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# EFFECT OF INDUSTRIAL POLLUTION ON SEED GERMINATION

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**Abstract**

The germination behaviour of seeds in polluted waters and polluted soil extracts was found to be identical, only a few species behaved differently. *Prosopis juliflora*, *Haloxylon recurvum*, *Acacia senegal* showed best germination in the two conditions but *Prosopis juliflora* was the most resistant to pollution. In *Suaeda fruticosa* no germination took place in the control treatment whereas highest germination (70%) was seen in treatment with polluted soil extract of EPLA. *Blepharis sindica* showed stimulating effect of polluted water on germination, whereas low germination was observed when their seeds were treated with the soil extract of the same site. Slightly high percentage (40%) of germination of *Suaeda monoica* was seen only in polluted water of Carbon & Ribbon Mfg. Co., whereas 30% of germination was found in control treatment. Low percentage of germination was found when the seeds of *Cassia holosericea* were treated with polluted waters of different industries as compared to soil extract treatments of the same industries. *Datura alba* showed 50, 30 and 10% of seed germination in polluted soil extract of Carbon & Ribbon Mfg. Co., in control and in polluted water of Darbar Soap Works, respectively.

## Introduction

After the creation of Pakistan, several industries were established in different areas of Karachi City but the Sind Industrial Trading Estate (S.I.T.E.) area is the central place where textile, soap, pharmaceutical and chemical industries are common. These industries cause air, water and soil pollution which affect the plant and human life in different ways. Among the three types of pollution, the water pollution is more serious than the others. Waste products of different industries pass through drains which often meet together to form a big drain, waste products of which ultimately fall into the sea. During the course of their movement, chemicals pollute the soil and change its composition and properties. Some waste drains are cemented where the soil is less affected.

No work has so far been done in Pakistan on the effect of industrial pollution on seed germination. However some work was available on the effect of industrial pollution on plants. Eloranta & Pertti (1970) studied pollution and aquatic flora of waters by sulfite cellulose factory at Maenttae, a Finnish lake district. Some species were benefitted by pollution and some suffered from it, while others were more or less indifferent to it. Vorobeva, Lapchenko Shalya (1970) carried out two irrigation to corn and sugarbeet with waste water from polyvinyl chloride production during the growing season in U.S.S.R. and observed that the harvest and composition of vegetation from experimental fields did not differ from the control. Baker (1971), described the seasonal effects of oil pollution on salt marsh vegetation near pembroke, South-West Wales. There was little long term vegetation damage to perennial species, but in annual (*Suaeda maritima*), the damage was severe. They further observed that flower density measurements for *Juncus gerardii*, *Festuca rubra*, *Plantago maritima* and *Spartina townsendii*, showed a marked reduction of flowers if plants were oiled while

the flower buds were developing. Klein (1962) and Odum (1971) have recently reviewed the problem of pollution and its control. The present paper describes the effect of soil and water pollution on seed germination.

## Materials and Methods

The seeds of those species were obtained from the University Campus which were known to germinate easily with distilled water or tap water. Selected number of seeds of each species were kept on blotting papers in Petri dishes. Blotting papers were kept moistened with the particular treatments of polluted water of an industry and daily germinations were noted till no further germination was observed.

For the seed germination the following treatments were applied.

(i) Normal water treatments (control).

(ii) Polluted water of different industries treatments (as shown in Table 1).

(iii) Polluted soil extract treatments (Table 1).

**TABLE 1. Comparative study of percentage of seed germination of different species when treated with different industrial polluted waters and polluted soil extracts.**

