



Research Paper

**CYTOTOXICITY OF MONOCROTOPHOS ON FRESH WATER CILIATE,
*Paramecium caudatum***

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Abstract

Paramecium caudatum which can be considered as ideal organisms for investigating water quality fluctuations and risk assessment of pesticides. Cell viability, cell morphology, cell behavior and macronucleus tests were performed using to different concentrations of Monocrotophos. In the present study experiments were conducted to evaluate the toxic effects of Monocrotophos on ciliate models. The used concentrations are respectively (0.02, 0.04, 0.06, 0.08, 0.10, 0.012 μ g/ml). The obtained results demonstrate that the cellular growth and respiratory metabolism exhibit a strong inhibition proportionally related to the increasing concentrations of the pesticide. The morphological studies showed the changes in shape, size, colour and width of *Paramecia*. Frequencies of macronuclear aberrations were significant showing deformities such as rod shaped, elongation, fragmentation, diffusion and total absence of nucleus and were concentration dependent. The data provided in the present study, on interaction of pesticides with nuclear structure can be of immense value because most of these pesticides have been reported to have carcinogenic, mutagenic and teratogenic properties.

Key words: *Paramecium caudatum*, pesticides, Monocrotophos, morphological deformities.

INTRODUCTION

The quality of water is vital concern for mankind since it is directly linked with human welfare. The quality of water in the river is seriously affected by pollutants which enter through drains that bring domestic as well as industrial effluents and discharge in to the river and also from the sewage system [12]. The environment is of major concern in recent times [5]. The level of increased industrialization especially textile industries have contributed in the pollution of the environment [2]. The studies of behavioral, morphological and physiological changes are becoming prominent in toxicity assessments in unicellular organisms [10]. Free living fresh water protozoan ciliates are

used as bioindicators of toxicity and chemical pollutants in an aquatic ecosystem. Paramecium is bottom dwellers, heterotrophic, eukaryotic animal and resists the changes of aquatic processes [3]. Due to small size, protists generally multiply through short cell cycle, thus making it possible to study the effect of pollutants on a large and genetically homogenous cell population over a short period as well as subsequent cell generation [6]. Various workers have been used Paramecium for the study of rapid toxicity of pesticides [13] [7]

The present study reports the effect of Monocrotophos on the population density, body length, cytopharynx, morphology and physiology of contractile vacuole, cyclosis, cell deformities and considered as an excellent cellular model for toxicity test.

MATERIALS AND METHODS

One litre of pond water along with hydrophytes was collected from different natural sources of water and was examined microscopically for *Paramecia*. *Paramecium caudatum* was cultured by following the method of [14]. *Paramecia* for experiment were selected from the log phase of cultures. MCP (technical grade, 98% purity) was obtained from insecticide shop was dissolved in acetone to prepare a 10 ml stock solution. Then the test solutions were used concentrations are 0.02, 0.04, 0.06, 0.08, 0.10, 0.012 μ g/ml. were prepared. The exposure of paramecia to the various concentrations of MCP for 24, 48, 72, 96 and 120 h was carried out in 100 ml glass beakers. Each beaker contained 50 ml test concentration prepared and 10³ paramecia. Parallel controls were maintained in 50 ml glass beaker.

The rate of population growth at the end of the exposure is measured and analyzed by using haemocytometer. The measurement of length and shape of paramecium along with width of cytopharynx is evaluated by using microscopy. *Paramecia* which were exposed in long term resulted abnormality in their physiology and shape includes trichocyst discharge is also recorded through observational method. For determining the feeding rate during experiment, the control and test paramecia were taken in a concavity glass slide and both these concavity is exposed with Congo red and milk powder. The paramecia were observed under microscope for 15 minutes and rate of ingestion of food particles/min was recorded. Along with the study of feeding rate, rate of cyclosis, the rotary movement of endoplasm and food vacuoles along a definite course was determined in conditions of time taken for completion of one cycle. Some of these paramecia change their physiology and behavior is also recorded and compare with control.

