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Original Article

Effect of Textile Effluent on Seedling Germination, Growth and Biochemical Characteristics of *Arachis hypogaea* l. Variety K6

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ABSTRACT

An industrial waste water of textile effluent was discharged on land and into water that effluent was induced environmental pollution. The pollution agent of textile effluent poses was used as plant growth because that effluent was contain several primary and secondary plant nutrients. The aim of the study was effect of effluent with respect to germination, morphology and biochemical characters of *Arachis hypogaea* L. variety K6 (groundnut). Dilution effluents (25%, 50%, 75% and 100%) and treated effluent were irrigated on *Arachis hypogaea* L. Seed germination and seedling growth were gradually decreased with increase in effluent concentrations but the best seedling germination and growth was observed in treated effluent compared to other doses. All concentrations of textile effluent were injurious and reduction on plant growth and its morphological parameters of hypocotyls length and epicotyls length. Number of root branches was observed in all effluent concentrations and mostly root affected by 100% textile effluent compared control. Biochemical characters of amino acids and protein were also reduction by increase in effluent concentrations. Morphological and biochemical characters were better growth in treated effluent and followed by 25% effluent than all other concentrations of effluent. From this study was confirmed that treated textile effluent can be used as optimal growth of *Arachis hypogaea* L.

Key words: Textile effluent, *Arachis hypogaea* L., Seed germination, Morphological and Biochemical changes.

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1. INTRODUCTION

Industrialization plays a vital in the growth and development of any country. The textile industry uses vegetables fibres such as cotton, animal fibres such as wool and synthetic materials such as nylon, polyester, and acrylics [1]. Textile waste water includes as large variety of dyes and chemicals addition that make the environmental changes for textile industry not only as liquid waste but also its chemical composition [2]. Dyes contributed to overall toxicity at all process stage also dye baths could have high level of BOD/COD, colour, toxicity, surfactant, fibres and turbidity many contain heavy metal [3]. Textile processing employs a variety of chemical depending on the nature of the raw material and product [4]. Textile effluents are high volume of water that eventually results, suspended solids. They can contaminate water with oil, grease and waxes while some many contain heavy metal such as chromium, copper, zinc and mercury. Dying process usually contributes lead, zinc, and copper to waste water [5].

The use of industrial effluents for irrigation has emerge in the recent past as an important way of utilizing waste water, taking the advantage of the presence of considerable quantities of N, P, K and Ca along with other essential nutrients [6]. The industrial effluents hold various organic and in organic chemical compounds. The presence of these chemical compounds will show harmful effects germination and growth of plants. Previous studies suggested that effluents form industries inhibit seed germination and seedling growth [7]. Seed germination is an important and vulnerable stage in the life cycle of terrestrial angiosperms and determined seedling establishment and plant growth [8]. Effluents discharged from the industries have either beneficial or lethal effects on the germination, growth and development of agricultural crops. The beneficial and harmful effects of the different concentration of effluents on crops have been assessed and after suitable dilution can be used as liquid fertilizer for several crops [9]. In this present study, an attempt has been made to identify the effect of textile effluent on seed germination and seedling growth and biochemical analysis of groundnut.

2. MATERIALS AND METHODS

Collection of Seed and Sterilization

The seeds of Ground nut (*Arachis hypogaea* L.) variety K6 were obtained from Assistant Agricultural Directory Office (AADO), Seelanaikanpatty by- pass, Salem. Seeds were collected in the beginning of January and thee experiments were conducted after a week of seed collection. Healthy and equally sized seeds were sterilized with 0.1% mercury chloride for 3 minutes. After repeated washings with sterilized distilled water. The experiment was conducted in Laboratory of botany, Government Arts College (Autonomous), Salem. The effluent water is collected from a private dyeing plant located in Dadagapatty, salem on 20th January.

