

Study of Allelopathic Effect of *Alternanthera philoxeroides* in Some Rice Cultivars of Assam

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Abstract

Three rice cultivars namely Bao, Boro and Aus were selected to examine the inhibitory effects of leachates and aqueous extracts of *Alternanthera philoxeroides* (Mart) Griseb. It is found that the inhibitory effect increases with the increase of the concentrations of the leachates and aquatic extracts. The effects were observed more prominent at higher concentrations of 50% and 100% than at lower concentration of the leachates and aquatic extracts. It is found that the allelopathic effect of *A. philoxeroides* is higher in deep water paddy variety (Bao) than in summer variety (Aus).

Key words: Allelopathy, Allelochemicals, Leachate, Rice cultivars, Weeds

This chemical interference which takes place between two plant species in the environment where one species inhibits or stimulate the growth of another species is called allelopathy and these chemical substances are called allelochemicals [1-2]. Recently allelopathy has undergone massive changes and now it is described as any reciprocal harmful or harsh effects between two plants while living in the same environmental condition [3]. Allelopathy has been receiving increasing concerns and attention from past few years due to its negative impacts on growth of plant communities and crop production [3-4] and also an important outlook on weed-crop interactions [5]. Weeds are a serious threat to our crop plants which effects their germination, seedling growth in a negative way [6]. Harmful chemicals release from allelopathic weeds in various manners like volatilization, exudation, decomposition of plant tissues and leaching from roots and shoots [7]. The weed-crop interaction is negative impact of one plant species to another, through the synthesis of a no. of chemical compounds on germination of seeds as well as growth of many crops and weeds [8]. Study shows that a large number of annual and some of destructive species of perennial weed can impose allelopathic influence [9]. Allelopathy needs more through study as it is still controversial [10]. According to many investigations it is found that rice cultivation is highly affected by various allelopathic weeds and investigations revealed that annual loss of rice yields due to weed infection is 15-21% in India [11-12].

Assam is well known for its agriculture. In Assam, the wetland rice varieties like Bao, Boro, Aus are cultivated vastly along the common rice variety. But weed infestations are highly impacting the rice production especially in case of the wetland varieties. *Alternanthera philoxeroides* (Mart) Griseb which is commonly known as Alligator weed is an aquatic perennial weed of wetland rice fields. The present study deals with the study of effects of the leachates and plant extracts of

Alternanthera philoxeroides on germination of seed and growth of seedlings of three rice varieties namely Bao, Boro and Aus.

MATERIALS AND METHODS

The plant, *A. philoxeroides* (Mart.) Griseb was collected from river side of Brahmaputra River of Dhubri District of Assam where summer variety Aus and deep-water paddy variety Boro, Bao were being cultivated. 250gm fresh plant material of *Alternanthera* was crushed with 250 ml distilled water in a mortar and the aqueous extract was prepared. By mixing and soaking fresh plant in equal amount of distilled water for 24 h, the leachates were prepared. The leachates and aqueous extract were filtered using muslin cloth and by pouring distilled water, the filtrates were diluted to 100 ml. By using dilution method, solutions of concentrations 15, 25, 50 and 100% were of both the leachates and plant extract. The effects of these leachates and plant extracts and were studied on germination of the seeds and growth of seedling of the 3 rice varieties namely Boro, Bao and Aus. For each bioassay, 25 seeds were taken in a Petri dish over a layer of moistened Whatman filter paper. Moistened seeds were served as control. The Petri dishes containing 25 seeds for each treatment were incubated at 25°C and after five days, germination of the selected seeds and also growth of the seedlings were documented. The date was examined by ANOVA (one way) and Duncan's new multiple range test (DMRT) to find out significant difference among mean values of the observations at 0.05 probability level.

RESULTS AND DISCUSSION

The *Alternanthera philoxeroides*' aqueous extract showed inhibitory effects to germination of the seeds and

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seedling growth of the three rice varieties namely Bao, Boro and Aus studied. It is observed that the inhibitory effect of the aqueous extract was more in Bao followed by Aus and in case of Boro the effect was very less (Table 1). The increasing concentrations of extract of *Alternanthera philoxeroides* also increase the allelopathic effect. It was observed that the

inhibitory effect of the extracts was more prominent on shoot growth than on root growth. In control treatment, shoot length of Aus cultivar was 4.45 mm, later at 100% concentration of plant extracts it was reduced to 0.35 mm again at control; the root length was 13.72 mm but was 0.54 mm at 100% concentration of plant extracts (Table 1).

