

Biochemical Studies on Lichens as Potential Source of Agrochemicals

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ABSTRACT

Agriculture is the pivotal sector for ensuring food and nutritional security, sustainable development and for alleviation of poverty. It is the key sector for generating employment opportunities for the vast majority of the population; most of them depend for their livelihoods. With limited land available for cultivation, there are growing concerns about environmental sustainability; growth of agricultural output must come through productivity improvements on the existing land. However, this additional production can only be achieved in part by suitable control of losses due to biotic agents (pests, weeds), which is estimated to be 38-42 % of the potential production.

In the present scenario, when the scientist community is compelled to develop environmentally benign pest control strategies, the present work was initiated aiming at the survey and collection of lichens from the high altitudes unexplored habitats. A survey was done from higher ridges of Himalayas and various endemic foliose and fruticose forms of lichens were collected. Current study was undertaken aiming at the isolation and identification of bioactive metabolites (chemical constituents) from the Himalayan lichen species unexplored for their agrochemical potential.

On the basis of the comprehensive and comparative study carried out, it can be concluded that investigated lichen extracts manifested strong, but varying degree of agrochemical activities. These similarities and differences in the agrochemical potentiality of extracts of different species of lichens are probably a consequence of the synergistic effect of different components present in the crude extracts. Biologically active extracts of all the lichen species yielded twenty four compounds. In total, fourteen compounds (Pr Ia- Pr XIVb) were isolated and identified from *P. reticulata*, six compounds (Rr Ia- Rr VIb) were isolated and identified from *R. roesleri*, three compounds (Ul Ia- Ul IIIb) were isolated and identified from *U. longissima*, four compounds (Sh I-a Sh IVb) were isolated and identified from *S. himalayense*. Further, these compounds were evaluated for various biological activities, in order to determine their agrochemical potential. Among the isolated compounds tested for their antifungal potentiality, protolichesterinic acid, an aliphatic α -methylene- α -lactone from hexane extract of *P. reticulata* and usnic acid, a dibenzofuran derivative from hexane extract of *R. roesleri* and *U. longissima* showed maximum

antifungal activity against all the test fungi as compared to other chemical constituents isolated from *P. reticulata* and *R. roesleri*.

Current study establishes lichens as potential source of agrochemicals. Their products can be used safely as crop protectants with no detrimental effects on major food crops. The study also highlights the plant growth regulating activity of the test lichens for the first time. The compounds isolated can also serve as lead for chemical synthesis to yield new products. Appropriate chemical modification may increase their potency. At the same time, field trials investigating the agrochemical efficacy of the samples under natural environmental stress conditions are also needed. The present study can further be extended to understand the mechanism of interaction with the test organism, in order to obtain products with improved efficacy and to develop a novel class of bioactive agents. This in turn may provide incentives for conservation of biodiversity and stimulate economic development.