RESEARCH ON THE FAUNA OF *CARABIDAE* (*COLEOPTERA, CARABIDAE*) OF SOME PLUM ORCHARDS IN EASTERN ROMANIA

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Abstract

The research ware made for three years, 2012-2015 in two plum plantations in Iasi, beloning to the Teaching Station Vasile Adamachi stationary located in Iasi at Rivers timpuriu and Stanley variety. For the gathering of traps were used the soil traps type Barber who were completed with a formalin solution in a 4-5% concentration. The traps functioned in each of the 3 years of research, from May to September. The gathering was done separately, on each of the 6 used trap and fauna species collected were selected only carabide (*Coleoptera-Carabidae*), which were then determined. The species collected were calculated a number of ecological indexes, such as abundance (A), consistency (C) dominance (D), the index of ecological significance (W). Among the species collected in the period research include: *Harpalus distinguendus*, *Anisodactylus signatus*, *Carabus coriaceus*, *Calathus melanocephalus*, *Carabus scabriusculus*, etc.

Key words: carabids, diversity, ecological indexes, plum plantations

Because of its nutritional and organoleptic characteristics qualities of the fruit, their capacity to be kept fresh a great time and the great production/ha can be obtained, the plum occupies the large areas of culture of all tree species in the temperate zone. The distribution area of plum is quite large, from the mountains to the plains, but large areas with intensive orchards are located in the foothills and the plateau, where they emerged true fruit basins (Iasi, Pitesti, Bistrita Fălticeni, etc.).The activity of to maintain complex and phytopathogens specific pests below the economic damage is of major importance, as they can cause significant losses in fruit production, so phytosanitary protection is one of the links basic technological culture of plum.

MATERIAL AND METHOD

The gatering of material was made using the soil traps type Barber (Herea M. *et al*, 2011). They consisted of approximately 800 ml capacity pots that were buried in the ground to collect epigenous fauna of plum orchards, so the top edge of the pots is at ground level. In the pots was put in a 4% strength formalin solution, about 400 to 500 ml (Talmaciu M *et al*, 2003). The gathering of samples was made every 10 -20 days and when it was completed or replaced, as appropriate, formalin solution. Thus, the material collected fos labeled, the label stating the trap number, variety, and date of collection. The traps were operated from May to August to September each year in the 3 years of observations (Butnariu G., 2014). The material brought into the lab, was cleared of plant debris particles of dirt or other contaminants, and we have been inventoried all insect species collected were then detained and identified the carabide species (order *Coleoptera*-family Carabids) (Reitter E. 1908). We note that the investigations were made during 3 years in 2012-2015 in a plum plantation belonging Vasile Adamachi stationary, at Teaching Station of USAMV from Iasi and we have been considered for the study two representative varieties of plum varieties current assortment, Rivers timpuriu variety and Stanley variety.

RESULTS AND DISCUSSIONS

At the Rivers timpuriu variety in 2013, from May to August were collected, 35 samples of Carabids belonging to a number of 6 species (*table 1*) .The 6 species were collected from a number 8 samples and represented 13.2% of total number of individuals collected in traps in 2013 (*table 2*).

In terms of the values of ecological indices of these *Carabidae* species collected is as follows (*table 3*):

- The highest abundance (A) had a species: *Harpalus distinguendus*, 12 specimens and followed by *Amara aenea* with 7 specimens;

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Consistency C) most had a *Amara aenea* species and *Cymindis vaporariorum*

- The species with dominance (D) was the highest value of 4.92 .

it was *Harpalus distinguendus*;

- The Ecological significance index (W) with the higest value it had *Amara aenea* species.

Table 1

The species of the beetle and the number of specimens collected in 2013, from stationary V.Adamachi, the Rivers timpuriu variety

No.	Name of beetles species	May 30.05.	June 15.06.	July 26.07.	August 23.08.	Total
1	*Anisodactylus binotatus*	-	-	2	-	2
2	*Amara aenea*	4	-	3	-	7
3	*Harpalus calceatus*	-	3	-	-	3
4	*Harpalus distinguendus*	12	-	-	-	12
5	*Ophonus azureus*	-	-	5	-	5
6	*Cymindis vaporariorum*	-	-	4	2	6
Total 6 species		16	3	14	2	35

