The Use of Lichen-derived Secondary Metabolites as Pesticides

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Bean beetles are an agricultural pest, destroying crops of legumes like mung beans and cowpeas. They decrease the yields of infested crops by up to 90% and reproduce quickly in warmer temperatures. The goal of the project was to see if the secondary metabolites of lichens could be used to eliminate bean beetles and prevent their larvae from hatching. Usnic acid, Vulpinic acid, and Fumarprotocetraric acid were isolated from Usnea barbata, Letharia vulpina, and Cladonia rangiferina respectively. All of the chosen metabolites have been observed to have antifeedant properties, however, the current lichen-related research has focused almost entirely on their medicinal uses, with many lichens going almost completely unresearched. Proving the efficacy of secondary metabolites could allow for new organic pesticides to come to the market. The lichens chosen for the experiment could easily be grown in the same climates that the mung beans, as well as bean beetles, thrive in. Vulpinic acid displayed the most promise as a pesticide, however, Usnic acid also showed a strong capacity to exterminate bugs in higher concentrations. The results mostly supported my hypothesis as the Vulpinic acid was most effective, followed by Usnic acid. The Fumarprotocetraric acid failed to show any pesticidal properties, which is likely due to the fact that it is a relatively weak antifeedant, and could therefore be easily metabolized by the bean beetles before causing any harm to them.

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