PARTICULARITIES OF THE EPIGEIC INVERTEBRATES POPULATIONS ON THE ROCKY HABITATS FROM THE DOFTANA VALLEY (PRAHOVA COUNTY)

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Abstract. Rocky habitats are considered ecological structures with particular characteristics, sometimes with extreme environmental conditions in comparison with other terrestrial habitats. Between 2008 and 2011 the rocky habitats were studied to identify the population structure of epigeic invertebrates and also the pattern of variations between years. The observations show obvious differences between the structural elements (numerical abundances, structure of dominance, constancy classes, specific diversity) of the invertebrate populations from rocky habitats and those of other terrestrial habitats (forests, meadows) but also the patterns of variations from year to year. It was also noticed that the local microclimatic factors have an extreme influence on the invertebrate populations, making the differences between the invertebrate populations inhabiting in the same climatic region. There are discussed the characteristics of the communities of epigeic invertebrates in each study area, there are compared the variations and differences between the studied areas and also, those between the studied areas and of the invertebrate populations from other terrestrial habitats of the Doftana Valley.

Keywords: rocky habitats, epigeic invertebrates, population structure, the Doftana Valley.

Rezumat. Particularităţi ale populaţiilor de nevertebrate epigee pe stâncării de pe Valea Doftanei (judeţul Prahova). Stâncăriile sunt considerate structuri ecologice cu caracteristici aparte, uneori cu condiţii de mediu extreme în comparaţie cu alte habitate terestre. În perioada 2008-2011 s-a realizat un studiu care a avut ca obiectiv indentificarea caracteristicilor structurale ale populaţiilor de nevertebrate epigee şi modelul variaţiilor multianuale. S-a observat că există diferenţe evidente între elementele structurale (abundenţe numerice, structura dominanţei, clase de constanţă, diversitate specifică) ale populaţiilor nevertebratelor epigee din habitate stâncoase şi cele ale populaţiilor din alte habitate terestre (păduri, pajişti) dar şi din punctul de vedere al modelelor lor de variaţie multianuală. De asemenea, s-a remarcat că factorii microclimatici locali au o influenţă extrem de importantă asupra populaţiilor de nevertebrate, făcând diferenţieri între populaţiile de pe stâncării aflate în aceeaşi zonă climatică. Sunt discutate caracteristicile comunităţilor de nevertebrate epigee din fiecare zonă studiată, sunt comparate tipurile de variaţii ale situsurilor studiate precum şi ale acestora în raport cu cele din alte habitate terestre de pe Valea Doftanei.

Cuvinte cheie: stâncării, nevertebrate epigee, structura populaţiilor, Valea Doftanei.

INTRODUCTION

The rocky habitats are very important ecological structures in the terrestrial landscape, with geomorphological and also (micro) climatic particularities determining special coenoses with special dynamics and heterogeneity noticed at various scales of time and space.

There are only a few studies on the epigeic invertebrates inhabiting the rocky habitats. The study undertaken in the last years on the rocky areas of the Doftana Valley started from the need determined by the lack of information in this domain (PURICE & CIOBOIU, 2011).

MATERIAL AND METHOD

The studied sites are located in Brebu gorges (the Doftana Valley) (N: 45° 12' 31,1"; E: 25° 44' 23,5") at 537 m altitude. There were chosen two slopes (northern and southern) due to their microclimatic differences. Vegetation was represented by different types of elements: Euro-Asian: *Rubus saxatilis*, *R. caesius*, *Hippophae rhamnoides*, *Populus tremula*, *Salix caprea*, *Salvia glutinosa*, *Campanula sibirica* (44,18%); European: *Valeriana montana, Crategus monogyna*, *Berberis vulgaris, Taxus baccata* (18,6%); central-european: *Centaurea stoebe*, *Cornus sanguinea, Cytisus nigricans* (9,3%); Carpathian: *Sesleria heuflerana*, *Thymus pullcherimus*, *Silene nutans* subsp. *dubia* (11,62%); Mediterranean: *Cnidium silaifolium*, *Hedera helix*. The highest representation had mesophytes species (42%), followed by xeromesophytes (37%) and mezohygrophytes (9%), and finally xerophytes (7%). More than 20% are pioneer species, as *Cytisus nigricans*, *Rosa canina* and *Hippophaë rhamnoides.*

Soils are classified in three classes: clayey till argillaceous on the moderate and strongly inclined peaks, which are serious affected by erosion; brown eumesobasic to pseudogleyic, which have a mineral component formed at soil surface, connected to a thin humified organic matter layer; typically alluvial soil.

