

PUBLISHED ON 29TH FEB 2012



ALLELOPATHIC EFFECTS OF AQUEOUS EXTRACTS OF *CAJANUS CAJAN* L. (PIGEON PEA) AND *VIGNA URICULATA* L. (BLACK GRAM) ON EACH OTHER'S SEEDLING GROWTH AND SEED GERMINATION

¹B. A. KUMBHAR, ²Y. B. DABGAR AND ¹G. R. PATEL

¹SHETH M.N. SCIENCE COLLEGE, PATAN (GUJARAT) INDIA.

²R.R. MEHTA COLLEGE OF SCIENCE AND C.L. PARIKH COLLEGE OF COMMERCE, PALANPUR (GUJARAT) INDIA.

bharat_bot@yahoo.co.in

ABSTRACT:

Allelopathic effects of aqueous extracts of *Cajanus cajan* L. and *Vigna uriculata* L. on each other's growth was studied. The suppressive effects of extracts from both the sources were concentration dependant being maximum at 100% concentration. Seed germination and seedling growth of *Cajanus cajan* L. was greatly affected by water extract of *Vigna uriculata* L. Aqueous extracts of *Cajanus cajan* L. at all concentrations (10%, 25%, 50% 100%) significantly inhibited seed germination and seedling growth of *Vigna uriculata* L. when compared with distilled water control. However, aqueous extracts of *Vigna uriculata* L. was found to have a stimulatory effect on the seed germination, root length and shoot length of Pigeon pea seedling. Seedling growth characteristics including root length, shoot length, fresh weight and dry weight of each crop were also affected due to allelopathic effects of the water extracts.

Key word: *Allelopathic, Aqueous extract, Pigeon pea, Black gram.*

INTRODUCTION:

Biochemical interactions between plants both inhibitory and stimulatory, through the release of secondary substances into the environment by decomposition of plant residues, root exudates or leaching by rain are termed as "Allelopathy" (Rice, 1984). The inhibition of one plant by another through the release of allelochemicals is well known (Jadhav & Gaynar, 1995). Allelopathy is a phenomenon of chemical regulating and controlling in natural ecological systems and is a mechanism of organisms accommodating environment (Peng *et al.*, 2004). Recent years, a lot of research has been conducted in the allelopathy of plants worldwide (Mo *et al.*, 2005). The objective of this study was planned to evaluate the allelopathic effects of aqueous extracts of *Cajanus cajan* L. (Pigeon pea) and *Vigna uriculata* L. (Black gram) on each other's seedling growth and seed germination.

MATERIALS AND METHODS:

Aqueous extracts of the whole plant mixture were prepared by digesting 10gm of air dried material of two pulses viz., *Cajanus cajan* and *Vigna radiata* in 100ml distilled water for 24 h at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. It was filtered through Whatmann filter paper no.1 of the volume of filtrate made to 100ml (Dhawan and Narwal 1994). Different dilution of the extract i.e. 10%, 25% 50% and 100% were prepared from this stock solution.

The experiment was laid out in complete randomized block design with three replications. For control seeds were soaked in distilled water only. The seeds of pulses were sterilized by dipping in the solution of 0.1% HgCl_2 for 1 min followed by 3-4 washing under running tap water to remove residues of HgCl_2 and dried in folds of ordinary filter papers in each Petri dish containing Whatmann no. 1 filter paper was kept at the bottom and there after seeds arranged on the top of the filter paper. The Petri dishes were covered with glass covering. They were incubated for 5 days. The whole set of experiment was kept undisturbed at room temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

RESULTS AND DISCUSSION:

In seed germination, 25 seeds of each pulse (*Vigna uriculata* and *Cajanus cajan*) were treated with 10%, 25%, 50%, 75% and 100% concentration of each pulse water extract (*Vigna uriculata* L. and *Cajanus cajan* L.) and the result was observed after five days as compared o control.

The seed germination of *Vigna uriculata* was influenced differently by various concentrations of pigeon pea water extract (P.W.E.). The highest concentration of P.W.E. (100%) significantly suppressed the seed germination (52%) of *Vigna uriculata* after four days. It indicates that germination decreased with an increase in the concentration of P.W.E. which suggested an inhibitory effect of P.W.E. on Black gram germination. Likewise, an inhibitory effect of P.W.E. on root length, shoot length, fresh and dry weight of Black gram seedlings was observed after five days. (Table I).

