CHAPTER 1
INTRODUCTION

The use of plants to assess environmental risks in the air, water, and soil ecosystems is a new scientific approach that has gained scientific attention recently and has a promising future. Plants are abundant and primary producers for many other life forms. Their development is closely related to the environmental conditions in which they grow and they exhibit stress responses within a short time. The threat of environmental pollutants to plants is a major environmental issue and plant-environmental research has been conducted worldwide. Included in this plant-environmental research, phytotoxicity tests are an important area of increasing interest.

These tests can be less time consuming, relatively inexpensive, and provide important information for environmental protection. Environmental monitoring by using biological materials, including plants, which have sensitivity to pollutants, is an important property of indicator species. Numerous studies of plant responses to pollutants, including heavy metals, have been investigated. Sensitive plant species, sensitive parameters, and sensitive morphological characters are studied to reveal the best one which can serve as early warning indicators for both *in situ* and *ex situ* biomonitoring. *In situ* means vegetation surveys (passive monitoring) and *ex situ* means phytotoxicity tests (active monitoring). Apart from this benefit, hyperaccumulator plant species, which can have inordinately high metal content, can be discovered from these studies.

Of the causes of soil pollution, heavy metals contamination represents a large proportion of the problems. According to the U. S. EPA, in 1997 the most common inorganic contaminant in the United States is lead (Pb; 47 % of sites) followed by arsenic (As; 41 %), chromium (Cr; 37 %), cadmium (Cd; 32 %), nickel (Ni; 29 %), and zinc (Zn; 29 %) (Lombi *et al.*, 2001). Lead, cadmium, chromium, nickel, zinc, copper, and cobalt naturally occur in many soils at concentration less than 300 mg/kg from weathering of parent bedrock materials (Fergusson, 1970). Martin and Coughtrey (1982) reported that the primary source of heavy metals in the environment is from naturally occurring geochemical materials.

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Heavy metal-pollution is a common phenomenon in industrial countries. The ability of individual plant species to tolerate or accumulate heavy metals has been widely investigated in Western nations. In contrast, tropical Asian countries have had very little investigations on plant indicators, therefore, more studies need to be done on this topic.

For this reason, this study was conduced to test the effect of lead on some plant species. In order to investigate the effects of toxic compounds in plants, there are three tests required by the U.S. EPA, U.S. FDA, and OECD which are seed germination, root elongation, and seedling growth (Fletcher, 1991). Due to toxic stress, the phenotypic characters of plants can be changed. A number of studies have reported the increased levels of fluctuating asymmetry (FA), *i.e.* abnormal symmetry, in contaminated environments (Kozlov and Junttila, 2002; Andalo *et al.*, 2000; Tarun *et al.*, 2002). Because of this information, FA was observed as a one-seedling growth parameter in my research.

The rationale and hypotheses of my study were:

1. There is a significant effect of lead toxicity on seed germination and seedling growth,
2. There is a difference of lead accumulation in various plant parts, and
3. There is a significant difference in plant responses to lead toxicity.

The aims of this study were:

1. To study the relationships between the germination rate, growth rates, and changes of plant phenotypes with different lead concentrations.
2. To study the lead uptake rate and translocation in plants, and
3. To determine the degrees to which some plant species are tolerant or sensitive to lead contamination.

The results of this study provides useful information about the potential ability of some plant species to be used as indicators for lead contamination monitoring and phytoremediation programs, as well as scientific evidence for selection of plant species for phytotoxic assessment programs.

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