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THE ALLELOPATHIC POTENTIAL OF *EUCALYPTUS TERETICORNIS* Sm.

Nazir Ahmed, Farrukh Hussain* and Mehmood Akram

PCSIR Laboratories, Peshawar, Pakistan

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The allelopathic potential of *Eucalyptus tereticornis* Sm., an introduced species, was assayed by using aqueous extracts from leaves, flower-buds and bark against *Sorghum vulgare* var. Dale, *Sorghum vulagare* var. Wiay, *Phaseolus mungo, Brassica chinensis, B. campestris, Sisymbrium irio, Nigella sativa, Raphanus sativus* and *Setaria italica* in filter paper bioassays. The germination and radicle growth of various species was reduced by aqueous extracts, especially by leaf and flower bud extracts *Sisymbrium, Nigella* and *Brassica* were more susceptible than other species. The phytotoxicity depended upon the part assayed, and test species used with an independent effect on germination and growth. Aqueous extracts through soaking is one of the suggested routes for releasing phytotoxins in this plant. Further study is underway to envisage other aspects of allelopathy by this euclypt.

INTRODUCTION

Eucalpytus tereticornis Sm. is an introduced euclypt in Pakistan, It is commonly cultivated in Peshawar along roadsides, avenues, in garden and in agricultural areas due to its rapid growth, adaptation and lofty height having handsome canopy. The tree sheds mature leaves and flower-buds regularly, during its growth in winter. Outer dead bark, naturally peeling off into pieces, is added to the soil environment. These plant parts become a component of soil as litter where they are subjected to natural decay process. Many agricultural and ,ornamental species have been found to be unhealthy and stunted under the canopy of *E. tereticornis.* Many other species of euclypts have been shown to exhibit allelopathy. del Moral and Muller [1,2] reported inhibited growth of associated plants by fog-drips from *E. camadulensis* exerted allelopathic effect against the neighbouring species. Phytotoxicity by *E. microtheca* is reported by Al-Mousawi and Al-Naib [3]. The allelopathic effects of *E. pilurlaris* [4], *E. grandis* [5], *E. reganas* [6] *E. baxteri* and *E. obliqua* [7] and many other trees [8-12] are well documented.

Since allelopathy can influence the productivity it may play a significant role in vegetational composition [13-17] and in agroecosystems [18-19]. The observed suppression of some, but not all species beneath *E. terecornis* and indication of allelopathy in other euclypts, lead us to the hypothesis that it is potentially allelopathic. In the present communication therefore we explore the allelopathic potential -

* Department of Botany, University of Baluchistan Quetta, Pakistan

MATERIALS AND METHODS

Fallen leaves, flower-buds and peeled off bark were collected from mature trees and dried in shade at room temperature (25-30°C). Five g of powdered leaves, flower-bud and bark was separately soaked in 100 ml. double distilled water for 24th at 25° and filtered. In nature the toxins are slowly released from litter and/or intact parts with natural water such as rain. In laboratory, however.the plant material was powdered to accelerate the extraction of toxin(s) following Lodhi [20]. The aqueous extracts were stored at 5-10° when not used, however they were utlized within a week.

Seeds of *Sorghum vulgare* var. Dale, *Sorghum vulgare* var. Wiay, *Phaseolus mungo, Brassica chinensis, B. compestris, Sisymbrium irio, Nigella sativa, Raphanus sativus* and *Setaria italica* were separately placed on twice folded sterillised Whatman No. 1 filter paper seed-beds in 9 cm Petri Dishes and soaked with the respecitve extract for testing. Controls were made by replacing extract with double distilled water. Dishes, sealed with polythylene sheets to avoid moisture loss and reduce aerial contamination, were incubated at 26°. Germination and radicle growth of 10 seeds in five replicates of every test species in each tratment was recorded after 72 hr. The aformentioned test species were prefered due to their agricultural , medicinal value and lower yield under canopy of *Eucalyputs tereticornis.* Results were statistically analyzed using "Z and t-test" [21].

RESULTS

1. *Leaves-extract Bioassay.* Extracts from leaves significantly inhibited germination of *Nigella, Sisymbrium* and

B. Campestris and redicle growth of all the test species (Table 1). *Nigella,* with zero germination, was closely approached by *Sisymbrium* and *B. campestris.* Among the germinated species the growth of radicle decreased from 45.87% of control in *Phaseolus* to 1.25% of control in *Sisymbrium,* through *Rhaphanus, Sorghum* var. Dale, *Setaria, B. chinensis, Sorghun* var Wiay and *B. campestris,* all arranged in increasing order of susceptibility.

