

SOME OBSERVATIONS ON THE DIVERSITY, ABUNDANCE AND DOMINANCE OF EPIGEAL ARTHROPODS IN THREE ORCHARDS (CHERRY ORCHARDS, APPLE ORCHARDS, PLUM ORCHARDS), CRÂNG VILLAGE, VASLUI COUNTY, MOLDAVIA, ROMANIA, 1996

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Abstract. The paper is a synthesis of the original collection data of epigeal arthropods from three orchards: cherry orchard, apple orchard, plum orchard. The aim of the paper is to present comparatively the variation of relative abundance and dominance of epigeal arthropods (classes, orders of insects, Coleopteran families, Carabidae species) from the three orchards. The material was collected from the Crâng village, Vaslui County, 1996, Central Moldavian Plateau (Bârlad Plateau), by biology professor Roșca Monica, using Barber pitfalls in each orchard with preservative liquid, 4 % formalin solution and protected against rainfalls, five pitfalls in each every orchard. The pitfalls have been operating in ecosystems continuously for 56 days. 1,217 specimens of epigeal Arthropods were collected in total, of which 605 (49.71 %) from the cherry orchard; 403 (33.11 %) from the apple orchard; 209 (17.17 %) from the plum orchard. In the cherry orchard, four classes of arthropods were collected; insects were eudominant, 587 (97.02%); seven orders of insects, Choleoptera 538 (91.75%), ten families of Coleoptera, the Carabidae family 441, (80.92) with 15 species. *Pseudoophonus rufipes* De Geer 1774 with 379 specimens (85.94%). Three classes of arthropods were collected in the apple orchard; insects 397 (98.51%) - six orders of insects; Choleoptera 373 (98.43%) - nine families of coleoptera; Carabidae, 326 (87.40) with 13 species, *Pseudoophonus rufipes* De Geer 1774, 286 individuals (87.73%). In the plum orchard, insects, 199 (95.22%) - 6 orders of insects, Choleoptera 158 (81.91%); 9 families of Choleoptera; Carabidae, 60 (37.97%); 8 species, *Pseudoophonus rufipes* 38 (63.33%). The presence of taxa in all those orchards is the following: two classes (Crustacea (Isopoda), Insecta; four orders of insects (Orthoptera, Choleoptera, Hymenoptera, Diptera; eight families of Choleoptera (Carabidae, Staphylinidae, Dermestidae, Elateridae, Tenebrionidae, Scarabaeidae, Chrysomelidae, Curculionidae); five species of Carabidae (*Pseudoophonus rufipes*, *P. griseus*, *Harpalus distinguendus*, *Zabrus tenebrioides*, *Amara consularis*).

Keywords: epigeal arthropods, abundance, dominance, cherry, apple, plum trees orchard.

