



## Assessment of reproductive capacity of *Parthenium hysterophorus* and its growth performance under the phytotoxic effect of *T. catappa*

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### Abstract

As an aggressive and noxious weed *Parthenium hysterophorus* is spreading very rapidly in various agricultural fields and along roadsides by eliminating various plants species. It is very hazardous to agricultural land, human and animal health. So, an attempt has been made to study the reproductive capacity and growth performance of *P. hysterophorus* under the influence of leachates of dried and dropped red leaves and phenolic compounds (Tannic acid, Gallic acid and Catechol) against *P. hysterophorus*. In *Parthenium* average flower-heads and seed output was 178.5 and 714 and reproductive capacity was found to be 135.38, 387.41 and 519.35 at 48, 72 and 96 hours respectively. 20.33, 54.83 and 72.13 was germination percentage at 24, 48 and 72h with 0.64 cm root length and 1.00 cm shoot length. In petriplate bioassay seed germination was completely suppressed due to the effect of 10% and 20% red leaf leachate. Root length and shoot length were reduced due to 20% red leaf leachate. In petriplate and soil bioassay, root and shoot length was inhibited due to phenolic compounds (20ppm Tannic acid, 20ppm Gallic acid and 20ppm Catechol) and 5%, 10% and 20% red leaf leachates. Total phenolic content was highest in 20% red leaf leachate (160.86 mg/100ml) as compared to 5% and 10% red leaf leachates. Anthocyanin content in red leaf was 0.76 Absorbance units. The Phytochemicals trans-9-Octadecenoic acid, Bis (2-ethylhexyl) phthalate, Diisooctyl phthalate, l-(+)-Ascorbic acid, Phenol and Phthalic acid were detected in red leaf leachates by GC-MS techniques. The adverse effect of red leaf leachates of *T. catappa* on the growth performance of *P. hysterophorus* may be due to phytochemicals present in the leaf leachates.

**Keywords:** anthocyanin content, *parthenium hysterophorus*, phytochemicals, reproductive capacity, seed germination, seedling growth, *terminalia catappa*, total phenolics

### Introduction

Invasive weeds are defined as the plants which can affect the native species adversely and significantly to sustainability of natural communities (Owen, 1998) [28]. *Parthenium hysterophorus* is an obnoxious and rapidly spreading aggressive weed. *Parthenium hysterophorus* belonging to family Composite is herbaceous annual weed, native to South North America (Knox *et al.*, 2010, Awan, 2017) [18, 4]. Bishnoi and Gautam (1991) [7] have reported role of reproductive capacity is the key indicator for density of population can be calculated as average seed output per plant. Grime (1977) [9] has noted that number and size of seeds produced by the plant having significant effect on ecology of the plant species in which large number of small seeds increase the dispersal ability of the species which can grow seedling under adverse environment conditions. It is harmful to human and animal health and reduces the crop yield (Kaur *et al.*, 2014; Narwal *et al.*, 2003) [17, 22]. Large numbers of phytochemicals are released in soil from the different organs of *Parthenium* which can affect the crop growth adversely (Narwal *et al.*, 2003) [22].

Allelopathic effects of *P. hysterophorus* have been reported by many workers (Kanchan and Jayachandra, 1979; Oudhia *et al.*, 1997; Adkins and Sowerby, 1996; Oudhia, 2000; Tefera, 2002; Sajjan and Pawar, 2005; Maharjan *et al.*, 2007; Netsere, 2015) [15, 27, 2, 26, 36, 30, 19, 24]. *T. catappa* is a good source of secondary metabolites such as tannins, flavonoids, cyclic triterpenes and other aromatics (Slinkard and Singleton, 1977) [34]. Allelopathic potential of *T. catappa* has been reported by workers (Manikandan and Rejula, 2008; Usha Rani and Murthy, 2008; Gulzar and Siddiqui, 2013) [20, 37].

Shedding of dried green and senescent (red) leaves is observed twice a year. Not much vegetation is observed under the canopy of *T. catappa* as per the report by Baratelli *et al.*, (2012) [5]. So, an attempt has been made to assess reproductive capacity and growth performance of *P. hysterophorus* under the effect of red leaf leachate of *T. catappa*.



