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Assessment of Allelopathic Potential of *Leucaena leucocephala (Lam) De Vit on Raphanus sativus l.*

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Abstract- Present study was conducted to evaluate the allelopathic effect of aqueous leachates from senescent leaves of Leucaena leucocephala. It inhibited the seed germination, root-shoot elongation and the development of lateral roots in the receptor plant, Radish under in vitro condition.

Index Terms- Allelopathy, leachate, stimulation, inhibition, DAS, (Days after sowing)

I. Introduction

The term allelopathy was introduced by Molish[1] (1937). It refers to beneficial or harmful effect of one on another plant, both crop and weed species, by the release of chemicals from plant parts by leaching, root exudation, volatilization, residue decomposition and other process in both natural and agricultural system ([2]Ferguson. F. and Rathinabapathi, 2009). These phytotoxic substances collectively known as allelochemicals, are secondary plant product or waste products of main on catabolic pathways of plants ([3]Ashrafi et. al. ; 2007, [4]Bernat et. al. ; 2004, [5]Chon and Kim 2002, [6]Hall and Henderlong, 1989). Phytotoxic allelochemicals identified in the leaves of this legume species include mimosine and phenolic compounds such as quercetin, p-hydroxycinamic acid, protocatechuric acid and gallic acid [7](Chon and Kuo, 1986). The physiological mechanisms of allelochemicals are complicated and the outcome of an allelopathic interaction between two plants is often species dependent ([8]Husain et. al., 2008). The chemicals thus released, inhibit the growth of other plants. There chemicals are absorbed by the plants, mainly by the roots, growing in close proximity. As a result other plants are damaged ([9]Angiras et. al.; 1988, [10]Saxena 1990).

Recently, several works have been done suggesting that this kind of influence holds great prospect for finding alternative strategies for weed management. Thereby, reliance on traditional herbicides in crop production can be reduced ([11]An, 1988; Keating, 1999; [12], Macias, 1995; Olofsdoltter, [13]1998; [14]Wu, 1999). Allelochemicals may also reduce pollution and decrease detrimental effects of auto-toxicity and soil sickness in agriculture and forestry ([15]Waller, 1987). Researches have revealed that there are some plants producing chemicals which are more effective in promoting growth of other plants like gibberellins or IAA ([16] Hasegawa, 1993). Recently works have been done on the bioherbicidal potential of allelopathic plant *L. leucocephala* against water hyacinth using a leaf disc assay by [17] Chai (2013).

Leucaena leucocephala is commonly known as subabul in India. This ia a miracle tree promoted for re-vegetation, soil and water conservation and animal improvement. Although the toxic metabolites are distributed in all plant tissue but in the present investigation we analysed the phytotoxic action of leaves on the germination radicle and plumule elongation of Raphanus.

II. Materials and Methods

The donor plant *L.leucocephala* belong to the family Fabaceae (Sub-family, Minosoideae). It contains a toxic, non-protein, amino acid, mimosine in leaves and foliage that inhibits the growth of other trees but not its own seedlings ([2]Ferguson and Rathinasabapathi 2009). Mimosine has antimitotic and depilator effect on animals. It is acutely toxic to non-ruminant animals but is normally converted to dihydroxy 4(H) –pyridone (DHP) upon ingestion. Leaves also contain 2-6% condensed tannins (CT) and phenolic compounds. The recipient plant is *Raphanus sativus (Brassicacea).*

III. Preparation of leaf leachates

Healthy mature leaves were collected from trees grown near fields in the Chas area of Bokaro district of Jharkhand. Leaflets were removed from the petioles, briefly washed and blotted dry. For preparing 20% of leaf leachate solution 200 gm of dried leaves were dissolved in 1000 ml. of distilled water, left for 24 hr, filtered using Whatman's filter paper NO.1. Similarly leaf leachate solution of different concentration 5, 10, 20, 40, 80 and 100% were prepared and stored in refrigerator. Seeds were kept in petridish lined with two layered filter paper soaked in distilled water at 25^0C. Fifteen seeds were kept in each for different concentration. Three sets were taken for each treatment and in one set of untreated seeds were taken which served as control.

IV. Results and Discussion

Seed germination of control and pre-treated seeds were scored – 10 days after sowing (DAS). [To-Control, T1-5%, T2-10%, T3-20%, T4-40%, T5-60%, T6-80%, T7-100%]

a) Seed Germination

Works have been done on the allelopathic influence of Leucaena on other plants. In wheat it was reported to have inhibitory effects whereas on paddy it has stimulatory effect (Ferguson and Rathinasabapathi, 2009).

The present study suggest the presence of allelochmicals in aqueous extract from leaves, Fig. I indicates the result for the effect of *L. leucocephala* on the germination of *R. sativus.* In

general the concentration of leaf leachates have inhibitory effects on seed germination. Maximum inhibitory effect was found at high concentration (100%). Recent work of [18]Khan (2011) also indicate similar effect on seed germination and seedling growth of maize. However in the present work it was found that at moderate concentration (40% - 50%) there was stimulatory effect (96%) little less than under control (98%).

b) Seedling Growth

Seedling performance of pretreated seeds as well as that of control was measured in terms of root-shoot growth. Fig. II indicates the measurement taken– 10 DAS (days after sowing). [To-Control, T1-5%, T2-10%, T3-20%, T4-40%, T5-60%, T6-80%, T7-100%]

i) Growth of Root

Growth of root of seedling was more adversely affected than that of shoot. Under control (To) the length was found to be 5.9 cm. Whereas under different concentration of leaf leachate it varied from (5.1 – 4.5 cm) with increase in concentration from (T1-T7).

ii) Growth of Lateral roots

Growth of lateral roots of Seedling was also found to be adversely affected under different concentration of leachate from (5-100%). Under control the number of lateral roots were found to be 8, with different concentration of leachate it was found to be the number decreased from 7 to 2.

iii) Shoot Growth

It was characteristic in that both at low and high concentration of leachate the growth was less but at moderate concentration (50%) it was found to be higher (8.5 cm) only little less than that under control (8.8 cm).

