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SEASONAL DYNAMICS OF MAIZE PESTS IN TWO PIONEER HYBRIDS BEFORE AND AFTER BUSTER BIOINSECTICIDE APPLICATION IN UZDIN, SERBIA

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Abstract. *The management of insect pests in maize increasingly requires approaches that combine crop monitoring with environmentally oriented protection strategies. This study investigated the seasonal dynamics of five maize-associated insect pests and the changes in their abundance before and after bio-insecticide (Bio Baster) application in two Pioneer maize hybrids cultivated in Uzdin, Serbia, during 2026. The experiment included Pioneer P0362 (FAO 530) and Pioneer P0725 (FAO 600), with an evaluated area of 1,000 m² per hybrid. Monitoring was conducted from 19 May to 14 September using yellow sticky panel traps without pheromones for Rhopalosiphum maidis and Oulema melanopa, pheromone-baited panel traps for Diabrotica virgifera virgifera, a Delta trap for Ostrinia nubilalis, and direct adult counts for Pentodon idiota. Insecticide Bio Buster was applied on 2 July 2026, and pest abundance was compared between the assessments of 1 and 16 July. The relative reduction in D. v. virgifera captures was approximately 81.4% in both hybrids, while reductions for O. melanopa reached 84.6% and 81.8%, respectively. O. nubilalis captures decreased by 75.0% and 78.9%, whereas R. maidis showed more variable reductions of 50.0% and 90.0%. Pentodon idiota was considered only in the analysis of seasonal occurrence, as its population decline had started before bioinsecticide application. Subsequent increases in D. v. virgifera captures were recorded during August. The study provides a field-based comparison of pest population dynamics in two maize hybrids and provide preliminary information for future controlled evaluations.*

Keywords*: maize hybrids; Bio Baster insecticide; pest monitoring; seasonal dynamics; traps; biological control.*

INTRODUCTION

Maize (*Zea mays* L.) is one of the major agricultural crops worldwide, with an important role in food production, animal nutrition and various industrial applications. Its productivity is influenced by several biotic factors, among which insect pests may cause significant damage during different stages of plant development. In European maize-growing regions, pest management remains an important component of crop protection, particularly under conditions favoring the development and spread of economically important insect species (MEISSLE ET AL., 2011; BAŽOK ET AL., 2021). Furthermore, FURLAN AND KREUTZWEISER (2015) emphasized the importance of alternative pest management approaches for reducing dependence on conventional insecticides.

Among the insect pests associated with maize, the western corn rootworm, *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae), is particularly important in Central and Southeastern Europe (COSTEA ŞI GROZEA, 2022). Following its introduction into Europe, the species progressively expanded into maize-growing regions, including Serbia and neighboring countries. Adults feed mainly on maize reproductive structures and other above-ground plant tissues, while larvae attack the root system, potentially affecting plant stability and development. BAŽOK ET AL. (2021) emphasized that pest monitoring, crop rotation and integrated management practices are essential for limiting the economic impact of this species.

Other insects associated with maize crops include the European corn borer, *Ostrinia nubilalis* (Hübner), the corn leaf aphid, *Rhopalosiphum maidis* (Fitch), and phytophagous beetles such as *Oulema melanopa* (L.) and *Pentodon idiota* (Herbst). These species differ in their feeding behavior, seasonal occurrence and potential impact on maize plants. While *O. nubilalis* larvae may damage stems and other plant tissues, aphid populations develop on above-ground plant organs and may influence plant physiology through feeding activity. Recent research has also highlighted the influence of agricultural management and environmental conditions on *R. maidis* populations (CSORBA ET AL., 2025). Consequently, monitoring several insect species within the same maize crop may provide a broader understanding of seasonal pest pressure.