**Fig 1:** Panoramic view of invaded fields with *Parthenium hysterophorus* L.



**Fig 2:** Flower heads and seeds of *Parthenium hysterophorus*



**Fig 3:** Shedding of red leaves under the canopy of *Terminalia catappa*.

## Material and Methods

### A. Collection of Plant material

Matured seeds of *Parthenium hysterophorus* were collected from area covering 10 km distance along the road side of Agriculture field from Atigre village Taluka Hatkangale of Kolhapur district. Dried and dropped red

leaves of *Terminalia catappa* were collected from different localities of Kolhapur district. The leaves were dried and stored under dry condition in polythene bags. Flower-heads and seeds were collected by selecting 10 plants of same locality.

### B. Reproductive capacity

After collecting the data on number of flower heads per plant and number of seeds per floral head and assays for seed germination reproductive capacity for the weed species was calculate by using the formula given by Salisbury (1942) <sup>[31]</sup>.

$$\text{Reproductive Capacity} = \frac{\text{Average seed output} \times \text{Average percentage germination}}{100}$$

100

### C. Preparation of Leachate

For preparation of leachates method given by Jadhav and Gaynar (1992) was followed. Five, ten and twenty grams of small pieces (about 2-3 mm<sup>2</sup>) dried red leaves of *Terminalia catappa* were washed with distilled water for 2 to 3 times and soaked in 100ml of distilled water for 24h. The leachate was filtered through Whatman filter paper No. 1 and used.

### D. Seed germination and Seedling growth

For petriplate bioassay healthy seeds of *P. hysterophorus* were washed with distilled water to remove surface dust and were treated with 300ppm gibberellic acid for 6 hours to break dormancy. Seeds were rinsed with distilled water 4 to 5 times to remove the traces of gibberellic acid and treated with 0.1% HgCl<sub>2</sub> for 5 minutes for surface sterilization. Ten sterilized seeds were placed in each sterile petriplate (9cm diameter) with a disc of sterile filter paper. Eight ml of sterile distilled water was added in petriplate served as control and 8ml of leachate was used for treatment. The seeds were allowed to germinate at room temperature (about 24 to 25°C) under natural light and dark conditions. Petriplates were arranged in triplicate. Numbers of seeds germinated were recorded at 24, 48 and 72 hours and seedling growth with respect to root length and shoot length was recorded at 120 hours stage (Afridi and Khan, 2015) <sup>[31]</sup>.

For soil bioassay plastic trays (22 cm x 17 cm x 4.2 cm) were filled with 750 g of dry soil. 30 health and sterile seeds were sown in moist soil. Fifty ml of leaf leachates and 50 ml of sterile distilled water were added for 5 alternate days. Seedling growth was noted after 10 days.

### E. Total Phenolic Content (TPC)

The method of Slinkard and Singleton (1977) <sup>[34]</sup> was used to determine the total phenolic content of red leaf leachates. One ml of Folin Ciocalteu phenol reagent was treated with 1 ml of leaf leachate and diluted to 1:5 proportions by using distilled water. The reaction mixture was kept at room temperature for 10 minutes and 3 ml of 2% Sodium Carbonate (Na<sub>2</sub>CO<sub>3</sub>) solution was added and was incubated for 2 hours with discontinuous shaking. The absorbance of the sample was recorded at 760 nm. Total Phenolic Content was expressed as mg/100 ml with help of calibration curve of standard gallic acid.

### F. Anthocyanin content

Estimation of Anthocyanin was carried out by the method of Murray and Hackett (1991) <sup>[21]</sup>. Two hundred mg powder of dried leaves was soaked in 3ml of 1% HCL in methanol for 48 hours at low temperature. The extract was centrifuged at 5000 rpm. The supernatant was used to record absorbance at 532 nm and 653 nm. Anthocyanin content was calculated by formula,

$$\text{Anthocyanin (Abs. unit)} = A_{532 \text{ nm}} - (0.24 \times A_{653 \text{ nm}})$$

Anthocyanin content was expressed in terms of absorbance unit.

### G. Statistical analysis

The mean value and Standard deviation were determined using Microsoft Excel Software (MS office version 2010). The percentage of inhibition or stimulation was calculated by using the formula given by Zhang *et al.*, (2015) <sup>[40]</sup>.

$$\text{Percent Inhibition/ Stimulation} = (\text{Treatment data} - \text{Control data}) / \text{Control data} \times 100$$

## Result and Discussion

### A. Seed output, Reproductive capacity and growth performance

The average number of flower-heads and average seed output is found to be 178.50 and 714 in *P.hysterophorus*. The reproductive capacity of *P. hysterophorus* is 135.38, 387.41 and 519.35 at 48h, 72h and 96h respectively and 24h it is zero. Germination of seeds is found to be 20.33%, 54.83% and 72.13% at 24, 48 and 72h stage with 0.64 cm average root length and 1.00 cm average shoot length (Table 1 and 2).

