ABSTRACT

The cherry plantations play an important role in Romania's fruit-growing sector due to the high economic value of the fruits and their impact on the biodiversity of agroecosystems. The cherry tree (*Prunus avium*) is a valuable species due to its delicious fruits, rich in vitamins, antioxidants, and bioactive substances. It is consistently in demand on both local and international markets. Therefore, cherry cultivation is a significant source of income for many farmers, especially in areas with a tradition of fruit growing in the eastern part of the country.

Arthropods have a crucial role in agricultural ecosystems, participating in activities such as pollination, biological pest management, organic material recycling, and maintaining trophic structure. Their variety directly reflects the health of the environment and the efficiency of agricultural practices used.

The analysis of the seasonal dynamics and interannual variations of arthropods can provide valuable insights into the effects of climate change or anthropogenic interventions on biodiversity. Therefore, these studies not only support the development of environmentally friendly agricultural practices but also contribute to the conservation of local species with high ecological value.

In this context, the study of arthropods in cherry plantations is not just a scientific activity but a practical necessity to support the sustainability of agroecosystems and conserve natural resources in the long term.

The doctoral thesis "***Research on the biodiversity, abundance, and dynamics of arthropods in some cherry orchards in the eastern part of Romania***" addresses in detail the biodiversity, number, and dynamics of arthropods in cherry orchards in the eastern region of Romania, aiming to gain a deeper understanding of their ecological role in agricultural ecosystems.

The thesis comprises 152 pages, divided into two parts, and includes four chapters, along with conclusions, bibliography, and annexes. It contains 31 tables, 22 figures, and 103 bibliographic sources.

Part I of the thesis, "Current State of Knowledge," presenting relevant information from the literature regarding the subject of the doctoral thesis. These data were later used to interpret and compare the results obtained in the "Own Research" section.

Part II, "Own Research," consists of three chapters:

Chapter II presents a detailed description of the natural framework of the Răducăneni commune in Iași County, highlighting essential aspects such as geographical location, pedoclimatic conditions, and meteorological characteristics. The information provided contributes to shaping a solid scientific context necessary for understanding and analyzing the research results.

Chapter III presents the objectives and goals of the research, the materials, and the methods used. The study aims to identify and evaluate useful species of arthropods, as well as harmful ones, and to investigate the complex ecological interactions affecting the stability and functioning of the fruit-growing agroecosystem.

Through this method, the aim is to develop sustainable management strategies for plantations, which will include effective integrated pest management techniques by utilizing the ecological potential of arthropods in maintaining a natural balance between pollinators, natural predators of pests, and arthropod species essential for soil fertility.

The purpose of this doctoral thesis is to examine in detail the biodiversity, number, and dynamics of arthropods in cherry orchards in the eastern region of Romania, in order to gain a deeper understanding of their ecological role in agricultural ecosystems.

To achieve the proposed goal, the following objectives have been set:

Collection and identification of arthropods from cherry orchards using Barber soil traps and Decis traps, to track arthropod species, including specific pests such as *Rhagoletis cerasi.* Barber soil traps will be used to collect terrestrial insects, while Decis traps will focus on flying insects, including species that damage cherries.

Establishing the number and frequency of pest populations such as Rhagoletis cerasi and others in cherry orchards. This information will be associated with climatic and phenological parameters to determine the peak presence times of these pests in the orchards.

Studying the dynamics of arthropod populations throughout the season using soil traps. This will facilitate the observation of population variations, highlighting key moments for phytosanitary measures and the influence of meteorological conditions on their dynamics.

Establishing the ecological diversity of arthropods in cherry orchards by using indicators such as the Shannon-Wiener index and the equity index, based on data collected from traps and direct observations, in order to analyze the stability and health of the orchard ecosystem.

Identifying beneficial arthropods within a biological control system by studying natural predators of pests and their contribution to reducing pest populations.

Formulating recommendations for cherry orchard management based on the data obtained from Barber soil traps and Decis traps, in order to implement effective integrated pest management strategies, considering the ecological particularities of *Rhagoletis cerasi* and other relevant species in the fauna.

Assessing the impact of chemical treatments on the structure and dynamics of the collected arthropod populations.

