THE STUDY OF INSECTS IN A VEGETABLE GARDEN IN THE ORLEȘTI VILLAGE OF THE VÂLCEA COUNTY

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Abstract. The study carried out in a vegetable garden from Orlești village, Vâlcea county, aimed to identify useful and harmful fauna by collecting insects. For this purpose, eight Barber traps were installed, one in each crop: onions, garlic, tomatoes, peppers, cucumbers, carrots, beets and corn. Following the systematic determination and categorization, the following insect orders were identified: Coleoptera, Orthoptera, Lepidoptera and Hymenoptera. The traps were operated from April through August 2023, and samples were collected while crops were in full vegetation. Insects were collected from the traps on a weekly basis, preserved, labelled, and identified using specialized identifiers. In total, 275 specimens were collected, with most species captured from the tomato crop totalling 92 specimens. The analysis of the captured species revealed that 87.53% of the insects belonged to the useful entomofauna, while 12.47% were crop-specific harmful species.

Keywords: insects, vegetable garden, Orlești commune, Vâlcea county.

Rezumat. Studiul insectelor dintr-un ecosistem agricol, o grădină de legume din comuna Orlești, județul Vâlcea. Studiul a avut ca scop identificarea faunei utile și dăunătoare prin colectarea insectelor. În acest scop, au fost instalate 8 capcane Barber, câte una în fiecare cultură: ceapă, usturoi, tomate, ardei, castraveți, morcovi, sfeclă și porumb. În urma determinării și încadrării sistematice, au fost identificate următoarele ordine de insecte: Coleoptera, Orthoptera, Lepidoptera și Hymenoptera. Capcanele au funcționat în perioada aprilie-august 2023, iar probele au fost prelevate pe când culturile se aflau în plină vegetație. Insectele au fost colectate din capcane săptămânal, apoi au fost conservate, etichetate și identificate cu ajutorul determinatoarelor de specialitate. În total, au fost colectate 275 de exemplare, cele mai multe specii fiind capturate din cultura de tomate, cu un total de 92 de exemplare. Analiza speciilor capturate a relevat că 87,53% din insecte aparțin entomofaunei utile, în timp ce 12,47% sunt specii dăunătoare specifice fiecărei culturi.

Cuvinte cheie: insecte, grădină de legume, comuna Orlești, județul Vâlcea.

INTRODUCTION

Insects play an essential role in the functioning and stability of agricultural ecosystems. They contribute significantly to biological diversity and are involved in many fundamental ecological processes. Within an agricultural ecosystem, insects perform vital functions such as pollination, biological pest control, decomposition of organic matter and improvement of soil structure and fertility (BAICU & SĂVESCU, 1986; BOGULEANU, 1994).

Pollinators, such as bees (*Apis* spp.), bumble bees (*Bombus* spp.) and various species of butterflies, are crucial for the production of many agricultural crops. By transferring pollen from male to female flowers, these insects facilitate plant reproduction and contribute to fruit and seed formation. Without pollinators, many crops would have greatly reduced yields, affecting global food security (STUGREN, 1982; MOISE, 2014).

Predatory and parasitic insects, such as beetles (Coccinellidae), parasitic wasps (Ichneumonidae, Braconidae) and syrphid flies (Syrphidae), help to keep insect pest populations under control. These beneficial species reduce the need to use chemical pesticides, thus contributing to more sustainable agricultural practices and protecting human health and the environment (CIOCHIA & MOISE, 2005; BUCUR & ROȘCA I., 2011; STANCĂ-MOISE, 2014).

Detritivores, such as saprophagous coleopterans and dipteran larvae, play a key role in the decomposition of organic matter. Through this process they contribute to the nutrient cycle, releasing essential elements into the soil and making them available to plants. Thus, they improve soil fertility and support healthy crop growth (BRADY & WEIL, 2009; BUCUR & ROȘCA, 2011).

Earthworms and soil-dwelling insects, such as some coleopteran and orthopteran species, help aerate the soil and improve soil structure. These activities favour water infiltration and root growth, contributing to robust plant development (VARVARA & GĂLUȘCĂ, 2007; VARVARA, 2016; COYLE et al., 2017).

Insects are indispensable components of agricultural ecosystems, having a profound impact on their productivity and sustainability. Studying and understanding the diversity and functions of insects in these environments are essential for the development of efficient and environmentally friendly agricultural practices. Protecting and promoting beneficial insects is a crucial strategy to ensure a healthy and resilient agricultural system (GHIZDAVU et al., 1997; FLORESCU et al., 2021).