**B. Effect of leaf leachates on seed germination and seedling growth**

Seed germination of *P. hysterophorus* is completely suppressed due to 10% and 20% red leaf leachate at 24, 48 and 72h stage and 5% red leaf leachate showed total inhibition and 75% inhibition of seed germination at 24 and 48h and 72h respectively (Table 3). At the higher concentration (20%) red leaf leachate of *T. catappa* showed overall reduction of seedling growth of *P. hysterophorus* as compared to 5% (PI-81.09, -89.09) and 10% leachate (PI-73.77, -91.18) (Table 4). In soil bioassay seedling growth with respect to root length (PS 0.69, 7.36) and shoot length (PS 2.94, 2.05) of *P. hysterophorus* is increased at 5 % and 10% red leaf leachate and it is reduced (PI-1.39, -10.37) due to 20% red leaf leachate of *T. catappa* (Table 5).

**C. Effect of standard phenolics and leaf leachate on seed germination and seedling growth**

In petriplate bioassay seed germination of *P. hysterophorus* is inhibited ((PI-40, -20, -5) due to 20 ppm tannic acid, gallic acid and catechol at 72h and complete inhibition of seed germination is observed due to treatment of standard phenolic compounds and leaf leachates at 24, 48 and 72h stages (Table 6). Root length (PI-60.54, -50, -51.57) and shoot length (PI- 50.14, -37.93, -36.68) is reduced by 20 ppm tannic acid, gallic acid and catechol and overall decrease in seedling growth is observed due to leaf leachates in petriplate bioassay. In soil bioassay seedling growth with respect to root length and shoot length is diminished due to treatment of phenolic compounds and leaf leachates (Table 7 and 8).

**Table 1:** Number of flower-heads and seeds and reproductive capacity of *Parthenium hysterophorus*.

Number of Plants	Number of Flower-heads	Seed Output	Reproductive capacity			
			24 hours	48 hours	72 hours	96 hours
1	194	776	0	219.84	426.80	582
2	170	680	0	204	408	521.28
3	155	620	0	206.64	434	496
4	188	752	0	137.84	487.50	601.60
5	172	688	0	149.02	424.20	550.40
6	190	760	0	139.30	304	519.30
7	184	736	0	73.60	380.21	478.40
8	187	748	0	19.72	386.41	498.61
9	195	780	0	103.97	273	546
10	150	600	0	99.96	349.98	399.96
Average Value	178.5	714	0	135.38	387.41	519.35

**Table 2:** Seed germination and Seedling growth of *P. hysterophorus*

Number of Plants	Germination Percentage				Seedling Growth	
	24 hours	48 hours	72 hours	96 hours	Average root length (cm)	Average shoot length (cm)
1	0	28.33±14.43*	55±10*	75±5*	0.63±0.10*	0.96±0.15*
2	0	30±13.22*	60±8.66*	76.66±7.63*	0.71±0.14*	1.11±0.14*
3	0	33.33±7.63*	70±13.22*	80±5*	0.73±0.10*	1.04±0.06*
4	0	18.33±5.77*	65±10*	80±5*	0.63±0.03*	1.03±0.06*
5	0	21.66±5.77*	61.66±14.43*	80±5*	0.68±0.23*	0.99±0.03*
6	0	18.33±5.77*	40±10*	68.33±7.63*	0.62±0.16*	0.99±0.16*
7	0	10±5*	51.66±5.77*	65±5*	0.54±0.12*	0.94±0.12*
8	0	13.33±2.88*	51.66±2.88*	66.66±2.88*	0.51±0.04*	0.89±0.06*
9	0	13.33±2.88*	35±5*	70±5*	0.7±0.09*	1.07±0.10*
10	0	16.66±2.88*	58.33±7.63*	66.66±2.88*	0.64±0.09*	0.99±0.05*
Average value	0	20.33±6.62*	54.83±8.76*	72.83±5.10*	0.642±0.11*	1.00±0.09*

\*All values are means of three replicates ± Standard deviation\*

**Table 3:** Effect of red leaf leachates of *T. catappa* on seed germination of *P. hysterophorus* (Petriplate bioassay)

