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LICHENS – ENSHROUDING THE BARE ROCKS IN PAPPAD AREA OF SAMBA DISTRICT, JAMMU & KASHMIR

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ABSTRACT

A field survey was conducted for collection of lichens in the Jammu division, on fragile, loose sandstone rocks in Pappad area of Samba district of Jammu and Kashmir, on way to famous Mansar Lake. The rocks were devoid of the original forest cover and appear black due to dense growth of dark olive green lichens. Under such climatic conditions, the loose sandstone rocks remains exposed to scorching heat and were mostly dry thus not suitable for the growth of most plants. The lichen specimens were collected from the rocky substrates with the help of hammer, chisel. The specimens were identified by studying the morphology, anatomy and chemistry. The recent literature was consulted for identification of most of the lichen taxa. The study revealed the occurrence of 04 species of lichens belonging to 03 genera and 03 families, it was observed that some unique lichen taxa such as *Endocarpon nanum* A. Singh & Upreti; *Endocarpon subrosettum* A. Singh & Upreti; *Peltula patellata* (Bagl.) Swinsc. & Krog and *Phylliscum indicum* Upreti are present. The hair like growth on the lower surface (Rhizinae or haptera or umbilicus) of the lichens bind together the sand particles of the rock. The lichens are nature's pioneers and establish themselves where other organisms cannot. Thus from the above observation it is well evident that lichens in the Pappad area of Samba district, J & K are playing important role in the binding, stability, hydrology and fertility of these rocks. The lichen taxa growing on the rocks have thick cushion like squamulose thallus, which are closely adpressed to the rocks. The organs of attachment present on the lower side of the thallus compactly bind the sandstone particles tightly together.

Key Words: Lichens, Pappad, Rocks, Erosion, Stabilize, Sandstone

INTRODUCTION

Lichens are some of the most amazing living things on this planet and are the most successful symbiotic organisms in nature. They have no specialized organs such as root, shoot and leaves and this permit them to live economically in the harshest of environmental conditions. They have developed and diversified as a result of symbiotic association between the green/ cynobacteria or blue green algae (Photobiont) and the fungus (Mycobiont), dominating over 8% of the earth's land surface (Hale, 1983; Ahmadjian, 1995) and have attracted considerable attention because of their perceived position on the ladder of evolution to land plants (Heckman et al., 2001; Selosse, 2002). This unique association probably evolved as an adaptation to the varied microhabitats with standing extreme microclimatic conditions unfavorable for the fungi and algae in the isolation. The associated entity grows at an average rate of 1-5 mm per year and persists for tens or hundreds of years on their substratum. Lichens grow on any substratum that provide a convenient foot hold to them or any structure that has been standing for a reasonable amount of time is likely to be adorned with lichen. They colonize great variety of substrates both natural as well as the manmade. By virtue of the peculiar structure and physiological quality, the lichens have high tolerance of drought and cold and are able to grow in the diverse geographical regions from icy expanses of the Himalaya to tropical and subtropical part of south India, from drier hot deserts of Rajasthan to moist, humid climate of Eastern Himalayas (Upreti, 1998). They also survive in extremes of climatic conditions, ranging from low tide level on the sea shore to the high reaches of the Himalaya beyond the tree line and also in the arctic tundra (Negi, 2003).

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During a field survey for collection of lichens in the Jammu division, the authors observed a unique feature of lichen growth on fragile, loose sandstone rocks in Pappad area of Samba district of Jammu and Kashmir, on way to famous Mansar Lake. The rocks were devoid of the original forest cover and appear black due to dense growth of dark olive green lichens **(Fig.1a &b).**

MATERIALS AND METHODS

The lichen specimens were collected from the rocky substrates with the help of hammer, chisel. The closely adnate forms were collected along with substratum. Along with the lichen collection the details of locality, substratum and altitude were also recorded. The collections made during the day time were placed in separate polythene bags, on reaching the camp in the evening the specimens were sorted out, packed in newspapers and left to dry. In the laboratory the dried specimens brought from the field were placed in lichen herbarium packets of 17x10 cm size, with the details of locality, date of collection, field number, collector and other ecological notes. The labeled and dried specimens are lodged in the Lichen Herbarium of National Botanical Research Institute (LWG), Luck now. The specimens were identified by studying the morphology, anatomy and chemistry. The recent literature of Awasthi (1988, 1991, 2000 and 2007), Upreti (1988), Divakar (2001), Nayaka (2004) and Singh and Upreti (1984) was consulted for identification of most of the lichen taxa. Identification of lichen substances was performed by methods of Culberson (1972), Walker and James (1980) and White and James (1985).