V. Conclusion

Considering the foregoing result it seems that there is significant allelopathic effect of *L. leucocephala* on germination, root-shoot, and growth of lateral roots with the leaf leachate extract.

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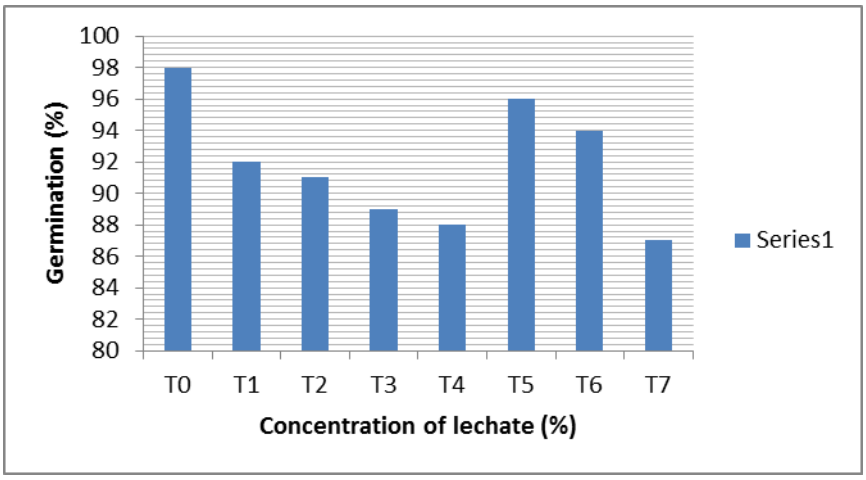

Figure I : Effect of different concentration of leaf leachate on seed germination of radish.

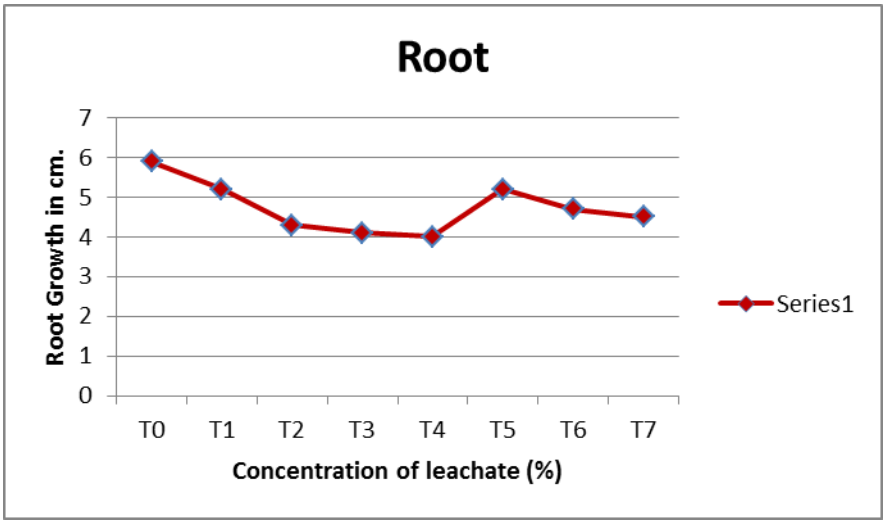

Fig. II

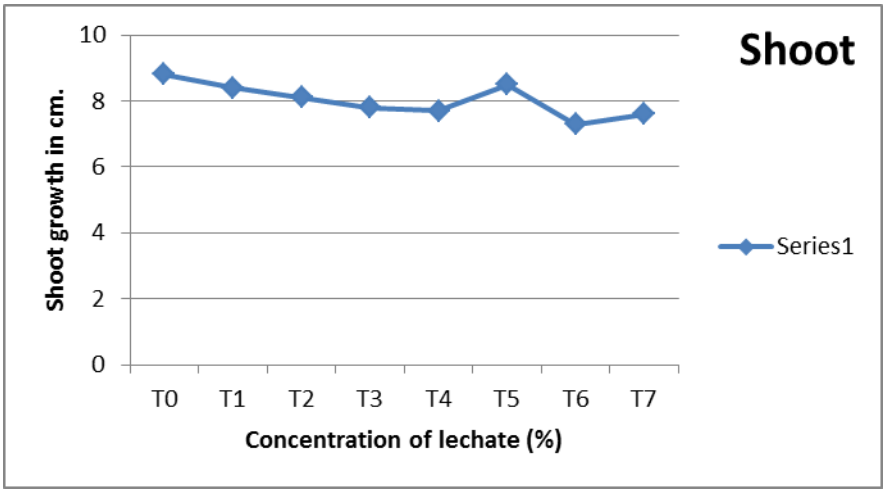

Fig. III

Fig. II & III showing Effect of different concentration of leaf leachate on root and shoot growth of radish.