

Some pollution indicating plants found in Puri-Konark Marine Drive, Odisha, India

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ABSTRACT

Introduction of any destructive materials that cause harmful to living organisms and environment which leads to environmental pollution. Certain plants are effectively used as cheap and naturally available indicating system for pollution called pollution indicator plant. Puri-Konark marine drive area is not polluted but this area is polluted by some solid wastes such as plastic plates, plastic bags, tins, refuses etc. that are left behind by tourists and deposited in large numbers that causes pollution. The most serious reasons are vehicular pollution, which releases the fuel by products like CO, SO₂ and particulate matters. In initial survey of this area, some pollution indicator plants such as lichens were found and this offer excellent alarm system for indicating air pollution of Puri-Konark marine drive. Likewise mosses are also found in this area which acts as excellent early alarming system of air pollution. Chlorosis of leaves was also noticed which extends from the tips towards the leaf base and loss of chlorophyll of mosses indicating SO₂ pollution in air. In Puri-Konark marine drive, presence of pollution indicator plants such as lichen and mosses indicates type and level of pollution.

Keywords: Chlorosis, Environment, Lichen, Mosses, Pollution

I. INTRODUCTION

Bryophytes are green land plants which lack a vascular system and are simple both morphologically and anatomically. The growth potential in bryophytes is not as highly polarized as vascular plants. Bryophytes grow in a variety of habitats especially in moist places on soil, rocks, trunks and branches of trees and fallen logs. They obtain nutrients directly from substances dissolved in ambient moisture. Some substances are probably absorbed directly from the substrate by diffusion through the cells of the gametophyte. Bryophytes are used as reliable indicators of air pollution (1).

Lichens are symbiotic organisms that are fashioned by mutual association of algae and fungi. Mostly Ascomycota (98%) is fungal partner in lichens (2, 3) and the others belong to the Basidiomycota and anamorphic fungi. Approximately 21% of all fungi are able to act as a mycobiont (3) thus lichens form the largest mutualistic group among fungi.

The feature of air quality is getting worse in the world. Air pollution is concerned with pollutants while air quality states to the consequence of contaminants on a diversity of matters containing all living organisms (4). Some critical pollutants are not basically measured by physical and chemical assessments because devices and laboratory equipment are used to measure inadequate pollutants for quick and cheap determination. Organisms give response to different pollution level is regarded as bio indicator (5). One of the best Marine Drive of World is Puri-Konark Marine Drive. It is the tourist place in golden triangle of Odisha. In Puri-Konark Marine Drive area, fantastic beach along the marine drive, and the other side is covered with forest area and also the Ramachandi Temple on the way. Introduction of any destructive substances that cause harmful to living organisms and environment leads to environmental pollution. This area is polluted by some solid wastes such as plastic bags, plastic plates, refuses etc. are left behind by tourist and also by fuel byproducts like CO, SO₂ and particulate matters are released from vehicles (6). Plants are used as very sensitive tools for prediction and recognition of environmental stresses are called plant indicator. The plant is used to indicate air quality and locate sources of air pollution utilizing known as 'air pollution indicator plant'. The category of plants as an indicator of air pollution are Lichens and Mosses which are found in this area act as excellent early alarming system of air pollution. They are very sensitive to selected gaseous air pollutants, they respond quickly with typical visible foliar symptoms to the presence of medium-to-low levels of polluting agents such as CO, SO₂ (7). Lichens and mosses are effectively used as cheap and naturally available monitoring systems of the level and type of air pollution in this area that represent a striking visual demonstration unit. The type and concentration of gaseous air pollutants are found out by various characteristics damage symptoms such as morphological, anatomical, ultra-structural physiological, biochemical etc., which are studied in sensitive plant species such as Lichens, Mosses to ascertain the presence of particular air gaseous pollutants such as CO, SO₂ in this area (8). They have no wax and cuticle to protect cells so that CO, SO₂ directly enter into the thallus and thereby causing loss of chlorophyll and inhibit photosynthesis resulting reduced growth and indicating advantage over vascular plants as bio indicator of air pollution (9).

II. MATERIALS AND METHODS

The survey was made during the winters of 2017-18 in an effort to reveal the distribution patterns of all lichens, mosses and liverworts on tree trunks, stone walls, non-metallic roofs and soil. During survey about biological monitoring plants for different types of pollutants were found at Puri-Konark Marine Drive, Odisha. The particularities of gaseous air pollutants were evaluated by bio indicator plant species such as lichens and mosses present in this area [10]. The distribution patterns of lichens and mosses were investigated and found to be grown on tree bark such as *Cocos nucifera*, *Mangifera indica*, *Anacardium occidentale*, *Shorea robusta* etc. In this survey, lichens and mosses were mapped in first method. Then in second method, individual sampling of lichens and mosses species were taken and then measurement of the pollutants that accumulate in the thallus

were recorded (9). Lichen sampling: Ten to twelve common trees in each site were randomly selected for the sampling. Area of tree trunk ranging between 0.5 m from the base to 1.5 m height was taken during the survey. A 250 cm² (25cm X 10cm) quadrat on the trunk of each tree was used to calculate coverage and frequency of lichens. Lichens species found within the gird, number of individuals of each species and the number of gird units in which a particular species was also recorded. Sample of Lichens were collected from tree bark and were identified with the help of National Botanical Research Institute (NBRI), Lucknow (11). Bryophytes and some mosses were identified with the help of flora of Odisha (12). The supportive specimens were collected, processed, critically studied, identified and preserved (13).

