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ALLELOPATHIC EFFECTS OF *PARTHENIUM HYSTEROPHORUS* ON SEED GERMINATION AND SEEDLING ESTABLISHMENT OF *CASSIA SPP.*

A. RAHMAN
Department of Botany, R. D. & D. J College, Munger-811201, Bihar, India.
Email : fai636@sify.com.

Allelopathic effects of different concentrations of aqueous extract of *Parthenium hysterophorus* were investigated on the seed germination and seedling establishment of *Cassia occidentalis, C. sophera* and *C. tora* in wastelands. The four aqueous extracts (5, 10, 15 and 20%) of *P. hysterophorus* induced in these parameters in the *Cassia* plants. The aqueous extracts of inflorescence, stem and leaf of *P. hysterophorus* on the seed germination and seedling establishment of the *Cassia* spp. showed the allelopathic interactions of *Parthenium* on *Cassia.* The increase in concentration of the extract caused drastic reduction in these parameters indicating a dose response relationship. Leaf extract appeared to more potent as compared to the extract from other parts. Such differential effect might indicate the presence of higher concentration of growth inhibitor in the leaf than in the other parts. This showed that leaves and inflorescence played a vital role in maintaining the dominance of *Parthenium* by suppressing the growth of *Cassia* species.

Keywords: Allelopathy; Aqueous extract; Bioassay; *Cassia occidentalis; C. sophera; C. tora;* Inhibition; *Parthenium hysterophorus;* Seed germination; Seedling establishment; Weed.

Molisch[1] coined the term allelopathy which includes chemical interactions among plants including microorganism. Rice[2] defined "Allelopathy" as plant chemical interactions, including both inhibitory and stimulatory effect. *Parthenium hysterophorus* L. (Heliantheae, Asteraceae, commonly called "congress grass" or "carrot weed") is an obnoxious weed. It is an annual herb of neotropical origin and has spread throughout India. Rapid growth of this weed species has been attributed mainly due to its ability for fast rate of germination on one hand and its ability to inhibit the process of germination and growth of other associated plant species on the other. The allelopathic nature of *P. hysterophorus* has been well documented and its part contain growth inhibitors viz., p-coumaric, ferulic and caffeic acid etc.[3] Kanchan and Jayachandra[4] have identified growth inhibitory phenolic acids (p-hydroxybenzoic acid, p-anisic acid, vanillic acid) from its aqueous leachates roots. Three *Cassia* spp. (Caesalpiniaceae, leguminosae) viz., *Cassia occidentalis, C. sophera* and *C. tora* growing as wasteland species are facing stiff competition from *P. hysterophorus* and are on verge of extinction in this area. The objective of the investigation was to evaluate the allelopathic effects of *Parthenium* weed on certain parameters (seed germination and seedling establishment) of the *Cassia* spp.

The experiment was conducted during February and March 1999 at R.D. and D.J. College, Munger (24°30' N, 86°30, E and 45m above sea level). To prepare aqueous extract inflorescence, stem and leaves of *P. hysterophorus* were collected randomly at flowering stage from wild populations and chopped into small pieces. Extracts, were prepared by crushing 10 gm of each plant organ in a mixer with 100 ml distilled water. The filterate served as the stock solution from which desired concentrations (5, 10, 15 and 20%) were prepared by dilution with distilled water. Each bioassay consisted of placing 25 seeds in a sterile petridish (11cm dia), which contained one filter paper and 10ml test solution or water. The treatments were replicated thrice.

The seeds of *Cassia occidentalis, C. sophera* and *C. tora* were scarified with concentrated H_2SO_4 for 20 min to eliminate seed coat imposed dormancy and then washed thoroughly in water otherwise these seeds do not germinate readily. 25 seeds of each plant were used for each single treatment. Seed germinated at room temperature (25±2°C). Control was maintained with distilled water. The covered petridishes were opened periodically for aeration, seed germination percentage were recoreded at 7 days after sowing. For the study of seedling establishment five seedlings of equal age were taken for each treatment of

Table 1. Effects of aqueous extracts of *Parthenium hysterophorus* infloresence, stem and leaf on seed germination (%) and seedling establishment (%) of *C. occidentalis, C. sophera* and *C. tora.* (S.G. - Seed Germination; Sl. Es - Seedling Establishment).

