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Differences in organic matter quality, chemical and microbiological characteristics of two Phaeozems under natural and anthropic influence

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Abstract

The soil degraded and changed by the anthropic activity must be monitored and the awareness of the intrinsic processes will allow a pertinent analysis of the effects of the application of the new technologies on the management and the sustainability of the soil.

Two natural and anthropic Phaeozems were analyzed from the point of view of chemical, microbiological characteristics, quality and composition of organic compounds.

Total values of microbial biomass and bacterial and fungal counts were generally twice higher in Calcaric Phaeozems than in Verti-Stagnic Phaeozems.

The content of humic precursors in Calcaric Phaeozems was quantitatively higher than that determined in Verti-stagnic Phaeozems, with a total content of phenols of 14.6mgGAExg^{-1}d.m., polysaccharides and proteins of 97mgxg^{-1}, respectivelly 16.6mgxl^{-1}.

The ascending chromatograms showed specific distribution and higher density of the organic compounds in the CAFT sub-fraction of the Verti-stagnic Phaeozems. Pfeiffer specific chromatograms revealed an enzyme activity much higher than average at the Verti-stagnic Phaeozems, with a well-characterized functional diversity. The nutritional reserve appeared increased but poorly diversified in the Calcaric Phaeozems. Humification processes are intense, colloidal substances are present, the mineral component is very well integrated in the organic material at the Verti-stagnic Phaeozems and complex protein content is well revealed especially in the Calcaric Phaeozems.

Capillary dynamolysis reflected a characteristic pattern of Phaeozems soils, with particularities for each soil type, represented by colors, contours and particular forms of the specific structures developed.

Both soils presented good conditions for sustaining vegetation either natural or cultivated but results indicated that anthropic intervention determined a more dynamic mineralization of organic matter. Further monitoring of soil organic matter dynamics is needed and adjusting management practices for conservation of biodiversity and global ecosystem protection against the effect of anthropic intervention.

Keywords: soil, microflora, biomass, organic matter, soil quality

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Introduction

The complex environmental conditions and the anthropogenic influence can determine the composition and distribution of the microbiota communities, allowing the identification of the relations between humic precursors, as well as obtaining important information about the microbial communities and the important physico-chemical parameters in the formation of humic substances (HS).

Holistic awareness of the importance of soil microflora, development and understanding of biological processes in the soil and of the influences induced by the changes in the soil environment can ensure a much more appropriate management and maintenance of the components of soil fertility that interact and depend on each other.

The structure and functions of the microbial communities, their predominant survival strategies determine the adaptation to the resources that are constantly changing. At the same time, these changes strongly influence the speed and direction of the stoichiometric displacements of the resources with effect on the quality of the edaphic microflora.

The anthropogenic influence on soil quality is profound, intense and can cause changes in the chemical, physical and biological properties.

Soil microorganisms are not only involved in the processes of decomposition of organic materials, but are the main factors in the biochemistry of soil organic matter, in its formation and stabilization. The organic matter is well correlated with the biological activity of the soil but also with the other indices of characterization of the health status of the soil. The increased microbial activity in the soil indicates a long-term capacity for carbon accumulation and the existence of the necessary conditions for a faster circuit of organic substances.

Soil organic matter (SOM) consists of labile and stable substances, and the content of stable humic substances, resulting in the degradation and recombination processes, influences the stability of the soil structure and its characteristics (1, 2).

HS are the most important products of organogenesis and the main source of influence on the environment. The organic matter is transformed through sequential biological processes, the humic precursors (PreHS) representing the main and extremely dynamic component of the organizing processes.

Recent studies have focused on the role of prehumic molecules with relatively low weight, given their contribution to the cation exchange capacity, of colloidal humus containing cationic nutrients, similar to clay (3).

Within the biosynthesis system, the production of precursors is not performed separately, the extended sources and the structures involved lead both to the production of various precursors for the formation of HS and to their interaction (4,5,6).

The production of PreHS in soil is closely related to the level of activity of edaphic biota, the degree of biotransformation of organic matter and their metabolic versatility (7, 8).