The use of insect traps represents an important tool for monitoring pest occurrence and population dynamics. Pheromone-baited sticky traps have been widely investigated for detecting and monitoring *D. v. virgifera*, with their performance depending on trap design and attractant characteristics (TÓTH ET AL., 2003; GROZEA, 2003; HORGOS ȘI GROZEA, 2020). Similarly, pheromone-based monitoring of *o. nubilalis* has been studied as a method for assessing adult flight activity and identifying periods of increased occurrence (PÉLOZUELO AND FRÉROT, 2007; GROZEA, 2015). However, trap captures reflect insect activity and trapping efficiency and should not automatically be interpreted as direct measurements of field population density.

In recent years, biological insecticides have received increasing attention as potential alternatives or complements to conventional chemical treatments. Microbial agents such as *Bacillus thuringiensis* have been investigated for their insecticidal activity, particularly against susceptible larval stages of certain insect groups (KUMAR ET AL., 2021). Botanical substances, including neem-derived compounds and essential oils, also represent potential components of integrated pest management programs, although their biological activity and field performance may vary according to target species, formulation and application conditions (ISMAN, 2006; ISMAN, 2020).

Biological alternatives have been investigated for the management of maize pests, particularly through microbial insecticides and complementary integrated pest management practices. HAZZARD ET AL. (2003) demonstrated the potential of *Bacillus thuringiensis* combined with vegetable or mineral oils for reducing insect damage in sweet corn, including that caused by *Ostrinia nubilalis*.

The biological insecticide Bio Buster, described by the manufacturer as a formulation containing *B. thuringiensis* and plant-derived oils, represents a potential option for evaluating changes in pest populations under field conditions.

The present study aimed to investigate the seasonal dynamics of five maize-associated insect species in two Pioneer hybrids, P0362 (FAO 530) and P0725 (FAO 600), cultivated in Uzdin, Serbia, during 2026. Particular attention was given to changes in insect captures before and after Bio Buster application, using species-specific monitoring methods. The study also aimed to compare the observed population patterns between the two hybrids and to provide preliminary field evidence relevant to the evaluation of biological protection strategies in maize production.

MATERIAL AND METHODS

The field study was conducted in 2026 in Uzdin, Serbia, using two maize hybrids, Pioneer P0362 (FAO 530) and Pioneer P0725 (FAO 600), sown on 2 May. A surface of 1,000 m² was evaluated for each hybrid, resulting in a total monitored area of 2,000 m². The research focused on

the seasonal dynamics of five insect pest species and changes in their abundance following the application of the biological insecticide Bio Buster.

Monitoring was performed on nine dates between 19 May and 14 September 2026. Five yellow sticky panel traps without pheromones were used for *Rhopalosiphum maidis* and *Oulema melanopa*, while five pheromone-baited sticky panel traps were used for *Diabrotica virgifera virgifera*. One Delta-type trap was installed for *Ostrinia nubilalis*. All traps were uniformly distributed within the experimental area of each hybrid. Adults of *Pentodon idiota* were assessed separately through direct counts on the soil surface around maize plants.

Bio Buster was applied on 2 July 2026 at a dose of 1 L ha^{-1}, using 300 L ha^{-1} of spray solution. Changes in insect abundance were assessed by comparing the observations recorded immediately before treatment (1 July) and 14 days after treatment (16 July). Seasonal population dynamics were evaluated using the complete series of nine observations.

The relative reduction in pest captures was calculated as:

$$R\ (\%) = [(Npre - Npost)/ Npre] \times 100$$

where Npre represents the number of individuals recorded before application and Npost the number recorded after application.

The recorded data were analyzed descriptively to highlight differences between hybrids, seasonal population fluctuations and post-treatment changes in pest abundance. The results were subsequently interpreted in relation to the potential integration of biological insecticides into future maize protection strategies.

RESULTS AND DISCUSSION

Seasonal dynamics of maize pest populations in the two Pioneer hybrids

The monitoring carried out between 19 May and 14 September 2026 revealed distinct seasonal patterns among the five insect species recorded in the two maize hybrids (Figure 1). Although all species were identified in both experimental plots, differences were observed in their periods of maximum abundance, capture intensity and duration of seasonal activity.