The epigeic invertebrate fauna was sampled with pitfall traps. We used plastic jars with 100 ml mixture of 4% formalin and ethylene glycol (1:1 vol.). Ten sample units were placed in each studied area, at a distance of 5 meters and the fauna was collected seasonally. The dataset covers the years 2010 and 2011 to emphasize the structure and the dynamics of the local epigeic invertebrate populations.

RESULTS

The invertebrate fauna collected in the two years of study belongs to 24 groups of invertebrates identified in the epigeic populations of the northern slope and 21 respectively, in the southern one (Tables 1 and 2).

The epigeic invertebrates population of the **northern slope of Doftana rocky habitat** had the maximum number of taxa during the summer of 2010 and autumn of 2011 respectively (Table 1); the same pattern of variation in number of taxa was noticed to the local population of epigeic invertebrates inhabiting the southern slope of Doftana rocky habitat (Table 2).

The seasonal variations of the average numerical densities in the population from the northern slope were maximum in summer 2010 and during the spring 2011 respectively. The trend was to decrease the annual values in 2011. On the southern side of Doftana rocky habitat, in both years, the highest densities of epigeic invertebrates were recorded during the summer season but as in the previous case, the average annual numerical density was lower in 2011.

Table 1. Structural characteristics of the epigeic invertebrates in 2010-2011 on northern slope of the Doftana Valley (%-relative abundances, F%-frequencies, N/s.u. average numerical densities). / Tabel 1. Caracteristicile structurale ale nevertebratelor epigee de pe versantul nordic al Văii Doftana în perioada 2010-2011 (%-abundenţa relativă, F%-frecvenţa. N/s.u. densitatea medie numerică.

TAXA	spring 2010			summer 2010			autumn 2010			spring 2011			summer 2011			autumn 2011		
	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.
GASTEROPODA	1.96	28.57	0.43	0.6	22.2	1.33	0.28	11.11	0.11	0.15	16.66	0.14	1.21	30	0.55	3.04	66.67	1.56
OLIGOCHAETA				0.1	11.1	0.11							0.24	10	0.11	1.73	55.56	0.89
ACARINA	24.2	85.71	5.28	16	99.9	35	50.4	100	19.78	14.53	83.3	13.28	22.46	90	10.33	13.5	44.44	6.89
OPILIONES	1.96	28.57	0.43	1.3	77.79	2.77	0.56	22.2	0.22				6.04	80	2.78	3.68	66.67	1.89
PSEUDOSCORPIONES				4.1	88.89	9.11	0.28	11.11	0.11	0.94	66.67	0.86	0.24	10	0.11	0.43	22.22	0.22
ARANEAE	4.57	57.14	1				3.12	66.67	1.22	5.62	100	5.14	1.69	50	0.77	2.38	66.67	1.22
ZYGENTOMA	1.31	28.57	0.28	0.8	77.78	1.66				0.47	33.3	0.43	2.41	60	1.11	2.6	55.56	1.33
CRUSTACEA Isopoda	0.65	14.28	0.14	0.6	33.3	1.33				0.47	33.3	0.43	2.41	60	1.11	2.6	55.56	1.33
COLLEMBOLA	36.6	100	8	31	88.89	69.33	15.9	88.89	6.22	27.41	100	25.1	14.25	90	6.56	14.3	100	7.33
THYSANOPTERA				0.4	33.3	0.78				0.15	16.66	0.14						
MYRIAPODA-Diplopoda				0.5	77.78	1.11				0.78	66.67	0.71	1.45	40	0.67	1.08	44.44	0.55
MYRIAPODA-Chilopoda				0.5	55.56	1				0.15	16.66	0.14	0.48	10	0.22	4.33	77.78	2.22
HETEROPTERA				0.4	100	0.89	0.28	11.1	0.11	15.29	100	14				0.43	22.22	0.22
HOMOPTERA -Aphididae	6.53	71.43	1.42	0.8	66.67	1.78	1.42	33.3	0.55				0.24	10	0.11	0.43	22.22	0.22
HOMOPTERA - Cicadoidea	1.31	28.57	0.28	0.5	66.67	1	1.42	55.56	0.55	0.15	16.66	0.14				0.21	11.11	0.11
HYMENOPTERA var	1.96	14.28	0.43	7.1	88.89	15.67	2.26	66.67	0.89	6.4	100	5.85	1.45	10	0.67	8.46	55.56	4.33
HYMENOPTERA - Formicidae	1.31	28.57	0.28	14.1	100	31.22	0.85	33.3	0.33				12.8	80	5.88	17.9	88.89	9.11
ORTHOPTERA var.										26.87	100	24.57						
ORTHOPTERA - Gryllidae										0.47	16.66	0.43						
COLEOPTERA	5.23	57.14	1.14	7.7	100	17	15.6	100	6.11				14.5	90	6.67	9.11	88.89	4.67
DIPTERA	9.8	71.43	2.14	13.4	88.89	29.67	7.65	66.67	3				18.1	100	8.33	13.9	77.78	7.11
MECOPTERA										0.15	16.66	0.14						
MEGALOPTERA	2.61	42.85	0.57															
LEPIDOPTERA				0.1	11.1	0.11												
TOTAL	**100**		**21.82**	**100**		**220.87**	**100**		**39.2**	**100**		**91.5**	**100**		**45.98**	**100**		**51.2**

