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ARTICLE

PHYTOTOXIC EFFECT OF POLLUTED WATER OF PARVATHY PUTHANAR ON GERMINATION OF *PISUM SATIVUM* VAR. *BUBLI*

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Abstract

Pollution is one of the major environmental problems due to the rapid industrialization and the failure to adopt available effluent treatment techniques. Many pollutants contaminate the soil due to the disposal of domestic sewage and industrial effluents. Due to the dumping of domestic waste, urban waste etc. on ground, water bodies and canals are increasingly gets contaminated. The present attempt is to analyze the toxic heavy metals in Parvathy puthanar, an artificial river canal in Kerala and its impact on nearby ground water. This study also aimed to evaluate the phytotoxic nature of polluted water on Pisum sativum (bubli variety). This study reveals that the water in the canal is highly polluted due to wide spheres of human activities, industrial proliferations etc. Germination study proves that percentage of germination increases at low effluent concentrations and it became a delayed process in high effluent concentrations. So high concentration of effluent used in the present study had an adverse effect on plant germination and growth.

Keywords: Parvathy puthanar, heavy metals, germination percentage, *Pisum sativum*

Introduction

Parvathy Puthanar, an artificially created river canal in Travancore era for commercial waterways. Now it stands still as a carpet of water hyacinth, with its water black as depth. The major problem is that drains from most of the houses and other industries here open to Parvathy Puthanar. For a present day Trivandrum, this canal is synonymous with pollution, a portal for disposal of communicable diseases and as end point for the raw sewage and wastes to the city. From some houses, septic tanks are directly connected to this canal with no humanity. So the water turns as black as soot, smells rotten, flow stagnated and the ecosystem consisting of rats, weeds, parasites, microbes. This canal also threatens the quality of nearby ground water. The physico-chemical analysis of water samples from the canal and ground water from nearby area can be selected for this study.

Materials and Methods

Water sample collection and analysis of heavy metals

Six representative stations fixed in the canal for regular monitoring for collecting data. Water samples from the sampling sites belonging to canal and adjacent ground water were collected and analyzed for various heavy metal concentration. Nickel (Ni), Cadmium (Cd), Lead (Pb), and Fluoride (F) were analyzed using Atomic Absorption spectroscopy.

Pretreatment of seeds

Certified and sterilized seeds of Pisum sativum (Bubli) were taken for presoaking treatments in different concentrations of effluent (25%, 50%, 75%, 100%). Distilled water taken as control. The seeds were surface sterilized using 0.01% mercuric chloride solution for 2 minutes and wash thoroughly in distilled water for 3 times and air dried. Different concentration of effluent was placed by diluting it with double distilled water. During presoaking the bottles were shaken at regular intervals and kept open for some time to prevent anaerobic respiration. The seeds spread in blotting paper and air dry in 3 days. Finally the seeds dried almost to their original weights. After this 10 ml of distilled water taken in petriplate and pretreated seeds placed on them. Pretreated seeds in double distilled water taken as control. After 24 hours the germination percentage can be calculated.

Results and Discussion

The results of heavy metal analysis are given in table 1.

Fluoride concentration is very high in all sites. High Nickel content seen in Station 1. The result clearly shows that not only the canal water, but also the nearby ground water sources are highly contaminated with toxic heavy metals.

