# ANTHROPIC IMPACT EVALUATION BY SOIL-PLANT PERSPECTIVE IN GRASSLANDS ECOSYSTEMS FROM NORTHEASTERN ROMANIA

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**Abstract**

This paper approaches by the soil-plant perspective the evaluation of plant ecophysiological parameters and biological indicators of soil (edaphic mesofauna) in different grassland ecosystems with different degrees of human intervention from the Northeastern Romania. We have studied natural reserves, pastures and hayfields, in two different geographical units - Central Moldavian Plateau and Moldavian Plain. Based on these results, it was considered the human impact through analysis of statistical indicators (arithmetic mean, standard deviation, coefficient of variation) in accordance with the characteristics of studied biotopes. Ecophysiological parameters were assessed by analysis of photosynthesizing pigments (chlorophylls and carotenoid pigments) and fractions of soluble carbohydrate. Variability of photosynthetic indicators was lower in the case of species from natural reserves and larger, but elevated in secondary meadows and pastures. Accumulation of the carbohydrates was discussed in relation with soil type and it was observed the smallest values occurred in anthropic ecosystems (pastures) and in the natural reserve of Central Moldavian Plateau. Bioedaphic indicators were represented by some main groups of soil mesofauna (mites, collembolans, and on the whole, other insects or groups of edaphic microarthropods), analyzed both in a quantitative and qualitative manner. The density of edaphic microarthropods from the grasslands of Moldavian Plain was higher than that of Central Moldavian Plateau. From the qualitative point of view generally, the mites are the dominant group and among them the oribatid mites prevails. The ratio between the main detritomicrophagous groups (oribatid mites/collembolans) is in the favour of the mites with few exceptions. Both quantitative and qualitative features of the edaphic mesofauna mostly depend on the biopedoclimatic stational conditions, especially to the degree of the environmental anthropization, humidity, type of soil etc. The most anthropized grasslands could be considered the hayfields from haplic chernozem in both studied geographic areas This study was financially supported by BIODIV Research Programme developed under coordination of National Institute of Research and Development for Biological Sciences Bucharest.

**Key words**: anthropic impact, bioindicators, carbohydrates, edaphic mesofauna, grasslands, statistic indicators

Moldavian Plain (Jijia Plain) with an altitude between 30-270 m, is almost entirely steppe zone with haplic chernozem continued south - east by small areas with chernozems. The zonal soils occupy slightly undulating ridges with altitudes below 160 m high terraces and gentle slopes. Below 80 m (lower terraces and dried valleys or glacises) we meet typical chernozems and above 160 m - gray soils and even clay illuviated brown soils and brown - luvic soils. Primary grassland steppe vegetation (currently subordinate to crops) is the association meso-xerofilous fescue (*Festuca* sp.), with feather grass (*Stipa* sp.) and other xero-mesophilous herbs and xerophytes. Fallow land, sometimes degraded because slope processes and grazing are secondary associations with *Poa bulbosa*, *Poa pratensis*, *Bromus* sp., *Artemisia austriaca, Euphorbia stepposa* etc. A synthesis of Jijia Plain grassland flora is offered by scientific reserve flora "Valea lui David" from the 6-7 km west of Iaşi where, in an area of 1 km$^2$, growing over 400 species of flowering plants.

A distinct unit of Moldavian Plateau, Central Moldavian Plateau is characterized by a rugged, hilly landscape with vegetation typically for silvosteppe. Lithologyc substrate is represented by loesssands and bedrocks. Soils that vegetation grows is represented by chernozem (moderate slopes) and regosols (steep slopes), humic gleysol (moist plains). The vegetation is typical for silvosteppe zone, 50 % of territories is occupied by crops although the soils are mediocre (Roşu A., 1980).

This ecological study is a part of a multidisciplinary research and carried out to the natural and anthropic type of ecosystems of North-eastern part of Romania. This work

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approaches by the soil-plant perspective the evaluation of plant ecophysiological parameters and biological indicators of soil (edaphic mesofauna) in relation with soil type of different grassland ecosystems with different degrees of human intervention from the Northeastern Romania: Moldavian Plain and Central Moldavian Plateau. Thus, it was performed the analysis of the statistic indicators depending on the type of ecosystem: natural reserves, hayfields, pastures to assess the stability or vulnerability of each ecosystem to external pressures (anthropogenic, climate fluctuations, erosions, changes in biotope resources etc). The concept of stability of mature ecosystems is based on the fact that these are more stable and resistant to stress conditions, while poor communities (removal/loosening of species) lose their ability to compensate the fluctuations of the biotopes conditions.

