Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
https://www.phytojournal.com
JPP 2024; 13(1): 248-250
Received: 05-12-2023
Accepted: 08-01-2024

Muneshwar Prasad Mandal
Department of Plant Physiology and Biochemistry, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India

Mukul Kumar
Department of Plant Physiology and Biochemistry, Mandan Bharti Agriculture College, Agwanpur, Saharsa, Bihar, India

Preeti Kumari
Department of Plant Physiology and Biochemistry, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India

Corresponding Author:
Mukul Kumar
Department of Plant Physiology and Biochemistry, Mandan Bharti Agriculture College, Agwanpur, Saharsa, Bihar, India

Allelopathic influence of *Ocimum tenuiflorum* (L.) Merr. on germination and seedling growth of wheat genotypes

Muneshwar Prasad Mandal, Mukul Kumar and Preeti Kumari

DOI: https://doi.org/10.22271/phyto.2024.v13.i1c.14834

Abstract
The aqueous leaf extracts of *Ocimum tenuiflorum* (L.) Merr. showed inhibitory effects on seed germination and seedling growth of wheat was investigated. The result showed that the extracts brought about considerable inhibition in the germination of wheat seeds and in the growth of its root and shoot. On the basis of value of per cent reduction in seed germination, germination relative index and vigour index, the inhibitory effect of different leaf extracts was maximum in susceptible genotypes (K-1317 and GW322) followed by tolerant genotypes (HD 2967 & HD 2733). The root and shoot length and root and shoot dry weight declined with increase in the concentration of leaf extracts of *Ocimum tenuiflorum* (Krishna Tusli). The results indicated that the allelopathic effect of aqueous leaf extracts of *Ocimum tenuiflorum* was maximum in terms of all physiological parameters.

Keywords: Krishna Tusli, *Ocimum tenuiflorum* (L.), allelopathy

Introduction
Allelopathy refers to both beneficial and harmful effects of one plant on another plant by the release of chemicals from plant parts through leaching, root exudation, Volatilization, residue decomposition and other process in both natural and agricultural systems. A study was conducted to investigate the allelopathic effects of dry leaf aqueous extracts of *Ocimum tenuiflorum* on the germination of seed and growth of young seedlings of wheat under laboratory. Krishna Tulsi (*Ocimum tenuiflorum*) was in use in Indian systems of medicine, since time immemorial leaves and stem constitute the drug. It is better toxic and possesses antityphoid and antibiotic properties. Tulsi has provided to be highly effective in protecting our body from various infectious and diseases heart, liver, skin, kidney. It is used to treat liver and digestion complaints, general weakness, fever, dysentery and excessive gas formation in stomach. Allelopathy is also regarded as a biochemical welfare. Plants inhibit the seed germination and seedling growth of other plants by means of producing toxic chemicals that is allelochemicals or allelopathins. Allelopathy refers to any process involving secondary metabolites produced by plants, microorganism, viruses and fungi that influence the growth and development of agricultural and biological systems including positive and negative effects. Allelochemicals from plants are released in to the environment by exudation from roots leaching from stem and leaves or decomposition of plants national [1]. reported that secondary metabolites of some medicinal and aromatic plants accounted for allelopathic activity likewise studied allelopathic effect of medicinal plants. *Ocimum tenuiflorum* which showed inhibition in germination and seedling growth of leaves Culinaris [2-4]. Hence the laboratory experiment was undertaken to study the behaviour of phytochemicals present in *Ocimum tenuiflorum* extracts in germination and seedling growth of wheat. Hence the present study was carried out to determine the allelopathic effects of medicinal plants species on wheat. The study was conducted under laboratory conditions.

Materials and Methods
The experiment was conducted in the Department of Plant Physiology and Biochemistry laboratory in Bihar Agricultural College, Bihar Agricultural University, Sabour, Bhagalpur, Bihar. There were shade dried for 8 days then powdered in grinder and sieved. For leaf extract, 30g leaf powder was soaked in 100 ml distilled water for 24 hours to get 30% extract. By dilution with distilled water 5%, 10%, 15% and 20% concentration of extracts were prepared. Seeds of wheat were surface sterilized with 0.1% mercuric chloride for 2 minutes and repeatedly washed with sterilized distilled water.

The seed were soaked in different concentration of extracts for 24 hours. The experiment was done in 11 cm diameter petri dishes with blotting paper and kept 25±2 °C in BOD incubator under controlled condition with three replications. The germination relative index (GRI) was calculated according to the formula given by the Srivastava and Saren [5] GRI = ∑xn (h-n), where xn= numbers of seed germination on nth count, h = total number of count, n= count number. Vigour index (VI) was worked out by multiplying germination (%) with total seedling lengths [6].