Thus, the processes of bioaccessibility, biostimulation and chelation of micronutrients in the rhizosphere, mediated by PreHS coud suffer from anthropogenic influences that are reflected on the control of plant mineral nutrition.

In the classification or description of soils, the qualitative characteristics of SOM are often simplified depending on the ratio of humic/fulvic acids or the absorption ratio of the alkaline extract at different wavelengths.

This paper provides information on two soils in natural structure and under anthropogenic influence, characterizes the two soils chemically and microbiologically, evaluates the content in humic precursors and the quality of the two Phaeozems.

Material and Methods

Soils characterization

The soils are of Phaeozems type, in WRB Calcaric Phaeozems and Verti-stagnic Phaeozems, belong to habitat 6210 from the site included in European network of protected areas Nature 2000 SCI Sighişoara-Târnava Mare, Mureş county, Romania. Calcaric Phaeozems, from Saschiz, GPS coordinates N 46.17495, E 024.96345, is weakly eroded, moderately clogged, at absolute altitude 492 m, 5% slope, E and NV exposure, semi-brittle, the parent material formed by disintegration materials, the underlying rock represented by silicate rocks, the depth of the groundwater >10 m, the bioclimatic zone of deciduous forests, the vegetation represented by vegetal crops instead of the forests of *Quercus petraea*, is used as arable land, humidity regime-humid, mesic temperature, a pedo-landscape for Luvosols.

Verti-stagnic Phaeozems, from Saschiz, GPS coordinates N 46.19345, E 024.00928, absolute altitude 654 m, slope, exposure, parental material, underlying rock, groundwater depth and bioclimatic area are similar to the Calcaric Phaeozems, the natural vegetation is represented by meadows with mesophilic associations of *Agrostis tenuis, Festuca rubra*, mesohygrophilic and hygrophilic of *Nardus stricta, Deschampsia caespitosa, Festuca pratensis*, it is used as a pasture, and the characteristics regarding the humidity, temperature and pedo-landscape regime are similar to the Calcaric Phaeozems.

The chemical analyzes performed for Phaeozems-type soils were: pH in aqueous suspension, humus by wet oxidation, total nitrogen (Nt) by Kjeldahl method, potentiometric nitric nitrogen ($N-NO_3$), extractable phosphorus (P_{AL}) and potassium extractable (K_{AL}) in ammonium acetate-lactate and total content of soluble salts (SS) in aqueous extract (9).

Microbiological analyzes carried out aimed at quantitative determinations of heterotrophic bacteria, using the method of dilutions with suspensions of natural and anthropic soils dispersed on the Topping culture medium, as well as quantitative determinations of microscopic fungi, by the same method, on the Czapek culture medium (10). Petri dishes with growth media were incubated at 25°C and counted the colonies developed to calculate the density of microorganisms. The number of colonies resulting from the dispersion, as well as soil moisture was taken into account. The results were related to 1g dry soil.

Microbial biomass determinations were performed by the substrate - induced respiration method (SIR) (11).

Taxonomic identifications were made on the basis of cultural, morphological and/or physiological characteristics, according to the specific determinative manuals for bacteria (12) and fungi (13, 14).

The phenol content in soil was determined by the oxidation of phenols with the Folin-Ciocalteu reagent and the formation of a colored product whose absorbance was measured spectrophotometrically at 750nm. Organic extracts were obtained from the combination of soil with solvents, acetone-methanol-water in equivalent ratio, centrifuged and analyzed according to the methodology for the content in phenolic compounds (15). Its concentration was calculated according to the calibrated curve for the standard phenolic compound (gallic acid) and the phenolic content of the soil extracts was expressed in mg GAE/g, equivalent gallic acid.

The polysaccharide content in the two soils was determined by the Lowe method (16). The soil samples were dried at room temperature and homogenized, weighed in Erlenmayer flasks and treated with H_2SO_4 (in three replicates). The absorbance reading was performed spectrophotometrically at 490nm.

The protein content in the analyzed soils was achieved by the Bradford method (17). The absorbance reading was performed spectrophotometrically at 595nm.

The organic carbon of the two Phaeozem-type soils was fractionated according to the Kononova-Belcikova method (18). The total fulvic acid carbon fraction (CAFT) was used to perform ascending chromatograms.

