

ALLELOPATHIC POTENTIAL OF *CAESALPINIA CORIARIA* (JACQ.) WILLD. ON *PARTHENIUM HYSTEROPHORUS* L.

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The aqueous extract of fresh leaves of *Caesalpinia coriaria* (Jacq.) Willd. inhibited the growth of *Parthenium hysterophorus* L. The decrease in plant dry weight, shoot height, leaf area, total chlorophyll, and protein is proportional to the increase in concentration of leaf extract. The inhibitory effect was striking with nearly complete mortality in higher (15% and 20%) concentrations. The results suggest that the higher content (40 mg/g Fr.wt.) of tannins in *C.coriaria* leaves might be responsible for the allelopathic effect.

Keywords: Allelopathy, *Caesalpinia coriaria*, *Parthenium hysterophorus*; Tannin.

Plants produce many compounds that have no apparent metabolic or physiologic role for the producer. These secondary metabolites often have effects on other organisms. They are believed to function as allelochemicals.^{1,2} *Parthenium hysterophorus* L. a common and serious weed has spread to almost all parts of the country. Its possible allelopathic potential on crop plants have been observed by many scientists.³⁻⁵ Phenolic compounds produced by teak leaf⁶, bamboo root⁷, bamboo leaf⁸ and eucalyptus leaf⁹ are inhibitory to seedling growth of groundnut and corn. Tannins are the another group of allelochemicals produced by plants showing inhibitory effect¹⁰. *Caesalpinia coriaria* (jacq.) Willd. (divi divi) is a small tree, which is common in our place. It was observed that no plant was growing around the divi divi trees. This effect may be due to the presence of higher content of tannins in divi divi leaves. Currently much interest exists in eliminating the deadly weed *Parthenium*. Therefore the present investigations were conducted to study the effect of aqueous extract of *C.coriaria* on *P.hysterophorus* seedlings.

Uniform size (30 days old) *P. hysterophorus* seedlings were selected from our College campus and transplanted to polythene bags of diameter 10 cm containing black alluvial soil mixed with farmyard manure in the ratio 1:4. The plants were maintained under normal photoperiod 12 ± 2 h and temperature ($28 \pm 2^\circ\text{C}$).

Fresh *C.coriaria* (divi divi) leaves were collected from 2 yr old tree. 10 gm of leaves were extracted with 100 ml of distilled water in a Waring blender and concentrated on a water bath, diluted in the ratio of 1:5, 1:10, 1:15, and 1:20 with distilled water. 50 ml/bag of the extract was used for irrigation from the day of transplantation at an interval of 3 days. The plants irrigated with water alone were considered as control. The analyses were being made at an interval of 10 days from the 10th day after transplantation (40th day) to the day of complete death of plants in 20% treatment (70th day). Third leaf of each seedling was used for the experiments.

The plant dry weight, shoot length, mortality rate, leaf area (measured using the

Table 1. Effect of water extract of fresh leaves of *C. coriaria* on the plant dry weight and shoot length of *P. hysterophorus* seedling.

Days	Plant dry weight (mg/g)					Shoot length (cm)				
	Control	5%	10%	15%	20%	Control	5%	10%	15%	20%
40	65.0	60.5	53.3	50.7	40.2	16.2	15.5	13.2	10.5	9.0
	±	±	±	±	±	±	±	±	±	±
50	5.50	5.00	4.41	5.15	2.50	1.5	1.5	1.1	1.0	1.0
	±	±	±	±	±	±	±	±	±	±
60	72.3	69.5	60.4	55.3	52.7	17.9	16.6	14.5	12.0	10.9
	±	±	±	±	±	±	±	±	±	±
70	70.7	63.9	60.5	56.5	50.4	18.5	17.0	15.5	14.0	12.0
	±	±	±	±	±	±	±	±	±	±
	3.50	5.50	6.21	5.41	3.91	1.8	1.5	1.6	1.0	0.7

(Values are ± SE of 5 samples expressed in mg/g and cm)

Table 2. Effect of water extract of fresh leaves of *C. coriaria* on the mortality rate (%) and leaf area* of *P. hysterophorus* seedling.

