Study on the variations of Soil Edaphic and Chemical Factors of different forest types of Achencovil Range during Post Monsoon Season

P. Vinod, M.G. Sanal Kumar, B. Bini

P.G. & Research Department of Zoology, N.S.S. College, Pandalam
Kerala, India – 689 501

Abstract- Comparison between the three forest types namely moist deciduous, semi evergreen and evergreen of Achencovil forest in the post monsoon season on the basis of soil edaphic factors like gravel, p^H, Organic carbon content (OC), Exchangeable Acid (EA), Exchangeable Base (EB), sand, silt, clay and soil chemical factors like Nitrogen, Phosphorous, Potassium, Calcium and Magnesium contents. 20 sites from moist deciduous, semi evergreen and Evergreen were randomly selected. Soil samples of 5×5 cm^2 area from a depth of 5 cm were collected from these three habitats. Mean with standard deviation were taken. Habitat wise variation was analyzed by using two way ANOVA. The study shows that the evergreen soil has high nitrogen content (3779.8 ppm). Phosphorous content (5.98 ppm), potassium content (242.45 ppm) and calcium content high in moist deciduous and magnesium (74.75ppm) content high in semi evergreen. The Evergreen soil has high organic carbon content (4.72 %).

Index Terms- Achencovil Forest, Moist deciduous, Semi evergreen, Evergreen, Soil edaphic factors, Post Monsoon

I. INTRODUCTION

Soil is a major component of earth's ecosystem. Soil must be considered as a complex of living and nonliving components which are present in different combinations, with identifiable gross characteristics. As cited by Kuhnelt (1961), 'the soil is the uppermost weathering layer of the solid earth Crust; it consists of broken up and chemically changed parent rock and the remains of the plants and animals. A thin layer of soil covers most of the earth's land surface. This layer is varying from a few centimeters to 2 or 3 meters in thickness. It is in this layer of soil that the plant and animal kingdom meet the mineral world and establishes a dynamic relationship. Early chemist considers soil as a store house of plant nutrients. One gram of soil supports a population of millions or even billions of bacteria and other microorganism. In addition to living components soil also contains nonliving components like rocks, minerals, soil water, soil air etc. Soil is made up of substances existing in solid liquid and gaseous states with colloidal particles of organic and inorganic origin.

Soil contains sand, clay and silt in definite proportions. Besides soil particles, the soil contains mineral nutrients which are important for plant metabolism and growth. These elements are essential for maintaining the osmotic balance and absorbing ions from soil solution. It include macro elements or macronutrients like Carbon, Hydrogen, Oxygen, Calcium, Nitrogen, Phosphorus, Sulphur and Magnesium and microelements or micronutrients like Potassium, Iron, Manganese, Zinc, Boron and molybdenum. The soil also contains organic matter and humus. These organic substances increase soil fertility and acts as a food substrate for microorganism and soil animals. Humus is the dark amorphous portion of the organic matter which has lost its structure through decomposition. The amount of organic carbon in the soil depends on various factors like soil texture, climate, vegetation and land use.

The present study was undertaken for the comparison of soil edaphic and soil chemical factors between the three habitats of the Achencovil forest namely moist deciduous, semi evergreen and evergreen as a part of Western Ghats.

II. METHODOLOGY

The study was conducted in Achencovil forest area of Kollam district lies between latitude 9^0 00 N and 9^0 08 N and longitude 77^0 00 E and 77^0 015 E. This forest area comprises different types of forest ecosystems, including tropical evergreen, semi evergreen and deciduous forests. Hence the study sites were selected evenly based on a primary observation on the forest and soil types in which they belong.

A. Collection and transportation of sample

Three forest types, moist deciduous, semi evergreen and evergreen of Achencovil forest range were selected. From each type, 20 sampling sites were identified. Soil samples of 5x5 cm^2 areas from a depth of 5 cm were randomly collected using soil auger during the monsoon period of 2014 (September, October and November). Collected samples were taken to the laboratory in polythene covers.

B. Soil edaphic factor analysis

From the sample collected, the soil edaphic factors like gravel content, P^H, organic carbon, Exchangeable acids, Exchangeable base and soil morphology (sand, silt and clay content) were detected using standard procedure. The soil gravel content was measured using standard procedures. The soil P^H was measured using P^H meter. Exchangeable acid and exchangeable bases were measured using the procedure of Trivedy and Goel (1987). Soil organic carbon content was measured by using the procedure of Walkley and Black (1934).

Soil sand, silt and clay content were measured by standard procedure.

C. *Soil chemical factor analysis*

Soil samples are air dried and sieved. From the sample chemical factors like Nitrogen, Phosphorus, Potassium, Calcium and Magnesium content were analyzed. Nitrogen content was analyzed by Kjeldhal distillation method, the Phosphorus content was analyzed by Molybdate stannous chloride method, Potassium content was analyzed by Flame photometry method

III. RESULT

A. *Soil edaphic factors*

In the three forest type of Achencovil (moist deciduous, semi evergreen and evergreen), the soil edaphic factors like gravel, P^H, organic carbon, Exchangeable acids, Exchangeable bases, sand, silt and clay content in the post monsoon season were detected.