Pfeiffer specific chromatograms allowed obtaining information regarding the biological quality of natural and anthropic soils through analytical separations and the formation of images whose pattern of uniformity, shape, size, color, texture indicates soil quality, vitality, fertility, intensity of biotic activity, conditions from the soil and the degree of complexity of the organic matter.

Capillary dynamolysis was used to highlight the qualitative differences between natural and anthropic soils and evaluated by the capillary ascending imaging method, also called capillary dynamolysis, according to the method described by Zalecka (19). A standard measured quantity of aqueous soil extract is distributed in a Kaehlin vessel, migrates vertically on Whatman paper, treated with metal salts, dried and analyzed for the development of specific images. The obtained images were scanned and analyzed the developed structures using the criteria described in the same methodology (19).

Statistical analysis All experiments were repeated three times. The data collected have been statistically processed and interpreted by one-way analysis of variance (ANOVA). Values represent the mean of three replicates ± standard deviation.

Results

The morphological characterization of the poorly eroded Calcaric Phaeozems was done for the Ap and Atp horizons, up to a depth of 0-30cm, thus, the Ap horizon 0-15cm has a lute-clay texture, very dark gray (10YR 3/1) in moist, gray-brown (10YR 5/2) in the dry state, structure destroyed, wet, friable in the wet state, hard in the dry state, moderately plastic, moderately adhesive, softened, small frequent pores, thick roots, thick coprolites, strong effervescence, gradual passage; and the adjacent Atp 15-30cm horizon has a clay-clay texture, very dark brown (10YR 3/2) in wet state, dark gray (10YR 4/1) in dry state, large, well-developed, reap, friable polyhedral structure in wet, hard in dry state, moderately plastic, moderately adhesive, moderately compact, low frequency pores, rare roots, rare coprolites, strong effervescence, clear passage (**Fig. 1a**).

The morphological characterization of the Verti-stagnic Phaeozems was done for the At and Am horizons, on the depth 0-20cm, so the At 0-5cm horizon has a clay-clay texture, very dark brown (10YR 2/2) in moist, very dark gray brown (10YR 3/2) in dry state, small grained structure, well developed, dry, hard in wet state, very hard in dry state, moderately plastic, poorly adhesive, moderately compact, root felt, frequent coprolites, gradual passage, and the horizon Am 5-20cm has a clay texture, black (10YR 2/1) in the wet state, very dark gray (10YR 3/1) in the dry state, large grained well-developed structure, dry, friable structure in the wet state, hard in the dry state, moderately plastic, moderately adhesive, cracks> 1cm, moderately compact, frequent thin roots, gradual passage (**Fig. 1b**).

The reaction of Phaeozems-type soils varied greatly, from pH 6.10 - moderately acidic recorded in the profile of Verti-stagnic Phaeozems, to 8.39 - weak alkaline recorded in the profile of Calcaric Phaeozems. Generally, the values of soil reaction under permanent grassland were between 4.40-6.00 (20, 21). Agrochemical samples collected from the profiles had high organic matter content (humus), frequently encountered in the mountain soils of meadows and pastures, well humified, an aspect reflected in the values of the C/N reports (between 4.5 and 31.4), except for the surface horizon at the Calcaric Phaeozems where there were present low humified organic residues from animal manure, which explains the high values of the nitric nitrogen content ($N\text{-}NO_3$). The total nitrogen content is normal for the pasture/meadow soils and it balances the organic matter well. Mobile phosphorus had a very low content. Mobile potassium was in large and very large quantities in both soils.

The soil samples analyzed are unsalinized, have total content of soluble salts below the limit value from which the low salinization of the soil begins (**Table 1**).

By quantitative determinations in Calcaric Phaeozems was estimated a bacterial microflora loading of 38.99 x 10^6 viable

Figure 1. Calcaric Phaeozems (a) and Verti-stagnic Phaeozems (b).