Chapter IV "Results and Discussions" presents the results obtained from a study conducted over three consecutive growing seasons, aiming to capture the variations recorded in the dynamics of arthropod populations in the context of climate change and anthropogenic interventions.

Research conducted in the period 2022–2024 in the cherry orchard in Răducăneni commune, Iași county, highlighted the importance of studying the biodiversity and dynamics of arthropods to understand the ecological role they play in fruit agroecosystems. The results obtained provide a solid scientific basis for the development of sustainable orchard management strategies that capitalize on the ecological potential of arthropods—either as pollinators, natural predators of pests, or essential elements in maintaining soil fertility. Thus, clear perspectives are emerging for the application of integrated crop protection techniques, contributing to ecological balance and sustainable productivity growth in fruit growing.

Decis Traps have proven useful in monitoring flying pests (especially lepidoptera, diptera, and aphids), providing essential information for correlating with tree phenology and establishing optimal times for phytosanitary treatments, while Barber-type soil traps have allowed the characterization of soil arthropod communities by passively capturing active terrestrial species, contributing to the assessment of functional biodiversity in the soil.

In 2022, 506 individuals from a wide range of taxonomic orders were collected using Barber traps, indicating a high level of edaphic biodiversity in the cherry orchards analyzed. The edaphic fauna included, in addition to predators, detritivores (Isopoda) and saprophagous species, indicating a well-balanced trophic ecosystem, capable of supporting multiple ecological functions, including the recycling of organic matter. Approximately 70–75% of the collected arthropods were considered beneficial to the agroecosystem, supporting the idea that the studied orchard offers favorable conditions for maintaining a balanced and functional edaphic fauna.

In 2023, research using Barber traps revealed significant biodiversity, with over 600 specimens collected from various orders (Coleoptera, Araneae, Dermaptera, etc.), reflecting the ecological complexity of the habitat. Arachnids were present in most of the samples, demonstrating high adaptability and continuous activity within the ecosystem, which grants them an important role in regulating insect populations. The arthropod community included both predators (carabids, arachnids, staphylinids) and other ecologically relevant groups (e.g., dermapterans), indicating an ecosystem capable of supporting functional food chains and natural self-regulation.

The results from 2024 indicate intense biological activity and significant faunistic biodiversity in cherry plantations, with a dominant presence of groups beneficial to maintaining ecological balance. Faunal abundance varied considerably throughout the season, with peaks of activity in June and August and a decline recorded in September, corresponding to seasonal changes in climatic conditions. Carabids, arachnids, formicids, and dipterans were the most representative groups, playing a significant role in the natural control of pests and in maintaining soil health. Ants had the greatest impact, with 797 specimens collected, contributing to soil aeration, organic matter recycling, and regulation of phytophagous insect populations.

Beneficial fauna showed a consistent and diverse presence throughout the three years of monitoring, with seasonal and annual variations influenced by climatic conditions, crop phenology, and habitat structure. This reflects a stable ecosystem and a favorable habitat for various groups of invertebrates.

Faunal abundance increased significantly in 2024, with a total of 1,392 specimens collected, compared to 506 in 2022 and 544 in 2023. This increase may indicate an improvement in environmental conditions, as well as greater mobility of fauna toward certain traps.

The Barber traps provided valuable information for managing the cherry plantation, serving to identify both harmful and beneficial arthropods. Monitoring these groups allowed for the implementation of more effective ecological control strategies, thus protecting the cherry crop and contributing to the sustainable management of natural resources.

Although most of the arthropods collected had a positive influence on the plantation, there were also species that could pose a threat to the crop. Among these are certain dipterans, such as *Rhagoletis cerasi* (cherry fruit fly), and some species from the order Coleoptera: *Otiorhynchus scaber, Agriotes spp.,* etc. The presence of these pests must be monitored in order to implement specific control measures without affecting the ecological balance of the system.

The increased abundance and diversity of beneficial fauna during 2022-2024 suggest a positive adaptation of the ecosystem to the local environmental conditions. The consistent rise in numbers of beneficial arthropods, especially in 2024, indicates an ecological maturation of the plantation, which may contribute to better soil structure, improved crop health, and support for biodiversity.