Preparation of sample

Textile dye effluent was collected from Salem District, Tamil Nadu, India. The effluent was prepared different concentration such as 25%, 50%, 75% and 100% with distilled water and used for the experiment. The sterilized seeds were soaked in distilled water 0 (control) and different concentration of effluent 25%, 50%, 75% and 100% and primary treated effluent for 2 hours.

Seed germination

Seed germination of was analysed with two types of culture like petriplates and pot culture. In petriplate culture, filter paper is wetted with water and respective effluent. Seeds were kept on the surface of wet filter paper and kept under dark for 2 days then transferred to the normal room condition. Addition of effluent at respective concentration was done when the filter paper became dry. In pot culture study, a lomy soil was collected from the field. Soil of each pot was mixed thoroughly with various concentration of effluent water 0 (control), 25%, 50%, 75% and 100% and treated effluent. The soaked 10 seeds were sown on each pots. The effluent at respective concentration was used for irrigation.

Observation

Observation for seed germination was recorded after 4 and 7 days of seed sowing. After 4 days of treatment, emergences of radical are recorded and after 7 days complete germination of the seed were considered. The seed germination rate is expressed in percentage. The pot culture, germination was recorded after 9 days of seed sowing.

Effect of effluent on seedling growth

To analyses the effect of effluent on seedling growth, the length of hypocotyls, epicotyls and number of branch roots were measured after 9 days of seed sowing in filter paper and is recorded. The fresh and dry weight of weight of seedling is also recorded. The free amino acids and soluble protein content was estimated in the leaves of seedling after 20 days of germination.

Biochemical analysis

The biochemical analysis which have carried out Estimation of total free amino acids and estimation of protein.

Estimation of amino acid

The free amino acid was estimated according to the method of Moore and stein [10].

Extraction

The plant tissue of 500mg was taken and homogenized with 10ml of 80 percent boiling ethanol. The extract was centrifuged at 800rpm for 15min and the supernatant was made up to 10ml with 80 percent ethanol used for the estimation of free amino acids.

Estimation

One ml of ethanol extract was taken in a 25ml test tube and neutralized with 0.1N NaOH using methyl red. To this, 1ml ninhydrin reagent was added. The contents were boiled in a boiling water bath for 20min, and then 5ml of diluting reagent was added, cooled and made up to 25ml with distilled water. The absorbance was read at 570nm in a spectrophotometer.

Reagent preparation (for amino acid)

Acid ninhydrin reagent

Two and half gm of ninhydrin was dissolved 60ml warm glacial acetic acid which was dissolved with mixture of 40ml of 6M phosphoric acid. This solution was allowed to agitation and stored in brown bottle in 20^0c until use.

Estimation of protein content (mg/g/fr.wt)

The protein was estimated according to the method of Lowry *et al.* [11].

Extraction

Five hundred mg of fresh plant tissue was ground with 20ml of 20 percent trichloroacetic acid (TCA) in pestle and mortar. The homogenate was spun at 800 rpm for 15min. the supernatant was discarded and the pellet, 5ml of 0.1N sodium hydroxide (NaOH) was added to solubilizer the protein and the aliquot was spun again centrifuged at 800rpm for 15 min. the supernatant was made up to 10ml with 0.1N NaOH and used for the estimation of protein content.

Estimation

0.5 ml of extract was taken in a clean test tube to whish 5ml of reagent-D and 1ml of foline phenol were added and kept in room temperature for 10minutes. The blue colour complex was read against the blank (reagent without extract) at 640nm in spectrophotometer (systronics). Bovine serum albumin was used for standard graph to calculate protein content.

3. RESULTS AND DISCUSSION

The seed germination of groundnut variety K6 treated with dye effluent was observed in both culture such as petriplate and pot culture. Seed germination percentage was gradually decreased with increasing concentration of dye effluent compared to control in petiplate cultures (Table.1). 75% and 100% concentration of dye effluent were reduced seed germination in pot culture (Table.2). The highest seed germination was found in treated effluent of both cultures. The germination percentage in raw effluent is concentration dependant decreasing with increasing effluent concentration [12]. The reduction in germination percentage at higher concentration may also be due to the excess amount of minerals and nutrients present in the effluent [13]. Similarly the lower values were observed at 100% effluent concentration. The higher concentration of sago factory effluent condensed the germination of gingelly seeds [14].

