

Allelopathic effect of *Digera muricata* (L.) mart on *in vitro* seed germination of *Pennisetum typhoideum*

V. BINDU AND B.K. JAIN

Received : May, 2011; Accepted : July, 2011

SUMMARY

A laboratory experiment was conducted to assess the allelopathic effects of aqueous extracts of stem, root and leaf of *Digera muricata*, a weed, on *in vitro* seed germination of *Pennisetum typhoideum* (bajra). The results of the effects of aqueous extracts of different concentrations viz., 1%, 3% and 5% of different parts of *Digera muricata* were compared with those of the distilled water (control). Different concentrations of various parts of weed showed inhibitory effects on shoot and root growth of *Pennisetum typhoideum*. The leaf extract proved more inhibitory in nature than stem and root.

Bindu, V. and Jain, B.K. (2011). Allelopathic effect of *Digera muricata* (L.) mart on *in vitro* seed germination of *Pennisetum typhoideum*. *Internat. J. Plant Sci.*, 6 (2): 332-334.

Key words : Allelochemicals, Inhibitory effect, Stimulatory effect

Influence of weeds on crops, crops on weeds and crops on crops have important implications on agriculture as study of these influence help in formulating and planning suitable agricultural operations. For improving the crop productivity it is essential to study the weed crop relationship as it will help in eliminating un-wanted weeds from the field. Unwanted plants other wise called as weeds are the biggest threat to agricultural crops. Plants compete with each other not only for space, light and water but also defend themselves against harmful microbes. When ever two or more plants occupy the same niche in nature, they compete with each other for various life support requirements (Caton *et al.*, 1999).

The inhibition of one plant by another through the release of chemicals is well known. All plant species produce allelochemicals. These allelochemicals can be inhibitory or stimulatory to the neighboring plants. Weeds also produce allelochemicals which affect the neighboring crop plants. Allelochemicals are produced by plants as end products, by products, and metabolites and are contained in the stem, leaves, roots, flowers, inflorescence, fruits, and seeds of the plant. These allelochemicals were found to be released into the soil

ecosystem through volatilization, root exudation, root and stem leachates. The plant produces chemicals which interfere with other plants and affect seed germination and seedling growth (Alam and Islam, 2002). Water soluble substances, released as leachate from different plant parts especially plant leaf may adversely affect seedling growth due to the following reasons; (1) allelopathic effects as allelochemicals, (2) immobilizing nitrogen and (3) increased microbial population and hence enhanced competition with plants (Inderjit and Bhowmik, 2004; Inderjit, 2006). *D. muricata* is a common weed in bajra fields. Hence, the present study was conducted to determine the influence of *D. muricata* on seed germination and seedling growth of bajra.

MATERIALS AND METHODS

Laboratory experiment was conducted to study the allelopathic effects of different concentrations of aqueous extracts of root, stem and leaf of *D. muricata* on *in vitro* seed germination and seedling growth of bajra. Fresh samples of young weeds before flowering stage, were collected from bajra fields and considered as donor plant. The weeds were thoroughly washed and the root, stem and leaves were separated and sun dried to prepare the aqueous extracts. For each part of the plant 1g powder was shaken in required amount of distilled water (DDW) for 24hrs. The extract was filtered through Whatman's filter paper no.1. A concentration series of 1%, 3% and 5% extracts from root, stem and leaf was prepared by taking powder of dried weed material and DDW in

Correspondence to:

V. BINDU, Gujarat National Law University,
GANDHINAGAR (GUJARAT) INDIA
Email : binduv2003@yahoo.com

Authors' affiliations:

B.K. JAIN, Department of Botany, M.G. Science Institute,
AHMEDABAD (GUJARAT) INDIA

different ratios, *i.e.* 1:100, 3:100, 5:100W/V (weed material : DDW). All the extracts were stored at room temperature ($25 \pm 2^\circ\text{C}$) prior use. Glass petri dishes were used to study the allelopathic effect of aqueous extract and DDW as control on the germination percentage and seedling growth in the form of root and shoot length. The seeds of bajra were sterilized by dipping in the solution of 0.1% HgCl_2 and dried in folds of ordinary filter paper. 5 seeds of test crop were arranged at equal distance in Petridishes lined with Whatman's filter paper no.1, moistened with different conc. of *D. muricata* plant extract. The petridishes were covered with glass covering. The whole set of experiment was kept undisturbed at $25^\circ\text{C} \pm 3^\circ\text{C}$. The polythene sheet was covered to all Petridishes to prevent further loss of moisture. The treatments were replicated four times. Number of seeds germinated were counted. The root length and shoot length were measured at the end of 5th day. Data were recorded in % of seed germination and shoot length and root length.