## MATERIAL AND METHOD

The investigations were carried out in eighteen meadow ecosystems (three protected areas, eight hayfields, seven pastures), as follows:

**-** *Fânaţurile de la Glodeni* located in the Central Moldavian Plateau (46°51′08″N 27°32′02″E) (Vaslui County) is a floristic reserve of sylvosteppe; soil type is haplic vertic chernozem. The impact of anthropogenic activity consists of mowing and using the surrounding land for agricultural use.

- *Movila lui Burcel* located in the Central Moldavian Plateau (46°50′44″N 27°48′08″E) (Vaslui County) is a floristic reserve; soil type is regosol arenic skeletic. The human impact consists here especially in reducing the reserve surface because of the construction of a church and by planting acacia (*Robinia pseudoacacia*) on the Eastern and North-Eastern slopes.

- *Fânețele Seculare Valea lui David* located in Moldavian Plain (47°11′47″N 27°27′44″E) (Iaşi County), a natural reserve represented by a secular hayfield, a steppic habitat in a forest steppe region; type of soil is haplic vertic chernozem.

- *Bobota*, located in the Central Moldavian Plateau (46°47′27″N 27°34′18″E) (Vaslui County) a secondary sylvosteppe meadow with numerous xerophilous and xero-mesophilous elements, exploited as a hayfield; type of soil is haplic chernozem moderately eroded.

- *Soleşti I* located in the Central Moldavian Plateau (46°47′17.4″N 27°46′41″E) (Vaslui County) is a coastal secondary meadow. Anthropo-zoogenous pressure is manifested especially by mowing being also noticed weed growth in a great extent, type of soil is haplic vertic chernozem.

- *Vulturi* located in the Moldavian Plain (47°15′1″N 27°32′11″E) (Iaşi County) exploited especially by mowing activities; type of soil is haplic vertic chernozem.

- *Horleşti* located in the Moldavian Plain (47°06′57″N 27°24′11″E) (Iaşi County) exploited especially by mowing activities; type of soil is haplic chernozem.

- *Sărata Fereşti* located in the Moldavian Plain (46°46′54″N 27°42′3″E) (Vaslui County), exploited especially by mowing activities; type of soil is haplic hyposalic chernozem.

- *Deleni* located in the Moldavian Plain (47°27′44″N 26°53′20″E) (at the limit of Botoşani and Suceava, County) on the bank of Bahlui River; type of soil is haplic vertic chernozem.

- *Uricani* located in the Moldavian Plain (47°9′24″N 27°29′10″E) (Iaşi County), type of soil is haplic chernozem.

- - *Valea lui David* located in the Moldavian Plain (47°11′47″N 27°27′44″E) (Iaşi County) a meadow outside of the reservation where the mode of exploitation is through intensive grazing; type of soil is haplic gleyc chernozem.

- *Ripiceni* a pasture located in the Moldavian Plain (47°56′51″N 27°8′37″E) (Botoşani County); type of soil is haplic chernozem.

- *Săveni* a pasture located in the Moldavian Plain (47°23′58″N 27°14′53″E) (Botoşani County), type of soil is haplic vertic chernozem.

- *Deleni* a pasture located in the Moldavian Plain (47°27′44″N 26°53′20″E) (Iaşi County), type of soil is haplic vertic chernozem.

- *Scobâlțeni* a pasture located in the Moldavian Plain 47°11′57″N 27°17′0″E) (Iaşi County), type of soil is haplic chernozem.

- *Soleşti II* located in the Central Moldavian Plateau (46°46′N 27°47′E) (Vaslui County) is a pasture in the valley where the the phreatic water is near the surface, floristic composition is mainly influenced by mesophilic species and meso-higrophilic species are common, but also the species that survive well in a certain degree salinization of the soil on this pasture grazing is intensive which causes weed growth; type of soil is gleyosol cernic vertic endosalic.

- *Pribeşti* located in the Central Moldavian Plateau (46°54′36″N 27°47′47″E) (Vaslui County) is a natural meadow situated on lower terrace on level ground or very little inclined. The mode of exploitation is through intensive grazing; type of soil is haplic vertic chernozem.

Series of 100 $cm^2$ soil samples have been taken over from every plot. Edaphic mesofauna has been extracted from samples through the Tullgren - Berlese method (the variant suggested by Balogh) and selected by systematic groups; it has been noted the abundance of each group, on samples and ecological stands. The primary data obtained have been processed by means of average abundance of each group (ā) and global average abundance (Ā), expressed as individuals/100 $cm^2$ for each grassland. In order to obtain more accurate and comparable data was calculated the mean of the average abundance by type of soil and by management practices.

