EFFECT OF DOMESTIC EFFLUENT IN RIVER GANGA, WEST BENGAL ON THE MORPHOLOGICAL AND BIOCHEMICAL PARAMETERS OF MUNG BEAN (*VIGNA RADIATA*)

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Abstract: A significant amount of untreated waste enters into the river in daily basis. An extensive analysis of waste water from selected outfalls in river Ganga in Howrah district, West Bengal, India was performed. The presence of enormous microbial mass including total coliform maximum 2.7 x 10^{7}/ 100 ml was reported. The effect of such waste water on selected plant like Mung bean (*Vigna radiata*) was observed. The inhibition in morphological growth along with biochemical parameters like chlorophyll and protein content was reported in the selected plant. Protein content was decreased more than 50% after 7 days of interval whereas Chlorophyll content was decreased up to 70%. The changes of their morphological parameters along with their changes in root length, stem length, leaf length, leaf width, petiole length, internodal distance were observed. The negative impact of those untreated wastewater on ecosystem is very alarming.

Keywords: Biochemical parameters, Coliform, Morphological growth, Mung bean, Waste water.

Introduction: A study on river Ganga shows the river is subjected to multiple uses like irrigation, bathing, disposal of sewage and industrial effluents [**1**]. Increase of human population, industrialization, use of fertilizers and man-made activity are responsible for polluting river water [**2**]. More than half of India's river and other surface water bodies are significantly polluted [**3**]. It is necessary that the quality of drinking water should be checked at regular time interval. Due to contaminated drinking water, human population suffers from varied of water borne diseases [**2**]. A questionnaire-based survey among resident users of the Ganges River in Varanasi shows the overall rate of water-borne/enteric disease incidence, including acute gastrointestinal disease, cholera, dysentery, hepatitis-A, and typhoid, was estimated to be about 66% during the one-year period prior to the survey [**4**]. The effect of wastewater on agriculture shows the chance of increasing insect attacks, diseases and excessive weed problem. The long term exposure of this water stimulates crop growth rapidly but it reduces grain production dramatically even its excess use can lead to crop damage [**5**].

The study aims to analyse waste water from three selected domestic outfalls in Howrah and 24 PGS (N) District, West Bengal. The effect of domestic effluent in River Ganga, West Bengal on the Morphological and Biochemical Parameters of Mung bean (*Vigna radiata*).

Study Area: Sampling was done from three selected outfalls in River Ganga in Howrah and 24 PGS (N) District, West Bengal i.e., Dewangaji, Bally, Rashbari Ghat, Belur and Dakshineswar.

Materials and Methods: The wastewater sample from different outfalls of River Ganga had been collected for their physical, chemical and biological analysis purposes [**6**]. It was done very carefully to avoid contamination. The sterile containers made up of glass and polyethylene was used to avoid interaction with analytical parameters. To minimize potential for volatilization and biodegradation between sampling and analysis, the samples were taken to the laboratory immediately and stored at 4°C.

Morphological parameters like stem length, leaf length, leaf width, petiole length and intermodal distance were recorded on the basis of treatment. The estimation of Chlorophyll [7] Protein [8] was performed.

Results and Discussions: According to Central Pollution Control Board (CPCB), the permissible limit of DO for outdoor bathing is minimum 5.0 mg/L, for conductivity it is 1000 mS/cm at 25°C, for chloride in Inland surface water is 250 mg/L when this water is used as drinking water without conventional treatment but after disinfection. Again for Iron (as Fe) in Inland surface water is 0.3 mg/L and for soluble phosphate (as P) is 5 mg/L. According to the study [Table I] zero dissolved oxygen was found at Dakshineswar. Conductivity of water was found the highest in Dakshineswar. The value of Chloride was found within range in all outfalls. For iron the values obtained in all outfalls were much greater than permissible limit. The value of phosphate as P_2O_5 was varied from 20 mg/L to 31 mg/L.

Table I: Physico-chemical parameters of different outfalls

Sl. No.	Site Name	pH	Temp (^{o}C)	DO (mg/L)	Conductivity $25^{0}C$ (mS/cm)	BOD (mg/L)	Nitrate Nitrogen (mg/L)	Chloride (mg/L)	Hardness (mg/L)	Iron (mg/L)	Phosphate (mg/L)
1	Dakshineswar, 24 PGS(N)	6.6	29.5	0	1768	7	17.49	158.32	286	132.5	27
2	Dewangaji, Bally, Howrah	7.0	29.5	4.4	570	6	33.66	55.43	184.8	320	20
3	RashbariGhat, Belur, Howrah	6.9	29	5.45	951	3.8	25.76	93.59	290	210	31

Table II: Coliform count of different outfalls

Sampling Area	Total Coliform Count, MPN/100 mL	Fecal Coliform, MPN/100 mL
Dakshineswar, 24 PGS(N)	2.7×10^{7}	4.1×10^{6}
Dewangaji, Bally, Howrah	2.1×10^{7}	3.7×10^{6}
RashbariGhat, Belur, Howrah	1.4×10^{7}	3.8×10^{6}

Number of Total Coliform and Fecal Coliform in outfalls play an important role to know inland surface water pollution. According to Central Pollution Control Board (CPCB), Number of Total Coliform (MPN/100 ml) may not exceed 500 for outdoor bathing. Maximum number of Total Coliform and Fecal Coliform were found at Dakshineswar [Table II]. Huge number of Total Coliform and Fecal Coliform was found in all outfalls. This indicated that all the outfalls contributed lots of Total Coliforms and Fecal Coliforms in River Ganga.

