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Research Article

Biometric analysis of selected Green Leafy Vegetables in fresh water, different concentrations of effluent and Biotreated effluent

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ABSTRACT

The Green Leafy Vegetables namely mustard, fenugreek, sirukeerai, araikeerai and agati were subjected to fresh water, different concentrations of effluent and biotreated effluent for 45 days and biometric analysis such as seed germination, root length and shoot length were measured. The percentage seed germination of all the GLVs in fresh water and biotreated effluent was above 90%. Both the fresh water and biotreated effluent treatments supported the germination of GLVs to the maximum. There was a significant increase in biotreated GLVs except *T.foenum* and *A.polygonoides* enhanced the root and shoot length to the maximum. The increasing concentrations of the effluent gradually decrease the average root length and shoot length.

Keywords: mustard, fenugreek, sirukeerai, araikeerai, agati, seed germination, root length, shoot length.

INTRODUCTION

Majority of water available on the earth is polluted and freshwater has become a scare commodity[3]. Water pollution caused by industrial effluent discharges has become an alarming trend with extreme toxicity to human health, to biological ecosystems which results in a shortened life expectancy[4]. More than 10,000 different textile dyes with an estimated annual production of $7x10^5$ metric tons are commercially available worldwide[2].The silk industry uses a lot of dyes generating about 3773 metric tons per annum (MTA) of hazardous waste of which only 3.25% is recyclable[7].The treatment prevailing are not adequate, so these dyes are given out as effluents to environment and remain for a long period of time. Recent research work has revealed the existence of wide variety of microorganisms capable of decolorizing wide range of dyes. The use of microorganisms for the removal of synthetic dyes from silk dyeing effluents offers considerable advantages which are relatively inexpensive, running low costs and the end products are completely mineralized with no toxicity[5]. So an attempt was carried out to analysis the effect of fresh water, different concentrations of effluent and biotreated effluent on seed germination, root length and shoot length of the selected Green Leafy Vegetables such as mustard (*Brassica juncea*), fenugreek (*Trigonella foenum*), sirukeerai (*Amaranthus polgonoides*), araikeerai (*Amaranthus tristis*) and agati (*Sesbania grandiflora*).

MATERIALS AND METHODS

2.1. Collection of Silk dyeing effluent

The silk dyeing effluent was collected from the effluent disposal site of small scale silk dyeing industry in airtight plastic containers, located at Seelanaickenpatti in Salem district and the technical details were also obtained.

2.2. Collection of Biofertilizers

The biofertilizer *Pseudomonas fluorescens* was collected from the Tamil Nadu Agricultural University, Coimbatore.

2.3. Soil preparation

The red soil and the sand were mixed at the ratio of 3:1. Each pot was filled with7 Kg of soil. In Phase I and Phase III, five GLVs were grown with four replicates. In phase II, 3 pots for each of the 4 different concentrations (25%, 50%, 75% and 100%) were used. The biofertilizer, *Pseudomonas fluorescens* was mixed at the rate of 5 Tonnes ha^{-1} with 75% of crude effluent and used in Phase III (Note: As the *T.foenum* plant did not grow in the highest concentrations (100%), the GLVs grown in 75% effluent were taken for the analyses). The bacterial concentration of the biofertilizer was 10^8 CFU ml^{-1} .

2.4. Collection of Seeds

Seeds of Mustard (*Brassica juncea*), Fenugreek (*Trigonella foenum*), Sirukeerai (*Amaranthus polygonoides*), Araikeerai (*Amaranthus tristis),* and Agati (*Sesbania grandiflora*) were collected from Superseeds Nursery, Coimbatore.

2.5.Layout treatments

The experiments were laid out with three replications for each of the five treatments in completely randomized block design.

GLVs grown in fresh water with normal conditions, different concentrations (25%, 50%, 75% and 100%) of the silk dyeing effluent, silk dyeing effluent treated with the biofertilizer (crude silk dyeing effluent treated with $12x10^7$ cells of *Pseudomonas fluorescens*/ ml.).

2.6. Seed sowing and maintenance of plants

About 20 seeds were sown in each pot and were allowed to germinate. Neem cake was mixed with water and poured around the pots as pest control. Fresh water, silk dyeing effluent of different concentration (25%, 50%, 75%, and 100%) and the silk dyeing effluent treated with *Pseudomonas fluorescens* have been used in Phase I, Phase II and Phase III respectively. After germination, 100% moisture condition was maintained throughout the study.

2.7. Harvest methodology

The plants were uprooted on the 45th day without any damage. The adhering soil particles were removed by washing gently with water and the water droplets were removed by blotting with the filter paper. Then these plants were subjected to analysis like biometric parameters as follows.

