

## Research on existing carabids species in orchards of apple, important ecological indicators in agrobiocenosis

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**Abstract** In this study, the research material is represented by carabid species of fruit growing in a plantation of apple with 8 ha, and the research method to be able to collect carabid species, was the method soil traps Barber. From the research carried out in the years 2017-2018 it was found that the majority of the species of logs are registered with abundance values between (1 and 123 specimens), the constant presents values from 2.38 to 95.24%, the dominant one presents values from 0.20 to 35.79%. Following the determination and centralization of the carabid species, the species with the largest number of individuals were *Harpalus calceatus*, *Anysodactilus binotatus*, *Harpalus pubescens*, *Harpalus tenebrosus* and *Harpalus distinguendus*.

### Key words

Carabids, variants, abundance, constancy, dominance

The existing data in the literature show that the species of insects belonging to the Carabidae family are extremely numerous and are included among the specimens of insects belonging to the useful fauna of these agrobiocenoses [1].

In the current strategies of integrated pest management, especially in orchards, an alternative economy and ecology represent and the methods of biological control, where predatory insect species have a particularly important role. Carabid are an incredibly diverse group of insects with over 40,000 species worldwide, of which 2,000 live in North America [4].

Carabids live in almost all available habitats, although some species are associated with certain ecosystems, such as grassland, forested land or cultivated land. Due to the specificity of habitats of certain species, these carabids can be used as biological indicators for assessing changes within different ecosystems [3].

### Material and Method

In the studied biotope were placed 10 traps, on two rows, installed from the edge to the inside, at a distance of 10 m between rows and at 6 m between traps per row.

Gathering the samples were collected in each of the 2 years of research (2017 and 2018) between April and September, at intervals of about 7-10 days. The establishment of the experimental lot was implemented in one of the SCDP Fălticeni plots. Thus, the identified plot is located in the pre-town area called Țarna Mare, with an area of 8 ha cultivated with apple in a superintensive system, with a density of 3,300 trees / ha.

In 2017, the experimental group with the following working variants was placed in the stationary Țarna Mare:

- V1 - existing plant carpet (control);
- V2 - vegetable carpet overgrown with pebbles (*Lotus corniculatus*);
- V3 - vegetal carpet covered with white clover (*Trifolium repens*);

The collection of the entomological material from the soil traps Barber-type was performed on the following data: Harvest I. 23.05., Harvest II. 08.06., Harvest III. 21.06., Harvest IV. 03.07., Harvest V. 17.07., Harvest VI. 29.07., Harvest VII. 11.08., Harvest VIII. 25.08., Harvest IX. 05.09. si Harvest X. 17.09.

The material thus collected was determined by variants, samples and harvests (Figure 1).



Fig. 1. Location of Barber soil traps at the beginning of the vegetation period (original)

In the laboratory the material was cleaned of vegetable debris and then washed under the water jet. The

material was selected by order or species, and the insects were determined with the help of determinants.



Fig. 2. The determination of the collected material (original)

## Results and Discussions

In 2017, the experimental group with the following working variants was placed in the research stationary:

- V1 - existing plant carpet (control);
- V2 - vegetable carpet overgrown with pebbles (*Lotus corniculatus*);
- V3 - vegetal carpet covered with white clover (*Trifolium repens*);

The collection of the entomological material from the Barber-type soil traps was done between May and September, at intervals of about 7-10 days, at the following dates: Harvest I. 23.05., Harvest II. 08.06., Harvest III. 21.06., Harvest IV. 03.07., Harvest V.

17.07., Harvest VI. 29.07., Harvest VII. 11.08., Harvest VII. 25.08., Harvest IX. 05.09. si Harvest X. 17.09.

By variants and harvests, in 2017, the situation is presented as follows:

**In variant 1, existing vegetal carpet (control), in 2017**, regarding the species and the number of carabids collected, the situation is presented as follows:

- A number of 9 species of carabids were collected, totaling 320 copies (Table 1).

- Carabids species with the largest number of specimens collected were *Harpalus calceatus* 121 copies, 48 copies *Anysodactylus binotatus*, *Harpalus tenebrosus* 41 copies, 40 copies *Harpalus pubescens*.