The inhibition per cent (Reduction) was calculated by using the following formula:

$$\text{Per cent inhibition} = \frac{\text{Experiment value (length of root/shoot)}}{\text{Control value (length of root/shoot)}} \times 100$$

The total inhibition was calculated by using following formula:

$$\text{Total Inhibition} = 100 \text{ per cent inhibition.}$$

RESULTS AND DISCUSSION

The results obtained from the present investigation have been discussed in the following sub heads :

Seed germination:

The allelopathic effect of *Digera muricata* on the *in vitro* seed germination of bajra is shown in Fig. 1. It is

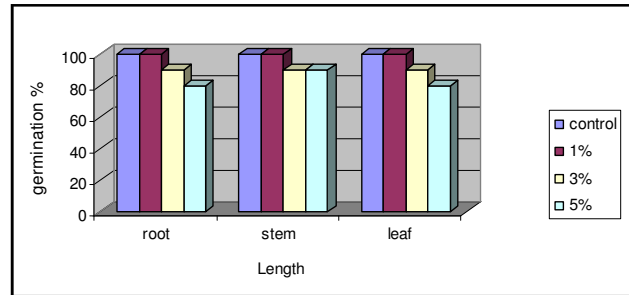


Fig. 1 : Effect of *D. muricata* extract on bajra seed germination at 5 days after sowing

obvious that all the extracts had weak effect on seed germination, although delayed germination was observed. The maximum percentage of seed germination was shown in the control and 1% weed extract. The root extracts having 3% and 5% concentrations showed 90% and 80% seed germination, respectively. The stem extract had a weak effect on seed germination, as with all the extract concentrations *viz.*, 1%, 3% and 5%, the germination percentage was above 90%. The extracts of leaf inhibited the seed germination at higher concentration. With 5% leaf extract only 80% of germination was observed. Thus 5% root and leaf extract proved more toxic to bajra seed germination.

Seed growth:

The study reveals that the *D. muricata* extracts decreased the *Pennisetum typhoideum* growth (Table 1). As the concentration of root extract of *D. muricata* increased in the medium, the root length decreased. The maximum length of root was registered in the control, which was 8.1 cm. With 1% the root length measured was 5.8cm indicating a reduction of 28.4% as compared to that of control. With 3% and 5% the root length measured were 5.1cm and 4.00cm, respectively and this reduction was 37.04% and 50.62%, respectively as

Table 1 : Effect of *D. muricata* on bajra seedling growth at 5 days after sowing

Treatments	Extra conc.	Root length	Shoot length
Control	DDW	8.1 ± 0.39	6.8 ± 0.36
Root extract	1%	5.8 ± 0.9 (28.4)	4.75 ± 1.9 (30.15)
	3%	5.1 ± 0.62 (37.04)	4.00 ± 0.83 (41.18)
	5%	4.00 ± 0.81 (50.62)	3.7 ± 0.81 (45.59)
Stem extract	1%	5.4 ± 1.8 (33.2)	4.5 ± 1.00 (33.83)
	3%	3.8 ± 1.36 (53.1)	3.5 ± 0.6 (48.53)
	5%	3.5 ± 0.5 (54)	3.3 ± 0.25 (51.48)
Leaf extract	1%	5.00 ± 1.8 (38.28)	4.5 ± 1 (33.83)
	3%	4.00 ± 1.00 (50.62)	3.93 ± 0.26 (42.41)
	5%	3.50 ± 1.80 (56.8)	2.27 ± 0.71 (66.62)

compared to that of in the control. Similarly the shoot length measured was maximum with control, where the length was recorded to 6.8cm. With 1%, 3% and 5% root extracts the shoot length measured was 4.75cm, 4.00cm and 3.7cm, respectively indicating a reduction of 30.15%, 41.18% and 45.59%, respectively as compared to that of in the control.

The stem extract also inhibited the seedling growth. At 1% the root length measured was 5.4cm indicating a reduction of 33.2% as compared to that of control. At 3% and 5% the root length measured were 3.8cm and 3.5cm, respectively and this reduction was 53.1% and 54%, respectively as compared to that of in the control. Similarly the shoot length also decreased with increasing concentration. At 1%, 3% and 5% media the inhibition percentage was 33.83%, 48.53% and 51.48%, respectively.