Diabrotica virgifera virgifera was first recorded in mid-June, followed by a considerable increase in adult captures at the beginning of July. In Pioneer P0362, the highest number was recorded on 1 July (59 adults), whereas P0725 reached 43 adults on the same date. A second period of increased activity was observed towards the end of August, when captures reached 45 and 47 adults, respectively. The subsequent decline in September suggests a progressive reduction in adult activity towards the end of the maize growing season.

The seasonal dynamics of *Oulema melanopa* were characterized by a shorter period of increased abundance. The first adults were recorded on 14 June, followed by maximum captures on 1 July, with 52 individuals in P0362 and 33 in P0725. Subsequently, the number of captured adults decreased progressively, reaching zero in both hybrids by the end of August.

Rhopalosiphum maidis showed relatively high abundance during the early developmental stages of maize. In P0362, the maximum of 71 individuals was recorded on 14 June, while in P0725 the highest value of 60 individuals occurred on 1 July. This difference indicates a slightly later population peak in P0725. In both hybrids, aphid captures decreased considerably during July and remained low throughout August and September.

Ostrinia nubilalis was recorded mainly between late May and August. Maximum captures occurred on 1 July, with 24 adults in P0362 and 19 in P0725. The subsequent decline

was gradual, with only a few individuals recorded during August and no captures at the final assessment.

In contrast, *Pentodon idiota* exhibited predominantly early-season occurrence. Adult numbers increased from May to mid-June, reaching maximum values of 25 individuals in P0362 and 18 in P0725. A pronounced decline followed, and adult occurrence became sporadic during July before disappearing from the field observations.