Tabel 1

The structure of the carabid species at variant 1 in 2017

No.	Species	Harvest										Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	<i>Anysodactylus binotatus</i>	7	21		4	15					1	48
2.	<i>Harpalus aeneus</i>							1				1
3.	<i>Harpalus calceatus</i>	10	54		5	13	9	21	4		5	121
4.	<i>Harpalus distinguendus</i>	9		4	5	10			2		4	34
5.	<i>Harpalus griseus</i>	2	21	1				2			3	29
6.	<i>Harpalus pubescens</i>	9		1	2	1	24	3				40
7.	<i>Harpalus tardus</i>		1	1							2	4
8.	<i>Harpalus tenebrosus</i>			3		20		18				41
9.	<i>Metabletus truncatulus</i>				1			1				2
<b>TOTAL 9 specimens</b>		<b>37</b>	<b>97</b>	<b>10</b>	<b>17</b>	<b>59</b>	<b>33</b>	<b>46</b>	<b>6</b>	<b>0</b>	<b>15</b>	<b>320</b>

### Ecological index values

For a deeper analysis of the results as were calculated a range of greater ecological indices such as the abundance of (A), the constancy (C), dominance (D), ecological significance index (W).

The values of this ecological index in 2017 at variant1 were:

- abundance (A) had values between 1 and 121 copies;
- the constancy (C) had values between 2.38 and 80.95%;
- dominance (D) had values between 0.29 and 35.79%;
- the ecological significance index had values between 0.007 and 26.972%.

Tabel 2

**The values of the ecological indices of the species collected in 2017 at variant 1**

No.	Species	ECOLOGICAL INDEX							
		A		C		D		W	
		%	%	Cl.	%	Cl.	%	Cl.	
1.	<i>Harpalus calceatus</i>	121	80,95	C2	35,79	D5	28,9720	W4	
2.	<i>Anysodactilus binotatus</i>	48	52,38	C1	14,20	D5	7,4380	W3	
3.	<i>Harpalus tenebrosus</i>	41	71,42	C1	12,13	D5	8,6632	W3	
4.	<i>Harpalus pubescens</i>	40	50,00	C1	11,83	D5	5,9150	W3	
5.	<i>Harpalus distinguendus</i>	34	45,24	C1	10,05	D5	4,5466	W3	
6.	<i>Harpalus griseus</i>	29	35,71	C1	8,57	D4	3,0603	W2	
7.	<i>Harpalus tardus</i>	4	2,38	C1	1,18	D2	0,0281	W1	
8.	<i>Metabletus truncatulus</i>	2	4,76	C1	0,59	D1	0,0281	W1	
9.	<i>Harpalus aeneus</i>	1	2,38	C1	0,29	D1	0,0070	W1	
<b>TOTAL 9 specimens</b>		<b>320 gathering specimens</b>							

In variant 2, a carpet of vegetation overgrown with pebbles (*Lotus corniculatus*), in 2017, as regards the species and the number of collected carabids, the situation is presented as follows:

- It has collected a total of 10 species of carabids which totaled 277 copies (Table. 3).

- Carabids species collected in this experimental variant are: *Amara aenea*, *Anysodactilus binotatus*, *Harpalus azureus*, *Harpalus calceatus*, *Harpalus distinguendus*, *Harpalus griseus*, *Harpalus pubescens*, *Harpalus tardus*, *Harpalus tenebrosus*, *Metabletus truncatulus*.

Tabel 3

**The structure of the carabid species at variant 2 in 2017**

No.	Species	Harvest										Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	<i>Amara aenea</i>								2			2
2.	<i>Anysodactilus binotatus</i>	11	12		11	11		2		1		48
3.	<i>Harpalus azureus</i>	2	3									5
4.	<i>Harpalus calceatus</i>	2	12	4	13	17	9	18				75
5.	<i>Harpalus distinguendus</i>	7	4	5	1	5		3		2	2	29
6.	<i>Harpalus griseus</i>	4	4	4	6			1				19
7.	<i>Harpalus pubescens</i>	4	18	1	15		3		6	2		49
8.	<i>Harpalus tardus</i>		2	2								4
9.	<i>Harpalus tenebrosus</i>			7		7	5	9	12	3		43
10.	<i>Metabletus truncatulus</i>							3				3
<b>TOTAL 10 specimens</b>		<b>30</b>	<b>55</b>	<b>23</b>	<b>46</b>	<b>40</b>	<b>17</b>	<b>36</b>	<b>20</b>	<b>8</b>	<b>2</b>	<b>277</b>

**Ecological index values**

For a deeper analysis of the results as were calculated a range of greater ecological indices such as the abundance of (A), the constancy (C), dominance (D), ecological significance index (W).

The values of this ecological index in 2017 at variant 2 were:

- abundance (A) had values between 2 and 75 copies;  
 - the constancy (C) had values between 2.38 and 85.71%;  
 - dominance (D) had values between 0.63 and 23.51%;  
 - the ecological significance index had values between 0.0150 and 20.1504%.