Table 2

The species structure, the number of gathering in which every species was collected in stationary V.Adamachi, the Rivers timpuriu variety, in 2013

No.	Name of beeltes species	No. of gathering (samples)	Total specimens	Percentage of total (265)
1	*Anisodactylus binotatus*	1	2	0.82
2	*Amara aenea*	2	7	2.87
3	*Harpalus calceatus*	1	3	1.23
4	*Harpalus distinguendus*	1	12	4.92
5	*Ophonus azureus*	1	5	2.05
6	*Cymindis vaporariorum*	2	6	2.26
Total 6 species of Carabids		**8**	**35**	**13.2**
Total 22 species (taxa)		-	265	100

Table 3

The values of ecological indices of beetles species in 2013, from V.Adamachi stationary, at the Rivers timpuriu variety

No	Species	The ecological indices			
		A	C	D	W
1	*Anisodactylus binotatus*	2	3.57	0.82	0.03
2	*Amara aenea*	7	7.14	2.86	0.20
3	*Harpalus distinguendus*	12	3.57	4.92	0.18
4	*Ophonus azureus*	5	3.57	2.04	0.07
5	*Harpalus calceatus*	3	3.57	1.23	0.04
6	*Cymindis vaporariorum*	6	7.14	2.46	0.18

At the Stanley variety in 2013, in the 7 data harvesting conducted at: 30.05, 15.06, 28.06, 12.07, 16.07, 10.08 and 24.08 were collected 26 specimens of carabids, belonging to a number of 6 species. These were: *Anisodactylus signatus* F, *Amara eurynota*, *Amara aenea*, *Anisodactylus binotatus* F., *Harpalus calceatus* and *Anisodactylus binotatus* Duft. (*table 4*).

Table 4

Structure, dynamics and abundance of beetles species collected in 2013, collected from stationary V.Adamachi, of Stanley variety

No.	Name of beetles species	I 30.05.	II 15.06.	III 28.06.	IV 12.07.	V 16.07.	VI 10.08.	VII 24.08.	Total
1	*Anisodactylus signatus*	-	-	-	3	-	-	-	3
2	*Amara eurynota*	-	-	-	3	-	-	-	3
3	*Amara aenea*	-	-	3	-	-	-	-	3
4	*Anisodactylus binotatus*	-	-	3	-	-	-	-	3
5	*Calathus melanocephalus*	-	3	-	-	-	-	-	3
6	*Harpalus calceatus*	-	2	-	-	-	9	-	11
Total 6 species		-	5	6	6	-	9	-	26

The higest number of species it was *Harpalus calceatus* Duft, with 11 specimens. The other species had each than 3 specimens, Harpalus calceatus Duft. it was collected in two traps, while the other species were collected from a single trap. The Carabides percentage (*table 5*) of all individuals collected was 17.21%.

In terms of ecological situation of species collected carabide is as follows (table 6): the highest values he had *Harpalus calceatus* Duft species. Other species having the same values in all indexes calculated.

Table 5

The structure beetles species, number of gathering in which every species was collected from stationary V.Adamachi farm the Stanley variety, in 2013

No	Name of beetles species	No. of gathering (samples)	Total specimens	Percentage of total (151)
1	*Harpalus calceatus*	2	11	7.28
2	*Anisodactylus signatus*	1	3	1.99
3	*Amara eurynota*	1	3	1.99
4	*Amara aenea*	1	3	1.99
5	*Anisodactylus binotatus*	1	3	1.99
6	*Calathus melanocephalus*	1	3	1.99
Total : 6 species of Carabids		**7**	**26**	**17.21**
Total 19 species		-	151	100

Table 6

Values ecological indices of species in 2013, stationary V.Adamachi, the Stanley variety

No.	Name of beetles species	The ecological indices			
		A	C	D	W
1	*Harpalus calceatus*	11	11.11	7.28	0.80
2	*Anisodactylus signatus*	3	5.5	1.99	0.11
3	*Amara eurynota*	3	5.55	1.99	0.11
4	*Amara aenea*	3	5.55	1.99	0.11
5	*Anisodactylus binotatus*	3	5.55	1.99	0.11
6	*Calathus melanocephalus*	3	5.55	1.99	0.11

At the Rivers timpuriu variety in 2014, they were collected the carabids belonging to a number of 9 species. These were: *Pterostichus niger*, *Harpalus distinguendus*, *Harpalus calceatus*, *Amara aenea*, *Pseudofonus griseus*, A*nisodactylus binotatu*, *Calathus fuscipes* and *Carabus coriaceus* (*table.7*).

