

## The effects of dusts of bartin cement factory on Taurus Cedar (*Cedrus libani* A. Rich.) seeds' germination

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### Abstract

The present study effects of pollutant particles from Bartın Cement Factory on development of seeds and leaves of Taurus Cedar (*Cedrus libani* Rich.) which in plantation area around the factory were examined. For this purpose, seeds were collected from sampling trees located 200m, 400m, 600m, 800m and 1000m (control) and germination percentage of seeds, and total chlorophyll content of seedlings were determined. Moreover, in the present study, the air movement around Bartın Cement Factory and level of pollutants in sampling areas were also determined. The directions of the prevailing winds around the cement factory were North, and Northwest. From the aspect of pollutant material level, the array of sampling areas was SP1>SP2>SP3>SP4>C. On the other hand, evaluating the results of mean seed germination percentages, a significant difference ( $P<0.01$ ) was noted between control and seeds of Taurus Cedar at various distances from are pollutant source. From the aspect of the power of seeds collected with 3 repetitions from Taurus Cedars located at various distances, it a significant difference ( $P<0.01$ ) was found between the control and experimental groups. Accordingly, from both the aspects of mean germination percentage and seed power, an apparent increase was observed from 400 m distance. On the other hand, as the distance from cement factory increased, total chlorophyll content in Taurus Cedar seedlings increases significantly. Results of bilateral regression analysis evaluated exponential relationship at level 97% between these 2 variables.

### Key words

Cedar, Chlorophyll content, Germination percentage, Pollution, Seed power, Taurus

### Introduction

Urbanization and industrialization is increasing with world's population growth. Particularly, the regions and countries where the numbers of industries are high air, water and soil are gradually being polluted by industrial wastes. Air, one of these natural sources, consists of 78% nitrogen, 21% oxygen, 0.93% argon, 0.3% carbon dioxide, and trace amount of other gases. Any substance changing this natural composition of air is considered to cause pollution. Within this context, air pollution can be defined as the change of air or the decrease of dusts, smut and stack gas in the air at the level harming the health of human and other living creatures and physical environment (Daly and Zanetti, 2007). Gaseous sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), carbon dioxide

(CO<sub>2</sub>), lead compounds, and carbon particles wastes caused from automobiles and industries change the composition of air. Another important part of pollution by industrialization consists of heavy metals. Heavy metals such as Pb, Cu and Zn emerging as a result of pollution cause significant toxicity in plants, human and animals by penetrating into soil and atmosphere (Prinn *et al.*, 2005). The aim of the present study was to determine the effect of Bartın region, on seed germination and seed physiology of Taurus Cedar plantation area around the factory.

### Materials and Methods

**Determining air-polluter particle's amount in experiment area :** In the presents study, 5 experimental areas were

selected at a distance at 200, 400, 600, 800 and 1000m from a cement factory, and seeds of Taurus Cedar trees were collected for study. These experiments of areas were selected by considering the direction of prevailing wind. The dimensions of particles in experiment areas were determined by hydrometer method (Bouyoucos, 1951).

**Obtaining seed samples :** Seeds were collected from plantation area shown in Fig. 1 between 200m and 1000m distances with 200m of interval in 3 repetitions. In order to determine the effects of dust of cement factory some seed characteristics and germination of seeds under laboratory conditions were studied. Seed collected from Taurus Cedar trees at 1000m distance were considered as control.

**Determining the seed characteristics :** Germination tests were carried out following the International Rules for Seed Testing (ISTA, 2014) criteria. Seeds in control group were kept in distilled water for 24h. All for the seed groups

collected from different distances were germinated for 21 days. For germination tests, mean germination percentage, seed power and chlorophyll content were studied. Total chlorophyll content was measured from fresh leaves of 21 days old Taurus Cedar seedlings in Bülent Ecevit University Laboratory following the method.

**Statistical analyses :** Analysis of variance (ANOVA) according to random block pattern was applied, while Duncan test was used for grouping the emerging differences. Regression analysis was used by determination of chlorophyll contents.

## Results and Discussion

It can be seen that the array of sample areas in terms of pollutant material amount is. Moreover, when specify were evaluated, no significant difference was observed between 200m and 400m distance (Table 1).

