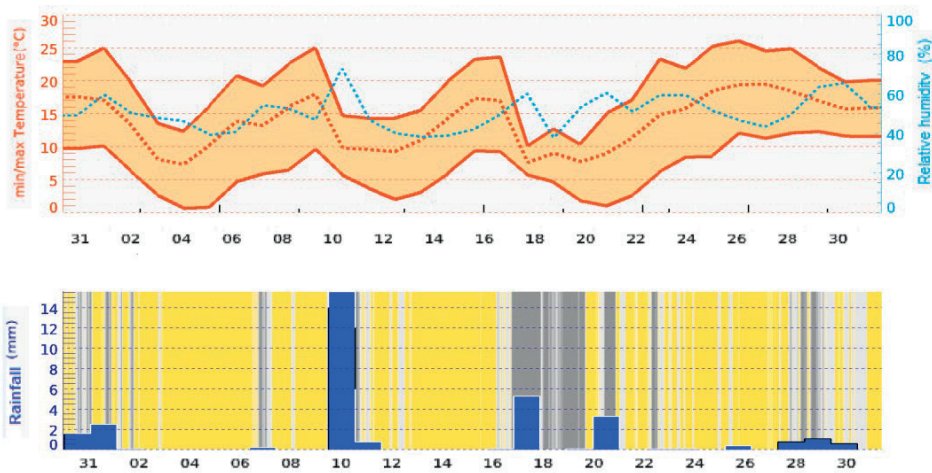


Figure 2. Temperatures recorded and the amount of rainfall in April 2023 (source: <https://www.meteoblue.com/>)

One can observe important differences regarding the number of days with temperatures higher than 20°C in 2023, over 10 days, while in 2022 only 3 days exceeded this threshold. From the point of view of precipitation, the year 2023 is much drier, registering 26 mm in April, while in 2022 the month of April exceeded 70 mm.

RESULTS AND DISCUSSIONS

Regarding the time of the appearance in the maize crops of the pests, it can be observed that they appeared much earlier in 2023 than in 2022 (Table 1). This is explained by lower temperatures and more abundant precipitation registered in 2022.

Thus, in 2023, *Tanymecus dilaticollis* was present since the end of February, more than a month before maize sowing, while in 2022 the first appearance was in the last decade of March, which is just before maize sowing in South Romania. Regarding the appearance of *Helicoverpa armigera* and *Ostrinia nubilalis*, in 2023, it happened 13 days earlier than in 2022.

Also, it has to be underlined that *Helicoverpa armigera* and *Ostrinia nubilalis* appeared in the maize crops in the same time.

Not only the time of the first appearance of the three studied pests was affected by the higher

temperatures, but also the pest density was significantly higher in 2023 compared to 2022 regardless of preceding crop (Tables 2, 3, and 4).

Table 1. The moment of first appearance of pests in maize crops

Pest	Year	The moment of appearance
<i>Tanymecus dilaticollis</i>	2022	20.03.2022
	2023	25.02.2023
<i>Helicoverpa armigera</i>	2022	17.05.2022
	2023	04.05.2023
<i>Ostrinia nubilalis</i>	2022	17.05.2022
	2023	04.05.2023

A metric frame was used to determine the density of *Tanymecus dilaticollis* pest. To determine the pest density for *Helicoverpa armigera* and *Ostrinia nubilalis*, pheromone traps were used placed between the maize rows at an average height from the ground and the maximum height of the maize plant. Figure 3 shows the attractant pheromone and the type of trap used to attract and capture pests.

Concerning the density of *Tanymecus dilaticollis* pest, a significant difference can be observed between the averages of the 2 years, the average of 2023 being almost double the average of 2022 (Table 2).



Figure 3. The pheromone trap and the pheromone used

Table 2. The density of *Tanyemecus dilaticollis*

Preceding plant	Year	Number of specimens/m ²
Maize monoculture year 1	2022	9
	2023	13
Maize monoculture year 2	2022	11
	2023	17
Maize monoculture year 3	2022	13
	2023	31
Wheat	2022	5
	2023	11
Peas	2022	2
	2023	5
Soybeans	2022	5
	2023	7
Average	2022	7.5
	2023	14

Regarding the average density of pests on the trap for *Helicoverpa armigera*, an average of almost 3 times higher in 2023 than the average of 2022 can be observed (Table 3).

Regarding the average number of pests per trap in 2023 compared to 2022 for *Ostrinia nubilalis*, this is also double in 2023 (Table 4).

CONCLUSIONS

The occurrence of pests is significantly influenced by the temperature conditions. The appearance of pests can be observed even a month earlier due to the higher temperatures, as in the case of *Tanyemecus dilaticollis*.

Table 3. The density of *Helicoverpa armigera*

Preceding plant	Year	Number of specimens/trap
Maize monoculture year 1	2022	2
	2023	5
Maize monoculture year 2	2022	2
	2023	8
Maize monoculture year 3	2022	6
	2023	17
Wheat	2022	2
	2023	4
Peas	2022	1
	2023	4
Soybeans	2022	4
	2023	13
Average	2022	2.83
	2023	8.5

Table 4. The density of *Ostrinia nubilalis*

Preceding plant	Year	Number of specimens/trap
Maize monoculture year 1	2022	3
	2023	5
Maize monoculture year 2	2022	2
	2023	8
Maize monoculture year 3	2022	9
	2023	14
Wheat	2022	3
	2023	7
Peas	2022	3
	2023	4
Soybeans	2022	2
	2023	8
Average	2022	3.66
	2023	7.66

Temperatures also radically influenced the density of pests. Thus, it was found a doubling of the annual average number of specimens/m² in the case of *Tanyemecus dilaticollis*. Regarding the density of *Helicoverpa armigera*, it almost tripled in 2023, where it recorded an average of 8.5 individuals/trap compared to 2022, when the average was only 2.83 individuals/trap. Regarding the density of *Ostrinia nubilalis*, the average density in 2023, of 7.66 individuals/trap, is double the average density in 2022 of only 3.66 individuals/trap.

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