Table 7

The beetles species and the number of samples collected in 2014, from stationary V.Adamachi, the Rivers timpuriu variety

No.	Name of beetles species	May	Iuly	August	September	Total
1	*Pterostichus niger*	3	-	-	-	3
2	*Harpalus distinguendus*	8	-	-	5	13
3	*Harpalus calceatus*	-	12	-	-	12
4	*Carabus scabriusculus*	5	-	-	-	5
5	*Amara aenea*	2	9	-	-	11
6	*Pseudophonus griseus*	-	8	-	-	8
7	*Anisodactylus binotatus*	-	-	-	7	4
8	*Calathus fuscipes*	4	-	-	-	4
9	*Carabus coriaceus*	-	-	-	6	6
Total 9 species of Carabids		20	29	-	18	69

Table 8

The structure of beetles species, the number of gathering in which every species was collected in V.Adamachi stationary, at the Rivers timpuriu variety, in 2014

No.	Name of beetles species	No. of gathering (samples)	Total specimens	Percentage of total
1	*Pterostichus niger*	1	3	0.40
2	*Harpalus distinguendus*	3	13	1.05
3	*Harpalus calceatus*	2	12	1.61
4	*Carabus scabriusculus*	1	5	0.67
5	*Amara aenea*	2	11	1.47
6	*Pseudophonus griseus*	1	8	1.08
7	*Anisodactylus binotatus*	2	7	0.94
8	*Calathus fuscipes*	1	4	0.54
9	*Carabus coriaceus*	2	6	0.81
Total 9 species of Carabids		**34**	**69**	**8.57**
Total 29 species				100

The Carabids species were collected in 34 traps of 69 specimens, represent 8.57% of the total *(table 8*). The ecological indexes for carabids species it have been the higest values at the species: *Harpalus distinguendus*, *Harpalus calceatus* and *Amara aenea* (*table 9*).

Table 9

The values of the ecological indices of the beetles species in 2014, from V.Adamachi stationary, at the Rivers timpuriu variety

No.	Name of beetles species	The ecological indices			
		A	C	D	W
1	*Pterostichus niger*	3	2.70	0.40	0.01
2	*Harpalus distinguendus*	13	8.11	1.75	0.14
3	*Harpalus calceatus*	12	5.41	1.61	0.09
4	*Carabus scabriusculus*	5	2.70	0.67	0.02
5	*Amara aenea*	11	5.40	1.48	0.08
6	*Pseudophonus griseus*	8	2.70	1.08	0.03
7	*Anisodactylus binotatus*	7	5.40	0.14	0.05
8	*Calathus fuscipes*	4	2.70	0.54	0.01
9	*Carabus coriaceus*	6	5.40	0.81	0.04

At the Stanley variety, in 2014, the species were collected 9 out of 29 carabid species collected. These were (*table 10*). *Harpalus distinguendus*, *Harpalus calceatus*, *Carabus coriaceus*, *Amara aenea*, *Pseudofonus griseus*, *Anisodactylus binotatus*, *Calathus fuscipes* and *Carabus coriaceus*, *Pseudophonus rufipes*. The carabides species were in total 246 specimens, representing 61.19% of the total (*table 11*).

Table 10

Structure, dynamics and abundance of species collected in 2014, collected from stationary V.Adamachi, of Stanley variety

No.	Name of beetles species	07.05.	21.05.	29.07.	12.09.	27.09.	Total
1	*Harpalus distinguendus*	25	9	-	-	34	68
2	*Anisodactylus binotatus*	4	4	-	-	10	18
3	*Pseudophonus griseus*	-	-	9	1	28	38
4	*Amarae aenea*	-	-	5	5	8	18
5	*Pseoduphonus rufipes*	-	-	50	18	18	86
6	*Carabus coriaceus*	-	2	-	-	-	2
7	*Calathus fuscipes*	2	-	-	2	-	4
8	*Carabus scabriusculus*	-	2	-	3	-	5
9	*Harpalus calceatus*	-	-	-	-	7	7
Total 9 species of Carabids		48		64	29	105	246

