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Contribution to the Study of the Soil's Diversity of the Algerian North-east, Case of the Transect «Souk-ahras -tebessa»

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ABSTRACT

Our study area is a transect that connects the wilaya of Souk-Ahras and the wilaya of Tebessa where it is formed by a mountainous massif site that includes a very important vegetal diversity. This area is located in the North East of Algeria where it prevails a Mediterranean climate, characterized by a temperature gradient that increases from North to South, whose average annual rainfall evolves in the opposite direction of the temperature. To identify the diversity of soils in this region we made a qualitative characterization of soils that integrate the axis between the north and south of the wilaya of Souk-Ahras and Tebessa, we chose six stations representative of the area in question, several physico-chemical parameters were studied such as, the granulometry, hydrogen potential, electrical conductivity, hygroscopic moisture, organic matter and total limestone to define and enhance the quality and richness of the soil of this region. The physico-chemical characterization reveals a diversity of the nature and quality of soils in this mountainous region, and an adequacy between the soil, the climatic environment and the type of plant cover whatever the region.

Key words: *Diversity, Qualitative characterization, Richness, Soil, Vegetation cover.*

Introduction

Biodiversity is currently a major issue in ecological research, both regarding its role in ecosystems, its determinism and its valuation in the field of environmental preservation (Solbrig *et al.,* 1994; Kaci, 2017). And to preserve the environment it is necessary to conserve the soil which is a fragile resource, and the need to protect it (Curry and Schmidt, 2007).

It is a complex compartment, a multifunctional crossroads, in relation to the lithosphere, hydrosphere, atmosphere and biosphere. It is the result of

the alteration, remodeling and organization of the upper layers of the earth's crust under the action of life and the energy exchanges that take place there (Gobat *et al.*, 1998; Lozet and Mathieu, 1997).

The soil is a living and dynamic entity, which is necessary for the functioning of terrestrial ecosystems (Doran *et al.*, 1999). Also it is a support of biodiversity, support of vegetation, carbon storage, filter, water storage (Pey, 2018). The soil is a superficial layer of the earth's crust, performs many functions essential to humans and their environment (Jouquet *et al.*, 2006). Although a non-renewable resource of the globe, soil is subject to many anthropogenic stresses that degrade its properties and can result in loss of essential functions (Séré, 2007).

It is for this reason that we access our work on the soils of North East Algeria, which is characterized by a great eco-systemic diversity with an invaluable biological wealth. This eco-systemic heterogeneity is reflected in the great geomorphological diversity (valleys, plains, swamps, lakes, dunes, hills, etc.), edaphic (clayey soils, sandy, halomorphic and limestone) and climatic (the interweaving of various bioclimatic stages of vegetation, humidity, subhumid and semi-arid (Benslama *et al.*, 2007).

This area is located in North East Algeria where a Mediterranean climate prevails, characterized by a temperature gradient that increases from North to South, and average annual rainfall that evolves in the opposite direction of temperature.

The effect of climatic factors on a sedimentary mother rock has favored the formation of different types of soil. For this reason, we tried to evaluate and characterize the different types of soils along a North-South transect that integrates the wilaya of Souk-Ahras and the wilaya of Tébessa (North-East of Algeria).

The choice of this route is dictated by the presence of diversity and richness of plant formation along the road axis that connects the two wilayas from which we have chosen six stations to take soil samples, to determine the diversity existing between the soils of these different study stations.

Materials and Methods

Our study area is located in the North East of Algeria, it is included between the locality of Machroha (wilaya of Souk-Ahras) and the locality of Bakkkaria (wilaya of Tébessa) (Fig. 1).

Our study area is characterized by a Mediterranean climate, characterized by a temperature gradient that increases from north to south, and average annual rainfall that evolve in the opposite direction of temperature. According to the climagram of (Emberger, 1955), the wilaya of Souk-Ahras is under the cool subhumid bioclimatic stage, and the wilaya of Tébessa is under the dry semi-arid climatic stage.