Table 2. Structural characteristics of the epigeic invertebrates in 2010-2011 on southern slope of the Doftana Valley (%-relative abundances, F%-frequencies, N/s.u. average numerical densities). / Tabel 2. Caracteristicile structurale ale nevertebratelor epigee de pe versantul sudic al Văii Doftana în perioada 2010-2011 (%-abundenţa relativă, F%-frecvenţa, N/s.u. densitatea medie numerică).

TAXA	spring 2010			summer 2010			autumn 2010			spring 2011			summer 2011			autumn 2011		
	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.	%	F%	N/s.u.
GASTEROPODA	0.32	10	0.14	0.1	11.1	0.11	0.27	11.11	0.11	4.54	66.67	0.28						
OLIGOCHAETA				0.64	33.3	0.67							0.23	11.1	0.22			
ACARINA	58.26	80	25.71	25.1	33.3	2.56	49.4	100	19.78	9.09	33.33	0.57	77.93	77.8	52.33	26.46	77.78	13.56
OPILIONES	0.32	10	0.14	1.62	44.4	1.67	0.55	22.22	0.22	4.54	33.33	0.28	1.88	33.3	1.78	2.38	55.56	1.11
PSEUDOSCORPIONES	0.32	10	0.14	0.42	33.3	0.44	0.27	11.11	0.11							0.65	22.22	0.33
ARANEAE	0.65	20	0.28	5.44	44.4	5.56	3.04	66.67	1.11	38.63	66.67	2.43	1.53	88.9	1.44	3.25	55.56	1.67
ZYGENTOMA				2.39	44.4	0.22	2.22	66.67	0.89									
CRUSTACEA Isopoda	0.32	10	0.14	1.85	44.4	1.89				4.54	33.33	0.28				0.65	33.33	0.33
COLLEMBOLA	24.6	70	10.86	25.1	44.4	48.56	15.5	88.89	6.22	25	33.33	1.57	1.17	88.9	22.44	15.83	77.78	8.11
THYSANOPTERA													0.23	11.1	0.22			
MYRIAPODA-Diplopoda	0.97	10	0.42	0.64	44.4	0.67				4.54	33.33	0.28				0.86	33.33	0.44
MYRIAPODA-Chilopoda	4.21	70	1.86	0.1	11.1	0.11				2.28		0.14				1.08	33.33	0.55
HETEROPTERA	0.65	20	0.28	0.22	11.1	0.22	0.27	11.11	0.11	2.28	33.33	0.14	0.47	33.3	0.44	0.86	22.22	0.44
HOMOPTERA -Aphididae				2.5	44.4	2.56	1.38	33.3	0.55				0.7	44.4	0.67	0.21	11.11	0.11
HOMOPTERA - Cicadoidea				0.95	11.1	1	1.38	55.56	0.55				0.35	33.3	0.33	0.43	11.11	0.22
HYMENOPTERA var				8.06	55.6	8.22	2.22	66.67	0.89	2.28	33.33	0.14	2.11	55.6	2	1.3	88.89	0.67
HYMENOPTERA - Formicidae	6.79	50	3				0.83	33.3	0.33	2.28	33.33	0.14	1.06	44.4	1	28.85	88.89	14.78
ORTHOPTERA var.				0.1	11.1	0.11												
BLATTODEA				0.22	11.1	0.22												
COLEOPTERA	1.62	40	0.71	5.55	44.4	5.67	15.2	100	6.11				12.34	88.9	11.67	11.49	77.78	5.89
DIPTERA	0.97	30	0.42	19	44.4	19.33	7.48	66.67	3							5.7	88.89	2.89
TOTAL	**100**		**44.1**	**100**		**99.79**	**100**		**39.98**	**100**		**6.25**	**100**		**94.54**	**100**		**51.1**

