STUDIES ON THE ALLELOPATHIC POTENTIAL OF SELECTED PLANT SPECIES AND CHARACTERIZATION OF ALLELOCHEMICALS

KIRIHETTILIYANAGE DON PATRICK HEMALAL

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Summary

The work embodied in this thesis endeavours deeply to evaluate the allelopathic potential of selected plant species: VIZ Gliricidia maculata (H.B.K) Steud. [Gliricidia sepium (Jacq.) Steud.] (Fabaceae) and Tithonia diversifolia (Hemsl.) Gray. (Asteraceae) After establishing that leachate and blended aqueous extracts of both species had considerable bioactivity (both stimulatory and inhibitory), the leaf material applied as surface mulches and/or soil- incorporated residues, was tested in field experiments as well as in glass house based pot experiments for weed suppression ability and other effects. Field studies as well as pot experiments indicated that both types of residues very significantly, stimulated the growth of crops (Tomato, Brinjal, Chilli), whilst controlling weeds in the treated plots very significantly, generally at rates of 2 or 4 kg/m^2. In these studies, the promotion of growth of the three field crops caused by both types of residues was quite spectacular.

Pot experiments clearly established that surface applied residues, as well as incorporated residues stimulated the growth of crop species, and caused significant inhibition of seed germination and seedling growth of weed species. Surface- placed residues were more effective than incorporated residues. When the effect of time of decomposition on the phytotoxicity of the residues was studied, evidence was obtained that Gliricidia residues were bioactive (stimulating the growth of crop species) mostly after one or two weeks of decomposition. With Tithonia residues, as decomposition progressed, there was evidence of the soil being ammended to be phytotoxic to the test species.

Bioassy-guided, activity directed extraction and fractionation of bioactivity of the two species was carried out, using a tomato seed germination and seedling growth bioassay. Characterization of active components was carried out using standerd spectroscopic methods, including UV, IR, Mass, and multi dimensional NMR techniques. Coumarin (i), a well-knowm seed germination inhibitor was identified as major active allelochemical in Gliricidia fresh leaves. From the dried leaves of Gliricidia, an active triterpene was found to be released to the environment. This compound was identified as 22 epimer of soyasapogenol (ii), which appears to be a previously not reported compound.

A series of sesquiterpene lactone germacronolides have been found as the active allelochemicals in dried leaves of Tithonia, as the leaf residues decompose in fields. Of the active allelochemicals isolated, previously known tagitinin A (iii), tagitinin C (iv) and previously unknown compound tagitinin G (v) appear to be the most important.

The significance of these findings indicate that Gliricidia and Tithonia leaf residues could be effectively used in field crop production for their combined effect of promoting the growth of crops and suppression of weeds.