DENSITY, DIVERSITY AND DISTRIBUTION OF THE ORIBATID MITES (*ACARI, ORIBATIDA*) IN SOME CULTIVATED SOILS FROM NORTH-EASTERN ROMANIA

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The present study analyzes the results of some researches carried out in different agro-ecosystems - perennial and annual crops – from the North-Eastern part of Romania, on the oribatid mites, a representative group of the edaphic mesofauna. Both faunistic and coenological analysis were performed. In the lucerne crops the global average abundance has closed values related to the natural lawns in this zone, but the number of species and the specific diversity are lower. The annual cultures offer less favourable conditions for the oribatid mites, an exception being the soy crop, where both quantitative and qualitative parameters have higher values, comparatively with the maize or oat cultures. The results acquired in two different years (2005 and 2007) showed that the drought phenomenon has obvious effects on the oribatid coenoses in agro-ecosystems, comparatively with the natural ecosystems.

***Keywords**: agro-ecosystems, oribatid mites, abundance, diversity, communities.*

Within the edaphic mesofauna, the oribatids – detritophagous mites – are distinguished by their density, by the richness in species, and also by a special selectivity in relation with the life conditions. From a functional point of view, they hold an important role in the bio-degradation processes of the vegetal necromass, contributing to humification of the organic matter, and therefore to preservation of natural soils' fertility.

MATERIAL AND METHOD

Following the observations and field researches, 5 ecological stations, located on the territory of Iaşi and Botoşani counties have been selected, as follows: 1. Sculeni; 2. Cotul Morii; 3. Răuseni; 4. Zaboloteni; 5. Dămideni. The first two are situated in the Prut meadow, and the others three – in the Moldavian Plain; our researches were performed in 2005, respectively in 2007. Both perrenial and annual cultures were taken into study, namely: lucerne (abbreviated l in the faunistic synopsis), maize (m), oat (o), and soy (s).

Series of 100 cm^2 soil samples have been taken over from each ecological station and culture type – 50 samples in all. Edaphic mesofauna has been extracted from samples through the Tullgren - Berlese method (the variant proposed by Balogh,

1958) and selected by systematic groups. The faunistic material has been submitted to microscopic study, in order to identify the species; it has been also noted the abundance of each species, on samples, cultures, and ecological stations. The primary data obtained have been processed using some analytic and synthetic ecological estimators: average abundance of each species (ā) and global average abundance (Ā), expressed as individuals/100cm^2 and, respectively, m^2; number of species (S); frequency (C) and relative density (D.r.) of each species; index of ecological significance (W), expressed as classes: V and IV-edifying species, III-influent species, II and I-accompanying species; specific diversity (H(s)max, H(s), H.r.), estimated by the Shannon - Weaver equation; the adults/preadults ratio.

The faunistic synopsis includes the list of recorded taxa, autecological peculiarities and world distribution of each species; also, for each species is indicated the presence in one or another of the investigated stations, as well as ecological significance, as follows: +++ edifying species, ++ influent species, + accompanying species.

RESULTS AND DISCUSSION

Within the faunistic material collected in the 10 investigated agro-ecosystems, the order *Oribatida* Dugès, 1834 was represented by 716 adult individuals and 412 preadults (larvae and nymphs); 28 species, belonging to 24 genera and 15 families were identified, the number of taxa being much lower comparatively with the lawn ecosystems in the same zone. On the whole fauna, the primitive oribatids represent 14.28%, the superior, picnonotic ones – 50%, and the poronotic oribatids – 35.71%. The high proportion of the picnonotic oribatids, and also the reduced representation of the primitive ones, which are less able to populate habitats with ample variations of the environmental factors, should be noticed. However, considering the number of individuals, the poronotic oribatids are dominant in most the analysed agro-ecosystems, this fact being characteristic for the lawn communities (see the faunistic synopsis) [1, 4, 5].

The zoogeographical analysis shows that the Palaearctic elements are the most numerous (32.14% of the total number of species), followed by the cosmopolitan and semi-cosmopolitan ones (28.6%), European (21.4%) and by Holarctic ones (17.85%). The species with Southern areal represent about 1/3 of the total number, their weight being higher related to the lawns of this zone. The cosmopolitan species have a representation comparable with pastures, but higher than in natural lawns [4, 5]. As regards the ecological spectrum, the lawn elements constitute the most numerous group (about 1/3 of the total number of species), this proportion being higher comparatively with the pastures and hayfields in this zone. The euryplastic and the sylvicolous species are similarly represented (as number of species), the last ones having low frequency and abundance. The meso-xerophilous and xerophilous species have a higher weight related to the lawns, this fact indicating the different bio-edaphic conditions in the cultivated soils (more quick and important loss of water), comparatively with those covered by natural vegetation [4, 5, 6].

Faunistic synopsis of the oribatid mites

Fam. *Brachychthoniidae* Thor, 1934

Poecilochthonius Balogh, 1943

-*P. spiciger* (Berlese, 1910): 3-l; mainly sylvicolous, meso-xerophilous; Holarctic, Argentina.