Biological material used consisted of fresh leaves of dominant species of studied grassland. Collections of material were made in June, July in the middle of summer. They used plants that were flowering phenophase when the physiological indices analyzed were in the maximum

concentration. It was analyzed the following indicators: chlorophylls a and b, total carotenoids and sugars content from leaves (mono-, di- and polysaccharides). Spectrophotometric method for determination of pigments was solving in 85 % of fresh leaves of the investigated species (Meyer-Bertenrath Ştirban, 1985). Results were expressed in mg/g of fresh weight (mg/g fr.w). Analysis of carbohydrates in dried plant material was made by Bertrand method combined with method Borel, 1953. Results were expressed as g % of dry matter.

Statistical analysis included the arithmetic mean, standard deviation and coefficient of variability calculated for every station. Soil classification is evaluated after WRB, 2006.

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## RESULTS AND DISCUSSIONS

Variation of the total photosynthetic pigments (chlorophylls and carotenoids) and soluble carbohydrates in leaf was disscused in relation with analyzed type of grassland (tab.1). Photosynthetic pigments showed a range between 4.2 until 5.27 mg/g fr.w. (Central Moldavian Plateau) and between 1.8 until 4.9 mg/g fr.w. (Moldavian Plain) (tab. 1). In natural reserve, the coefficient of variation of photosynthetic pigments is inversely proportional to the age of grassland; the lowest values were recorded in reserves such as Movila lui Burcel and Valea lui David, and the highest in the Fânaţul de la Glodeni (*table 1*). From previous studies it was observed that the variation of ecophysiological parameters (between species within the same plot) is much lower in natural reserves than in anthropogenic grasslands (Acatrinei L., 2006, 2010). Although the amount of photosynthetic pigments is not highest( especially, in Moldavian Plain), the coefficient of variation obtained in natural reserves is lowest(in reserves of Central Moldavian Plateau and respectively, Moldavian Plain), where individuals of the community exploited equally the biotope condition (photosynthetic radiation). It was observed that took place a decreasing of total photosynthetic pigments in xerophilous pastures, grazed, as Valea lui David and Deleni (tab.1). Soluble carbohydrates in leaf have a ranging mean between 8.8 - 17.96 g % (Central Moldavian Plateau) and between 7.75 g % until 16.6 g % (Moldavian Plain). Coefficient of variation for the soluble sugars ranged between 9 % until 57 % (Central Moldavian Plateau) and between 10 % until 38.53 % (Moldavian Plain). The soluble carbohydrates have the higher values in grassland with mesophilous and even meso-xerophilous vegetations, with moisture soil as Săveni, Horleşti and even Scobâlţeni but reduced in xerophilous pastures and eroded as Valea lui David and Ripiceni (*table 1*).

Accumulation of the leaf sugars is correlated with soil properties as well as, mineral uptake, water availability and with humus content. The photoassimilatory pigments in dominant species reflected their photosynthetic capacity and the adjustment to conditions in the station biotope (Antohe A. et al., 1991). Plants are considered to be most vulnerable to grazing damage when carbohydrates in the roots are not sufficient enough to initiate regrowth. With intense defoliation, the entire root system becomes smaller, shallower, and less branched. This affects the plant ability to absorb water and nutrients from the soil (Murariu A., 2003).

As regards the edaphic mesofauna, the present research continues some older ones. In a previous work developed in the hayfields and pastures from Moldavian Plain we found that the densities from pastures and hayfields have generally the same values, with two exceptions, that of Ripiceni - an anthropic xerophilous pasture and that of Deleni - a xerophilous eroded, grazed pasture; here we found the biggest densities, respectively the lowest ones from all the lawns taken into study (*table 1*) (Călugăr A., 2006). In the framework of the present research analysis of the densities of the edaphic mesofauna from different categories of grasslands/soil types/two geographic areas has shown that the biggest values from all investigated grasslands were found in pastures developed on haplic vertic chernozem from Moldavian Plain, followed by the pastures from Central Moldavian Plateau developed on the same type of soil (*table 2*). The next highest density was observed in Moldavian Plain in natural reserves developed also on haplic vertic chernozem. In the haplic vertic chernozem the smallest densities of the edaphic mesofauna were observed in the case of hay fields, both in Moldavian Plain and Central Moldavian Plateau (*table 2*). These results are concordant with others being well known that mowing reduces markedly the development of litter and restricts food sources for many species of soil mesofauna and also leads to unfavourable microclimatic changes (Pižl V. and Stary J., 2006).

