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MONITORING OF PESTS IN SWEET CORN

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Abstract

Sweet corn is infested by different pests which are almost constantly present in the planted fields and pest outbreak could cause serious losses. In this regard, identification of the species composition of pests and the critical moment of their control are quite important in growing the crop.

Studies for identifying the species composition of pests in sweet corn fields were carried out in the period 2011-2013 on the training and experimental site of the Agricultural University – Plovdiv. Standard entomological methods were used: route observations, visual observations on labelled plants arranged in a checkerboard pattern over the entire planted area, etc.

As a result of the performed studies, the species composition of harmful entomofauna was identified and its development during vegetation was followed. Immediately after sowing until the stage of 3-6th leaf soil-borne pests of the following families were identified: *Elateridae*, *Tenebrionidae*, *Melolonthidae* and *Noctuidae*, as well as corn weevil (*Tanymecus dilaticollis* Gyll.) There were damages on the leaves caused by adult forms of the cereal leaf beetle (*Oulema melanopa* L.). Larvae of the cotton bollworm (*Helicoverpa armigera* Hb.) and the European corn borer (*Ostrinia nubilalis* Hb.) were isolated at the stage of tassel and silk development. Referring to omnivorous pests, single damages caused by locusts and crickets were established.

The most serious damages in the sweet corn fields were caused by pests attacking the generative plant parts – the cotton bollworm and European corn borer.

Keywords: sweet corn, pests, damage.

INTRODUCTION

Sweet corn is a crop, which is infested by some pests attacking the vegetative and generative plant parts and in some years their outbreak results in serious yield losses and worsened commercial quality of production. Pests are found throughout the period of vegetation from sowing the seeds through harvesting the yield, attacking all the plant parts – leaves, stems and generative organs.

At the initial phenological stages of the crop serious damages are caused by omnivorous pests of *Elateridae* family (wireworms), *Noctuidae* family (cutworms) and *Melolonthidae* family (white grubs), (Li et al., 2004; Bessin, 2010; Foster, 2010). They spend most of their lives in soil and can destroy the young plants.

At emergence, until to 3-4th leaf, significant damages are caused by corn weevil (*Tanymecus dilaticollis* Gyll.), which can destroy much of the crop when occurring at high density. Cereal leaf beetle (*Oulema melanopa* L.) is a serious threat, its adults and larvae damaging the leaves in a specific way by gnawing longitudinal stripes.

The most harmful pests at the phenological stage of tassel and silk development are cotton bollworm (*Helicoverpa armigera* Hübner) and

European corn borer (*Ostrinia nubilalis* Hübner). Plant damages caused by them seriously worsen the commercial qualities of the crop (Hagerman, 1997; Hazzard and Westgate, 2004), which, combined with improper agrotechnical activities, can completely compromise the yield.

According to a number of authors, such as Cameron et al. (1995), Scholz et al. (1998), Rajapaks and Walter (2007), Capinera (2008), cotton bollworm (*H. armigera*) is the most harmful pest in sweet corn in all the countries where the crop is grown – Australia, New Zealand, Canada, the USA, etc. In some years the losses caused by it reached up to 60-90%.

Malvar et al. (2002) found out in their studies that there were significant fluctuations in the population density of cotton bollworm (*H. armigera*), while the European corn borer (*O. nubilalis*) is permanently present in sweet corn fields. The pest prefers to lay its eggs on higher plants and infests all the above-ground plant parts: leaves, stems, silk, cobs and grains. Adult larvae cause more significant damages (Capinera, 2000).

Beres (2012) studied the preferences of European corn borer (*O. nubilalis*) to three nutrition hosts: fodder maize, sweet corn, and sorghum. The results obtained showed that the level of damages

depended on meteorological conditions and host plants. What is more, the highest percentage of damaged plants (89,5-93%) and cobs (34,7-66,7%) was reported in sweet corn. In fodder maize those values were lower – 58-80,2% and 29,5-42,2% respectively. In sorghum, only 3,0-16,2% of damaged plants and an insignificant percentage (0,7-1,5%) of damaged generative organs were reported. It undoubtedly proves that sweet corn is the preferred food plant by the European corn borer (*O. nubilalis*).

It was established that the late ripening sweet corn cultivars are less attacked by the European corn borer compared to the early ripening cultivars (Capinera, 2008). According to Mejdanic and Keric (2010) the sweet corn hybrids having a higher sugar content, are more preferred by the pest.

