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# Changes in growth, photosynthetic responses and biochemical contents of carrot plants under cadmium toxicity

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**SUMMARY**

The effect of increasing concentrations (10, 30 and 50mg $kg^{-1}$) of soil cadmium on growth and biochemical contents in carrot (*Daucus carota* L.) plants were analysed on two different sampling *viz.*, 30th and 45th days. Photosynthetic rate and stomatal conductance were measured on 45th sampling days only. Control plants were maintained separately. The inner surface of pots was lined with a polythene sheet. Each pot contained 3kg of air dried soil. Six seeds were sown in each pot. All pots were watered to field capacity daily. Plants were thinned to a maximum of three per pots, after a week of germination. Cadmium at all levels (10,30 and 50mg $kg^{-1}$) tested, decreased the growth parameters such as root and shoot length, number of leaf, total leaf area, photosynthetic responses such as photosynthetic rate and stomatal conductance and biochemical constituents such as total chlorophyll, carotenoid and total sugar contents of carrot plants compared to untreated plants.

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Heavy metals are important environmental pollutants particularly in areas where there is a high anthropogenic pressure, but they also occur naturally (Alloway,1995a; Sanità di Toppi and Gabbrielli, 1999). Anthropogenic cadmium contamination often results from mining or smelting of metal ores, but cadmium is also released into the environment by power stations, heating systems, waste incinerators, urban traffic, cement factories and as a by-product of phosphate fertilizers. Use of sewage sludges as fertilizers has further contributed to a significant contamination of agricultural soils. In areas with low anthropogenic pressure, natural high concentrations are observed, for example in soils formed on metal rich rocks, such as serpentine soils that release cadmium as a result of rock mineralization processes (Alloway, 1995a; Sanità di Toppi and Gabbrielli, 1999; Adriano, 2001). Apart from some emission into the atmosphere in the form of dust particles or vapors, heavy metals stay largely in the aquatic and soil phases of the planet.

Cadmium is one of the toxic heavy metal which has many deleterious biological aspects (Nriagu, 1981), and it enters the biosphere through various industrial waste products, certain plants can accumulate heavy metals in their tissues. Uptake is generally increased in plants that are grown in areas with increased soil concentrations of metals. Many people could be at risk of adverse health effects from consuming common garden vegetables cultivated in contaminated soil. Often the condition of garden soil is unknown or undocumented; therefore, exposure to toxic levels can occur. Xu and Thornton (1985) suggested that there are health risks from consuming vegetables with elevated heavy metal concentrations. The populations most affected by heavy metal toxicity are pregnant women or very young children (Boon and Soltanpour 1992). In the present investigation extent of changes in growth parameters such as, root and shoot length, number of leaves and leaf area, photosynthetic rate, stomatal conductance and biochemical constituents such as, total chlorophyll, carotinoids, and total sugar contents in carrot plants due to cadmium toxicity were

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