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Allelopathic potential of *Ziziphus nummularia* against *Vigna radiata* and *Brassica campestris* seeds

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A B S T R A C T

The phytotoxic potential of leaf, bark and fruit of Ziziphus nummularia (Rhamnaceae) was assessed against Vigna radiata and Brassica campestris seeds. The aqueous fraction of ethanol extract and aqueous extracts of various parts were observed to have significant inhibitory effect on germination rate and seedling growth parameters of both test species. On overall basis, ethanolic extract was more inhibitory than aqueous one. The effect was observed to be dose dependent. Bark of Z. nummularia was comparatively inhibitory than other parts. The fruit was found to be growth promoter at minimum dose while inhibitory at higher doses (1000 ppm).

Keywords: *Allelopathy of Z. nummularia, Vigna radiate, Brassica campestris seeds.*

INTRODUCTION

Ziziphus nummularia is commonly called Jharber or Jujube belonging to Family *Rhamnaceae*. *Z. nummularia* is bushy much branched up to 2 m in height with grey color. Leaves are rounded, orbicular or ovate-orbicular and 1-2 cm x 0.5-2 cm. fruit diameter is 1.5cm. A delicious past prepared from its fruit past called 'Borakuti is a rich source of vitamin C (Rathore, 2009). The fruit is cooling, astringent, stomachic, cures mucous and increase biliousness effect. The ripe fruits are used for worship and different religious ceremonies in Rajasthan (Purohit and Wajid 1981). The ethanol extract of bark is used for nematicidal, anthelmintic, antipyretic and anti-inflammatory activities (Bachayaa *et al*. 2009). The leaf paste is used for the treatment of skin disease like scabies (Singh *et al*. 2002). Allelopathy refers to the phenomenon of the direct and indirect influence of one plant on another by the production of some chemical compounds escape into the environment (Rice. 1984). Many substances called *allelochemicals* have been isolated from plant tissues which promote growth or inhibit or germination of seeds (Whittaker and Feeny. 1977). Allelochemicals are secondary plant products and released into the environment by plant residues decomposition and root exudation etc. The ethanole extract of various parts of *Z. nummularia* is not yet studied for allelopathic effect. Thus in the present study various parts of *Z. nummularia* were studied to investigate there allelopathic potential.

MATERIALS AND METHODS

Healthy plant parts of *Ziziphus nummularia*, collected from Distract Swabi Khyber Pukhtoonkhwa, Pakistan, were shade dried at room temperature (25±3^{0}C). Then powdered and stored for experimental use. Washed glassware was sterilized at 170 ^{0}C for about 4 h. The results were subjected to one way ANOVA (analysis of varriences).

First 30g of dried powder of leaves, fruit and bark of *Z. nummularia* were soaked in 100ml ethanol for 48 hours at room temperature (25±3^{0}C) and filtered. The filtrate was evaporated and viscous extract was dissolved in distilled water to prepare 10µg/ml, 100µg/ml and 1000µg/ml. The pH and Electrical conductivity of the extract was determined. The ethanolic extracts along with distilled water control were used against *Vigna Radiata* and *Brassica Compestris*. Ten seeds of test species were kept in Petri dishes on two folds of filter papers and moistened with respective ethanol extracts for making test. Distilled water was used as control. For each treatment 5 replicates, each with 10 seeds were taken. Germination, plumule and radical length,

fresh and dry weight and moisture contents were recorded after 72 h. Twenty seedlings from each treatment were randomly selected for determination of fresh and dry weight.

Aqueous extract bioassay:

The dried powder of leaves fruit and bark of *Z. nummularia* weighing Five and Ten grams were separately soaked in 100ml of distilled water at room temperature (25±3°C) for 24 and 48h and filtered to get aqueous extracts for which the pH and electrical conductivity was determined. These aqueous extracts were tested against *Vigna Radiata* and *Brassica Compestris* on 2-folds of filter paper in petri dishes. The filter papers were moistened with the respective plant parts extracts and the distilled water as control treatment. Germination, growth of plumule and radical were noted after 72h. Fresh and dry masses were determined for 20 randomly selected seedlings.