Using biotechnological approaches, the researchers developed sweet corn cultivars that are genetically resistant to European corn borer (*O. nubilalis*). A gene from *Bacillus thuringiensis* (Bt) bacterium is inserted in maize plants, as a result of which the plants can produce a protein, which, when consumed by the pest, makes it stop feeding and the pest dies. This protein can be used for controlling the density level of European corn borer (*O. nubilalis*). It is harmless to humans, to other insects and it does not pollute the environment. Those cultivars can control the number of European corn borers and some other larvae, without being necessary to apply additional insecticide treatments (Hagerman, 1987).

In the recent years, the interest in sweet corn has significantly increased, which necessitated the study on the species composition of harmful entomofauna.

MATERIALS AND METHODS

In the period 2011-2013 studies were carried out in sweet corn fields on the training and experimental site of the Agricultural University – Plovdiv. Pest multiplication and development in the experimental areas were followed up using standard entomological methods: route observations, visual observations on labeled plants arranged in a chequerboard pattern over the entire planted area, soil excavations for soil-borne pests. Observations were conducted throughout the growing season, at an interval of 7-10 days.

RESULTS AND DISCUSSION

The results of the study show that the harmful entomofauna belong to 4 orders: *Orthoptera*, *Coleoptera*, *Lepidoptera* and *Hemiptera*, suborder *Sternorrhyncha*. In all the three years of the study, the largest number of found pests belonged to species of the order

Lepidoptera. Second-ranked the representatives of the order *Coleoptera*. Less represented were the species of the orders *Hemiptera* (*Sternorrhyncha*) and *Orthoptera* (Table 1).

Meteorological conditions are the determining factors for pest development and outbreak in sweet corn fields. Immediately after sowing until the stage of 3-6th leaf, pests of the following families were identified: *Elateridae*, *Tenebrionidae*, *Melolonthidae*, and *Noctuidae*, which are found in mixed populations. From *Elateridae* family, common click beetle (*Agriotes lineatus* L.), western click beetle (*Agriotes ustulatus* Schall.) and dusky wireworm beetle (*Agriotes obscurus* L.) were identified. Along with them, larvae of darkling beetle (*Pedinus femoralis* L.) from *Tenebrionidae* family were also found. That reporting period was characterized by a dry spell of weather, due to which a lower density level of 1 pcs./m² was established (Fig. 1).

From white grubs of *Melolonthidae* family, some species of genera *Amphimallon*, *Anoxia* and *Melolontha* were detected. In the same period cutworm larvae of *Agrotis* genus, *Noctuidae* family is found. They cut the germs and the young stems of sweet corn plants close to the soil surface. Cutworms were found at low density in all the three years of the study – 1 pcs./m² (Fig. 1).

Some damaged spots were found at corn emergence, caused by corn weevil (*T. dilaticollis*). At later stages of plant development, single damages caused by locusts and crickets were reported. Most common among them are Moroccan locust (*Dociostaurus maroccanus* Thunbg.), Italian locust (*Calliptamus italicus* L.), Great Green Bush-Cricket (*Tettigonia viridissima* L.) and desert cricket (*Melanogryllus desertus* L.). Their occurrence in sweet corn fields is sporadic, and their spread in different areas can be explained with their wider nutrient profile.

Significant leaf damages caused by cereal leaf beetle (*O. melanopa*) were reported during the period of study. As a result of the environmental conditions in 2011, the outbreak of the species was established, and much higher density was reported – 40 pcs./m². That necessitated the application of insecticide treatment. In 2012 and 2013 the pest was found at a much lower density – 10 and 15 pcs./m², respectively.

At the phenological stage of tassel and silk development, second instar larvae of cotton bollworm (*H. armigera*) and European corn borer (*O. nubilalis*) were established. In 2011 lower densities of those pests were reported. A low level of damages was reported in that period – 5% of damaged cobs by cotton bollworm and 2% by European corn borer, respectively (Fig. 1).

In 2012 an outbreak of cotton bollworm was reported and the established damages in that period were significant – 70% of the cobs. That confirmed the studies of other authors – Cameron et al. (1995), Scholz et al. (1998), Rajapaks and Walter (2007), Capinera (2008) and it is evident that in a similar situation the pest can almost completely compromise the yield.