The leaf extract proved more inhibitory in nature than root and stem. With 1%, 3% and 5% media the root length measured were 5.00, 4.00 and 3.50 cm and this reduction was 38.28%, 50.62% and 56.8%, respectively as compared to that of in the control. The shoot length was also affected by the leaf extract. With 1%, 3% and 5% concentrations the inhibition percentages were 33.83%, 42.41% and 66.62%, respectively. Thus higher concentration of the weed extract inhibited the seedling growth. Development of lateral roots was observed with all extract concentration. Maximum allelochemicals were present in leaf leachates. The order of toxicity was leaf

> stem > root. Similar to the present findings, Dave and Jain (2009) reported leaf extracts of *Chenopodium album* showed inhibitory effects on shoot and root growth of *Triticum aestivum*. Bindu and Jain (2010) also reported that leaf extracts of *Lantana camara* showed maximum inhibition to root and shoot growth of *Phaseolus mungo* as compared to stem and root extracts. Thus, the foliar leachates have been regarded to be most phytotoxic/allelopathic in nature, probably owing to their proportionately greater biomass and with greater metabolic activity or production of metabolites (Xuan *et al.*, 2004)

The present findings corroborate the earlier report by Sen *et al.* (1969) who found that the leaf, stem and root extracts of *Digera muricata* did not influence the seed germination but inhibited the seedling growth of pearl millet. Ashraf and Sen (1980) also reported that the root, shoot and seed extracts of *Digera alternifolia* inhibited germination and seedling growth of pearl millet and sesame. Ashraf and Sen (1980) reported that the root shoot and seed extract of *Digera arvensis* inhibited germination and seedling growth of pearl millet and sesame. Vijaysri and Sarma (2003) observed that the aqueous extracts of root, stem and leaves of *Digera muricata* inhibited the growth of *Rhizobium* under laboratory conditions. Karthiyayini *et al.* (2003) reported inhibitory effect of *Digera muricata* on sorghum.

Thus the present study provides the evidence that, *Digera muricata* has allelopathic potential and can inhibit the growth of bajra.

REFERENCES

- Ashraf, N. and Sen, D.N. (1980). Allelopathic influence of *Digera alternifolia* on cultivated crops in Indian arid zone. *Indian J. Weed Sci.*, **12**: 69-74.
- Bindu, V. and Jain, B.K. (2010). Allelopathic effect of *Lantana camara* L. on *in vitro* seed germination of *Phaseolus mungo*. *Internat. J. Plant Sci.*, **5** (1): 43-45.
- Caton, B.P., Mortimer, A.M., Hill, T.C., Gibson, J.E., Fisher and A.J. (1999). Weed morphology effects on competitiveness for light in direct-seeded rice. Proc. 17th Asian-Pacific, Weed Sci., Soc. Conf., Bangkok, pp. 116-120.
- Dave, D.N. and Jain, B.K. (2009). Allelopathic effect of *Chenopodium album* L. on *in vitro* seed germination of *Triticum aestivum* L. *J. Indian Bot.Soc.*, **88** (1&2): 191-194.
- Inderjit and Bhowmik, P.C. (2004). Sorption of benzoic acid into soil colloids and its implications for the Allelopathy studies. *Biol. Fert. Soil*, **40**:345-34
- Inderjit (2006). Experimental complexities in evaluating the allelopathic activities in laboratory bioassay: A case study. *Soil Biol.Biochem.*, **38**: 256-262.
- Karthiyayini, R.K., Ponnammal, N.R. and Rajesh, B. (2003). Effects of *Digera muricata* L. Mart on germination and seedling growth of *Shorgum bicolor* L.varieties. *Allelopathy J.*, **12**: 89-91.
- Sen, D.N., Chawan, D.D. and Sharma, K.D. (1969). Preliminary observations on the influence of certain weeds on germination and growth of *Pennisetum typhoideum* Rich. *Proc. Indian Acad.Sci.B.*, **70**: 111-117.
- Vijaysri, M. and Sarma, K.K.V. (2003). Allelopathy effect of *Digera muricata* on *Rhizobium*. *J. Cur. Bio. Sci.*, **1**(2):1-4.
- Xuan, T.D., Shinjichi, T., Hong, N. H., Khann, T.D. and Min Cl. (2004). Assessment of phytotoxic action of *Ageratum conyzoides* L. (Bill goat weed) on weeds. *Crop Pro.*, **1**:1-8.