Similar studies have been conducted over time in Romania by various authors (MANOLE et al., 2009; MOCANU et al., 2017; STANCĂ-MOISE, 2019; 2023a, b; STANCĂ-MOISE & DIACONEASA, 2022).

MATERIALS AND METHODS

The study was conducted in a 10 m^2 vegetable garden located in the Orlești village, Vâlcea county. On April 1, 2023, a set of 8 soil traps (Table 1) were placed in order to collect insect populations in vegetable crops: onions, garlic, tomatoes, peppers, carrots, beets, and corn. One trap was placed in each vegetable crop.

In the vicinity of the garden, according to the geographical coordinates, the following ecosystems were found: to the north, a deciduous forest, to the east, a corn crop, to the south, residential houses and to the west, agricultural crops.

These environmental conditions and trapping locations in different vegetable crops were strategically chosen to assess and control insect populations in an efficient and crop-specific manner in the garden.

Table 1. Geographical coordinates for each collection point in 2023.

Trap	Latitude	Longitude
1	N 44º 79' 19"	E 24º 22' 12"
2	44º 79' 40"	24º 22' 37"
3	44º 79' 29"	24º 22' 65"
4	44º 79'12"	24º 22' 34"
5	44º 79' 50"	24º 22' 55"
6	44º 79'92"	24º 22'60"
7	44º 79' 84"	24º 22'27"
8	44º 79'59"	24º 22' 97"

Figure 1. Traps installed in the studied ecosystems (original photo).

The traps used in the experiment (Fig. 1) were made of PET bottles of two different sizes. A 2-litre bottle served as a protective vessel, which was perforated for water drainage, and a 1.5-litre bottle was placed inside it, which was used as a collecting vessel. The two pots, forming the trap, were buried in the soil, and the surrounding soil was carefully arranged to prevent the insects from bypassing the trap. A funnel made from the neck of a two-litre bottle was installed at the mouth of each protective jar.

Table 2. Collection days and climatic values of each collection day.

Day of entomological sampling	Time	Temperature (^{0}C)	Humidity (%)	Rainfall (%)
12.04.2023	14:06	19	86	21
19.04.2023	13:50	12	39	4
26.04.2023	11:40	16	63	13
03.05.2023	12:05	18	75	72
10.05.2023	14:30	17	47	4
17.05.2023	10:10	13	54	55
24.05.2023	15:45	22	2	17
31.05.2023	13:30	25	2	10
07.06.2023	16:00	31	52	10
14.06.2023	12:30	27	2	40
21.06.2023	11:40	28	55	14
28.06.2023	12:05	26	37	23
1.08.2023	14:30	31	54	62
8.08.2023	10:10	23	21	41
15.08.2023	15:45	29	12	57
21.08.2023	13:30	27	56	19
28.08.2023	16:00	31	26	11
2.09.2023	12:30	27	52	12

9.09.2023	11:40	21	42	43
16.09.2023	12:05	23	51	14
23.09.2023	14:30	21	12	15
30.09.2023	10:10	19	10	27

The traps were monitored from the beginning of April 2023 through the end of August until the insects entered summer diapause. Detailed information including date and time of trapping, air temperature, atmospheric humidity and rainfall was recorded in the field notebook for each week of trap collection (Table 2). The captured material was preserved, stung and displayed, while systematic species classification was performed with specialized determiners. The used traps had a collection hole diameter of 12 cm, providing a trapping area of approximately 226.08 cm2, representing approximately 29.37% of the circumference of the trapping circle. This trap geometry allowed efficient collection of the studied species. In order to interpret the collected data, statistical calculations were carried out to determine the dominance and abundance of the captured species, facilitating their systematic categorization and status as useful or harmful species.

RESULTS AND DISCUSSIONS

Trap 1 was installed in the onion crop in early April 2023 (Fig. 2; Table 3). In this trap, 57 insect specimens were captured, belonging to 3 orders: Coleoptera, Orthoptera and Hymenoptera. The best represented order was Coleoptera with 2 families, followed by Orthoptera with 2 families and 2 species, and Hymenoptera with 1 family and 1 species. The dominance of Coleoptera species was 64.91%, followed by Order Orthoptera with 24.56% and Order Hymenoptera with 10.53%.