Tabel 4.

**The values of the ecological indices of the species collected in 2017 at variant 2**

No.	Species	ECOLOGICAL INDEX							
		A		C		D		W	
		%	%	Cl.	%	Cl.	%	Cl.	
1.	<i>Harpalus calceatus</i>	75	85,71	C4	23,51	D5	20,1504	W5	
2.	<i>Harpalus pubescens</i>	49	69,05	C3	15,36	D5	10,6061	W5	
3.	<i>Anysodactilus binotatus</i>	48	64,28	C3	15,04	D5	9,6677	W4	
4.	<i>Harpalus tenebrosus</i>	43	71,43	C3	13,47	D5	9,6216	W4	
5.	<i>Harpalus distinguendus</i>	29	47,62	C2	9,09	D4	4,3287	W3	
6.	<i>Harpalus griseus</i>	19	23,81	C1	5,95	D4	1,4167	W3	
7.	<i>Harpalus azureus</i>	5	4,76	C1	1,56	D2	0,0743	W1	
8.	<i>Harpalus tardus</i>	4	7,14	C1	1,25	D2	0,0893	W1	
9.	<i>Metabletus truncatulus</i>	3	7,14	C1	0,94	D1	0,0671	W1	
10.	<i>Amara aenea</i>	2	2,38	C1	0,63	D1	0,0150	W1	
<b>TOTAL 10 specimens</b>		<b>277 gathering specimens</b>							

In variant 3, vegetal carpet overlaid with white clover, in 2017, as regards the species and the number of collected carabids, the situation is presented as follows:

- In experimental version 3, a number of 10 species of carabids were collected, totaling 248 copies (Table 5).

- Carabids species collected in this experimental variant are: *Amara aenea*, *Anysodactylus binotatus*, *Harpalus azureus*, *Harpalus calceatus*, *Harpalus distinguendus*, *Harpalus griseus*, *Harpalus pubescens*, *Harpalus tardus*, *Harpalus tenebrosus*, *Metabletus truncatulus*.

Tabel 5

The structure of the carabid species at variant 3 in 2017

No.	Species	Harvest										Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	<i>Amara aenea</i>					2						2
2.	<i>Anysodactylus binotatus</i>	4	28		6	7				4		49
3.	<i>Harpalus azureus</i>	1										1
4.	<i>Harpalus calceatus</i>	9	6	5	18	15	10	15				78
5.	<i>Harpalus distinguendus</i>	1	8			6		5	2			22
6.	<i>Harpalus griseus</i>	6	5		9							20
7.	<i>Harpalus pubescens</i>			8	15	1						24
8.	<i>Harpalus tardus</i>			3						6		9
9.	<i>Harpalus tenebrosus</i>					24		12	3			39
10.	<i>Metabletus truncatulus</i>	3			1							4
<b>TOTAL 10 specimens</b>		<b>24</b>	<b>47</b>	<b>16</b>	<b>49</b>	<b>55</b>	<b>10</b>	<b>32</b>	<b>5</b>	<b>10</b>	<b>0</b>	<b>248</b>

**Ecological index values**

For a deeper analysis of the results as were calculated a range of greater ecological indices such as the abundance of (A), the constancy (C), dominance (D), ecological significance index (W).

The values of this ecological index in 2017 at variant 3 were:

- abundance (A) had values between 1 and 78 copies;
- the constancy (C) had values between 2.38 and 95.24%;
- dominance (D) had values between 0.34 and 26.90%;
- the ecological significance index had values between 0.0081 and 25.6196%.

Tabel 6

The values of the ecological indices of the species collected in 2017 at variant 3

No.	Species	ECOLOGICAL INDEX							
		A	C		D		W		
		%	%	Cl.	%	Cl.	%	Cl.	
1.	<i>Harpalus calceatus</i>	78	95,24	C4	26,90	D5	25,6196	W5	
2.	<i>Anysodactylus binotatus</i>	49	78,57	C4	16,90	D5	13,2783	W5	
3.	<i>Harpalus tenebrosus</i>	39	59,52	C3	13,45	D5	8,0054	W4	
4.	<i>Harpalus pubescens</i>	24	21,43	C1	8,28	D4	1,7744	W3	
5.	<i>Harpalus distinguendus</i>	22	21,43	C1	7,59	D4	1,6265	W3	
6.	<i>Harpalus griseus</i>	20	28,57	C2	6,90	D4	1,9713	W3	
7.	<i>Harpalus tardus</i>	9	7,14	C1	3,10	D3	0,2213	W2	
8.	<i>Metabletus truncatulus</i>	4	14,29	C1	1,38	D2	0,0985	W1	
9.	<i>Amara aenea</i>	2	7,14	C1	0,69	D1	0,0493	W1	
10.	<i>Harpalus azureus</i>	1	2,38	C1	0,34	D1	0,0081	W1	
<b>TOTAL 10 specimens</b>		<b>248 gathering specimens</b>							