On the basis of this analysis, waste water from Dakshineswar had been used for the further studies.

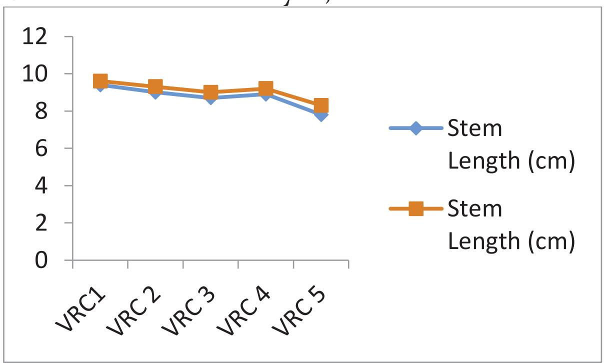

Fig 1: The changes of stem length of *Vigna radiata* in Control

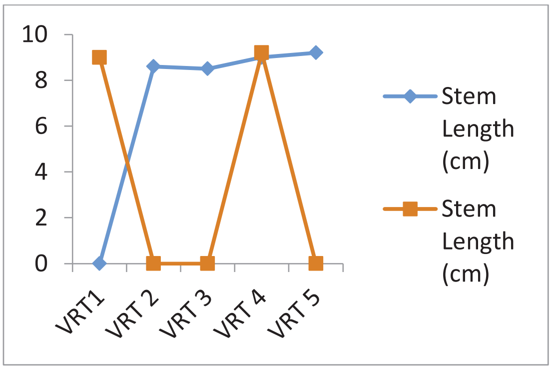

Fig 2: The changes of stem length of *Vigna radiata* before and after wastewater treatment

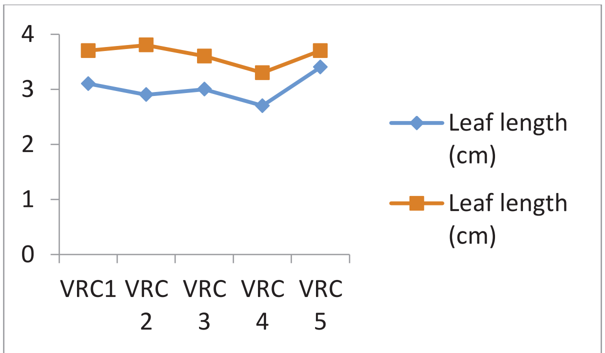

Fig 3:The changes of leaf length of *Vigna radiata* in Control

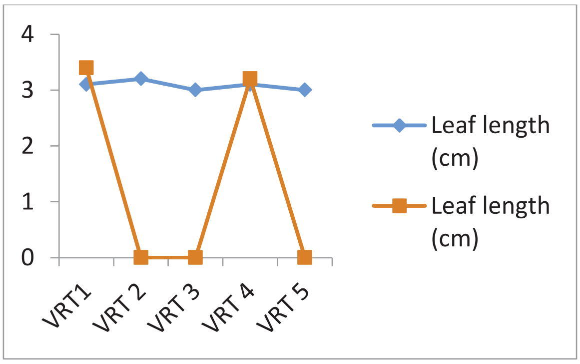

Fig 4: The changes of leaf length of *Vigna radiata* before and after wastewater treatment

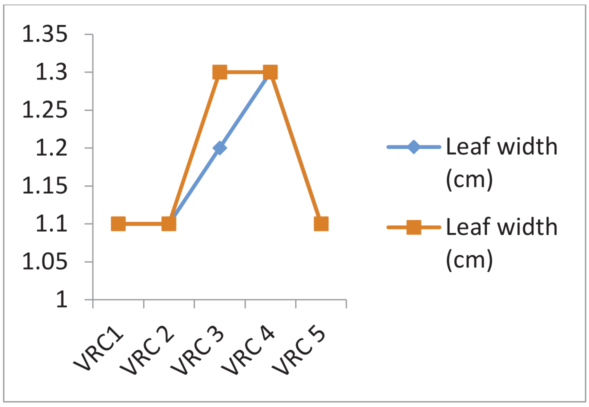

Fig 5: The changes of leaf width of *Vignaradiata* in Control

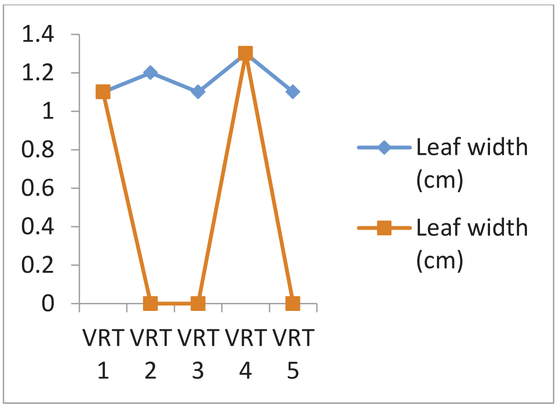

Fig 6: The changes of stem leaf width of *Vignaradiata* before and after wastewater treatment