Figure 2. Trap no.1 located in *Allium cepa* L. (original photo).

Table 3. Insect species collected in the onion crop, trap I.

Crt no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	COLEOPTERA	Scarabaeidae	*Geotrupes stereorarius* L., 1758	coprophagous	useful	8
2	COLEOPTERA	Coccinellidae	*Hyperaspis campestris* Herbst, 1783	zoophage	useful	29
3	ORTHOPTERA	Gryllotalpidae	*Gryllotalpa gryllotalpa* L. 1758	phytophage	harmer	9
4	ORTHOPTERA	Gryllidae	*Gryllus campestris* L., 1758	phytophage	useful	5
5	HYMENOPTERA	Apidae	*Apis mellifera*, L., 1758	nectar	useful	6
Total						**57**

Trap 2 was installed in the garlic crop (Fig. 3; Table 4). In this trap, 51 specimens of insects belonging to 2 orders were captured: Coleoptera and Orthoptera. The best represented order was Coleoptera with 4 families, followed by Orthoptera with 1 family and 1 species. The dominance was 90.20% for Coleoptera species, followed by Orthoptera with 9.8%.

Figure 3. Trap no. 2 located in *Allium cepa* L. and *Allium sativum* L. (original photo).

Table 4. Insect species collected in the onion crop, trap II.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	ORTHOPTERA	Gryllotalpidae	*Gryllotalpa gryllotalpa* L. 1758	phytophage	harmful	5
2	COLEOPTERA	Cerambycidae	*Leptura maculata Poda, 1761*	phytophage	useful	3
3	COLEOPTERA	Carabidae	*Poecilus versicolor* Sturm, 1824	zoophage	useful	16
4	COLEOPTERA	Phalacridae	*Phalacrus coruscus* Panzer, 1796	phytophage	useful	12
5.	COLEOPTERA	Coccinellidae	*Coccinella septempunctata* Linnaeus, 1758	zoophage	useful	15
Total						**51**

Trap 3 was installed in the cucumber crop. In this trap, 18 specimens of insects belonging to 2 orders were captured: Coleoptera and Orthoptera. The best represented order was Coleoptera with 3 families, followed by Orthoptera with 1 family and 1 species. The dominance was 83.33% for Coleoptera species, followed by Orthoptera with 16.66% (Table 5).

Table 5. Insect species collected in the cucumber crop, trap III.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	ORTHOPTERA	Gryllotalpidae	*Gryllotalpa gryllotalpa* Linnaeus 1758	phytophage	harmful	3
2	COLEOPTERA	Cerambycidae	*Leptura maculata Poda, 1761*	phytophage	useful	2
3	COLEOPTERA	Scarabaeidae	*Cetonia aurata* Linnaeus, 1758	Hemiphytophage, pollen	useful	6
5.	ORTHOPTERA	Gryllidae	*Gryllus campestris* Linnaeus, 1758	phytophage	useful	7
Total						**18**

Trap 4 was installed in the tomato crop (Fig. 4; Table 6). In this trap, 92 specimens of insects were captured, belonging to 2 orders: Coleoptera and Hemiptera. The best represented order was Coleoptera with 3 families and 4 species, the order of Hemiptera with 1 family and 1 species. The dominance was 61.96% for Coleoptera species, followed by the order of Hemiptera with 38.04%.

Figure 4. Trap no.4 located in *Lycopersicon esculentum* L. (original photo).

Table 6. Insect species collected in the tomato crop, trap IV.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	COLEOPTERA	Scarabaeidae	*Copris lunaris* L., 1758	coprophagous	useful	11
2	COLEOPTERA	Scarabaeidae	*Geotrupes stereorarius* L., 1758	coprophagous	useful	13
3	COLEOPTERA	Carabidae	*Carabus nemoralis* O. F. Müller, 1764	zoophage	useful	21
4	COLEOPTERA	Coccinellidae	*Coccinella septempunctata* L., 1758	zoophage	useful	12
5.	HEMIPTERA	Pyrrhocoridae	*Pyrrhocoris apterus* L., 1758	seminifage	useful	35
Total						**92**

Trap 5 was installed in the pepper crop (Fig. 5; Table 7). In this trap, 39 specimens of insects belonging to 3 orders were captured: Coleoptera, Lepidoptera and Orthoptera. The best represented order was Coleoptera with 3 families and 4 species, the order of Lepidoptera with 1 family and 1 species and the order of Orthoptera with 1 family and 1 species. The dominance was 74.36% for Coleoptera species, followed by the order of Orthoptera with 17.95% and the order of Lepidoptera with 8.28%.

