Study of Growth of *Vigna radiata* due to polluted water of Shiv Ganga

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Abstract- The present work is an attempt to analyse various morphological development of *Vigna radiata* due to the effect of Shiv ganga water of Deoghar, Jharkhand. Water is one of the most important natural resources without which life on earth cannot be imagined. Irrigation of agricultural lands about 70% of the water used worldwide. Water contains substances necessary for the metabolism and photosynthesis in plants, including micro and macro-nutrients. Future agricultural development strategies of most of these countries depend on the other possibility of water for irrigation, mainly waste water. Nutrients present in waste water directly influence the growth of plant. In the present study we have studied the plant growth and development of *Vigna radiata* due to the effect of Shiv ganga water. Because vermillion deposition done by pilgrims, which contain many heavy metals, through which Shiv ganga get polluted. We used different concentrations of sample to better understand their response towards specific morphological development of *Vigna radiate*. Maximum growth of most these morphologies were found at 40% sample concentration as compared to control. Nonetheless, 60% sample concentration contains optimum micro and micro-nutrients which are useful for better growth of *Vigna radiata*. Moreover, we found that growth of *Vigna radiata* first increased with increased in concentration and then decreased with increased in effluent concentrations. At higher concentrations (80% - 100%) development of crop is significantly diminished suggesting certain constituents in polluted water are present excess than their tolerance limit.

Index Terms- Development, Shiv ganga, Morphology, *Vigna radiata*, vermillion.

I. INTRODUCTION

Water is one of the most important natural resources without which life on earth/planet cannot be imagined. We depend upon water for drinking, washing, bathing, irrigation, industries, domestic needs, farming, shipping, sanitation, and disposal wastages. Water bodies like ponds, rivers, impoundment, lakes etc came being in different ways and at different times. Heavy metals pollution is a wide spread problem in all parts of the world and it present in higher amounts these element are highly toxic and harmful for all organism. (Nagajyoti, Lee et al. 2010). Microorganism could be used for migration of different types of heavy metal pollutants through the process of bioremediation(Chibuike and Obiora 2014).The comparative studies of Central Pollution Control Board of India (CPCB) on wastewater generation, collection and treatment indicates that the quantity has increased from 7,007 million liters day"'(ML/d) in 1978-79 to 16,622 ML/d in 1994-95 in class I cities. However, the treatment capacity has increased only from 2755.94 ML/d in 1978-79 to 4037.20ML/d in 1994-95. Nowadays wastewater is frequently use in irrigation to decrease the pollution level.(Hussain, Raschid et al. 2002; Khaleel, Ismail et al. 2013). Wastewater is full of nutrients required for crop growth. So can be used as liquid fertilizer, by this way cost of fertilized can be reduced. For improvement of plant growth artificial fertilizers are used which provide essential nutrients.(Liu, Ren et al. 2011; Liu, Sung et al. 2014) (Hussain, Raschid et al. 2002; Khaleel, Ismail et al. 2013). Moreover, use of fertilizer increase the rate of crop production. Artificial fertilizer inhibits soil fertility when used in larger amount. (Savci 2012; Savci 2012). One of the main reasons of water pollution in India is near holy place. In present work the area of investigation is Deoghar, which is a holy city located in Jharkhand state. Here in the month of Sawan (June to July) millions of pilgrims used to came due to Baidyanathdham temple. Near the temple there is a holy river called Shive Ganga which is get polluted due to excessive discharge of sindur (Vermilion) and other discharge of pollutant by pilgrims. One of the most advantageous factors behind the use of wastewater in irrigation is the presence of desirable nutrients (Hussain, Raschid et al. 2002). However, types of nutrients and their requirement substantially differ for specific crop developmental growth (Hanchang 2009; Rana, Singh et al. 2014).

Moreover, type of wastewater which depends on the strategies used while treatment of wastewater such as untreated or partially treated, also affect the concentration of nutrients (Chauhan 2016). Despite important nutrients, wastewater also contains several undesirable components which often toxic for plant growth. It has been reported that certain micro and macro-nutrients at lower concentration is beneficial however their higher concentration is lethal for crop growth (Yadav 2010; Barakat 2011; Chibuike and Obiora 2014; Yu, Li et al. 2014). In this study we have investigated the effect of Shiv ganga on different morphological development of *Vigna radiata*. We examined their different concentrations (0% - 100%) effect on various developmental stages of *Vigna radiata*.