RESULTS

The study revealed the occurrence of 04 species of lichens belonging to 03 genera and 03 families **(Table 1).** We found only crustose growth form of lichens. During major part of the year the climate of the area is characterized by high temperature. Under such climatic conditions, the loose sandstone rocks remains exposed to scorching heat and were mostly dry thus not suitable for the growth of most plants. It, however invites some unique lichen taxa such as *Endocarpon nanum* A. Singh & Upreti; *Endocarpon subrosettum* A. Singh & Upreti; *Peltula patellata* (Bagl.) Swinsc. & Krog and *Phyllis-cum indicum* Upreti, to thrive **(Fig. 1., c, d, e & f).**

DISCUSSION

The thalli of these lichens form dense cushion on the rock surface. Due to luxuriant growth of the lichens, the surface of rocks appear black. The hair like growth on the lower surface (Rhizinae or haptera or umbilicus) of the lichens bind together the sand particles of the rock. The lichens are nature's pioneers and establish themselves where other organisms cannot. These plants are well known organisms in pedogenic succession (soil formation), which changes the rocky mountains into the waving forest (Topham, 1977). The time scale required to convert the rocky mountain into a waving forest is indeed long,over 1000 years are involved in a system (Richardson, 1958). The biophysical and biochemical weathering of rocks by lichens is well known. However, in the present study it was observed that most of the rock surfaces devoid of lichen growth clearly exhibit weathering while the areas having lichen cover were intact.

The adaptation which permit certain lichen species to 'enshrouding the bare rocks' and exploit an environment inimical to most other forms of life include resistance to desiccation and to extremes of temperature, longevity and a growth rate commensurate rock . The lichens are remarkably resistant to drought. They have an ability to adhere, penetrate and digest the substance of the rock. They can extract nutrients from nutrient poor rocks that are unavailable to higher plants. The ability of lichens to completely cover the substratum in dry region has an important impact on soil stability, hydrology and fertility. Lichen crust retard erosion of soil by wind and water to a marked extent. The lichen thalli prevent raindrop impact of the soil and their rhizoids binds the usually fragile rock particles. Lichen crusts capping uneroded soil pedestals upto 10 cm higher than the surrounding eroded areas (Cameron and Blank, 1966).

Due to inclined plane in the study site, the rocks are not able to hold the water, however the porous texture of the rocks exhibits excellent water holding capacity. The lichen cushion on soil surface retain a great deal of water which could not infiltrate into the soil and also reduce the flow rates to a great extent. Lichen stabilized soil crusts contribute significantly to the fertility of soil and presumably, to the growth of vascular plants (Rogers, 1977). The nitrogen content of soil with a lichen crust is 2-7 times higher than soils without lichen crust (Shields, 1957., Shields *et al*.1957). The organic carbon levels in lichen stabilized soils are higher than that of other desert soils. Apart from the fixation of nitrogen by certain pioneer species the favorable effects of lichens on soil seems to depend on the physical effect of the lichen layer as a protective crust or mulch. A moss-lichen layer may reduce the soil temperature at a depth of 7.6 cm by 10-11^{o}C relative to bare soil (Kreshaw & Rouse 1973). The decomposition of lichens invading bare rock surfaces contribute small amount of humus on the surface, permitting the establishment of other humus requiring species of plants. The destruction of lichen crusts by the trampling animals or by other biotic and abiotic factors has far- reaching effects. Once the crust is destroyed, the surface soil which contain most of the soil nutrient is easily blown away. The soil texture changes when the lichen crust is damaged and the living conditions for the soil microflora are radically changed. This will in turn affect the growth of higher plants especially by alteration of seedbed characteristics.

CONCLUSION

The lichens are well known biodeteriorating agent, responsible for physical and chemical weathering of rocks and help in soil formation. However, from the observation in the study area it is clear that most of the lichens growing on the rocks of the Pappad area of Samba district of J & K belongs to a group of lichens lacking the chemical substances involved in chemical weathering of rocks by chelating action. The lichen taxa growing on the rocks have thick cushion like squamulose thallus, which are closely adpressed to the rocks. The organs of attachment present on the lower side of the thallus compactly bind the sandstone particles tightly together. Thus from the above observation it is well evident that lichens in the Pappad area of Samba district, J & K are playing important role in the binding, stability, hydrology and fertility of these rocks.

