

ALLELOPATHIC INFLUENCE OF *BALANITES ROXBURGHII* PL. ON ARID LAND CROPS

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ABSTRACT

The effects of the aqueous extracts of the leaf and fruit of *Balanites roxburghii* Pl. on germination and seedling growth of *Pennisetum typhoides* S. & H. *Sesamum indicum* L., *Vigna aconitifolia* (Jacq.) and Marechal *V. radiata* (L.) Wilczek were investigated. The seedling growth of all the four crop species was adversely affected by the extracts, especially at higher concentrations (from 5% onwards). The allelochemic causing such inhibition was possibly the steroid sapogenin present in the leaves and the fruits.

INTRODUCTION

Allelopathy is the influence of one plant on another through the release of chemical substances (allelochemicals). Most allelochemicals are secondary substances (Whittaker & Feeny, 1971) liberated into the environment from different plant parts. Once in the environment, these allelochemicals exert deleterious effect on seed germination and seedling growth of other plants (Rice, 1974). Al-Naib and Rice (1971) concluded that chemical inhibitors from leaves was the basic cause of failure of most herbaceous species to grow under *Platanus occidentalis* tress. Presence of allelopathic chemicals was reported by Mohnot and Soni (1976) in the leaves of *Salvadora oleoides*, and by Lahiri and Gaur (1969) in *Prosopis juliflora* leaves.

The Agricultural Research Planning Conference (Anon, 1977) laid stress to assess the impact of allelopathic compounds on agricultural production and to determine high priority research needs to reduce the deleterious effects, and to improve the beneficial effects, of such chemicals on agricultural production.

Balanites roxburghii Pl. (Balanitaceae), a deciduous tree found commonly growing in the Indian desert, is a potential source of commercial diosgenin. *Balanites* trees in cultivated fields and on bunds shed their leaves and fruits in the fields during December to March. These remain and disintegrate in the fields till July when rains start. *Balanites*, a component of the pre-climax stage in vegetation succession on older alluvial and sandy plains in arid Rajasthan, ends up in a climax community of *Prosopis cineraria*-*Salvadora oleoides*.

Crop plants growing in fields with *Balanites* trees were observed to have stunted growth. This biochemical inhibition is of great consequence, especially in arid environment where leaching of toxic substances does not take place rapidly because of erratic precipitation. The present study was, therefore, undertaken to investigate into the allelopathic effects of *B. roxburghii* on four important arid land crops commonly cultivated in western Rajasthan.

MATERIAL AND METHODS

The investigation was done by petridish bioassay method under laboratory conditions. 10 g each of the air dried leaf and fruit pulp (mesocarp) of *B. roxburghii* were ground separately with 100 ml of double distilled water and kept at 5°C for 24 hours and then filtered. From the filtrate (10% stock solution), various aqueous dilutions, viz., 7.5%, 5.0%, 2.5%, 1.0%, 0.5% and 0.1%, were prepared. The viable seed material of *Pennisetum typhoides* S. & H. (var. M. 78), *Sesamum indicum* L. (var. TC-25), *Vigna aconitifolia* (Jacq.) Marechal (var. JMM 259) and *V. radiata* (L.) Wilczek (var. S-8) were kept separately in sterilised petridishes which were lined with Whatman No. 1 filter papers moistened with the respective concentration of the aqueous extracts prepared (*vide supra*) for the treatments and with distilled water, for the control. All the petri dishes were kept covered for germination at $28 \pm 2^\circ\text{C}$ and under continuous illumination (1000 lux). There were 3 replicates of each treatment. Germination counts were made after 48 hours and the linear growth (mm) of radicle and plumule hypocotyl in different treatments was measured.

RESULTS AND DISCUSSION

The aqueous extracts of *Balanites roxburghii* leaf and fruit showed inhibitory effects on germination and seedling growth in all the four test crops. At 10% concentration of extract, the germination percentage was reduced in all, but the effect was statistically significant only in case of *P. typhoides* (Table 1).

Table 1. Germination % of four crop seeds as influenced by the leaf and fruit extracts of *Balanites*:
(1 *Pennisetum typhoides*, 2 *Sesamum indicum*, 3 *Vigna radiata*, 4 *Vigna aconitifolia*)

Per cent concentration of extract	Leaf extract				Fruit extract			
	1	2	3	4	1	2	3	4
0.1	100	93.3	100	100	93.3	100	100	100
0.5	100	100	100	96.7	96.7	100	96.7	100
1.0	100	96.7	100	96.7	96.7	93.3	100	100
2.5	96.7	100	100	100	96.7	90	100	96.7
5.0	96.7	96.7	96.7	86.7	100	96.7	100	93.3
7.5	96.7	93.3	100	86.7	100	93.3	96.7	90
10.0	80.0	90	90	73.3	96.7	93.3	96.7	93.3
0	100	100	100	96.7	100	100	100	100
SEm \pm	4.3	5.9	3.3	8.2	4.9	5.5	3.8	4.9
CD 5%	13.0	NS	NS	NS	NS	NS	NS	NS