Table 7. Insect species collected in the pepper crop, trap V.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	COLEOPTERA	Cerambycidae	*Morimus funereus* Mulsant 1863	phytophage	useful	2
2	COLEOPTERA	Lucanidae	*Lucanus cervus* Linnaeus, 1758	phytophage	useful	2
3	LEPIDOPTERA	Sphingidae	*Acherontia atropos* Linnaeus, 1758	phytophage	useful	3
4	COLEOPTERA	Scarabaeidae	*Melolontha melolontha* L., 1758	phytophage	harmful	12
5	COLEOPTERA	Scarabaeidae	*Cetonia aurata* Linnaeus, 1758	Seminifage, pollen	useful	13
6.	ORTHOPTERA	Gryllidae	*Gryllus campestris* Linnaeus, 1758	phytophage	useful	7
Total						**39**

Trap 6 was installed in the carrot crop. In this trap, 42 specimens of insects belonging to 3 orders were captured: Coleoptera, Hymenoptera and Orthoptera. The best represented order was Coleoptera with 3 families and 4 species, order Hymenoptera with 1 family and 1 species and order Orthoptera with 1 family and 1 species.

The dominance was 71.43% for Coleoptera species, followed by the order of Orthoptera with 16.16% and the order of Hymenoptera with 12.41% (Table 8).

Figure 5. Trap no.6 located in *Daucus carota* Georg Franz Hoffmann, 1791(original photo).

Table 8. Insect species collected in the carrot crop, trap VI.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	HYMENOPTERA	Apidae	*Apis mellifera*, Linnaeus, 1758	nectar	useful	5
2	ORTHOPTERA	Gryllidae	*Gryllus campestris* Linnaeus, 1758	phytophage	useful	7
3	COLEOPTERA	Carabidae	*Carabus nemoralis* O. F. Müller, 1764	zoophage	useful	19
4	COLEOPTERA	Coccinellidae	*Coccinella septempunctata* L., 1758	zoophage	useful	11
Total						**42**

Trap 7 was installed in the beet crop (Fig. 6). In this trap, 35 insect specimens were captured, belonging to 3 orders: Coleoptera, Hymenoptera and Orthoptera. The best represented order was Coleoptera with 2 families and 2 species, the order Hymenoptera with 1 family and 1 species and the order of Orthoptera with 1 family and 1 species.

The dominance was 77.14% for the Coleoptera species, followed by the order of Orthoptera with 8.57% and the order of Hymenoptera with 14.29% (Table 9).

Table 9. Insect species collected in the beet crop, trap VII.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	HYMENOPTERA	Apidae	*Apis mellifera* Linnaeus, 1758	nectar	useful	5
2	ORTHOPTERA	Gryllidae	*Gryllus campestris* Linnaeus, 1758	phytophage	harmful	3
3	COLEOPTERA	Carabidae	*Carabus nemoralis* O. F. Müller, 1764	zoophage	useful	12
4	COLEOPTERA	Coccinellidae	*Coccinella septempunctata* Linnaeus, 1758	zoophage	useful	15
Total						**35**

Figure 6. Trap no.7 located in *Beta vulgaris* L. (original photo).

Trap 8 was installed in the corn crop (Fig. 7). In this trap, 37 insect specimens belonging to 2 orders were captured: Coleoptera and Hymenoptera. The best represented order was Coleoptera with 3 families and 3 species and the order of Orthoptera with one family and one species. The dominance was 86.49% for the Coleoptera species, followed by the order of Hymenoptera with 13.51% (Table 10).

Figure 7. Trap no.8 located in *Zea mays* L., 1753 (original photo).

Table 10. Insect species collected in the corn crop, trap VIII.

Crt. no.	Order	Family	Species	Trophic regime	Role in the ecosystem	Number of specimens
1	HYMENOPTERA	Apidae	*Apis mellifera* Linnaeus, 1758	pollen nectar	useful	5
2	COLEOPTERA	Curculionidae	*Hylobius abietis* Linnaeus, 1758	phytophage	harmful	9
3	COLEOPTERA	Carabidae	*Carabus auratus* Latreille, 1802	predator	useful	15
4	COLEOPTERA	Coccinellidae	*Coccinella septempunctata* Linnaeus, 1758	zoophage	useful	8
Total						**37**

As a result of investigation, a total number of 17 species from four orders (Coleoptera, Hymenoptera, Lepidoptera and Orthoptera), 16 genera and 10 families (Apidae, Coccinellidae, Cerambycidae, Carabidae, Gryllotalpidae, Gryllidae, Lucanidae, Phalacridae, Scarabeidae and Sphingidae) were revealed (Table 11).

