Schismatomma galactinum (lichenized ascomycota), a lichen species new to India

The lichen family Roccellaceae is represented by 48 genera and about 200 species in the world[1], of which 56 species under 18 genera are known to occur in India[2]. This family consists of mostly microlichens, with the genus *Roccella*, being the most prominent macrolichen in the group. Genus *Schismatomma* is an important microlichen of family Roccellaceae. Among the 11 species of *Schismatomma* known from the world, India is represented by four species[3], namely *Schismatomma atomellum* (Stirt.) Zahlbr., *Schismatomma cinereum* (Müll. Arg.) Zahlbr., *Schismatomma gregantulum* (Müll. Arg.) Zahlbr. and *Schismatomma melastigmum* (Nyl.) Zahlbr. The species of the genus mostly occur in the tropical regions and are found growing as epiphytes on trees and shrubs. The species are characterized by crustose, thin and sometimes endophloedal thalli, containing calcium oxalate crystals; ecorticated, thallus with green alga as a photobiont; round, stellate to lirellate, black apothecoid ascocarps; ascomata with carbonized exciple, rudimentary and covered by thalline margin, black or brownish disc; eight-spored asci; 2–11 septate, acicular-fusiform, straight or curved colourless ascospores.

During the course of studies on lichens of Jammu and Kashmir, Western Himalaya, India, an interesting specimen of *Schismatomma* was found growing on the rocks. *Schismatomma galactinum* (Leight.) Zahlbr., is described as a new record for Indian lichen flora (Figure 1).

The morphological characters of thallus, reproductive structures, colour, size and shape were examined under stereomicroscope (NIKON SMZ 1500). Handcut sections were made and mounted in water for studying the anatomy of thalli and fruiting bodies under a compound microscope (NIKON Eclipse 50i). Sections and ascospores were also stricted with 10% KOH and iodine. Chemistry was studied with the help of colour-spot tests and thin layer chromatography (TLC). The colour tests were performed with the usual chemical reagents, including 5% KOH solution (K test), aqueous solution of calcium hypochlorite (C test) and paraphenylene diamine (PD test). Lichen substances were investigated using TLC in solvent system A (180 toluene: 60 dioxane: 8 acetic acid) following the techniques mentioned in the literature[4,5].

Schismatomma galactinum (Leight.) Zahlbr., *Cat. Lich. Univ.* 2: 556, 1923; *Platygrapha galactinum* Leight., *Trans. Linn. Soc. London*, 27: 179, 1869.

Thallus saxicolous, crustose, whitish or pale white, rugose to verrucose, with calcium oxalate crystals; prothallus a black line around the thallus; apothecia irregular in shape, oblong to round or elongate lirellate, 0.3–1.5(3) mm long and 0.08–0.2 mm wide, immersed to slightly raised; thalline margin poorly developed, more or less white; disc white pruinose; epithecium reddish-brown K+ pale red; hymenium pale to pink, with oil, 50–100 μm tall, I + blue; hypothecium dark brown, 30–80 μm tall, K+ olivaceous green; paraphysoid sparsely branched, pale brown above; asci eight spored, clavate, 40–60 × 12–15 μm; spores colourless, fusiform to curved, coiled together in ascus, 3–5 septate, 18–20 × 4–7 μm; pycinidia not seen; thallus K-, C-, KC-, PD-, no chemical substance in TLC.

Lichen genus *Schismatomma* shows close resemblance with *Enterographa* and *Lecanactis*; however, both the latter genera differ in lacking thalline margin but have well-developed true exciple. This species was reported from Sri Lanka[6] and it is a new record for Indian lichen flora. The species is characterized by saxicolous habitat, whitish

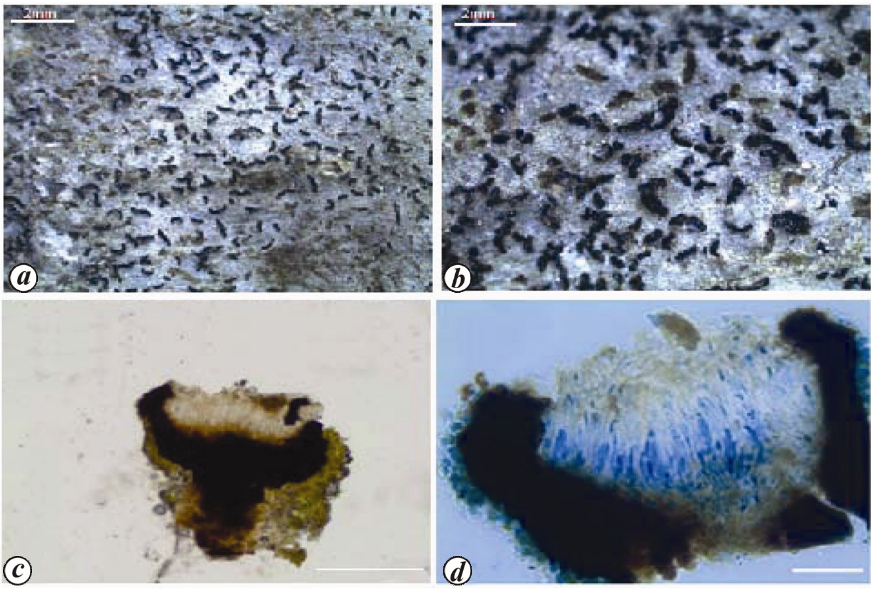

Figure 1. ***a***, ***b***, Thallus of *Schismatomma galactinum* (Leight.) Zahlbr. ***c***, ***d***, L.S. of apothecia of *S. galactinum*. Scale ***c*** = 200 μm, ***d*** = 50 μm.