Table: I Effect of Pigeon pea water extract on seed germination and seedling growth of *Vigna uriculata* seedlings

Concentration	Seed germination (%)	Root length (cm)	Shoot length (cm)	Fresh weight (gm)	Dry weight (gm)
Control	96	13.6	7.9	0.973	0.402
10%	88	11.2	4.4	0.732	0.336
25%	76	7.3	4.1	0.549	0.313
50%	72	6.9	2.7	0.487	0.172
75%	60	3.8	2.1	0.323	0.098
100%	52	2.3	1.9	0.297	0.094

Table: II Effect of Black gram water extract on seed germination and seedling growth of *Cajanus cajan* seedlings

Concentration	Seed germination (%)	Root length (cm)	Shoot length (cm)	Fresh weight (gm)	Dry weight (gm)
Control	96	11.7	9.8	1.021	0.579
10%	100	11.7	10.2	1.023	0.478
25%	100	12.8	11.3	1.106	0.531
50%	96	9.7	7.1	0.781	0.238
75%	92	4.3	4.6	0.492	0.107
100%	80	3.8	4.1	0.241	0.097

Figure 1: Effect of Pigeon pea and Black gram water extracts on each other's seed germination

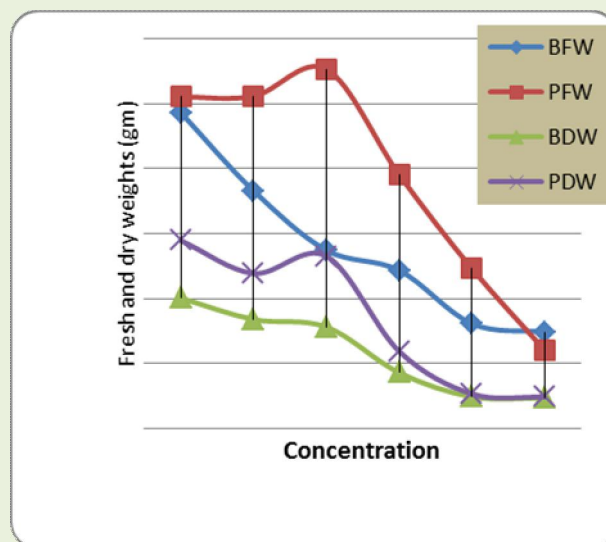
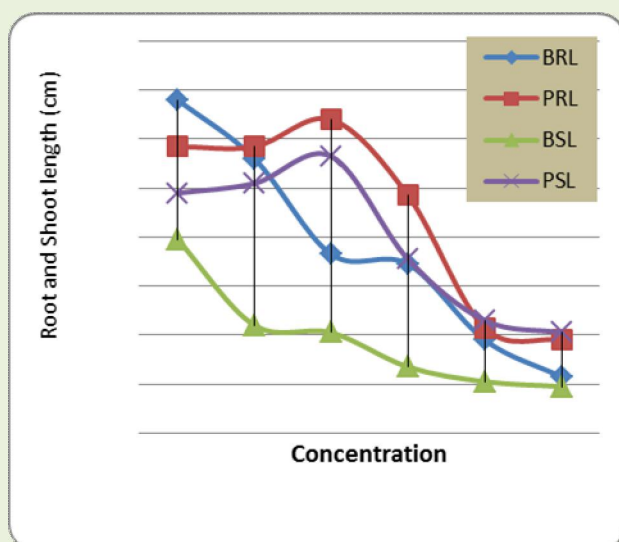
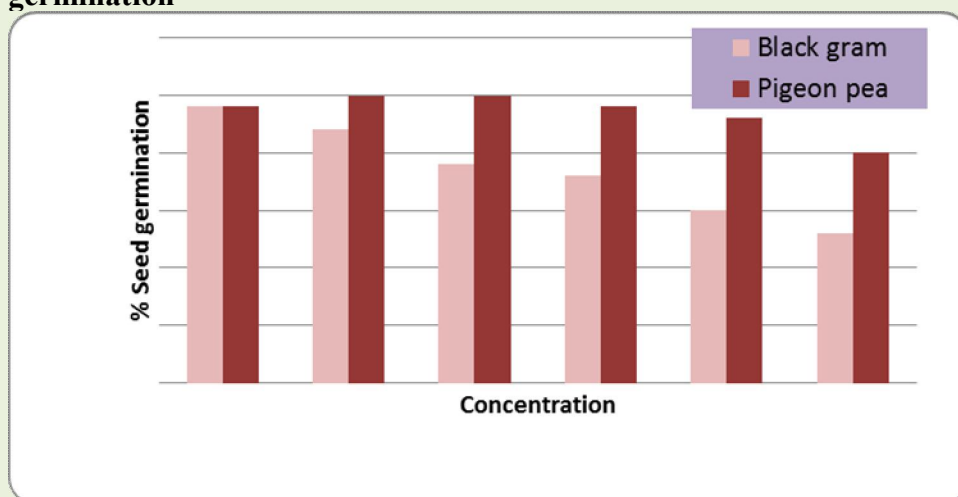