The inhibitory effect of the leaf and fruit extracts on seedling growth increased with the concentration and it was highly significant (at 1% level) especially at concentrations 5% and above, in all the test crops. Leaf extracts caused statistically significant reduction of radicle growth in *P. typhoides* and *S. indicum*. Fruit extract inhibited radicle growth in *V. radiata* at all the concentrations and in *P. typhoides* in all but one concentrations [(Table 2). In *S. indicum*, root hair formation was suppressed in the portion which remained in contact with the extract.

Table 2. Effect of *Balanites* leaf and fruit extracts on radicle growth (mm) of the test crop seedlings (1 *Pennisetum typhoides*, 2 *Sesamum indicum*, 3 *Vigna radiata*, 4 *Vigna aconitifolia*)

Concentration of extract %	Leaf extract				Fruit extract			
	1	2	3	4	1	2	3	4
0.1	23.7	15.6	24.8	20.1	22.3	13.0	19.5	16.3
0.5	28.2	13.2	22.4	16.6	18.5	12.8	17.5	15.4
1.0	19.2	10.8	23.1	14.7	25.5	10.3	16.3	16.1
2.5	18.5	8.7	18.7	15.5	17.8	7.8	13.6	12.5
5.0	13.0	4.7	14.8	8.9	9.7	3.2	11.1	7.9
7.5	7.3	2.2	14.3	6.1	7.9	1.9	8.3	6.6
10	0.0	0.6	5.3	1.6	9.3	4.2	7.6	6.1
0	42.7	19.8	27.4	18.3	30.7	14.3	23.4	19.4
SEm ±	3.3	1.1	1.1	1.5	2.1	1.8	0.7	1.3
CD 5%	2.14	3.42	3.47	4.64	6.24	5.53	2.14	3.85

Plumule/hypocotyl growth in *Pennisetum* and *V. radiata* was significantly affected by the leaf extract at all concentrations. The fruit extract of *B. roxburghii* inhibited plumule growth in *Pennisetum* and *Sesamum* at all concentrations when compared to control (Table 3). Per cent rate of reduction in growth, for per unit increase in extract concentration, revealed that the most affected crop was *S. indicum*, followed

Table 3. Effect of *Balanites* leaf and fruit extracts on plumule/hypocotyl growth (mm) of the test crop seedlings (1 *Pennisetum typhoides*, 2. *Sesamum indicum*, 3. *Vigna radiata*, 4. *Vigna aconitifolia*)

Extract %	Leaf extract				Fruit extract			
	1	2	3	4	1	2	3	4
0.1	19.5	9.6	17.6	10.8	15.7	3.9	10.2	3.6
0.5	19.8	8.6	16.5	9.5	8.8	3.8	7.5	3.7
1.0	10.7	6.5	15.8	8.1	10.7	2.9	8.0	4.7
2.5	9.9	4.7	13.1	7.1	6.6	3.1	8.4	5.1
5.0	7.4	3.6	9.7	4.6	3.4	2.4	7.2	3.4
7.5	3.7	1.6	10.3	4.9	2.0	1.3	6.3	3.2
10	1.1	0.1	5.3	1.9	1.4	1.8	5.6	2.5
0	24.1	9.7	21.8	11.7	24.4	9.6	11.4	6.0
SEm ±	1.4	0.6	0.9	0.6	1.4	0.7	0.9	0.7
CD 5%	4.1	1.8	2.9	1.9	4.3	2.2	2.7	2.1

by *P. typhoides*, *V. aconitifolia* and *V. radiata* (Table 4). There was more reduction in growth with leaf extract than with fruit extract.

Table 4. Per cent reduction in seedling growth for per unit increase in concentration of leaf and fruit extracts

Test crop	Leaf extract	Fruit extract
<i>Sesamum indicum</i>	5.4	4.8
<i>Pennisetum typhoides</i>	5.3	4.9
<i>V. aconitifolia</i>	4.3	3.0
<i>V. radiata</i>	3.7	3.1

Leaf extracts had greater inhibitory influence on seedling growth than the fruit extract. Thus, leaves seem to be the most consistent source of inhibitors. Fruits have generally been neglected in allelopathic studies (Rice, 1974). The probable inhibitors in the case of *B. roxburghii* are the steroids (sapogenins) obtained from leaves and fruits by Ghanim *et al.* (1980).

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