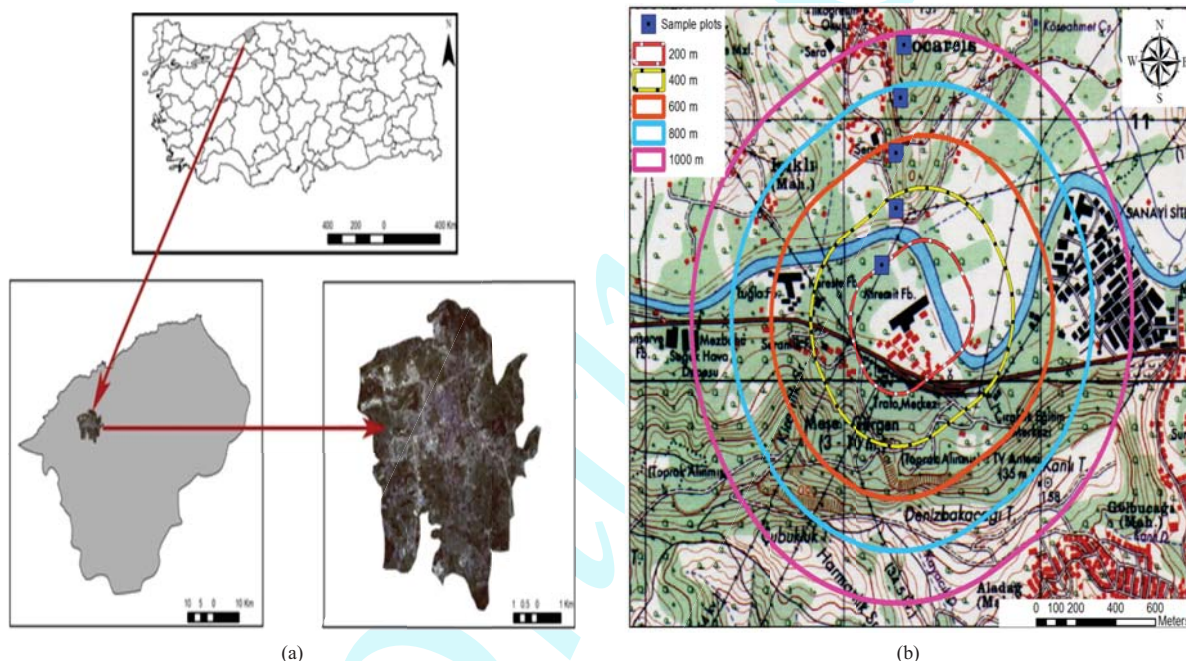
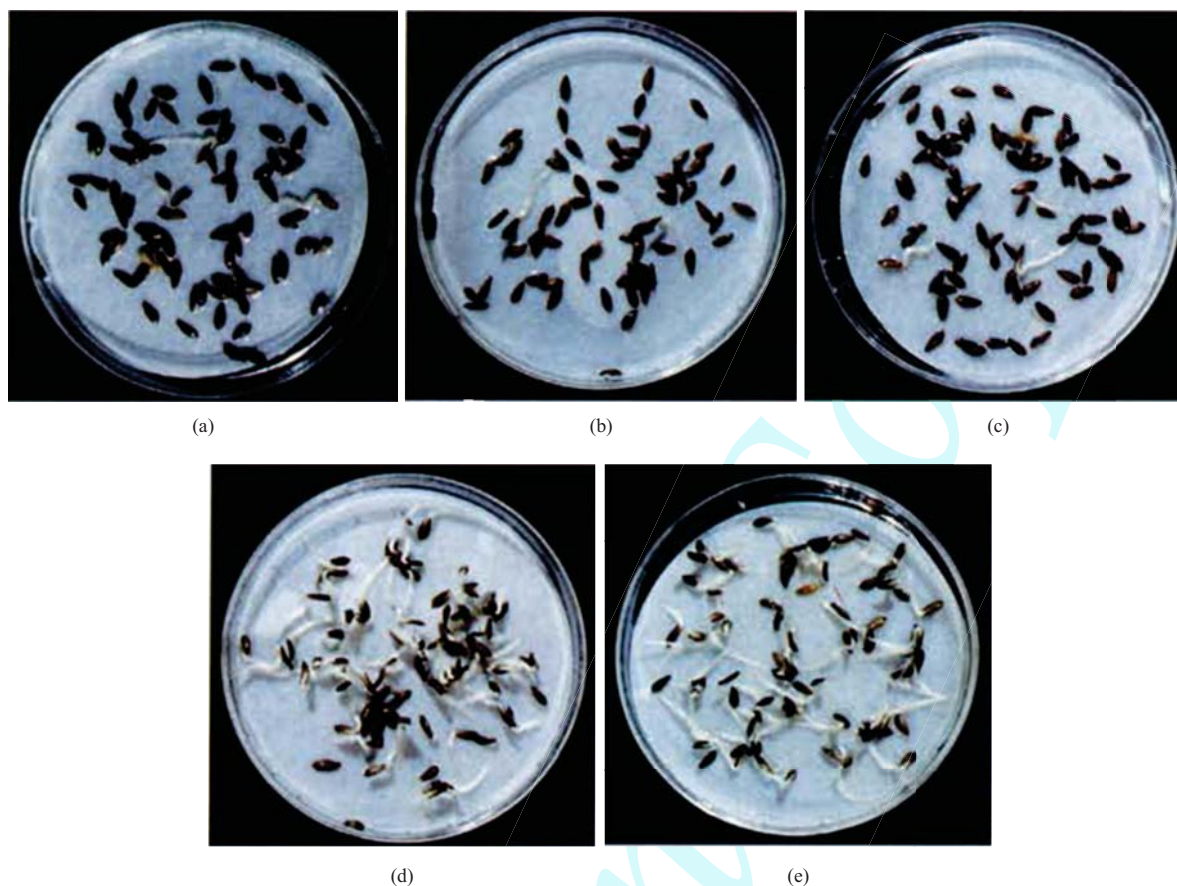


