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ALLELOPATHIC EFFECTS OF TREVESIA PALMATA ROXB.EX LINDL LEAF EXTRACT ON SEEDLING GROWTH OF MAIZE (ZEA MAYS L.) AND FRENCH BEAN (PHASEOLUS VULGARIS L.)

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ABSTRACT: Bioassay was carried out to determine the allelopathic effects of *Trevesia palmata* on root and shoot length, fresh and dry weight of two commonly grown crops viz., *Zea mays* and *Phaseolus vulgaris*. Different concentrations (20%, 40%, 60% and 100%) of leaf extracts were used to evaluate the allelopathic effects on growth of the test crops. Root:shoot ratios, inhibition (-) or stimulatory (+) percentage, relative root elongation ratio of root and shoot were also calculated. The inhibitory effect on the root and shoot length, fresh and dry weight of the test crops increases with an increase in the concentration of leaf extracts. Maximum root and shoot elongation for maize and french bean was found in 40% and minimum in 100% extract concentration when compared to control. Inhibitory effect on the root and shoot length, fresh and dry weight was more pronounced at 100% and maximum stimulatory effects was shown in 40%. The study conclude that inhibitory effects on the test crops increased as the concentration of leaf extracts increased from 20% to 100% when compared to control.

KEYWORDS: Allelopathic, French bean, maize, *Trevesia palmata*.

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1. INTRODUCTION

Trevesia palmata Roxb.ex Lindl is a small evergreen tree armed with incurved sharp prickles belongs to family Araliaceae. It forms an important component tree crop in homegardens of NE India especially in Mizoram. The shoots, flower buds and young fruits are eaten as vegetables. Traditionally, the roots and leaves are also used to treat stomachache. The plants occur in wild as well as cultivated. It has its distribution in NE India, Bangladesh and China. Due to its wide distribution in homegardens, an in-depth knowledge on this tree needs to be evaluated for its allelopathic potential and to assess its compatibility with other crops to be introduced as an intercrop in agroforestry systems. Many tree species like *Leucaena leucocephala*, *Mangifera indica*, *Eucalyptus* and *Acacia* are found to produce allelochemicals thereby affecting the growth of crops.[1-3] These chemicals are present in many plant parts including leaves and fruits.[4] Many allelopathic compounds produced by plants are released by means of volatilization, leaching, decomposition and root exudates into the environment;[5] thereby affecting the growth and development of the adjoining crops. The concept of allelopathy was first introduced by Hans Molisch to describe both the beneficial and the detrimental chemical interactions of plants and micro-organisms.[6] Since then, the term 'allelopathy' has undergone several changes and it has been defined as any direct or indirect harmful or beneficial effects of one plant on another through the production of chemical compounds that is released into the environment.[7] To our knowledge, presently there is limited information on the phytotoxic effect of *T. palmata* on agricultural crops. Thus, the purpose of the present study was to elucidate the allelopathic potential of different concentrations of leaf extract of *T. palmata* on Maize and French bean. This information could be helpful while planning for growing crops beneath the trees in agroforestry systems.

2. MATERIALS AND METHODS

Leaves of *Trevesia palmata* Roxb. ex Lindl was collected from Sakawrtuichhun village in the capital district of the State that lies between 22˚ 45`40.6``N to 28˚ 45`44.6``N latitudes and 92˚ 40`19.4``E to 92˚ 40`29.5``E longitudes and the elevation ranging from 700 – 840 m above mean sea level (msl). The collected leaves were air dried for one week at room temperature. The air dried leaves were ground and aqueous extracts were prepared by adding 100g of ground leaf in 1l of distilled water and soak it for 24 h. The extracts were filtered with Whatman Filter paper and diluted with distilled water taken as control. Different concentrations (20%, 40%, 60% and 100%) were made from the stock solution. The test crops selected were *Zea mays* L. and *Phaseolus vulgaris* L. which are common cash crops of the state. Ten seeds of each crops were surface sterilized with 0.5% NaClO and the treated seeds were kept in each Petri-dishes lined with filter paper wetted with different concentration of extracts. The Petri-dishes were kept in growth chamber for 20 days at 20±2˚C. The root length, shoot

length, fresh weight and dry weight of root and shoot were measured and recorded.