At Doftana North, the structure of invertebrates population is dominated numerically by Acarina and Collembola in both years, and with a few more groups in summer (Diptera for instance) and autumn (Coleoptera,

Formicidae etc., see table 1). The euconstant groups of invertebrates were Gasteropoda and Acarina in both years, Collembola, Homoptera, Coleoptera and Diptera also in 2010, and in 2011 – Pseudoascorpiones and Chilopoda. It is noticed a raise of the invertebrate numerical densities in spring and autumn of 2011, but drastic lower values in summer 2011, as the average temperature raised and the humidity decreased in comparison with the previous year.

Doftana South has a similar structure of the invertebrate population: Acarina and Collembola are eudominant numerically all the year 2010 and also in 2011 (Acarina / Collembola, but not both groups, see table 2). Euconstant in both years were Acarina, Opiliones, Araneae, Collembola, Heteroptera and moreover, some other groups, varying seasonally (Table 2). The same trend of raising the numerical densities in spring and autumn 2011 is noticed also on the southern slope, but during the summer, the average numerical densities are quite similar to those of 2010.

The taxonomical composition but also the structure of dominance and constancy of classes of Coleoptera fauna vary seasonally in both studied areas (Table 3).

As the taxonomic composition, the beetles fauna shows seasonal changes in both years of study and differences from one year to another. It is not noticed a pattern or a trend of variations in composition of beetles communities: in 2010 the number of Coleoptera families raised from spring to autumn in both populations, and the same happened in 2011 on the southern slope, even if the number of families was lower than in the previous year.

Table 3. The presence and numerical relative abundances (%) of Coleoptera families in the studied areas. / Tabel 3. Prezenţa şi abundenţa numerică relativă (%) a familiilor de coleoptere din zonele studiate.

COLEOPTERA	Doftana North						Doftana South						Lunca Mare		
	spring 2010	summer 2010	autumn 2010	spring 2011	summer 2011	autumn 2011	spring 2010	summer 2010	autumn 2010	spring 2011	summer 2011	autumn 2011	spring	summer	autumn
Staphylinidae	0.65	2.31	3.4	1.2	2.93	3.34		1.74	3.06		0.35	1.73	0.66	6.71	3.32
Silphidae	0.65	0.6	0.28	0.75	0.73	0.89		0.33	0.28			1.73	4.6	1.43	0.28
Scarabaeidae	0.65	0.2	3.12					0.43	1.38		0.59	0.22		2.38	3.05
Curuculionidae		0.9		0.75	1.22	0.45			1.66		0.23	1.3		0.23	
Carabidae		0.75	5.97	0.3	6.84	3.34	1.62	1.41	1.94		1.6	0.65		6.44	5.81
Tenebrionidae	3.28		1.7	0.3		0.89		0.24	1.38			0.65		1.91	0.83
Chrysomelidae		2.93	0.85	2.28	2.44			0.54	2.21		1.52	4.34			
Elateridae			0.28	0.3	0.49	0.45		0.87	1.66		0.94	0.43		0.23	0.28
Cantharidae				0.15							1.65	0.22		2.15	
Mycetophagidae				0.15					1.66		1.41			0.48	0.83
Nitidulidae				0.15							1.41	0.22		0.95	0.83

The ground beetle fauna (Family Carabidae) is represented in both populations mainly by predator species. *Carabus violaceus* LINNAEUS 1758, *Carabus coriaceus* LINNAEUS 1758 are the big predator species present in both populations of the Doftana Valley, while *Carabus glabratus* PAYKULL 1790 was found at Lunca Mare. Other predator ground beetle species found in all the studied sites and with important densities in populations is *Abax parallelipipedus* (PILLER & MITTERPACHER 1783).

