RESEARCH ARTICLE

Effects of industrial pollution on pollen morphology of *Cassia* species

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Manuscript details:

Received : 06 December, 2013
Revised Received: 05 February, 2014
Finally accepted : 05 March, 2014

Date of publication (online):
30 March, 2014

ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Arvind Chavhan

Citation: Kalkar Surekha A and Jaiswal Renu (2014) Effects of industrial pollution on pollen morphology of *Cassia* species, *International journal of Life Sciences,* 2 (1): 17-22.

ABSTRACT

Air pollution effects on pollen morphology of two species of *Cassia* viz. *C siamia* L. and *C. fistula* L were studied in industrial area (MIDC, Hingna), Nagpur. Civil lines area was considered as control area. In order to study impact of air pollution, pollen grains were subjected to LM and SEM (light and scanning electron microscopic studies). LM studies revealed that pollen grains in control area have shown clear exine pattern, trizonocolporate condition of pollen, whereas in experimental area shrinkage in its size and breakage of exine was noticed. SEM studies of pollen in experimental area have shown some particulate matter was attached to its surface. The studies have discussed the structural changes in pollen characteristics of *Cassia siamia* L. and *Cassia fistula* L. under the influence of air pollution.

Key Words : *Cassia*, pollen morphology, LM, SEM, Industrial pollution

INTRODUCTION

Now a day's industrial air pollution is one of the major problems. Industrial area is one of the highly polluted areas in any country. Harmful emissions from various types of industries & gaseous pollutants released in the atmosphere by it are not only harmful for human health but it also affects plants in many ways. Studies of the effect of air pollution on pollen showed changes such as shrinkage, thinning and fragility (Rezanejad *et al.*, 2003). Airborne pollen grains can be affected directly by air pollutants. If a plant grows in polluted soil, its physiological functions may change and affect the properties of the developing pollen grains (Helender *et al.,* 1997). Also, injury to floral organs, especially the anther, can cause pollen abnormalities and sterility and consequently malfunction of fertilization. *Cassia siamea* and *Cassia fistula* are dominant avenue trees found abundantly in experimental area. Pollen grains of these two species of *Cassia* were selected in order to study the air pollution effects.

MATERIALS AND METHODS

Pollen morphology: LM studies- Light microscopic studies were carried out by acetolysis method (Erdtman, 1952). The fresh material consisting of full flowers or anthers were placed in test tube, crushed with glass rod in 70% alcohol, then filtered, centrifuged and decanted.

The sediment left in the test tube after decantation of alcohol is covered with glacial acetic acid, centrifuged and the sediment covered with fresh acetolysis mixture prepared by mixing 9 parts of acetic anhydride and 1 part of concentrated sulphuric acid, the latter being put drop by drop. The tube with the mixture is placed in a hot water bath until the pollen grains become brownish black. The test tube was then cooled and centrifuged and this centrifuged acetolysis mixture was decanted and again centrifuged with glacial acetic acid and then decanted. This procedure was repeated 2-3 times with distilled water. After decanting water, 50% glycerine was added and centrifuged, small quantity of glycerine jelly was placed on warming the slide, gently pollen sample was added from test tube; it was then covered with cover slip, the slide thus was sealed with paraffin wax and then kept for microscopic observation.

SEM Studies: Scanning Electron Microscopy of pollen grains of study and control area carried out at NBSS & LUP (National Bureau of Soil Survey & Land Use Planning), Nagpur. SEM study was done with dry powder. The pollen powder of both the area was collected in butter paper and kept in petri-plate. Pollen grains were mounted on aluminum stub using double sided cello tape and then subjected to scanning; the magnification was between 400 X and 7500 X**.**

RESULTS AND DISCUSSION

Cassia siamia pollen grains were found to be trizonocolporate, prolate, ora lolongate, sexine thicker than nexine, tectate, reticulate sculpturing, colpi are wider at the equator. Pollen grains in polluted area have shown shrinkage, breakage of exine (Fig.1 & 2). *Cassia fistula* pollen grains were found to be sub- prolate, tricolporate, non-angular, colpi divided, exine thin, sexine thicker than nexine, tectum reticulate-rugulate. *Cassia fistula* pollen grains of polluted industrial area have shown some deposition, exine reticulation is not clearly seen (Fig.3 & 4).

