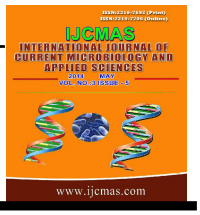
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 4 (2014) pp. 122-128**
http://www.ijcmas.com



Original Research Article

Allelopathic effects of some weeds on germination and growth of *Vigna mungo* (L). Hepper

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K e y w o r d s

Allelopathy, *Hyptis saveolens*, *Parthenium histerophorus*, and *Tridax procumbens*

A B S T R A C T

The effect of leaf leachates of *Parthenium*, *Hyptis* and *Tridax* on the germination of black gram was studied . Seeds were placed in petridishes containing 0.5, 1.0 and 5.0% leaf leachates of each weed extracts. The germination percentage was evaluated at the end of 10th day after sowing (DAS) whereas seedling growth was evaluated at 28th day (28 DAS). The increase in leachate concentrate was associated with the increased reduction of seed germination and seedling growth. All the leachates at 5.0% concentration ,significantly reduced seed germination, root and stem length and dry matter. At 5.0% leachate concentration the greatest inhibition of seed germination, growth and dry matter was attributed in *Parthenium*. The other weeds i.e. *Tridax* and *Hyptis* are relatively safe leachates when compared to *Parthenium*.

Introduction

Weeds are a menace in all crops as they compete for light , water and nutrients and harbor diseases and insects (Pathipati *et al*.,2011). High volumes of herbicide usage induces numerous changes in plant growth like inhibition of growth, foliar chlorosis, albinism and necrosis (Subba Rao and Madhulety,2005). Many herbicides persist in the environment and causes biomagnifications. So there is every need to develop herbicides which are biodegradable .Herbicides developed from the plants will be safer and they are biodegradable. Allelopathy holds potentials for selective biological weed management. The phenomenon of allelopathy refers to chemical interactions between all types of plants. In this process the chemical exudates or leachates released from leaves, stems or roots of a plant can inhibit the growth of a neighboring one (Scrivanti *et al.*,2011). *Vigna mungo* (L.) Hepper is commonly known as black gram or urdbean. It is one of the important crops cultivated

extensively in India. It is a short duration crop and considered to have been domesticated in India from its wild ancestral form *Vigna mungo* (L.) Var. *silvestris lukoki,* (Manchal & Otoul). It belongs to the subgenus *Ceratotropis* in the genus *Vigna* (Zeven and deWet,1982). Black gram is cultivated mainly for its seeds and forms an integral part of the vegetarian diet in the Indian subcontinent. It has the high biological value. It is an important source of easily digestible high quality of proteins. Being rich source of protein it maintains soil fertility through biological nitrogen fixation by some microorganisms prevalent in its root nodules and thus plays vital role in sustainable agriculture.

Vigna mungo is usually sown in the late rainy season (August / September) when rainfall is high. So that ,heavy infestation of weeds will occur . Because of this, the crop may be seriously damaged. The common infesting weeds are *Parthenium, Tridax* and *Hyptis.* These weeds release allelochemicals which affects the plant growth, seed germination thereby influence the production. The present study aimed to find the allelopathic effects of *Hyptis. Tridax* and *Parthenium* on germination and growth of *Vigna mungo*.

Materials and Methods

Bioassays

The leaves were collected from the fields of *Vigna mungo* at the beginning of flowering stages. Leaves were separated and chopped into small pieces. The leaves were oven dried at 75°C for 48 h and ground by grinder to fine power. The dried powdered material was mixed separately in 100 ml distilled water and the mixture was homogenized for 2 h in blender. The mixture was shaken for 24 h. then the aqueous extract was centrifuged at 2000 rpm for 10 min. and filtered through Whatman No.1 filter paper and filtrate were diluted with distilled water to give 0.5%, 1.0% and 5.0% concentrations. Pure distilled water served as control. The experiment consists of (1) one test crop, (2) three leaf extracts, *i.e, Hyptis, Tridax* and *Parthenium,* (3) three different concentrations including control viz., 0.5, 1.0 5.0%. The experiment was repeated thrice.