The Barber traps were a valuable tool in assessing the arthropod fauna in cherry plantations, providing essential data for ecological and integrated pest management. The presence of a significant number of beneficial arthropods, especially ants, spiders, and carabids, suggests that the studied cherry plantations benefit from a healthy, balanced ecosystem in which biological control plays a fundamental role in protecting the crop.

In 2022, in variant 1, the Decis Trap traps captured a significant number of *Rhagoletis cerasi* specimens, with a peak in the population observed in May and June. Beneficial species were also collected, such as *Chrysopa spp.* and *Coccinella 7-punctata,* which are natural predators of pests. These species suggest a balanced ecosystem in which predators help with the natural control of pest populations.

The collected data suggest that monitoring pests with Decis Trap traps is an effective method for determining the optimal times for applying chemical treatments, thereby reducing the risk of damage to the cherry crop. The increase in the number of natural predators in the traps reflects the health of the ecosystem and the effectiveness of biological control. Additionally, the diversity of species collected throughout the year highlights the importance of integrated pest management, which includes both active monitoring and support for local biodiversity.

In 2022, the use of Decis Trap traps in variant V2 led to the collection of a variety of insect species, with a peak in the activity of *Rhagoletis cerasi* in June, when the number of specimens collected reached 31 on June 19. These data suggest that the period of intense cherry fruit fly infestation concentrates around June and July, when cherries are in the ripening stage, and the pest is active in the plantation. After the peak in June, its activity significantly decreased, which may be attributed to the end of the cherry ripening period or the migration of the insect to other food sources.

In the case of late cherry varieties (V3), the data collected in 2022 from the Decis Trap traps show significant activity of *Rhagoletis cerasi*, with a constant presence of the pest throughout the season. The data highlight a steady increase in the number of *Rhagoletis cerasi* specimens starting in May, with the peak of activity in July, when 148 specimens were collected on July 18. These data suggest that Rhagoletis cerasi remains active throughout the summer and can significantly affect the late cherry harvest, especially during the ripening period.

Late cherry varieties, which ripen towards the end of summer, are exposed to a longer period of infestation by *Rhagoletis cerasi*, providing more time for feeding and egg-laying. Therefore, they may be more vulnerable compared to early or mid-season varieties, which have a shorter life cycle and less exposure to pests.

The results of collecting *Rhagoletis cerasi* in variant V1, using Decis Trap traps in 2023, reflect an interesting and variable dynamic throughout the season, with a peak in activity in June and a gradual decline in July and August. The absence of captures in August suggests the end of the active flight period of *Rhagoletis cerasi*, indicating a cessation of the pest's activity during this period.

The results of collecting *Rhagoletis cerasi* in variant V2, using Decis Trap traps in 2023, show that the pest's activity was predominant in the first three collections (May 21 - June 23), with a peak capture on June 23 (62 specimens), reflecting the period of maximum pest activity. The continuous but low presence of *Rhagoletis cerasi* in August suggests residual activity of the species and a possible completion of its biological cycle.

The results of collecting *Rhagoletis cerasi* in variant V3, using Decis Trap traps in 2023, show that it continued to be present until mid-July, indicating an extended infestation period, typical of late cherry varieties, but with a significant decrease in the number of specimens in the latter part of the season. In the August 15 collection, the significant presence of chrysopids (8 specimens) and other beneficial species suggests a return of beneficial entomofauna, which helps to balance the pest population.

Based on the analysis of data from 2022 and 2023, it can be concluded that *Rhagoletis cerasi* exhibits typical behavior in terms of activity peaks in May-June, corresponding to the development periods of adults and larvae. The abundance of the species was significantly higher in 2022 compared to 2023, suggesting that in 2022, climatic conditions and available resources were more favorable for the species' development. On the other hand, 2023 saw lower abundance, indicating less favorable ecological or climatic factors. This variability between years highlights the importance of continuous monitoring of the *Rhagoletis cerasi* population, especially in May-June, to quickly detect any activity peaks. In years with high abundance, population control measures, such as phytosanitary treatments or biological control, should be implemented, while in years with low abundance, control measures can be reduced, but monitoring should remain active.