SEM studies of pollen grains of *Cassia siamea* of control area have shown trizonocolporate, condition of pollen with reticulate surface (Fig.5). Whereas SEM studies of pollen grains of *Cassia siamea* of industrial area have observed in equatorial and polar views with some particulates attached on surface of pollen (Fig.6). *Cassia fistula* pollen grains of control area showed smooth surface of pollen, whereas pollen grains from industrial area have also indicated particulate matter attached to pollen grains (Fig.7 & 8).

Pollen grains and fungal spores are the most predominant allergens in the air (Kalkar and Patil, 1994; Kalkar *et al.,* 1998). The morphological studies of the pollen are very important. It is also applicable in genetic study, forensic science in tracing history of vegetation, which consists of individual species, community and climate change study (Aftab and Perveen, 2006). Some reports are available on pollen morphology of some dicot families from various parts of the world such as Apocynaceae by Schill & Leuenberger (1972) and van Campo *et al*., (1979), Caesalpiniaceae and Mimosaceae by Ferguson (1981), Graham & Barker (1981), Guinet (1981), Ferguson & Pear (1984), Lock (1988) and Perveen & Qaiser (1998), Malvaceae by Christensen (1986), Culhane & Blackmore (1988) and Perveen *et al*., (1994).

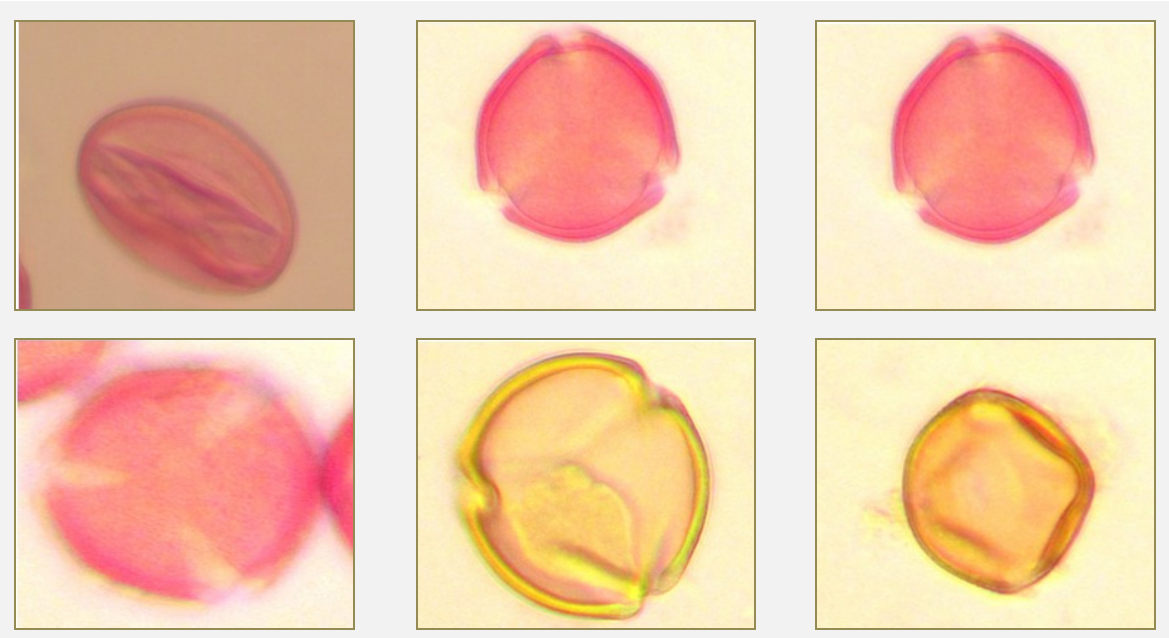

Fig. 1 : LM-*Cassia siamea* pollen grains of control area

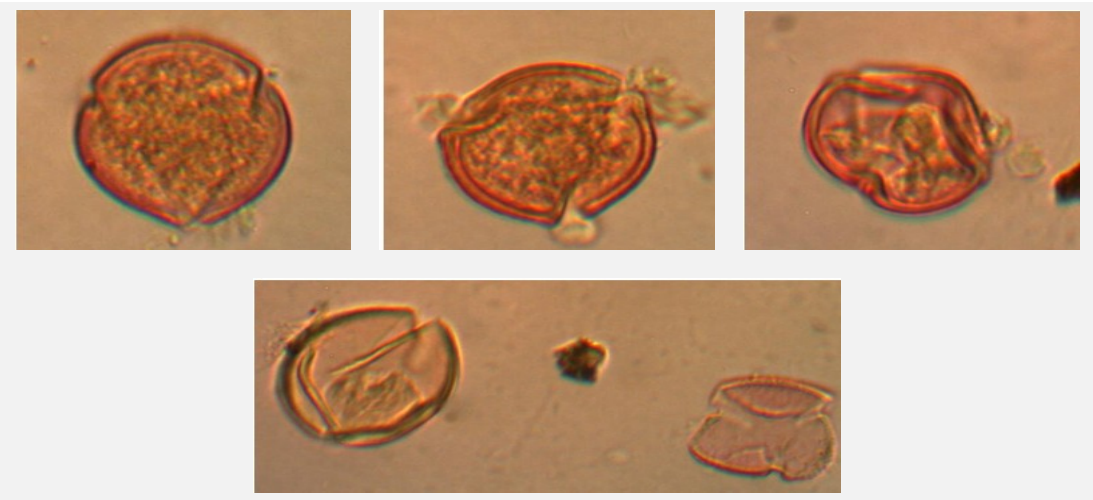