MATERIALS AND METHODS

Shiv Ganga Shiv Ganga water was collected at regular interval of four months from the Deoghar Jharkhand, India. Different concentrations 0%, 20%, 40%, 60%, 80% and 100%.of sample were prepared with distilled water. Distilled water was used as

control (0%) and 100%Shiv Ganga water concentration was used as crude. To study the effect of Shiv Ganga water sample concentrations on growth of different morphologies of *Vigna radiata* pot study experiment was done. After post flowering stage different morphologies such as and were analyzed. Quadruplicate pots study were done. Meter scales were use to measure the length and width of respective morphologies and the number was counted and scored. All data were expressed with mean values and the corresponding standard deviations (SD).

Table 1. Study of growth of different parts of *Vigna radiate* at different concentrations of Shiv ganga water sample.

Shiv ganga water sample concentration	Plant length (cm)	Root length (cm)	Total number of stem	Total number of branch	Total number of nodule	Total number of flower
0%	24.04 ± 1.16	14.14±1.08	2	5	5	2
20%	21.14 ± 1.4	9.60±08.02	4	6	6	5
40%	24.67± 1.96	9.26 ± 0.5	3	7	8	3
60%	19.65± 1.82	4.94 ± 0.71	3	8	6	6
80%	13.5 ± 0.50	3.04 ± 0.63	1	6	7	2
100%	9.47 ± 1.01	2.96 ± 0.86	1	2	6	1

I. RESULTS

To study the specific response of different concentrations of Shiv Ganga polluted water we systematically examined the several morphological development of plant. We examined the effect of different sample concentrations (0%, 20%, 40%, 60%, 80% and 100%) on the length of root and shoot, total number of nodule, stem, branch, leaf , flower and length and width of leaf. After post flowering stage all the morphologies were examined.

Plant length: Whole length of plant was found maximum at 40% sample concentration (24.67cm) and it was found to be similar at control (24.04 cm) (table 1). Moreover, plant length was higher at 20% and 60%, as 21.14 cm and 19.65 respectively. Length decreased at 80% and 100% concentrations as compared to control as 13.5 cm and 9.47 cm. The pattern of plant growth at various concentrations represent 0% and 40% concentrations are optimum and all other concentrations can decrease the plant length.

Root length: Results show that at different concentrations of water sample length of root were different. The length of root was decreased at higher tested concentrations and maximum length of root was found to be 9.60 cm at 20% concentration of sample (table 1). Moreover length of root was 9.26 at 40%, 4.94 at 60%, 3.04 at 80% and 2.96 cm at 100% effluent concentrations. According to result 20% - 60% effluent concentrations are suitable for root development and higher concentrations (80% - 100%) of sample water decreased the root development as compared to control.

Total number stem: Results show that total number of stem increased at 20% concentration as compared to the control (table 1). The total number of nodules was 4 at 20% concentration and 2 at control. However stem number decreased with increased in concentration. At 40% effluent concentration number of stem was same as 60% control and that was 3. At 80% effluent concentration number of stem was same 100% concentration it remain 1.

Total number of branch: Development of branch was found maximum at 60% concentration (table 1). At 60% concentration total 8 branches were developed however total number of branch was 5 at control. We found that number of branch initially increased with increased in the concentrations. Moreover the number of branches was similar 6 at 20% and 80% concentration. The total number of branch was 7 at 40% concentrations. However their development further decreased at 100% concentration become 2. The obtained result suggesting that 60% concentrations are more beneficial for branch growth compared to control.

Total number of nodules: Results show that number of nodule maximum at 40% concentration (table1). The number of nodule at 40% concentration was 8. However the number of nodule was similar 6 at 20%, 60% and 100% concentration.. Total number of nodule was 7 at 80%. However it was 5 at control. Effect of water sample on number of nodule was minor as compared to root and shoot development.

Total number of flower: Development of flower was found maximum at 60% concentration. At 60% concentration total 6 flowers was developed (table 1). However total number of flowers was similar 2 at control and 80% concentration. We found that number of flower decreased gradually with increased in the concentrations. The total number of flower was 5, 3 and 1 at 20%, 40% and 100% concentrations respectively. The obtained result suggesting that 20% to 60% concentrations are more beneficial for flower development as compared to control.