Sampling technique

The soil samples are taken from the surface layer of different stations, these stations are chosen accord-

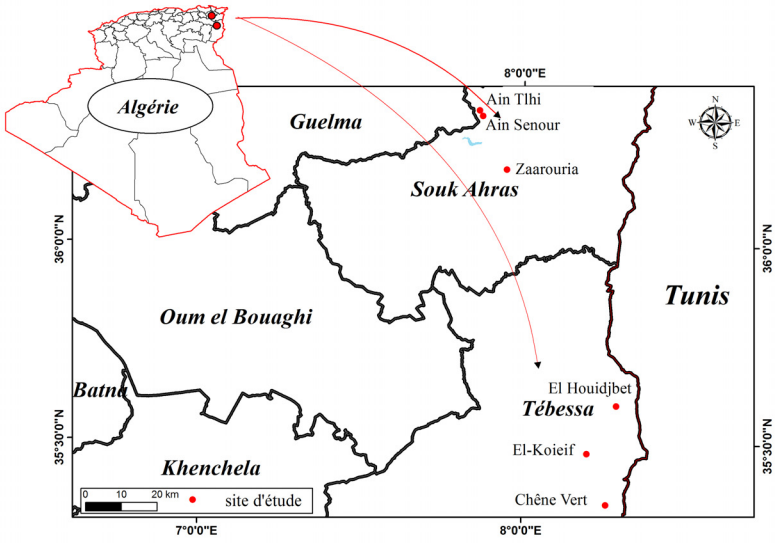

Fig. 1. Map of the geographical position of the study area.

ing to the change and diversity of plant formations along the road axis that connects between the wilaya of Souk-Ahras and the wilaya of Tébessa where it is formed of a site of mountainous massif, We count the station of Ain Tlhi, the station of Ain Senour, the station of Zaarouria, the station of El Houidjbet, the station of El-Koieif and the station of Chêne vert.

The collected soil samples were dried, crushed and sieved, then analyzed in the laboratory.

On the fine fraction of the soil the following physico-chemical analyses were carried Out

The granulometry → International pipette method (Baize, 2000).
The hydrogen potential (pH) → pH meter. (Morel, 1986)
Electrical conductivity (CE) → Conductivity meter (AFNOR, 2004).
Hygroscopic humidity (H) → Séchage à l'étuve (24h à 105°C) (Baise & Girard, 1995).
Organic matter (Mo%) → Muffle furnace incineration (4h à 450°C) (Delcour, 1981).
Total limestone ($CaCO_3$) → Tetrimetric method (Mathieub and Pieltain, 2003).

Results and Discussion

The results obtained have been grouped in the graphs and histograms below.

Granulometry

The granulometric analysis is one of the classical means of studying soils. It makes it possible to define the texture, which in turn partly conditions the physical and physicochemical properties of the soil (Gobat *et al.*, 1991).

The texture of the soil is the reflection of the proportion of sand, silt and clay particles that are present. These proportions determine the size of the pores or spaces between the soil and air particles and to a large extent, the ability to retain moisture and nutrients. These soil particles are classified into three categories: Sand (the largest), Silt and Clay (the smallest).

Using the textural triangle of (Jamagne, 1967) we deduce that we have several textural classes; we note an almost balanced clay-silt-sand texture in the stations affiliated to the wilaya of Souk-Ahras, and a sandy-silt texture in the stations affiliated to the wilaya of Tébessa (Fig. 2).

Hydrogen potential (pH)

The hydrogen potential corresponds to the concentration of free H^+ ions, existing in the soil solution (Mathieu *et al.*, 2003).

The results obtained from the measurement of pH and according to the scale proposed by Soltner (1999), the pH ranges from a little basic to a basic pH, it increases from North to South (Fig. 3).