The high day-and-night temperatures during that period limited the spread of the European corn borer (*O. nubilalis*), as a result of which the damaged cobs were only 10%.

In 2013 low densities of cotton bollworm (*H. armigera*) and European corn borer (*O. nubilalis*) were reported. The level of infestation was low – 10% by cotton bollworm (*H. armigera*) and 2% by European corn borer (*O. nubilalis*), respectively. In all the three years of the study, a

higher density was reported for cotton bollworm (*H. armigera*) and a lower density – for European corn borer (*O. nubilalis*). The damages caused by those two pests had a direct impact on yield and production quality.

In 2011 a high density of leaf aphids was reported. *Rhopalosiphum maydis* was isolated at the phenological stage 6-8th leaf. It forms single colonies most often on the leaves and at the upper parts of the stem, their rating scale is 1 (Fig. 2). The number of aphids gradually increased. At the phenological stage of tassel development, 1-2 colonies of leaf aphids per plant were reported (rating scale 2). At silk development stage the aphid density reached a rating scale 3 and the pest attacked over 50% of the area. That necessitated carrying out a treatment.

Table 1. Species composition of economically important pests found in sweet corn fields

Species	Family	Order
<i>Doclostaurus maroccanus</i> Thunbg.	Acrididae	Orthoptera
<i>Calliptamus italicus</i> L.		
<i>Tettigonia viridissima</i> L.	Tettigoniidae	
<i>Melanogryllus desertus</i> L.	Gryllidae	
<i>Agriotes lineatus</i> L. – common click beetle	Elateridae - wireworms	Coleoptera
<i>Agriotes ustulatus</i> Schall. – western click beetle		
<i>Agriotes obscurus</i> L. – dusky wireworm beetle		
<i>Pedinus femoralis</i> L. – darkling beetle	Tenebrionidae- darkling beetle larvae	
Genus <i>Melolontha</i>	Melolonthidae	
Genus <i>Anoxia</i>		
Genus <i>Amphimallon</i>		
<i>Tanymecus dilaticollis</i> Gyll. – corn weevil	Curculionidae	
<i>Oulema (Lema) melanopa</i> L. – cereal leaf beetle	Chrysomelidae	
<i>Rhopalosiphum maydis</i> Fitch.	Aphididae	Hemiptera, Sternorrhyncha
<i>Ostrinia nubilalis</i> Hb.– European corn borer	Crambidae	Lepidoptera
Genus <i>Agrotis</i>	Noctuidae	
<i>Helicoverpa armigera</i> Hb. – cotton bollworm		

After carrying out the treatment, a lower number of aphids were reported during observations. At the flowering stage, only single aphids were found in the corn plants.

The pests identified in sweet corn fields showed clear organotropism. Wireworms, darkling beetle larvae, cutworms and white grubs attack the underground parts. Corn weevil, cereal leaf beetle,

and European corn borer attack the leaves; European corn borer damages the stems; the

generative organs are damaged by cotton bollworm and European corn borer.

