Mosses, Liverworts, and Hornworts Screened for Antitumor Agents[1]

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The National Cancer Institute's record of bryophytes (mosses, liverworts, and hornworts) screened for biologically active chemicals is reviewed. In 1977, an extract of a moss from Maryland, Polytrichum ohioense, *showed cytotoxicity in KB cell culture, but antitumor activity was not discovered in bryophytes until 1980. This led to a greater emphasis in collecting and screening bryophytes during 1980–1981. Samples weighing 0.5–2 kg (dried) were collected for each of 208 species and varieties. These included 184 species in 97 genera of mosses, 23 species in 16 genera of liverworts, and 1 hornwort. The methodologies for field work, extraction, and screening are briefly described. The screening results are summarized in a table listing all species alphabetically by family and by genus. For each species, the origin of the sample (country or state), collector's number, extract number, type of extract, and 3 bioassays employed (including the dose levels used and toxic dose for the P388 lymphocytic leukemia assay) are indicated. Extracts of 75 species were toxic; extracts of 43 species were active. Activity was especially noted in the moss families Thuidiaceae, Mniaceae, Neckeraceae, Hypnaceae, Brachytheciaceae, Polytrichaceae, Dicranaceae, and Grimmiaceae. The authors suggest that bryophytes are a promising source for discovery of novel biologically active compounds. The possibility that biological activity in bryophytes may be the result of allelopathy, or the reputed ability of bryophytes to accumulate toxic substances, is considered.*

The National Cancer Institute (NCI) has conducted an extensive screening program to identify and isolate novel chemicals from natural products that may have potential for treating cancer. An estimated 15% (35,000 species) of the world's higher plant flora has been sampled from which more than 120,000 extracts were prepared and prescreened in laboratory bioassays (Suffness and Douros, 1982). Also approximately 15,000 crude extracts of animal samples (mostly marine) and 100,000 extracts of fermentation broths have been similarly screened. This screening was conducted primarily during 1957–1981. Since 1981, emphasis has been on voluntary submission of extracts, acquisition of pure compounds, and support for bioassay costs in chemical fractionation of sample materials with moderate to highly significant *in vivo* activity.

The NCI screening of higher plants for antitumor agents has been reviewed from various perspectives: folklore (Spjut and Perdue, 1976), chemotherapeutic potential of active compounds isolated (Hartwell, 1976; Suffness and Douros, 1979), taxonomy (Barclay and Perdue, 1976), and phytogeography (Spjut, 1985).

On the other hand, systematic reviews of the lower plants and prokaryotes

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