Table 11

The structure of the beetles species, the number of gathering in which every species was collected from V.Adamachi stationary at the Stanley variety, in 2014

No	Name of beetles species	No. of gathering (samples)	Total specimens	Percentage of total (402)
1	*Harpalus distinguendus*	11	68	16.91
2	*Anisodactylus binotatus*	4	18	4.47
3	*Pseudophonus griseus*	6	38	9.45
4	*Amara aenea*	3	18	4.47
5	*Pseoduphonus rufipes*	10	86	21.39
6	*Carabus coriaceus*	1	2	0.49
7	*Calathus fuscipes*	2	4	0.99
8	*Carabus scabriusculus*	2	5	1.24
9	*Harpalus calceatus*	2	7	1.74
Total : 9 species of Carabids		**41**	**246**	**61.19**
Total: 29 species		29	402	100

The highest values of ecological indices calculated (A, C, D, W), they had species: *Pseudophonus rufipes*, *Harpalus distinguendus*, *Pseudophonus griseus* and *Amara aenea* (*table 12*).

Table 12

The values of ecological indices of the beetles species in 2014, at the V.Adamachi stationary, the Stanley variety

No.	Name of beetles species	The ecological indexes			
		A	C	D	W
1	*Harpalus distinguendus*	68	37.93	16.91	6.41
2	*Anisodactylus binotatus*	18	13.79	4.47	0.61
3	*Pseudophonus griseus*	38	20.68	9.45	1.95
4	*Amara aenea*	18	44.82	4.47	2.00
5	*Pseoduphonus rufipes*	86	34.48	21.39	7.37
6	*Carabus coriaceus*	2	3.44	0.49	0.016
7	*Calathus fuscipes*	4	6.89	0.99	0.06
8	*Carabus scabriusculus*	5	6.89	1.24	0.08
9	*Harpalus calceatus*	7	6.89	1.74	0.11

In 2015, at Rivers timpuriu variety, the carabide species were collected following (*table 13*): *Cymindis vaporariorum*, *Notiophylus palustris*, *Calathus fuscipes*, *Anisodactylus binotatus*, *Harpalus calceatus*, *Pseudophonus rufipes*, *Carabus coriaceus*, *Amara aenea* and *Harpalus distinguendus*. In total 156 specimens were collected, representing 13.8% of all samples colected (*table 14*).

Table 13

The species and the number of specimens collected in 2015, from V.Adamachi stationary, at the Rivers timpuriu variety

No.	Name of beetles species	Data of gathering materials										Total
		I. 02.05.	II. 14.05	III. 26.05.	IV 04.06	V. 18.06	VI. 02.07	VII. 16.0.	VIII. 30.07	IX 10.08	X. 24.08	
1	*Cymindis vaporariorum*	5	-	9	-	-	-	-	-	-	-	14
2	*Nothiophylus palustris*	-	5	6	-	-	-	-	-	-	-	11
3	*Calathus fuscipes*	-	-	-	-	-	11	-	-	-	-	11
4	*Anisodactylus binotatus*	-	6	-	-	-	-	6	-	-	12	24
5	*Harpalus calceatus*	4	6	-	-	-	12	-	-	6	18	46
6	*Pseudophonus rufipes*	-	-	-	-	-	-	-	5	-	31	36
7	*Carabus coriacus*	2	-	-	-	-	-	-	-	-	-	2
8	*Amara aenea*	-	-	9	-	-	-	-	-	-	-	9
9	*Harpalus distinguendus*	-	-	-	-	3	-	-	-	-	-	3
Total: 9 species of Carabids												156

Table 14

The structure of the beetles species, the number of traps in which every species was collected in V.Adamachi stationary, the Rivers timpuriu variety, in 2015

No.	Name of beetles species	No. of gathering (samples)	Total specimens	Percentage of total
1	*Cymindis vaporariorum*	2	14	1.24
2	*Nothyophylus palustris*	2	11	0.97
3	*Calathus fuscipes*	3	11	0.97
4	*Anysodactylus binotatus*	5	24	2.65
5	*Harpalus calceatus*	7	46	4.07
6	*Pseudophonus rufipes*	4	36	3.19
7	*Carabus coriaceus*	1	2	0.18
8	*Amara aenea*	2	9	0.35
9	*Harpalus distinguendus*	1	3	0.27
Total 9 species of Carabids		**27**	**156**	**13.8**
Total 46 species		57	1130	100

