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Comparative Assessment of Nutrient Status of Selected Plateaus in Western Ghats, Maharashtra

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Abstract - Western Ghats area is a small part of the Deccan Traps continental flood basalt province, which has erupted about 65 Million years ago. This area is considered as Hotspot which has attracted the attention of many geologists, botanists and geo-morphologists for over a century. The Western Ghats represents one of the critical habitats which are plateaus. Plateaus are considered as “island upon islands” which has many endemic species. Many previous studies covered either their plant species composition or geological and geo-morphological status. An analytical study of microhabitats and associated therophytes of four outcrops Durgawadi Plateau (DP), Naneghat Plateau (NP) which are basalt outcrops and Zenda plateau (ZP) and Amba Plateau (AP) which are laterite outcrop of the northern Western Ghats revealed correlation between basalt and lateritic rock outcrop. The out crops how differences not only in species composition but in their nutrient status also.

Keywords - Rock outcrop, microhabitat, therophytes.

I. Introduction

The Sahyadri Range is one of the spectacular geographic features of the Indian subcontinent. A compilation with complimentary of landmark papers by the Geological Society of India (Gunnell and Radhakrishna 2001) findings up to the date gives us an idea about its uniqueness. One of the distinctive aspects of Geomorphology of Sahyadri Range is the presence and preservation of two “paleo surfaces”

indicated by laterite. (Fox, 1923; Widdowson, 1997; Widdowson and Cox 1996). “Rock outcrops” is the type of habitat; this is an IUCN documented category of habitats. In such areas the percentages of freely exposed bedrock protrude above the soil level because of natural causes. Cliffs, isolated hills and platforms of rocks are shaped due to some landscape level activities of weathering which are the most common types of habitats (Watve 2005). All over the world’s one of the Familiar rock outcrops habitats are inselbergs, barrens, cedar glades, cliffs, serpentine, ultramafic, limestone and gypsum outcrops. Each of these habitats is known to support definite type of vegetation rich in micro habitat specific and endemic plants. Such Rock outcrop areas are of small range within a region and they have particular habitat limits *e.g.*, larger exposure to sun and lack of the soil. The microenvironment at the rock surface ranges from very hot and arid in dry period to the water logged in the monsoon spell. That is why edaphically precise herbaceous plant communities are the characteristic flora of rock outcrops. Rock outcrops which are very well identified everywhere in the world for its exclusivity in species but these are less studied habitats. Studies are from African, American and Australian outcrops (Porembski et al. 1994, 2000; Burke 2005 a,b; Jacobi et al. 2007) which has defined the habitat classes and its associated vegetation composition. In India, comparatively very few studies occur about vegetation on these distinct habitats (Porembski & Watve 2005; Watve 2008, 2013; Lekhak & Yadav 2012; Bhattarai et al. 2012). The rock outcrops in the Western Ghats are chiefly of two categories based on the rock establishment and soil type advanced from it: (i) Lateritic—lateritic rock cover which is well conserved over the parental basalt rock and soil rich in iron and low altitude plateaus in the Konkan region and (ii) Basaltic—which are having black solid rock and soil. Some of the plateaus in the northwestern corner of Pune are totally basaltic but they have some lateritic soil due to weathering. These areas have diversity in micro-habitats as well as are rich in species composition. On these habitats trees or shrubs are fewer in number, but herbaceous angiosperms, algae, mosses, ferns and lichens are generally dominant. On these special kinds of habitat many endemic ephemerals, herbaceous angiosperms, pteridophytes and lichens are can be observed. On these areas Species composition patterns and communities representing outcrop are supported by a number of several environmental aspects like soil type, elevation, rock outcrop aspect and micro-environments which are being exclusive here. Earlier the vegetation studies of plateaus in the northern Western Ghats and Konkan region done by Watve (2008, 2013) deliberates the vegetation composition and of microhabitats form son plateaus. An all-inclusive botanical study of two rock outcrops, Durgawadi Plateau (DP) and Naneghat Plateau (NP), on the ridge of the northern Western Ghats has concluded a very high plant diversity within and between sites. (Rahangdale & Rahangdale). Herbaceous vegetation of high-rise lateritic plateaus of southwestern Maharashtra have been studied by Lekhak and Yadav (2012). Recent studies have talked about the importance of microhabitats as plateau vegetation have unique microhabitats that support distinct plant communities depending primarily on soil, depth of the soil and moisture availability. None of the studies describes the association between nutrient status and vegetation communities. The present study was carried out with an objective to find out correlation as well as similarity and differences within the plateau and across the plateaus.

