EFFECT OF THE SURROUNDING ENVIRONMENTAL CONDITIONS ON THE SOIL OF BETHUNE COLLEGE CAMPUS

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ABSTRACT

The work deals with the influence of the surrounding conditions of the soil such as leaf litter or the fecal matter of the tree dwelling organisms (bird-droppings), resulting into variation in the physico- chemical parameters of the soil. Certain physical and chemical parameters of the soil of Bethune College Campus, situated in North Kolkata, with different surrounding conditions were studied. Great variations were observed in the colour, pH, temperature, inorganic constituents and organic constituents of the soil. So, there occurs a great influence of the surrounding conditions of the soil even after having the same ecosystem.

Keywords : Environmental Conditions, Soil, Bethune College.

INTRODUCTION

Soil is highly generalized term for the shallow upper layer of the land surface of the earth, which by weathering of underlying rocks, intimate association with life processes and the organic remains of plants, animals and micro-organisms has been converted into a suitable habitat for the root system of plants, burrowing and permanently dwelling animals and for the host of micro-organisms that form a link between the chemical phases of the soil and metabolic phases of higher organism.

The Soil as a habitat is unique in characteristics. It forms a suitable environment for the complex root system and provides mechanical support to the above ground vegetation. The major community of the soil consists of detritivores and decomposers that gradually breakdown the organic matter, releasing the nutrients and moving in the biochemical cycles on which the terrestrial organisms rely.

Soil is a decomposition product. Its solid phases have two main constituents, namely mineral matter, derived from the weathering of parent rock material, and organic matter provided by the gradual colourization of such material by plants and animals. Both the components undergo decomposition with the help of physical, chemical and biological processes. The two constituents, then closely integrate to form organo-mineral complexes which characterize the mineral soil.

OBJECTIVE

1. To divide the study area in some microhabitats.

2. To study and compare the physico-chemical properties of the soil of Bethune College campus, with respect to four different surrounding environment.

MATERIALS and METHODS

A six month study was done in the campus of Bethune College.

1. Observing the physiographic variation, the area was divided into four sub area viz.

A] Soil under the *Ficus* tree [Site1]

A large number of bats dwell in this tree, so the soil under the tree consists of the excreta of the bat (*Pteropus giganteus*) which may affect its natural properties.

B] Sports field soil [Site 2]

It consists of the natural soil of the campus with about no external sources to affect the soil quality.

C] Soil from the garden of medicinal plants [Site 3]

This garden consist of medicinal plants like- Aloe vera, *Ocimum sanctum, Asparagus ramosus* etc.

D] Flower garden soil [Site 4]

The flower garden soil consists of flowering plants like- West-Indian Jasmine (*Ixora sp.*), *Thevetia peruviana etc.*

2. Eight physico-chemical parameters were analysed viz. temperature, pH, colour, Nitrogen, Phosphorous, Potassium, free carbonate and organic Carbon.

Temperature was measured by using soil thermometer. pH was recorded by pH meter. Nitrogen, Potassium and Phosphorous were analyzed through NICE soil testing kit. Organic carbon and free carbonate were measured by Chemical measures.

OBSERVATION :

The following were conducted for six months (October-March) for all the four selected sites of Bethune College campus.

1. Temperature of soil (in °C) : Table I

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	23.4	23.2	20.5	21.1	21.1	24.2
2	Sports field soil	22.0	21.2	21.2	20.3	20.3	20.1
3	Soil from the garden of medicinal plants	23.2	22.9	22.0	21.6	21.2	21.2
4	Flower garden soil	23.1	22.7	22.4	21.9	21.9	21.3

2. Colour of Soil : Table II

Sample no.	Sample name	Colour
1	Soil under the *Ficus* tree	Blackish Brown
2	Sports field soil	Light Brown
3	Soil from the garden of medicinal plants	Deep Brown
4	Flower garden soil	Brown

3. pH of soil : Table III

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	6.5	6.5	6	6	6	6
2	Sports field soil	7.5	7.5	7.5	7.5	7	7
3	Soil from the garden of medicinal plants	8.5	8	8	8	8.5	8
4	Flower garden soil	7.0	7.5	7	7	7	7

4. Nitrogen content: Table IV

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	L2	L2	L2	L2	L2	L2
2	Sports field soil	Nil	Nil	Nil	Nil	Nil	Nil
3	Soil from the garden of medicinal plants	Nil	Nil	Nil	Nil	Nil	Nil
4	Flower garden soil	L1	L1	L1	L1	L1	L1

5. Phosphorous content: Table V

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	M2	M2	M2	M2	M2	M2
2	Sports field soil	L2	L2	L1	L1	L1	L1
3	Soil from the garden of medicinal plants	M2	M2	M2	M2	M2	M2
4	Flower garden soil	L1	L1	L1	L1	L1	L1

6. Potassium content: Table VI

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	H1	H1	H1	H1	H1	H1
2	Sports field soil	M2	M1	M1	M2	M1	M1
3	Soil from the garden of medicinal plants	M1	M1	M1	M1	M1	M1
4	Flower garden soil	M2	M2	M2	M2	M1	M2

7. Free Carbonate Content (in %) : Table VII

Free Carbonate Content (in %)

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	3.72	4.65	4.18	3.72	4.65	3.72
2	Sports field soil	11.62	10.69	11.62	11.16	10.69	11.16
3	Soil from the garden of medicinal plants	2.32	0.93	2.32	1.39	1.39	2.79
4	Flower garden soil	0.93	1.86	1.86	0.93	0.93	1.39

8. Organic matter of Carbon : Table VIII

Organic matter of Carbon (%)