Table 1. Agrochemical characteristics of soils

No crt	Soil type	Depth cm	pH pH units	Humus %	Nt %	$N\text{-}NO_3$ [1)] mgxkg^{-1}	P_{AL} [2)] mgx/kg^{-1}	K_{AL} mgxkg^{-1}	SS mgx100 $^{g-1}$
1	Calcaric Phaeozems	0-20	8.08±0.27	4.56±0.32	0.209±0.1	60±4.20	15±0.32	356±9.1	47±3.1
2	Verti-stagnic Phaeozems	0-10	6.24±0.23	11.76±0.96	0.562±0.1	7±0.64	1±0.17	171±6.3	16±1.7
		10-20	6.25±0.23	10.56±0.98	0.505±0.1	11±0.67	1±0.18	117±3.4	14±0.9

[1)] values recalculated for dry soil at 105°C

[2)] values recalculated based on soil pH

Table 2. Quantitative analysis of fungi, bacteria and microbial biomass

No. sample	Soil type	Bacterial microflora (x10^6 viable cells xg^{-1} d.s.)	Fungal microflora (x10^3 cfuxg^{-1} d.s.)	Microbial biomass (mgCxkg^{-1} d.s.)
1	Calcaric Phaeozems	38.992±1.7	178.879±4.1	498±5.5
2	Verti-stagnic Phaeozems	19.890±1.2	93.231±3.8	210±4.3

Table 3. Qualitative analysis of fungal and bacterial microflora

No.	Soil type	Fungal microflora	Bacterial microflora
1	**Calcaric Phaeozems**	*Trichoderma viride* *Fusarium oxysporum* *Alternaria alternata* *Cladosporium cladosporioides*	*Bacillus cereus var. mycoides* *Pseudomonas fluorescens* *Bacillus megaterium* *Bacillus* sp. *Bacillus circulans* *Arthrobacter globiformis* Actinomycetes Series Albus Actinomycetes Series Fuscus Actinomycetes Series Ruber
2	**Verti-stagnic Phaeozems**	*Aspergillus ustus* *Aspergillus wentii* *Acremonium strictum* *Verticillium leccani* *Mortierella sp.* *Cladosporium herbarum* *Stachybotrys chartarum* *Mycelia of Dematiacee*	*Bacillus cereus var. mycoides* *Bacillus cereus* *Pseudomonas fluorescens* *Pseudomonas* sp. Actinomycetes Series Fuscus

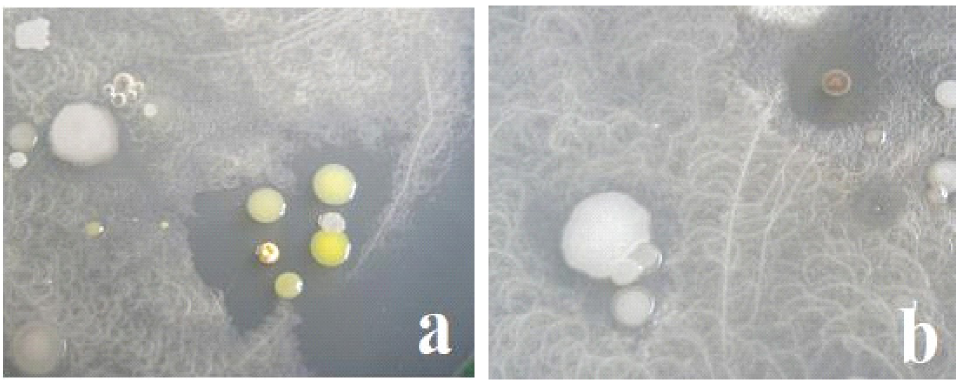

Figure 2. Bacterial microflora a) Calcaric Phaeozems and b) Verti-stagnic Phaeozems.