II. Study Area



Durgawadi Plateau:

It is located 60 kms away from Junnar town at 1200m. The plateau top can be reached after a steep climb from Ingulun village at. The road passes through villages of Ambehatwij and Kathewadi and ends at the sacred grove of Durgawadi, which overlooks the Konkan area. Adjacent to it is the plateau of Warsubai temple. Durgawadi Plateau is unique in terms of floristic composition and very significant as a number of original taxa are described from this region or associated region. All new taxa designated from Durgawadi region are endemic.

Naneghat Plateau:

It is located 26 km away from Junnar. The rocky hills of this region are well known forts. There is a tar road from Junnar to Naneghat (Ghatghar village). Here the basalt which is uncovered as a widespread at a low altitude and this plateau is confined by a number of sacred groves, few reserve forest areas, many rice fields and upright slopes. The out crop and its surroundings are dominated by anthropogenic pressures. Floristically the area is rich in diversity.

Zenda plateau:

Zenda-Dhangarwada-plateau a least disturbed out crop. The plateau known as Zenda dongar is located between Manoli-Gajapur-Dhangarwada villages near Amba ghat the plateau top on Manoli side can be approached from a forested footpath branching from Amba to Vishalgad road.

Amba Plateau

The plateau locally known as Amba plateau overlooks Amba Ghat which is a famous monsoon tourist destination. The plateau top can be reached from a forested path through Amba village.

Table No.1: Study area description:

Sr. No	Name	Latitude Longitude	Elevation	Type of associated Rock &Area of plateau	Number of Microhabitats
1	Durgawadi Plateau, Junnar, Dist-Pune Maharashtra	19°11'37.99"N ,73°41'42.57" E to 19°13'3.59"N 73°38'33.92"E	1156m ASL	Basalt 2.87 sq km	11=10 GPS marked Quadrates
2	Naneghat Plateau, Junnar Dist-Pune Maharashtra	19°16'15.63"N 73°43'14.45"E to 19°17'53.29"N 73°40'22.37"E	760m ASL	Basalt 2.01 sq km	10=10 GPS marked Quadrates
3	Amba Plateau,Amba Ghat, Dist-Kolhapur	16°59'7.72"N 73°47'04.72"E To 16°59'16.87"N 73°47'23.15"E	680m ASL	Lateritic: 4 sq km	10= 10 GPS marked Quadrates
4	Zenda Plateau,Amba Ghat, Dist-	16°55'5.50"N, 73°47'50.62"E to	1025m ASL	Lateritic 7.67 sq km	10=10 GPS marked Quadrates

III. Methods

Samples have been collected from microhabitats which were identified during the surveys and rock and soil samples have been collected from different microhabitats .Total 41 of samples 10 from each plateau by random selection method have been analyzed. For the analysis of nutrients basically, Organic Carbon by Walkeley and Black method and Nitrogen by Kjeldahl's Method was used. From the same coordinates from where the rock and soil samples have been collected the plants samples which are abundant in that area have been collected. The samples have been carefully dried in shade, soil particles from the roots have been carefully removed and fine powder has been prepared by using Mortar and pestle. Collected 41 samples which is considered as first set have been analyzed for nutrient analysis Organic Carbon by Walkeley and Black method and Nitrogen by Kjeldahl's Method. The second set of plant samples have been mounted on Herbarium sheets by standard Herbarium techniques Authentication for the species have been done from Agharkar Research Institute, Pune. All the plant samples collected are Therophytes as an analysis on the life-form reveals that nearly 70% of the species which are associated with plateau Ecosystem are Therophytes. The dominance of therophytes is possibly due to their greater ability to survive under disadvantageous environmental conditions (Porembski, 2000).Statistical analysis was done using software like PAST. This was done to understand correlation among elements as well as regions.

IV. Results and Discussion

A. Sourcewise Correlation-

Statistical analysis has been done for all four regions, to find out correlation between carbon/nitrogen content between of rocks and plants. Both Pearson (Parametric) and spearman (Non parametric) correlation method is used. The correlation value is also associated with p-value for checking the significance of correlation. At 0.05 significance level, no significant correlation is observed between rocks and plants with respect to either carbon or nitrogen content in any region which indicates in all four areas the variation in carbon and nitrogen content is almost similar region wise. At 0.05 significant level significant correlation has been observed between Rocks in Zenda and plants. Zenda Plateau which is the least disturbed plateau as compared with the other three plateaus. It is observed that if nitrogen in rock is more, the plant nitrogen content will also more. In other regions if the rock Nitrogen content is less the rocks, plants may have alternate source of Nitrogen other than rocks or soil. This supports the presence of insectivorous plants on the plateaus.