Days	Mortality rate (%)					Leaf area (Cm ²)				
	Control	5%	10%	15%	20%	Control	5%	10%	15%	20%
40	0	0	0	0	20	6.39	6.10	6.00	5.91	5.74
	±	±	±	±	±	±	±	±	±	±
50	0	0	0	20	20	9.45	9.15	7.95	6.54	6.30
	±	±	±	±	±	±	±	±	±	±
60	0	0	20	40	40	12.80	12.00	10.85	8.45	8.00
	±	±	±	±	±	±	±	±	±	±
70	0	0	40	80	80	13.50	12.95	11.75	11.40	11.05
	±	±	±	±	±	±	±	±	±	±
	0.95	1.65	1.10	1.10	1.05	0.95	1.65	1.10	1.10	1.05

* (Values are ± SE of 5 samples expressed in Cm²)

Table 3. Effect of water extract of fresh leaves of *C. coriaria* on total chlorophyll and protein content of *P. hysterophorus* seedlings.

(Values are \pm SE of 5 samples expressed in mg/g Fr. wt.)

Days	Total chlorophyll (mg/g)					Protein (mg/g)				
	Control	5%	10%	15%	20%	Control	5%	10%	15%	20%
40	0.31	0.29	0.27	0.24	0.22	50.75	49.50	47.41	44.35	40.55
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
50	0.02	0.01	0.02	0.01	0.02	3.00	2.50	4.71	4.51	4.21
	0.39	0.31	0.30	0.26	0.23	55.05	52.57	50.52	48.37	46.65
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
60	0.03	0.01	0.02	0.03	0.01	2.75	2.00	4.50	4.00	3.51
	0.46	0.38	0.35	0.29	0.25	60.76	57.54	54.32	50.59	48.57
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
	0.02	0.03	0.03	0.02	0.01	6.00	5.15	5.01	3.25	4.21
70	0.45	0.37	0.30	0.27	0.23	57.51	55.91	52.75	49.50	47.09
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
	0.03	0.04	0.02	0.03	0.02	5.90	5.00	3.95	2.59	3.50

Table 4. Effect of water extract of fresh leaves of *C. coriaria* on amino acid and proline content of *P. hysterophorus* seedlings.

Days	Amino acid (mg/g)					Proline (mg/g)				
	Control	5%	10%	15%	20%	Control	5%	10%	15%	20%
40	15.95	14.21	13.00	11.95	10.51	5.60	5.75	6.36	7.52	8.95
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
50	1.00	1.10	1.00	1.20	0.85	0.50	0.50	0.54	0.60	0.71
	17.80	16.35	15.45	13.41	12.35	7.50	7.95	8.04	9.05	9.90
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
60	1.05	1.00	1.25	1.00	0.90	0.60	0.45	0.70	0.85	0.89
	19.50	18.51	16.95	15.12	13.18	9.10	8.60	8.90	9.25	10.00
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
70	1.75	1.75	1.51	1.50	1.20	0.65	0.75	0.65	0.69	1.00
	18.45	17.59	16.06	15.00	13.01	8.55	7.96	7.11	7.05	6.70
	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm	\pm
	1.70	1.70	1.50	0.95	1.41	0.80	0.72	0.75	0.70	0.57

automatic area meter Model AAM-7), total chlorophyll¹¹, protein¹², amino acid¹³ and proline¹⁴ were studied. Tannin content¹⁵ was estimated in the leaves of 70th day plants. The experiment was replicated 5 times in completely randomised design and SE values were determined¹⁶.

Tannin content in divi divi leaves was 40 mg/g Fr.wt. and significant reductions in plant dry weight, shoot length, mortality rate and leaf area of *P.hysterophorus* were observed as the concentration of *C.coriaria* leaf extract increased (Table 1 & 2). This reduction indicates that the aqueous extracts contained growth inhibiting allelopathic substances and that the effect of the extract was concentration dependent. This result is in agreement with earlier studies^{17,18}. A decrease in total chlorophyll, protein, amino acid content and increase in proline content were also observed (Table 3 & 4). Similar inhibition was reported from aqueous extracts of teak leaf, bamboo root, bamboo leaf and eucalyptus leaves on groundnut and corn due to water soluble inhibitors in the extracts^{6,10}. It is inferred that the inhibition in growth, decrease in total chlorophyll, protein, amino acid contents and increase in proline content of *P.hysterophorus* leaves by *C.coriaria* leaf extract might be partly due to the inhibitory effect of tannins.

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