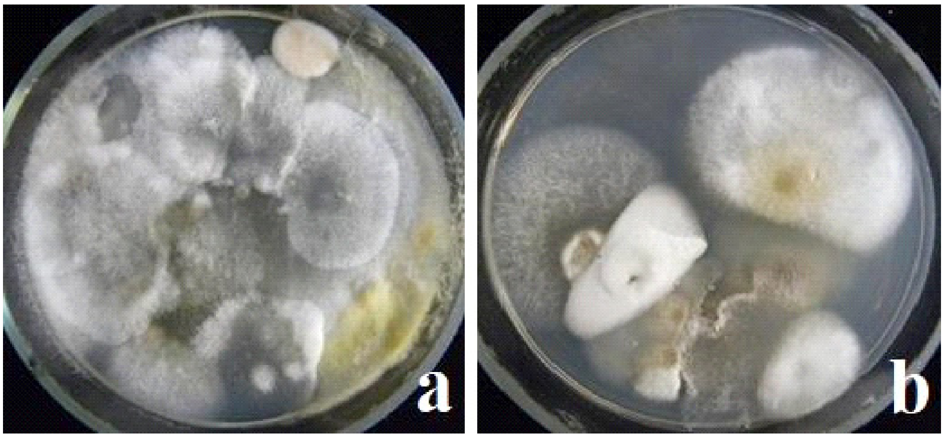

Figure 3. Fungal microflora a) Calcaric Phaeozems and b) Verti-stagnic Phaeozems.

cellsxg^{-1} d.s, with a fungal microflora 178.87x10^{3} cfuxg^{-1} d.s and a microbial biomass of 498 mgC x kg^{-1}.

In the case of Verti-stagnic Phaeozems was estimated the total counts of bacterial microflora of 19.89 x 10^{6} viable cellsxg^{-1} d.s. and of fungal microflora of 93.23x10^{3} cfuxg^{-1} d.s. with a microbial biomass of 210mgC x kg^{-1} (**Table 2**).

Soil microflora is an integral part of soil organic matter. Different microorganisms were isolated and identified from soil samples collected (**Table 3 and Fig. 2**).

Thus, most of the bacteria in the Calcaric Phaeozems have been reported as belonging to the species *Bacillus cereus var. mycoides, Pseudomonas fluorescens, Bacillus megaterium, Bacillus* sp., *Bacillus circulans, Arthrobacter globiformis* and Actinomycetes from the Albus, Fuscus and Ruber series.

In Verti-stagnic Phaeozems, the most abundant bacterial microflora belonged to the species *Bacillus cereus var. mycoides, Bacillus cereus, Pseudomonas fluorescens, Pseudomonas* sp. and Actinomycetes from the Fuscus Series.

Most of the fungi identified belong to the species *Trichoderma viride, Fusarium oxysporum, Alternaria alternata, Cladosporium cladosporioides* in Calcaric Phaeozems and to species *Aspergillus ustus, Aspergillus wentii, Acremonium strictum, Verticillium leccani, Mortierella* sp. *Cladosporium herbarum, Stachybotrys chartarum* and mycelia of Dematiaceae in Verti-stagnic Phaeozems (**Fig. 3**).

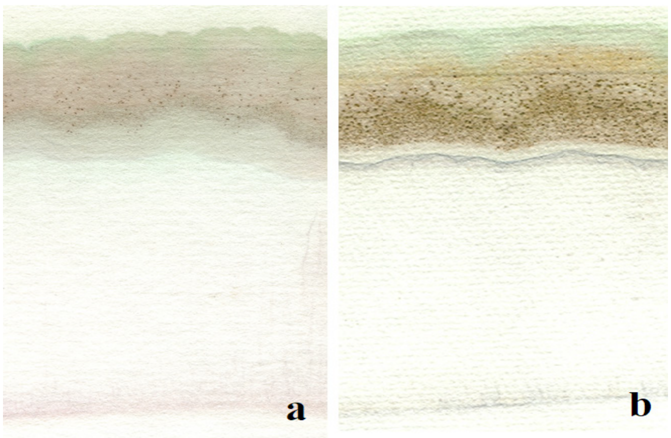

Figure 4. CAFT sub-fraction a) Calcaric Phaeozems b) Verti-stagnic Phaeozems.

The content of humic precursors in Calcaric Phaeozems was quantitatively higher than that determined in Verti-stagnic Phaeozems. Thus, the total content of phenolic compounds determined in Calcaric Phaeozems was 14.6 mg GAExg^{-1} d.m. and 9.7 mg GAExg^{-1} d.m. in Verti-stagnic Phaeozems.