The experiments were designed in completely randomized block design with five replications. The experiments were done in 9.0 cm diameter Petri dishes in which sterile Whatman No.1 filter paper was placed. The Petri dishes were washed, then were sterilized by dipping in ethyl alcohol. The plant seeds were surface sterilized by dipping in 0.05% $HgCl_2$ solution for 10 min and then washed in tap water. Ten uniform black gram seeds were placed per petridish on germination paper and 5 ml extract was added in each petriplate as per treatment and afterwards it was added on alternate days. Germination tests were made in incubator at 22°C with 70% humidity in dark. Distilled water served as control. Seeds forming 3.0 mm radicle were considered as germinated. The germination was recorded daily upto 10 days. Seedling growth was measured at the end of the experiment i.e., (28^{th} day) Fresh and dry weights were also recorded after the experiment.

Pot Culture

Aqueous leaf extracts (0.0, 0.5, 1.0 and 5.0%) of three weeds viz., *Hyptis, Tridax* and *Parthenium* were prepared. A plastic pots of 10 cm diameter were filled with 500 g soil mixture (clay : sand : peat in

ratio of 3:1:1 (pH 8.1). Pots were sown with 10 seeds of test crops and then irrigated with aqueous leaf extracts of the three weeds. The control pots were irrigated with distilled water. The experimental design was, Completely Randomized Design (C.R.D.) with three replications. Fresh and Dry weight of test crops were recorded at 28 days after sowing.

Statistical Analysis

The results were subjected to ANOVA test to determine the effects of treatments on plant growth. Based on the ANOVA results, the means of treatments were grouped with Duncan Procedure at the 5% and 1% probability level. The software INSTAT was used to conduct all the statistical analysis.

Results and Discussion

Recent searches indicates that allelo chemicals were universally present in plants and one of the most important physio-biochemical functions of them is defense against its enemies. (Gavazzi *et al.,).* Although toxic metabolites are distributed throughout the plant (Rice,1974), but the leaves and bark are their most potential sources (Bhatt *et al*.,1997, Bhatt and Chauhan,2000). In nature water is the solvent extraction medium (Hill *et al*.,2006) that's why aqueous extracts are used in the present experiment. As these chemicals are biodegradable in short time, their persistence in plants or soil system will not cause problems like pesticides.

Bioassay

All the extracts inhibited seed germination of the test crop (Table-1). The germination percentage was decreased with the increased concentrations of the all the three weed extracts. The leaf leachate of *Parthenium* caused maximum suppression (32 ± 0.5) in germination of Mungbean followed by *Tridax* and *Hyptis* when compared to control. Germination percentage in mungbean was significantly reduced by 0.5% and 1.0% leaf leachates. However, no significant reduction was recorded for *Hyptis saveolens* at 0.5% and 1%. Thus, in case of *Vigna mungo, Parthenium hysterophorus* leaf extracts at 5.0% concentration reduce the germination percentage. So they might be inhibitors at this concentration. Oudhia and Tripathi(1999) also observed same effects about *Parthenium* in case of wheat. The stem length and root length was also decreased with the increasing concentration of *Parthenium* extracts, when compared to control (Oudhia and Tripathi,1999). It may be due to inhibition of cell division and cell elongation.

It was perhaps due to inhibitory effect of allele chemicals of *Parthenium* on mineral uptake and translocation. In case *Tridax procumbens* and *Hyptis* it was reverse. These extracts at low concentration 0.5% and 1.0% cause elongation both in stem and root length. Thus, these two plants on the growth of the crop cause positive effect. The similar observation was made in different species with different allelo chemicals (Shoo *et al.*,2007). The aqueous leaf extracts reduced fresh and dry weights over the control (Fig. 1). Among the three weeds *Parthenium* showed more toxic effects than the / remaining three weed extracts.

Pot Culture

When the different concentration of aqueous leaf extracts were applied in the

Table.1 The effects of leaf extracts of different weeds on *Vigna mungo* (L.) germination and growth (in Bio-assay)

Sl.No.	Scientific Name of the Weed	Concentration of the Extract %	Germination (%)	Length of Root (cm)	Length of Shoot (cm)
1.	*Parthenium hysterophorus*	Control	98[a]	5.80[a]	19.50[a]
		0.5	81[b]	2.68[b]	13.20[b]
		1.0	42[c]	2.15[b]	10.50[c]
		5.0	32[c]	1.60[c]	3.30[d]
2.	*Tridax Procumbens*	Control	98[a]	5.80[d]	19.50[b]
		0.5	90[a]	6.77[c]	20.10[a]
		1.0	80[b]	8.60[b]	21.25[a]
		5.0	70[b]	9.07[a]	19.05[ab]
3.	*Hyptis Saveolens*	Control	98[a]	5.80[c]	19.50[a]
		0.5	98[a]	7.45[ab]	17.10[ab]
		1.0	98[a]	8.00[a]	20.10[a]
		5.0	60[b]	8.90[a]	17.60[ab]

Means within same column followed by the same letter(s) are not significantly different at the 0.05% level of probability.

