

A STUDY OF USEFUL AND HARMFUL INSECTS CAUGHT IN CROPS IN BOGATU-ROMÂN, SIBIU COUNTY

STANCĂ-MOISE Cristina

Abstract. Following the collection of insects in the garden of the Bogatu-Român village, Sibiu county, where 11 Barber traps were installed, one in each crop (cherry, rose, redcurrant, aubergine, pepper, strawberry, raspberry, corn, potato and tomato) we reported the following Order of insects: Coleoptera, Orthoptera, Diptera, Dermaptera, Hemiptera, Lepidoptera and Hymenoptera. The traps were installed in May 2021 and 2022 traps operated from 2021 to September. Samples were taken during five months (May and September) in 2021 and 2022 from May to present when the crops were in full vegetation. Insects were collected from traps weekly over 20 trips during a growing season, preserved, labelled and determined using specialist determiners. A total of 338 specimens were collected, most of which from the maize crop totalling 76 specimens. Following the determinations and the analysis of the captured species, we can conclude that 73.4% of the captured insects belong to the useful entomofauna and the species that cause damage to agricultural crops represent 26.6% and are crop-specific pest species.

Keywords: insects, vegetable garden and fruit trees, Bogatu-Român village, Sibiu county.

Rezumat. Studiu insectelor utile și dăunătoare întâlnite în culturile din Bogatu-Român, județul Sibiu. În urma colectării insectelor de grădină, din comuna Bogatu-Român județul Sibiu, în care au fost instalate 9 capcane Barber câte una în fiecare ecosistem (cireș, prun, lucerna, varza, ardei, capșuni, porumb, cartof și viță de vie) am semnalat următoarele ordine de insecte: Coleoptera, Orthoptera, Diptera, Hemiptera, Lepidoptera și Hymenoptera. Capcanele au fost instalate în luna mai a anului 2021 și 2022 au funcționat cele din anul 2021 până în luna septembrie. Probele au fost prelevate pe parcursul a cinci luni (din luna mai până în septembrie) în anul 2021 și din anul 2022 din luna mai, când culturile au fost în plină vegetație. Insectele au fost ridicate din capcane săptămânal în timpul a 20 de deplasări pe parcursul unui sezon de vegetație, conservate, etichetate și determinate cu ajutorul determinatoarelor de specialitate. Au fost colectate 338 de exemplare. Cele mai multe specii au fost capturate din cultura de lucernă totalizând 76 de exemplare. În urma determinărilor și a analizei speciilor capturate, putem concluziona faptul că 73,4% din insectele capturate aparțin entomofaunei utile și sunt cele mai numeroase iar speciile care produc pagube culturilor agricole reprezintă 26,6% și sunt specii dăunătoare specifice fiecărei culturi în parte.

Cuvinte cheie: insecte, grădină de legume și pomi fructiferi, comuna Bogatu-Român, județul Sibiu.

INTRODUCTION

The present study on the study of useful and harmful insects captured in the vegetable garden of Bogatu-Român, Sibiu County, is based on the research of entomological species present in vegetable crops and fruit plantations in a restricted perimeter. This survey will be carried out during an annual growing cycle, with weekly collection of entomological fauna from Barber traps and systematic classification of each species.

Following this research, the level of influence that the entomological fauna has on the plants grown in the area can be determined and various methods of pest control can be applied to prevent a possible invasion, or in unfortunate cases, measures can be applied to combat pest attacks, re-establishing control by physical methods (temperature, light, etc.) mechanical methods (traps, girdlers, caterpillars, etc.), biotechnical methods (agro-technical work, crop rotation, etc.), biological methods (biopreparation, beneficial fauna, etc.) or chemical methods (insecticides).

The objectives proposed in this study were to:

- To determine the actual entomological populations in the crops in one's own garden;
- The influence of entomofauna on garden biodiversity;
- Systematic classification of collected insect species;
- Identification of useful and harmful insects found in the perimeter;
- Determination of the main pests found in the crops;
- Means of control and pest control used in each crop.

Studies on the structure of insects in agricultural crops have been published over time by different authors (BAICU & SĂVESCU, 1986; BOGULEANU, 1994; BUCUR & ROȘCA, 2011; CIOCHIA & MOISE C., 2005; FLORESCU et al., 2021; GHIZDAVU et al., 1997; MANOLE et al., 2021; MANOLE et al., 2009; MOISE, 2014; STANCĂ-MOISE, 2014, 2019, 2020; STANCĂ-MOISE & DIACONEASA, 2022; STUGREN, 1982; VARVARA & GĂLUȘCĂ, 2007). The aim of this study was to identify the epigeal insects, harmful and useful, captured from different ecosystems with the help of soil traps, from a household in the Bogatu-Român village, Sibiu county, in the 2022-2023 climate conditions.

MATERIALS AND METHODS

Insect collection traps were placed in one's own vegetable and fruit tree garden, located in the incorporated area of Bogatu-Român, with easy access from County Road 141 C (Fig. 1). The total usable area of the garden is

approximately 2,500 m² (0.25 ha), enclosed by a wire mesh fence measuring approximately 200 m in perimeter. Nine different plant crops were selected for this research (Table 1): *Capsicum annuum* (pepper), *Brassica oleracea* (cabbage), *Prunus domestica* (plum), *Zea mays* (corn), *Fragaria sp.* (strawberry), *Medicago sativa* (lucerne), *Vitis vinifera* (vine), *Prunus avium* (cherry) and *Solanum tuberosum* (potato).