The comparison made between the grasslands from the two geographic areas has shown that in Central Moldavian Plateau the edaphic microarthropods communities have the abundances 1.5-35 times lower than those in Moldavian Plain.

Table 1

**Variation of photosynthetic pigments and leaf carbohydrates in different type of grassland**

| Central Moldavian Plateau | Station | Type of grassland | Total photosynthetic pigments (mg/g fr. w.) | CV of total photosynthetic pigments (%) | Soluble carbohydrates in leaf (g %) | CV of soluble carbohydrates in leaf (%) |
|---|---|---|---|---|---|---|
| | **Movila lui Burcel** | *Xerophilous Hayfield, Natural Reserve* | 4.7 ± 0.09 | 5.96 | 8.8 ± 0.17 | 25.04 |
| | **Glodeni** | *Xerophilous Hayfield, 3 Years old Natural Reserve* | 4.3 ± 0.27 | 20.84 | 10.7 ± 0.2 | 26.12 |
| | **Bobota** | *Xero-mesophilous Hayfield, fallow for eight years* | 4.2 ± 0.25 | 39.60 | 13.09 ±0.14 | 34.24 |
| | **Soleşti I** | *Xero-mesophilous Secondary, coastal grassland* | 4.42 ± 0.32 | 23.38 | 14.9 ± 0.34 | 9.078 |
| | **Soleşti II** | *Mesophilous and meso-hygrophilous, Meadow pasture* | 4.86 ± 0.70 | 31.35 | 17.96 ±0.25 | 32.58 |
| | **Pribeşti** | *Meso-xerophilous, salted meadow pasture, overgrazed* | 5.27 ± 0.20 | 11.76 | 13.76 ± 0.15 | 57.22 |
| **Moldavian Plain** | **Valea lui David** | *Xerophilous Hayfield, Natural Reserve* | 4.9 ± 0.03 | 1.42 | 13.6 ±0.01 | 25 |
| | **Vulturi** | *Xerophilous, coastal hayfield* | 4.33 ± 0.36 | 10 | 11.5 ± 0.13 | 25.47 |
| | **Sărata** | *Xerophilous coastal hayfield* | 4.47 ± 0.16 | 3 | 12.08 ± 0.89 | 17.62 |
| | **Horleşti** | *Hayfields, meso-xerophilous, meadow, anthropized* | 4.96 ± 0.02 | 1.04 | 14.6 ± 025 | 27.76 |
| | **Uricani** | *Wet and salted grassland* | 4.56 ± 0.01 | 25 | 7.92 ± 0.05 | 33.53 |
| | **Săveni** | *Mesophilous, wet pasture* | 3.04 ± 0 | 29.83 | 16.6 ± 1.39 | 23.68 |
| | **Ripiceni** | *Anthropic Xerophilous pasture* | 2.15 ± 0.18 | 5.6 | 9.06 ± 0.2 | 30 |
| | **Scobâlţeni** | *Meso-xerophilous, recent pasture* | 2.38 ±0.96 | 37 | 11.5 ± 0.05 | 26.14 |
| | **Valea lui David** | *Xerophilous pasture, over grazed* | 1.8 ± 0.22 | 38 | 7.75 ± 0.08 | 38.53 |
| | **Deleni** | *Xerophilous eroded, grazed pasture* | 1.96 ± 0.4 | 5.96 | 10.5 ± 1.53 | 10 |

Legend: Mean ± SE, CV-coefficient of variation

The lowest value was observed in the case of hayfields with haplic chernozem, followed by a natural reserve developed on regosol arenic skeletic (*table 2*). Reporting the present results to that obtained in the case of some pastures and hayfields from the middle sector of Prut, we observed similar or even slightly higher densities in the Moldavian Plain while those observed for the Central Moldavian Plateau are lower, especially regarding the hayfields (Călugăr A., 2005).

From the qualitative point of view this study relieved with rare exceptions that among mites the oribatids are the dominant group in all categories of ecosystems: natural reserves, pastures and hayfields, both in Moldavian Plain and Central Moldavian Plateau (*figure 1, 2, 3*). One of the mentioned exceptions is represented by the pastures developed on haplic chernozem from Moldavian Plain where acaridid mites represent the most numerous group (40% from the total effectives of mites). These mites were abundant only in pastures while in hayfields they have only a sporadic presence; in samples provided from natural reserves was even absent. This fact was also observed during other investigations and related to the increased intake of organic matter carried by the manure of grazing animals, knowing that acaridids are stimulated by anaerobic environments, rich in nitrogenous substances (Wallwork, J.A., 1970, Krantz, 1978, Huţu & colab., 1992, Călugăr A., 2005).

