Allelopathic Influence of Celosia Argentea L. Against α-Amylase Activity In Lens Culanaris Medic. During Seed Germination

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Abstract- *Celosia argentia L. is dominant weed reported in crop fields of Islampur of Sangli district of Maharashtra, India. It has been scrutinized for its allelopathic potentiality against lentil (**Lens culanaris** Medic.). The laboratory experiments were conducted to assess activity of α-amylase during seed germination of lentil after treating different concentrations (5, 20, 40, 60 and 80%) of stem, leaves and inflorescence (flower) aqueous leachates separately. There is positively correlation between the aqueous leachate and activity of α-amylase. The activity of enzyme amylase was increased in germinating seeds of lentil after treatment of aqueous leachates of C. argentea L. plant parts. The treatment of 40 to 80% aqueous leachate of inflorescence, leaf and root were recorded doubled α-amylase activity as compared to control in germinating seeds. The activity of α-amylase was more pronounced in leaf leachate treated seedlings as compared to other leachate treatments. It indicated that allelochemicals are more in leaf than other plant parts. This study indicates that some allelochemicals are present in aqueous extract of C. argentea and regulated the activity of enzyme α-amylase.*

Keywords- Allelochemicals, α-amylase, Lens culanaris Medic., Celosia argentea L. etc

I. INTRODUCTION

Weeds are unwanted unplanted redundant plant that affects the growth of main crop in field through releasing chemicals called as allelochemicals (Batish *et al*., 2007). They often affect growth dynamics crop (Kadiolgue *et al.*, 2005) and physiological functions including photosynthesis, respiration, mineral nutrition and such others (Saxena *et al.*, 2004) through allelopathic mechanism (Benyas *et al*., 2010). Allelopathy functions either negatively or positive interaction between the plants, results in to stimulatory or inhibitory actions on neighboring plants through releasing allelochemicals via root exudation, volatilization, leaching, and decomposition of plant residues (Inderjit and Duke, 2003). The weed, *Celosia argentea* L. is an exotic flowering herb belonging to Amaranthaceae predominately interfere in crop field of legumes (Inamdar and Kamble,2009). Lentil (*Lens culinaris* Medic.) belongs to the family Fabaceae, has been part of the human diet since the ceramic times. Lentils have the third-highest level of protein, by weight, of any legume, after soybeans and hemp. These proteins include the essential amino acids such as isoleucine and lysine. Especially in the Indian subcontinent, it's consumption by large vegetarian populations (Estrella *et al*., 1994). It has been cultivating all over world including Maharashtra but its field is affecting by weed like *C. argentea* L. in western part of Maharashtra, India.

In this connection the attempt has made to study the influence of aqueous leachates of plant parts of *C. argentea* L. on this activity of enzyme α-amylase, to evaluate the allelopathic potentiality of *C. argentea* L. on carbohydrate metabolism during seed germination of lentil. This attempt signified for understanding weed crops interactions and open new area for further research on this background.

II. MATERIALS AND METHODS

Preparation of aqueous leaf leachates

The weed, *C. argentea* L. was collected from crop 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 10 gm 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, 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 filtrate was used as leachates, for further analysis.

Seed treatment with aqueous Leachates:

Healthy uniform seeds of lentil 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 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, for 72h. The analysis of carbohydrates and bioassay for enzyme amylase was carried out after 72h of germination.

Bioassay for enzyme Alpha amylase was carried out through a modified method of Katsumi and Fukuhara (1969).

Statistical analysis

The analysis was carried out in three replicates for all determinations and the mean were calculated.

III. RESULTS AND DISCUSSION

Qualitative and quantitative changes were involved in several metabolic pathways during seed germination and seedling growth (Kengar *et al.*, 2014). Seed germination is linked with degradation and mobilization of food accumulated during seed maturation (Borisjuk *et al.*, 2004 & Penfield *et al.*, 2005). These carbohydrates are utilizes by developing seedling for the synthesis of various metabolic products. Carbohydrate storage in the form of starch and oligosaccharides were hydrolyzed and increased the sugar levels due to metabolic changes in legume seeds during germination process (Urbano *et al.*, 2005). Pawar and Chavan (2007) reported the degradation of starch might be due to the enhanced action of ά- amylase during the process of germination, which hydrolyzes the starch into simple carbohydrate. The entry of allelochemicals in plants may result in changes in growth with fluctuation in carbohydrate contents (Roushan Islam, 2016) and affect the various metabolic activities and growth components in plants (Mali and Kanade, 2004). Gulzar and Siddiqui, (2014) found that total carbohydrate contain was increased in allelopathic treated plants. The result of present investigation showed that, the activity of amylase in lentil after seed treatment of *C. argentea* L. plant parts leachates.

Activity of enzyme α-Amylase [E.C. 3.2.1.1]:-

The activity of amylase enzyme recorded after treatment of aqueous leachates of *C. argentea* L. on germinating seeds of lentil in Table 1 and Fig. 1. It was noticed the elevated activity of amylase after treatment of leachates of *C. argentea* L. The treatment of 40 to 80% inflorescence, leaf and root aqueous leachate recorded doubled amylase activity as compared to control in germinating seeds of lentil. The 5 to 80% inflorescence aqueous leachates treatment recorded 1.09, 1.67, 2.23, 2.84 and 3.17μg amylose hydrolysed $min^{-1}g^{-1}$ respectively, Leaf leachates showed 2.12, 2.76, 2.94, 3.10 and 4.36μg amylose hydrolysed $min^{-1}g^{-1}$ where as root leachates treatment reported elevated values of amylase as 1.25, 1.69, 1.98, 2.27 and 2.59μg amylose hydrolysed $min^{-1}g^{-1}$ respective to treatment. The leaf leachates treatment influences more positively on activity of amylase as compared to treatment of inflorescence and root aqueous leachates. It indicated as allelochemicals are more active in leaf than other plant parts of *C. argentea* L. (Fig. 1)

