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Allelopathic effects of *Lantana camara* L. on *in vitro* seed germination of *Phaseolus mungo*

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SUMMARY

Lantana camara L. (Verbenaceae) is a noxious weed causing serious threat to the bio-diversity. As per global invasive species data base (GISD 2007) the weed is one among the 100 worst invaders of the world. It was introduced as an ornamental plant in 19th century. An experiment was conducted to understand the effects of aqueous extracts of *L. camara* on *Phaseolus mungo*. The aqueous extract showed inhibitory effect on seed germination, shoot and root elongation. This inhibitory effect may be due to the presence of volatile and non-volatile components present in the aqueous extract. Earlier studies have indicated inhibitory effect of *L. camara* on variety of crops *viz. Brassica juncea, Zea mays* and *Mimosa pudica*.

Key words : *Lantana camara* L. *Phaseolus mungo*, Volatile and non-volatile components, Inhibitory effect

Lantana camara L. is a serious weed in 47 countries owing to its wide adaptability to different environmental conditions and habitats. In natural areas the shrub has serious deleterious effects on some endemic animal and plant species and is known to displace natural scrub communities as well as prevent natural regeneration of some tree species (Sharma *et al*., 1998) This weed exhibits allelopathy. Allelopathy can be regarded as a component of biological control in which plants are used to reduce the vigour and development of other plants. Allelopathy refers to the direct or indirect chemical effects of one plant on the germination, growth, or development of neighboring plants. This can be through the release of allelochemicals while the plant is growing or from plant residues as it rots down. These chemicals can be released from germinating seed, in exudates from plant roots, from leachates in the aerial part of the plant and in volatile emissions from the growing plant. Both crops and weeds are capable of producing these allelochemicals. They may interfere with essential physiological processes of the receiver plant, like inhibition of cell division and elongation (Jankay and Muller, 1976 and Ahmed *et al.*, 2007), effect of stomatal opening (Arntzen *et al.* , 1973), effect of soil activity (Blum and Shafer, 1998) and physiochemical activities (Maiti *et al*., 2008). Allelopathy in general has been considered as the suppressive effect on the growth of some plants through chemicals released from other plants. It is one of the important factors affecting the plant growth in agrihorticultural situations. All plants releases certain chemicals called allelochemicals which either inhibit or stimulate the growth ofneighboring plants. These chemicals can be found in any part of the plant but leaves are the major sources. They can also be found in soil rhizosphere. Similar results have been reported by Shaukat and Siddiqui (2002) in *Mungbean*, Zhang Maoxin *et al.* (2005) in *Eicchornia crassipes* (Mert), Ahmed *et al.*(2007) in some crops and Maiti *et al.*(2008) in *Mimosa pudica*, Their concentration vary with age, season, plant part etc. Allelochemicals selectively inhibit the growth of soil microorganism or other plants. Allelochemicals from plants may be released from living leaves as volatile or leachates or from roots through exudation or sloughing off of dead tissues. They also may be leached from leaf litter or the leaf surface. These allelochemicals can be beneficial or detrimental. The beneficial allelopathic effect of any weed or crop on another weed can be exploited to prepare eco-friendly, cheap and effective green herbicides. Similarly the negative allelopathic effects of many weeds or crops on another crop can be utilized to develop growth-promoting substances(Oudhia and Tripathi,1999). Therefore, in the present study an attempt was made to study the effect of *Lantana camara* on *Phaseolus mungo*.

MATERIALS AND METHODS

To study the effect of *Lantana camara* on crop biodiversity, *Phaseolus mungo* was selected as test crop.

The powder of sun dried root, stem and leaves was used to prepare the aqueous extracts. For each plant part dried powder was taken in required amount of DDW for 24 hours. The extracts were filtered through Whatman's filter paper no. 1. A concentration series of 1%,3%and

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5% of each extract was prepared by taking powder (in gm) of dried weed material and DDW in different ratio *viz.*,1:100,3:100,5:100 w/v. All the extracts were stored at room temperature (25 ± 2^0C) prior to use. Glass Petridishes were used to study the allelopathic effect of aqueous extract and DDW as a control on the germination percentage and seedling growth in the form of root and shoot length. The seeds of *Phaseolus mungo* were sterilized by dipping in the solution of 0.1% $HgCl_2$ for 1 min. followed by 3-4 washings under running water to remove residues of $HgCl_2$ and dried in folds of ordinary filter papers. 5 seeds of test crop are arranged at equal distance in Petridishes lined with Whatman's filter paper no. 1, moistened with different conc. of *L. camara* plant extract. The Petridishes were covered with glass covering. The whole set of experiment was kept undisturbed at $25^0 \pm 3^0$C. The polythene sheet was covered to all Petridishes to prevent further loss of moisture. The treatments were replicated four times.