Table 2: Correlation of Element

Correlation of Element	Between	In Region	PearsonCor	PearsonCor Pvalue
Nitrogen	Rocks and Plants	Zenda	0.0120559	0.9754429

B. Nutrient wise Correlation

Statistical analysis has been done for all four regions, to find out correlation between carbon and nitrogen content of rocks/plants. Both Pearson (Parametric) and spearman (Non parametric) correlation method have been used. The correlation value is also associated with p-value for checking the significance of correlation. None of them are significant at 0.05 significance level. Significant correlation is observed between Carbon and Nitrogen contents of Rocks in Zenda, Plants in Zenda, Plants in Durgawadi and Rocks in Naneghat. The results clearly indicate that in Durgawadi region plants if carbon increases, Nitrogen content will also increase. In Naneghat region a positive correlation is observed between carbon and Nitrogen content of Rocks. But in Zenda region both in plants as well as Rocks the carbon content will increase, the associated Nitrogen content will also increase. As Zenda region is the minimum disturbed area the system here is a different as compared with the other regions.

Table No 3: Correlation of Nutrients:

Correlation Between	Of	In Region	PearsonCor	PearsonCor Pvalue	SpearmanCor	SpearmanCor Pvalue
Carbon and Nitrogen content	Plants	Durgawadi	-0.6897579	0.0397827	-0.4769916	0.1941792
Carbon and Nitrogen content	Rocks	Naneghat	0.6727849	0.0470523	0.6554853	0.0552845
Carbon and Nitrogen content	Rocks	Zenda	0.7545398	0.0187939	0.6498411	0.0581551
Carbon and Nitrogen content	Plants	Zenda	0.6800534	0.0438431	0.6276206	0.0703650

C. Region wise correlation:

The statistical analysis has been done to find correlation between carbon and nitrogen content of rocks/plants between any two regions at 0.05 significance level, Significant correlation is observed between Rock Nitrogen content of Amba and Zenda which are lateritic plateaus so although having same Rock type the Nitrogen content is significantly different from each other. Rock Nitrogen content of Naneghat Rocks and Amba Rocks which shows differences in Basalt and Lateritic plateaus. Rock Nitrogen Content of Durgawadi Rocks and Naneghat Rocks is significantly different. This clearly indicates the regions under study are altogether different from each other with respect to Rock Nitrogen content. In terms of plants Durgawadi plants and Naneghat plants are having significantly different Nitrogen content having similar rock type that is basalt.

Table No 4: Region wise correlation:

Region1	Region2	PearsonCor	PearsonCor Pvalue	SpearmanCor	SpearmanCor Pvalue
Durgwadi_Rocks__ Nitrogen	Naneghat_Rocks_ Nitrogen	-0.0999850	0.7980015	0.0464139	0.9056159
Naneghat_Rocks_ Nitrogen	Amba_Rocks_ Nitrogen	0.6630567	0.0515774	0.4037574	0.2811772
Amba_Rocks_ Nitrogen	Zenda_Rocks_ Nitrogen	0.6998023	0.0358444	0.5048252	0.1657207
Durgwadi_Plants__ Carbon	Naneghat_Plants_ Carbon	0.0987295	0.8004965	0.0333333	0.9483907

V. Conclusion

The study areas covered four rock outcrop areas on the high hill ridge of Western Ghats. They harbour significant species diversity in the boundaries. Many times it is generally assumed that plateaus must have extremeness ambivalences with respect to ecology and nutrient status. The present study washes out such beliefs of similarity between the four areas as they totally differ in their Nitrogen as well as Carbon content. They also vary in having varied microhabitats on the plateaus. It is also significant that, the microhabitats on these plateaus have explicit representatives of the flora as well as fauna. On this basis plateaus in Western Ghats should be designated as distinct units while considering more studies. The study highlights the need of micro level accounts of smaller areas by taking rigorous studies for documentation of diverse aspects of the biotic and biotic diversity and other environmental and anthropogenic variables. At most care should be taken not to disregard a small area/outcrop while considering random sampling methods as it is the common method used in most of the, scientific studies and Environmental Impact Assessments (EIAs) for any developmental activity. The overall results show that carbon and Nitrogen content of all four selected plateaus are significantly different with respect to rocks as well as plants. Basalt plateaus and Lateritic plateaus are different within as well as across the regions. Nutrient wise also the regions are different with respect to either carbon or nitrogen content across the four regions under study which indicates all four plateaus are significantly different in their nitrogen and carbon content. More studies are required to understand the system dynamics clearly. These ecosystems are unique in their species composition as well as nutrient status also. While these should not be considered as wastelands or barren lands these are ecologically important areas.

VI. References

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