Each crop was monitored by setting a home-made trap, starting on 1 May 2022, with the first harvest of insect populations on 8 May 2023. This monitoring and collection process will be carried out weekly throughout the annual development of the insects, until they cease their activity due to the winter diapause.



Figure 1. Location of the study area (google earth).

Table 1. Plant crops to be studied.

Trap number	Studied crop	Sampling site coordinates	Altitude (m.d.m.)
C.1	<i>Capsicum annuum</i> (pepper)	45°59'15"N 23°55'46"E	374m
C.2	<i>Brassica oleracea</i> (cabbage)	45°59'14"N 23°55'47"E	375m
C.3	<i>Prunus domestica</i> (plum)	45°59'14"N 23°56'48"E	378m
C.4	<i>Zea mays</i> (corn)	45°59'14"N 23°55'47"E	377m
C.5	<i>Fragaria</i> (strawberry)	45°59'14"N 23°55'46"E	375m
C.6	<i>Medicago sativa</i> (lucerne)	45°59'13"N 23°56'48"E	375m
C.7	<i>Vitis vinifera</i> (vine)	45°59'15"N 23°55'47"E	378m
C.8	<i>Prunus avium</i> (cherry)	45°59'13"N 23°55'48"E	377m
C.9	<i>Solanum tuberosum</i> (potato)	45°59'15"N 23°55'47"E	374m

Making and using collecting traps for entomological study, we can say that these entomological traps are an essential part of our research equipment, as they are built to retain insects in their habitat, making the researcher's job easier and the capture of entomological material for study more efficient.

The traps made should preferably be easy to assemble, low cost, resistant to environmental factors, and as small as possible so as not to disrupt activities in the area. This is why Barber traps made of PET were chosen as they are easy to handle, durable, cheap and readily available.

Two types of PETs were used, one measuring 2.5 litres as a support and protective vessel, with holes at the bottom to drain excess liquid from the other PET, which has a slightly smaller volume (2 litres), the purpose of which is to collect insects attracted by the detergent water stored for 7 days in the vessel.

The list of materials used in the manufacture, assembly and operation of the collector process: PET bottles, Cater, Numbered signs, Harel, Hammer, Water with detergent, Notebook, Pen, Graduated ruler, Mobile phone, Sieve, Collecting jars, Styrofoam sheets, Glazing needles.

The traps (Fig. 2) were mounted in the area of each crop so that the upper edge was flush with the soil surface. They measure a diameter of 10 cm of the collecting surface (Fig. 1)



Figure 2. Materials needed for this study (original photo).



Figure 3. Fitting the traps (original photo).



Figure 4. Diameter of collection area (original photo).

Sampling was carried out weekly following the steps:

- Step 1: Removal of foreign material or plant debris in or around the trap that has been transported by wind, rainfall, living creatures or human activities.
- Step 2: Removal of the collection vessel from the protective container and filtration through a fine sieve of the entomological material from the liquid (water with detergent); this liquid solution was collected from each trap in a 5-litre container and disposed of in the sewer system so as not to pollute nature.
- Step 3: Emptying the sieves on a flat material (polystyrene plate) to evaporate the water from the collected entomological material, thus avoiding its degradation or destruction.
- Step 4: Replace the liquid solution with fresh solution and prepare the trap for the next week of sampling.
- Step 5: The last step is to transport the insects in the collection containers with an information note attached to them.

During each sampling, the date, time, air temperature, precipitation (day), atmospheric humidity, wind direction and wind speed were transcribed from the mobile phone into the field logbook in order to be able to compile the weather information logs.

These traps should be dismantled immediately after the entomological survey is completed so as not to harm or even exterminate insects unnecessarily. If they can no longer be used for any other purpose, these PET traps can easily be recycled in the yellow bins to be recycled in other areas, thus avoiding the risk of harming the environment or the living creatures (Figs. 3, 4).

All meteorological data in Tables 2, 3, 4, 5 and 6 have been transcribed from the analysis of the "Weather & Radar" mobile app, based on the European Centre for Medium-Range Weather Forecasts (ECMWF) monitoring.

Table 2. Weather Information for May 2022.

Date	Hour	Air Temperature	Precipitation	Humidity	Wind Direction	Wind Speed
08.05	13:00	16 °C	0,1 mm	45%	Est	9 km/h
15.05	12:30	15,5°C	0 mm	56%	Sud-Est	19 km/h
22.05	15:00	21 °C	0,4 mm	49%	Nord-Vest	8 km/h
29.05	17:00	20,7°C	0,2 mm	50%	Nord-Vest	14 km/h

Table 3. Weather Information for June 2022.

Date	Hour	Air Temperature	Precipitation	Humidity	Wind Direction	Wind Speed
05.06	13:00	22,3°C	2,1 mm	56 %	Sud-Vest	12 km/h
12.06	12:30	21 °C	4,6 mm	59 %	Nord-Vest	7 km/h
19.06	16:00	24 °C	0 mm	40 %	Sud-Est	4 km/h
26.06	13:30	23,6°C	0,1 mm	47 %	Sud-Vest	6 km/h

Table 4. Weather Information for July 2022.

