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EFFECT OF CEMENT DUST POLLUTION ON THE GROWTH OF SOME TREE SPECIES

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Effect of cement dust on dry weight of *Albizia lebbeck, Leucennea leucocephala* and *Thespesia populneoides* was observed as compared to control (unpolluted) plants. Height, number of leaves, leaf area and biomass of *T. populneoides* was affected, while reduction in plant dry weight, cover and leaf area in *A. Lebbeck and L. Leucocephala* was comparatively less affected than the other species investigated.

Key words: Cement dust, Pollutants, Seedling growth, Trees.

Introduction

Air pollution studies are a matter of utmost concern in urban and industrial areas. Much research has been performed by researchers in order to obtain information about the effect of air pollution on human health [1] and vegetation. A particular problem in large urban areas is the high pollution burden of air borne particulate matter which arises mostly from different human activities. The degradation of human environment has been proceeding for centuries and there have been many changes. Rapidly growing population and construction of new structures is changing the flora and fauna.

Among other industrial units, cement plants are a great source of pollution. The effects of cement dust on plants (especially on fruit setting) were already studied at the beginning of the twentieth century [2,3]. Peirce [2] stated that starch formation in citrus trees decreased as a result of interference caused by pollution with cement dust which forms a crust on the leaves. According to Steinhubel [4], the gradation absorbing and reflecting capacity of dust covered plants changed. Bohne [5] stated that unfavourable effect of cement dust on radiation balance was responsible for the decreased photosynthetic activity in polluted plants. The cement dust is dangerous because it brings about negative changes in the metabolic process of plants. Pollution is responsible for increasing plant temperature which in turm decreases photosynthesis [6,7].

The damage done by pollution to photosynthesis and respiration causes a decrease in dry substance production. The rate of decrease gradually lessens as distance from the source of pollution increases [8]. Due to changes in dry substances a depression was also found in the energy contents [7,8].

Rapid industrialization particularly in developing countries has been responsible for adverse environmental conditions adding many toxic pollutants to the atmosphere [9-10]. The cement industry is one of the basic industries which plays a vital role in the national economic development; with its development, environmental imbalances in general and air pollution hazards in particular are bound to figure predominantly [11]. The fugitive dust inside the plant is a complex mixture of gases and soils. Toxic elements present in the air may not only affect the workers but also the general public, animals and vegetation in the surrounding area [12]. Hanus and Toth [13] have found that photosynthetic intensity of plants polluted with cement dust is increased at the early phase of pollution and the depression described by others occurs only later.

There has been relatively little research on the effect of cement dust in the country. However, attention has been drawn by Shah *et al.* [11] to the chlorophyll contents, stomatal clogging and biomass of some selected plants. The effect of cement dust on stomatal clogging was also observed by Abdullah and Iqbal, [12]. Shafiq and Iqbal [13] have conducted a phytosociological studies around the stone quarries and processing plants of Karachi and Thatta districts. They have recorded reduction in a number of species around the industrial units.

The aim of the present study was to investigate phytotoxic effect of cement dust on the growth of some tree species.

Materials and Methods

Investigation into the effects on growth of *Albizia lebbeck* (L.) Benth., *Leucennea leucocephala* (Lam.) de Wit, and *Thespesia populneoides* (Roxg.) Kostel, by cement dust were carried out at the Department of Botany, University of Karachi. The cement dust was collected around the vicinity of National Cement Factory. The seeds of these species were sown in pots, filled with garden soil (2 parts soil and 1 part manure). The uniform seedlings of each species were transferred into other pots (1 plant/pot). After establishment, the seedling of each species were divided into two groups, 5 seedlings of each species were treated as control (unpolluted), while the other

five seedlings were dusted with cement dust. One gram of cement dust was dusted twice a week on every treated seedling. The rate of cement dust was chosen as stated by Lerman [14], according to which the deposition of dust was 1.5g per sq. cm. in the vicinity of a cement factory. Dusting was carried out for five weeks and the pots were irrigated daily. No rain fall occurred during the experimental period.

After the completion of five weeks, the seedlings were removed from the pots. Quantitative studies were carried out on plants height, cover (circumference of aerial parts), leaf area and number of leaves. Later the seedlings after washing with water were kept in oven at 80°C for 24 hr. for dry weight determination.

The level of significance of difference between control and dusted groups was determined by student t-test.

