DIVERSITY AND STRUCTURE OF EDAPHIC MESOFAUNA IN RELATION OF CULTURE SYSTEM

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The aim of the present work is to evidence the effects of the various cultural practices (greenhouses and field, ecological and conventional) on the edaphic mesofauna. The investigations concerning edaphic mesofauna consist in inventory and analyze of the mites belonging to Oribatida, Gamasida, Actinedida and Acaridida orders, of the Collembola, as well as other insects and other groups of microarthropods. In the analyzed cultures the edaphic mesofauna have relatively low abundances excepting those with organic fertilizers. The horizontal distribution of the effectives is unequal; therefore the standard deviation and the variation coefficient are so much higher as the density is lower. Irrespective of the culture system (ecological and conventional) it was established that the edaphic mesofauna depends on humidity factor. In the protected cultures from greenhouses ratio between oribatids and collembolans - the main detritomicrophytophagous groups - is mostly under unit, so we can appreciate that the mineralization processes are predominant in the detriment of the humification ones.

Key words*: greenhouses, field cultures, edaphic microarthropods*

Nowadays there are proposed new methods for soil quality assessment based on the evaluation of soil fauna. It is well known the great importance of soil organisms in maintaining the functionality of an ecosystem. The edaphic mesofauna, in interrelation with fungal and bacterial microflora, affect nutrient cycling, regulate decomposing rate and play an important role in soil fertility, for the normal growth of the plants. From this point of view, it is very important to know which are the effects induced by the various cultural practices (greenhouses and field, ecological and conventional) on the edaphic mesofauna. Despite the fact that in Romania, there are series of investigations on the edaphic mesofauna from different types of cultures, the information about the protected spaces are lacked [1, 2,3,4,5,7,8 9,10]. In the present paper were studied the edaphic microarthropods from greenhouses and solariums, in relation with culture practice; therefore this is a new approach regarding the agro-ecosystems. Also, it was analyzed the effect of the plastic mulches on the edaphic communities. Different opinions support that plastic mulches have many positive advantages for the user, such as increased yields, earlier maturing crops, crops of higher quality, enhanced insect management, and weed control. Because there are not any early works on the effects of plastic mulches on the edaphic communities the present study is focused on this aspect, too.

MATERIAL AND METHOD

For reaching the proposed objectives, it was collected samples of soil with a surface of 100 cm^2, seven or nine samples/series as follows: first 4 respectively 5 samples of moist soil on the row, and the other ones (3 or 4 samples) dry soil from the spaces between rows. The samples were taken in different sequences of time, at different cultures: Bârlad (Vaslui County) - tomatoes, green peppers and aubergines (April and July), cultivated in conventional system in greenhouses; Bacău (Bacău County) - ecological cultures of tomatoes, green peppers and aubergines (June, July and November) cultivated in solaria; Spătărăşti (Suceava County) - ecological cultures of tomatoes (June and July) cultivated in solaria.

At Bacău in the tomatoes cultures were used mulches, but in November the samples were taken from both mulches and non mulches areas.

The edaphic mesofauna was extracted from the samples by Tullgren – Berlese method, after that being selected by systematic groups. The faunistic material has been analyzed at the microscope, for each station and culture being registered sample by sample the number of number of individuals. The average abundance of each identified group, expressed as individuals/100 cm^2 ($\bar{a}$) and the global average abundance ($\bar{A}$) were calculated. Also, standard deviation (σ), Pearson's coefficient of variation (s%) and the ratio between oribatids (O) and collembolans (C) - the main detritomicrophytophagous groups - has been calculated.

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RESULTS AND DISCUSSIONS

The investigations concerning edaphic mesofauna consist in inventory and analyze of the mites belonging to *Oribatida, Gamasida, Actinedida* and *Acaridida* orders, of the *Collembola,* as well as other insects; other groups of microarthropods was taken into consideration, too (pseudoscorpiones, myriapods etc).

The quantitative analyze of the edaphic microarthropods resulted from the soil of the greenhouses of Bârlad showed higher densities in April comparatively with July. At the same time with the densities decrease, the standard deviation and the coefficient of variation are higher. This fact indicated an aggregate distribution of the effectives. For the both sequences of time, the higher abundances were registered at the green pepper cultures, followed by tomatoes. The densities observed at aubergines were lower than at the other two cultures: 3.4-4.6 times in April and 1.8 – 5 times in July (*table 1*). From the qualitative point of view it was observed the domination of the mites in April at green peppers and aubergines with 85% and respectively 73% of the total effectives of the mesofauna, while the insects were dominant at aubergines in July with 71%. The weight of the mites' groups has significant variations from a sequence of time to another in all the investigated cultures.

