

SHORT COMMUNICATION

ALLELOPATHIC EFFECTS OF *XANTHIUM STRUMARIUM* ON
PARTHENIUM HYSTEROPHORUS

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A laboratory experiment revealed that the growth of *Parthenium hysterophorus* was found restricted by the leaf extracts of *Xanthium strumarium*. The maximum germination inhibition in *Parthenium* was recorded in 25% leaf extract of *Xanthium strumarium* treatment. Twenty and 25 per cent leaf extract was found to be more potent in reducing the root/shoot length and plant dry weight of *Parthenium hysterophorus*. A significant reduction was also recorded in seedling vigour and vigour index of *Parthenium* by the different leaf extract treatment of *Xanthium strumarium*.

Key words : Allelopathy, *Parthenium hysterophorus*, seedling vigour, vigour index, *Xanthium strumarium*.

Parthenium hysterophorus is alien and invasive weed introduced from American continents. In India *Parthenium* was first noticed in 1955 near Pune (Rao 1956). It has spread throughout the length and breadth of the country badly infesting millions hectares of land generally fallow along with the national highways, state highways, railways, pasture land, waste land (Paradkar *et al.* 1997). Its infestation increased manifold due to its prolific seed production capacity and its wider physiological adaptability. It removes major portion of nutrients, destroys natural vegetation (Anonymous 1976) and is also known to cause allergic hazards to human beings and animals (Pahwa *et al.* 2000). It has also become menace of fallow urban and suburban land causing serious threat to people and cattle. It has become one of the seven most dangerous weeds of the world (Singla 1992). This weed started infestation even in cropped areas (Tiwari and Bisen 1984). Invasiveness of this alien weed is more pronounced in short shuttered and slow growing crops like vegetables, groundnut, soybean etc. (Dixit *et al.* 2001).

In north-east India, *Parthenium* germinates mainly in the month of February-March and attain peak growth in June-July and produce seeds in September-October

completing life cycle in 200-240 days. Phyto-sociologically the plant is a rapid colonizer and competes out other vegetation in its vicinity within two growing seasons. The successful survival and spread of this weed in India may be attributed to its allelopathic properties (Marsie and Singh 1987). No body cares to control under fallow no mans land though the chemical control methods are available (Arya and Singh 1996). It has been reported that growth of any plant can be affected positively, negatively or modified due to other plant(s) growing in its association which may be due to competitive ability and inherent vigour of plant species or the release of certain bio-chemicals from the plant which affect the physiology of other plant in co-existence (Rice 1984). Studies on allelopathy has gained tremendous importance owing to its potential for biological control of weeds. A visible allelopathic effect was observed by *Xanthium strumarium* on *Parthenium hysterophorus* in fallow lands of calcareous soil. To utilize this phenomenon for weed control, the allelopathic effects of *Xanthium strumarium* were studied to control *Parthenium hysterophorus* in fallow lands.

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An experiment was carried out during 2001-2002 at Agronomy Department of Rajendra Agricultural University, Bihar, Pusa, Samastipur, to evaluate the allelopathic effects of *Xanthium strumarium* on *Parthenium hysterophorus*. The treatments comprising six concentrations 0, 5, 10, 15, 20 and 25 per cent fresh leaf extract of *Xanthium strumarium* leaves collected from fallow lands. The experiment was designed in R.B.D. and replicated thrice. Twenty five healthy and uniform sized seeds of *Parthenium* were germinated on double layer of filter paper placed in petridishes moistened with fresh extract as per treatment with distilled water used as control and kept in a BOD incubator pre-adjusted at $25 \pm 1^\circ\text{C}$. Germination of *Parthenium hysterophorus* under study was stabilized at six days, therefore, all growth parameters of seedlings were recorded after six days.

The data on germination, root and shoot length, dry weight of plant, seedling vigour and vigour index were recorded. Dry weight of 12 days old seedlings were recorded after drying the seedling parts along with seeds in an oven at $70^\circ \pm 1^\circ\text{C}$ for 48 hrs. The seedling vigour and vigour index was calculated by multiplying the germination per cent with root and shoot length, respectively.

The mean data revealed that the aqueous leaf extract of *Xanthium strumarium* caused significant reduction in germination of *Parthenium hysterophorus* (Table 1). The data showed the germination percentage of treated seeds to range between 14.5 to 98.3. Maximum germination percentage was obtained in control, *i.e.* in

Table 1. Allelopathic effect of *Xanthium strumarium* on germination of *Parthenium hysterophorus*.

