

## EFFECT OF 2-BENZOXAZOLINONE (BOA) ON MORPHO-PHYSIOLOGICAL AND BIOCHEMICAL ASPECTS OF *CASSIA OCCIDENTALIS* L.

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**Abstract:** The present laboratory experimental study was carried about to evaluate the allelopathic potential of an allelochemical, 2-benzoxazolinone (BOA) on some morpho-physiological and biochemical parameters of *Cassia occidentalis*. 100, 500, 1000  $\mu$ M concentrations of BOA were applied to determine their effect on morpho-physiological parameters (seed germination, root length, shoot length, fresh weight, dry weight etc.) and biochemical parameters (chlorophyll, carotenoids, protein and  $\alpha$ -amylase) of test plant under laboratory condition. Study was conducted on 10 day seedlings of *Cassia occidentalis*. Not only seedling growth parameters even the chlorophyll, carotenoids, protein and  $\alpha$ -amylase were appreciably reduced, thereby indicating that BOA negatively affects the growth of *Cassia occidentalis*. The study was concluded that BOA possesses weed suppressing ability.

**Keywords:** Allelopathy, Allelochemical, Weed, BOA, *Cassia occidentalis*

### INTRODUCTION

Among the natural plant products, the allelochemicals create one of the major groups and provide allelopathic property to the donor plant, being biologically active. The allelopathic interactions, in general, and the allelochemicals, in particular, are regarded as an important tool for sustainable weed and pest management, and disease control (Singh *et al.*, 2001). The purified allelochemicals and/or their derivatives and even the compounds synthesized on their chemistry can be utilized as novel agrochemicals for sustainable management in an eco-friendly manner (Singh *et al.*, 2001). Allelochemicals represent a diversity of chemical nature. One of the groups of allelochemicals that has been in focus during the last two decades is the benzoxazinoids and their derivatives (Villagrasa *et al.*, 2006). The group of chemical compounds named benzoxazinoid derivatives has been subdivided into hydroxamic acids (Hx), lactams, benzoxazolinones and methyl derivatives of the hydroxamic acids. The cyclic hydroxamic acids (Hx) and lactams (together also referred to as benzoxazinones) are naturally present in the seedlings of several members of family Poaceae, Scrophulariaceae, Ranunculaceae and Acanthaceae (Hartenstein and Sicker, 1994; Pratt *et al.*, 1995). Weeds are unwanted and undesirable plants that interfere with the utilization of land and water resources and thus, adversely affect crop production and human welfare. Weeds compete with crop plants for nutrients, soil moisture, space and sunlight (Rajan and Sankaran, 1974). The world food loss due to weeds has been estimated to be about 11.5 percent of the total food production (Parker and Fryer, 1975).

### MATERIALS AND METHODS

Seeds of *Cassia occidentalis* were collected locally from wildy growing area of Distt. Muzaffarnagar. 2-benzoxazolinone (BOA) was purchased from Sigma-aldrich, Germany.

Seeds were surface sterilized with 0.1% mercuric chloride. Seeds were dipped in distilled water for 24 h for imbibition prior to germination trials. These were then equidistantly placed in normal size petri dishes lined with two layers of moistened Whatman no.1 filter paper. The filter paper was treated with 100, 500, 1000  $\mu$ M (T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively) of 2-benzoxazolinone (BOA). For each treatment three replicates were kept. A similar set up of three replicates without treatment served as control (T<sub>0</sub>). The entire set up was kept in an environmentally controlled seed germinating chamber at 25<sup>0</sup>C and 75 % relative humidity with a photoperiod of 16/8 day/night. After 10 days, the number of seeds that germinated was counted, root length, shoot length, seedling fresh weight and dry weight were measured and the total chlorophyll, total carotenoids, total protein and  $\alpha$ -amylase activity were estimated.

### RESULTS AND DISCUSSION

Morpho-physiological attributes of *Cassia occidentalis* were recorded in terms of % germination, root and shoot length, fresh and dry weight, vigour index, tolerance index and germination speed in different treatments of BOA. It is very clear from the results that in response to different concentrations of BOA, Germination was considerably reduced in compared to control (Fig.1). Reduction in germination was more at 1000  $\mu$ M as compared to others. At the lowest concentration of 100  $\mu$ M BOA treatment, germination was reduced by about 7.5% while at 500  $\mu$ M, a reduction of over 13% was observed. An appreciable inhibition of