Table.2 The effects of aqueous leaf extracts of different weeds on *Vigna mungo* seed germination and growth (in Pot Culture)

Sl.No.	Scientific Name of the Weed	Concentration of the Extract %	Germination (%)	Length of Root (cm)	Length of Shoot (cm)
1.	*Parthenium hysterophorus*	Control	98[a]	5.90[a]	20.05[a]
		0.5	80[a]	2.58[b]	13.10[b]
		1.0	40[b]	2.13[b]	10.80[c]
		5.0	31[b]	1.58[c]	3.35[d]
2.	*Tridax Procumbens*	Control	98[a]	5.90[d]	20.05[a]
		0.5	93[a]	6.80[c]	21.01[a]
		1.0	84[b]	8.73[b]	21.80[a]
		5.0	75[b]	9.21[a]	19.15[b]
3.	*Hyptis Saveolens*	Control	98[a]	5.90[d]	20.05[a]
		0.5	97[a]	7.54[c]	18.16[b]
		1.0	92[c]	8.10[b]	21.11[a]
		5.0	60[c]	9.10[a]	18.20[b]

Means within same column followed by the same letter(s) are not significantly different at the 0.05% level of probability.

Fig. 1: The effect of aqueous leaf extracts of some weeds on Biomass of *Vigna mungo*