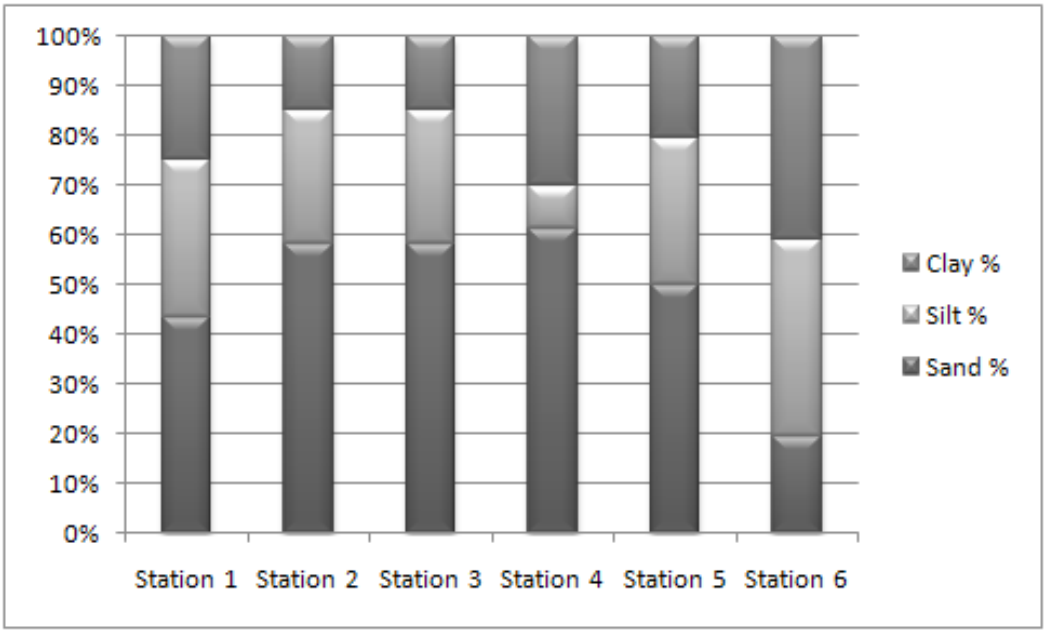

Fig. 2. Histogramme représente la granulométrie de la région d'étude.

They are under the control of several factors which are mainly; the topographic position, the nature of the bedrock and the nature of the vegetation cover.

Electrical conductivity (EC)

Electrical conductivity varies with temperature. It is related to the concentration and nature of dissolved substances.

In general, mineral salts are good conductors as opposed to organic and colloidal matter which are poor conductors. Electrical conductivity is important to know because it gives us a general idea of the salinity of a soil. It is directly proportional to the quantity of mineral salts dissolved in the water (Durand, 1983).

According to Durand (1983), the soils in our study area are not salty, with electrical conductivity values not exceeding 110 µs/cm in all stations sampled.

Hygroscopic moisture (H%)

Hygroscopic moisture comes from atmospheric moisture and forms a thin layer around soil particles. It is highly energetically retained and cannot be used by soil fauna or flora (Mbakwiravyo, 2009).

The monitoring of moisture in the different stations studied allows us to announce that our soils retain a low water content that does not exceed 6% (Fig.3).

Moisture is controlled by several factors: climatic conditions (precipitation and evaporation), vegetation and physical characteristics of the soil which are: permeability, infiltration, water retention capacity and capillary action (Zahi, 2014).

Organic matter (OM%)

Organic matter plays a very important role in the physical, chemical and biological functioning of the soil. It improves the coherence of structural elements, promotes the retention of useful water, participates in the reversible storage of nutritional elements, limits the development of certain parasites, increases soil aeration. It is formed essentially by flows of plants in stages of decomposition, animal droppings and microbial cells (Davet, 1996).

The results of the analysis of the total organic matter in the different stations (Fig. 3) allows to distinguish a variation of the rates of organic matter from one station to another, but on the whole all the study area is rich in organic matter, and the variation of the rate from one station to another is due to the nature of the plant cover.

Total limestone ($CaCO_3$%)

It is the total limestone of the soil represented in all dimensions (sizes). Its quantity in the soil can be determined after its dissolution by a medium concentrated acid. To interpret the results of the analyses obtained, we use the scale of appreciation in the table below (Baize *et al.*, 2007).

According to (Baize *et al.*, 2007); the soils of our study area are not very calcareous, because the total limestone contents are less than 5% (Fig. 3), this is

