The Indicators of the Soils and Their Importance upon the Entomologic Fauna in the Corn Culture in Copsa Mica - Axente Sever (Sibiu County)

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Abstract. The concept of quality of the soil takes within its content the entire range of the necessary factors for the development of the plants. This proves that the soil represents a complex in an everlasting interpenetration. In this respect there exists the interest and the obligation as well of offering the soil favorable conditions in order to give it properties that can afford, as a feed-back to assure the social and economical development of the community. The observations and the collecting of samples were done during March – April 2012. There were analyzed the physical indicators as the granulometry and the chemical indicators: pH, the content of nutritive elements (pH, N, K,) and the organic carbon and humus. Among the biologic indicators the attention was focused to the agricultural entomologic fauna, the diversity of species and the vigor of plants. There was emphasized the content of heavy metals in Axente Sever–Copşa Mică area, knowing that these have serious implications upon the vegetation, animals and humans. The object of our research is the corn culture because this represents the main field culture in Romania, with surfaces all over the country, including the Sibiu County. In the corn field in Axente Sever – Copşa Mică there were identified 2 species of pest with a significant economical importance: Tanymecus dilaticollis (corn weevil) and Locusta migratoria, species that cause great damages in production and even compromising the culture. The obtained results from the chemical and agricultural chemical analysis make the object of the present work.

Keywords: physical and chemical indicators of the soil

INTRODUCTION

The biologic properties of the soil haven’t been still well understood in the spite of the fact that their relations with the physical and chemical properties, with the health of the plants and the quality of the food are obviously important. In this respect the invertebrates are very important in the appreciation of the soil.

Our researches are part of a more ample study: Researches regarding the biodiversity of the agricultural entomologic fauna in the corn culture, its importance upon the pedologic ecosangogenesis and upon the ecologic economy in Sibiu County and which has as its final goal finding a biologic index that expresses the state of equilibrium or non equilibrium between the fauna of invertebrates useful for the ecosangogenesis of the soil and the pest one. We have approached this theme because the soil is a dynamic and vital system for the human activities and for maintaining the ecologic systems. The main function of the soil consists in the fact that represents the fundament for agriculture in its main purpose of assuring the food security and safeties of the population, this function being due to its physical, chemical and biologic properties. The first step in this respect was the analysis of the heavy metals in the corn plots in Axente Sever, Copşa Mică area. The next step in our studies was the analysis of the physical indicators as granulometry as well as the chemical indicators: ph and the content of nutritive elements (P, N, and K).
MATERIALS AND METHODS

Investigation place: the agricultural ecosystem in Axente Sever, Copşa Mică area (Sibiu County). There was chosen the corn culture because this represents the main field culture in Romania, having cultivated areas in all zones of the country, including Sibiu County. The researched corn agricultural system raised two major problems: the excessive pollution of the soil (Barbu, 2006, Micu, 2001) and the apparition in the culture of two important pest insects: Tanymecus dilaticollis (corn weevil) and the migratory grasshopper Locusta migratoria.

Mapping: three types of maps for each researched agricultural ecosystem:
1. Google Earth maps, general and detailed view;
2. Maps LPIS (cadastral maps) – map of APIA (photo plan) at a scale of 1:2500, 1:5000 and 1: 10000. There can be seen the researched plot after the number of the physical block: 661 for Axente Sever/Copşa Mică.
3. Administrative plans of the agricultural plots from the local City Hall. The part named “Şesul zăvoi” is for the area in Axente Sever that is contiguous to that in Copşa Mică.

Collecting methods: soil sampling in the studies of the agricultural ecosystem, agricultural – geological drillings (using the metric frame) and the Barger traps.

Investigating seasons: The spring collecting was done during 02.04 – 06.04.2012.

The determination of 6 agricultural and chemical parameters (medium tests): pH, the texture, humus, N, P, K, in the Labs of the Faculty of Agricultural Sciences, Food Industry and the Protection of the Environment.