2. *Flower-buds-extract Bioassay.* Germination of *Sisymbrium, Nigella, B. campestris, B. chinensis, Raphanus* and *Setaria,* arranged in declining of order of inhibition, and radicle growth of the test species was severely arrested by extract (Table 2). The germination varied from zero in *Sisymbrium* to 89.47% in *Setaria.* The most and least inhibited growth, ranging in between zero to 48.14% of control, was respectively exhibited by *Sisymbrium* and *Nigella.* The remaining species in dwindling order of containment were *B. campestris, B. chinensis, Raphanus, Setaria, Sorghum* var. Waiy, var Dale, and *Phaseolus.*

3. *Bark Extract Bioassay.* Expect Sisymbrium, the germination of all species remain unarrested by bark extracts (Table 3). While the radicle grwoth was singnificantly

Table 1. Effect of aqueous extract of leaves of *Eucalyptus tereticornis* on the germination and radicle growth of test species. Each value is a mean of 5 replicates, each with 10 seeds.

Test species	Germination (%) Control	Test	% of control	Radicle growth (mm) Control	Test	% of control
Sprgji, valgare- Dale	88.00	92.00	104.54	36.33	8.18	22.51★
S. Valgare – Wiay	86.00	88.00	102.32	48.37	7.72	15.96★
Phaseolus mungo	80.00	86.00	107.50	22.89	10.50	45.87☆
Brassica chinensis	96.00	90.00	93.75	17.94	3.17	17.67★
B. campestris	98.00	58.00	59.18☆	30.24	4.78	15.80★
Sisymbrium irio	66.00	04.00	06.06★	3.20	0.04	1.25★
Nigella sativa	70.00	00.00	00.00★	2.62	0.00	00.00★
Raphanus sativus	54.00	52.00	96.29	30.97	7.19	23.21★
Setaria italica	78.00	82.00	105.12	15.14	2.73	18.03★

☆= Significant at P = 0.05; ★Significant at P = 0.01

Table 2. Effect of aqueous extract from flower buds of *Eucalyptus tereticornis* on the germination and radicle growth of test species. Each value is a mean of 5 replicates, each with 10 seeds.

Test species	Germination (%) Control	Test	% of control	Radicle growth (mm) Control	Test	% of control
Sarghum vulgare-Dale	*84.00*	*88.0*				
Sarghum vulgare-Dale	84.00	88.00	104.76	16.17	4.02	24.86★
S. vulgare – Wiay	98.00	92.00	93.87	27.86	4.96	17.80★
Phaseolus mungo	82.00	96.00	117.07	23.89	11.28	47.21☆
Brassica chinensis	98.00	50.00	51.02☆	25.88	1.38	5.33★
B. campestris	96.00	42.00	43.75☆	42.07	1.47	3.49★
Sisymbrium irio	66.00	00.00	00.00★	4.04	00.00	00.00★
Nigella sativa	92.00	28.00	30.43★	1.08	0.52	48.14☆
Raphanus sativus	46.00	28.00	60.86☆	33.36	3.91	11.72★
Setaria italica	76.00	68.00	89.47☆	9.59	1.53	15.95★

☆= Significant at P = 0.05; ★= Significant at P = 0.01.

Table 3. Effect of aqueous extract from bark of *Eucalyptus tereticornis* on the germination and radicle growth of test species. Each value is a mean of 5 replicates, each with 10 seeds.

Test species	Germination (%)			Radicle growth (mm)		
	Control	Test	% of control	Control	Test	% of control
Sorghum vulgare- Dale	84.00	80.00	95.23	35.51	4.34	12.22★
S. vulgare – Wiay	92.00	94.00	102.17	31.12	8.07	25.93★
Phaseolus mungo	94.00	88.00	93.61	27.35	19.09	69.79☆
Brassica chinensis	92.00	96.00	104.34	38.43	5.11	13.29★
B. compestris	90.00	94.00	104.44	24.70	4.45	18.01★
Sisymbrium irio	60.00	44.00	73.33	4.59	1.46	31.80★
Nigella sativa	46.00	50.00	108.69	0.75	0.56	74.66★
Raphanus sativus	40.00	44.00	110.00	56.31	14.30	25.39★
Setaria italica	70.00	66.00	94.28	10.17	2.12	20.84★

☆= Significant at P = 0.05; ★= Significant at P = 0.01.

inhibited in all test species (Table 3). The inhibition of growth intensified from 74.66% in *Nigella* to 12.22% in *Sorghum* var Dale among the species. The decreasing order of susceptibility was respectively *Sorghum* var Dale, *B. chinensis, B. campestris, Setaria, Raphanus, Sorghum* var Wiay, *Sisymbrium, Phaseolus* and *Nigella.*

The results of the 3 different bioassays further reveal that phytotoxicity was related to the part assayed and test species used (Fig. 1). Leaves and flower-buds were more inhibitory than bark. Moreover, germination and radicle growth were independently affected. In some cases species were arrested in their growth but relaxed in germination, with insignificant stimulation in certain species *Nigella, Sisymbrium* and *Brassica* were highly sensitive species while Phaseolus was less susceptible (Fig. 1).

