SUMMARY

The importance of carabids to wheat, maize, and sunflower crops can be understood by their crucial role in the ecology of agroecosystems. Here's how these cultures influence each other: Carabids are active predators of many agricultural pests, such as ground beetles, lepidopteran larvae, and other insect pests that affect wheat, corn, and sunflower crops. By feeding on these pests, carabids help reduce their populations and limit crop damage.

Carabids are an integral part of the food chain in agroecosystems. By regulating pest populations and feeding on other small organisms, they help maintain a healthy ecological balance in the soil and in the crops themselves.

Certain species of carabids may also contribute to plant pollination and seed dispersal, although this is not their primary role. However, in some cases, these secondary aspects may be important in certain habitat conditions.

Studies of carabid populations provide valuable information about soil health and local biodiversity in agroecosystems. Changes in carabid diversity and abundance may indicate the impact of agricultural practices on the ecosystem.

Carabids are sensitive to pesticides and can be used to assess their impact on non-target fauna in wheat, maize, and sunflower crops. Their monitoring can contribute to the development of more sustainable pesticide management strategies.

In conclusion, carabids are of significant importance to wheat, maize, and sunflower crops through their contribution to pest control, the maintenance of ecological balance, and as indicators of agroecosystem health. Protecting and conserving these insects is essential for sustainable agriculture and sustaining food production in the long term.

The present study starts with the need to know the exact composition of the carabid fauna in some agroecosystems in the north-west of Romania in order to protect and use it later as a tool for measuring the degree of anthropogenic damage to habitats.

Thus, starting with the importance of carabids as indicators of the degree of damage to habitats, these results will be able to be used later, providing a basis for comparison regarding the carabid fauna of northwestern Romania.

The doctoral thesis "**Research on the Population of Carabids (Ord. Coleoptera-Fam. Carabidae), important ecological indicators in some agroecosystems**" addresses the knowledge of the current state of research on the fauna of carabids (Coleoptera-Carabidae) from the crops studied, the identification of carabid species, the comparative study of the carabid fauna (Coleoptera-Carabidae) collected from the crops studied according to the chemical treatments used on the seed or on the vegetation, and the analysis of the biodiversity of the carabid fauna from the crops studied.

The work extends over 170 pages and conforms to the regulations in force and consists of two parts, namely: the first part entitled "The current state of knowledge at l national and international, which includes 29 pages and the second part entitled "Own research", which includes 141 pages, 84 tables and 17 figures.

"The current state of knowledge" includes two chapters in which information from the specialized literature is presented with reference to the carabid species found in wheat, corn, and sunflower crops and which have been used later for the interpretation and comparison of the data obtained in the "Own research" as well as the description of the natural setting of the municipality of Arad.

In this chapter, information is presented regarding the geographical location, pedoclimatic conditions, and weather conditions rologice.Part II, "Own Research," consists of 2 chapters: Chapter 1 presents the purpose and objectives of the research, the research materials, and the methods used. The proposed objectives were:

1. knowledge of the current state of research on the fauna of carabids (Coleoptera: Carabidae) from the crops studied;

2. identification of carabid species;

3. the comparative study of the fauna of carabids (Coleoptera: Carabidae) collected in the studied crops according to the chemical treatments used on the seed or on the vegetation.

4. the analysis of the biodiversity of carabid fauna from the crops under study

In 2022, 27 carabid species were identified in the wheat crop, totaling 406 specimens. The most numerous species were *Pseudophonus pubescens* with 98 specimens, followed by *Pterostichus cylindricus* with 92 specimens, *Pterostichus niger* with 28 specimens, *Pseudophonus griseus* with 27 specimens, and *Harpalus distinguendus* also with 27 specimens. On the other hand, 13 carabid species were represented by a single specimen.

In 2023, the number of species collected was 21, totaling 271 specimens. The most numerous were *Pseudophonus pubescens* (109 specimens), *Pterostichus cylindricus* (89 specimens), *Harpalus distinguendus* (17 specimens), and *Harpalus tardus* (15 specimens). Ten species were represented by a single specimen.

During the research period, for the V1 (untreated) variant of the wheat crop, 461 carabid specimens were collected during the study period. *Pseudophonus pubescens* and *Pterostichus cylindricus* are the most abundant species in this study, recording 141 specimens and 133 specimens, respectively. It is also noted that there are 12 species that were identified only with a single specimen during the research.