Resuming the situation of the oribatid mites, a detritomicrophytophagous representative group, the biggest value of their abundance in all the studied grasslands is observed in the pastures with haplic vertic chernozem from Central Moldavian Plateau; here these mites developed densities even bigger than that observed in natural reserves with the same type of soil from Moldavian Plain where was found the biggest next value of the oribatid abundances in all the grassland ecosystems analyzed (*figure 1, 2*). A relative high density is also remarked in pastures developed on the haplic vertic chernozem from Moldavian Plain (*figure 2*). The smallest densities are observed in Central Moldavian Plateau in hayfields on haplic vertic chernozem and haplic chernozem (9 respectively 14 times lower than the biggest density). In Moldavian Plain the lowest density is remarked in the case of a natural reserve with regosol arenic skeletic followed by a hayfield with haplic chernozem (*figure 1, 3*). Ivan, 2006 in a study devoted to oribatid mites from some lawn ecosystems from Moldavian Plain found the biggest densities and number of species in a nature reserve, followed by hayfields. The pasturing practiced even periodically on some surfaces determines a considerable diminution of abundance especially in the plots where an ecological factor becomes limiting (excessive humidity, salinisation). This limitation from some ecological factors could be the explanation also in the case of this study, when qualitative and quantitative characteristics of the edaphic communities are different, even the type of soil and the category of grassland are the same.

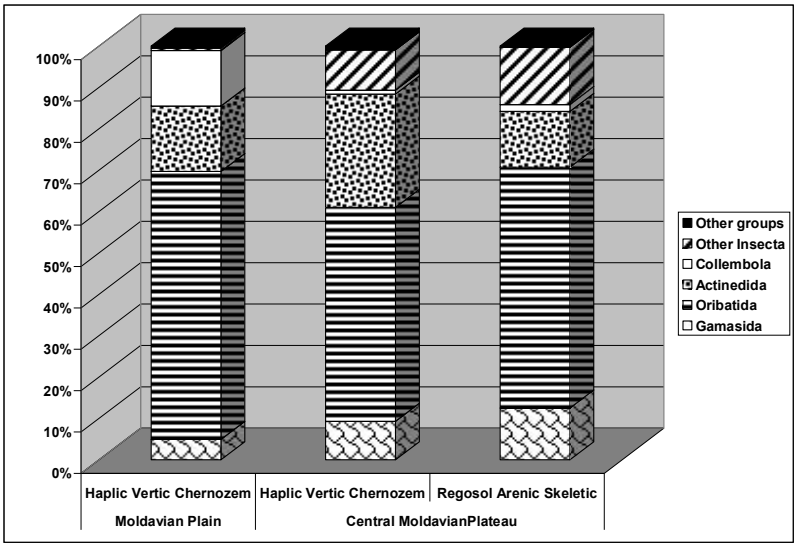


Figure 1 **Weight of the main edaphic microarthropods groups in natural reserves**

The ratio between the main detritomicrofitophagous groups (oribatid mites/collembolans) is under unit only in three cases, all of them identified for Moldavian Plain: pastures and hayfields developed on haplic

chernozem and pastures developed on haplic vertic chernozem (*table 2*).

In the rest of the investigated situations, this ratio is in the favour of the mites, the biggest values being observed in the case of nature reserves from Central Moldavian Plateau. The lowest ratio was remarked in the natural reserves from Moldavian Plain, on haplic vertic chernozem and pastures from Central Moldavian Plateau, on gleyosol cernic vertic endosalic. Literature data indicate this ratio as an important bioindicator of the quality and state of humification of the organic substrate (Huţu & colab., 1992, Huţu & Bulimar, 1993, Bulimar & colab., 1993).

A subunitary ratio indicates a predominance of high humidity and mineralization, and an over unit ratio, a lower humidity and the predominance of the humification process.

