SOME CONSIDERATION CONCERN TO THE SOIL HETEROGENITY AND PHYTODIVERSITY FROM GHETARI PLATEAU

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Abstract

In the study area of Gheári Plateau, from the Apuseni Mountains, were undertaken studies on the dominant plants species and on some characteristics of the dominant soil. The study of soil cover showed the existence of several types of soil such as: Eutricambosols, Districambosols, Luvisols, Regosols, Rendzina and Litosols. An interesting aspect is that on these soils have found a great biodiversity especially great phytodiversity.

In the study area were highlighted more than 350 species of plants belonging to groups with different ecological requirements. Such plants have been identified to prefer slightly alkaline or neutral soils and those that grow on acid soils. Some characteristic of dominant soils, such as red soils, presented in the paper could explain presence of the group's plants with different ecological requirements.

Keywords: grassland, biodiversity, red soils, limestone, Apuseni Mountains.

INTRODUCTION

Even if Romania's area is only238 391 square km area but due to the reliefs, hydrology, climate and vegetation characteristics there are most global soils. It is well known that in the mountain region the soil cover has high heterogeneity. The soil properties are influenced by a multitude of factors such as parent rock, relief, climate and vegetation. There some soils such as Rendzinas, Terra rossa, Rhodic soils in which profile character was mainly determined by the nature of the parent material. These soils were considered by Glinka to be typical endodynamomorphic soils (TESU, 1974). Frequently, the mentioned soil, are developed on the calcium carbonate rocks. The soil developed on the lime rocks have been included in the intrazonal soil group. This group of soils is justified by the fact that identifying soil characteristics reflects the influence of local factors such as parent material, absolute soil age and relief.

Our studies have confirmed numerous bibliographic references where it is mentioned that the soils formed on limestone have some common characteristics, even if they have developed in different areas of climate and vegetation.

Thus the red soils formed on limestone have been identified in mountain and plateau areas such as Mehedinti Plateau, Apuseni Mountains and only localy in the Orientali Mountains Obcina. The Apuseni belongs to the Western Romanian Carpathians, also called Occidentali Mountains in Romania. Their name translates from Romanian as Mountains of the sunset (i.e. western). These mountains are part of the Alpine-*Carpathian Mountain* belt and were formed in Cretaceous times. There are sharp geological contrasts with crystalline schists, limestones and volcanic rocks all very prominent; generating biodiversity and pedodiversity. On the residues resulted after limestone dissolving some rhodic-chromic soils are developed. These soils are found in the *Apuseni Mountain*s with annual average temperatures even 5°C and with rainfall exceeding 1000 mm. Red soils are common in area of Mediterranean climate and form a discontinuous and shallow cover on hard carbonate rock.

In the area with temperate climate, red soil (known as terra rossa) are considered relict soils, formed under warmer *paleoclimates* (TORRENT *et al.*, 1983; SWERTMAN, 1988; BOERO, 1992; POPOVAT, 1970). FLOREA *et al.* (1968), considers that the red soils from Romania, also known as the *Terrra Rosa*, are relict soils, current climatic conditions allow only maintaining these soils. The survey conducted by PARICHI *et al.* (2004) in the Apuseni Mountains releaved that rhodi-eutric cambisols could also develop in some particular existing condition of temperate region. Our investigation confirms that red soils are developed in temperate region, even in the current phase. An interesting aspect is that on these soils have found a great biodiversity especially great phytodiversity.

In the study area were highlighted more than 358 species of plants belonging to groups with different ecological requirements. Such plants have been identified so prefer slightly alkaline or neutral soils and those that grow on acid soils. In this paper we try to identify the causes of great floristic composition of grassland

MATERIAL AND METHOD

Our investigation was carried out since 2013 in the Ghetari Plateau area from Apuseni *Mountains* renowned for great biodiversity of grassland. In order to highlight some soil characteristics and soil capabilities for grassland were used traditional research of soil survey. The soil units were corrected and completed with new obtained data, in the field and laboratory.

It was necessary the equivalence of taxonomic units

name, from the Romanian System of Soil Classification (CONEA *et al.*, 1980) and the Romanian Systems of Soil Taxonomy published 2003, 2012 and 2014 (FLOREA and MUNTEANU, 2003, 2012; VLAD *et al.*, 2014).The specific local particularities is reflected by great biodiversity of grassland. Disturbed samples from the soil profiles were used to determine the pH values and size particles. The chemical analyses in three replicates for each depth were independently performed (STOICA *et al.*, 1986, DUMITRU *et al.*, 2009). The particle size distribution was also determined. The textural classes and subclases were established after Romanian clasification system (Soil Survey Methology, 1987).