rugose thallus, oblong to lirellate apothecia and 18–20 × 4–7 μm sized spore. In spore size, the species is close to *Schismatomma ceylanicum* Tehler, but the latter differs in having corticolous habitat and presence of psoromic acid in thallus. In white thallus colour, the species is close to *Schismatomma melastigmum*, but the latter differs in punctiform to submoniliform linear ascocarps. *Schismatomma kurzii* (Krempelh. in Nyl.) Zahlbr, *Schismatomma gregantulum* (Müll. Arg.) Zahlbr and *Schismatomma cinereum* (Müll. Arg.) Zahlbr also have whitish to grey thallus, but differ in having corticolous habit and bigger spores (40–60 μm long).

Specimens examined: India: Jammu and Kashmir State; Doda district; Tehsil Bhaderwah, Nalthi, on rock. April, 2012, alt.1945 m, Reema LWG, 011-019718.

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Soil organic carbon pool under different land uses in Achanakmar Amarkantak Biosphere Reserve of Chhattisgarh, India

Global climate change caused by rising levels of carbon dioxide (CO_2) and other greenhouse gases (GHGs) is recognized as a serious environmental issue of the 21st century. The role of land-use systems in stabilizing CO_2 levels and increasing carbon (C) sink potential of the soils has attracted considerable scientific attention in the recent past[1,2]. Type of land-use system is an important factor controlling soil organic matter (SOM), since it affects the amount and quality of litter input, litter decomposition rates and processes of organic matter stabilization in the soils[3]. SOM which contains more reactive soil organic carbon (SOC) than any other single terrestrial pool, plays a major role in determining C storage in ecosystems and moderating atmospheric concentrations of CO_2 (ref. 4). Soil C sequestration is the process of transferring CO_2 from the atmosphere into the soil in a form that is not immediately re-emitted, and this process is being considered as a strategy for mitigating climate change[5–7]. It is a natural, cost-effective and environment-friendly process[8]. Once sequestered, C remains in the soil as long as restorative land use, no-till farming and other recommended management practices are developed[8]. Land misuse and soil mismanagement can cause depletion of SOC stock with an attendant emission of CO_2 into the atmosphere[7–9]. In contrast, an appropriate land use and proper soil management can increase SOC stock, thereby reducing net emission of CO_2 to the atmosphere[10,11] and increase sustainability of land-use systems to reduce vulnerability to climate change[12].

Soils are the largest carbon reservoirs of the terrestrial carbon cycle. About three times more carbon is contained in the soils than in the world's vegetation and soils hold double the amount of carbon that is present in the atmosphere. Worldwide the top 30 cm of soil holds 1500 Pg ($1 \text{ Pg} = 10^{15}$ g) carbon[13]; for India the figure is 9 Pg (ref. 14). The first estimate of the organic carbon stock in Indian soils was 24.3 Pg based on 48 soil samples[15]. Jenny and Raychaudhuri[16] conducted comprehensive studies on the distribution of SOC in Indian soils in relation to the prevailing climate. Dadhwal and Nayak[17] using ecosystem areas and representative global average carbon density, estimated organic carbon at 6.8 Pg in the Indian soil. Chhabra *et al.*[18] estimated organic carbon pool at 6.8 Pg C in the top 1 m using estimated SOC density and remote sensing-based area under forest. Gupta and Rao[19] reported SOC stock at 24.3 Pg for the soil ranging from surface to an average subsurface depth of 44–146 cm based on 48 soil series. Based on a much broader national database, Velayuthum *et al.*[20] reported on total mass of SOC pool, while Bhattacharya *et al.*[21] reported on both organic and inorganic carbon pools.

In the tropical regions of Central India, few studies have been conducted on C pool of soils. The knowledge and study of the impact of different land uses on soil carbon pool at greater depths, more than 30 cm in India and particularly in Chhattisgarh is limited. Therefore, the purpose of the present study was to generate knowledge and develop conservation strategies for efficient storage of C pool in the soils. To achieve this objective, study of SOC pool was under taken under four land uses, viz. forest land, agriculture land, grassland and wasteland.

The study was conducted in Achanakmar Amarkantak Biosphere Reserve (AABR), Chhattisgarh. AABR lies between 81°48′–82°24′E long. and 22°8′–23°7′N lat. (Figure 1). The Reserve covers a huge area of 3835.51 sq. km. It has varied topography and climatic conditions which provide congenial habitat for a unique diversity of vegetation. The vegetation of the forest area of the Reserve represents tropical deciduous and is classified into Northern Tropical Moist