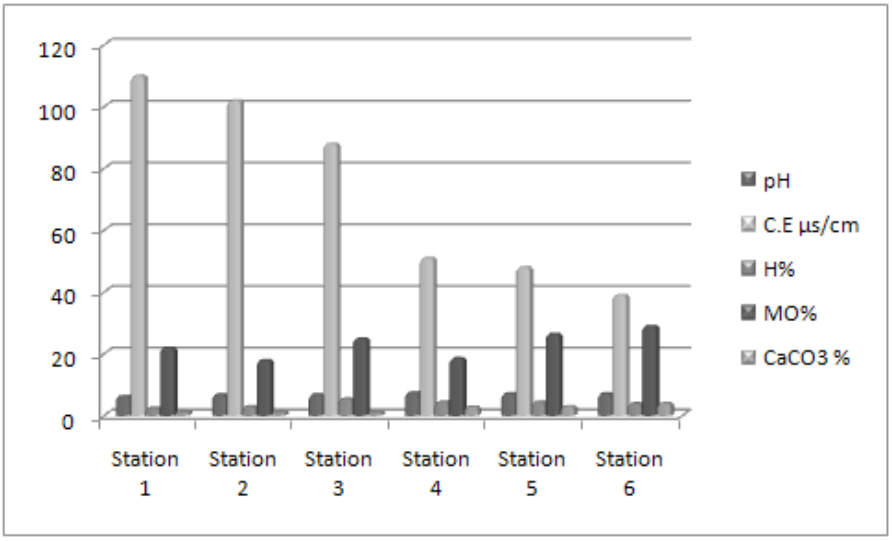

Fig. 3. Spatial variation of physicochemical parameters in the different study stations.

due to the nature of the parent rock, especially in the north of the study area which is grate from Numidia.

The analysis of variance with only one criterion of classification of the physico-chemical parameters of the soil between Tebessa and Souk Ahras showed a highly significant difference for the pH, $CaCO_3$ %, and C.E µs/cm p= 0.000, Nevertheless, we did not notice any difference p= 0.122 and 0.198 respectively for the MO% and the H%.

Conclusion

The soil is the most poorly known component of the environment, although it is the direct support of most human activities (Robert, 1996). Indeed, by its position as an interface between the organic and inorganic world, it is the seat of several chemical reactions ensuring the passage from one world to the other.

The characterization and the determination of the diversity of the existing soils along the transect which connects the wilaya of Souk-Ahras with the wilaya of Tébessa where it is formed of a site of mountainous massif, brings out the close relation between the nature of the substratum and the types of the vegetal cover and also with the conditions of the environment in general and the climatic conditions in particular

The results obtained show that the sampled soils have different physico-chemical characteristics, which allowed us to classify these soils into two categories, the first of which is located in the northern part of the wilaya of Souk-Ahras which is characterized by weakly acidic soils, not salty, very rich in organic matter with the absence of limestone which is related to the nature of the parent rock Numidian sandstone, and the second category of soils is located in the southern part of the wilaya of Tébessa which is characterized by low basic soils, not salty, rich in organic matter and they have little limestone.

These informative results are the subject of the study of the organic litter which appears very important in the stabilization of the soil where the need to preserve the plant cover in order to increase the

Analysis of variance of pH

Source	DL	SomCaradjust	CM adjust	Value and F	Value and p
CITIES	1	1,6020	1,60205	34,17	0,000
Error	16	0,7502	0,04689		
Total	17	2,3522			
Analysis of variance CE µs/cm :					
Source	DL	SomCaradjust	CM adjust	Value and F	Value and p
CITIES	1	13122,0	13122,0	212,07	0,000
Error	16	990,0	61,9		
Total	17	14112,0			
Analysis of variance H% :					
Source	DL	SomCaradjust	CM adjust	Value and F	Value and p
CITIES	1	1,767	1,7672	1,80	0,198
Error	16	15,681	0,9801		
Total	17	17,448			
Analysis of variance MO% :					
Source	DL	SomCaradjust	CM adjust	Value and F	Value and p
CITIES	1	41,68	41,68	2,66	0,122
Error	16	250,37	15,65		
Total	17	292,05			
Analysis of variance $CaCO_3$ % :					
Source	DL	SomCaradjust	CM adjust	Value and F	Value and p
CITIES	1	24,082	24,0818	173,17	0,000
Error	16	2,225	0,1391		
Total	17	26,307			

productive potential of the soil and increase its diversity.

References

AFNOR., 2004. Evaluation of soil quality - Volume 1: chemical analysis methods; volume 2: physical and biological analysis methods. 946p.

Baise, D. and Girard, M. 1995. *Soil Reference System*. AFES. Paris. INRA, 336p

Baize, D. 2000. Guide to pedology analyzes choice of expression presentation interpretation Editions Quae.