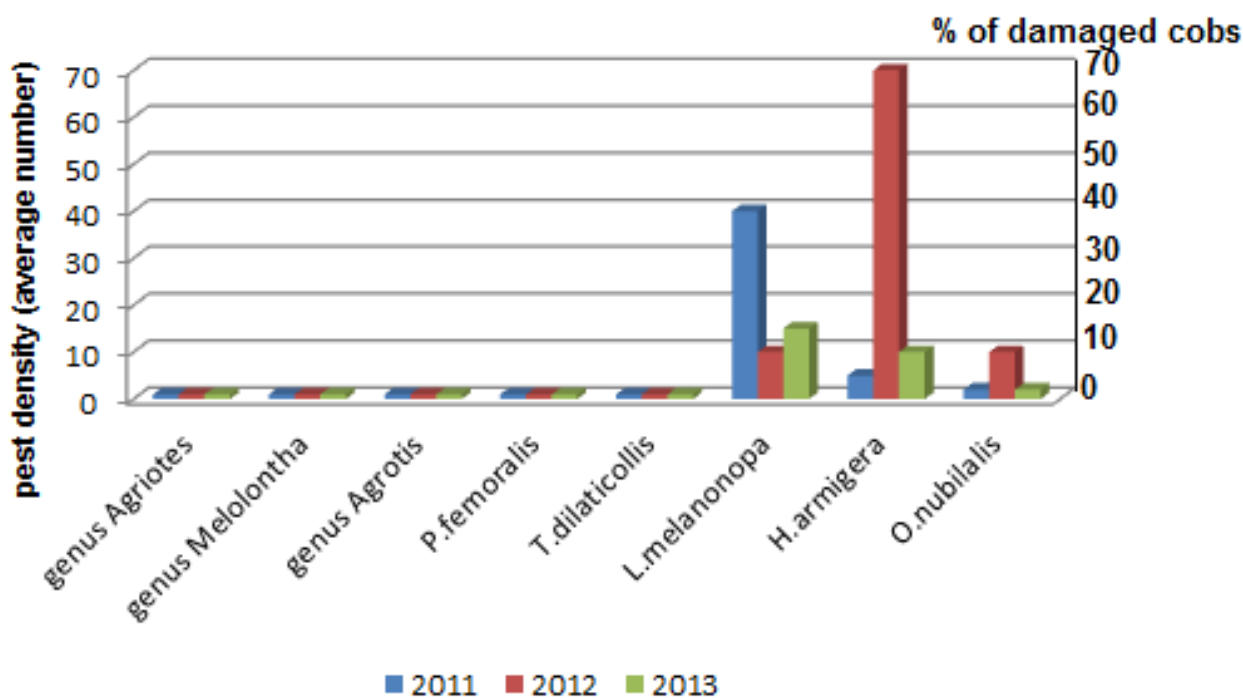


Fig. 1. Species composition, pest density (average number) and percentage of cobs damaged by cotton bollworm and European corn borer (%) in sweet corn fields during the period of study

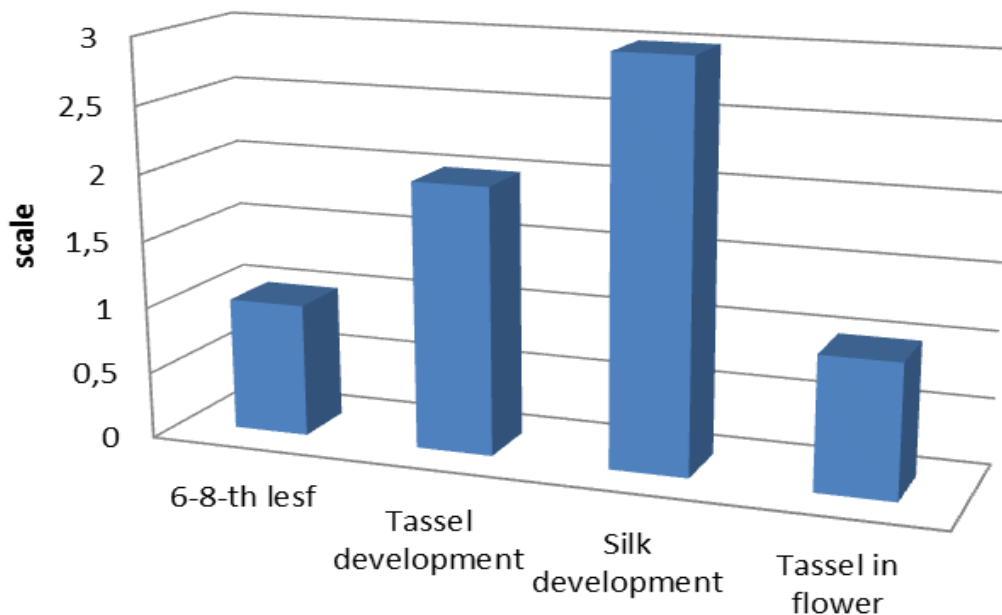


Fig. 2. Level of infestation of *Rhopalosiphum maydis* in 2011 (rating scale)

CONCLUSIONS

The results of the conducted studies allow us to draw the following conclusions:

1. Sweet corn is a host plant of a large number of harmful pest species, belonging to 4 orders: *Orthoptera*, *Coleoptera*, *Lepidoptera* and *Hemiptera*, suborder *Sternorrhyncha*. They damage all the plant parts: leaves, stems and generative organs.

2. The most serious economically important damages in sweet corn are caused by the pests feeding on generative organs, i.e. European corn borer (*Ostrinia nubilalis* Hübner) and cotton bollworm (*Helicoverpa armigera* Hübner).

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