

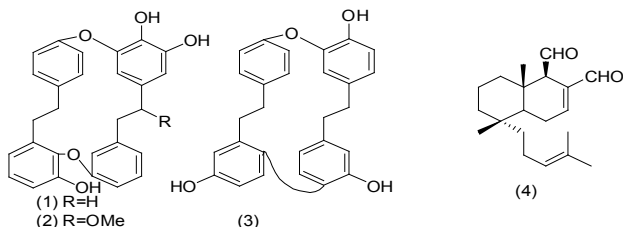
Liverworts-Potential Source of Medicinal Compounds

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Bryophytes are the oldest terrestrial green spore-forming plants, although no strong scientific evidence for this has been appeared in the literature. This hypothesis was mainly based on the resemblance of the present-day liverworts the first land plant fossils, the spores of which date back almost 400 million years. They are taxonomically placed between the algae and the pteridophytes and there are 14000 species of Bryophyta, 6000 of Marchantiophyta (=liverworts) (Figures 1 and 2) and 300 of Anthocerotophyta, species.

Generally bryophytes are not damaged by microorganisms, insects, snails, slugs and mammals, however, studies on their chemical constituents have been neglected for one century. Bryophytes are considered to be useless for human diets, difficulty of identification and collection of a large amount, although several liverworts have been used as medicinal plants in China to cure cut, burns, bruises, pulmonary tuberculosis, neurasthenia, fractures, convulsions, ulopathy, neurasthenia etc. Over several hundred new compounds have been isolated from liverworts and more than 40 new carbon skeletal acetogenins, phenolic compounds and terpenoids have been found in this class, for example, marchantin A (1), marchantin E (2) and riccardin C (3) and diterpene dialdehyde, sacculatal (4), by recent development of spectroscopic apparatus, particularly by high resolution NMR techniques. The most interesting chemistry of liverworts is that most of sesqui- and diterpenoids are enantiomers of those found in higher plants and some different species of the same genus, like *Frullania* produce both normal and its enantiomeric sesquiterpenoid [1-5].



Some of the isolated terpenoids from liverworts show characteristic scents, pungency and bitterness, allergenic contact dermatitis, cytotoxicity, anti-HIV inhibitory, antimicrobial, antifungal, insect



Figure 1: *Reboulia hemisphaerica*.



Figure 2: *Pellia endiifolia*.

antifeedant and mortality, nematocidal activity, superoxide anion radical release, NO production inhibitory (riccardin A: IC₅₀ 2.50 μM, riccardin F: 7.42, marchantin A (1): 1.44, marchantin B: 4.10) and plant growth inhibitory, neurotrophic and piscicidal activity, 5-lipoxygenase, calmodulin, hyaluronidase and cyclooxygenase inhibitory, cardiotoxic and vasopressin antagonist, muscle relaxing, anti-obesity [1-3,5,6], anti-influenza activity [7] and vasorelaxant effect [8]. Total syntheses of many bioactive compounds isolated from bryophytes, such as 1, 3 and 4 have been accomplished [3].

Chemosystematics of 40 families of liverworts have been discussed using recent findings on new chemical constituents [2,3-5]. At present only 10% of liverwort species have been studied chemically although they are rich sources of new secondary metabolites which show interesting biological activity.

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