Cassia Spp	Aqueous extract conc-entration (%)	Infloresence		Stem		Leaf	
		S.G. (%)	Sl. Es. (%)	S.G. (%)	Sl. Es. (%)	S.G. (%)	Sl. Es. (%)
C. occidentalis	Control	90	75	90	75	90	75
	5	53	40	37	35	32	20
	10	40	30	33	32	30	18
	15	37	25	27	24	28	17
	20	30	20	22	15	23	12
C. sophera	Control	92	80	92	80	92	80
	5	90	60	80	58	71	45
	10	52	55	76	52	68	40
	15	78	45	73	48	67	35
	20	72	38	68	45	58	30
C. tora	Control	85	70	85	70	85	70
	5	63	42	66	40	53	30
	10	60	32	63	35	50	25
	15	23	20	56	30	48	20
	20	50	10	50	20	45	10

different concentration and planted into medium sized earthen pots containing soil manure in the ratio of 3 :1. Each pot was irrigated daily for 14 days with equal amount of various concentrations of the extract. Establishment of seedlings were recorded only after 14 days. Control seedlings were irrigated with distilled water.

The allelopathic effects of different concentrations of aqueous extracts of inflorescence, stem and leaves of *Parthenium hysterophorus* were inhibitory to the seed germination and seedling establishment in all *Cassia* spp. (Table 1, Fig. 1-2).

Seed germination : Inhibition values calculated for seeds of *C. occidentalis, C. sophera* and *C. tora* indicated that inhibition increased progressively as the concentrations of aqueous extracts of *P. hysterophorus* enhanced. (Table 1, Fig. 1). Effects of different aqueous extract concentrations of inflorescence showed the inhibition was more (67%) in *C. occidentalis* than other *Cassia* species at the highest concentration (20%). The inhibition of seed germination in *C. sophera* was less (3%) than *C. tora* (26%) and *C. occidentalis* (42%) at the lowest concentration (5%) over the control. In stem aqueous extract the inhibition was higher in *C. occidentalis* (75%) as compared to *C. sophera* (26%) and *C. tora* (41%) at 20% concentration over the control. Leaf aqueous extract exhibited more inhibitory effect in *C. occidentalis* (75%) than *C. sophera* (37%) and *C. tora* (47%) at the highest concentration (20%) over the control.

Seedling establishment : Seedling establishment in these *Cassia* species were also affected by the treatment of seedling with the aqueous extract of inflorescence, stem and leaf of *P. hysterophorus.* Decrease in the seedling establishment percentage was recorded with increase in the concentration of the extracts. The leaf extract treated seedlings appeared to be affected more as compared to inflorescence and stem extract treated seedlings (Table 1, Fig. 2). It indicated that inhibitory chemicals present in *P. hysterophorus* affected process of growth of *Cassia* species at all levels including the process of establishment. Similar observations on seedling establishment had been made by other workers also [5-10].

With increase in concentration of extract, reduction in seed germination and seedling establishment might be indicative of the presence of germination inhibitors in extract. The magnitude of inhibition varied in three *Cassia* species and is in conformity with the other workers[11-16]. Such inhibitory effects of various extracts might be attributed to the presence of parthenin and phenolic acid : p-hydroxybenzoic, p-anisic acid, vanilic acid. Presence of higher concentration of inhibitors in leaves might also be indicative of the fact that the synthesis of allelochemic, probably taking place in the leaf and are being translocated to the other parts of the plant body. This showed that leaves and inflorescence played a vital