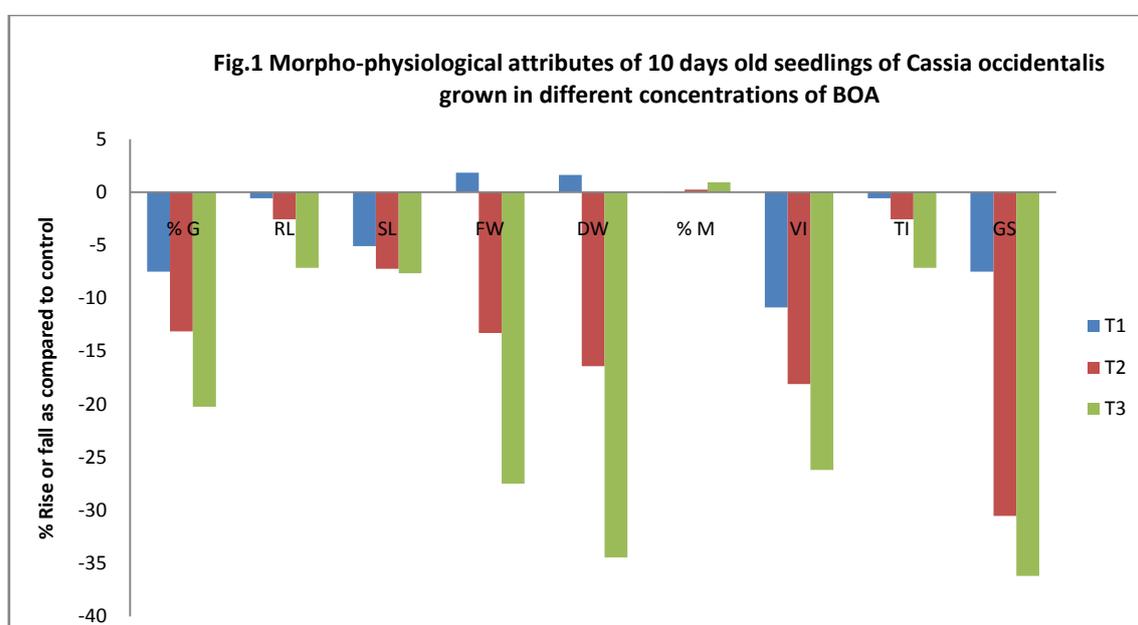
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germination of the test weed was observed at a concentration of 1000  $\mu\text{M}$ . The root length and shoot length of the test weed was also appreciably reduced but not significant reduction was observed (Fig.1). The fresh weight of test weed was slightly increased at 100  $\mu\text{M}$  conc. but significant reduced in 500 and 1000  $\mu\text{M}$  (13% and 27.5% respectively) as compared to control (Fig.1). Similarly dry weight was slightly

increased at 100  $\mu\text{M}$  conc. but significantly reduced at 500 and 1000  $\mu\text{M}$  conc. (16% and 34.5% respectively) as compared to control (Fig.1). In case of % moisture, a little increase was observed at lower to higher conc. as compared to control (Fig.1). Vigour index, tolerance index and germination speed were also significantly reduced at different conc. as compared to control (Fig.1).

**Table.1 Morpho-physiological attributes of 10 days old seedlings of *Cassia occidentalis* grown in different concentrations of BOA**

Treatment ( $\mu\text{M}$ )	% Germination	Root length	Shoot length	Fresh weight	Dry weight	% Moisture content	Vigour Index	Tolerance index	Germination speed
0	89.00 $\pm$ 2.00	3.51 $\pm$ 0.17	7.47 $\pm$ 0.11	65.5 $\pm$ 3.7	6.1 $\pm$ 0.42	90.73	977.22	100	22.25
100	82.33 $\pm$ 2.52	3.49 $\pm$ 0.12	7.09 $\pm$ 0.10	66.7 $\pm$ 3.5	6.2 $\pm$ 0.40	90.7	871.05	99.43	20.58
500	77.33 $\pm$ 2.08	3.42 $\pm$ 0.03	6.93 $\pm$ 0.10	56.8 $\pm$ 1.3	5.1 $\pm$ 0.31	90.96	800.36	97.43	15.46
1000	71.00 $\pm$ 2.00	3.26 $\pm$ 0.20	6.90 $\pm$ 0.90	47.5 $\pm$ 2.5	4.0 $\pm$ 0.20	91.58	721.36	92.87	14.2



