CHANGES IN THE STRUCTURE OF ACTINOMYCETE POPULATIONS IN THE RHIZOSPHERE OF *VICIA SATIVA* SPECIES

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ABSTRACT
It is a known fact that species of legumes improve the soil they are grown on, but at the same time, they produce the so-called rhizosphere effect or rhizodeposit that has a selective effect on the microorganisms which are considered "fertility effectors" for soil. From the three studied area the highest number of actinomycetes was found in edaphosphere and the lowest number in the area influenced by roots. Among the few factors under research for the purpose of this paper, humus and potassium were observed to have the strongest impact on this group. Humidity is a factor that could change the competition between soil microorganisms and plants in the soil for N and it could affect the stability of aggregates.

Keywords: actinomycetes, rhizodeposition, rhizosphere, edaphosphere, Gause medium

INTRODUCTION

Rhizosphere microbial communities are important for plant nutrition and plant health (MARSCHNER ET AL., 2004) . The increased use of cereal/legume crop rotation has been advocated as a strategy to increase cereal yields of subsistence farmers in West Africa, and is believed to promote changes in the rhizosphere that enhance early plant growth (ALVEY ET AL., 2003**).** Rhizosphere is influenced by the region, soil and the roots of plants with high microbial activity (HILTNER, 1904**).** Plant roots secrete a large variety of compounds that they release into the rhizosphere, which leads to unique micromedia for microorganisms. Rhizodeposits differ in relation with plant species and plant developmental stage (WHIPPS, 2001; RENGEL, 2002). Interactions and biochemical exchanges that take place between plants and microorganisms in the soil have already been described and analysed (PINTON ET AL., 2007). Competitiveness is fierce among the microorganisms in this area under the influence of plant roots; this makes it possible for intimate associations to be realized between these organisms and plants (HARTMANN ET AL., 2009).

The exudates produced by plant roots select and influence the development of bacterial and fungal populations in their vicinity (GRAYSTONE ET AL., 1996**;** YANG and CROWLEY, 2000**;** WHIPPS, 2001). The stimulation of actinomycetes in the rhizospere has never been studied in detail. There exists a general observation that actinomycetes are less stimulated by the rhizosphere effect than the bacteria, but when the number of antagonistic actinomycetes increases in this area, bacteria are inhibited (LECHEVALIER, M., 1989B).

Of actinomycetes, genera *Nocardia* and *Streptomyces* play an important part in phosphorus solubilisation .Edaphosphere is the area that is not influenced by plant roots. Sporogenic bacteria and actinomycetes are larger in numbers than any other type.

The microbial population in the rhizosphere is influenced by the interaction between the type of soil, plant species and its stage of development (MARSCHNER ET AL., 2001, 2004).

The same authors state that the bacteria in the rhizosphere are also affected by the complex interaction among the type of soil, plant species and the location in relation to the root. In some situations, the effect of the soil type on the microbiota in the rhizosphere can be stronger as compared with that of some plant species (SINGH ET AL., 2007), but there are also cases when plant species have a greater influence on the structure of microbial populations (WIELAND ET AL., 2001, GRAYSTON J. SUSAN AND CAMPBELL D. COLIN**,** 1996).

Humidity is the factor that could change the competition between soil microorganisms and plants in the soil for N (LIPSON and MONSON, 1998)**.** It could affect the stability of aggregates (LAVEE ET AL., 1996), the intensity of humectation-rehumectation cycles, and in their turn, they could affect root secretions (GORRISEN ET AL., 2004).

The interactions among plants, soils and microorganisms are well known. Nevertheless, few studies have been made in order to understand the microbial diversity, the way soil functions and the influence of the cultivated plant.

MATERIAL AND METHOD

The soil under study is moderately gleyic eutric cambisol found in Banat area and cultivated with a vetch species (*Vicia sativa*). The depth for sampling soil was between 0 and 20 cm. The samples were taken from the rhizosphere of the cultivated plants, from the edaphosphere and a control variant. The samples were processed in laboratory conditions. We isolated the actinomycetes using the method of decimal dilutions and sowing the suspension of culture medium Gause 1. The incubation of the samples was at a temperature of 28 ºC for five days (STEFANIC, 2006). The data were statistically analyzed using PAST 2.14 (HAMMER ET AL, 2001).