The content of polysaccharides and proteins in Calcaric Phaeozems was higher than that determined in Verti-stagnant Phaeozems. Thus, the content of polysaccharides in Calcaric Phaeozems was 97mgxg^{-1} compared with 83mgxg^{-1} in Verti-stagnic Phaeozems and the protein content was 16.6mgxl^{-1} and 12.7mgxl^{-1}, respectively. These compounds, in the analyzed soils, can participate in the release of nutrients (through degradation of organic matter), they can be considered sensitive indicators of ecological changes and destruction.

The total fulvic acid carbon fraction (CAFT) was used to perform ascending chromatograms from Calcaric Phaeozems and Verti-stagnic Phaeozems.

The samples from the two analyzed soils were divided into several sub-samples and after extraction in solutions, mixed with sodium pyrophosphate, considered the best for the extraction of humic fractions; the sub-fractions of total extractable carbon (CET) were separated, total carbon in humic acids (CAHT) and after the first wash, total carbon in fulvic acids (CAFT).

The ascending chromatogram showed the specific distribution and densities of the organic compounds in the CAFT sub-fraction of the two soil types (**Fig. 4**).

The analysis of soil chromatograms reveals an enzyme activity that is much higher than average at the Verti-stagnic Phaeozems, with a well-characterized functional diversity. The nutritional reserve with the highest level and with the highest degree of diversification appears in the same sample.

The increased but poorly diversified nutritional reserve appears in the Calcaric Phaeozems.

Humification processes are intense, colloidal substances are present and the mineral component very well integrated in the organic material at the Verti-stagnic Phaeozems.

The well-structured, complex protein content is well emphasized especially in the Calcaric Phaeozems.

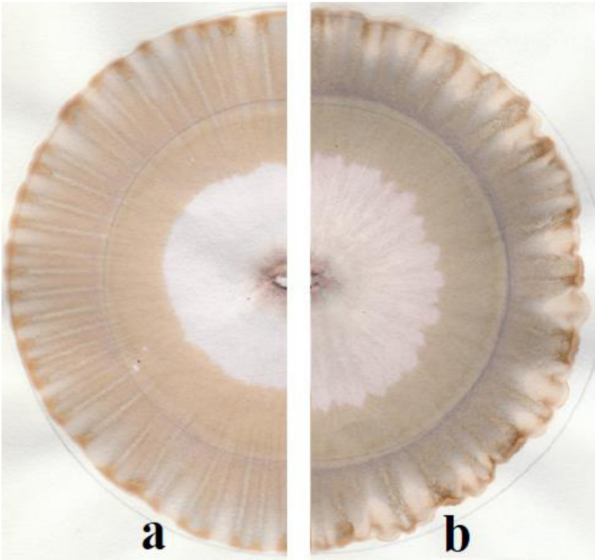

Figure 5. Pfeiffer specific chromatograms a) Calcaric Phaeozems and b) Verti-stagnic Phaeozems.

In general, there is a good connection between the components, with aggregates in the solution, an accentuated mineralization and a high content of salts accessible at the Verti-stagnic Phaeozems (**Fig. 5**).

The rising pictures of soil extracts from Calcaric and Verti-stagnic Phaeozems presented a general allure with differences in color pattern, structural elements from base, bowl and especially flag zone (**Fig. 6**).

The general color of the picture was lighter for Calcaric Phaeozems and darker, grey with rose tint for Verti-stagnic Phaeozems.

The base zone layers are relatively similar as number and color, excepting the corona, which is diffuse and low represented in Calcaric Phaeozems and irregular with bowl zone open and more frayed in Verti-stagnic Phaeozems.

Flag zone is lighter in color, with shorter concave flags starting from the half of the zone, well contoured with thin, grey, almost parallel margins and ending diffuse at a distance of the superior margin.

Flag zone of Verti-stagnic Phaeozems presents concave structures, similar in form but they start from basal third and are less contoured. They end also diffuse and at a distance of apical zone, where rare parallel pipes narrowed towards the apex appear, doubled by the second rose-grey layer as seen in the picture of the Calcaric Phaeozems but more diffuse.

