Research Paper:

Chronic toxicity of chlorophenoxy herbicide on growth, metabolites and enzymatic activities of *Anabaena fertilissima* Rao

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SUMMARY

Correspondence to : J.I. NIRMAL KUMAR P.G. Department of Environmental Science and Technology, Institute of Science and Technology for Advanced Studies and Research (ISTAR), ANAND (GUJARAT) INDIA Study was carried out to investigate the chronic response of Cyanobacterium, *Anabaena fertilissima* to chlorophenoxy herbicide 2,4-Dichlorophynoxyacetic Acid (2,4-D) ethyl ester at different concentrations 15, 30 and 60ppm. The influence of 2,4-D on growth (pigments), release of metabolites such as carbohydrates, protein, amino acid, phenols and nitrate reductase and glutamine synthetase activities was analyzed. The test concentrations caused a concentration dependent decrease in pigments. Depletion in carbohydrate and protein content was registered with rise in herbicide concentrations. However, phenols were found to rise with increased herbicide concentrations but amino acids were reported to decline. The inhibition of nitrate reductase and glutamine synthetase activity was also concentration dependent and showed more sensitivity for substituted phenoxy herbicide. This study therefore suggests that decrease in metabolite content and enzyme activity can be used as a signal of herbicide toxicity in Cyanobacteria

Key words :

Anabaena fertilissima, Chronic response, Glutamine synthetase, Growth, Inhibition, Metabolites,

Herbicides are produced to kill or injure plants and therefore affect various mechanisms associated with photosynthesis, respiration, growth, cell and nucleus division or synthesis of proteins, carotenoids or lipids (Ecobichon, 1991). 2,4-D is the most widely used and extensively studied herbicide (Marie et al., 2001) and is generally used to control excess growth of weeds in aquatic habitat (Das and Singh, 1977). The application of herbicides in crop fields for selective control of herbs in the modern age has led to serious environmental contamination resulting in greater loss of crop productivity and growth of many beneficial micro-organisms like Cyanobacteria (Shetty et al., 2000). For better exploitation of Cyanobacteria as biofertiliser, it is indispensable to select tolerant strains along with understanding of their tolerance (Kumar et al., 2008).

Kobbia and El-Sharouny (2007) employed Cyanobacteria- *Nostoc muscorum, Tolypothrix lanata* and *Aulosira laxa* to assess different responses against 2,4-D herbicide at all concentrations. Rana and Nirmal Kumar (1995) have also made some observations of the effect of the herbicide N-(4isopropylphenyl)-N, N-dimethyl urea on the aquatic organisms. Perhaps, it is evident that many pesticides at the recommended field application have none or accelerating effect on growth of Cyanobacteria but may affect various physiological processes like nitrogenase activity, photosynthesis, carbon fixation and enzymes of assimilatory nitrate reduction and ammonia assimilation in cyanobacteria (Nagpal and Goyal, 1992). In this perception, an investigation was carried out to elucidate the effect of commercial chlorophenoxy herbicide, 2,4 dichlorophenoxyacetic acid (2,4-D) ethyl ester at different doses like 15, 30 and 60 ppm in response to metabolites like proteins, carbohydrates, amino acids, phenolic compounds and enzymes nitrate reductase and glutamine synthetase for every four days up to sixteen days.

MATERIALS AND METHODS

Pure cultures of Anabaena fertilissima, a heterocystous form was obtained from culture collection of NFF blue-green algae, IARI, New Delhi, and grown photoautotrophically in BG11 medium under controlled illumination of 800 lux light for 14:10 hours photo and dark period per day at $25\pm2^{\circ}$ C. A. fertilissima was maintained in nitrogen free BG11 medium and was subjected to different concentrations of chlorophenoxy herbicide 2, 4-D response. To analyze the effect of different concentrations of herbicide on growth, the experimental