| S. No. | Name of species | I | II | | III | | IV | | V | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | A | B | A | B | A | B |
| 1. | *Prosopis juliflora* | 40 | 50 | 70 | 70 | 80 | 60 | — | 10 | 100 |
| 2. | *Suaeda fruticosa* | Nil | 60 | 40 | 50 | 70 | Nl | — | Nil | 50 |
| 3. | *Blepharis sindica* | 30 | 40 | 10 | 70 | 30 | Nil | 10 | — | Nil |
| 4. | *Suaeda monoica* | 30 | 40 | 10 | 10 | 10 | Nil | — | Nil | 10 |
| 5. | *Haloxylon recurvum* | 90 | 80 | 80 | 100 | 80 | 90 | 80 | Nil | 70 |
| 6. | *Cassia holosericea* | 60 | 10 | 80 | 60 | 30 | 30 | 100 | Nil | 20 |
| 7. | *Datura alba* | 30 | Nil | 50 | Nil | Nil | 10 | — | Nil | Nil |
| 8 | *Acacia senegal* | 90 | 80 | 90 | 60 | 90 | — | 100 | — | 80 |

A — Polluted water treatment.

B — Polluted soil extract treatment.

I — Control treatment (tap water).

II — Treatment with polluted water & polluted soil extract of Carbon & Ribbon Mfg. Co.

III — Treatment with polluted water & polluted soil extract of Eastern Pharmaceutical Laboratory.

IV — Treatment with polluted water & polluted soil extract of Darbar Soap Works.

V — Treatment with Polluted water & polluted soil extract of Valika Chemical Industries.

## Results and Discussion

Stimulating effects of polluted waters were found in some species while seeds of other species did not show germination and in certain species, the germination percentage was less than the control treatment (Table 1). High percentage of germination was seen in some seeds which had hard seed coat e.g., *Prosopis juliflora* DC.

Most resistant species to polluted conditions at germination stage were *Prosopis juliflora* DC., *Haloxylon recurvum* (Moq.) Bunge. *Cassia holosericea* Fres. and *Acacia senegal* Willd. *Prosopis juliflora* and *Cassia holosericea* are the most common species of the vegetation of disturbed areas formed by mechanical distrubance. Their high percentages of germination are in conformity with the abundance of these species in industrial areas away from the waste disposal drains. Among the waste products of different industries, most toxic for the seed germination was of Valika Chemical Industries and the least toxic was of Carbon & Ribbon Mfg. Co. and Eastern Pharmaceutical Laboratory. Waste products of Darbar Soap Works were also toxic but not so much as that of Valika Chemical Industries. The waste products of Valika Chemical Industries seem to have a variety of chemical substances, acids, alkalies and complex organic compounds produced during manufacturing of ethanol, methanol etc. Waste products of Darbar Soap Works probably consist of different compounds of sodium and potassium as carbonates, bicarbonates, hydroxyl ions and chlorides with oil emulsion. The waste products of Carbon & Ribbon Mfg. Co., and pharmaceutical laboratories etc., may contain complex carbon compounds and calcium salts in the polluted waste products.

The polluted waters and polluted soil extracts showed similar effects on seed germination yet water was found to be more harmful as the seeds of some species showed negative results as compared to the germination with polluted soil extract of the same locality e.g., seed germination in *Prosopis juliflora*, *Cassia holosericea*, *Datura albanees*, *Suaeda fruticosa* L. Forsk. and *Acacia senegal*. One species *Blepharis sindica* showed high percentage of germination in polluted water of Carbon & Ribbon Mfg. Co. and EPLA, probably due to the presence of complex carbon compounds and calcium salts in the respective industries.

*Haloxylon recurvum* and *Acacia senegal* showed no significant difference with polluted waters and polluted soil extracts. They showed best germination in polluted conditions as well as in the control treatment. It seems that these species have great tolerance to the chemicals present in the polluted waters and polluted soil extracts.

Absence of germination in polluted water of Valika Chemical Industries except *Prosopis juliflora* and low germination percentage in *Blepharis sindica* and *Cassia holosericea* in polluted soil extract of the same industry is apparently due to the presence of too many chemicals in the waste products. *Prosopis juliflora* seeds showed the best germination (100%) in the soil extract of Valika Chemical Industries. Soil seems to be less polluted due to leaching of chemicals and the chemicals present in the soil induced seed germination of this species more vigorously as compared to the chemicals present in the soils of other industries. Ten percent germination in *Prosopis juliflora* might be because of hard seed coat of this species whereas in other species, the seed coats were not so hard and the embryo might have been injured.

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