RESULTS AND DISCUSSIONS

` In the studied area predominate red soils, known under as *Terra rossa* in the "Romanian Soil Classification System"(RSCS-1980; CONEA *et al.*, 1980). In the new updated version of Romanian System of Soil Taxonomy (FLOREA *et al*., 2003, 2012) the red soils are defined as rodic soil subtypes of *Eutricambosols, Preluvosols* and *Luvosols*. In the International soil classification system World reference base of soil resources 2014 the red soils are defined by the term of rhodic, notion which represents principal qualifers of *Nitisols, Ferralsols, Lixisols, Alisols, Luvisols, Cambisols, Arenosols* or supplementary qualifers of *Stagnosols, Phaeozems,Umbrisols, Calcisols* and *Acrisols*. The association of rhodic terms as principal or supplementary qualifers of of a multitude of soil groups highlights the very different conditions of climate, relief and vegetation under the influence of which formed.

Our investigation revealed that moist soil with color redder than 5YR is present in other soil types than those mentioned in Romanian System of Soil Taxonomy. Since Romania red soils are formed under certain conditions local relief and lithology in the following lines we present a brief description of the natural environment of the study area. The soil parent material is represented by the insoluble residues resulted after dissolving of limestone. We mention that a multitude of bibliographic references mentions residual theory of red soils formation, especially in the temperate climate zones. Consequently, the impact of climate on the development of red soils, such is *Terra rossa* is not significant.

Its genesis is significantly influenced by the minerals of the insoluble residue. It can be said that red soils from Romania belongs to the lithomorphic soils group.

Mineralogical analyzes confirms the similarities between the chemical and mineralogical composition of soil with with color redder than 5YR and the insoluble residue. BRONGER (1983) considers that the red soils from temperate climates zone have been considered *relict soils.*

BOERO and SCHWERTMANN (1989) revealed decisive role of limestone in determining the specific pedoclimate characteristics under which the hematite can form. The high internal drainage of the limestone generates a xeric environment and favors hematite formation and therefore the process of rubification. Our studies confirms that red soils could form in temperate climate conditions on the certain limestone such as black Triassic limestone. Interesting is great color contrast between white color of surface rock fragments (due reprecipitation calcium carbonate like montmilch of cave), bluish black color of the skelet section and red soils formed from these rocks (Fig.1).

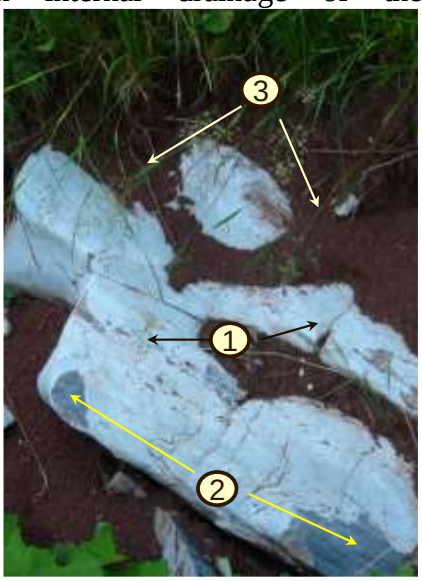

Fig. 1. The contrast of color between surface of coarse fragment (1), cross section of skeleton (2) and soil (3)

Fig. 2. The red color of the surface of the fine cracks of limestone rocks from the red soil

In some fissures of the limestone fragments is present hematite - the main constituent of the insoluble residue (Fig. 2).

The hematite present in the recent cracks of limestone justifies the hypothesis that the red soils can form even in the current climate of temperate zone. After dissolution of limestone resulted superficial karst and deep karst. On the exposed surfaces were developed lapiez

(runnels, clints and grikes), sinkholes (closed endorheic basins). The diameter of sinkholes or dolines varies from few meters to tens meters. The depth of these landforms is up to 15-20 m (Fig. 3). The complex underground drainage, extensive caves and cavern systems prevents water stagnation and excessive soil moistening. Plant associations of sinkholes confirm good internal drainage (Fig. 3).

Fig. 3. Plant associations of sinkholes confirm good underground drainage

The average annual temperature is estimated at 4°C. Frequently, the average annual precipitation exceeding 1000 mm. Large amounts of precipitation, evapotranspiration, short vegetation season (6-7 months) associated with plant species in grasslands confirms the existence of a complex underground drainage system. The dominant species of forest vegetation are represented by *Picea abies Abies alba, Fagus sylvatica* and *Acer pseudoplatanus*. The dominant specie of pastures is *Festuca rubra*. On the studied area. The 348 plant species identified in the study area reflect biodiversity and complexity of soil cover. The study of soil cover showed the existence of several types of soil such as: Eutricambosols, Districambosols, Luvisols (Fig. 4), Regosols, Rendzina and Litosols.