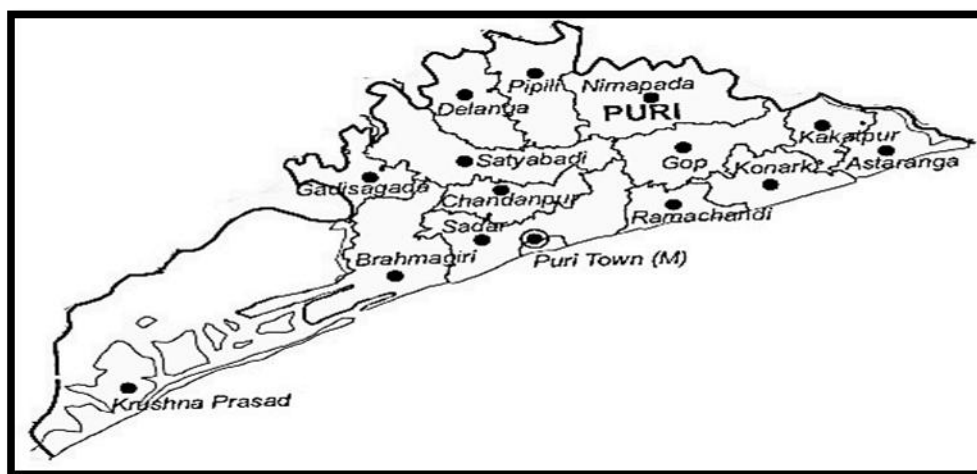
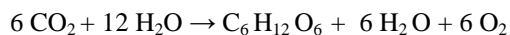


Fig.1 Map of surveyed area

III. Results and Discussion

The present study revealed that Puri-Konark Marine Drive area is polluted due to anthropogenic activities such as vehicular pollution, litters such as plastic bags, plastic plates etc. are left at the back by tourist. This area is suffering from a high level of pollution from vehicular emission. The major source of pollution is petrol and diesel fed vehicles. Dispersion of the pollutant between source and receptors is a process which depends upon metrological conditions. After emission, pollutants are dispersed both vertically and horizontally in the atmosphere (14). In this area, air pollutants especially SO₂ is released from vehicle engines dissolved in rain water. Lichens and mosses are found in this area act as pollution indicator. Lichens are long-living, perennial organisms are exposed to air pollutants which are grown on tree bark of *Cocos nucifera* and *Mangifera indica*. Lichens are symbiotic organisms composed by a fungal partner i.e mycobiont and one or more algal partner i.e phycobiont. Fungal mycelium assists in absorbing atmospheric moisture for algal photosynthesis and provides protection to algae from intense light and UV which reciprocates, algae provide energy and assimilate via photosynthesis.



Lichens absorb atmospheric moisture i.e. rain, fog, dew and nutrients to grow. Rainwater contains just enough nutrients to keep them alive but air pollutants especially CO, SO₂ are dissolved in rainwater. They lack of protective structures like stomata, cuticle, wax to protect neither cells, nor means of controlling nutrient uptake, unlike vascular flora and liberated exchange of both gasses and solutions occurs across cell surfaces. In the absence of cuticle, gaseous air pollutants such as CO, SO₂ find an easier way to enter into the thallus and diffuse through the thallus layers and the photobiont cells that causes destruction of chlorophyll which is an important organelle function in absorbing light energy for photosynthesis producing organic matter and also damage photobiont as a result inhibit photosynthesis process and thereby reduces the growth, lost protective function against insect and pest and also causes damage to lichens. Presence of fewer amounts of lichens in study area indicates the air pollution by SO₂.

Field studies demonstrated that the production of lichen species are declined and also changes in morphological modifications of lichen thalli have been detected i.e. discoloration of thalli is due to the death of algal cells and the breakdown of chlorophyll molecules. SO₂ is found to be the cause for changes in lichens ultrastructure along with the shape of chloroplast and mitochondria, appearance of electron-opaque vacuolar accumulations, increased density of cytoplasm, decreased size of cytoplasmic storage droplets and also cause disturbances in the organization of cell membrane with consequent disruption of membrane - bound processes such as photosynthesis and change of membrane permeability to ions mainly loss of K⁺ ion. Presences of lichen species such as foliose lichens like *Parmeliella papillata*, *Dirinaria confluens*, *Pyxine cocolos* and crustose lichens like *Bacidia* sp., *Arthonia* sp., *Cryptothecia* sp., *Lecanora* sp. indicate air pollution of the study area. Mosses are small flowerless plants that grow in mats in this area. Likewise lichens, mosses absorb atmospheric moisture and nutrients direct from the air and rain rather than the soil along with SO₂ that causes chlorosis of leaves which extends from the tip towards the leaf base causes loss of chlorophyll, inhibit growth, and also damage the mosses. This symptoms, species of mosses such as *Fissidens orishae*, *F. schmidii* and *F. sylvatus* indicate air pollution of this area. The negative impact of air pollution on sensitive lichens and mosses cause the disappearance and damage of these species in this polluted areas and there by changes in lichen and mosses diversity and communities. In Puri-Konark Marine Drive presence of pollution indicator plants such as lichens, mosses provide early warning signals about air is polluted by CO, SO₂.

IV. CONCLUSION

The above study concluded that Puri-Konark Marine Drive territory is contaminated by strong solid waste and furthermore by fuel by product i.e., CO and SO₂ that are discharged from vehicles. The effects of air pollutant on lichens and mosses were studied in this area. The negative impacts of air contamination on photosynthesis activity, chlorophyll, and development condition of lichens and mosses were appeared to decay fundamentally

with expanding the level of CO, SO₂ toxins in this area, confirmed that these specific contamination demonstrating plants can be normally accessible showing framework for air pollution.

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