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Phytotoxic Effect of Lantana Camara Leaf Extract on Germination and Growth of Pistum Sativum

KEYWORDS: Lantana camara, Pistum sativum, inhibitory effect.

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ABSTRACT *The current study was conducted to test the inhibitory potential of aqueous leaf extracts on seed germination and seedling growth of Pistum sativum under laboratory conditions. Inhibitory effects increased with increasing aqueous extract concentration. Maximum seed germination and seedling growth observed in control. This inhibitory effect may be due to the presence of volatile and non volatile components present in the aqueous extract.*

Introduction

The term allelopathy was coined by Molish (1937) to refer to biochemical interactions among all kind of plant, including microorganism. He referred that the term allelopathy is meant to encompass both inhibitory and stimulatory biochemical interactions. Allelochemicals are present is plant roots, rhizomes, stems, leaves, flowers, inflorescence, pollen, fruits and seed but leaves are the major sources of allelochemicals. Some allelochemical induced changes in germination behavior and growth parameters of target species (Chaudhary and Agarwal (2002) and Maiti et al. (2008).Vijay and Jain (2010) reported that Lantana camara is a noxious weed causing serious threat to the biodiversity. Lantana camara is a significant weed of which there are some 650 varieties in over 60 countries. It is established and expanding in many regions of the world. Lantana camara is a notorious, noxious and invasive weed belonging to verbenaceae family. Lantana camara is one of the ten worst weeds of the world, which is a native of tropical and subtropical America.

Pea (Pisum sativum L.) is a annual herb belonging to Fabaceae family. It is self pollinated, stem weak, alternate leaves and terminal branched tendrils leaflets ovate or elliptic. Peas are cultivated for the fresh green seeds, tender green pods, dried seeds and foliage in the temperate region of the world and as winter crop in sub-tropics.

Therefore, in the present study an attempt was made to study the inhibitory effect of L.camara leaf extract on seed germination and growth of Pisum sativum.

Materials and Methods

The leaves were detached and washed with distilled water to remove the adherent dust particles. Aqueous extract of L.camara leaves was prepared as under 200g of fresh leaves chopped in small pieces and crushed in the mixture grinder after grinding the material of leaf were soaked in 1000 ml of distilled water for 24 hour, the aqueous extract was filtered through the muslin cloth and then some of the extract was diluted to make the concentrations to 10% (T_1), 25% (T_2), 50% (T_3), 75% (T_4), 100% (T_5) (on the basis of volume) and distilled water as a control (T_0) treatment.

Experiments of the present investigation were carried out with fully viable healthy seeds of Pistum sativum as bioassay material. The seeds were surface sterilized with 0.1% $HgCl_2$ for 10 min and again washed with sterilized distilled water 4-7 times.

The germination test was carried out in sterile Petri dishes of 12 cm in size placing a whatman number 3 filter paper on petridishes. The extract of each concentration was added to each petridish of respective treatment daily in such an amount just enough to wet the seeds. The controls were treated similarly with distilled water. Twenty seeds were spread in containing whatman's filter paper petri dish. The petridish were set in the four replications. The treatments were kept in randomized design with laboratory of the M.G.C.G.V, Chitrakoot at room temperature ranging from 10-15^{0}C. The experiment was extends over a period of 6 days to allow the last seed germination. The germination was recorded on daily basis.

Data were recorded on counting the number of germinated seeds and lengths of root and shoot.

Result and Discussion

Effect on germination

Percentage seed germination of Pistum sativum were inhibited or reduced significantly by the varied concentrations of leaf aqueous extracts of Lantana camara. Variation of the germination percentage varied evenly due to different concentrations. With the increase of concentration, the inhibitory effect was progressively increased.

The maximum percentage of seed germination was observed in control (T_0) 100%. In 10% (T1) concentration of Lantana camara aqueous leaf extract was observed 90% germination over control. T_2 treatment germination were observed 85% . T_3 treatment germination were observed 75% and in T_4 treatment germination were observed 50% over control. Minimum percentage 30% germination was recorded in T_5 treatment.

Table. 1. Effect of L.camara leaf extract on germination and seedling growth of Pistum sativum at 6th day after sowing.

