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Inhibitory effects of *Mangifera indica L.* leaf leachate on *Pennisetum glaucum. L.* (Pearl millet) growth.

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ABSTRACT

The given experiment was laid down to evaluate the allelopathic effect of *Mangifera indica* L. (mango) aqueous leaf leachate on physical growth of *Pennisetum glaucum* (Pearl millet). Leaf leachate in ratio of 5:100, 10:100 w/v (leaf : water) were supplied to 6 days old healthy plants of *Pennisetum glaucum* (Pearl millet) while control plants were irrigated with normal water. The leaf leachate of *M. indica* exhibited dose dependent effect as stimulatory as well as inhibitory on shoot and root elongation and also on dry matter of treated plants. The concluded result also indicated the allelopath inhibition was significantly pronounced at high concentrations of applied leachate (10%) with shoot and root length as well as with dry weight accumulation over control treatment, while the low concentration was found as less inhibitory for plant growth.

Keywords: *Allelopathic, Mangifera indica, Pennisetum glaucum, leachate*

INTRODUCTION

Plants produce thousands of chemicals; which can be persistent over a long period of time or may be biodegradable in the soil. Several natural phenomenons like plant degradation, volatilization, leaching and root exudation cause these chemicals to enters the environment from the plant (Weir *et al.* 2004) where these allelochemicals serves an important role by improving nutrient uptake, root lubrication, plant growth regulation & microorganism defense (Bertin *et al.*, 2003). Some of these compounds may alter the growth or physiological functions of receiving plants. These allelochemicals are found in different plant parts, including flowers, leaf litter, stems, bark, roots in varying amount that varies over a growing season.

The analysis of mango leaves extract by HPLC revealed the presence of coumaric acid, vanelic acid, cinnamic acid, benzoic acid & other phenolic acid (El-Rokiek *et al.*, 2010) along with these compounds some essential secondary metabolites were also found in mango leaf leachate including benzoquinones, terpenoids, glucosinolates, tannins, phytosterols and polyphenols (Singh, 2004). The Allelopathic effect of plant leachate is the basically the interaction of different biochemicals found in the living system like phenolic compounds, flavonoids, terpenoids, alkaloids, steroids, carbohydrates, and amino acids that affect plants in a variety of ways (Einhellig, 2002). Allelochemicals may inhibit shoot and root growth, mineral nutrients uptake from soil, or may attack a naturally occurring symbiotic relationship thereby destroying the usable source of plants of a nutrient. The consequent effects are inhibiting or retarding germination rate, reducing roots or radical and shoot or coleoptiles extension, causing lack of root hairs, swelling or necrosis of root tips, curling of root axis, discolouration, reduced dry weight accumulation and lowering reproductive potential (Ayeni, A.O, *et al.*, 1997). The reduction in germination and growth are attributable to restrain cell division, reduction

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in mineral uptake, hinder or augments respiration, hamper the production of protein and leghemogloblin in certain crops (Rice, E.L., 1984). Some allelochemical may act on plant's respiration by blocking and inhibiting plant's energy transformation.

Allelopathic plants mainly spread their toxic chemicals through the rhizosphere (soil medium) to the nearest plant/crop (although some may also be absorbed directly from the air). For control measure it is necessary to analyses how much chemicals accumulate in the soil medium, this is depends upon how well the soil drains, how much aeration there is in the soil, temperature and a number of other factors. Allelopathic substances work like herbicides, preventing the germination and growth of the seedlings of competing species. Although, derived from plants, allelochemicals are more biodegradable than traditional herbicides but may have undesirable effects on non-target species. Thus, they must be applied after checking all precautions regarding their effects on target plant (Qasem, J.R. and T.R. Hill, 1989). Plants that are under stress, such as those with pests, diseases, or less than optimum access to nutrients, sun, or moisture, are at an higher risk for being eliminated by allelopaths. The present study was aimed to evaluate the inhibitory effects of aqueous leachate of *Mangifera indica* L. on *Pennisetum glaucum* L. to assess the compatibility among both plants (i.e. mango & millet) so that appropriate combination can be suggested to enhance their productivity.

MATERIAL AND METHODS

Extraction of Leaf Leachate: Air dried litter of *Mangifera indica* L. leaves were crushed and immersed in water in the ratio of 5:100 & 10:100 w/v (leaf : water) in water for 24 hours in room temperature to allow the auto extraction of plant metabolites. Filtered & stored as 5% & 10% leaf leachate and applied as Allellochemical to analyze its effect on the test crop.

Experimental Setup: Chemically sterilized seeds of *Pennisetum glaucum L.* (Pearl millet) were sown in separate pots filled with garden soil under controlled lab condition, maintained with water for 6 days. Now the plants were ready to expose the acquired treatment. Choose the nine best pots with five plants each that are of approximately the same height and with the same number of leaves. Three plants pots were maintained as control irrigated with enough water with normal sunlight and temperature. The remaining six pots were grouped into two sets (i.e. T1= 5% & T2= 10% leaf leachate). Three replicates/treatment and five plants/ replicate were supplied as T1 & T2 with respective leachate concentrations after 6 days of germination. The set up was laid in RCBD under controlled condition. The plants were constantly irrigated with respective treatments and maintained up to 6 days. After that plants were harvested and recorded as five individuals / treatment and subjected to measure growth parameters including length and weight.

