PEDO-BIOLOGICAL AND PEDO-ECOLOGICAL RESEARCHES ON THE QUALITY OF SOIL RESOURCES

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Biological activity of the soil characterizes the soil fertility and it reflects the ecological vocation of soil microflora. In this paper we present the results of the eco-pedological and pedo-biological researches accomplished in the forestry ecosystems (Quercus sp.) located in North-Eastern of Romania- Moldavian Plateau, county Iasi. The studies of soil microflora pointed out the physiological activity (soil respiration and cellulosolysae) and the enzymatic activity (catalase, invertase, urease and total phosphatase) in the ecological conditions. Our results showed the moderate to high values for physiological activity of the soil, moderate values for enzymatic activity and low to moderate values for the indicators of soil quality. These values pointed out the moderate to high levels, significant for the biochemical processes of transformation of the organic matter, in the humification trend and the partial mineralization of organic matter.

***Key words**: forestry ecosystems, microflora, physiological activity, enzymatic activity, indicators of soil quality*

Stability or instability of the ecosystems is determined by the reversible and permanent changes of substances, energy and informations which achieve between biotope and biocenosis, depending on the local and regional ecological specific [8, 12]. Therefore, the soil must be studied as an essential constituent part of the terrestrial ecosystems, not just alone, as otherwise neither the vegetation, the climate or other factor of environment examined separately, represent the factor which put assign it the capacity of the ecosystem to produce the biomass but only of whole complex of the ecological factors and conditions, in the reciprocal interaction of whole constituents parts of environment [2, 14]. Ecological interpretation of the soil defines, from a quantitative and qualitative point of view, the two target characteristics of the soil: trophy potential and ecological specific, the soil being able to manifests complete or restricting, seasonal and local [3, 4].

Soil is a living space where take place the biological processes, they contributing at transforming of the organic matter and, also, at ensuring of the favourable conditions for plant nutrition [7, 10, 15]. The whole soil activity and its

evolution takes place under the influence and the supervise of biological factor. Biological activity of the soil characterises the soil fertility and it reflects the ecological vocation of soil microflora, allowing, simultaneously, the impact of the local factors of environment, as well as the impact of the polutants and anthropogenic stress factors or another kind [1, 5, 6, 9, 11, 16, 17]. The fertility is the essential feature of the soil, which distinguish it of bedrock. The soil and its fertility are formed in time, under the action of the pedogenetic factors [1].

The main objectives of this research have in view: analysis of the physiological and enzymatic activity of the soil; analysis of the soil quality by the pedo-biological and pedo-ecological indicators and monitoring of soil quality.

MATERIALS AND METHODS

Ecopedological and microbiological researches was accomplished in the field and laboratory, on the soil samples. Soil samples was drawed from representative soil profiles which belong to Luvisols (Luvisols) and Cambisols (Eutric Cambisols) classes from natural forestry ecosystems (*Quercus sp.*) located in North-Eastern of Romania, Moldavian Plateau (Poieni and Şanta Districts, county Iaşi). We have effected the studies on the main features of the biotope, in the ecological context, through ecological specificity file. Consequently, we analysed a „constellation" of 20 main ecological factors and determinants, climatic and pedological, through 8 classes of ecological size from a quantitative point of view and 6 classes of ecological favourability from a qualitative point of view.

The pedo-biological studies pointed out the physiological activity (soil respiration and cellulosolysae) and enzymatic activity (catalase, invertase, urease and total phosphatase) of the soil, in the ecological conditions. On the basis of physiological and enzymatic activities we determined the pedo-biological indicators: Indicator of Vital Activity Potential (IVAP%), Indicator of Enzymatic Activity Potential (IEAP%), Biological Synthetic Indicator (BSI%), Chemical Synthetic Indicator (CSI%) and Synthetic Indicator of Soil Fertility (SISF%). IVAP% and IEAP% was calculated accordingly to definition of the soil fertility elaborated to Ştefanic [19, 20]. These indicators was constituted by the method of numerical taxonomy, used in soil biology and, also, in soil chemistry by many scientists [13, 18, 21, 22]. On the basis of IVAP% and IEAP% we calculated BSI% and CSI%. SISF% were calculated depending on BSI% and CSI%.

RESULTS AND DISCUSIONS

a.) Eco-pedological researches pointed out the trophy content of qualities, lack and excesses of the forestry soils (Luvisols and Eutric Cambisols) from forests of Poieni and Şanta Districts (*fig. 1*). Thus in the both forestry ecosystems the zone climate and microclimate are favourable, with moderate annual average precipitations and conditions of winds. In spite of this, in the summer season, the excessive droughts and the low level of the summer relative humidity can have the negative consequences on the forestry vegetation.

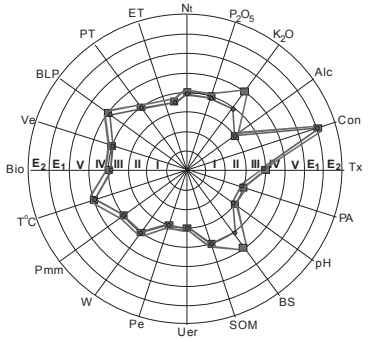


Figure 1 **Eco-pedological specific**
■_____■ **Forest of Poieni-Iaşi District** ●_____● **Forest of Şanta-Iaşi District**