Table 1 Effect of *Alternanthera philoxeroides*' aqueous extract on germination of seeds and growth of seedlings of Bao, Aus and Boro for 5-day time period

Bao				Aus			Boro		
Conc. (in %)	Germination (%)	Root length++ (mm)	Shoot length++ (mm)	Germination (%)	Root length++ (mm)	Shoot length++ (mm)	Germination (%)	Root length++ (mm)	Shoot length++ (mm)
0	88a	20.15±8.40a	7.9±1.96a	85a	13.72±2.17a	4.45±1.54a	86a	12.45±4.88a	9.35±2.61a
15	85ab	13.55±5.54b	8.12±2.84a	80b	11.07±3.19b	5.07±1.88a	85a	5.2±1.72b	7.3±2.35b
25	80a	11.40±8.6bc	4.57±2.65b	74b	7.35±2.85c	3.07±2.11b	79a	4.07±0.88b	6.8±2.01b
50	71c	7.42±6.46c	2.9±1.54c	62c	6.82±1.91c	2.4±1.65b	66b	2.27±0.62c	6.25±2.22b
100	51d	2.40±4.47d	0.67±1.33d	49d	4.47±1.08d	0.71±1.07c	58b	1.5±0.37d	3.47±1.97c
F	119.31	12.09	28.46	62.76	46.01	20.06	20.4	64.1	16.9
F(C)	0.42	1.58	0.49	0.49	0.54	0.35	0.66	0.54	0.51

The Values are calculated as mean of 4 observations

The mean of 20 observations with \pm S.D

According to new DMRT, at 5% level, the means of same letter are not significantly different

The observation for the leachates of *Alternanthera philoxeroides* showed that the inhibition of seedling growth and

seed germination was least in Boro, mediocre in Aus and highest in Bao (Table 2).

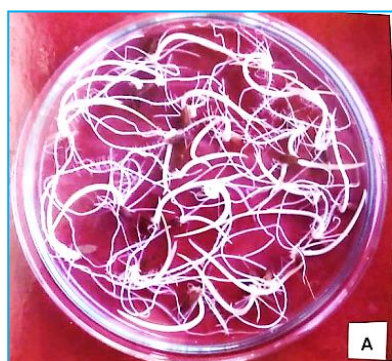
Table 2 *Alternanthera philoxeroides*' leachates effect on seed germination and seedlings growth of Bao Boro and Aus for 5-day time period

Bao				Aus			Boro		
Conc. (in %)	Germination (%)	Root length++ (mm)	Shoot length++ (mm)	Germination (%)	Root length++ (mm)	Shoot length++ (mm)	Germination (%)	Root length++ (mm)	Shoot length++ (mm)
0	87a	17.82±3.45a	10.72±3.15a	91a	16.92±4.45a	10.7±3.058	88a	17.12±2.29a	8.2±1.78a
15	85a	16.62±3.50a	10.65±1.71a	88a	16.65±4.55a	10.75±2.11b	86a	17.15±3.70a	8.42±1.67a
25	83a	13.25±3.22b	7.2±1.95b	86a	13.82±4.22b	7.3±2.11b	82a	14.95±3.46b	6.75±1.34b
50	82b	7.80±1.45c	5.2±1.42c	84a	12.82±2.22b	6.2±1.48bc	85a	13.12±2.32bc	6.62±1.43b
100	77b	4.12±1.30d	2.35±0.55d	69b	6.42±1.38c	4.85±0.67c	81a	11.97±2.43c	6.52±1.12b
F	6.13	35.1	32.54	21.16	37.11	33.59	0.29	12.2	7.32
F(C)	0.51	0.72	0.35	0.49	0.82	0.46	0	0.67	0.34

