



Herbicidal activity of surfactant formulation of karanj

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Received: 1 November 2014; Revised: 21 December 2014

Key words: Surfactants, Non edible oil, Herbicidal activity, *Pongamia pinnata*

Natural plant products are catching attention of scientist for their use as pesticide/herbicides to control pests/weeds. The main advantage of these products is that they may be easily and cheaply produced by farmers and small-scale industries as crude, or partially purified extracts (Copping and Duke 2007). In the last two decades, considerable efforts have been made for screening the plants in order to develop new botanical pesticides as alternatives to the existing chemicals. Surfactants are adjuvants that facilitate and accentuate the emulsifying, dispersing, spreading, or other surface modifying properties of liquids. They are biodegradable in the soil environment. The foliar uptake of pesticide in the presence of adjuvants has been investigated extensively and some prediction on the ease of foliar uptake can be realized in relation to the formulation technology (Hess and Foy 2000).

Non edible oil seeds are the potential source of biochemicals which can be converted into surfactants having secondary metabolites as lipid associates. A work was therefore initiated to explore herbicidal activity of surface active formulation against broad-leaved weeds *Checorium intybus* and *Medicago denticulata* commonly found in field.

Seeds of *Pongamia pinnata* commonly known as karanj were extracted with petroleum ether (60-80 °C) for 6 hours. Solvent was evaporated with the help of vacuum evaporator under reduced pressure and was separated. Surfactant formulation was prepared with *P. pinnata* seeds oil and additives. Following properties of surfactant formulation were done:

Wetting power: The Draves- Clarkson method was used as reported in Bureau of Indian Standard. Strips of 1x1 inch were cut from cotton fibre cloths. Sinking times were determined for different concentrations of product.

Emulsifying power: Forty ml of liquid paraffin and 40 ml of aqueous phase containing different concentration of test sample in a 500 ml stoppered conical flasks

were shaken vigorously up to ten times then the mixture was transferred to a measuring cylinder and the time taken for 10 ml of the aqueous phase to separate was recorded.

Surface tension: Surface tension of modified oil of different concentration was determined with the help of stalagmometer.

Viscosity: Viscosity of different concentration were determined with the help of viscometer.

Testing of surfactant formulation on seed germination: The seeds of *Checorium intybus* and *Medicago denticulata* were collected locally from wild stands and seeds germination, seedling development were tested by filter paper method. Surfactant dilutions were prepared by dissolving in water to reach the final concentration of 7.5, 5.0, 2.5 and 1% w/v. Five ml of each tested solution was then added to 9 cm diameter Petridish that contained paper filter. Ten uniform size seeds were put on the filter paper and covered with a lid. The tested Petridishes were kept under room temperature (25 ± 5 °C). The experiment was done with 5 replications. The treatment with distilled water served as control. Data on germination, shoot length and root length were recorded at 14 days after inoculation.

The surface tension of different dilutions varied 0.04 – 0.052 dyns/cm while pH ranged 7.2 – 8.9 (Table 1). The treatment with 7.5% dilution of formulation showed complete retardation of growth of *M. denticulata* while no shoot formation of *Checorium intybus* was observed (Table 2). The per cent shoot growth inhibition of weeds *M. denticulata* and *Checorium intybus* varied 51.1 – 100% and 71.7 – 100%, respectively (Fig. 1 and 2). The incorporation of lowest dilution *i.e.* 1% concentration of formulation also reduced growth significantly. The herbicidal efficacy of formulation is a reflection that it penetrates into the seed cuticle and affects germination as well as growth of seedling. Surface tension of different dilution was low in comparison to water without surfactant.

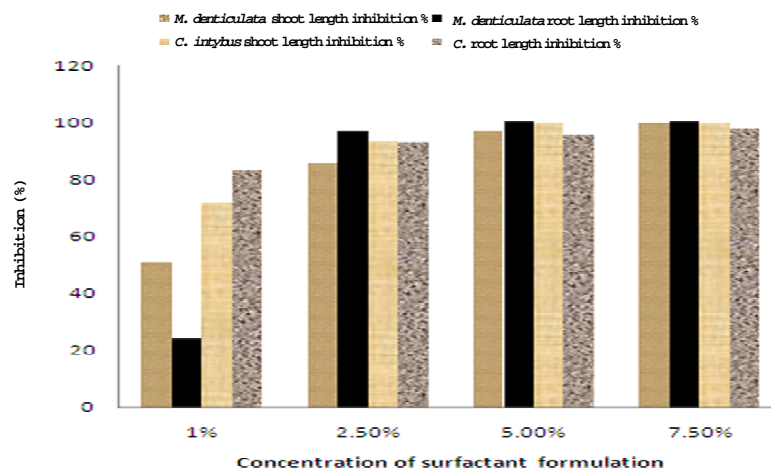
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Table 1. Properties of surfactant formulation at different dilutions

Surfactant formulation dilution (%)	pH	Wetting power (min.)	Emulsifying power (min.)	Surface tension (dyns/cm)	Viscosity (mPa.s)
1.0	7.2	1.00	1.24	0.052	0.60
2.5	7.3	1.12	3.11	0.046	0.75
5.0	7.9	1.26	9.14	0.044	0.80
7.5	8.9	1.44	10.34	0.040	0.98

Table 2. Effect of surfactant formulation on growth of two weed species at 14 days after incubation

Concentration of surfactant formulation (%)	<i>Medicago denticulata</i>		<i>Checorium intybus</i>	
	Shoot length (cm)	Root length (cm)	Shoot length (cm)	Root length (cm)
1.0	1.82	0.95	0.85	0.72
2.5	0.53	0.12	0.20	0.31
5.0	0.12	0.00	0.00	0.19
7.5	0.00	0.00	0.00	0.10
Control	3.72	1.25	3.00	4.30
LSD (0.5)	0.56	0.13	0.23	0.42

**Fig. 1. Effect of surfactant formulation on shoot and root inhibition at different concentration**

The role of polyethylene glycols in herbicidal formulations is well documented. Bioefficacy of glyphosate was enhanced with the addition of surfactant (Triton x 100) which reduces surface tension, enhance spreading of drop and fine drop deposition as reflected by biomass reduction bioassay to glyphosate alone (Kudsk *et al.* 1989). Manthey *et al.* (1989) explained that refined or esterified vegetable oil may be as effective or more effective than petroleum oils in enhancing the phytotoxicity of herbicides. Robert and John (1999) showed that sethoxydin was most phytotoxic when applied with vegetable oils. This study indicates that surfactants from non edible oil seeds can be potentially utilized as herbicide or as adjuvant in herbicides to reduce doses of synthetic chemicals significantly.

SUMMARY

Surface active formulation from non edible oil was evaluated for herbicidal activity against weeds, *Checorium intybus* and *Medicago denticulata* under *in vitro* conditions. Different dilutions of formulation exhibited markedly variable herbicidal activities against germination and seedling growth of the target weed species. Different concentrations (1.0 – 7.5%) inhibited the growth of shoot and root of *C. intybus* and *M.denticulata* by 71.7 – 100, 83.3 – 97.7% and

51.17 – 100, 24 – 100%, respectively. No shoot formation was recorded in 5.0 and 7.5% dilution against *C. intybus* and *M. denticulate*. The present study concluded that the surfactant formulations from non edible oil of *Pongamia pinnata* possess potential herbicidal activities against weeds. Pollution of the environment is now a major concern. Therefore, utilization of plant product based surfactant as herbicide will pave a way for possible exploitation of surfactants in weed management.

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