Treatment	Germination percent	% inhibition over control
T ₁ – Control	98.3	-
T ₂ – 5% leaf extract of <i>Xanthium strumarium</i>	86.6	11.9
T ₃ – 10% leaf extract of <i>Xanthium strumarium</i>	80.0	18.6
T ₄ – 15% leaf extract of <i>Xanthium strumarium</i>	71.0	27.8
T ₅ – 20% leaf extract of <i>Xanthium strumarium</i>	40.2	59.1
T ₆ – 25% leaf extract of <i>Xanthium strumarium</i>	14.5	85.2
CD(0.05)	4.216	-

distilled water and the minimum in 25 per cent leaf extract of *Xanthium strumarium*. Although, control and 5 per cent leaf extract recorded statistically at par but as the concentration increased there was a significant reduction in germination percentage of *Parthenium hysterophorus*. However, T₅ (20% leaf extract) treatment was also observed affective in germination inhibition (59.1%). Like wise, 25 per cent leaf extract treatments were most effective in minimizing the root length (Table 2). The length of shoot of six days old seedlings also showed minimum value in T₆(25% leaf extract) treated plant. Shoot length also showed an effective decrease in T₅(20% leaf extract) treatment.

Table 2. Allelopathic effects of *Xanthium strumarium* on seedling growth of *Parthenium hysterophorus*.

Treatment	Root length (cm)	Shoot length (cm)	Dry weight of seedling (mg/seedling)	Seedling vigour	Vigour index
T ₁ – Control	2.6	3.2	6.8	255.6	314.6
T ₂ – 5% leaf extract of <i>Xanthium strumarium</i>	1.9	2.8	5.4	164.5	242.5
T ₃ – 10% leaf extract of <i>Xanthium strumarium</i>	1.6	2.0	3.8	128.0	160.0
T ₄ – 15% leaf extract of <i>Xanthium strumarium</i>	1.2	1.6	2.6	85.2	113.6
T ₅ – 20% leaf extract of <i>Xanthium strumarium</i>	0.9	1.4	1.7	36.2	56.3
T ₆ – 25% leaf extract of <i>Xanthium strumarium</i>	0.4	0.7	1.0	5.8	10.1
CD(0.05)	0.402	0.237	0.332	4.638	3.481

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All treatments were effective in reducing the dry weight of seedlings by 1.0 mg in 25 per cent, 1.7 mg in 20 per cent, 2.6 mg in 15 per cent leaf extract of *Xanthium*. The minimum value of seedlings vigour and vigour index was also observed in T₆ (25% leaf extract) treatment. Mean data show a sharp decrease in the seedling vigour and vigour index value in all treatments. It was also reported that the *Xanthium strumarium* adversely affects the growth of maize (Saayman *et al.* 1996) and Soybean (Ellis *et al.* 1998). In the present study, separation of allelochemicals from extract was not done. The effect of germination and early growth stages may be due to presence of some allelochemicals in the leaf. Further studies, on this aspect under field conditions would provide better understanding of allelopathic phenomenon of *Xanthium* on *Parthenium* control.

REFERENCES

- Anonymous (1976). *Parthenium* a new weed in India. *PANS* **22**: 280-282.
- Arya, M.P.S. and Singh, R.V. (1996). Effect of varying levels of herbicides against *Parthenium hysterophorus* L. and other associated weeds. *Ind. J. Weed Sci.* **28**: 36-39.
- Dixit, Anil, Raghuwanshi, M.S. and Bhan, V.M. (2001). *Parthenium hysterophorus* and its control. *Pesticides Information.* **27**: 9-11.
- Ellis, J.M., Shaw, D.R. and Barrentine, W.L. (1998). Soybean (*Glycine max*) seed quality and harvesting efficiency as affected by low weed densities. *Weed Techn.* **12**: 166-173.
- Marsie, W. and Singh, M. (1987). Allelopathic effects of *Parthenium* extract and residue on some agronomic crops and weeds. *J. Chem. Ecol.* **13**: 1739-1747.
- Pahwa, S.K., Yadav, A., Malik, R.K., Balyan, R.S. and Punia, S.S. (2000). Allelopathic effects of *Parthenium hysterophorus* on weeds. *Ind. J. Weed Sci.* **32** (3&4): 177-180.
- Paradkar, N.R., Kurchania, S.P. and Tiwari, J.P. (1997). Chemical control of *Parthenium hysterophorus* L and other associated weeds in upland Drilled Rice. *Ind. J. Weed Sci.* **29** (3&4): 151-154.
- Rao, R.S. (1956). *Parthenium* – a new record for India. *J. Bombay Natural History Soc.* **54**: 218-220.
- Rice, E.L. (1984). Allelopathy, Second edn. Academic Press, Inc., Orlando, New York.
- Saayman, A.E.J., Venter, H.A. and Van De (1996). Influence of weed competition on the germination and seed vigour of the produced caryopses of *Zea mays*. Proc. Second International Weed Control Congress. 25-28 June, pp. 101-106. Compenhagen, Denmark.
- Singla, R.K. (1992). Can *Parthenium* be put to use. *The Tribune* **112**: 6.
- Tiwari, J.P. and Bisen, C.R. (1984). Ecology of *Parthenium hysterophorus*. *Ind. J. Weed Sci.* **16**: 203-206.