In 2017, the most abundance species of carabids were common the three experimental variants are: *Harpalus calceatus*, *Anysodactylus binotatus*, *Harpalus*

*tenebrosus*, *Harpalus pubescens*, *Harpalus distinguendus*, *Harpalus griseus*, *Harpalus tardus*, *Metabletus truncatulus* (Figure 3).

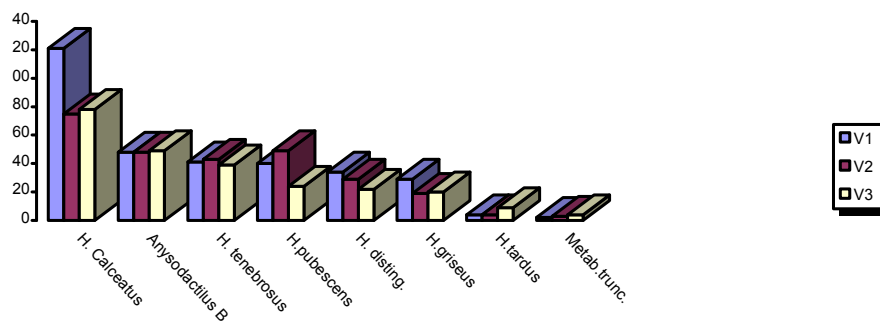


Fig. 3. Abundance of the species of carabids in the three experimental variants in 2017

Regarding the number of carabids collected in 2017, it is observed that variant V 1 (Control variant, existing vegetable carpet) recorded the highest copies (320

copies), and the smallest number of copies collected had the variant V 3 (248 copies) (Figure 4).

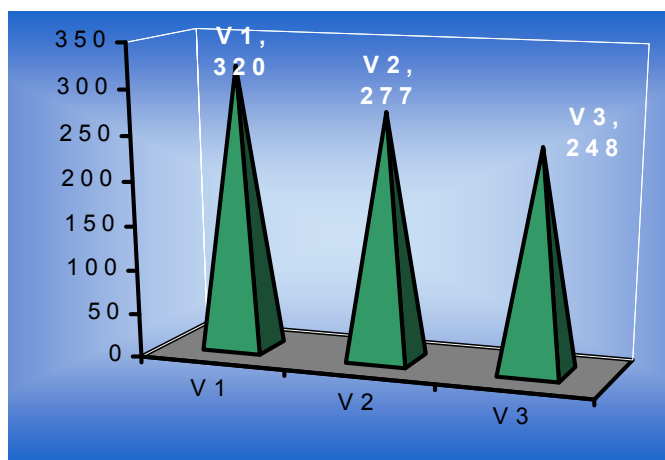


Fig. 4. Graphical representation of carabid species on experimental variants

**By variants and harvests, in 2018, the situation is presented as follows:**

At first variant, in 2018, regarding the number of carabids species collected, the situation is presented as follows:

- In this experimental variant, it has collected a total of 20 species of carabids which totaled 302 copies (Table 7).

- The carabids species collected in this experimental variant are: *Amara crenata*, *Anisodactylus binotatus*, *Harpalus azureus*, *Harpalus calceatus*, *Harpalus distinguendus*.

Tabel 7

**The structure of the carabid species at variant 1 in 2018**

No.	Species	Harvest										Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	<i>Amara aenea</i>					3			1			4
2.	<i>Amara crenata</i>		4		1	1	2					8
3.	<i>Anisodactylus binotatus</i>		24	24	7	2	12	6	10	1	1	87
4.	<i>Brachynus explodens</i>						1					1
5.	<i>Harpalus azureus</i>									3	3	6
6.	<i>Harpalus calceatus</i>		30		3			1	6			40
7.	<i>Harpalus distinguendus</i>		41	15	4	1	5	2	16	1	1	86
8.	<i>Harpalus griseus</i>		2					4	3			9
9.	<i>Harpalus pubescens</i>				2		2					4
10.	<i>Harpalus rufipes</i>		4									4
11.	<i>Harpalus tardus</i>		1			1		3	1			6
12.	<i>Harpalus tenebrosus</i>		16		3	2		3	5			29
13.	<i>Idichroma dorsalis</i>								1			1
14.	<i>Metabletus truncatulus</i>		1	1		3						5
15.	<i>Microlestes maurus</i>								5			5
16.	<i>Ophonus obscurus</i>			1								1
17.	<i>Ophonus sabulicola</i>						2					2
18.	<i>Pseudophonus pubescens</i>				1							1
19.	<i>Pterostichus cupreus</i>						1					1
20.	<i>Pterostichus niger</i>						1			1		2
<b>TOTAL 20 specimens</b>		0	123	41	21	13	26	19	48	6	5	<b>302</b>