Date	Hour	Air Temperature	Precipitation	Humidity	Wind Direction	Wind Speed
10.07	12:30	23 °C	1 mm	48 %	Vest	12 km/h
17.07	17:00	27,6°C	0 mm	34 %	Sud-Vest	17 km/h
24.07	12:00	29 °C	0 mm	25 %	Sud-Vest	9 km/h
31.07	15:00	28,2°C	0,9 mm	40 %	Vest	18 km/h

Table 5. Weather Information for August 2022.

Date	Hour	Air Temperature	Precipitation	Humidity	Wind Direction	Wind Speed
07.08	14:00	28 °C	0 mm	40 %	Est	10 km/h
14.08	12:00	24,6°C	1 mm	48 %	Vest	8 km/h
21.08	16:00	30 °C	0 mm	37 %	Sud-Vest	15 km/h
28.08	13:30	27 °C	0 mm	29 %	Sud-Vest	7 km/h

Table 6. Weather Information for September 2022.

Date	Hour	Air Temperature	Precipitation	Humidity	Wind Direction	Wind Speed
04.09	15:00	18 °C	0 mm	53 %	Nord-Vest	5 km/h
11.09	17:00	23 °C	1,1 mm	60 %	Vest	12 km/h
18.09	12:30	17,2°C	0,2 mm	69 %	Sud	20 km/h
25.09	13:00	15 °C	0 mm	58 %	Sud-Est	9 km/h

RESULTS AND DISCUSSIONS

Trap 1 was installed in the pepper crop in early May 2022 (Fig. 5). In this trap 37 insect specimens were caught and 4 orders were identified: Coleoptera, Diptera, Hemiptera, Orthoptera and Lepidoptera. The *Coleoptera* order was best represented with 6 families and 6 species (Table 7), followed by the orders of Hemiptera with one family (*Pyrrhocoridae*) and one species, the Orthoptera (*Gryllotalpidae*) order, Lepidoptera (*Sphigidae*) and Diptera (*Muscidae*) also with one family and one species (Table 7). The majority of 89.2 % is represented by the *Coleoptera* species, followed by *Lepidoptera* 2.7%, *Hemiptera* 2.7%, *Orthoptera* 2.7% and *Diptera* 2.7%.



Figure 5. Trap no.1 located in *Capsicum annuum* crop (original photo).

Table 7. Trap 1 – Systematic classification of insect species collected from *Capsicum annuum* crop.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	8.05.2022 14.08.2022	4
2	Diptera	Muscidae	<i>Musca domestica</i> Linnaeus, 1758	8.05.2022, 22.05.2022, 5.06,12.06, 7.08.2022	5
3	Orthoptera	Gryllotalpidae	<i>Gryllotalpa</i> <i>108gryllotalpa</i> Latreille, 1802	15.05.2022, 5.06.,10.07, 24.07.2022, 11.09.2022	5
4	Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus., 1758	15.05.2022, 17.07,14.08, 25.09	5
5		Chrysomelidae	<i>Leptinotarsa decemlineata</i> Say, 1824	12.06.2022, 26.06 (2ex.), 24.07, 31.07, 28.08. 2022	9
6		Cleridae	<i>Necrobia violacea</i> Linnaeus, 1758	15.05.2022	1
7		Staphylinidae	<i>Staphylinus caesareus</i> Cederhjelms, 1798	18.05.2022	2
8		Carabidae	<i>Harpalus latus</i> Linnaeus, 1758	22.05.2022, 4.09.2022	2
9		Elateridae	<i>Cardiophorus vestigialis</i> Erichson, 1840	29.05.2022, 7.08.2022	2
10	Lepidoptera	Sphigidae	<i>Acherontia artopos</i> Linnaeus., 1758	21.08.2022	2
Total					37

Trap 2 was installed in the cabbage crop in early May 2022 (Fig. 6). In this trap, 30 specimens of 10 insect species were caught and 4 orders were identified: *Diptera*, *Orthoptera*, *Coleoptera* and *Hymenoptera*. The best represented was the *Coleoptera* Order with 5 families and 6 species (Table 8), followed by the *Orthoptera* Order with two families (*Gryllotalpidae*, *Gryllidae*), the *Diptera* and *Hymenoptera* orders with one family and one species each (Table 8). The majority of 87.5% is represented by the *Coleoptera* species, followed by *Orthoptera* 6.3% and *Diptera* and *Hymenoptera* 3.1%.



Figure 6. Trap no.2 located in *Brassica oleracea* crop (original photo).