Gravel content was an average of 30.03 in the moist deciduous, 14.99 in semi evergreen and 23.11 in the Evergreen (Table 1). Two way ANOVA showed no significant variation between the sites (P>0.05) of the same habitats and significant variation between the habitats (P<0.05).The average P^H of the moist Deciduous was found to be 4.615, in the semi evergreen 4.54 and in the evergreen is 4.74 (Table 1). The two way ANOVA showed no significant variation between the sites (P>0.05) and showed significant variation between the habitats (P<0.05) (Table 2). All the three habitats show an acidic P^H.

The organic carbon content in the moist deciduous forest was an average of 3.42%, in the semi evergreen of 4.33% and in the Evergreen of 4.72%.The exchangeable acids in the moist

(APHA 2012). Calcium and Magnesium content of the soil were analyzed by the methods of Jackson (1958).

D. *Statistical analysis*

Descriptive statistical analyses were done by using Microsoft Excel Software. Two way Analysis of variance (ANOVA) was conducted to determine the significant differences in the value of each parameters between the sites and the forest habitat using SPSS package 14.00.

deciduous forest was an average of 2.61%, in the semi evergreen of 2.54% and in the Evergreen of 1.45%. The exchangeable base in the moist deciduous forest was in an average of 5.41%, in the semi evergreen of 12.06% and in the Evergreen of 3.34 % (Table 1). The two way ANOVA showed no significant variation in the level of organic carbon, exchangeable acids and Exchangeable bases between the sites (P>0.05) and showed significant variation the level of organic carbon, exchangeable acids and Exchangeable bases between the habitats (P<0.05) (Table 2).

The Sand content in the moist deciduous forest was an average of 83.3%, in the semi evergreen of 75% and in the Evergreen of 75.45%.The silt content in the moist deciduous forest was an average of 6.7%, in the semi evergreen of 12.4% and in the Evergreen of 14%. The clay content in the moist deciduous forest was an average of 10.25%, in the semi evergreen of 13.35% and in the Evergreen of 11.25 % (Table 1). The two way ANOVA showed no significant variation in the level of sand, silt and clay content between the sites of the same habitat (P>0.05) and showed significant variation the percentage of sand, silt and clay content between the habitats (P<0.05) (Table 2).

Table 1: Soil Edaphic Factors of Achencovil forest in post monsoon season

Forest Type	Gravel	P^H	Organic Carbon%	EA%	EB%	Sand%	Silt%	Clay%
Moist Decidous	30.03±1.15	4.61±0.08	3.42±0.09	2.61±0.15	5.41±0.15	83.3±1.03	6.7±0.97	10.25±0.71
Semi Evergreen	14.99±0.33	4.54±0.08	4.33±0.009	2.54±0.12	12.06±0.46	75±0.72	12.4±1.72	13.35±1.34
Evergreen	23.11±0.14	4.74±0.12	4.72±0.05	1.45±0.06	3.34±0.06	75.45±2.79	14±1.58	11.5±0.71

Table 2: Two way ANOVA for soil Edaphic Factors of Achencovil forest in post monsoon season

Parameter analyzed	Comparison aspect	F- value	F- Critical Value	P value
Gravel	Within the Habitat	1.023918	1.867332	0.458822
	Between the Habitat	2341.566	3.244818	1.62×10^{-40}
P^H	Within the Habitat	1.100467	1.898622	0.390108
	Between the Habitat	2301.818	3.259446	1.04×10^{-38}
Organic Carbon	Within the Habitat	0.545426	1.867332	0.920619
	Between the Habitat	1.849569	3.244818	1.37×10^{-38}
Exchangeable Acids	Within the Habitat	2.790126	1.867332	0.00348
	Between the Habitat	953.2968	3.244818	3.37×10^{-33}
Exchangeable Base	Within the Habitat	1.223812	1.867332	0.290031
	Between the Habitat	5520.67	3.244818	1.48×10^{-47}
Sand	Within the Habitat	1.562811	1.867332	0.118711
	Between the Habitat	164.6394	3.244818	1.91×10^{-19}
Silt	Within the Habitat	0.662338	1.867332	0.830732
	Between the Habitat	121.101	3.244818	3.27×10^{-17}

| Clay | Within the Habitat | 1.130309 | 1.867332 | 0.362489 |
| | Between the Habitat | 55.09266 | 3.240818 | 5.9×10^{-12} |

B. Soil chemical factors

The nitrogen content in the moist deciduous forest was an average of 2253.45ppm, 3260.6ppm in the semi evergreen and 3779.8ppm in the evergreen. The phosphorus content in the moist deciduous forest was an average of 5.92ppm, in the semi evergreen is 4.80ppm and in the Evergreen is 4.70ppm (Table 3). The two way ANOVA showed there is no significant variation in the level of nitrogen and phosphorus content between the sites of the same habitat ($P>0.05$) and showed significant variation in the level of nitrogen and phosphorus content between the habitats ($P<0.05$) (Table 4) during the post monsoon season.

