

Impact of air pollution on floral morphology of *Nerium oleander*

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Abstract

Plants face severe danger from air contamination because it changes many plant characteristics from the morphological to the physiological and biochemical levels. The research investigates floral morphological effects of air pollution on *Nerium oleander* which serves as a common ornamental and pollution-tolerant bush. Analysts studied four essential morphological flower characteristics in specimens obtained from polluted sites alongside specimens collected from non-polluted areas. Plants under elevated pollution exhibited petal deformities along with smaller flowers and petal discoloration and stamen-pistil developmental anomalies. *Nerium oleander* plants growing at two different sites (polluted and low polluted) on various places showed considerable differences in their floral morphology and floral biology. The flowers of polluted areas i.e. along the M.G Road of Agra showed marked reduction in flowering density, colour, size of the floral parts; Pollen fertility, stigmatic receptivity and fruit & seed set as compared to the low polluted areas i.e. gardens of Taj Mahal and Shahjahan Garden. These changes were found to be closely associated with the extent of air pollution caused mainly vehicular area which is injurious to floral parts. These alterations suggest that air pollutants, may interfere with normal floral development, potentially affecting pollination success and plant reproductive health.

Keywords: Air pollution, *Nerium oleander*, Floral morphology, Petal deformation, Reproductive structures, Pollution stress, Bio-indicator, Urban environment, Plant physiology

Introduction

Diverse studies conducted by Gajic *et al.* (2009) [3] alongside Bell *et al.* (2011) [1] prove that air pollution in urban areas normally reduces the dimensions of plant body parts in affected environments. The detection of environmental pollutants including particulate matter together with Sulfur dioxide (SO₂) and Nitrogen oxides (NO_x) indicates these substances cause negative plant morphological changes which lead to decreased growth with misshapen structures. Studies conducted by Syed Dubey *et al.* (1991, 2008) [2] demonstrate that plant reproductive organs react strongly to environmental changes because their flowers act excellently as biological indicators of pollution. Air pollution causes floral structures to exhibit visible changes to their petals and stamens and pistils which makes them effective markers of environmental stressful events. The research examined how air pollution changes the structure of floral parts in *Nerium oleander*. *Nerium oleander* stands out as an attractive decorative plant which survives well in challenging environments. The research examines floral attributes including shape, colour, reproductive features and size and form of petals to determine the effect of air pollution

on plant fertility and floral health.

Material and Methods

Present study was carried out on *Nerium oleander* plants growing at the highly polluted areas i.e. M.G Road Agra and low polluted areas like Taj Garden and Shahjahan gardens. Floral morphology and floral biology were studied by various methods and described by Shivanna and Rangaswami (1992) [6].

Results and Discussion

Floral morphology

The flowers of *Nerium oleander* possess pink colors which grow from cyme inflorescences. The inflorescence pattern of cyme positions a central flower which opens before lateral flowers open as it develops into a branched cluster. The pollination-capable floral structure of *N. oleander* differs from most flowering plants since it fails to generate nectar during the blooming stage. The lack of nectar indicates *N. oleander* uses flower appearance and shape instead of food for attracting pollinators.

