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Original Research Paper

Efficacy of Saponin Glycosides Against the Weed, *Echinochloa colanum*

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Echinochloa colanum
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ABSTRACT

Saponins were isolated from the neoil bearing forest seeds *viz*., *Maduca indica*, *Sapindus mukrossi* and their herbicidal activities were assessed under laboratory conditions at different dilutions against *Echinochloa colanum*, a notorious weed of silvi-agri (babul-paddy) agroforesty model. The effect of dilutions *viz*., 2.5, 5, 10% of saponin isolates on % germination, and root and shoot length were recorded. The incorporation of 2.5 % concentration of saponin dilutions of different species drastically reduced germination (35-47%) as compared the control. No root formation was recorded in all treatments while 60.09-94.95% shoot length inhibition over control (3.27 cm) was recorded in different treatments. Screened species grow luxuriantly in tropical region and easily available source for the isolation of saponins, which can be utilized as a lead molecule for the synthesis of safer, eco-friendly and more economical weed control agents.

INTRODUCTION

Increasing global concern about the indiscriminate use and hazards of deadly poisonous synthetic herbicides have prompted exploration of natural plant products in management of weeds of forests, agricultural fields as well as barren lands. Plant-derived materials are more readily biodegradable. Some are less toxic to mammals, may be more selective in action, and may retard the development of resistance. Their main advantage is that they may be easily and cheaply produced by farmers and small-scale industries as crude or partially purified extracts. In the last two decades, considerable efforts have been directed at screening plants in order to develop new botanical herbicides as alternatives to the existing chemicals.

Saponins are glycosidic, which constitute one of the most fragmentary occurring group of secondary metabolites. More than one hundred families are known to contain saponin glycosides which possess tremendous biological activities and have commercial application, especially in medicine and pharmacy. Neoil bearing forest seeds are the potential source of saponin glycosides (Hostettman et al. 1982, Kubo & Nakanishi 1979, Munakata 1983, Jain & Tripathi 1991).

Echinochloa colanum is a notorious weed of silvi-agri (babul-paddy) agroforesty model, major pest of several economically important crops throughout the world and causes substantial losses in production because of its high germination efficiency. The present study was carried out to determine the germination inhibition potential by saponin glycosides derivatives from the plants, *Maduca indica* and *Sapindus mukrossi.*

MATERIALS AND METHODS

Seeds of *Madhuca indica* were collected locally during the growing season, air dried, and seed coat

Table 1: Herbicidal activity of saponins from *S. mukrossi* and *M. indica* against *Echinochloa colanum.*

Treatments	Shoot length (cm)	Root length (cm)	% shoot length inhibition over control	% root length inhibition over control
S. mukrossi				
2.5 %	0.97	0.16	70.34	95.54
5.0 %	0.46	Nil	85.93	-
10 %	0.17	Nil	94.95	-
Control	3.27	3.59		
LCD (0.05)	2.4582	3.674		
M.indica				
2.5 %	1.28	Nil	60.09	-
5.0 %	0.56	Nil	82.87	-
10 %	0.19	Nil	93.98	-
Control	3.27	3.59		
LCD (0.05)	3.9021	9.0432		

removed manually. Seeds of *Sapindus mukrossi* were collected from Nagpur, pericarp removed and utilized for the isolation of saponins.

Dried kernels/pericarp were crushed and extracted with petroleum ether and 80% ethanol subsequently. Solvent was evaporated at reduced pressure. The brown residue, thus, obtained was dissolved in water and further fractionated with solvent butanol (3 × 100mL). All butanol fractions were combined and solvent evaporated under reduced pressure. Saponins were precipitated with the excess of diethyl ether.

Laboratory experiment was conducted to find out the herbicidal effects of saponins by Petri plate method under laboratory conditions at different dilutions against *Echinochloa colanum*. Seeds of *E. colanum* were placed in Petri plates in triplicate, moistened with 5 mL solution of different concentrations in a filter paper medium and incubated at 25°C and compared with control maintained with normal irrigation water. The germination%, and length of root and shoot were recorded on seventh day.