Sellnickochthonius Krivolutsky, 1964

-*S. immaculatus* (Forsslund, 1942): 1-l(++); mainly sylvicolous, eurytopic; Holarctic, N Neotropical

Fam. *Epilohmanniidae* Oudemans, 1923

Epilohmannia Berlese, 1910

-*E. cylindrica* (Berlese, 1904): 1-l(++); euedaphic, lawn species; cosmopolitan

Fam. *Euphthiracaridae* Jacot, 1930

Acrotritia Jacot, 1923

-*A. ardua* (Koch, 1841): 1-l(+), 1-s(+++), 2-o(+); mainly sylvicolous, eurytopic, mesophilous; cosmopolitan

Fam. *Damaeidae* Berlese, 1896

Epidamaeus Bulanova-Zachvatkina, 1957

-*E. kamaensis* (Sellnick, 1925): 1-l(+); sylvicolous; Palaearctic

Metabelba (Metabelba) Grandjean, 1936

-*M. (M.) pulverulenta* (Koch, 1839): 1-m(+); eurytopic, mesophilous; Holarctic

Fam. *Liacaridae* Sellnick, 1928

Liacarus (Liacarus) Michael, 1898

-*L. (L.) coracinus* (Koch, 1841): 1-l(+); eurytopic, mesophilous; Palaearctic

Fam. *Tectocepheidae* Grandjean, 1954

Tectocepheus Berlese, 1896

-*T. velatus* (Michael, 1880): 1-l(++), 1-m(++), 1-s(+++), 3-l(+++), 3-m(+), 4-l(+++), 4-m(+), 4-o(+), 5-s(+++); euryplastic; cosmopolitan

Fam. *Oppiidae* Sellnick, 1937

Anomaloppia Subias, 1978

-*A. differens* Mahunka et Topercer, 1983: 1-l(+), 5-s(+); Central, S Europe

Graptoppia (Graptoppia) Balogh, 1983

-*G. (G.) parva* (Kok, 1967): 5-s(+); xerophilous, euedaphic; S Africa, S Europe

Ramusella (Ramusella) Hammer, 1962

-*R. (R.) assimiloides* Subias et Rodriguez, 1987: 4-l(+); meso-xerophilous, euedaphic; W Mediterranean

Ramusella (Insculptoppia) Subias, 1980

-*R. (I.) insculpta* (Paoli, 1908): 1-l(+), 1-s(+++), 3-l(++), 3-m(+++), 5-s(++); eurytopic, xerophilous; W Palaearctic (except N).

Ramusella (Rectoppia) Subias, 1980

-*R (R.) mihelcici* Perez-Iñigo, 1965): 1-l(+); xerophilous, euedaphic; S Palaearctic, Venezuela.

Medioppia Subias et Minguez, 1985

-*M. obsoleta* (Paoli, 1908): 2-o(+); euryplastic; Palaearctic, New Zealand, Hawai

Microppia Balogh, 1983

-*M. minus* (Paoli, 1908): 1-s(+); eurytopic, euedaphic; cosmopolitan
Oppiella (Oppiella) Jacot, 1937
-*O. (O.) nova* (Oudemans, 1902): 1-s(++), 5-s(+); euryplastic; cosmopolitan
Fam. *Suctobelbidae* Jacot, 1938
Suctobelbella (Suctobelbella) Jacot, 1937
-*S. (S.) acutidens* (Forsslund, 1941): 1-l(+); mainly sylvicolous, eurytopic; Holarctic, Argentina
Suctobelbella (Flagrosuctobelba) Hammer, 1979
-*S. (F.) nasalis* (Forsslund, 1941): 1-l(+); meso-hygrophilous; Palaearctic, New Zealand.
Fam. *Scutoverticidae* Grandjean, 1954
Scutovertex Michael, 1879
-*S. sculptus* Michael, 1879: 1-s(+); meso-xerophilous, lawn species; S Palaearctic.
Fam. *Oribatellidae* Jacot, 1925
Tectoribates Berlese, 1910
-*T. ornatus* (Schuster, 1958): 1-l(++), 1-s(+); eurytopic, lawn species; Palaearctic, Argentina, Uruguay
Fam. *Ceratozetidae* Jacot, 1925
Ceratozetes (Ceratozetes) Berlese, 1908
-*C. (C.) conjunctus* Mihelčič, 1956: 3-l(+); meso-xerophilous; Mediterranean
Zetomimus (Protozetomimus) Perez – Iñigo, 1990
-*Z. (P.) acutirostris* (Mihelčič, 1957): 1-m(+++), 2-o(+), 3-l(+), 4-m(+), 4-o(+), 5-s(+++); lawn species; S Europe
Fam. *Punctoribatidae* Thor, 1937
Minguezetes Subias, Kahwash et Ruiz, 1990
-*M. hexagonus* (Berlese, 1908): 2-o(+); meso-hygrophilous, lawn species; Holarctic.
Punctoribates Berlese, 1908
-*P. punctum* (Koch, 1839): 1-l(+++), 1-m(+++), 1-s(+++), 3-l(+++), 3-m(+), 4-l(+++), 4-m(+), 5-s(++); eurytopic, lawn species; semi-cosmopolitan.
Fam. *Oribatulidae* Thor, 1929
Oribatula (Oribatula) Berlese, 1896
-*O. (O.) pannonica* Willmann, 1949: 1-l(+++), 3-l(++), 3-m(+++), 5-s(+++); lawn species; Palaearctic.
Fam. *Scheloribatidae* Grandjean, 1933
Scheloribates (Scheloribates) Berlese, 1908
-*S. (S.) fimbriatus* Thor, 1930: 3-l(+), 5-s(+); recorded in lawns, in cultivated soils; cosmopolitan.
-*S. (S.) labyrinthicus* Jeleva, 1962: 1-l(+), 1-s(+++), 5-s(++); eurytopic, lawn species; S and S-E Europe
Fam. *Protoribatidae* J. et P. Balogh, 1984
Protoribates (Protoribates) Berlese, 1908
-*P. (P.) capucinus* Berlese, 1908: 1-l(+); eurytopic, mesophilous; cosmopolitan.