Table 1: Effect of textile effluent on seed germination in *Arachis hypogaea* L. variety K6 on Petriplate culture

Treatment	Percentage of seed germination	
	After 4 days	After 7 days
Control	60%	100%
25%	40%	80%
50%	30%	75%
75%	20%	70%
100%	10%	60%
Treated effluent	50%	100%

Table 2: Effect of textile effluent on seed germination in *Arachis hypogaea* L., variety K6 on Pot culture

Treatment	Percentage of seedling growth
	After 9 days
Control	100%
25%	40%
50%	30%
75%	-
100%	-
Treated effluent	100%

Hypocotyls length of groundnut variety K6 treated with dyeing industry effluent was observed after 7 days of seed sowing. The highest hypocotyls length was observed in treated effluents (4.78cm) irrigated seedlings compared to other all effluent concentrations. 25% concentration of textile dye effluent was increased length of hypocotyls day to day of 10 days after seedling. In seedlings treated with 100% effluent, the hypocotyls length was highly reduced (0.8 cm) compared to control. Average length of hypocotyls was significantly decreased day to day in after seven days of seedling and treated effluent was better growing of hypocotyls compared to other all concentrations except control (Table.3). All the growth parameter increased at 20% effluent concentration and decreased at 100% effluent concentration. At 100% effluent concentration nutrients were raised too high to become toxic resulting in retarded root and shoot length [15].

Table 3: Effect of textile effluent on hypocotyls length of Arachis hypogaea L. VarietyK6

Treatment	Length of hypocotyls (cm) after seven days										Average
	1	2	3	4	5	6	7	8	9	10	
Control	6.5	6.2	5.3	6.5	4	4.5	5	4.6	3.5	3.2	4.93
25%	3.5	4	4.5	4.6	3.8	3.6	3.6	4	4.3	3.8	3.75
50%	3	2.5	3.5	2	2.3	3	2.1	2.2	2	2.5	2.51
75%	1.5	2.5	2.3	2.4	1.6	1.4	1.5	2	2.2	1.5	1.89
100%	1.3	1.7	1.2	0.8	0.5	0.6	-	-	-	-	0.8
Treated	5.5	6.5	3.9	4.6	4	6.2	5	3.5	4.1	4.5	4.78

The Average of epicotyls length was observed in after seven days of seedling with approximately 10 days. The maximum length of epicotyls was found in 25% of textile effluent at 4th day compared to other concentrations and control. Increasing of effluent concentration reduced epicotyls length and 100% effluent treatment epicotyl was not grown. (Table.4).

Table 4: Effect of textile effluent on epicotyls length of *Arachis hypogaea* L. VarietyK6

Treatment	Length of epicotyls (cm) after seven days										Average
	1	2	3	4	5	6	7	8	9	10	
Control	6.5	6.2	5.1	6.5	5.9	6.2	6.4	5.5	5.2	6.4	6.03
25%	5.2	5.5	6.2	6.7	4.2	5.2	4.1	4.3	4.5	5.3	5.04
50%	5.4	4.9	3.2	4.3	4.1	3.1	5.2	3.7	4.2	3.8	4.16
75%	3.8	3.1	2.2	2.5	1.5	2.3	2.7	2.8	2.7	12.2	12.56
100%	-	-	-	-	-	-	-	-	-	-	-
Treated	6.7	6.8	5.2	6.3	6.4	5.3	6.7	6.1	5.3	5.4	6.02

Number of root branch if *Arachis hypogaea* was recorded after 7 days of seed sowing. The maximum root branches were observed in treated effluent (15.2), followed by 25 % concentration (13.9) of textile effluent compared to control. Number of root branch was highly decreased in 100% concentration of dye effluent compared to other doses (Table.5). Similarly, Number of root branches was reduced with increasing concentration of textile dye effluent.