Rezumat. Unele observații privind diversitatea, abundența și dominanța artropodelor epigee din trei livezi (livada de cireși, livada de meri, livada de pruni), satul Crâng, județul Vaslui, Moldova, România, 1996. Lucrarea este o sinteză a datelor originale de colectare a artropodelor epigee din trei livezi: livada de cireși, livada de meri, livada de pruni. Scopul lucrării este de a prezenta comparativ variația abundenței relative și a dominanței artropodelor epigee (clase, ordine de insecte, familii de Coleoptere, specii de Carabidae) din cele trei livezi. Materialul a fost colectat din satul Crâng, județul Vaslui, 1996, Podișul Central al Moldovei, (Podișul Bârladului) de către profesor de biologie Roșca Monica, folosind capcane Barber cu lichid conservant, 4 %, soluție de formalină, protejate împotriva precipitațiilor, cinci capcane în fiecare livadă. Capcanele au funcționat în ecosisteme, continuu, 56 de zile. În total, au fost colectate 1.217 exemplare de artropode epigee din care 605 (49,71%) din livada de cireși; 403 (33,11%), livada de meri; 209 (17,17 %), livada de pruni. În livada de cireși au fost colectate patru clase de artropode; insectele au fost eudominante, 587 (97,02 %); șapte ordine de insecte, Choleoptera 538 (91,75%), zece familii de coleoptere, familia Carabidae 441, (80,92), cu 15 specii. *Pseudoophonus rufipes* De Geer 1774 cu 379 exemplare (85,94%). În livada de meri au fost colectate trei clase de artropode; insecte 397 (98,51%) - șase ordine de insecte; Choleoptera 373 (98,43 %) - nouă familii de coleoptere; Carabidae, 326 (87,40) cu 13 specii, *Pseudoophonus rufipes* De Geer 1774, 286 indivizi (87,73 %). În livada de pruni, insecte, 199 (95,22 %) - 6 ordine de insecte, Choleoptera 158 (81,91%); 9 familii de Choleoptera; Carabidae, 60 (37,97 %); 8 specii, *Pseudoophonus rufipes* 38 (63,33 %). Prezența taxonilor în toate cele trei livezi: două clase, Crustacea (Isopoda), Insecta; patru ordine de insecte (Orthoptera, Choleoptera, Hymenoptera, Diptera); opt familii de Coleoptere (Carabidae, Staphylinidae, Dermestidae, Elateridae, Tenebrionidae, Scarabaeidae, Chrysomelidae, Curculionidae); cinci specii de Carabidae (*Pseudoophonus rufipes*, *P. griseus*, *Harpalus distinguendus*, *Zabrus tenebrioides*, *Amara consularis*).

Cuvinte cheie: artropode epigee, abundență, dominanță, livada de cireși, livada de meri, livada de pruni.

INTRODUCTION

Taxonomic units and subunits in the animal kingdom operate in action and interaction with the environment. Relief, the major structure of the environment, influences the main climate values, temperature, precipitations. The main relief form in Moldova is the Moldavian Central Plateau, subdivided into three subunits: the Suceava Plateau, the Moldavia Plateau and the Bârlad Plateau. Multiannual average values of temperatures are between 8-10 C, annual average rainfall, 400-500 mm, outdoor climatic influences are those of aridity.

Collection and research were performed in the South of Moldavia, Crâng locality, Vaslui County, 1996, subunity, Bârladului Plateau. The main forms of relief of the Bârlad Plateau are the hills. The maximum altitude of the Bârlad Plateau is 561 m. The climate is moderate-continental, with annual average temperatures of 8-10 degrees Celsius, average rainfall of 400-500 mm, outdoor climatic influences are those of aridity.

“In Moldavia (Romania), there were two phases in the knowledge of the species of ground beetles: a the first phase had a faunistic character and the second one, modern and of perspective, an ecological one. Ecology is the science of concrete biology”.

The authors who published papers about the species of Carabids in Moldavia (Romania), apple trees orchards, are: TĂLMACIU M., TĂLMACIU NELA, DIACONU A., ARTENE I. (2006); TĂLMACIU M., TĂLMACIU N., DIACONU A. (2007); TĂLMACIU M., TĂLMACIU N., DIACONU A. (2008); TĂLMACIU M., TĂLMACIU N., DIACONU A. (2008).

As for plum trees orchards, the main authors are: TĂLMACIU NELA, TĂLMACIU M., GEORGESCU TH., FILIPESCU C. (2001); TĂLMACIU NELA, TĂLMACIU M., GEORGESCU TH., FILIPESCU C. (2002); TĂLMACIU NELA, TĂLMACIU M., FILIPESCU C., GEORGESCU TH. (2003); TĂLMACIU M., TĂLMACIU NELA, GEORGESCU TH. (2004); TĂLMACIU NELA, TĂLMACIU M., DIACONU A. (2007).

MATERIAL AND METHODS

The entomologic material is completely original and it was collected from the three orchards mentioned earlier, in order to show the influence of the kind of the ecosystem on the number of taxonomic arthropods (classes of arthropods, orders of insects, families of Choleoptera, species of Carabidae), 1996.

The entomological material was collected by Roșca Monica, teacher of Biology, first degree. 5 Barber pit-falls were used in each orchard to collect the material ecologically, rationally and continually. The traps were arranged in one row in each orchard. The distance among pit-falls was 5 m. The pit-falls were protected against rainfalls.