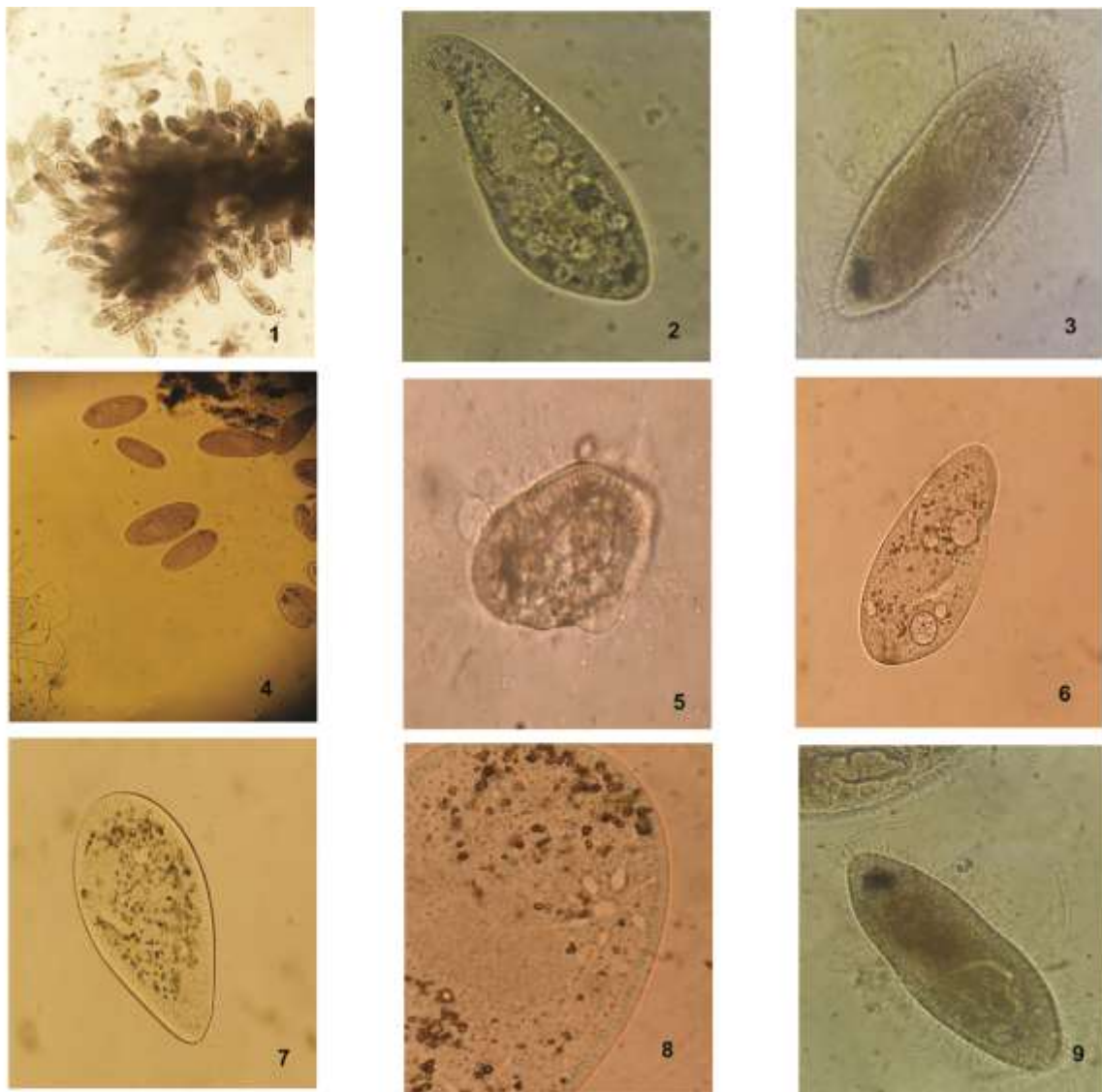


Photo plate showing effect of monocrotophos on *Paramecium caudatum*

Fig. 1 Showing Control group of *Paramecium caudatum* (10x10X)