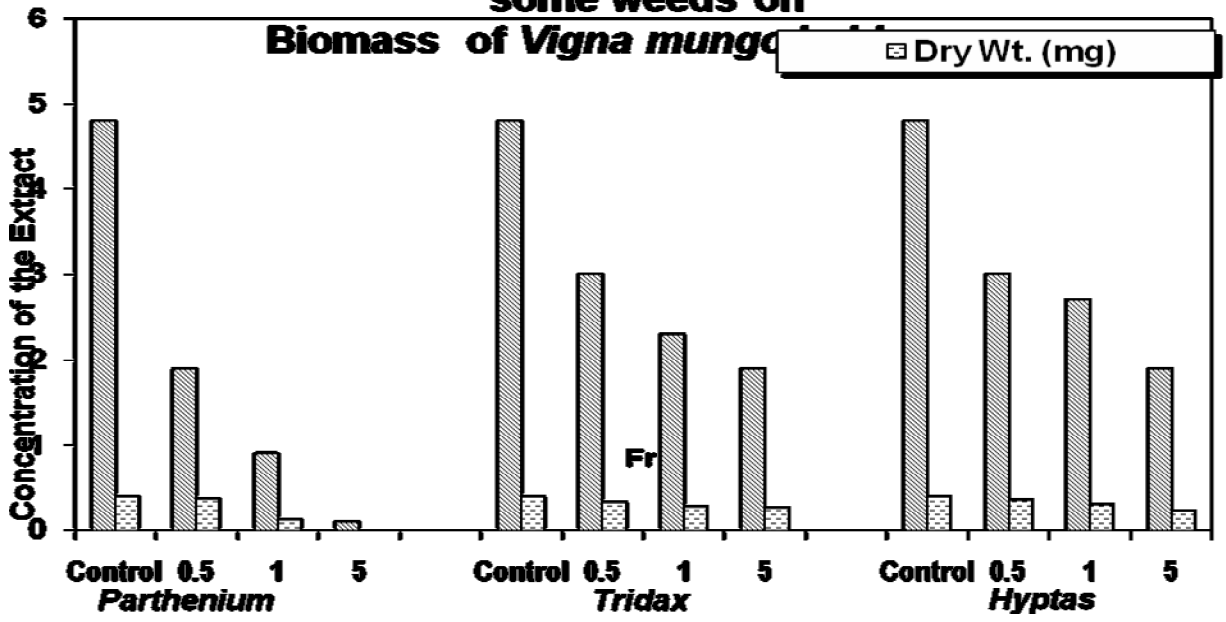
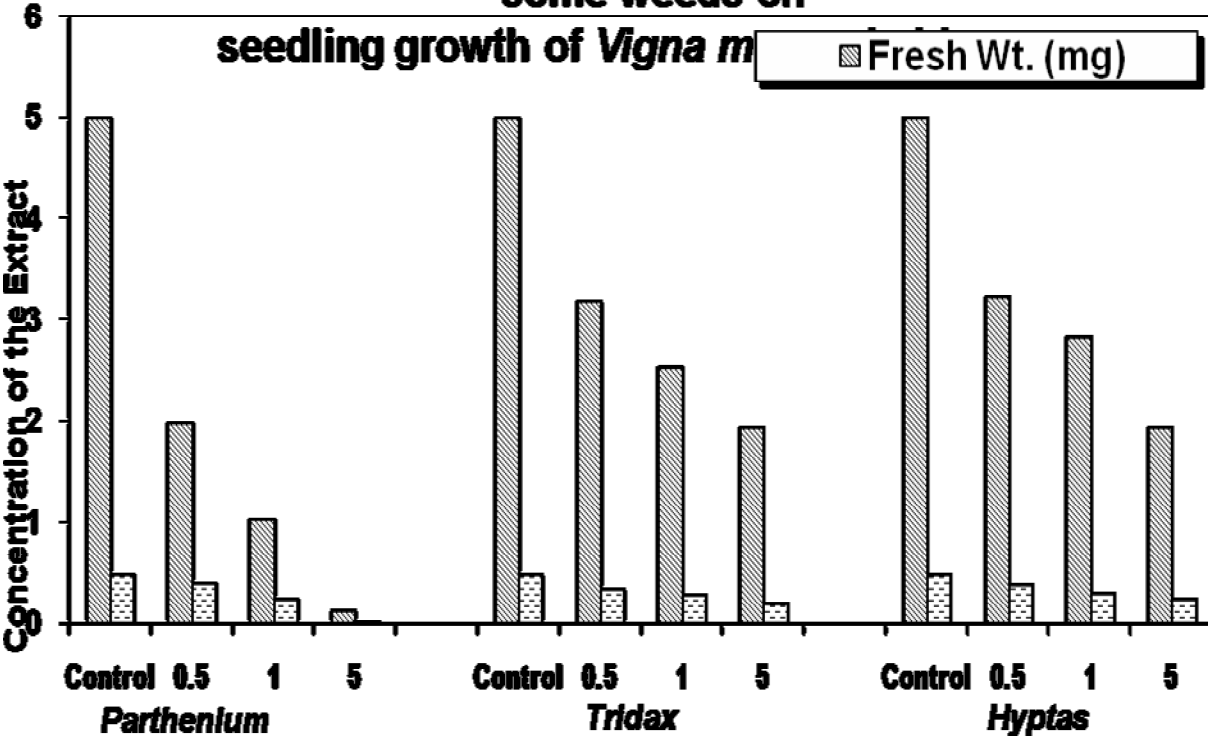


Fig. 2: The effect of aqueous leaf extracts of some weeds on seedling growth of *Vigna m*



pot culture inhibited the seed germination (Table-2) as observed in the bio assay. The *Parthenium* showed more lethal effect than the *Tridax* and *Hyptis*. In comparison to control all the three weeds suppressed the seedling germination. The extract of *Parthenium* reduced the root growth and shoot growth but it was not true for *Tridax* and *Hyptis* extracts (Fig-2). The fresh and dry matter production was also minimum when applied leaf extract of *Parthenium* and maximum with *Hyptis* and *Tridax*.

For better management of crops, it is necessary to identify local / weeds with minimum accumulation of toxins in the soil. Phytotoxic responses of leaf extracts of various agro forestry tree croups of germination, radicle and plumule extension of field crops has also been reported earlier (Todaria *et al*.,2005;Bhatt and Chauhan,2000, and Bhatt *et al.*,1997). Harmful allelopathic effects of these weeds on germination and seedling vigour of many agricultural crops have been reported Narwal, 1994). In this study, *Parthenium* leaf leachate was identified as harmful leachates as these leachates resulted in lower germination and seedling vigour. This may be due to the presence of lethal allelochemical viz., Parthenin cormopillin, Caffeic acid, P-Coumaric acid, alkolaids and Sequiterpene lactones in *Parthenium*. This study suggests that early removal of these weeds, from the field is essential in order to avoid the losses in terms of poor germination and seedling vigour. *Tridax* and *Hyptis* leaf leachates were identified as relatively safe leaf leachates.

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