The analysis of the average abundance of the oribatid mites shows that this parameter ranges between wide limits, being dependent mainly by the culture type, which involves certain agricultural practices. In perennial crops the density is higher related to the annual ones, regardless of the soil type and even of the climatic conditions (the summer of 2005 – with abundant precipitations, while 2007 – excessively droughty); among the annual crops, the grain ones are the less populated (*table 1*).

The weight of the oribatid mites within the edaphic mesofauna is obviously influenced by the climatic conditions, and mostly by the soil's humidity. Thus, in the stations from the Prut meadow (investigated in 2005) the oribatids represent 3.8-17.9% of the total mesofauna's effectives, and the *Oribatida/Collembola* ratio (O/C) is, without exception, lower than 1. In the stations from Moldavian Plain (analyzed in 2007) the weight of the oribatid mites is higher, between 15.8% and 71.2%, and the O/C ratio is, in the main, over 1 [2]. The numerical ratio between the two main groups of detritophages is an indicator concerning the effect of the organic matter's decomposition processes; it is known that the values over 1 indicate prevailing of the humification processes, while the values under 1 show that the mineralization is intense, the circuit of nutrients being speedy [3, 7]. Therefore, in the agro-ecosystems under analysis the organic matter's decomposition is fast, and humification is reduced, in high humidity conditions. The decrease of the soil's humidity affect especially the *Collembola*, the oribatids proving an increased resistance; in such conditions, if the dryness is not excessive, the humification processes prevail related to the mineralization ones.

Table 1

Structural global parameters of the oribatid communities in the soil of perennial and annual cultures

Types of cultures		Stations	Ā		S	Adults/ preadults	Specific diversity		
			total	adults			H(s)max.	H(s)	H. r.
perennial	lucerne	Sculeni	5,580	4,220	16	3.1	3.9999	2.6891	67.23
		Răuseni	9,400	5,380	8	1.34	2.9999	1.9808	66.03
		Zaboloteni	1,740	1,120	3	1.8	1.5849	1.1756	74.17
annual	maize	Sculeni	580	520	4	8.66	1.9999	1.5414	77.07
		Răuseni	520	300	4	1.36	1.9999	1.2354	61.77
		Zaboloteni	80	60	3	3	-	-	-
	oat	Cotul Morii	140	80	4	1.33	1.9999	1.9998	99.99
		Zaboloteni	60	40	2	2	-	-	-
	soy	Sculeni	2,040	1,040	9	1.04	3.1699	2.7402	86.44
		Dămideni	2,420	1,560	10	1.81	3.3219	2.7286	82.14

Legend: Ā - global average abundance, individuals/m^2; S - number of species; H(s)max - maximal specific diversity; H(s) - real specific diversity; H.r. – relative diversity (%).

The coenological analysis shows that in lucerne crops the global average abundance and the number of species have comparable values with the natural lawns in this zone. The adults/preadults ratio and the specific diversity characterize a stable and functional community, with well-balanced structure (*table 1*) [4, 5, 6]. The annual cultures offer less favourable conditions for the edaphic microartropods, being populated by a limited number of species, with reduced exigencies and demographic strategies which allow them to increase the populations' effectives in a short time. In the soy cultures the oribatids' density is much higher related to the grain crops; the number of species and specific diversity are, also higher in the soy crops (*table 1*). It is probably that, the nitrogen enriching of the soil cultivated with legume crops (lucerne, soy etc.) constitute a factor which indirectly favour many oribatid species.

CONCLUSIONS

In the soil of agro-ecosystems the oribatid fauna comprise a limited number of species, comparatively with the natural ecosystems; among them, few species with reduced exigencies have high values of the ecological significance index, in all of stations and in all types of cultures.

In perennial cultures the density, the number of species and specific diversity of the oribatid mites are higher, related to the annual crops; especially in the grain crops, these parameters have low values and communities' instability is marked.

The decrease of the soils' humidity affects in different manner the main groups of edaphic mesofauna, occurring changes of the numerical ratios between them. In conditions of excessive drought, the simple coenoses (as in annual cultures) are much more affected, proving that the communities with low specific diversity have also a reduced self-regulation capacity.

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