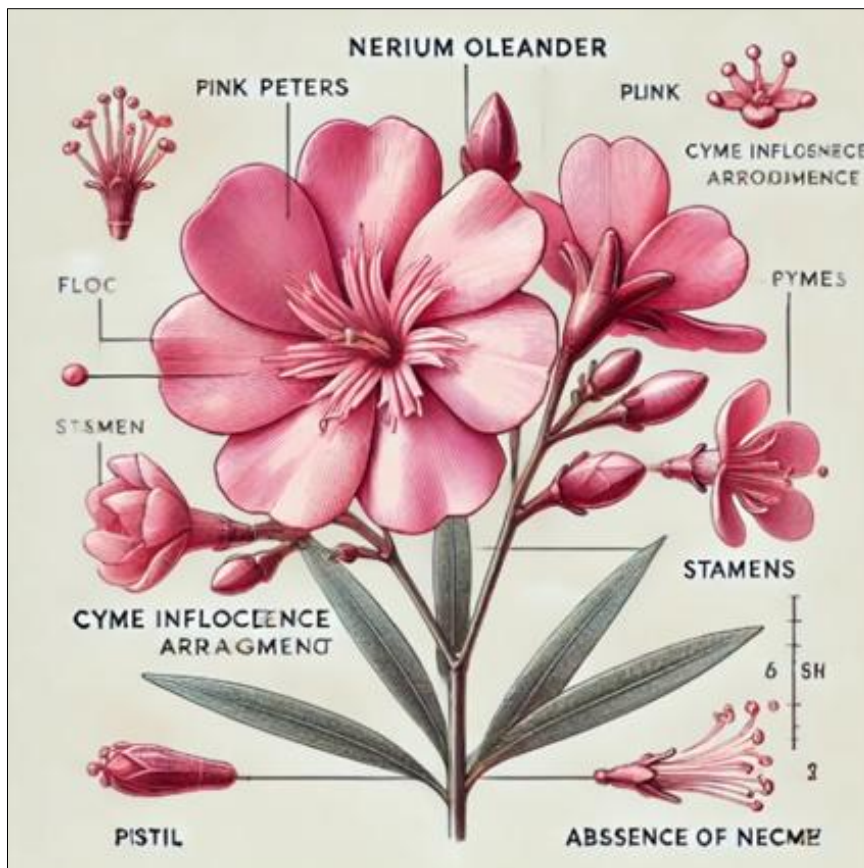


Fig 1: Diagram of Nerium oleander flower structure



Fig 2: Comparative diagram of floral morphology of Nerium oleander flower in polluted vs. non-polluted area

A statistical study evaluated various morphological parameters related to floral morphology changes in *N. oleander* that resulted from air pollution exposure. The analysis measures four characteristics of flowers such as petal dimensions and both reproductive organs' development and floral symmetry as

well as their general health status. Table 1 and Table 2 showcase the research findings regarding the alterations of *N. oleander* floral characteristics in diverse environmental pollution scenarios.

Table 1: Floral morphology of *N. Oleander*

Parameter	Polluted area	Low polluted area
Inflorescence/ Plant	26 ± 5	52 ± 5
Total Flowers / inflorescence	12 ± 4	26 ± 4
Flower colour	Faded Pink	Bright Pink
Corolladiameter	41.1 ± 1.5	52.6 ± 2.3
Tube Length	19.2 ± 0.5	23 ± 1.2
Pollen / anther	1517 ± 1.7	3145.6 ± 1.5
Ovules / flower	256 ± 0.7	381 ± 0.2
Pollen – ovule ratio	19.45 ± 0.2	32.40 ± 0.1
Fruit Length	8.6 ± 0.5	13.15 ± 0.7
Seeds / fruit	153 ± 1.7	282 ± 1.5

Table 2: Floral Biology of *N. Oleander*

	Polluted area	Low polluted area
Opening of Flower	Semi Opened	8-9 am
Anther dehiscence	10 – 10.30 am	8.30 – 9.30 am
Stigma receptivity	10 – 11 am	9 – 9.30 am
Pollen viability (%)	47.8 %	82.4 %
<i>In vivo</i> pollen germination	34.2 %	68.7 %

It is clear from the Table 1 & Fig 2 that there was significantly difference in the comparative studies of polluted and low polluted areas of Agra region. It is clearly indicated that faded pink flowers of polluted sites, exhibited marked, reduction in the size of corolla diameter, tube length, pollen production, ovules/flower, pollen ovules ratio fruit size and seeds per fruit as compared to low polluted sites.

Also, it is very clear from the Table 2 that flowers of Agra region clear from row at the low pollen viability and poor stigmatic receptivity and less *in vivo* pollen germination as compared to Low polluted sites.

Recent findings confirm reduction of plant growth as a of pollution stress. (Dubey, 1991, Gupta and Iqbal, 2005) [2, 4] Syed *et al.*, (2008) [7].

The results from sites surveyed in 2008 indicated significant injuries to the floral parts of *Cassia glauca* Lank in air-polluted areas, where the size of these floral structures was notably reduced. Similar adverse effects were observed in *Calendula* and *Cassia siamea*, highlighting the impact of pollution on plant development. Beyond morphological changes, pollution also disrupted plant metabolism, affecting overall growth, flower formation, and reproductive biology (Syed *et al.*, 2008) [7]. These findings emphasize the importance of assessing the effects of pollution on plant morphology and floral biology, as such evaluations serve as valuable tools for biomonitoring and impact assessments in urban habitats, particularly concerning air pollution.

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