Table 1

The average densities of the edaphic microarthropods – Bârlad (Vaslui County)

		10.04			24.07		
		tomatoes	peppers	aubergines	tomatoes	peppers	aubergines
Gamasida	ā	3.86	1.43	0.71	0.11	0.22	0.11
Oribatida	ā	3.28	15.57	2.14	0.11	0.44	0.11
Actinedida	ā	3.86	11	2.14	-	0.55	-
Acaridida	ā	0.14	-	0.14	0.33	0.55	-
Total	ā	11.14	28	5.14	0.55	1.77	0.22
Acari	σ	7.32	23.99	5.51	0.95	2.85	0.41
	s	65.7	85.68	107.2	172.72	161.02	186.36
Collembola	ā	4.28	4	1.28	0.55	2	0.44
Other insectes	ā	8.71	0.57	0.57	0.11	0.11	0.11
Total	ā	13	4.57	1.85	0.66	2.11	0.55
Insecta	σ	11.02	6.02	2.35	1.33	4.95	0.83
	s	84.77	131.72	127.03	201.51	234.59	150.90
Other groups	ā	-	-	-	0.22	0.11	-
	Ā	24.14	32.57	7	1.44	4	0.77
T O T A L	σ	12.32	28.68	7.23	2.49	7.58	0.91
	s	51.03	88.05	103.28	172.92	189.5	118.18

Legendă: ā – average abundance of each identified group (individuals/100 cm^2), Ā - the global average abundance (individuals/100 cm^2), σ - standard deviation, s % - Pearson's coefficient of variation

In April, at tomatoes there is equilibrium among the three groups of mites - gamasids (34%), oribatids (29%) and actinedids (35%), while the acaridids have only 6%. In July the actinedids are absent and the acaridids are the majority representing 60% of the total individuals of mites. At green peppers, in April, the oribatids are dominant (55%), followed by the actinedids (39% of the total of mites). In July the actinedids and the acaridids (which are absent in April), representing 31% each, are followed by oribatids (25%). In the aubergines culture it was observed that in April the oribatids and actinedids registered the higher densities (42% each of the total of mites). In July the actinedids are absent and the weight of oribatids and gamasids mites increased up to 50% for each. Referring to the ratio between oribatids and collembolans, the main detritomicrophytophagous groups, it was noted that at tomatoes the values are over unit both in April and June, while in green pepper and eggplant cultures only in April. Generally speaking, a ratio O/C over unit indicates a fast process of decomposition and a humification tendency. In contrast, a ratio O/C under unit indicates a mineralization process [7, 8].

At Bacău, in July the highest density of the mesofauna was registered at green peppers, 2 times higher than at the other *Solanaceae* cultures. In July at tomatoes the abundance of the mesofauna remains almost constant, while at green peppers is 3 times higher (*table 2*). From a qualitative point of view the mites have higher weights in the both sequences considered only at green pepper, while at tomatoes and aubergines the insects hold the majority. The covering with plastic

mulches in tomato cultures prevents the water evaporation from soil, but at the same time the aeration is diminished.

Table 2

The average densities of the edaphic microarthropods – Bacău (Bacău County)

		03.06			24.07	
		tomatoes*	peppers	aubergines	tomatoes*	peppers
Gamasida	ā	0.28	0.86	0.28	-	1.55
Oribatida	ā	0.14	0.28	0.28	-	1.44
Actinedida	ā	0.14	1.43	0.28	0.22	1.33
Acaridida	ā	0.14	0.86	0.28	0.11	9.66
Total *Acari*	ā	0.71	3.43	1.12	0.33	14
	σ	1.75	4.34	1.88	0.94	20.14
	s	246.48	126.53	164.91	284.84	143.85
Collembola	ā	1.85	1.43	1	2	2.88
Other insects	ā	0.14	0.57	0.28	-	0.55
	ā	2	2	1.28	2	3.44
Total	σ	3.21	3.38	2.43	4.08	4.03
Insecta	s	160.5	169	189.84	204	117.15
Other groups	ā	-	0.14	-	0.11	0.11
	Ā	2.71	5.57	2.40	2.44	17.55
T O T A L	σ	4.68	7.42	4.27	4.96	23.34
	s	172.69	133.21	175.72	203.27	132.99

