STRUCTURE, DYNAMICS, AND ABUNDANCE OF BEETLE SPECIES FROM A SUNFLOWER CROP FROM THE WESTERN AREA OF ROMANIA

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Abstract

The observations were made in the western part of Romania in the town of Aldea, Arad County, in a sunflower crop. For these observations, were used 12 pitfall traps ground traps. These were placed in the culture in two rows of six per row from the beginning of the plants' emergence until harvesting, harvesting at intervals of about 2 weeks throughout the year 2022 on the following calendar dates: 15.05, 29.05, 12.06, 26.06, 24.07, 7.08, 21.08, 4.09, and 18.09. Carabid species were retained from the collected material. Two variants were used: Variant 1 is represented by an ecological sunflower culture where no chemical treatment was done to combat pathogens and pests and Variant 2, represented by a sunflower crop cultivated in a conventional system where chemical treatments were applied both to the seed and to the crop to combat pathogens and pests. In general, a greater diversity and an important number of carabids are found in the sunflower culture cultivated in an ecological system (variant 1).

Key words: carabids, sunflower, crop, traps

The Carabidae family presents an objective of great attraction for coleopterological specialists and amateurs; thus, interest in the study of this group has increased greatly in the last decades (Neculiseanu, 2004).

Carabids are very diverse and well represented in the epigean arthropod fauna (Tălmaciu M. *et al*, 2022). They are very important in ecological studies due to the ecological roles they fulfill, such as prey, predator, detritivore, and necrophage (Sakine, 2006), but in addition to this role, the special value of carabids has been established in recent years also as bioindicators for the evaluation of the state of health of ecosystems (Varvara & Cîrlan, 1990).

Studying the structure, dynamics, and abundance of carabid species in a sunflower crop is important to understand the interaction between various biotic agents and agricultural systems. Coleoptera constitute a major group of insects that can have a significant impact on crops, having both beneficial-predatory and harmful species (Bărbulescu P., 2002).

Dominant species are those that appear in large numbers and have a significant impact on ecosystem dynamics (Chițimia, 2010). In a sunflower crop, the dominant species can be harmful or predatory species (*Adalia bipunctata*) with a role of biological regulation on pests.

Ecological agricultural practices or biological pest control can support a more diversified and balanced population of beetles (Eyre and Leifert, 2011).

The abundance of carabids species in a sunflower crop can vary according to various ecological and agricultural factors: temperature, humidity, and precipitation; application of pesticides that can reduce populations of harmful coleopterans but also of beneficial predators (Stork and Eggleton, 1992).

Studying beetles in a sunflower crop is essential for integrated pest management and maximizing the ecological benefits of natural predators, thus promoting sustainable agriculture (Schowalter, 2016).

MATERIAL AND METHOD

Samples were collected using pitfall traps, this method being effective for capturing species with high abundance and mobility (Stoyenoff, 2001; Spungis, 2008).

The entomological material was collected by means of 24 pitfall traps soil traps in each crop, more precisely 12 traps for each variant, during the entire vegetation period. The traps were made of plastic containers filled with a solution of acetic acid, a solution also used in other studies (Magura *et al*, 2005; Balog *et al*, 2012). The traps were buried to ground level (Figure 1). The location of the traps was made in the shape of a circle at a distance of 10 m between them.

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Plastic jars with a volume of 1000 ml, 13.5 cm wide, and 12.0 cm high were used to collect the entomological material. As a fixative-preservative liquid, 50% diluted acetic acid was used, in which a few drops of detergent were added to reduce the surface tension.

A hole is dug in the ground with suitable dimensions for the container so that it is inserted at ground level. The upper edge of the container must be perfectly aligned with the surface of the soil so that the insects enter the container.

The specimens captured there were collected and tagged. Labeled samples were protected from sunlight and transported to the laboratory for analysis and determination.

In the 2022 research year, using the pitfall trap method, a total of 10 periodic collections of biological material were carried out on the following dates: 15.05, 29.05, 12.06, 26.06, 10.07, 24.07, 07.08, 21.08, 04.09, and 18.09.