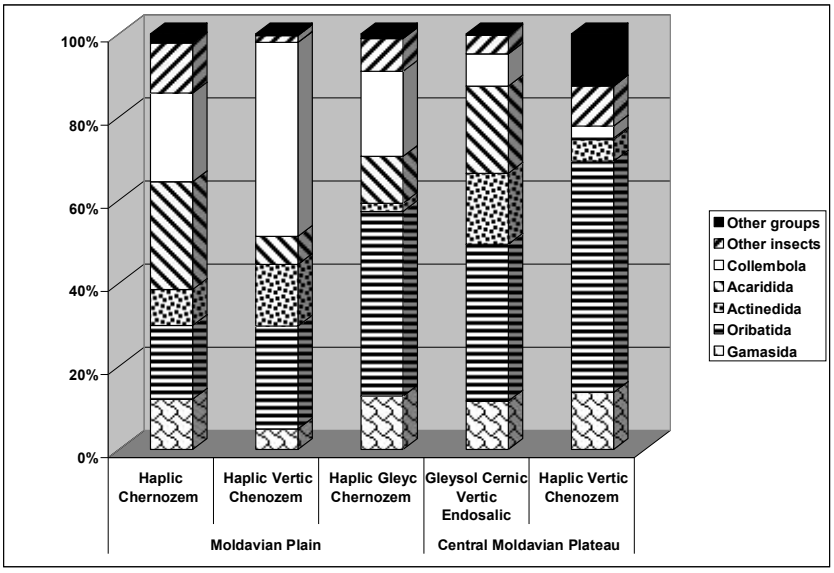


Figure 2 **Weight of the main edaphic microarthropods groups in pastures**

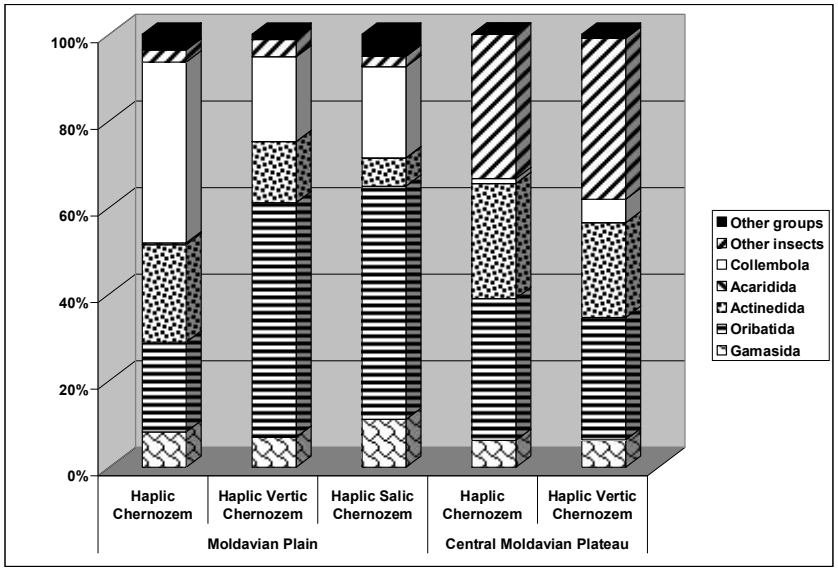


Figure 3 **Weight of the main edaphic microarthropods groups in hayfields**

Considering all these aspects we can appreciate that in pastures and hayfields on haplic chernozem, as well as in pastures on haplic vertic chernozem from the Moldavian Plain the mineralization predominates; in all these ecosystems the collembolans are much numerous, their populations being probably stimulated by the highest humidity. The rest of grassland ecosystems in the Moldavian Plain and all of them from the Central Moldavian Plateau are characterized by an efficient necromass bioconversion, the humification prevailing. An observation to be made is that related to situations in which the edaphic microarthropods have small

densities but oribatid/collembolans ratios are over unit like in the case of hay fields from Central Moldavian Plateau. Here, despite of smaller densities the humification prevails, as confirms previous researches indicating that a greater fertility is not the result of a numerical stimulation of the microarthropods, but an edaphic community with well balanced groups for a favourable conversion of the necromass (Huțu & colab., 1992).

A synphysiological view of total photoassimilatory pigments and leaf carbohydrates were carried out in relation with different type of soil from the two geographical units (*table 2*). On haplic chernozem, are distributed the hayfields and some pastures (Moldavian Plain) and it were obtained close values of ecophysiological parameters in hayfields but smaller in the pasture. The values of total content of photosynthetic pigments (PP) are comparable in natural reserve with hayfields growth on haplic vertic chernozem in Moldavian Plain with Central Moldavian Plateau (*table 2*). This small variation is due to an adaptation of similar conditions to irradiance and biotopes resources, all being coastal xerophilous grasslands. The plant community from natural reserve from Central Moldavian Plateau on haplic vertic chernozem and on regosol arenic skeletic registered the smallest values of soluble sugars (LSC) comparative with other grasslands from this area and also, with ones from Moldavian Plain.