RESULTS AND DISCUSSIONS

The experimental data obtained after the incubation period were interpreted statistically and they are represented graphically below (*Figures 1-6*).

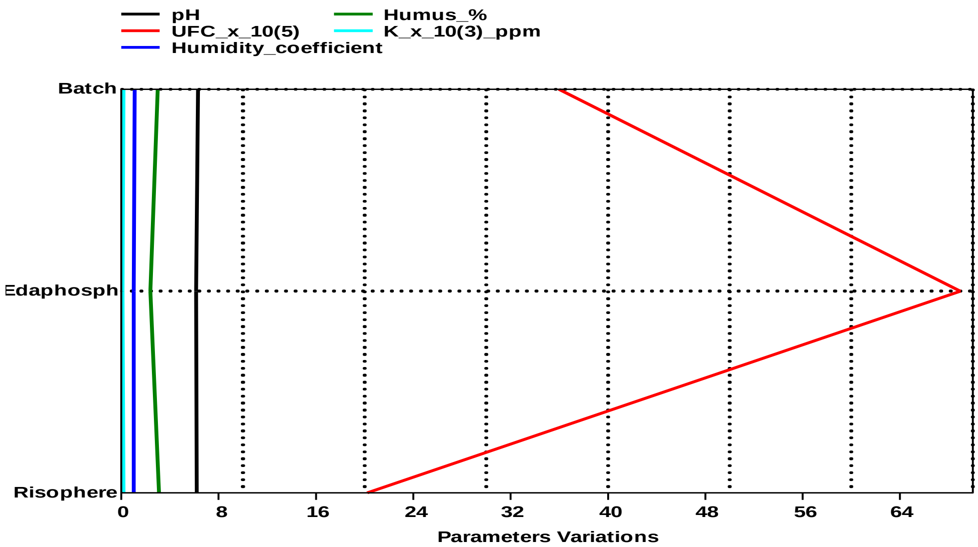

Figure 1. Evolution of studied parameters

Of the three areas under study, edaphosphere (68.96 CFU/g soil) presents the largest number of actinomycetes, followed by the control variant. The smallest number of actinobacteria is to be found in the rhizosphere (20.22 CFU/g soil).

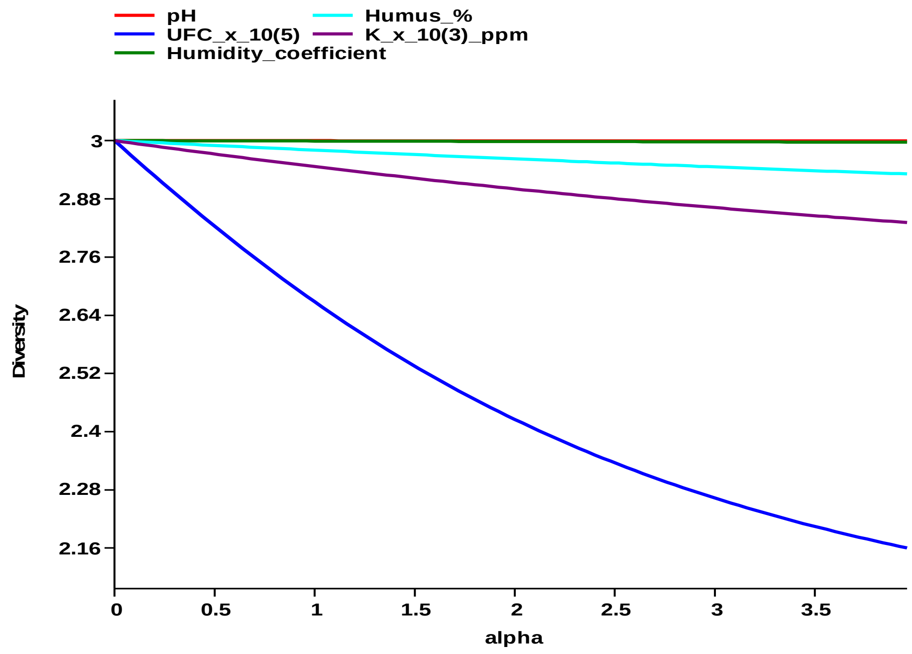

Figure 2. Diversity profiles

The edaphosphere is the area that is not influenced by plant roots. This area is dominated by sporogenic bacteria and by actinomycetes. A large variety of media were used in order to isolate and count the actinomycetes in the rhizosphere, but also to compare cultures and numbers of actinomycetes, eubacteria and fungi found in the soil (BASIL ET AL., 2004).