Figure 2: Effect of Pigeon pea and Black gram water extracts on each other's seedling growth

Figure 3: Effect of Pigeon pea and Black gram water extracts on each other's fresh and dry weight

BRL= Black gram Root Length
BSL= Black gram Shoot Length

PRL= Pigeon pea Root Length

PSL= Pigeon pea Shoot Length

BFW= Black gram Fresh Weight

PFW= Pigeon pea Fresh Weight

BDW= Black gram Dry Weight

PDW=Pigeon pea Dry Weight In contrast to it, low concentrations (10% and 25%) of Black gram water extract (B.W.E.) promote germination of seeds and seedling growth while at higher concentrations (75% and 100%) significantly reduced the seed germination, root length, shoot length and fresh weight of *Cajanus cajan* (Table II). The Figures 1, 2 and 3 showing the details of the allelopathic effect of *Cajanus cajan* and *Vigna uriculata* water extracts on each other's seed germination and seedling growth.

Similar inhibitory or stimulatory effects of different plants have been reported previously (Evenari, 1949; Singh, 1957; Guenzi and McCalla, 1966; Worsham, 1984; Aslam and Azmi, 1989).

CONCLUSION:

It can be concluded that Pigeon pea water extract as the concentrations increase, progressively reduced seed germination and seedling growth of *Vigna uriculata* while in Black gram water extract, at lower concentrations stimulate but at higher concentrations suppressed the seed germination and seedling growth of *Cajanus cajan* and these inhibitory or/ and stimulatory effect was possibly due to the presence of some allelochemicals in plant.

ACKNOWLEDGEMENT:

The authors express their gratitude to the H.K. Parmar, Head, Dept. of Biotechnology, for the facilities and thankful to Principal Dr. K.S. Parikh, Science College, Patan for necessary facilities and inspiration during the course of investigation.

REFERENCES:

- Aslam, S.M. and A.R. Azmi, 1989. Influence of *Prosopis glandulosa* water extract on seedling growth of wheat cultivars. *Pakistan J. Sci. Ind. Res.*, 32:708.
- Dhavan, S.R. and Narwal, S.S. 1994. Critical assessment of allelopathy bioassays in India. Proc. Int Symp. *Allelopathy in Sustainable agriculture, Forestry and environment*. New Delhi: Indian society of Allelopathy, IARI.
- Evenari, M., 1949. Germination inhibitors. *Bot. Rev.*, 15:153-94
- Guenzi, W.D and T.M. MaCalla, 1966. Phenolic acid in Oats, Wheat, Sorghum and Corn residues and their phytotoxicity. *Agron. J.*, 58: 303-4.
- Jadhav, B.B. and D.G. Gaynar, 1995. Effect of *Casuarina equisetifolia* J.R. leaf litter leachates on germination and seedling growth of rice and cowpea. *Allelopathy J.*, 2: 105–8
- Mo, M., Q. Xifu, X. Zhang and C. Nie, 2005. Allelopathy of aqueous of *Lactarius hatsudake* on several crops and barnyard grass (*Echinichloa crusgalli* L.). Proceedings and

Selected Papers of the 4th World Congress on Allelopathy. Wagga Wagga, NSW, Australia.

Peng, S.L., J. Wen and Q.F. Guo, 2004. Mechanism and active variety of allelochemical. *Acta Bot. Sinica*, 46: 757-766.

Rice, E.L. 1984. Allelopathy. Academic press, orlndo, Florida, USA.

Singh, A., 1957. Effect of mixed cropping on growth behavior and yield of association crops and on nodulation of legume. *Proc. Nat. Acad. Sci., India*, 27: 180-90.

Worsham, A.D., 1984. Crop residues kill weeds. Allelopathy at work with wheat aand rye. *Crops and Soils Magazine*, 37: 19-20.