In Moldavian Plain, pastures on haplic vertic chernozem has different level of moisture, and contribution of mesophilous vegetation besides xerophilous one (eroded and intensive grazed) lead to mean of total photosynthetic pigments smaller than in hayfields and reserves.

Table 2

**Variation of biological indicators in relation with type soil in different grasslands**

| Geographic region / Type of soil | | Moldavian Plain | | | Central Moldavian Plateau | | |
|---|---|---|---|---|---|---|---|
| | | natural reserves | pastures | hay fields | natural reserves | pastures | hay fields |
| **Haplic chernozem** | **Ā** | - | 213.0 | 178.9 | - | - | 35.4 |
| | **O/C** | - | 0.83 | 0.49 | - | - | 29.0 |
| | **PP** | - | 1.21 | 4.8 | - | - | 4.2 |
| | **LSC** | - | 8.03 | 11.3 | - | - | 13.09 |
| **Haplic vertic chernozem** | **Ā** | 242.8 | 377.7 | 164.9 | 167.2 | 255.8 | 63.0 |
| | **O/C** | 4.82 | 0.52 | 2.76 | 54.0 | 19.33 | 5.23 |
| | **PP** | 4.3 | 2.85 | 4.33 | 4.3 | 5.27 | 4.42 |
| | **LSC** | 13.6 | 12.23 | 11.5 | 10.7 | 13.46 | 14.9 |
| **Haplic gleyc chernozem** | **Ā** | - | 141.8 | - | - | - | - |
| | **O/C** | - | 2.17 | - | - | - | - |
| | **PP** | - | 1.8 | - | - | - | - |
| | **LSC** | - | 7.75 | - | - | - | - |
| **Haplic hyposalic chernozem** | **Ā** | - | - | 168.2 | - | - | - |
| | **O/C** | - | - | 2.55 | - | - | - |
| | **PP** | | | 1.47 | | - | - |
| | **LSC** | | | 3.08 | | - | - |
| **Gleyosol cernic vertic endosalic** | **Ā** | - | - | - | - | 178.2 | - |
| | **O/C** | - | - | - | - | 4.86 | - |
| | **PP** | - | - | - | - | 4.86 | - |
| | **LSC** | - | - | - | - | 18 | - |
| **Regosol arenic skeletic** | **Ā** | - | - | - | 60.8 | - | - |
| | **O/C** | - | - | - | 35.4 | - | - |
| | **PP** | - | - | - | 4.7 | - | - |
| | **LSC** | - | - | - | 8.8 | - | - |

**Legend**: O/C- oribatid mites/collembolans; Ā – global average density expressed as individuals/100cm$^2$, PP- Mean of photosynthetic pigments, LSC- Mean of leaf soluble carbohydrates.

## CONCLUSIONS

The most important fact in variation of biological indicators could be considered the biopedoclimatic conditions in each plot (type of soil, soil moisture, type of vegetation and anthropic impact etc).

The great majority of soil is represented by haplic vertic chernozem, this type being present in all categories of investigated grasslands and also, in the both geographic areas. In haplic vertic chernozem densities of microarthropods, generally are higher in pastures and smaller in hayfields in the two regions. From functional point of view, humification is predominant in all categories of grasslands and in both geographical

regions with exception of pastures from Moldavian Plain, where mineralization is predominant. In these pastures collembolans developed greater populations higher than oribatids.

The humidity factor strongly influences the photoassimilation in grasslands, as meso-xerophilous, meadow of lower terrace, even in the grazed ones, could have an intense photosynthetic activity. Soluble sugars have smaller values in pastures, in this case the leaf content of insoluble polysaccharides increased as an adaptation of overgrazed vegetation. In all hayfields developed on haplic chernozem photosynthetic pigments have close values, vegetations being xerophilous and meso-xerophilous. The content of soluble leaf carbohydrates in pasture of Moldavian Plain on this type of soil is smallest, mainly because of land use and anthropization degree. Both in Moldavian Plain and in Central Moldavian Plateau, the smallest densities of the edaphic mesofauna were observed in the case of hayfields.

Despite of overgrazing, the pastures especially, ones from the Central Moldavian Plateau, have the higher potential of regeneration due to a meso-and hygrophilous character and optimal ratio between systematic and trophic groups of mesofauna as indirect indicator of soil fertility. So, the most anthropized grasslands could be considered the hayfields from haplic chernozem in both studied geographic areas.

