Indian J. Weed Sci. **28** (1 & 2) : 104-106 (1996) *Short Communication*

Response of Crop Seeds Towards the Leaf Leachates of *Parthenium hysterophorus* L.

Water-leachable chemicals with allelopathic potential are virtually present in all plant parts viz., roots, stems, leaves, bark, flowers and fruits (Tukey, 1970). Water extracts from a number of weeds have been reported to inhibit germination and early seedling growth of crop seeds (Bhowmik and Doll, 1979; Rasmussen and Einhellig, 1979; Datta and Chatterjee, 1980). Parthenium (*Parthenium hysterophorus*) is a strong allelopathic plant (Kanchan and Jayachandra, 1980; Mersie and Singh, 1987; Kohli and Batish, 1994). Though a weed of unattended land, it has not even spared agricultural and horticultural fields. There are a few reports indicating the allelopathic impact of its aqueous leachates on other plants (Kanchan and Jayachandra, 1980; Kumari *et al.*, 1985). However, the bio-efficacy studies of these leachates on a wide range of seed types are lacking. A study was, therefore, planned to test the germination response of some crop seeds towards the leaf leachates of *P. hysterophorus.*

Procurement of Seeds

Pure-line, healthy, viable and uniform seeds of the following crops were procured from the Punjab Agricultural University, Ludhiana and Haryana Agricultural University, Hisar.

(a) **Pulses** : *Cajanus cajan* DC. var. AL-15, *Cicer arietinum* L. var. C-235, *Lens esculentum* var. LG-12, *Phaseolus aureus* Roxb. var. ML-5, *P. mungo* L.var. Pantu-19, and *Vigna unguiculata* (L.) Walp vars. FOS-1 and HFC-42/1.

(b) **Forages** : *Cyamopsis tetragonoloba* (L.) Taub. vars. FS-277 and HG-182, *Medicago falcata* L., *M. sativa* L. and *Trifolium alexandrinum* L.

(c) **Vegetables** : *Allium cepa* L., *Brassica oleracea* L. vars. Botrytis, Capitata and Caulcrpa, *B. rapa* L., *Capsicum annuum* L., *Daucus carota* L., *Lycopersicon esculentum* (L.) Moench, *Rephanus sativus* L. and *Solanum melongena* L.

Preparation of Aqueous Leaf Leachates

The aqueous leaf leachates of *P. hysterophorus* were prepared following the method of Kumari and Kohli (1987). For this, 500 g freshly collected, healthy and surface cleaned leaves were suspended in 1 litre of distilled water (conductivity <0.05 µS) as to give solution with 0.5 g/ml concentration. The conductivity of the aqueous leachates was determined to be 0.09 µS compared to 0.05 µS of distilled water.

Germination Trial

For each seed type, 100 seeds were soaked in distilled water (control) or the aqueous leachates (treatment) for 8-16 h depending upon the imbibition optima of the seed types. The imbibed seeds were then arranged equidistantly in four petri dishes (6" dia) on Whatman No. 1 filter paper discs underlined with a thin absorbent cotton wad. The set up was transferred to a seed germinator maintained at temperature of 27±2°C and relative humidity of 75±2%. The observations were made daily in each of the petri dishes of control as well as treatment. After seven days, per cent germination and seed vigour were calculated and the seedling lengths were measured. Seed vigour (an index of speed of germination) was calculated as per the following formula given by Agrawal (1980) :

$$\text{Seed vigour} = \sum \frac{\text{Quotients of daily counts of germination}}{\text{Number of days of germination}}$$

Table 1. Effect of leaf leachates of *P. hysterophorus* on germination, seed vigour and seedling length of few pulses, vegetables and forages presented as with reference to control

Crop	Germination	Seed vigour	Seedling length
Pulses			
C. cajan var. AL-15	0.16	0.035	0.18
C. arietinum var. C-235	0.05	0.014	0.08
L. esculentum var. LG-12	0	0	0
P. aureus var. ML-5	0.30	0.300	0
P. mungo var. Pantu-19	0.05	0.017	0
V. unguiculata var. FOS 1	0	0	0
V. unguiculata var. HFC 42/1	0	0	0
Forages			
C. tetragonoloba var. HG-182	1	0.760	0.34
C. tetragonoloba var. FS-277	1	0.510	0.54
M. falcata	0.95	0.390	0.37
M. sativa	0.95	0.395	0
T. alexandrinum	1	0.420	0.27
Vegetables			
A. cepa	0.33	0.24	0.31
B. oleracea var. Botrytis	0.82	0.42	0.50
B. oleracea var. Capitata	0.88	0.40	0.49
B. oleracea var. Caulerpa	0.71	0.41	0.59
B. rapa	0.10	0.04	0.21
C. annuum	0.55	0.65	0.16
D. carota	0.90	0.53	0.084
L. esculentum	0.75	0.47	0.45
R. sativus	0.50	0.37	0.07
S. melongena	1.00	0.74	0.084

The data on seed germination, seed vigour and seedling length were presented with reference to control.