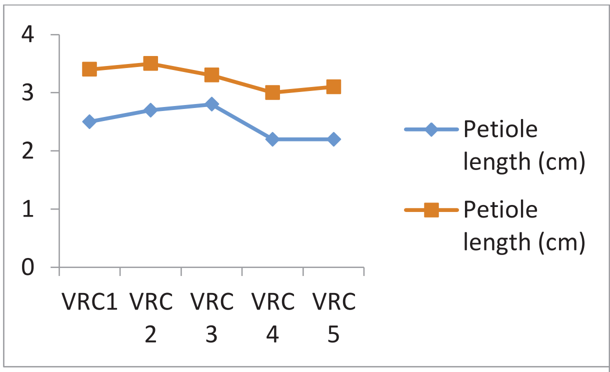

Fig 7:The changes of petiole length of *Vigna radiata* in Control

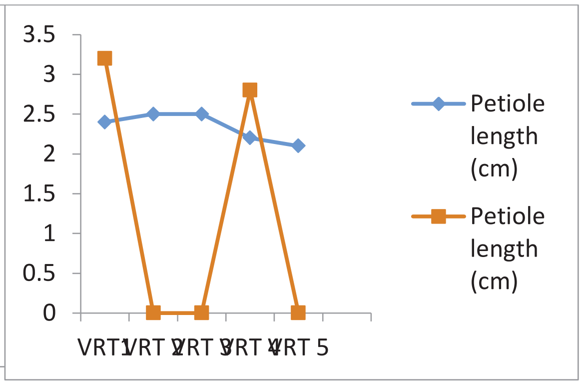

Fig 8: The changes of petiole length of *Vignaradiata* before and after wastewater treatment

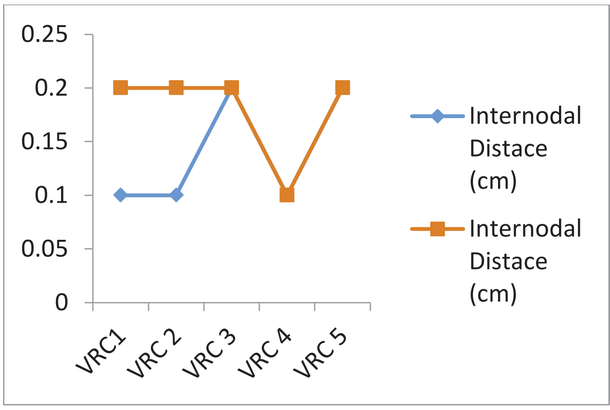

Fig 9:The changes of Internodal Distance of *Vigna radiata* in Control

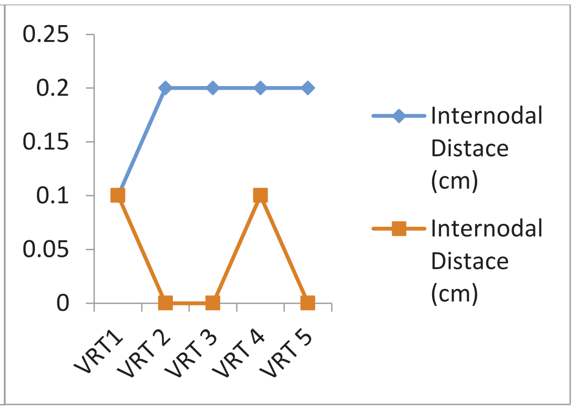

Fig 10: The changes of Internodal distance of *Vigna radiata* before and after wastewater treatment

A significant effect of wastewater on *Vigna radiate* has been observed. The plants which were treated with tap water showed better growth pattern than where waste water was used [Fig 1-10]. Data showed on second day of the treatment one among five of the test plants was died. The decrease of leaf length, leaf width, stem length, petiole length and internodal distance were observed in each case. The harmful effect of wastewater on plants was clearly noticed.

Table III: Reduction of Chlorophyll and Protein content before and after treatment

	Chlorophyll Content		
	Time after treatment days	% of Reduction in Control	% of Reduction in Test
Vigna radiata	0	0	0
	7	40%	70%
	Protein Content		
	0	0	0
	7	20%	50%

The sharp reduction of chlorophyll and protein content had been observed when the plant species were treated with wastewater [Table III].

Conclusion: After thirty years of launching the first phase of Ganga Action Plan, the status of River Ganga is still at a risk. A significant amount of untreated waste enters into the river in daily basis. The accumulation of microbial density as well as other aquatic pollutants should be a matter of great concern. With waste full water of Ganga, the morphological parameters and biochemical parameters of selected plant spices are very much subjected under stress.

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