Treatment	% Germination	Shoot length (cm)	Root length (cm)	Vigor index	% Inhibition in		
					Germination	Shoot length	Root length
T_0	100	2.7	5.3	800	-	-	-
T_1	90	1.7	3.8	495	10	37.04	28.31
T_2	85	1.4	2.9	365.5	15	48.15	45.29
T_3	75	0.9	2.2	232.5	25	66.67	58.5
T_4	50	0.6	1.3	95	50	77.78	75.48
T_5	30	0.4	0.6	30	70	85.19	88.68

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Effect on seedling growth

According to the result recorded in table- 1 the different concentration of aqueous leaf extract of Lantana camara had significant effect on shoot and root length of seedling Pistum sativum. Plant shoot and root length were decrease over control with the increasing concentration of extract. Maximum growth of shoot and root were observed in control (T_0). Maximum inhibition of shoot and root length were observed 85.19% and 88.68% respectively in T_5 treatment In T_1 treatment the plant growth were observed 37.04% inhibited in shoot and 28.31% inhibited in root over control. In T_2 treatment the plant growth were observed 48.15% inhibited in shoot and 45.29% inhibited in root over control. In T_3 treatment the plant growth were observed 66.67% inhibited in shoot and 58.5% inhibited in root over control. In T_4 Treatment the plant growth were observed 77.78% inhibited in shoot and 75.48% inhibited in root over control.

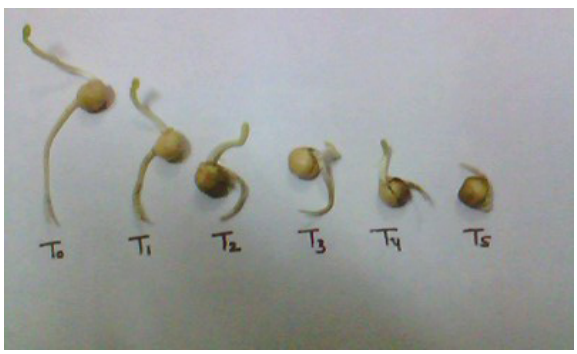

Fig. inhibitory effect of L.camara leaf extract on seedling growth of Pistum sativum.

The inhibition in seed germination was due to allelochemicals, particularly, phenolices (Kaur et al. 1999) and other secondary metabolites like growth regulators, alkaloids (Overland 1966), terpenoides (Miller et al 1968) and toxins which are present in various plant parts and are released into the environment through volatilization, leaching, root exudation and decomposition of plant residues. It is evident from the data that allelochemicals present in L.camara might inhibit the process of seed germination. Lantana camara leaf, stem and root contain some harmful allelochemicals, which inhibited the germination of Funaria hygrometrica (Choyal, R and Sharma, S.2011). The probable reason of inhibition may be the presence of allelochemicals. Yi et al. reported the presence of several phenolic compounds in lantana leaf extract identified by HPLC as salicylic, gentisic, β-resorcylic acid, vanillic, caffeic, ferulic, phydroxybenzoic acids, coumarin and 6- methyl coumarin. The extracts of Lantana camara different parts such as leaf, stem, flower and fruit inhibited growth of Parthenium hysterophorus. Leaf extract of Lantana camara inhibited early growth control followed by stem and flower (Mishra, A and Singh, R.2009). The water soluble allelochemicals of Lantana camara inhibited the initial growth of both the agricultural (Oryza sativa, Triticum aestivum, Vigna sinensis, Cucurbita pepo, Abelmoschus esculentus, Amaranthus tricolor and forest crops (Acacia auriculiformis, Paraserianthes falcataria, Albizia procera) in the laboratory conditions (Hossain & Alam, 2010). The growth of the aquatic weed Eichhornia crassipes and the alga Microcystis aeruginosa may be inhibited by fallen leaves of Lantana camara. The extracts of Lantana camara leaves and their fractions reduced the biomass of Eichhornia crassipes and Microcystis aeruginosa within 7 days under laboratory conditions (Kong et al 2006). These chemicals interfere with various physiobiochemical processes of seed germination, root elongation, plant growth as well as various metabolic activities of many species.

In the present investigation, thus concludes that all the concentrations of leaf aqueous extract of L. camara reduced the germination and growth Pistum sativum. Hence the fast growing exotic weed L.camara having inhibiting properties should be treated as a potential threat to plant diversity in a natural ecosystem.

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