Treatments	Germination percentage					
	24 hours		48 hours		72 hours	
		PI (-) / PS(+) %		PI (-) / PS(+) %		PI (-) / PS(+) %
Control	26.66±2.88*		46.66±7.63*		56.66±7.63*	
5% Red leaf leachate	0	0	0	0	11.66±2.88*	75 (-)
10% Red leaf leachate	0	0	0	0	0	0
20% Red leaf leachate	0	0	0	0	0	0

\*All values are means of three replicates ± Standard deviation \*

PI- Percent Inhibition, PS- Percent Stimulation

**Table 4:** Effect of red leaf leachates of *T. catappa* on seedling growth of *P. hysterophorus* (Petriplate bioassay)

Treatments	Seedling growth (After 120 hours)			
	Average root length (cm)		Average shoot length (cm)	
		PI (-) / PS (+) %		PI (-) / PS (+) %
Control	0.91±0.12*		1.36±0.22*	
5% Red leaf leachate	0.17±0.06*	81.09(-)	0.35±0.08*	73.77(-)
10% Red leaf leachate	0.1±0.05*	89.09(-)	0.12±0.04*	91.18(-)
20% Red leaf leachate	0	0	0	0

\*All values are means of three replicates ± Standard deviation \*

PI- Percent Inhibition, PS- Percent Stimulation

**Table 5:** Effect of red leaf leachate of *T. catappa* on seedling growth of *P. hysterophorus* (Soil bioassay)

Treatments	Seedling growth (10 days old seedlings)			
	Average root length (cm)		Average shoot length (cm)	
		PI(-) / PS(+) %		PI (-) / PS(+) %
Control	2.40±0.10*		2.60±0.07*	
5% Red leaf leachate	2.41±0.02*	0.69	2.68±0.14*	2.94
10% Red leaf leachate	2.57±0.23*	7.36	2.65±0.22*	2.05
20% Red leaf leachate	2.36±0.23*	1.39 (-)	2.33±0.50*	10.37 (-)

\*All values are means of three replicates ± Standard deviation \*

PI- Percent Inhibition, PS- Percent Stimulation

**Table 6:** Effect of Standard Phenolic Compounds and red leaf leachates of *T. catappa* on seed germination of *P. hysterophorus* (Petriplate bioassay)

Treatments	Germination percentage					
	24 hours		48 hours		72 hours	
		PI (-)/ PS(+) %		PI (-) / PS(+) %		PI (-) / PS(+) %
Control	0	0	16±2.88*		33.33±2.88*	
20ppm Tannic acid	0	0	6.66±2.88*	60 (-)	20±5*	40 (-)
20ppm Gallic acid	0	0	0	0	26.66±2.88*	20 (-)
20ppm Catechol	0	0	0	0	31.66±2.88*	5 (-)
5% Red leaf leachate	0	0	0	0	0	0
10% Red leaf leachate	0	0	0	0	0	0
20% Red leaf leachate	0	0	0	0	0	0

\*All values are means of three replicates ± Standard deviation \*

PI- Percent Inhibition, PS- Percent Stimulation

**Table 7:** Effect of Standard Phenolic Compounds and red leaf leachates of *T. catappa* on seedling growth of *P. hysterophorus* (Petriplate bioassay)

Treatments	Seedling growth (After 120 hours)			
	Average root length (cm)		Average shoot length (cm)	
		PI(-)/PS(+) %		PI(-)/PS(+) %
Control	0.74±0.13*		1.16±0.17*	
20ppm Tannic acid	0.29±0.04*	60.54 (-)	0.58±0.08*	50.14 (-)
20ppm Gallic acid	0.37±0.12*	50 (-)	0.72±0.13*	37.93 (-)
20ppm Catechol	0.36±0.09*	51.57 (-)	0.73±0.14*	36.68 (-)
5% Red leaf leachate	0	0	0	0
10% Red leaf leachate	0	0	0	0
20% Red leaf leachate	0	0	0	0

\*All values are means of three replicates ± Standard deviation \*

PI- Percent Inhibition, PS- Percent Stimulation

**Table 8:** Effect of Standard Phenolic Compounds and red leaf leachates of *T. catappa* on seedling growth of *P. hysterophorus* (Soil bioassay)

Treatments	Seedling growth (10 days old seedlings)			
	Average root length (cm)		Average shoot length (cm)	
		PI (-)/PS (+) %		PI (-)/PS (+) %
Control	2.40±0.18*		2.82±0.40*	
20ppm Tannic acid	1.78±0.32*	25.76 (-)	2.57±0.33*	8.63 (-)
20ppm Gallic acid	1.53±0.12*	36.43 (-)	2.12±0.13*	24.82 (-)
20ppm Catechol	1.42±0.34*	40.86 (-)	2.09±0.42*	25.65 (-)
5% Red leaf leachate	1.67±0.26*	30.47 (-)	2.20±0.25*	21.99 (-)
10% Red leaf leachate	1.83±0.11*	23.96 (-)	2.37±0.26*	15.84 (-)
20% Red leaf leachate	1.71±0.07*	28.81 (-)	2.25±0.08*	20.09 (-)