Number of seeds germinated on each day was counted. At the fifth day, main root length and shoot length were measured.

Data were recorded in % of seed germination and length of shoot and root in cm.

RESULTS AND DISCUSSION

The extracts of root, stem and leaf have significant effect on seed germination. The process of germination decreased as the concentration in the medium increased from 1% to 5%. Leaf extract of *Lantana camara* had greater inhibition on the germination of test crop as compared to the extracts of stem and root. However, the root extract has minimum effect on seed germination. 5% leaf extract of *Lantana camara* caused maximum germination inhibition over control.

Table 1 : Effect of aqueous extracts of different parts of *Lantana camara* L. on germination and seedling growth of *Phaseolus mungo* at 5th day after sowing

Part of weed used	Concentration (c) %	Germination (%)	Root length(cm)	Shoot length(cm)
Control	DDW	100	10.10±3.04	7.60±3.91
Root	1%	80	5.50±1.00	4.75±1.50
	3%	80	3.75±1.50	4.50±1.30
	5%	60	3.50±1.80	3.50±0.50
Stem	1%	80	6.00±2.82	4.75±1.90
	3%	80	4.50±1.00	4.00±1.40
	5%	60	4.00±1.00	3.75±1.36
Leaf	1%	80	4.75±1.26	4.50±1.30
	3%	80	3.25±0.96	4.00±0.81
	5%	40	3.00±1.41	1.60 ±0.56

According to the result recorded (Table 1) all parts of *Lantana camara* had significant effect on root and shoot lengths of *Phaseolus*. Present results indicate that as the concentration of the extracts increases the root and shoot lengths decrease. Maximum decrease was noted with 5% leaf extract as compared to stem and root extracts. Shoot length was more affected than root length. All these findings indicate that maximum allelochemicals are present in leaf leachates. Similar to the present result several studies also indicated inhibitory effect of *Lantana camara* on a variety of crops (Shaukat and Siddiqui, 2002; Ahmed *et al.*, 2007 and Maiti *et al.*, 2008).

Extracts of different parts of *L. camara* inhibited the germination of *Bryum cellulare* spores.The inhibitory effect of leaf extract was found to be qualitatively and quantitatively more potent (Chaudhari and Kothari, 2002). Repetition of this work using different crop varieties and different concentrations would provide a better under standing of allelopathy.

One study showed that extracts of *L. camara* leaves and their fractions reduced the biomass of *E. crassipes* and *M. aeruginosa* within 7 days under laboratory conditions. Two fractions with highly inhibitory activity from the extract were isolated and subsequently identified as the pentacyclic triterpenoids, lantadene A and lantadene B. Both compounds significantly inhibited *E. crassipes* and *M. aeruginosa* growth, even at a low concentration (Kong *et al.*, 2006) It was also proved that its leaf extract contain14 phenolic compounds.

The phytotoxicity of its leaf extract was due to complex interaction of these phenolic compounds (Jain *et al.*, 1989). In addition to phenolics, a recent report indicates lantadene A and B as more potent allelochemicals.

So careful management of *Lantana camara* is required,as it is considered to be a potential inhibitor of many crops and weeds. It was concluded that *Lantana* has inhibitory allelopathic effect on *Phaseolus mungo*. Invasive plant species threaten the balance among natural systems throughout the world by displacing native plant communities and establishing monocultures. One leading theory regarding the success of invading species is that the absence of natural enemies allows them to use all of their resources for competition. A recent theory that is now being substantiated by published findings is that allelopathy may be associated with the success of some invasive plants (Inderjit and Weston, 2003; Weston and Duke, 2003).

Hence the fast growing exotic invasive weeds like *Lantana* having inhibiting property should be treated as a potential threat to plant diversity in a natural ecosystem.

Therefore, this study calls for the proper management of *Lantana* and other invasive weeds showing similar behavior.

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