The Ecological indices was calculated at the collected species of carabid with higher values: *Harpalus calceatus*, *Pseudophonus rufipes* and *Anisodactylus binotatus* (*table 15*)

The Stanley variety, 2015 were collected only 4 species of carabids of the 29 species collected. These were (*table 16*): *Harpalus distingurndus*, *Calathus fuscipes*, *Pterostichus niger*, *Anisodactylus binotatus*.

In total was collected a total of 45 specimens of carabide, representing 5.73% of specimens collected (*table 17*).

Table 15

The values of ecological indices of the beetles species (taxons) in 2015, from V.Adamachi stationary, at the Rivers timpuriu variety

No.	Name of beetles species	The ecological indexes			
		A	C	D	W
1	*Cymindis vaporariorum*	14	3.50	1.24	0.04
2	*Nothyophylus palystris*	11	350	0.97	0.03
3	*Calathus fuscipes*	11	5.26	0.97	0.05
4	*Anysocactylus binotatus*	24	8.77	2.65	0.23
5	*Harpalus calceatus*	46	12.28	4.07	0.49
6	*Pseudophonus rufipes*	36	7.02	3.19	0.22
7	*Carabus coriacus*	2	1.75	0.18	0.003
8	*Amara aenea*	9	3.51	0.80	0.02
9	*Harpalus distinguendus*	3	1.75	0.27	0.004

The ecological indices was calculated at carabide species collected and the highest values were inregistred at *Calathus fuscipes* Goeze species (*table 18*).

Table 16

The structure, dynamics and abundance of the collected species in 2015, from V.Adamachi stationary, of Stanley variety

No.	Name of species (taxa)	I 02.08	II 14.05	III 28.05	IV 04.06	V 18.06	VI 10.07	VII 22.07	VIII 30.07	IX 10.08	X 24.08	Total
1	*Harpalus distinguendus*	3	-	-	-	-	-	-	-	-	-	3
2	*Calathus fuscipes*	2	2	6	4	4	-	2	3	-	2	25
3	*Pterostichus niger*	-	-	-	-	-	-	5	2	-	-	7
4	*Anisodactylus binotatus*	4	-	-	-	-	-	4	2	-	-	10
Total 4 species of Carabides		9	2	6	4	4	-	11	7	-	2	45

Table 17

The structure of the beetles species, the number of traps in which every species was collected from V.Adamachi stationary at the Stanley variety, in 2015

No.	Name of species	No. of gathering (samples)	Total specimens	Percentage of total
1	*Harpalus distinguendus*	1	3	0.38
2	*Calathus fuscipes Goeze*	9	25	3.19
3	*Pterotichus niger Schall*	2	7	0.64
4	*Anisodactylus binotatus F*	4	10	1.27
Total 4 species of Carabides		**16**	**45**	**5.73**
Total: 29 species		29	785	100

Table 18

Values ecological indices of the beetles species in 2015, stationary V.Adamachi, the variety Stanley

No.	Name of species (taxa)	Ecological indexes			
		A	C	D	W
1	*Harpalus distinguendus* Duft	3	1.75	0.38	0.007
2	*Calathus fuscipes* Gaeze	25	16.07	3.19	0.52
3	*Pterotichus niger* Schall	7	3.57	0.64	0.02
4	*Anisodactylus binotatus* F	10	7.14	1.27	0.09

CONCLUSIONS

During the research we were collected from a number of specimens belonging to 14 species of carabide. These were: *Anisodactylus binotatus, Amara aenea., Harpalus calceatus, Harpalus distinguendus, Ophonus azureus, Cymindis vaporariorum, Amara aenea, Anisodactylus signatus, Calathus melanocephalus, Carabus scabriusculus, Pseudophonus griseus, Carabus coriaceus*. and *Pterostichus niger* .

The carabide species we were collected with the lowest percentage of 5.73% of the total collected specimens entomofauna at Stanley variety in 2015 and the highest percentage of 61.19% to Stanley variety in 2014.

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