The drop zone is thin in the rising picture of Calcaric Phaeozems, light brown, linear and with white deposits following the contour lines. The drop zone in rising picture of Verti-stagnic Phaeozems is light brown, thicker, sinuous, with middle-length drops (reduction spots), generally single, but sometimes very closed or in pair towards the apical light-colored layer of the flag zone.

Discussions

The bacterial microflora of Calcaric Phaeozems is increased due to its role in the degradation of organic matter, nitrogen fixation, nitrification, etc. In cultivated soil, many recalcitrant substances arrive and induce the growth of effectives, especially actinomycetes, to increase the biodegradative capacities. Also, through the quantitative growths of the bacterial microflora, large quantities of nitrogen are provided to the plants, an element that is often in small quantities in the soil. Many of the edaphic bacteria secrete enzymes for phosphorus solubilization and increase its availability for plants.

As the soil is less disturbed and the diversity of the plants increases, as observed in natural pasture from Verti-Stagnic Phaeozems, the nutrient supply of the soil becomes more balanced and diverse, which makes the micronutrients of the soil more available in a suitable environment for different plant species. The growth of the microbial populations sustains increase of the biodiversity that improve the level of recycling of the nutrients and the control of the pathogenic organisms in the soil.

The increased microbial biomass in the Calcaric Phaeozems reflects the level of transformation of the entire natural organic material in the soil and acts, at its level, as a labile reservoir of nutrients available for plants, but may also be a significant parameter of appreciation of soil health. For the functioning

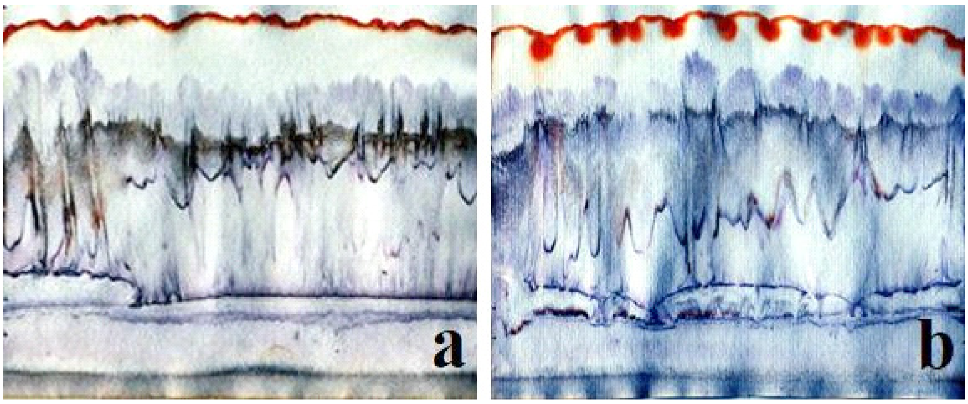

Figure 6. Capillary dynamolysis a) Calcaric Phaeozems and b) Verti-stagnic Phaeozems.

of the ecosystem in Phaeozems, the synthesis/dynamics of microbial biomass and its role in plant nutrition are of particular importance for interpreting the role in determining soil type, in particular, under different conditions of its exploitation, as carbon (C) and nitrogen (N) are the elements mainly involved when discussing microbial biomass. Similar research on other types of soil (grey brown podzolic soil and brown podzolic soil) confirmed connection between the organic carbon and nitrogen content and total phenolic compounds accumulation, differences between the soil types investigated and the source of organic matter or fertilizers input accessible to microbial transformation (15). Authors reported higher total phenolics level and percentage of water - soluble phenols (29.1%) in brown podzolic soil than in grey brown podzolic soil (18.44%).

The content of labile organic matter can be considered as a quantitative parameter, as well as the soil respiration, for the level of the biological activity of the soil (11).

Specific soil conditions and anthropogenic influence can determine the composition and distribution of microbiota communities. Also, by identifying the PreHS and the relationships between them in communities and with known physico-chemical parameters, one can determine the conditions regarding the formation mode and the specific composition of the HS.