Total number of leaf: Growth of leaf of *Vigna radiate* most briefly explained the effect of water. Results show that the maximum number of leaves was at 60% and 20% concentration (table 2). The total number of leaves was 50 at 60% and 49 at 20% concentration. However number of leaf was 35 at control and increased gradually with increased in the concentrations till 60%. The total number of leaf was 46 at 40% concentration. However it gradually decreased 43 and 16 at 80% and 100% concentrations respectively. These results indicate that 20% to 60% concentrations are suitable for leaf development as

compared to control. However use of crude sample 100% concentrated sample can inhibit the leaf development.

Leaf length: Effect of water sample on leaf growth (length and width) was not following the sample pattern as root and shoot development. However maximum length of leaves were found to be at 80% and 100% as compared to control and other tested sample concentrations (table 2). The length of leaves at 80% and 100% sample concentration were 9.19 and 8.38 cm respectively. Though the length of leaves was decreased at 20% and 40% concentration as 4.34 and 4.31 respectively. It almost remains similar at control and 60% concentration. The length at control and 60% concentrations were 7.7 and 7.02 respectively.

Leaf width: Effect of water sample on leaf width was following the sample pattern as root and shoot development. However maximum length of leaves was found to be 9.93 cm at 60% concentration (table 2). After that the width of leaves gradually decreased at 80% and 100% sample concentration as 8.47 and 7.83 cm respectively. Though the width of leaves were almost remains similar at control, 20% and 40% concentration as 7.76 cm, 7.75 cm and 7.84 cm respectively. The obtained result suggesting that there is no correlation between the growth of length of leaf and width of leaf.

Table 2. . Study of leaf growth of *Vigna radiate* at different concentrations of Shiv ganga water sample.

Shiv ganga water sample Concentration	Total number of leaf	Leaf length (cm)	Leaf width (cm)
0%	35	7.7 ± 0.23	7.76 ± 0.32
20%	49	4.34 ± 0.41	7.75± 0.38
40%	46	4.31± 0.27	7.84± 0.21
60%	50	7.02± 0.17	9.93± 0.48
80%	43	9.19 ± 0. 21	8.47± 0.49
100%	16	8.38± 0.51	7.83± 0.43

DISCUSSION

In the present study we have studied the plant growth and development of *Vigna radiata* due to the effect of Shiv ganga water . Shiv Ganga river flow region is in Deoghar, Jharkhand and in nearby area its water is used in agriculture. The water quality used for irrigation is essential for the yield and quantity of crops, maintenance of soil productivity, and protection of the environment. Water is full of nutrients required for crop growth. So can be used as liquid fertilizer, by this way cost of fertilized can be reduced. Future agricultural development strategies of most of these countries depend on the possibility to maintain, improve and expand irrigated agriculture. Though, this strategy is beneficial for certain crop. Although optimum concentration which can be used in irrigation for specific plant such as *Vigna radiate* have to be investigated. We used different concentrations of sample to better understand their response towards specific morphological development of *Vigna radiata*. We grow the plant in the presence of different concentrations of sample (0%, 20%, 40%, 60%, 80%,100%). Moreover, analysis of suitable concentration Shiv Ganga water sample for better crop growth could economize the agriculture methods. We analyzed the effect of water sample on length of root and shoot, length- width of leaf. We calculated total number of nodule, stem, branch, leaf and flower after post flowering stage. Maximum growth of all these morphologies was found at 40% sample concentration as compared to control. Moreover, we found that development first increased with increased in concentration and then decreased with increased in effluent concentrations. Among all tested dilution the optimum concentrations of water sample were found to be 20% to 40% for root, shoot, leaf and nodule. For stem the optimum concentrations of water sample were found 20%. For branch, flower and leaf the optimum concentrations of water sample were found 20% to 60%. These results indicating that highest concentration contain excess nutrients or heavy metals which possibly inhibit the proper growth of different parts of plant of *Vigna radiata*. Thus, their lower concentrations are not sufficient to provide required amount of nutrient. Mid concentration are important and optimum for plant growth. Moreover their qualitative and quantitative analysis and investigation of their effect on different morphological parameters will be useful to select the optimum concentration of Shiv ganga water use in irrigation. Though, higher concentrations can lead to declination in the plant growth. Several studies have reported the toxic effects of excess nutrients and heavy metals on plant growth (Yadav 2010; Barakat 2011; Chibuike and Obiora 2014; Yu, Li et al. 2014) . Physico-chemical analysis will be required to investigate the presence of specific nutrients and heavy metals in Shiv ganga water sample.

ACKNOWLEDGMENT

Authors acknowledge whole Botany department and especially Head of department, University department of Botany, Ranchi University, Jharkhand, India.

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