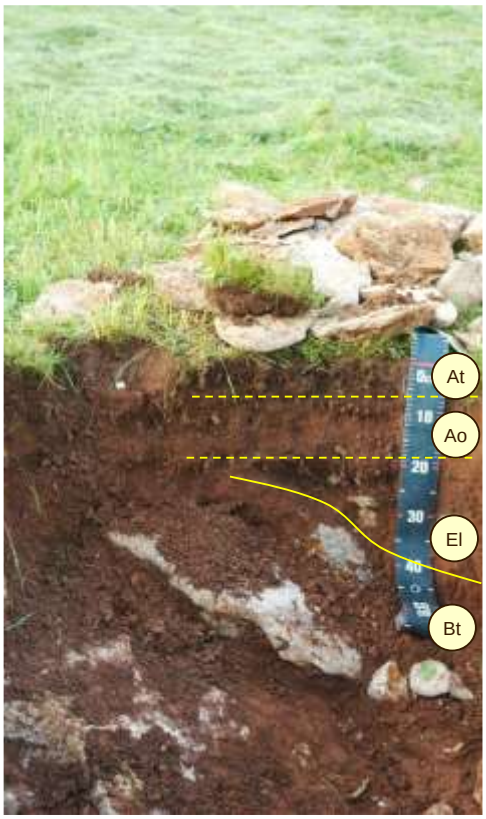

Fig. 4. Rhodic luvisol

Rhodic Luvosols (Fig. 4) and Rhodic Eutricambosol are representative soils of studied area.

Rhodic Luvosols have a medium texture in the upper part of soil profile and fine texture in bottom part of soil. The content of clay (diameter<0,002mm) falls in the range between 33,3 and 45,7% limits (Tab.1). The maximum content of clay. Maximum clay content recorded on the bottom horizon of profile suggests that migration processes clay have contributed to soil genesis.

The soil is moderately acid, the pH values range from 5.1 to 5.7. The pH values of soil near coarse fragment of limestone is 6.5-7.3. The volume of fine earth of studied soils is middle, small and very small (Fig. 5).

Table 1

The size particle and pH values of Rhodic Luvosols

Depth (cm)	Soil horizon	The content (%) of particle size fraction:			pH
		Sand	Silt	Clay	
0÷5	At	35,2	31,5	33,3	5,4

5÷19	Ao	34,9	29,7	35,4	5,3
19÷25(43)	El	39	28.3	32,7	5,1
25(43)-32 (50)	Bt	27,9	26,4	45,7	5,6

At organic horizon; Ao ocric horizon; El eluvial horizon; Bt-illuvial horizon

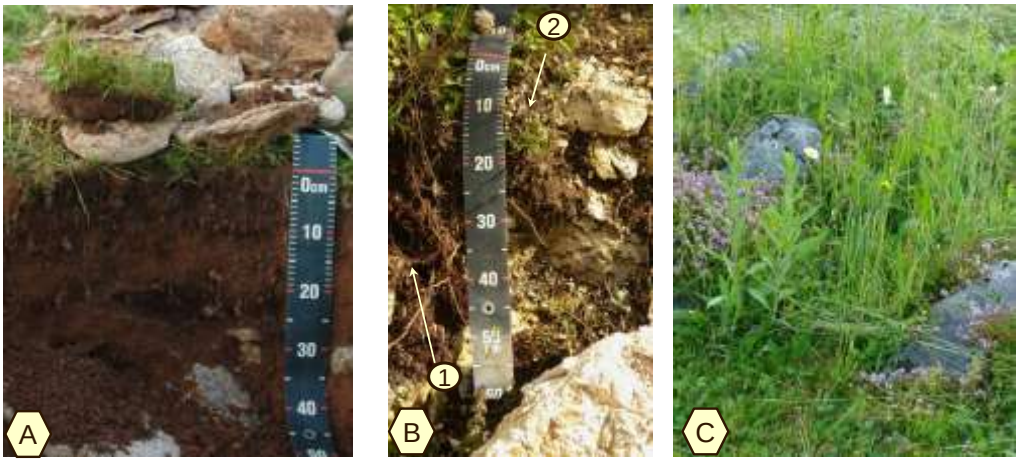

Fig. 5. The edaphic useful volume of dominant soils
(A & 1B -miidle; 2 B –low; C-very low)

On the Ghetari Plateau was noticeable high biodiversity (phytodiversity). On the rendzic leptosols, *Festuca rubra* is associated with *Lathyrus pratensis, Trifolium pratense, Lotus corniculatus, Anthyllis vulneraria.* On the rhodic/chromic eutricambisols *Agrostis capillaris* became codominant. In the area with rhodic/chromic luvisol *Lotus corniculatus* is frequent.

CONCLUSIONS

The land from Ghetari Plateau has good suitability for grassland due to local particularities such as good drainage, ensured by endocarst relief. The soil parent material is represented by the insoluble residues resulted after dissolving of limestone. The complex underground drainage, extensive caves and cavern systems prevents water stagnation and excessive soil moistening. The study of soil cover showed the presence of Eutricambosols, Districambosols, Luvisols, Regosols, Rendzina and Litosols.

The middle, small and very small volume of fine earth of studied soils anh high amplitude of soil pH favored the development of great biodiversity.

On the Renzina rendzic litosols, *Festuca rubra* is associated with *Lathyrus pratensis, Trifolium*

pratense, Lotus corniculatus, Anthyllis vulneraria. On the rhodic/chromic eutricambisols *Agrostis capillaris* became codominant. In the area with moderately acide soils such as rhodic/chromic luvisol *Lotus corniculatus* is frequent.

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