The relative numerical abundances of the beetle families are low in relation with integrating invertebrate populations.

During this study, 6 species of gastropods were identified in the rocky habitats (Table 4). Inside the integrating food webs, one of their predator group is represented by the predator ground beetles (especially *Carabus* species, known as consumers of slugs and snails) (CIOBOIU, 2004; GROSSU, 1987, 1993).

Table 4. Gastropod species of rocky habitats on the Doftana Valley. / Tabel 4. Specii de gastropode pe stâncării de pe Valea Doftanei.

FAMILY	SPECIES
Enidae WOODWARD 1903	*Ena montana montana* (DRAPARNAUD 1801)
Clausillidae SCHMIDT 1857	*Alopia (Alopia) doftanae* (NORDSIECK 1977)
Zonitidae MORCH 1864	*Vitrea jetschini* (KIMAKOWICZ 1890)
	Nesovitrea petronella (L. PFEIFFER 1853)
	Oxychilus (Cellariopsis) orientalis (CLESSIN 1887)
Helicidae RAFINESQUE 1815	*Helix pomatia* LINNAEUS 1758

Alopia (*A.*) *doftanae* (NORDSIECK 1977) is an endemic species, found only on the Doftana Valley (at Brebu and Lunca Mare).

The species of the Family Zonitidae are hygrophilous species, well adapted to high humidity and cool climate, with preference for the areas of higher altitude.

Vitrea jetschini (KIMAKOWICZ 1890), a species of 4 - 4.5 mm length, is an endemic species; it inhabits the humid litter layer of the deciduous forests, under stones, at the base of rocks and sometimes, on the ground.

Oxychilus (Cellariopsis) orientalis (CLESSIN 1887), a species of 5.5 - 10 mm, is quite common in the mountain areas, especially in humid litter layer and logs of the deciduous forests.

Nesovitrea petronella (L. PFEIFFER 1853) is a rare species, sporadically collected in Europe. In Romania, it is found only in the mountain areas, especially in Bucegi Massif; it prefers open areas, meadows and pastures (among the roots of the herbaceous species, in the litter layer, under stones).

Helix pomatia LINNAEUS 1758 is a common, eurytopic species, of 38 - 40 mm, found in many habitats (gardens, forests, etc.), in humid and shadowed places. It is an oviparous species (it lays eggs in June-July) (NEACŞU & CIOBOIU, 1999, 2000).

DISCUSSIONS

To have a better image about the seasonal variations in the structure of the epigeic invertebrates populations of rocky habitats, we took into account (for comparison), the invertebrate population of Lunca Mare (an alluvial shrub land of *Salix purpurea*, situated also on the Doftana Valley, at 485 m altitude) that we studied during 2008 (Table 5).

Table 5. Seasonal variations of air temperature (T - °C) and humidity (Humid. - mm) and average densities (n/s.u.) of epigeic invertebrates at Câmpina meteorological station, Doftana (northern and southern slopes) and Lunca Mare. / Tabel 5. Variaţiile sezoniere ale temperaturii aerului (T - °C) şi umidităţii (Umidit. – mm) şi densitatea medie a nevertebratelor epigee la staţia meteorologică Câmpina, Doftana (versanţii nordici şi sudici) şi Lunca Mare.

	Spring			Summer			Autumn		
	T	Humid.	N/s.u.	T	Humid.	N/s.u.	T	Humid.	N/s.u.
Câmpina	19.06	0.71	0	21.56	0.64	0	12.33	0.77	0
Doftana-N	18.64	72.8	21.86	21.03	67.63	220.88	12.71	73.38	39.22
Doftana-S	19.81	72.91	44.14	22.01	19.39	102	15.67	73.13	40.11
Lunca Mare	16.67	0.7	21.68	21.36	0.64	46.52	12.3	0.77	40.09

A simple view on the seasonal variations of the main climatic parameters (air temperature and humidity) shows obvious differences at local level between the northern and southern slope. Thus, related to temperature, the highest differences are noticed in autumn (on the southern slope the average temperature is about 3°C higher) and during the summer, also on the southern slope, the air humidity is about 3.5 times lower than on the northern side.