It is clear from the present study that the aqueous leachates of fresh leaves of *P. hysterophorus* exerted phytotoxic impact on the germination parameters of pulses, vegetables and forages. In nature, rain, fog, dew, snow and mist generally facilitated their movement from the plant into the immediate environment where these may persist and accumulate to affect the vegetation. Some of the seeds especially those belonging to pulses viz., *L. esculentum* and *V. unguiculata* totally failed to germinate (Table 1). On the contrary, all of the seeds of *C. tetragonoloba* and *T. alexandrinum* germinated exhibiting 100% germination. Likewise, the germination of *M. sativa, M. falcata* and *D. carota* was above 90 per cent. In other seeds, the per cent germination varied from 5 to 75 per cent. The speed of germination represented as seed vigour was seen to be further reduced in the germinated seeds (Table 1). It was considerably less in seeds which otherwise exhibited 100% germination. Rarely it remained same as that of germination e. g. *P. aureous* (Table

1). Thus, aqueous leaf leachates of *P. hysterophorus* either completely inhibited germination or delayed/reduced it as evidenced by the low values of seed vigour. William and Hoagland (1982) and Jobidon (1986) have considered delay in germination of seeds in response to allelopathic solution to be as important factor as reduction itself. Further, seedling growth was still more reduced except in *B. rapa* where seedling growth was better compared to germination and seed vigour (Table 1). In some cases where initially seeds germinated, the seedling failed to develop (*P. mungo* and *P. aureus*). The significant reduction in germination, seed vigour or seedling growth may be explained as possible interference of the allelochemicals with various physiological processes.

From the present study, it could be concluded that *C. tetragonoloba*—a forage crop exhibited maximum resistance, whereas the seeds of *L. esculentum* and *V. unguiculata* which failed to germinate were most susceptible. The response of the other crops varied considerably. Such a variable response was not uncommon and has been observed by various workers (Overland, 1966; Datta and Chatterjee, 1980).

REFERENCES

Agrawal, R. L., 1980. Seed Technology. Oxford and IBH Publishing Company, New Delhi.

Bhowmik, P. C. and J. D. Doll, 1979. Evaluation of allelopathic effects of selected weed species on corn and soybeans. *Proc. North Cent. Weed Control Conf.* 34 : 43-45.

Datta, S. C. and A. K. Chatterjee, 1980. Allelopathic potential of *Polygonum orientale* in relation to germination and seedling growth of weeds., Flora (Jna) 169 : 450-465.

Jobidon, R. 1986. Allelopathic potential of conifer species in old field weeds in eastern Quebec (Canada). *For. Sci.* 32 : 112-118.

Kanchan, S. D. and Jayachandra, 1980. Allelopathic effects of *Parthenium hysterophorus*. II. Leaching of inhibitors from aerial vegetative parts. *Plant and Soil* 55 : 61-66.

Kohli, R. K. and D. R. Batish, 1994. Exhibition of allelopathy by *Parthenium hysterophorus* L. in agroecosystems. *Trop. Ecol.* 35 : 295-307.

Kumari, A. and R. K. Kohli, 1987. Autotoxicity of ragweed parthenium (*Parthenium hysterophorus*). *Weed Sci.* 35 : 629-632.

Kumari, A., R. K. Kohli and D. B. Saxena, 1985. Allelopathic effects of *Parthenium hysterophorus* L. leachates and extracts on *Brassica campestris* L. *Ann. Biol.* 1 : 189-196.

Mersie, W. and M. Singh, 1987. Allelopathic effects of parthenium (*Parthenium hysterophorus* L.) : Extract and residue on some agronomic crops and weeds. *J. Chem. Ecol.* 13 : 1739-1747.

Overland, L. 1966. The role of allelopathic substances in the smother crop barley. *Amer J. Bot.* 53 : 423-432.

Rasmussen, J. A. and F. A. Einhellig, 1979. Allelochemic effects of leaf extracts of *Ambrosia trifida* (Compositae). *South West. Nat.* 24 : 637-644.

Tukey, H. B. Jr. 1970. The leaching of substances from plants. *Ann. Rev. Plant Physiol.* 21 : 305-324.

William, R. D. and R. E. Hoagland, 1982. The effects of naturally occurring phenolic compounds of germination. *Weed Sci.* 30 : 206-212.

Eco-Physiology Unit
Department of Botany,
Punjab University, Chandigarh- 160 014, India.

R. K. KOHLI
DAISY RANI
H. P. SINGH
and
SUNEET KUMAR