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ORIGINAL RESEARCH ARTICLE

SEED GERMINATION STUDIES ON ALLELOPATHIC EFFECTS OF WEEDS ON *VIGNA RADIATA L.*

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Abstract: Aqueous extracts of leaves of *Hyptis sauveolens (L.), Ricinus communis (L.), Alternanthera sessilis (L.), Ipomoea carnea (Jacq), Malachra capitata (L.)* and *Cymbopogon citrutus* (Stapf), were studied for their effects on seed germination of *Vigna radiata* L. Extracts of1%, 2%, 3% & 5% concentrations were prepared and Final germination percentage, weight of germinated seeds and their corresponding radicle and plumule length was recorded at the end of 7 days. Seedling vigor index was calculated (SVI) using the formula percent germination× by average radicle length. An control was maintained by watering the seeds with water. Statistical analysis was done to compare the mean values using T Test. There was a significant reduction in all the parameters at high concentrations of the weed extracts in all the plant species under the study. The tolerance level of allelopathic activities of various weed extracts in terms of seed vigor index represented as *Cymbopogon strictus > Ipomoea carnea> Hyptis saveolens >Malachra capitata> Ricinus communis> Alternanthera sessilis*.

Key Words: Allelopathy, Weeds, *Vigna radiata*, seed vigor index

INTRODUCTION

Weeds play a significant role in reduction of crop yields by way of chemicals exuded out from their plant parts. Allelopathy is an interference mechanism, in which live or dead plant materials release chemical substances, which inhibit or stimulate the associated plant growth (Harper, 1977; Dhavan SR and Narwal SS. 1994) In survey conducted on the diversity of ruderal vegetation in and around Mumbai showed that in the vicinity of several plants no plants were present or very few plant species were able to survive. Some of the plants are *Hyptis sauveolens, Ricicnus communis, Eclipta alba, Eupatorium sps, Alternanthera sessilis, Ipomoea carnea, Cymbopogon citrutus*, *Wedellia sps* etc. on waste lands and barren patches of land the locals in the area cultivated crops after the rainy season or during the monsoon by harvesting the plots of weeds present in such areas (Joshi, 1990).

Allelochemicals released from the weed residues may affect the crop plants in following manner: (i) inhibition of biological nitrogen fixation, (ii) inhibition of nutrient uptake and (iii) inhibition of seed germination, growth and yield. The negative (simulatory) effects of leaf extracts and leachates of different weeds parts on germination and seedling vigour and final yield on agricultural crops have been reported. The identification of harmful and beneficial weeds can be done by studying its allelopathic affects on crops. Several workers have shown that allelopathy plays an important part in weed and weed interaction (Rejila and Vijayakumar, 2011; Eyini M, Jayakumar M, Pannirselvam S, 1989; Oudhia P, SS Kolhe and RS Tripathi, 1998 and Oudhia P. 1999) and weed/ crop interaction (Akmal M, Vimala and Junaid, 2011) weeds affect crops by way of direct competition and also through their allelopathic effects. Allelopathic effects have been reported for many species including crop plants annual and perennial weeds.

The extent to which the weed has an effect on crops has been worked out by several using various indices like seedling vigor index (SVI), Mean Germination Time, Germination Index, (Munesh kumar *et al.,* 2007) Total germination (also known as final germination percentage) (GT), Number of days required for 50% of the total number of seeds to have germinated (T50), Number of days for 50 %of the total number of seeds germinated (T'50), Speed of germination (S), Speed of accumulated germination (AS) and Coefficient of the rate of germination (CRG) (Tehimina and Rukhsana. 2005)

In the current work the effects of leaf aqueous extracts of certain weeds are studied on seed germination of a common leguminous crop, moong – *Vigna radiata* (L.). Laboratory bioassay is the first step to investigate probable involvement of Allelopathy (Foy, 1999). Aqueous extract bioassays have been widely employed to evaluate Allelopathy of a suspected donor species. Extract bioassays are simple, rapid, inexpensive and straight forward.

Objectives of the present study were to calculate different germination indices from the same data in order to make comparisons between each of them and to evaluate better ways of using these indices in order to improve the precision in seed germination bioassays.

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MATERIALS AND METHODS

Selection of the plants: Aqueous extracts of leaves of *Hyptis sauveolens* (L.), *Ricinus communis* (L.), *Alternanthera sessilis* (L.), *Ipomoea carnea* (Jacq), *Malachra capitata* (L.) and Cymbopogon citrutus (Stapf), were studied for their effects on seed germination on moong

Plant sampling and preparation of extracts

Leaves were washed several times with water and the method proposed by Dhawan and Narwal, 1994 to prepare aqueous extract. For leaf extract, leaves were collected from local area and dried. The dried leaves were grinded in a grinding mechanism. The powder of the leaves were taken in the quantity of 1, 2, 3, & 5 grams separately then dissolved in 100 ml of water in a bottle and left for 48 hours at room temperature. The bottles were shaken every 24 hours in the 48 hours period. The resulting extract was filtered through muslin cloth and stored in bottles. Thus 1%, 2%, 3% & 5% extract was obtained.