The pitfalls functioned continually in each ecosystem, in total 56 days, from May 20th till July 15th, 1996. Four collections were made and 60 samples were analysed, that is the content from 15 pit-falls (4 x 15) to determine the individuals belonging to classes of arthropods, orders of insects, families of Choleoptera, species of Carabidae.

The aim of the paper is to present the taxonomic structure of the epigeal arthropods (classes, orders of insects, families of Choleoptera, species of Carabidae, their abundance and dominance from three orchards Crâng Village, Vaslui County, southern Moldavia, Romania, 1996).

Objectives of the paper. 6 objectives of the paper were established, expressed in their natural and logical order: **1.** Documentation on the subject of the paper; **2.** Collecting the material from the three orchards; **3.** Taxonomic determination of the material; **4.** Knowledge of the presence of classes of Arthropods, orders of insects, families of Choleoptera and the species of the family Carabidae in the ecological conditions of those three orchards, 1996, Locality Crâng, Galați County, Southern Moldavia, Romania, 1996; **5.** Knowledge of the variation of the concrete values of the relative abundance and dominance of the classes of Arthropods, orders of insects, families of Choleoptera, species of Carabidae; **6.** Discussion of results.

The studied region (collections and researches) belongs to the South of Moldavia. The material is completely original and was collected from three orchards, mentioned above, to show the influence of the ecosystem on the number of taxonomic Arthropods (classes of Arthropods, orders of insects, families of Choleoptera), species of Carabidae, and their number of individuals, 1996. The scientific material was collected by Pașa Marin, a teacher of Biology. To collect the material ecologically, rationally and continually, 5 Barber pit-falls were used in each orchard. The traps in each orchard were arranged in one row. The distance among pit-falls was 5 m. The pit-falls functioned continually in the ecosystems 61 days, from May 20 till July 20, 1996.

Four collections were made from each orchard and 60 samples were analysed in total, that is the content from 15 pit-falls x 4 to determine the individuals belonging to classes of arthropods, orders of insects, families of Choleoptera and species of Carabidae. The taxonomic order of the species of Carabidae in tables is according to NECULISEANU & MATALIN (2000).

RESULTS

The results of the paper are shown in four tables and represented graphically in three histograms. In presenting the sub-units, results, discussions and conclusions, we followed and respected the natural, logical, pedagogical and psychological principle from general to particular.

Taxa exist through individuals having specific morphological characters from kingdom to species.

The main numerical characteristic of each taxon is the number of individuals. The number of individuals specific to a taxon is the result of evolution in perfect concordance with all the conditions of the environment. The total number of collected individuals was 1,217 (Table 1).

Table 1. The taxonomic structure, abundance and dominance of the epigeal Arthropods (classes) from three orchards, Crâng village, Vaslui County, Moldavia, Romania, 1996.

	Choleoptera, Name of classes	Cherry orchard		Apple orchard		Plum orchard		Total	
		A	D %	A	D %	A	D %	A	D %
1	Crustacea	2	0.33	4	0.99	10	4.78	16	1.31
2	Arachnida	15	2.48	2	0.50	-	-	17	1.40
3	Myriapoda	1	0.17	-	-	-	-	1	0.08
4	Insecta	587	97.02	397	98.51	199	95.22	1,183	97.21
5	Total classes	4		3		2		4	
6	Total individuals	605		403		209		1,217	
7	% of total	49.71		33.11		17.17			100

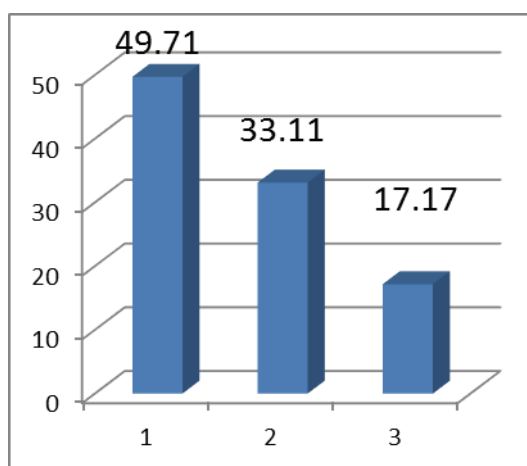


Figure 1. The percentage variation of the total number of individuals, collected from three orchards, Crâng Village, Vaslui County, Moldavia, Romania, 1996.
Subtitles 1. Cherry trees orchard; 2. Apple trees orchard; 3. Plum trees orchard.