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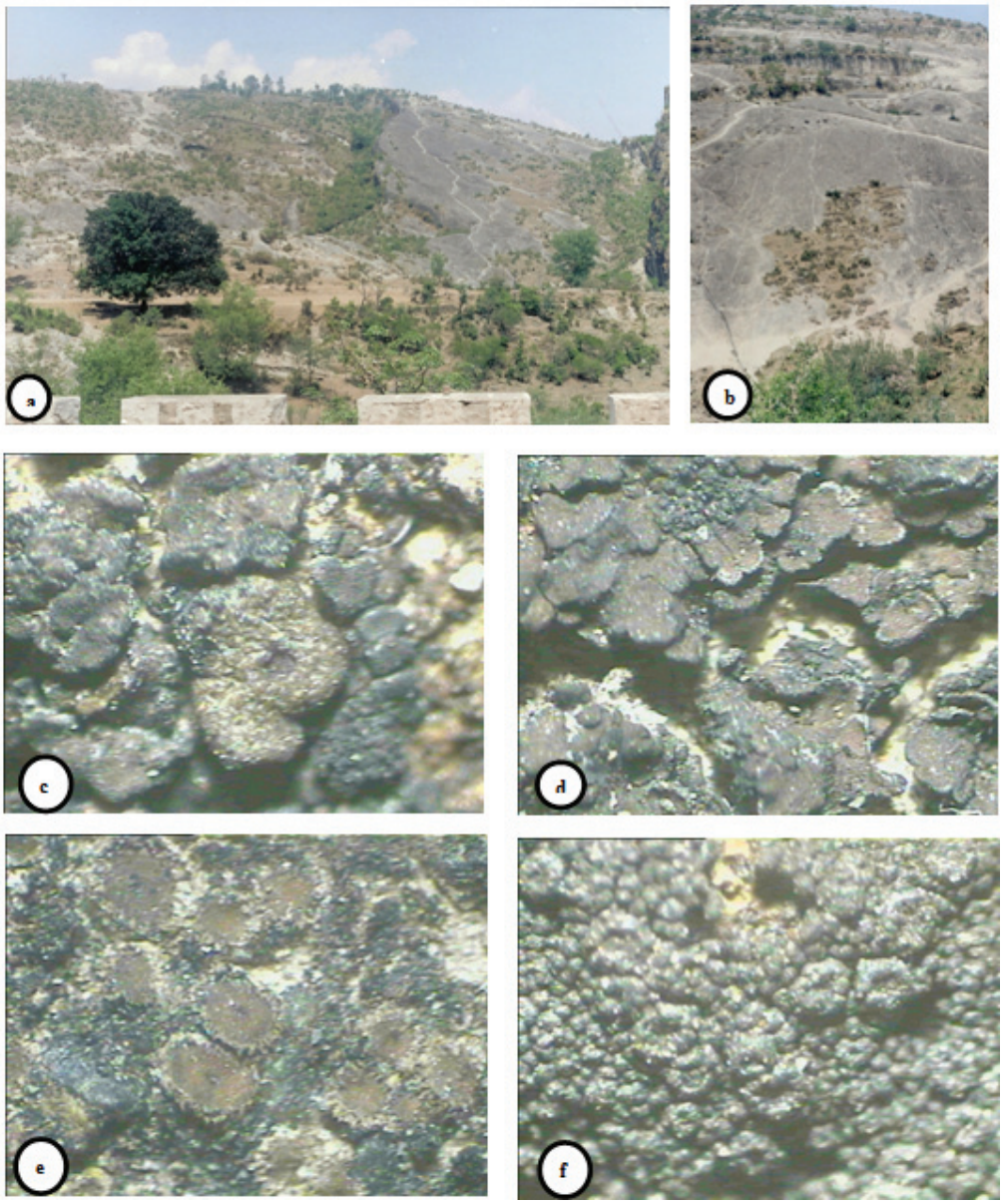

Figure 1: Landscape of the Pappad area and lichen species

a & b, Pappad area of Samba District, J& K; **c,** *Endocarpon nanum* A. Singh & Upreti; **d,** *Endocarpon subrosettum* A.Singh & Upreti; **e,** *Peltula patellata* (Bagl.) Swinsc. & Krog; **f,** *Phylliscum indicum* Upreti.

Table 1: Lichen species collected from the Pappad area of Samba district.

S. No.	Lichen taxa.	Family	Substratum	Growth Form
1	*Endocarpon nanum* A. Singh & Upreti	Verrucariaceae	Rock	Crustose
2	*Endocarpon subrosettum* A. Singh & Upreti	Verrucariaceae	Rock	Crustose
3	*Peltula patellata* (Bagl.) Swinsc. & Krog	Peltulaceae	Rock	Crustose
4	*Phylliscum indicum* Upreti	Lichinaceae	Rock	Crustose