RESULTS AND DISCUSSION

Soil sampling represents a first important part in the study of the agricultural entomologic fauna, being standardized in Romania by STAS 7184/1 – 84 Collecting samples for geological, agricultural and chemical studies. The configuration of the researched plots had regular (rectangular) forms. From every studied piece of land we collected an average sample, made up from 40 elementary soil samples (20 per hectare), the land surface being walked in zigzag. The soil samples for the agrochemical classification were collected at a depth of 30cm with the agrochemical probe. The elementary samples were introduced in collecting bags corresponding to each plot. These bags were numbered and labeled with sampling data. The samples were transported to the Agrochemical Laboratory of The Agricultural Sciences and Environmental Protection Department in order to be dried (at room temperature, for two days), grinded, sieved (2mm mesh) and finally analyzed, for pH, humus, mobile phosphorous, assimilable potassium, sodium content and so on (Antonic, 2012).

The determination of pH is compulsory no matter from the goal of the agrochemical analysis, knowing its value helping in the appreciation of the state of fertilization of the soil. The determination of pH was done with the help of an electronic device for measuring pH Hanna Instruments, having a precision of ± 0.01 units pH (SR ISO 10523/1997).

The analysis of the granules establishes the texture of the soil by determining the percentage of rough sand (φ > 0.2 mm), smooth sand (φ = 0.2 – 0.02mm), rough dust I (φ = 0.02 – 0.01), smooth dust II (φ = 0.01 / 0.002mm) and colloidal clay (φ < 0.002mm). This method is based upon the sedimentary laws (Stokes). For the rough fractions with a diameter bigger than 0.2mm was applied the wet sieving and for the smooth fractions with a diameter
of 0.02 or smaller was applied the method with the device Eijkelkamp provided with a dropper.

The determination of the organic carbon and of the humus in the soil was done after the standardized SR ISO 14235/2000. Regarding the determination of the azoth that was done after the method described in the standard ISO 11261, representing the translation of the English version of ISO 11261/1995. This standard refers to the method of determination of the content of total azoth in the soil, derive from the Kjeldahl method, in which the main modification is the replacing of the catalytic with selenium with one with titan oxide, from ecological and toxic reasons. The standard proved to be useful for the lab of soil analysis in the field of agricultural and the plants protection.

The determination of the accessible phosphorus in the soil (P-AL). “The mobile phosphorus” or “the accessible phosphorus” represents that fraction from the total existing phosphorous in the soil, which can be used by the plants. Taking into consideration the complexity of the reactions soil-plant, the determination of this size has a conventional character, but it also can give valuable information regarding the quantity of available phosphorous (Barbu, 2008).

The determination of the content of potassium is done in the soil extract obtained with the acetate ammonium lactate. The hydrogen ions of the extracting solution replace by turn, being excessively the potassium ions in a changeable shape from the soil sample that are passed in this way in the solution (Barbu, 2008). In this determination was used a device provided with phial.

As a result of the agricultural chemical analysis done in the labs of the Faculty of Agricultural Sciences, Food Industry and Protection of the Environment in the “Lucian Blaga” University in Sibiu there were obtained the following results (Tab.1):

Tab. 1From the table 1 we can see that the reaction of the soil from the researched agricultural ecosystem was weakly alkaline. The texture is with clay and sand (middle). The content of carbon and humus is small as well as the content of azoth and phosphorous and the potassium is temperate.

<table>
<thead>
<tr>
<th>Sample name</th>
<th>pH</th>
<th>Total dust %</th>
<th>Total Sand %</th>
<th>Clay 0,002 %</th>
<th>Texture Lab</th>
<th>C. org. %</th>
<th>Humus %</th>
<th>N mg/Kg</th>
<th>P mg/Kg</th>
<th>K mg/Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axente Sever/Copşa Mică</td>
<td>7,72</td>
<td>26,3</td>
<td>57,8</td>
<td>15,9</td>
<td>clay and sand</td>
<td>0,50</td>
<td>0,82</td>
<td>74</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

From the table 1 we can see that the reaction of the soil from the researched agricultural ecosystem was weakly alkaline. The texture is with clay and sand (middle). The content of carbon and humus is small as well as the content of azoth and phosphorous and the potassium is temperate.

The texture is a middle one but it needs temperate dozes of organic fertilizers and big dozes of chemical fertilizers. The texture with clay and sand encourages the population of *Locusta migratoria*.