In comparison with this situation, we notice that at Lunca Mare, the seasonal values of air temperature and humidity are very close to those of Campina meteorological station.

The relationships between the invertebrates and the abiotic factors are reflected by the values of r and show a positive correlation of invertebrates with temperature and a negative one with humidity; gastropods seem not to be very much influenced by temperature (maybe the amplitude of the air temperature variations are not so high to influence the gastropods).

As prey-predators relationships, on the northern slope of Doftana was noticed a negative connection between gastropods and spiders (r=-0. 504). On the southern slope, it seems that it does not exist a relationship gastropods-spiders (r=0.115) because these predators access their prey (Diptera and Isopoda) in a positive relationship (r=0.901 Araneae-Diptera and r=0.942 Araneae-Isopoda respectively) (see also Fig. 1).

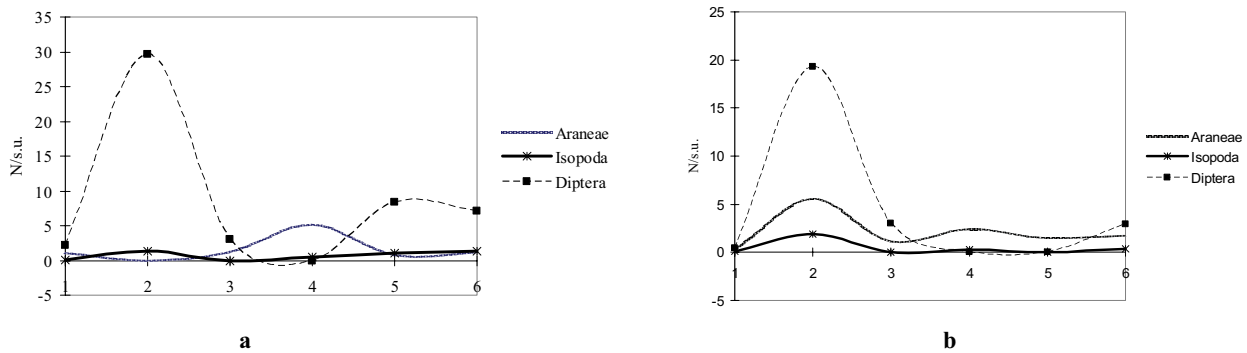

Figure 1. The variations of average densities (N/s.u.) of Araneae and of two groups of prey within Doftana study sites (a – Northern slope, b – Southern slope). / Figura 1. Variaţiile densităţii medii (N/s.u) la Araneae şi două grupuri de pradă din zone studiate de pe Doftana (a – versantul nordic, b – versantul sudic).

Pseudoscorpiones have a positive relationship with Acarina and Collembola on the northern slope (r=0.977 Pseudoscorpiones-Collembola and r=-0.85 for Pseudoscorpiones-Acarina) and also with collembolan on the southern slope (r=0.621), while with Acarina it is almost a negative correlation (r=-0.476).The variations of average numerical densities of Pseudoscorpiones, Acarina and Collembola are illustrated in figure 2.

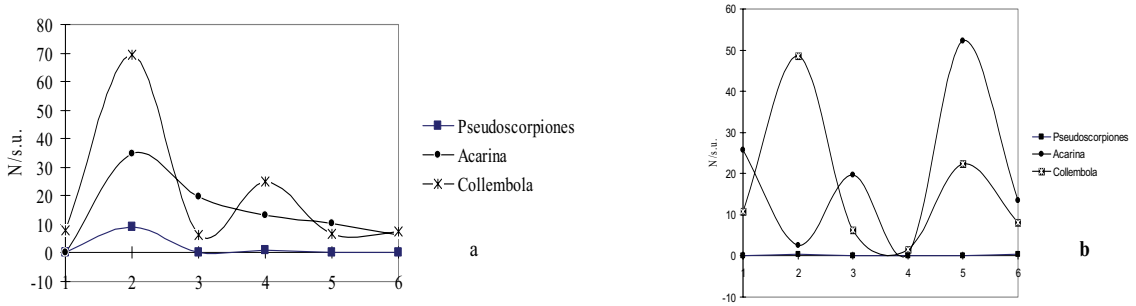

Figure 2. The variations of average densities (N/s.u.) of Pseudoscorpiones, Collembola and Acarina within Doftana study sites (a – Northern slope, b – Southern slope). / Figura 2. Variaţiile densităţii medii (N/s.u) la Pseudoscorpiones, Collembola şi Acarina din zone studiate de pe Doftana (a – versantul nordic, b – versantul sudic).