Seed germination studies

Ten surface sterilized seeds *Vigna radiate (L.)* were placed in a Petri dish (9 cm diameter) on double-layered Whatman filter paper No. 1. The filter paper was moistened with 5mL of leaf extract concentrations (i.e., 1, 2, 3, and 5%). There were three replicates of each treatment in completely randomized designed. Seeds were incubated at 20°C±2 and Petri plates were regularly checked for moisture.

A separate control series was placed up using water. Moisture in the petri dishes was maintained by adding about two ml of extract or water every day for 7 days. Final germination percentage, weight of germinated seeds and their corresponding radicle and plumule length was recorded with the help of weighing balance and metered scale respectively. Seedling vigour index was calculated (SVI) using the formula percent germination× by average radicle length (Abdul and Anderson 1973). A control was maintained by watering the seeds with water. Statistical analysis was done to compare the mean values using T Test.

RESULTS AND DISCUSSIONS

Effect on length of radicle: When the effect of aqueous concentration on radicle length of *vigna radiata* seeds after seven days were compared, seeds exposed to aqueous extract of Alternanthera were most affected with seeds not showing any germination at 3% and 5%. At high concentration of 5% aqueous extract, *Alternanthera, Hyptis and Cymbopgon* extracts affected the most. There was a significant difference in the length of the radicle in all concentrations of extracts of *Hyptis sauveolens, Malachra capitata, and Alternenthera sessilis*. Table 1.0 and Figure 1.0

Table 1: Effect of various concentrations of aqueous weed extracts on average radicle length of *Vigna radiata* after 7 days in cms.

Concentration of extract	Ipomoea	Cymbopogon	Ricinus	Hyptis	Malachra	Alternanthera
0%	6.233	6.223	6.233	6.223	6.223	6.233
1%	6.756	6.313	5.033*	5.413*	5.45*	4.343*
2%	5.566*	6.916	5.85*	5.416*	5.00*	4*
3%	5.682*	6.286	5.183*	4.633*	5.00*	0
5%	6	4.05*	5.373*	3.833*	4.5*	0

*Significant at P<.05. Values are mean of 60 samples

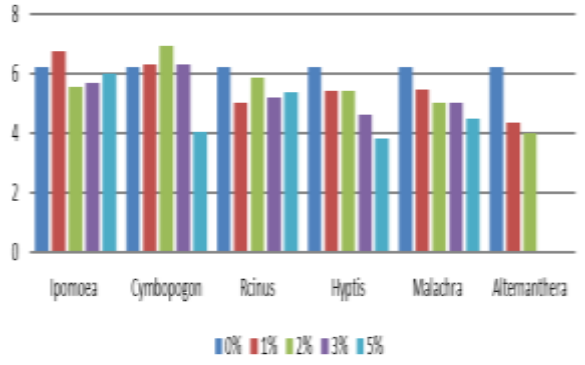

Figure 1: Effect of various concentrations of aqueous weed extracts on radicle length of *Vigna radiata* after 7 days in cms

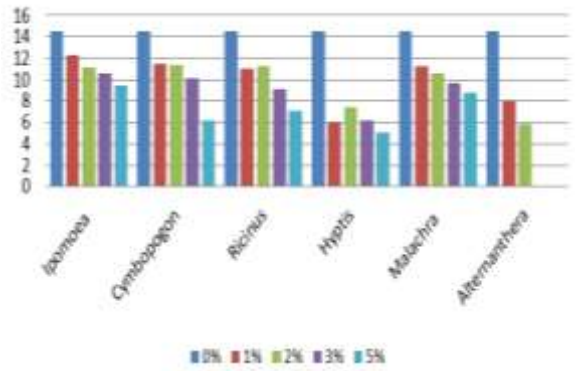

Figure 2: Effect of various concentrations of aqueous weed extracts on plumule length of *Vigna radiata* after 7 days in cms

Table 2: Effect of various concentrations of aqueous weed extracts on average length of plumule of *Vigna radiata* after 7 days in cms.

Concentration of extract	Ipomoea	Cymbopogon	Ricinus	Hyptis	Malachra	Alternanthera
0%	14.533	14.533	14.533	14.533	14.533	14.533
1%	12.286*	11.506*	10.993*	6.01*	11.29*	7.986*
2%	11.116*	11.34*	11.3*	7.403*	10.62*	5.8*
3%	10.628*	10.12*	9.15*	6.193*	9.67*	0*
5%	9.41*	6.216*	7.1*	5.033*	8.82*	0*

All values significant at p<.05. Values are mean of 60 samples

Effect on length of plumule: Effect of various concentrations of aqueous leaf extracts of weeds on the length of the plumule also showed drastic effects of aqueous extract of Alternanthera on the reduction plumule length. At 3% and 5% of the extract of the plant the seeds failed to germinate. The next plant which affected the growth of plumule most was Hyptis sauveolens. At concentrations of 5%aqueous extract maximum effect in reduction of plumule was seen in *Hyptis sauveolens* extracts. All the values were significantly lower and statistically significant for all concentrations. All the plant extracts showed a gradual decrease in length of the plumule as the concentrations of the extracts increased. Table 2.0 and Figure 2.0.

