INTRODUCTION
The environmental pollution has now assumed alarming magnitude and its frontiers are no longer confined to any particular region of the world. It is a growing threat to the whole planet (Hobbs et al., 1975), endangering the ultimate future of the living beings on the earth. Our present day efforts are focussed on the technological expansion hopefully aimed at achieving the economic growth, and fulfilling the rising expectations of wealth processes. These very efforts constitute the ultimate source of the environmental "Crisis" (Ellul, 1954).

According to Ehrlich et al., (1973) "Man's present pattern puts him on collision course with the laws of nature. Man's ruthless assault on nature, in quest of more food, more energy, more raw material for his burgeoning industries to achieve the material comfort, he thinks he needs, has poisoned the air we breath, the water we drink, the drugs we use, the places we live in and even the soil we cultivate upon". The modern technology of today has committed a number of violations of the environmental safety and low almost every facet of modernisation poses a health risk. Thus, most efforts of man for an easy and comfortable life have inadvertently brought about dire consequences leading to severe changes in the environmental and a large scale ecological imbalance.

Steve Van Matre (1984) of George William College, Chicago, estimates that in the present world only 20% of air is breathable, only 10% of land is capable of being exploited for producing food and just 1% of the earth water is portable. It is estimated that hundreds
of million tons of the harmful gases and dust are emitted into the
earth's atmosphere every year (Astanin & Blagosklonov, 1983). In
1969, smoke concentration was estimated to be 35 mg/m³ in Stockholm.
It was 25 folds this figure in Mexico, 10 folds in Osaka, 7 folds in
Bombay, 5 folds in Parague and 4 folds in Tokyo (Kochhar, 1982).
The amount of pollutants such as hydrocarbons, nitrogen oxides, carbon
monoxide, sulphur dioxide and dust entering the air of Calcutta and
Howrah cities is as much as 1299 tons per day (Sharma, 1981). Some
1,400 tons of hydrocarbon, CO, NOₓ and SO₂ are emitted in the air of
Delhi every day by Power Plants, Automobiles, Industries and Chullas.
Further, about 60,000 tons of CO, 24,000 tons of hydrocarbon and 2000
tons of NOₓ are released annually in Delhi by the petrol using vehicles
alone (Rai, 1984). Another report (Agarwal et al., 1982) reveals that
over 70% of the available water in India is polluted, 60% of Calcutta
residents suffer from respiratory disease because of air pollution, and
incidence of blood cancer has increased five times in Lucknow during
the last decade. The information provided in a recent communication
(Anonymous, 1991) on the ambient air quality of major cities of India
and the WHO guide lines, after modification, have been presented below
(Table 1).

Of the five major cities mentioned above, Calcutta is still
the most polluted city and has already exceeded the WHO guide line
with particular reference to SO₂ and suspended particulate matters.
This harm caused to the human health is enormous. Likewise, green
plants being more sensitive and tender can not be spared of the
severity of these air-born pollutants.
Table 1: Ambient air quality in major cities of India and WHO guidelines for air pollutants.

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>WHO Guidelines (Annual Mean) (Mg/m³)</th>
<th>Cities</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Delhi</td>
<td>Calcutta</td>
</tr>
<tr>
<td>Sulphur dioxide (SO₂)</td>
<td>40 - 60</td>
<td>13.00</td>
<td>87.50</td>
</tr>
<tr>
<td>Nitrogen oxide (NOₓ)</td>
<td>400</td>
<td>17.50</td>
<td>108.90</td>
</tr>
<tr>
<td>Suspended particulate matters (SPM)</td>
<td>60 - 90</td>
<td>331.00</td>
<td>554.00</td>
</tr>
</tbody>
</table>

Industrialisation brings forth environmental and ecological degradation to which the power generation activities, contribute significantly. The Thermal Power Stations consume more than 1/3 of all the fuel produced and thus significantly affect the local environment and the whole green world. The influence of the Thermal Power Stations on the surroundings is determined by their ejecting flue gases, heat and contaminated waste water.

On complete burning of fuel in the air, the combustion products contain CO$_2$, H$_2$O, NO$_2$, SO$_2$, gas & SO$_3$ and ash. With an incomplete combustion, carbon monoxide, hydrocarbons, CH$_4$, C$_2$H$_4$ etc. and some carcinogenic substances may form additionally. The products of the incomplete combustion are rather harmful, but the modern techniques of combustion enable us to prevent fully or at least, minimize their formation. On the whole, the environmental pollution broadly encompasses the by-products of active industrialisation and the multitude of toxic effluents that are being cumulatively discharged into air, water and land.

The deleterious effects of the various pollutants on human, animal and plant life and even on our climate are now well recognised. For the last few decades, the literature on the effects of the environmental pollution on plants has been accumulating in alarming proportions (see Thomas, 1951; Thomas & Hendricks, 1956; Thomas, 1961; Guderian, 1967; Brandt & Heck, 1968; Sinclair, 1969; Treshow, 1970; Mudd & Kozlowski, 1975; Treshow, 1975; Mansfield, 1976; Manning & Feder, 1976; Oliva & Steubing, 1976; Koziol & Jordan, 1978; Ashmore
et al., 1980; Ormrod et al., 1980; Gupta, 1981; Heck et al., 1982; Jacobson, 1982; Taylor, 1982; Roberts et al., 1983; Whitmore & Mansfield, 1983; Ashmore, 1984; Khan, 1985; Elsom, 1987; Treshow & Anderson, 1989; Saquib, 1989; Usmani, 1990) and has established that the air pollution poses a potent hazard to the green world.