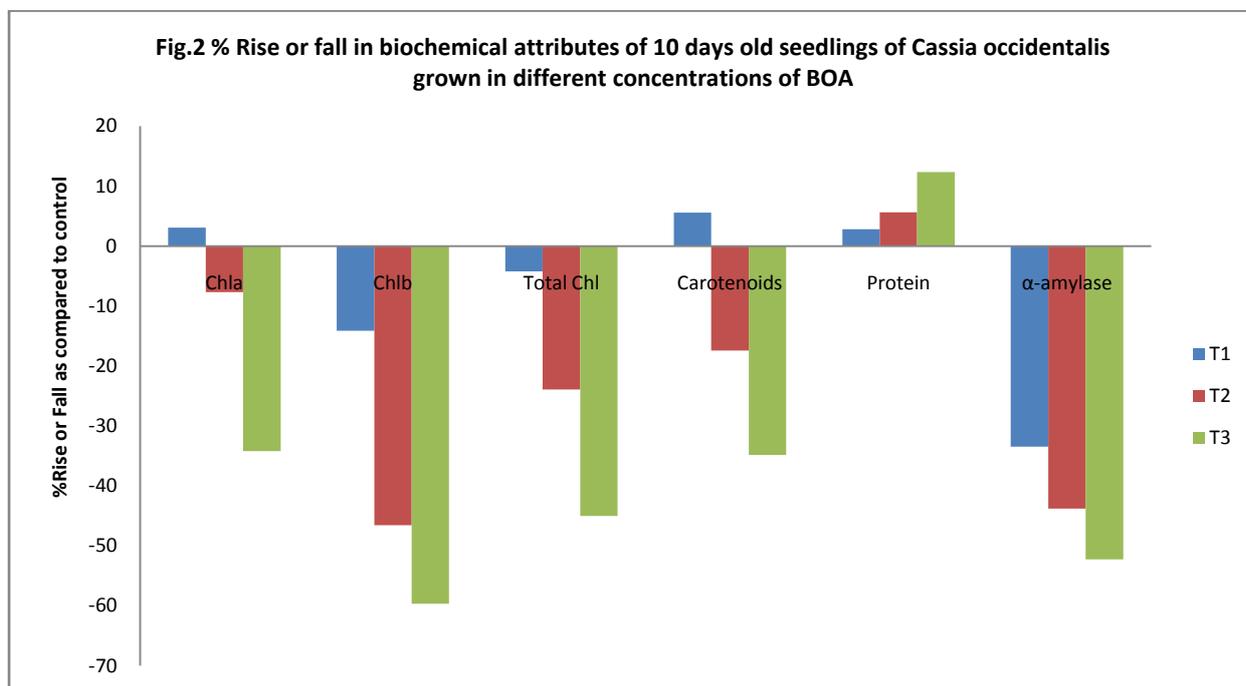
Biochemical attributes of *Cassia occidentalis* were recorded in terms of Chl.a, Chl.b, total chl., total carotenoides, total proteins and  $\alpha$ -amylase activity. Chl.a was slightly increased at 100  $\mu\text{M}$  conc. but significantly reduced at 500, 1000  $\mu\text{M}$  conc. (8% and 34% respectively) as compared to control (Fig.2). Chl.b was significantly reduced at 100, 500 and 1000  $\mu\text{M}$  conc. (14%, 47% and 60% respectively) as compared to control (Fig.2). Total chl. was slightly reduced at 100  $\mu\text{M}$  conc. but significantly reduced at 500 and 1000  $\mu\text{M}$  conc. (24% and 45% respectively)

as compared to control (Fig.2). Total carotenoides were slightly increased at 100  $\mu\text{M}$  conc. but significantly reduced at 500 and 1000  $\mu\text{M}$  conc. (18% and 35% respectively) as compared to control (Fig.2). Total protein was appreciably increased at all conc. 100, 500 and 1000  $\mu\text{M}$  (3%, 6% and 12.5% respectively) as compared to control (Fig.2).  $\alpha$ -amylase activity was significantly reduced at all conc. 100, 500 and 1000  $\mu\text{M}$  (34%, 44% and 52% respectively) as compared to control (Fig.2).

**Table.2 Biochemical attributes of 10 days old seedlings of *Cassia occidentalis* grown in different concentrations of BOA**

Treatment ( $\mu\text{M}$ )	Chla (mg/g fwt)	Chlb (mg/g fwt)	Total Chl (mg/g fwt)	Total Carotenoides (mg/g fwt $\pm$ )	Protein (mg casein eq./g fwt $\pm$ SD)	$\alpha$ -amylase (mg starch degraded/min/gfwt $\pm$ SD)
0	0.260 $\pm$ 0.006	0.191 $\pm$ 0.005	0.451 $\pm$ 0.000	0.304 $\pm$ 0.003	14.24 $\pm$ 0.18	32.43 $\pm$ 2.01

100	0.268±0.004	0.164±0.011	0.432±0.015	0.321±0.005	14.64±1.10	21.58±2.38
500	0.240±0.006	0.102±0.018	0.343±0.012	0.251±0.004	15.04±0.42	18.23±1.43
1000	0.171±0.004	0.077±0.001	0.248±0.002	0.198±0.004	16±0.66	15.48±0.85



## CONCLUSION

It is clear from the present study that 2-benzoxazolinone (BOA) has a potential to reduce the some morpho-physiological parameters as well as biochemical parameters (germination, early growth and development of the weed species and thus could prove very useful for future weed management programmes.

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