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## REFERENCES

**Acatrinei L.**, **2006** - *Ecophysiological studies at dominant species in some grassland ecosystems from Moldavian Plain*, Studii şi Comunicări, Anua. Ştiinţf. al Complx. Muz. de Ştiinţele Naturii „Ion Borcea" Bacău., vol.21:174-176.

**Acatrinei L.**, **2010** - *Ecophysiological peculiarities of some dominant species from natural reserves of community interest, Movila lui Burcel and Glodeni(Vaslui county),* Romania. Lucr. Ştiinţif: "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine Iaşi, vol. 53(2):31-35.

**Antohe A., Pisica-Donose A., Murariu A., 1991** - *Ecophysiological research in species of grassland from Calimani Massif(in Romanian)*. St şi Cercet de biologie, ser. Biol. Veget., 2, 43-47.

**Bireescu G., Ailincăi C., Răuş L., Bireescu L., 2010** - *Studding the Impacts of Technological Measures on the Biological Activity of Pluvial Eroded Soils.* In: P. Zdruli, M. Pagliai, S. Kapur, A. Faz Cano (Editors). Land Degradation and Desertification. Assessment, Mitigation and Remediation. Springer Dordrecht Heidelberg London New York, ISBN 978-90-481-8656-3; e-ISBN 978-90-481-8657-0; ISBN 978-90-481-8656-3; DOI 10.1007/978-90-481-8657-0; pp. 529-545.

**Bulimar F., Huţu M., Călugăr M., 1993** - *Mezofauna edafică indicatoare a stării funcţionale a solurilor forestiere*, St. cerc. biol, Seria biol. Anim., t 45, nr. 1, Bucureşti, p.93-97

**Călugăr A., 2005** – *Influenţa aridizării asupra microartropodelor edafice din ecosisteme praticole din lunca Prutului*, Lucr. celui de-al- X - lea Simpozion de Microbiologie şi Biotehnologie, Iaşi, 15-16 oct., Ed. Corson, p. 471-474.

**Călugăr A, 2006** - *Qualitative and quantitative studies on the edaphic microarthropods fauna in some grassland ecosystems from Moldavian Plain (Romania)*, Studii şi comunicări. Complexul Muzeal de Şt. Nat. „Ion Borcea" Bacău, vol 21: 230-231.

**Huţu M., Bulimar F., Donose-Pisică A., Davidescu G., 1992** - *Succesiunea microartropodelor edafice în cursul descompunerii unor resturi organice monospecifice,* St. cerc. biol, Seria biol. Anim., t 44, nr. 1, Bucureşti, p. 15-24

**Huţu M., Bulimar F., 1993** - *Cercetări asupra comunităţilor de microartropode edafice în etajul gorunului (Bârnova - Podişul Central Moldovenesc)*. St. cerc. biol, Seria biol. Anim., t 45, nr. 1, Bucureşti, p. 25-29.

**Ivan O., 2006 -** *Diversity and distribution of the oribatid mites (Acari, oribatida) in some lawn ecosystems from Moldavian Plain* Studii şi comunicări. Complexul Muzeal de Şt. Nat. „Ion Borcea" Bacău, vol 21: 236-243

**Ivan O., 2010** - *Fauna and structure of the oribatid communities (Acari, Oribatida) in some hayfield protected areas from Eastern Romania*, Scientific Annals of „Alexandru Ioan Cuza" University of Iasi. (New Series), Section 1. Animal Biology, LVI: 53-61

**Krantz G.W., 1978** - *A manual of Acarology*, second ed., Oregon State Univ., Book Stores Inc. Corvalis, 509 pp.

**Murariu, A**., **2003** - *Fiziologia plantelor din pajişti*. Ed. Junimea. Iaşi.

**Pižl V, Stary J., 2001 -** *The effects of mountain meadows management on soil fauna communities (on example of earthworms and oribatid mites)*, Silva Gabreta, vol. 7, Vimperk, 87-96

**Roşu A., 1980**- *Geografia fizică a României.* Ed Didactică şi pedagogică, Bucureşti.

**Wallwork J.A., 1970** - *Ecology of soil animals*. Mc Graw-Hill Publishing Company Limited, Maidenhead-Berkshire (England): 283 pp.

***** - World reference base for soil resources 2006** *A framework for international classification, correlation and communication* ftp://ftp.fao.org/docrep/fao/009/a0510e/a0510e00.pdf