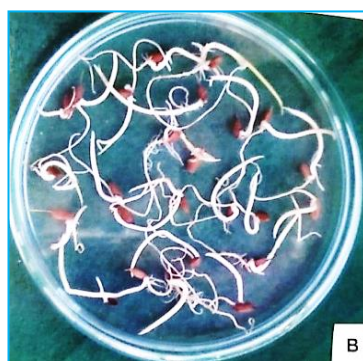
The Values are calculated as mean of 4 observations

The mean of 20 observations with \pm S.D

According to new DMRT, at 5% level, the means of same letter are not significantly different



(A) Control



(B) Treatment with 100% leachate of the *A. philoxeroides*



(C) Treatment with 100% aqueous extract of the *A. philoxeroides*

Fig 1 Bioassay of seedling growth using pre-germinated seeds of Boro rice

The present study shows that the Alligator weed, *Alternanthera philoxeroides* has strong allelopathic effect on the wetland rice varieties. The study shows that the leachates and aqueous extract contain allelochemicals which reduces the root and shoot growth of the rice varieties, these allelochemicals are supposed to release from the alligator weed by microorganisms or by rain water during weed residue's

decomposition. The effect of aqueous extract was more than the leachates. The reason may be presence more amount of allelochemicals in aqueous extract than the leachates. Rice [13] had found similar results. Similar experiment was done on effect of *Alternanthera philoxeroides*, where it caused inhibition in wheat's germination and growth of seedlings [14]. Mehmud *et al.* [15] in his experimental survey has shown that

Alternanthera philoxeroides has direct effect on production and quality of rice variety. Many similar works were done by researchers like Mubeen *et al.* [16] where they have examined the allelopathic effect of *Trianthema portulacastrum* L. and

Dactyloctenium aegyptium L. on rice and got significant result. According to a study by Shah *et al.* [17], germination of the wheat seeds was inhibited by the abscised plant part of *Terminalia arjuna*.

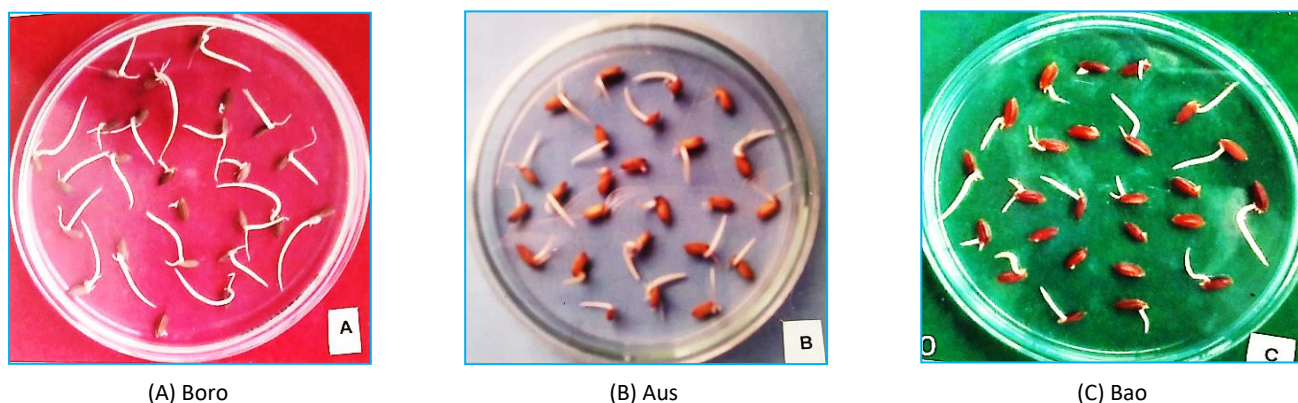


Fig 2 Comparative studies on the effects of *Alternanthera philoxeroides*' aqueous extracts on germination and growth of seedlings of Bao, Boro and Aus exposed for 5-day time period

CONCLUSION

This study showed that *Alternanthera philoxeroides* contains allelopathic molecules which impart negative impact on germination and growth of seedling of rice varieties. As there are significant decline in growth and production of rice due to weed invasion. Therefore, this type of weed should be controlled in proper manner or eliminated completely so that cannot impact the crop production. The control of this weed can be done by different strategies like manual, cultural,

mechanical, chemical weeding and also integrated weed management which is a cost-effective method to control weed population.

Conflict of interest

There are no conflicts of interests.

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