RESULTS AND DISCUSSION

Effects of Ethanolic extracts

Ethanolic extracts of *Ziziphus nummularia* altered the germination and overall growth of both test plant species (*Brassica compestris, Vigna radiata*). Extracts from leaves and fruits significantly delayed germination of both test species at higher concentrations (100µg/ml and 1000µg/ml). Extracts from bark significantly delayed the germination of both test species at all concentrations. Ethanolic extracts of all parts (bark, fruit and leaves) also significantly retarded the plumule and radical growth of both test species (Table 1). Bark extract was found inhibitorier. Almost similar effects were observed for ethanolic extracts of *Solidago Canadensis* against *Brassica campestris* by Sun *et al*, (2006).

Table 1. Effect of Aqueous fraction of ethanol extracts of three parts of *Z. nemularia* on germination and seedling growth of *Brassica compestris* and *Vegna radiate.* Each value is a mean of 5 replicates

Test species	*Brassica compestris*			*Vegna radiata*		
Treatments	10 µg/ml	100 µg/ml	1000 µg/ml	10 µg/ml	100 µg/ml	1000 µg/ml
	Germination%					
control	86			96		
Leaves	79^{NS}	70*	64**	90^{NS}	88^{NS}	82*
Bark	69*	73*	58**	68**	72**	69**
Fruit	80^{NS}	73*	70*	77**	89^{NS}	66**
	Radical length (mm)					
Control Mean±S.E	14.85±1.69			61.39±4.56		
Leaves Mean±S.E	11.79±1.92	10.24±1.48	8.47±1.74	34.23±2.93	21.65±2.38	37.92±1.91
Bark Mean±S.E	11.34±1.13	9.11±0.76	7.71±0.91	22.36±1.76	31.56±2.08	23.58±1.93
Fruit Mean±S.E	10.34±1.38	11.94±0.89	9.66±1.07	44.71±3.34	30.87±1.92	36.08±3.13
	Plumule length					
Control	12.67±2.27			55.38±3.78		
Leaves Mean±S.E	9.20±1.12	10.38±0.76	8.84±0.87	41.28±2.72	33.91±1.16	39.23±1.75
Bark Mean±S.E	8.17±1.01	8.70±0.97	9.47±1.28	29.45±1.97	30.19±2.19	22.78±1.83
Fruit Mean±S.E	10.32±1.44	7.11±1.17	7.45±0.73	38.74±2.45	29.96±2.17	38.67±2.46

Effects of aqueous extracts

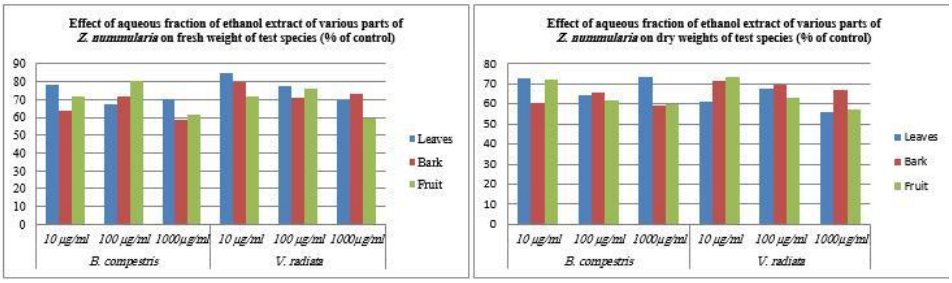
Allelopathy involves the addition of some toxic substances into the habitat to render it unfavorable (Sher *et al.* 2011) Water soluble plant extracts mainly contain phenols (Singh *et al.*, 2005; Rashid *et al.* 2010; Sisodia & Siddiqui, 2010; Moosavi *et al.* 2011), which may inhibit plant growth by affecting the cell division, elongation and ultra-structure of cells or by altering the normal physiological processes such as photosynthesis, respiration, mineral uptake and enzyme activity (Tseng *et al.*, 2003). Aqueous extracts of all parts (bark, fruit and leaves) delayed the germination of *V. radiata* at all concentrations and soaking durations, except for leaves extract at 5g/24h, which showed no significant effect. Aqueous extracts also significantly