Results and Discussion

In the present study leaf extracts of *Ocimum tenuiflorum* (L.) Merr. inhibited the seed germination of wheat. Maximum inhibitory effect was observed with concentrated leaf extracts. The increasing concentration of aqueous leaf extracts of *Ocimum tenuiflorum* inhibited the seed germination of HD2967, HD2733, K 1317 and GW322 genotypes of wheat (table 1). Maximum decline in germination percentage was observed in susceptible genotype (K 1317 and GW322) at 20% leaf extract in comparision to control, followed by tolerant genotypes (HD2967 & HD2733). The germination relative index (GRI) and Vigour index (VI) of test genotype decreased with increase in the concentration of leaf extracts. The interaction between treatment and genotypes was found significant. Decreased germination and growth with increasing aqueous leaf extracts have been observed [4, 6]. Also found similar trend of germination and seedling growth of various crops, with increase in leaf extract concentration [7-8]. The effects of leaf leachate on seed germination and seedling growth were due the presence of nutrients, growth regulators, alkaloids and toxins [9-10]. Further, the phenolic compounds synthesized in the root and shoots of plants and released into the soil, inhibits seed germination of surrounding plant species [11]. Shoot and root length invariably decreased with increase in aqueous leaf extract concentration (table 1). Shoot and root lengths were higher in tolerant genotypes (HD 2967 & HD2733) than susceptible genotype (K-1317 & GW322). The maximum inhibition in shoot and root length was found at 20% leaf extract. Effect of leaf extract on all four genotypes were found highly significant. The greater inhibition in shoots and roots growth observed in the study was accordance with findings of [12], have also reported such effects of leaf extracts [9, 12-13]. The effect of growth parameter of wheat seedlings were concentration dependent and satisfactory significant. The dry weight of shoot and root declined with increasing aqueous leaf extracts of all four test genotypes under test (table 1). Dry weight of shoot and root of different genotypes was significantly decreased with increase in concentration of leaf extract at each leaf extract. At each extract concentration maximum value of shoot dry weight was recorded for tolerant genotypes (HD2967 & HD2733) followed by susceptible genotypes (K-1317 & GW322). The maximum reduction in biomass occurred in susceptible genotypes.

Table 1: Influence of aqueous leaf extract on *Ocimum tenuiflorum* on germination, growth and biomass of wheat seedlings at 8 days.

Aqueous extract con. (%)	Wheat genotypes	Germination (%)	GRI	Vigour Index	Shoot length (cm)	Root length (cm)	Dry root DW (mg)	Dry shoot DW (mg)
Control	HD2967	100.00	287.67	2729.00	14.29	13.00	52.33	107.67
	HD 2733	99.67	286.33	2693.00	14.12	12.90	51.66	106.97
	K-1317	99.33	276.67	2575.63	13.98	11.95	51.33	105.99
	GW 322	99.33	275.67	2563.71	13.96	11.85	50.66	105.37
	MEAN	99.58	281.58	2640.33	14.09	12.42	51.49	106.5
5%	HD2967	98.33	281.33	2501.51	13.10	12.34	49.33	102.33
	HD 2733	97.33	279.67	2432.28	12.88	12.11	48.74	100.98
	K-1317	95.67	264.33	2179.36	12.05	10.73	46.12	94.67
	GW 322	95.67	262.67	2150.66	11.97	10.51	45.33	92.94
	MEAN	96.75	272.00	2315.95	12.50	11.42	47.38	97.73
10%	HD2967	95.67	273.33	2240.59	11.98	11.44	47.01	96.34
	HD 2733	94.33	271.67	2174.31	11.72	11.33	46.05	95.33
	K-1317	88.637	249.33	1907.29	11.52	9.99	40.99	88.33
	GW 322	88.33	246.67	1845.21	11.01	9.88	38.89	87.34
	MEAN	91.75	260.25	2041.85	11.56	10.66	43.48	91.83
15%	HD2967	90.33	261.33	1913.19	10.24	10.94	44.67	90.67
	HD 2733	87.67	259.67	1814.77	9.84	10.86	43.46	89.37
	K-1317	82.33	230.67	1430.89	8.70	8.68	36.37	80.34
	GW 322	81.67	228.67	1106.63	8.53	8.02	35.93	79.33
	MEAN	85.50	245.08	1566.37	9.33	9.62	40.10	84.92
20%	HD2967	83.67	238.33	1467.61	8.42	9.24	41.33	84.34
	HD 2733	82.33	236.67	1404.55	8.14	8.92	40.86	83.12
	K-1317	70.33	196.33	790.51	6.08	5.16	29.67	63.34
	GW 322	68.67	192.67	751.94	5.97	4.98	28.94	61.67
	MEAN	76.25	216.00	1103.65	7.15	7.07	35.2	73.11
CD (0.05)	Treatment	0.81	1.26	57.28	0.47	0.49	0.57	0.74
	Genotypes	0.64	1.28	57.28	0.47	0.49	0.57	0.74
	Interaction	1.59	2.49	114.56	0.94	0.99	1.15	1.48

Conclusion

Potentially of different concentration of aqueous leaf extracts of *Ocimum tenuiflorum* was investigated germination and seedling growth of four genotypes: HD 2967, HD 2733, K-1317 & GW322. On the basis of reduction in seed germination, germination relative index (GRI) and vigour index (VI), the inhibitory effect of leaf extract was maximum in GW322 followed by HD2957, HD2733 & K-1317 with increase in leaf concentration, the shoot and root length and their dry weight decreased. The result indicated that allelopathic effects of the leaf extract of *Ocimum tenuiflorum* were maximum in GW 322.

Acknowledgement
The author are thankful to the PPB for financial support through BAU, Sabour, Bhagalpur, Bihar.

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