**Ecological index values**

For a deeper analysis of the results as were calculated a range of greater ecological indices such as the

abundance of (A), the constancy (C), dominance (D), ecological significance index (W) (Table 8).

The values of this ecological index in 2018 at variant 1 were:

- abundance (A) had values between 1 and 87 copies;  
 - the constancy (C) had values between 2.38 and 85.71%;

- dominance (D) had values between 0.20 and 17.03%;  
 - the ecological significance index had values between 0.0048 and 14.5964%.

Tabel .8

The values of the ecological indices of the species collected in 2018 at variant 1

No.	Species	ECOLOGICAL INDEX						
		A	C		D		W	
		%	%	Cl.	%	Cl.	%	Cl.
1.	<i>Anysodactilus binotatus</i>	87	85,71	C4	17,03	D5	14,5964	W5
2.	<i>Harpalus distinguendus</i>	86	69,05	C3	16,83	D5	11,6211	W5
3.	<i>Harpalus calceatus</i>	40	35,71	C2	7,83	D4	2,7961	W3
4.	<i>Harpalus tenebrosus</i>	29	38,10	C2	5,68	D4	2,1641	W3
5.	<i>Harpalus griseus</i>	9	11,90	C1	1,76	D2	0,2094	W2
6.	<i>Amara crenata</i>	8	7,14	C1	1,57	D2	0,1121	W2
7.	<i>Harpalus azureus</i>	6	9,52	C1	1,17	D2	0,1114	W2
8.	<i>Harpalus tardus</i>	6	7,14	C1	1,17	D2	0,0835	W2
9.	<i>Metabletus truncatulus</i>	5	9,52	C1	0,98	D1	0,0932	W2
10.	<i>Microlestes maurus</i>	5	9,52	C1	0,98	D1	0,0932	W2
11.	<i>Amara aenea</i>	4	4,76	C1	0,78	D1	0,0371	W1
12.	<i>Harpalus pubescens</i>	4	7,14	C1	0,78	D1	0,0557	W1
13.	<i>Harpalus rufipes</i>	4	9,52	C1	0,78	D1	0,0742	W1
14.	<i>Ophonus sabulicola</i>	2	4,76	C1	0,39	D1	0,0186	W1
15.	<i>Pterostichus niger</i>	2	4,76	C1	0,39	D1	0,0186	W1
16.	<i>Brachynus explodens</i>	1	2,38	C1	0,20	D1	0,0048	W1
17.	<i>Idichroma dorsalis</i>	1	2,38	C1	0,20	D1	0,0048	W1
18.	<i>Ophonus obscurus</i>	1	2,38	C1	0,20	D1	0,0048	W1
19.	<i>Pseudophonus pubescens</i>	1	2,38	C1	0,20	D1	0,0048	W1
20.	<i>Pterostichus cupreus</i>	1	2,38	C1	0,20	D1	0,0048	W1
<b>TOTAL 20 specimens</b>		<b>302 gathering specimens</b>						

In variant 2, vegetal carpet overlaid with guides, in 2018, as regards the species and the number of collected carabids, the situation is presented as follows:  
 - In this experimental variant, it has collected a total of 14 species of carabids which totaled 225 copies (Table 7).

- Carabids of species collected in this experimental we mention: *Amara aenea*, *Anatis ocellata*, *Anysodactilus binotatus*, *Harpalus calceatus*, *Harpalus distinguendus*, *Harpalus tenebrosus*, *Metabletus truncatulus*.