There are many results in the literature similar with our results concluding that HS are the most important products of organogenesis and the main source of influence on the environment (22, 23, 24). The organic matter is transformed through sequential biological processes, the PreHS representing the main and extremely dynamic component of the organizing processes. The degradation of the organic matter in the soil leads to the formation of a large variety of simple organic components (polyphenols, amino acids, polypeptides, polysaccharides) that can be used by microorganisms to form HS.

Our previous research evidences that edaphic microorganisms are significant sources of biosynthesis of stable extracellular compounds (secondary metabolites), with structure similar to HS (6) belonging to the aromatic groups (quinones, flavins, anthraquinones, naphthoquinones).

The effect of PreHS with phenolic content on soil organic matter has been studied indirectly through extracellular enzymatic activity and respiration. The increase of the phenol content in soils influences the mineralization rate and the extracellular microbial enzymatic activity, more dependent on the source and composition of the phenols, than on the quantities of phenolic compounds (25, 26).

Also, the content of phenols determines the decrease of CO_2 production in disturbed conditions, the formation of covalent bonds with proteins, the increase of nitrogen limits for microorganisms, the oxidation of other phenolic compounds, formation of humus and phenol-enzyme complexes. Small-molecule prehumic phenolic compounds are a labile substrate through which they can promote microbial biomass increases observed in Calcaric Phaeozems or increase cellulase production, with implications on reducing organic matter content in soil, as reported in other similar research (27).

The activity level of the extracellular compounds analyzed in the two soils can influence its biological conversion capacity, as their presence and quantity are considered important components in the models of decomposition of organic matter (28, 29). Also, their activity is associated with the presence of organic or inorganic colloids, the formation of organo-protease complexes with role in determining biochemically active organic fractions in soil fertility. Other authors confirmed the importance of assessing the role of microbial activities and their correlation with phenolics following nutrient dynamics change in soil caused by climatic changes for slowing down decomposition processes and adapting the management of methods applied for carbon sequestration in terrestrial ecosystems (30).

In our present study, both soils from the network of protected area Nature 2000 present good conditions for sustaining vegetation either natural (from Verti-Stagnic Phaeozems) or cultivated (from Calcaric Phaeozems), but slowly higher level of compounds such as proteins and polysaccharides than in natural pasture ecosystem indicate that anthropic intervention, by using previous forest soil as actual arable land, determines a more dynamic microbial mineralization and transformation of stable organic matter. Further monitoring of soil organic matter content, dynamics and structure is needed for adjusting management practices, aiming the conservation of biodiversity and global ecosystem protection against climatic changes caused by anthropic intervention.

Conclusion

Total values of microbial biomass and bacterial and fungal counts were generally twice higher in Calcaric Phaeozems than in Verti-Stagnic Phaeozems.

Verti-stagnic Phaeozems showed, in compare with Calcaric Phaeozems, different chemical characteristics represented by high organic matter content well humified, low nitric nitrogen content (N-NO_3), normal total nitrogen, low mobile phosphorus, high mobile potassium, a very high cation exchange capacity and a higher sum of bases.

The density of CAFT sub-fraction of Verti-stagnic Phaeozems, in ascending chromatograms, was higher than similar CAFT sub-fraction from Calcaric Phaeozems.

Specific chromatograms revealed an enzyme activity much higher than average in Verti-stagnic Phaeozems, with a well-characterized functional diversity, with a higher level of nutritional reserve than in Calcaric Phaeozems, intense humification processes, with a presence of colloidal substances and mineral components very well integrated in the organic material.

The rising pictures obtained by capillary dynamolysis evidenced a characteristic pattern of Phaeozems soils, but with particularities represented by colors, contours and in particular forms of the specific structures developed in the basal and the flags areas and deposition or reduction spots in apical borders, different to the Calcaric Phaeozems from the Verti-stagnic one.

Results indicated that anthropic intervention determined a more dynamic microbial mineralization of organic matter.

Further monitoring of SOM dynamics is needed and adjusting management practices for conservation of biodiversity and global ecosystem protection against the effect of anthropic intervention.

Aknowledgment

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Conflict of Interest

The authors declare that they have no conflicts of interest.

Ethical Compliance

This article does not contain any studies involving human participants or animals performed by any of the authors.

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