Table 8. Trap 2 - Systematic trapping of collected insect species from *Brassica oleracea* crop.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Diptera	Muscidae	<i>Musca domestica</i> Linnaeus, 1758	15.05.2022, 5.06, 24.07, 7.08.2022	6
2	Orthoptera	Gryllotalpidae	<i>Gryllotalpa gryllotalpa</i> Latreille, 1802	22.05.2022 19.06., 21.08, 2022	5
3		Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	8.05.2022	2
4	Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus., 1758	8.05, 29.05. 2022	3
5		Carabidae	<i>Agonum muelleri</i> Herbst, 1784	12.06.2022	2
6		Cleridae	<i>Necrobia violacea</i> Linnaeus, 1758	31.07.2022	3
7		Silphidae	<i>Silpha obscura</i> Linnaeus, 1758	7.08.2022	2
8		Cerambycidae	<i>Rhamnusium bicolor</i> Latreille, 1829	17.07.2022	1
10		Carabidae	<i>Harpalus latus</i> Linnaeus, 1758	26.06.2022, 4.09.2022	4
11	Hymenoptera	Apidae	<i>Apis mellifera</i> Linnaeus, 1758	12.06.2022	2
Total					30

Trap 3 was installed in the plum orchard in early May 2022 (Fig. 7). Forty-eight specimens of 14 insect species were caught in this trap and 4 orders were subsequently identified: Coleoptera, Hymenoptera, Hemiptera and Orthoptera. The Coleoptera order was best represented with 7 families and 10 species (Table 9), followed by the Hymenoptera order with two families and one species. The Orthoptera and Hemiptera orders were each represented by one family and one species (Table 9). The majority of 91.6% is held by the Coleoptera species, followed by Hymenoptera 4.2%, Orthoptera and Hemiptera with 2.1% each.



Figure 7. Trap no.3 located in *Prunus domestica* (original photo).

Table 9. Trap 3 - Systematic trapping of collected insect species from *Prunus domestica*.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	15.05.2022	4
2	Orthoptera	Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	22.05.2022 19.05.2022 4.08.2022	5
3	Hymenoptera	Vespidae	<i>Vespa crabro</i> Linnaeus, 1758	17.07, 28.09. 2022	2
4		Apidae	<i>Diadasia rinconis</i> Cockerell, 1897	15.05.2022	2
5	Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus, 1758	15.05.2022	5
6		Lucanidae	<i>Lucanus cervus</i> Linnaeus, 1758	5.06.2022 (2 ex.)	1
7		Tenebrionoidea	<i>Blaps mortisaga</i> Linnaeus, 1758	8.05, 14.08, 18.09, 2022	3
8		Silphidae	<i>Silpha obscura</i> Linnaeus, 1758	29.05, 26.06, 2022	5
9		Carabidae	<i>Carabus monilis</i> Fabricius, 1792	31.07.2022	5
10		Carabidae	<i>Carabus granulatus</i> Linnaeus, 1758	31.06.2023	3
11		Carabidae	<i>Pterostichus melanarius</i> Illiger, 1798	29.05, 10.07, 24.07, 18.09.2022	7
12		Cerambycidae	<i>Rhamnusium bicolor</i> Latreille, 1829	12.06.2022	1
13		Cerambycidae	<i>Moneilema gigas</i> LeConte, 1873	7.08, 11.09.2022	1
14		Elateridae	<i>Cardiophorus vestigialis</i> Erichson, 1840	10.07.2022	4
Total					48

Trap 4 was installed in the maize crop in early May 2022 (Fig. 8). Thirty-nine individuals of 8 insect species were caught in this trap and 4 orders were identified: *Coleoptera*, *Diptera*, *Hemiptera* and *Orthoptera*. The *Coleoptera* order was best represented with 3 families and 3 species, followed by the *Orthoptera* and *Hemiptera* orders with two families with two species, and the *Diptera* order being represented by one family and one species (Table 10). The majority of 87.14% is represented by *Coleoptera* species, followed by the *Orthoptera* and *Hemiptera* orders with 5.13% and the *Diptera* order with 2.6%.



Figure 8. Trap no.4 located in *Zea mays* (original photo).

Table 10. Trap 4 - Systematic trapping of collected insect species from *Zea mays*.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	8.05, 15.05, 22.05, 12.06, 19.05, 10.07, 24.07, 7.08, 28.08, 11.09, 25.09.2022	13
2		Cercopidae	<i>Cercopis vulnerata</i> Rossi, 1807	19.05.2022 17.07.2022	2
3	Orthoptera	Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	8.05.2022 21.08.2022 25.09.2022	4
4		Acrididae	<i>Locusta migratoria</i> Linnaeus, 1758	4.09, 11.09.2022	3
5	Diptera	Tabanidae	<i>Tabanus atratus</i> Fabricius, 1775	18.09.2022	4
6	Coleoptera	Tenebrionoidea	<i>Blaps mortisaga</i> Linnaeus, 1758	24.07, 4.09.2022	5
7		Geotrupidae	<i>Geotrupes stercorarius</i> Linnaeus, 1758	5.06, 14.08, 25.09.2022	3
8	Coleoptera	Coccinellidae	<i>Harmonia axyridis</i> Pallas, 1773	28.08.2022	5
Total					39

Trap 5 was installed in the strawberry crop in early May 2022 (Fig. 9). 35 specimens of 12 insect species were caught in this trap and 6 orders were identified: *Coleoptera*, *Diptera*, *Hemiptera*, *Hymenoptera*, *Lepidoptera* and *Orthoptera*. The *Lepidoptera*, *Coleoptera* and *Hymenoptera* orders were the best represented, each with 3 families and 3 species (Table 11), followed by the *Orthoptera*, *Diptera* and *Hemiptera* orders with 1 family and 1 species each (Table 11). The *Lepidoptera*, *Coleoptera* and *Hymenoptera* orders dominate with 30.4%, followed by the *Hemiptera*, *Orthoptera* and *Diptera* orders with 2.9%.