Tabel 9

The structure of the carabid species at variant 2 in 2018

No.	Species	Harvest										Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	<i>Amara aenea</i>			1	2		8					11
2.	<i>Anysodactilus binotatus</i>		48	16	5		8		3			80
3.	<i>Brachynus explodens</i>			1								1
4.	<i>Harpalus aeneus</i>							2				2
5.	<i>Harpalus azureus</i>								1			1
6.	<i>Harpalus calceatus</i>		1		3	1			7			12
7.	<i>Harpalus distinguendus</i>		21	17	8		3	5	19			73
8.	<i>Harpalus griseus</i>								3			3
9.	<i>Harpalus tardus</i>		4								6	10
10.	<i>Harpalus tenebrosus</i>							8	8			16
11.	<i>Metabletus truncatulus</i>		5		1	1	4	1	1			13
12.	<i>Microlestes maurus</i>								1			1
13.	<i>Ophonus obscurus</i>			1								1
14.	<i>Pterostichus cupreus</i>									1		1
<b>TOTAL 14 specimens</b>		<b>0</b>	<b>79</b>	<b>36</b>	<b>19</b>	<b>2</b>	<b>23</b>	<b>16</b>	<b>43</b>	<b>1</b>	<b>6</b>	<b>225</b>

### Ecological index values

For a deeper analysis of the results as were calculated a range of greater ecological indices such as the abundance of (A), the constancy (C), dominance (D), ecological significance index (W) (Table 10).

The values of this ecological index in 2018 at variant 2 were:

- abundance (A) had values between 1 and 96 copies;
- the constancy (C) had values between 2.38 and 95.23%;
- dominance (D) had values between 0.24 and 19.42%;
- the ecological significance index had values between 0.0057 and 18.4937%.

Tabel 10

The values of the ecological indices of the species collected in 2018 at variant 2

No.	Species	ECOLOGICAL INDEX						
		A	C		D		W	
		%	%	Cl.	%	Cl.	%	Cl.
1.	<i>Anysodactilus binotatus</i>	96	95,23	C4	19,42	D5	18,4937	W5
2.	<i>Harpalus distinguendus</i>	73	64,29	C3	17,72	D5	11,3922	W5
3.	<i>Harpalus tenebrosus</i>	16	23,81	C1	3,88	D3	0,9238	W2
4.	<i>Metabletus truncatulus</i>	13	21,43	C1	3,16	D3	0,6772	W2
5.	<i>Harpalus calceatus</i>	12	19,05	C1	2,91	D3	0,5544	W2
6.	<i>Amara aenea</i>	11	9,52	C1	2,67	D3	0,2542	W2
7.	<i>Harpalus tardus</i>	10	14,29	C1	2,43	D3	0,3472	W2
8.	<i>Harpalus griseus</i>	3	4,76	C1	0,73	D1	0,0347	W1
9.	<i>Harpalus aeneus</i>	2	2,38	C1	0,49	D1	0,0117	W1
10.	<i>Brachynus explodens</i>	1	2,38	C1	0,24	D1	0,0057	W1
11.	<i>Harpalus azureus</i>	1	2,38	C1	0,24	D1	0,0057	W1
12.	<i>Microlestes maurus</i>	1	2,38	C1	0,24	D1	0,0057	W1
13.	<i>Ophonus obscurus</i>	1	2,38	C1	0,24	D1	0,0057	W1
14.	<i>Pterostichus cupreus</i>	1	2,38	C1	0,24	D1	0,0057	W1
<b>TOTAL 14 specimens</b>		<b>225 gathering specimens</b>						

In variant 3, vegetal carpet overlaid with white clover, as regards the species and the number of collected carabids, the situation is presented as follows:  
- In this experimental version, a number of 14 species of carabids were collected, totaling 251 copies (Table 11).

- Carabids of species collected in this experimental we mention: *Amara aenea*, *Anysodactilus binotatus*, *Harpalus calceatus*, *Harpalus distinguendus*, *Harpalus tenebrosus*, *Metabletus truncatulus*, *Calathus fuscipes*, *Carabus coriaceus*.

Tabel 11

The structure of the carabid species at variant 3 in 2018

No.	Species	Harvest										Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	<i>Amara aenea</i>			1		2						3
2.	<i>Amara crenata</i>				1			1				2
3.	<i>Anthichus floralis</i>				1		2					3
4.	<i>Anysodactilus binotatus</i>	12	37	35	18	2	1	4	14			123
5.	<i>Calathus fuscipes</i>		1				1					2
6.	<i>Carabus coriaceus</i>						1					1
7.	<i>Carabus scabriusculus</i>		1									1
8.	<i>Harpalus calceatus</i>				6			2	3			11
9.	<i>Harpalus distinguendus</i>	3	33	6	10	3	1	6	8			70
10.	<i>Harpalus pubescens</i>								1			1
11.	<i>Harpalus tenebrosus</i>		4					6			11	21
12.	<i>Metabletus truncatulus</i>	1	1	1		2	2	1				8
13.	<i>Ophonus obscurus</i>			2		2						4
14.	<i>Ophonus tenebrosus</i>	1										1
<b>TOTAL 14 specimens</b>		<b>17</b>	<b>77</b>	<b>45</b>	<b>36</b>	<b>11</b>	<b>8</b>	<b>20</b>	<b>26</b>	<b>0</b>	<b>11</b>	<b>251</b>

### Ecological index values

For a deeper analysis of the results as were calculated a range of greater ecological indices such as the

abundance of (A), the constancy (C), dominance (D), ecological significance index (W) (Table 12).