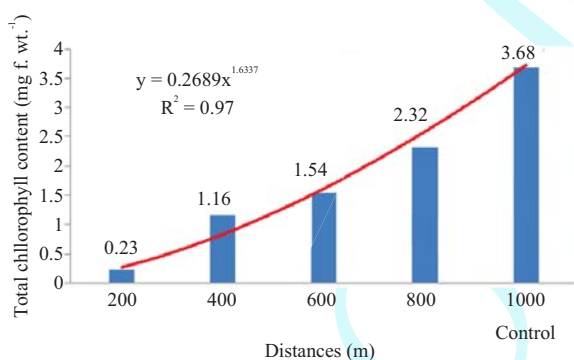
Fig. 1 : Location of research field within Bartın basin (a) and the seed sampling zones (b)

Table 1 : Mean concentration values of air pollutant particles determined in experiment area

Experiment area	Distance from cement factory (m)	Mean concentration ( $\mu\text{g cm}^{-3}$ )	Concentration(%)
SP1	200	942.53	27.2
SP2	400	936.75	27.1
SP3	600	745.96	21.6
SP4	800	643.27	18.7
C (Control)	1000	185.84	5.4



**Fig. 2 :** Germination status of Taurus Cedar seeds collected at 200m and different distances from pollutant source (at the end of 21<sup>st</sup> day) (a: seeds collected at 200m distance, b: seeds collected at 400m distance, c: seeds collected at 600m distance, d: seeds collected at 800m distance, e: seeds collected at 1000m distance (control))



**Fig. 3 :** Total chlorophyll content of the fresh leaves of seedlings grown from seeds collected from sample Taurus Cedar trees at various distances from cement factory

The results of ANOVA and Duncan test on germination percentage of Taurus Cedar seeds. The results have been evaluated, it has been determined according to the

variance analysis implemented between germination percentage of seeds collected that there is a significant difference at confidence level of  $P < 0.01$ . As a result of Duncan test was performed. Accordingly, germination percentage values of Taurus Cedar seeds showed significant increase after 400m of distance (Fig. 2).

The results are in confirmation will the serious reports of where germination percentage of particles released from cement factory *Croton bonplandianum*, *Cassia auriculata* species', it was used determined that mean germination percentage of seeds collected at 300-500m distance from cement factory varied between 23% and 55%, while these as 500m distance varied between 73% and 92% respectively. In another study the effect, of particles released from cement factory on germination percentage of *Azadiractha indica*, *Mangifera indica*, *Andropogon gayanus*, *Uvarea chamae* and *Gmelina arborea* species was evaluated and the results revealed that the mean germination percentage of seeds



**Table 2 :** Mean germination percentage values of the Taurus Cedar seeds collected at various distances from pollutant source, the results of Variance analysis and Duncan test

Distance from cement factory (m)	Germination percentage(%)
	<i>F=183.46**</i>
200	28a
400	34b
600	65c
800	82c
1000 (control)	94d

\*\* : significant difference at  $P < 0.01$  level

**Table 3 :** Seed power values of the Taurus Cedar seeds collected at various distances from the pollutant source, the results of variance analysis and Duncan test

Distance from cement factory (m)	Seed power index
	<i>F=292.54**</i>
200	32a
400	45b
600	78c
800	86c
1000 (Control)	95d

\*\* : significant difference at  $P < 0.01$  level

collected at first 400m from factory varied between 12.5% and 24.6% the mean germination percentage of same species varied between 54.6% and 88.3% or what distance while distance (Prince will et al., 2011). Similarly use what particles are emitted from the factory mention on plant species have been reported by several researches (Iqbal and Shafiq, 2007; Khashman and Shawabkeh 2006; Mandal and Voutchkov, 2011).

Zargari and Shoar (2008) seed power index of *Helianthus annuus* L. varied between 66.8 and 73.6 as 300m distance from the pollutant. As stated before, in Turkey, there is not enough number of and detailed studies carried out on the effects of air pollutant particles released from cement factory on germination of seed of forest trees. In a study carried out in India, the effects of the particles released from cement factory on germination and seed power of corn plant seeds were investigated, and it was reported that the seed power index value of the seeds collected at 500m distance from the cement factory varied between 85 and 92 (Gupta and Abdullah, 2011).

The exponential regression curve revealed that total chlorophyll content of Taurus Cedar seedlings significantly increased will increase in distance from the cement factory.

The curve showed 77% level between total chlorophyll content fresh leaves of Taurus Cedar seedlings and from cement factory (Fig. 3).

In a similar study carried out by Fakhry and Migahid (2011), it was observed that particles released from cement factory. In another study on agricultural plants, it was found that the particles released from cement factory caused air pollution in plants (Bilen, 2010).

The factories must implement the control methods developed in order to minimize the negative effects on environment and the pollutant values. Particularly the particle pollutants released from cement factories mentioned in study. Even though it is not a solution for domestic and industrial air-polluters created intensively, air-polluter-resistant plant types should be developed in order to minimize the effects of air pollution on the plants.

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