Figure 9. Trap no. 5 located in *Fragaria sp.* (original photo).

Table 11. Trap 5 - Systematic trapping of collected insect species from *Fragaria sp.*

No. Crt	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	25.09.2022	5
2	Diptera	Syrphidae	<i>Eristalis tenax</i> Linnaeus, 1758	8.05, 22.05.2022	3
3	Lepidoptera	Sphingidae	<i>Deilephila elpenor</i> Linnaeus, 1758	4.09.2022	2
4		Sphingidae	<i>Macroglossum stellatarum</i> Linnaeus, 1758	31.07.2022	1
5		Nymphalidae	<i>Boloria selene</i> Denis & Schiffermüller, 1775	12.06.2022	1
6	Orthoptera	Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	7.08.2022	3
7	Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus, 1758	15.05, 29.05, 12.06 (2ex.), 18.09.2022	5
8		Cerambycidae	<i>Rhamnusium bicolor</i> Latreille, 1829	24.07, 28.08.2022	2
9		Carabidae	<i>Pterostichus melanarius</i> Illiger, 1798	28.08.2022	6
10	Hymenoptera	Apidae	<i>Apis mellifera</i> Linnaeus, 1758	15.05, 22.05, 21.08, 11.09.2022	2
11		Apidae	<i>Bombus pratorum</i> Linnaeus, 1761	29.05.2022	3
12		Vespidae	<i>Vespa crabro</i> Linnaeus, 1758	19.05.2022	2
Total					35

Trap 6 was installed in the lucerne crop in early May 2022 (Fig. 10). In this trap, 59 specimens of 10 insect species were caught and 3 orders were identified: *Coleoptera*, *Hemiptera* and *Orthoptera*. The best represented was the *Coleoptera* order with 6 families (*Tenebrionoidea*, *Carabidae*, *Coccinellidae*, *Cerambycidae*, *Buprestidae*, *Silphidae*) and 8 species (Table 12), followed by the *Orthoptera* order with two families (*Gryllidae*, *Tettigonioidae*) and 3 species, the *Hemiptera* order with two families (*Pyrrhocoridae*, *Cercopidae*) and two species and the *Lepidoptera* order with one family and one species (Table 12). The *Coleoptera* order dominates with 60 %, followed by the *Orthoptera* order with 20 %, the *Hemiptera* order with 20 %.



Figure 10. Trap no. 6 located in *Medicago sativa* (original photo).

Table 12. Trap 6 - Systematic trapping of collected insect species from *Medicago sativa*.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	8.05. 2022	2
2		Cercopidae	<i>Cercopis vulnerata</i> Rossi, 1807	29.06, 19.06, 10.07, 7.08, 21.08.2022	5
3	Orthoptera	Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	8.05, 12.06, 17.07, 7.08, 28.08, 18.09.2022	6
4		Tettigonioidae	<i>Gampsocleis buergeri</i> Haan, 1843	11.09.2022	2
5		Tettigonioidae	Pholidoptera <i>griseoptera</i> De Greer, 1773	4.09, 25.09.2022	3
6	Coleoptera	Tenebrionoidea	<i>Blaps mortisaga</i> Linnaeus, 1758	22.05, 17.07, 21.08, 25.09. 2022	4
7		Carabidae	<i>Carabus granulatus</i> Linnaeus, 1758	29.05, 19.06.2022	2
8		Carabidae	<i>Carabus coriaceus</i> Linnaeus, 1758	18.09.2022	3

9		Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus, 1758	15.05, 22.05, 29.05, 5.06, 12.06, 24.07, 31.07, 7.08, 21.08, 11.09, 25.09.2022	17
11		Cerambycidae	<i>Rhamnusium bicolor</i> Latreille, 1829	8.05, 15.05, 26.06, 28.08.2022	6
12		Buprestidae	<i>Temognatha heros</i> Géhin, 185	26.06.2022	2
14		Carabidae	<i>Pterostichus melanarius</i> Illiger, 1798	15.05, 10.07, 14.08. 2022	4
15		Silphidae	<i>Silpha obscura</i> Linnaeus., 1758	5.06, 4.09.2022	3
Total					59

Trap 7 was installed in the vineyard in early May 2022 (Fig. 11). 30 specimens of 11 insect species were caught in this trap and 4 orders were identified: *Coleoptera*, *Hemiptera*, *Hymenoptera* and *Diptera*. The *Coleoptera* order was best represented with 6 families (*Scarabeidae*, *Carabidae*, *Coccinellidae*, *Cerambycidae*, *Silphidae*) and 6 species (Table 13), followed by the *Hemiptera* order with 3 families (*Pyrrhocoridae*, *Cercopidae*, *Pentatomidae*) and 3 species and the *Hymenoptera*, *Diptera* and *Lepidoptera* orders with 1 family and 1 species (Table 13). The majority of 84.3% is represented by the *Coleoptera* order, followed by the *Hemiptera* order with 7.9% and the *Diptera*, *Lepidoptera* and *Hymenoptera* orders with 2.6%.



Figure 11. Trap no. 7 located in *Vitis vinifera* (original photo).