Table 11. Systematic classification of insect species collected from a vegetable garden in the Orlești village, Vâlcea county.

Crt. no.	Order	Family	Species
1.	**I. COLEOPTERA**	Scarabaeidae	*Geotrupes stereorarius* Linnaeus, 1758
2.			*Copris lunaris* Linnaeus, 1758
3.			*Cetonia aurata* Linnaeus, 1758
4.			*Melolontha melolontha* Linnaeus, 1758
5.		Coccinellidae	*Hyperaspis campestris* Herbst, 1783
6.			*Coccinella septempunctata* Linnaeus, 1758
7.		Cerambycidae	*Leptura maculata Poda, 1761*
8.			*Morimus funereus* Mulsant 1863
9.		Carabidae	*Poecilus versicolor* Sturm, 1824
10.			*Carabus nemoralis* O. F. Müller, 1764
11.			*Carabus auratus Latreille, 1802*
12.		Phalacridae	*Phalacrus coruscus* Panzer, 1796
13.		Lucanidae	*Lucanus cervus* Linnaeus, 1758
14.	**II. ORTHOPTERA**	Gryllotalpidae	*Gryllotalpa gryllotalpa* Linnaeus 1758
15.		Gryllidae	*Gryllus campestris* Linnaeus, 1758
16.	**III. HYMENOPTERA**	Apidae	*Apis mellifera* Linnaeus, 1758
17.	**IV. LEPIDOPTERA**	Sphingidae	*Acherontia atropos* Linnaeus, 1758

CONCLUSIONS

Following insect sampling in the vegetable garden, where 8 Barber traps were installed, one in each crop (onions, garlic, tomatoes, peppers, cucumbers, carrots, beets and corn), the following insect orders were identified: Coleoptera, Orthoptera, Lepidoptera, and Hymenoptera. The traps were installed in April 2023, through August when the crops were in full vegetation. Insects were collected from the traps on a weekly basis, preserved, labelled and determined using specialized determinants. The order Coleoptera was the best represented, 7 families and 12 species of insects were identified, most of them being phytophagous, zoophagous, coprophagous or nectariphagous, all belonging to the useful entomofauna, only two species being harmful to the vegetable crops (*Melolontha melolontha* Linnaeus, 1758 and *Gryllotalpa gryllotalpa* Linnaeus, 1758) monitored.

Two protected species have also been reported: *Morimus funereus* (Mulsant, 1863): is a vulnerable species with protected status under the Habitats Directive 92/43/EEC (Annex II); OUG 57/2007 (Annexes 3, 4A). Present in Romanian deciduous forests (MURARIU & MAICAN, 2021). Previously reported in Dumbrava Forest in 2015, saproxylic species, preferring beech and oak (STANCĂ-MOISE, 2015).

Lucanus cervus, commonly known as the common stag beetle, is one of the largest beetle species in Europe. *L. cervus* prefers deciduous forests, especially oak woodlands, where decaying tree trunks can be found, which provide egg-laying sites and food for the larvae (STANCĂ-MOISE, 2021). It is widespread in Europe but can also be found in parts of Asia (MURARIU & MAICAN, 2021). In Romania, it is common in deciduous forests and natural parks (STANCA-MOISE et al., 2023). *L. cervus* is considered a vulnerable species in many European countries due to habitat loss and declining numbers of old or decaying trees.

L. cervus is a symbol of biological diversity in deciduous forests and an indicator of the health of these ecosystems. The conservation of this species helps to maintain the natural balance and protect many other organisms that depend on the same habitats. The Order of Orthoptera was represented by two families and two species, the Order of Hymenoptera by one family and one species, and the Order of Lepidoptera also by one family and one species.

Following the determinations and the analysis of the captured species, we can conclude that the insects belong to the useful entomofauna, which do not cause damage to agricultural crops, most of them being species characteristic of deciduous forests. This can be explained by the location of the experiment in areas adjacent to the forest, as the captured insects were only passing through the study area.

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