DISCUSSION

Suppression of growth of susceptible associated species through release of phytotoxic susbstances is widespread in plants (13, 14, 17). Such phytotoxic effects retard health and productivity of certain species on one hand while on the other hand they may improve the dominance of allelopathic species. In the present study aqueous extracts from various parts of euclypt inhibited germination and early growth of the test speceis susgesting the presence of some water soluble toxic substance(s). Soaking in water caused these water soluble toxins to move out of the tissue and thus got mixed with the soil environment. Our results are strenghtened by findings of del Moral and Muller [1-2], Al-Mousawi and Al-Naib [3] and Wills [6] demonstrated inhibited growth of test species in aqueous extracts from other euclypts. The extraction of toxins in

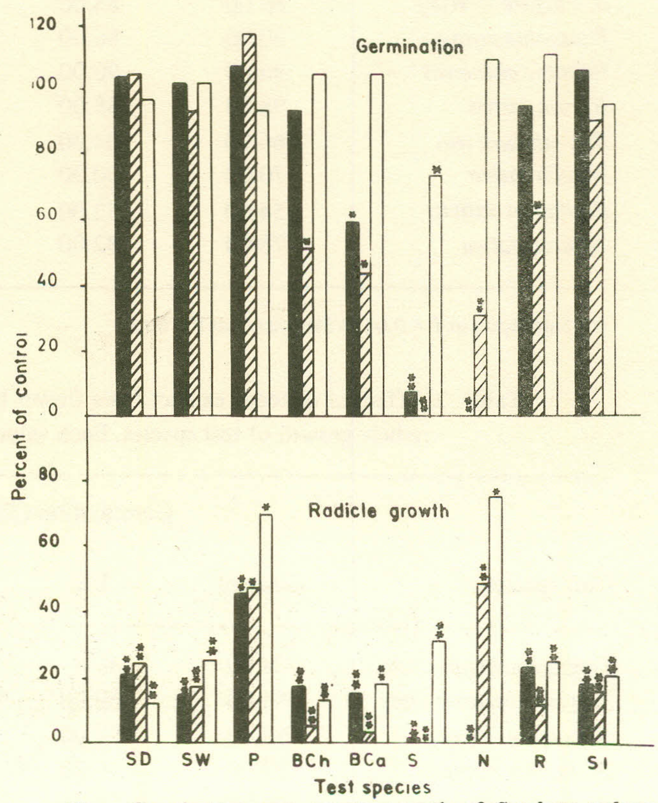

Fig. Germination and radicle growth of *Sorghum vulgare* var Date (SD), *Sorghum vulgare* var Wiay (SW), *Phaseolus mungo* (P) *Brassica chinensis* (BCh) *Brassica campestris* (BCa), *Sisymbrium irio* (S), *Nigella sativa* (N), *Raphanus sativus* (R), and *Setaria (solid)* flower buds (Thatched) and bark (open) aqueous extracts. Each value, expressed as % of control, is mean of 5 replicates, each with 10 seeds.

the laboratory by wetting is comparable to the process that is expected to operate in nature. Litter in the form of leaves, floral-buds, bark and other parts, accumulating underneath the tree, is subjected to nartural and artificial wetting. Litter generally is believed to enhance soil fertility during its decomposition but it is presumed that the release of nutrients from litter of *E. tereticornis* is probably preceded by setting free of phytotoxins into the soil, thereby affecting the associated plants. One of the wild associate, *Sisymbrium irio,* which shows unhealthy growth under the *E. tereticornis* canopy, exhibited significantly arrested germination and growth. Allelopathically induced soil-phytotoxicity has been reported for *Sorghum*[22], *Euphorbia* [23], *Datura*[24] and many other plants [19]. In the present case too, we believe that soil is rendered unfavourable for the growth of susceptible plants owing to phytotoxicity. Our results thus agree with those reported by Naqvi and Muller[25], Hussain *et al* [24] and Hussain and Gadoon [22]. This character would play a significant role in either elimination or retaining associated species, depending upon their susceptibility. Release of toxins through wetting of litter is but one possible method of allelopathic suppersion, operating in this plant but is probably not the sole mechanism. Other routes of toxin release are volatilization, root exudation, stem and bark water flow and soil phytotoxicity. These deserve further study. The findings so far suggest the presence of strong allelopathy by this species.

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