Table 13. Trap 7 - Systematic classification of the insect species collected from *Vitis vinifera*.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	8.05.2022	3
2		Cercopidae	<i>Cercopis vulnerata</i> Rossi, 1807	5.06, 7.08.2022	2
3		Pentatomidae	<i>Eurydema oleracea</i> Linnaeus, 1758	22.05.2022	2
4	Hymenoptera	Vespidae	<i>Vespa crabro</i> Linnaeus, 1758	12.06, 28.08.2022	3
5	Diptera	Syrphidae	<i>Eristalis tenax</i> Linnaeus, 1758	8.05, 29.05, 19.06, 14.08.2022	4
6	Coleoptera	Scarabaeidae	<i>Melolontha melolontha</i> Linnaeus, 1758	15.05.2022	2
7		Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus., 1758	8.05, 15.05, 12.6, 24.07,	5
8		Cerambycidae	<i>Rhamnusium bicolor</i> Latreille, 1829	10.07.2022	2
10		Carabidae	<i>Pterostichus melanarius</i> Illiger, 1798	22.05, 28.08.2022	3
11		Silphidae	<i>Silpha obscura</i> Linnaeus., 1758	26.06.2022	2
12		Scarabeidae	<i>Cetonia aurata</i> Linnaeus, 1758	15.05.2022	2
Total					30

Trap 8 was installed in the cherry and sour cherry orchard in early May 2022 (Fig. 12). In this trap, 38 specimens of 10 insect species were caught and 5 orders were identified: *Coleoptera*, *Hemiptera*, *Hymenoptera*, *Diptera* and *Orthoptera*. The *Coleoptera* and *Hymenoptera* orders were best represented with 3 and 2 families and 3 species (Table 14), followed by the *Diptera* order with two families and two species. The *Hemiptera* and *Orthoptera* orders were each represented by one family and one species (Table 14).

Species of the *Coleoptera* and *Hymenoptera* orders dominated with 44.8%, followed by the *Diptera* order with 5.3% and the *Hemiptera* and *Orthoptera* orders with 2.6%.

Figure 12. Trap no. 8 located in *Prunus avium* (original photo).

Table 14. Trap 8 - Systematic trapping of collected insect species.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	12.06. (2ex.), 24.07, 14.08 (2 ex)	4
2	Hymenoptera	Vespidae	<i>Vespa crabro</i> Linnaeus, 1758	5.06, 19.06, 31.07.2022	3
3		Apidae	<i>Bombus pratorum</i> Linnaeus, 1761	15.05.2022	2
4		Muscidae	<i>Musca domestica</i> Linnaeus, 1758	8.05.2022	2
5	Diptera	<u>Syrphidae</u>	<i>Eristalis tenax</i> Linnaeus, 1758	5.06.2022	3
6	Hymenoptera	Apidae	<i>Apis mellifera</i> Linnaeus, 1758	8.05, 29.05, 10.07.2022	3
6	Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus, 1758	15.05, 22.05, 17.07, 24.07, 11.09.2022	9
7		Tenebrionoidea	<i>Blaps mortisaga</i> Linnaeus, 1758	15.05.2022	3
8		Carabidae	<i>Pterostichus melanarius</i> Illiger, 1798	29.05, 28.08, 18.09, 26.09.2022	7
9	Orthoptera	Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	19.06, 7.08.2022	2
Total					38

Trap 9 was placed in the potato crop in early May 2022 (Fig. 13). In this trap 59 specimens of 9 insect species were caught and 4 orders were identified: *Coleoptera*, *Hemiptera*, *Diptera* and *Orthoptera*. The *Coleoptera* and *Hemiptera* orders with 3 families and 3 species were the best represented (Table 15), followed by the *Orthoptera* Order with two families and two species (Table 15) and the *Diptera* Order with one family and one species.

Species of the *Coleoptera* and *Hemiptera* Orders dominated with 47.5%, followed by *Orthoptera* 3.3% and *Diptera* 1.7%.

Figure 13. Trap no. 9 located in *Solanum tuberosum* (original photo).

Table 15. Trap 9 - Systematic trapping of collected insect species from *Solanum tuberosum*.

No. Crt.	Order	Family	Species	Collection date	Number of specimens
1	Hemiptera	Pyrrhocoridae	<i>Pyrrhocoris apterus</i> Linnaeus, 1758	8.05, 5.06.2022	3
2		Coreidae	<i>Coreus marginatus</i> Linnaeus, 1758	29.05, 7.08.2022	3
3		Pentatomidae	<i>Pentatoma rufipens</i> Linnaeus, 1758	31.07.2022	2
4	Diptera	Syrphidae	<i>Eristalis tenax</i> Linnaeus, 1758	22.05, 11.09.2022	2
5	Orthoptera	Gryllotalpidae	<i>Gryllotalpa gryllotalpa</i> Latreille, 1802	15.05, 10.07, 28.08.2022	3
6		Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758	25.09.2022	2
7	Coleoptera	Chrysomelidae	<i>Leptinotarsa decemlineata</i> Say, 1824	8.05, 15.05, 22.05, 29.05, 5.06, 12.06, 19.06, 26.06, 10.07, 17.07, 24.07, 31.07, 7.08, 14.08, 4.09, 18.09, 25.09. 2022	37
8		Carabidae	<i>Pterostichus melanarius</i> Illiger, 1798	8.05.2022	3
9		Tenebrionoidea	<i>Blaps mortisaga</i> Linnaeus, 1758	7.08.2022	4
Total					59

