Allelopathic effects of *Celosia argentea* L. on fresh weight and dry biomass of seedlings of Wheat (*Triticum aestivum* L.)

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ABSTRACT

Celosia argentia L. is dominant alien weed reported from crop field of Islampur in Walwa taluka of Sangli district of Maharashtra, India. It has been scrutinized for its allelopathic potentiality of *C. argentea* against fresh weight and dry biomass of seedlings of wheat (*Triticum aestivum* L.). The laboratory experiments were conducted to assess fresh weight and dry biomass of seedlings of wheat after treating seeds with different concentrations (5, 20, 40, 60 and 80%) of aqueous leachates of inflorescence (flower), leaves and root of *C. argentea* separately. It was observed that the inflorescence and root leachates treatment responds in decline of dry weight of wheat seedling. The leaf leachates treatment was responsible for enhancement in dry weight of wheat seedlings but at lower treatments (5 to 40%). The higher treatment (60 and 80%) of leaf leachates cause much detrimental effect on dry weight, it reduces dry weight more than half as compared to control. The fresh and dry weight of wheat seedlings was increased after treatment of 5 to 40% leaf leachates however decreased more in 60 and 80% leaf leachates treatments. The allelotoxicity regarding wheat seedling was in pattern of leaf > inflorescence > root leachates were toxic on fresh and dry weight but at higher concentrations (80%). The present study indicated that the allelochemicals are present in the weed, *C. argentea*. This study needs further screening of allelochemicals and their characterization for detailed study.

KEY WORDS: Allelochemicals, *Celosia argentea* L., Seedling growth, wheat etc.

INTRODUCTION:

Weeds are mostly redundant plants that affect the growth of standing crop through releasing chemical substances nearby area, called as allelochemicals (Batish *et al.*, 2007). They often affect growth and development of crop plants (Kadioglue *et al.*, 2005) and affect metabolic functions like photosynthesis, respiration, mineral uptake nutrition and such others (Saxena *et al.*, 2004) through allelopathic mechanism (Benyas *et al.*, 2010). Allelopathy signifies either negatively or positively between the plants and weeds, results in to inhibitory or stimulatory effect on adjacent plants (Kengar and Patil, 2018).

Wheat is staple food of mankind cultivating throughout the world but its field is generally affected by various weeds causing allelopathic effect on physiological aspects. In western part of Maharashtra (India), field of wheat is affecting by weed like *C. argentea* L. (Kengar and Patil, 2018).

In this connection the attempt has made to study the influence of aqueous leachates plant parts of *Celosia argentea L.* on fresh weight and dry biomass of seedlings of wheat. This attempt signified for understanding weed crops interactions.

MATERIALS AND METHODS:

Preparation of aqueous leachates

The weed, *C. argentea* was collected from wheat fields of Islampur, Sangli district of Maharashtra, India [17° 15' - 18° 01' N latitude and 74° 12' - 74° 74' E longitude] and washed with tap water to remove soil particles. The plant parts such as leaves, roots and inflorescence were separated and shade dried for 10 days. Dried parts were powered with the help of grinder and stored in polythene bag. The extract were prepared by taking 10gm of fine powder of each part and poured in 100ml distilled water as pure extract, stock solution. From this extract, the different (5, 20, 40, 60 and 80%) concentrations were prepared for treatments while distilled water used as control (0%). The extract was filtered after 24h through a double layered muslin cloth; the filtrates were used as leachates, for further analysis.

Seed treatment with aqueous leachates:

Healthy uniform seeds of wheat (variety Trimbak) were selected and procured from authorized shop of Shetkari Sahakari Sangh Pvt. Ltd, Kolhapur. The seeds were surface sterilized with 1% sodium hypo-chloride for 10 min, then rinsed with distilled water for several times to remove excess of chemical. Then surface sterilized seeds were soaked for treatments in 20 to 80% concentrations of plant leachates for 6h. The seeds were soaked in distilled water were used as a control. These treated seeds were placed in petriplate ((9.0 cm diameter) containing wet blotting paper and covered with a lid. At each concentration and incubation period, triplicate sets were arranged and placed in the laboratory under normal temperature for germination. After 72h, the fresh weight was measured and same seedlings were dried in laboratory oven to record dry biomass of wheat seedlings.

Statistical analysis

The analysis was carried out in three replicates for all determinations and the mean were calculated. The statistical analysis performed according to Duncan's multiple range test. The letter on values are not significantly different ($P<0.05$).

RESULTS

Fresh weight and dry weight of wheat seedling:

The fresh weight and dry weight of wheat seedling is studied after influence of leachates of inflorescence, leaf and root of *C. argentea* (Table 1). It was evidenced that the fresh and dry weight was enhanced after treatment of inflorescence leachates but only at 5 to 40%, however it was declined in other treatments such as leaf and root leachates treatments.

The fresh weight of wheat seedlings recorded after inflorescence leachates treatments was 1.492, 1.461, 1.437, 0.912 and 0.823g; leaf leachates treatments as 1.668, 1.580, 1.558, 0.805 and 0.685g; root leachates treatment as 1.459, 1.301, 1.072, 1.003, and 0.956g with control 1.512g. It was observed that the inflorescence and root leachates treatment responds in decline of fresh weight of wheat seedling while leaf leachates responsible for enhancement in fresh weight of wheat seedlings but at lower treatments (5 to 40%). The higher treatment of leaf leachates cause much detrimental effect on fresh weight, it reduces fresh weight more than half as compared to control.