Legend: see *table 1* *with mulches

So, the favourable role of a higher humidity on the edaphic mesofauna is counteracted by the weak aeration. In these conditions, in July gamasids and oribatids are absent; in June the gamasid mites held the first place among the mites' fauna (39%); the oribatids, actinedids and acaridids had approximately 19%. At green peppers in June the majority is represented by actinedids (42%) and in July by acaridids (69%). The ratio O/C is under unit in all the analyzed cultures for the both sequences of time. In November, all the groups have higher densities in the non mulched variant. On the other hand, only in mulched variant were found acaridids, group of mites which indicate some anaerobiotic process in soil. The ratio oribatids/collembolans is over unit in the non mulches variant, while in the mulched soil only the oribatids is present (*table 4*).

In the tomato culture from Spătărăşti the mesofauna registered densities 2.64 times higher in June comparatively with July, but 4.6 times lower with that identified in field, in a clover culture (*table 3*). There are also differences from the qualitative point of view. In opposition to clover where the mites are dominant (62%), in protected culture the insects hold the majority (65-69%). Among the mites, in the tomatoes case it was observed ample variation from a month to another. In the main, the oribatid community is very unstable, in June this group representing 38% from the mites' population and in July only 0.94%. A similar decreasing of the abundance was observed at acaridids, from 21% to 9.5%. The gamasids and actinedids record higher weights - 25% in June and 32% in July, respectively 15% and 57% of the total effectives of mites. In the clover the

oribatids are dominant (59%), followed by actinedids (27%) and then by the gamasids (8.35%). In the protected culture, the ratio O/C is distinctly favourable to collembolans both for June and July, while in the field the two main detritophagous groups have almost equal densities (*table 3*).

Table 3

The average densities of the edaphic microarthropods – Spătărăşti (Suceava County)

Taxa		11.06	24.07	11.06
		tomatoes	tomatoes	clover
Gamasida	ā	6.87	3.77	21
Oribatida	ā	10.14	0.11	147.2
Actinedida	ā	4	6.66	68
Acaridida	ā	5.57	1.11	15.2
Total *Acari*	ā	26.57	11.66	251.4
	σ	29.14	13.04	94.91
	s	109.67	111.84	37.75
Collembola	ā	59.28	21.22	141.8
Other insects	ā	1.57	0.44	13.2
Total *Insecta*	ā	60.85	21.66	155
	σ	94.27	19.87	75.26
	s	154.92	91.74	48.55
Other groups	ā	0.86	-	0.4
T O T A L	ā	88.28	33.33	406.8
	σ	115.66	32.61	161.9
	s	131.01	97.83	39.8

Legend: see table 1

Table 4

The average densities of the edaphic microarthropods (individuals/100cm^2) in protected spaces at Bacău – November 2008

Taxa	without mulches	with mulches
Gamasida	4.85	0.14
Oribatida	5	1.85
Actinedida	5.57	1.14
Acaridida	-	0.42
Total *Acari*	15.42	3.57
Collembola	2.28	-
Other insects	-	0.14
Total *Insecta*	2.28	0.14
Other groups	1	-
Total	18.7	3.71

CONCLUSIONS

In the soil of the protected cultures under study the edaphic mesofauna has relatively low abundance, excepting the cultures in which the organic fertilization was applied. The horizontal distribution of the effectives is uneven, the standard deviation and the coefficient of variation being so higher, as the density is more reduced.

Irrespectively of the culture practice (conventional or ecological), the dependence of the edaphic mesofauna's distribution on the humidity factor was observed. In the moist soil on the plants rows the effectives were much higher than in the dry soil between the rows.

From a time sequence to another, ample variations of the abundance – for all the microarthropod groups – were remarked, this fact indicating instability of their communities.

In cultures growing in protected spaces the oribatid mites do not find favourable conditions, so the ratio between oribatids and collembolans is under unit, with only few exceptions. The collembolans, which are extremely sensitive in relation to humidity, are favoured by the controlled irrigation used in greenhouses and solariums. Therefore, it can consider that within the biodegradation of the organic matter in these soils, the mineralization processes are predominant, in the detriment of the humification ones.

The effects of plastic mulches on the edaphic communities are negatives, expressed by the densities reduction of the main mesofauna groups.

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