Insects are represented by eight orders. Numerically, the best represented order in all the orchards is the order of Choleoptera, on average, 91.73 %, with a variation between 81.91 % (plum trees orchard) and 98.43 % (apple trees orchard) (Table 2).

Table 2. The taxonomic structure, abundance and dominance of Orders of the epigeal insects from three orchards, Crâng village, Vaslui County, Moldavia, Romania, 1996.

No	Insecta, Name of Orders.	Cherry trees orchard		Apple trees orchard		Plum trees orchard		Total	
		A	D %	A	D %	A	D %	A	D %
1	Orthoptera	2	0.34	1	0.26	9	4.52	12	1.02
2	Gryllodea	2	0.34	1	0.26	-	-	3	0.26
3	Dermaptera	17	2.86	4	1.04	-	-	21	1.79
4	Heteroptera	-	-	-	-	4	2.01	4	0.34
5	Homoptera	3	0.51	-	-	8	4.02	11	0.94
6	Choleoptera	545	91.75	373	98.43	158	81.91	1,076	91.73
7	Hymenoptera	11	1.85	13		13	6.53	37	3.15
8	Diptera	7	1.18	1	0.26	2	1.01	10	0.85
	Total orders:	7		6		6		8	
	Total individuals:	587		393		193		1,173	
	% of total:	49.74		33.70		16.55		100	

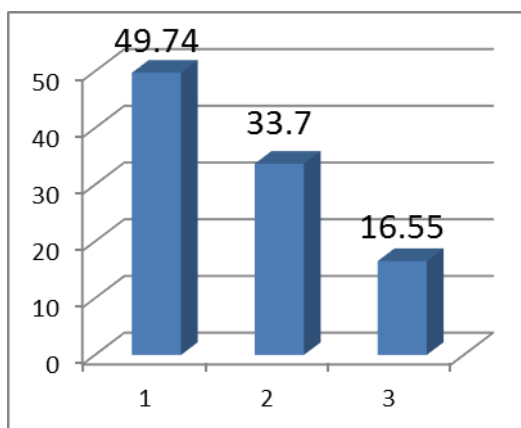


Figure 2. The percentage variation of the total number of individuals of the orders of insects, collected from three orchards, Crâng Village, Vaslui County, Moldavia, Romania, 1996.
Subtitles: 1. Cherry trees orchard; 2. Apple trees orchard; 3. Plum trees orchard.

10 families were identified in the Choleoptera order. The best represented family in those three orchards is the family Carabidae, on average 827 specimens (77.36 %) with a variation between 60 individuals, 37.97 % (plum trees orchard) and 441 specimens, 80.92% (cherry trees orchard) (Table 3).

Table 3. The taxonomic structure, abundance and dominance of families of the epigeal Choleoptera from three orchards, Crâng village, Vaslui County, Moldavia, Romania, 1996.

No	Choleoptera, Name of families	Cherry orchard		Apple orchard		Plum orchard		Total	
		A	D %	A	D %	A	D %	A	D %
1	Carabidae	441	80.92	326	87.40	60	37.97	827	77.36
2	Staphylinidae	4	0.73	3	0.80	7	4.43	14	1.31
3	Dermestidae	38	6.97	13	3.49	11	6.96	62	5.80
4	Elateridae	2	0.37	2	0.54	11	6.96	15	1.40
5	Anthicidae	4	0.73	-	-	8	5.06	12	1.12
6	Tenebrionidae	18	3.30	9	2.41	36	22.78	63	5.89
7	Scarabaeidae	3	0.55	6	1.61	8	5.06	17	1.59
8	Coccinellidae	1	0.18	1	0.27	-	-	2	0.19
9	Chrysomelidae	6	1.10	2	0.54	2	1.27	10	0.94
10	Curculionidae	21	2.02	11	2.95	15	9.49	47	4.40
	Total families	10		9		9			
	Total individuals	538		373		158		1,069	
	% of total:	50.23		34.75		15.02			100

