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THE MORPHOLOGICAL AND BIOCHEMICAL FOLIAR STUDY OF TRIGONELLA FOENUM-GRAECUM L. GROWING NEAR RAILWAY LINE IN MUMBAI SUBURBAN

Botany

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ABSTRACT

Plants are used medicinally and are a source of many potent drugs. The plant Trigonella foenum-greacum belongs to the family Leguminosae and is the third-largest family among flowering plants. The present research reveals the leaves of the same plant belonging to the same species are being affected environmentally and still grow under such conditions. The leaves of both sites were collected in polythene bags in the summer and studied for Anatomical, micromorphological, and biochemical parameters. The micromorphology was studied by the epidermal peeling method. Biochemical parameters selected for foliar studies were, chlorophyll a, Chlorophyll b, Total Chlorophyll, and proline. In contrast to experimental plants leaves control plant's leaves had significantly less Chlorophyll and Proline content. The results of the present study reveal that the leaves belonging to a species are being exposed to environmental stress due to plantation along railway lines in contaminated sewage water.

KEYWORDS

Trigonella foenum greacum L., micromorphological and biochemical parameters, Railway line, sewage water.

INTRODUCTION

India is an agricultural nation. Nearly 72% of the entire population relies on agriculture for a living. Most of the vegetables and other crops are produced and consumed in various regions of India, and a significant portion of them are exported to other countries worldwide. This concept of growing vegetables alongside railway tracks is gaining popularity because there isn't adequate space for vegetable production, which may be due to construction activities, other development projects, land degradation from overuse of agriculture, climate change causing drought conditions, etc.

The water source for this particular form of agricultural activity is sewage water, where effluents from domestic and water drainage pipelines may leak out and contaminate the ground, soil, and vegetables. If consumed, this contamination may also endanger the consumer's health in the near or distant future. (P. P. Doshi, R. A. Zele, 2014)

The plants are more affected by environmental pollutants since the plants are directly exposed to them for the maximum of their life span. This causes toxic effects on the plants. It's been observed that the environmental pollutants have increased rapidly in India, affecting this country's different plant species. It has been observed that, there was a difference in the behavior of the plants depending on their exposure to different climatic conditions. Thus, the same plants growing in minimally polluted rural areas exhibit different properties as compared to those growing in highly polluted railway areas.

Environmental pollution is caused by vehicular emissions consisting of gases such as CO_2, CO, NO_2 and SO_2. Plants are grown in such a polluted atmosphere the absorption of such toxic gases will cause both genetic and physiological changes. The genetic changes will be in the form of mutations affecting the normal development of the plant and even affecting the biochemical pathways. Thus, the overall development and behavior of the plant will be affected due to the polluted environment.

When pollution in the air or water contaminates the plants from which herbal drugs are derived, they affect both plant physiology and biochemical characteristics. Plants exposed to pollution stress show changes in the production of secondary metabolites. High levels of contamination in medicinal or other plants may either suppress or uncontrollably increase secondary metabolite production thereby affecting the production of the biochemicals.

These different physiological and biochemical modifications taking place within a plant can be reflected by performing a phytochemical analysis. This can be done by performing a comparative analysis of the plants obtained from unpolluted and polluted regions. The analysis will include the observation of the biochemical changes in the plants of both these categories. (Ankita, 2014)

The desired plant of consideration is Trigonella foenum-graecum belongs to the family Leguminosae, the family Leguminosae (Fabaceae) commonly known as the legume or bean family is the third largest family among the flowering plants which is represented by 19,500 species under 770 genera. (Subhajit, 2018)

It has been used as medicine for the treatment of wounds, abscesses, arthritis, bronchitis, and digestive disorders, etc since the oldest time. It is also eaten in winter to improve immunity and protects the heart, brain, and other vital organs of the body through its medicinal properties. (Prajapati, 2014)

The plant has been observed from two different areas that are unpolluted and polluted areas. The present work is a small effort towards comparing and observing plant species in different locations, with the help of morphological and biochemical studies and the impact of environmental conditions on Trigonella foenum-graecum. It also marks how the environment plays a significant role in taxonomy and rages with its constituents.

MATERIALS & METHODS

For the present study, two sites were selected Experimental and control field site. The Railway station, Kandivali-Malad experimental location was chosen because it was a busy building site. As the control location, Umbar Pada Nandade, Saphale was chosen.

Leaves of the plant Trigonella foenum greacum L. were collected in polythene bags from both sites in summer and studied for Anatomical, micromorphological and biochemical parameters. The Anatomy of T.S of the leaf was studied. The micromorphological parameters selected for foliar studies were the stomatal index. Micromorphology was studied by the epidermal peeling method. Biochemical parameters selected for foliar studies were, chlorophyll a, chlorophyll b, total chlorophyll, (Arnon's method, 1949), and proline (Sadasivam and Manickam,1996). Acid extract preparation for detecting Iron content, Calcium content, and magnesium content (Walkely's method).