Sample no	Sample name	Month					
		October	November	December	January	February	March
1	Soil under the *Ficus* tree	0.60	0.60	0.67	0.57	0.57	0.60
2	Sports field soil	0.57	0.57	0.60	0.57	0.60	0.60
3	Soil from the garden of medicinal plants	0.33	0.33	0.26	0.33	0.30	0.33
4	Flower garden soil	0.36	0.36	0.40	0.30	0.36	0.30

Soil Composition :

An ideal soil for landscape plants is generally as one that has 25% air spaces, 25% water, 45% minerals and 5% organic matter. Before planting anything in the landscape (except trees), re-establishment of this ratio in Soil is needed. After things are planted, we should strive to maintain this balance equipment across the surface

Air: Plant roots need oxygen to grow. Without an adequate supply of free oxygen in the soil, roots will die and as a result the plant may not receive water and nutrients. Turning the soil during tillage and the tunneling activity of the creatures such as earthworm helps to keep the soil aerated. Soil compaction is an enemy of plants because it causes the loss of air spaces in the soil.

Water: It is one of the basic factors required for the plant growth. Excess of anything in harmful. Similarly, if the water level goes above 25%, it squeezes out oxygen. If adequate drainage is allowed by the soil structure, enough water will be left in the root zone so that the plant can absorb it when needed.

Minerals: The basic building blocks of standard soils are the inorganic particles that come originally from minerals. Mostly, minerals are the result of the breakdown of rocks into smaller particles over the ions through the action of rain, freezing water and winds.

The minerals in the soil are defined by 3 types of particles:

1. **Sand** – These particles are the largest of the three and range from 0.5 to 2.0 mm in size.
2. **Silt** – the particles are finer than the sand particles with size of about 0.002 to 0.05 mm.
3. **Clay** – these are extremely tiny particles which are less than 0.002 mm in size.

Organic matter: although the smallest fraction of a good soil, organic matter is one of the most important components. Micro-organisms such as fungi and bacteria feed on it and reduce it to the basic components such as Nitrogen, which can be then used by the plants. Earthworms feed on organic matter and provide air spaces through their tunneling. The structure of Organic matter in the soil also provide air spaces and it has high cation exchange capacity so it helps to hold on to the nutrients.

Temperataure – It varies with the depth, season, soil type and time of the day. So, we did not find much variation in temperature due to the surrounding conditions but a slight variation due to seasonal change in six months data could be observed.

Colour – It is due to the pressure of various inorganic and organic constituents. The four soil samples we collected, were having four different colours. So, here we found complete impact of the presence of variability in the surrounding conditions into the soil.

pH – The effect of pH on the chemical and biological properties makes its determination very important. It is one of the most important parameters in soil chemistry and is defined as – log [H^+] and measured as the intensity of acidity or alkalinity on a scale ranging from 0 to 14. If free H^+ are more, it is expressed as acidic (i.e, pH < 7) while more OH^- ions is expressed as alkaline (i.e., pH > 7).

Here, the pH of the soil under the *Ficus* tree (Sample – 1) was found to be most acidic among all the soils. It was due to the acidity of the fecal matter (birds dropping), content of the Bats (*Pteropus giganteus*) on the soil. And, the most alkaline soil among the four was found to be the soil from the garden of medicinal plants (Sample – 3). The reason behind was the basicity of certain medicinal plants.

Inorganic content – The inorganic constituents such as Nitrogen, Phosphorous and Potassium constituent in the soil under the *Ficus* tree (Sample-1) was comparatively higher than the rest other soil samples. The same reason applies here too, i.e. the presence of fecal matter of the Bats in the soil. According to the literature, the fecal matter of Bats contain a large amount of Ammonia along with Uric, Phosphoric, Oxalic and Carbonic acids as well as some earth salts and impurities. As a result the soil of Sample -1 is rich in all these nutrients.

Free Carbonate – The free carbonate is highest in the sports field soil (Sample – 2). It is because, very often, chalk dust is used to draw lines in the field for sports event. This chalk dust in nothing but Calcium carbonate ($CaCO_3$). Presence of $CaCO_3$enriches the soil free carbonate content. The amount of Free carbonate in the rest other soil is very low.

Organic matter – Soil organic matter (SOM) is the organic matter of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organisms. The amount of Organic matter content is more or less the same in all the four soil samples.

DISCUSSION

After studying the physico-chemical parameters of the soil samples of variant months, we can conclude that each factor does play its important role but at the same time, the final effect is the combined result of the interactions of all factors.

The variation in **Colour** of the soil must be an important parameter in soil media. Although, all the soil samples have been taken from the campus itself, but still we find variation from Light brown to Blackish brown in colour. It is due to the surrounding conditions of the soil.

The **Temperature** variation is seen in between 20.3°C to 23.4°C. Here, we find, seasonal variation affecting the temperature of the soil to a greater extent than the surrounding conditions. The surrounding conditions have rarely a role in temperature variation of the soil.

A great variation could be seen in the **pH** of soil. The soil under the *Ficus* tree (Sample - 1) is the most acidic whereas the soil of the medicinal garden (Sample -3) has the highest pH value (i.e., alkaline).

The **Inorganic constituents** such as Nitrogen, Phosphorous and Potassium do not show any seasonal variation but varied with the surrounding conditions. We see large variations among the four samples collected.

The **Organic matter** and **Free Carbonate** content of the soil also showed variation due to the surrounding environment.

Acknowledgement : The authors wish to thank DST-FIST for providing infrastructural help in the departments of Computer Science and Zoology of Bethune College, Kolkata.

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