- abundance (A) had values between 1 and 123 copies;

- the constancy (C) had values between 2.38 and 90.48%;  
 - dominance (D) had values between 0.22 and 27.27%;

- the ecological significance index had values between 0.0052 and 24.6739%.

Tabel 12

The values of the ecological indices of the species collected in 2018 at variant 3

No.	Species	ECOLOGICAL INDEX						
		A	C		D		W	
		%	%	Cl.	%	Cl.	%	Cl.
1.	<i>Anysodactilus binotatus</i>	123	90,48	C4	27,27	D5	24,6739	W5
2.	<i>Harpalus distinguendus</i>	70	69,05	C3	15,52	D5	10,7166	W5
3.	<i>Harpalus tenebrosus</i>	21	26,19	C2	4,66	D3	1,2205	W3
4.	<i>Harpalus calceatus</i>	11	11,90	C1	2,44	D3	0,2903	W2
5.	<i>Metabletus truncatulus</i>	8	16,67	C1	1,77	D2	0,2951	W2
6.	<i>Ophonus obscurus</i>	4	7,14	C1	0,89	D1	0,0636	W1
7.	<i>Amara aenea</i>	3	4,76	C1	0,67	D1	0,0319	W1
8.	<i>Amara crenata</i>	2	2,38	C1	0,44	D1	0,0105	W1
9.	<i>Calathus fuscipes</i>	2	4,76	C1	0,44	D1	0,0210	W1
10.	<i>Carabus coriaceus</i>	1	2,38	C1	0,22	D1	0,0052	W1
11.	<i>Carabus scabriusculus</i>	1	2,38	C1	0,22	D1	0,0052	W1
12.	<i>Harpalus pubescens</i>	1	2,38	C1	0,22	D1	0,0052	W1
13.	<i>Anthichus humeralis</i>	1	2,38	C1	0,22	D1	0,0052	W1
14.	<i>Ophonus tenebrosus</i>	1	2,38	C1	0,22	D1	0,0052	W1
<b>TOTAL 14 specimens</b>		<b>251 gathering specimens</b>						

In 2018, the most abundant species of Carabids were common the three experimental variants are: *Anysodactilus binotatus*, *Harpalus distinguendus*, *Harpalus calceatus*, *Harpalus tenebrosus*, *Harpalus*

*griseus*, *Amara crenata*, *Harpalus tardus*, *Metabletus truncatulus*, *Amara aenea* si *Harpalus pubescens* (Figure 5).