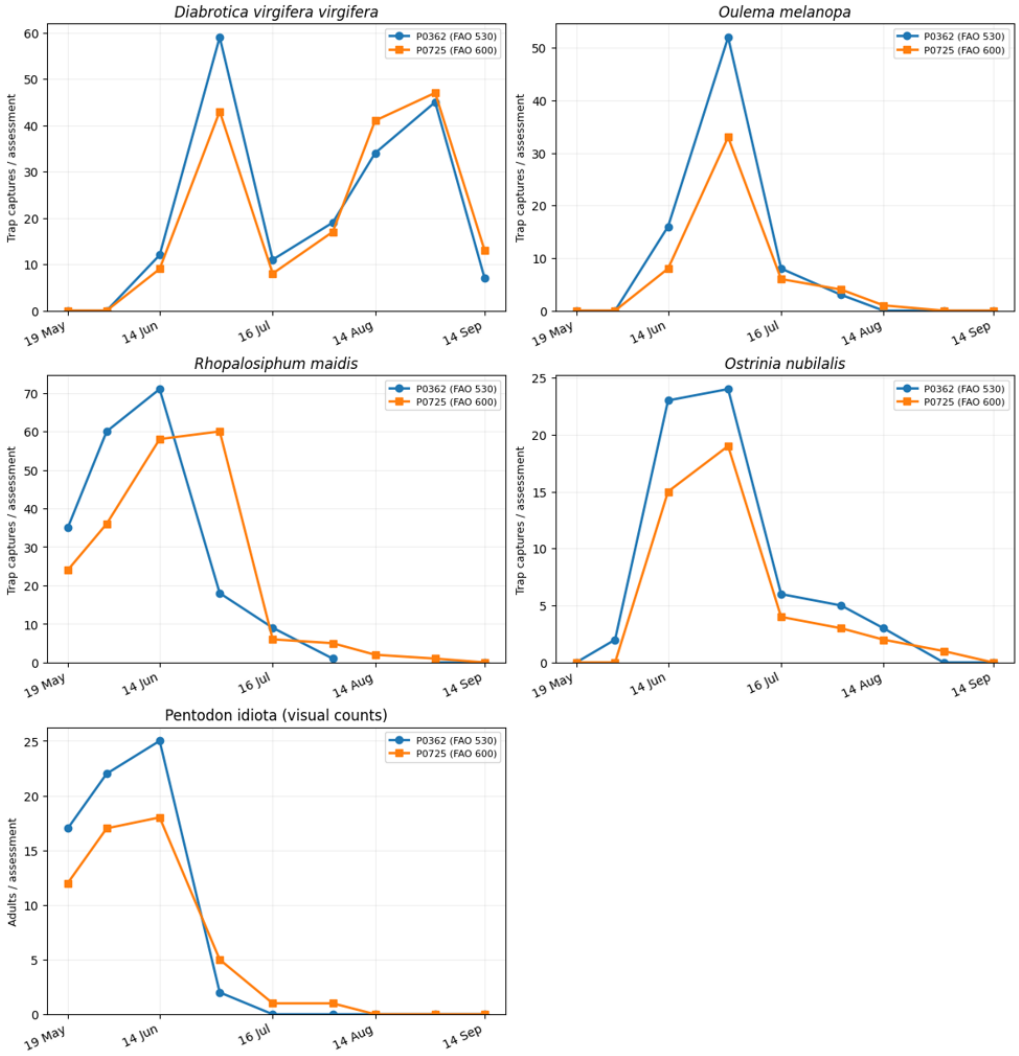


Figure 1. Seasonal dynamics of five maize pest species (*Diabrotica virgifera virgifera*, *Oulema melanopa*, *Rhopalosiphum maidis*, *Ostrinia nubilalis* and *Pentodon idiota*) in Pioneer P0362 and P0725 hybrids, based on trap captures and direct field observations conducted in Uzdin, Serbia, from May to September 2026

Overall, the comparative monitoring indicated that P0362 generally recorded higher values during the early and middle growing season, whereas P0725 showed a slightly later maximum for certain species. The different seasonal patterns emphasize the importance of continuous monitoring and species-specific assessment in maize pest management.

Changes in pest abundance before and after Bio Buster application

Following Bio Buster application on 2 July 2026, a marked reduction in insect captures was recorded in both Pioneer maize hybrids. The comparison between the assessments performed on 1 July, immediately before treatment, and 16 July, 14 days after application, revealed different levels of population reduction among the four species monitored using insect traps (Table 1).

Table 1

Changes in maize pest captures before and 14 days after Bio Buster application in the two Pioneer hybrids

Specie	Hybrid	Before treatment (1 July)	After treatment (16 July)	Relative reduction (%)
D. v. virgifera	P0362	59	11	81.36
	P0725	43	8	81.40
O. melanopa	P0362	52	8	84.62
	P0725	33	6	81.82
O. nubilalis	P0362	24	6	75.00
	P0725	19	4	78.95
R. maidis	P0362	18	9	50.00
	P0725	60	6	90.00

The most similar relative reductions between hybrids were recorded for *Diabrotica virgifera virgifera*. In Pioneer P0362, captures decreased from 59 to 11 adults, corresponding to a reduction of 81.36%, while in P0725 they decreased from 43 to 8 adults, representing 81.40%. These results indicate a remarkably similar proportional decrease in adult captures in the two maize hybrids (Figure 2).