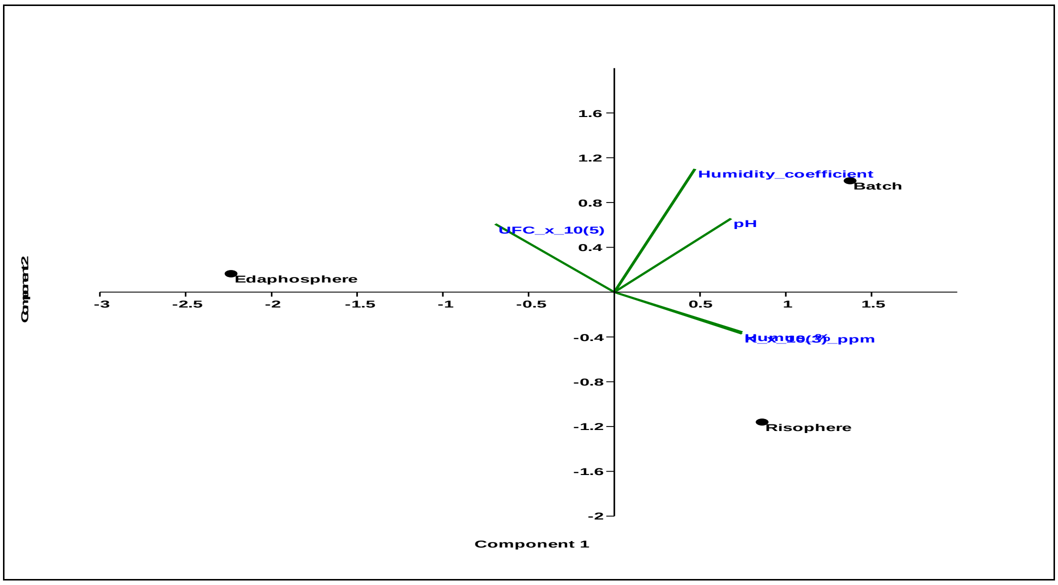

Figure 3. PCA graphical representation of studied parameters

Figure 2 is presenting linear variations for pH, humidity coefficient, humus and potassium content and it is visible that humus and potassium content is influenced by the pH and humidity of soil. UFC is presenting a different profile, but it's visibly influenced by humus and potassium content

PCA analysis is presented in figure 3. Humidity and pH describe the batch, UFC is characteristic to edaphosphere while rhizosphere is characterized more by humus and potassium content (*Figure* 3). Soil humidity is the key factor that influences the microbial activity in the soil and the processes of decomposition of organic matter (BRADY and WEIL 2002). The variance of the values is 76.344% for the first PC and 23.656 % for the second PC. The PCA loadings for the first axis are presented in *Figure 4*.

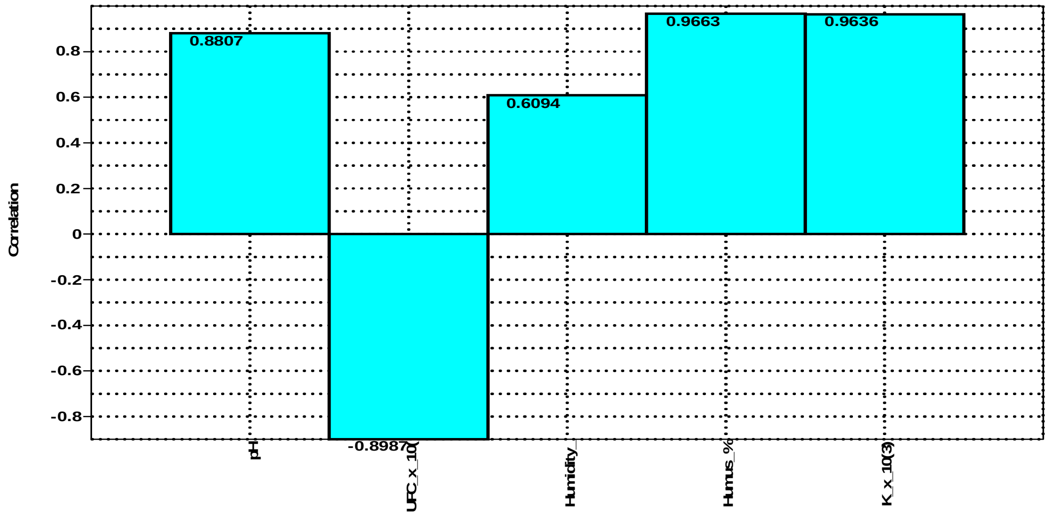

Figure 4. PCA correlations of the first component loadings

The pH, humidity, humus and K contents show positive correlations while UFC presents negative correlation (*Figure* 4).