Results and Discussion

The ill effects of cement dust on the number of leaves, leaf area, plant height, cover and dry weight to *T. populneoides, A. lebbeck* and *L. leucocephala* were observed. A significant effect of cement dust on dry weight of all the species was observed at $p<0.05$ level (Fig. 1). A significant reduction in leaf area and cover of *A. lebbeck* was also observed at $p<0.001$ level, while *A. lebbeck* did not show any significant difference in the number of leaves and plant height. *L. leucocephala* did not show any significant difference in the number of leaves, leaf area and plant height. Besides, a significant ($p<0.05$) reduction in cover and dry weight of *L. leucocephala*, the species was found least affected. *T. populneoides* showed a significant reduction in number of leaves, leaf area and dry weight at $p<0.05$ and a significant effect on height at $p<0.001$. However, the same species did not show any significant effect on cover.

The effect of cement dust on plant growth may be arranged in the following order according to their sensitivity:

T. populneoides > *A. lebbeck* > *L. leucocephala*

Accumulation of toxic substances in the biosphere is causing serious changes in the structure and function of natural ecosystem. Among other pollutants, cement pollution produced adverse effects on dry matter and yield of the plants. Significant reductions in dry weights of all species were observed as compared to the control. The damage done by pollution to photosynthesis and respiration caused a decrease in dry matter production. The rate of decrease gradually lessened with distance from the source of pollution [8]. It is important to recognize that cement dust is exhibiting hazardous effects on the growth of plants. The actual extent of disruption of reduction in leaf area of *A. lebbeck*, agree with the findings of Shah *et al.*, [11] around the cement factory of Wah, Rawalpindi district. A significant reduction by cement dust on cover of *A. lebbeck* and *L. leucocephala* species suggests that the damage may occur at any stage of the growth and on any part of the plants. No visible injury was reported in the above species investigated. Similarly, in the vicinity of cement factories, some other workers [12,13] did not report any visible symptom of damage in the plants. According to Steinhubel [4] the radiation absorbing and reflecting capacity of dust overed plants changed. *A. lebbeck* alongwith *T. populneoides* also showed reduction in leaf area. According to Shah *et al.* [11] small leaf area and reduced biomass in plants was due to poor growth. Bohne [5] states that the

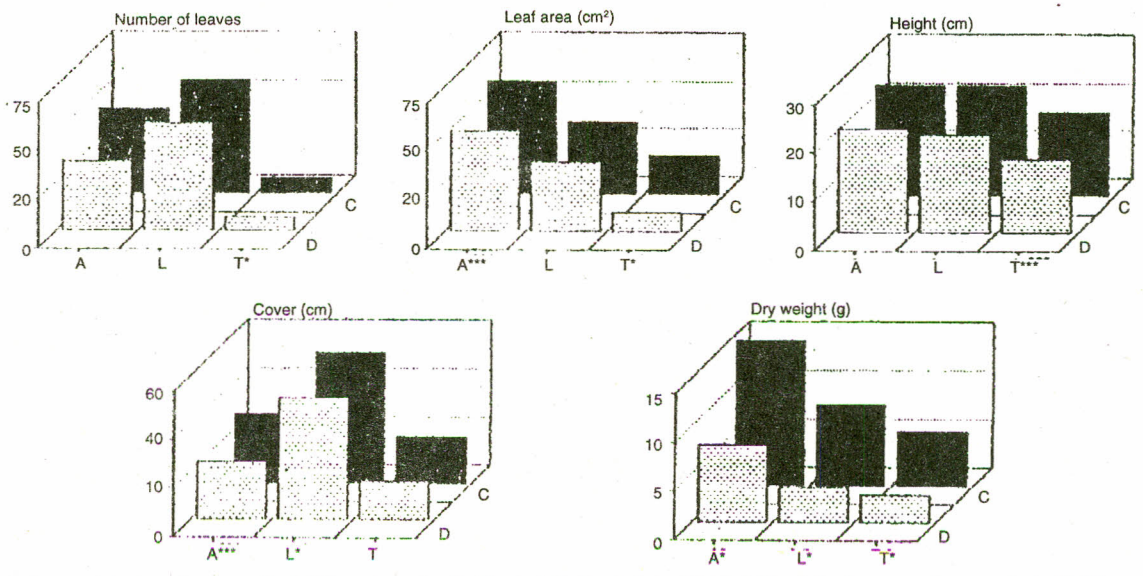

Fig. 1. Effect of cement dust on plant growth of different species. C=Control, D=Dusted, A=*Albizia lebbeck*, L=*Leucaena leucocephala*, T=*Thespesia pupulnea*. x-axis labels followed by * or *** indicate that the difference between control and dusted samples was significant at 5 and 0.1% levels of significance, respectively, as determined by Student's t-test.

unfavourable effect of cement dust on radiation balance was responsible for decreased photosynthetic activity in polluted plants. Among all the studied species, *T. populneoides* was found greatly affected for leaf area, number of leaves, dry weight and plant height. Some other workers [15,16] have also found stunted growth reduction in water uptake and stomatal closure in plants by cement dust. More research is needed on the effects of plants to cement dust.

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