2.8. Biometric observations

2.8.1. Germination percentage

The seeds that germinated from 20 sown seeds were counted and the percentage germination was calculated.

2.8.2. Root length

The Root length was measured from the crown region of the plant to the tip of the root and expressed as cm per plant.

2.8.3. Shoot length

The Shoot length was measured from the point of first cotledonary node to the tip of the longest leaves and expressed as shoot length in cm per plant.

Results and Discussion

3.3.1 Effect of fresh water, different concentrations of effluent and biotreated effluent on seed germination of the selected GLVs

The percentage seed germination of the selected GLVs treated with fresh water, different concentrations of the effluent and biotreated effluent was presented in Figure 1.

The percentage seed germination of all the GLVs treated with different concentrations of silk dyeing effluent was found to be very low when compared to their germination in fresh water and biotreated effluent. Also the percentage of seed germination declined with the increasing concentrations of the effluent. Whereas the percentage seed germination of all the GLVs in fresh water and biotreated effluent was nearing or above 90%. So it is clear that both the treatments (fresh water and biotreated effluent supported the germination of GLVs to the maximum.

3.3.2. The root length and shoot length of the selected GLVs in fresh water, different concentrations of the effluent and biotreated effluent

The root length of the GLVs grown in fresh water, 25% - 100% effluent and biotreated effluent was illustrated in Figure 2.

Figure 3 explains the difference in shoot length of the GLVs subjected to various treatments.

As indicated above in figure 3, the root length of all the plants was affected significantly by the treatment with crude silk dyeing effluent. The maximum reduction in the root length of the selected GLVs was noticed in 100% effluent.

