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Allelopathic Effect of *Jatropha curcas* on Selected Intercropping Plants (Green Chilli and Sesame)

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Summary

The aqueous leaf extracts of *Jatropha curcas* showed inhibitory effects on seed germination, shoot length and root length in *Capsicum annum* L.(green chilli).The inhibitory effect of the crop plant is directly proportional to the increasing concentration (5%, 10%, 15%, 20%) of aqueous leaf extracts of *Jatropha curcas.* The *Jatropha curcas* leaf extract showed stimulatory effects on seed germination and shoot length in *Sesamum indicum* L. (sesame). The stimulatory effect is directly proportional to the increasing concentration (5%, 10%, 15%, 20%), but the root growth was inhibited in all treatment when compared with the control. The result of bioassay studies revealed that the inhibitory and stimulatory effect may be due to the presence of water soluble allelochemicals like phenols and tannins etc.

Key Words: Allelopathic effect, *Jatropha curcas*, *Capsicum annum*, *Sesamum indicum*

Introduction

Jatropha curcas is a multipurpose shrub, growing naturally in countries of the equatorial America, whereas it has been introduced in the other tropical countries as well. *Jatropha* seeds are rich in oil and when extracted, pure plant oil can be used directly or as bio diesel in engines. For this reason, *Jatropha* is an attractive crop and it is being contributed to augmenting the income of farmers by improved agronomic procedures like selection of the suitable intercropping systems and by increasing the efficiency of rural agricultural processes. Throughout the world, including India, *Jatropha* has been cultivated along with other crops, in particular it is cultivated with groundnut, sunflower, green gram, green chilli , sesame etc.

Monoculture practices of agricultural have been replaced by polycultural practices owing to the stress of nutrient demand, disease infestation and poor yield. It was noticed that in polyculture, too, some crops give better yield, while others give lower yield. Plant have been found to produce and store various allelochemicals viz., alkaloids, phenolics and others as preferably defense compounds [1]. Many of the phytotoxic substances suspected of causing germination and growth inhibition have been identified from plant tissues and soil. A wide array of these compounds is released into the environment in appropriate quantities *via* root exudation and as leachates during litter decomposition. Most of these are phenolic compounds and are implicated in allelopathy, a process which includes the direct or indirect detrimental effect of one plant on the germination, growth and development of another plant [2].

There is lack of knowledge on the allelopathic effect of *Jatropha* on the growth and development of the intercropping plants. Several researchers have reported the release of a variety of secondary metabolites by *Jatropha* through leaching, root exudation etc. These secondary metabolites may influence the growth and development of the near by plants by eliciting stimulatory or inhibitory responses [3].

In the present work an attempt has been made to study the allelopathic effect of *Jatropha curcas* aqueous leaf extracts on the seed germination and seedling growth of *Capsicum annum* and *Sesamum indicum* which is commonly cultivated along with Jatropha as an intercropping in the *Jatropha* plantation.

Materials and Methods

Mature fresh leaves of. *Jatropha curcas L.* were collected from the Jatropha plantation and dried in an oven at 60^{o}C ± 20^{o}C for two days, powdered (40 mesh) and used for bioassay treatment. Seeds of *Capsicum annum* var. K-1 and *Sesamum indicum* TMV-3 were collected from Tamil Nadu Agricultural University, Coimbatore, India.

The dried leaves were ground to a fine powder in Wiley Mill (40 mesh). Using this powder aqueous extracts were prepared by the method of [4]. The aqueous extract was diluted with water to get 5, 10, 15 and 20% concentrations. The dilutions corresponded to 0.05, 0.1, 0.15 and 0.2 % of water extractable materials. The seeds of crops were surface sterilized with 0.1% mercuric chloride for 1 min. to remove the fungal spores on the seeds. Then the seeds were washed with distilled water for several times to remove the mercuric chloride.

Bioassay Studies

Bioassay studies were carried out following the method of [4]. Ten seeds of crops were placed on Whatman No.1 filter paper in petriplates (9 cm x 2 cm). Petriplates were moistened with 2 ml/ plate of leaf extract, distilled water (control) and incubated in room temperature. The experimental design was a randomized complete block with five replicates for each

treatment and control. Germination percentage, root and shoot length were measured after 15 days.

Results and Discussion

In bioassay studies of leaf aqueous extract of *Jatropha curcas* on *Capsicum annum* seeds showed a gradual inhibition in seed germination, root length and shoot length. The inhibitory effect was concentration dependent (Table 1 and Fig.1). The inhibition of seed germination in leaf aqueous extract was 35% at 20% concentration. The reduction in root was gradual in leaf extract at all the concentration. Maximum reduction of 34 % in root growth was recorded at 20% concentration. The effect on the shoot growth by the leaf aqueous extract was drastic. There was a maximum of 30% reduction in shoot growth was recorded at 20% leaf extract concentration.

Table 1: Bioassay studies of aqueous leaf extract of *Jatropha curcas* on seed germination and seedling growth of *Capsicum annum* (Values are mean ± SE of 10 samples).

Capsicum annum			
Concentration (%)	Germination (%)	Root length (cm)	Shoot length (cm)
Control	85 ± 8.5	4.9 ± 0.4	4.7 ± 0.4
5	80 ± 8.0	3.2 ± 0.3	3.8 ± 0.3
10	80 ± 8.0	3.2 ± 0.3	3.4 ± 0.3
15	75 ± 7.5	3.2 ±0.3	2.8 ± 0.2
20	50 ± 6.0	1.5 ± 0.1	1.7 ± 0.1

Table 2: Bioassay studies of aqueous leaf extract of *Jatropha curcas* on seed germination and seedling growth of *Sesamum indicum* (Values are mean ± SE of 10 samples).

