

## Research article

# RESPONSE OF SUNFLOWERS (*HELIANTHUS ANNUUS L.*) CULTIVARS TO DIFFERENT LEVELS OF EXOGENOUSLY APPLIED CADMIUM AND ELUCIDATION OF POSSIBLE TOLERANCE MECHANISM

Abdul Ghani

Department of Biological sciences, University of Sargodha, Pakistan

**The effects of different concentrations of Cadmium on the growth of sunflower (*Helianthus annuus L.*) and its accumulation in roots, stem and leaves were investigated using Atomic absorption spectrophotometer. The concentrations of Cadmium chloride used were 0, 6, 9 and 12 mg/kg soil. Seedlings of three sunflower cultivars viz., HI-SUN33, HI-SUN38 and S278 exposed to 9 PPM Cd exhibited substantial growth reduction and all of them died 10 days after treatment application. Growth of roots and shoots was inhibited at concentrations of 9 mg/kg soil and 12 mg/kg. Cd during the entire experiment (20 days). Cadmium accumulation in roots, stems and leaves increased significantly ( $p < 0.05$ ) with increasing Cd concentrations. Cadmium was concentrated mainly in the roots, and variable amounts of Cd were also transported to stem and leaves. Among the three cultivars, HI-SUN38 produced more roots and higher biomass than HI-SUN33 and had a greater ability to accumulate Cd when compared with S278.**

**Key words:** Cadmium, sunflower, *Helianthus annuus*, Atomic absorption, Growth of roots and shoots

## Introduction

Cadmium (Cd) a trace heavy metal is considered a hazardous pollutant due to its high toxicity and solubility in water (Lockwood, 1976). At a low concentration it has stimulatory effect on root growth of *Allium sativum* (Liu et al., 2003, 2004), but at a higher concentration it is toxic and directly or indirectly inhibits physiological processes such as respiration, photosynthesis, cell division, plant-water relationships, metabolism and mineral nutrition, resulting in poor growth and low biomass (Barcelo & Poschenrieder, 1990; Sanita & Gabrielli, 1999; Liu et al., 2003/2004). Cadmium can be easily taken up by plants, transferred through food chains to impart adverse effects on human health (Nordberg, 2003; Wagner, 1994). Emphasis has become more prevalent towards the problems of Cd pollution with the development of

modern industry and agriculture. Anthropogenic activities, such as mining, industry, agriculture and waste disposal has increased since the beginning of the 20<sup>th</sup> century (Alloway, 1995). Most conventional remediation approaches do not provide an acceptable solution to treating contamination caused by metal pollution. Alternatively, phytoremediation provides an attractive strategy, being low cost and environmentally sustainable (McGrath et al., 2002; Salt et al., 1998). The idea of using rare plants which hyperaccumulate metals to selectively remove and recycle excessive soil metals was introduced by Chancy (1983). Salt et al. (1996) also considered phytoremediation as an emerging technology using selected and engineered metal-accumulating plants for environmental clean-up. Metal-accumulating plants can accumulate unusually high concentrations of heavy metals in both roots and shoots from polluted soil and waters (Kumar et al., 1995; Dushenkov et al., 1995). A few terrestrial plant species e.g. *Thlaspi* sp., (Lombi et al., 2000) and *Arabidopsis halleri* (Bert et al., 2002) were reported to accumulate high concentrations of Cd,

\*Correspondence author Email: [ghaniuaf@yahoo.com](mailto:ghaniuaf@yahoo.com)