In the V2 (treated) variant of the wheat crop, 216 carabid specimens were collected during the study period. *Pseudophonus pubescens* and *Pterostichus*

cylindricus are again among the most abundant species, with 69 and 131 specimens recorded, respectively. Also, there are 12 species that were only identified with a single specimen during the research.

In 2022, 25 carabid species were collected in the corn crop, totaling 917 specimens. Most specimens were collected from the species *Pseudophonus pubescens* (484 specimens), *Pseudophonus griseus* (235 specimens), *Pterostichus cylindricus* (94 specimens), *Harpalus distinguendus* (32 specimens), and Pterostichus niger (188 specimens). Nine carabid species were represented by a single specimen.

In 2023, 30 carabid species were collected in the corn crop, totaling 516 specimens. The most numerous specimens were of the species *Pseudophonus pubescens* (250 specimens), *Pterostichus cylindricus* (85 specimens), and *Harpalus distinguendus* (27 specimens).

During the research period, in the V1 variant (untreated) of the corn crop, there were 845 carabid specimens. The species *Pseudophonus pubescens, Pterostichus cylindricus* and *Pseudophonus griseus* represent the largest part of the fauna collected, contributing to 72.54% of the total specimens collected. More precisely, Pseudophonus pubescens recorded 375 specimens, *Pterostichus cylindricus* had 124 specimens and *Pseudophonus griseus* was recorded with 114 specimens.

In the V2 variant (treated) of the corn culture, there were 588 carabid specimens during the study period. The species *Pseudophonus pubescens* and *Pseudophonus griseus* are the most abundant in this variant, registering 359 specimens and 138 specimens, respectively. Together, these two species represent a significant proportion of the total fauna collected in the conventional variant. In addition, there are nine species that were only identified with a single specimen during the research.

In 2022, 18 carabid species totaling 716 specimens were collected from the sunflower crop, and in 2023, 26 carabid species were collected with a total of 447 specimens. The most specimens collected were of the species *Pterostichus cylindricus* (166 specimens), *Pseudophonus pubescens* (134 specimens) and *Pseudophonus griseus* (23 specimens); seven carabid species recorded only one specimen: *Ophonus pincticollis, Ophonus ruficola, Ophonus sabulicolla, Pterostichus lepidus,* and *Pterostichus marginalis*.

The total for the V1 variant (untreated) of the sunflower crop is 786 carabid specimens. The species *Pseudophonus pubescens* and *Pterostichus cylindricus* are the most abundant in this variant, contributing significantly to the total fauna collected, with 293 specimens and 181 specimens, respectively. These two species together represent 73.83% of the total specimens collected in the untreated version of the sunflower culture.

During the research period, 377 carabid specimens were collected at the V2 (treated) sunflower culture during the study period. The species *Pterostichus cylindricus* and *Pseudophonus pubescens* are the most abundant in this variant, registering 204 specimens and 121 specimens, respectively. These two species contribute significantly to the total fauna collected in the conventional variant of sunflower culture. Also, there are 8 species that were only identified with a single specimen during the research.

During the research period, a total of 3273 specimens were collected for both experimental variants. This suggests an analysis of the impact and distribution of carabids on agricultural crops, indicating that maize was the most affected crop, with 1433 carabids collected, and wheat had the least impact, with 677 carabids.

The total number of carabid specimens per culture is as follows:

- ✓ In the V1 variant, in the wheat crop, it was 4.43 specimens, while in the V2 variant it was only 2.07, and the average was 3.25 specimens.
- ✓ In the V1 variant, in the corn crop, it was 3.52 specimens, while in the V2 variant it was 2.45, and the average of the two variants was 2.98 specimens.
- ✓ In the V1 variant, in the sunflower culture, it was 3.27 specimens, while in the V2 variant it was 1.57, and the average of the two variants was 2.42 specimens.

In all cultures, the V1 variant had a higher number of specimens collected and a higher mean per trap compared to the V2 variant. The number of traps used varied by crop studied, with the highest number of traps used in maize and sunflower (240 each for each variant).