Percentage of inhibition/stimulation effect on germination over control was calculated using the formula.[8]

$$I = 100 – (E2 \times 100/E1)$$

Where,

I = % inhibition/stimulation,

E1= response of control,

E2= the response of treatment.

Relative elongation ratio (RER) of shoots and roots of crops was also calculated.[9]

$$R= (T/Tr) X 100$$

Where,

R = relative elongation ratio,

T =ratio of treatment crop,

Tr= test ratio of control**.**

STATISTICAL ANALYSIS

To determine the statistical difference between treatments, variance analysis and least significant difference (LSD) tests were performed using MS Excel software.

3.RESULTS AND DISCUSSION

The shoot and root length of both the test crops decreases with an increase in the concentration of leaf extracts when compared to control. The highest stimulatory effect on shoot and root length was observed at 40% extract concentration; significant stimulatory effect on shoot length of french bean ($p<0.05$) and maximum inhibitory effect was observed at 100%. The maximum root (123.16% and 104.91%) and shoot (125.40% and 177.20%) elongation in maize and french bean was found in 40% and minimum root (13.28% and 20.76%) and shoot (31.85% and 56.45%) elongation in 100% extract concentration. The result of the present study is in agreement with the report that leaf extracts of *L. camara* inhibits shoot elongation when the concentration of leaf extract increased.[10] The root growth was more sensitive and responds more strong to an increase in percent content of *Lantana* extracts due to allelopathic effect.[11] Similar observations were also found where increase in the concentrations of leaf and root extracts of *A. ferox* increased inhibitory effect on root and shoot elongation of beetroot and carrot.[12] Significant suppression on root elongation on mung bean is also due to allelopathic effect of *Lantana* weeds.[13] Aqueous leaf extracts of *Schima wallichi* and *Mesua ferrea* cause inhibitory effect on the root and shoot length of maize in bioasssay when the concentration of extracts increased.[14]

Table 1. Effect of aqueous leaf extracts of *T. palmata* on root length and shoot length of Maize and French bean. (The values are means±SE)

Concentrations	*Trevesia palmata* on Maize			*Trevesia palmata* on French bean		
	Root length(cm)	Shoot length(cm)	Root:Shoot	Root length(cm)	Shoot length(cm)	Root:Shoot
Control	7.08±0.50	2.48±0.07	2.86±0.19	8.14±0.36	6.36±0.26	1.28±0.06
20%	6.84±0.62 (-3.38)	2.59±0.12 (+4.44)	2.63±0.13	6.12±1.69 (-24.82)	5.64±1.52 (-11.32)	1.07±0.11
40%	8.72±1.96 (+23.16)	3.11±0.41 (+25.40)	3.17±0.46	8.54±0.80 (+4.91)	11.27±1.41 (+77.20)	0.76±0.02
60%	4.62±0.29 (-34.75)	2.38±0.08 (-4.03)	4.26±2.34	4.35±0.82 (-46.56)	6.35±0.80 (-0.16)	0.68±0.05
100%	0.94±0.36 (-86.72)	0.79±0.26 (-68.15)	1.20±0.29	1.69±0.29 (-79.23)	3.59±0.98 (-43.55)	0.51±0.08
CD(0.05)	2.55	0.85	4.03	3.49	4.06	0.27

Values in the parenthesis indicates the inhibitory (-) or stimulatory (+) effects in comparison to control.

Table 2. Effect of aqueous leaf extracts of *T. palmata* on fresh weight and dry weight of Maize and French bean.