Baize, D., Deslais, W. and Saby N., 2007. Levels of eight trace elements (Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn) in agricultural soils in France. Results of a national data collection. Simplified final report. ADEME. Angers, 86 pages.

Benslama, M., Andrieu-Ponel, V., Guiter, F., Reille, M., Beaulieu, J.L, Migliore, J. and Djamali, M. 2007. New contributions to the late glacial and holocene history of vegetation in Algeria: pollen analyses of two sedimentary profiles from the El-Kala wetland complex. *Comptes Rendus Biologies.* 333 (10) : 744-754.

Curry, J.P. and Schmidt, O. 2007. The feeding ecology of earthworms - A review. *Pedobiologia.* 50(6) : 463-477.

Davet, P. 1996. Soil microbial life and plant production. INRA. Paris. 383 pages.

Delcour, F. 1981. *Introduction to Pedology.* Fac, Sc, Agron. Gembloux 78p.

Doran, J., Jones, A., Arshad, M. and Gilley, J. 1999. Determinants of Soil Quality and Health. In Soil quality and soil erosion par R. La l, Soil and Water Conservation Society. p 329.

Durand, J.H. 1983. Irrigable soils. Agency for Cultural and Technical Cooperation. Presse Universitaire de France. Paris, 198 pages.

Emberger, L. 1955. A biogeographic classification of climates. Nature. *Monspl. Series Bot.* (7).

Gobat, J.M., Grosvernier, Ph., Matthey, Y. and Buttler, A. 1991. A particle size triangle for peats: semi-automatic analysis and graphical representation. *Soil Science.* 29 (1) : 23-35.

Gobat, J.M., Aragno, M. and Matthey, W. 1998. The living soil, basics of pedology, soil biology. 1st edition revised and argued, 819 pages.

Jamagne, M. 1967. Basics and techniques of soil mapping.

Jouquet, P., Dauber, J., Lagerlöf, J., Lavelle, P. et Lepage, M. 2006. Soil invertebrates as ecosystem engineers : Intended and accidental effects on soil and feedback loops. *Applied Soil Ecology*. 32 : 153-164.

Kaci, H. 2017. Contribution to the study of the fauna of a forest floor (Region of Bouira). Diploma of Master 2. Field: SNV Field: Agronomic Sciences Speciality: Health of plants. University Akli Mohand Oulhadj. Bouira, Algeria.

Lozet, J et Mathieu, C. 1997. Dictionary of Soil Science. Lavoisier, p 269.

Mathieu, C. and Pieltain, F. 2003. Chemical analysis of soils - Selected methods. Eìditions Tec & doc. Parie. France. 386p.

Mbakwiravyo, K. 2009. Notes on general ecology. Kasugho University of Nature Conservation and Conservation and Development.

Morel, R. 1986. *Cultivated Soils.* Lavoisier 1ère Edition. Paris.

Pey, B. 2018 : Contribution of soil fauna to the functioning and evolution of Technosols. Agricultural Sciences. National Polytechnic Institute of Lorraine. France.

Robert, M. 1996. The soil: interface in the environment, resource for development, Paris, 241 pp.

Séré, G. 2007. Functioning and pedogenetic evolution of Technosols from a soil construction process. National Polytechnic Institute of Lorraine. Vandoeuvre-lès-Nancy, Ecole Nationale Supérieure d'Agronomie et des Industries Alimentaires Doctoral School Resources, Processes, Products and Environment Soils and Environment Laboratory INPL(ENSAIA)/INRA UMR 1120.

Solbrig, O.T., Van Emden, H.M. and Van Oordt, P.G.W.J., 1994. Biodiversity and global change, IUBS, Cab International, Wallingford. 227 p.

Soltner, D. 1999. The basics of plant production, Volume III, the plant and its improvement. 2nd Edition, Editions Sciences et techniques agricoles, 304 pages.

Zahi, F. 2014. Contribution to the hydrochemical study of the Fetzara Lake sub-catchment (North-East Algeria). Geochemical approach and functioning of soils and waters. Thesis of Doctorate es-sciences. Department of Geology. Faculty of Earth Sciences. Université Badji Mokhtar Annaba, 193 pages.