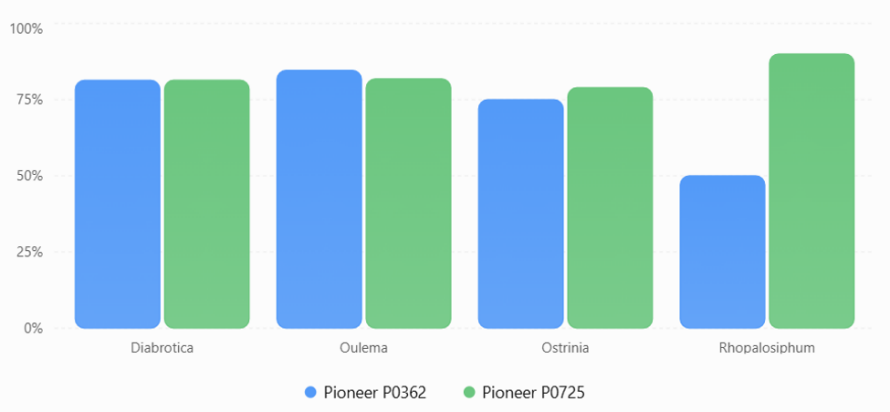


Figure 2. Relative reduction (%) in captures of four maize pest species (*Diabrotica virgifera virgifera, Oulema melanopa, Ostrinia nubilalis* and *Rhopalosiphum maidis*) in Pioneer P0362 and P0725 hybrids, comparing observations before (1 July) and 14 days after (16 July) Bio Buster application in Uzdin, Serbia, 2026

For *Oulema melanopa*, captures declined from 52 to 8 adults in P0362 and from 33 to 6 adults in P0725, corresponding to reductions of 84.62% and 81.82%, respectively. A comparable trend was observed for *Ostrinia nubilalis*, with reductions of 75.00% in P0362 and 78.95% in P0725.

The most pronounced difference between hybrids was observed for *Rhopalosiphum maidis*. In P0362, captures decreased from 18 to 9 individuals, representing a relative reduction of 50.00%, whereas in P0725 they declined from 60 to 6 individuals, corresponding to 90.00%. This difference was associated with distinct population levels recorded before treatment and highlights the variability of aphid dynamics between the monitored hybrids.

Overall, the reductions observed during the first 14 days following Bio Buster application indicate substantial short-term changes in insect capture activity. The similar patterns recorded for several pest species in the two maize hybrids provide useful information for assessing post-treatment population dynamics and for developing future monitoring-based biological protection strategies.

Post-treatment population dynamics and implications for biological maize protection

The monitoring conducted after 16 July 2026 provided additional information on the evolution of insect populations in the two Pioneer maize hybrids. The recorded data showed different seasonal patterns among the monitored species, with *Diabrotica virgifera virgifera* exhibiting the most pronounced increase in adult captures during the later part of the growing season.

In Pioneer P0362, *D. v. virgifera* captures increased from 11 adults on 16 July to 19 on 2 August, 34 on 14 August and 45 on 31 August. A similar pattern was observed in Pioneer P0725, where captures increased from 8 to 17, 41 and 47 adults, respectively. By 14 September, adult captures had decreased to 7 individuals in P0362 and 13 in P0725. The increase recorded during August indicates the continuation of adult activity and suggests that a single early-season intervention may not correspond to the entire period of pest occurrence.

In contrast, *Oulema melanopa* maintained low capture levels following the July assessments. In P0362, the number of adults decreased from 8 on 16 July to 3 on 2 August, with no further captures recorded. In P0725, captures decreased more gradually, reaching 4 adults on 2 August and only one individual on 14 August. No adults were recorded during the final two assessments.

A similar declining trend was observed for *Ostrinia nubilalis*. After the July peak, captures remained relatively low during August and eventually reached zero in both hybrids by September. These results indicate a more restricted period of adult activity compared with D. v. virgifera.

The population dynamics of *Rhopalosiphum maidis* also showed a progressive decline during the later growing season. In P0362, captures reached zero by 14 August, whereas small numbers of individuals continued to be recorded in P0725 until the end of August. This difference suggests a slightly longer period of aphid occurrence in the latter hybrid.

Overall, the results highlight the importance of continuous monitoring beyond the first evaluation following insecticide application. The prolonged occurrence of *D. v. virgifera*, compared with the shorter periods of activity observed for the other species, indicates that pest-specific seasonal dynamics should be considered when planning future biological protection strategies. The combination of species-specific traps and repeated field observations may

provide useful information for selecting appropriate treatment periods and optimizing pest monitoring programs in maize crops.

Comparative pest occurrence in maize hybrids and perspectives for biological pest management

The comparative assessment of the two Pioneer maize hybrids revealed both similarities and differences in the seasonal dynamics of the monitored insect species. Although P0362 (FAO 530) and P0725 (FAO 600) differed in maturity group, several pest species exhibited comparable periods of occurrence, particularly during June and July. However, differences in capture intensity and the timing of population peaks were observed throughout the growing season.

