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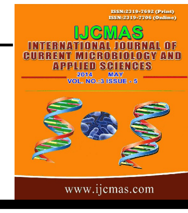

Original Research Article

Response to biochemical characteristics by mercuric chloride on *Clitoria ternatia L.*

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Keywords

Clitoria ternatia; germination; chlorophyll; mercury; heavy metal stress.

A B S T R A C T

The effects of heavy metal stress on pigmentation level were studied in the leaves of *Clitoria ternatia. Clitoria ternatia* were grown for 30 days and the heavy metal mercuric chloride was sprayed after 10 days from the date of planting. Effect of mercuric chloride was observed in treated plants. The selected plant *Clitoria ternatia* was grown under mercuric chloride treatment in a specified concentration 1 µg/10ml. The control plant maintained without the treatment of mercuric chloride. The following growth parameters such as root and shoot lengths and the concentration of photosynthetic pigments such as chlorophyll, carotenoid and xanthophyll were affected by the treatment due to mercuric chloride stress. Here mercuric chloride was accumulated more in matured leaves. Since the chlorophyll content was reduced in leaves because excess of mercuric chloride supressed biomass production in leaves. The results are discussed with the literature.

Introduction

One of the major concerns of this century is the prevention of environmental quality and management. Photosynthesis is one of the most severely affected processes during salinity stress (Sudir and Murthy, 2004). This is mediated by decreased chlorophyll pigment, inhibition of RUBISCO (Soussi *et al*., 1998) and closure of stomata thereby decreasing the CO_2 pressure (Betheky and Drew, 1992). Heavy metal stress is another environmental problem that leads to loss in agriculture productivity and hazardous health effects. A common consequence of most abiotic stresses such as salinity (Sairam *et al.*, 2005) and heavy metals (Cd_2+) (Muthuchelian *et al.*, 2001) is an increased production of reactive oxygen species (ROS). However, salinity is not inimical to all plants. Mostly a wide range of plant varieties grows naturally against the different stress (Ravindran *et al*., 2007).

Heavy metal contamination of land and water resources is a growing problem in many countries. Although heavy metals are the natural components of soils in trace level activities such as mining, industry and localised agriculture have contributed to undesirable accumulations of these metals at toxic levels (Alloway, 1995).

The mechanisms of heavy metal toxicity on photosynthesis is still a matter of speculations, this may be partly due to the differences in experimental design but some evidence points to the involvement of electron transport in light reactions (Giardi *et al.*,1997) and enzyme activities in the dark reactions (Chugh and Sawhney, 1991). Several plant species and genotype can colonize metal rich soils and are known for their natural ability. These metal tolerant plants are often excluders nonetheless a class of plants called hyper accumulators not only tolerate high metal leaves but also have the ability to accumulate or hyper accumulate large quantities of trace elements them (Verbruggen *et al.,* 2009). However, Cd hyper accumulators are very rare in plant kingdom (Lux *et al.,* 2011) and their tolerance mechanisms are not well known (Sun *et al.,* 2007).

These species react very rapidly with lipids, nucleic acids, pigments and proteins. The stress affecting plants are numerous and often species are even variety are location specific (Ravindran *et al*., 2010). Irrigation water qualities not only affect the growth of crops, but also affect the soil health (Aldesuquy *et al*., 2014). (Mascher *et al*., 2002) reported that in many cases of soil pollution with heavy metal studies. Therefore the present work is to demonstrate the growth characteristics and pigment concentration against heavy metal stress by using *Clitoria ternatia* plants.

Materials and Methods

Plant Material

Seeds of *Clitoria ternatia* were collected from Kerala Agricultural University, Kerala. Seeds of *Clitoria ternatia* were germinated in pots. Seedlings were supplemented with water regularly.

Heavy metal treatment

After 10 days of germination, mercuric chloride was sprayed in soil in the level of 1µg/ml. Shoot and root length was measured. Plant pigments such as chlorophyll a, chlorophyll b, total chlorophyll (Moran and Porath, 1980), anthocyanin, xanthophyll (Mancinelli *et al*., 1975) and carotenoids (Ikan, 1969) were analysed by using column chromatography.