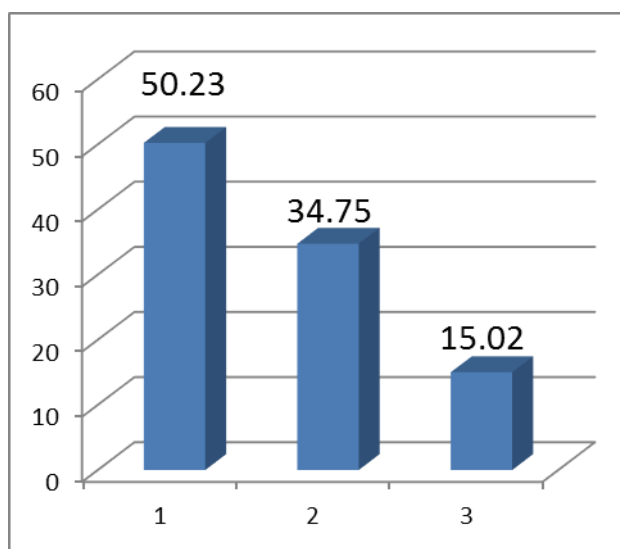


Figure 3. The percentage variation of the total number of individuals of the families of Choleoptera, collected from three orchards, Crâng Village, Vaslui County, Moldavia, Romania, 1996.
Subtitles: 1. Cherry trees orchard; 2. Apple trees orchard; 3. Plum trees orchard.

Within the Carabidae family there were determined 20 species. The best represented species is *Pseudoophonus rufipes* De Geer 1774: 63.33 % (plum trees orchard) and 85.94 % (cherry trees orchard) (Table 4).

Table 4. The taxonomic structure, abundance and dominance of species of the epigeal Carabidae from three orchards, Crâng village, Vaslui County, Moldavia, Romania, 1996.

No	Carabidae, Name of species	Cherry trees orchard		Apple trees orchard		Plum trees orchard		Total	
		A	D %	A	D %	A	D %	A	D %
1	<i>Calosoma auropunctatum</i> Herbst 1784	1	0.23	-	-	-	-	1	0.12
2	<i>Carabus besseri</i> Fischer von Waldheim 1822	1	0.23	-	-	-	-	1	0.12
3	<i>Poecilus sericeus</i> Fischer von Waldheim 1822	5	1.13	-	-	-	-	5	0.60
4	<i>Poecilus cupreus</i> Linne 1758	-	-	1	0.31	-	-	1	0.12
5	<i>Pseudoophonus rufipes</i> De Geer 1774	379	85.94	286	87.73	38	63.33	703	85.01
6	<i>P. griseus</i> Panzer 1797	1	0.23	6	1.84	2	3.33	9	1.09
7	<i>Anisodactylus signatus</i> Panzer 1797	2	0.45	1	0.31	-	-	3	0.36
8	<i>Harpalus distinguendus</i> Duftschmid 1812	9	2.04	1	0.31	5	8.33	15	1.81
9	<i>H. aeneus</i> Fabricius 1787	4	0.91	-	-	-	-	4	0.48
10	<i>H. tardus</i> Panzer 1797	1	0.23	-	-	2	3.33	3	0.36
11	<i>H. dimidiatus</i> Rossi 1790	-	-	1	0.31	-	-	1	0.12
12	<i>Metophonus azureus</i> Fabricius 1775	2	0.45	-	-	-	-	2	0.24
13	<i>Calathus fuscipes</i> Goeze 1777	4	0.91	5	1.53	-	-	9	1.09
14	<i>C. melanocephalus</i> Linne 1758	1	0.23	6	1.84	-	-	7	0.85
15	<i>C. abiguus</i> Paykull 1790	5	1.13	2	0.61	-	-	7	0.85