In order to achieve the research objectives, two work variants located in the same location were studied for each culture:

V1-Untreated crops;

V2-Crops to which treatments against pathogens and pests have been applied.

Treatments used on seeds:

- the following chemicals were used to treat wheat seeds: Permis 700 WS and Bariton Super 97.5 FS;
- the following chemicals were used to treat sunflower seeds: Permis 700 WS and Apron XL;
- the following chemicals were used to treat corn seeds: Permis 700 WS and Lebosol.

Treatments used on vegetation:

- the following substances were used to treat the corn crop: Mospilan 20 SG, Dicopur D and Elumis.
- the following substances were used to treat the sunflower crop: Karate Zeon, Mirage 45 EC and Pyrus 400;
- the following substances were used to treat the wheat crop: Attribut 70 and Hussar Activ OD.

Figure 1**. The inventory of the entomological material collected**

RESULTS AND DISCUSSIONS

In 2022, 16 distinct species of beetles were identified in the V1 version, which totaled a number of 491 specimens (table 1). The species captured in very small numbers were *Amara similata* and *Bembidion ruficorne*, each being captured only once. *Pseudophonus pubescens* is the best represented species, with a total of 235 captured specimens being predominant over the other species. *Pseudophonus griseus* and *Pterostichus cylindricus* are also well represented, with 96 and 114 specimens captured, respectively.

Tabel 1

Carabid species collected in the sunflower crop in V1 at 2022

No.	Species name	Trap												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
1.	Amara familiaris		3											3
2.	Amara similata		1											1
3.	Bembidion ruficorne		1											1
4.	Calatus fuscipes	3	1			1								5
5.	Carabus coriaceus		1					1				1		3
6.	Harpalus aeneus											1		1
7.	Harpalus distinguendus	1	1	3	1			3	1		1			11
8.	Harpalus tardus							1	1			1		3
9.	Leistus ferrugineus											1		1
10.	Ophonus puncticollis		1			1								2
11.	Platynus assimilis											1		1

12.	Pseudophonus griseus	5	12	2	6	15		9	14	2	12	13	6	96
13.	Pseudophonus pubescens	19	34	14	37	26	7	18	31	8	7	27	7	235
14.	Pterostichus cylindricus	11	16	7	5	9	5	20	14	4	9	8	6	114
15.	Pterostichus lepidus		1	1	1			1						4
16.	Pterostichus niger		1	1		2		1	2			2	1	10
TOTAL V1		**39**	**73**	**28**	**50**	**54**	**12**	**54**	**63**	**14**	**29**	**55**	**20**	**491**

In the V2 variant, 8 distinct species of carabids were collected (table 2). The best represented species is *Pterostichus cylindricus*, with 127 specimens caught, which represents over half of the total catches.

Other significantly represented species are *Pseudophonus pubescens* (63 specimens) and *Pseudophonus griseus* (17 specimens). Species such *as Zabrus tenebrioides* and *Nebria brevicollis* were very rarely encountered, each being captured only once.

Tabel 2

Carabid species collected in the sunflower crop in V2 at 2022

No.	Species name	Trap												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
	Calatus fuscipes								2					2
2.	Harpalus distinguendus							2	1					3
3.	Nebria brevicollis							1						1
4.	Pseudophonus griseus	3					1	8	3		1		1	17
5.	Pseudophonus pubescens	12	6	1	5		3	18	8	1	4	4	1	63
6.	Pterostichus cylindricus	12	9	10	11	12	9	18	14	5	7	14	6	127
7.	Pterostichus niger	3		1	3		1	2	3	1				14
8.	Zabrus tenebrioides								1					1
TOTAL V2		**30**	**15**	**12**	**19**	**12**	**14**	**49**	**32**	**7**	**12**	**18**	**8**	**228**

In 2022, 18 carabid species were collected from the sunflower crop, which totaled 716 specimens (Fig. 1).