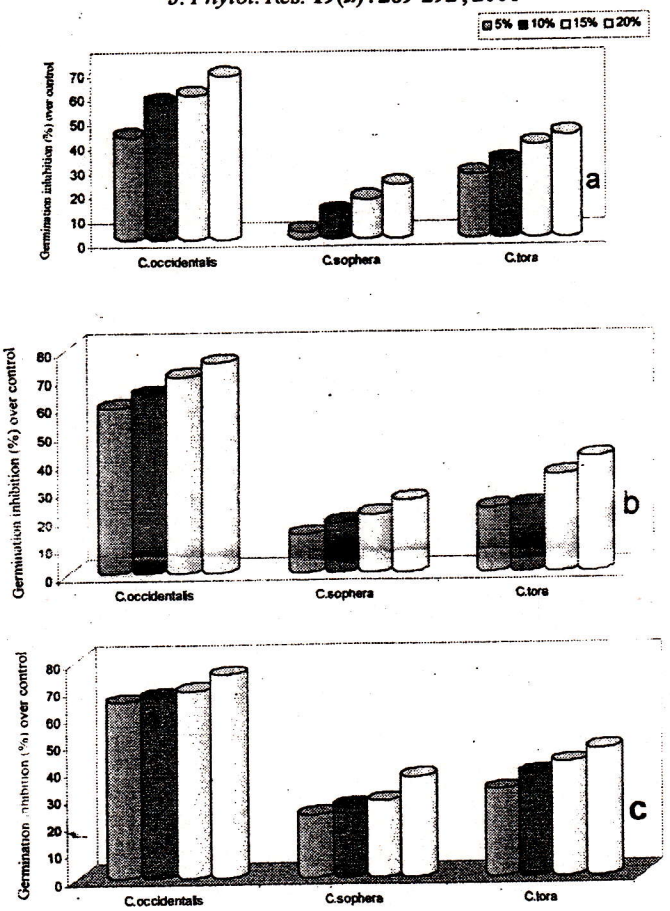

Fig.1a, b & c. Effects of *Parthenium* inflorescence (a), stem (b) and leaf (c) aqueous extracts on germination of *Cassia* spp.

role in maintaining the dominance of *Parthenium* suppressing the growth of *Cassia* species.

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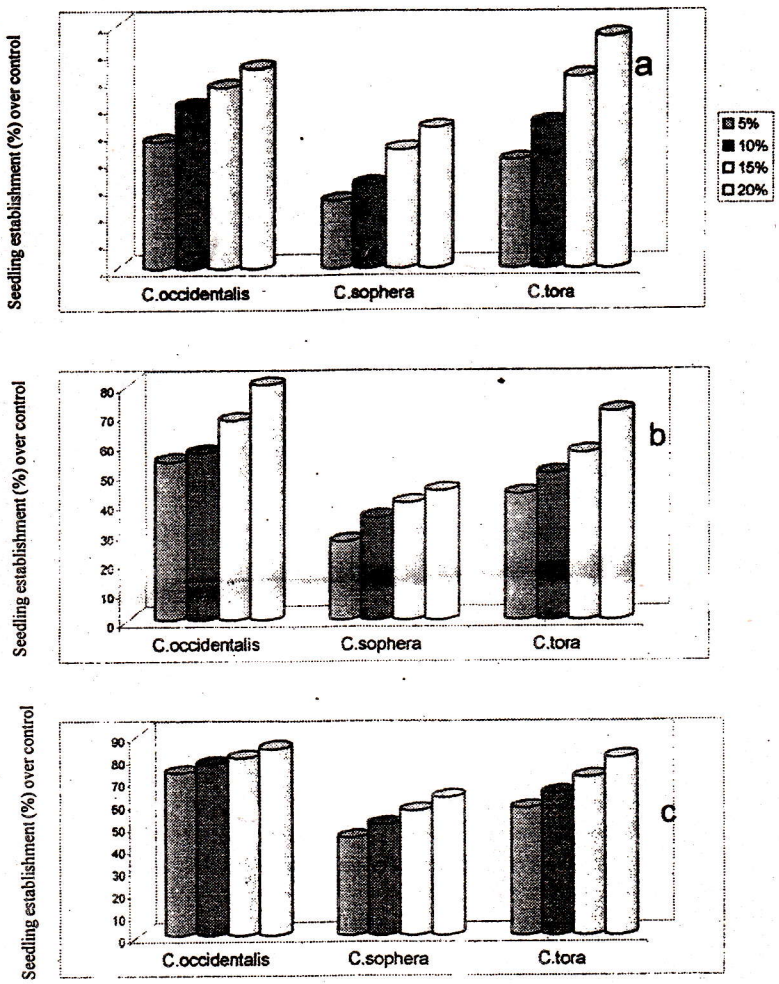

Fig.2a, b & c. Effects of *Parthenium* inflorescence (a), stem (b) and leaf (c) aqueous extracts on seedling establishment of *Cassia* spp.

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