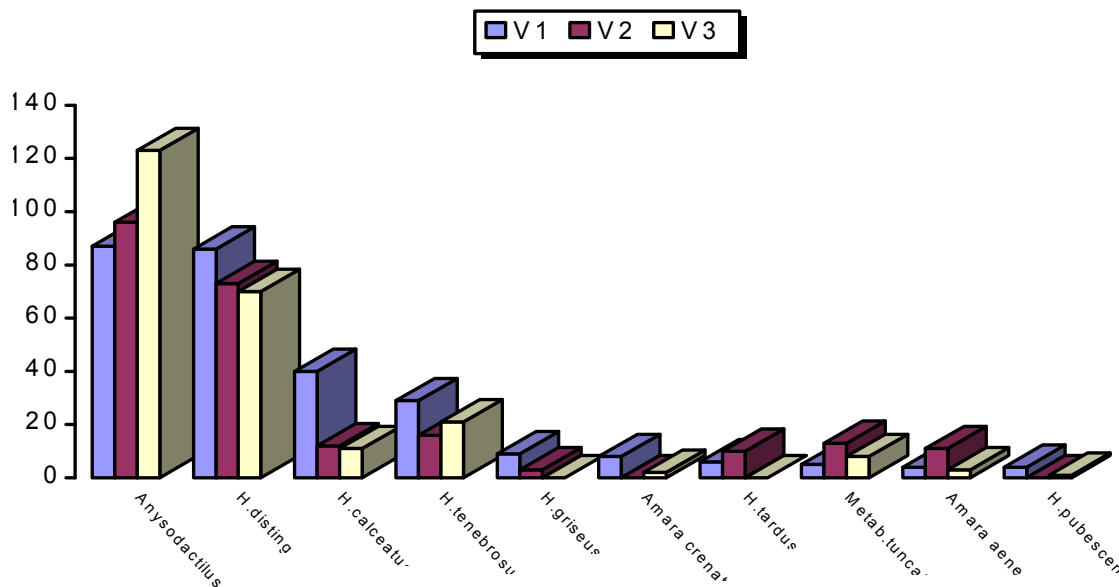


Fig. 5. Carabids abundance species in the three experimental variants in 2018

Regarding the number of carabids collected in 2018, it is observed that variant V 1 (Control variant, existing vegetable carpet) recorded the highest number of

copies (302 copies), and the smallest number of copies collected had the variant V2 (225 copies) (Figure 6).

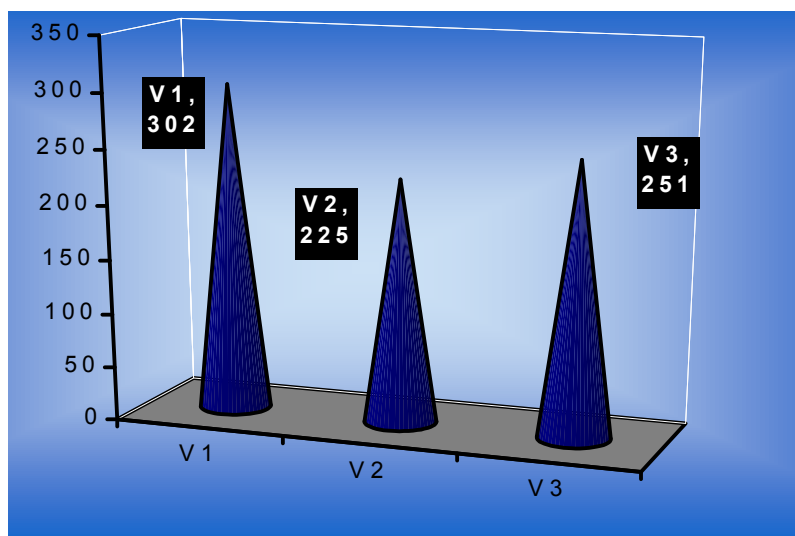


Fig. 6. Graphical representation of carabid species on experimental variants in 2018

## Conclusions

1. During the two years of research, 2017 and 2018, the collection of the samples was done periodically, at intervals between 10 and 14 days, each 10 collections in each of the two years, at the following dates, as follows:

- harvest I on 23.05, respectively 25.05;
- the harvesting of II on the date of 8.06, respectively, 7.06;
- the harvesting of the III on the date of 21.06 respectively, 20.06;
- IV harvest on 3.07, respectively 4.07;
- V harvesting on 17.07, respectively, 16.07;
- harvesting of the VI on the date of 29.07, respectively, 31.07;
- the harvesting of VII on the date of 11.08, respectively, 12.08;
- the harvesting of VIII on the date of 25.08, respectively, 23.08;
- the harvesting of IX on 5.09, respectively, 12.09;
- X harvesting on 17.09, respectively, 26.09;

2. In the year 2017, following the ten harvests, a number of 845 specimens were obtained, in the three experimental variants:

- V1 - existing vegetal carpet (control), totaled 320 copies;
- V2 - vegetable carpet overgrown with pebbles (*Lotus corniculatus*), totaled 277 samples of carabids;
- V3 - vegetal carpet covered with white clover (*Trifolium repens*) totaled 248 samples of carabids;

3. It is noted that the largest number of copies collected in 2017, was registered variant V 1 (Control variant, existing vegetable carpet), with 320 copies, and the smallest number of copies collected had variant V 3 with 248 samples of carabids.

4. In the year 2018, following the ten harvests, a number of 778 specimens were obtained, in the three experimental variants:

- V1 - existing vegetal carpet (control), totaled 302 copies;
  - V2 - vegetable carpet overgrown with pebbles (*Lotus corniculatus*), totaled 225 samples of carabids;
  - V3 - vegetal carpet covered with white clover (*Trifolium repens*) totaled 251 samples of carabids;
5. It is noted that the largest number of copies collected in 2018, was registered also variant V 1 (Control variant, existing vegetable carpet), with 302 copies, and the smallest number of copies collected had variant V 2 with 225 samples of carabids.

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