



EFFECTS OF ALLELOPATHIC STRESS ON PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS OF POTTED GRAM (*Cicer arietinum*) PLANTS

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ABSTRACT

Allelopathy is effect of one plant on other. This phenomenon can be useful to improve the crop productivity and quality. Alternanthera is an important weed, taking a heavy toll of soil ingredients. So this weed is used to induce allelopathic effect on important food legume i.e gram. The qualitative analysis of biochemical contents after inducing allelopathic effect on gram showed increase in contents of proteins, Non-reducing sugars and starch.



Cicer arietinum L.

KEYWORDS: Allelopathy, *Alternanthera*, proteins, Non reducing sugars, starch, biochemical analysis.

INTRODUCTION:

Allelopathic effects are caused through release of various types of allelochemicals. Allelochemicals are present in almost all plants and in many tissues, like leaves, stems, flowers, fruits, seeds and roots (Putnam, 1988). They are often water-soluble substances that are released into the environment through root exudation, leaching and decomposition of plant residues (Aminidehaghi et al., 2006). Allelochemicals that inhibit the growth of some species at certain concentrations might in fact stimulate the growth of the same or different species at different concentrations (Narwal, 1996). The quality of the contents may also be

changed due to such stress in plants.

Multiple physiological effects have also commonly been observed from treatments with many allelochemicals. These effects include decreases in plant growth, absorption of water and mineral nutrients, ion uptake, leaf water potential, shoot turgor pressure, and osmotic potential caused by phenolic compounds (Barkosky and Einhellig, 2003). Such investigations are necessary for making use of noxious weeds which grow in our agricultural lands.

2. MATERIALS AND METHODS

2.1 Collection of Material:

Crop seeds : Seeds of Gram var. Kabuli was collected from Agriculture College, Pune.

Weed *Alternanthera tenella colla* Weeds was collected from campus of K.N.Bhise Arts, commerce and science college. Kurduwadi, Solapur

2.2 Preparation of Extract:

A 10% extract of *Alternanthera* leaves was prepared by crushing 10 gm leaf material in 100 ml distilled water. This was used as stock for preparation of different concentration of 2%, 4%, 6% and 8% as required for bioassay and treatment of crop plants.

2.3 Experimental design for pot cultures:

Seeds were sown in polythene bags after germination and development of seedlings, after 15 days these were arranged in triplicate for control (D.W), 2%, 4%, 6%, 8% and 10% treatments. Each bag contained 3 to 4 seedlings.

2.3a Application of extract:

Foliar application of extract was applied to potted plants after every 15 days up to flowering stage.

2.4 PHYSIOLOGICAL ANALYSIS

2.4. A. Growth parameters:-

Plants were selected randomly and labeled for recording following growth observations.

a) Plant height (cm)-

The plant height (cm) of randomly selected plants from each pot was recorded in cm by measuring from the base of the plant near the ground to the apex. The plant height was recorded at 15 days interval starting from 15 days after sowing.

b) Number of leaves per plant –

The total number of leaves on observation plant was recorded at an interval of 15 days starting 15 days after sowing.

2.5 BIOCHEMICAL ANALYSIS:

The metabolic changes and different biochemical parameters were estimated for treated and controlled plants by the methods as described below.

2.5a Estimation of total free amino acids:

Total free amino acids were estimated as per the method described by Sadasivam and Manickam, (1996).

2.5b Estimation of reducing sugar:

Reducing sugars were estimated by using Dinitrosalicylic acid (DNSA) reagent as per the method described by Sadasivam and Manickam, (1996).

2.5c Estimation of non-reducing sugar:

Non-reducing sugar were estimated according to the method of Thayumanavan and Sadashivam (1984).

2.5d Estimation of starch:

Starch was estimated using Anthrone reagent as per the method described by (Sadasivam and Manickam, 1996).

2.5e Estimation of total phenols:

Total phenols were estimated as per the method of Farkas and Kiraly, (1962).

2.5f Estimation of chlorophyll:

Chlorophyll were extracted and estimated by Arnon's (1949) method.

RESULTS AND DISCUSSION**3.1 Effect of *Alternanthera* leaf extract on growth parameters of potted Gram plant :****i) Plant height :**

According to results at very low concentration i.e 2% treatment no effect is seen. While on slightly and more higher concentration treatments height of plants are stimulated. Maximum height is observed in 4% concentration treatment, about 90% more than control. At higher concentrations less stimulation is observed, but height of plants is more in all the plants as compared to control.

ii) Number of leaves :

Maximum no of leaves where observed in 4% treated plants.

The vegetative growth of plants is the important stage in its life cycle, which is greatly affected by the inhibitory or stimulatory influence of the foliar application of leachets and extracts of weeds. Workers like Ghayal and Dhumal (2007), Ambika and Smitha (2005) and Raun et al. (2005) have recorded increase in plant height in different crops. Ghayal and Dhumal (2007), Prasad (2004), Rao and Shaktawat (2001) reported increase in number of leaves.

Table 1 Effect of *Alternanthera* leaf extract on physiological parameters of potted Gram plants:

Treatments	Proteins* mg/gm	Non-reducing Sugars* mg/gm	Starch* mg/gm	Reducing Sugars* mg/gm	Phenols* mg/gm
Control	207.50 ±14.53	41.19 ±2.88	27.96 ±1.96	9.55 ±0.67	09.54 ±0.67
2%	174.17 ±5.23	67.21 ±2.01	45.43 ±1.36	6.60 ±0.20	07.58 ±0.23
4%	158.75 ±7.94	79.53 ±3.98	45.43 ±2.27	7.76 ±0.39	07.21 ±0.36
6%	213.33 ±12.80	93.74 ±5.62	32.78 ±1.97	7.06 ±0.42	06.97 ±0.42
8%	249.17 ±9.97	127.63 ±5.10	40.79 ±1.63	6.60 ±0.26	14.67 ±0.59
10%	384.58 ±11.54	141.41 ±4.24	43.97 ±1.31	7.76 ±0.23	12.35 ±0.37

* indicates mean of three determinants

3.1 Effect of *Alternanthera* leaf extract on Biochemical parameters of potted Gram plants:

As seen in table 1 amount of proteins reduces initially but increases at more than 4% concentration continuously. Non reducing sugars show regular increase in quantity with increase in treatment concentration. Amount of starch is higher in treated crop plants but at lower concentration treatment of extract show more increase as compared to higher concentration treatment. Reducing sugars quantity decreases in treated crop plants as compared to control. Amount of phenols reduces at low concentrations of treatment but increases at higher concentration treatments.

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