\*All values are means of three replicates ± Standard deviation (\*)

PI- Percent Inhibition, PS- Percent Stimulation

#### Chemical analysis of red leaf leachates

The phytochemicals detected in 5%, 10% and 20% aqueous red leaf leachate of *T. catappa* are trans-9-Octadecenoic acid, Bis (2-ethylhexyl) phthalate, Diisooctyl phthalate, l-(+)-Ascorbic acid, Phenol and Phthalic acid by GC-MS technique. Phenolic content is increased by the increase in the concentration of leachates, such as 120.53, 147.08 and 160.86 mg per 100 ml at 5%, 10% and 20% leachates respectively. Anthocyanin content in red leaf leachate is 0.76 Absorbance units (Table 9).

**Table 9:** Chemical analysis of Red leaf leachate of *T. catappa*.

Leaf leachates	Total Phenolic Content (mg/100ml)	Anthocyanin Content (Absorbance unit)	Phytochemicals detected by GC-MS (5%, 10% and 20% leachate of red leaves)
5% Red leaf leachate	120.53±0.89*	0.76±0.11*	n-Hexadecanoic acid, l-(+)-Ascorbic acid, Pentadecanoic acid, Eicosanoic acid, 9-Octadecenoic acid, Oleic Acid, Cyclopentadecanone, trans-9-Octadecenoic acid, Hexanedioic acid, Diisooctyl adipate, Bis(2-ethylhexyl) phthalate, Diisooctyl phthalate, Phenol, gamma.-Sitosterol, beta.-Sitosterol, Phthalic acid.
10% Red leaf leachate	147.08±3.81*		Acetic acid, Acetic acid, anhydride with formic acid, Cyclotrisiloxane, Benzeneethanamine, Pphenylalanine, Amphetamine, Ethane, Ethanol, Propane, 1,3,2-Dioxaphosphorinane, Isoquinolin-6-ol-1-carboxylic acid, D-Streptamine, Cyclohexanone.
20% Red leaf leachate	160.86±10.18*		5-Hydroxymethylfurfural, Thiophene, 4-Hepten-3-one, 1,2,3-Benzenetriol, 1,2,4-Benzenetriol, Pyrazole-5-carboxylic acid, n-Hexadecanoic acid, l-(+)-Ascorbic acid, 2,6-dihexadecanoate, Pentadecanoic acid, 9-Octadecenoic acid, Oleic Acid, Palmitoleic acid, trans-9-Octadecenoic acid, Phenol, Methanone, [1,4-dimethyl-7-(1-methylethyl)-2-azulenyl]phenyl, Silane, Methanone, [2,4-dimethyl-7-(1-methylethyl)azulenyl]phenyl, Xanthen-9-one, Bis(2-ethylhexyl) phthalate, Diisooctyl phthalate, 4,8-Ditert-butyl-N,N-diethyl-2,10-dimethyl-12H-dibenzo[d,g][1,3,2]dioxaphosphocin-6-amine, Phthalic acid.

\*All values are means of three replicates ± Standard deviation \*

Welch (1966 b) stated that six characteristics as the number of inflorescences produced, the number of florets per inflorescence, the number of florets which ripen to fruits, the number of seeds per fruit, the number of seeds that are dispersed, and the number that germinate determined the reproductive capacity of flowering plants. Seed output means number of seeds produced by a plant is one of the reproductive changes and size of seeds is crucial factor for successful seed germination (Salisbury, 1942) [31]. Weeds become competitive and aggressive after production of large number of seeds and fast growth. Most of the weeds have well adapted due to extreme dispersion and reinfestation by the production of small sized abundant seeds (Talaka and Rajab, 2013) [35]. Allelopathic effects are most commonly indicated by inhibition of seed germination and growth of seedling (Ferguson and Rathinasabapathi, 2003) [8]. As the report of Narwal (1994) [23] reduced seed germination, elongation of coleoptile and root and shoot growth of seedlings are the communal changes monitored during the study of effects of allelochemicals on sensitive plants. Inderjit and Dakshini, (1995) [11] have specified that seed

germination and seedling growth are most extensively used parameters in the study of allelopathy by using laboratory bioassays due to ecological relevance and involvement of seed survival physiological processes. As the earlier reports seed germination and seedling growth are most widely used parameters, we have tried to evaluate allelopathic potential of leachates of dried and dropped red leaves of *T. catappa* on germination and growth of seedling of *P. hysterophorus*.