The systematic classification of the species caught is shown below:

COLEOPTERA ORDER

Family	Species
Coccinellidae	<i>Coccinella septempunctata</i> Linnaeus, 1758
	<i>Harmonia axyridis</i> Pallas, 1773
Chrysomelidae	<i>Leptinotarsa decemlineata</i> Say, 1824
Cleridae	<i>Necrobia violacea</i> Linnaeus, 1758
Staphylinidae	<i>Staphylinus caesareus</i> Cederhjelms, 1798
Carabidae	<i>Harpalus latus</i> (Linnaeus, 1758)
	<i>Agonum muelleri</i> (Herbst, 1784)
	<i>Carabus monilis</i> Fabricius, 1792
	<i>Carabus granulatus</i> Linnaeus, 1758
	<i>Pterostichus melanarius</i> Illiger, 1798
	<i>Carabus coriaceus</i> Linnaeus, 1758
Elateridae	<i>Cardiophorus vestigialis</i> Erichson, 1840
Silphidae	<i>Silpha obscura</i> Linnaeus, 1758
Cerambycidae	<i>Rhammusium bicolor</i> Latreille, 1829
	<i>Moneilema gigas</i> LeConte, 1873
Lucanidae	<i>Lucanus cervus</i> Linnaeus, 1758
Tenebrionoidea	<i>Blaps mortisaga</i> Linnaeus, 1758
Geotrupidae	<i>Geotrupes stercorarius</i> (Linnaeus, 1758)
Buprestidae	<i>Temognatha heros</i> Géhin, 185
Scarabaeidae	<i>Melolontha melolontha</i> Linnaeus, 1758
	<i>Cetonia aurata</i> (Linnaeus, 1758)

HEMIPTERA ORDER

Family	Species
Pyrrhocoridae	<i>Pyrrhocoris apterus</i> (Linnaeus, 1758)
Cercopidae	<i>Cercopis vulnerate</i> Rossi, 1807
Pentatomidae	<i>Eurydema oleracea</i> (Linnaeus, 1758)
Pentatomidae	<i>Pentatoma rufipens</i> (Linnaeus, 1758)
Coreidae	<i>Coreus marginatus</i> (Linnaeus, 1758)

DIPTERA ORDER

Family	Species
Muscidae	<i>Musca domestica</i> Linnaeus, 1758
Tabanidae	<i>Tabanus atratus</i> Fabricius, 1775
Syrphidae	<i>Eristalis tenax</i> Linnaeus, 1758

ORTHOPTERA ORDER

Family	Species
Gryllotalpidae	<i>Gryllotalpa gryllotalpa</i> Latreille, 1802
Gryllidae	<i>Gryllus campestris</i> Linnaeus, 1758
Acrididae	<i>Locusta migratoria</i> (Linnaeus, 1758)
Tettigonioidea	<i>Gampsocleis buergeri</i> (Haan, 1843)
Tettigonioidea	<i>Pholidoptera griseoptera</i> (De Greer, 1773)

HYMENOPTERA ORDER

Family	Species
Apidae	<i>Apis mellifera</i> Linnaeus, 1758
Apidae	<i>Diadasia rinconis</i> Cockerell, 1897
Apidae	<i>Bombus pratorum</i> Linnaeus, 1761
Vespidae	<i>Vespa crabro</i> Linnaeus, 1758

LEPIDOPTERA ORDER

Family	Species
Sphingidae	<i>Deilephila elpenor</i> (Linnaeus, 1758)
Sphingidae	<i>Macroglossum stellatarum</i> (Linnaeus, 1758)
Nymphalidae	<i>Boloria selene</i> (Denis & Schiffermüller, 1775)

CONCLUSIONS

Following the centralization of the 375 collected insects, we can conclude that they fall into 6 orders, being divided into 28 families, respectively 41 species. The best represented order is that of coleoptera with 219 specimens belonging to 21 species. The most insects were captured in the alfalfa crop and potato totaling 59 specimens from 13 species.

The Coleoptera order is represented by 13 families: *Coccinellidae*, *Chrysomelidae*, *Cleridae*, *Staphylinidae*, *Carabidae*, *Elateridae*, *Silphidae*, *Cerambycidae*, *Lucanidae*, *Tenebrionoidea*, *Geotrupidae*, *Buprestidae*, *Scarabaeidae* and 24 species. The best represented species are those belonging to the family *Carabidae* which represent 25% of the total coleopteran species caught. These insect species are entomophagous and feed on small insects, larvae and eggs of other insects or are mixophagous, scavenging and saprophagous species with an essential role in the studied ecosystem, being considered important ecological indicators.

The Hemiptera order is represented by 4 families: *Pyrrhocoridae*, *Cercopidae*, *Pentatomidae*, *Coreidae* and 5 species. The best represented species are those belonging to the family Pentatomidae which represent 40% of the total hemiptera species caught. The captured insects of this order are mostly phytophagous and are harmful to agricultural crops in the studied ecosystem.

The Diptera order is represented by 3 families: *Muscidae*, *Tabanidae* and *Syrphidae* and as many species, insects of this order in the adult stage are important pollinators together with bees in the studied crops.