Amylase is an important hydrolytic enzyme synthesized during seed germination in plants. This enzyme is abundant in the germinating seeds and catalyses a random hydrolysis of α-1, 4 glucosidic linkage in the starch component (Kengar *et al.*, 2014). Seed development is closely associated with seed metabolism and transport processes (Weber *et al.*, 1998). It is involved in the mobilization of starch reserves which are transported as sugars and utilized by the growing embryo (Ernst David Floyd, 1971). The enzymes most commonly endorsed with the initial attack on starch granules are α-amylase and β-amylase, responsible for breakdown and initiating the mobilization of starch in germinating seeds (Trethewey & Smith, 2000).

Ramakrishnan *et. al*., (2014) reported that the leaf leachates of *Gmelina arborea* on red gram, green gram, black gram, and chickpea they studied allelochemicals inhibited the expression and activity of the enzymes required for efficient germination. Allelopathic plants water extract application at low concentration improved the performance of maize which might be attributed to the presence of various secondary metabolic (Casimiro *et.al.*, 2001). Pawar and Chavan (2007) studied the effect of leaf leachates of *Eucalyptus globulus*, *Moringa oleifera, Parthenium hysterophorus* and *Glycine max* on seedlings of *Sorghum bicolor*, recorded decreased activity of α-amylase and invertase. The similar results were reported by Madane and Patil (2017), they observed increased α-amylase activity in *Cajanus cajan* and *Cicer arietinum* seeds during germination after treatment of *E. odoratum* at lower concentrations.

In present investigation, there is positively correlation between the aqueous leachate concentrations of *C. argentea* L. and activity of α-amylase in lentil. The activity increased in germinating seeds of lentil after treatment of aqueous leachates of all plant parts however the treatment of 40 to 80% inflorescence, leaf and root aqueous extract recorded doubled amylase activity as compared to control in germinating seeds (Table 1 and Fig. 1). The activity of α-amylase was more pronounced in leaf leachate treated seedlings as compared to inflorescence and root leachate treatments. This elevation in activity of α-amylase is due to allelochemicals present in plant parts (Madane and Patil, 2017), indicated that allelochemicals are more in leaf than other plant parts. This study indicates that some allelochemicals are present in aqueous extract of *C. argentea* L. and it worked as enzyme amylase regulators. It has been also reported that even lower concentrations of allelochemicals were shown to stimulate amylase activity and therefore increased soluablization of starch during the germination process (Singh *et al*., 2009).

IV. CONCLUSION

The present study indicated that the amylase activity in lentil was stimulated in the all selected concentrations of aqueous leaf leachates of C. *argentea* within germinating seeds of lentil. This increased activity of α-amylase is due to allelochemicals present in *C. argentea* (Narwal, 1994). It needs further screening of allelochemicals and their characterization for detailed study. Therefore, present investigation recommended that, some eco-friendly preventing measures should be taken to minimize the deleterious effects of *C. argentea* L. at the time of growing crops.

Table 1: Effect of aqueous leachates of *C. argentea* on activity of α-amylase in germinating seeds of Lentil.

	Activity of Alpha amylase in germinating seeds of Lentil * (µg amylose hydrolysed $min^{-1}g^{-1}$)		
Control	0.98^{a}		
Aqueous Leachates (%) of *C. argentea* L.	**Inflorescence**	**Leaf**	**Root**
5%	1.09^{a} ± 0.011	2.12^{b} ± 0.020	1.25^{a} ± 0.013
20%	1.67^{a} ± 0.018	2.76^{b} ± 0.019	1.69^{a} ± 0.016
40%	2.23^{b} ± 0.016	2.94^{b} ± 0.021	1.98^{b} ± 0.012
60%	2.84^{b} ± 0.012	3.10^{c} ± 0.018	2.27^{b} ± 0.025
80%	3.17^{c} ± 0.015	4.36^{d} ± 0.023	2.59^{b} ± 0.022

All values are mean of three determinations with standard deviations.

Values are expressed in µg amylose hydrolysed $min^{-1}g^{-1}$ fresh weight.

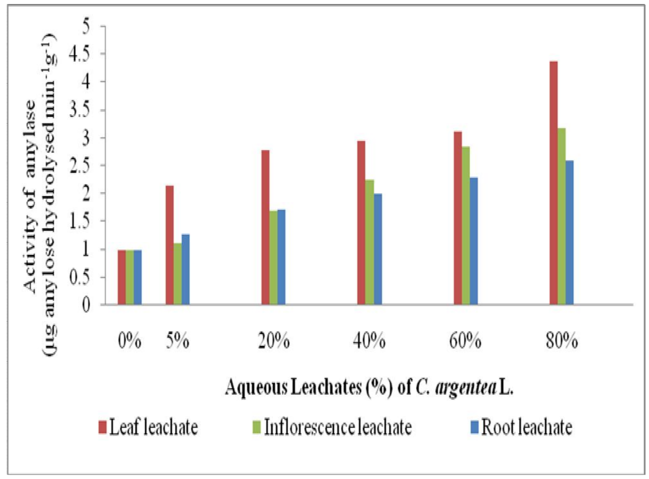

Fig. 1 Effect of aqueous leachates of *C. argentea* on activity of α-amylase in germinating seeds of Lentil.

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