The potassium content in the moist deciduous forest was an average of 242.45ppm, 164.4ppm in the semi evergreen and 152.05ppm in the evergreen. The calcium content in the moist deciduous forest was an average of 371.2ppm, in the semi evergreen is 346.95ppm and in the Evergreen is 141.35ppm. The magnesium content in the moist deciduous forest was an average of 28.30ppm, 74.75ppm in the semi evergreen and 48.19ppm in the evergreen (Table 3). The two way ANOVA showed there is no significant variation in the level of potassium, calcium and magnesium content between the sites of the same habitat ($P>0.05$) and showed significant variation in the level of potassium ,calcium and magnesium content between the habitats ($P<0.05$) (Table 4) during the post monsoon season.

Table 3: Soil Chemical Factors of Achencovil forest in post monsoon season

Forest type	Nitrogen ppm	Phosphorus ppm	Potassium ppm	Calcium ppm	Magnesium ppm
Moist Deciduous	2253±22.21	5.92±0.03	242.45±0.99	371.2±15.00	28.30±3.19
Semi Evergreen	3260.6±11.77	4.80±0.03	164.4±3.03	346.95±3.60	74.75±2.26
Evergreen	3779±10.53	4.70±0.04	152.05±1.23	141.35±1.08	48.19±0.73

Table 4: Two way ANOVA showing soil chemical Factors of Achencovil forest in post monsoon season

Parameter analyzed	Comparison aspect	F- value	F- Critical Value	P value
Nitrogen	Within the Habitat	1.191899	1.867332	0.313439
	Between the Habitat	51739.9	3.244818	5.38×10^{-66}
Phosphorus	Within the Habitat	1.535661	1.867332	0.127962
	Between the Habitat	7462.404	3.244818	4.91×10^{-50}
potassium	Within the Habitat	1.048597	1.867332	0.435252
	Between the Habitat	12498.89	3.244818	2.77×10^{-54}
calcium	Within the Habitat	1.2061	1.867332	0.302848
	Between the Habitat	4275.361	3.244818	1.87×10^{-45}
Magnesium	Within the Habitat	1.843237	1.867332	0.053598
	Between the Habitat	2624.608	3.244818	1.88×10^{-41}

IV. DISCUSSION

From the three habitat of Achencovil forest, moist deciduous, semi evergreen and evergreen soil edaphic factors like gravel content, P^H, organic carbon, Exchangeable acid, Exchangeable base, sand, silt and clay content were detected. The soil gravel content is high in moist deciduous forest and low in the semi evergreen. The entire three habitats showed an acidic P^H and evergreen habitat found more acidic.

In the moist deciduous forest the soil is sandy, loam and moderately acidic. Organic carbon content is high. Exchangeable acid was generally low but Exchangeable base is high. The soil has high nitrogen, potassium and calcium content but low potassium and magnesium content.

In the semi evergreen type, the soil is moderately acidic with high amount of organic carbon, Exchangeable acid was generally low but Exchangeable base is high. The soil is sandy with slightly higher level of clay. The level of Nitrogen, potassium and calcium was high but the level of phosphorus and magnesium was found to be low.

In the evergreen forest the gravel content showed a medium range ,moderately acidic ,with high carbon content, with low value of Exchangeable acid and a moderate value of Exchangeable base. The soil has high nitrogen, potassium and calcium content but low level of phosphorus and magnesium content.

The present study showed that nitrogen content is high in evergreen habitat and low in moist deciduous habitat. Phosphorus content is high in moist deciduous and low in evergreen. Potassium and calcium content is high in moist deciduous and low in evergreen habitat. Magnesium content is high in semi evergreen and low in moist deciduous.

V. SUMMARY AND CONCLUSION

Compared the three habitat of Achencovil forest; moist deciduous, semi evergreen and Evergreen based on the soil edaphic factors like soil temperature, pH, exchangeable acid, exchangeable base, organic carbon content, moisture content, sand silt, and clay content, soil chemical factors like nitrogen, phosphorus, potassium, calcium and magnesium content. In each habitat, 20 sites were selected for the soil study. Soil samples were taken during the post monsoon season. Mean with standard deviation were taken for each parameter value. Two way ANOVA was conducted to test whether the samples have variation in values between sites and habitats. From this study found that the Evergreen habitat was more fertile than Moist deciduous and semi evergreen.

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AUTHORS

First Author – P. Vinod, M.Sc. Zoology, M. Phil., Assistant Professor, Post Graduate and Research Department of Zoology, N.S.S. College, Pandalam, Kerala, India. Vinod7175@yahoo.co.in

Second Author – Dr. M.G. Sanal Kumar, Ph.D., Assistant Professor, Post Graduate and Research Department of Zoology, N.S.S. College, Pandalam, Kerala, India. mgsanalkumar@gmail.com

Third Author – B. Bini, M.Sc. Zoology, Research scholar, Post Graduate and Research Department of Zoology, N.S.S. College, Pandalam binirohini@gmail.com

Correspondence Author – P.Vinod, vinod7175@yahoo.co.in, +91 9447248307