We also noticed that between the predator groups, between Araneae and Chilopoda it is an ‘‘attempt’’ of negative correlation in the population of the northern slope of Doftana (r=-0.47) , while on the southern slope, Araneae-Carabidae seem to become negative correlated (r=-0.534) (see also Fig. 3).

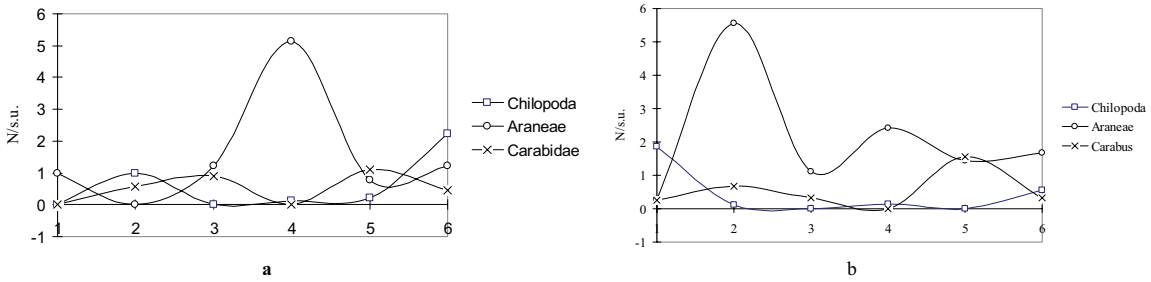

Figure 3. The variations of average densities (N/s.u.) of some predator invertebrates within Doftana study sites (a – Northern slope, b – Southern slope). / Figura 3. Variaţiile densităţii medii (N/s.u) ale unor nevertebrate prădătoare din zone studiate de pe Doftana (a – versantul nordic, b – versantul sudic).

The increased numerical abundances of epigeic invertebrates during the summer are due to the increase of phytophagous densities as vegetation develops. This situation occurs also in shrub lands and forests we studied in the same climatic region (the Doftana Valley) (MANU, 2008; PAUCĂ *et al*., 2008 a, b; VASILIU-OROMULU *et al*., 2008).

The beetle fauna, with its high diversity, is an important part of any coenotic structure. The qualitative and quantitative characteristics of the beetle populations reflect their involvement in the coenotic dynamics and plasticity.

At Lunca Mare, Pseudoscorpiones and Acarina seem to be negatively correlated with air temperature(r=-0.95 and r=-0.998 respectively). Araneae, Collembola and Diptera – negatively correlated with air humidity (r= -0.816, -0.892 and -0.856 respectively), while Acarina and Pseudoscorpiones are positively correlated with humidity (r=0.768 and 0.577 respectively).

As in the populations of Doftana slopes, there is a correlation between gastropods and predators (*Carabus* sp. and Araneae), a negative one this time, and between the predator groups - a positive correlation. Spiders feed on Diptera and Isopoda – an abundant source of food (r has positive values in both cases) and Pseudoscorpiones feed on Acarina (r positive) and Collembola (r negative).

CONCLUSIONS

Seasonal variations in the composition of epigeic invertebrates populations are similar in all studied areas; the presence/absence of some groups of invertebrates are determined by vegetation (composition, degree of development of primary producers (e.g. during summer – a higher number of phytophagous groups of invertebrates) and also by the main abiotic factors (temperature, humidity) influencing the invertebrates phenology.

The quantitative characteristics of invertebrate populations (numerical densities for instance) are also reflected in the populations structure. The presence of the predator invertebrates is conditioned in all habitats by the source of food and the proportions between the predator groups – by their prey abundance.

If as populations structure we have realized an image with the actual data, the pattern of a multi-annual variations is far from being clear with actual data; it seems to be necessary further studies to define in which way the

abiotic factors, with their particular variations in these particular habitats, affect the epigeic invertebrates populations at a larger scale of time.

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