Fig. 2: LM- *Cassia siamea* pollen in industrial area

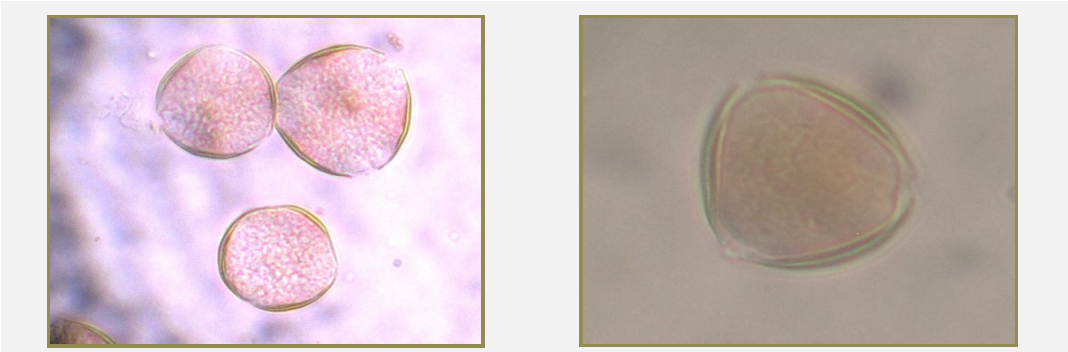

Fig.3: LM- Cassia *fistula* pollen grains of control area

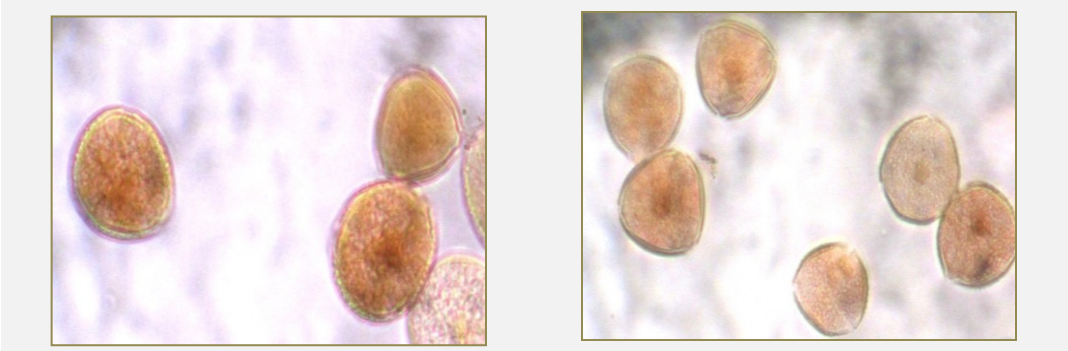

Fig. 4: LM - *Cassia fistula* pollen grains of industrial area

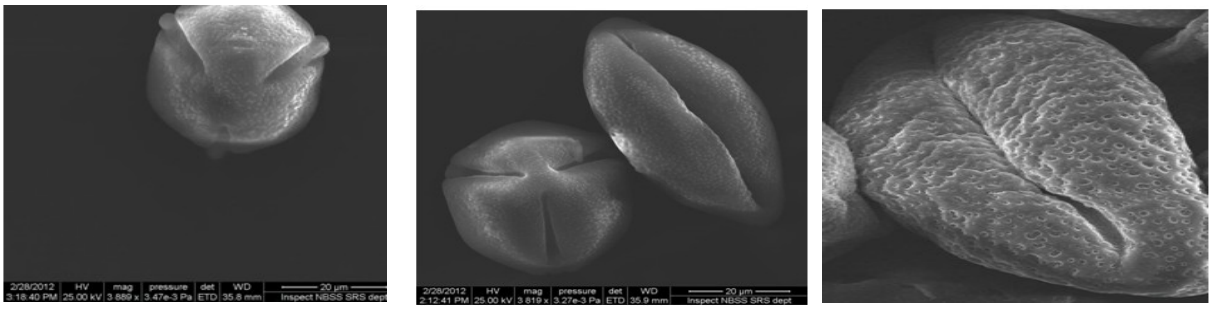

Fig.5: SEM-Pollen grains of *Cassia siamea* in control area

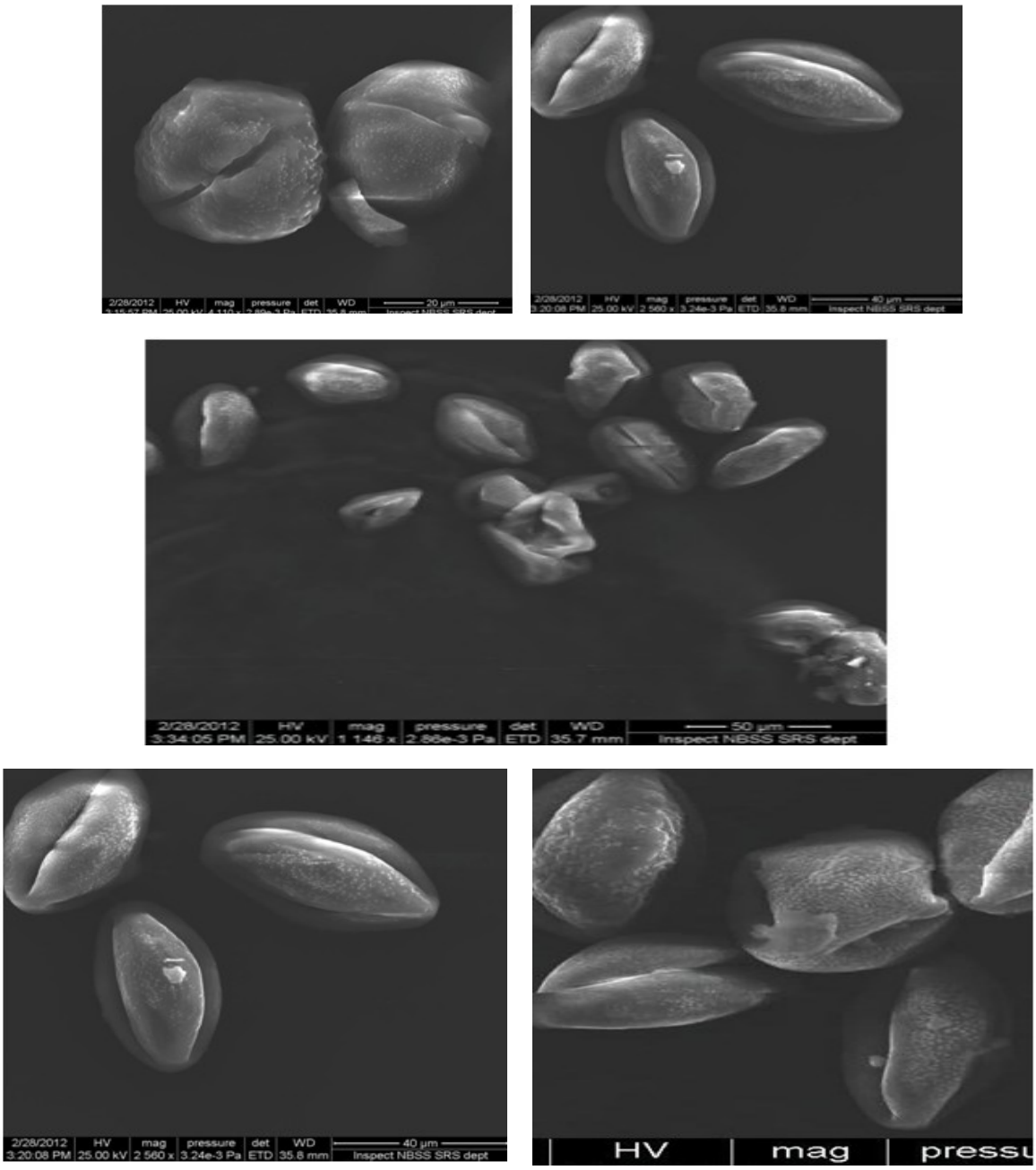

Fig.6: SEM - Pollen grains of C*assia siamea* in industrial area

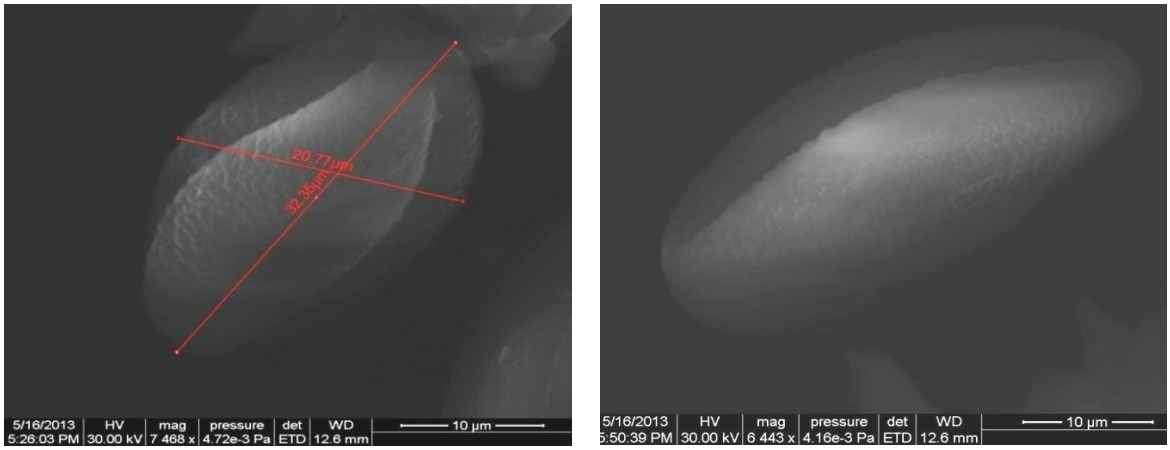

Fig.7: SEM - *Cassia fistula* pollen grains in control area

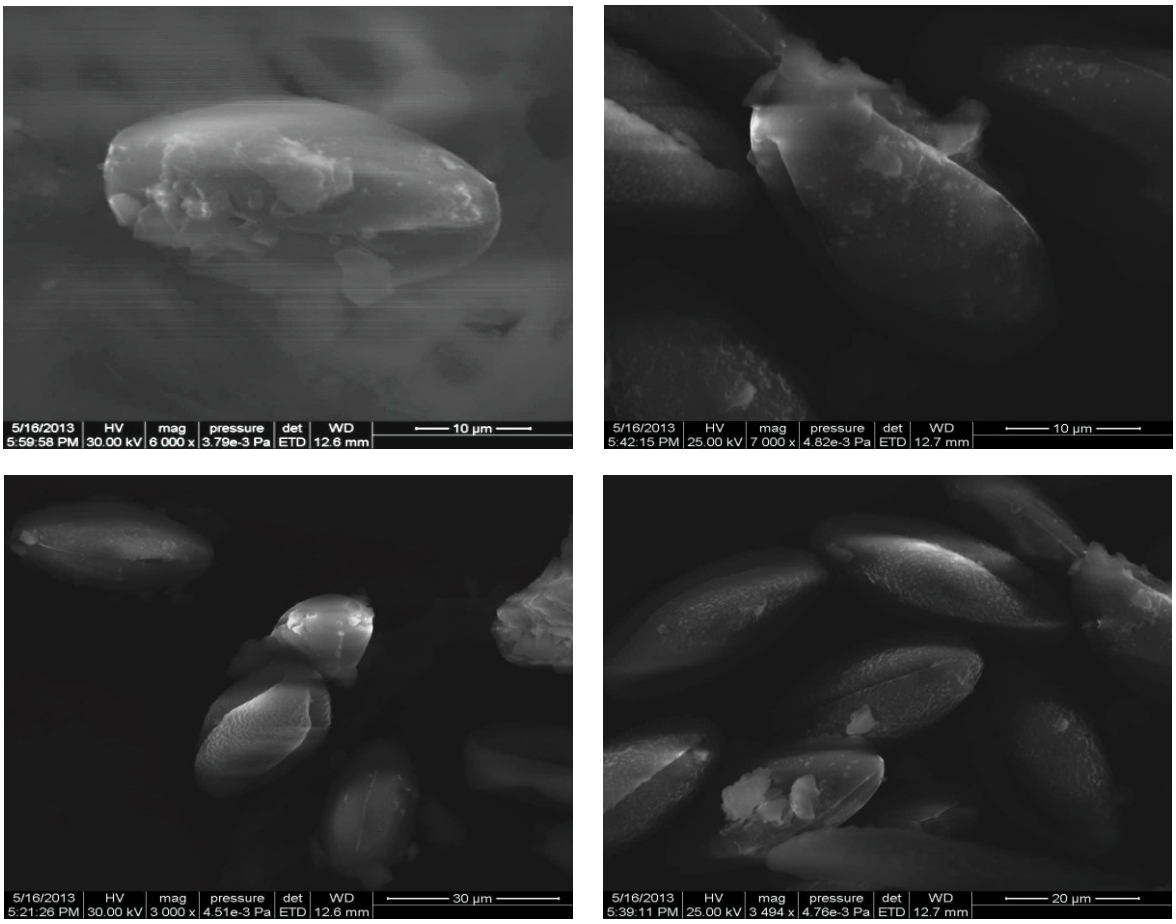

Fig.8: SEM-*Cassia fistula* pollen grains from industrial area.

Scientists have concluded from their studies that the environmental factors, especially air pollution are responsible for increasing allergenicity of pollen (Breiteneder & Scheiner; 1991, Jilek *et al*., 1993). From both results of control and experimental area, it was found that, pollen grains of experimental area were affected by polluted air as damage in pollen structure, attached particulate matter, breakage in exine was observed. LM studies have shown that fresh pollen grains were with clear exine pattern, trizonocolporate condition of pollen is clearly seen, whereas in industrial pollen grain shrinkage, breakage of exine was observed. SEM studies of equatorial and polar views of exposed pollen grain have shown some particulates get attached on surface of pollen, while in control area pollen surface structure, reticulation, are seen clearly. Pollen grains are important male reproductive organs of plants and are also found allergic to human beings. Air pollution can cause allergic symptoms but when associated with allergen pollen grains, alleregenicity power are increased (Chehregani *et al.,* 2004). Such studies will be helpful to know the harmful effects of air pollution on growth of plants. Thus from above studies it can be concluded that pollution may affect the structure or morphology of pollen grains.

ACKNOWLEDGEMENT

Authors are thankful to Director, NBSS and LUP, Nagpur for providing SEM facilities.

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