The most specimens collected were of the species *Pseudophonus pubescens* (298 specimens), *Pterostichus cylindricus* (241 specimens), *Pseudophonus griseus* (113 specimens), and *Pterostichus niger* (21 specimens); 7 carabid species recorded only one specimen.

These were: *Amara similata*, *Bembidion ruficorne*, *Harpalus aeneus*, *Leistus ferrugineus*, *Nebria brevicollis*, *Platynus assimilis*, and *Zabrus tenebrioides*.

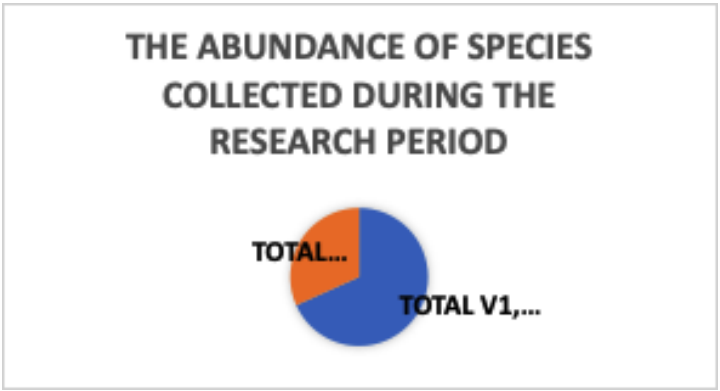

Figure 2**. Graphic representation of the structure of carabid species collected in 2022**

In the sunflower crop, in 2022, 6 common carabid species were identified with a total of 697 specimens, the species with the highest abundance being *Pterostichus pubescens* (298 specimens) and *Pterostichus cylindricus* (241 specimens), which represents 77 .33% of the total common species (table 3).

Tabel 3

Carabids species common to the sunflower crop in the two variants in 2022

No.	Species name	Variant		Total
		treated	untreated	
1.	Calatus fuscipes	5	2	**7**
2.	Harpalus distinguendus	11	3	**14**

3.	Pseudophonus griseus	96	17	**113**
4.	Pseudophonus pubescens	235	63	**298**
5.	Pterostichus cylindricus	114	127	**241**
6.	Pterostichus niger	10	14	**24**
TOTAL 6 species		471	226	**697**

CONCLUSIONS

The use of pitfall traps proved to be effective in capturing the carbids species with high abundance and mobility, as shown by the total number of specimens collected (716 in total). This confirms the specialized literature, according to which this method is suitable for such insects.

The best represented species were *Pseudophonus pubescens* (298 specimens) and *Pterostichus cylindricus* (241 specimens), contributing to 77.33% of the total catches from sunflower crops. This dominance indicates an effective adaptation of these species to the specific habitat and conditions in the studied crops.

In the untreated variant (V1), 471 specimens from 16 species were collected, while in the treated variant (V2), 226 specimens from 8 species were collected. This suggests that phytosanitary treatments applied in variant V2 had an impact on the abundance and diversity of carabids, reducing the number of species and specimens captured. However, the species *Pterostichus cylindricus* was more abundant in the treated variant, which indicates the possibility of greater resistance to the treatments.

A small number of species (7 in number), such as *Amara similata, Bembidion ruficorne*, and *Zabrus tenebrioides*, were found, only one specimen each. These rare species may indicate either a greater sensitivity to the treatments applied or a reduced natural presence in the respective agro-systems.

The treated variant of the sunflower crop had a reduced biodiversity, capturing only 8 species compared to 16 in the untreated variant. This shows that the application of pest and pathogen treatments can negatively affect the biodiversity of beneficial insects such as carabids.

Periodic captures throughout the entire growing season provide a detailed picture of carabid population dynamics, highlighting seasonal fluctuations in diversity and abundance. Thus, long-term monitoring is essential to understanding the impact of agricultural factors on these species.

In conclusion, the research highlighted the significant impact of agricultural practices on carabid communities, with their involvement in natural pest control and maintaining the balance of agricultural

ecosystems.

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