During germination the embryo axis and the cotyle-

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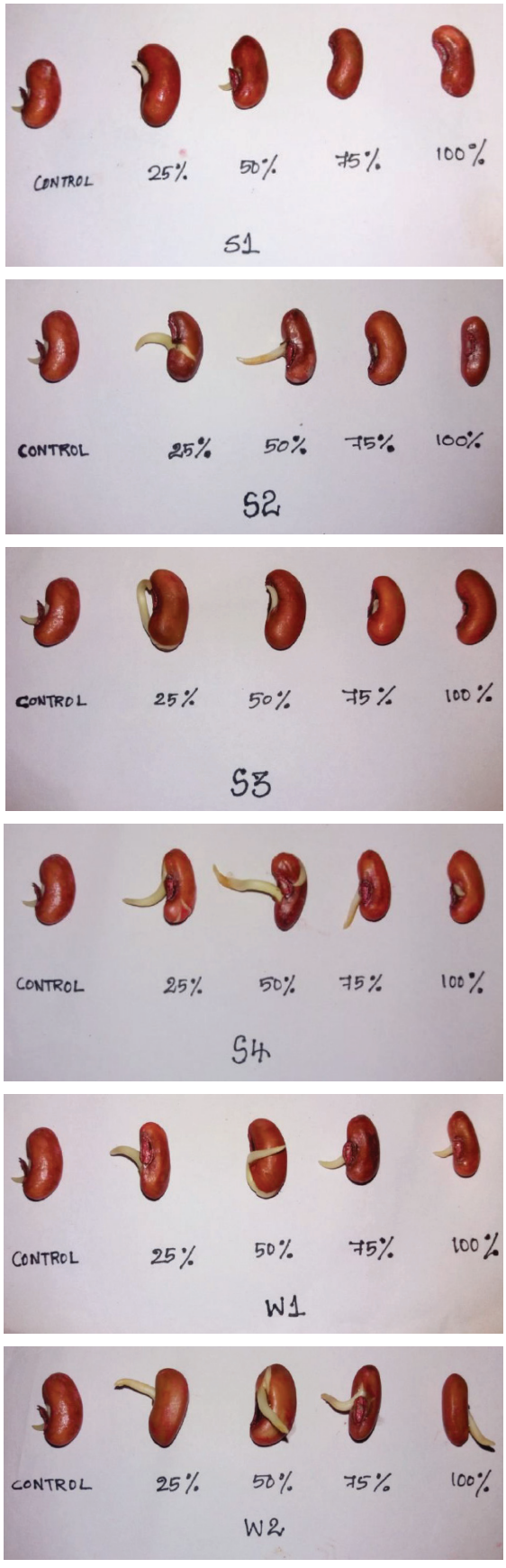

Figure 1 - Plates showing germination of *Pisum sativum* in various water samples and different concentrations vs control

Table 1. Heavy metal analysis of water samples

Sampling sites	Ni (µg/L)	Cd(µg/L)	Pb(µg/L)	F(µg/L)
S1 (Karikkakom bridge)	3.8	0.1	2.0	210
S2 (near airport)	2.7	0.1	1.2	355
S3 (Vayyamoola)	3.2	0.25	2.5	377
S4 (Vallakadavu)	2.6	0.1	1.3	256
W1 (well water)	2.9	0.1	2.4	314
W2(well water)	2.0	0.1	1.7	297

dons absorb water from the medium. After 24 hours the germination percentage decreases when the concentration of effluent in the medium increases. Various metals, salts present in the effluent prevent the uptake of water by the seeds. That is, a stress created in the seeds placed in high effluent concentration. In high concentration delay in seed germination was also observed. This may be due to the high salt concentration which prevents osmosis. In low effluent concentration there is a rise in germination percentage because small amount of nutrients present in that water. This finding supports the work of Agarwal et. Al. (1980), Mishra (1988). In high concentration the germination became a delayed process due to the high level of Total dissolved solids, presence of heavy metals, toxic chemicals etc.

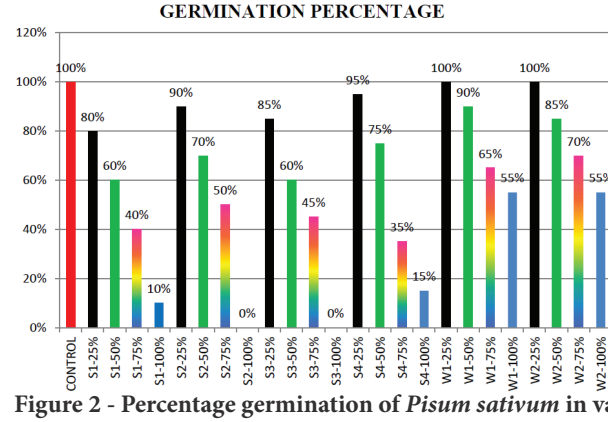

Figure 2 - Percentage germination of *Pisum sativum* in various water samples and different concentrations vs control

Conclusion

Data collected on various Physico-chemical factors indicate that the river has been deteriorated at downstream due to the continuous discharge of effluents in addition to the domestic waste pollution. Heavy metals such as Cadmium, Lead, Manganese exceeds the limit set by WHO (1985) and higher desirable limit set by ISI (1984). As concentration of effluent increases the seeds fail to germinate. The present analysis indicates that infiltration of contaminated water in

the canal leads to pollution of nearby ground water. High level of toxic heavy metals like fluoride present in both canal water and well samples. This may lead to health hazards to local people. So certain remedial measures must be taken for the conservation and sustainable management of the canal.

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