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Research Article

Leaf Morphology

Effect of Roadside Pollution on the Leaf Morphology of Celosia argentea

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Celosia argentea (common name - plumed cockscomb or silver cock's comb) is a small edible and ornamental plant belonging to Family Amaranthaceae. In traditional medicine, all parts of the Celosia plant are used to treat a variety of conditions. The leaves and young stems of the Celosia plant are rich in iron, retinol, and ascorbic acid. The leaves are often used in stews and soups.

In this study, the quantitative leaf traits such as leaf length, width, and area were analyzed to assess the impact of vehicular pollution on roadside vegetation. In the case of Celosia argentea, exposure to pollution resulted in changes in leaf morphology, including alterations in leaf shape, size, area, and colour.

These alterations could be a result of the plant's adaptation, where smaller leaf size may serve as a survival mechanism to cope with the stress induced by pollution.

Keywords: leaf morphology, leaf size, leaf width, leaf area, roadside pollution

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1. Introduction

Celosia argentea, a small edible and ornamental plant belonging to Family Amaranthaceae, is commonly known as the plumed cockscomb or silver cock's comb (Tang et al., 2016). The plant bears simple leaves that are spirally arranged and often pinkish or white flowers. In traditional medicine, all parts of the *Celosia* plant are used to treat a variety of diseases.

The leaves and young stems of the *Celosia* plant are rich in iron, retinol, and ascorbic acid, and are often used in stews and soups. *Celosia argentea* is a natural source of hyaluronic acid, which is used in moisturizers, serums, and other skincare products. It possesses hepatoprotective (Sun et al., 2010; Wang et al., 2010; Xue et al., 2011; Wu et al., 2013), anti-tumor (Hayakawa et al., 1998), anti-diarrhea (Sharma et al., 2010), anti-diabetic (Vetrichelvan et al., 2002), anti-oxidant (Molehin et al., 2014) and miscellaneous medicinal properties. Furthermore, because of its high-nutritive value, it is also widely consumed in some regions as a leafy vegetable (Nadkarni, 1982; Kiritikar and Basu, 1987)

Plants are subjected to various external stress factors, with the intensity of these stresses varying depending on the environmental conditions in which they grow. Leaves are the first plant organs to show visible signs of stress, including those caused by air pollution (Zahid et al., 2023). Pollution can impact the morphology and structure of plants, affecting their growth and development through mechanisms such as the deposition of toxic substances on the leaves. Air pollution has a significant impact on the characteristics of plant leaves.

The aim of this study is to examine and compare the leaf characteristics of *Celosia argentea* plants from both control (plants growing in a protected area) and polluted sites (plants growing on the roadsides that are exposed to vehicular pollution).

Quantitative leaf traits such as leaf length, width, and area were analyzed to assess the impact of vehicular pollution on roadside vegetation. Leaf morphology plays a crucial role in evaluating a plant's response to environmental stress and will provide insights into the potential use of these traits as indicators of adaptability.

2. Materials and Methods

Celosia argentea plants were collected from both control and polluted sites for the experiments. Fresh leaves were used for all the experiments. Mature leaves were taken from branches having almost the same thickness from both the control and polluted site samples.

In this study, leaf morphology parameters like leaf length, leaf width and leaf area were measured. For measuring width, the broadest part of the lamina was measured. For measuring area, the graph paper method was used. For each experiment, 15 leaves were used, and three repetitions of each experiment were conducted.

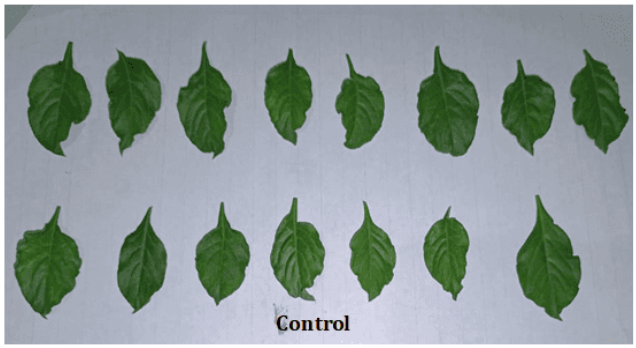
3. Results and Discussion

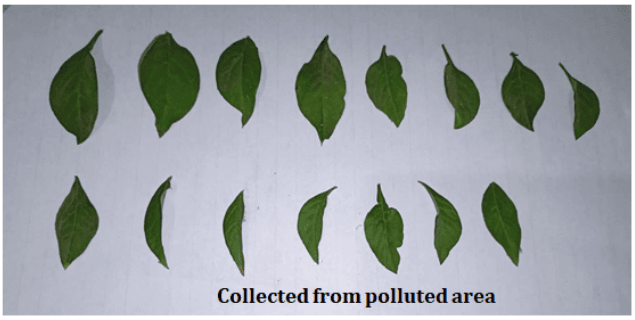
A preliminary examination of the leaves from both control and polluted sites revealed an increased occurrence of chlorosis and mechanical damage in the leaves collected from the polluted site.