The PCA loadings for the second component (*Figure* 5) present positive correlation for UFC, pH and humidity content while humus and potassium content present negative correlations.

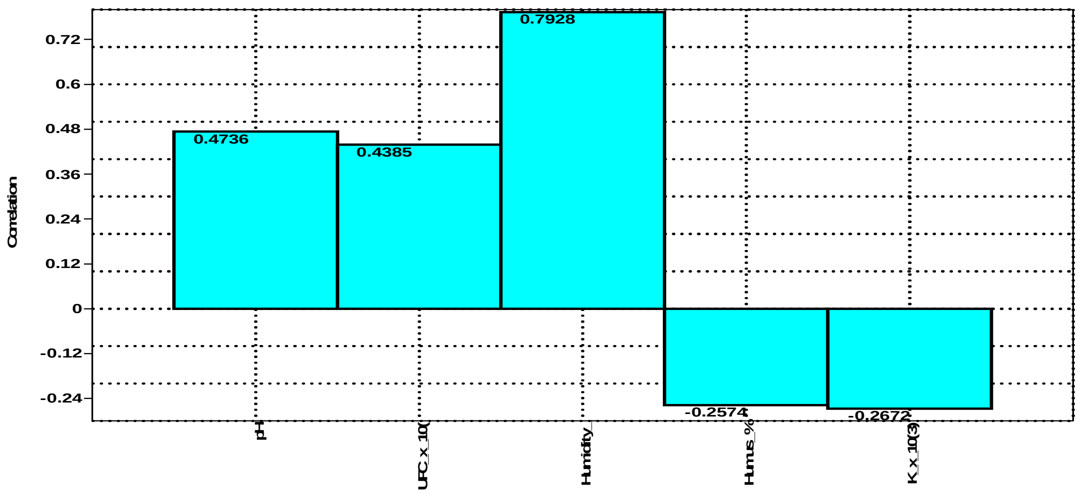

Figure 5. PCA correlations of the second component loadings

This module is used for plotting taxon abundances in descending rank order on a logarithmic (Whittaker plot) scale. This will give a straight descending line in the Whittaker plot. Fitting is by simple linear regression of the logarrithm abundances.

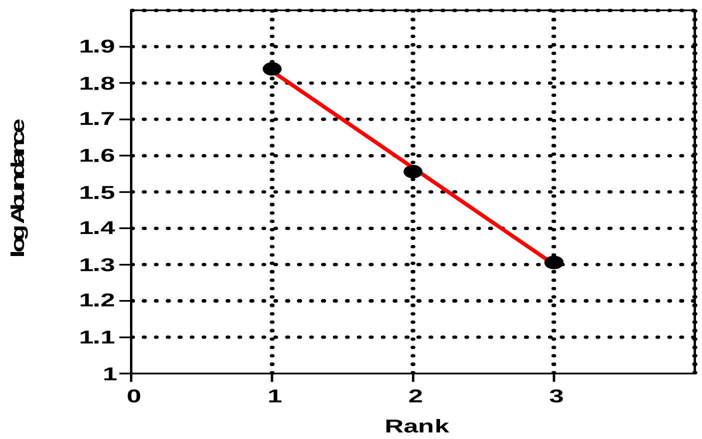

Figure 6. Log Abundance Model of the UFC (k=0.4585; chi^2= 0.0365; p(same) =0.849)

CONCLUSIONS

The experimental data obtained are confirmed by the bibliography we studied for the purpose of this paper. The data show that actinomycetes are dominant in the area that is not influenced by legume roots and that their numbers decrease in numbers in the rhizosphere of *Vicia sativa*. The study shows that, of all the factors of influence considered, humus and potassium influence CFU/g soil in a positive way.

As for edaphosphere, the statistical data show a correlation with the pH and the humidity coefficient.

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