Between 2022 and 2024, the treatment plan applied to the cherry plantation was well-planned and adapted to the development stages of the crop, with the goal of protecting the trees from diseases and pests, as well as ensuring balanced nutrition. A notable change observed in 2024 was the replacement of some products used in previous years, such as replacing the stimulant Atonik with Isabion, the calcium-based foliar fertilizer Lebosol with Foliq Calmax, and the herbicide Barbarian with Glypho. These changes indicated an adaptation and optimization of treatments to better meet the needs of the plantation.

A detailed analysis of the arthropod community in the cherry plantation from 2022 highlights complex ecological structures and provides valuable insight into the biodiversity and functionality of the studied agricultural ecosystem. It is interesting to note that, although most species are present in small numbers, there is a high species richness (61 species identified). The Pielou evenness index suggests a relatively uniform distribution of individuals among species, which is a positive sign of the ecosystem's stability. However, the concentration of abundance around a small number of species suggests some vulnerability of the community to environmental changes, such as climate change or anthropogenic pressures.

In 2023, the analysis of the arthropod fauna structure collected in the cherry plantation highlighted an ecological community with significant diversity, but dominated by a small number of species with high abundance. This species distribution, with accidental and dominant species, suggests a dynamic ecosystem influenced by a wide range of ecological factors, such as seasonal changes, types of microhabitats, and anthropogenic interventions. From an abundance perspective, it is noteworthy that only a few species dominate the faunal structure. "Eudominant" species such as arachnids (31.8%) and *Anisodactylus binotatus* (16.5%) are highly represented and have a considerable ecological impact on the ecosystem, being successfully adapted to local conditions. Additionally, the Shannon-Wiener biodiversity index ($H' = 2.74$) confirms moderate to high diversity within the biocenosis, indicating a well-balanced and stable ecosystem where the coexistence of multiple species is supported.

In conclusion, the 2023 analysis suggests that the cherry plantation represents a fairly stable and diverse ecosystem, with dominant species excellently adapted to local conditions and accidental species

indicating high ecological biodiversity. This diversity, combined with a balanced distribution of individuals and the presence of species with significant W index values, reflects the health of the ecosystem and its ability to respond to ecological variables, providing a favorable habitat for a wide range of arthropod species.

In the analysis of the arthropod community structure in 2024, based on specific ecological indicators such as abundance, constancy, dominance, and ecological significance index, a balanced composition is observed, but with an evidently unbalanced structure in terms of individual abundance. Ants represent the most numerous category in the community, with 797 individuals, making them ultra-dominant species, indicating a habitat with abundant trophic resources and a favorable microclimate.

Regarding the community's diversity, the Shannon-Wiener index (H' = 2.47) reflects moderate diversity within the invertebrate community in 2024, suggesting a relatively balanced distribution of individuals among species. This is supported by the Pielou evenness index (J' = 0.70), which indicates a moderately uniform distribution of individuals. Additionally, the Simpson index (1-D = 0.76) suggests a high probability that two randomly selected species will be different, confirming the functional diversity of the community.

In conclusion, the biodiversity analysis from 2024 indicates a balanced community, dominated by adaptable species, but with a notable presence of rare species that add functional diversity. These results reflect a stable ecosystem with moderate biological diversity, supported by dominant species such as ants and dipterans, which ensure functional balance in the face of potential ecological disturbances.

Linear regression proves to be an essential tool in analyzing ecological data, providing an efficient method for identifying temporal trends and relationships between variables. The study conducted on the biodiversity of the cherry plantation indicates a significant decrease in the number of species, coupled with an increase in the total arthropod abundance, suggesting possible ecological imbalances. Applying linear regression in this context helps to understand how the studied variables influence each other and predict future developments. At the same time, it aids in identifying ecological imbalances that may require conservation and intervention measures.

These changes suggest potential ecological shifts in the cherry plantation, which may be influenced by environmental factors or human interventions. It is important to emphasize that linear regression not only aids in data analysis but also in formulating hypotheses about the possible causes of these trends, such as anthropogenic interventions or changes in the ecosystem structure.