Results and Discussion

Effects of mercuric chloride on the growth of *Clitoria ternatia* plant

Clitoria ternatia plant growth was measured in terms of total fresh length of shoot and root when compared with control plant. The shoot length of control plant was 2.1 cm and treatment plant is about 1.3 cm. The shoot length was reduced 161% in treated seedlings when compared to control. The root length of control plant is 1.3 cm and treatment is 0.7 cm. In root length was reduced 53.8% in treated seedlings when compared to control seedlings.

Effects of mercuric chloride on analysis of plant pigments

In order to investigate the effects of heavy metals on chlorophyll content, total chlorophyll was calculated. As a result the

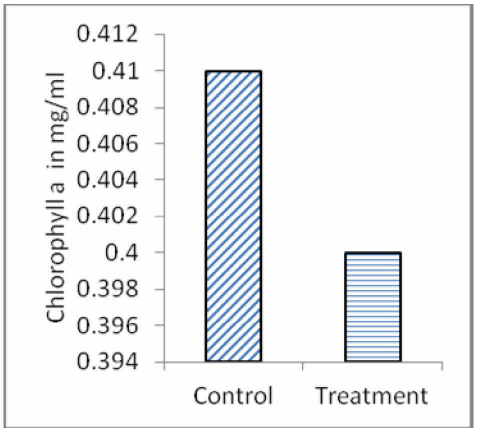

Fig: 1 Effect of $HgCl_2$ treatment on Chlorophyll a of *Clitoria ternatia* leaves leaves

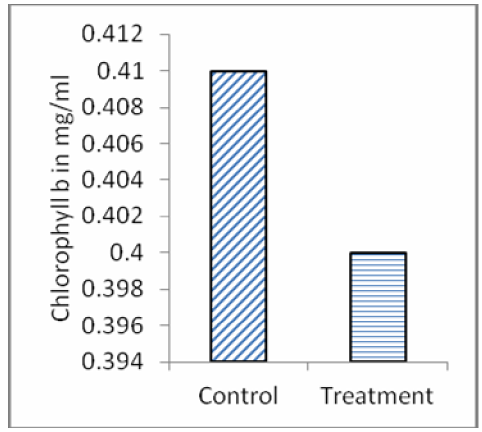

Fig: 2 Effect of $HgCl_2$ treatment on Chlorophyll b of *Clitoria ternatia*

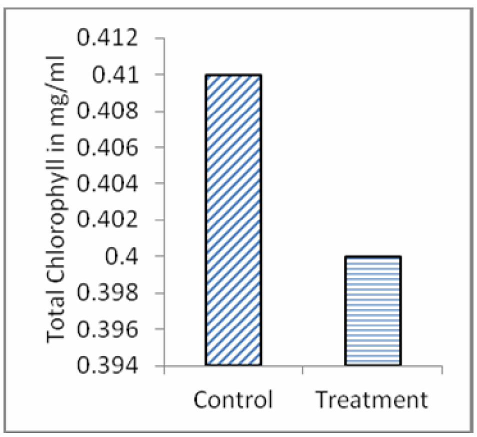

Fig: 3 Effect of $HgCl_2$ treatment on Total Chlorophyll of *Clitoria ternatia* leaves