Summer climatical indicators (summer precipitations-Pe and summer relative humidity-Uer) are classified into the low class (II) of ecological size. Air-water regime of the soil is critical for both of forestry ecosystems. Thus, air porosity is classified into the low class (II) of ecological size. Summer consistency of dry soil is classified into the excessive E_1 class of ecological size, with restricting effects on plants. The level of soil supply with nutrients (N, P, K) is moderate and it is higher in the Forest of Poieni District, comparatively with Forest of Şanta District. Soil reaction is low-acide, low differentiated, depending on ecological specific of both forestry ecosystems. Soil organic matter content has high values (8-12%) in the Forest of Poieni District and little lower values (6-7%) in the Forest of Şanta District. Potential Trophycity (PT) and Effective Trophycity (ET) have moderate to high values, ensuring the high trophy conditions for the forestry vegetations. In the summer season excessive droughty and, also, in the humid periods, the air-water regime is critical and stressed.

b.) Pedo-biological activity has moderate values in the Forest of Şanta District and higher values in the Forest of Poieni District. Also, physiological activity and enzymatic activity are correlated with soil reaction, soil organic matter content and base saturation, during vegetation. The highest values of physiological activity, enzymatic activity and quality indicators of the soil pointed out on the 0-20 cm depth These values decrease approximately to 50% on the 20-40 cm depth, depending on the ecological specific, while on 40-60 cm depth these values decrease approximately to 30% (*fig. 2, 3 and 4*).

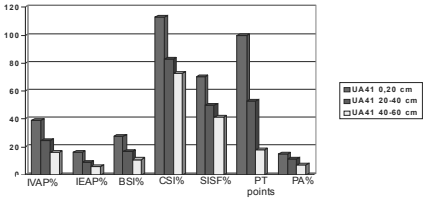
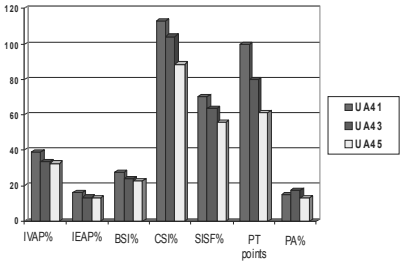


Figure 2 **The variation on depth of the pedo-biological and pedo-ecological indicators of soil quality during vegetation period in the forestry ecosystems**

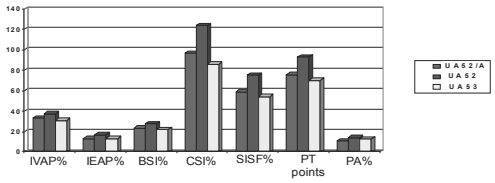
The highest values allow in case of CSI% (72.26 - 113.12% in the Forest of Poieni District and little lower values, 42.64 – 96.56% in the Forest of Şanta District). Indicator of Vital Activity Potential (IVAP%) and Indicator of Enzymatic Activity Potential (IEAP%) have moderate values, little higher values in the Forest of Poieni District. In this forest ecosystem the values of IVAP% vary between 16.14 – 37.77% and between 5.92% - 17.01% for IEAP%.



IVAP%	**IEAP%**	**BSI%**	**CSI%**	**SISF%**
DL5%-1.1%	DL5%-1.3%	DL5-1.1%	DL5%-11.5%	DL5%-4.1%
DL1%-1.8%	DL1%-1.9%	DL1%-1.7%	DL1%-16.8%	DL1%-5.6%
DL0.1%-2.3%	DL0.1%-2.1	DL0.1%-2.7	DL0.1%-21.4%	DL0.1%-7.8%

Figure 3 **Pedo-biological and pedo-ecological indicators of soil quality in forestry ecosystems - Poieni Iasi District (0-60 cm depth)**

Biological Synthetic Indicator (BSI%) has moderate values (10.75–27.52%) depending on the ecological specific from Forest of Poieni District. We pointed out, also, close values (11.03 – 27.39) in case of Forest of Şanta District.



IVAP%	**IEAP%**	**BSI%**	**CSI%**	**SISF%**
DL5%-1.4%	DL5%-1.6%	DL5-1.5%	DL5%-9.1%	DL5%-6.1%
DL1%-2.1%	DL1%-1.8%	DL1%-1.6%	DL1%-13.6%	DL1%-7.4%
DL0.1%-3.1%	DL0.1%-2.4	DL0.1%-2.0	DL0.1%-18.3%	DL0.1%-11.8%

Figure 4 **Pedo-biological and pedo-ecological indicators of soil quality in forestry ecosystems - Şanta Iasi District (0-60 cm depth)**

SISF% has moderate values, closely, depending on ecological specific. In case of Forest of Poieni District these values vary between 41.51 – 70.32%. In case of Forest of Şanta District these values are little lower (30.18 – 61.92%).

CONCLUSIONS

Study of the „constellation" of 20 ecological factors and determinants pointed out the content of qualities, lacks and excesses. In the forestry ecosystems (*Quercus sp.*) the climate and microclimate are characterized through moderate level of precipitations and moderate conditions of wind. In the summer season, the level of atmospheric humidity (below 50%) and the excessive drought can have immediate effects on forestry vegetation (the second class of ecological size and the low class of ecological favourability). Air and water regime in soil showed a deficit, the air porosity being situated into the second class of ecological size and very low or low class of ecological favourability. Summer consistency of the soil is a negative ecological factor, restricting and stressed, the soil being very hard (E_1-excessive class of ecological size and very low class of ecological favourability). The level of supply of the soil with nutrients is low.

Physiological activity (soil respiration and cellulolysae) has moderate to high values. Enzymatic potential (catalase, invertase, urease and total phosphatase) has moderate values. Indicators of soil quality (IVAP%, IEAP%, CSI%, BSI% and SISF%) have low to moderate values. These values pointed out moderate to high levels, significant for the biochemical processes of transformation of the organic matter towards humification and the partial mineralization of organic matter. In the excessive droughty summer season, the biological activity is stressed, restricting and disturbed, depending on the soil and the ecological context.

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