RESULT

When compared to the stomatal index of leaves of Trigonella foenum greacum from two different sites control and experimental sites that are unpolluted and polluted respectively, exhibited the standard deviation of both the regions is nearly the same and they belong to the same species (Table 1).

A high amount of proline content was observed in the leaves of the Trigonella foenum greacum experimental site. (Table 2) It is directed

that it grows under stressed conditions. Due to this, the pathways for the production of these compounds are activated in plants exposed to environmental pollution.

Chlorophyll in polluted (2.5215± 0.05397) is seen more than in the unpolluted region (1.6578 ± 0.05310) (Table 2). Control plant leaves had significantly less chlorophyll a, chlorophyll b, and total chlorophyll.

Iron, calcium, and magnesium estimation are a few other small components that have been studied in the lab. Iron and Magnesium content is found to be significantly low in the Trigonella foenum greacum leaves of the Experimental site. (Table 2). The amount of calcium is high in the leaves of the experimental location (32.058 ± 3.2726) and low (24.05 ± 3.2742) in the leaves of the control location.

Table1: Micromorphological Observations- Upper and Lower Epidermis of Trigonella foenum greacum

SR.NO	PARAMETERS	CONTROL	EXPERIMENTAL
STOMATAL INDEX			
i.	UPPER EPIDERMIS	26.32 ± 2.5520	27.09± 2.3299
ii.	LOWER EPIDERMIS	24.96 ± 2.2202	25.4567 ± 2.1049

Values represent Mean ± Standard deviation

Table 2: Biochemical Analyses Results of Trigonella foenum greacum

Sr.No	PARAMETERS	UNPOLLUTED	POLLUTED
1	Proline	0.000224 ± 0.00015	0.00495 ± 0.00015
2	Chlorophyll	1.6578 ± 0.05310	2.5215± 0.05397
3	ACID EXTRACT METHOD		
i.	Iron	7.1574 ± 0.0164	3.1147± 0.0799
ii.	Calcium	24.05 ± 3.2742	32.058 ± 3.2726
iii.	Magnesium	21.6 ± 1.9596	15.2 ± 1.1314

Values represent Mean ± Standard deviation

DISCUSSION

The parameter of the stomatal index of both regions is found to be nearly equal in both locations concluding that the plant belongs to the same species. It differs in stomatal index to some extent because the plant is environmentally affected but it is tolerant species.

In the present study, a rise in proline level also indicates that Trigonella foenum greacum at the experimental site has been exposed to stress due to plantation along the railway line in contaminated sewage water. Accumulation of proline in higher plants is an indication of disturbed physiological conditions, triggered by biotic or abiotic stress conditions. Free proline content can increase upon exposure of plants to drought, salinity, cold, heavy metals, or certain pathogens. (Ábrahám, March 2010).

In contrast to experimental plant leaves, control plant leaves had significantly less chlorophyll a, chlorophyll b, and total chlorophyll. (Table 2) Morphologically darker green color leaves were observed at the polluted site. Since The Chlorophyll in polluted is seen more than that of the unpolluted region. Light, its intensity, and quality are factors that affect the concentration of different chlorophylls, especially the ratio of chlorophyll a to chlorophyll b. Plants that get abundant sunlight have less overall chlorophyll concentration and higher amounts of chlorophyll a than chlorophyll b. The chlorophyll pigment plays a major role in many metabolic pathways of plants and hence due to less proportion, it disrupts the productivity of minor and major constituents.

Elements used in large quantities by the plant are termed macronutrients, which can be further defined as primary or secondary. These elements contribute to plant nutrient content, the function of plant enzymes and biochemical processes, and the integrity of plant cells. The deficiency of these nutrients contributes to reduced plant growth, health, and yield; thus, they are the most important nutrients supplied by fertilizers. The secondary nutrients include calcium (Ca), and magnesium (Mg). The elements are used in small quantities by the plant, but nevertheless are necessary for plant survival. These micronutrients include iron (Fe).

The Iron and magnesium content is seen more in unpolluted regions and least in control that is polluted whereas, the calcium is more in polluted and less in unpolluted. site due to which the plant capacity of absorption of Fe is reduced and hence, comparatively more Fe is in the leaves of the control site. Where the amount of calcium is high in polluted and low in unpolluted.

Ethically the vegetables grown along the railway tracks using the sewer/gutter water are not feasible for consumption due to the absorption of Heavy metal ions. Cost-effective sand filters to purify the water supply should be used for irrigation. complete substitution of other environmentally friendly agriculture for such methods.

The present research work reveals the leaves of the same plant Trigonella foenum greacum belonging to the same species being affected environmentally in different conditions and still growing under such conditions. The species Trigonella foenum greacum is tolerant to dust and pollution to some extent.

Effective farming practices should be utilized and the agricultural activities beside the rail lines must be appropriately managed. Regulating bodies must set up a reliable source of water for irrigation and take appropriate measures if sewer water is used for irrigation. (P. P. Doshi, R. A. Zele, 2014)

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