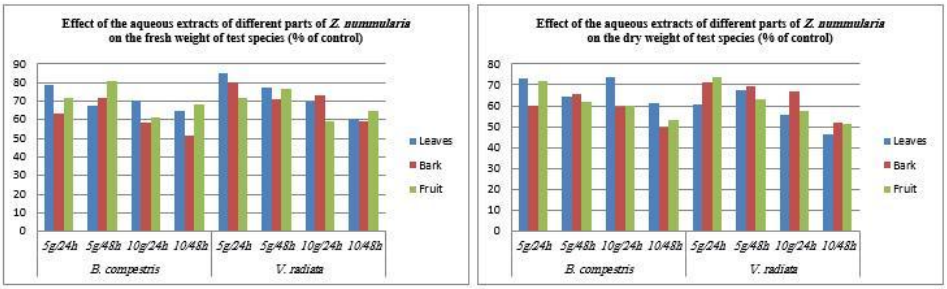
retarded the radical and plumule growth of *V. radiata* at all concentrations and soaking durations (Table. 1). The germination and overall growth of *V. radiata* was also inhibited by aqueous extracts from *Silybum marianum* (Khan *et al.,* 2011), *Anthemis cotula* (Allaie *et al.* 2006) and *Sorghum bicolor* (Moosavi *et al.*, 2011).

Aqueous extracts of the plant exhibited varied activity against *B. campestris.* Extracts from bark delayed the germination at all concentration and soaking durations. Extracts from leaves and fruits significantly delayed germination only at 10g/48 h, showed nonsignificant activity at 5g/48h and 10g/24h and interestingly stimulated the germination at 5h/24h. The plumule and radical growth was significantly retarded by aqueous extract of bark at all concentrations and soaking durations. In case of leaves and fruits extracts the radical and plumule growth was significantly retarded only by extracts of longer durations (48h). 10g/24h extracts of both leaves and fruit showed no significant activity, while 5g/24h extracts significantly enhanced the radical and plumule growth. Aqueous extracts from *Parthenium hysterophorus* (Singh *et al.,* 2005, Maharjan *et al*., 2007) and *Solidago canadensis* (Sun *et al.* 2006), *Prosopis juliflora* & *Acacia nilotica* (Khan *et al.,* 2005, Maharjan *et al*., 2007) and *Hemistepta lyrata* (Gao *et al.* 2009) delayed/retarded the germination and overall growth of *Brassica campestris.* Bark extract was found inhibitorier. All extracts were found more inhibitory towards the *V. radiata.*

Table 2. Effect of aqueous extracts of various parts of Z. nummularia on of germination rate and seedling growth of Brassica compestris and Vegna radiate. Each value is a mean of 5 replicates

Test species	Brassica compestris				Vegna radiata			
Treatments	5g/24h	5g/48h	10g/24h	10g/48h	5g/24h	5g/48h	10g/24h	10g/48h
	Germination %							
control	86				96			
Leaves	98*	77^{NS}	79^{NS}	40**	90^{NS}	72**	61**	50**
Bark	60**	65**	59**	10**	81*	55**	63**	39**
Fruit	100*	70*	85^{NS}	74*	79*	70**	74**	63**
	Radical length							
Control	14.85±1.69				61.39±4.56			
Mean±S.E								
Leaves	19.23±2.17	9.72±1.28	11.81±1.62	6.25±0.63	54.28±5.70	44.90±4.19	40.38±3.94	31.900±4.18
Mean±S.E								
Bark	8.12±1.44	10.07±1.19	6.33±0.92	4.71±0.29	49.07±5.18	37.38±3.67	41.49±4.29	29.18±3.91
Mean±S.E								
Fruit	18.43±2.38	13.12±2.18	12.16±1.77	9.96±1.47	53.00±4.10	48.26±3.75	40.13±3.86	41.83±4.39
Mean±S.E								
	Plumule length							
Control	12.67±2.27				55.38±3.78			
Leaves Mean±S.E	17.12±5.3	7.22±1.17	10.31±4.52	4.31±2.19	30.38±4.12	37.29±3.18	37.28±3.01	31.03±3.79
Bark Mean±S.E	5.17±2.13	6.34±2.01	4.27±1.26	3.15±2.28	45.06±3.06	41.02±2.37	36.86±3.54	34.14±2.00
Fruit Mean±S.E	21.43±1.59	9.54±2.15	11.12±2.01	7.17±2.03	55.09±5.17	45.78±3.14	41.46±2.78	28.34±4.54





CONCLUSIONS

The present study revealed that both aqueous and ethanolic extracts of plant parts exhibited significant allelopathic potential against test species. *Vigna radiata* was found more susceptible. Further work is required to test the effects of plant extracts under field conditions. Further work is also needed to identify the secondary metabolites of the plant which are actually responsible for the observed allelpathic potential.

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