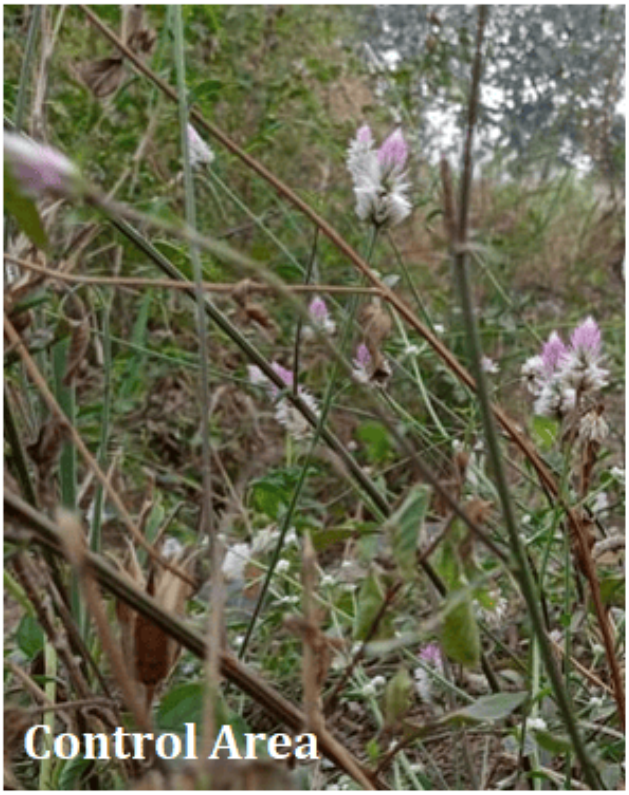
The plants from the control site exhibited an average leaf length of 4.15 cm, whereas those from the polluted site had an average leaf length of 3.29 cm. A significant reduction in leaf length was observed in the plants from the polluted site compared to those from the control site. The width of the leaves was measured from the broadest part of the lamina, and there was a significant decrease in the leaf width of the plants collected from the polluted site.

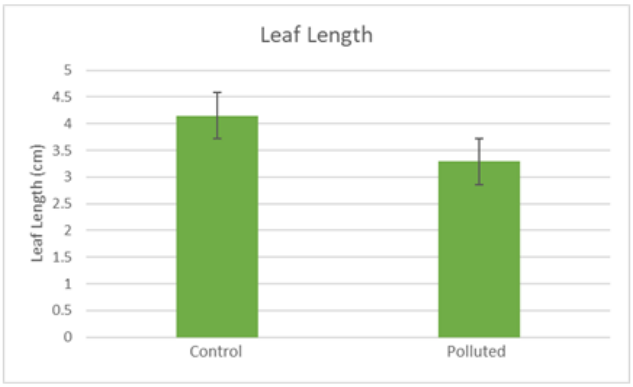
Leaf area is an important parameter that indicates proper growth and development of a plant, and it is directly related to its biomass production. In this study, the polluted site plants showed a significant reduction in leaf area when compared to the control site plants.

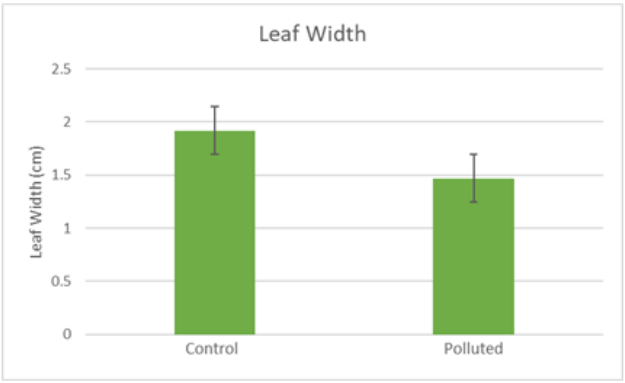
The plants that grow alongside roads have shorter petiole lengths and smaller leaf surfaces. In comparison to controlled regions, contaminated areas had decreased leaf lengths, leaf widths, leaf areas, and petiole lengths (Assadi et al., 2011). In the case of *Celosia argentea*, exposure to pollution can changes in leaf morphology, including alterations in leaf shape, size, area, and color.

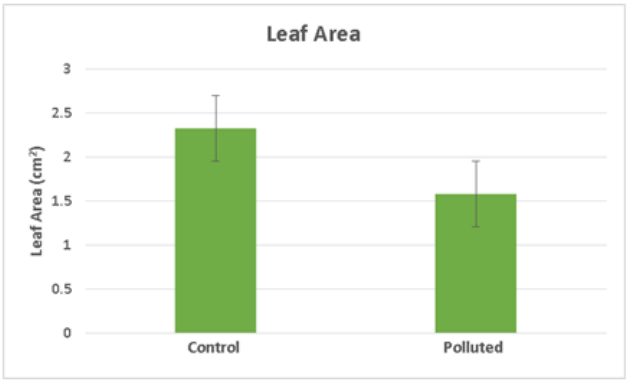

Control


Collected from polluted area


Control Area


Leaf Length
Leaf Length (cm)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Control
Polluted


Leaf Width
Leaf Width (cm)
2.5
2
1.5
1
0.5
0
Control
Polluted



Leaf Morphology Parameters of Control and Polluted Plants

4. Conclusion

Studies have revealed that exposure to vehicular pollution can lead to a reduction in leaf length in plants. Reduced leaf area, leaf length, and leaf width may shield the plant from pollution by reducing the contact between air pollutants and plant leaves. When pollutants are absorbed by the leaves, they can block sunlight, thereby limiting the amount of energy available for photosynthesis. This reduction in photosynthetic capacity can ultimately result in stunted leaf growth (Lobo et.al., 2015). The overall results suggest that morphological parameters such as leaf length, area, and width are significantly reduced in plants from the polluted area. This reduction could be a result of the plant's adaptation, where smaller leaf size may serve as a survival mechanism to cope with the stress induced by pollution.

By reducing leaf size, plants can limit the amount of polluted particles absorbed by their leaves, thereby minimizing the impact of pollution. This adaptive strategy allows the plants to continue growing despite the polluted environment. Even though the surrounding conditions are stressful, the reduction in leaf length helps the plant mitigate the effects of pollution and cope with the environmental stress.

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