The air pollution causes a serious set-back to the normal function and structure of the flora. Thermal Power Plants are among the major sources of air pollution and one such power plant is located in Kasimpur town of Aligarh District, U.P., India. The effluents released into the air from this plant have been found to affect some timber trees (Khan, 1982; Ghouse et al., 1984a,b, 1986a; Gupta et al., 1988; Kalimullah et al., 1987; Mahmooduzzafar & Iqbal, 1988), vegetable crops (Amani & Ghouse, 1978; Gupta, 1981; Khan et al., 1987) and various weeds of the locality (Amani et al., 1979a,b; Amani, 1982; Ghouse & Khan, 1983, 1984; Iqbal et al., 1986a,b, 1987a,b; Khan & Ghouse, 1988; Khan & Khair, 1984, 1985a,b; Mahmooduzzafar et al., 1986, 1987. Disturbed meiosis (Amani, 1982) and anatomical disorders (Ghouse & Khan, 1983; Ghouse et al., 1984a,b, 1986; Iqbal et al., 1986a,b, 1987a,b; Khan et al., 1984; Mahmooduzzafar et al., 1986, 1987) have been noted in certain weeds thriving in the vicinity of the Power Plant Complex. But the range of the area approached by the air pollutants in quantities sufficient to effect such alterations, is still to be assessed thoroughly.

Leaves of plants are directly exposed to the obnoxious mixture of gases, emitted into the atmosphere by the combustion of
several fuels such as the bituminous coal. The hazardous effects of these gases include the deterioration of leaf surface due to destruction of essential leaf pigments and other elements. The toxic mist which results from a sharp increase in the concentration of the atmospheric pollutants in an unfavourable meteorological situation, causes disturbance to photosynthesis and other metabolic activities, which leads to leaf withering.

The exposure may be continuous, but the exposure concentrations are generally variable. Many studies with varied air pollutants have used the visible foliar injury to evaluate the plant response. The amount of foliar injury sustained by a plant has a direct effect on the amount of photosynthate it produces. The gaseous pollutants make for the development of diverse foliar injuries such as chlorosis, necrosis and curling (Costonis, 1971; Chaphekar & Karabhari, 1974; Ghouse et al., 1980; Gupta & Ghouse, 1987; Ahmad et al., 1987).

The failure of crops and the death of trees provide ample proof of the adverse effects of air pollution. Ahmad and his colleagues, working at the National Botanical Research Institute (NBRI), Lucknow, studied various sensitive and resistant species from the polluted industrial areas (Ahmad et al., 1988) to assess the cuticular and epidermal features of leaves, and the height, phytomass, chlorophyll pigments and the protein contents of plants under the pollution stress (Yunus et al., 1979, 1982, 1985a,b; Yunus & Ahmad, 1980, 1981, 1983; Singh et al., 1985). Dubey and his associates at Ujjain investigated the effect of $SO_2$ and fly ash on the chlorophyll contents and the
dry-matter production of crop plants (Dubey et al., 1982a,b). Similar studies were carried out by Mishra (1980) and Mishra and Shukla (1986a,b) at Kanpur.

In addition to foliar responses, the growth of stem is also affected by the pollutants directly or indirectly. A positive correlation often exists between the secondary growth of plant and the leaf formation. Also, the greater the number of leaves produced, the larger the amount of the secondary xylem formed (or the stem circumference) (Satoo, 1956). Sachs (1972) has shown that the differentiation of stem fibres depends on stimuli originating in very young leaf primordia, and that early removal of these leaf primordia prevents formation of fibre strands. Young (Aloni, 1978) and mature (Aloni, 1976, 1978) leaves of Coleus are the source of signals for fibre differentiation in the stem; when leaves are excised no fibres differentiate in the stem. Teh and Swanson (1982) found that exposure of the leaf of P. vulgaris to pollutants inhibited the rate of net photosynthesis; at the same time the rate of translocation of photosynthate from the leaf decreased.

However, there is a general lack of information concerning the response of leaves and the secondary plant growth to different pollutants. Some preliminary reports indicate that the secondary-xylem production is markedly retarded in certain trees (Grill et al., 1979; Ghouse et al., 1984a,b, 1986a; Mahmooduzzafar & Iqbal, 1988). Reduced production of the secondary phloem in trees (Ahmad & Kalimullah, 1988), and the general anatomical variations in certain annuals (Ahmad et al., 1987; Ghouse et al., 1985, 1986b, 1989; Iqbal et al., 1986a,b,
1987a,b; Mahmooduzzafar et al., 1986, 1987; Salgare & Chakaraborty, 1988; Saquib et al., 1986) are also on record.

Enough progress has been made in the last few decades towards documenting the impact of air pollution on vegetation, but several aspects related to the impact of coal-smoke pollution need further elucidation. Given this, it was thought relevant to study the effects of the pollutants emitted from the Thermal Power Plant Complex at Kasimpur on the morphology and growth of Cassia sophera L. and Sida rhombifolia L. The study carried out for three consecutive years brought out changes due to the pollution at three developmental stages of the selected plants under field conditions.