From above observations, the leaf leachates were responsible for enhancement in fresh weight of wheat seedling at 5 to 40% treatments. The inflorescence and root leachates treatment responds in inhibition of fresh weight of wheat seedling.

Similar trend of action of leachates was recorded regarding dry weight of wheat seedlings. The dry weight of wheat seedlings recorded after inflorescence leachates treatments was 0.221, 0.214, 0.196, 0.173 and 0.142g; leaf leachates treatments as 0.318, 0.301, 0.284, 0.163, and 0.108g; root leachates treatment as 0.216, 0.182, 0.151, 0.139, and 0.112g with respect to 5 to 80% treatment. It was observed that the inflorescence and root leachates treatment responds in decline of dry weight of wheat seedling. The leaf leachates treatment was responsible for enhancement in dry weight of wheat seedlings but at lower treatments (5 to 40%). The higher treatment (60 and 80%) of leaf leachates cause much detrimental effect on dry weight, it reduces dry weight more than half as compared to control.

The fresh and dry weight of wheat seedlings was increased after treatment of 5 to 40% leaf leachates however decreased more in 60 and 80% leaf leachates treatments. The allele toxicity regarding wheat seedling was in pattern of, leaf > inflorescence > root leachates were toxic on fresh and dry weight but at higher concentrations (80%).

DISCUSSION:

Our results clearly showed that the fresh and dry weight of seedlings of wheat was increased after 5 to 40% leaf leachates of *C. argentea*. The inflorescence and root leachates of *C. argentea* were acts as inhibitor on fresh and dry biomass of wheat seedlings.

The negative allelopathic effect of extracts and leachates on biomass was recorded by many workers during seed germination studies. Some reviews are taken in to consideration for this discussion. Aqueous leaves extract of common weed *Tridax procumbens* L. inhibited seed germination, root, shoot length, and fresh-dry weights of legume plants, according to Fammina *et al.* (2012). Similarly, seed germination, root length, shoot length, and dry weight of groundnut (*Arachis hypogaea*) were considerably reduced when it was treated with dried leaves of *Eucalyptus camaldulensis*, according to Ghanuni *et al*. (2015). At greater concentrations, the aqueous extract of Milk thistle plant (*Silybum marianum*) leads to reduction in fresh weight, dry weight, and length of the radicle and shoot of wheat (Lehoczky *et al*., 2017). According to Novak Nenda *et al*. (2018), the weeds like Abutilon, Ambrosia, Datura, Xanthium, Amorpha, Reynoutria, and Solidago have been found to inhibit seed germination, radical and plumule length in Oat, Mustard and Sunflower. The allelopathic effects of Eucalyptus species such as citriodora, camaldulensis, and globules aqueous leaf extract tested against groundnut seed that revealed substantial inhibitory effects on germination and root elongation, according to Lawan *et al*. (2011).

Similar to above context, we have recorded that the leaf leachates treatment only acts stimulatory on fresh and dry biomass of wheat. Considering some earlier work of different researchers our findings and facts are quite new to allelopathic studies except some reports. Garg *et al.* (2005) recorded the positive effects on plant height, number of leaves, leaf area, and dry matter pearl millet after treating it with water extracts of stem of *Cassia angustifolia* (senna). Our results showed differential action mechanism of leachates of *C. argentea* in wheat crops. This concluded with presence of some promoting and inhibiting substance in leachates of *C. argentea*.

CONCLUSION:

The present results of study showed that the stimulation and suppression of fresh weight and dry biomass of wheat seedling is due to allelochemicals present in plant parts of weed *C. argentea* L. that affects on seedling growth dynamics. It needs further screening of allelochemicals and their characterization for detailed study.

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Table 1: Fresh weight and dry weight of wheat seedlings under influence of leachates of *C. argentea* L.

Source of Leachates	Treatments	Wheat Seedling	
		Fresh weight	Dry weight
	Control	1.512 ±0.051^{a}	0.263 ±0.011^{c}
Inflorescence Leachates	5%	1.492 ±0.060^{a}	0.221 ±0.002^{c}
	20%	1.461 ±0.017^{a}	0.214 ±0.003^{c}
	40%	1.437 ±0.064^{a}	0.196 ±0.015^{c}
	60%	0.912 ±0.020^{a}	0.173 ±0.007^{c}
	80%	0.823 ±0.045^{c}	0.142 ±0.010^{c}
Leaf leachates	5%	1.668 ±0.065^{c}	0.318 ±0.006^{c}
	20%	1.580 ±0.024^{a}	0.301 ±0.013^{c}
	40%	1.558 ±0.018^{a}	0.284 ±0.009^{bc}
	60%	0.805 ±0.028^{b}	0.163 ±0.012^{a}
	80%	0.685 ±0.036^{b}	0.108 ±0.009^{c}
Root leachates	5%	1.459 ±0.066^{a}	0.216 ±0.018^{c}
	20%	1.301 ±0.073^{a}	0.182 ±0.008^{c}
	40%	1.072 ±0.020^{c}	0.151 ±0.007^{c}
	60%	1.003 ±0.032^{a}	0.139 ±0.01^{c}
	80%	0.956 ±0.026^{b}	0.112 ±0.013^{c}

Note: The fresh and dry weights are expressed in gm.

Values are mean of three replications and according to Duncan's multiple range test. The letter on values are not significantly different ($P<0.05$).