The Orthoptera order is represented by 4 families: *Gryllotalpidae*, *Gryllidae*, *Acrididae* and *Tettigonioidea* and 5 species, the species are phytophagous insects (crickets), with a useful role in the ecosystem, but they are also harmful species (locusts) and some of them are predatory species.

From the Hymenoptera Order, four species belonging to two families have been identified, most species are phytophagous, species of the Family *Apidae* feed on nectar, pollen, leaves and sweet juices, while species of the Family *Viespidae* are predatory and feed on larvae or are egg parasites. Adult *Vespa crabro* are nectarivores, but also predators, feeding on larvae. These species can also damage ripe fruit and gnaw the bark to build their nests, becoming pests in these cases.

The Hymenoptera order includes omnivorous species with a wide range of food but mainly pollinating and nectariferous insects.

From the Lepidoptera Order, three families and three species have been identified, omnivorous with a wide food spectrum but mainly pollinating and nectariferous insects.

Following the systematic classification, we can conclude that 71.4% of the collected insects belong to the useful entomofauna, 28.6% being species that cause damage to the studied crops. In these cultures, the predominant species of useful entomofauna is *Coccinella septempunctata* (Linnaeus, 1758) with 49 specimens, and the most widespread harmful species is *Leptinotarsa decemlineata* (Say, 1824) with 48 specimens.

REFERENCES

- BAICU T. & SĂVESCU A. 1986. *Sisteme de combatere integrată a bolilor și dăunătorilor pe culturi*. Edit. Ceres. București. 220 pp.
- BOGULEANU G. 1994. *Fauna dăunătoare culturilor agricole și forestiere din România II*. Edit. Tehnică Agricolă. București. 576 pp.
- BUCUR A. & ROȘCA I. 2011. Research regarding biology of rape pests. *Scientific Papers. UASVM Bucharest. Series A*. **54**: 356-359.
- CIOCHIA V. & MOISE CRISTINA. 2005. *Protecția ecologică a plantelor de cultură și mediul înconjurător*. Edit. Pelecanus. Brașov. 181 pp.
- FLORESCU I., TEODORU A., GEICU A. G., CHIRILOAIE-PALADE A., FĂTU V., MANOLE T., MITEL T., MIREA E., MANEA V., TOADER A., STAIKU B., BURNICHI F., CHIRECEANU C. 2021. Preliminary study on epigeal invertebrates fauna in experimental pepper crops at SCDL Buzău. *Romanian Journal for Plant Protection*. Roumanian Academy Press. Bucharest. **14**: 53-69.
- GHIZDAVU I., PAȘOL P., PĂLĂGESIU I., BOBÎRNAC B., FILIPESCU C., MATEI I., GEORGESCU T., BAICU T., BĂRBULESCU A. 1997. *Entomologie agricolă*. Edit. Didactică și Pedagogică. București. 432 pp.
- MANOLE L., TĂLMACIU M., TĂLMACIU N. 2009. Some aspects on the structure and abundance of species coleoptere for rapeseed crop-autumn. *Analele Universității din Craiova, Seria Agricultură-Montanologie-Cadastru*. Edit. Universitaria. Craiova. **39**: 216-222.
- MOISE G. 2014. Promotion of ecologic product certification as instrument to speed up the ecologic agriculture. *Scientific Papers Series-Management. Economic Engineering in Agriculture and Rural Development*. Bucharest. **14**(1): 241-244.
- STANCĂ-MOISE CRISTINA. 2014. Controlul populațiilor de dăunători. Edit. Universității Lucian Blaga. Sibiu. 224 pp.
- STANCĂ-MOISE CRISTINA. 2019. The insects abundance monitoring in a meadow from Marita village (Vâlcea County, Romania). *Studia Universitatis "Vasile Goldiș"*. University Press. Arad. **29**(3): 106-113.
- STANCĂ-MOISE CRISTINA. 2020. Forests and agricultural ecosystems pests (Lepidoptera), preserved in the Entomological Collections of the Natural History Museum in Sibiu (Romania). *Analele Universității din Oradea, Fascicula Biologie*. Edit. Universitaria. Oradea. **27**(2): 224-232.
- STANCĂ-MOISE CRISTINA & DIACONEASA I. G. 2022. A study of the diversity of useful and harmful epigeal insects in an household from Bogatu-Român village, Sibiu county (Romania), in 2021. *Analele Universității din Oradea, Fascicula Biologie*. . Edit. Universitaria. Oradea. **29**(9): 192-204.
- STUGREN B. 1982. *Bazele ecologiei generale*. Edit. Științifică și Enciclopedică. București. 178 pp.
- VARVARA M. & GĂLUȘCĂ S. 2007. Diversity and ecological aspects of the species of Carabidae (Coleoptera, Carabidae) in the sugar beet crop ecosystem from the locality of Trușești (Botoșani County). *Oltenia. Studii și Comunicări. Stiințele Naturii*. Muzeul Olteniei Craiova. **23**: 125-133.

Stancă-Moise Cristina

“Lucian Blaga” University of Sibiu, Faculty of Agricultural Sciences,
Food Industry and Environmental Protection, Sibiu, Romania.
E-mail: cristinamoise1@yahoo.com

Received: April 15, 2023
Accepted: August 20, 2023