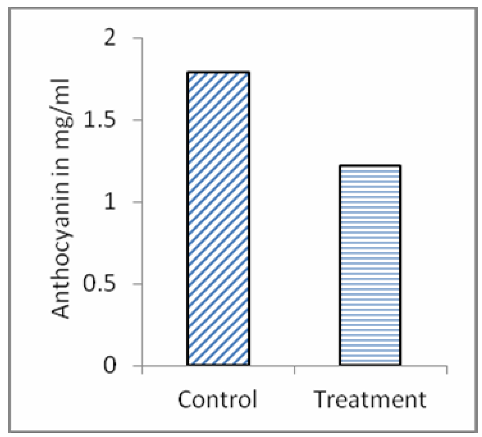

Fig: 4 Effect of $HgCl_2$ treatment on Anthocyanin of *Clitoria ternatia* leaves

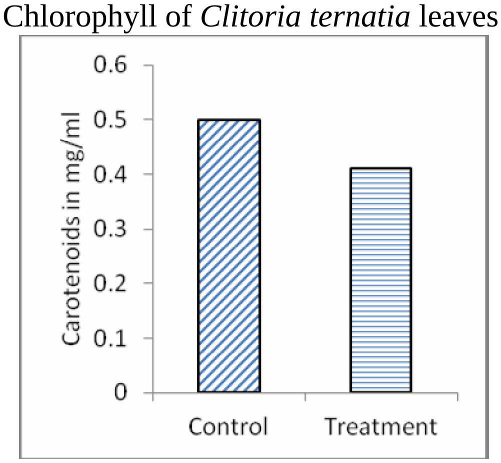

Fig: 5 Effect of $HgCl_2$ treatment on Carotenoids of *Clitoria ternatia* leaves

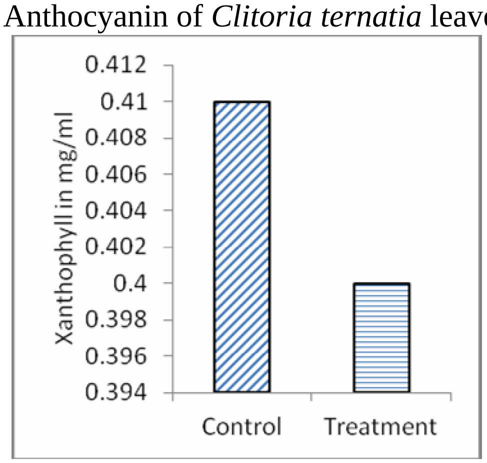

Fig: 6 Effect of $HgCl_2$ treatment on Xanthophyll of *Clitoria ternatia* leaves

pigment content was increased in control plant and in mercuric chloride treated plant the chlorophyll content was decreased. This is because of pigment depression by heavy metal stress. Compared to the control, the parameters such as chlorophyll a, chlorophyll b, total chlorophyll, anthocyanin, carotenoids and xanthophyll were decreased. The extent of pigment depression of mercuric chloride was 146.15% chlorophyll a, 164% of chlorophyll b, 143.13% of total chlorophyll, 146.72% of anthocyanin, 121.95% of carotenoids and 120% of xanthophyll (Fig: 1-6). This is that chlorophyll b is more effective than all other parameters. This may be attributed to reduced activity of photosynthetic rates due to heavy metal concentration of mercuric chloride.

The pigment concentration is expected decreases in photosynthetic pigments had previously been reported for the impact of sublegal concentrations of volatile chlorocarbons in various plants (Debus and Schroder, 2000). The result was obtained in the pigment analysis is in line with that of heavy metal stress (Dixon *et al*., 1998). The heavy metal ions showing toxicity in plants (Nieboer and Richardson *et al*., 1980) are observed through leaves (Kelly *et al*., 1979). Considering the effects of mercuric chloride on the growth of *Clitoria ternatia*, the growth was retarded more when compared to control and the effect on growth of plant was different depending on heavy metal. In our results suggested that *Clitoria ternatia* may be more tolerant to mercuric chloride. On investigating the effect of chlorophyll content decreases by mercury. This result is considered due to the fact that mercuric chloride served as a strong inhibitor of chlorophyll accumulation. (Rajani sowparnika and Balakrishnan, 2013) stated that the rapid industrialization and urbanization causes an environmental pollution and releases several xenobiotic compounds in to the environment. Some physicochemical processes have been shown to be effective in heavy metal removal (Yogalakshmi and Balakrishnan, 2013). The present study clearly indicates that the leaf increases the concentration of mercury in treated plants as compared to control due to higher uptake of heavy metals causing accumulation.

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