Table 5: Effect of textile effluent on root branches of *Arachis hypogaea* L. Variety K6

Treatment	Root Branches										Average
	1	2	3	4	5	6	7	8	9	10	
Control	20	13	19	6	17	22	8	10	6	12	13.3
25%	16	13	18	10	12	14	13	12	14	16	13.9
50%	8	6	17	6	8	12	13	7	9	6	9.2
75%	8	6	7	9	10	5	4	6	8	7	7
100%	6	4	6	6	7	3	3	4	5	6	6
Treated	18	30	28	16	9	10	16	10	15	10	15.2

Fresh weight and dry weight of *Arachis hypogaea* was observed in after 7 days of seed sowing. Maximum fresh weight and dry weight were found in treated effluent (1.27 and 0.55) compared to control and other doses. The highest reduction of fresh weight was 100% effluent treatment (0.57gm) compared to control (1.26). The dry weight of seedlings was reduced with increased effluent concentrations (Table.6). Powel et al., [16] reported reduction in fresh weights of seedlings, while dry weights remained unaffected under the pollution stress [17].

Table 6: Effect of textile effluent on fresh weight and dry weight of Arachis *hypogaea* L. Variety K6

Treatment	Average of fresh weight (g)	Average of dry weight (g)
Control	1.26 ± 0.015	0.51 ±0.023
25%	1.25 ± 0. 021	0.41 ± 0.021
50%	0.80 ± 0.024	0.34 ± 0.015
75%	0.65 ± 0.017	0.31 ± 0.026
100%	0.57 ± 0.015	0.27 ± 0.019
Treated	1.27 ± 0.020	0.55 ± 0.016

The textile dye effluent was significantly decreased in amino acids and soluble proteins of ground nut except treated effluent. The highest value of amino acids was observed in treated effluent (83.62), followed by 25% (64.87), 50% (53.62), 75% (48.57) and 100% (26.75) except control. Similarly, the protein content was decreased in all concentration of dye effluent compared to control, followed by treated effluent (Table.7). Under the environmental stress conditions, the energy forming molecules may be disturbed and subsequently carbohydrates and protein metabolites of the membrane are altered [17]. The amount of carbohydrate, protein and total free amino acids were comparable with control, their amounts were increased in the 30% effluent treated seeds. Most of the enzymes were stimulated and their activity was found to be enhanced in the 30% effluent treated seeds [12].

Table 7: Effect of textile effluent on biochemical analysis of *Arachis hypogaea* L. Variety K6

Treatment	Amino acid (mg/g fresh weight)	Protein (mg/g fresh weight)
Control	105 ± 0.026	62.53 ± 0.016
25%	64.87 ± 0.021	35.67 ± 0.020
50%	53.62 ± 0.017	28.15 ± 0.015
75 %	48.57 ± 0.023	22.65 ± 0.027
100%	26.75 ± 0.015	16.74 ± 0.0 21
Treated	83.62 ± 0.023	40.89 ± 0.019

4. CONCLUSION

The textile dye of effluent on seed germination and seedling growth, protein and amino acids content of groundnut variety K6 is analysed in the present study. Distilled water is used as control and also used to make various dilution of the effluent. In this study control, 25%, 50%, 75%, 100% and treated effluent is used. Seed germination and seedling growth is superior in control followed by treated effluent. The effluent at lower dilution (25%) is also promising with respect of germination and growth of seedlings. Hundred percent effluent affected seedling germination, hypocotyls, and epicotyls length, biomass, protein and amino acids content. Hence this preliminary study proves the toxicity of dyeing industry effluent on groundnut. A further study is needed to confirm the effluent toxicity with more analyses.

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