Fig. 2 Showing Control showing normal shape and size (10x40X)

Fig. 3 Showing reduction in size of *Paramecium caudatum* due to Monocrotophos (10x40X)

Fig. 4 Showing oval shape body and deform contractile vacuole (10x40X)

Fig. 5 Showing decrements in breadth and length of body, exocytosis and blebbing of cell (10x40X)

Fig. 6 Showing reduced cytopharynx and cell structure (10x40X)

Fig. 7 Showing decrease in rate of cyclosis (10x40X)

Fig. 8 Showing deformities and enlargement of contractile vacuole(10x40X)

Fig. 9 Showing Deformities of contractile vacuole at higher concentration of Monocrotophos (10x40X)

RESULTS AND DISCUSSIONS

Monocrotophos is organophosphate pesticide used in discriminately in India to control the insect and pest. MCP is likely to enter surface water and cause water pollution [13]. Such exogenous chemical may causes irreversible environmental damages and reducing the diversity and disrupting the aquatic ecosystem [4].

Paramecium species is an organism of choice on cytotoxicity studies. It has short generation time and can be quickly grown in laboratory culture medium. Free living fresh water protozoan ciliates like *Paramecium caudatum* are considered as bioindicator of toxicity stress and chemical pollution. In this study we used *Paramecium caudatum* as a model cell to study the impact of Monocrotophos.

In the present study experiments were conducted to evaluate the toxic effects of Monocrotophos on ciliate models. The used concentrations were respectively (0.02, 0.04, 0.06, 0.08, 0.10, and 0.012mg/ml). The obtained results demonstrated that the cellular growth and respiratory metabolism exhibit the strong inhibition propositionally related to the increasing concentrations of the pesticides. The morphological study shows the changes in shape, size, colour and width of *Paramecium*. (Plate-1, Fig-3-9). At lower concentration, Monocrotophos did not affect the population density of *Paramecium* exposed to 24 hours but exposure to higher concentration for a period of longer than 24 hours significant decrease in population, shape and size of *Paramecium* at all the test concentration (Plate-1, Fig-3). After exposure of 48 hours the degree of decrements in breadth and length of cytopharynx was dependent upon the concentration of Monocrotophos (Plate-1, Fig- 5, 8, 6). Monocrotophos also decrease the rate of cyclosis. Therefore contamination of aquatic ecosystem with pesticides would have detrimental effects on micro fauna [9]. [7] also studied the sub lethal concentration of Monocrotophos and observe that number of generations of *Paramecia* decrease with extension of concentration. The reduction of length of *paramecia* under the influence of Monocrotophos appears to be partly due to a longitudinal contraction of the body and partly due to the loss of the cytoplasm and also associated with cyclosis with digestion [1]. [13] studied the decrements in breadth and length of cytopharynx due to exposure of sub lethal concentrations of Monocrotophos and also decline the population density. Our results are inconformity with this study.

[8], observe the morphological and physiological alterations in *Paramecium* due to exposure of biological insecticide Delfin at lower concentratios. [11] observe the physiological and morphological deformities in *Paramecium* due to exposure of neurotoxic insecticide Dimethoate. They observe irregular beating of cilia, blubbing and spinning movements. At higher concentrations the blebbing was observed to occur in a short time while the lower concentrations created blebbing later.

CONCLUSIONS

After considering the results of the present study, it is to be concluded that the *Paramecium* shorts reduction of population density, length of animal as well as reduction of length and breadth of cytopharynx which leads to reduction of feeding rate as well as cyclosis. The methods used were cheap and easy to perform. It is an alternative model organism in the place of eukaryotes for carrying out bioassay of toxicity having economic and effective approach.

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