RESULTS AND DISCUSSION

Table-1 Allellopathic effects of *Mangifera indica L.* leaf leachate on *Pennisetum glaucum L.* growth.

Treatments		Shoot Length (cm)	Root Length (cm)	Plant Fresh Wt. (gm)	Plant Dry Wt. (gm)
T0	Control	18.42a (0)	9.9c (0)	0.34b (0)	0.040c (0)
T1	5% Leaf Leachate	16.513b (-10.352)	8.61b (-13.03)	0.37c (+8.823)	0.0366b (-8.5)
T2	10% Leaf Leachate	15.96c (-13.35)	5.02a (-49.29)	0.296a (-12.941)	0.023a (-42.5)

Parenthesis value shows percent increase (+) or decrease (-) over control.

Means followed by letter represents significant result as + Standard deviation

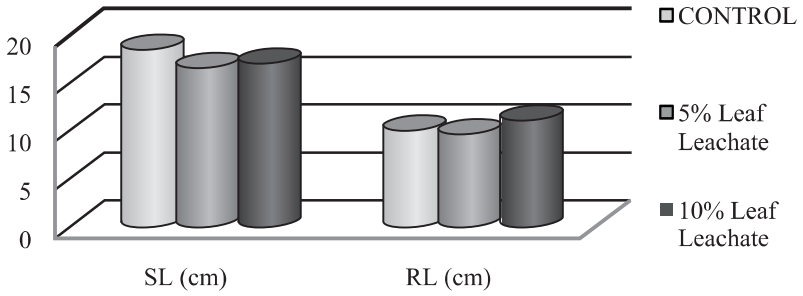

Figure 1: Allelopathic effects of *Mangifera indica* L. leaf leachate on *Pearl millet.* L Length (cm).

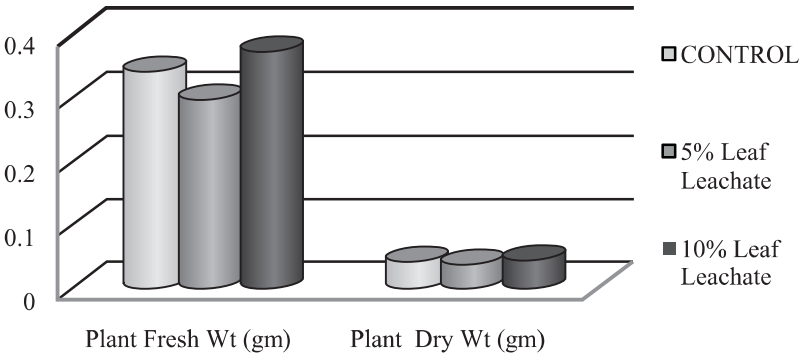

Figure 2: Allelopathic effects of *Mangifera indica* L. leaf leachateon *Pearl millet.* L Length (cm).

The given data evaluate the inhibitory effects of mango leaf litter leachate on *Pennisetum glaucum* L. growth with differential concentration. The tabulated values confirmed the dose-dependent phenomenon of leaf leachate inhibition on plant growth i.e. increases in leachate concentration exerted more inhibition on growth (Rice E.L.,1984). Table-1 showed that, the leaf leachate at both concentration i.e. 5% and 10% were found inhibitory for all studied growth parameters including SL, RL, FW, DW over control. On comparison with control plants (0% leachate) the treated plant length was negatively influenced with leaf leachate application. The inhibitory effect of leaf leachate on shoot and root length was recorded 10.35 % and 13.03% at 5% leaf leachate and 13.35% and 49.29% at 10% leaf leachate treatment respectively over control (graph-a). This result also supported by Hussain and Reigosa (2011) who also observed the inhibitory effect of allelochemicals (phenolic compounds) on root and shoot length of *Dactylis glomerata*, *Lolium perenne* and *Rumex acetosa* plants. The growth inhibition with *Mangifera indica L.* leachate may be due to the presence of high amount of variety of phenolic compounds like caffiec acid, vanelic acid, benzoic acid and coumaric acid in mango leaf that cause growth inhibition in treated plants (El-Rokiek *et al.*, 2010). These phenolic compounds might have interfered with the phosphorylation pathway or inhibiting ATPase activity, decreased the synthesis of total carbohydrates, proteins and nucleic acids (DNA and RNA) along with interference in cell division, mineral uptake and biosynthetic processes (Sasikumar, K., *et al.*, 2002). It was previously found that, impaired metabolic activities caused by allelochemicals decreased root and shoot length (Rice E.L.,1984). Also, these allelochemicals inhibits absorption of ions therefore, resulted in arrested growth (Dos Santos, *et al.*, 2004).

Table-1 also revealed that, the inhibition in root growth had direct effects on both physiological and biological functions of a plant such as anchoring, absorption of water and other essential nutrients required by plant for its survival (M. An, J. E. Pratley and T. Haig, 1998). This might have contributed to the decrease in fresh weight and dry weight of the test plant at both applied levels of leachate concentrations (Figure 2). The observed data of given research also support this view, the highest inhibition was found with 10% leachate

on plant dry weight due to high toxic effect on plants physiological functioning whereas at low concentration leachate was found supported for improving water uptake thus increases plant fresh weight up 8.8% over control. (Figure 2).

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