RESULTS AND DISCUSSION

The data on germination, growth, i.e., root and shoot length are presented in Table 1. The effect of dilutions, *viz.*, 2.5, 5, 10% of saponin isolates on % germination, and root and shoot length were recorded. There were statistically significant ($P < 0.05$) in the treatments at different dilutions. The treatment with 10% concentration of saponins drastically reduced the germination as compared the control. Only 58.8% germination was recorded in *S. mukrossi* treatments. *M. indica* showed 47% germination. Considering the shoot length, 0.165 cm length was recorded at 10% concentration of *S. mukrossi* followed by *M. indica* (0.197 cm) as compared to control with 3.27 cm. The incorporation of 2.5 % concentration of saponin dilution of tested species drastically reduce germination (35-47%) as compared the control. No root formation was recorded in any treatment, while 60.09-94.95% shoot length inhibition over control was recorded in different treatments. No root formation was recorded in any treatment except 2.5% *S. mukrossi* (0.16 cm), i.e., 95.54% root length inhibition over control.

Saponin glycosides from *S. mukrossi* and *M. indica* showed potential herbicidal property against the notorious weed, *E. colanum* by affecting on growth. Biological activities of saponin glycosides

as pesticidal, molluscidal, insecticidal and fungicidal were observed by Hostettman et al. (1982), Kubo & Nakanishi (1979) and Jain & Tripathi (1991). However, reports on herbicidal activities are negligible. It is evident from the present findings that saponins exhibited remarkable herbicidal activities and can be used for preparation of weed control agents. Screened species grow luxuriantly in tropical region and application of saponin glycosides is an inexpensive and effective technique as these are water soluble compounds, easily available source for the isolation of saponins, safe to use, easy to store and have a longer shelf life which can be utilized as a lead molecule for the synthesis of safer, eco-friendly and more economical weed control agents.

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INNOVATIONS, NEW ENVIRONMENTAL TECHNOLOGIES

Solar Cleaning of Wastewater

Engineers have come up with a novel way to decontaminate hazardous industrial wastewater by harnessing the power of the sun.

Ecosystem Environmental Services SA, a small Spanish firm participating in CADOX, contributed to the creation of SolarCadox. The new technology combines the Fenton process, discovered more than a century ago, with modern photochemistry. Specifically, ultraviolet and visible light are used to reduce Fe(III) to Fe(II), iron's initial state in the Fenton process. The reaction also produces hydroxyl radicals, which help break down organic pollutants in the wastewater.

A major advantage of SolarCadox is that the light is derived from solar radiation. This ensures that no additional energy is required, and consequently no further pollution is generated. A turn-key solution was produced in collaboration with the CADOX project coordinator, the Plataforma Solar de AlmerAa of the Research Centre for Energy, Environment and Technology in Spain. Ecosystem Environmental Services SA can provide consulting services to tailor SolarCadox to specific sites, climates and types of wastewater.

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Chicken Waste to Biofuel

Chicken-feather meal is a byproduct of large- scale poultry production. It often includes blood and offal, and contains about 11 percent fat. Researchers at the University of Nevada, USA, boiled the feather meal to extract the fat and then processed the fat into biodiesel using potassium hydroxide as a catalyst. The process produced 7–11 percent biodiesel, of good quality, comparable to biodiesels from soybean and palm oil. As claimed, this process is very economical and does not use expensive or toxic chemicals. It will benefit both developed and developing countries.

To implement this technology in developing countries [where there are few large poultry farms], one may need an additional step to collect the poultry waste. If this can be done by a company and/or by government regulations, this technology will have a huge immediate impact on the economy. The researchers are developing a production process that could reduce the price of the feather meal biodiesel still further.

Science & Development Network, August 12, 2009