Sesamum indicum			
Concentration (%)	Germination (%)	Root length (cm)	Shoot length (cm)
Control	90 ± 9.0	2.6 ± 0.2	4.4 ± 0.4
5	95 ± 9.0	1.0 ± 0.1	4.9 ± 0.4
10	95 ± 9.0	1.0 ± 0.1	5.5 ± 0.5
15	95 ± 9.0	1.0 ± 0.1	5.6 ± 0.5
20	95 ± 9.0	1.0 ± 0.1	5.7 ± 0.5

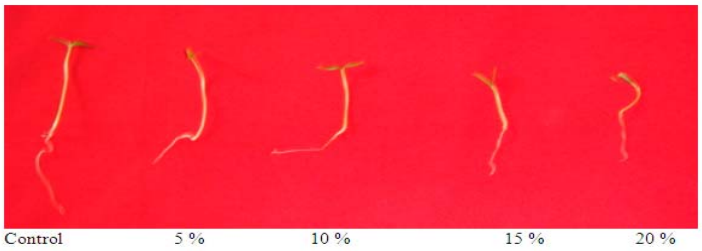

Fig. 1. Effect of Aqueous Leaf Extract of *Jatropha curcas* on Seedling of *Capsicum annum* (Green chilli)

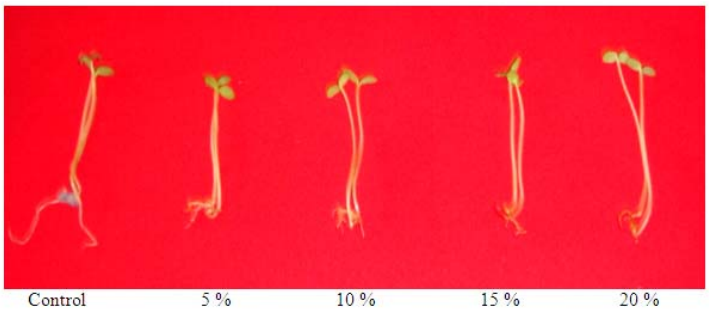

Fig. 2. Effect of Aqueous Leaf Extract of *Jatropha curcas* On Seedling of *Sesamum indicum* (Sesame)

In bioassay studies of leaf aqueous extract of *Jatropha curcas* on *Sesamum indicum* seeds showed a gradual stimulatory effect in seed germination percentage and shoot growth, but the root growth was inhibited in all the concentrations as compared to control. The stimulatory effect was concentration dependent (Table 2 and Fig.2). The stimulatory effect in shoot growth brought about by leaf extract was gradual in all the concentration. Maximum of 27 % was recorded at 20% leaf extract. The effect on the seed germination percentage was promoted in all concentrations nearly 5 % as compared to the control plants. The reduction in root growth by leaf extract was drastic in all the concentrations nearly 36 % growths was affected when compared with the control plants.

The aqueous extracts decreased the growth of the crop plant *Capsicum annum* considerably only at higher concentration. Similar inhibition of shoot length and root length of crop plants by allelopathic extracts have been reported in *Oryza sativa*, *Zea mays* by *Rhizophora apiculata* [5], in ground nut by bamboo [6], in groundnut and corn by *Eucalyptus* [7]. Reduction in leaf area of the crop plants by aqueous leaf extracts have been reported in few crop species *viz.,* by bamboo in groundnut by *Eucalyptus globulus* in groundnut and maize .*Acacia holosericea* in cowpea,sesame, horse gram [8]. Inhibition of yield in several other crops, by aqueous leaf extracts was reported only by few researchers, Sundramoorthy and Kalra [9] reported a reduction in yield of pearl millet, sesame and cluster bean by the aqueous leaf extracts of *Acacia fortilis.* Palani and Dasthagir [8] observed a significant yield reduction in cowpea, sesame, horse gram and sorghum by aqueous leaf extracts of *Acacia holosericea.* These reports on the inhibitory effect of allelochemicals on the yield of crop plants corroborate our results. The inhibition of nodulation by aqueous leaf extracts of *Arisdia adscensionis* on rhizobium [10] by decomposed rice straw on rhizobium was reported. Reduced nodulation similar to our study occurred in white clover and red kidney bean after exposure to extracts of *Bromus* and *Euphorbia* species. Putnam and Weston [1] explained that allelochemics were inhibitory to root hair formation which subsequently prevented infection by *Rhizobia.*

The aqueous extracts stimulated the growth of *Sesamum indicum* (seed germination and shoot growth).The similar pattern of stimulated effect on crop plants have been reported only in few crop species. *Rhizopora apiculata, Rhizophora mucornata* and *Salicornia brachiata* in *Arachis hypogaea* [5], by *Grewia optiva* in maize [11].

Conclusions

The detailed study revealed that *Jatropha* curcas aqueous leaf extract inhibit the growth of *Capsicum annum* and stimulate the shoot growth and seed germination percenatge in *Sesamum indicum.* Based on this result *Sesamum indicum* is more suitable for intercropping in *Jatropha* plantation than the *Capsicum annum.* Therefore this information is highly valuable to the *Jatropha* cultivation based on intercropping system. Further, investigation on the identification of allelochemicals and their effect on these crop plants are necessary.

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