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Title: "Interaction Of Malathion Pesticide With Osmolytes And Free Radicals In *Anabaena variabilis*"

ABSTRACT

Finding:

The toxic effect of malathion in *A. variabilis* was well pronounced showing declining trend of growth, photosynthetic pigments, nitrate reductase activity in dose and time dependent manner. Malathion exerted its toxic effect through ROS formation as indicated by increased MDA and H_2O_2. Enzymatic, non-enzymatic antioxidants and osmolytes contributed to the defense mechanism probably by providing metabolic protection to the cellular machinery of the cyanobacterium. Growth as well as SOD, CAT and APX activities of malathion exposed culture were enhanced with the exogenous addition of osmolytes (proline, trehalose, glycogen, sucrose and mannitol) which further confirmed that metabolic protective role of osmolytes under abiotic pesticide stress.

Result:

Malathion showed varying toxicity to the selected cyanobacterial strain (*A.variabilis*).

1) The growth pattern (absorbance, biomass and chlorophyll) of *A. variabilis* as well as specific growth rate showed pronounced reduction from 50 µg mL^{-1} to 100 µg mL^{-1} malathion.

2) The photosynthetic pigments chlorophyll, carotenoid and phycobiliprotein contents were adversely affected by malathion in *A. variabilis* showing overall decreasing trend in concentrations and time dependent manner.

3) The total protein content increased in concentration and time dependent manner in response to malathion. But at higher concentration of malathion (75 and 100 µg mL^{-1}) the protein content showed declining trend.

4) The total carbohydrate content showed increasing trend with increasing concentration of malathion in comparison to control as time progressed.

5) Malondialdehyde (MDA) and hydrogen peroxide (H_2O_2) increased with increasing concentrations of pesticide suggesting induction of oxidative stress.

6) Osmolytes (proline, glycine-betaine, sucrose, mannitol, trehalose and glycogen) were induced indicating their involvement as osmoprotectants in a free radical scavenging mechanism.

7) Nitrate reductase (NR) was affected as time progressed in all the treated concentration of malathion in *A. variabilis*.

8) The enzymatic antioxidant viz. superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), glutathione S- transferase (GST) and glutathione reductase (GR) and non-enzymatic antioxidant (GSH & GSSG) were enhanced for the detoxification of free radicals.

9) Enhancement of growth with extracellular addition of 200mM each of the osmolytes (proline, sucrose, trehalose, mannitol and glycogen) with 100 µg mL^{-1} malathion in comparison to control with pesticide gave additional protection to the organism.

10) Increased CAT, SOD and APX activities in *A.variabilis* in presence of exogenous osmolytes (proline, sucrose, trehalose, mannitol and glycogen) and malathion (100 µg mL^{-1}).

11) 57.54 and 24.10 kDa protein bands were observed in presence of only lower concentration of malathion while 21.99 kDa protein band appeared in presence of 75 and 100 µg mL^{-1}. 14.12 kDa band was more expressed in 25 and 50 µg mL^{-1} malathion, though it also existed in control and higher pesticide concentration. 29.85, 25.11, 23.71 and 10.59 kDa bands were expressed only in 25 and 50 µg mL^{-1} pesticide concentration along with control. 66.83, 42.16, 39.81, 16.78 and 14.96 kDa bands also appeared in control as well as malathion exposed cultures but their expression decreased with increasing pesticide concentration.