Pioneer P0362 generally recorded higher captures of *Diabrotica virgifera virgifera*, *Oulema melanopa* and *Pentodon idiota* during the first part of the monitoring period. In contrast, P0725 showed a more pronounced occurrence of *Rhopalosiphum maidis* at the beginning of July and slightly higher *D. v. virgifera* captures towards the end of August. These differences may reflect variations in crop development, insect activity and local field conditions.

Following Bio Buster application, pronounced reductions in captures were recorded for several species in both hybrids. Particularly similar relative reductions were observed for D. v. virgifera, while the responses recorded for *R. maidis* differed considerably between the two plots. These observations suggest that the evaluation of biological protection measures should consider species-specific population dynamics and the developmental characteristics of the cultivated hybrids.

The results also emphasize the importance of selecting appropriate monitoring methods for different insect groups. Pheromone-baited traps provided information on the seasonal activity of *D. v. virgifera* and *O. nubilalis*, whereas yellow sticky traps allowed the assessment of *O. melanopa* and *R. maidis*. Direct field observations complemented trap-based monitoring by documenting the early-season occurrence of *P. idiota*.

From an applied perspective, the combination of continuous monitoring and biological insecticide application represents a useful direction for developing integrated maize pest management strategies. Future studies could further investigate treatment timing, species-specific responses and the relationship between insect abundance and maize developmental stages. Such approaches may contribute to improving the practical use of biological insecticides in maize production systems in Serbia and other agricultural regions with similar growing conditions.

The field observations conducted in Uzdin, Serbia, during 2026 revealed distinct seasonal patterns of maize pest occurrence in the two Pioneer hybrids, P0362 and P0725. The monitored species differed in their periods of maximum abundance, with *Rhopalosiphum maidis* and *Pentodon idiota* showing more pronounced early-season occurrence, while *Diabrotica virgifera virgifera* maintained adult activity over a longer period, including late August.

Following Bio Buster application, substantial reductions in insect captures were recorded in both hybrids. The most consistent response was observed for *D. v. virgifera*, with relative reductions of approximately 81.4% in both plots. *Oulema melanopa* and *Ostrinia nubilalis* also showed pronounced decreases, whereas R. maidis exhibited greater differences between hybrids.

The subsequent increase in *D. v. virgifera* captures during August highlighted the importance of continued monitoring throughout the growing season. Differences in pest abundance between the two hybrids further indicated the relevance of crop development and seasonal insect activity when evaluating protection strategies.

Overall, the results provide useful preliminary field information on pest population changes following Bio Buster application and support the integration of biological products with species-specific monitoring.

CONCLUSIONS

The reviewed The field observations conducted in Uzdin, Serbia, during 2026 revealed distinct seasonal patterns of maize pest occurrence in the two Pioneer hybrids, P0362 and P0725. The monitored species differed in their periods of maximum abundance, with *Rhopalosiphum maidis* and *Pentodon idiota* showing more pronounced early-season occurrence, while *Diabrotica virgifera virgifera* maintained adult activity over a longer period, including late August.

Following Bio Buster application, substantial reductions in insect captures were recorded in both hybrids. The most consistent response was observed for D. v. virgifera, with relative reductions of approximately 81.4% in both plots. *Oulema melanopa* and *Ostrinia nubilalis* also showed pronounced decreases, whereas *R. maidis* exhibited greater differences between hybrids. The subsequent increase in *D. v. virgifera* captures during August highlighted the importance of continued monitoring throughout the growing season. Differences in pest abundance between the two hybrids further indicated the relevance of crop development and seasonal insect activity when evaluating protection strategies.

Overall, the results provide useful preliminary field information on pest population changes following Bio Buster application and support the integration of biological products with species-specific monitoring. Future research should focus on optimizing application timing and evaluating biological protection strategies under different maize-growing conditions.

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