There are reports, allelopathic effects of different plant species are studied against *P. hysterophorus*. Sinha and Singh (2004) [33] observed the growth performance of *Parthenium hysterophorus* under the influence of leaf extract of *Xanthium strumarium* and noticed maximum inhibition of germination in *Parthenium* at 25% of leaf extract of *X. strumarium*. Aqueous root and shoot extracts (5, 10, 15 and 20%) of *Desmostachya bipinnata* inhibited the seed germination of *P. hysterophorus*, at 20% of root and shoot extract complete inhibition of seed germination of *Parthenium* was observed (Javaid *et.al*, 2005) [13]. Javaid and Anjum (2006) reported that aqueous shoot and root extract of grasses such as *Dicanthium annulatum*, *Cenchrus pennisetiformis* and *Sorghum halepense* reduced the germination and seedling growth of invasive weed *P. hysterophorus*. Nupur and Trivedi (2011) [25] have studied the allelopathic interaction between *P. hysterophorus* and *C. tora* and found that aqueous extract of *C. tora* decreased the radicle length of *P. hysterophorus* by increasing concentration of extract. At 0.5% and 4% aqueous leaf extract of *C. tora*, radicle length of *P. hysterophorus* decreased up to 1.73cm and 0.53cm. Singh *et.al*, (2013) [32] stated the allelopathic potential of leachates of different parts of *Cassia occidentalis* against *Parthenium hysterophorus*. The effect of leaf leachate caused maximum inhibition of germination and seedling growth of *Parthenium* in both petriplate and pot bioassay as compared to pods and seed leachates. Also decreased the root and shoot length and fresh and dry weight. Vitonde *et.al*, (2014) [38] after examining the allelopathic effect of *Cassia tora* and *Cassia uniflora* on *Parthenium hysterophorus* germination noticed that the aqueous extract of seeds of *C. tora* and *C. uniflora* diminished the germination of *Parthenium hysterophorus* as compared to control. Khan *et.al*, (2017) [16] carried out work on the effect of aqueous leaf extract of *Jatropha curcas* at 5%, 10%, 15%, 20% and 25% concentrations after pre-soaking treatment for 8 hours on germination of *Parthenium* and reported decreased seed germination, root length, shoot length, dry biomass, relative water content and seed vigor index of *P. hysterophorus* at higher concentrations.

Our results are supported by the reports in which seed germination and seedling growth are studied morphological parameter under the influence of leaf leachates and extracts of different species of *Terminalia* and phenolic compounds. Many workers have been studied allelopathic potential of *Terminalia* (Rao *et al.*, 1994; Bhatt *et al.*, 1997; Manikandan and Rejula, 2008; Abugre *et al.*, 2011; Usha Rani and Murthy, 2008) [29, 6, 20, 1, 37]. Baratelli *et al.* (2012) [5] have conducted an experiment to check the allelopathic influence of extracts of fallen fruits and green and yellow leaves of *T. catappa* prepared with the use of solvents like ethanol, hexane, dichloromethane, ethylacetate and water on growth of *Lactuca sativa*, *Euphorbia heterophylla* and *Commelina benghalensis* by using petriplate bioassay and showed 77% inhibition in germination by 1000ppm dichloromethane extract and reduction of root growth (by 55%, 86% and 73%) due to ethanol, dichloromethane and ethylacetate extracts and shoot growth (by 41% and 49%) by dichloromethane and ethylacetate extracts at 1000 ppm concentration. Extract did not affect adversely the growth performance of *E. heterophylla* and *C. benghalensis*.

## Conclusion

Number of seeds in *Parthenium* was high which is crucial factor for successful seed germination. As *P. hysterophorus* showed optimal reproductive capacity it has become most aggressive and competitive weed of the area. Seed germination and seedling growth of *P. hysterophorus* was inhibited due to application of red leaf leachates of *T. catappa* due to presence of phytochemicals in leachates. As compared to standard phenolic compounds leaf leachates are having more adverse effects on growth of weed. Alteration in seed germination and seedling growth of *P. hysterophorus* may be because of combined effect of phytochemicals detected in leaf leachates of *T. catappa*.

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