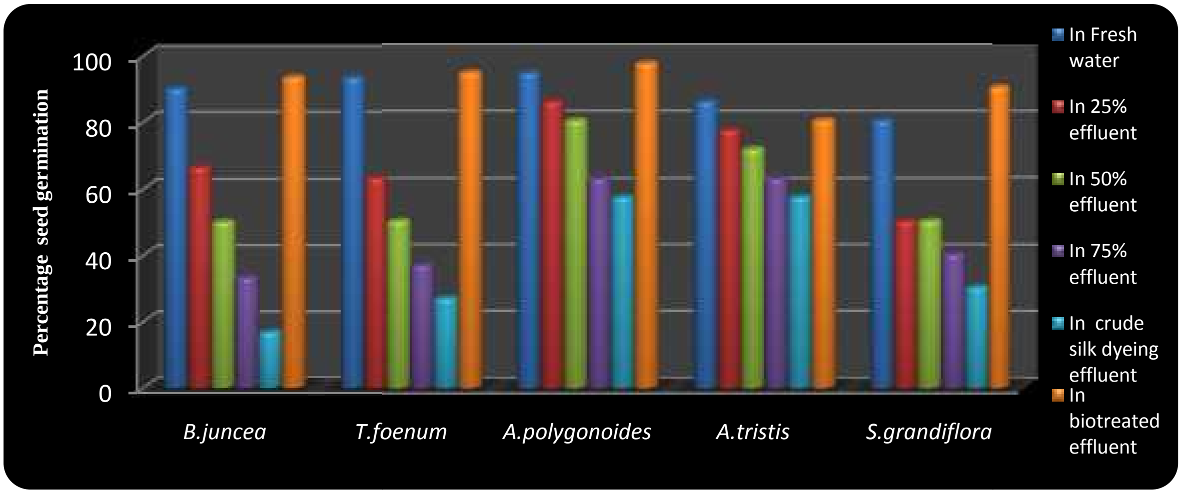

Figure 1
Seed germination of the selected GLVs

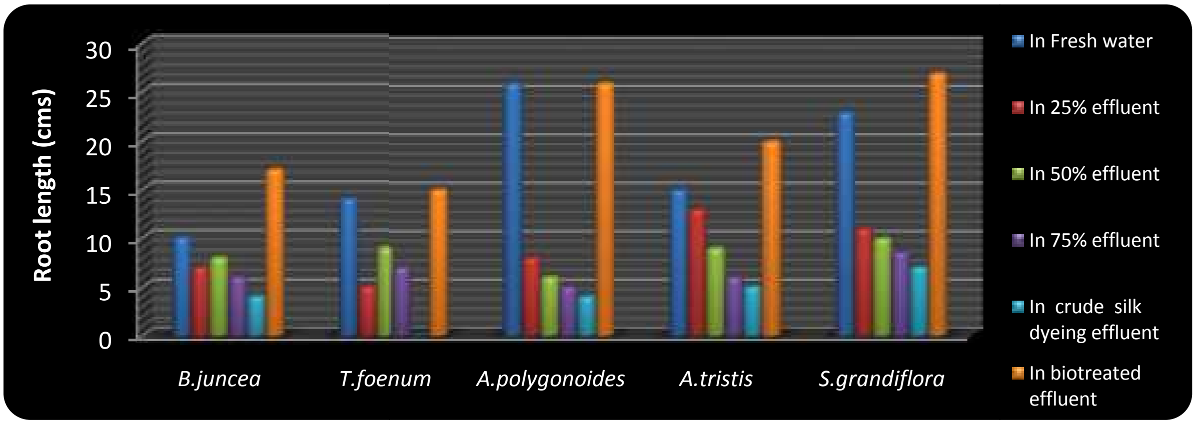

Figure 2
Root Length of the selected Green Leafy Vegetables in different treatments

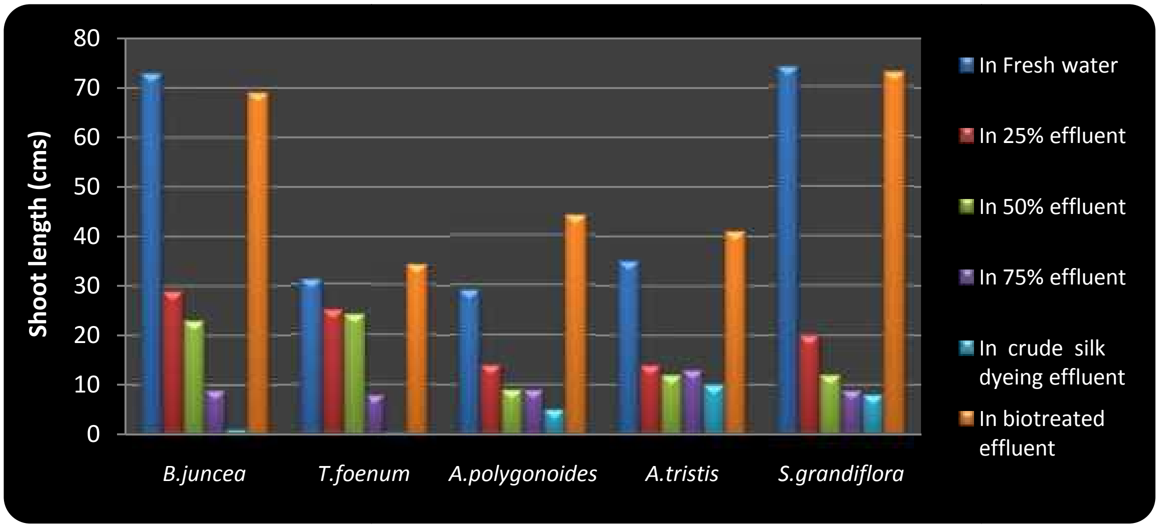

Figure 3
Shoot length of the selected GLVs as influenced by various treatments

The increasing concentrations of the effluent gradually decrease the average root length. The biotreated GLVs except *T.foenum* and *A.polygonoides* enhanced the root length to the maximum when compared to the GLVs grown in fresh water. The root length was reduced in 100% distillery effluent when compared to the control plant of *Vigna radiata*[9]. The significant difference in shoot length was noticed in control, effluent exposed and biotreated GLVs. There was a significant increase in the shoot length of *T.foenum*, *A.polygonoides* and *A.tristis* grown in biotreated effluent when compared to fresh water. Whereas the shoot length of the *B.juncea* and *S.grandiflora* did not differ very much between fresh water and biotreated effluent. The increase in effluent concentration was inversely proportional to the shoot length. The plant height of sorghum also showed that control had better plant height compared to treatment with different concentration of textile water 0, 25, 50, 75 and 100% because there was no stress of effluents[1]. Similar observations were obtained in sorghum plant treated with textile effluents till 12 weeks of its growth[6]. The root length and shoot length was affected drastically in 45 days of maize growth treated with 75 and 100% of brewery effluent[8]. Thus it was clear that the *Pseudomonas fluorescens* treated effluent was found to be effective when compared to the different concentrations of the effluent.

CONCLUSION

Overall, from the findings of this study it could be concluded that the selected GLVs grown in biotreated effluent had a better percentage seed germination, root length and shoot length compared to GLVs grown in fresh water. From the observations the increasing concentration of the silk dyeing effluent drastically affects the biometric parameters of the GLVs and the effluent which was biotreated counteracts its effect.

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