Regarding the species common to the three cultures and to the two variants, the situation is as follows:

- ✓ In the wheat crop, *Pterostichus cylindricus* was consistently the most abundant species in both years, both in the untreated and treated versions. Species distribution can vary significantly between untreated and treated variants, which may indicate different influences of agricultural practices on the carabid community. These data are crucial for assessing the impact of agricultural practices on the biodiversity and structure of carabid communities in wheat crops. This information is essential for research and sustainable management of agricultural crops, contributing to the understanding of the ecology and population dynamics of carabids in agricultural environments.
- ✓ In the corn crop, the species *Pseudophonus pubescens* and *Pseudophonus griseus* were the most abundant, demonstrating a dominance in the collection of specimens. The distribution of species between organic and conventional variants can vary significantly, reflecting the impact of agricultural practices on carabid diversity and abundance.
- ✓ In the sunflower crop, *Pterostichus pubescens* and *Pterostichus cylindricus* continued to be the dominant species, registering significant amounts.

The number of common species increased from 6 in 2022 to 13 in 2023, indicating a possible diversification of carabid communities in the sunflower crop.

The species *Pseudophonus pubescens* has a diverse diet that includes small invertebrates and plant material. This omnivorous feeding habit makes them beneficial for pest and weed control in agricultural environments. Understanding the feeding behavior of this beetle species is crucial for harnessing their ecological roles in natural and managed ecosystems.

In conclusion, *Pterostichus cylindricus* plays an important role in the ecosystems in which it is present, both as a predator of other invertebrates and as a participant in the organic decomposition process. This feeding behavior not only allows them to survive in diverse habitats but also contributes to maintaining the ecological health of these environments.

For the wheat crop, the index calculation shows that the diversity and evenness are slightly higher in the untreated wheat crops compared to the treated ones in 2022.

Diversity decreased slightly in 2023 compared to 2022 for both crop types (treated and untreated).

Crop treatment appears to slightly reduce species diversity and evenness.

These conclusions suggest that treatment interventions can influence species composition and diversity, although the differences are not very large. However, in 2023, overall diversity is slightly lower than in 2022.

For the maize crop, the calculation of the indices shows that the treatment applied to the maize crops seems to reduce species diversity, favoring the dominance of specific species. There are annual variations in the impact of treatments, which suggests that other factors (climate, soil, etc.) may influence the results. Farmers and researchers should closely monitor the effects of treatments on biodiversity and adjust practices to maintain a healthy balance in agro-ecosystems.

For the maize crop, the calculation of the indices shows that, in general, the treated crops tend to have a greater diversity and a more even distribution of species, which is indicated by the higher values of the diversity and evenness indices (Shannon Entropy, Index Shannon of Evenness, Shannon Index of Fairness, Menhinick, Margalef, and McIntosh). Untreated cultures show a higher dominance of certain species, as suggested by higher relative frequency and Berger-Parker values. Treatment applied to sunflower crops appears to favor greater species diversity and equity, while untreated crops show greater dominance of specific species and greater overall abundance.

These observations are useful to understand how applied treatments influence species diversity in sunflower crops.

The Kendall rank correlation coefficients for the three crops are: wheat (τ wheat) = 0.1429, corn (τ corn) = 0.0667, and flower (τ flower) = -0.1333. These coefficients reflect the extent to which species orderings in one culture are

concordant or discordant with species orderings in the other culture, based on their ranks. For the Kendall rank correlation coefficients calculated for the three crops (wheat, corn, and flower), we have the following values:

For wheat (τ) = 0.1429: This coefficient indicates a very weak positive correlation between species ordinations in wheat crops V1 and V2. The species rank values in wheat are only slightly consistent with those in V2.

For maize (τ) = 0.0667: This coefficient indicates a very weak positive correlation between species ordinations in maize crops V1 and V2. The species ranks in maize are also only marginally concordant between the two variants.

For sunflower (τ) = -0.1333: This coefficient indicates a very weak negative correlation between species ordinations in flower crops V1 and V2. The rank values of species in flower are slightly discordant between the two variants. In conclusion, the low values of the τ coefficients for wheat and maize show a low concordance between species ordinations in the two variants of the respective crops. In the case of the flower, the negative coefficient indicates a low discordance between the ordering of the species in the two variants of the culture.

In conclusion, research on carabid populations in agroecosystems is essential for understanding the complex interactions between agricultural practices, biodiversity, and ecosystem functions. They provide a solid basis for the development of sustainable agricultural practices and the conservation of natural resources in the context of global changes and the needs of sustainable food production growth.