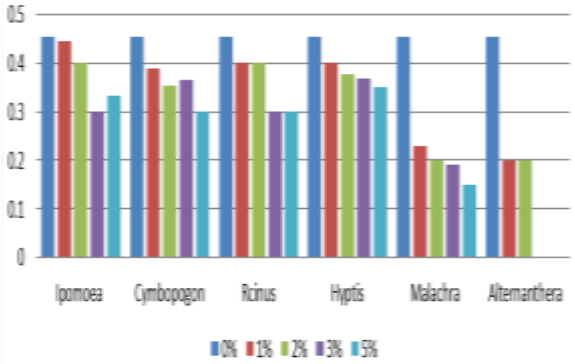

Figure 3: Effect of various concentrations of aqueous weed extracts weight of seedling of *Vigna radiata* after 7 days in cms.

Table 3: Effect of various concentrations of aqueous weed extracts weight of seedling of Vigna radiata after 7 days in mg.

Concentration of extract	Ipomoea	Cymbopogon	Rcinus	Hyptis	Malachra	Alternanthera
0%	0.452	0.452	0.452	0.452	0.452	0.452
1%	0.443	0.387*	0.4	0.4	0.23*	0.2*
2%	0.4	0.353*	0.4	0.376	0.2*	0.2*
3%	0.3*	0.365*	0.3*	0.367*	0.19**	0
5%	0.333*	0.3*	0.3*	0.35*	0.15	0

*Significant at P<.05. Values are mean of 60 samples.

Fresh weight of seedlings: As seen from Table 3.0 and Figure 3.0 the weight of seedlings was most affected by the extracts of *Alternanthera sessilis* followed by *Malachra capitata* with all the concentrations showing a significant decrease in the readings in comparison to control. At 3% and 5% of extracts all the plants showed a significant decrease in the weight of the seedlings. Reduction in root and plumule length was also observed with increasing concentration of *Parthenium hysterophorus* L. (Parthasarathi T, Suganya V and Sivakumar, 2012)

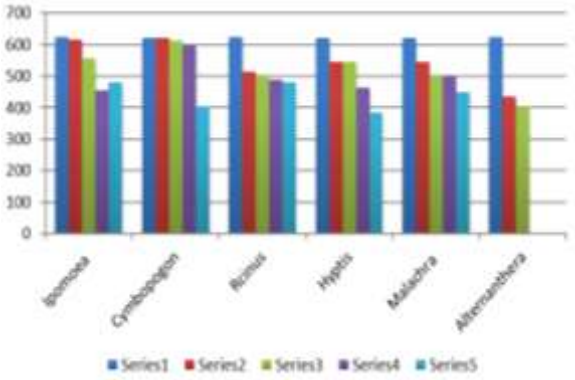

Figure 4: Effect of various concentrations of aqueous weed extracts on seed vigour index of *Vigna radiata* after 7 days

Table 4: Effect of various concentrations of aqueous weed extracts on seed vigor index of *Vigna radiata* after 7 days

Concentration of extract	Ipomoea	Cymbopogon	Ricinus	Hyptis	Malachra	Alternanthera
0%	623.3	622.3	623.3	622.3	622.3	623.3
1%	615.6	621.3	513.3	546	545	434.3
2%	556.6	611.6	500	546	500	400
3%	454.56	600	490	463	500	0
5%	480	405	480	383	450	0

Table 4 and figure 4 shows that *Alternanthera sessilis* affected the seed vigor index the most. The extracts of *Ricinus communis* affected the seed vigour index most after *Alternanthera*. At concentration of 5% all the plants extracts showed an drastic effect on seed vigor index. At high concentrations of 3 % and 5% the seed vigour index was lowest for the extracts of all plant species studied. The seed vigor index decreased progressively for all the plant extracts with increasing concentrations of weed extracts.

CONCLUSIONS

All the plant extracts showed significantly decreasing trend in the length of radicle, plumule, fresh weight of seedling and seed vigor on *Vigna radiata*. The tolerance level of allelopathy activities of various weed extracts in terms of seed vigor index can be represented as *Cymbopogon strictus* > *Ipomoea carnea*> *Hyptis saveolens* > *Malachra capitata*> *Ricinus communis* > *Alternenthera sessilis*. So, in field condition, the incorporation of these weeds to the soil affects the growth and yield of succeeding crops. To decrease the allelopathic effect of these weeds on the crop the removal of these plants before it's flowering or before sowing of crop may be recommended, after further research. All the weed extracts showed a decrease in all the parameters of *Vigna radiata* in comparison with control, confirming the toxic effects of theses extracts on the growth of the crop.

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