16	<i>C.(Dolichus) halensis</i> Schaller 1783	-	-	1	0.31	1	1.67	2	0.24
17	<i>Zabrus tenebrioides</i> Goeze 1777	17	3.85	13	3.99	5	8.33	35	4.23
18	<i>Amara consularis</i> Dufschmid 1812	9	2.04	2	0.61	4	6.67	15	1.81
19	<i>Amara similata</i> Gyllenhal 1810	-	-	-	-	3	5.00	3	0.36
20	<i>Licinus casideus</i> Fabricius 1792	-	-	1	0.31	-	-	1	0.12
	Total species	15		13		8		20	
	Total individuals	441		326		60		827	
	% of total	53.33		39.42		7.27			100

DISCUSSIONS

Discussions have to point out some generalizations and interpretations of results.

The fundamental form of existence of life is the individual within a taxon that has all the hierarchical general and specific characteristics.

The environment of a taxon is concretized in three components: biological, ecological and physical factors.

Both the presence of taxa and the number of individuals within taxa in the cherry orchard, apple orchard and plum orchard are variable due to the concrete ecological conditions in orchards.

The total number of collected specimens was 1,217 individuals. The cherry orchard offers better ecological conditions for all the taxa and their individuals, then it is followed by the apple orchard.

Thus, four classes of arthropods, 7 orders of insects, 10 families of Choleoptera and 20 species of Carabidae were collected in the mentioned orchard, with 605 individuals.

The best represented species of Carabidae in the cherry orchard was *Pseudoophonus rufipes*, it was collected in a percentage of 85.94 % in comparison with those 14 species from the same orchard. It is a meso-xerophilous pantophagous species of open habitats.

This is not a general truth in all apple orchards. In one of our papers (VARVARA & ANDRIESCU, 2003) with material collected from four apple orchards, Chicerea in 1979, Miroslava in 1991, Breazu in 1980; Botanical Garden Iași in 2000, (Iasi County, Moldavia), the total number of collected individuals of the mentioned species varied among 4 individuals, Breazu in 1980 and 213 at Chicerea in 1979, representing 35.85 % in comparison with those 20 species of collected Carabids.

Favorable or unfavorable local ecological factors dictate the number of species and individuals belonging to a biocoenosis. We can safely deduce that the moisture factor of the soil was the one that reduced the number of species and individuals in the plum trees orchard, where it was collected a total number of individuals, 60, that is 7.35 % less in comparison with the cherry orchard (441 individuals) and a total number of species, 8, 1.87 % less in comparison with the cherry orchard.

CONCLUSIONS

The collecting effort of the epigeal entomological material in the year 1996 from three orchards (cherry trees orchard, apple trees orchard and plum trees orchard), Crâng village, Vaslui County, Moldavia, Romania, 1996, the taxonomic identification of those 1,217 individuals (classes of Arthropods, orders of insects, families of Choleoptera, species of Carabidae) give us the scientific right to conclude the following:

Within the epigeal fauna of Arthropods, the following taxa are present in all three orchards, Crâng village, 1996: Crustacea (Isopoda), Insecta; four orders of insects, Orthoptera, Choleoptera, Hymenoptera, Diptera; 8 families of Choleoptera (Carabidae, Staphylinidae, Dermestidae, Elateridae, Tenebrionidae, Scarabaeidae, Chrysomelidae, Curculionidae); 5 species of Carabidae (*Pseudoophonus rufipes* De Geer 1774; *P. griseus* Panzer 1797; *Harpalus distinguendus* Duftschmid 1812; *Zabrus tenebrioides* Goeze 1777; *Amara consularis* Dufschmid 1812).

The best represented taxa through individuals in those three orchards in the south of Moldavia, Crâng village, 1996 are: Insecta, Choleoptera, Carabidae, Tenebrionidae, Dermestidae, *Pseudoophonus rufipes* De Geer 1774.

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