The gathering done with the help of agricultural geological drillings (using the metric frame) and the Barber traps led to a first inventory of the species and groups of arthropods from the researched culture. There is presented the first information regarding the structure and the abundance of the useful and pest arthropods that were collected during April (Tab. 2 and Tab.3).
As a result of the soil drillings in April there were collected a number of 63 samples of arthropods. We want to mention that this type of drilling was done for the first time in this month. From the total of the collected samples 49 belong to the group of useful arthropods and 14 samples belong to the group of pest arthropods. The biggest abundance of 52.38% is presented by the species Myrmica rubra. We remark the fact that the biodiversity of the arthropods in the soil is extremely reduced especially of the indicative species belonging to Aranea (2 samples) and Geophilus flavus (1 sample). As a result of the drillings there wasn’t collected any frame, that means that the soil continuously presents a high degree of pollution with heavy metals (lead and cadmium) making the soil not proper for this group of invertebrates.

The list of species, the number of samples and the relative abundance of the arthropods in the experimental plots in the corn culture in Axente Sever – Sibiu County (original)

<table>
<thead>
<tr>
<th>Species</th>
<th>Soil drillings (April 2012)</th>
<th>Barber traps (April 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td><strong>Samples number</strong></td>
<td><strong>Relative abundance %</strong></td>
</tr>
<tr>
<td>Aranea*</td>
<td>2</td>
<td>3,18</td>
</tr>
<tr>
<td>Geophilus flavus De Geer*</td>
<td>1</td>
<td>1,59</td>
</tr>
<tr>
<td>Phymatocera aterrima Klug. +</td>
<td>1</td>
<td>1,59</td>
</tr>
<tr>
<td>Lasius niger L.*</td>
<td>4</td>
<td>6,35</td>
</tr>
<tr>
<td>Myrmica rubra L.*</td>
<td>33</td>
<td>52,38</td>
</tr>
<tr>
<td>Melolontha melolontha L. +</td>
<td>3</td>
<td>4,77</td>
</tr>
<tr>
<td>Opatrum sabulosum L. +</td>
<td>10</td>
<td>15,88</td>
</tr>
<tr>
<td>Bembidion properans Steph. *</td>
<td>9</td>
<td>14,29</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100,00</td>
</tr>
</tbody>
</table>

Note: Where * are useful species and + are pest species
From the Barber traps were collected during the same interval of time 92 arthropods samples from which 65 samples belong to the group of useful and 27 samples belong to the group of pest arthropods. The biggest abundance is represented by Formica rufa L with 27.18%, followed by Aranea with 22.82% and Lasius niger with 10.86%.

The restoration of the biodiversity of the fauna on the ground in the researched corn culture is linked by the placing in the area of a pioneer flora in the successive evolution of the biocenosis on the background of diminishing in time of the concentration of cadmium and lead, as a result of shutting down from nearly ten years of the great polluters in the area.

CONCLUSIONS

The researches have been done in the experimental plot in Axente Sever nearby Copşa Mică. The researched culture was the corn one.

The first collecting of the invertebrates in the soil as well as of those on the ground was done during 02.04 – 04.04.2012.

In order to sort out the agricultural chemical samples, the soil samples were brought out from a depth of 30cm, using the agricultural chemical drill.

The fauna on the ground was caught with the help of the Barber traps.

As result of the agricultural chemical analysis we can say that the reaction of the soil in the researched agricultural ecosystem is weakly alkaline; the texture is clay with sand (middle); the content of carbon and humus is little, as well as the content of azoth and phosphorous and for potassium is temperate. The soil is of middle fertilization having an alkaline reaction. The middle texture needs moderate dozes of organic fertilizers and big dozes of chemical fertilizers.

The texture of clay with sand encourages the population of Locusta migratoria that explains the growth of the population of this pest in the years 2005 and 2009.

As a result of the drillings in the soil during April there were collected a number of 63 samples of arthropods of which 49 samples belong to the group of useful arthropods and 14 samples belonging to the group of pest arthropods. The biggest abundance of 52.38% is presented by the species Myrmica rubra.

As a result of the drillings there wasn’t collected any frame that means that the soil still presents a high degree of pollution with heavy metals (lead and cadmium).

In the Barber traps were collected in the same time interval 92 samples of arthropods from which 65 samples belong to the group of useful arthropods and 27 samples belong to the group of pest arthropods. The biggest abundance is represented by Formica rufa I, with 27.18%, followed by Aranea with 22.82% and Lasius niger with 10.86%.

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