Concentrations	*Trevesia palmata* on Maize					*Trevesia palmata* on French bean				
	Fresh wt.(g)		Dry wt.(g)		Root: Shoot (Dry wt.)	Fresh wt.(g)		Dry wt.(g)		Root: Shoot (Dry wt.)
	Root	Shoot	Root	Shoot		Root	Shoot	Root	Shoot	
Control	1.13±0.07	1.89±0.18	0.13±0.01	0.25±0.02	0.53±0.01	1.13±0.06	3.96±0.43	0.05±0.00	0.30±0.04	0.18±0.02
20%	1.97±0.14 (+79.33)	2.07±0.06 (+9.52)	0.30±0.02 (+130.76)	0.26±0.00 (+4)	1.16±0.09	0.82±0.06 (-27.43)	3.02±0.79 (-23.74)	0.15±0.01 (+200)	0.28±0.06 (-6.66)	0.57±0.09
40%	2.22±0.22 (+96.46)	2.69±0.23 (+42.33)	0.33±0.06 (+153.85)	0.29±0.04 (+16)	1.15±0.09	1.64±0.25 (+45.13)	5.75±0.53 (+45.20)	0.21±0.01 (+320)	0.38±0.02 (+26.66)	0.55±0.02
60%	1.68±0.06 (+48.67)	1.88±0.16 (-0.53)	0.30±0.01 (+130.77)	0.23±0.01 (-8)	1.31±0.08	1.38±0.19 (+22.12)	3.71±0.26 (-6.31)	0.21±0.02 (+320)	0.30±0.01 (0)	0.69±0.04
100%	0.34±0.19 (-69.91)	0.50±0.25 (-73.54)	0.08±0.03 (-38.46)	0.08±0.03 (-68)	1.11±0.04	0.68±0.16 (-39.82)	2.23±0.72 (-43.68)	0.10±0.02 (+100)	0.17±0.04 (-43.33)	0.55±0.05
CD(0.05)	0.55	0.69	0.11	0.09	0.27	0.61	2.15	0.05	0.15	0.19

Values in the parenthesis indicates the inhibitory (-) or stimulatory (+) effects in comparison to control.

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The reductions in the growth of shoot and root with increase in the concentration of leaf extracts might have contributed to the decrease in both the fresh weight and dry weight of the test crops.[15] Significant stimulatory effect on the biomass (fresh and dry) of maize was observed at 20%, 40% and 60% extract concentration ($p<0.05$). Stimulatory effect was also observed in the fresh weight of root and shoot in french bean at 40% and 60% but not significant ($p<0.05$), however significant stimulatory effect on the dry weight of root in french bean was noticed in all the concentrations when compared to control and significant stimulatory effect was shown only at 40% extract concentration in the dry shoot weight of french bean ($p<0.05$). Maximum dry weight of shoot (0.29g and 0.38g) and root (0.33g and 0.21g) in maize and french bean was found in 40% and minimum shoot (0.08g and 0.17g) and root (0.08g and 0.10g) was observed in 100%. The dry weight of chilli, soybean, maize, rice and lady's finger decreased at higher concentrations of aqueous leaf extract of *M. indica*.[2] The dry weight of shoot and root get reduce at various level of leachate.[16] The findings also conform to the findings in which the aqueous leaf extracts of *Leucaena leucocephala* and *Tectona grandis* reduces the fresh and dry weights of maize.[17] *Acacia auriculiformis* leaf leachates shows decreased shoot and root dry weights of maize over control.[18] This experiment was for the first time conducted to demonstrate the allelopathic potential of *Trevesia palmata* on agricultural crops. The experimental results clearly indicate that leaf extracts of *T. palmata* inhibit the shoot and root length and biomass of maize and french bean. However, further investigations should be conducted in the natural environment where this species grow in close association with important agricultural crops especially in home gardens.

4. CONCLUSION

It can be concluded that aqueous leaf extracts of *T. palmata* had inhibitory activity on the growth of the test crops which suggest that this species has allelopathic potential and may possess allelopathic substances. Inhibitory effect was more pronounced in maize than French bean when compared to control. Inhibitory effect increases with increased in the concentration of leaf extracts. Therefore this species could not be a prefer component in agroforestry systems. However, further investigation needs to be conducted in natural environment where this species grows in close association with other crops.

CONFLICT OF INTEREST

The authors have no conflict of interest.

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